Geology and Ground-Water Resources of the Winter Garden District Texas, 1948

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1481

Prepared in cooperation with the Texas Board of Water Engineers

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By SAMUEL F. TURNER, THOMAS W. ROBINSON, *and* WALTER N. WHITE
Revised by DONALD E. OUTLAW, W. O. GEORGE, *and others*

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GEOLOGY AND GROUND-WATER RESOURCES OF THE WINTER GARDEN DISTRICT, TEXAS, 1948

By SAMUEL F. TURNER, THOMAS W. ROBINSON, and WALTER N. WHITE

Revised by DONALD E. OUTLAW, W. O. GEORGE, and others

ABSTRACT

The Winter Garden district, as described in this report, includes all of Dimmit and Zavala Counties and the eastern part of Maverick County—a total of about 3,200 square miles. The fieldwork for the investigation was completed in 1948.

The district, famed for its production of garden vegetables, is in the West Gulf Coastal Plain and is drained chiefly by the Nueces River and its tributaries. The maximum relief is about 550 feet. The average annual rainfall is about 20 inches.

The rocks exposed in the Winter Garden district are mostly sedimentary and from oldest to youngest are as follows: The San Miguel, Olmos, and Escondido formations of Cretaceous age; the Kincaid and Indio formations, the Carrizo sand, and the Mount Selman and Cook Mountain formations of Tertiary age; the Uvalde gravel of Tertiary(?) age; and the Leona formation of Quaternary age. None of the rocks in the district older than the Indio formation contain fresh water and the Uvalde gravel is devoid of water.

The Indio formation is composed predominantly of thin-bedded and laminated clayey sand and sandy shale. It also includes some thick layers of clay, both lenses and persistent layers of sandstone, a few beds of lignite, and numerous calcareous, arenaceous, and ferruginous concretions.

The Carrizo sand consists of beds of massive, commonly crossbedded, loosely cemented, remarkably clean sand. It is composed chiefly of grains of pure quartz that range from a fraction of a millimeter to slightly more than 5 millimeters in diameter.

The Bigford member of the Mount Selman formation consists chiefly of clay but also contains subordinate amounts of sandy clay, sandstone, beds of lignite, beds of yellow limestone, and some thin beds of hematite.

The post-Bigford beds of the Mount Selman formation are similar lithologically to the Bigford member but are composed principally of clay and a few relatively thin layers of sandstone and limestone.

The Cook Mountain formation consists chiefly of partly consolidated medium-grained sand and sandstone.

The formations dip about 60 feet per mile to the south and southeast, a slope that is somewhat greater than that of the land surface; thus, progressively younger beds are exposed from northwest to southeast. The Uvalde gravel and Leona formation are distributed unevenly over the beveled edges of the older rocks. The structure is modified by a broad syncline trending slightly south of east through the center of Zavala County and a broad anticline passing south-

eastward through Carrizo Springs. Several minor faults were mapped, but the faults probably have little effect on the occurrence and movement of ground water.

The principal water-bearing formations in the district are the Carrizo sand and the Leona formation. Minor water-bearing formations include the Indio formation and the Bigford member of the Mount Selman formation. The Carrizo sand and the Leona formation both yield water suitable in quantity and quality for irrigation. The Leona is the less important of the two owing to its limited thickness and areal extent.

The Carrizo sand crops out in a crescent-shaped band that roughly parallels the western, northwestern, and northern edges of the district. Wells tapping the Carrizo sand provided about 27,000 acre-feet of water to irrigate about 27,000 acres in the district in the irrigation season of 1929–30, about 22,000 acre-feet of water to irrigate about 24,000 acres in the irrigation season of 1937–38, and about 52,000 acre-feet of water to irrigate about 42,000 acres in the irrigation season of 1947–48. The withdrawals caused declines of artesian pressure in the artesian area of the Carrizo sand ranging from 0.2 foot to 42.4 feet between 1947 and 1948, and water levels in some wells declined about 90 feet between 1930 and 1948.

Laboratory tests of samples and pumping tests indicate that the Carrizo sand has an average permeability of about 200 gallons per day per square foot and an average transmissibility of about 30,000–40,000 gallons per day per foot. The tests showed a storage coefficient of about 0.0001 in the artesian area; it is conservatively estimated to be about 0.1 in the outcrop area.

The Leona formation crops out in narrow strips adjacent to the Nueces and Leona Rivers. About 6,800 acre-feet of water was pumped from the Leona formation in Zavala County to irrigate about 5,100 acres in 1947–48. The withdrawal resulted in the temporary failure of several irrigation wells in the Batesville area.

Records and locations of more than 1,100 wells, water-level measurements made in representative observation wells from 1929 through 1948, and hydrographs from 6 representative wells are illustrated and tabulated in the report.

The quality of water varies between wide limits in all formations. Generally, water from the Leona formation is the best for irrigation and the least mineralized. Water in the Carrizo becomes softer downdip as the percent sodium increases. Water from the Bigford member of the Mount Selman formation and the Indio formation in parts of the district is too highly mineralized for most uses. The investigation revealed that the contamination of wells in the Carrizo sand by mineralized water from the Bigford member of the Mount Selman formation is a local problem and that up to 1948 no general contamination had occurred in the Carrizo sand.

INTRODUCTION

LOCATION AND GENERAL FEATURES OF THE DISTRICT

The Winter Garden district is in a semiarid part of southern Texas, but large supplies of ground water that is suitable for irrigation, together with fertile soils and infrequent killing frosts, make possible the growing of garden vegetables. The Winter Garden district is one of the principal sources of winter vegetables in the United States; the chief products are spinach, onions, carrots, and tomatoes. It is reported that more spinach is grown in the Winter Garden district than in any other place of equal area in the world. During the summer the irrigated crops include onion and tomato plants, grain sorghum, and cotton.

The Winter Garden district as defined in this report comprises about 3,200 square miles in southern Texas and includes Dimmit and Zavala Counties and the eastern part of Maverick County. (See fig. 1.) Carrizo Springs, near the center of the district, is about 100 miles southwest of San Antonio and 40 miles east of the Mexican border at Eagle Pass. The district extends shortly beyond the irrigated areas in order to include that part of the outcrop of the Carrizo sand that is hydrologically important to the district.

The principal towns in Dimmit County and their populations in 1950 are as follows: Carrizo Springs (the county seat), 4,316; Asherton, 2,425; Big Wells, 1,077; Catarina, 380; and Brundage, 50. In Zavala County they are as follows: Crystal City (the county seat), 7,198; La Pryor, 500; and Batesville, 250. Maverick County has no towns within the area of this report.

Figure 1.—Map of Texas showing location of Dimmit, Zavala, and eastern Maverick Counties, the Winter Garden district of this report.

The Winter Garden district is served by the San Antonio, Uvalde, and Gulf Railroad Co., and the Asherton and Gulf Railroad Co. Paved highways in the area include U. S. Highway 85 extending east and west, and U. S. Highway 83 running north and south. Secondary public and private roads reach nearly all parts of the district.

PHYSIOGRAPHIC FEATURES AND HISTORY

The Winter Garden district lies in the northwestern part of the West Gulf Coastal Plain, which as defined by Hill (1901, p. 48) extends in Texas from the Gulf of Mexico to the Balcones scarp. Within this part of the West Gulf Coastal Plain there are two main terraces: one relatively high terrace underlain by remnants of the Uvalde gravel and a lower and broader terrace, underlain by the Leona formation. Between these terraces are low, approximately parallel asymmetrical hills having gentle slopes in the direction of the dip and steeper slopes in the opposite direction. These hills trend north and northeast parallel to the strike of the Leona formation, which dips generally east and southeast. The crests of the hills are formed by the more resistant beds in the formations. The relatively flat areas between the hills are suitable for irrigation. The total relief in the district is about 550 feet, the altitude ranging from about 400 feet in the eastern part of Dimmit County to 964 feet on Batesville Hill, about 9 miles northwest of Batesville (fig. 2).

The terrace remnants formed by the Uvalde gravel are relatively high, narrow divides; and most of the relief in the district has resulted from degradation by the streams that cut through the Uvalde into the underlying formations.

During the latter part of the Cenozoic era, the Winter Garden district was probably a relatively flat land tilted slightly to the south and southeast. At some time that was probably within the Pleistocene (Weeks, 1941, p. 932; Trowbridge, 1932, pl. 7) epoch, streams began cutting through the Uvalde gravel, carrying with them and depositing the materials of the Leona formation. The upper surface of the Leona formation forms broad flats which slope toward the Nueces, Frio, and Leona Rivers. These flats form part of the Nueces Basin of Trowbridge (1932, p. 14–21). Near its outer margin the Leona terrace is 74–100 feet above stream level. Near the Nueces River it is commonly 30 feet above the stream, but where the stream is cutting against a bank composed of the Leona formation, this height may be considerably greater.

The greater part of the district is drained by the Nueces River, but the northeastern part is drained by the Frio and Leona Rivers, and the extreme southwestern part by tributaries of the Rio Grande.

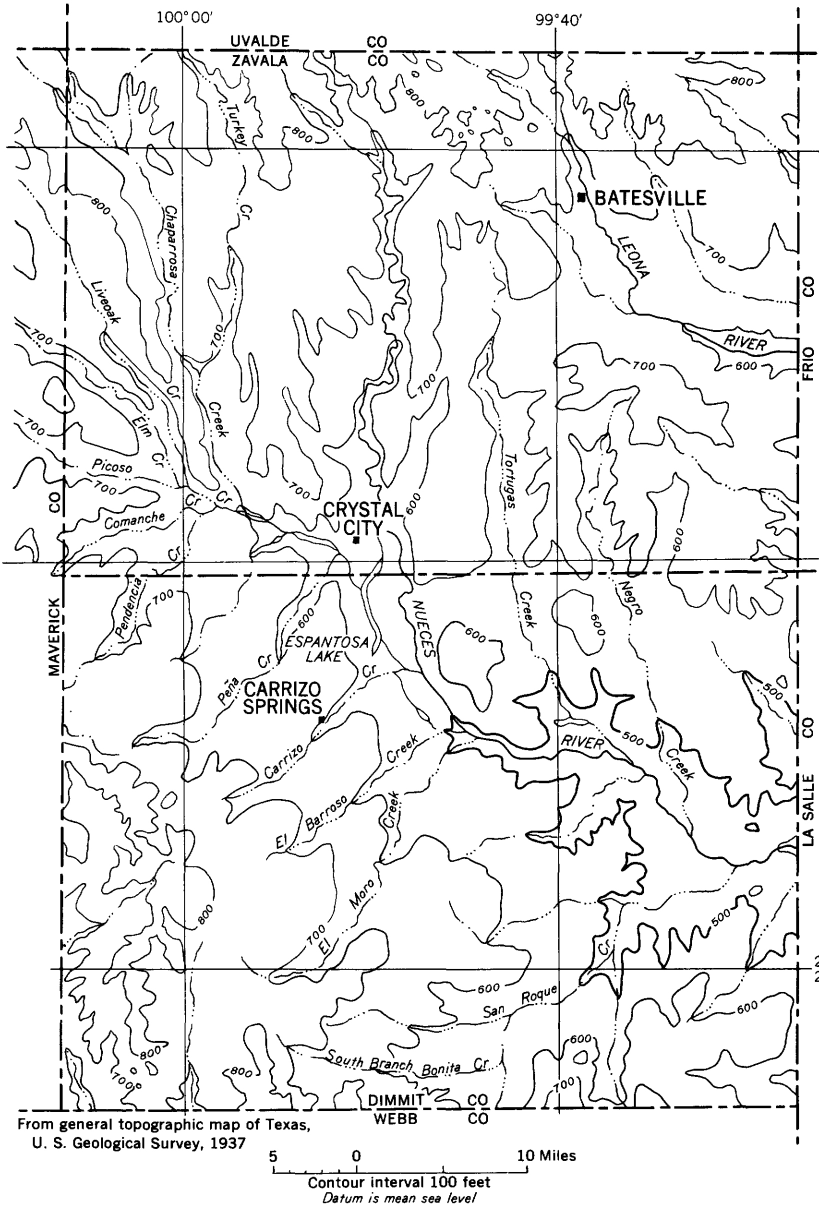

FIGURE 2.—Topographic map of the Winter Garden district, Texas.

The larger tributaries of the Nueces River in the district are Turkey, Chaparrosa, Elm, Picoso, Peña, Carrizo, Pendencia, and San Roque Creeks.

The Nueces River is intermittent in the northern part of the area, but from a point 4 miles southeast of La Pryor, perennial flow is maintained for a distance of about 5 miles by springs issuing from the bed of the river. This flow is used for irrigation in the southern part of Zavala County and in the northern part of Dimmit County. The greater part of the total discharge of the river, however, is in the form of flood runoff. The Leona River in southern Uvalde and northern Zavala Counties has a perennial flow which is maintained by the flow of springs. All other streams in the district carry water only during brief periods after heavy rains.

The upper reaches of the streams are still degrading the Edwards Plateau north of the district and have cut through the Leona formation, exposing older formations in the stream channels. In the latitude of Crystal City, however, the main streams are aggrading and showing evidence of old age. An area, locally called the Bayuca, consists of several thousand acres of lowland north along Turkey Creek from a point 4 to 6 miles west of Crystal City. The Bayuca is densely covered with vegetation and in time of flood is covered by a few feet of water which is in part backwater from Comanche Lake. Espantosa Lake, northeast of Carrizo Springs, is a partly abandoned meander of the Nueces River.

In the area along the Rio Grande that Trowbridge (1932, p. 14–21) called the breaks of the Rio Grande, the surface is sharply dissected, and the area is not suitable for irrigation. This area includes the southwestern part of Dimmit County.

CLIMATE

In the Winter Garden district the winters are generally mild; frosts occur occasionally but seldom cause serious damage to the more resistant vegetables and fruits. In 1947 and 1948, however, damaging frosts occurred in November. The summers are hot but the heat is tempered somewhat by breezes from the Gulf of Mexico. According to records of the Texas Agricultural Experiment Station at Winter Haven in Dimmit County the mean annual temperature during the 18-year period beginning January 1931 and ending December 1948 was 71.9°F (fig. 3), whereas according to records of the United States Weather Bureau at La Pryor in Zavala County, the mean temperature during the 27-year period 1915–35 and 1943–48 was 71.3°F.

The mean monthly evaporation at Winter Haven was 4.85 inches during the 18-year period 1931–48 (fig. 3). The mean monthly evaporation ranged from a minimum of 1.88 inches in January and December to a maximum of 8.01 inches in July.

In most years irrigation is required for the successful production of crops in the Winter Garden district. Generally some rain falls in at least 10 months of each year, but the precipitation in summer

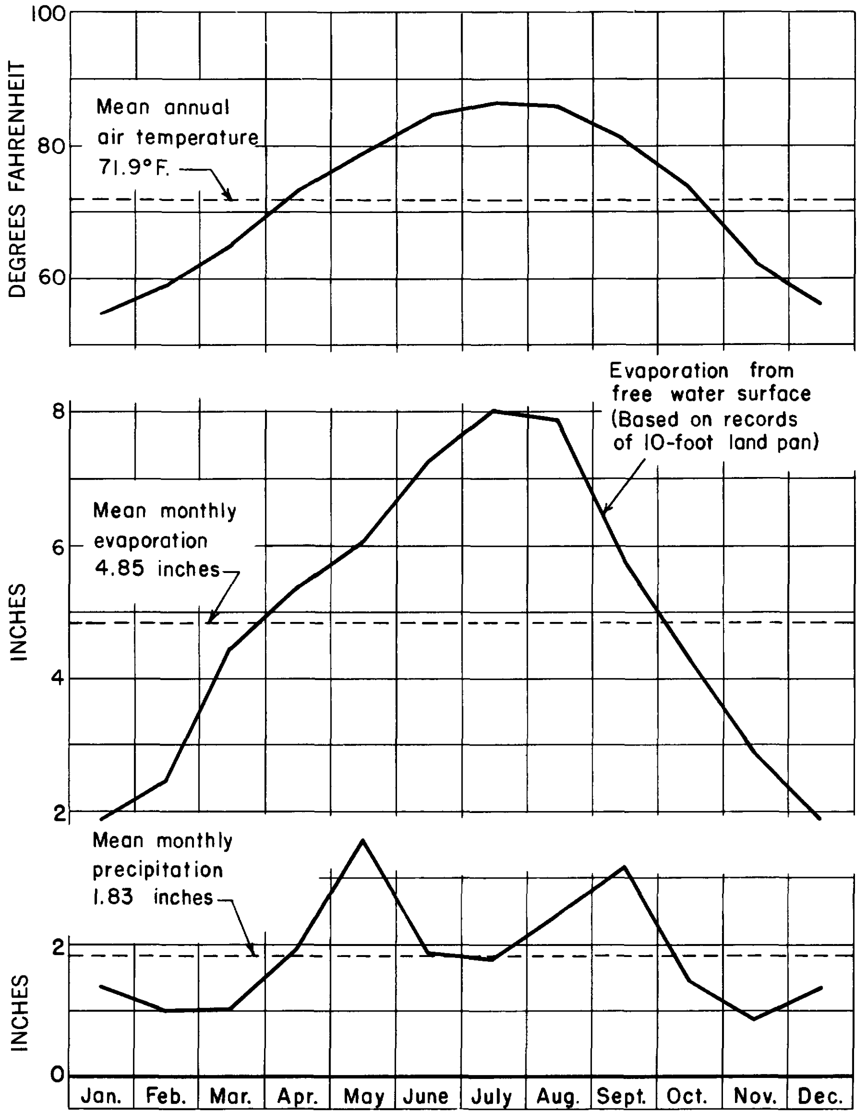

FIGURE 3.—Mean monthly temperature, evaporation, and precipitation at Winter Haven, Tex. From records of the Texas Agricultural Experiment Station.

normally is much heavier than in winter; the average precipitation from May to October is nearly twice that from November to April. It is lightest, therefore, when it is most needed for winter crops (figs. 3 and 4, and tables 1–5). According to records of the U. S. Weather Bureau, the mean annual rainfall at Carrizo Springs for the 27-year period was 21.79 inches (fig. 4); at Big Wells the average precipita-

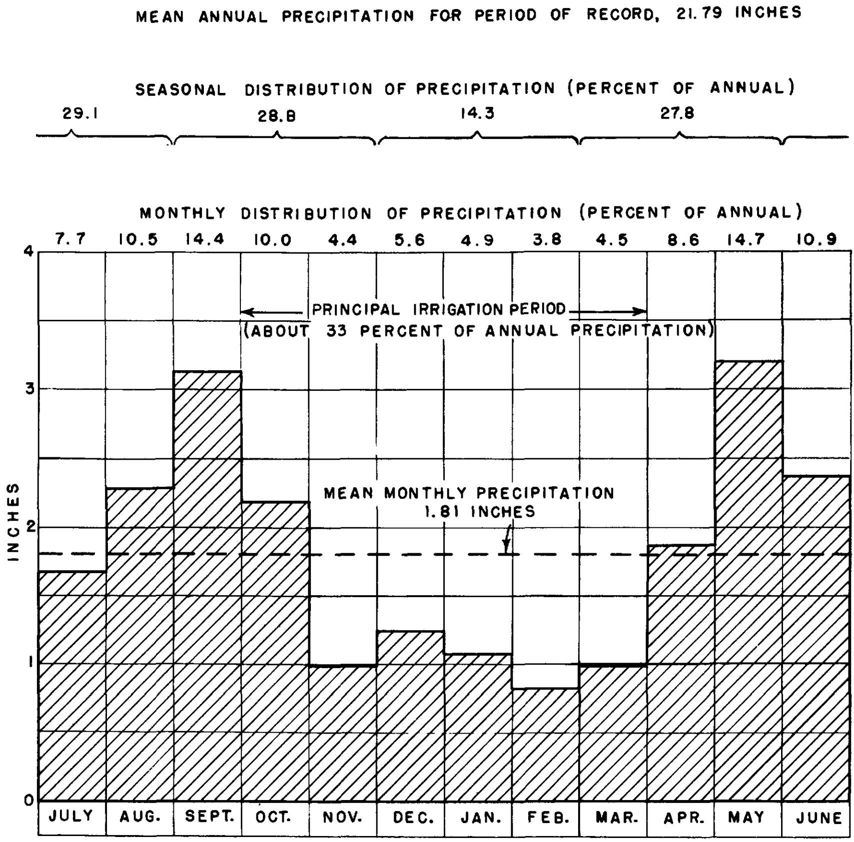

FIGURE 4.—Monthly distribution of precipitation at Carrizo Springs, Tex. From records of the U.S. Weather Bureau.

tion for the 32-year period was 21.05 inches (table 1); at La Pryor the average precipitation for the 23-year period was 21.71 inches (table 2); at Uvalde, 21 miles north of La Pryor, the average precipitation for the 51-year period was 24.01 inches (table 3); and at Eagle Pass, 44 miles west of Carrizo Springs, the average precipitation for the 70-year period was 20.83 inches (table 4). The annual precipitation varies within comparatively wide limits. At La Pryor it ranged from 6.51 inches in 1917 to 42.01 inches in 1919, or from less than one-third to almost twice the 23-year average. At Big Wells it ranged from 5.84 inches in 1917 to 35.49 inches in 1919, or from less than 1/3 to about 1¾ times the 32-year average. At Carrizo Springs it ranged from 7.37 inches in 1917 to 33.87 inches in 1931, or from about 1/3 to more than 1½ times the 27-year average. At Eagle Pass it ranged from 7.03 inches in 1893 to 44.36 inches in 1900, or from about one-third to more than twice the 70-year average.

TABLE 1.—*Monthly, annual, and average precipitation, in inches, at Big Wells, Dimmit County, Tex., 1916–48*

[From records of the U.S. Weather Bureau]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1916	0.50	0.00	0.37	2.01	0.77	0.70	3.54	6.69	3.06	1.57	1.19	0.42	20.82
1917	.34	.00	.04	.00	1.47	.65	.47	.71	1.88	.04	.24	.00	5.84
1918	Tr.	.39	.69	.98	2.55	.81	.77	.20	2.15	3.78	1.60	2.28	16.20
1919	.92	1.79	1.22	2.35	2.86	4.99	4.67	.25	8.48	5.61	1.12	1.23	35.49
1920	1.88	.40	.00	1.18	3.11	1.80	.57	3.68	.00	3.31	1.10	.05	17.08
1921	.00	.00	1.26	1.40	2.18	3.50	.00	.00	1.73	.27	.24	1.00	11.58
1922	.39	.45	2.37	6.04	2.73	6.67	.10	.00	2.71	2.30	.57	.00	24.23
1923	.18	6.23	2.75	.00	.19	.00	1.39	3.61	5.14	1.70	3.77	4.07	29.03
1924	.49	2.93	.58	3.11	2.57	.14	.80	.00	2.64	.56	.00	1.10	14.92
1925	.23	.00	1.98	.22	1.74	.00	1.83	1.69	4.46	.94	1.05	.94	15.08
1926	2.54	.84	2.85	1.60	2.64	2.65	1.20	1.81	.76	3.32	1.38	1.71	23.30
1927	.72	.85	1.02	.00	.00	3.20	.43	.30	1.05	2.87	.00	1.38	11.82
1928	1.31	1.39	.10	.94	2.01	2.10	.91	1.57	6.21	.00	.20	1.29	18.03
1929	.16	.05	1.74	.79	4.70	.00	1.20	.00	2.35	1.53	1.15	2.07	15.74
1930	.15	.22	3.09	3.83	1.83	4.92	2.47	.00	.28	8.93	2.90	.35	28.97
1931	5.66	.82	.99	2.57	6.86	2.02	2.71	2.77	.00	.34	.23	4.34	29.31
1932	.86	4.02	.91	.91	2.70	.40	1.62	5.87	5.59	.41	.60	.98	24.87
1933	.59	4.64	.15	.00	1.69	.00	2.29	1.85	1.86	.71	.44	.34	14.56
1934	3.63	.50	.47	4.35	2.35	.00	4.39	.74	4.25	.10	2.40	2.65	25.83
1935	.00	1.38	1.00	.80	1.85	5.37	4.03	.46	4.60	1.09	.00	2.33	22.91
1936	.22	.03	.34	2.68	2.84	2.30	.55	1.80	5.58	1.61	2.08	.30	20.33
1937	.50	.15	1.85	.00	2.13	1.61	1.75	.00	2.18	.88	.22	5.33	16.60
1938	2.18	.52	.67	1.85	.49	.05	4.47	.95	.17	.00	.06	1.42	12.83
1939	1.34	.30	.32	.00	5.85	1.46	4.93	.42	.93	3.30	1.88	.75	21.48
1940	.54	1.79	2.15	2.86	4.48	8.16	1.84	2.81	.53	1.72	1.13	2.61	30.62
1941	1.14	2.56	1.59	5.76	2.66	2.13	2.25	.43	3.97	1.29	.52	.65	24.95
1942	.71	1.95	1.27	1.44	2.47	1.40	1.90	2.60	4.76	1.21	.00	.70	20.41
1943	.95	.00	.05	.48	4.77	2.17	1.34	.00	3.44	1.74	1.31	2.22	18.47
1944	1.41	.43	1.57	.07	5.34	2.17	.83	9.15	.52	.94	1.13	1.97	25.53
1945	.44	1.21	4.17	2.51	.66	.89	.33	.88	6.73	5.41	.57	.30	24.10
1946	1.77	.36	.34	11.32	5.15	2.24	.00	3.04	5.10	1.36	.16	.81	31.65
1947	2.34	.11	.00	1.09	3.50	7.58	.62	3.14	.79	2.52	.62	.38	22.59
1948	.16	1.55	.12	-------	2.33	4.24	.74	.45	3.61	3.03	.87	.83	-------
Average	1.04	1.15	1.15	1.97	2.71	2.31	1.72	1.75	2.95	1.95	0.93	1.42	21.05

TABLE 2.—*Monthly, annual, and average precipitation, in inches, at La Pryor, Zavala County, Tex., April 1915 to October 1935 and January 1943 to August 1948*

[From records of the U.S. Weather Bureau]

Year	Jan.	Feb.	May.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	------	------	------	2. 51	1. 30	1. 51	2. 34	5. 35	3. 13	0. 80	0. 02	0. 13	------
1916	0. 95	0. 02	0. 03	4. 09	1. 35	. 70	5. 30	7. 49	1. 33	. 12	. 86	. 03	22. 26
1917	. 70	. 18	. 04	. 00	1. 76	1. 36	. 77	. 97	. 40	. 20	. 13	. 00	6. 51
1918	. 05	. 26	. 37	1. 34	3. 86	2. 17	. 35	. 48	. 80	3. 79	2. 79	2. 45	18. 71
1919	3. 84	1. 30	2. 55	2. 19	3. 59	5. 28	6. 26	1. 62	6. 16	7. 22	1. 04	. 96	42. 01
1920	2. 29	. 20	1. 02	. 04	1. 55	4. 53	3. 24	3. 20	. 65	1. 65	1. 26	. 08	19. 71
1921	. 14	1. 77	. 81	2. 55	. 94	3. 02	1. 52	1. 85	1. 18	. 99	1. 32	. 00	16. 09
1922	. 58	. 79	1. 75	4. 87	2. 57	4. 56	. 65	. 00	1. 89	2. 13	. 71	. 07	20. 57
1923	. 43	4. 46	3. 06	2. 05	1. 16	2. 24	1. 94	2. 30	6. 79	2. 45	1. 87	2. 83	31. 58
1924	. 59	1. 61	. 79	3. 36	3. 14	2. 59	. 07	. 00	2. 99	. 33	. 02	. 67	16. 16
1925	. 18	. 00	. 89	. 59	3. 74	. 28	. 26	1. 09	2. 92	1. 50	. 71	1. 46	13. 62
1926	1. 89	. 06	2. 72	9. 58	1. 20	3. 18	1. 72	. 47	. 54	2. 91	. 91	1. 35	26. 53
1927	. 81	2. 16	. 49	. 48	. 26	4. 32	2. 14	. 79	. 51	1. 30	. 00	1. 81	15. 07
1928	. 76	1. 53	. 09	1. 14	6. 19	3. 23	. 78	1. 70	4. 96	. 84	. 45	1. 03	22. 07
1929	. 37	. 13	1. 53	1. 95	5. 72	1. 23	2. 84	. 03	2. 49	4. 62	. 66	. 54	22. 11
1930	. 58	. 34	1. 63	2. 57	2. 22	3. 52	. 69	. 33	. 66	5. 62	2. 65	. 52	21. 33
1931	5. 59	1. 17	1. 18	1. 89	6. 98	2. 34	4. 44	1. 89	. 00	. 13	. 61	2. 77	28. 99
1932	. 52	3. 25	. 81	1. 40	4. 66	6. 16	10. 35	4. 46	5. 63	. 20	1. 12	. 96	39. 52
1933	1. 50	1. 89	. 17	1. 00	1. 77	. 03	. 18	1. 80	. 39	. 49	. 11	. 29	9. 62
1934	2. 85	. 43	. 40	1. 88	3. 19	. 05	2. 17	. 12	2. 97	. 20	. 09	2. 18	16. 53
1935	. 18	1. 06	. 36	1. 23	6. 38	5. 21	9. 66	. 00	6. 13	. 79	------	------	------
1943	. 88	. 15	. 11	. 82	2. 34	2. 32	1. 47	. 00	3. 72	. 84	3. 69	. 93	17. 27
1944	1. 49	. 35	1. 21	1. 12	5. 80	2. 19	. 39	7. 52	. 62	1. 42	2. 24	1. 74	26. 09
1945	2. 51	1. 74	1. 73	1. 94	1. 71	. 83	. 07	. 34	6. 28	1. 79	. 05	. 37	19. 36
1946	1. 94	. 05	. 20	1. 99	4. 25	2. 25	. 01	1. 77	6. 36	1. 69	. 54	. 35	21. 40
1947	2. 07	. 12	. 86	1. 10	1. 60	6. 61	------	2. 92	. 12	1. 02	1. 11	. 52	------
1948	. 07	1. 06	. 08	1. 51	4. 22	2. 30	2. 91	. 32	------	------	------	------	------
Average	1 30	1. 00	0. 96	2. 04	3. 09	2. 74	2. 40	1. 81	2. 68	1. 73	1. 00	0. 96	21. 71

TABLE 3.—*Monthly, annual, and average precipitation, in inches, at Uvalde, Uvalde County, Tex., November 1849 to April 1855; January 1859 to February 1861; May 1877 to May 1883, and March 1905 to December 1948*

[From records of the U.S. Weather Bureau]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1849	------	------	------	------	------	------	------	------	------	------	2.05	2.30	------
1850	0.38	0.71	1.42	1.11	1.07	7.00	2.70	3.19	1.50	1.70	3.60	2.10	26.48
1851	.80	3.54	1.45	2.95	1.08	.73	2.84	3.53	.73	1.50	1.43	.29	20.87
1852	.34	1.40	2.62	.15	5.76	8.07	6.82	.12	2.83	3.19	1.52	.00	32.82
1853	2.16	3.58	1.51	2.42	3.28	9.00	4.97	1.59	1.20	6.76	.15	1.02	37.64
1854	.20	2.15	3.00	.75	3.88	2.09	.97	1.67	4.80	.33	3.71	.50	24.05
1855	.10	1.86	.75	.17	------	------	------	------	------	------	------	------	------
1859	.70	.67	.08	.91	1.42	2.80	.26	2.35	5.11	3.15	.06	.55	18.06
1860	1.04	1.79	1.19	3.71	.00	1.85	.04	5.06	.94	2.77	.82	.23	19.44
1861	1.47	.05	------	------	------	------	------	------	------	------	------	------	------
1877	------	------	------	------	.32	.72	1.17	.09	1.92	.77	1.01	6.74	------
1878	.57	1.59	2.62	2.32	2.98	1.53	4.85	2.54	1.28	1.07	1.93	.69	23.97
1879	.08	.90	.94	3.08	3.48	.80	Tr.	5.66	3.29	.89	.01	.09	19.22
1880	2.85	1.82	1.96	2.59	1.76	2.01	4.82	5.71	4.46	.44	1.64	1.23	31.29
1881	.43	.82	.59	2.39	6.44	.00	1.22	1.91	1.44	3.15	2.24	.91	21.54
1882	.84	.71	1.41	.33	4.73	.36	1.37	3.23	4.05	.96	1.88	.17	20.04
1883	.28	.87	4.88	1.99	.17	------	------	------	------	------	------	------	------
1905	------	------	3.48	5.67	------	------	------	------	------	------	1.72	1.25	------
1906	------	------	------	------	------	------	5.71	------	------	------	------	------	------
1907	------	------	------	------	------	.38	1.62	Tr.	------	------	------	------	------
1908	.98	1.55	1.48	3.16	6.90	1.28	3.57	5.11	1.48	.63	1.58	.57	28.29
1909	.08	.62	1.34	.98	3.40	2.04	3.54	3.13	1.02	.37	.41	1.26	18.19
1910	.55	.49	2.68	3.27	2.04	.50	.42	Tr.	1.30	2.98	.22	.39	14.84
1911	.30	2.48	2.23	3.85	.53	Tr.	1.01	1.05	.03	4.87	3.00	1.13	20.47
1912	.08	------	------	1.69	2.64	------	------	------	------	------	------	------	------
1913	.35	.77	.46	1.26	2.30	12.78	.85	2.08	4.80	6.42	5.95	2.73	40.75
1914	Tr.	1.25	.77	2.43	5.44	3.13	Tr.	2.74	.33	1.90	1.20	.87	20.06
1915	1.52	1.40	1.68	1.53	1.00	Tr.	Tr.	4.78	2.78	.00	.00	Tr.	14.69
1916	2.02	.00	2.62	4.17	1.55	.72	7.66	7.20	5.71	.83	1.20	Tr.	33.68
1917	.86	.16	.08	.20	1.89	5.29	1.00	.60	1.06	.27	.98	.00	12.39
1918	.10	.13	.65	1.56	2.74	1.52	Tr.	1.48	1.80	5.23	1.81	3.15	20.17
1919	3.04	1.36	1.50	2.75	3.91	3.31	4.21	1.63	7.68	6.52	1.42	1.07	38.40

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TABLE 3.—*Monthly, annual, and average precipitation, in inches, at Uvalde, Uvalde County, Tex., November 1849 to April 1855; January 1859 to February 1861; May 1877 to May 1883, and March 1905 to December 1948*—Continued

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1920	2.25	.25	.28	.95	2.45	2.83	.80	3.30	1.75	1.47	1.24	.16	16.94
1921	.46	.78	4.09	.60	5.22	2.92	1.44	.40	1.46	1.55	.38	.20	19.50
1922	.20	.85	1.35	6.70	1.97	7.45	.75	Tr.	.39	.65	.64	Tr.	20.95
1923	.40	3.88	3.07	4.03	1.03	3.42	.67	.49	3.94	4.00	2.34	2.57	29.84
1924	.60	1.55	1.07	2.30	2.66	.75	.82	.05	1.95	.93	.05	2.95	15.68
1925	.10	.00	.85	1.45	3.45	.45	.90	2.10	2.76	1.67	1.45	1.14	16.32
1926	2.20	.00	2.66	9.83	1.40	3.86	2.15	1.73	.67	2.93	1.55	1.63	30.61
1927	.50	3.01	1.51	1.30	1.38	2.71	3.97	.50	.55	1.88	.00	2.25	19.53
1928	.58	2.17	.63	.84	3.87	4.68	.30	1.90	4.94	.40	.12	.78	21.21
1929	.45	.27	2.07	.74	5.60	2.03	1.90	.10	5.45	2.30	.82	1.60	23.23
1930	.83	.14	1.83	2.15	1.46	8.27	1.00	.71	.88	6.04	2.48	.65	26.44
1931	5.82	1.40	.50	6.74	9.08	2.35	3.85	3.25	Tr.	.10	.64	2.61	36.34
1932	.67	1.85	1.40	1.70	2.19	1.18	21.01	4.55	8.62	.12	.58	1.15	45.02
1933	2.71	2.06	.20	.85	2.80	.86	1.57	2.25	.30	.95	.27	.40	15.22
1934	2.95	.22	.88	1.08	1.88	.15	3.53	.42	2.52	.08	.28	2.71	16.70
1935	.36	1.98	.22	2.49	17.67	4.93	4.54	.05	5.27	.38	.15	3.13	41.17
1936	.25	.08	1.45	.45	4.97	3.52	1.39	1.70	6.75	2.36	1.19	.42	24.53
1937	.73	.14	1.50	.45	1.29	3.05	.77	.00	2.05	1.82	.22	5.86	17.88
1938	2.00	.62	1.37	1.43	1.17	Tr.	4.34	.27	.23	.33	.08	1.28	13.12
1939	2.18	.31	.24	.36	2.44	.44	2.01	7.42	1.38	4.47	1.89	1.16	25.30
1940	.43	2.11	1.29	2.42	4.73	4.14	.29	3.09	.31	3.71	2.23	2.91	27.66
1941	1.93	3.17	4.17	5.15	4.11	2.58	2.91	.31	4.57	2.01	.44	.44	31.79
1942	.27	1.32	.35	2.80	1.73	.30	4.43	2.78	4.04	.30	.06		
1943	.39	.32	.82	2.11	3.18	2.18	.76	Tr.	6.17	2.19	1.35	1.26	20.73
1944	2.14	2.24	1.89	.40	3.97	4.45	.26	10.18	1.33	1.95	1.88	2.07	32.76
1945	2.60	1.22	4.27	2.61	.77	2.91	.68	1.05	3.78	1.44	.34	.70	22.37
1946	1.93	.78	.40	1.68	5.71	2.70	1.18	2.32	7.07	2.08	.37	.18	26.40
1947	2.76	.45	1.26	2.15	1.34	7.61	.56	2.38	.08	1.31	2.20	.57	22.67
1948	.20	1.77	.15	1.98	2.13	1.68	2.58	.77	3.95	1.82	.93	.35	18.31
Average	1.09	1.23	1.55	2.22	3.13	2.82	2.44	2.23	2.73	2.04	1.23	1.30	24.01

TABLE 4.—*Monthly, annual, and average precipitation, in inches, at Eagle Pass, Maverick County, Tex., March 1871 to May 1883 and January 1889 to December 1948*

[From records of the U.S. Weather Bureau]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1871	------	------	1. 68	0. 14	0. 54	0. 32	0. 00	3. 21	1. 10	4. 75	0. 00	0. 00	------
1872	0. 00	1. 40	1. 60	1. 60	1. 20	5. 16	1. 40	. 60	. 10	. 50	1. 90	2. 60	18. 06
1873	. 00	. 00	. 84	. 20	6. 19	6. 61	2. 84	4. 05	4. 10	. 44	1. 40	1. 00	27. 67
1874	. 30	. 20	4. 00	. 00	1. 50	. 68	. 30	. 16	6. 26	. 04	3. 17	1. 98	18. 59
1875	. 21	2. 15	. 00	. 06	1. 05	. 05	. 56	2. 92	. 52	2. 60	. 96	. 66	11. 74
1876	. 47	1. 40	. 30	1. 12	3. 06	. 90	. 10	1. 95	4. 58	1. 27	. 05	1. 27	16. 47
1877	. 56	4. 48	. 62	3. 65	. 63	1. 17	5. 26	. 13	1. 98	. 81	. 52	6. 61	26. 42
1878	. 34	2. 03	. 93	. 87	4. 43	4. 39	3. 17	4. 30	4. 18	. 41	. 47	. 35	25. 87
1879	. 10	. 95	2. 05	2. 47	. 63	5. 12	. 14	3. 10	3. 08	. 69	. 03	. 29	18. 65
1880	3. 73	. 56	1. 14	. 68	2. 50	. 12	6. 68	5. 60	7. 16	2. 70	. 55	. 30	31. 71
1881	1. 15	. 34	. 32	. 87	8. 16	. 00	1. 74	1. 64	4. 99	6. 54	1. 57	. 72	28. 04
1882	1. 39	1. 60	. 77	1. 25	4. 98	1. 02	3. 54	6. 04	. 46	. 83	. 71	. 09	22. 68
1883	. 01	. 32	5. 59	1. 10	. 98	------	------	------	------	------	------	------	------
1889	4. 85	1. 06	1. 79	2. 65	1. 10	2. 03	5. 55	2. 85	5. 33	1. 26	. 90	. 10	29. 47
1890	. 28	. 22	. 08	4. 45	2. 65	6. 15	. 83	. 60	3. 96	. 27	1. 15	. 45	21. 09
1891	. 90	. 10	1. 46	1. 99	3. 65	1. 58	. 00	6. 50	1. 03	. 00	. 42	1. 34	18. 97
1892	. 25	. 00	. 96	. 00	2. 60	. 20	. 78	9. 10	1. 67	5. 30	1. 30	. 81	22. 97
1893	1. 01	. 32	. 31	. 11	1. 42	. 00	Tr.	1. 90	1. 66	. 00	. 19	. 11	7. 03
1894	. 39	. 05	. 03	. 93	5. 96	. 35	. 15	5. 97	6. 14	. 06	. 00	. 00	20. 03
1895	. 20	1. 75	2. 55	. 40	4. 80	3. 40	. 00	3. 32	5. 95	. 21	2. 15	. 00	24. 73
1896	1. 13	1. 65	. 00	. 40	2. 01	1. 52	3. 00	. 05	2. 14	3. 35	. 42	. 57	16. 24
1897	. 35	. 00	. 33	1. 01	3. 44	1. 50	. 15	1. 98	. 68	. 00	. 04	. 82	10. 30
1898	. 06	. 39	2. 98	1. 30	. 95	8. 55	1. 11	2. 76	1. 54	. 06	1. 75	. 96	22. 41
1899	. 00	. 00	. 00	. 00	3. 00	13. 50	. 00	. 00	6. 50	3. 00	2. 50	1. 33	29. 83
1900	2. 08	. 25	4. 00	8. 10	8. 15	3. 20	1. 70	2. 56	8. 20	5. 50	. 40	. 22	44. 36
1901	. 00	. 30	. 00	6. 45	2. 85	1. 40	. 00	. 42	1. 62	Tr.	1. 01	. 00	14. 05
1902	. 24	. 75	Tr.	. 45	2. 86	. 00	1. 02	. 00	4. 20	. 30	2. 92	3. 00	15. 74
1903	2. 80	2. 00	. 25	. 30	3. 25	5. 12	4. 00	. 40	4. 26	Tr.	. 00	. 40	22. 78
1904	. 00	. 15	. 00	------	------	------	------	------	------	------	------	------	------
1905	. 10	. 86	1. 02	5. 59	5. 88	2. 67	. 24	2. 40	1. 78	2. 30	2. 77	1. 65	27. 26
1906	Tr.	. 92	. 45	1. 08	4. 02	. 00	7. 01	3. 03	4. 40	1. 60	1. 30	. 24	24. 05
1907	. 25	. 08	. 02	. 32	2. 66	. 84	2. 20	. 00	5. 34	4. 61	2. 93	Tr.	19. 25

TABLE 4.—*Monthly, annual, and average precipitation, in inches, at Eagle Pass, Maverick County, Tex., March 1871 to May 1883 and January 1889 to December 1948*—Continued

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1908	.15	.50	.71	3.06	3.80	.10	1.35	3.62	.20	1.12	.92	.15	15.68
1909	.00	.11	.85	.35	1.71	.40	1.35	1.82	.80	.00	.64	.60	8.63
1910	.12	.03	1.30	2.22	.45	.05	.00	1.02	2.60	.47	.12	.14	8.52
1911	.20	1.92	2.22	.96	.30	.02	.08	2.13	.03	7.68	2.84	1.52	19.90
1912	.04	.37	.98	2.12	.75	8.73	2.70	.00	.71	3.15	1.19	1.95	22.69
1913	.34	.54	.29	.60	3.43	13.06	.11	1.82	1.70	4.33	3.58	.63	30.43
1914	.25	.55	1.21	1.51	7.37	.93	.38	2.50	.45	2.35	2.39	.50	20.39
1915	3.19	.48	.96	2.82	1.85	.44	.41	3.12	3.89	.10	.00	.05	17.31
1916	.62	.03	.08	.75	2.23	.11	7.48	6.19	.86	.27	.63	.00	19.25
1917	.48	.15	.18	.00	1.53	.76	.77	3.68	.76	.00	.22	.00	8.53
1918	.05	.05	.00	.83	3.91	3.74	Tr.	.29	.62	5.07	1.93	.82	17.31
1919	1.38	.49	2.91	4.29	2.16	3.19	5.88	4.23	7.29	4.74	2.12	.70	39.47
1920	2.30	Tr.	.07	.05	2.95	1.27	5.69	3.11	1.13	1.86	.78	.06	19.27
1921	.04	2.89	1.12	.26	2.07	2.44	1.58	.68	1.33	.12	.25	.51	13.29
1922	.17	.20	.34	3.25	3.98	5.38	1.99	.19	3.81	.60	.65	.00	20.56
1923	.45	4.82	2.89	1.37	.03	2.65	2.46	1.82	4.47	1.39	2.74	1.65	26.74
1924	.35	1.36	.54	2.60	7.14	1.45	.37	.00	3.79	.95	.01	.65	19.21
1925	.10	.00	1.20	1.14	12.72	.05	.02	.59	2.76	2.12	1.33	.88	22.91
1926	1.72	.17	1.43	7.16	2.73	.32	3.86	1.24	.42	3.51	1.02	1.33	24.91
1927	.97	1.33	.86	.42	.04	4.95	2.17	1.55	.34	2.54	Tr.	2.03	17.20
1928	1.01	1.43	.05	.88	3.71	1.31	1.56	1.85	12.24	.44	.40	1.03	25.91
1929	.30	.18	.94	.80	2.98	.36	1.36	Tr.	7.23	1.93	.45	1.79	18.32
1930	Tr.	.16	1.11	1.53	3.73	3.40	1.28	.05	.08	4.10	2.69	.43	18.56
1931	4.54	.57	1.47	.78	5.49	4.25	1.12	7.17	.00	.00	.32	2.61	28.32
1932	.27	1.87	.47	1.80	1.83	2.02	1.42	7.68	8.12	.04	.75	.65	26.92
1933	.68	1.08	.10	Tr.	3.21	2.16	.33	3.18	.76	1.63	.20	.24	13.57
1934	1.12	.07	.56	1.43	1.60	2.28	3.54	.05	1.70	.49	.06	1.52	14.42
1935	.54	.57	Tr.	2.63	8.90	4.19	5.58	.11	1.95	1.40	.78	2.45	29.10
1936	.14	Tr.	.69	1.44	2.44	16.38	2.16	1.09	3.41	2.09	.67	.52	31.03
1937	.18	.09	1.01	.23	1.51	.11	2.39	Tr.	.71	.98	.76	3.98	11.95
1938	1.84	.30	.68	5.89	.76	2.88	5.15	1.27	.74	.02	.23	1.28	21.04
1939	1.13	.07	.17	.45	1.36	.54	1.82	1.87	.44	2.77	1.32	1.26	13.20
1940	.36	1.80	2.33	2.53	8.06	2.83	.89	4.55	.11	2.16	1.03	1.24	27.89

1941	4. 98	2. 39	1. 77	2. 70	3. 68	. 84	. 72	1. 44	2. 54	. 26	. 30	. 51	22. 13
1942	. 66	1. 51	. 08	3. 73	3. 19	. 95	4. 37	1. 87	5. 62	. 18	. 10	. 70	22. 96
1943	. 53	. 23	. 03	. 68	4. 33	1. 18	1. 74	. 00	5. 83	3. 05	2. 16	1. 22	20. 98
1944	1. 52	. 39	. 54	Tr.	4. 85	. 23	. 22	7. 79	1. 27	. 87	. 92	1. 62	20. 22
1945	2. 70	. 78	1. 83	2. 54	2. 31	. 33	. 50	Tr.	. 93	2. 81	Tr.	. 07	14. 50
1946	1. 56	. 12	. 31	5. 19	4. 51	5. 16	. 00	1. 60	2. 55	1. 17	45	. 52	23. 14
1947	1. 82	. 14	1. 92	1. 20	3. 11	3. 47	. 73	2. 32	Tr.	. 78	1. 17	. 47	17. 15
1948	Tr.	. 94	. 06	. 56	1. 71	. 44	1. 97	. 14	5. 67	2. 14	. 91	. 02	14. 56
Average	0. 86	0. 79	0. 99	1. 71	3. 21	2. 55	1. 84	2. 24	2. 99	1. 71	1. 02	0. 92	20, 83

TABLE 5.—*Monthly, annual, and average precipitation, in inches, at Carrizo Springs, Dimmit County, Tex., 1912–17 and 1928–48*

[From records of the U.S. Weather Bureau]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	0.02	0.54	1.02	1.50	1.81	7.45	0.25	0.00	1.05	8.30	1.15	1.90	24.99
1913	1.43	1.75	1.70	1.15	.45	3.53	.45	Tr.	4.20	4.10	1.70	2.00	22.46
1914	.40	1.95	2.60	2.70	7.06	1.05	Tr.	1.75	2.00	3.80	4.70	.50	28.51
1915	2.00	.70	.51	1.65	2.00	2.70	.80	2.15	4.95	Tr.	.00	Tr.	17.46
1916	1.60	Tr.	.20	1.60	1.00	Tr.	5.40	9.44	5.95	.35	.50	Tr.	26.04
1917	Tr.	Tr.	Tr.	.00	.85	.45	2.00	2.50	1.32	.02	.23	.00	7.37
1928	1.16	1.22	.80	.94	3.24	1.01	2.13	1.52	5.48	.10	.30	1.16	19.06
1929	.23	.11	2.02	1.23	3.21	.85	.79	.00	1.05	2.62	.14	.55	12.80
1930	.16	.03	1.64	4.67	1.53	3.82	.33	.02	.29	4.04	2.66	.31	19.50
1931	4.74	.65	1.42	2.52	8.22	4.25	3.88	4.66	.00	.00	.20	3.33	33.87
1932	.61	3.48	.82	.46	1.19	.11	6.35	4.81	9.93	.54	.67	.57	29.54
1933	1.44	2.65	.34	1.12	1.33	.67	2.67	1.52	1.52	1.04	.21	.36	14.87
1934	3.49	.19	.61	3.21	2.02	.18	3.12	.78	2.56	1.32	1.96	2.49	21.93
1935	.27	.70	.93	1.19	1.35	4.27	2.69	2.03	2.80	.57	.45	2.21	19.46
1936	.18	.09	.32	1.30	3.93	4.52	1.78	2.16	8.22	1.46	1.40	.82	26.18
1937	.47	.20	1.23	.12	.95	2.14	1.42	.07	1.06	.80	.49	5.75	14.70
1938	1.17	.28	.34	1.61	1.29	1.70	1.68	.79	.55	.01	.05	1.29	10.76
1939	.85	.33	.19	.00	9.09	.40	2.25	2.69	1.92	3.22	1.55	1.13	23.62
1940	.43	1.72	1.10	3.43	6.58	5.62	.27	3.20	.19	.76	.86	1.68	25.84
1941	1.57	1.17	1.67	4.88	3.13	.79	1.01	1.97	3.82	1.39	.69	.55	22.64
1942	.69	1.11	1.86	.95	2.87	.85	2.64	2.34	8.32	.86	.26	.76	23.51
1943	1.06	.09	.13	.18	3.40	4.58	.96	.01	3.00	3.55	2.09	1.07	20.12
1944	.94	.67	1.04	.01	5.76	1.14	.04	11.38	.63	.33	1.51	2.01	25.46
1945	.95	.93	3.19	5.07	1.51	.61	.50	.37	7.34	8.54	.50	.28	29.79
1946	1.39	.22	.34	7.15	4.17	3.38	.68	2.83	3.12	3.15	.24	.84	27.51
1947	1.51	.05	.25	.98	5.29	3.23	.58	2.95	.16	1.20	.76	.74	17.70
1948	.18	1.37	.27	.74	3.26	4.57	.68	.02	3.20	6.69	.90	.92	22.80
Average	1.07	0.82	0.98	1.87	3.20	2.37	1.68	2.29	3.13	2.18	0.97	1.23	21.79

The annual trend of precipitation may be shown by a cumulative-departure curve for data collected at Carrizo Springs for the 21-year period 1928–48. (See fig. 5.) This is not the total period of record at the station, but it is the longest continuous period; no records are available from 1918 to 1927. During a 3-year period 1928–30, the precipitation was below normal and throughout 1931–32 it was above normal. From 1933 to 1938 the cumulative-departure curve was directed downward, indicating generally deficient precipitation, although in 1936 it was above normal. In 1939 the direction of the curve was reversed, but not until 1946 was the previous deficiency fully made up. During the 21 years of record, precipitation was below normal in 9 years, above normal in 11 years, and about normal for 1 year.

PURPOSE AND SCOPE OF THE INVESTIGATION

The use of water from a flowing well for irrigation as early as 1884 in the Winter Garden district was reported by Roesler (1890, p. 287). Large-scale pumping from the Carrizo sand commenced during the middle twenties and as a result the artesian pressure declined rapidly. In 1929 considerable apprehension arose among local water users as to the permanence of the underground-water supplies in the Winter Garden district. As a result the district was one of the first selected for study when a statewide investigation of the ground-water resources of Texas was begun by the U.S. Geological Survey in cooperation with the Texas Board of Water Engineers.

In 1929–30 W. N. White, A. G. Fiedler, P. P. Livingston, A. N. Sayre, S. F. Turner, T. W. Robinson, and Walter Lynch began various phases of an intensive investigation of the water resources of the Winter Garden district.

The broad phases of the investigation included the study of the geology and the water-bearing properties of the different rock formations in the Winter Garden district, the rate and direction of movement of ground water, the mutual interference between irrigation wells, the effects of withdrawals on artesian pressures, and the ultimate effects of ground-water withdrawals on the water resources of the district.

The investigation also covered other phases of the ground-water problem, such as the source of salt-water contamination in irrigation wells in parts of the district, the quality of the water that might be expected in different localities at different depths, and the depths to the chief water-bearing beds. In addition to the study of the ground-water supplies for irrigation, the investigation was designed to reveal all sources of ground water, including small supplies suitable for domestic or stock purposes.

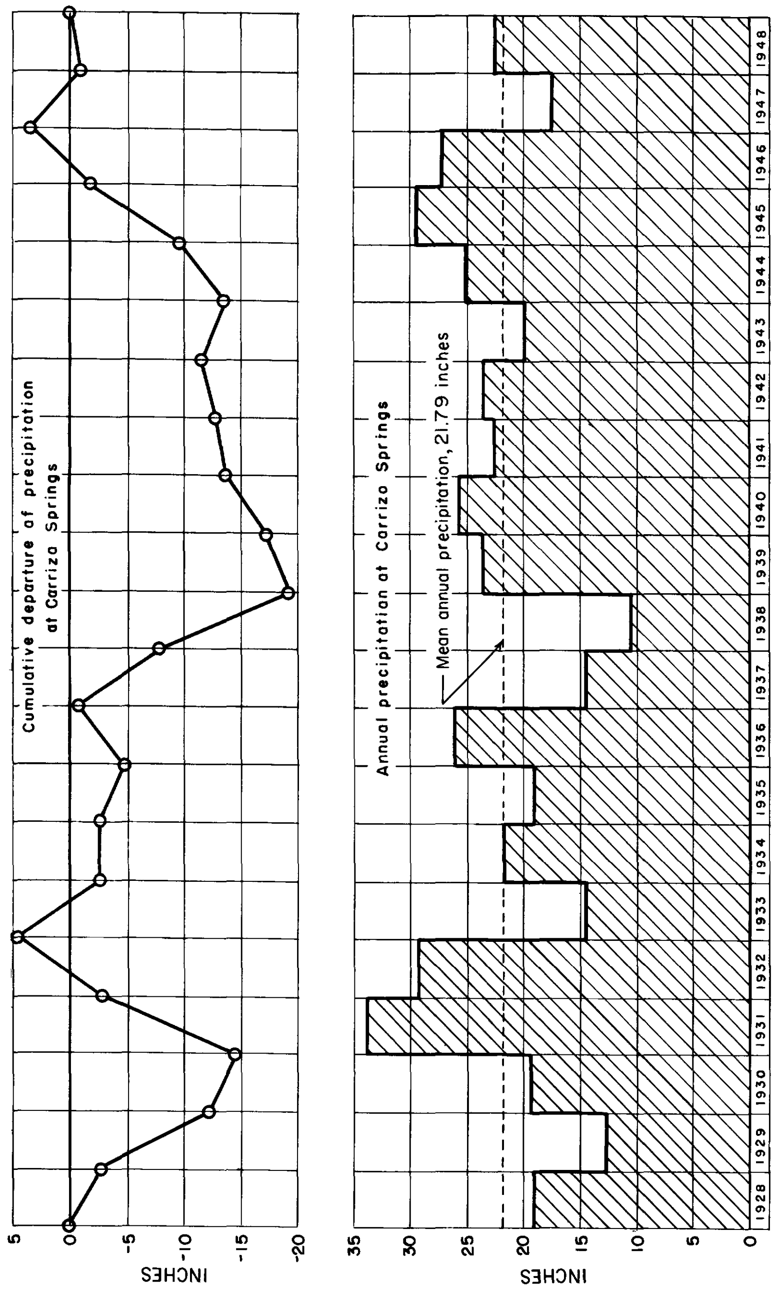

FIGURE 5.—Cumulative-departure curve and annual precipitation at Carrizo Springs, Tex., 1928–48. From records of the U.S. Weather Bureau.

The field investigation included an inventory of wells, pumpage, and land irrigated. Determinations of chloride content of ground waters were made in the field, and samples of water were collected for more detailed analysis by the Geological Survey in the laboratory at Austin, Tex. About 90 rock samples from wells and cores cut from outcrops of sands were collected for tests that were made in the Washington, D.C., laboratory of the Geological Survey. Pumping tests by the method of Thiem (1906) were made to determine the permeability of the Carrizo sand. About 60 wells were selected for periodic observation of water levels, about 46 of which have been measured at least once a year for a period of 20 years. Approximately 500 miles of levels were run to determine the altitudes of observation wells. A technique was developed for the detection of leaks in well casings by chemical and electrical methods. The areal extent of the Carrizo sand was mapped in order to estimate the recharge area, the thickness, and the altitude of the formation.

In February 1931 a comprehensive summary of the results of the investigation was prepared by White and Meinzer (1931). The investigation of salt-water leaks in irrigation wells that was started by Livingston and Fiedler was continued by Livingston and Lynch (1937). In 1938 Turner and Robinson prepared sections on a report on the district, but because of insufficient funds and the need of their services elsewhere, the manuscript was not completed.

In 1938–39 Livingston, assisted by Raymond Lynch, returned to the Winter Garden district to make additional tests for salt-water leaks in casings. During the same period G. H. Cromack obtained additional well records. In 1940 the well data obtained by Turner, Robinson, Livingston, Cromack, Walter Lynch, and Raymond Lynch were published (Robinson, Turner, and Cromack, 1940). A special investigation was made in the Leona River valley by Livingston (1947) to determine the relationship of ground-water and surface-water flow.

In 1947–48, after a period in which little was done on the project because of World War II, D. E. Outlaw brought the inventories up to date, made additional geologic studies which included stratigraphic correlation by means of electric logs, made additional hydrologic studies which included pumping tests, and revised the data of previous manuscripts. During the early part of this period, H. M. Babcock spent 3 months in the field obtaining hydrologic data, and R. W. Sundstrom supervised one of the pumping tests. W. O. George and others brought the report to its present form in the period 1949–56, the work on it having to be interrupted from time to time in order that other urgent projects could be completed. Information on the development of water from the Carrizo sand, the principal aquifer of the Winter Garden district, during the period through 1955 is given in an open-file report prepared by the Geological Survey in cooperation with the Texas Board of Water Engineers and the Nueces River Conservation and Reclamation District. The report was written by E. A. Moulder and is entitled, "Development of Ground Water from the Carrizo Sand and Wilcox Group in Dimmit, Zavala, Maverick, Frio, Atascosa, Medina, Bexar, Live Oak, McMullen, La Salle, and Webb Counties, Tex."

Both published and unpublished data from all phases of the investigations have been drawn upon in the compilation of this report. Descriptions of 1,196 wells, drillers' logs of 82 wells, records of water levels for 46 wells, and chemical analyses for water from 177 wells are given in tables 9, 10, 11, and 12, respectively. The locations of the wells are shown on plate 1.

The investigations were carried on under the administrative directions of O. E. Meinzer and A. N. Sayre, successive chiefs of the Ground Water Branch of the U.S. Geological Survey. The fieldwork was done under the supervision of W. N. White, W. L. Broadhurst, and R. W. Sundstrom, successively in charge of ground-water investigations in Texas. A large part of the revision of the manuscript was done under the direction and with the assistance of W. O. George and W. N. White of the Geological Survey.

PREVIOUS INVESTIGATIONS AND REPORTS

Among the early reports that include data on ground water in the Winter Garden district are those by Hutson (1898, p. 50–54), Hill (1901), and Taylor (1902; 1907, p. 51–52). With the exception of Hill's work, these reports were based on data obtained by correspondence and brief visits to the field.

Ground-water investigations that include studies in adjacent areas of parts of the ground-water reservoirs found also in the Winter Garden district have been made by Lonsdale (1935), Sayre (1936), and Lonsdale and Day (1937).

Of the purely geologic investigations, the works of Trowbridge (1923 and 1932) and Deussen (1924) are the most comprehensive. Trowbridge (1932) contains many references to earlier geologic publications pertaining to the Winter Garden district.

WELL-NUMBERING SYSTEM

The wells were numbered according to their location. The 30-minute quadrangles were assigned letters in order, beginning with the letter G at the upper left-hand corner (pl. 1). Each 30-minute quadrangle was subdivided into 10-minute quadrangles that were numbered consecutively, again beginning at the upper left-hand corner. Within each 10-minute quadrangle the wells were numbered consecutively as inventoried. For example, well N5–48 in Crystal City is in the 30-minute quadrangle designated N, in the fifth 10-minute quadrangle of N, and is the 48th well investigated in the 10-minute quadrangle.

ACKNOWLEDGMENTS

The writers are indebted to a number of well drillers, including the firms of Cribbs and Davidson (later Ira Cribbs), W. D. Morrison, E. L. Kite, O. F. Webb, and others who furnished logs of wells and collected samples of well cuttings; to the property owners who allowed the use of their wells for observation purposes; to the county officials of Dimmit and Zavala Counties who furnished office space without charge for several years; and to the California Packing Corp. and G. E. Whitney who allowed pumping tests to be made on their wells. Grateful acknowledgment is made to F. M. Getzendaner, consulting geologist, who made available the results of his extensive geologic studies in the district. L. W. Stephenson and Julia Gardner of the Geologic Division of the Geological Survey were consulted on geologic problems. Many others aided in one way or another throughout the extensive period of investigation, and their names are not intentionally omitted.

HISTORY OF IRRIGATION

The first recorded attempt at irrigation in the Winter Garden district was in 1876 when a dam built on the Leona River 2½ miles north of Batesville in Zavala County provided sufficient water to irrigate 500 acres of corn, oats, cane, hay, cotton, fruits, and truck-garden produce (Taylor, 1902, p. 67). The first flowing well in the Winter Garden district was completed at Carrizo Springs in 1884 at a depth of 165 feet (Roesler, 1890, p. 287). The owner was S. D. Frazier, and the flow of about 40 gallons a minute was used for domestic purposes and for the irrigation of about 4 acres of land.

By 1898 Hutson (1898, p. 51) reported a considerable amount of irrigation by windmills at Batesville and Carrizo Springs, some irrigation from flowing artesian wells at Carrizo Springs, and the irrigation of about 500 acres from flowing wells in Zavala County. Many of the wells did not penetrate the full thickness of the sand, and most did not yield enough water for large-scale irrigation. At this time, 1898, it was not known that larger yields could be obtained by deeper penetration.

The development of surface-water supplies for irrigation was accelerated about 1910 when two dams were constructed on the Nueces

River: the Taylor Dam at Bermuda about 7 miles east of Carrizo Springs and the Boynton Dam about 4 miles southeast of Crystal City. Bowie (1905, p. 456–457) states that the system at the Taylor Dam could irrigate 175 acres, 100 by gravity and 75 by pumping. He also states that 30 wells were reported to be supplying water for the irrigation of 1,026 acres in the vicinity of Carrizo Springs.

By 1907 Taylor (1907, p. 51–52) reported more than 60 flowing artesian wells in Dimmit County and 26 wells in Zavala County which were being used for stock and irrigation. By 1910, according to the Census Bureau, there were 250 irrigation wells in Dimmit and Zavala Counties, 35 of which were flowing wells.

In 1918 the Rancho de la Palma Dam was constructed about 5 miles northeast of Carrizo Springs to provide water for irrigation. The dam is at the lower end of Espantosa Lake, an old channel of the Nueces River which carries a part of the flow only when the river is at flood stage. During the decade 1920–29, however, ground water was used for irrigation more extensively than was surface water. This probably resulted from the increased efficiency of modern deep-well turbine pumps and the lack of storage space for surface water.

During 1929–30 a total of 27,000 acres was irrigated with ground water from 403 wells. In addition, 50 irrigation wells were equipped for pumping but were idle. During the same period about 13,000 acres was irrigated with both river and well water by 50 irrigation plants. At 29 of these plants standby wells were used when surface water was not available, and about 15 percent of the water was supplied from the standby wells.

A slight decline in the use of wells for irrigation took place in the 1930's because of unfavorable market conditions and the increased cost of lifting the water owing to the decline in artesian pressure. During the 1937–38 pumping season 394 irrigation wells were in operation and 27 wells were equipped but idle. The upward trend was resumed in the 1940's, and by the 1947–48 irrigation season 480 active wells were irrigating approximately 49,000 acres of land. In addition 96 wells were equipped for irrigation but were inactive. These figures include acreage and wells for both the Carrizo sand and the Leona formation.

In 1948 the Zavala–Dimmit Counties Water Control and Improvement District No. 1 completed a dam on the Nueces River about 6½ miles north of Crystal City providing storage for 7,590 acre-feet of water. A total of about 120 surface-water pumping plants in the two counties irrigated approximately 17,000 acres during the 1947–48 season. The total irrigated area in the Winter Garden district thus was about 66,000 acres.

GEOLOGY

GENERAL GEOLOGY

The rocks exposed in the Winter Garden district consist chiefly of clay, shale, sand, and sandstone, but in some places they include lenticular bodies of limestone and beds of gravel and silt. The oldest rocks exposed at the surface in the district are sandstone, shale, and limestone of Late Cretaceous age, which crop out in the extreme northwestern part of Zavala County and in a part of eastern Maverick County. The Cretaceous rocks were deposited in a shallow sea which was an embayment of the Gulf of Mexico. Beds of clay, shale, sand, and sandstone of early Tertiary age overlie the Cretaceous rocks and crop out at the surface in most of the district. The Tertiary rocks were deposited as detrital material at or near an oscillating shoreline. Gravel of Pliocene(?) age caps most of the hills and ridges. The gravel is the remnant of extensive flood-plain deposits laid down on the beveled surface of the older rocks. Gravel, sand, and silt of Quaternary age occur as valley fill and terraced deposits along all major streams. The deposits have been slightly tilted and broken by faults resulting from earth movements that have taken place intermittently since middle Cretaceous(?) time.

The relative position and thickness of the geologic formations and brief descriptions of their lithologic and water-bearing properties are given on page 24. In the present investigation only the outcrop pattern of the Carrizo sand and the Leona formation was mapped. (See pls. 1 and 4.) The cross sections (pls. 2 and 3) show the strata in profile. The Uvalde gravel, generally found on the tops of hills, was not mapped.

The Cretaceous and Tertiary formations crop out in crescent-shaped bands that roughly parallel the western and northern edges of the district. A traverse of the district from northwest to southeast crosses the outcrops of progressively younger formations. The rocks dip southeastward at an angle slightly greater than the slope of the surface; therefore, a formation that crops out in the northwestern part of the district will be penetrated at increasingly greater depths in wells toward the southeast.

The Carrizo sand is the chief water-bearing formation in the district. It supplies most of the ground water used for irrigation, public supply, and industrial purposes. The outcrop area of the Carrizo sand is shown on plates 1 and 4. Moderate quantities of ground water are obtained from the Leona formation, and small quantities from the Bigford member of the Mount Selman formation and the Indio formation. Water-bearing formations older than the Indio generally contain highly mineralized water and are too deeply

Generalized section of geologic formations in the Winter Garden district, Texas

System	Series	Group	Formation or member	Thickness (feet)	Lithologic character	Water-bearing properties
Quaternary	Recent		Alluvium		Silt, sand, and gravel in the stream valleys.	Locally yields small supplies of water to wells for domestic use.
	Pleistocene		Leona formation	0–75	Alluvial silt, sand, and gravel forming wide, nearly flat terraces in the stream valleys.	Many domestic and stock wells derive potable water from Leona formation in valleys of Leona and Nueces Rivers. About 6,800 acre-feet was pumped for irrigation during 1947–48.
	Pliocene(?)		Uvalde gravel	0–20	Mostly chert gravel, but contains some silt. Caps the hills and divides.	Yields no water to wells in the district.
			Cook Mountain formation	0–700	Chiefly medium-grained glauconitic, micaceous, and ferruginous sandstone, interbedded with dark clays and lenses of gray limestone. Marine fossils abundant.	Yields small supplies of water in southeastern Zavala County.
			Mount Selman formation: Post-Bigford beds	0–700	Mostly dark clays but a few thin beds of sand and limestone containing numerous concretions. Marine fossils rare.	Yields small supplies of highly mineralized water from a few ranch wells in eastern Dimmit and Zavala Counties.

Tertiary	Eocene	Claiborne	Bigford member	0–800	Dominantly gypsiferous sandy clay; contains many lenses of sandstone near the base; also contains concretions and a few layers of limestone. Marine fossils rare, but plant remains abundant.	Yields small supplies of good water in part of northern Zavala County. Elsewhere in the district the water is too highly mineralized for use.
			Carrizo sand	0–360	Mostly fine to coarse cross-bedded sand; contains clay lenses, sandstone, lignite, pyrite, and ironstone concretions. No marine fossils. Plant remains not abundant.	Yields more than 90 percent of the water pumped in the district. Many wells flowed, prior to heavy development for irrigation. During 1947–48 about 54,000 acre-feet was pumped and no wells flowed.
		Wilcox	Indio formation	0–1, 320	Dominantly gypsiferous clay, but contains many lenses and persistent layers of sandstone. Calcium carbonate and ironstone concretions are abundant.	Some stock and domestic wells yield small supplies of potable water. However, the water is generally highly mineralized and in some wells is unfit for stock.
	Paleocene	Midway	Kincaid formation	0–550	Chiefly dark shale, but contains lenses and layers of sandstone and limestone.	Yields no water to wells in this district.
Cretaceous	Upper Cretaceous (Gulf)	Navarro	Escondido formation	450–1, 300	Shale and fine-grained yellowish and brown sandstone layers, in places impregnated with asphalt.	Do.

Generalized section of geologic formations in the Winter Garden district, Texas—Continued

System	Series	Group	Formation or member	Thickness (feet)	Lithologic character	Water-bearing properties
Cretaceous—Con.	Upper Cretaceous (Gulf)—Con.	Navarro—Con.	Olmos formation	400–920	Shale, sandy shale, coal, and thin beds of sandstone.	Yields no water to wells in this district.
			San Miguel formation	300–800	Sand and sandy limestone grading upward into clay and sandy shale.	Do.

buried to be practical sources of water supply in the Winter Garden district.

STRUCTURAL GEOLOGY

The Winter Garden district is in the region where the dominantly easterly structural trends of the Balcones fault zone meet and blend with the dominantly northward-trending structural features of the folded areas of Mexico. The resulting structural features are broad, gentle flexures. The dips are low, generally not more than 60 feet to the mile, but in some places they are as much as 150 feet to the mile. The regional dip increases from the youngest to the oldest formations. The dip in northern Zavala County is southward, whereas in southern Zavala County and western Dimmit County the dip generally is eastward. As a result, in northwestern Zavala County the outcrops of the formations make a broad right-angle turn. (See pls. 1 and 4.)

Trowbridge (1932, p. 237) observed and named the La Pryor syncline and the Carrizo Springs anticline. The outcrop of the Carrizo sand swings in a broad arc around the northwestern end of the La Pryor syncline, which plunges gently southeast from an area about 15 miles south of the northwest corner of Zavala County. The syncline is clearly shown in the cross section on plate 2. The strata show no appreciable synclinal thickening; hence, the folding was evidently post-Carrizo in age.

The axis of the Carrizo Springs anticline passes through Carrizo Springs. (See pls. 1 and 4.) In Dimmit County the axis trends nearly east, but in Maverick County it probably swings northwest and may be an extension of the Chittim anticline described by Vanderpool (1930, p. 252). The anticlinal structure is shown by the position of the outcrop of the Carrizo sand, which in the vicinity of Carrizo Springs swings several miles east of its position to the north and south.

Numerous subsurface and surface normal faults have been mapped in the Winter Garden district. The presence of most of the subsurface faults is inferred from shortened sections within formations as indicated on electric logs. The throw of the faults generally is small, and at no place is the estimated throw sufficient to restrict completely the free movement of ground water. The faults are neither numerous enough nor large enough to cause major hydrological problems.

Trowbridge (1923, p. 104) describes two normal faults of small displacement, one about half a mile east of the old Jones ranch about 10 miles northwest of Crystal City and another on Chaparrosa Creek, 11 miles west of La Pryor. These faults were not observed in the field during this investigation and are not shown on plate 1.

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The contact of the Carrizo sand and the Bigford member of the Mount Selman formation in the Nueces River valley, 5 miles northeast of La Pryor, is marked by a northwest-trending fault of undetermined but probably small throw (pl. 1). A fault trending northeast was inferred from the reentrant in the Indio-Carrizo contact just east of the Nueces River, 7 miles north of La Pryor (pl. 1). Another fault trending northeast is well exposed in Bee Bluff on the east bank of the Nueces River, 3 miles southeast of the railroad bridge which crosses the Nueces River near the Zavala–Uvalde County line (pl. 1). In southwestern Dimmit County another fault may be seen on a small hill near Olmos Creek about 3 miles west of the Hamilton ranch house (pl. 1). Clay of the Indio formation crops out on the top of the hill, whereas the Carrizo sand crops out about halfway down the hill on the north side. The fault dips slightly toward the south and, therefore, is probably a small reverse fault.

ROCK FORMATIONS AND THEIR WATER-BEARING PROPERTIES

CRETACEOUS SYSTEM

The San Miguel, Olmos, and Escondido formations, all of Late Cretaceous age, crop out in a small section in the northwestern part of Zavala County and in the eastern part of Maverick County. These formations are described briefly on page 25–26; no further description is given here because none of the formations are known to yield water to wells in the Winter Garden district. None of the formations of Cretaceous age that underlie the San Miguel formation are known to yield water to wells in the Winter Garden district. It is reported that no water was obtained from the Edwards limestone of Early Cretaceous age in a test well (H8–75), 7½ miles north of La Pryor drilled to a depth of 3,065 feet.

TERTIARY SYSTEM

PALEOCENE SERIES

MIDWAY GROUP

The Kincaid formation named by Julia Gardner (1933) is the only formation of the Midway group in the Winter Garden district, the younger Wills Point formation of east Texas was absent. The Kincaid lies unconformably on and overlaps the rocks of Late Cretaceous age in the Winter Garden district. The type exposure of the Kincaid is along the Frio River on the old Kincaid ranch where about 100 feet of the section is exposed. Drillers' logs and electric logs, however, indicate an average thickness of about 200 feet in northern Zavala County and an average thickness of about 300 feet in Dimmit County.

The Kincaid formation consists of dark fossiliferous marine shale, sandy shale, sandstone, and sandy limestone. According to Sayre (1936, p. 59), the formation generally has a greenish cast owing to the presence of glauconite. Sayre also reports the presence of shark teeth, phospate nodules, and small rounded pieces of the underlying Escondido formation at the base of the Kincaid. The Kincaid is composed predominantly of impermeable rocks, and the cross sections on plates 2 and 3 show little change in lithology within the formation in the district.

The Kincaid formation crops out in northwestern Zavala County and in eastern Maverick County, but the full thickness is not exposed in the district because part of the formation is covered by the overlapping beds of the Indio formation. The Kincaid does not yield water to wells in the Winter Garden district.

EOCENE SERIES

WILCOX GROUP

INDIO FORMATION

The strata overlying the Kincaid formation and underlying the Carrizo sand were named the Indio formation by Trowbridge (1923, p. 90). The type locality of the Indio formation is on the old Indio ranch in Maverick and Dimmit Counties.

The Indio formation lies unconformably on and overlaps the Kincaid formation. The Indio crops out in a belt that extends northward from the Rio Grande through western Dimmit and Zavala Counties and eastern Maverick County and thence swings eastward to parallel the northern boundary of Zavala County (pl. 4). Although the outcrop is about 8–10 miles wide near the Rio Grande southwest of Carrizo Springs, it narrows to about 2–4 miles along most of the western and northern boundaries of Zavala County where the Indio is partly overlapped by the Carrizo sand.

The beds of sandstone near the base of the Indio are relatively resistant to erosion and form escarpments facing updip that persist for many miles. One of the escarpments, caused by the outcrop of a lime-cemented sandstone, crosses the Carrizo Springs-Eagle Pass highway near the Dimmit-Maverick County line. The upland formed by beds of the lower Indio grades into low featureless areas which have been developed on the less resistant clay and soft sandstone dominant in the middle and upper parts of the Indio. The upland formed by the lower part of the Indio usually is covered with grass and has little brush except along streams, whereas the lowland areas generally have a heavy covering of vegetation consisting of mesquite (*Prosopis juliflora*), guajillo (*Acacia berlandier*), black brush (*Acacia amentacea*), catclaw (*Acacia greggii*), and various types of cactuses and grasses.

The Indio is composed predominantly of thin-bedded and laminated argillaceous sand and arenaceous shale, but it includes some thick layers of clay, lenses and persistent layers of sandstone, discontinuous beds of lignite, and numerous calcareous, arenaceous, and ferruginous concretions. The laminated shale and shaly sand contain a fine yellow powder along the bedding planes. The powder has been identified as copiapite, ferric-sulfate mineral (Julia A. Gardner, oral communication, Nov. 1929). The clay and shale are greenish, bluish gray, or light chocolate brown and generally are gypsiferous. The sandstones are gray, yellow, brown, or red, generally medium to fine grained, and not notably crossbedded. Most of the calcareous and arenaceous concretions are flat or biscuit shaped. The ferruginous concretions are thin and are particularly abundant near the upper and lower contacts. In several localities the surface near the Carrizo-Indio contact is nearly covered with concretions.

The physical properties of samples of sand obtained from the Indio formation are shown in table 6. Results of laboratory analyses made on four samples of well cuttings (N6–2, R3–6, and S2–18) show that the largest percentage of sand grains is in the 0.25–0.125 millimeter range, and the next largest percentage is in the 0.125–0.062 millimeter range. These 2 groups comprise an average of about 75 percent of the 4 samples. The analysis of a core sample from the outcrop area of the Indio formation (table 6) shows that the sample is similar to the samples obtained from the wells. The sands of the Indio formation are similar to the fine-grained sand of the Carrizo sand and of the Bigford member of the Mount Selman formation. In general, however, the Indio has a greater percentage of fine-grained sand than the Carrizo.

Part of the Indio formation is of nonmarine origin but part of it is marine, as indicated by the presence of oyster shells and Foraminifera. (See Gardner, 1924, p. 141–145, and Trowbridge, 1923, p. 90–91.) Lignite is common throughout the formation, suggesting lagoonal conditions of deposition.

The upper part of the Indio in northern Zavala County contains thick lenses of water-bearing sand which are fairly extensive but do not appear to be continuous for long distances (pls. 2 and 3). The sand beds are neither as thick nor as permeable as the sand beds in the overlying Carrizo sand. Few wells are reported to have penetrated water-bearing sands in the middle part of the Indio. Some

TABLE 6.—*Laboratory tests on samples of sands from drilled wells and on cores taken from the surface outcrops in the Winter Garden district, Texas*

[Analyst, M. N. Short]

Well or core	Depth (feet)	Mechanical composition (percent [1]) for indicated mesh (mm)						Apparent specific gravity	Porosity (percent)	Moisture equivalent (percent by volume)	Specific retention (percent) [2]	Specific yield (percent)	Coefficient of permeability (gpd/ft [2])
		2–1	1–0.5	0.5–0.25	0.25–0.125	0.125–0.062	0.062						
Indio formation													
N6–2	2,075	None	0.7	2.0	51.6	28.3	6.6	----	----	----	----	----	----
	2,165	8.4	6.3	6.3	44.0	26.5	7.0	----	----	----	----	----	----
R3–6	230	3.0	3.0	9.5	54.0	21.0	8.0	1.44	----	9.0	----	----	38
S2–18	670	.5	.5	7.0	64.0	17.6	9.5	1.51	----	8.1	----	----	39
4	Core	1.3	3.8	6.0	53.3	26.8	7.3	1.44	42.6	11.5	13.5	29.1	24
Carrizo sand													
N6–2	1,450	None	5.0	70.0	16.5	1.5	1.5	----	----	----	----	----	----
	1,600	None	1.0	5.6	69.0	18.8	3.0	----	----	----	----	----	----
N7–18	200	2.5	6.9	41.5	30.0	8.5	9.7	1.61	----	6.8	----	----	25
29	(3)	2.0	8.0	40.9	38.3	7.0	4.0	1.65	37.1	.9	2.4	34.7	473
46	830	1.6	4.7	45.2	43.0	4.0	.7	1.61	41.6	2.5	5.2	36.4	412
	850	2.2	8.0	64.0	23.3	1.7	.1	1.64	38.8	1.4	3.5	35.3	683
	860	6.0	2.9	44.1	44.5	1.5	.1	1.59	41.0	1.9	4.4	36.6	609
	870	7.5	14.8	56.0	20.0	.6	.1	1.66	38.9	2.4	5.3	33.6	534
	880	2.0	9.0	57.9	28.9	1.1	.1	1.58	40.7	2.1	4.7	36.0	676
	940	2.5	5.9	23.0	58.4	11.0	2.0	1.55	41.8	2.4	5.0	36.8	275
	960	1.0	3.0	20.1	63.3	9.6	1.4	1.54	42.4	1.6	3.8	38.6	252
	980	.4	5.5	38.9	48.6	5.0	.9	1.58	40.8	1.3	3.2	37.6	329
	1,000	.1	2.7	29.8	56.2	8.9	1.7	1.60	42.3	2.4	5.2	37.1	335
	1,022	.1	2.6	30.0	57.7	8.0	1.5	1.64	38.8	1.3	3.2	35.6	321
51	78	.5	2.5	14.4	61.5	13.3	6.0	1.46	44.8	9.7	12.4	32.4	----
101	190	2.4	6.8	8.9	41.0	19.5	19.5	1.43	46.2	17.3	18.7	27.5	----
	285	6.1	7.2	8.0	21.0	37.0	18.7	1.41	46.6	10.2	12.7	33.9	----
	332	.5	1.5	26.0	40.5	22.0	7.0	1.47	45.1	2.0	4.4	40.7	----

See footnotes at end of table.

TABLE 6.—*Laboratory tests on samples of sands from drilled wells and on cores taken from the surface outcrops in the Winter Garden district, Texas*—Continued

Well or core	Depth (feet)	Mechanical composition (percent [1]) for indicated mesh (mm)						Apparent specific gravity	Porosity (percent)	Moisture equivalent (percent by volume)	Specific retention (percent) [2]	Specific yield (percent)	Coefficient of permeability (gpd/ft [2])
		2–1	1–0.5	0.5–0.25	0.25–0.125	0.125–0.062	0.062						
Carrizo sand—Continued													
N7–101	377	.1	1.2	37.7	44.0	9.5	6.0	------	------	------	------	------	------
	380	.1	2.4	59.0	27.4	5.9	4.5	------	------	------	------	------	------
N8–43	390	None	.1	1.1	73.5	17.9	6.5	1.46	44.9	2.2	4.7	40.2	176
	400	None	.1	2.2	75.0	13.0	7.8	1.54	41.8	3.1	6.2	35.6	79
	410	.1	2.8	23.7	51.1	14.5	6.7	1.52	43.0	2.7	5.5	37.5	158
	420	.5	1.5	24.0	49.0	12.0	12.0	1.51	43.6	7.2	10.2	33.4	3
	440	.1	1.5	24.0	49.0	10.2	9.0	1.52	43.0	3.4	6.5	36.5	56
	478	None	.2	13.3	55.5	18.4	10.9	1.48	44.0	3.2	6.1	37.9	33
	485	None	.1	10.4	67.8	13.0	6.0	1.48	45.0	3.4	6.4	38.6	78
	500	None	.1	13.8	59.9	19.5	6.0	1.52	43.4	1.9	4.4	39.0	148
	510	None	.8	21.0	52.0	18.5	6.0	1.49	44.2	3.3	6.3	37.9	95
66	302	1.0	1.0	1.9	60.7	23.0	13.1	1.52	43.3	8.1	11.2	32.1	20
	322	.7	.7	1.5	60.0	24.0	14.0	1.35	49.7	6.3	9.0	40.7	33
	342	.1	.2	.5	62.5	22.0	11.5	1.44	45.9	5.2	8.2	37.7	20
	350	14.9	30.2	36.4	17.3	.8	.1	1.73	35.4	1.0	2.7	32.7	1,440
	362	.2	1.0	4.9	34.9	48.0	10.5	1.48	44.8	2.9	5.8	39.0	155
	382	.8	1.1	1.2	40.2	44.6	12.0	1.43	47.0	3.9	6.9	40.1	82
	402	.9	1.0	1.3	45.0	38.6	12.0	1.43	46.6	3.6	6.5	40.1	------
S1–15	40	1.3	1.1	13.5	66.2	15.6	2.7	1.45	46.0	2.8	5.7	40.3	270
	50	.1	7.6	55.0	30.0	4.3	2.6	1.52	42.8	2.0	4.5	38.3	399
	60	.1	5.2	50.5	36.9	4.3	3.0	1.54	42.5	2.5	5.2	37.3	425
	70	.1	.8	29.5	49.4	14.9	10.0	1.45	45.9	6.3	9.1	36.8	121
	80	.5	1.0	44.2	46.9	4.5	2.5	1.50	48.8	1.8	4.1	39.7	567
	90	2.9	14.5	50.2	29.0	2.9	.8	1.62	38.6	1.0	2.7	35.9	464
	100	.5	4.9	34.0	39.0	12.0	8.6	1.60	32.2	9.0	12.1	20.1	76
	110	.5	2.5	31.0	54.4	8.0	1.9	1.59	40.9	1.3	3.2	37.7	373
	120	.3	1.5	14.0	69.1	11.1	2.3	1.54	42.3	1.6	3.8	38.5	416
	130	.5	1.0	10.1	72.0	13.0	2.5	1.51	43.3	1.9	4.3	39.0	433
	140	.2	1.0	11.0	70.0	14.7	2.0	1.51	43.7	1.9	4.3	39.4	355
	150	1.0	1.6	12.9	65.5	10.7	3.0	1.51	43.6	1.8	4.1	39.5	335

	160	.1	.8	20.5	67.8	7.9	2.5	1.53	43.0	1.1	2.9	40.1	435
	170	.1	.8	10.8	70.9	7.7	1.0	1.52	42.6	2.1	4.6	38.0	395
	180	.1	.8	15.5	73.0	8.9	1.5	1.54	43.0	1.5	3.6	39.4	422
	190	.1	1.0	20.0	66.8	9.0	2.0	1.54	42.8	3.7	6.8	36.0	411
	200	.1	13.1	60.3	29.9	3.5	1.2	1.71	36.2	1.2	3.1	33.1	480
	210	2.5	28.1	12.8	17.8	5.0	2.5	1.75	34.3	2.7	5.8	28.5	178
	220	3.5	28.0	45.0	15.8	4.0	2.5	1.70	36.8	2.6	5.6	31.2	256
	230	3.4	41.0	37.8	10.3	3.0	2.3	1.76	34.4	2.8	5.9	28.5	410
	240	4.1	34.5	41.0	12.7	3.7	2.8	1.76	34.7	2.0	4.7	30.0	762
	250	5.1	38.5	38.5	11.9	3.1	2.0	1.75	33.1	.8	2.2	30.9	610
	260	3.0	20.5	44.0	25.0	4.0	2.6	1.60	40.5	1.5	3.7	36.8	246
	270	2.0	17.2	52.3	23.0	3.0	1.1	1.67	37.5	1.3	3.2	34.3	625
18	120	5.4	13.0	41.0	28.0	7.2	3.8	1.55	46.0	7.0	8.0	38.0	26
	140	3.0	4.9	32.2	46.0	9.3	4.0	1.47	46.7	4.3	7.3	39.4	245
	160	2.4	2.0	4.5	68.0	18.9	3.3	1.42	47.5	4.9	11.5	36.0	148
	180	.2	.8	13.7	65.3	15.6	4.0	1.49	43.8	1.7	10.7	33.1	204
	200	1.0	11.2	42.5	27.0	9.2	8.0	1.62	40.3	3.4	11.8	28.5	32
	220	.1	1.8	18.9	54.0	17.0	7.7	1.54	42.6	2.8	11.4	31.2	83
	240	.5	1.6	21.0	58.0	11.0	7.0	1.55	41.9	1.7	13.4	28.5	154
	260	.2	1.2	14.1	67.0	13.6	4.0	1.54	38.5	1.2	8.5	30.0	187
	280	.2	1.0	13.0	66.8	14.9	5.0	1.51	43.0	1.3	12.1	30.9	170
	300	.2	4.0	40.1	48.1	5.8	2.1	1.55	42.4	.9	5.6	36.8	677
	320	.6	.9	20.2	64.9	10.0	1.5	1.52	43.3	1.6	9.0	34.3	307
S2–18	384	1.0	2.1	10.5	73.0	10.0	2.0	1.51	------	3.1	------	------	238
	465	3.6	8.7	10.0	53.5	20.0	3.0	1.55	------	8.0	------	------	151
6	Core	1.1	16.3	58.4	17.1	4.3	1.2	1.50	44.0	4.7	5.5	38.5	433
7	Core	1.6	16.4	58.0	13.0	6.0	3.0	1.54	42.3	7.1	10.2	32.1	100
8	Core	.6	4.6	20.4	51.0	18.0	4.0	1.48	45.3	3.3	6.3	39.0	116
9	Core	.3	2.0	8.5	83.0	3.9	1.5	1.43	46.9	6.9	9.7	37.2	251
10	(4)	4.0	35.6	44.5	11.2	2.0	1.6	------	------	------	------	------	------
11	Core	.1	2.0	57.7	35.4	2.0	2.2	1.44	45.9	3.7	6.5	39.4	259
12	Core	.1	2.7	21.1	64.6	6.7	3.4	1.42	47.7	3.8	6.7	41.0	113
13	Core	.2	1.5	50.0	47.4	38.9	5.5	1.45	45.6	3.3	6.2	39.4	75
14	Core	.1	.6	29.8	64.9	2.9	.9	1.43	46.8	3.9	6.8	40.0	285
15	Core	None	.2	19.0	73.7	4.8	1.5	1.44	46.7	3.4	6.3	40.4	265
16	Core	4.0	35.2	52.7	5.4	1.1	.2	1.42	46.9	4.3	7.3	39.6	217
17	Core	1.0	14.2	48.7	32.1	2.5	1.0	1.46	44.9	6.0	8.8	36.1	------
18	Core	7.4	42.2	40.7	5.9	2.0	.7	1.48	44.9	4.3	7.4	37.5	247
19	Core	.1	1.0	36.7	61.7	4.0	.9	1.41	47.4	2.9	5.6	41.8	363

See footnotes at end of table.

TABLE 6.—*Laboratory tests on samples of sands from drilled wells and on cores taken from the surface outcrops in the Winter Garden district, Texas*—Continued

Well or core	Depth (feet)	Mechanical composition (percent [1]) for indicated mesh (mm)						Apparent specific gravity	Porosity (percent)	Moisture equivalent (percent by volume)	Specific retention (percent) [2]	Specific yield (percent)	Coefficient of permeability (gpd/ft [2])
		2–1	1–0.5	0.5–0.25	0.25–0.125	0.125–0.062	0.062						
Mount Selman formation, Bigford member													
N6–2	775	3.6	7.1	45.4	36.3	3.8	1.6						
N7–101	145	3.5	12.8	7.3	16.3	33.3	24.8	1.38	47.7	20.3	20.7	27.0	
N8–123	809	2.0	7.5	8.4	23.5	44.0	13.5						
	820	1.9	7.0	30.0	50.0	7.5	1.5						
20	Core	.3	3.0	4.5	16.5	59.8	15.0	1.35	49.7	13.4	15.3	34.4	18
Mount Selman formation, post-Bigford beds													
21	([5])	0.2	9.6	21.5	39.5	16.9	10.8						
Cook Mountain formation													
N6–2	80	None	0.1	0.6	18.8	60.0	19.0						
	120	None	.1	3.0	26.0	50.2	18.0						

[1] Analyses were made by sieving a 100-gram sample through a set of United States Standard screens, then transferring the portion remaining on each screen to a balance and weighing. The weight of each portion is reported in percent although the sum of the different portions of the sample usually does not equal 100 grams, because the weight of each portion was rounded off to the nearest 0.1 gram.

[2] Obtained by a method proposed by Piper (1933).

[3] From composite sample from Carrizo sand at depths from 106 to 248 ft.

[4] Sandstone from the Carrizo sand just above the Carrizo-Indio contact at Brand Rock. Very coarse grained, crossbedded, and probably windblown.

[5] Sandstone from the Mount Selman formation in bed of creek just above spring, 7 miles north and 2 miles east of Crystal City.

Explanation of cores:

4. Core taken parallel to the bedding planes from the upper sandstone of the Indio, 2½ miles south of Pulliam's bridge on the west side of Nueces River, 15 feet below the Carrizo-Indio contact. Bedding prominently shown by many indurated and iron-stained layers.
6. Core taken perpendicular to the true bedding planes in the bed of a small wash, 200 feet east of Chaparrosa Creek, 1 mile north of the La Pryor–Eagle Pass road. The sandstone is highly crossbedded and probably windblown.
7. Core taken parallel to the bedding planes from a bluff on the west side of the Nueces River, about 20 feet above waterhole, 2.3 miles below the old Uvalde–La Pryor road crossing. This outcrop is probably in the lower part of the upper sand of the Carrizo. Bedding prominently shown by iron stains.
8. Core taken perpendicular to the true bedding planes in the bed of Chacon Creek, 100 feet below the road crossing, 1¼ miles east of the Burke ranch. Sandstone was very soft and contained much clay. Bedding very poorly shown by black sand grains.
9. Core taken parallel to the bedding planes from the Carrizo sand, in a bluff on the west side of the Nueces River half a mile above the old Uvalde–La Pryor road crossing. Bedding poorly shown by iron-stained layers.
11. Core taken perpendicular to the bedding planes from the Carrizo sand on the Nueces River 2 miles below the old Uvalde–La Pryor road crossing. Bedding very indistinct. Several root holes were noticed and top of core contained considerable dirt.
12. Core taken perpendicular to the bedding planes from the Carrizo sand on the Frio River, 4 miles below the Lewis ranch. Bedding and ripple marking shown by caliche layers.

Explanation of cores:—Continued

13. Core taken perpendicular to the bedding planes from the upper sand of the Carrizo about 7 miles northwest of Cometa. This is a water-laid, evenly stratified deposit. Bedding planes shown by many lenses of caliche and layers of iron-stained sand.
14. Core taken perpendicular to the bedding planes from the upper Carrizo sand at the Carrizo Springs–Dentonio road crossing on Carrizo Creek about 4 miles south of Carrizo Springs. This is a massive deposit with no apparent stratification and is probably water laid. Bedding shown only by faint iron stains.
15. Core taken parallel to the true bedding planes from the same locality as no. 14.
16. Core taken perpendicular to the true bedding planes from the lower sand of the Carrizo at the type locality at Brand Rock on Peña Creek, 5 miles west of Carrizo Springs. This is a very coarse crossbedded deposit and is probably dune sand. Bedding shown by very coarse layers.
17. Core taken perpendicular to the true bedding planes from the lower sand of the Carrizo near the type locality, 200 feet south of well N7-73. This sand is probably water laid.
18. Core taken parallel to the true bedding planes from same locality as no. 16.
19. Core taken parallel to the true bedding planes from the lower sand of the Carrizo, 300 feet north of well R3-9. This is a very crossbedded sandstone and is probably windblown.
20. Core taken from the Bigford member of the Mount Selman formation perpendicular to the bedding planes. The upper part contained considerable caliche. Locality is 1 mile northeast of Moore in Frio County, Tex., on the I. & G. N. RR. This core disintegrated when it came into contact with the water, so the core was practically loose sand. Fine bedding shown by mica and iron stains

thick water-bearing sandstones have been reported near the base, but they are believed to be lenticular in shape. Wells developed in water-bearing sands in the Indio formation are given in table 7, which gives also the depth to the top of the sand below land surface, the thickness of the water-bearing sand, and the reported quality of the contained water.

In the western part of the district where the sands crop out, small supplies of water can be obtained from the Indio. Electric logs indicate that downdip in southern Dimmit County the water in the sands in the Indio becomes highly mineralized.

TABLE 7.—*Water-bearing sands in the Indio formation in Dimmit and Zavala Counties, Tex.*

Well	Depth to top of sand below land surface (feet)	Thickness of sand (feet)	Reported quality of water	Well	Depth to top of sand below land surface (feet)	Thickness of sand (feet)	Reported quality of water
H7-4	130	20	Good.	N8-102	890	55	
	390	3	Do.		980	9	
	525	5	Salty.		1,035	7	
18	390	60			1,050	20	
19	392	53			1,105	60	
H8-5	140	5	Good.		1,197	8	
	170	65	Do.		1,210	7	
7	185	3		N9-24	1,250	5	
12	374	26		33	1,501	22	
16	580	68	Fresh.	R3-6	230	10	See analysis.
N2-19	1,340	55		S2-4	590	10	
N5-8	1,225	25			620	50	
12	910	25			677	15	
N6-2	1,900	70	See analysis.	18	650	20	Good.
	2,470	13	Do.	29	625	20	
N7-18	350	10		46	705	20	Good.
27	422	30			780	15	
29	336	16			880	20	
32	668	25			1,235	5	
36	100	------			1,505	80	Salty.
72	130	10	Salty.	47	545	20	
77	127	18			660	10	
	215	15		50	835	10	
N8-97	880	5		91	1,284	23	
101	954	21			1,342	43	
	1,056	44		S6-5	1,712	7	

CLAIBORNE GROUP

The Claiborne group in the Winter Garden district includes the Carrizo sand, the Mount Selman formation, and the Cook Mountain formation. The Yegua formation, the uppermost formation of the Claiborne group, crops out in Frio and La Salle Counties but is not present in the Winter Garden district.

CARRIZO SAND

The name Carrizo, from the town of Carrizo Springs, was applied by Owen (1889, p. 70) to the thick, massive sand layers that lie disconformably on the clays of the Indio formation. There is no type locality for the Carrizo sand, but Plummer (in Sellards, Adkins, and Plummer, 1932, p. 614) has suggested that the type locality be designated at Brand Rock on the east bank of Peña Creek, about 5 miles west of Carrizo Springs.

The disconformable relationship between the Carrizo sand and the Indio formation is clearly shown by several exposures, and in some places conglomerate is found at the base of the Carrizo. The Carrizo may be seen lying on the eroded surface of the Indio formation at Bee Bluff on the east side of the Nueces River about 3 miles south of the Uvalde County line. The basal conglomerate is well exposed on the west side of the river a short distance downstream from Bee Bluff. The contact is irregular for about a mile along Comanche Creek near the western boundary of Zavala County and can be seen at several places in the banks of the stream.

The Carrizo crops out in a belt extending in the western part of Dimmit County from the Rio Grande almost to the Zavala County line, where the outcrop swings in a wide arc through eastern Maverick County and thence eastward along the northern boundary of Zavala County. Near the Rio Grande the belt of outcrop is about 2–3 miles wide. In the vicinity of the Carrizo Springs anticline, west and southwest of Carrizo Springs, the outcrop has a maximum width of about 6 miles, and in the remainder of the area the width ranges from less than a mile to about 3 miles. (See pls. 1 and 4.)

In general, the relief is greater in the area of outcrop of the Carrizo sand than in the adjacent areas underlain by less resistant clay and shale of the Indio and Mount Selman formations. The topography is not rugged although in some places quartzitic masses form rather prominent hills. The poorly cemented sand that composes most of the Carrizo weathers rapidly, and the resulting surface is gently rolling. Sand dunes are numerous, and the unimproved roads crossing them are often impassable by automobile. The drainage in the dune areas is poorly developed.

Most of the creeks that cross the area of outcrop of the Carrizo head on the outcrops of the Indio formation or of the Cretaceous formations. Small closed drainage basins, some of them covering more than 50 acres, are found on the outcrop of the Carrizo. Storm waters form ponds in these depressions during exceptionally heavy rains. Most of the ponds disappear in 2 or 3 days, but the beds of some of them have become covered with silt, and these hold water for weeks or even months.

The vegetation on the Carrizo outcrop generally is sparse. Although mesquite trees are common, they generally are widely spaced, giving the outcrop an open appearance. The area of outcrop supports a fairly vigorous growth of grass, and in the spring it is carpeted more abundantly with brightly colored flowers than are the outcrops of other formations in the district.

The Carrizo sand consists of beds of massive commonly cross-bedded loosely cemented remarkably clean sand and some minor amounts of sandstone and clay. The sand is composed chiefly of grains of quartz ranging from a fraction of a millimeter to more than 5 millimeters in diameter. In general, the sand grains are coarse near the base of the formation and somewhat finer near the top. In many places the upper part contains fine-grained stratified sand and a few lenses of gray, brown, and brownish-red clay and sandy shale. In general, the sand is loosely cemented and weathers readily to incoherent sand, but in some places on the outcrop certain layers or masses of the rock are firmly cemented with silica, commonly iron-stained, and have the appearance and character of pink quartzite. In a few places, such as along Picoso Creek in Maverick County, the upper part of the Carrizo is cemented with calcium carbonate; but on the whole, calcareous material is rare. Ferruginous concretions are abundant in the formation in some localities. The Carrizo is a continental deposit. Poorly preserved fossil leaves have been found in some of the thin-bedded sands and clays, but neither invertebrate nor vertebrate fossils have been found in the Carrizo in this district. Lignite has been reported by drillers in several wells in the Carrizo, but it is probably rare. Copiapite, of common occurrence in the Indio formation, is relatively rare in the Carrizo. It is found in the form of a yellow powder along the bedding planes of some of the thin-bedded sand and sandy shale.

The purity of the quartz sand constitutes one of the chief criteria for differentiating sand beds of the Carrizo from the sand beds of other formations. The sands of the underlying Indio formation and of the overlying Bigford member of the Mount Selman formation commonly are lime cemented, contain considerable mica, and have appreciable amounts of such heavy minerals as magnetite, tourmaline, and garnet. In Webb County, Lonsdale and Day (1937, p. 17) found 2–3 percent of clay, carbonates, and heavy minerals in the Carrizo; and a petrographic examination by M. N. Short of the U. S. Geological Survey of 5 samples of the Carrizo from the Winter Garden district (nos. 6, 9, 13, 14, and 16 in table 6) showed that quartz constitutes at least 95 percent of the volume of each sample. The remainder consists of muscovite mica and partly kaolinized feldspar. No heavy minerals are present. Short examined in more detail a sample from Brand Rock, the proposed type locality of the Carrizo, on the east bank of Peña Creek about 5 miles west of Carrizo Springs. No fraction of this sample, which had previously been crushed, sank in a bromoform solution having a specific gravity of 2.83. The proportion of heavy minerals in the sand, therefore, must be very low, if not zero.

The coarse-grained sand in the Carrizo is much coarser than the sand in other formations in the district. The fine-grained sand is similar in mechanical composition to fine-grained sand in the Indio formation and in the Bigford member of the Mount Selman formation. The results of mechanical analyses of 89 samples from well cuttings and outcrops of the Carrizo sand in different parts of the district are given in table 6. A comparison of these analyses with similar analyses showing the mechanical composition of sand from the Indio formation and the Bigford member leads to the conclusion that it is impossible to differentiate by means of mechanical analyses between the fine-grained sand of the Carrizo and those of the Indio and Bigford.

An excellent exposure of the lower part of the Carrizo sand is at Brand Rock, on Peña Creek west of Carrizo Springs. Brand Rock is an expanse of rock of about 2 acres which has been swept clean of loose sand and dirt by wind and water. The sand, which is very coarse and generally well sorted, contains some grains of quartz as large as 5 millimeters in diameter. The sand grains are rounded to subangular and are polished. The whole deposit is strongly crossbedded. (See fig. 6.) Section is given below:

Carrizo sand:	*Feet*
Sandstone, white, crossbedded	25
Clay of gumbo, blue, very sticky	8
Clay, gray, sandy, containing irregular iron-cemented concretions, partly concealed	6
Sand, white and gray, thin-bedded, argillaceous sand, and sandy clay	12

An exposure of coarse crossbedded sand in the upper part of the Carrizo may be seen on Chaparrosa Creek, three-quarters of a mile north of the crossing of the Eagle Pass–La Pryor road and about 9 miles west of La Pryor. (See fig. 7 and sample 6, table 6.)

A few sandstone beds are found in the Carrizo sand. Fine-grained thin-bedded somewhat lenticular sandstones are well exposed in Bell quarry, 2 miles southwest of Carrizo Springs (fig. 8), and a massive fine-grained sandstone, apparently 40–50 feet thick, crops out on Carrizo Creek just east of the Carrizo Springs–Dentonio road.

Beds of clay are not common in the area of outcrop of the Carrizo sand. Clay and sandy shale may form a larger part of the Carrizo than is apparent, however, because such beds may be covered by sand

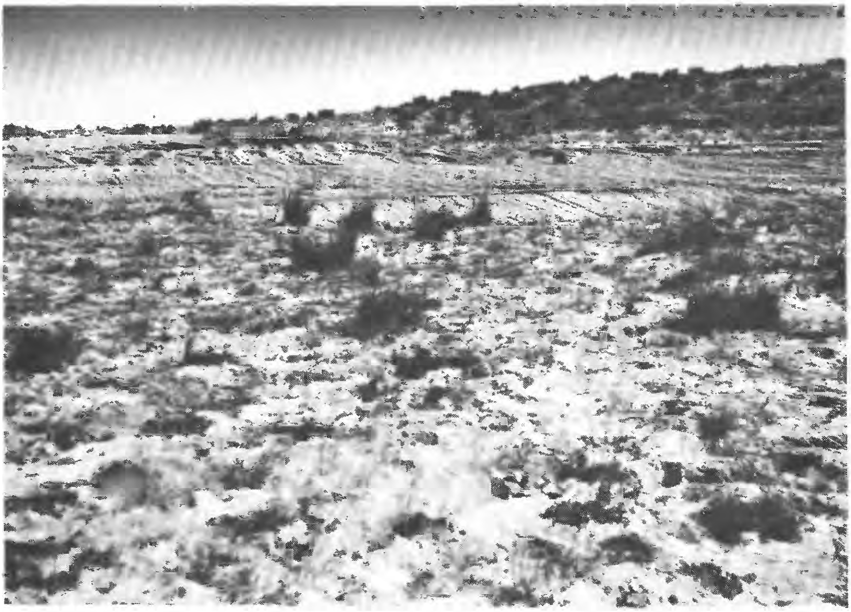

FIGURE 6.—Crossbedding in the Carrizo sand. Outcrop near Brand Rock on Peña Creek, Dimmit County, Tex.

which is readily spread by wind and rain over the adjacent areas of outcrop. Well logs in the Winter Garden district show beds of clay in the Carrizo near the outcrop. Lenses of clay appear to increase in number and thickness as the formation thickens to the southeast (pl. 3). A study of the logs of 175 widely spaced wells penetrating the Carrizo showed that no clay bed was noted in 65 wells, 1–2 clay beds were found in 99 wells, 3 clay beds were found in 7 wells, and more than 3 clay beds were found in 4 wells. The clay beds range in thickness from 1 to 80 feet and average about 20 feet.

In places certain beds in the Carrizo sand have been indurated to quartzite by secondary cementation of sand grains by silica. The quartzite generally ranges from pink to deep red. Some of the quartzitic masses, such as the one on Mustang Creek at the Uvalde–La Pryor road crossing appear to have been formed along fairly definite lines that can be followed as far as a mile. Hypothetical faults have been mapped by some geologists along the outcrops of the quartzite. Theoretically, deep-seated solutions rich in silica have moved upward along fault planes and the silica was deposited in the sand. Other quartzitic masses are localized, such as those forming Chimney Rock, on the Red ranch 12 miles southwest of Carrizo Springs, and Castle Rock, on the Chupadero ranch 25 miles southwest of Carrizo Springs. A quartzitic mass about 25 feet wide on the

FIGURE 7.—Crossbedded Carrizo sand. Outcrop on Chaparrosa Creek, three-quarters of a mile north of the crossing of the Eagle Pass–La Pryor road and 9 miles west of La Pryor, Tex.

Williams ranch, 6 miles northwest of La Pryor, is shown in figure 9. The outcrop consists of a dome-shaped mass of crossbedded and coarse-grained sandstone that breaks across the grains. Thin hard-rock layers of "shell" are often reported in wells drilled through the Carrizo sand near the quartzite outcrops. This suggests that the secondary silica may extend for some distance downdip. The "black basalt rock" indicated in the log of well M3–6 and the "shell" in the log of well M3–20 may be quartzite. (See table 10.)

Two types of iron concretions are abundant in the Carrizo sand in a few localities. One type, which may be irregularly shaped, round, or spheroidal, consists of sand grains cemented by iron carbonate (siderite). These concretions range from a quarter of an inch to 3 inches in diameter and some are aggregated into irregular masses. Near the base of the Carrizo sand on the east side of the Nueces River, 6 miles north of La Pryor, the valley slopes are nearly covered with spherical concretions. When these concretions are broken, loose sand pours out from the center. Concretions found in several localities in eastern Maverick County generally are less than 1 inch in diameter and are irregular in shape.

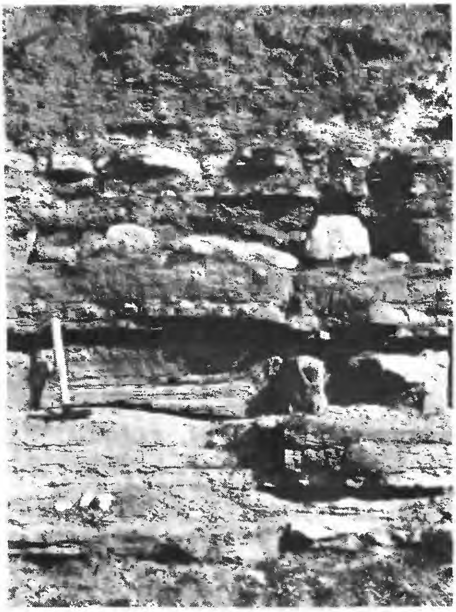

FIGURE 8.—Fine-grained Carrizo sand. Outcrop in the Bell quarry, 2 miles southwest of Carrizo Springs, Tex.

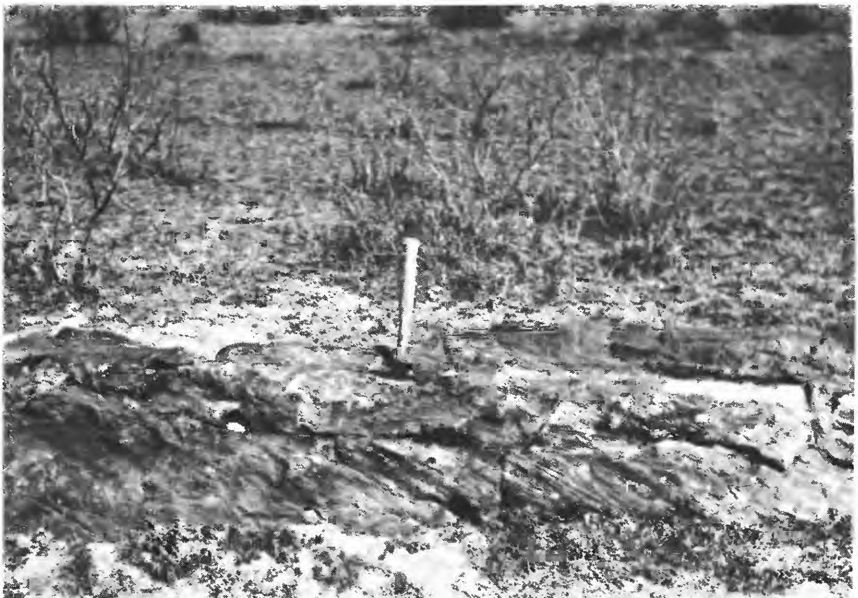

FIGURE 9.—Indurated quartzitic Carrizo sand. Williams ranch about 6 miles northwest of La Pryor, Tex.

The second type of concretion is in stalagmitic form, generally irregular, but occasionally spherical and appears to be relatively pure limonite. These concretions resemble castles having columns up to 1 inch in diameter and 3–4 inches in height, and are most abundant at the contact with the Indio formation. In most places, however, iron concretions cannot be found at the contacts or elsewhere in the Carrizo sand.

Some of the beds in the Carrizo sand are highly ferruginous, and they weather to a brick red. Other beds that contain only small quantities of iron are gray or white. Hard layers 1–2 feet thick containing pyrite are found in some wells at the top of the first water-bearing sand, just below the contact between strata of clay and sand within the Carrizo. At well N8–10 layers of sand cemented partly by lime and partly by pyrite were penetrated with difficulty by the drill.

The average thickness of the Carrizo sand in the Winter Garden district, as determined from the logs of 153 widely spaced wells, is about 200 feet, and a thickness of more than 300 feet was logged in 8 of the wells. The logs show that the formation increases in thickness from northwest to southeast. The average thickness is 130 feet in the northern part of the district, 200 feet near Crystal City and Carrizo Springs, 225 feet near Asherton, and 250 feet near Catarina.

The dip of the Carrizo differs from place to place in the district but averages about 60 feet to the mile. The direction of dip generally is southeast, but owing to structural irregularities, it differs from north-northeast to south.

Close to the outcrop the beds of sand in the Carrizo are massive and comparatively well defined, but downdip the individual sand beds commonly are thinner and are separated by shale beds. Shale beds, however, are indicated in all the electric logs on the cross sections in plates 2 and 3.

The Carrizo sand is the principal water-bearing formation of the Winter Garden district, furnishing about 90 percent of the water used for irrigation and nearly all the water used for domestic purposes during 1947–48. The occurrence of water in the Carrizo sand, including the percolation of the water into the formation and its movement and discharge, the artesian head, the ability of the sand to transmit water, and the chemical character of the water, are discussed in greater detail in later sections of this report.

MOUNT SELMAN FORMATION

The name Mount Selman, from the town of Mount Selman in Cherokee County, Tex., was applied by Kennedy (1892, p. 52–54) in 1892 to the lower part of the "marine beds" that lie on the Lignitic group of Kennedy (Carrizo-Wilcox) and under the Yegua formation. The name Cook Mountain was applied to the upper part of the marine beds.

In the Winter Garden district the Mount Selman formation lies with apparent conformity on the Carrizo sand. The lower part of the Mount Selman was named and defined by Trowbridge (1923, p. 92) as the Bigford formation. After a detailed study in Webb County by Lonsdale and Day (1937), the lower part of the Mount Selman was classified as the Bigford member of the Mount Selman formation and the upper part of the Mount Selman was called post-Bigford beds. The same terminology is used in this report.

Bigford member

In the Winter Garden district the contact between the Carrizo sand and the Bigford member generally has been drawn between the clean massively to thinly bedded sand at the top of the Carrizo and the clayey to sandy shale at the bottom of the Bigford. Exposures of this contact are visible on Carrizo Creek beneath the bridge on the Asherton road half a mile south of Carrizo Springs; on Comanche Creek, 13½ miles west of Crystal City; on Elm Creek, 1 mile northeast of the Burke ranch; and on the Nueces River, 2½ miles below the old Uvalde–La Pryor crossing.

At some places the contact between the Carrizo and the Bigford is not well defined, especially where the top of the Carrizo is in contact with a sand of the Bigford member. Apparently the sand from the Carrizo has been reworked to form the basal sand beds or lenses of the Bigford (fig. 10). Such sands easily could be mistaken for the Carrizo sand and be so recorded in drillers' logs. The water from these sands could be fresh, whereas most water from the Bigford is highly mineralized.

The Bigford member crops out in a belt trending northward through Dimmit County and southern Zavala County, thence eastward through northern Zavala County into Frio County (pl. 4). Southeast of Carrizo Springs and northwest of Crystal City, where the dip is comparatively low, the outcrop of the Bigford is about 12 miles wide, whereas at the Zavala-Frio County line the outcrop is only about 2 miles wide.

Resistant sandstone beds in the lower part of the Bigford member form distinct scarps, some of which extend for several miles. Where clay beds are interbedded with resistant sandstone beds, the scarps are rugged. The Mills bed of Getzendaner (1930, p. 1436) stands out as a north-facing scarp across northern Zavala County and as a west-facing scarp through western Zavala and Dimmit Counties.

FIGURE 10.—Sandstone in the Bigford member of the Mount Selman formation. Sandstone contains reworked sand from the Carrizo, exposed in a tributary of El Barroso Creek, 4 miles south of Carrizo Springs, Tex.

The scarp, especially prominent near Dentonio, is also seen about halfway between Carrizo Springs and Crystal City.

The vegetation on the outcrop area of the Bigford is very much the same as that on the Indio formation. Mesquite grows thickly, guajillo, catclaw, and cactus are generally thick, but small shrubs and grass also thrive.

In the Winter Garden district the Bigford member consists chiefly of clay, which is generally calcareous and of many colors. It contains subordinate amounts of gray or brown sandy clay and sandstone; many beds of lignite, some as much as 3 feet thick; a few "paper" shales and sands, such as are present in the Indio formation; and a few thick coarse-grained crossbedded quartzitic sand beds, similar to those in the Carrizo sand. The Bigford also contains many beds, lenses, and concretions of yellow limestone and some thin beds of hematite. Many beds contain gypsum that weathers out in thin plates or as very small twinned crystals of selenite. Cone-in-cone structure is fairly common in the clayey beds in which calcareous and argillaceous materials are about equally mixed.

The sandstone for the most part is fine grained, containing much mica, many grains of heavy minerals, and a small amount of glauconite. The sand grains are clean and well rounded and range from pink to maroon. Most beds are thin to massive, but several layers of fine-grained lime-cemented crossbedded sand have been observed. Some of the layers, however, are poorly cemented. The sandstone beds are relatively much thicker and coarser grained near the base of the member.

A very hard lime-cemented gray sandstone, 6 inches–2 feet thick, is an excellent marker about 25–50 feet above the Carrizo-Bigford contact. This bed extends for more than 50 miles in western Dimmit County and Zavala County. In many places a layer of irregularly banded ironstone of varying thickness was found directly underneath the sandstone. The following description is of an outcrop on the Carrizo Springs–Eagle Pass highway, about 8½ miles northwest of Carrizo Springs, where beds of very hard sandstone are exposed on each side of the road.

Bigford member of the Mount Selman formation	*Feet*
Sandstone, very hard, fine-grained, lime-cemented; consists of quartz, but contains many grains of limonite; breaks with subconchoidal fracture; unweathered surfaces are gray, but weathered surfaces are light yellow	1–2
Sandstone, softer, lime-cemented, crossbedded	1
Ironstone, argillaceous, conglomeratic, containing calcite; weathers in parallel or concentric bands of brown and yellow	½–2

The mechanical analyses of five samples from the Bigford member (table 6) indicate marked variations in the distribution of grain sizes in the different well cuttings. Most of the grains, however, are 0.25 millimeter in diameter or smaller. The distribution of grain size of the fine-grained sand in the Bigford member is similar to that of the fine-grained sand in the Carrizo sand and Indio formation.

The lime concretions in the Bigford are predominantly lens shaped and are a distinctive mustard yellow. The smaller concretions are commonly formed about a leaf or twig. Large lenticular concretions containing cavities and veins filled with deep-yellow calcite crystals are found near the top of the member. Siderite is present in some of the concretions, and in a few localities limonite or marcasite is found as more or less spherical concretions 1–2 inches in diameter in hard lime-cemented sandstone. Small irregularly shaped iron concretions were found at a few contacts of the sandstone and clay.

Layers of ironstone occur in the Bigford, but they are thin and the parallel banding resembles the grain in wood. On the surface the exposures resemble brick pavements because of a tendency to crack into uniform-sized blocks. The ironstone contains much hematite associated with limonite, siderite, and clay.

Fossil leaves and leaf imprints are fairly well preserved in some of the thin-bedded argillaceous sand and carbonaceous shale beds in the Bigford member. Trowbridge (1932, p. 66) described a small collection of molluscan fossils and fish scales taken from the Bigford near Dentonio. Getzendaner (1930, p. 1436) states that several mussel shells belonging to the fresh-water genus *Unio* have been found in the Bigford. Unidentifiable fragments of fossils have been taken from the Bigford at several localities. Although no guide fossils have been described from the member, Lonsdale and Day (1937, p. 19–21) reported 8 fossil zones in the Bigford in Webb County, 2 of them traceable across the county.

The electric logs (pls. 2 and 3) indicate that shale and sandy shale predominate in the Bigford member in Zavala County, but to the south in Dimmit County the member becomes predominantly sandy. Throughout nearly all the Winter Garden district the Bigford contains highly mineralized water. The upper part of the Bigford in the district closely resembles the post-Bigford beds of the Mount Selman formation, and, it is therefore almost impossible to determine the thickness of the Bigford from well logs. It is estimated that the Bigford has a minimum thickness of about 400 feet near the outcrop and a maximum thickness of about 800 feet downdip in eastern Dimmit County.

The sand and sandstone beds in the Bigford member are relatively thin, rarely exceeding 30 feet. In the northern part of the district near La Pryor and Batesville, a few shallow stock and domestic wells draw their supply from the Bigford. Several of the wells were formerly pumped for irrigation and yielded as much as 100 gallons a minute without excessive drawdown. The town of La Pryor was formerly supplied from a well in the Bigford, but the well has been deepened and now draws from the Carrizo sand. South of La Pryor wells penetrate sands in the Bigford that generally are of low permeability and yield small quantities of highly mineralized water only. In general, the sands of the Bigford are thin, probably lenticular, and do not yield large amounts of water.

Nearly all the water in the Bigford is under artesian pressure; however, no flowing wells have been reported. The outcrops of the water-bearing sands are narrow in most places, and the amount of recharge to them is probably small. The sands may lens out or decrease in permeability, and many of them probably have no surface outcrop.

Post-Bigford beds

The post-Bigford beds of the Mount Selman formation crop out in a broad belt in the central and eastern parts of Dimmit and Zavala

Counties (pl. 4). The width of the outcrop belt diminishes northward from 23 miles at the Dimmit-Webb County line to 16 miles near the Dimmit-Zavala County line, and about 12 miles at the Zavala-Frio County line.

The following lithologic description of the post-Bigford beds is chiefly from the observations of Trowbridge (1932). The post-Bigford beds are lithologically similar to the beds of the Bigford member but are composed chiefly of clay, a few relatively thin ledges of sandstone and gray limestone, and beds of coal, either lignitic or bituminous. The clay is gray, black, greenish gray, and bluish gray where fresh and yellow or buff where weathered. Some of the beds are sandy, others are limy, but most of them consist chiefly of stiff, compact clay, plastic and sticky when wet, hard and brittle when dry. The beds of clay contain large quantities of gypsum as lenses, stringers, joint fillings, and irregular aggregates of crystals. The thin ledges of sandstone and limestone serve to protect the underlying clay from erosion and provide some relief in a topography that is otherwise monotonously flat. The exposed sections probably exaggerate the proportion of sandstone because outcrops occur only where lenses of the more resistant materials are abundant. Some of the sandstone lenses, most common near the base of the post-Bigford beds, are 25–30 feet thick. They contain fine to coarse quartz grains of sand and small amounts of mica and glauconite; they are fairly well indurated but are not quartzitic.

Many calcareous concretions are distributed throughout the post-Bigford beds, but they are found chiefly in clay and shale. Most of the concretions are composed of compact fine-grained pure almost lithographic limestone. The exterior of the concretions is pale yellowish gray or buff; on the inside they are light chocolate brown or gray, and the septarian fractures are filled with calcite. They range in diameter from about a quarter of an inch to about 6 feet; some are cylindrical; some are biscuit shaped; some are irregularly nodular; and some are spheroidal.

The maximum thickness of the post-Bigford beds in the district is estimated to be 700 feet. Though the Claiborne group is typically fossiliferous, the fossils are poorly preserved and scarce in the post-Bigford beds in the Winter Garden district.

In the Winter Garden district the sandstone lenses in the lower part of the post-Bigford beds yield small supplies of highly mineralized water. Farther east in Frio County, however, the post-Bigford beds yield adequate supplies of good water to many farm and ranch wells (Lonsdale, 1935, p. 34–35).

COOK MOUNTAIN FORMATION

The name Cook Mountain, from Cook Mountain, Houston County, Tex., was applied by Kennedy (1892, p. 52–54) to the upper part of the marine beds that underlie the Yegua formation. The Cook Mountain formation crops out in southeastern and northeastern Dimmit County and southeastern Zavala County (pl. 4). The geologic map of Texas from which plate 4 was adapted shows the Cook Mountain formation and Sparta sand undifferentiated. The Sparta sand, however, is not believed to be present in the Winter Garden district and is not shown on plate 4 as being included with the Cook Mountain formation. The outcrop area of the Cook Mountain commonly has greater relief than outcrops of the other Eocene formations in the district. It is characteristically a series of rather high rolling red hills of resistant sandstone and fossiliferous limestone. Vegetation generally is dense, consisting of guajillo, mesquite, low shrubs, and grass.

The following description of the Cook Mountain is in part from observations by Trowbridge (1932, p. 104–107) and Miss Julia A. Gardner (written communication). The Cook Mountain consists chiefly of sand and sandstone. The sand, most of which is medium grained, is more or less firmly cemented. The beds of sandstone range from fine to coarse grained and are green, brown, red, yellow, and gray and are commonly glauconitic, ferruginous, and micaceous. Many of them are crossbedded and ripple marked. Mechanical analyses of 2 samples from the Cook Mountain show that more than 95 percent of the grains are 0.25 millimeter in diameter or smaller. (See table 6.) Interbedded with the sandstone are some white, yellowish, bluish, and greenish-gray or chocolate-colored clay beds and a few thin lenses of gray limestone. The sandstone, and at some places the clay, contains large dark-gray firmly cemented crystalline limestone concretions, some of which are fossiliferous. The lower two-thirds of the formation weathers characteristically into red sandy soil; the upper third at most places weathers gray. Marine fossils are abundant in the clay and in the calcareous sandstone. The full thickness of the Cook Mountain is not exposed in the Winter Garden district but is estimated to be about 700 feet.

The lower part of the Cook Mountain formation contains many permeable beds of sandstone in the district, but tests have not been made to determine the quantity of water that might be developed from them. Well N6–1, which is in the outcrop of the Cook Mountain near Loma Vista, was the only well observed that taps the Cook Mountain. The water from well N6–1 has a relatively low mineral content. (See table 12.) However, it is reported by the ranchers in the outcrop area that cattle would not drink water from the Cook Mountain formation and that all ranch wells were drilled to deeper formations.

In Frio County, east of the Winter Garden district, the Cook Mountain formation in places yields sufficient water for irrigation. The water varies in quality, but the lower sandy parts of the formation yield the best water (Lonsdale, 1935, p. 40–41).

PLIOCENE(?) SERIES

UVALDE GRAVEL

The Uvalde gravel includes the gravel and silt that were first named the "Uvalde formation" by R. T. Hill (1891, p. 368) from its occurrence in the vicinity of the town of Uvalde. Trowbridge (1923, p. 98–100) correlated these deposits with the Reynosa formation of south Texas, but it has been shown since that the Uvalde gravel is younger than the Reynosa formation and the name Uvalde gravel is now accepted by the U. S. Geological Survey.

The Uvalde gravel, which consists primarily of pebbles and cobbles of chert, quartz, and igneous rock and of black silt, caps the divides between the streams. It is generally only 1–2 feet thick, but in a few places is as much as 20 feet thick. It is commonly cemented with caliche. In the northern part of the district the maximum size of the cobbles is about 6 inches; in the southern part, about 3 inches. In the area drained by the Nueces River and its tributaries, most of the Uvalde consists of chert derived from the Edwards limestone of the Edwards Plateau, but on the divide between the Nueces River and the Rio Grande, broad plains of black silt are underlain by gravel deposits consisting chiefly of pebbles of igneous rocks.

A typical deposit of the Uvalde gravel can be seen in a roadcut on the Carrizo Springs–Dilly highway about 1.8 miles east of the Nueces River bridge. The deposit is about 2 feet thick and contains pebbles and cobbles from 1 to 6 inches in diameter. A good exposure of the gravel, cemented by caliche, is on the west side of the Carrizo Springs–Crystal City highway in a gravel pit on top of the highest hill, about 6 miles north of Carrizo Springs and a little south of Winter Haven. The Uvalde gravel does not contain appreciable quantities of water because of its topographic position and lack of reservoir capacity.

QUATERNARY SYSTEM

PLEISTOCENE SERIES

LEONA FORMATION

The Leona formation was named by Hill and Vaughan (1898, p. 253–254) from the extensive deposits composing the first wide terrace in the valleys of the Nueces and Leona Rivers. These flood-plain deposits are of Pleistocene age and consist of light-gray and buff silt and lenticular beds of sand and gravel. The Leona formation lies in the valleys of the Leona, Nueces, and Frio Rivers and their tributaries between the high-level deposits of the Uvalde gravel and the Recent flood-plain deposits. It is mapped with the Recent alluvium on plate 4, as Quaternary alluvium, undifferentiated.

The pebbles and cobbles of the Leona formation were derived chiefly from the Edwards limestone and are composed of limestone, chert, and minor amounts of igneous rock. The silt commonly contains fossil shells of land snails. The grain size of the material in the Leona decreases rapidly to the south away from the source area. Thus, more gravel is found near Uvalde County and more silt occurs south of Batesville.

Trowbridge (1923, p. 101) lists several fresh-water air-breathing mollusks in the Leona formation. Large teeth from Pleistocene elephants reportedly were found in the old spring valley at Carrizo Springs, which was a bog before the springs ceased flowing.

In the valleys of the main streams, the Leona formation ranges in thickness from 0 to 75 feet, and the base of the formation may be as much as 70 feet below the beds of the rivers. Along the tributary streams the Leona is generally only a few feet thick.

The Leona commonly contains several layers of permeable sand and gravel which yield water freely to wells in parts of the district where the formation is thick enough to be water bearing. In 1947–48 about 60 shallow wells supplied water for irrigation of approximately 5,000 acres near Batesville and 5 shallow wells were used to irrigate 900 acres southeast of La Pryor. The yield of these wells varies with the thickness and permeability of the sand and gravel, but yields of as much as 1,000 gallons per minute have been reported for some wells. In the area north of Batesville, practically all the domestic supplies are obtained from the Leona. In an area 5–8 miles north of La Pryor, gravel of the Leona rests on the Carrizo sand and wells draw both from the gravel and the sand. North of La Pryor where the Leona overlies the Carrizo sand, the water in the Leona probably contributes to the recharge of the Carrizo. Throughout much of its outcrop the Leona formation is separated from the Carrizo sand by at least part of the Mount Selman formation. Water can move from the Leona formation to recharge the Carrizo directly only in the outcrop area of the Carrizo. Such recharge probably takes place within the Nueces River valley on the outcrop of the Carrizo north of La Pryor and within the Leona River valley north of Batesville. South of the outcrop of the Carrizo, however, the Leona formation and the Carrizo sand are not hydrologically connected.

CALICHE

Caliche is rock composed largely of calcium carbonate deposited by evaporation at or near the surface of the ground. Water percolating through the soil dissolves soluble materials in the order of and in proportion to their solubility. In semiarid and arid regions the total evaporation exceeds the total precipitation, and water evaporated at or near the ground surface leaves a residue of the contained minerals. The mineral matter may be deposited by water that is moving from the ground surface toward the water table or from the water table toward the ground surface.

In the Winter Garden district, caliche generally consists of a few inches of an upper layer or crust of hard banded gray to light-buff calcium carbonate which grades downward into a greater thickness of softer white porous to powdery calcium carbonate. In most parts of the district, the caliche is only a few feet thick; however, it is as much as 20 feet thick in many places along the outcrop of the lower part of the Bigford member of the Mount Selman formation from Carrizo Springs northwestward for a distance of about 12 miles.

Caliche has considerable economic value for use in road construction. Although not everywhere suitable for quarrying, it is common as a surficial deposit in all parts of the district except in the outcrop area of the Carrizo sand. The presence of caliche in exposed rocks of all ages and the fact that it is still being formed suggests that it is at least in part of Recent age, possibly extending back to Pleistocene time.

Caliche may restrict the downward percolation of water and thus reduce the quantity of recharge to the ground-water reservoir. Caliche also may hold some water in temporary storage, this water later evaporating. Caliche, however, generally can be regarded as having only a minor effect on the hydrology in the district.

RECENT SERIES

ALLUVIUM

Most of the stream valleys of the Winter Garden district contain some alluvial deposits of Recent age which consist primarily of material reworked from the Leona formation; the two formations are shown as a single unit on plate 4. The Nueces River flood plain through central Zavala County and central and eastern Dimmit County has a thick mantle of fertile, porous silt which produces large crop yields when properly irrigated. Gravel deposits along the Nueces River yield small quantities of water to wells for domestic purposes. Other alluvial deposits occupy rather narrow areas within the streambeds or on Recent flood plains and do not yield significant quantities of water. The Recent river gravels serve to retard the runoff of storm water and where they overlie the outcrop of the Carrizo sand in the beds of the Nueces and Leona Rivers possibly aid to a small extent in the recharge of the Carrizo.

OCCURRENCE OF GROUND WATER

Most of the precipitation on the earth is derived from water evaporated from the sea. A part of the precipitation on the land surface runs off directly in surface streams; a part is returned to the atmosphere by evaporation; and a part penetrates the surface of the earth. There, a part of it is later evaporated or is transpired by plants, and a part descends to the zone of saturation. After entering the zone of saturation, the water, under the influence of gravity, moves slowly through the water-bearing beds until it is intercepted by wells or is discharged through natural outlets. Then a part returns directly to the air and a part flows to the sea and completes the hydrologic cycle. Ground water is the water that occurs below the surface of the earth in the zone of saturation, where all the interstitial openings in the rocks are filled with water under hydrostatic pressure.

The fundamental principles of the occurrence and movement of ground water have been presented in papers by Meinzer (1923a, 1923b, and 1932), Meinzer and Wenzel (1942), and Wenzel (1942), among others. The discussion that follows is a brief outline of those general principles and is limited to those phases that are essential to an understanding of the problems in the Winter Garden district.

Ground water in the Winter Garden district moves principally through sand and gravel in the Carrizo sand and Leona formation from points of recharge to points of discharge. The water in the Leona deposits and in the outcrop of the Carrizo is unconfined—that is, the surface of the ground-water body (water table) occurs in permeable materials and is subject only to atmospheric pressure. Where the Leona overlies a permeable material, that material may be recharged from water in the Leona. Downdip from the outcrop, where the Carrizo is overlain by the Mount Selman formation, ground water in the Carrizo sand is confined by the relatively impermeable overlying strata. Although the confining beds often are regarded as entirely impermeable under natural hydraulic gradients, it has been suggested that water may move very slowly even through clays. (See Winslow and Doyel, 1954, p. 16 and 17.) Even though the permeability of the overlying beds may be very low, the relatively large area of contact may allow large quantities of water to escape from the aquifer. Water also may move directly from one formation to another where the two are not separated by impermeable beds. Natural

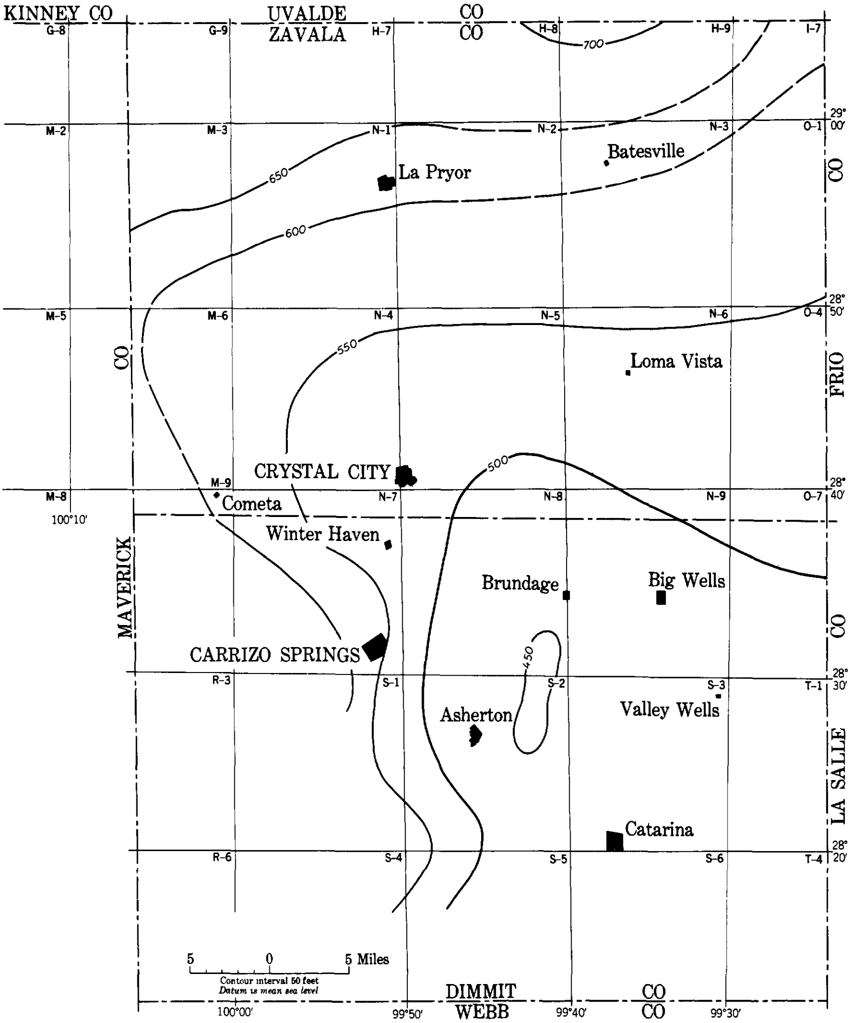

FIGURE 11.—Approximate altitude to which water would rise in 1930 in wells screened in the Carrizo sand, Winter Garden district, Texas.

discharge occurs from the confined water-bearing beds through springs or seeps as the water finds its way to the land surface. Water in the unconfined or water-table areas is discharged naturally by springs and seeps where a stream or other drainage feature cuts below the regional water table or by evapotranspiration where the water table is close to the land surface. Artificial discharge is by wells, or other artificial structures. The confined water is under sufficient hydrostatic pressure to rise in tightly cased wells above the level at which it is found. If the altitude to which water will rise is greater than the altitude of the land surface, flowing wells may be obtained. The confined water is called artesian water whether or not it flows

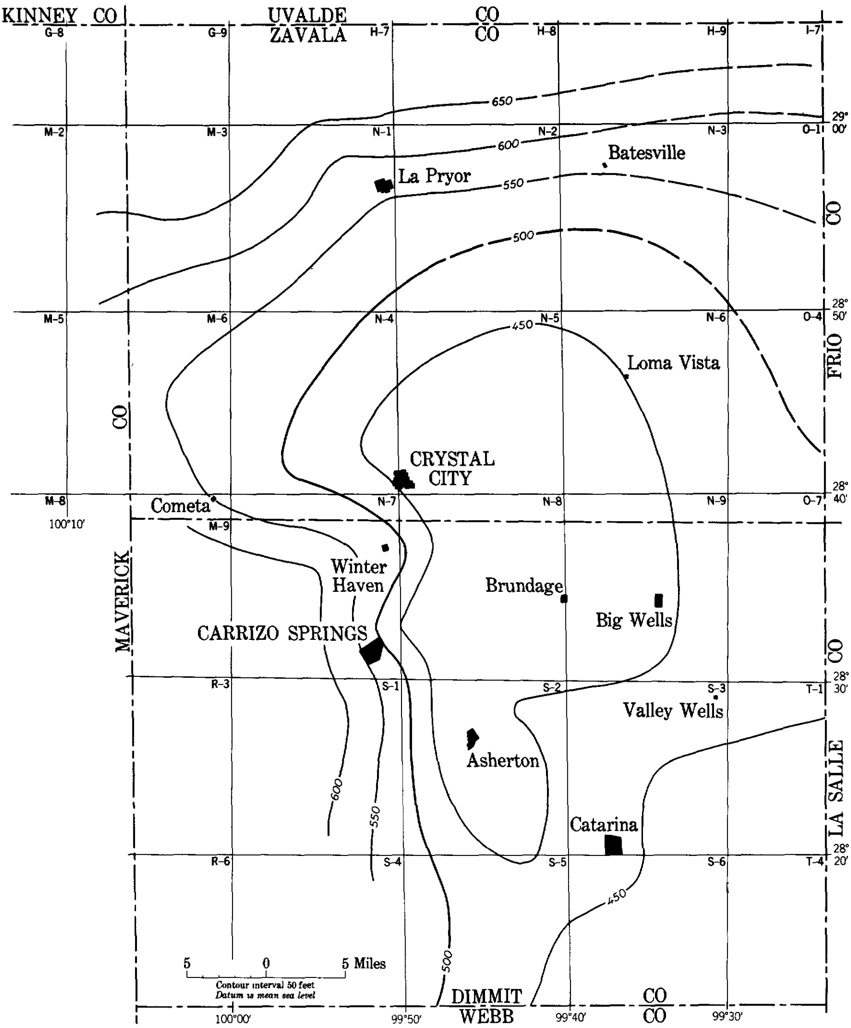

FIGURE 12.—Approximate altitude to which water would rise in 1948 in wells screened in the Carrizo sand, Winter Garden district, Texas.

from wells. The height above sea level to which water from the Carrizo sand would rise in wells in the Winter Garden district was determined in 1930 and 1948, and the piezometric surface based on these determinations is shown in figures 11 and 12.

The Carrizo is separated from beds of sand in the Bigford member of the Mount Selman formation by a relatively impermeable clay. Where the seal of the clay is broken by an improperly constructed well, water from the Carrizo may move through the well and mix with water in the Bigford member, or vice versa, depending on the relation of the artesian head in the two units.

PRINCIPAL AQUIFERS

CARRIZO SAND

GROUND-WATER WITHDRAWALS

The Carrizo sand is the principal ground-water reservoir, or aquifier in the Winter Garden district. About 90 percent of the ground water used during the 1947–48 irrigation season was pumped from the Carrizo.

The quantity of water pumped from the Carrizo sand in the Water Garden area first assumed significant proportions during the 1920's. During the 1929–30 season about 27,000 acre-feet of water was pumped to irrigate about 27,000 acres. During the depression years all farming operations declined, but irrigation farming declined more, percentagewise. During the 1937–38 season only about 22,000 acre-feet of water was pumped to irrigate about 24,000 acres. The rate of development increased sharply at the beginning of World War II and has accelerated since the war.

The total withdrawal of water for irrigation purposes in the 1947–48 season from the Carrizo sand in the Winter Garden district was about 52,000 acre-feet, which was pumped to irrigate about 42,000 acres. The estimate of pumpage for irrigation was based on records of pumpage from 76 wells and the total acreage and type of crop under irrigation. The average amount of water used for irrigation was computed to be about 1.6 acre-feet per acre for vegetables and citrus trees and about 0.8 acre-foot per acre for feed crops and cotton.

The public water supply for seven towns in the Winter Garden district in 1947–48 was obtained from wells in the Carrizo sand. Total pumpage at Asherton, Big Wells, Brundage, Carrizo Springs, Catarina, Crystal City, and La Pryor was estimated to be 1,400 acre-feet per year or 1.25 million gallons per day.

Pumpage for domestic and stock supply from the Carrizo sand in 1947–48 was estimated at 1,000 acre-feet per year or about 900,000 gallons per day. Pumpage for industrial purposes, not accounted for under public supply, was about 400 acre-feet per year or 360,000 gallons per day.

FLUCTUATIONS OF WATER LEVELS AND ARTESIAN PRESSURES

Water levels and artesian pressures fluctuate in response to recharge from precipitation and discharge through natural and artificial outlets. A record of the fluctuations of water levels in 46 wells in the Carrizo sand has been maintained since the start of the investigation in 1929. (See table 11.) Of the observation wells, 8 are water-table wells on the outcrop of the Carrizo sand, whereas the remaining 38 wells, which are downdip from the outcrop, are artesian wells.

WATER-TABLE WELLS

Water-level fluctuations in 4 water-table wells near Carrizo Springs, in 2 wells near Cometa, and in 1 well west of La Pryor all show a similar pattern of decline during the 19-year period from 1930 through 1948. The magnitude of the decline for the period varied, ranging from 3.1 to 20.7 feet. The records of water-level measurements in wells M6–19 and S1–18, shown in figures 13 and 14, respectively, are typical examples of the observed fluctuations in wells in the outcrop area. The water levels in both wells declined persistently throughout the period, and the decline has been slightly accelerated since 1941. During the 19-year period the annual rainfall at Carrizo Springs averaged 0.93 inch above average. It is concluded, therefore, that the decline in water levels in wells on the outcrop area has not been caused by a deficiency in recharge, but by withdrawals from wells in both the water-table and the artesian areas.

ARTESIAN WELLS

During the early development of irrigation in the Winter Garden district, flowing wells in the Carrizo sand were common. In 1904 Bowie (1905, p. 460–463) estimated the pressure head to be 18–40 feet above the land surface southeast of Carrizo Springs. In 1907, Taylor (1907, p. 51–52) presented records of 40 wells within 10 miles of Carrizo Springs; all but 2 of the wells flowed. He recorded 23 wells, 16–31 miles southwest of Batesville; 15 of these were reported to flow. Before the development of ground water for irrigation, several springs southwest of Carrizo Springs spilled water from the Carrizo sand into Carrizo Creek. As development continued, the head was lowered until the springs flowed only during the periods of least withdrawals. By 1929 the springs on Carrizo Creek ceased to flow.

The following discussion refers to the average fluctuations of water levels in observation wells near La Pryor, Crystal City, Cometa, Winter Haven, Carrizo Springs, Asherton, and Catarina. The declines show the trends, but not necessarily the average magnitude for the areas because of the limited number of observation wells having continuous records. The magnitude of the decline for 2 periods is shown on figures 15 and 16.

In the La Pryor area the artesian pressure remained fairly constant from 1930 to 1940. (See well N1–40 in fig. 13 and wells N1–24 and N1–40 in table 11.) Since 1940 the artesian pressure has declined almost continuously. The decline in wells N1–24 and N1–40 from

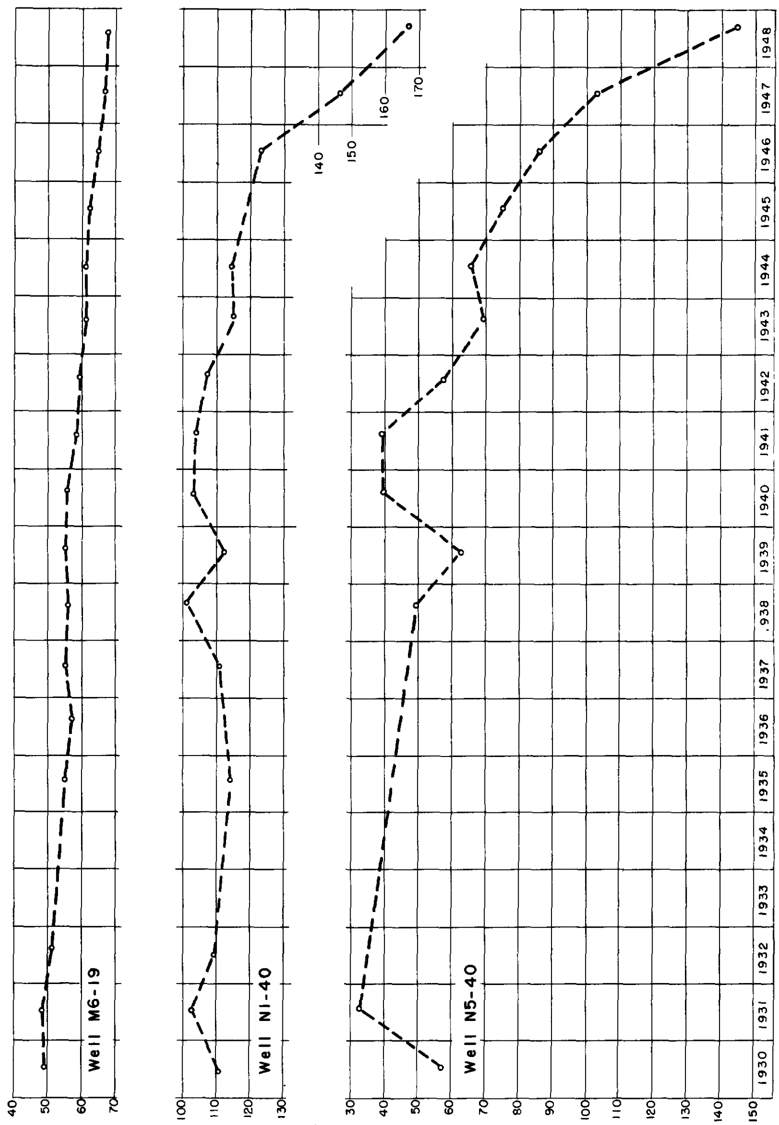

FIGURE 13.—Hydrographs of wells in Zavala County, Tex.

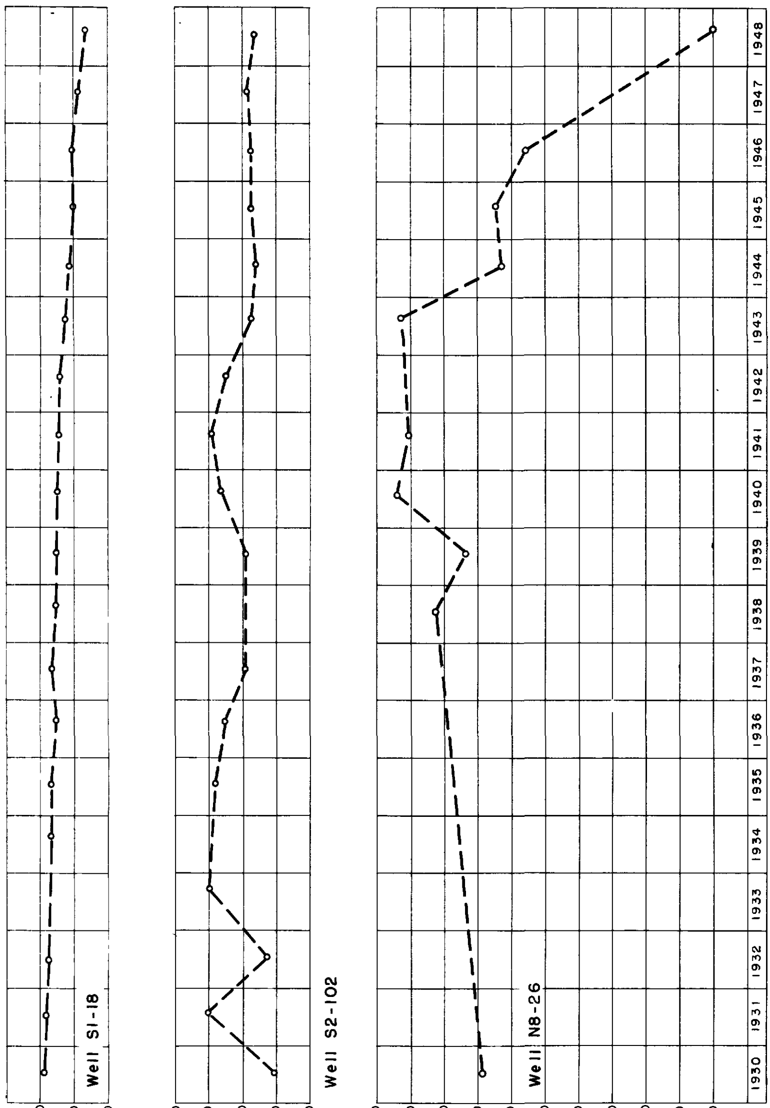

FIGURE 14.—Hydrographs of wells in Dimmit County, Tex.

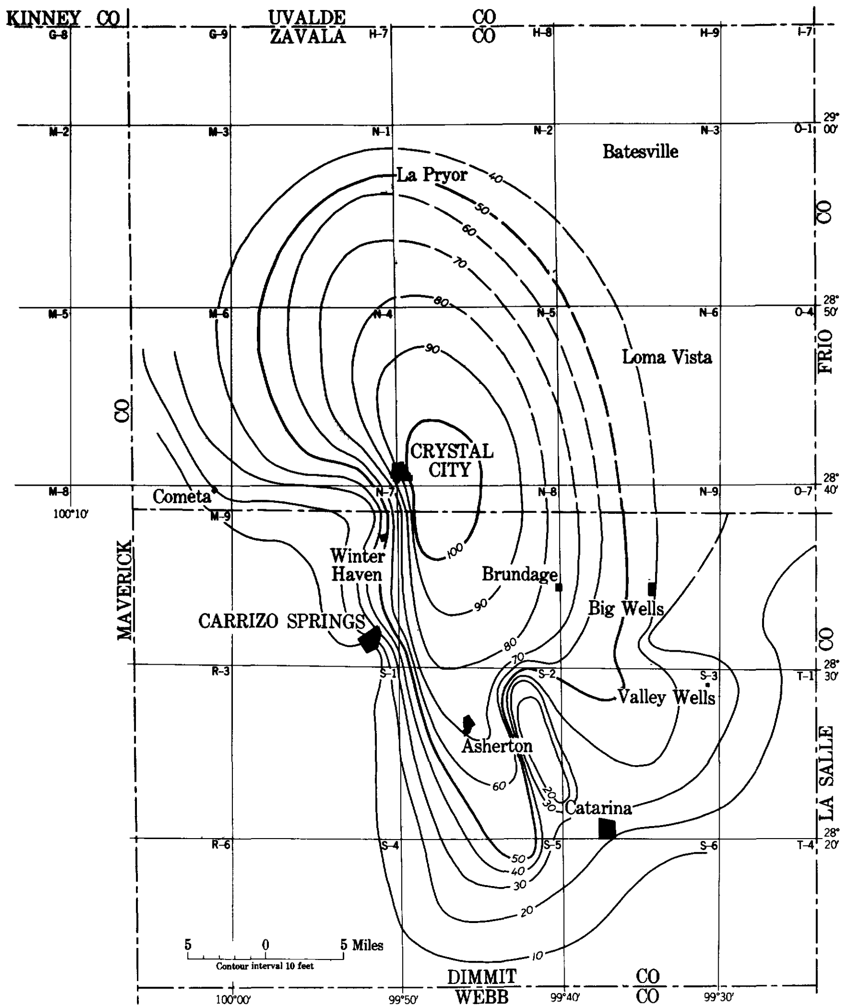

Figure 15.—Approximate decline of water levels in the Carrizo sand in the Winter Garden district, Texas, 1941–48.

1940 to 1948 averaged about 54 feet. The accelerated decline after 1940 was caused by increased pumping as the irrigated area increased from about 4,600 to about 7,600 acres.

In the Crystal City area the artesian pressure declined an average of about 20 feet from 1930 to 1936, recovered about 20 feet from 1936 to 1941, and declined about 106 feet from 1941 to 1948. The greatest decline occurred after 1946 (fig. 13, well N5–40). Between 1938 and 1948 the area irrigated was increased from about 8,400 to about 15,600 acres.

In the Cometa area the artesian pressure declined an average of about 7 feet from 1930 to 1936, showed no appreciable change from

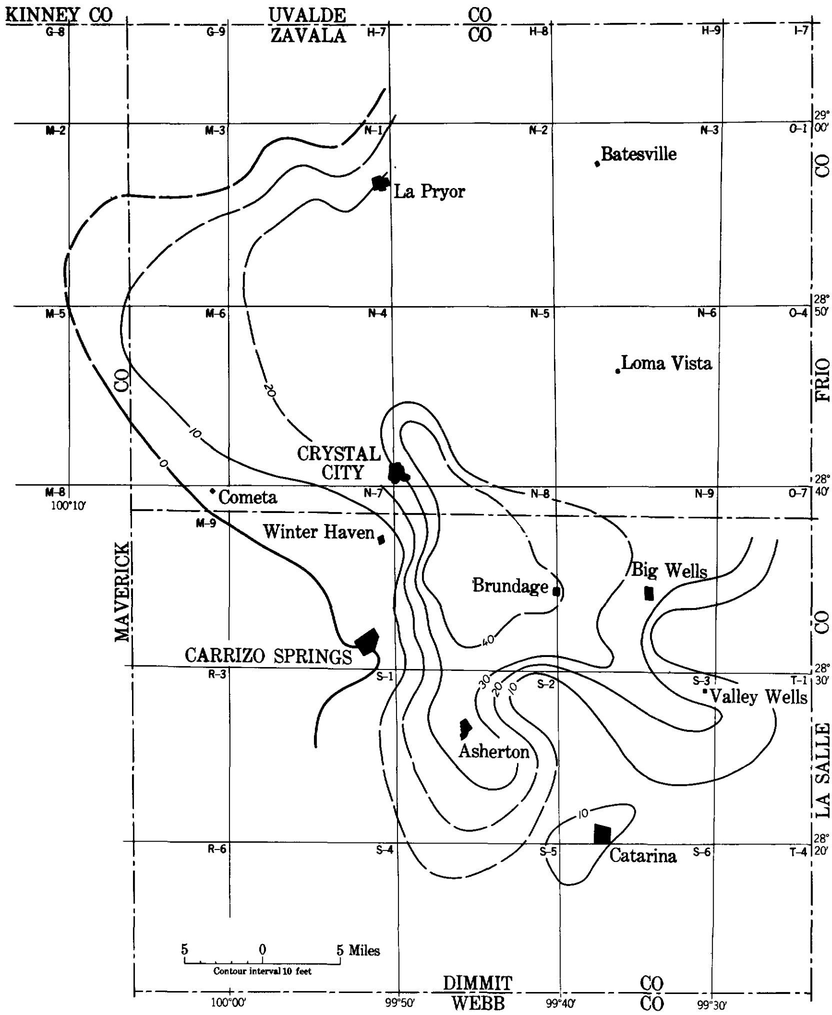

FIGURE 16.—Approximate decline of water levels in the Carrizo sand in the Winter Garden district, Texas, 1947–48.

1936 to 1941, and declined about 21 feet from 1941 to 1948. Between 1938 and 1948 the area irrigated was increased from about 1,000 to about 1,600 acres.

In the Winter Haven area the artesian pressure rose an average of about 30 feet from 1930 to 1940 but declined an average of about 70 feet from 1941 to 1948. Between 1938 and 1948 the area irrigated was increased from 1,100 acres to about 2,000 acres. Nevertheless, the greatest decline, which occurred after 1946, appears to have been caused by pumping in adjacent areas, especially the Crystal City area, rather than in the Winter Haven area itself.

In the Carrizo Springs area the artesian pressure fluctuated considerably. There was no material decline in head from 1930 to 1941; however, there was a decline of about 68 feet from 1941 to 1948. The number of pumped wells increased from 50 to 59 from 1938 to 1948, and the irrigated area increased from 1,200 to about 3,100 acres.

In the Asherton area the artesian pressure rose an average of about 19 feet from 1930 to 1941; however, the pressure declined about 36 feet from 1941 to 1948. In 1938, 62 wells were in use as compared with 56 wells in use in 1948; however, during the same period the irrigated area increased from 2,900 to about 3,700 acres.

In the Catarina area the artesian pressure increased an average of about 14 feet from 1930 to 1937, declined slightly from 1938 to 1939, and recovered slightly in 1940 to 1941. A decline in pressure of about 27 feet took place from 1941 to 1948. Between 1938 when 24 wells were in use and 1948 when 38 wells were in use, the area irrigated was increased from about 1,300 to about 3,000 acres.

SEASONAL FLUCTUATIONS

Seasonal changes in water requirements for crops cause seasonal changes in the water levels and artesian pressures. In recent years the trend has been to produce 2 or 3 crops per year, in contrast to the practice during the 1930's when only 1 crop a year was produced on most farms. During the crop-year 1929–30 the irrigation season began in the middle of September and ceased in the latter part of April. The cessation of irrigation allowed water levels to recover, reaching maximum altitudes just prior to the next irrigation season. Seasonal fluctuations as great as 150 feet have been recorded. The present practice of irrigating 2 or 3 crops per year tends to decrease the amplitude of the fluctuations; however, the highest levels still generally occur during the late summer.

Annual water-level measurements are apt to give a false picture of water-level trends if the seasonal fluctuations are not considered. Therefore, water-level measurements should be made at the same time each year to make the data comparable.

NATURAL RECHARGE

The quantity of water recharged to an aquifer is the most significant factor determining the quantity of water that may be continually withdrawn from the aquifer. The sources of recharge are infiltration from precipitation directly on the outcrop of the aquifer, seepage from surface streams which cross the outcrop of the aquifer, and interformational leakage.

The area of outcrop of the Carrizo sand in the Winter Garden district that is available for recharge to the pumped areas is about 200,000 acres (White and Meinzer, 1931, p. 10). During a rain nearly all the water penetrates the surface of the ground in the outcrop area, but most of the rainwater eventually is lost by evapotranspiration. Under favorable conditions a part of the precipitation reaches the zone of saturation, and this recharges the sand.

At Carrizo Springs, part of which is on the outcrop of the Carrizo sand, the average annual precipitation for a 27-year period of record is 21.79 inches. A little more than 3 inches of water, equivalent to 15 percent of the precipitation, over the 200,000 acres of outcrop available to receive recharge would be enough to provide the 53,000 acre-feet of water withdrawn (for all purposes) during the 1947–48 season. It is obvious that several times 3 inches of water is available from precipitation on the outcrop, but it is equally obvious that the recharge has been equivalent to only a part of 3 inches a year during the period 1930–48, for when the average annual withdrawals have exceeded 27,000 acre-feet, the water table in the outcrop area has declined.

Attempts were made to measure percolation on the outcrop of the Carrizo sand by using lysimeters. White and Meinzer (1931, p. 9) state "that during the period of unusually heavy precipitation in October and November 1930, most of the rain that fell on the outcrop disappeared underground and moved slowly downward to depths of 5 feet or more."

The lysimeter experiments, however, produced widely varying results, chiefly because of the lack of uniformity in the texture of the material through which the water moved before reaching the zone of saturation. The percolating water tended to follow animal burrows and root channels. Some of the lysimeters collected more water than could be accounted for by the measured precipitation, whereas others collected less water than was expected. On the whole, the experiments with the lysimeters were inconclusive.

Seepage measurements were made on several streams crossing the Carrizo outcrop to determine the extent of recharge from the streams to the aquifer. The Nueces River is the largest stream that crosses the outcrop within the Winter Garden district, although much of the time it carries little or no water. Peak discharges often reach several thousand acre-feet, but conditions at such times are unfavorable for determining the losses on the outcrop. Measurements made when the flow is between about 20 and 200 second-feet show that the loss of the river between points immediately above the outcrop and points several miles below the outcrop generally is between 15 and 40 second-feet. However, a considerable part of this seepage enters the extensive alluvial deposits in the river valley and is returned to the river farther downstream, chiefly in a stretch 8–10 miles below the Carrizo outcrop. This return flow continues long after the stream ceases to flow above the outcrop.

Seepage measurements on Carrizo Creek showed a high rate of loss in a short stretch 2 or 3 miles above the crossing of Highway 83, but comparatively little loss in the rest of the course over the Carrizo outcrop. Peña Creek loses heavily in only part of its course on the outcrop. Two sets of measurements made on Pendencia Creek in Dimmit County and on Comanche and Turkey Creeks in Zavala County showed no losses on the outcrop.

Carrizo Creek heads on the outcrop of clay of the Bigford member, and Pendencia, Comanche, and Turkey Creeks head on the outcrops of shale and clay of Late Cretaceous or Eocene age. Consequently, the storm waters which these streams carry are laden with clay and silt. These sediments have been deposited in the streambeds in many places on the Carrizo outcrop, thereby making a seal which prevents or retards penetration of storm water to the underground reservoir.

The possibility of interformational leakage has been discussed by Winslow and Doyel (1954, p. 15–17) in connection with the Houston area. The greater heads normally attained in the more permeable sands permit the movement of water into adjacent less permeable shale, silt, and clayey beds. A reduction in head caused by large withdrawals may reverse the head differential and reverse the direction of movement. In the Winter Garden district the Carrizo is the most permeable formation, but large declines of artesian pressure may have caused the movement of water into the Carrizo from adjacent formations. The quantity of recharge from this source, however, is probably relatively small owing to the low permeability of the adjacent beds.

It is concluded that nearly all the recharge to the Carrizo sand in the Winter Garden district comes directly from precipitation on the outcrop area. Only a small part comes from streams that cross the outcrop, and the actual recharge in the vicinity of streams probably is only slightly more per unit of area than in the remainder of the outcrop.

In order to reach a tentative figure of the amount of replenishment from the outcrop of the Carrizo to the pumped districts in Zavala and Dimmit Counties for 1929–30, White and Meinzer (1931, p. 11) assumed that the inflow passed through a vertical section of the sand 60 miles long along the 550-foot contour line shown on figure 11. They estimated that along this contour the average thickness of the formation was 200 feet, the average coefficient of permeability 200, and the average hydraulic gradient 10 feet to the mile. On this basis the estimated flow from the outcrop to the pumped districts was estimated to be 24 million gallons a day, or about 27,000 acre-feet a year—the same as the estimated withdrawal for the 1929–30 irrigation year.

During the 1937–38 irrigation year, the water levels in water-table wells remained essentially at the same altitude while about 22,000 acre-feet of water was pumped from the Carrizo for irrigation within the district. The average water level in 36 wells in both the water-table and the artesian areas rose about 1 foot. Thus, the recharge to the Carrizo during 1937–38 is estimated to have been about 22,000 acre-feet.

Estimates of the annual recharge thus range from 22,000 to 27,000 acre-feet per year. The data on which these estimates are based are meager, and additional work should be done to refine them; however, it is the opinion of the writer that a fair value for the average annual recharge is 25,000 acre-feet.

ARTIFICIAL RECHARGE

The possibilities of appreciably increasing the recharge to the Winter Garden district appear unfavorable. If dams on the streams and small drainageways were constructed to spread the water over the outcrop area to allow more time for the percolation of water into the sand, undoubtedly the amount of water recharged to the sand would be increased for a time. Eventually, however, the recharge to the Carrizo might be reduced to even less than at present because the area covered by the stored water probably would become silted, and this would reduce the area available for infiltration of precipitation. The silt problem could be alleviated by conducting the water into recharge basins after allowing the heaviest silt load to pass downstream and by periodically rejuvenating the basins by scarifying them when they are dry. (See Moffitt, 1943, and Sayre and Stringfield, 1948, p. 8.) However, the installation of numerous reservoirs on the small drainageways would appreciably reduce the runoff to the principal streams, which seldom supply an adequate amount to meet existing surface-water appropriations.

Artificial recharge by means of wells does not appear to be feasible in the Winter Garden district. The only water that could be used for artificial recharge is surface water which is already appropriated and is not even sufficient to irrigate all the arable lands along the streams. Moreover, such water might have to be filtered and treated chemically at a cost that might exceed the present value of water for irrigation.

HYDRAULIC PROPERTIES OF THE AQUIFER

GLOSSARY OF TECHNICAL TERMS

The following definitions are presented as a reference to basic quantitative terms used in the following sections of this report.

Porosity can be quantitatively expressed as the percentage of the total volume of a rock that is occupied by interstices.

Permeability is the capacity of an aquifer to transmit water. The field coefficient of permeability (*P*) is defined (Wenzel, 1942, p. 7) as the number of gallons of water a day that percolates under prevailing conditions through each mile of water-bearing bed (measured at right angles to the direction of flow) for each foot of thickness of the bed and for each foot per mile by hydraulic gradient. The standard, or laboratory, coefficient of permeability is the same figure corrected to 60° F.

The coefficient of transmissibility (*T*) is the product of the thickness, in feet, of the saturated part of a water-bearing bed and the field coefficient of permeability.

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. The coefficient of storage is a dimensionless unit and is expressed as a decimal fraction.

Specific yield relates to the water that is free to drain by gravity from saturated water-bearing material. It is the fraction of a cubic foot of water that will drain by gravity from a cubic foot of saturated material. For practical purposes the specific yield equals the coefficient of storage in water-table areas.

The specific capacity is used to indicate the relationship of well yield to drawdown and generally is expressed in terms of gallons per minute per foot of drawdown. The term implies that the ratio of yield to drawdown remains constant for any rate of withdrawal for any length of time. Because both the rate of withdrawal and the time element affect the specific capacity, the term should be considered approximate.

The moisture equivalent of a soil is the ratio of the weight of the water which the soil, after saturation, will retain against a centrifugal force of 1,000 times the pull of gravity to the weight of the soil when dry, or it may be expressed as the ratio of the volume of water to the bulk volume of sample. The moisture equivalent usually is expressed as a percentage.

LABORATORY TESTS

Laboratory tests to determine the physical and hydraulic properties of 104 samples of loose sand and coherent sand obtained from well cuttings and outcrops in Dimmit and Zavala Counties were tested in the hydrologic laboratory of the U. S. Geological Survey in Washington, D. C. Determinations included porosity, permeability, apparent specific gravity, centrifuge-moisture equivalent, and specific yield. The average computed porosity of 89 samples from the Carrizo sand was about 40 percent (table 6). The permeability ranged from 3 to 1,440 and averaged 286 gallons per day per square foot. The specific yield averaged about 37 percent. The coefficients determined in the laboratory generally are not directly applicable to field problems because of factors such as failure to get representative samples, failure to repack samples in original state, and deterioration of samples before testing.

The values of specific yield from laboratory samples were calculated using an adjustment proposed by Piper (1933) and currently used in the Survey's hydrologic laboratory. The adjustment is based on the experimental relationship between the moisture equivalent and the specific retention. The values for specific yield ranged from 20.1 to 41.8 percent and averaged 36.5 percent. The specific yield under field conditions may be considerably less than the laboratory results indicate. The magnitude generally considered correct for a sand ranges from 10 to 20 percent. Alluvial materials tested in the Safford Valley in Arizona (Gatewood and others, 1950, p. 92) averaged 16 percent. If it is assumed that the average annual recharge to the Winter Garden district for the 18-year period 1930–48 was 22,000 acre-feet as determined for the irrigation year 1937–38, the decline in water level would indicate a specific yield of about 10 percent. Thus, it is concluded that the specific-yield values calculated by the laboratory method are probably too high.

PUMPING TESTS

Pumping tests were made in the field to determine the coefficients of transmissibility and storage. In 1930, pumping tests using the method of Thiem (1906) were made in three localities in the Winter Garden district. The average coefficient of permeability of the Carrizo sand was computed to be about 200 gallons per day per square foot.

In 1948, additional pumping tests were made, and the results of the tests were analyzed by means of the following equation developed by Theis (1935):

$$s=\frac{114.6Q}{T}\int_u^\infty \frac{e^{-u}}{u}\,du,$$

where

$$u=\frac{1.87r^2S}{Tt}.$$

In this equation, s is the drawdown in feet at any point in the vicinity of a well pumped at a uniform rate; Q is the discharge of the well, in gallons per minute; T is the transmissibility of the aquifer, in gallons a day per foot; r is the distance from the discharging well to the point of observation in feet; S is the coefficient of storage; and t is the time the well has been pumped, in days. Water-level data from the pumped well were analyzed using the Theis recovery method (Wenzel, 1942, p. 95).

A pumping test was made in Zavala County about 9½ miles northeast of Crystal City. During the test, well N5–91 was pumped, and the effect of pumping was observed in wells N5–90, N5–92, N5–93, and N5–95. Each of the wells completely penetrated the Carrizo sand, which had an average thickness of 194 feet. The wells had been idle for about 3 weeks prior to the test, and the water levels in all the wells were measured daily for 1 week prior to the test to determine the regional trend in water levels. On February 14 the pump in well N5–91 was started and run continuously for 48 hours at the average rate of 934 gallons per minute. Periodic water-level measurements were made in the observation wells throughout the period of pumping and in the pumped well for 6½ hours after pumping ceased. Representative data and calculations are shown on figures 17, 18, and 19.

Another pumping test was made in 1948 on wells N7–167 and N7–168 in Dimmit County, 3½ miles northwest of Carrizo Springs, where the thickness of the Carrizo averages about 150 feet. The water levels in both wells were measured daily for 1 week prior to the test. On October 19, well N7–167 was pumped continuously for 8 hours while the drawdown of the water level in well N7–168 was observed at intervals of about 15 minutes. At the end of the pumping period the recovery in the pumped well was observed periodically for 16 hours.

The coefficients of transmissibility and storage computed by the Theis method from the data collected during the tests were as follows:

Coefficients of transmissibility and storage computed by the Theis method

Well	Coefficient of transmissibility, T (gpd per ft)	Coefficient of storage, S	Remarks
N5–90	40,000	1.1×10^{-4}	See fig. 18.
91	36,000		T computed from recovery in pumped well. See fig. 19.
92	36,000	1.1×10^{-4}	
93	37,000	9.9×10^{-5}	
95	38,000	1.1×10^{-4}	See fig. 18.
Average	37,400	1.0×10^{-4}	
N7–167	30,000		
168	30,000	1.9×10^{-4}	

The average coefficient of permeability computed by the Theis method for both tests was 196 gallons per day per square foot. This compared with the figure of 200 gallons per day per square foot

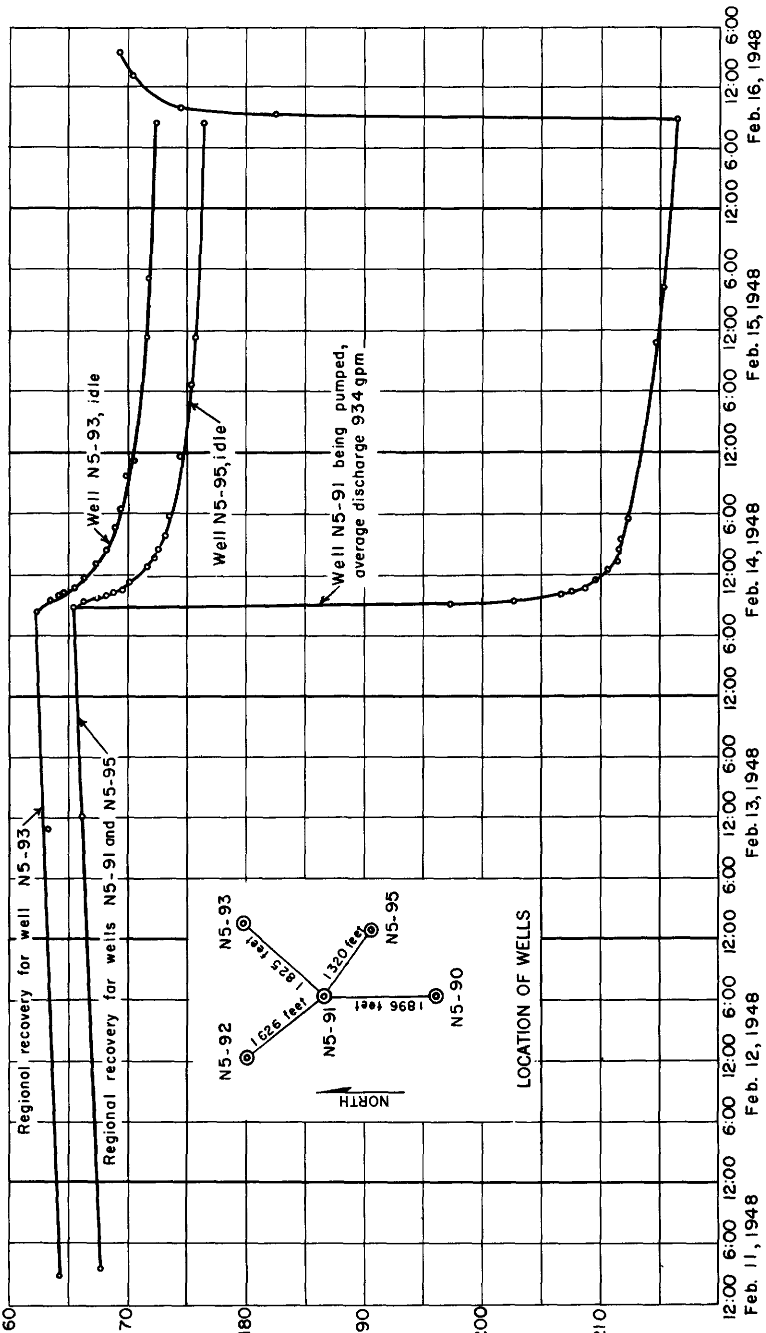

FIGURE 17.—Results of pumping test at wells in Zavala County, Tex.

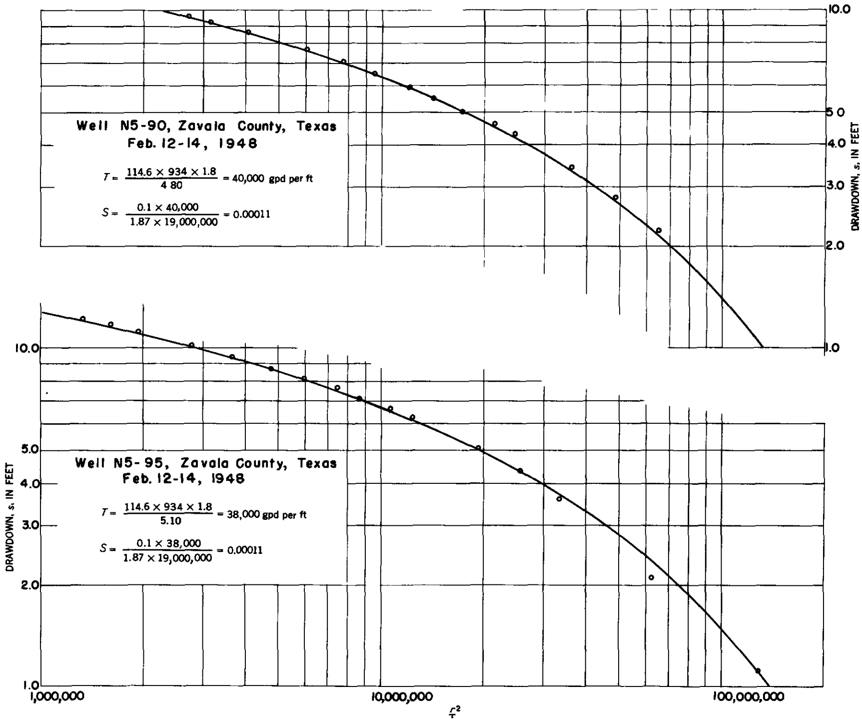

FIGURE 18.—Coefficients of transmissibility and storage by the Theis nonequilibrium method.

computed by the Thiem method and 286 gallons per day per square foot by the laboratory method in 1930.

INTERFERENCE BETWEEN WELLS

The cost of power to pump water from wells increases as the pumping lift increases. The pumping lift of a well is affected not only by its own withdrawals, but also by the withdrawals of wells surrounding it. Thus, the mutual interference of pumping wells is of economic importance in the Winter Garden district.

Wenzel (1942, p. 98) states that

> As soon as a pump begins discharging water from a well that penetrates a water-bearing formation with a water table, a hydraulic gradient from all directions is established toward the well and the water table is lowered around the well. The water table soon assumes a form comparable to an inverted cone . . .

Under artesian conditions a similar cone of depression is formed on the piezometric surface. Other wells within the cone of depression experience a lowering of water level. The water levels will continue to decline, but at a decreasing rate unless the expansion of the

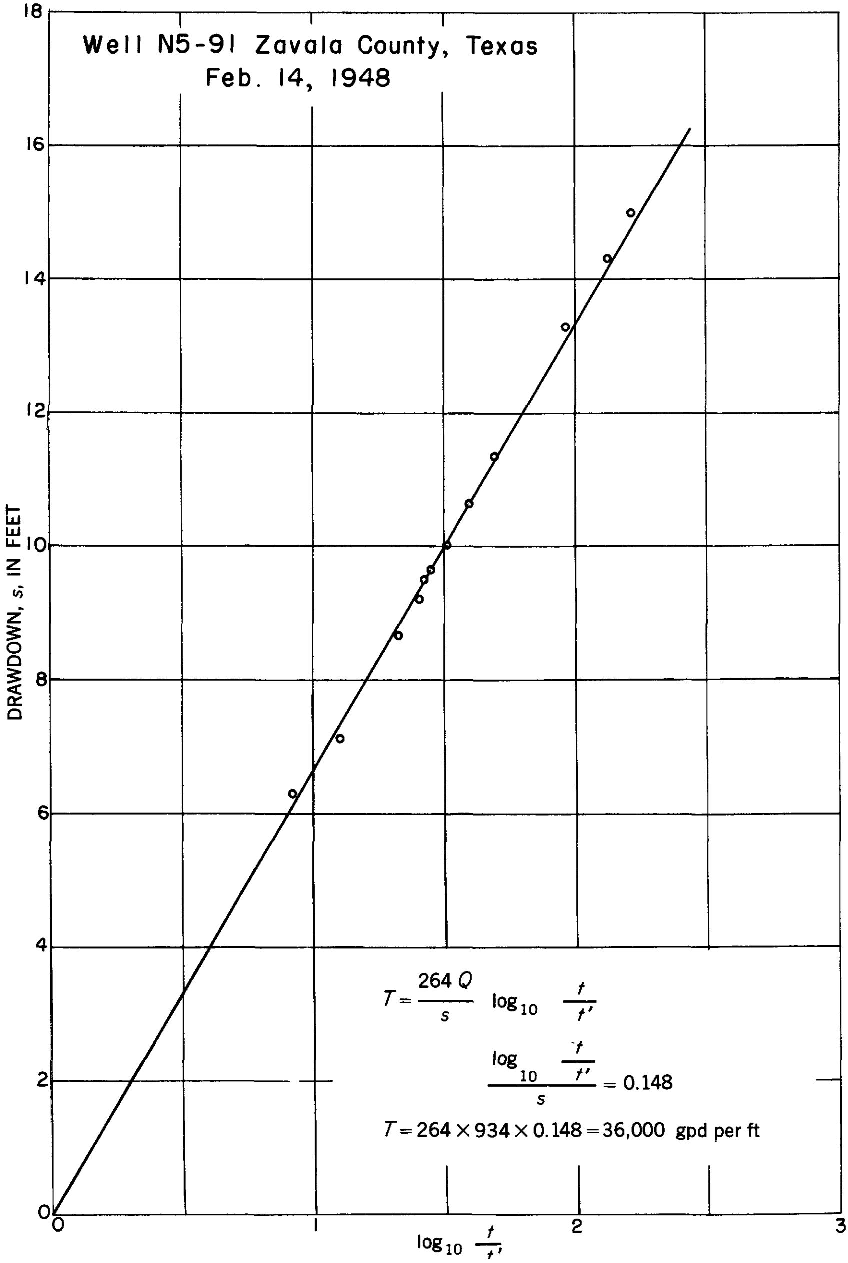

FIGURE 19.—Coefficient of transmissibility determined by the Theis nonequilibrium method.

cone is stopped by a source of recharge. The size and rate of expansion of the cone of depression are much greater in an artesian area than in a water-table area because the quantity of water released from storage per unit decline of pressure is many times less than the quantity that will drain per unit decline of the water table when dewatering the formation. Thus, interference effects are much more important in the artesian area than in the water-table area.

The rate of development of the cone of depression of an artesian well is retarded when the cone extends into the outcrop area where water-table conditions prevail. The large difference in storage coefficient between the two areas is the principal factor causing the retarded development. If the recharge in the outcrop is sufficient to prevent appreciable lowering of the water table, the development of the cone will be further retarded and will, in time, halt. For practical purposes, when calculating artesian-pressure declines, it may be assumed that the outcrop acts as a source of recharge whether or not withdrawals exceed the average rate of recharge in the outcrop. Figure 20 illustrates the declines of artesian pressure to be expected under assumptions based on observed conditions in small areas which may or may not be representative of the entire Winter Garden district.

The calculated values indicated on figure 20 are for 1 well pumping 1 million gallons per day. If the distance to the outcrop were 10 miles, the decline would be within about 1 foot of its maximum value within 4 months; at greater distances from the outcrop, it would take longer times to approach maximum declines. The mutual effect of pumping many wells may be calculated by employing the image-well theory as outlined by Kazmann (1946) in combination with the Theis equation. Because of the unpredictable nature of development in the Winter Garden district, estimates based on calculations of this type appear unwarranted. The purpose of figure 20, therefore, is to show the order of magnitude of interference that may be expected by the addition of another well in the already heavily pumped Carrizo sand in the Winter Garden district and to give to the reader a better understanding of the causes of past declines of artesian pressure.

The development of the cone of depression around a well pumping in the outcrop area where water-table conditions prevail is relatively slow. Several years of continuous pumping from a well a few miles from the edge of the outcrop of a formation or a stream may show no noticeable effect on the normal development of the cone of depression. Figure 21 shows the decline of the water table in the vicinity of a well discharging 1 million gallons per day from an aquifer of infinite areal extent. It portrays the general order of magnitude

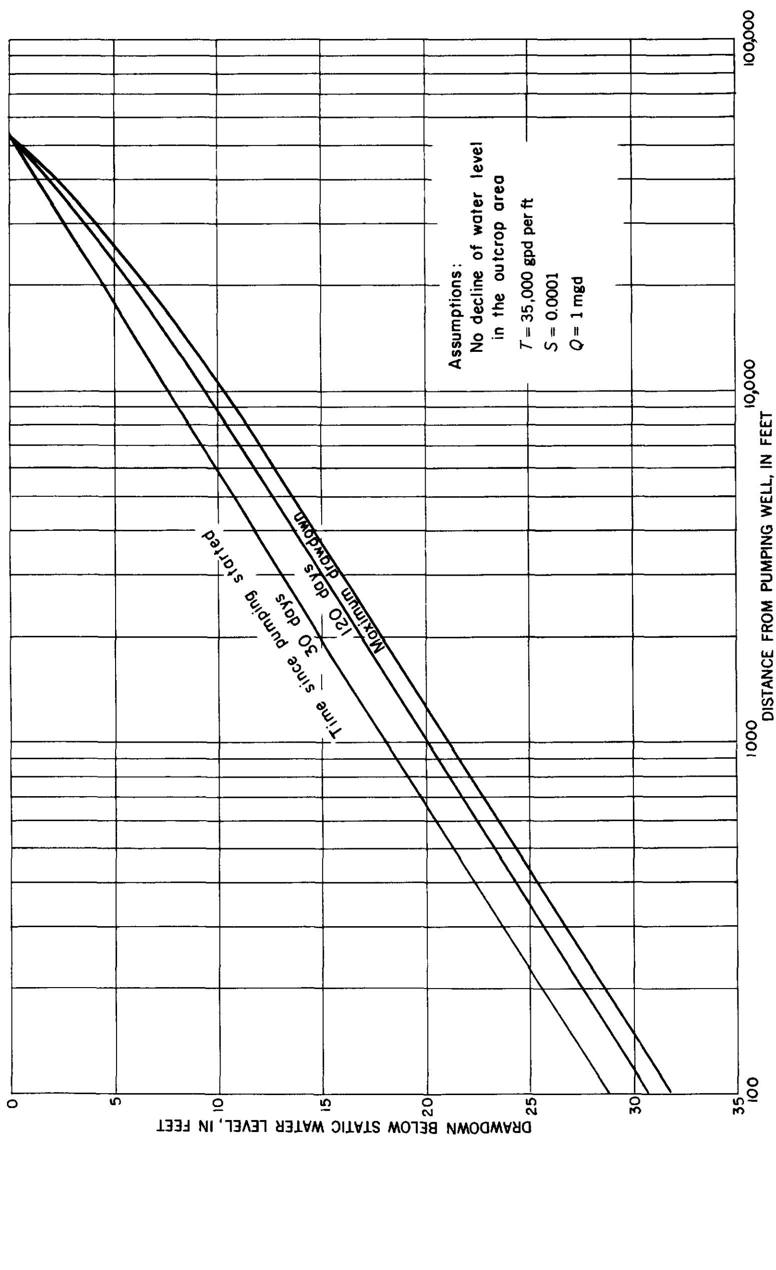

FIGURE 20.—Theoretical decline in water levels along a 10-mile profile between a pumping well and the outcrop of the Carrizo sand.

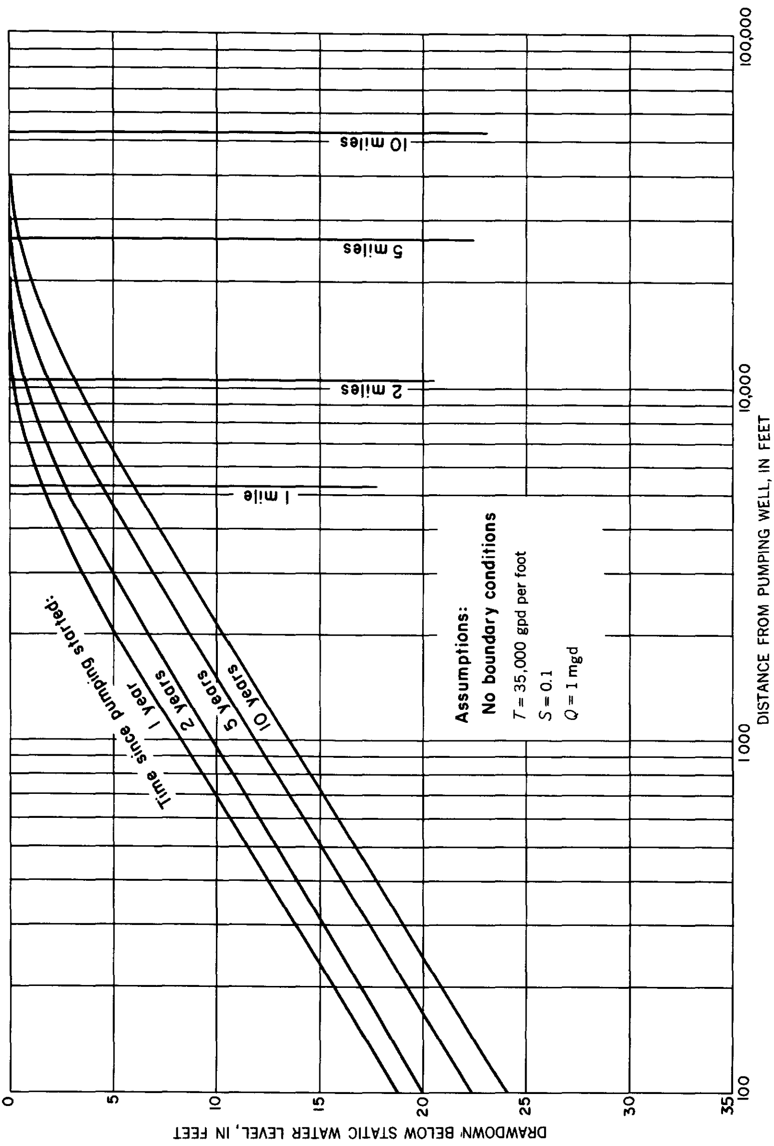

FIGURE 21.—Theoretical decline in water levels in the vicinity of a well discharging from the Carrizo sand in the outcrop area.

of declines expectable in the outcrop area. By comparison with figure 20, figure 21 shows that interference between wells in the outcrop is much less than in the artesian area. For example, the drawdown after 1 year at 1 mile from the pumping well would be about 1.5 feet as compared with about 13 feet in the artesian area where the outcrop is 10 miles from the pumping well.

DEPLETION OF THE RESERVOIR

In terms of reservoir depletion, dewatering of the sands in the Carrizo outcrop is of primary importance. A unit lowering of water level in the outcrop area represents a loss of storage per unit area about 1,000 times as great as a unit lowering of pressure in the artesian area. If it is assumed that the annual rate of recharge is 20,000 acre-feet, that the rate of withdrawal will average 60,000 acre-feet, and that the specific yield is 10 percent, the average rate of decline of water levels in the outcrop (neglecting any contribution from artesian storage) is calculated to be about 2 feet per year over an area of 200,000 acres.

SALT-WATER LEAKS IN WELLS

Numerous irrigation wells and a few public-supply and stock wells in Dimmit and Zavala Counties have become contaminated by saline water from the Bigford member of the Mount Selman formation, which contains water of high mineral content, largely sodium chloride (common salt). The wells known to be affected by salt water are not confined to any one locality but are widely distributed among the noncontaminated wells in several of the irrigated areas in the central and southern parts of the district. Some of the wells that were most seriously affected have been abandoned; others, in which the contamination is slight, are in regular or part-time service but may have to be abandoned if the contamination increases.

The source of contamination is interformational leakage from the Bigford member of the Mount Selman formation into the Carrizo sand. The Bigford member consists chiefly of relatively impermeable beds of clay and shale that contain lenses of sand or sandstone. The clay and shale impede the vertical movement of the water within the Bigford member itself and also impede interformational leakage into the Carrizo sand. When wells penetrate the clay and shale, however, the seal is broken; and if the wells are not cased or if the casing is defective or improperly installed, water may move from one formation to the other. Prior to 1925, before the development of large-scale irrigation, the artesian pressure in the Carrizo was higher than the pressure in the Bigford, and there appears to have been no appreciable contamination. In fact, it appears

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probable that during that period water moved from the Carrizo into the sands of the Bigford through defective wells. As the pressure in the Carrizo declined below that in the Bigford, however, movement of water was reversed and as a result the wells became contaminated.

Contamination of wells by salt water is detrimental for several reasons. Salt water has a highly corrosive action on the well casing and pumping equipment, and the water is injurious to the crops irrigated. Also, the soil of some of the irrigated farms has been seriously injured by water from contaminated wells.

In some contaminated wells in the Winter Garden district the chloride concentration in the water during prolonged periods of pumping is not very high, the salt water entering the well being greatly diluted by water from the fresh-water-bearing beds. When the pump is stopped, however, the salt water continues to enter the well, though perhaps at a slower rate; and being heavier than the fresh water, it accumulates in and around the well below the leak. Above the leak, however, the water in the well casing and pump, representing the water that entered at the close of the preceding period of pumping, remains comparatively fresh. Under conditions prevailing in the Winter Garden district, fresh water may rest on salt water in an idle well without appreciably mixing, and the contact between the two may be sharply defined for a long time. These relations between fresh water and salt water provide a key for exploration to determine the locations of the salt-water leaks. The results of methods employed in exploration of contaminated wells are discussed by Thompson (1928) and Livingston and Lynch (1937). Contamination that is confined to the leaky wells and their immediate vicinity is detrimental, but it is not so serious to the community as widespread contamination of the water-bearing formation. So far the Carrizo sand has not been noticeably affected except at individual wells, but continued neglect of leaky wells may result in widespread contamination.

All wells abandoned because of contamination and wells that cannot be profitably repaired should be sealed from top to bottom. Sealing can be done by pumping cement or heavy mud into the hole through a tube, beginning at the bottom and continuing until the well is filled to the surface. No attempt should be made to seal a well by simply shoveling dirt or other debris in at the top; the filling material probably will bridge at some point above the bottom of the well and, although the well may appear to be sealed, voids may exist through which salt water can enter the well and move into the Carrizo sand.

LEONA FORMATION

The Leona formation is an important aquifer in the Batesville and La Pryor areas. Only 5 irrigation wells yielded water from the Leona formation in northern Zavala County in 1940, but by 1948 about 60 wells were in use. The withdrawal from the Leona formation between July 1, 1947, and June 30, 1948, was about 6,800 acre-feet, of which about 5,400 acre-feet was used to irrigate about 4,200 acres in the Batesville area and about 1,400 acre-feet was used on 900 acres east of the Nueces River near La Pryor.

Marked declines in yields of wells in the Leona formation during 1947–48 prompted many farmers in the Batesville area to drill wells to the Carrizo sand. Some of the wells along the western edge of the Leona formation penetrated only about 15 feet of saturated gravel, and when the water table declined 10–12 feet these wells began to fail. In the area of most recent development (south of Batesville on both sides of the Leona River), however, conditions have been more favorable.

The absence of long-term water-level records made quantitative conclusions regarding the potential development of ground water from the Leona formation speculative. From changes in well yields, however, it appears that the supply is not dependable during periods of extended drought.

The opportunities for recharge to the Leona deposits in Zavala County are as follows: From rainfall and local runoff on the surface of the Leona, seepage from the streams and flood plains when they are inundated, subsurface inflow from the north where the deposits are recharged principally from the underlying Edwards limestone, and percolation of irrigation water.

The relative importance of rainfall and runoff is unknown. Soil conditions and topography in some places are very favorable to the infiltration of water. If these conditions are extensive enough, large quantities of water may be recharged during periods of heavy precipitation.

Livingston (1947, p. 16), referring to the Leona River observed that

> *** the river bed is above the water table in the gravel both in Uvalde and Zavala Counties. Therefore, the river loses water by seepage, but, on the whole, the loss is comparatively small, owing to the presence of travertine and fine silt in the river bed which makes it nearly impermeable. During floods which cause the stream to overflow its banks, however, large quantities of water may seep into the underground reservoir.

Subsurface inflow to the area from the north is probably of minor importance. Calculations based on rough estimates of the thickness and permeability of the saturated material and hydraulic gradient indicate that the rate of inflow is probably a small percentage of the total recharge.

The rapid development of water for irrigation from the Carrizo could make irrigation losses a major source of recharge to the Leona deposits where permeable materials occur between the surface and the water table. This source may, however, increase the dissolved mineral content of the water in the Leona, as it leaches salts from the soil while percolating downward.

Further development of the Leona formation for a supplemental irrigation supply appears favorable. The wells may be spaced fairly close to each other (one-fourth-mile spacing) without appreciably reducing individual well yields. However, variations in water-bearing properties reduce the certainty of obtaining successful irrigation wells. Further data are needed to determine the thickness, nature, and extent of saturated deposits.

QUALITY OF WATER

The general chemical quality of the ground water in the Winter Garden district is shown by the analyses in table 12. Most of the analyses were made by the U. S. Geological Survey, but a few of the earlier analyses were made by the Bureau of Industrial Chemistry, of the University of Texas.

As rain falls through the atmosphere, it is relatively free from dissolved minerals, though every drop carries dissolved atmospheric gases, of which carbon dioxide is the most important because it increases the solvent power of the water. As it percolates into the earth the rainwater dissolves the more soluble minerals. The amount and kind of mineral matter dissolved in natural water depends upon the chemical composition and physical structure of the rocks with which the water comes in contact, the temperature, the pressure, and the duration of contact.

Formations deposited in marine waters originally contained sea water in all pore spaces, but the sea water eventually may be flushed out by rainwater percolating in from the outcrop area. In highly permeable rocks that permit good circulation of ground water, the flushing action may have proceeded to a considerable depth downdip. Less permeable formations may not be flushed as far downdip and may contain water of poor quality close to the surface in areas where the circulation is particularly poor.

MINERAL CONSTITUENTS

Silica (SiO_2) is found in most natural water. Silica has no effect on the use of water for irrigation or domestic purposes, but it does contribute to boiler scale, particularly in high-pressure boilers.

Iron (Fe) is dissolved from practically all rocks and also from iron pipes. Iron generally occurs in water as ferrous bicarbonate. When present in large amounts, it adds to the hardness and causes an unpleasant astringent taste. If a water contains much more than 0.3 part per million (ppm) of iron, the excess may separate out when exposed to the air and settle as a reddish sediment which stains clothing and plumbing fixtures. Most of the iron can be removed from solution by aeration, which causes the iron to precipitate, followed by settling or filtration. Iron is not harmful in irrigation waters.

Appreciable amounts of calcium (Ca) and magnesium (Mg) are found in water that has been in contact with limestone, dolomite, calcareous gravel or sand, gypsum, and many other rocks. The salts of calcium and magnesium make water hard and in the Winter Garden district are generally characteristic of water from shallow wells.

Sodium (Na) and potassium (K) are found in all natural water, although generally there is much less potassium than sodium. Sodium is the chief basic constituent in sea water and most brines. Large percentages of sodium are undesirable for irrigation because they cause the soil to become hard and untillable.

Bicarbonate (HCO_3) is found in nearly all natural waters. Bicarbonate results from the action on carbonate and other rocks of the carbon dioxide dissolved in water. Bicarbonate in large amounts causes the water to have an objectionable taste. Carbonate generally is not found in natural water except in that which is strongly alkaline.

Sulfate (SO_4) may be dissolved in large quantities from gypsum, from alkali deposits of sodium sulfate, or from the oxidation of iron sulfides, principally pyrite. Sulfate of calcium and magnesium contributes to hard boiler scale. Sulfate is undesirable in drinking water if the concentration is more than 250 ppm, particularly if the magnesium content is high (epsom salt is magnesium sulfate).

Chloride (Cl) has little effect on the utility of water except when present in large amounts. Appreciable quantities of chloride in combination with calcium and magnesium may increase the corrosiveness of water. Chloride is harmful to plants if present in excessive amounts, and water having a chloride salt content exceeding about 500 ppm will taste salty to most people.

Fluoride (F) commonly occurs in rocks, but most fluorides are relatively insoluble. The amount of fluoride in natural water seldom exceeds a few parts per million. In small amounts, fluoride inhibits tooth decay in children, but excessive quantities cause mottling of tooth enamel if used during calcification of the teeth.

Nitrate (NO_3) is considered to be the final oxidation product of nitrogenous organic material. High concentrations of nitrate may serve as an indicator of contamination by sewage or other organic wastes. However, many wells yield water high in nitrate without apparent contamination by harmful bacteria.

Boron (B) in appreciable amounts has been found to be detrimental to citrus fruits and many other crops. Plant species differ markedly in their tolerance to high concentrations of boron; the permissible limits of boron for several classes of irrigation waters are shown in table 8.

TABLE 8.—*Permissible limits of boron for several classes of irrigation waters* [1]

[Measurements are given in parts per million]

Boron class	Sensitive crops	Semitolerant crops	Tolerant crops
1	<0. 33	<0. 67	<1. 00
2	0. 33–0. 67	0. 67–1. 33	1. 00–2. 00
3	. 67–1. 00	1. 33–2. 00	2. 00–3. 00
4	1. 00–1. 25	2. 00–2. 50	3. 00–3. 75
5	>1. 25	>2. 50	>3. 75

[1] From Scofield (1936).

The dissolved solids—the residue on evaporation—represents the approximate total of the dissolved mineral substance in solution, including any organic matter and water of crystallization. The palatability of water is affected by the amount of dissolved solids contained in the water. Water containing less than 500 ppm of dissolved solids is usually satisfactory for most uses. The amount of dissolved solids in irrigation water is commonly expressed as tons per acre-foot, which may be computed by multiplying the number of parts per million of dissolved solids by 0.00136.

Hardness is generally caused by the calcium and magnesium present in the water. It is usually recognized by the increased amount of soap required to make a good lather. Temporary or carbonate hardness is caused principally by bicarbonates of calcium and magnesium and is that part of the hardness that can be removed by boiling. Permanent or noncarbonate hardness is caused by the other dissolved salts of calcium and magnesium. The degree of hardness can be expressed as follows: Water having a hardness of 60 ppm or less, soft; 61–120 ppm, moderately hard; 121–200 ppm, hard; and more than 200 ppm, very hard.

The percent sodium shows the relative proportion of sodium ions to total cations and is used as an index of the suitability of a water for irrigation. It is a ratio of the sodium to the total positive ions (sodium, potassium, calcium, and magnesium) in the water, all expressed in equivalents per million. A classification for the suitability of a water for irrigation in arid areas based on the percent sodium and the dissolved solids has been suggested by Wilcox (1948). Analyses of water samples collected in the Winter Garden district are classified accordingly on figure 22. Other factors affecting the suit-

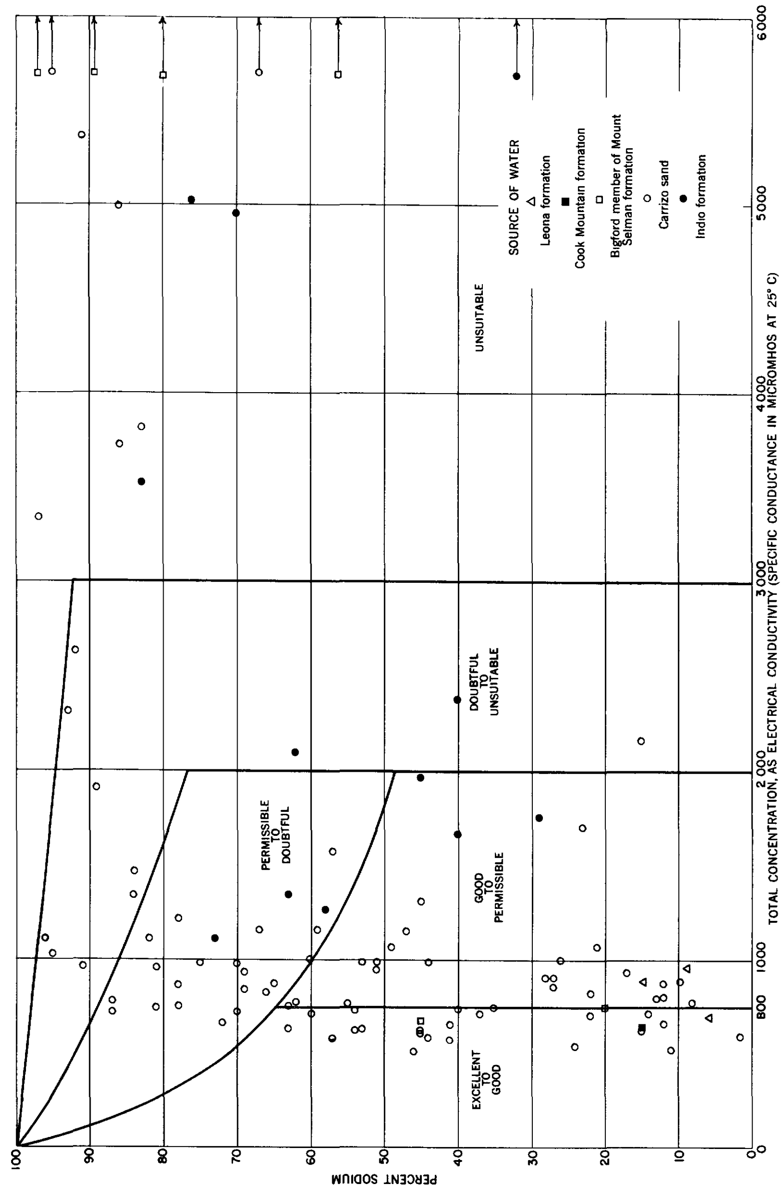

FIGURE 22.—Classification of ground water used for irrigation in the Winter Garden district, Texas.

ability of a water for irrigation, however, are type of soil, subsurface drainage, type of crop grown, amount and distribution of rainfall, and quantity of water applied.

The specific conductance (micromhos at 25°C) of a water is a measure of its ability to conduct electricity. The conductance varies with the concentration and degree of ionization of the different minerals in solution and with the temperature of the water. When considered in conjunction with results of determinations for other constituents, specific conductance gives a good indication of the total quantity of dissolved minerals in the water.

The hydrogen-ion concentration (expressed as pH) of a water is a measure of its acidity or alkalinity, a factor which has an important bearing on the corrosiveness of the water. Values lower than 7.0 denote acidity and values higher than 7.0 denote alkalinity. Acid waters generally are more corrosive than alkaline waters.

QUALITY OF WATER IN THE WATER-BEARING FORMATIONS

The water in the Indio formation exhibits marked differences in chemical character from place to place, probably because the sands are deviously connected and there is little circulation in the water-bearing beds. In 12 samples the dissolved solids ranged from 664 to 3,740 ppm, and the percent sodium ranged from 29 to 83. The upper beds may produce water usable for stock in some places near the outcrop, but the water in the lower part of the formation is generally too highly mineralized for most uses.

The Carrizo sand generally contains water of good quality. The water in the outcrop area is low in dissolved solids but generally is hard because of the solution of calcareous material present in the Carrizo in the outcrop area. The water obtained downdip, however, contains more dissolved solids but is softer because of base-exchange reactions which occur as the water moves downdip through the sand. In 79 samples the dissolved solids ranged from 270 to 7,430 ppm, and the percent sodium ranged from 2 to 97. Analyses of water from the Carrizo sand which reveal high dissolved solids are generally indicative of contamination from the Bigford member of the Mount Selman formation.

Shallow wells in the Bigford member of the Mount Selman formation northeast of La Pryor yield water of satisfactory quality for domestic and stock use. Downdip, however, the water is highly mineralized and is unfit for any use.

Although no samples of water were obtained from the post-Bigford beds of the Mount Selman formation, the water is reported to be highly mineralized. Ranchers in the eastern part of the district reported that it is undesirable even for stock use.

Only one sample was obtained from a well that definitely draws water from the Cook Mountain formation; the water was of good quality. Ranchers reported, however, that the water from the Cook Mountain generally was too highly mineralized for stock use. Several shallow wells draw water for domestic use from the formation east of the district in Frio County, but only one of these wells was reported to yield water of good quality.

Water from the Leona formation is generally hard but relatively low in dissolved solids. In 3 samples the dissolved solids ranged from 368 to 536 ppm and the percent sodium ranged from 6 to 15. Thus the quality of the water is excellent for irrigation.

SUMMARY AND CONCLUSIONS

The Carrizo sand and the Leona formation constitute the principal aquifers in the Winter Garden district. Water in sufficient quantities and of suitable quality for irrigation is available from each. The Carrizo sand is by far the more important because of its greater thickness and extent. In part of northern Zavala County, potable water is available for domestic and stock supplies from the Bigford member of the Mount Selman formation. Water from the Indio formation generally is highly mineralized, but in some areas it is suitable for domestic and stock supplies. Other water-bearing formations present in the area generally yield highly mineralized water and are relatively unimportant as aquifers.

Irrigation development and annual withdrawals of ground water have been variable. Profits made by the irrigation farmers in 1929–30 were sufficient to stimulate development. During the depression that followed, prices of farm products were low, and the irrigated acreage was materially reduced. Europe's entry into World War II increased the prices of farm products, again stimulating irrigation development, which has continued at a rapid pace through the postwar period to the present time. Ground-water withdrawals from the Carrizo for the crop-year 1947–48 were estimated to be 55,000 acre-feet, as compared with 27,000 acre-feet for the 1929–30 season and 22,000 acre-feet during the 1937–38 season. Withdrawals from the Leona formation increased about tenfold from 1940 to 1948, when about 6,800 acre-feet was pumped.

The decline of water levels in the outcrop area of the Carrizo sand indicates that the present rate of withdrawals exceeds the average rate of natural recharge, which is probably about 25,000 acre-feet per year. If withdrawals continue at this rate, it is estimated that the recharge area (Carrizo outcrop) will be dewatered at an average rate of about 2 feet per year. Continued irrigation expansion would, of course, accelerate the dewatering.

Intensive water-conservation practices by the farmers of the district would reduce the rate of depletion of the aquifer and prolong the high productivity of the district. Conservative irrigation and farming practices recommended by various private and governmental farm agencies if followed carefully will tend to conserve the water resources of the area. Further use of surface reservoirs to collect storm runoff for irrigation use should be considered wherever possible.

Perhaps the most imminent problem related to continued expansion of irrigation is the decline of artesian pressure, which directly affects the cost of pumping water. Although the water stored in the Carrizo sand is in no danger of being depleted completely for many years, the increased pumping lifts caused by increased withdrawals eventually may make it uneconomical to pump water for irrigation. During the period of record 1929–48, the water level declined in some areas more than 90 feet. Excessive declines caused by concentrated withdrawals of ground water may be reduced by spacing wells farther apart.

A substantial number of irrigation wells have been abandoned because the water became too highly mineralized. Tests on these wells showed that highly mineralized water from the Bigford member of the Mount Selman formation was entering the wells through leaks in or along the sides of the casings. A better grade of casing and a more effective seal above the fresh-water-bearing material would help to prevent leakage. Wells that are too expensive to repair, unless carefully plugged, will likely lead to widespread contamination.

Further studies are needed to refine the estimates of recharge made in this investigation and to reevaluate the ground-water potential periodically. Extensive studies should be made to determine the rate of natural recharge more accurately and to evaluate the possibilities further of increasing the recharge by artificial means. The Leona formation should be extensively studied to determine its thickness, areal extent, and water-bearing characteristics so that quantitative conclusions can be reached as to its potential development. Pumpage inventories and frequent water-level measurements should be made so that ground-water conditions may be reevaluated every few years. The more acute the problems become, the greater the need for accurate and current information on the ground-water conditions.

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BASIC DATA

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*

Method of lift: B, bucket; C, cylinder; Cf, centrifugal; E, electric; G, gasoline, diesel, or oil; H, hand; Ng, natural gas; T, turbine; W, windmill. Number indicates horsepower.
Use of water: D, domestic; Ind, industrial; I, irrigation; N, none; P, public supply; S, stock.
[All wells are drilled unless otherwise indicated in remarks column. For wells marked with an asterisk (*) see table 12 for chemical analyses of ground waters]

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
G9-1	$16\frac{3}{4}$ NW	G. B. Bentley	------	------	125	4	------	47.7	12-12-29	C, W	D, S	------	------	------	
H7-1	$9\frac{1}{4}$ N	C. L. Bloom, and others.	------	1920	687	------	------	------	------	------	------	------	------	------	R. L. Anderson well 2, gas test. Basalt reported at 650-654 ft and 684-687 ft.
2	$9\frac{1}{2}$ N	N. B. Pulliam	------	1909	40	6	38	34.4	4- 4-30	C, W	D, S	------	------	------	
*3	$9\frac{1}{2}$ NW	E. B. Flowers	------	------	100	5	------	83.1	---do---	C, W	D, S	------	------	------	
4	$7\frac{1}{2}$ N	Washer Bros	------	1927	640	8	150	------	------	------	------	------	------	------	Casing: 130 ft of 8-in.; 20 ft of 8-in. perforated with $\frac{1}{2}$-in. holes. Well plugged back to 200 ft. Water reported slightly salty.
5	6 NW	A. R. Hibdon	B. F. Kite	1922	300	8	------	111.4	11-19-29	C, G, 6	S	------	------	------	
6	$6\frac{3}{4}$ NW	Turk Ranch	------	------	48	------	------	42.1	4- 4-30	C, W	S	------	------	------	Dug.
7	$4\frac{3}{4}$ NW	Tepley	B. F. Kite	1911	155	10	155	99.8	11-19-29	C, W	D, S	------	------	------	Casing: 95 ft of 10-in.; 60 ft of 10-in. perforated.
8	$4\frac{3}{4}$ NW	McCrary	-----do-----	------	------	8	------	111.1	---do---	C, G	N	------	------	------	
9	$4\frac{1}{2}$ NW	-----do-----	-----do-----	------	------	------	------	112.0	---do---	C, W	D, S	------	------	------	

10	$4\frac{3}{4}$ NW	J. N. Wheeless	do	1926	144	6	144	111.3	do	C, W	D, S	-------	-------	-------	Casing: 124 ft of 6-in.; 20 ft of 6-in. perforated. Log.
11	$4\frac{3}{4}$ N	Scott	-------	-------	-------	-------	-------	114.4	do	C, W	D, S	-------	-------	-------	
12	5 NW	do	B. F. Kite	1923	175	10	175	114.5	do	-------	N	-------	-------	-------	Casing: 115 ft of 10-in.; 60 ft of 10-in. perforated with $\frac{1}{2}$- and 5/8-in. holes. Log.
*13	$4\frac{1}{4}$ NW	Roy Cornett	do	1912	172	10	172	113.3	11- 7-29	C, W	S	-------	-------	-------	Casing: 132 ft of 10-in.; 40 ft of 10-in. perforated.
14	$4\frac{3}{4}$ N	Frank Wampler	Cox & Davis	1929	133	8	-------	111.4	11-19-29	T, G	I	-------	-------	50	Deepened to 190 ft.
15	$4\frac{3}{4}$ N	do	B. F. Kite	1912	170	10 3/8	170	-------	-------	-------	N	50	0	0	Screen set at 130-170 ft. Temp 75°F.
16	$4\frac{1}{2}$ N	do	do	1927	130	6	-------	-------	-------	-------	N	-------	-------	-------	
17	4 N	Campbell	L. F. Kite	1926	240	10	230	103	2- 8-28	T, E, 40	I	160	160	-------	Casing: 130 ft of 10-in.; 100 ft of 10-in. perforated with 3/8-in. holes. Temp 76°F.
18	4 N	B. F. Kite	B. F. Kite	1922	1,730	8	-------	-------	-------	-------	-------	-------	-------	-------	Gas well.
19	4 N	-------	Cribbs & Davidson.	-------	1,150	-------	-------	-------	-------	-------	-------	-------	-------	-------	Gas test, abandoned and filled.
*20	$5\frac{1}{4}$ N	O. V. Vickery	B. F. Kite	1926	130	6	130	a/72.8 76.1	11-13-29 9-15-48	C, W	D, S	-------	-------	-------	Casing: 90 ft of 6-in.; 40 ft of 6-in. perforated. Log.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
*H7-21	$5\frac{1}{2}$ N	O. V. Vickery	Cribbs & Davidson.	1934	164	12	164	-------	-------	-------	N	-------	-------	-------	Casing: 70 ft of 12-in.; 94 ft of 12-in. perforated. Log.
22	$5\frac{1}{4}$ N	do	do	1934	192	12	192	-------	-------	T, E, 40	I	-------	-------	-------	Reported low yield. Assists H7-23. Log.
*23	$4\frac{3}{4}$ N	do	do	1934	182	$12\frac{1}{2}$	168	-------	-------	T, E, 40	I	-------	380	700	Casing: 101 ft of $12\frac{1}{2}$-in.; 67 ft of 10-in. perforated. Used with H7-22. Log.
24	$3\frac{3}{4}$ N	Seth Davenport	O. F. Webb	1946	270	10	180	270	-------	T, G	I	-------	-------	-------	
25	$4\frac{1}{4}$ N	do	do	1948	277	10	270	-------	-------	T, G	I	-------	-------	190	
26	$4\frac{1}{2}$ N	George C. Tondre	E. L. Kite	1946	232	10	232	-------	-------	T, G	I	-------	-------	160	
27	$4\frac{1}{2}$ NW	Campbell	J. E. & E. L. Kite.	1943	191	12	191	127.0	11-15-43	C, W	D	-------	-------	0	
28	5 N	Frank Wampler	E. L. Kite	1948	244	12	244	146	4-18-48	T, G, 35	I	-------	-------	P	
29	$4\frac{3}{4}$ N	George Vickery	do	1943	156	$12\frac{1}{2}$	175	-------	-------	T, E, 20	I	-------	-------	-------	
30	$5\frac{1}{2}$ NW	A. R. Hibdon	B. F. Kite	1920	199	6	199	135.8	11-19-29	C, W	D, S	-------	-------	-------	Log.
*H8-1	$9\frac{1}{2}$ NE	A. W. West	-------	-------	120	5	-------	79.0	11-11-29	C, W	S	-------	-------	-------	Indio formation.

2	10 NE	West-Burns		1905	240	6				C, W	S				
3	10 NE	A. W. West			200	6		81.0	12-23-29	C, W	S				
4	$11\frac{3}{4}$ NE	do			1,470										Mission Drilling Co., No. 1, gas test.
5	$11\frac{1}{2}$ NE	do			850										Keystone No. 1, gas well.
6	$12\frac{1}{2}$ NE	T. P. Lee		1909	400	6		67.8	11-29-29	C, W	S				Reported low yield, no water below 80 ft.
7	$12\frac{1}{2}$ NE	A. W. West			1,308										Pundt No. 1 West, gas test.
8	$6\frac{1}{2}$ N	I. T. Pryor		1926	3,503										Continental-Old Dominion Co., I. T. Pryor No. 1, oil test.
9	5 NE	I. T. Pryor, Jr		1930	1,155										State No. 1, gas test in bed of Nueces River.
10	5 NE	do		1930	456										Texas Gas Utility Co., No. 1, gas test, not completed.
12	9 NE			1921	1,395										La Pryor Oil & Gas Co., Well 1, gas test.
15	10 NE			1929	1,125	8	860								Oil test.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level		Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
								Below land surface (feet)	Date of measurement			1929-30	1937-38	1947-48	
	La Pryor:														
H8-16	$10\frac{1}{2}$ NE	A. W. West	------	------	1,100	------	------	------	------	------	------	------	------	------	Witherspoon No. 3, West, gas test.
*17	$10\frac{3}{4}$ NE	----do----	Munroe Fenley	1927	234	6	------	179.0	11-28-29	C, W	S	------	------	------	Temp $72\frac{1}{2}$°F, 1929.
18	$9\frac{1}{2}$ E	Smith-Flowers	------	------	1,820	------	------	------	------	------	------	------	------	------	Navarro Oil Co., No. 1, gas test.
19	$10\frac{1}{2}$ E	T. P. Lee	------	1927	310	6	290	131.5	11-30-29	------	N	------	------	------	Casing: 250 ft of 6-in.; 40 ft of 6-in. perforated with $\frac{1}{2}$-in. holes.
20	$11\frac{1}{2}$ NE	----do----	Munroe Fenley	------	300+	8	------	94.9	1-30-46	C, W	S	------	------	0	
21	13 NE	----do----	----do----	------	------	6	------	------	------	C, W	S	------	------	0	
22	12 NE	----do----	----do----	------	------	8	------	144.4	1-30-46	C, W	S	------	------	0	
23	$11\frac{1}{2}$ NE	----do----	----do----	------	------	6	------	------	------	C, W	D, S	------	------	0	
*68	$4\frac{1}{2}$ NE	A. D. Walker	E. L. Kite	1943	84	6	84	61.9	12-27-46	C, W	D	------	------	0	Federal observation well.
69	$4\frac{1}{4}$ N	----do----	----do----	1945	190	10	190	------	------	T, Ng	I	------	------	160	
70	$4\frac{1}{2}$ N	----do----	----do----	1946	203	10	203	------	------	T, Ng	I	------	------	80	
71	$4\frac{3}{4}$ N	----do----	----do----	1947	203	12	202	78	6-27-47	T, Ng	I	------	------	190	
72	5 N	V. O. Vickery	----do----	1948	193	12	193	------	------	T, E	I	------	------	------	Samco test, 1,100 gpm. Drawdown, 35 ft.

73	5¼ N-----	George Vickery-	--------------	1948	156	8	136	115	1-23-47	T, E	I	-------	-------	0	
74	9 NE ----	I. T. Pryor ----	--------------	------	2, 720	-------	-------	--------	---------	--------	------	-------	-------	-------	Jergins Oil Co. No. 1 oil test.
75	7½ N-----	Washer Bros ---	--------------	1930	3, 065	-------	-------	--------	---------	--------	------	-------	-------	-------	Southern Crude Production Co. No. 1 gas test.
	Batesville:														
*H9-1	8½ N-----	---------------	--------------	------	58	6	-------	49. 5	11- 4-29	C, W	S	-------	-------	-------	
*2	8½ NE ---	Kincaid Bros ---	--------------	1904	250	6	-------	186. 2	11- 5-29	C, W	S	-------	-------	-------	
3	11 NE ---	-----do--------	Munroe Fenley	1929	204	6	-------	160. 5	---do---	C, W	S	-------	-------	-------	
4	4 N------	Baxter---------	--------------	1929	45	48	-------	42. 0	11-12-29	B, H	D	-------	-------	-------	In Leona formation.
5	8 NW----	T. P. Lee -----	--------------	------	147	6	-------	41. 7	2-14-46	C, W	S	-------	-------	-------	
6	6½ NW---	-----do--------	--------------	------	200	6	-------	--------	---------	C, W	S	-------	-------	-------	
7	6 NE ----	-----do--------	--------------	------	-------	6	-------	58. 4	---------	C, W	S	-------	-------	-------	
8	6 N------	-----do--------	--------------	------	57	8	-------	50. 5	1-28-46	C, W	S	-------	-------	-------	
9	5 NW ---	-----do--------	--------------	------	-------	6	-------	62. 3	2-14-46	C, W	S	-------	-------	-------	
10	4 NW ---	-----do--------	--------------	------	110	6	-------	57. 5	---do---	C, W	S	-------	-------	-------	
11	4 NW ----	-----do--------	--------------	------	66	6	-------	56. 8	---do---	None	N	-------	-------	-------	
12	3¼ NW ---	J. H. Newcomer	--------------	------	-------	48	-------	45. 0	1-16-46	None	N	-------	-------	-------	
13	3¼ NW ---	-----do--------	--------------	------	-------	6	-------	44. 9	---do---	C, H	D, S	-------	-------	-------	
14	3¼ N-----	William A. Jones	--------------	------	50	10	-------	43. 4	---do---	C, W	D, S	-------	-------	-------	
15	3¼ N-----	Clay Sherer ----	--------------	------	43	6	-------	37. 2	---do---	C, W	D, S	-------	-------	-------	
16	2¾ N-----	T. T. Nelson---	--------------	------	48	6	-------	43. 0	---do---	None	N	-------	-------	-------	
I7-1	12¼ NE --	Kincaid Bros ---	--------------	1907	140	-------	-------	91. 6	11- 9-29	C, W	S	-------	-------	-------	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Batesville:														
I7-2	10 NE	Kincaid Bros	---	---	---	6	---	43.4	11- 6-29	C, W	S	---	---	---	
*3	$10\frac{3}{4}$ NE	---	---	---	---	6	---	78.0	2-10-30	C, W	D, S	---	---	---	
4	$13\frac{1}{2}$ NE	H. J. Tiller	---	---	120	6	---	77.8	---do---	C, W	D, S	---	---	---	
5	$13\frac{1}{2}$ NE	---do---	---	---	115	12	---	81.6	---do---	C, W	S	---	---	---	
	La Pryor:														
M2-1	$20\frac{1}{4}$ W	Fessman	---	---	500	---	---	---	---	C, W	N	---	---	---	Low yield, salt water.
2	21 W	Gus Black Estate	Charley Lindenborn.	---	130	---	---	---	---	C, W	S	---	---	---	
4	24 W	Chittem Estate	---	---	---	12	---	3.0	3-23-30	C, W	S	---	---	---	Chilipetin oil test, used as stock well. Indio formation.
M3-1	16 W	Lens	---	1929	202	8	---	---	---	C, W	S	---	---	---	Yields salt water. Indio formation.
*2	$13\frac{1}{4}$ W	Fenley	---	---	---	---	---	---	---	---	---	---	---	---	Do.
*3	$13\frac{1}{4}$ W	Ingram	---	---	---	6	---	71.0	3-30-30	C, W	D, S	---	---	---	Temp 75°F.
5	$11\frac{1}{4}$ W	H. Rambie	Cox & Davis	1928	68	6	---	42.5	---do---	C, W	S	---	---	---	
*6	$16\frac{3}{4}$ W	M. Rambie	---do---	1927	100	10	60	---	---	T, G	N	---	---	---	Casing: 40 ft of 10-in.; 20 ft of 10-in. perforated. Reported in 1938 no irrigation since 1934. Temp 78°F. Log.

7	$16\frac{1}{2}$ W	do		1900	40	5		30.5	1-27-30		N				
8	$16\frac{1}{4}$ W	H. P. Street			47	3				C, W	D, S				Supply reported weak.
9	$14\frac{3}{4}$ W	George Park	Cox & Davis	1928	132						N				
10	$14\frac{3}{4}$ W	do		1910		5		50.9	1-27-30		N				
11	$14\frac{1}{4}$ W	R. W. Horton			194	6	20	91.0	3-30-30	C, W	D, S				
12	14 W	do			150					C, W	S				
13	$11\frac{3}{4}$ W	do			150	8		52.4	3-30-30	C, W	S				Temp 75°F.
14	$19\frac{1}{4}$ W	Gus Black Estate	Charley Lindenborn.		250						N				Found only small salt-water seep. Abandoned and filled.
15	$19\frac{1}{2}$ W	do	Munroe Fenley	1928	120	8	20	51.0	2-12-30	C, W	D, S				Temp 76°F.
16	$19\frac{1}{2}$ W	do	Charley Lindenborn.		100						N				Bad water reported. Abandoned.
17	$17\frac{3}{4}$ W	G. W. Williams	Cox & Davis	1928	104	10	103			C, W	D, S				Casing: 24 ft of 10-in.; 80 ft of 10-in. perforated.
18	$19\frac{3}{4}$ SW	Gus Black Estate	Joe York	1912	80	6	20	46.3	5-19-30	C, W	S				
19	$19\frac{3}{4}$ SW	do	Charley Lindenborn.	1910	90	6	20	38.4	do	C, W	S				Temp 75°F.
20	$18\frac{3}{4}$ W	do	Cox & Davis	1928	80	6	20	50.6	2-12-30		N				Log.
21	$18\frac{1}{4}$ W				81	6		44.6	2- 6-30		N				
22	$11\frac{1}{4}$ W	G. W. Williams	Cox & Davis	1929	70	6	57			C, W	S				
23	$16\frac{3}{4}$ W	do	do	1929	107	8		56.5	2-12-30	C, W	D, S				

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
M3-24	16½ W	C. F. Jackson	Cox & Davis	1929	102	10	82	------	------	------	N	20	0	------	Reported no irrigation for several years prior to 1937-38. Log.
25	16 W	do	------	------	24	48	------	------	------	C, W	N	------	------	------	Dug. Abandoned because creek overflows into it.
26	16¼ W	do	------	1910	35	5	------	31.4	2-12-30	C, W	D, S	------	------	------	
27	15½ W	do	W. H. Rose	1910	32	5	20	------	------	C, W	S	------	------	------	
28	14½ W	Hope & Perkins	Cox & Davis	1928	123	10	80	41.5	2-12-30	------	N	------	------	------	
29	13½ W	R. W. Norton	------	------	150	6	------	a/96.7 97.8	1-25-30 9-16-48	C, W	S	------	------	------	
30	14½ W	Hope & Perkins	Cox & Davis	1927	65	5	65	26.8	2-12-30	C, W	S	------	------	------	
31	13¾ W	do	------	------	115	5	------	70.5	do	C, W	S	------	------	------	
32	12½ W	G. W. Williams	------	------	175	4	------	------	------	C, W	S	------	------	------	Water reported slightly salty.
33	12¾ W	do	------	------	------	4	------	------	------	C, W	S	------	------	------	
34	14 SW	Hope & Perkins	------	------	------	6	------	46.3	2-12-30	C, W	S	------	------	------	
35	15½ SW	Chittem Estate	------	------	------	6	------	32.6	2-11-30	C, W	S	------	------	------	
*36	15¾ SW	Willie Clark	Cox & Davis	1928	263	8	191	------	------	C, W	S	------	------	------	

37	$15\frac{1}{2}$ SW	do	---	---	---	112	---	39.0	2-11-30	C, W	D, S	---	---	---	
38	$14\frac{1}{2}$ SW	Chittem Estate	---	---	---	6	---	10.5	do	C, W	D	---	---	---	Once flowed according to report.
39	$14\frac{1}{2}$ SW	R. W. Norton	---	---	---	---	---	---	---	C, W	S	---	---	---	
40	$16\frac{3}{4}$ W	---	Elmo Owens	1935	148	12	20	---	---	T, G	I	0	---	---	
41	$16\frac{1}{2}$ W	---	do	1935	120	12	20	---	---	T, G	I	0	353	---	
42	$16\frac{1}{2}$ W	---	do	1935	112	12	20	---	---	T, G	D, I	0	---	---	
43	$16\frac{1}{4}$ SW	---	do	1935	108	12	20	a/14	5- -35	T, G	I	0	---	---	
44	$18\frac{3}{4}$ W	Gus Black Estate	do	1935	92	10	20	---	---	T, G	S, I	---	0	---	
45	$12\frac{1}{2}$ SW	R. W. Norton	---	---	---	6	---	39.8	2- 6-30	C, W	S	0	---	0	
46	$19\frac{1}{2}$ SW	Chittem Estate	---	---	---	---	---	---	---	C, W	S	---	---	---	
47	$19\frac{1}{2}$ SW	do	---	---	---	---	---	---	---	C, W	S	---	---	---	
48	$17\frac{1}{2}$ W	F. G. Taylor	O. F. Webb	1948	122	12	122	---	---	T, E 20	I	---	---	60	
49	$18\frac{1}{4}$ W	do	James Sellars	1948	95	12	95	---	---	T, E 10	I	---	---	---	Completed after irrigation season.
50	$18\frac{1}{2}$ W	do	O. F. Webb	1948	79	12	79	---	---	T, E 10	I	---	---	---	Do.
51	$18\frac{1}{4}$ W	do	do	1948	95	12	77	---	---	T, E 10	I	---	---	---	Do.
52	18 W	A. Wozencraft	---	1948	100	12	---	---	---	T, E 30	I	---	---	---	Do.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
M5-1	23 SW	Chittem Estate	Joe York	------	------	------	------	------	------	C, W	S	------	------	------	Reported weak. Yields salt water.
	Crystal City:														
M6-1	11½ E	A. N. Erskine	J. McFarland	1906	600	8	------	------	------	T, G 16	I	------	------	50	
2	11½ E	G. C. Marshall	------	------	------	------	------	------	------	T, G	I	------	------	300	
3	20¾ NW	Chittem Estate	------	------	------	6	------	------	------	C, W	S	------	------	------	Reported weak. Yields salt water.
4	20¼ NW	----do----	------	------	------	4	------	68.0	5-19-30	C, W	S	------	------	------	
5	19¼ NW	Plumley & Stewart.	------	------	------	4	------	75.8	---do---	C, W	S	------	------	------	
6	18½ NW	Chittem Estate	------	------	------	6	------	------	------	C, W	S	------	------	------	Water reported mineralized.
7	17 NW	Plumley	------	1928	------	6	------	83.5	1-17-30	C, W	S	------	------	------	Water reported salty.
8	17 NW	King Ware	Will Terry	1905	228	5 5/8	160	------	------	C, W	S	------	------	------	90 ft deep and salty when first drilled, later deepened and salt cased off.
9	16¾ NW	----do----	Elmo Owens	1928	335	------	------	67.8	1-17-30	C, W	S	------	------	------	Water reported salty.
*10	16¼ NW	W. M. Van Cleve	Harry Bowers	1914	150	5 5/8	96	a/70.1 97.1	1-21-30 9-16-48	C, W	D, S	------	------	------	
11	20 NW	Chittem Estate	------	------	------	5	------	53.5	3-12-30	C, W	S	------	------	------	

12	19 NW ---	-----do--------	--------------	------	140	6	-------	64.0	---do----	C, W	S	-------	-------	-------	
13	18½ NW --	-----do--------	--------------	------	-------	16	-------	66.8	3-11-30	C, W	S	-------	-------	-------	
14	16¼ W ---	-----do--------	--------------	------	-------	4	-------	88.4	3-13-30	C, W	S	-------	-------	-------	
15	15½ NW --	-----do--------	--------------	------	-------	6	-------	37.2	3-12-30	C, W	S	-------	-------	-------	
16	14¾ NW --	J. W. Stuart ---	Will Clark ----	------	300	5 3/16	-------	a/43.9 49.6 83	1-17-30 10-16-48 12-19-47	C, W	D, S	0	0	0	
17	15¼ NW --	C. Van Cleve---	Ive White -----	1904	160	5 5/8	100	41.7	1-21-30	C, W	D, S	-------	-------	-------	
18	14 NW ---	N. E. Ware ----	Charley Lindenborn.	1904	530	5 5/8	-------	a/35.8 66.9	1-17-30 9-16-48	C, W	D, S	-------	-------	-------	
19	14 W ----	L. D. Van Cleve	Ive White -----	1905	180	5 5/8	100	a/49.2 69.0	1-17-30 9-16-48	C, W	D, S	-------	-------	-------	
20	11¾ NW --	J. W. Stuart ---	W. E. Campbell	1910	715	6	440	39.2	1-19-30	--------	N	-------	-------	-------	
21	11½ W ---	A. W. Allison --	Charley Lindenborn.	1929	420	-------	-------	--------	---------	--------	N	260	0	-------	
22	11¾ W ---	Ben Patterson --	--------------	1900	-------	-------	-------	--------	---------	T, G	D, S I	-------	125	0	
23	11¾ W ---	-----do--------	L. D. Stripling	1934	522	10	192	--------	---------	T, G 20	S, I	-------	55	200	Temp 81°F.
*M9-1	11¾ W ---	T. B. Mear ----	Charley Lindenborn.	1904	335	6	60	a/58.2 87.0	12-18-29 9-15-48	C, W	D, S	-------	-------	-------	Reported water level 20 ft below surface in 1913. Temp 80°F.
2	11¼ W ---	A. W. Allison --	-----do-------	------	425	5	-------	--------	---------	--------	N	-------	-------	-------	Plugged and abandoned.
3	11½ W ---	Fred Erskine---	John McFarland.	1907	432	10 5/8	219	--------	---------	T, G, 40	D, S, I	-------	-------	100	Casing: 20 ft of 10 5/8-in. drive pipe; 200 ft of 8-in. Log.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
*M9-4	13¼ W	Chittem Estate	Harry Bowers	1900	200	8	------	51.4	2- 4-30	C, W	S	-------	-------	-------	Indio formation.
5	13¼ W	Pablo Sanchez	J. Galan	1926	100	6	20	76.0	---do---	C, W	D, S	-------	-------	-------	
6	14 W	Farias Ranch	-------	------	460	------	------	-------	-------	C, W	N	-------	-------	-------	Salt-water seeps reported at 40, 80, and 460 ft.
7	12¾ SW	W. M. Singleton	-------	------	700	------	------	-------	-------	C, W	N	-------	-------	-------	Water reported salty.
8	12½ SW	-----do-----	-------	1928	100	6	------	29.2	5-15-30	C, W	D, S	-------	-------	-------	
9	12¼ SW	Myers	-------	------	------	10	------	a/75.2 87.5	12-12-29 9-16-48	C, W	S	-------	-------	-------	
10	14½ SW	Farias Ranch	-------	1910	250	------	------	-------	-------	C, W	N	-------	-------	-------	Yields salt water.
11	12¼ SW	Myers	M. McCorley	1924	110	8	------	-------	-------	C, W	S	-------	-------	-------	
12	15½ SW	-------	George Petty	1920	200	6	200	-------	-------	C, W	S	-------	-------	-------	Reported weak. Yields salt water.
*14	11¼ W	B. H. Erskine	L. D. Stripling	1937	410	10	256	-------	-------	T, G, 30	I	-------	180	52	Irrigated land supplied in part from well.
15	12 W	Sweet	Elmo Owens	1948	390	12	280	-------	-------	T, G	I	-------	-------	200	
	Carrizo Springs:														
*16	9¾ W	Ed Gardner	Owens	------	------	------	------	-------	-------	C, W	S	-------	-------	-------	See chemical analyses.

*17	$10\frac{1}{4}$ W ---	-----do--------	-----do-------	------	------	------	------	--------	---------	C, W	S	-------	-------	-------	Do.
*18	10 W ----	-----do--------	-----do-------	------	------	------	------	--------	---------	C, W	S	-------	-------	-------	Do.
*19	$10\frac{1}{4}$ NW --	Ben Patterson --	-------------	------	200	------	------	--------	---------	C, W	S	-------	-------	-------	Do.
*20	$9\frac{1}{2}$ W ----	Ed Gardner ----	Owens --------	------	------	------	------	--------	---------	C, W	S	-------	-------	-------	Do.
*21	$9\frac{3}{4}$ W ----	-----do--------	-----do-------	------	------	------	------	--------	---------	C, W	S	-------	-------	-------	Do.
	La Pryor:														
N1-1	$3\frac{1}{2}$ NW ---	W. C. Gilbert --	E. L. Kite ----	1943	350	10	350	--------	---------	T, G	I	-------	-------	235	
2	$2\frac{3}{4}$ NW ---	Fritz Kral -----	-----do-------	------	------	------	------	--------	---------	T, G	I	-------	-------	80	
3	4 NW ----	C. W. Aten ----	-----do-------	1910	150	10 5/8	-------	119.8	12-23-29	C	D	-------	-------	0	Temp $75\frac{1}{2}$°F.
4	4 NW ----	George B. Pitts	-----do-------	1910	165	10 5/8	-------	119.9	---do----	T, G, 25	D, S, I	45	$21\frac{1}{4}$	6	Do.
5	$3\frac{3}{4}$ NW ---	Grant ---------	-----do-------	1910	$177\frac{1}{2}$	10 5/8	178	--------	---------	C, W	D, S	40	0	-------	Casing: 118 ft of 10 5/8-in.; 60 ft of 10 5/8-in. perforated with $\frac{1}{2}$-in. holes. Reported used for irrigation until 1930. Log.
6	4 NW ----	B. F. Kite -----	-----do-------	1910	170	10 5/8	170	--------	---------	C, W	D, S	-------	-------	-------	Casing: 110 ft of 10 5/8-in.; 60 ft of 10 5/8-in. perforated with 5/8-in. holes. Temp $75\frac{1}{2}$°F.
*7	$4\frac{1}{4}$ NW ---	D. H. Monkhouse.	-----do-------	1912	175	10 5/8	161	112.0	2- 8-28	C, W	D, S	-------	-------	-------	Casing: 121 ft of 10 5/8-in.; 40 ft of 10 5/8-in. perforated. Temp 76°F. Log.
*8	4 NW ----	W. Richey -----	B. F. Kite ----	1910	180	7 7/8	180	109.7	---do----	T, G	N	-------	-------	-------	Screen set from 100 to 180 ft. Temp $75\frac{1}{2}$°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
N1-9	4 N	Cox Produce	B. F. Kite	1928	240	------	------	------	------	T, E, 40	I	160	160	160	Temp 76°F.
10	3½ N	do	do	1928	225	12	------	------	------	T, E, 40	I	160	160	14	Do.
11	3½ N	------	do	1910	225	8 5/8	255	------	------	C, H	D	------	------	------	Casing: 95 ft of 8 5/8-in.; 160 ft of 8 5/8-in. perforated.
12	3½ N	B. F. Kite	do	1912	160	10 5/8	160	109.7	1- 3-28	C, W	D, S	------	------	------	
13	3¾ N	Bill House	Charley Lindenborn.	1928	225	------	------	------	------	T, E	I	665	200	145	Used in conjunction with N1-33, N1-34, and N2-36 in 1929-30. Temp 76°F.
14	9 W	R. W. Norton	------	------	150	8	------	66.4	3-30-30	C, W	S	------	------	------	Temp 78°F.
15	6½ W	Mathews Ranch	L. F. Kite	1926	157	6	------	------	------	C, W	S	------	------	------	
16	6 W	do	do	1929	157	8	------	74.4	3-26-30	C, W	S	------	------	------	Temp 76°F. Log.
*17	5 W	do	do	1932	134	8	134	126.1	1-27-30	C, W	S	------	------	------	Log.
18	5½ NW	do	------	------	------	------	------	------	------	C, W	D, S	------	------	------	
20	5 NW	do	------	------	------	------	------	------	------	C, W	S	------	------	------	

21	3 NW	A. R. Hibdon	B. F. Kite	1913	264	8 5/8	264	--	--	--	N	2	0	--	Casing: 204 ft of 8 5/8-in.; 80 ft of 8 5/8-in. perforated with ½-in. holes. Reported no irrigation for several years prior to 1937-38. Log.
22	2¾ NW	Helena Noack	C. C. Richey	--	--	8	--	115.1	1- 4-30	--	I	--	--	80	
23	2½ W	J. C. Williams	B. F. Kite	1915	300	8	300	--	--	C, W	D, S	--	--	--	
24	2½ W	do	do	1917	350	12	350	a/120.2 168.7	12-23-29 9-15-48	T, G	I	10	0	--	Casing: 140 ft of 12½-in.; 210 ft of 10-in. perforated. Reported, in 1938, no irrigation since 1930.
25	3¼ N	J. A. Lanning	L. F. Kite	1917	200	10	200	--	--	--	N	--	--	--	Casing: 140 ft of 10-in.; 60 ft of 10-in. perforated with ½ and 1-in. holes. Log.
26	3 N	do	--	1912	229	10 5/8	229	--	--	C, W	--	--	--	--	Temp 76°F.
27	1¾ N	do	--	1912	369	10	253	--	--	T, E 40	I	--	--	32	Casing: 233 ft of 10-in.; 20 ft of 8¼-in. perforated.
*28	1½ NW	A. R. Hibdon	--	1910	222	8	220	--	--	C, W	--	--	--	--	Screen from 160 to 220 ft. Water sand from 175 to 222 ft. Bigford member of Mount Selman formation.
29	2½ N	Ollie Hibdon	W. H. Rose	--	--	6	--	103.5	1- 4-30	--	N	--	--	--	
30	3 N	J. P. Warren	B. F. Kite	1925	180	8	180	--	--	C, W	D, S	--	--	--	Casing: 140 ft of 8-in.; 40 ft of 8-in. perforated. Log.
31	2½ N	Copenhaver	S. M. Gibbons	--	185	--	--	--	--	--	N	--	--	--	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
N1-32	$1\frac{1}{2}$ N-----	C. & M. Produce Co.	Charley Lindenborn.	1929	398	$12\frac{1}{2}$	300	--------	---------	T, E, 40	I	168	160	96	Casing: 158 ft 9-in. of $12\frac{1}{2}$-in.; 152 ft 10-in. of 10-in. casing. Temp $80\frac{1}{2}$°F.
33	$2\frac{1}{2}$ N-----	Blinka ---------	-----do-------	1928	290	-------	-------	--------	---------	T, E, 40	I	-------	940	152	
34	$2\frac{3}{4}$ N-----	George Kelley --	-----do-------	1928	295	$12\frac{1}{2}$	-------	--------	---------	C, G	D	-------	-------	-------	Temp 78°F.
35	$2\frac{3}{4}$ N-----	-----do--------	--------------	------	275	-------	-------	--------	---------	--------	N	-------	-------	-------	Well would not produce enough water for irrigation. Abandoned.
36	3 N------	-----do--------	Charley Lindenborn.	1928	265	10	-------	--------	---------	T, E, 40	I	-------	-------	71	
37	$1\frac{3}{4}$ N-----	R. W. McCarley	B. F. Kite ----	1929	347	-------	-------	--------	---------	T, E, 40	I	590	600	142	Temp 78°F.
38	$1\frac{1}{2}$ N-----	Earl Harvey----	-----do-------	1926	380	10	376	--------	---------	T, G	I	-------	-------	110	Temp 80°F. Log.
39	$8\frac{1}{2}$ W ----	R. W. Norton --	Monroe Gibbons	1925	300	6	-------	a/74.4	1-25-30	C, W	S	-------	-------	-------	
40	2 SW ----	I. T. Pryor ----	B. F. Kite ----	------	-------	10	-------	a/122.3 165.5	9-16-48 ---do---	C, W	S	-------	-------	-------	
41	$1\frac{3}{4}$ SW ---	Bertha Hester --	-----do-------	------	330	8	-------	123.3	12-23-29	--------	N	-------	-------	-------	
42	$1\frac{1}{2}$ W ----	I. T. Pryor Estate.	C. C. Richey--	1913	332	8	332	--------	---------	--------	N	-------	-------	-------	Casing: 317 ft of 8-in.; 15 ft of sand strainer.

43	1½ SW	Homer P. Rainey.	B. F. Kite	------	230	8 5/8	230	--------	---------	C, W	S	-------	-------	-------	Casing: 190 ft of 8 5/8-in.; 40 ft of 6 5/8-in. perforated. Water sand from 200 to 230 ft. Bigford member(?) of Mount Selman formation.
44	1 W	Helena Noack	B. F. Kite	1912	193	8 5/8	190	--------	---------	C, G, 9	D, S	-------	-------	-------	Casing: 133 ft of 8 5/8-in.; 30 ft of 6 5/8-in. perforated. Water sand from 135 to 193 ft. Bigford member(?) of Mount Selman formation.
45	½ NW	Paul Jessee	-----do-----	1943	315	10 5/8	255	--------	---------	C, W	D, S	-------	-------	-------	Perforated casing in sand. Deepened in 1943. Log.
46	In La Pryor.	Epifinio Enriguez.	-----do-----	------	315	10 5/8	315	--------	---------	C, G, 1½	D, S	-------	-------	-------	
47	In La Pryor.	John Karl	S. M. Gibbons	------	376	-------	-------	--------	---------	C, G, 5	D, S	-------	-------	-------	
48	¾ N	Bud Timberlake	C. C. Richey	1912	422	10 5/8	422	--------	---------	T, E, 30	I	-------	-------	0	Casing: 321 ft of 10 5/8-in.; 8¼-in. perforated through sand. Temp 78°F.
*49	In La Pryor.	R. K. Miller	--------------	1927	520	10	520	129.3	1-28-30	T, E, 7½	P	-------	-------	-------	Casing: Length of 10-in. unknown; 425 ft of 6 5/8-in.; 60 ft of 6 5/8-in. perforated. Temp 78°F.
50	In La Pryor.	-----do-----	--------------	------	303	10	-------	129.3	---------	--------	N	-------	-------	-------	La Pryor's municipal well.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
N1-51	In La Pryor.	Wilson	B. F. Kite	1925	570	6	550	--------	---------	C, G, 5	D, S	-------	-------	-------	Casing perforated with ½-in. holes from 510 to 550 ft. Log.
52	1¼ S	J. F. Kreuger	do	1927	740	10	720	--------	---------	T, G, 32	N	-------	-------	-------	Casing perforated with ½-in. holes from 640 to 720 ft.
53	1½ S	J. A. Michalk	do	1910	245	8	245	--------	---------	C, W	D, S	-------	-------	-------	Casing: 165 ft of 8-in.; 40 ft of 8-in. perforated. Water sand from 210 to 245 ft. Bigford member(?) of Mount Selman formation. Log.
54	1½ S	I. T. Pryor Estate.	--------------	1909	100	6	-------	91.9	12-20-29	--------	N	-------	-------	-------	Obtains water from Leona formation.
55	1½ S	do	W. M. Mitchell	1909	800	8	726	--------	---------	C, W	S	-------	-------	-------	Casing: 726 ft of 8-in. Open hole through sand. Log.
*56	2 S	T. L. Pitts	B. F. Kite	1925	230	6	230	91.6	12-27-29	C, W	D, S	-------	-------	-------	Casing: 190 ft of 6-in.; 40 ft of 6-in. perforated with ½-in. holes. Water from 200 to 230 ft. Bigford member(?) of Mount Selman formation. Temp 78°F. Log.

*57	2¼ S	T. J. Dube	do	1919	97	5	97	86.3	12-27-29	C, W	D, S	-------	-------	-------	Casing: 82 ft of 5-in.; 15 ft of 5-in. perforated. Water from Leona formation at 86-97 ft. Temp 76°F. Log.
*58	10 SW	R. W. Norton	Munroe Fenley	------	202	6	202	61.3	2- 6-30	C, W	D, S	-------	-------	-------	
60	9½ SW	do	-------	------	-------	6	-------	-------	-------	C, W	S	-------	-------	-------	
61	9½ SW	do	-------	------	-------	4	-------	18.0	2- 6-30	-------	N	-------	-------	-------	Water reported salty.
*62	4 SW	Mathews Ranch	B. F. Kite	1930	630	6	-------	-------	-------	C, W	S	-------	-------	-------	Temp 80°F. Log.
63	5 SW	G. Hardin	-------	------	-------	6	-------	-------	-------	C, W	S	-------	-------	-------	Do.
64	6 SW	R. W. Norton	B. F. Kite	------	490	6	482	-------	-------	C, W	S	-------	-------	-------	Casing: 442 ft of 6-in.; 40 ft of 6-in. perforated with ½-in. holes.
65	8 SW	G. Hardin	-------	------	-------	6	-------	-------	-------	C, W	S	-------	-------	-------	
*66	4 S	Mrs. Emma Mangum.	L. F. Kite	1924	655	8	600	-------	-------	C, W	S	-------	-------	-------	Casing: 560 ft of 8-in.; 40 ft of 8-in. perforated with ½-in. holes. Log.
67	7 S	do	-------	------	600	10	-------	263.7	10-23-29	C, W	S	-------	-------	-------	
*68	4½ W	Shaw	Cribbs & Davidson.	1935	300	12	300	-------	-------	T, G, 40	D, S, I	-------	95	-------	Casing: 200 ft of 12-in.; 100 ft of 12-in. perforated. Temp 80°F., Dec. 23, 1947.
69	3¾ NW	W. Richey	B. F. Kite	1936	200	12	200	131.7	5- 4-39	T, G, 40	I	-------	185	40	Casing: 160 ft of 12-in.; 40 ft of 12-in. perforated.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
*N1-70	$3\frac{1}{2}$ NW---	J. A. Lanning, Sr.	B. F. Kite----	1938	240	10	205	--------	---------	T, G	I	-------	152	-------	Casing: 165 ft of 10-in.; 40 ft of 10-in. perforated. Used in conjunction with N1-25.
71	3 NW----	Bob Porter-----	--------------	1932	-------	-------	-------	--------	---------	T	N	-------	0	0	Reported in 1938 no irrigation since 1936.
72	2 N------	A. E. Whitley--	L. F. Kite----	1932	410	10	373	110	1932	T, E, 40	I	-------	-------	180	
73	$4\frac{1}{2}$ W ----	Mathews Ranch-	E. L. Kite----	1945	483	6	471	191.1	12-27-46	C, W	D, S	-------	-------	-------	
74	$3\frac{3}{4}$ W ----	O. L. Grelle---	J. E. & E. L. Kite.	1945	427	8	419	--------	---------	T	I	-------	-------	18	
*75	$2\frac{3}{4}$ W ----	Sam Kone------	E. L. Kite----	1944	494	10	494	--------	---------	T, G	I	-------	-------	400	Log.
76	$2\frac{3}{4}$ W ----	-----do--------	-----do-------	1944	450	10	450	--------	---------	T, G	I	-------	-------	400	
77	$2\frac{3}{4}$ W ----	-----do--------	-----do-------	1943	360	10	360	--------	---------	T, G	I	-------	-------	400	
78	$2\frac{1}{4}$ NW---	Chitwood-------	-----do-------	1948	383	10	343	--------	---------	T, Ng	I	-------	-------	0	
79	$2\frac{1}{2}$ NW---	J. A. Lanning, Sr.	-----do-------	1944	323	10	323	--------	---------	T, E, 35	I	-------	-------	115	
80	$2\frac{1}{2}$ NW---	Ollie Trees ----	-----do-------	1945	246	6	240	105	11- -46	T, G	I	-------	-------	40	
81	$2\frac{1}{2}$ N-----	Copenhaver ----	O. F. Webb---	1946	290	10	290	104	3- -46	T, G 78	I	-------	-------	160	

82	3 N	M. Eaker	E. L. Kite	1945	245	8	224	---	---	T, E, 40	I	---	---	80	
83	1 SW	I. T. Pryor, Jr.	Roy Gibbon	Old	---	---	---	93.4	12-27-48	C, W	S	---	---	---	Federal observation well. Railroad and stock pen well.
84	$2\frac{1}{4}$ SW	M. A. Garcia	do	---	400	8	400	---	---	T, G, 50	I	---	---	100	
85	$3\frac{1}{2}$ NW	J. A. Lanning, Sr.	E. L. Kite	1941	201	10	201	---	---	T, E, 40	I	---	---	---	
86	3 NW	A. R. Hibdon	do	1948	338	8	300	170	4- -48	T, G	I	---	---	80	
87	$1\frac{3}{4}$ NW	do	do	1947	404	10	330	---	---	T, E, 40	I	---	---	100	
88	1 NW	Paul Jessee	do	1947	388	10	366	---	---	T, E	I	---	---	---	
89	$\frac{3}{4}$ N	R. K. Miller	do	1947	449	6	400	---	---	T, E, 20	I, P	---	---	10	Irrigation and public supply for La Pryor. Old well cleaned out, deepened.
90	$\frac{3}{4}$ S	W. C. Hunter	---	---	---	---	---	---	---	T, E, 40	I	---	---	80	
92	$7\frac{1}{4}$ W	Mathews Ranch	E. L. Kite	1923	335	---	---	---	---	C, W	S	---	---	---	Observation well.
93	$3\frac{1}{2}$ N	Bill House	do	1948	230	10	230	---	---	T, G, 35	I	---	---	235	
94	4 NW	E. H. Grelle	do	1945	269	8	269	---	---	---	I	---	---	170	
N2-1	3 N	G. W. Beard	Charley Lindenborn.	1928	275	12	275	---	---	T, G, 55	I	940	---	155	12-in. casing to top of sand, 10-in. perforated casing through sand. Temp $77\frac{1}{2}$°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level		Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
								Below land surface (feet)	Date of measurement			1929-30	1937-38	1947-48	
	La Pryor:														
N2-2	3½ NE	O. B. Sharp	Charley Lindenborn.	1928	235	12	235	--------	--------	C, W	D, S	-------	-------	-------	12-in. casing to top of sand, 10-in. perforated casing through sand. Temp 76½°F.
3	3½ NE	do	do	1928	215	12	-------	--------	--------	T, E, 40	I	-------	1,340	25	Temp 76°F.
*4	3¼ NE	Stanfield	B. F. Kite	1928	338	12	-------	--------	--------	T, E, 40	I	-------	-------	113	Temp 77°F.
5	2½ N	--------------	--------------	1930	1,818	-------	-------	--------	--------	--------	N	-------	-------	-------	Gas test. Casing pulled and well filled.
6	2½ N	--------------	--------------	------	3,434	-------	-------	--------	--------	--------	N	-------	-------	-------	Do.
7	3¾ NE	Frank Burdette	W. H. Rose	1910	50	5 3/16	50	--------	--------	C, W	D, S	-------	-------	-------	In Leona formation.
8	2 N	W. R. Holmes, Jr.	Charley Lindenborn.	1928	376	-------	-------	--------	--------	T, E, 40	I	-------	-------	125	Temp 78°F.
9	2¼ NE	do	B. F. Kite	1912	256	10 5/8	256	140.2	12-27-29	--------	N	-------	-------	-------	Abandoned and filled.
10	1½ NE	W. R. Holmes, Sr.	Charley Lindenborn.	1928	435	-------	-------	--------	--------	T, E, 40	I	-------	-------	155	Temp 79°F.
*11	2½ NE	W. M. Clark	--------------	------	123	8	-------	--------	--------	C, H	D, S	-------	-------	-------	Sand from 107 to 123 ft. Bigford member(?) of Mount Selman formation.
12	1¼ NE	Newton Davis	B. F. Kite	1916	449	6	-------	136.6	12-27-29	C, W	D, S	-------	-------	-------	

13	3 E------	Hope & Perkins	--------------	------	34	-------	------	--------	---------	--------	------	-------	-------	-------	Dug, yields water from Leona formation at 27-34 ft.
14	1¼ SE----	Treybig--------	S. M. Gibbons-	1909	298	-------	------	--------	---------	C, W	D, S	-------	-------	-------	
15	1½ SE----	Andy Able------	B. F. Kite----	------	139	8 5/8	139	--------	---------	C, W	S	-------	-------	-------	Sand from 87 to 139 ft. Yield 30 gpm. Bigford member(?) of Mount Selman formation.
16	1¾ SE----	J. B. Treybig--	-----do-------	1910	315	8 5/8	------	--------	---------	C, G, 7½	D, S	-------	-------	-------	
17	2½ SE----	Jimmie Hope---	--------------	------	------	8	------	84.7	12-20-29	C, W	S	-------	-------	-------	
18	3½ E-----	I. T. Pryor Estate.	--------------	------	28	6	28	--------	---------	C, W	S	-------	-------	-------	Water in gravel and sand at 11-28 ft. Casing perforated with ½-in. holes from 8 to 28 ft. Reported test yield of 400 gpm.
*19	6½ E-----	-----do--------	--------------	1921	2,680	-------	------	--------	---------	C, W	S	-------	-------	-------	Gas test now used as stock well.
20	3 NE ----	Hargraves & Bingham.	L. F. Kite----	1930	325	10	211	110	1930	T, E, 40	I	-------	-------	88	
21	2½ N-----	F. W. Gray----	-----do-------	1930	327	10	327	110	---do----	T, E, 40	I	-------	-------	70	
22	10¼ E----	T. R. Price----	--------------	------	180	6	------	100.1	1-24-46	C, W	D, S	-------	-------	-------	
23	¾ SE-----	Clarence H. Lemons	O. F. Webb---	1946	617	10	617	--------	---------	T, Ng	I	-------	-------	98	
24	¾ SE-----	Kirby Attwood--	J. E. Kite----	1943	617	10	617	--------	---------	T, E, 40	I	-------	-------	380	Log.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	La Pryor:														
N2-25	1½ SE----	J. B. Treybig--	J. E. & E. L. Kite.	1943	686	10	686	--------	---------	T	I	-------	-------	160	
26	1¾ SE----	-----do--------	-----do-------	1947	734	10	734	--------	---------	T	I	-------	-------		
27	3½ SE----	Mrs. Emma Mangum.	E. L. Kite----	1948	52	12	52	28.5	9-17-48	T, E, 15	I	-------	-------	0	
*28	4½ SE----	I. T. Pryor, Jr-	-----do-------	1948	70	12	70	--------	---------	T, E, 15	I	-------	-------	-------	McCallom Bros. lessee. Leona formation.
29	5 SE-----	-----do--------	--------------	1948	70	12	70	--------	---------	T, E, 15	I	-------	-------	-------	Do.
30	5¼ SE----	-----do--------	--------------	1948	70	12	70	--------	---------	T, E, 15	I	-------	-------	900	Do.
31	5½ SE----	-----do--------	E. L. Kite----	1948	71	12	71	--------	---------	T, E, 20	I	-------	-------		Do.
32	5 SE-----	-----do--------	--------------	1948	70	12	70	--------	---------	T, E, 20	I	-------	-------		Do.
33	¾ NE ----	H. C. Brantley-	I. C. Cribbs --	------	462	10	462	--------	---------	T, Ng	I	-------	-------		
34	¾ NE ----	Brantley-------	E. L. Kite----	1946	460	10	460	177.2	9-17-48	T, G, 50	I	-------	-------	200	
35	2¼ NE ---	L. Collard-----	-----do-------	1944	375	10	375	--------	---------	T, E, 40	I	-------	-------	160	

36	2½ NE	W. F. Koehler	do	1947	367	10	360	---	---	T, E, 40	D, I	---	---	153	
*37	3¼ NE	C. F. Mang	O. F. Webb	1946	470	10	470	---	---	T, E, 15	I	---	---	100	
38	3¾ NE	B. H. Atkinson	E. L. Kite	1946	226	8	220	90	6- -46	T, G, 50	I	---	---	150	
39	2¼ NE	W. S. Dickerson	do	1946	378	10	378	---	---	T, G	I	---	---	153	
40	2½ NE	O. L. Johnson	do	1946	408	10	395	---	---	T, G	I	---	---	156	
41	2¼ NE	Boysen	O. F. Webb	1946	472	10	472	---	---	T, G	I	---	---	---	
42	10 E	C. W. Cliff, Jr	---	1949	---	---	---	---	---	T	I	---	---	---	Carrizo sand well. Not completed when visited.
43	10 E	Spring Bros	Lassiter	1949	876	12	750	---	---	T, E, 75	I	---	---	---	
44	5 E	D. M. Pryor	Sun Oil Co	1948	2,868	---	---	---	---	---	---	---	---	---	Oil test.
45	3¼ SE	Ike T. Pryor	Humble Oil & Refining Co.	1944	5,862	---	---	---	---	---	---	---	---	---	Do.
	Batesville:														
N3-1	1¾ NW	Carl White	---	1929	56	12	---	43.4	11-30-29	T, G, 6	S	5	0	---	Leona formation well. Located on river terrace.
2	1¼ N	J. B. Reeves	Pate	1929	132	6	---	15	2- 5-30	C, W	D, S	5	0	---	Water sand from 110 to 120 ft. Log.
3	1¼ N	do	---	---	45	---	---	30	do	---	N	---	---	---	Caved in by flood-waters and abandoned.
*4	¼ SW	E. W. King	---	1928	45	5 5/8	54	43.2	2- 9-30	C, W	D, S	---	---	---	Leona formation from 45 to 54 ft. Casing perforated from 45 to 54 ft. Temp 72°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Batesville:														
*N3-5	3 SE-----	R. Willoughby --	Herman Crawford.	1937	60	$12\frac{1}{2}$	60	--------	---------	T, G, 25	I	-------	-------	-------	Leona formation well. Bottom 20 ft of casing is perforated.
*8	3 SE-----	-----do--------	-----do-------	1937	60	$12\frac{1}{2}$	60	--------	---------	T, G, 25	I	-------	350	60	Do.
*7	$3\frac{1}{2}$ SE----	-----do--------	-----do-------	1937	125	10	60	--------	---------	C, E	D	-------		0	Originally 60 ft. Draws from Bigford member of Mount Selman formation.
*8	$3\frac{1}{4}$ SE----	-----do--------	-----do-------	1938	60	$15\frac{1}{2}$	60	--------	---------	T, G, 42	I	-------	-------	15	Leona formation well. Bottom 20 ft of casing is perforated.
9	$2\frac{1}{4}$ NW---	Mrs. Murdine --	--------------	------	-------	6	-------	11.6	1-18-48	C, W	D,S	-------	-------	-------	Leona formation.
10	$1\frac{3}{4}$ NW---	L. E. King-----	--------------	------	60	8	-------	40.0	---do----	C, W	D, S	-------	-------	-------	Do.
11	2 NW ----	Ashton & Vickery	--------------	------	60	8	-------	42.2	---do----	C, W	D, S	-------	-------	-------	Do.
12	$1\frac{1}{2}$ NW---	P. C. Riddle ---	--------------	------	52	6	-------	39.9	---do----	C, W	D, S	-------	-------	-------	Do.
13	2 N------	E. P. King-----	--------------	------	45	6	-------	37.4	---do----	None	N	-------	-------	-------	Do.
14	$1\frac{1}{2}$ N-----	A. L. Wilson---	--------------	------	44	6	-------	38.1	---do----	C, W	D, S	-------	-------	-------	Do.
15	$1\frac{1}{2}$ NW---	J. B. Reeves---	--------------	------	46	36	-------	41.9	---do----	C, H	N	-------	-------	-------	Dug. Abandoned.
16	$1\frac{3}{4}$ N-----	-----do--------	--------------	------	-------	6	-------	38.2	---do----	C, W	D, S	-------	-------	-------	Leona formation.
17	$1\frac{1}{4}$ NW---	Mobley --------	--------------	------	60	8	-------	42.1	---do----	C, W	D, S	-------	-------	-------	Do.

18	¾ NW	L. Loter	------	------	46	6	------	45.5	3-20-46	None	N	------	------	------	Test well. No casing. Open hole.
19	1 NW	T. T. Nelson	------	------	60	10	------	45.2	1-16-46	T, G	D, S, I	------	------	------	Leona formation.
20	¼ NW	J. N. Sayers, Jr	------	------	54	8	------	45.2	1-24-46	C, W	D, S	------	------	------	Do.
21	¼ NW	W. T. Turner	------	------	59	8	------	45.6	---do---	C, W	D, S	------	------	------	Do.
22	In Batesville.	Zavala County	------	------	48	6	------	44.7	---do---	C, W	N	------	------	------	Do.
23	½ SW	Joe Hunter	------	------	52	10	------	44.6	1-23-46	C, W	D, S	------	------	------	
24	1¾ SW	H. T. Christmas	------	------	49	8	------	45.2	---do---	C, W	D, S	------	------	------	Leona formation.
25	1½ SW	Ross	------	------	46	8	------	39.4	---do---	C, W	S	------	------	------	Do.
26	1 SW	Jose Vasquez	------	------	44	48	------	43.4	1-24-46	None	N	------	------	------	Dug. Leona formation
27	¾ S	R. T. Rhodes	------	------	55	6	------	44.3	1-23-46	C, W	D, S	------	------	------	Leona formation.
28	½ SW	Dave Valentine	------	------	51	6	------	44.0	---do---	C, W	D, S	------	------	------	Do.
29	½ SE	T. Nelson	------	------	46	48	------	45.9	1-24-46	None	N	------	------	------	Dug. Leona formation.
30	½ SE	M. Ortiz	------	------	53	48	------	48.6	---do---	None	N	------	------	------	Do.
31	¼ SE	A. Ross	------	------	54	6	------	43.7	---do---	C, W	D, S	------	------	------	Leona formation.
32	½ SE	Ross	------	------	84	8	------	35.4	---do---	------	D	------	------	------	Do.
33	¾ NE	Jim West	------	------	51	48	------	40.9	1-17-46	C, W	D, S	------	------	------	Dug. Leona formation.
34	1 SE	Bob Sheffield	------	------	61	12	------	53.4	1-23-46	C, W	D, S	------	------	------	Leona formation.
35	1½ SE	Eusebio Rodriguez.	------	------	------	48	------	53.9	---do---	------	N	------	------	------	Abandoned when visited Mar. 7, 1949.
36	1½ SE	Steven Torres	------	------	55	48	------	53.9	---do---	------	D	------	------	------	Dug. Leona formation.
37	1½ SE	Santos Nava	------	------	54	48	------	53.3	---do---	------	D	------	------	------	Do.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Batesville:														
N3-38	2 SE	R. E. Brubeck	------	------	60	6	------	50.9	1-17-46	None	N	------	------	------	Abandoned.
39	2 SE	do	------	------	------	------	------	50.8	do	T, G	I	------	------	------	Leona formation.
40	2¼ SE	Lewis Caldwell	------	------	------	------	------	------	------	T, G	I	------	------	------	Do.
41	2¼ SE	R. E. Brubeck	------	------	60	------	------	50.4	1-17-46	T, G	I	------	------	------	Do.
42	2½ SE	Lewis Caldwell	------	------	60	6	------	44.0	do	C, W	D, S	------	------	------	Do.
43	2½ SE	R. E. Brubeck	------	------	------	------	------	------	------	T, G	I	------	------	------	Do.
44	2½ SE	do	------	------	60	------	------	48.0	1-17-46	T, G	I	------	------	------	Do.
45	3¼ SE	R. Willoughby	------	------	58	6	------	41.5	1-23-46	None	S	------	------	------	Do.
46	2¾ SE	do	------	------	60	12	------	44.0	do	None	N	------	------	------	Do.
47	2¾ SE	Spring Bros	------	------	60	6	------	43.7	1-17-46	C, H	D	------	------	------	Do.
48	2¾ SE	do	------	------	------	------	------	------	------	T	I	------	------	------	Do.
49	3½ S	E. W. Cassin	------	------	40	6	------	33.0	1-23-46	C, W	S	------	------	------	Do.
50	3½ S	do	------	------	62	6	------	39.1	do	C, W	D, S	------	------	------	Do.
51	3¼ S	Leona Farms	------	------	------	------	------	------	------	T, E	I	------	------	------	Do.
52	3¼ S	do	------	------	60	12	------	40.1	1-17-46	T, E	I	------	------	230	Do.
53	3½ SE	R. W. Willoughby.	------	------	------	------	------	------	------	None	N	------	------	------	Do.

54	$3\frac{1}{2}$ SE----	-----do--------	--------------	------	-------	-------	-------	--------	---------	T, E	I	-------	-------	-------	Do.
55	$3\frac{1}{2}$ SE----	-----do--------	--------------	------	-------	-------	-------	--------	---------	T, E	I	-------	-------	-------	Do.
56	$3\frac{3}{4}$ SE----	-----do--------	--------------	------	-------	6	-------	37.2	1-23-46	C, G	S	-------	-------	-------	Do.
57	4 SE-----	W. A. Davis ---	--------------	1946	60	16	-------	38.9	---do----	T, E	I	-------	-------	500	Do.
58	4 SE-----	-----do--------	--------------	1946	61	-------	-------	38.9	---do----	T, E	I	-------	-------		Do.
59	$5\frac{1}{2}$ SE----	Ottenhouse Ranch.	--------------	------	56	8	-------	30.3	1-30-46	C, W	S	-------	-------	-------	Do.
60	$5\frac{1}{2}$ SE----	-----do--------	--------------	------	47	6	-------	26.5	---do----	C, W	D, S	-------	-------	-------	Do.
61	$6\frac{1}{4}$ SE----	George West ---	--------------	------	26	6	-------	19.8	---do----	C, W	S	-------	-------	-------	Do.
62	7 SE-----	-----do--------	--------------	------	237	8	-------	23.5	---do----	C, W	S	-------	-------	-------	Reported salty. Bigford member(?) of Mount Selman formation.
63	8 SE-----	C. N. Carmichael.	--------------	------	33	8	-------	21.2	1-30-46	C, W	D, S	-------	-------	-------	Leona formation.
64	$9\frac{1}{4}$ SE----	George West ---	--------------	------	52	8	-------	44.8	---do----	C, W	S	-------	-------	-------	Reported bad water.
65	7 SE-----	E. Barkley-----	John Sellars---	1948	71	12	71	--------	---------	T, E, 20	I	-------	-------	-------	Leona formation.
66	$7\frac{1}{4}$ SE----	-----do--------	-----do-------	1948	68	12	68	--------	---------	T, E, 15	I	-------	-------	-------	Do.
67	$6\frac{3}{4}$ SE----	-----do--------	-----do-------	1948	61	12	61	--------	---------	T, E, 30	I	-------	-------	200	Do.
68	$6\frac{1}{4}$ SE----	-----do--------	B. Locke -----	1947	68	12	68	--------	---------	T, E, 15	I	-------	-------	100	Do.
69	$5\frac{1}{4}$ SE----	-----do--------	John Sellars---	1948	77	12	77	--------	---------	T, E, 40	I	-------	-------	-------	Do.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Batesville:														
N3-70	5¼ SE	E. Barkley	John Sellars	1948	60	12	60	--------	--------	T, E, 20	I	--------	--------	300	Leona formation.
71	5¼ SE	W. Price	P. Hine	1947	73	12	67	--------	--------	T, E	I	--------	--------	--------	Do.
72	4½ SE	R. W. Willoughby.	do	1948	67	14	67	--------	--------	T, E	I	--------	--------	60	Do.
73	3¾ SE	W. A. Davis	do	1948	60	12	60	--------	--------	T, E	I	--------	--------	160	Do.
74	3¼ SE	R. W. Willoughby.	do	1948	60	12	60	--------	--------	T, E	I	--------	--------	104	Do.
75	3½ SE	do	do	1948	60	12	60	--------	--------	T, E, 15	I	--------	--------	50	Do.
76	3¾ SE	W. A. Davis	do	1948	60	12	60	--------	--------	T, E	I	--------	--------	75	Do.
77	4 SE	do	do	1948	60	12	60	--------	--------	T, E	I	--------	--------	0	Do.
78	4¼ SE	do	do	1948	60	12	60	--------	--------	T, E	I	--------	--------	0	Do.
79	4¼ SE	do	do	1948	60	12	60	--------	--------	T, E, 15	I	--------	--------	75	Do.
80	3¼ SE	R. W. Willoughby.	do	1948	67	14	67	--------	--------	T, E, 30	I	--------	--------	15	Do.
81	3¾ S	N. Foley	--------	--------	--------	--------	--------	--------	--------	T, E	I	--------	--------	--------	Do.
82	3¾ S	do	--------	--------	--------	--------	--------	--------	--------	T, E	I	--------	--------	250	Do.
83	3¾ S	do	P. Hine	1947	56	12	56	--------	--------	T, E, 30	I	--------	--------		Do.

84	3¾ S	do	------	------	------	------	------	------	------	T, E	I	------	------	250	Do.
85	3¼ S	Leona Farms	------	------	------	------	------	------	------	T, E	I	------	------	330	Do.
86	2¼ SE	Felton Fitch	------	1947	60	12	60	------	------	T, E, 25	I	------	------	------	Do.
87	2 SE	do	------	1947	60	12	60	------	------	T, E, 25	I	------	------	400	Do.
88	2 SE	do	Lassiter	1948	920	12	920	------	------	T, E	I	------	------	------	
89	1¾ SE	do	------	1947	60	12	60	------	------	T, E, 10	I, D	------	------	350	Used for irrigation in 1947-48. Domestic only in 1949. Leona formation.
90	2¼ S	do	------	1947	60	12	60	------	------	T, E, 25	I	------	------	------	Leona formation.
91	2¼ S	do	------	1947	60	12	60	------	------	T, E, 25	I	------	------	------	Do.
92	2½ S	E. W. Cassin	P. Hine	1947	60	12	60	------	------	T, G	I	------	------	------	Do.
93	2½ S	do	do	1947	60	12	60	------	------	T, E, 20	I	------	------	265	Do.
94	1½ S	H. R. Wood	B. Locke	------	------	------	------	------	------	T, E	I	------	------	------	Do.
95	1½ S	do	------	------	------	------	------	------	------	T, E	I	------	------	190	Do.
96	1½ S	do	------	1947	60	12	60	------	------	T, E, 10	D, S	------	------	------	Do.
97	1¼ S	do	B. Locke	1947	60	12	60	------	------	T, E, 20	I	------	------	40	Do.
98	1¼ S	do	do	1946	60	12	60	------	------	T, E, 10	N	------	------	40	Abandoned 1949. Leona formation.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Batesville:														
N3-99	2 SW	C. W. Cliff, Jr.	B. Locke	1948	900	12	------	43.8	11- -47	T, E	I	-------	-------	520	Casing: 0-135, 200-700.
100	$1\frac{1}{2}$ SW	do	B. Bishop	1937	57	12	57	-------	-------	T, E, 10	I	-------	-------	-------	Leona formation.
101	$1\frac{1}{2}$ SW	do	do	1947	55	12	55	-------	-------	T, E, 75	I	-------	-------	520	Do.
102	$1\frac{1}{2}$ SW	do	B. Locke	1947	55	12	55	-------	-------	T, E, 75	I	-------	-------	-------	Do.
103	$\frac{3}{4}$ NW	do	B. Bishop	1947	57	12	57	-------	-------	T, Ng, 25	I	-------	-------	50	Do.
104	$\frac{3}{4}$ NW	do	P. Hine	1947	60	10	60	-------	-------	T, E, 15	I	-------	-------	56	Do.
105	1 NW	do	B. Locke	1948	67	15	67	-------	-------	T, E, 30	I	-------	-------	200	Do.
106	1 NW	do	P. Hine	1947	65	12	65	-------	-------	T, E, 25	I	-------	-------		Do.
107	$\frac{1}{2}$ SW	Joe Hunter	W. Seyler	1946	56	12	56	-------	-------	T, Ng, 25	I	-------	-------	60	Do.
108	$3\frac{3}{4}$ SE	W. A. Davis	P. Hine	1948	60	12	60	-------	-------	T, G, 30	I	-------	-------	-------	Do.
109	5 SE	Shelton	J. Sellars	1948	71	16	71	-------	-------	T, E, 40	I	-------	-------	-------	Do.

110	$5\frac{1}{4}$ SE	W. Price	Crawford	1948	72	16	72	--------	--------	T, E, 15	I	--------	--------	--------	Leona formation.
111	$5\frac{3}{4}$ SE	Shelton	J. Sellars	1948	72	12	72	--------	--------	T, E, 20	I	--------	--------	--------	Do.
112	$6\frac{3}{4}$ SE	Barkley	do	1948	72	16	75	--------	--------	T, E	I	--------	--------	--------	Do.
113	$3\frac{1}{2}$ SE	Spring Bros	do	1948	70	12	70	--------	--------	T, E, 20	I	--------	--------	--------	Do.
114	$3\frac{3}{4}$ SE	do	do	1948	68	12	68	--------	--------	T, E, 20	I	--------	--------	--------	Do.
115	4 SE	do	do	1948	73	12	73	--------	--------	T, E	I	--------	--------	--------	Do.
116	$2\frac{1}{2}$ SE	R. E. Brubeck	V. M. Marks	1949	925	12	752	114	1- -49	T	I	--------	--------	--------	
117	4 S	N. Foley	Carl Vickers	1948	1,005	12	1,005	--------	--------	T, E, 75	I	--------	--------	--------	
118	$4\frac{3}{4}$ SW	Morgan	--------	1949	--------	--------	--------	--------	--------	--------	I	--------	--------	--------	Not completed when visited.
119	$1\frac{3}{4}$ S	H. R. Wood	--------	1947	900	12	900	--------	--------	T, G, 140	I	--------	--------	190	
120	$1\frac{3}{4}$ S	do	Lassiter	1948	910	12	830	105	12- -48	T, G, 145	I	--------	--------	--------	
121	6 SE	W. Price	Crawford	1949	72	12	72	--------	--------	--------	I	--------	--------	--------	Not completed when visited. Leona formation.
122	$5\frac{1}{2}$ SE	do	do	1948	74	12	74	--------	--------	T, E, 15	I	--------	--------	--------	Leona formation.
123	$2\frac{3}{4}$ SE	J. M. Saunders	--------	1949	--------	--------	--------	--------	--------	--------	I	--------	--------	--------	Not completed when visited.
124	4 SE	do	--------	1949	--------	--------	--------	--------	--------	--------	I	--------	--------	--------	Do.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N4-1	13½ NW	R. W. Norton	------	------	------	6	------	------	------	C, W	S	------	------	------	Old well. Reported flowing until 1920.
2	13 NW	-----do-----	B. F. Kite	------	400	6	------	------	------	C, W	D, S	------	------	------	
3	10½ NW	-----do-----	------	------	150	6	------	------	------	C, W	S	------	------	------	
4	10 N	R. A. Nash	------	1927	803	12½	803	152	1-16-28	T, G, 40	D, S, I	0	10	80	Casing: 203½ ft of 12½-in.; 305 ft of 8¼-in.; 308½ ft of 6 5/8-in. perforated. Both reductions made with swedge nipples. Log.
5	10 NW	R. W. Norton	Dawson	1909	641	6	------	------	------	C, W	D, S	------	------	------	Reported flowing until 1924.
6	7 N	Thomas H. Davidson.	R. E. Homer	1911	838	8¼	640	------	------	------	N	------	------	------	
7	7 N	-----do-----	-----do-----	1911	232	8¼	180	------	------	------	N	------	------	------	Yields salt water from 180 to 232 ft. Bigford member(?) of Mount Selman formation.
8	6½ N	------	-----do-----	1911	923	8¼	727	------	------	T	N	3	0	------	Reported in 1938, no irrigation for several years.
9	9 NW	R. W. Norton	------	1907	------	6	------	53.4	2- 6-30	C, W	S	------	------	------	Reported flowing until 1924.

10	9 NW	do		1911	746	6	510			C, W	S				Do.
11	8½ NW	do		1911	741	6	741			C, W	D, S				Reported flowing until 1924. 483 ft of 6-in. casing and 285 ft of 4-in. perforated casing.
12	7½ W	S. B. Carr Estate.	Harris	1912	500	8		47.7	12-27-29		N	60	60		Reported static head 20 ft above ground when drilled.
13	7 W	do	Cribbs & Davidson.	1928	766	10	766			T, G, 25	D, S, I	190	137	200	Casing: 546 ft of 10-in.; 230 ft of 8-in. perforated. Log.
14	6½ NW	Keller Farm	do	1928	820	10	565	64	11-15-39	T, G, 25	D, S, I	105	150		Casing: 309 ft of 10-in.; 256 ft of 8-in. Temp 86°F.
15	6½ W	do		1912	704	8	704			T, G, 25	D, S, I	38	175	515	Temp 87°F.
16	7 NW	E. D. Watrus	E. L. Johnson	1912	700	6 5/8					N	77	0		Reported casing corroded through and water became too highly mineralized for irrigation in 1930.
17	6 NW	L. M. Davenport	Cribbs & Davidson.	1928	682	10	682			C, H	D, S	50	0		Casing: 264 ft of 10-in.; 536 ft of 8-in.; 144 ft of 6 5/8-in. liner. Reported in 1938, no irrigation since 1935. Temp 86°F.
18	5½ NW	S. Guyler	Holland & Dawson.	1911	700	6	600			T, G	S, I	57	10	0	Casing: 360 ft of 6-in.; 100 ft of 5-in. Temp 87°F.
19	5½ NW	do	E. L. Johnson	1911	700	5		71.4	12-23-29		N	50	0		Reported, in 1938, no irrigation since 1932.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N4-20	6 NW	S. Guyler	Cribbs & Davidson.	1927	652	10	652	--------	---------	T, G	I	110	0	250	Casing: 251 ft of 10-in.; 300 ft of 8-in.; 147 ft of 6 5/8-in. perforated. Reported no irrigation 1934-38.
21	6 NW	-----do--------	Dawson & Holland.	1910	707	4	540	79.6	12-23-29	--------	N	-------	-------	-------	Casing: 360 ft of 4-in.; 180 ft of 3-in.
22	$5\frac{1}{2}$ NW	-----do--------	Cribbs & Davidson.	1927	828	8	828	70.0	12-23-29	--------	D, S	50	0	0	Casing: 272 ft of 8-in.; 280 ft of 6 5/8-in.; 290 ft of 5-in. perforated.
23	6 NW	Franklin Rutledge.	-----do-------	1928	812	10	812	--------	---------	T, G, 60	S, I	105	40	50	Casing: 240 ft of 10-in.; 383 ft of 8-in.; 185 ft of 6 5/8-in. perforated. Used in conjunction with N4-24.
24	$5\frac{1}{2}$ NW	-----do--------	--------------	1905	910	10	720	--------	---------	T, G, 60	D, S, I	-------	-------	70	
25	$4\frac{3}{4}$ NW	Jack Chinn	--------------	------	960	-------	-------	--------	---------	T, Ng	D, S	100	20	0	Temp 83°F.
26	$4\frac{1}{4}$ NW	Andrew Miller	I. L. Dingman	1928	975	$12\frac{1}{2}$	975	--------	---------	T, Ng, 30	D, S	70	65	0	Casing: 200 ft of 12-in.; 506 ft of 8-in.; 6 5/8-in. perforated opposite sand. Apparently not used in 1947-48.

27	4¼ N	Guy Webb	Cribbs & Davidson.	1929	950	10	950	--------	--------	T, Ng, 36	D, S, I	160	54	100	Casing: 331 ft of 10-in.; 411 ft of 8-in.; 225 ft of 6-in. perforated.
28	5 N	F. W. Pulliam	do	1928	950	12	950	122	10- 3-29	T, Ng, 70	I	240	0	100	Casing: 274 ft of 12-in.; 10-in. to 634 ft; 328 ft of 8¼-in. perforated.
29	4¼ N	R. C. Donnell	I. L. Dingman	1927	976	12½	976	86.9	12-23-29	T, G, 25	D, S, I	90	90	7	Casing: 220 ft of 12½-in.; 417 ft of 8¼-in.; 369 ft of 6 5/8-in. blank and perforated.
30	4¾ N	F. W. Pulliam	--------	1926	967	12½	967	--------	--------	T, E, 50	D, S, I	165	322	230	Casing: 250 ft of 12½-in.; 8¼ in. to sand; 6 5/8-in. opposite sand. Temp 85°F.
31	9½ W	John Flanagan	Harry Bowers	1910	582	6 7/8	582	39	6- -29	T, G, 15	I	40	0	30	Reported no irrigation from 1932-38.
32	6½ W	Bruce Holsenback.	Cribbs & Davidson.	1928	680	10	680	--------	--------	T, G, 36	D, S, I	150	150	--------	Casing: 214 ft of 10-in.; 240 ft of 8-in.; 226 ft of 6 5/8-in. perforated.
33	3½ NW	Ferris & Lentz	do	1927	939	10	939	--------	--------	T, G, 55	D, S, I	60	38	38	Casing: 10-in., 8-in. and 6 5/8-in. perforated. Temp 88°F.
*34	3½ N	W. Y. Giesler	Floyd Trimm	1927	1,035	12½	1,035	126	10- 3-29	T, G, 60	D, S, I	115	350	150	Casing: 240 ft of 12½-in.; 510 ft of 10-in.; 280 ft of 8-in. perforated. Temp 90°F.
35	2¾ N	Ben Cowden	--------	1914	985	18	985	--------	--------	T, G, 75	D, S, I	320	0	320	Casing: 75 ft of 18-in.; 900 ft of 8-in.; 85 ft of 6 5/8-in. perforated. Temp 88°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N4-36	$3\frac{1}{4}$ N-----	John W. Laird--	Tom Leary----	1912	966	6	-------	98.7	12-16-29	T, G, 20	D, S, I	-------	30	60	Temp 87°F. Log.
37	$3\frac{1}{4}$ N-----	Coates---------	Dawson & Balch	1908	1,400	6	800	--------	---------	T, G	------	60	40	0	Not used in 1947-48.
*38	$10\frac{1}{2}$ W ---	F. M. Dunkle --	--------------	1905	450	8	-------	17.5	6-18-30	T, G, 25	D, S, I	45	76	60	Reported flowing in summer of 1927.
39	$10\frac{1}{2}$ W ---	L. D. Van Cleve	--------------	------	-------	-------	-------	--------	---------	C, W	D, S	14	0	0	Reported no irrigation 1930-38.
40	$10\frac{1}{2}$ W ---	Eugene Green --	George Leonard	1914	562	$6\frac{1}{4}$	562	--------	---------	T, G, 15	D, S, I	13	42	35	
41	8 W -----	R. A. Guenther-	--------------	1910	400	10	-------	17.8	10-30-29	T, G, 25	D, S, I	-------	146	450	Casing: 4-in. set inside of 10-in.
42	8 W -----	-----do--------	A. Coe -------	1908	660	$6\frac{1}{4}$	-------	--------	---------	T, G	D, S, I	30	78		Reported flowing in 1928. Temp 82°F.
43	$7\frac{1}{2}$ W ----	-----do--------	A. Coe & George Leonard.	1909	606	$8\frac{1}{4}$	500	9.5	10-30-29	--------	N	-------	-------	-------	Do.
44	$4\frac{1}{4}$ W ----	M. Balsamo Estate.	Cribbs & Davidson.	1928	810	12	810	--------	---------	T, G, 42	D, S, I	720	0	0	Reported in 1938 no irrigation since 1933. Used in conjunction with lake pump during drought. Temp 84°F.

45	3 W	Byrd Cattle Co	------	1928	925	10	------	------	------	T	N	480	0	0	Casing: 200 ft of 10-in.; 340 ft of 8-in. Reported no irrigation for several years prior to 1937-38.
46	3 W	K. & M. Ranch	Cribbs & Davidson.	------	948	10	948	91.0	12-14-28	T, Ng, 82	I	156	105	200	Casing: 754 ft of 10-in.; 198 ft of 8¼-in. perforated. Temp 88°F.
47	2½ W	Roy Barker	do	1928	948	10	948	------	------	T, G, 65	D, S, I	190	100	190	Casing: 600 ft of 10-in.; 200 ft of 8-in.; 148 ft of 8-in. perforated.
48	2¼ W	Dick Prassel	Tom Leary	1912	1,015	8	1,015	------	------	T, G, 42	D, S, I	203	160	------	Casing: 650 ft of 8-in.; 365 ft of 6-in.; length of perforated unknown.
49	1¾ NW	A. Fehlis	J. P. Jones	1918	976	6	976	------	------	T, Ng, 25	D, S, I	80	161	160	
50	2¼ NW	W. Bookout	Cribbs & Davidson.	1928	960	10	960	------	------	T, Ng, 40	D, S, I	95	60	60	Casing: 254 ft of 10-in.; 554 ft of 8-in.; 160 ft of 6 5/8-in. perforated.
51	1¾ NW	C. A. Harrel	Tom Leary	1914	967	8	967	------	------	T, G, 20	D, S, I	------	30	80	Temp 88°F.
52	1½ NW	Bill Rutledge	J. N. Lawson	1910	983	6	983	------	------	T, G, 25	D, S, I	70	0	45	Casing: 898 ft of 6-in.; 85 ft of 5 3/16-in. perforated.
53	3¼ NW	Julius DeWinnie	Cribbs & Davidson.	1933	960	10	960	------	------	T, G, 30	N	------	120	0	Casing: 740 ft of 10-in.; 231 ft of 8¼-in. perforated.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.* —Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N4-54	3½ NW	J. B. McKnight	Cribbs & Davidson.	1929	906	10	906	------	------	T, E	N	------	0	0	*Casing:* 370 ft of 10-in.; 401 ft of 8-in.; 153 ft of 6 5/8-in. perforated set with lead seal. Reported in 1938 no irrigation since 1936.
*55	7 W	D. C. Mandell	-----do-----	1934	703	10	703	60	12- 8-37	T, G, 85	D, S, I	------	200	300	Casing: 517 ft of 10-in.; 193 ft of 8-in. perforated. Log.
*56	9 W	Owen Williams	-----do-----	1938	520	10	520	------	------	T, G, 15	I	------	0	160	Casing: 133 ft of 10-in.; 247 ft of 8¼-in. set with swage nipple.
57	9 W	Oscar Poppa	------	------	------	------	------	------	------	T, G, 25	S	------	------	------	Reported, in 1938, no irrigation since 1936.
58	8¾ NW	D. C. Mandell	I. C. Cribbs	1945	680	12	680	------	------	T, G	I	------	------	250	Log.
59	7½ W	R. A. Guenther	-----do-----	1946	635	10	635	------	------	T, G, 45	I	------	------	450	
60	11 W	G. C. Marshall	------	1914	380	17	380	------	------	T, G, 70	D, S, I	------	------	130	
61	11 NW	Sam Guyler	I. C. Cribbs	1946	985	12	985	------	------	T, Ng, 145	I	------	------	140	
62	9 NW	-----do-----	------	1927	------	------	------	------	------	T	I	------	------	450	

63	8½ NW---	Rosa-Wolf No. 1	Humble Oil & Refining Co.	1941	6,889	-------	-------	--------	---------	--------	------	-------	-------	-------	Oil test.
64	6½ N-----	Cross-S Ranch No. 3.	The Texas Co -	1947	3,365	-------	-------	--------	---------	--------	------	-------	-------	-------	Do.
N5-1	8½ N-----	Spencer--------	Cribbs & Davidson.	------	827	10	827	--------	---------	T, G	D, I	315	0	225	Casing: 282 ft of 10-in.; 368 ft of 8¼-in.; 181 ft of 6 5/8-in. perforated. Reported, in 1938, no irrigation since 1934. Supplemented by river water.
2	9 N------	Bud Guyler-----	L. L. Dingman-	1928	954	12½	954	--------	---------	T, G, 60	D, S, I	250	364	200	Casing: 248 ft of 12½-in.; 359 ft of 8¼-in.; 371 ft of 6 5/8-in. perforated. River water supplies.
3	9 N------	Sol Freed------	--------------	------	-------	8¼	-------	72.0	11-22-29	--------	N	-------	0	-------	
4	8½ N-----	A. J. Plummer-	Tom Leary----	1913	987	6	987	72.6	---do---	--------	N	-------	-------	-------	
5	8½ N-----	Sweeney & Newton.	R. E. Homer--	1910	990	8¼	990	--------	---------	--------	N	-------	-------	-------	Casing: 757 ft of 8¼-in.; 243 ft of 7¼-in. perforated.
6	8½ NE ---	Sol Freed------	--------------	------	-------	6	-------	69.7	11-22-29	C, W	S	-------	-------	-------	
*7	9½ NE ---	-----do--------	Pat McQuirt---	1929	1,001	8	-------	66.8	---do---	T	I	0	0	160	Temp 89°F.
8	10 NE ---	Sweeney & Newton.	--------------	------	3,010	-------	-------	--------	---------	--------	N	-------	-------	-------	Oil test, abandoned and filled.
*9	7 N------	W. E. Richardson.	Cribbs & Davidson.	1928	858	10	858	--------	---------	T, E, 30	D, S, I	130	0	100	Casing: 251 ft of 10-in.; 430 ft of 8-in.; 200 ft of 6 5/8-in. perforated. Temp 79°F. Log.
10	7 N------	G. Puente------	Morgan-------	1910	985	8½	-------	68.5	11-29-29	T, E, 30	S, I	0	80	50	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N5-12	6½ N	W. C. Hardaway	Morgan	1911	965	6	965	--------	--------	T, E, 20	I	-------	40	-------	Casing: 840 ft of 8-in.; 125 ft of 4-in. perforated.
13	7½ N	Mrs. Margarite D. Rutledge.	-------	------	------	8	-------	70.4	11-20-29	--------	N	-------	-------	-------	
15	6½ N	Mrs. Hyman	-------	------	------	8¼	-------	85.8	11-23-29	--------	N	-------	-------	-------	
16	7½ NE	F. Newton	Hardy Robinson	1911	906	8¼	906	92.2	---do---	T, G, 24	I	41	0	700	Casing: 702 ft of 8¼-in.; 204 ft of 8¼-in. perforated. Reported, in 1938, no irrigation since 1936. Used in conjunction with N5-99.
17	6 N	McLean	-----do-----	1911	925	8	-------	--------	--------	--------	N	80	0	-------	
18	6½ NE	L. J. Mazzoni	I. L. Dingman	1928	955	12½	955	--------	--------	T, E, 40	D, S, I	320	0	239	Casing: 250 ft of 12½-in.; 197 ft of 6 5/8-in. perforated. Used in conjunction with N5-19 and 5-78 in 1929-30. Reported, in 1938, no irrigation since 1936. Temp 88°F.
19	6 NE	I. C. Cribbs	Hardy Robinson	1910	1,007	8¼	886	--------	--------	T, E, 25	I	-------	-------	500	Reported, in 1938, no irrigation since 1936. Log.

20	$5\frac{1}{2}$ NE	do	do	1910	-------	$8\frac{1}{4}$	-------	77.0	11-23-29	T	I	-------	120	80	
21	8 NE	A. N. Box	--------------	1909	1,000	8	-------	--------	---------	C, W	S	0	0	0	Reported, in 1938, no irrigation since 1932. Federal observation well.
*22	8 NE	H. Britton	George Leonard.	------	1,000	6	-------	--------	---------	--------	N	-------	-------	-------	Abandoned.
23	7 NE	A. N. Box	--------------	1910	1,000	-------	-------	--------	---------	--------	N	40	0	-------	Reported, in 1938, no irrigation since 1936.
24	6 NE	do	Tom Leary	1911	1,017	8	1,017	--------	---------	C, W	D, S	180	0	-------	Reported, in 1938, no irrigation for several years. Temp 89°F.
25	$4\frac{3}{4}$ N	Gulick	Cribbs & Davidson.	1929	818	10	818	--------	---------	T, E, 50	I	200	0	300	Casing: 307 ft of 10-in.; 317 ft of 8-in.; 210 ft of $6\frac{1}{4}$-in. perforated. Temp 85°F.
26	$3\frac{1}{4}$ N	M. McLean	--------------	------	-------	6	-------	--------	---------	T, G, 25	D, S	80	32	0	
27	$3\frac{1}{2}$ N	E. Butler	--------------	1908	993	6	-------	--------	---------	T, E, 20	D, S, I	176	94	400	Temp 87°F. Supplemented by river water.
28	$4\frac{1}{2}$ N	Gulick	Cribbs & Davidson.	------	890	10	890	--------	---------	T, G	I	80	0	-------	Casing: 253 ft of 10-in.; 423 ft of 8-in.; 224 ft of 6 5/8-in. perforated. Reported, in 1938, no irrigation since 1932. Used in conjunction with N5-25.
29	$2\frac{3}{4}$ NE	Bert Fry	Floyd Trimm	------	949	10	949	97.0	12-12-29	T, E, 35	I	120	0	-------	Casing: 334 ft of 10-in.; 347 ft of 8-in. Reported, in 1938, no irrigation since 1934.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Water level		Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
							Depth cased (feet)	Below land surface (feet)				1929-30	1937-38	1947-48	
	Crystal City:														
N5-30	$2\frac{3}{4}$ NE	Richie Bros	I. L. Dingman	1928	940	$12\frac{1}{2}$	-------	-------	-------	T, E, 50	I	575	0	-------	Reported, in 1938, no irrigation since 1936.
31	$3\frac{1}{4}$ NE	do	-------	-------	930	8	-------	78.3	11-26-29	-------	N	-------	-------	-------	Reported casing corroded through prior to 1937-38 and water became too highly mineralized for irrigation use.
32	$4\frac{1}{4}$ NE	N. J. Thoreen	Joseph Davis	-------	775	6	775	-------	-------	T, G, 60	D, S, I	34	23	220	Uses river water to supplement on 750 acres total.
33	$4\frac{3}{4}$ NE	B. Masterson	Hardy Robinson.	1910	-------	-------	-------	-------	-------	T	N	0	0	-------	Reported, in 1938, no irrigation for over 10 years.
34	$1\frac{1}{2}$ N	C. C. Hasket	Cribbs & Davidson.	1929	941	$8\frac{1}{4}$	941	-------	-------	T, G, 60	D, S, I	-------	150	60	Casing: 768 ft of $8\frac{1}{4}$-in.; 178 ft of 6 5/8-in. perforated.
35	$\frac{1}{2}$ N	Guyler	-------	1923	-------	-------	-------	77.0	12- 4-27	T, G, 60	D, S, I	140	197	150	
36	$1\frac{3}{4}$ N	H. L. Harkey	R. F. Schroeder	1923	1,040	$15\frac{3}{4}$	1,040	-------	-------	T, G, 42	D, S, I	150	58	125	Casing: 85 ft of $15\frac{3}{4}$-in.; 755 ft of 8-in.; 200 ft of 8-in. perforated.
37	1 N	Bruce Holsenback.	Balch	-------	-------	8	-------	-------	-------	T, G, 60	D, S, I	86	50	60	

38	1 NE ----	Campbell ------	L. H. Duncan -	1926	1,000	12	1,000	--------	---------	T, G, 42	D, S, I	200	0	80	Casing: 200 ft of 12-in.; 8-in. to sand; perforated to bottom. Temp 88°F.
39	$2\frac{1}{4}$ NE ---	Richie Bros ----	Cribbs & Davidson.	1929	940	$12\frac{1}{2}$	940	a/74.6 146.3	11-26-29 8-11-48	T	I	600	0	80	Casing: 260 ft of $12\frac{1}{2}$-in.; 460 ft of 10-in.; 242 ft of $8\frac{1}{4}$-in. perforated. Reported, in 1938, no irrigation since 1935. Temp $86\frac{1}{2}$°F. Uses river water supplementally. Total 800 acres.
40	$2\frac{1}{2}$ E----	-----do--------	-----do-------	1929	1,070	$12\frac{1}{2}$	1,070	a/80.4 144.1	11-26-29 9-13-48	T	I	-------	0	-------	Casing: 272 ft of $12\frac{1}{2}$-in.; 538 ft of 10-in.; 268 ft of $8\frac{1}{4}$-in. perforated. Reported, in 1938, no irrigation since 1935. Temp 87°F. Used in conjunction with N5-39.
41	4 E------	A. A. Akin-----	Tom Wren ----	1910	1,000	8	1,000	--------	---------	--------	N	-------	-------	-------	Casing: 800 ft of 8-in.; 50 ft of 6-in. screened.
*42	$3\frac{3}{4}$ E-----	E. B. Taylor---	H. H. Bailey--	1926	1,082	$12\frac{1}{2}$	1,082	--------	---------	--------	N	160	160	-------	Casing: 200 ft of $12\frac{1}{2}$-in.; 650 ft of 8-in.; 232 ft of 6 5/8-in. perforated. Temp 89°F.
43	$4\frac{1}{4}$ E-----	W. B. Gates ---	Cribbs & Davidson.	1929	997	10	997	--------	---------	T, E, 50	I	240	0	100	Casing: 353 ft of 10-in.; 408 ft of 8-in.; 251 ft of 6 5/8-in. perforated. Reported, in 1938, no irrigation since 1933. Temp 89°F.
44	$4\frac{3}{4}$ E-----	M. McLean ----	Floyd Trimm--	1926	-------	-------	-------	--------	---------	T, G, 50	N	350	180	0	Temp 89°F. Salty water. Not used 1947-48.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N5-45	5 E	M. McLean	I. L. Dingman	1927	1,038	12½	------	--------	---------	T, G, 42	D, S, I	160	10	100	Casing: 200 ft of 12½-in.; 8-in. to sand; 6 5/8-in. perforated opposite sand. Temp 89°F.
46	5½ E	Smith	--------------	------	------	-------	------	--------	---------	T, G, 42	D, S, I	0	58	15	
47	6 E	A. Wagner	H. Hardy Robinson.	1912	------	8	------	105.1	11-26-29	C, W	S	-------	-------	-------	
*48	In Crystal City.	City of Crystal City.	Floyd Trimm	1927	1,050	12	1,050	--------	---------	T, E, 50	N	-------	-------	-------	Formerly main supply for Crystal City. Used some in 1947-48.
49	In Crystal City.	do	A. Coe	1908	1,070	6	------	--------	---------	--------	N	-------	-------	-------	Supplemented N5-48 for peak loads. Abandoned before 1947-48.
51	¾ E	Mrs. Sally Packingham Estate.	James A. Wilson.	1910	1,100	8	------	74.0	10- 3-29	T, G, 60	D, S, I	35	60	190	Temp 90°F.
52	¾ E	G. C. Miller	Will Byrd	1911	955	6¼	------	--------	---------	--------	N	80	0	0	Casing: 665 ft of 6¼-in.; rest unknown. Reported, in 1938, no irrigation since 1933.
53	1¼ SE	Frank Johnson	Cribbs & Davidson.	1928	1,053	------	------	--------	---------	T, G, 60	D, S, I	75	110	-------	

54	2 E------	Roy Chastin ----	-----do-------	1927	1,065	10	1,065	--------	---------	T, E, 25	D, S, I	125	0	-------	Casing: 258 ft of 10-in.; 551 ft of 8-in.; 278 ft of 6 5/8-in. perforated. Reported no irrigation for several years prior to 1937-38.
55	2 E------	Warren Wagner-	-----do-------	1928	1,070	10	1,070	a/81.6 149.9	11-27-29 9-13-48	T, E, 40	I	120	0	330	Casing: 250 ft of 10-in.; 620 ft of 8-in.; 245 ft of 6 5/8-in. perforated. Reported, in 1938, no irrigation since 1935. Temp $88\frac{1}{2}$°F.
56	$2\frac{1}{4}$ E-----	H. C. Plumley -	-----do-------	1926	1,147	10	1,147	--------	---------	T, E	D, I	244	0	250	Casing: 264 ft of 10-in.; 636 ft of 8-in.; 261 ft of 6 5/8-in. perforated. Reported no irrigation for several years prior to 1937-38.
57	$2\frac{1}{4}$ E-----	Mrs. D. H. Holsenback.	-----do-------	1929	1,030	$12\frac{1}{2}$	1,030	84.5	11-26-29	T, E, 40	I	475	525	-------	Casing: $219\frac{1}{2}$ ft of $12\frac{1}{2}$-in.; $570\frac{1}{2}$ ft of 8-in.; 248 ft of 6 5/8-in. perforated.
*58	$3\frac{1}{2}$ E-----	Marrs McLean -	Floyd Trimm--	1925	1,038	$12\frac{1}{2}$	1,038	--------	---------	T, G, 50	D, S, I	240	240	130	Casing: 200 ft of $12\frac{1}{2}$-in.
*59	$3\frac{1}{2}$ E-----	-----do--------	P. C. Paul----	1910	970	$8\frac{1}{4}$	-------	--------	---------	--------	N	-------	-------	-------	Casing: 820 ft of $8\frac{1}{4}$-in. Temp 88°F.
60	4 E------	Julius DeWinnie	-------------	------	-------	-------	-------	a/81.0 148.5	11-16-29 9-13-48	T, G	I	160	0	-------	Reported, in 1938, no irrigation since 1932. Small cotton acreage. Salty water.
61	$4\frac{1}{2}$ E-----	H. W. Hartung -	I. L. Dingman-	1928	1,100	$12\frac{1}{2}$	-------	--------	---------	T, G, 50	D, S, I	200	195	195	Yield, 400 gpm.
62	$4\frac{1}{2}$ E-----	M. McLean ----	-----do-------	1927	1,100	$12\frac{1}{2}$	-------	--------	---------	T, G, 50	D, I	200	65	240	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N5-63	4½ E	J. Black	P. C. Paul	1911	999	8	780	79.0	10-31-29	T, G, 25	N	80	20	0	Casing: 780 ft of 8-in. Salt water contaminated.
64	5½ E	John Hughes	George Leonard	1913	1,000	8	-------	-------	-------	-------	N	-------	-------	-------	
65	7 E	Adolf Wagner	W. J. Campbell & Tom Leary	1911	982	6	-------	100.4	11-26-29	C, W	S	-------	-------	-------	
66	4¾ NE	W. B. Gates	Cribbs & Davidson.	1932	1,001	12½	725	-------	-------	T, G, 40	I	-------	630	-------	Casing: 327 ft of 12½-in.; 398 ft of 10-in.
*67	5 NE	do	do	1932	1,060	12½	1,057	-------	-------	T, G, 40	S, I	-------	-------	925	Casing: 340 ft of 12½-in.; 487 ft of 10-in.; 256 ft of 8-in. perforated. Log.
69	6½ E	C. F. Jackson	do	1932	1,228	12	1,228	-------	-------	T, G, 70	D, S, I	-------	1,310	960	Casing: 361 ft of 12-in.; 593 ft of 8-in. cemented; 292 ft of 6¼-in. perforated, used in conjunction with N5-70 and N8-110. Log.
70	7 E	do	do	1932	1,225	12	1,225	-------	-------	T, G, 70	D, S, I	-------	-------	-------	Casing: 327 ft of 12-in.; 645 ft of 8-in.; 274 ft of 6¼-in. perforated.
71	4¼ N	E. Butler	L. D. Stripling	1933	835	10	907	-------	-------	-------	D, S, I	-------	30	-------	Casing: 274 ft of 10-in.; 435 ft of 8¼-in. set in cement. Swedge nipple between 8¼ and 10-in.

*72	6½ NE ---	Mrs. C. L. Coleman.	Cribbs & Davidson.	1934	1,160	12½	1,160	75	12- 8-37	T, G, 65	D, S, I	-------	320	420	Casing: 325 ft of 12½-in.; 579 ft of 10-in.; 280 ft of 8¼-in. perforated. Swedge nipple between 8¼ and 10-in. Log.
73	10 N-----	Sol Freed ------	L. D. Stripling	1929	903	10	903	--------	---------	T, G, 45	I	-------	100	220	Casing: 642 ft of 10-in.; 261 ft of 8-in. perforated.
74	10½ N----	-----do--------	Cribbs & Davidson.	1930	900	12½	900	--------	---------	T, G, 45	I	-------	0	250	Casing: 267 ft of 12½-in.; 409 ft of 8-in.; 248 ft of 6 5/8-in. perforated.
75	9½ N-----	-----do--------	-----do-------	1930	950	12½	950	--------	---------	T, E, 25	I	-------	0	60	Casing: 248 ft of 12½-in.; 402 ft of 8-in.
*76	7 N------	Ira Cribbs -----	-----do-------	1931	950	12½	950	--------	---------	T, E, 75	S, I	-------	380	250	Casing: 329 ft of 12½-in.; 398 ft of 10-in.; 258 ft of 8¼-in. perforated.
78	6 N------	L. J. Mazzoni--	-----do-------	1932	940	10	940	--------	---------	T, G, 25	I	-------	0	0	Casing: 278 ft of 10-in.; 437 ft of 8-in. set with lead seal at 253 ft; 247 ft of 6 5/8-in. perforated cemented 20 sacks cement at 715 ft.
79	In Crystal City.	City of Crystal City.	Ira Cribbs ----	1941	990	12½	990	180	2- 2-48	T, E, 75	P	-------	-------	-------	Cement repair to control salinity, fall 1948. Log.
80	In Crystal City.	-----do--------	Clark --------	1948	1,035	12	1,035	--------	---------	T, E, 75	P	-------	-------	-------	Not used 1947-48.
*81	2¼ N-----	R. L. Guyler---	Ira Cribbs ----	1948	990	10	765	153.6	9-17-48	T, G, 85	I	-------	-------	-------	Do.
82	7 NE-----	Holt-Murphy ---	McKinsly -----	1946	1,300	12	1,300	--------	---------	T, G, 77	I	-------	-------	195	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Crystal City:														
N5-83	7 NE	Holt-Murphy	McKinsly	1946	1,200	12	1,200	--------	--------	T, D, 88½	I	-------	-------	115	
84	7½ NE	-----do-----	-----do-----	1946	1,200	12	1,200	--------	--------	T, G, 116	I	-------	-------	290	
85	7¼ NE	J. R. S. Ranch	-----do-----	1947	1,185	10	1,185	143	11- -47	T, G, 90	I	-------	-------	250	
86	7½ NE	-----do-----	Ira Cribbs	1947	1,215	12	1,215	169	---do---	T, G, 126	I	-------	-------		Yield 1,300 gpm. Drawdown 48 ft, Nov. 1947.
87	7¼ NE	California Packing Corp.	Wiegand Bros	1948	1,150	12	1,150	179.5	9-17-38	T, G, 146	I	-------	-------	-------	
88	8 NE	-----do-----	-----do-----	1948	1,155	12	1,155	176.4	---do---	T, G, 146	I	-------	-------	-------	Log.
89	8½ NE	J. Paul Little	I. C. Cribbs	1948	1,180	12	1,180	100.6	7-16-48	T, Ng, 130	I	-------	-------	320	
90	9¼ NE	California Packing Corp.	L. S. D. Drillers.	1946	1,225	12	1,225	166.7	2-14-48	T, G, 146	I	-------	-------	-------	
91	9¼ NE	-----do-----	-----do-----	1946	1,193	12	1,193	165.3	---do---	T, G, 146	I	-------	-------	-------	
*92	9¼ NE	-----do-----	Wiegand Bros	1946	1,163	12	1,163	165.7	---do---	T, G, 146	I	-------	-------	-------	Log.
93	9½ NE	-----do-----	-----do-----	1946	1,137	13 3/8	1,137	162.3	---do---	T, G, 146	I	-------	-------	1,200	
94	9½ NE	-----do-----	-----do-----	1946	1,143	13 3/8	1,143	--------	--------	T, G, 146	I	-------	-------	-------	

95	$9\frac{1}{4}$ NE ---	-----do--------	-----do-------	1946	1, 146	13 3/8	1, 146	165. 2	2-24-48	T, G, 146	I	-------	-------	-------	
96	$9\frac{1}{2}$ NE ---	-----do--------	-----do-------	1948	1, 220	$12\frac{3}{4}$	1, 220	--------	---------	T, G, 146	I	-------	-------	-------	
97	$9\frac{3}{4}$ NE ---	-----do--------	-----do-------	1948	1, 151	$12\frac{3}{4}$	1, 151	--------	---------	T, G, 146	I	-------	-------	-------	
98	$6\frac{3}{4}$ NE ---	Robert S. Yantis	Ira Cribbs ----	1944	980	10	980	70	10- -44	T, E, 40	I	-------	-------	265	Log.
99	7 NE ----	A. N. Box -----	-----do-------	1947	945	12	945	130	6- -47	T, E, 50	I	-------	-------	160	
100	7 NE ----	California Packing. Corp.	Wiegand Bros -	1948	1, 152	$12\frac{3}{4}$	1, 152	--------	---------	T, G, 146	I	-------	-------	-------	
101	$7\frac{1}{2}$ NE ---	-----do--------	-----do-------	1948	1, 150	$12\frac{3}{4}$	1, 150	--------	---------	T, G, 146	I	-------	-------	-------	
102	$\frac{1}{2}$ NW ----	-----do--------	Layne-Texas --	1946	1, 054	16	1, 054	96	7-25-47	T, E, 75	Ind	-------	-------	-------	Gravel-walled well.
103	$7\frac{1}{2}$ NE ---	Holsenback & Butler.	Adams & Lyles	1947	3, 756	-------	-------	--------	---------	--------	------	-------	-------	-------	Oil test.
104	4 NE ----	Marrs McLean -	Humble Oil & Refining Co.	1945	5, 000	-------	-------	--------	---------	--------	------	-------	-------	-------	Do.
*N6-1	15 NE ---	Norman Gates --	--------------	------	48	-------	-------	--------	---------	C, W	D, S	-------	-------	-------	Dug.
*2	$15\frac{1}{2}$ NE --	Wiegand Bros --	--------------	1930	-------	-------	-------	--------	---------	--------	------	-------	-------	-------	Loma Vista oil test by Wiegand Bros.
3	12 E ----	L. G. Gates----	Tom Wren ----	1921	1, 313	8	1, 313	80	8-22-29	T, G, 35	D, S, I	-------	0	-------	Casing: 1, 000 ft of 8-in.; 159 ft of 6-in. screened. Log.
	Carrizo Springs:														
N7-1	13 NW ---	B. H. Erskine--	McFarland ----	1906	580	8	260	--------	---------	C, W	D, S	18	0	0	Casing: 200 ft of $8\frac{1}{2}$-in.; 60 ft of 7 5/8-in. Reported flowing until 1920. Reported, in 1938, no irrigation since 1932.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season-- 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N7-2	$12\frac{1}{2}$ NW	Eugene Greene	Charley Lindenborn.	------	400	8	60	26.5	10-30-29	T, G	I	-------	-------	27	
3	$12\frac{1}{2}$ NW	Frank Harris	-------------	------	------	------	------	--------	---------	--------	------	55	64	0	
4	$12\frac{1}{2}$ NW	-----do-------	-------------	------	------	8	------	21.9	10-30-29	--------	N	-------	-------	-------	
5	$12\frac{3}{4}$ NW	-----do-------	-------------	------	------	------	------	--------	---------	T, G, 42	D, S	76	0	-------	
6	$8\frac{1}{2}$ N	Carl Reiker	C. F. Seward	1928	1,021	10	603	--------	---------	--------	N	195	0	0	Reported, in 1938, no irrigation for several years. Formerly used in conjunction with N7-35. Log.
7	$12\frac{1}{4}$ NW	E. C. Sorrel	Charley Lindenborn.	1905	475	12	60	--------	---------	T, G, 15	D, S, I	17	24	20	Reported flowing about 500 gpm when drilled.
8	12 NW	J. F. Harris	-----do-------	1906	450	8	150	--------	---------	C, W	D, S	-------	-------	-------	
9	12 NW	-----do-------	-----do-------	------	450	8	150	--------	---------	C, W	D, S	10	0	-------	Reported, in 1938, no irrigation for several years.
10	12 NW	W. G. Orr	-----do-------	1904	475	$8\frac{1}{4}$	100	4	---------	T, D, 20	D, S, I	170	0	6	Reported flowing about 400 gpm when drilled.
11	$11\frac{1}{4}$ NW	-----do-------	-------------	1904	450	10	100	4	---------	T, G, 25	I	-------	$50\frac{1}{2}$	100	
12	$11\frac{1}{2}$ NW	J. L. Mogford	I. L. White	1904	450	$8\frac{1}{4}$	60	41.4	5-29-30	C, W	S	-------	-------	-------	
13	$10\frac{1}{2}$ NW	B. C. White	Frank Kellogg	1917	402	8	40	--------	---------	T, G, 25	D, S, I	40	61	90	

14	10 NW ---	-----do--------	B. C. White---	1927	319	12	60	--------	---------	T, G, 20	D, S, I	45	23	65	
15	10 NW ---	L. A. Watts----	L. A. Watts---	1926	376	10	35	--------	---------	C, W	S	9	0	0	Reported, in 1938, no irrigation since 1936.
16	9½ NW ---	B. J. Cook-----	Frank Kellogg -	1928	360	10	20	--------	---------	T, G, 20	D, S, I	40	37	60	
17	9¾ NW ---	Percy Herman--	--------------	------	-------	6	-------	78.7	3-10-30	--------	N	-------	-------	-------	
18	9¾ NW ---	Ida O. Straus---	Elmo Owens---	1914	400	6	-------	91.7	12-19-29	C, W	D	-------	-------	-------	
19	9¼ NW ---	Mrs. O. V. Underwood.	--------------	------	185	8	-------	65.0	---do----	C, W	S	-------	-------	-------	
20	9½ NW ---	J. A. Garrison -	G. A. Petty ---	1928	330	12	-------	--------	---------	T, Ng, 40	D, S, I	45	40	65	
21	9¾ NW ---	A. H. Swindell -	--------------	1926	425	10	280	66.2	10-29-29	T, G, 25	D, S, I	-------	39	60	
22	8¾ NW ---	Mrs. O. V. Underwood.	S. M. Owens --	1910	400	8	-------	--------	---------	--------	N	-------	-------	-------	
23	9¼ NW ---	Mary H. White -	-----do-------	1916	472	8	200	--------	---------	C, W	D, S	20	0	0	Reported, in 1938, no irrigation since 1934.
24	9¼ NW ---	J. N. Stern ----	I. White ------	1903	450	6¼	100	31.4	2- 2-38	--------	N	15	0	0	Reported flowing 400 gpm when drilled. Reported, in 1938, no irrigation since 1933.
25	9 NW ----	Mrs. Ella Perrin	George Petty --	1925	350	6	-------	52.3	5-14-30	--------	N	0	0	0	
26	9¾ NW ---	Bennett --------	Elmo Owens---	1928	352	10	39	--------	---------	T, G, 60	D, S, I	103	39	150	Casing: 39 ft of 10-in.
*27	7½ NW ---	Eardley Estate -	Charley Lindenborn.	1929	472	10	-------	58.0	10-28-30	T, G, 25	D, S, I	100	44½	80	Temp 79°F.
28	7¾ NW ---	M. H. Love ----	Elmo Owens---	1928	240	10	40	65.0	---do----	C, E, ½	D, S	31	0	0	
29	7 NW ----	-----do--------	Floyd Trimm--	1930	1,580	-------	-------	--------	---------	T, G, 65	I	-------	-------	-------	Drilled as gas test, now used for irrigation.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N7-30	7½ NW	Catlett	Frank Kellogg	1929	495	10	65	------	------	T, G, 40	I	120	10	300	N7-163 and N7-30. Supplement 300 acres.
31	8 NW	Byrd Cattle Co	Floyd Trimm	1928	755	10	------	------	------	T, E, 25	D, S, I	20	160	500	
32	7½ NW	do	------	1910	980	8¼	360	------	------	T, G, 65	D, S, I	160	180		Reported flowing 75 gpm in 1913.
33	7¼ NW	do	------	1910	614	10	------	------	------	------	N	------	------	------	
34	8 N	do	Floyd Trimm	------	------	8	------	a/50.7 58.9	12- 7-29 9-14-48	------	N	------	------	------	
35	8¼ N	Carl Reiker	do	1928	921	8	------	------	------	T, G, 25	D, S	------	45	0	
36	9¼ NW	Williams and others.	------	------	140	6	------	77.0	2- 7-30	C, W	S	------	------	------	
37	9 NW	J. A. Webb	George Petty	1913	100	6	------	------	------	C, W	S	------	------	------	
*38	9 NW	do	------	------	900±	------	------	51.6	2- 7-29	C, W	S	------	------	------	
39	7 NW	I. O. Kotchman	George Petty	1913	115	6	------	82.2	12-19-29	C, W	S	------	------	------	
*40	6½ NW	Lynch Bros	Frank Kellogg	1927	188	10	78	------	------	C, W	S	18	0	0	Reported, in 1938, no irrigation since 1935. Temp 76°F. Log.
41	6 NW	A. N. Box	S. M. Owens	1906	504	8¼	80	41.0	5- 9-30	C, W	S	40	5	0	Reported flowing 150 gpm in 1913.

42	7 NW	Byrd Cattle Co	Floyd Trimm	------	------	------	------	------	------	T, Ng, 85	I	800	410	410	Used in conjunction with N7-44 and N7-45.
43	$6\frac{1}{2}$ NW	do	George Leonard	1910	840	$8\frac{1}{4}$	483	------	------	T, Ng, 85	I	------	------	------	Used in conjunction with N7-44.
44	$6\frac{1}{2}$ NW	do	Barnett	1910	960	5 3/16	------	------	------	T, Ng, 85	D, S I	------	------	------	Used in conjunction with N7-42 and N7-43.
45	$7\frac{3}{4}$ NW	do	George Leonard	1913	805	10	605	------	------	------	N	------	------	------	Used in conjunction with N7-42, N7-43, and N7-44.
*46	$7\frac{3}{4}$ NW	State of Texas	Cribbs & Davidson.	1930	1, 022	$12\frac{1}{2}$	1, 022	90	7- -30	T, E, 50	D, S, I	0	$58\frac{1}{2}$	80	Casing: 254 ft of $12\frac{1}{2}$-in.; 523 ft of 8-in. 264 ft of 6 5/8-in. perforated. Temp 91°F. Log.
47	$7\frac{1}{2}$ NW	Dr. G. Matteson Heirs.	do	1927	992	10	780	------	------	T, G, 40	D, S, I	45	6	------	
48	$7\frac{1}{4}$ NW	Hugh Greer	George Crowell	1926	1, 001	------	------	61.0	10- 9-29	T, G	D, I	70	8	80	
49	7 NW	Davidson Co	do	1926	890	$12\frac{1}{2}$	------	------	------	T, G	D, I	$22\frac{1}{2}$	0	8	
50	8 NW	Ben Patterson	John Bell	1920	90	6	------	58	5-15-30	C, W	S	------	------	------	
51	6 NW	Sam McKnight	Elmo Owens	1930	282	10	------	------	------	C, W	S	------	------	------	Log.
52	5 NW	E. L. Wetzig	Frank Kellogg	1928	176	10	40	------	------	T, G, 15	I	19	26	29	
53	5 NW	do	------	------	------	10	------	80.5	12-19-30	T, G	D, S, I	------	------	40	
54	5 NW	John Stahl	Elmo Owens	1928	176	10	------	------	------	C, W	S	20	0	0	Reported, in 1938, no irrigation since 1936. Temp $76\frac{1}{2}$°F.
55	4 N	R. W. Williams	Frank Kellogg	1929	370	6	------	------	------	C, W	D, S	------	------	------	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
*N7-56	4 N	H. H. Herrington	S. M. Owens	1909	600	10	400	65.5	5-15-30	T, G, 65	D, S, I	20	5	-------	
57	4½ N	W. G. Orr	--------------	1927	705	8	-------	67.7	10- 3-30	T, G, 60	D, S	63	0	0	Reported, in 1938, no irrigation since 1936. Temp 86°F.
58	5 N	A. R. Ponder	Floyd Trimm	1925	700	6	500	--------	---------	--------	N	-------	-------	-------	
59	5½ N	do	George Leonard	1924	752	10	550	--------	---------	T, G, 40	I	150	125	-------	
60	5½ N	do	--------------	1921	800	10	-------	--------	---------	T, G, 65	D, S, I	-------	-------	300	
61	6½ N	C. Zedler	--------------	------	760	12	525	--------	---------	T, G, 52	D, I	42	20	0	
62	6½ W	Central Securities Co.	--------------	------	-------	6	-------	20.6	6-19-30	C, W	S	-------	-------	-------	
63	5 W	Sam McKnight	Humble Oil & Refining Co.	1928	5,004	-------	-------	--------	---------	--------	N	-------	-------	-------	Abandoned deep oil test.
64	3¾ NW	Henry Moses	George Petty	------	375	-------	-------	--------	---------	--------	N	2	0	0	Reported, in 1938, no irrigation since 1936.
65	4 NW	L. A. Warren	Elmo Owens	1928	230	12	230	49.2	10-29-29	C, W	D, S	-------	-------	-------	Log.
66	3¾ NW	J. A. Heyman	W. D. Morrison	1927	332	12	79	--------	---------	T, G, 20	D, S	40	5	0	Temp 78½°F. Log.
*67	3½ NW	Dr. B. F. Smith	do	1927	310	10	90	93.1	10-28-29	None	N	20	31¼	0	Temp 78°F.

68	$2\frac{3}{4}$ NW	J. M. Davis	George Petty	1927	210	10	-------	87.9	2- 2-28	--------	N	-------	-------	0	Abandoned.
*69	$3\frac{1}{4}$ N	G. E. Whitney	-----do-------	1923	504	$8\frac{1}{4}$	160	--------	---------	None	N	45	$87\frac{3}{4}$	0	Do.
*70	$3\frac{1}{2}$ N	C. M. Burns	S. M. Owens	1905	530	$6\frac{1}{4}$	60	8	1913	C, W	D, S	-------	-------	-------	Reported flowing 125 gpm in 1905.
71	$3\frac{3}{4}$ N	-----do--------	-----do-------	1929	500	8	165	-------	---------	T, Ng, 47	D, S, I	14	0	30	Reported flowing 75 gpm in 1907. Reported, in 1938, no irrigation since 1935.
72	$8\frac{1}{2}$ W	Dr. R. F. Miller Estate.	George Petty	1912	140	6	-------	79.5	2- 7-30	C, W	S	-------	-------	-------	
73	6 W	Sam McKnight	--------------	------	40	6	-------	9.6	1-16-30	C, W	S	-------	-------	-------	
*74	5 W	-----do--------	G. B. Williams	------	-------	8	-------	72.0	9-24-29	C, W	D, S	-------	-------	-------	Temp 78°F.
*75	4 W	F. Kirk	--------------	------	306	10	-------	--------	---------	C, W	S	-------	-------	-------	
76	4 W	-----do--------	--------------	1926	309	10	-------	--------	---------	C, W	S	-------	-------	-------	
77	3 W	Sam McKnight	W. D. Morrison	1930	436	8	251	105	5- -30	T, G	S, I	-------	-------	40	Log.
78	2 NW	C. Schmitt	Sam Howard	1915	300	10	-------	a/91.7 112.4	1- 6-30 9-14-48	C, G, 6	D, S, I	2	$\frac{1}{2}$	$\frac{1}{2}$	
79	$1\frac{3}{4}$ NW	B. Padilla	Frank Kellogg	------	-------	6	-------	--------	---------	C, G, 6	D, S, I	10	$10\frac{1}{2}$	20	
80	$1\frac{1}{2}$ NW	T. A. Smith	Elmo Owens	1929	356	10	$59\frac{1}{2}$	--------	---------	C, G, 6	D, S, I	9	16	4	
81	$1\frac{1}{2}$ N	Joe Gardner	Frank Kellogg	1926	525	10	-------	--------	---------	C, G, 6	N	58	12	0	
82	$1\frac{1}{2}$ N	-----do--------	Sam Howard	------	312	8	-------	--------	---------	T, G, 15	D	5	0	0	
83	$1\frac{3}{4}$ N	P. Tijarena	A. Brown	1927	300	8	-------	--------	---------	--------	N	27	10	0	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N7-84	2½ N	Shaw	Elmo Owens	------	315	8	-------	--------	---------	--------	N	-------	-------	0	
85	2¼ N	-----do-----	-----do-----	------	318	8	40	--------	---------	--------	N	0	0	0	
86	2 N	Gus Jeffery	George Petty	1922	456	-------	-------	--------	---------	T, G, 65	D, S, I	35	37	50	
87	2¼ N	M. L. Norwood	S. M. Owens	1924	312	12	169	--------	---------	T, E, 15	D, S, I	35	46	40	
88	2¼ N	Butcher	Elmo Owens	1922	305	10	40	--------	---------	T, G, 6	D, S, I	40	3	50	
89	2½ N	-----do-----	-----do-----	------	315	8	-------	--------	---------	--------	N	-------	-------	-------	
90	3 N	Crosby	S. M. Owens	1910	454	8¼	80	--------	---------	C, G, 10	N	20	0	0	Reported, in 1938, no irrigation since 1936.
91	2¾ N	G. O. Bell	--------------	------	310	5	-------	--------	---------	T, G, 20	N	23	0	-------	Do.
92	2½ N	Citizens State Bank.	S. M. Owens	1914	324	18	140	--------	---------	T, G, 37	D, S, I	75	30	150	
93	2¾ N	J. L. Spear	A. E. Petty	1918	350	5	40	--------	---------	--------	N	24	0	-------	Reported, in 1938, no irrigation since 1931.
94	3 N	Mary Witherspoon.	S. M. Owens	1916	608	12	100	--------	---------	T, G, 65	D, S, I	60	2	70	
95	3¼ W	M. E. Cook	G. A. Petty	1915	232	10¾	-------	a/69.4 76.0	1- 6-30 7-10-46	--------	N	-------	-------	-------	

96	$3\frac{3}{4}$ W	Central Securities Co.	W. D. Morrison	1930	272	10	25	65	5- -30	C, W	S	------	------	------	Log.
97	$2\frac{1}{4}$ SW	T. M. Leavers	------	------	200	------	------	------	------	C, G, 6	D	------	0	0	
98	$1\frac{1}{2}$ W	Spears Dairy	Petty	------	400	10	50	------	------	C, W	D, S	------	0	------	
*99	1 N	Mobley Bros	Frank Kellogg	1925	410	12	------	------	------	------	N	75	57	0	Yield 75 gpm.
100	$1\frac{1}{2}$ N	Siberio Zavata	S. M. Owens	1920	455	10	40	------	------	T, G	I	20	0	15	Reported no irrigation for several years, prior to 1937-38.
101	$1\frac{1}{4}$ N	-----do-----	------	1930	388	------	------	------	------	------	N	------	------	------	
102	$1\frac{3}{4}$ N	Gus Jeffery	S. M. Owens	1925	325	------	------	------	------	T, E	I	32	0	35	Reported, in 1938, no irrigation since 1934.
103	2 N	William D. Cater	------	1917	315	10	140	------	------	T, E	I	15	0	0	Reported, in 1938, no irrigation since 1932. Will be used 1948-49.
104	$1\frac{1}{2}$ N	I. Martinez	Elmo Owens	------	230	8	------	------	------	C, G, 3	D, S, I	5	5	------	
105	$1\frac{1}{2}$ N	T. J. Haire	G. A. Petty	1920	347	10	140	------	------	T, E, 15	D, S, I	45	28	19	
106	$1\frac{3}{4}$ N	S. A. Byers	-----do-----	1917	315	10	140	------	------	C, G, 10	I	14	0	20	Reported, in 1938, no irrigation since 1932.
107	2 N	A. R. Miller	-----do-----	1920	321	$7\frac{3}{4}$	60	------	------	T, E, 7	D, I	8	6	$13\frac{1}{2}$	
108	$3\frac{1}{4}$ NE	Guy Scoggins	Simpson	1922	450	10	------	------	------	T, G, 60	D, S, I	32	47	60	Well cleaned out in 1938. Recased: 140 ft of 10-in.; 100 ft of 8-in. perforated lapped 20 ft into 10-in.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N7-109	$1\frac{1}{2}$ NE ---	R. T. Mooreman	Sam Howard---	1912	315	10	48	18	2-19-13	T, E, 10	D, S, I	37	26	22	Temp 80°F.
*110	$1\frac{1}{2}$ NE ---	Ward & Conn---	-----do-------	1912	312	$8\frac{1}{4}$	60	4	---do----	C, G, 6	------	10	$\frac{1}{2}$	0	Temp 78°F.
111	$1\frac{1}{4}$ NE ---	T. J. Haire ----	Frank Kellogg -	1925	250	8	100	--------	---------	T, E, $7\frac{1}{2}$	D, S, I	$14\frac{1}{2}$	17	17	Citrus irrigation.
112	$1\frac{1}{4}$ NE ---	N. Castellos ---	A. E. Eardley-	1910	-------	10	-------	70.4	5- 3-30	T, G, 15	D, I	40	$64\frac{3}{4}$	49	Temp $78\frac{1}{2}$°F.
113	$1\frac{3}{4}$ N-----	O. N. Ratcliff --	John Eardley --	1911	301	$8\frac{1}{4}$	60	4	2-19-13	T, E	I	-------	-------	$12\frac{1}{2}$	Temp 78°F.
114	$1\frac{3}{4}$ NE ---	H. Petry-------	S. M. Owens --	1916	316	12	60	--------	---------	C, G	D	23	10	-------	
115	2 N------	Noble----------	G. A. Petty ---	1916	318	$9\frac{3}{4}$	-------	--------	---------	T, E, $7\frac{1}{2}$	D, S, I	16	$5\frac{1}{4}$	14	
116	2 NE ----	Eardley Estate -	Simpson ------	1916	325	16	140	--------	---------	--------	N	90	80	0	
118	$1\frac{3}{4}$ W ----	G. A. Bryant---	Frank Kellogg -	1927	476	10	150	--------	---------	C, W	D, S	4	4	-------	
119	$1\frac{1}{4}$ W ----	A. B. Shaw ----	-----do-------	1928	380	-------	-------	--------	---------	C, G, 7	D, S, I	20	5	10	One acre citrus, 9 acres vegetables.
120	$1\frac{1}{4}$ SW ---	-----do--------	W. D. Morrison	1927	252	10	40	--------	---------	--------	N	-------	-------	-------	
121	$1\frac{1}{4}$ SW ---	John Stahl------	--------------	------	-------	-------	-------	--------	---------	C, G, 6	D, S, I	15	12	50	Yield, 50 gpm.
122	$\frac{3}{4}$ SW ----	Mrs. Ive White--	W. D. Morrison	1927	404	10	20	56.5	2- 2-28	C, W	D, S	-------	-------	-------	

123	1 SW	W. A. Hoose	do	1927	344	10	40	-----	-----	C	D, S	5	0	0	Reported, no irrigation for several years prior to 1937-38.
124	¾ SW	A. Tocquigny	-----	1918	349	12	20	-----	-----	C, G, 6	D, S, I	5	6	14	
*125	In Carrizo Springs.	A. J. Knaggs	-----	1910	133	6	-----	[a]/57.5 71.8	2-26-30 9-14-48	-----	N	-----	-----	-----	Temp 76° F.
*126	In Carrizo Springs.	City of Carrizo Springs.	W. D. Morrison	1928	322	12½	123	82.4	3-12-30	T, E, 30	P	-----	-----	-----	Supplies city of Carrizo Springs.
127	1 NE	Mrs. F. F. Kellogg.	G. A. Petty	1912	450	6	150	58.1	10- 8-29	-----	N	-----	-----	-----	
128	1 NE	H. O. Case	do	1919	325	10	-----	73.5	do	T, G, 65	D, S, I	32	32	15	
129	1¼ NE	E. M. McClendon.	do	1924	246	8	-----	-----	-----	C, W	D, S	66	0	-----	Reported, in 1938, no irrigation since 1935.
130	1 NE	Mrs. F. F. Kellogg.	-----	-----	28	54	-----	18.5	5- 5-30	-----	-----	-----	-----	-----	Dug. Water formerly used locally for medicinal purposes.
131	1¼ NE	Mrs. W. C. Butler.	-----	1890	-----	6	-----	-----	-----	C, W	D, S	-----	-----	-----	
132	1¾ NE	Mrs. Gus Jeffery.	G. A. Petty	1922	300	6	-----	86.1	4-11-30	-----	N	-----	-----	-----	
133	1¾ NE	do	S. M. Owens	1921	318	6	60	-----	-----	-----	N	30	15	0	
134	1¾ NE	A. M. Thorpe	do	1904	360	14	0	-----	-----	-----	N	5	0	-----	Reported, in 1938, no irrigation since 1935. Temp 80½° F.
135	1¾ SW	J. L. Bell	J. L. Bell	1921	106	6	20	25.0	1- 7-30	-----	N	-----	-----	-----	
136	1¾ SW	William Haun	-----	1929	112	8	15	41.0	2- 5-30	C, H	D, S	-----	-----	-----	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level		Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
								Below land surface (feet)	Date of measurement			1929-30	1937-38	1947-48	
	Carrizo Springs:														
*N7-137	$\frac{3}{4}$ E------	G. A. Hero Estate.	--------------	------	31	36	-------	26.5	4-30-30	--------	N	-------	-------	-------	
138	1 E------	A. Dickens Estate.	--------------	------	-------	6	-------	50.0	10-24-29	--------	N	-------	-------	-------	
139	1 E------	W. L. Measles-	--------------	1926	140	10	-------	--------	---------	C	N	10	0	0	Reported no irrigation for several years prior to 1937-38.
140	$1\frac{1}{4}$ SE----	M. Nistler-----	--------------	1924	480	10	150	--------	---------	--------	N	33	0	0	Well replaced by N7-147 in 1932. Temp $79\frac{1}{2}$°F.
141	$1\frac{1}{4}$ SE----	Joe Gardner----	--------------	------	235	10	80	--------	---------	T, E, 15	D, S, I	45	54	40	
*142	$2\frac{1}{4}$ N-----	L. B. Huth-----	Elmo Owens---	1932	420	6	-------	--------	---------	T, G, 10	D, S, I	-------	$12\frac{1}{4}$	34	
143	$1\frac{1}{2}$ N-----	Locadio Zarate-	-----do-------	1932	485	10	20	--------	---------	C, G, 6	D, S, I	-------	13	58	Casing: 20 ft of 10-in.
144	$1\frac{1}{2}$ N-----	Joe Gardner----	-----do-------	1938	300	8	200	--------	---------	T, G, 15	D, S, I	-------	-------	-------	Casing: 200 ft of 8-in.
*145	1 N------	Mobley Bros ---	--------------	1917	340	10	-------	--------	---------	C, G, 10	D, S	-------	-------	0	
*146	$1\frac{1}{4}$ SW ---	Wilson---------	Frank Kellogg-	1934	300	6	20	--------	---------	C, G, 6	D	-------	2	0	Casing: 20 ft of 6-in.

147	$1\frac{1}{4}$ SE	V. Oldroyd	Elmo Owens	1932	180	12	140	--------	--------	T, E, 15	D, S, I	--------	9	20	Casing: 140 ft of 12-in.
148	In Carrizo Springs.	J. H. Long	Petty Bros	1937	397	$8\frac{1}{4}$	230	86.81	12- 7-37	C, E, $3\frac{1}{2}$	D	--------	0	--------	Casing: 230 ft of $8\frac{1}{4}$-in. Log.
*149	1 E	W. L. Measles	L. D. Stripling	1934	280	$8\frac{1}{4}$	140	--------	--------	T, G, 65	D, P, S	--------	18	0	Casing: 140 ft of $8\frac{1}{4}$-in. Supplies public swimming pool.
150	$3\frac{1}{4}$ W	M. E. Cook	--------	--------	565	10	--------	--------	--------	--------	N	--------	0	0	Reported, in 1938, no irrigation since 1932.
151	$3\frac{1}{2}$ N	E. Goodwin	Petty Bros	1936	355	8	200	--------	--------	--------	--------	--------	0	--------	Casing: 200 ft of 8-in. Reported, in 1938, no irrigation since 1936. Log.
*152	1 W	Tisdell	Sam Howard	1913	375	10	88	--------	--------	--------	N	--------	6	0	Casing: 88 ft of 10-in. galvanized tin.
*153	1 W	L. H. Upchurch	Petty Bros	1936	215	8	51	85	2- -36	C, G, $7\frac{1}{2}$	D, S, I	--------	4	2	Log.
154	$1\frac{3}{4}$ NE	Katenhaid	--------	1900	333	5 3/16	60	--------	--------	C, W	D, S	--------	--------	--------	Reported flowing 100 gpm when drilled.
155	1 W	J. H. McGee	--------	--------	--------	--------	--------	--------	--------	C, G, 6	D, S	--------	0	0	Reported no irrigation for several years prior to 1937-38.
156	$1\frac{3}{4}$ NW	Ben Fleming	--------	--------	--------	--------	--------	--------	--------	C, G, 6	D, S	--------	0	--------	
157	4 N	H. Rouw	I. C. Cribbs	1944	565	12	428	105	12-22-44	T, Ng, 67	I	--------	--------	--------	Log.
158	$4\frac{1}{2}$ N	do	Ed Owens	1947	600	12	400	--------	--------	T, Ng, 67	I	--------	--------	--------	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N7-159	$4\frac{3}{4}$ N	H. Rouw	I. C. Cribbs	1944	600	12	600	110	8-21-48	T, Ng, 67	I	-------	-------	590	Used in conjunction with wells N7-57, 157, 158, 159, 160, 161, and 162.
160	$4\frac{3}{4}$ N	do	do	1945	-------	12	510	85	1-25-45	T, Ng, 67	I	-------	-------	-------	Do.
161	$4\frac{1}{4}$ N	do	do	1947	610	11	407	150	7-17-47	T, Ng, 67	I	-------	-------	-------	Do.
162	$4\frac{3}{4}$ NW	do	do	1945	570	12	-------	90	---------	T, Ng, 67	I	-------	-------	-------	Do.
163	$7\frac{1}{2}$ NW	Catlett	O. F. Webb	1947	490	12	200	109	6- -47	T, G	I	-------	-------	-------	Supplemental to N7-30.
164	$3\frac{3}{4}$ NW	H. Rouw	I. C. Cribbs	1945	395	10	395	90	2-15-45	T, Ng	I	-------	-------	-------	Log.
165	$3\frac{3}{4}$ NW	do	do	1944	427	10	427	110	11- -44	T, Ng	I	-------	-------	258	
166	$3\frac{1}{2}$ NW	H. Rouw	do	1946	350	10	350	87	5-10-46	T, Ng	I	-------	-------		
167	$3\frac{1}{2}$ N	G. E. Whitney	do	1943	471	10	459	116.5	3- 3-48	T, Ng	I	-------	-------		Used in conjunction with N7-168, 169, and 170.
168	$3\frac{1}{2}$ NW	do	do	------	478	10	-------	116.9	---do---	T, Ng	I	-------	------	220	Log.
169	$3\frac{1}{4}$ N	H. Rouw	do	1945	456	10	456	95	10- -45	T, Ng	I	-------	-------		
170	3 N	do	do	1942	460	10	460	95	8- -42	T, Ng	I	-------	-------	175	Log.

171	3½ N-----	Carroll Burns--	Elmo Owens---	1947	600	12	280	--------	---------	T, G	I	-------	-------	100	
172	1¼ NW---	Mobley Bros ---	-----do-------	1948	330	12	146	--------	---------	--------	I	-------	-------	0	
*173	½ N------	City of Carrizo Springs.	-----do-------	1943	338	16	122	117	11- 2-48	T, E, 30	P	-------	-------	-------	Static level 117 ft, pumping level 178 ft. Log.
174	1½ W-----	L. H. Upchurch-	--------------	------	-------	-------	-------	--------	---------	C, G	I	-------	-------	6	
175	10½ NW--	J. L. Mogford--	R. B. Owens--	1948	250	12	34	95	10- 8-48	--------	I	-------	-------	25	
176	11 NW---	-----do--------	-----do-------	1948	254	12	32	95	10-23-48	--------	I	-------	-------	0	
177	8 NW----	Bennett--------	-----do-------	1948	400	12	56	105	6-15-48	T, G	I	-------	-------	0	
178	12½ NW--	Frank Harris---	O. F. Webb---	1947	485	10	485	85	10- -47	T, Ng	I	-------	-------	0	
179	12 NW---	H. L. Sweet----	E. Owens-----	1949	344	12	78	--------	---------	T	I	-------	-------	0	
180	2 S------	Joe Gardner----	Luke Simpson -	1924	440	10	100+	--------	---------	C, W	D, S	30	0	0	Reported, in 1938, no irrigation since 1936.
181	2 S------	Beasley--------	Elmo Owens---	1928	256	10	93	--------	---------	T, E, 10	D, S, I	9	5	30	
*182	8½ W ----	Joe Gardner----	-----do-------	------	-------	-------	-------	--------	---------	C, W	S	-------	-------	-------	Temp 79°F.
*183	8¼ W ----	-----do--------	-----do-------	1948	-------	-------	-------	--------	---------	C, W	S	-------	-------	-------	Temp 80°F.
*184	9¼ NW---	Ben Patterson--	Petty---------	------	200±	-------	-------	--------	---------	C, W	S	-------	-------	-------	Temp 82½°F.
N8-1	9¼ NE ---	W. G. Orr-----	George Leonard	1911	1,060	6¼	810	--------	---------	--------	N	288	0	-------	Formerly used in conjunction with N8-2.
2	9¾ NE ---	S. C. Freed----	Cribbs & Davidson.	1927	1,080	10	1,080	--------	---------	T	N	-------	120	-------	Casing: 190 ft of 10-in.; 620 ft of 8-in.; 270 ft of 6 5/8-in. perforated.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N8-3	10 NE	S. C. Freed	A. B. Brown	1928	92	6	------	53	11-14-29	--------	N	-------	-------	-------	
4	10 NE	Mrs. M. B. White.	-----do-------	1928	77	6 5/8	------	37.5	11-13-29	C, H	D	-------	-------	-------	
5	$10\frac{3}{4}$ NE	-----do-------	-----do-------	1928	100	6 5/8	100	44.6	11-14-29	C, W	D, S	-------	-------	-------	
6	10 NE	N. C. Ginter	Cribbs & Davidson.	1927	1,208	10	1,208	--------	---------	T, E, 30	N	465	150	0	Reported no irrigation for several years prior to 1937-38. Used all river water.
7	$10\frac{3}{4}$ NE	Walter Bidelspach.	R. F. Schroeder	1923	1,085	$15\frac{1}{2}$	1,085	[a]78.2 102.5	11-27-29 7-24-47	T, E, 25	I	320	320	0	Casing: 120 ft of $15\frac{1}{2}$-in.; 757 ft of 8-in.; 220 ft of $6\frac{1}{4}$-in. perforated.
*8	$10\frac{1}{4}$ NE	Wagner	George Leonard	1911	1,212	$7\frac{1}{4}$	1,012	--------	---------	T, G, 20	D, S, I	192	0	330	Reported, in 1938, no irrigation since 1935.
*9	$4\frac{3}{4}$ E	A. Wagner	Tom Leary	1912	1,094	$8\frac{1}{4}$	------	66.5	10-31-29	T	N	60	0	-------	Reported, in 1938, no irrigation since 1930.
10	$4\frac{1}{2}$ E	Sam Ward	L. D. Stripling	1929	1,080	$12\frac{1}{2}$	1,053	--------	---------	T, G	I	160	0	160	Casing: 200 ft of $12\frac{1}{2}$-in.; 527 ft of 8-in.; 333 ft of 6 5/8-in. perforated. Reported, in 1938, no irrigation since 1932. Log.
11	$11\frac{1}{4}$ NE	J. E. Baylor	Tom Leary	------	1,210	8	------	85.6	11-26-29	C, W	S	-------	-------	-------	

12	$7\frac{1}{2}$ NE ---	Hugh Greer ----	Cribbs & Davidson.	------	1,020	10	760	--------	---------	T, E, 25	I	60	0	100	Reported no irrigation for several years prior to 1937-38.
13	9 NE ----	L. Wagner -----	-----do-------	1928	1,140	10	1,140	--------	---------	T, E, 30	D, S, I	62	0	50	Casing: 284 ft of 10-in.; 706 ft of 8-in.; 168 ft of 6 5/8-in. perforated. Reported, in 1938, no irrigation since spring of 1937. Temp 91°F.
14	$8\frac{3}{4}$ NE ---	Sid Parkinson --	A. B. Webb ---	1912	-------	6	1,137	61.0	11-14-29	--------	N	-------	-------	-------	
15	$9\frac{1}{4}$ NE ---	N. C. Guenther-	--------------	1925	1,175	-------	-------	67.5	---do----	T, E, $37\frac{1}{2}$	I	160	0	0	Reported, in 1938, no irrigation since 1933. Temp 92°F.
16	$9\frac{1}{4}$ NE ---	E. P. Curtis ---	S. M. Owens --	1910	1,116	$8\frac{1}{4}$	1,116	78.0	---do----	T, G, 55	D, S	190	0	0	Reported, in 1938, no irrigation since 1933. Salty water.
17	10 NE ---	J. M. Merriwether	I. L. Dingman-	1927	-------	12	-------	--------	---------	T	N	300	0	-------	Reported no irrigation for several years prior to 1937-38.
18	$10\frac{1}{2}$ NE --	J. E. Baylor ---	Tom Leary----	1913	1,210	8	-------	--------	---------	C, W	S	16	0	-------	Do.
19	$5\frac{1}{4}$ NE ---	E. L. Omera---	--------------	------	-------	10±	-------	a/94.5 93.6	12-18-29 9-14-48	--------	I	-------	-------	0	Drilled for irrigation. Never used. To be used 1948-49.
20	$7\frac{3}{4}$ NE ---	A. N. Box -----	Floyd Trimm--	1927	1,250	12	-------	--------	---------	T, E, 35	I	200	0	150	Reported, in 1937-38, no irrigation since 1935. Temp 91°F.
21	8 NE ----	E. L. Omera---	A. Coe -------	1912	1,070	8	-------	--------	---------	T	N	45	0	-------	Reported, in 1937-38, no irrigation since 1934. Temp 91°F. Salty water.
22	$7\frac{3}{4}$ NE ---	Morris & Pannill	S. M. Owens --	1910	1,100	$8\frac{1}{4}$	-------	--------	---------	T, E, 20	S	90	105	0	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N8-23	8½ NE	Fred Foster	A. B. Webb	1910	-------	8	1,100	73.2	11-15-29	--------	N	-------	-------	-------	Reported flowing 50 gpm in 1913.
*24	4 NE	H. P. Bailey	--------------	------	66	8	-------	20.2	11-18-29	--------	N	-------	-------	-------	Temp 79½°F.
25	4 NE	Hiram G. Hines	S. M. Owens	1907	654	6	-------	42.0	---do---	C, W	S	-------	-------	0	Reported flowing 100 gpm in 1907 and 75 gpm in 1913. Salty water.
26	5½ NE	G. C. Rheia	--------------	1908	818	8	-------	a/62.4 136.3	---do--- 9-14-48	T, E, 55	I	-------	22	2	
27	5½ NE	J. S. Ward	A. B. Webb	1909	818	6	650	61.5	11-18-29	T, E, 10	D	-------	0	0	Reported flowing 50 gpm in 1913. Temp 86°F.
28	5¾ NE	-----do-----	Petty	1928	1,008	6	-------	a/64.3 131.6	---do--- 9-14-48	C, W	D, S	-------	-------	0	
*29	7½ NE	J. C. & O. E. Bookout.	Cribbs & Davidson.	1928	1,005	12½	1,005	65.7	11-15-29	T, E, 40	D, S, I	340	526	154	Casing: 210 ft of 12½-in.; 532 ft of 8-in.; 288 ft of 6 5/8-in. perforated. Temp 88°F.
*30	2¾ NE	I. J. New	Frank Kellogg	1930	435	8	-------	64.0	5-15-30	C, E, ¼	D, S	-------	-------	-------	
31	2½ NE	M. M. Adams	S. M. Owens	1925	387	10	150	--------	---------	--------	N	38	13	0	Offset.

32	$2\frac{3}{4}$ NE ---	L. D. Stripling--	Owens --------	1910	-------	6	-------	--------	---------	--------	N	16	0	-------	Reported, in 1938, no irrigation since 1934.
34	2 NE ----	J. L. Mogford--	Frank Kellogg -	1928	460	10	-------	--------	---------	C, H	N	55	20	0	
35	$2\frac{1}{4}$ NE ---	J. G. Benavides	A. E. Eardley-	1916	504	10	-------	--------	---------	T, E, 10	D, S	44	3	0	
36	$2\frac{1}{4}$ NE ---	S. Statler ------	G. A. Petty ---	1920	440	10	-------	--------	---------	--------	N	-------	-------	-------	
37	$2\frac{1}{4}$ NE ---	R. Rodriguez---	A. B. Webb ---	1903	510	7 5/8	50	--------	---------	T, E, 55	D, S, I	18	15	40	
38	$2\frac{1}{4}$ NE ---	F. Riha--------	Elmo Owens---	1928	454	10	150	--------	---------	--------	------	30	0	-------	Reported, in 1938, no irrigation since 1936.
39	$2\frac{1}{2}$ NE ---	Frank Riha-----	A. E. Eardley-	1910	459	$6\frac{1}{4}$	228	--------	---------	C, E	D, S	-------	8	0	Reported flowing 100 gpm when drilled and 80 gpm in 1931.
40	$2\frac{1}{2}$ NE ---	John Stahl------	--------------	1910	380	$5\frac{1}{2}$	-------	a/51.5 108.5	12- 5-29 9-14-48	--------	N	27	0	-------	Replaced by N8-106 located 50 *ft* southwest.
41	$2\frac{1}{2}$ NE ---	-----do-------	--------------	1910	-------	6	-------	--------	---------	--------	N	-------	-------	-------	
*42	$2\frac{3}{4}$ NE ---	W. Wilcox -----	K. B. Ayres --	1907	425	5 7/8	55	43.0	5- 7-30	--------	N	45	0	-------	Replaced by N8-43.
43	$2\frac{3}{4}$ NE ---	A. N. Box -----	Frank Kellogg -	1930	522	10	176	41.6	---do----	T, G, 83	D, S, I	-------	10	10	Citrus irrigation. Log.
44	3 NE ----	J. F. House----	Moehrig ------	1903	550	5 5/8	330	--------	---------	--------	D, S	22	0	0	Reported flowing 150 gpm in 1907. Salty water.
45	$1\frac{3}{4}$ E-----	Eardley Estate -	A. E. Eardley-	1904	500	6	80	86.2	10- 9-29	--------	N	0	0	-------	
46	$1\frac{3}{4}$ E-----	G. W. Baylor --	--------------	-------	590	6	-------	--------	---------	C, W	D, S	2	0	-------	Reported, in 1937, no irrigation since 1934. Temp 79° F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level		Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
								Below land surface (feet)	Date of measurement			1929-30	1937-38	1947-48	
	Carrizo Springs:														
N8-47	1¾ E	Dimmit County Airport.	------	------	500?	6	------	95.7	10-12-29	------	N	------	------	------	
48	2 E	do	W. D. Morrison	1927	545	10	------	------	------	------	N	16	12	0	
49	2¼ E	C. W. Miller	do	------	475	6	------	91.0	10-12-29	C, W	D, S	------	------	------	
50	2¾ E	I. O. Kotchman	------	1904	570	5 5/8	------	73.8	do	------	N	------	------	------	Reported flowing 400 gpm when drilled.
51	3 E	do	Frank Kellogg	1927	707½	8	707	------	------	C, W	D, S	40	0	------	Reported, in 1938, no irrigation since 1935.
52	4 NE	Marion Allen	A. B. Webb	1924	565	8	------	------	------	T, G, 15	D, S, I	20	2	------	
53	4¼ NE	W. A. Farley	George Petty	1928	645	8	430	------	------	T, G, 15	I	23	7	------	
54	4¼ NE	Mrs. Beatrice McClean.	A. B. Webb	1925	640	8	250	------	------	T, G, 20	I	47	0	40	Reported, in 1938, no irrigation since 1934.
55	4 NE	F. C. Garcia	George Petty	1929	733	8	500	------	------	T, G, 15	D, S, I	7	20	40	
*56	4¼ NE	John Ivey	A. B. Webb	1925	700?	10	------	59.0	10-14-29	T, G	D, S, I	0	0	125	
57	5½ NE	Arthur Ivey	------	1924	835	8	------	------	------	------	N	------	------	------	

58	6 NE ----	G. Denton Estate	--------------	------	834	8	-------	45.7	10-16-29	--------	N	-------	-------	0	Deep oil test plugged back and formerly used for irrigation.
59	6½ NE ---	Mrs. Jennie Campbell.	--------------	------	35	8	-------	2.8	---do---	--------	N	-------	-------	-------	Probably yields water by seepage from Nueces River.
60	10¼ NE --	W. S. Swart----	--------------	------	-------	6	-------	38.9	10-18-29	C, W	S	-------	-------	-------	
*61	10¾ NE --	T. W. Courtney -	A. B. Webb---	1912	1,170	10	1,170	--------	---------	T, G, 25	D, S, I	80	26	-------	
62	11½ NE --	G. Pickett -----	Tom Wren ----	1910	1,200	6	-------	--------	---------	T, G, 25	D, S, I	0	35	35	
63	11¾ NE --	F. V. Standifer -	-----do-------	1910	1,190	6	-------	--------	---------	T, G, 20	N	40	42½	0	Temp 93°F. Abandoned 1947-48.
*64	In Brundage	City of Brundage	Wheeler ------	1909	1,170	6	-------	--------	---------	C, G, 15	P	-------	-------	-------	Supplies city of Brundage.
65	2 E------	A. A. Swindell -	W. D. Morrison	1927	725	10	-------	--------	---------	T, E, 15	I	85	28		
*66	2 E------	-----do--------	Elmo Owens---	1929	408	12	-------	--------	---------	T, G, 20	D, S I	-------	-------	25	Used in conjunction with N8-65.
*67	2 E------	S. P. Spalding--	L. Simpson ---	1925	495	12	180	--------	---------	T, E, 20	D, S, I	109.5	30	100	Temp 81°F.
68	3 E------	H. J. Whitecotton.	S. M. Owens--	------	512	10	-------	--------	---------	C, W	S	16	0	0	Reported no irrigation for several years prior to 1937-38.
69	4 E------	-----do--------	George Petty--	1928	680	10	542	--------	---------	C, G, 10	D, S	17½	11	0	
70	4¾ E-----	-----do--------	--------------	1917	545	12	12	56.5	11-29-30	T, E	D, S	-------	-------	0	
71	7 E------	Dr. B. E. Pickett.	Seward -------	1927	-------	8	-------	52.9	---do---	T, G, 20	D, S, I	0	40	115	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N8-72	$8\frac{1}{4}$ E	Reeves & Eardley.	Seward	1928	866	10	630	--------	---------	T, G, 25	D, S	139	64	0	Casing: 260 ft of 10-in.; 370 ft of 8-in.
73	$10\frac{1}{2}$ E	Mrs. Moody Beascon.	C. W. Wheeler	------	-------	6	-------	30.0	10-21-29	C. W	S	-------	-------	-------	
74	$10\frac{3}{4}$ E	Nueces Land & Irrigation Co.	--------------	1908	960	8	860	2	2- -28	T, G, 25	N	80	120	0	Casing: 660 ft of 8-in.; 200 ft of $7\frac{1}{4}$-in. perforated. Temp 88°F.
*75	2 SE	Ehlers Bros	Petty	1928	440	10	150	--------	---------	T, E, 25	D, S, I	166	$126\frac{1}{2}$	-------	Temp 81°F.
76	2 SE	do	A. E. Eardley	1917	700	10	150	--------	---------	T, G, 15	D, S, I	-------	-------	-------	Used in conjunction with N8-75. Temp 80°F.
77	$2\frac{1}{4}$ SE	do	L. Simpson	1923	441	10	150	--------	---------	T, E, 15	I	-------	-------	30	
78	$2\frac{1}{4}$ SE	U. R. Brown	Frank Kellogg	1925	500	10	150	--------	---------	C, G, 15	D, S	49	18	0	
79	$3\frac{1}{2}$ SE	Mrs. A. F. Childress.	W. D. Morrison	------	615	10	-------	--------	---------	--------	N	-------	-------	-------	
80	$3\frac{3}{4}$ SE	do	A. E. Eardley	1903	600	8	-------	75.2	6-26-30	--------	N	-------	-------	-------	Reported flowing 200 gpm in 1903; no flow in 1913.

81	4 E	Mrs. Cramer M. Bell.	do	1900	590	6	60	-------	-------	-------	N	-------	-------	-------	Do.
*82	$4\frac{1}{2}$ E	R. N. Mitchell	A. B. Webb	1907	660	$6\frac{1}{4}$	240	-------	-------	T, G, 20	D, S, I	16	35	35	Reported flowing 500 gpm when drilled; no flow in 1913. Temp 82°F.
83	$11\frac{1}{2}$ E	M. McLean	R. J. Bauereisen.	-------	-------	-------	-------	-------	-------	T, G, 60	D, S, I	100	$201\frac{1}{2}$	150	
86	5 SE	W. E. Wroe	A. B. Webb	1910	660	8	48	-------	-------	-------	N	0	0	-------	Reported flowing 700 gpm when drilled.
87	$5\frac{1}{4}$ SE	do	-------	1910	643	5 5/8	48	-------	-------	C, W	D, S	-------	-------	-------	
88	$5\frac{1}{2}$ E	do	-------	1920	660	12	-------	-------	-------	T, G, 45	N	-------	-------	0	Not used in 1947-48. Will be used 1948-49.
89	$7\frac{1}{4}$ NE	D. Davenport	McKinley	1947	1,010	12	900	92	1947	T, Ng, 100	I	-------	-------	432	
91	6 E	Eardley Estate	W. W. Miller	1903	725	8	350	-------	-------	-------	N	-------	-------	-------	Reported flowing 450 gpm when drilled.
92	$3\frac{3}{4}$ NE	E. Burton	-------	Old	-------	-------	-------	-------	-------	T, G, 25	I	-------	-------	40	
97	$8\frac{1}{2}$ E	Marrs McLean	Layne-Texas Co.	-------	897	-------	-------	-------	-------	T, G, 60	I	350	$1,035\frac{1}{2}$	100	
98	$8\frac{3}{4}$ E	do	-------	-------	-------	8	-------	30	2- -28	-------	N	180	0	-------	Reported, in 1938, no irrigation since 1934.
99	$9\frac{1}{4}$ E	do	-------	1906	852	6 5/8	-------	30	do	-------	N	-------	-------	-------	Reported flowing 500 gpm in 1906.
100	$8\frac{1}{2}$ E	do	R. J. Bauereisen.	-------	1,100±	-------	-------	-------	-------	T, G, 25	N	-------	0	0	
*101	$9\frac{1}{4}$ E	do	E. & F. Eckert	1927	1,135	10	960	39	2- -28	T, G, 25	I	208	-------	50	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
*N8-102	9¼ E	Marrs McLean	Layne-Texas Co.	------	1,224	15½	1,224	--------	---------	T, G, 60	I	-------	-------	100	Log.
103	10½ E	do	E. & F. Eckert	1927	780	10	-------	a/40.2 80.0	11-26-29 9-14-48	T, G, 25	I	160	-------	30	
*104	3¾ NE	Hiram G. Hines	G. A. Petty	1936	582	8	437	35.7	12- 4-37	T, G	I	-------	-------	35	Log.
105	3¾ E	T. G. Paterson	Elmo Owens	1928	566	8	515	--------	---------	T, G	D, S, I	-------	0	35	
*106	2¾ NE	John Stahl	Petty Bros	1936	450	8	150	57	3-15-36	T, G, 65	D, S	-------	21	0	Log.
107	4½ NE	Jack Greer	--------------	------	-------	------	-------	--------	---------	T, G, 15	S, I	-------	0	75	
*108	3¼ NE	F. Webb	Elmo Owens	1935	564	10	-------	39.8	7-15-39	C, G	D	-------	13	0	
109	10½ NE	Sam Ward	Cribbs & Davidson.	1931	1,204	8	1,011	--------	12- -31	T, G, 55	I	-------	0	160	Casing: 1,011 ft of 10-in.; 212 ft of 8¼-in. perforated. Log.
110	12¾ NE	C. F. Jackson	do	1932	1,200	12	1,200	--------	---------	T, G, 70	D, S, I	-------	-------	-------	Casing: 290 ft of 12-in.; 644 ft of 8-in.; 297 ft of 6¼-in. perforated.
111	2½ SE	W. H. Gardner	Petty	------	-------	------	-------	--------	---------	T, E	I	-------	-------	160	
114	10½ E	M. McLean	McKinley	1946	1,150	12	-------	71.7	1-22-48	--------	N	-------	-------	-------	New well. Pump not installed.

115	2 NE ----	Dimmit County -	O. F. Webb ---	1948	510	8	-------	130	8- 3-48	T, G	D	-------	-------	-------	For airport use only.
116	$2\frac{1}{2}$ NE ---	J. M. Saunders-	-----do-------	1946	557	10	300	--------	---------	T, E, 30	I	-------	-------	47	Indio formation 525-557 ft.
117	$5\frac{1}{2}$ NE ---	Arthur Ivey ----	-----do-------	1947	805	10	800	97	12- -47	T, G	I	-------	-------	-------	Supplements surface water.
118	$10\frac{1}{4}$ NE --	S. C. Freed----	I. C. Cribbs --	1945	1, 130	12 5/8	1, 130	85	9-20-45	T, G, 65	Ind	-------	-------	-------	Supplies cannery. Log.
119	$5\frac{1}{4}$ NE ---	D. S. Starachan-	--------------	Old	-------	6	-------	--------	---------	T, Ng	I	-------	-------	35	
120	10 NE ---	S. C. Freed----	I. C. Cribbs --	1946	1, 120	12	812	100	12-13-46	T, G, 65	I	-------	-------	350	
121	$2\frac{1}{4}$ NE ---	A. M. Thorpe --	Charles Petrie	1905	500	18	0	--------	---------	T	N	$5\frac{1}{2}$	-------	-------	Reported, in 1938, no irrigation since 1935.
*122	$10\frac{1}{2}$ NE --	B. R. Guyler---	Will Byrd & C. H. Goodlink	1912	912	6	912	--------	---------	--------	N	-------	50	0	Casing: 640 ft of 6-in.; 200 ft of 5 5/16-in.; $4\frac{1}{2}$-in. perforated to bottom.
123	$11\frac{1}{2}$ NE --	Sam Ward------	L. D. Stripling-	1930	1, 114	10	805	--------	---------	T, G, 40	D, S, I	-------	80	160	Casing: 275 ft of 10-in.; 530 ft of 8-in. Swedge nipple between 8 and 10-in.
N9-1	$15\frac{3}{4}$ NE --	W. C. Coffey---	Floyd Trimm--	1926	1, 400	10	1, 400	--------	---------	C, W	D, S	23	0	-------	Reported no irrigation for several years prior to 1937-38.
2	$19\frac{1}{2}$ NE --	S. A. Armstrong	--------------	------	2, 000	6	-------	51. 3	1-31-30	C, W	D, S	-------	-------	-------	
*3	13 NE ---	H. A. Moore ---	--------------	1912	1, 236	6	1, 200	26. 1	1-31-28	T, G, 20	D, S, I	66	93	150	Casing: 900 ft of 6-in.; 300 ft of 5-in. perforated. Temp 95°F.
4	$13\frac{1}{4}$ NE --	H. C. Moore ---	--------------	1920	------	-------	-------	33. 6	11-27-29	T, G, 20	I	80	38	80	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N9-5	15 NE ---	P. C. Levering-	Howell & Stalter.	1912	1,353	8	1,350	90.6	11-29-29	T, G, 25	D, S, I	130	138	60	Casing: 920 ft of 8-in.; 250 ft of $7\frac{1}{4}$-in.; 175 ft of $6\frac{1}{4}$-in. perforated.
*6	17 NE ---	O. H. Nance ---	Ed. Homer----	1912	1,448	8	1,306	24.7	2- 1-29	T, G, 25	D, S, I	50	64	60	Casing: 1,306 ft of 8-in. Temp 98°F.
*7	18 NE ---	J. T. Kinnard--	Patterson, Zarderson & Rodley.	1911	1,600	8	-------	--------	---------	T, G, 25	D, S, I	-------	63	5	Temp 96°F.
*8	18 NE ---	H. Brown------	C. W. Wheeler	1909	1,412	8	1,412	54.1	11-30-29	T, G, 25	D, S	30	24	0	Casing: 808 ft of 8-in.; 404 ft of 5-in.; 200 ft of 5-in. perforated. Temp $98\frac{1}{2}$°F.
9	$16\frac{1}{4}$ NE --	W. H. Zimmerman.	Ed. Homer----	1914	1,147	8	1,147	32.5	10-18-29	T, E, 15	D, S	22	0	0	Reported static head was $18\frac{1}{2}$ ft above ground in 1916.
10	$16\frac{3}{4}$ NE --	Commercial National Bank.	--------------	------	1,470	8	-------	--------	---------	C, W	S	-------	-------	-------	Temp 96°F.
11	$16\frac{3}{4}$ NE --	T. P. Bowles --	Floyd Trimm--	1928	1,553	10	1,553	26.0	1-31-29	T, G, 25	D, S	-------	0	0	Casing: 220 ft of 10-in.; 1,200 ft of 8-in.; 312 ft of $6\frac{1}{4}$-in. perforated.

12	17 NE ---	Federal Land Bank.	--------------	1911	1,469	10	1,469	a/17.1 53.9	10-18-29 9-14-48	T, G, 25	I	-------	-------	80	Casing: 302 ft of 8-in.; 883 ft of 6-in.; 284 ft of 6-in. perforated.
13	$17\frac{3}{4}$ NE --	-----do--------	W. E. Stalter -	1912	1,580	8	1,580	--------	---------	--------	------	-------	19	0	Casing: 840 ft of 8-in.; 260 ft of $7\frac{1}{4}$-in.; 480 ft of $6\frac{1}{4}$-in. perforated at intervals.
14	$17\frac{1}{2}$ NE --	B. F. Pickett --	Cribbs & Davidson.	1928	1,416	10	1,416	--------	---------	T, G, 25	D, S, I	44	$57\frac{1}{2}$	55	Casing: 406 ft of 10-in.; $829\frac{1}{2}$ ft of 8-in.; $218\frac{1}{2}$ ft of 6 5/8-in. perforated.
*15	In Big Wells.	City of Big Wells.	George Crowell	1909	1,580	$6\frac{1}{4}$	1,580	--------	---------	--------	N	-------	-------	-------	Plugged and abandoned. Replaced by N9-46.
16	$19\frac{1}{2}$ NE --	N. Boyd -------	R. E. Homer--	1914	1,640	6	-------	a/74.0 92.8 98.9	11-18-29 1-16-48 9-14-48	T, G, 42	I	100	230	-------	Casing: 121 ft of 8-in.; 1,259 ft of $7\frac{1}{4}$-in. Temp 102°F.
17	$12\frac{1}{2}$ NE --	R. L. Jenkins --	McCrary -----	1913	1,200	8	-------	--------	---------	T, G, 25	D, S, I	43	48	-------	
18	13 NE ---	City of Brundage	A. E. Eardley-	1909	1,137	8	1,137	--------	---------	--------	N	31	0	0	Reported, in 1938, no irrigation since 1934.
19	$11\frac{3}{4}$ E----	M. McLean ----	Layne-Texas Co.	1909	1,224	10	-------	30.6	11-30-29	C, W	S	-------	-------	-------	Water level, 43.56, Jan. 22, 1948.
*20	In Big Wells.	City of Big Wells.	Cribbs & Davidson.	1937	1,355	10	400	--------	---------	T, E, 20	P	-------	-------	-------	Casing: 400 ft of 10-in. Broken sand at 895-950 ft. Supplies Big Wells. Log.
21	14 NE ---	Hancock Bros --	Littlejohn Drilling Co.	1911	1,365	8	1,365	--------	---------	T, G, 25	D, S, I	80	131	125	Temp 94°F.
22	13 NE ---	J. F. Webb ----	George Leonard	1912	1,410	6	1,400	--------	---------	T, G	D, S, I	45	25	60	Casing: 1,022 ft of 6-in.; 383 ft of 5-in. perforated.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level		Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
								Below land surface (feet)	Date of measurement			1929-30	1937-38	1947-48	
	Carrizo Springs:														
N9-23	$14\frac{1}{2}$ NE	C. W. Barker	Littlejohn Drilling Co.	------	------	------	------	------	------	T, G, 55	D, S	60	45	0	Not used in 1947-48.
24	14 E	-----do-----	Cribbs & Davidson.	1927	1,305	$12\frac{1}{2}$	1,305	60.2	11-29-29	T, G, 50	D, I	------	0	200	Casing: 208 ft of $12\frac{1}{2}$-in.; 828 ft of 10-in.; 275 ft of $8\frac{1}{4}$-in. perforated. Log.
*25	$14\frac{1}{2}$ E	-----do-----	------	------	1,300±	10	------	a/17.7 57.5	---do--- 9-14-48	T, G, 25	I	------	211	175	Reported flowing in 1925.
26	$14\frac{1}{4}$ E	Dr. L. B. Jackson.	------	------	------	20	------	17.1	11-29-29	T, G, 15	D, S	55	$19\frac{1}{2}$	0	Not used in 1947-48.
27	$17\frac{1}{2}$ E	Mrs. Regina Dullnig.	C. W. Wheeler	1912	1,540	8	------	------	------	C, G, 8	I	102	0	30	Reported, in 1938, no irrigation since 1936.
28	17 E	J. Straitz	-----do-----	1910	1,394	6	------	------	------	------	D, S	48	45	0	
29	$16\frac{1}{2}$ E	-----do-----	G. W. Crowell	1909	1,240	$6\frac{1}{4}$	------	+	11-30-29	Flows	N	------	------	------	Temp 95°F.
30	$16\frac{1}{4}$ E	C. W. Barker	W. E. Stalter	1912	1,226	8	1,226	------	------	T, E, 20	I	62	70	200	
31	$17\frac{1}{4}$ E	P. J. Lewis	-----do-----	1911	1,408	8	1,408	------	------	T, E, 25	I	8	------	------	Casing: 868 ft of 8-in.; 260 ft of $7\frac{1}{4}$-in.; 300 ft of $6\frac{1}{4}$-in. perforated.

32	17 E-----	-----do--------	-----do-------	------	1,428	8	1,428	a/22.8 62.4	12- 3-29 9-14-48	T, E, 25	I	-------	455	455	Casing: 860 ft of 8-in.; 400 ft of $7\frac{1}{4}$-in.; 158 ft of $6\frac{1}{4}$-in. perforated.
33	$17\frac{3}{4}$ E----	-----do--------	C. W. Wheeler	1909	1,523	6	1,297	a/16.0 46.2	8-12-32 9-14-48	C, W	S	-------	-------	-------	Casing: 806 ft of 6-in.; 256 ft of 5-in.; 450 ft of 5-in. perforated. Log.
35	$16\frac{3}{4}$ E----	V. I. Powers --	--------------	------	1,447	10	1,447	--------	---------	T, G, 25	I	-------	18	100	Oats.
36	$17\frac{1}{4}$ E----	Frito Co-------	--------------	------	-------	6	-------	8.7	1-16-29	T, E, 25	I	-------	-------	-------	
*37	$17\frac{1}{2}$ E----	-----do--------	--------------	------	1,500+	6	-------	--------	---------	T, G, 25	D, S, I	20	0	300	No irrigation during 1937-38 season.
38	$18\frac{1}{4}$ E----	G. Lubbock ----	C. W. Wheeler	1914	1,720	10	-------	--------	---------	T, G, 20	D, S, I	90	0	20	No irrigation during 1937-38 season. Temp 96°F.
39	$18\frac{3}{4}$ E----	V. Murrell-----	W. M. Doods--	1912	1,529	8	-------	23.1	1-16-30	T, G, 20	D, S, I	50	37	92	Casing: 1,026 ft of 8-in.; 83 ft of 6 5/8-in.; 420 ft of 6 5/8-in. perforated.
40	$19\frac{3}{4}$ E----	Vernon Standifer	--------------	------	-------	8	-------	--------	---------	T, G, 25	D, S	25	$60\frac{3}{4}$	0	
41	22 E-----	Jim Standifer---	--------------	------	-------	36	-------	35.3	12- 3-29	--------	N	-------	-------	-------	
*42	$21\frac{1}{2}$ E----	Wallace Rogers-	--------------	------	120	6	-------	--------	---------	C, W	S	-------	-------	-------	Reported water highly mineralized. Temp 80°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
N9-43	21¼ E----	Wallace Rogers-	--------------	------	1,760	8	1,760	27.0	1- 3-30	T, G, 20	N	-------	59	0	
44	19¾ E----	Mortgage Land & Investment Co.	--------------	------	100	5	-------	--------	---------	--------	N	-------	-------	-------	
*45	17½ NE --	Federal Land Bank.	--------------	------	-------	6	-------	--------	---------	--------	N	-------	57	0	
O7-1	26¾ NE --	G. W. Hatch ---	Trinity Drilling Co.	1928	2,200	12	-------	172 129.8	3-15-28 1-16-48	--------	N	0	0	0	
2	26¼ NE --	-----do--------	Bob Roberts---	1929	1,800	12	-------	--------	---------	--------	N	-------	-------	-------	
3	26½ NE --	-----do--------	-----do-------	1929	1,800	12	-------	a/96.1 118.0	11-18-29 9-14-48	C, W	D, S	-------	-------	-------	
4	27½ NE --	-----do--------	-----do-------	1929	1,400	12	-------	--------	---------	--------	N	-------	-------	-------	
5	22¾ NE --	F. V. Standifer-	Bob Hall ------	------	110	5	-------	61.0	10-22-29	C, W	D, S	-------	-------	-------	
*6	24 E-----	Jim Standifer---	-----do-------	------	140	5	-------	29.5	---do----	C, W	S	-------	-------	-------	
7	24¾ E----	-----do--------	-----do-------	------	160	5	-------	58.5	---do----	C, W	S	-------	-------	-------	

8	22 E	W. Rogers	Floyd Trimm	1910	1,800	10	----	41.0	1- 4-30	C, W	D, S	----	----	----	Temp 99°F.
9	25 E	D. Vesper	Jack Ward	1909	1,800	$6\frac{1}{2}$	----	----	----	C, W	D, S	----	----	----	
R3-1	$10\frac{1}{4}$ SW	John Bonham	----	----	----	----	----	----	----	C, W	D, S	----	----	----	
2	$12\frac{1}{4}$ SW	Hal A. Hamilton	----	----	----	6	----	----	----	C, W	S	----	----	----	
3	13 SW	do	----	----	----	6	----	----	----	C, W	S	----	----	----	
4	$11\frac{1}{2}$ SW	do	----	----	----	6	----	----	----	C, W	S	----	----	----	
5	$11\frac{1}{2}$ SW	do	----	----	----	6	----	----	----	C, W	D, S	----	----	----	
*6	$12\frac{1}{2}$ SW	W. C. Ammann	Owens	1930	475	6	----	----	----	C, W	D, S	----	----	----	Reported sands at 210-220 ft and 230-240 ft. Temp 81°F.
7	$13\frac{1}{4}$ SW	----	Howard	----	600	6	----	----	----	----	N	----	----	----	
8	$16\frac{1}{4}$ SW	Hal A. Hamilton	----	----	----	6	----	----	----	C, W	S	----	----	----	
*9	15 SW	do	----	----	50	6	----	42.6	2-10-30	C, W	S	----	----	----	
10	15 SW	do	Owens	1929	----	10	----	105.3	do	C, W	S	----	----	----	
S1-1	$5\frac{3}{4}$ SW	S. E. McKnight	----	1915	250	10	----	101.6	1- 9-30	C, G, $1\frac{1}{2}$	D	----	----	----	
2	$3\frac{3}{4}$ SW	do	----	1930	253	10	15	67.0	5-13-30	C, W	S	----	----	----	
3	$2\frac{1}{2}$ SW	A. Hausen	Charley Lindenborn.	1928	320	10	----	----	----	T, E, 15	D, S, I	57	22	33	
4	$2\frac{3}{4}$ SW	Mrs. Charles Bradshaw.	Frank Kellogg	1927	462	10	----	----	----	T, G, 65	D, S, I	----	27	----	
5	$2\frac{1}{4}$ SW	Etta Finhaute	Elmo Owens	1930	250	12	12	----	----	C, G, 6	D	0	$2\frac{1}{2}$	0	
6	$2\frac{1}{4}$ SW	Cruz Pena	S. M. Owens	1916	235	10	100	----	----	C, G, 6	D	6	5	0	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S1-7	$2\frac{1}{4}$ SW	E. B. Cartwright.	Charley Lindenborn.	1928	325	12	0	--------	--------	C, E, 5	D, S, I	9	6	7	
8	$2\frac{3}{4}$ SW	Mrs. Charles Bradshaw.	-----do-----	1927	312	10	--------	--------	--------	C, W	S	14	0	0	Reported no irrigation for several years prior to 1937-38.
9	3 SW	Mrs. F. K. Davis.	Elmo Owens	------	210	10	20	--------	--------	T, G, 60	D, S, I	0	$6\frac{1}{2}$	-------	
10	3 SW	C. Greseclose	W. D. Morrison	1929	250	10	30	--------	--------	T, G, 50	D, S, I	10	$11\frac{1}{2}$	30	
11	$2\frac{3}{4}$ SW	Dr. W. L. Northcut.	Charley Lindenborn.	1928	150	15	6	45.2	1- 7-30	--------	N	-------	-------	-------	
14	$5\frac{1}{2}$ SW	J. C. Johnson	--------------	1930	240	10	20	56.4	3- 4-30	C, W	S	0	0	0	
15	$5\frac{1}{2}$ SW	-----do-----	--------------	1930	270	10	20	a/52.0 57.6	4- 1-30 7-21-47	C, W	S	0	0	0	Temp 79°F.
16	$4\frac{1}{2}$ SW	C. W. Gilfillan & Son.	--------------	1929	295	10	20	a/54.9 65.1	3- 1-30 9-14-48	T, E, 10	D, S, I	10	45	45	
17	$4\frac{1}{4}$ SW	J. C. Johnson	Frank Kellogg	------	200	10	-------	39.0	11-14-29	C, W	D, S	-------	-------	-------	
*18	$4\frac{1}{4}$ SW	-----do-----	--------------	1930	320	10	30	a/99.0 114.3	3-18-30 12-23-48	--------	N	0	0	0	Temp $79\frac{1}{2}$°F. Log.
19	$3\frac{3}{4}$ S	Erskine Rhodes	Frank Kellogg	1925	360	10	90	88.0	3- 7-30	C, G, 10	D, S, I	15	12	-------	

20	3¼ S----	G. E. Light----	--------	------	------	6	------	94.0	--------	--------	N	------	------	------	
21	3 SE----	W. T. Powell --	Frank Kellogg -	------	410	------	------	--------	--------	T, G, 25	D, S, I	12	25	25	Reported drilled through three strata of sand.
24	5½ SW ---	O. P. Leonard -	--------	1930	------	10	------	51	2-20-30	T, G, 65	I	------	------	25	
25	6 SW ----	Johnson Ranch--	--------	------	------	10	------	56.0	11-12-30	C, W	D, S	------	------	------	
26	5½ S----	Judge S. G. Taylor.	A. E. Eardley-	1902	350	6¼	100	50.4	3- 8-30	C, W	D, S	------	------	------	
29	8½ SW ---	C. T. Shook Estate.	--------	------	------	5	------	--------	--------	C, W	S	------	------	------	
30	11¾ SW --	H. A. Fitzsimmons.	--------	------	280	8	------	197.2	11-12-30	C, W	S	------	------	------	
31	9¼ SW ---	Joe Gardner----	A. E. Eardley-	1903	640	8	100	20	1913	C, W	D, S	------	------	------	
*32	6 SW ----	H. C. Umburn--	--------	1932	------	8	------	--------	--------	T, E, 15	D, S, I	------	72	34	
33	4½ SW ---	P. E. Burlison--	--------	------	------	8	------	--------	--------	T	I	------	8	8	
34	5¼ SW ---	A. D. Groseclose.	--------	1930	380	10	------	--------	--------	T, G, 20	I	------	10	60	
35	5¼ SW ---	R. C. Salisbury.	G. A. Petty ---	1932	323	10	29	--------	--------	--------	N	------	------	------	
36	4¾ SW ---	Jeff Fowler ----	-----do------	1932	326	10	39	--------	--------	--------	N	------	------	------	
*37	6 SW ----	O. P. Leonard--	--------	1930	------	8	------	--------	--------	--------	N	------	------	------	
38	6½ SW ---	G. J. Kroscheusky.	Elmo Owens --	1930	------	8	------	--------	--------	T, G, 20	D, S, I	------	37¾	40	
39	6½ SW ---	N. Erickson----	-----do------	1932	------	8	------	--------	--------	T, G, 30	D, S, I	------	18	32	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S1-40	7½ SW	H. Brauer	Elmo Owens	1936	-------	-------	-------	--------	---------	T, G, 30	D, S, I	-------	24	40	
41	5¾ SW	W. V. Ausmos	O. F. Webb	1947	275	10	40	--------	---------	T, E, 15	I	-------	-------	20	
42	5½ SW	do	do	1946	330	10	60	--------	---------	T, E, 20	I	-------	-------	40	
43	5¾ SW	Enid L. Vance	do	1944	360	10	40	90	1944	T, E, 15	I	-------	-------	40	
44	4¾ SW	W. A. Morris	do	1947	341	10	60	--------	---------	T, Ng, 40	I	-------	-------	30	
45	4¾ S	Walker Burns	W. D. Morrison	1922	355	10	45	--------	---------	T, G, 72	I	-------	-------	80	
46	4½ S	do	Elmo Owens	1944	355	10	40	--------	---------	T, G, 62	I	-------	-------	150	Probably some sand of Indio formation.
47	4¼ S	do	W. D. Morrison	1922	404	10	40	--------	---------	T, G, 72	I	-------	-------	150	Do.
48	4¾ S	do	do	1922	355	10	40	--------	---------	T, G, 72	I	-------	-------	100	
49	4¾ S	do	do	1922	355	10	40	--------	---------	T, G, 50	I	-------	-------	-------	Used very little, 1947-48.
50	4½ SE	H. Rouw	I. C. Cribbs	1944	670	10	670	--------	---------	T, E, 40	I	-------	-------	-------	See S2-135. Log.

51	2½ SE----	Eardley Estate -	O. F. Webb---	1946	545	10	270	--------	---------	T, G, 70	I	-------	-------	110	
52	5 S------	Walker Burns --	R. B. Owens--	1948	355	10	60	--------	---------	T, G, 41	I	-------	-------	40	
53	12 SW ---	Carl Johnson---	Owens--------	1930	253	6	-------	--------	---------	C, W	S	-------	-------	-------	
54	2¼ SW ---	Mogford & Kimble.	Humble Oil & Refining Co.	1946	2,994	-------	-------	--------	---------	--------	------	-------	-------	-------	Oil test.
*S2-1	3½ SE----	F. Guerrera ---	--------------	1925	510	8	300	--------	---------	C, G, 10	D, S, I	24	15	30	
2	3¼ SE----	Stennitt & Oelkers.	Burkett-------	1926	600	-------	-------	--------	---------	T, E, 30	D, S, I	325	49	-------	
*3	3½ SE----	-----do--------	-----do-------	1926	600	-------	-------	--------	---------	T, E, 25	D, S, I	-------	25	306	Temp 83°F.
*4	3¾ SE----	B. Bounds -----	Cribbs & Davidson.	1927	694	10	-------	100	2-20-27	T, E, 15	I	100	202¼	95	Temp 83½°F. Log.
*5	3¾ SE----	-----do--------	--------------	------	634	10	-------	--------	---------	C, W	D, S	-------	-------	-------	
6	3¾ SE----	W. E. Wroe----	A. E. Eardley-	1903	638	6¼	100	--------	---------	--------	N	-------	-------	-------	Reported flowing 100 gpm in 1903; none in 1913. Bridged at 33 ft in 1938.
7	4 SE-----	N. Borden -----	L. Simpson ---	1921	720	10	500	--------	---------	T, E, 25	D	65	113½	0	Now used for house well. Temp 85°F.
*8	4¼ SE----	Eardley Estate -	W. W. Miller	1918	670	10	320±	--------	---------	T, G, 25	D, S, I	266	43	43	Formerly used in conjunction with S2-9, S2-10, and S2-11. Temp 83°F.
9	4¼ SE----	-----do--------	A. B. Webb---	------	670	8	320	--------	---------	N	------	0	0		
10	4½ SE----	-----do--------	W. W. Miller -	1926	670	10	265	--------	---------	N	------	0	0		

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S2-11	$4\frac{1}{2}$ SE	Eardley Estate	W. W. Miller	1903	640	10	100	--------	--------	T, G, 20	I	0	45		
12	5 SE	Richardson Estate.	--------	1900	601	12	--------	--------	--------	--------	N	--------	262	0	Temp 84°F. Salty water.
13	5 SE	-----do-----	--------	1915	601	12	--------	--------	--------	--------	N	10	0	0	Temp 83°F.
15	7 E	Francis Giller	--------	1913	700	8	300±	--------	--------	T, G, 15	I	45	105	75	
16	$7\frac{1}{2}$ E	W. S. Minus	Luke Simpson	1910	723	$8\frac{1}{2}$	153	--------	--------	--------	N	--------	--------	--------	
17	7 E	Francis Giller	-----do-----	1910	700	6	350	--------	--------	--------	N	50	0	0	
*18	$4\frac{1}{4}$ SE	J. Kinney	Elmo Owens	1930	670	10	518	--------	--------	T, E, 25	D, S, I	--------	25	40	Temp 83°F.
19	$4\frac{1}{4}$ SE	Alamo Lumber Co.	A. B. Webb	1903	600	5 5/8	215	--------	--------	--------	N	--------	--------	--------	
20	4 SE	-----do-----	-----do-----	1903	418	$6\frac{1}{4}$	200	--------	--------	--------	N	--------	--------	--------	
21	$4\frac{1}{2}$ SE	Joe White	A. E. Eardley	1904	500	8	80	--------	--------	C, W	D, S	8	--------	--------	Reported no irrigation for several years prior to 1937-38.
22	$4\frac{1}{2}$ SE	J. A. Hibdon	--------	1915	740	12	740	--------	--------	C, G, 25	D, S	100	118	0	Casing: 200 ft of 12-in.; 400 ft of 8-in.; 140 ft of 5-in. perforated.

23	5 SE	A. J. Votaw	------	1916	600	6	------	------	------	T, G, 20	D, S, I	20	0	40	Temp 83° F.
*24	6 SE	G. S. Gay	W. W. Miller	1928	667	12	290	a/136.0 163.7	11- 1-28 9-14-48	T, E, 25	I	92	105½	------	Temp 83½° F.
*25	6½ SE	Oscar Pollard	Luke Simpson	1927	677	10	420	------	------	T, G, 20	D, S	40	60	0	Not used in 1947-48.
27	9¾ SE	Mrs. J. A. McDonald.	W. W. Miller	------	1,000	8	------	a/75.2 74.2	11-26-29 9-14-48	T, G, 60	D, S	------	------	------	Completed before 1910.
28	10½ SE	F. T. Fuller	Luke Simpson	1924	820	6	820	------	------	C, W	D, S	------	------	------	
29	5 SE	H. Rouw	Petty	1928	680	10	------	87.8	10-22-29	T, E	I	56	0	0	Original depth, 380 ft. Deepened to 680 ft. Reported, in 1938, no irrigation since 1933.
30	6½ SE	J. N. Lockley	Frank Kellogg	1925	650	10	250	------	------	T, G, 25	D, S, I	55	93½	70	
31	6½ SE	William Werner	------	1927	625	6	375	------	------	T, G, 20	D, S, I	30	24	24	
32	6½ SE	H. F. Dillinger	L. Simpson	1927	693	10	377	------	------	T, G, 25	D, S, I	83	57	57	
33	7 SE	Kimble Land & Cattle Co.	------	------	------	6	400±	------	------	------	N	------	------	------	
34	7 SE	H. W. Goodpaster.	A. E. Eardley	------	1,000	------	------	------	------	T, G, 25	D, S, I	70	44	30	Completed before 1910.
35	6¾ SE	Farrow	L. Simpson	------	600	------	------	------	------	T, G, 20	I	70	0	60	Reported no irrigation for several years prior to 1937-38.
36	6½ SE	Wiatriech	do	------	675	6	450	------	------	------	N	69	30	0	Completed before 1915. Abandoned.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season-- 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S2-37	$6\frac{1}{2}$ SE----	A. Silvas ------	--------------	------	-------	$6\frac{1}{4}$	------	--------	---------	T, E, 20	D, S, I	-------	$23\frac{3}{4}$	24	
38	$6\frac{1}{2}$ SE----	V. Martinez----	--------------	------	-------	$6\frac{1}{4}$	------	--------	---------	T, E, 20	D, S, I	-------	9	20	
39	$6\frac{1}{2}$ SE----	P. E. Johnson--	--------------	------	500	$5\frac{1}{4}$	500	--------	---------	C, W	D, S	40	4	0	
40	$6\frac{1}{2}$ SE----	-----do--------	J. C. Moore --	1911	800	$6\frac{1}{4}$	------	--------	---------	C, W	D, S	-------	-------	-------	
42	$6\frac{1}{2}$ SE----	J. Votaw-------	--------------	1928	-------	10	------	56.7	10-15-29	--------	N	40	0	-------	Reported no irrigation for several years prior to 1937-38.
43	$7\frac{3}{4}$ SE----	-----do--------	--------------	1929	700	10	300±	--------	---------	T, Ng, 60	S, I	-------	-------	100	
44	$7\frac{3}{4}$ SE----	J. C. Minus----	W. D. Morrison	1929	600	10	300	--------	---------	C, W	D, S	20	0	0	Temp $81\frac{1}{2}$°F.
45	8 SE-----	C. M. Oliver---	--------------	1912	650	6	------	--------	---------	C, W	S	-------	-------	-------	Reported flowed until 1917.
46	$7\frac{1}{2}$ SE----	W. E. Wroe----	W. W. Miller -	1922	-------	12	350	a/180	5- -29	--------	N	$259\frac{1}{2}$	$18\frac{1}{4}$	0	
47	$7\frac{1}{4}$ SE----	-----do--------	C. Davenport--	1922	803	12	350	--------	---------	--------	N	-------	-------	-------	Well shot with nitroglycerine, reported capacity increased from 200 to 900 gpm.
48	$7\frac{1}{2}$ SE----	O. Granberry --	L. Simpson ---	1926	601	10	350	--------	---------	T, G, 25	I	64	$5\frac{1}{2}$	10	

49	7¼ SE----	C. H. Risley---	N. Simpson ---	1909	666	6	400±	--------	---------	C, W	D, S	8	24½	0	
50	7¼ SE----	-----do--------	J. C. Moore --	1909	860	6	460	--------	---------	--------	N	-------	-------	-------	
51	7½ SE----	Mrs. R. D. Campbell.	N. Simpson ---	1909	643	6	373	--------	---------	C, W	D, S	21	0	0	Reported no irrigation for several years prior to 1937-38.
52	7½ SE----	-----do--------	-----do-------	1909	650	6	373	--------	---------	--------	N	-------	-------	-------	
53	7½ SE----	W. C. Smith ---	W. W. Miller -	1917	680	6	400	--------	---------	T, G, 15	D, S	33	11	0	
54	7½ SE----	D. O. Leftwich--	Cribbs & Davidson.	1911	625	12½	320	--------	---------	T, E, 30	I	78	37	37	
56	7½ SE----	P. D. Smith----	C. Davenport--	1922	499	10	350	--------	---------	T, G, 25	D, S, I	22	0	50	Reported, in 1938, no irrigation since 1932.
57	7½ SE----	W. A. Williams -	--------------	1911	691	6¼	320	--------	---------	C, W	D, S	-------	-------	-------	
58	7½ SE----	George Courtney	N. Simpson ---	1910	749	6	310	--------	---------	T, G, 25	D, S, I	63	63	100	Reported flowing 125 gpm when drilled.
59	8 SE-----	O. Granberry --	--------------	1923	537	10	350	--------	---------	T, G, 25	I	100	30	20	
60	8½ SE----	C. C. Caperton -	N. Simpson ---	------	703	8	-------	--------	---------	--------	N	21	29¼	0	Completed before 1910.
61	In Asherton	W. C. Campbell-	L. Simpson ---	------	-------	6	-------	--------	---------	--------	N	60	0	0	Reported, in 1938, no irrigation since 1935.
*62	In Asherton	Central Power & Light Co.	Layne-Texas Co.	1926	640	12	352	52.5	6-19-27	T, E, 25	P	-------	-------	-------	Supplies city of Asherton. Temp 82°F.
63	8¼ SE----	Alamo Lumber Co.	W. W. Miller -	1907	600	6	-------	--------	---------	--------	N	-------	-------	-------	Reported flowing 300 gpm in 1908.
64	8½ SE----	-----do--------	-----do-------	1914	740	12½	300	93.3	10-15-29	--------	N	125	121½	0	Temp 84°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S2-65	8½ SE	Polo Vasquez	George Crowell	1910	774	12	774	--	--	--	N	110	0	--	Casing: 320 ft of 12-in.; 454 ft of 9 5/8-in. perforated.
66	8¾ SE	do	--	--	774	6	300	--	--	T, E, 25	I	0	0	80	Completed before 1905
67	9 SE	do	--	1921	740	6	360	--	--	--	N	--	17	0	
68	9 SE	J. G. Garcia	--	1910	600	6	--	--	--	T, G, 25	I	--	2½	20	
69	8¾ SE	E. T. Grisham	--	1917	586	6	350	--	--	--	N	--	16	0	
70	8¼ SE	Mrs. Maggie Tollet.	--	--	--	6	--	67.8	12-21-38	--	N	--	2	0	
71	8½ SE	E. T. Grisham	--	1915	716	6	300	--	--	--	N	--	--	--	
72	8½ SE	do	George Crowell	1915	680	8	300	--	--	T, G, 42	I	--	--	60	
73	9 SE	Mrs. W. R. Harris.	Fred Poole	1917	730	6	--	--	--	--	N	--	2	0	
74	8½ SE	C. M. Mathis	S. M. Owens	1917	736	8	--	--	--	--	N	8	0	0	Reported, in 1938, no irrigation since 1933.
75	8½ SE	Alamo Lumber Co.	--	--	--	6	--	--	--	C, W	S	--	--	--	

76	9 SE-----	O. K. Braune --	G. A. Petty ---	1928	690	10	400	--------	---------	C, G, 10	D, S	18	$19\frac{1}{2}$	0	Casing: 240 ft of 10-in.; 160 ft of 8-in. Temp 86°F.
77	9 SE-----	Gordon Smith---	--------------	------	-------	10	-------	--------	---------	--------	N	20	0	0	Reported, in 1938, no irrigation since 1942.
*78	$10\frac{3}{4}$ SE---	McClendon-----	N. Simpson ---	1911	1,000	12	400	a/190.8 212.0	12- 7-29 9-15-48	C, G, 6	D, S	60	0	0	Reported, in 1938, no irrigation since 1933. Temp 88°F.
79	$11\frac{1}{4}$ SE---	Roger Brown---	L. Simpson ---	1910	960	12	250	--------	---------	C, G, 20	D	20	0	0	Reported, in 1938, no irrigation since spring of 1937.
80	11 SE----	P. G. Scruggs--	Cribbs & Davidson.	1926	933	10	312	--------	---------	T, E, 25	D, S, I	100	60	60	
81	$11\frac{1}{2}$ SE---	C. C. Mull-----	--------------	------	-------	-------	-------	--------	---------	T, G, 20	D, S, I	55	12	80	
82	$11\frac{1}{4}$ SE---	Alamo Lumber Co.	Fred Poole----	------	-------	-------	-------	144.9	12-20-38	T, G, $37\frac{1}{2}$	D, S	113	82	0	Temp 89°F.
*83	$11\frac{1}{2}$ SE---	G. Grisham ----	Floyd Trimm--	1926	1,100	10	830	--------	---------	T, Ng, 60	I	85	0	107	Casing: 165 ft of 10-in.; 400 ft of 8-in.; 265 ft of 6 5/8-in. perforated. Temp 88°F.
84	$11\frac{1}{4}$ SE---	C. M. Decker --	W. W. Miller -	1917	822	$8\frac{1}{4}$	822	--------	---------	--------	N	5	0	0	Casing: 400 ft of $8\frac{1}{4}$-in.; 422 ft of $7\frac{1}{4}$-in. perforated. Reported, in 1938, no irrigation since 1932.
85	$11\frac{1}{2}$ SE---	A. E. Powell---	Cribbs & Davidson.	1928	985	10	742	--------	---------	--------	N	75	0	0	Casing: 302 ft of 10-in.; 440 ft of 8-in. Reported, in 1938, no irrigation since 1932. Temp 89°F.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level		Method of lift	Use of water	Land irrigated (acres) for season--			Remarks
								Below land surface (feet)	Date of measurement			1929-30	1937-38	1947-48	
	Carrizo Springs:														
*S2-86	12 SE----	D. J. Hill------	Fred Poole----	1928	1,021	10	727	--------	---------	T, G, 40	I	77	0	80	Reported, in 1938, no irrigation since 1936. Temp 91°F.
87	$11\frac{3}{4}$ SE---	Miller & Holsenback.	--------------	1928	996	10	712	--------	---------	C, W	S	80	0	0	Casing: 344 ft of 10-in.; 368 ft of $8\frac{1}{4}$-in. Reported, in 1938, no irrigation since 1933. Temp 88°F.
88	$12\frac{1}{2}$ SE---	L. Hester------	Fred Poole----	1928	1,020	10	-------	--------	---------	T, E, 20	D, S	145	70	0	Temp 80°F.
89	$12\frac{1}{2}$ SE---	Joe Moss ------	Cribbs & Davidson.	1928	1,016	10	795	--------	---------	T, D, 60	D, S, I	90	73	30	
91	$12\frac{1}{2}$ SE---	L. Zanbrecher--	--------------	------	1,385	10	-------	153.5	12-13-29	--------	N	-------	-------	-------	
92	$13\frac{1}{4}$ SE---	H. A. Dillon ---	Fred Poole----	------	1,018	10	1,018	--------	---------	T, G	I	100	0	20	Casing: 400 ft of 10-in.; 320 ft of $8\frac{1}{4}$-in.; 321 ft of 5 3/16-in. perforated. Reported, in 1938, no irrigation since 1933.
93	$13\frac{1}{2}$ SE---	-----do--------	Floyd Trimm--	1926	1,085	10	-------	--------	---------	--------	N	30	0	0	Reported, in 1938, no irrigation since 1930.
94	$13\frac{1}{2}$ SE---	Catarina Farms	--------------	------	1,424	10	-------	a/190.7 193.0	12-10-29 7-10-46	C, W	S	-------	-------	-------	Log.

95	14 SE----	William Raver--	Fred Poole----	1928	1,141	8	872	--------	--------	C, W	D, S	31	0	0	Casing: 8-in. cemented at 872 ft. Reported, in 1938, no irrigation since 1931.
*96	$13\frac{3}{4}$ SE---	L. Hester------	--------------	------	1,081	-------	-------	--------	--------	T, E, 25	D, S, I	$74\frac{1}{2}$	120	135	Temp 90°F.
97	$14\frac{1}{4}$ SE---	J. H. Long-----	--------------	1928	1,099	8	809	--------	--------	--------	N	70	0	-------	Reported, in 1938, no irrigation since 1935.
98	$14\frac{3}{4}$ SE---	Catarina Farms	Fred Poole----	1928	1,195	10	871	--------	--------	C, W	D, S	50	0	-------	Reported, in 1938, no irrigation since 1931.
99	15 SE----	C. M. Kilgore--	Floyd Trimm--	1927	1,143	10	790	--------	--------	C, W	S	43	0	-------	Reported, in 1938, no irrigation since 1935. Temp $91\frac{1}{2}$°F.
100	$15\frac{3}{4}$ SE---	R. A. Smith----	--------------	------	-------	10	-------	138.2	11-20-29	--------	N	45	0	-------	Reported, in 1938, no irrigation since 1934. Temp 91°F.
102	$15\frac{1}{2}$ SE---	J. P. Giles ----	Floyd Trimm--	1926	1,185	10	-------	a/109.8 115.5	10-25-29 12-23-48	--------	N	130	0	0	Not used during 1937-38 season.
*103	$4\frac{1}{4}$ SE----	M. W. Fardwell	--------------	1932	512	$8\frac{1}{4}$	90	a/80	1932	T, E, 20	D, S, I	-------	34	30	
104	$4\frac{1}{2}$ SE----	M. Ramos -----	--------------	1928	350	$8\frac{1}{4}$	200	--------	--------	C, G, 10	D, S, I	-------	16	20	
105	5 SE-----	C. A. Johnson--	--------------	1931	500	$8\frac{1}{4}$	-------	--------	--------	C, G, 6	D, S	-------	10	0	
106	5 SE-----	Mrs. Felix Reynolds.	--------------	1931	503	$8\frac{1}{4}$	-------	--------	--------	C, W	D, S	-------	6	0	
107	4 SE-----	A. Jung--------	--------------	1931	728	10	563	--------	--------	T, E, 30	I	-------	69	70	Casing: 305 ft of 10-in.; 123 ft of 8-in. set at 563 ft.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S2-108	8¼ SE----	L. F. Kleeman -	-------	------	------	------	------	------	------	T, G, 60	D, S	------	15	0	
109	8½ SE----	Elem ----------	-------	------	650	8	650	------	------	T, G, 25	D, S, I	------	44	10	Casing: 400 ft of 8-in.; 250 ft of 5 3/16-in. perforated. Temp 81°F.
*110	7¾ SE----	E. F. Simpson -	-------	------	------	6	------	------	------	T, G, 20	D, S, I	------	10	10	
*111	14½ SE---	J. H. Long-----	Floyd Trimm--	1931	------	------	------	------	------	T, G, 25	D, S, I	------	85	24	Orchard irrigation.
112	5 SE-----	Joseph Herman -	-------	------	------	------	------	------	------	------	N	------	19	0	
113	4¾ SE----	H. Rouw-------	I. C. Cribbs --	1944	900	10	652	110	7-14-44	T, E, 40	I	------	------	------	Used in conjunction with S1-50, 51, 52, 53, and S2-29, 114, 115, and 135. Log.
114	5¼ SE----	-----do-------	-----do------	1944	600	10	660	140	11- 9-44	T, E, 40	I	------	------	------	
115	5 SE-----	-----do-------	-----do------	1945	506	10	506	100	3- 7-45	T, E, 40	I	------	------	------	Log.
*116	3 SE-----	J. T. Stennitt --	-----do------	1943	572	10	572	135	7- -48	T, E	I	------	------	181	Used in conjunction with N8-114.
117	4 SE-----	N. Borden -----	-----do------	1940	------	------	------	------	------	T, E	I	------	------	100	

118	$9\frac{1}{4}$ SE----	Elem----------	--------------	1945	-------	10	-------	--------	---------	T, G, 60	I	-------	-------	120	
119	$8\frac{3}{4}$ SE----	A. Heam-------	--------------	------	-------	------	-------	--------	---------	T, G	I	-------	-------	11	
120	$8\frac{1}{2}$ SE----	Gene Grisham --	O. F. Webb---	1943	706	8	706	70	1943	T, E, 30	I	-------	-------	60	
121	$4\frac{3}{4}$ SE----	W. E. Wroe----	--------------	------	650	8	350	--------	---------	T	D, S, I	-------	-------	25	
122	$5\frac{1}{4}$ SE----	Eardley Estate -	Miller Bros---	1910	663	6	320	--------	---------	T, G, 16	D, S	-------	-------	0	Reported flowing 400 gpm when drilled. Temp 82° F.
123	$6\frac{3}{4}$ SE----	-----do-------	--------------	1916	625±	10	400	--------	---------	T, G	D, S	-------	-------	0	Reported no irrigation for several years prior to 1937-38.
124	$6\frac{3}{4}$ SE----	-----do-------	--------------	1916	675	8	400	--------	---------	--------	N	-------	-------	-------	Do.
125	$6\frac{1}{2}$ SE----	-----do-------	--------------	1920	670	10	-------	--------	---------	--------	N	55	0	-------	Do.
126	$6\frac{3}{4}$ SE----	-----do-------	--------------	------	-------	6	-------	--------	---------	--------	N	-------	-------	-------	Do.
127	7 SE-----	-----do-------	W. W. Miller -	1916	675	10	373	--------	---------	--------	N	-------	-------	-------	Do.
128	$5\frac{1}{2}$ SE----	William Volbrect	A. E. Eardley-	1903	720	10	50	--------	---------	C, W	S	59	0	-------	Reported flowing 1,200 gpm when drilled. Reported no irrigation for several years prior to 1937-38. Log.
129	5 SE-----	W. E. Wroe----	--------------	1921	660	15	350	--------	---------	T	I	-------	-------	17	
130	$4\frac{3}{4}$ SE----	-----do--------	W. W. Miller -	1926	660	12	320	--------	---------	T	I	-------	-------	70	Used in conjunction with N8-85, N8-88, and S2-121.
131	3 SE-----	J. Galan-------	O. F. Webb---	1945	610	10	610	--------	---------	T, G	I	-------	-------	-------	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S2-132	2¾ SE----	J. C. Oelkers --	I. C. Cribbs --	1941	565	10	565	--------	---------	T, E	I	-------	-------	179	Used in conjunction with S2-116. Log.
*133	3¼ SE----	J. W. Walthall -	Frank Kellogg -	------	420	8	-------	--------	---------	T, E, 30	D, S, I	29	0	-------	Reported no irrigation for several years prior to 1937-38.
134	3½ SE----	-----do--------	-----do-------	1924	452	10	150	--------	---------	T, E, 30	D, S, I	30	32	126	Temp 80°F.
*135	4½ SE----	H. Rouw -------	S. M. Owens --	------	-------	-------	-------	--------	---------	T, G, 20	D, S, I	0	90	700	Supplemented by 8 other wells on farm. S1-50, 51, 52, 53, and S2-29, 113, 114, and 115.
136	4½ SE----	-----do--------	I. C. Cribbs --	1944	665	10	665	130	7-31-44	T, E, 40	I	-------	-------	-------	
137	4¾ SE----	-----do--------	-----do-------	1944	675	12	675	--------	---------	T, E, 40	I	-------	-------	-------	Log.
138	5 SE-----	Judge S. G. Taylor.	--------------	------	-------	6	-------	50.7	3- 8-30	--------	N	-------	-------	-------	
139	4½ SE----	H. Rouw -------	I. C. Cribbs --	1942	624	10	439	118	5- 2-42	T, E, 40	I	-------	-------	-------	
140	5¼ SE----	Ethel Payne ----	The Texas Co -	1947	4,013	-------	-------	--------	---------	--------	------	-------	-------	-------	Oil test.

*S3-1	$20\frac{1}{4}$ E----	William O'Brien	A. H. Rife----	1910	1,800+	6	1,800	--------	1- 4-30	T, G, 20	D, S, I	0	48	20	Casing: 1,400 ft of 6-in.; 400 ft of $5\frac{3}{4}$-in. perforated. Flowing, Jan. 4, 1930. Reported temp 104°F when drilled.
2	21 E-----	C. J. Ducos----	Floyd Trimm--	------	1,668	8	-------	--------	1-31-30	T, G, 15	D, S, I	16	20	20	Flowing, Jan. 31, 1930.
3	21 E-----	Weaver & Gary-	-----do-------	1924	1,697	8	1,400	--------	1- 4-30	T, G, 20	D, S, I	0	53	60	Flowing, Jan. 4, 1930.
*4	21 E-----	Rasmussen and others.	W. M. Doods--	------	1,776	8	1,776	--------	---do----	T, G, 20	D, S, I	0	50	75	Casing: 1,400 ft of 8-in.; 376 ft of $7\frac{3}{4}$-in. perforated. Reported flowing 50 gpm Jan. 4, 1930. Temp 99°F Feb. 1, 1928.
5	13 SE----	R. E. Brooks --	--------------	------	-------	-------	-------	78	1- -28	T, G, 30	D, S, I	60	0	-------	Reported no irrigation for several years prior to 1937-38.
6	$13\frac{1}{2}$ SE---	C. Ward-------	--------------	1927	-------	-------	-------	78.3	3-21-27	T, Ng, 40	I	72	0	180	Reported no irrigation for several years prior to 1937-38.
7	$17\frac{1}{2}$ SE---	Emerson, O'Banion & Rick.	Floyd Trimm--	1929	1,400	8	1,098	--------	---------	--------	N	80	0	0	8-in. set and cemented at 1,098 ft. Reported, in 1938, no irrigation since 1935.
8	$17\frac{1}{2}$ SE---	Catarina Farms	-----do-------	------	1,263	12	-------	146.3	11-19-29	C, W	D, S	160	0	0	Reported, in 1938, no irrigation since 1932. Temp 93°F.
9	$17\frac{1}{2}$ SE---	H. Nolt--------	--------------	1928	1,283	10	970	--------	---------	--------	N	80	0	0	10-in. casing set and cemented at 970 ft. Reported, in 1938, no irrigation since 1935.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
*S3-10	$19\frac{3}{4}$ SE---	H. H. Coffield--	--------------	1928	1,419	8	-------	a/83.5 102.0	12-17-29 9-16-48	T, G, 40	I	47	0	44	Reported, in 1938, no irrigation since 1934. Temp 96°F.
11	21 SE----	-----do--------	Floyd Trimm--	1924	1,470	8	-------	15	1- -30	T, G, 40	I	28	0	120	Reported no irrigation for several years prior to 1937-38. Temp 94°F.
12	$16\frac{1}{4}$ SE---	Catarina Farms	--------------	------	-------	-------	-------	--------	---------	C, W	S	138	0	0	Reported, in 1938, no irrigation since 1933.
13	$17\frac{1}{4}$ SE---	C. N. Beasley--	Floyd Trimm--	1926	1,315	10	980	115	10- -29	T, E, 30	D, S, I	100	152	25	Casing: 150 ft of 10-in.; 830 ft of 8-in. Temp 95°F.
14	$17\frac{3}{4}$ SE---	Irwin & Mosley -	--------------	1928	1,226	10	951	--------	---------	--------	N	65	0	0	Casing: 10-in. set at 951 ft. Reported, in 1938, no irrigation since 1932.
15	$17\frac{3}{4}$ SE---	B. Ewell-------	--------------	------	-------	-------	-------	--------	---------	--------	N	50	0	0	Reported, in 1938, no irrigation since 1933.
16	17 SE----	Catarina Farms	--------------	------	-------	10	-------	a/137.8 152.5	8-27-36 9-16-48	--------	N	-------	-------	-------	
17	18 SE----	-----do--------	--------------	1928	1,339	10	1,021	--------	---------	C, W	D, S	20	35	0	Casing: 10-in. set and cemented at 1,021 ft.
18	$18\frac{1}{4}$ SE---	-----do--------	--------------	1928	1,355	-------	985	71.0	11-19-29	--------	N	120	0	0	Reported, in 1938, no irrigation since 1934.

19	$19\frac{1}{4}$ SE	McArdle	-------	1927	1,297	10	1,008	-------	-------	T, G, 65	I	-------	$33\frac{3}{4}$	30	Casing: 525 ft of 10-in.; 483 ft of 8-in. set with lead seal. Temp 93°F.
20	$17\frac{1}{2}$ SE	H. A. Dillon	Fred Poole	------	1,280	10	1,259	a/104	7-17-29	C, W	D, S	65	0	0	Casing: 315 ft of 10-in.; 629 ft of 8-in.; 315 ft of perforated. Reported, in 1938, no irrigation since 1931.
21	$22\frac{3}{4}$ SE	C. L. Howard	Floyd Trimm	------	1,574	10	-------	15.0	7- 5-30	T, G, 20	S	27	0	0	Reported, in 1938, no irrigation since 1935.
*22	In Catarina	Catarina Farms	-----do-----	------	1,140	$12\frac{1}{2}$	1,025	102.6	12-22-38	T, E, 50	P, I	-------	75	86	Casing: 307 ft of $12\frac{1}{2}$-in.; 718 ft of 10-in. Supplies town of Catarina. Temp 99°F.
23	$19\frac{3}{4}$ SE	Franklin Shank	-------	------	------	------	-------	-------	-------	C, W	D, S	140	0	0	Reported, in 1938, no irrigation since 1930.
24	$15\frac{3}{4}$ SE	J. P. Giles	Floyd Trimm	1926	1,188	10	-------	138.2	11-20-29	-------	N	75	7	0	
25	$13\frac{1}{4}$ SE	R. E. Brooks	-------	1928	------	10	-------	127.5	12-14-29	T, G, 30	D, S, I	120	85	120	Temp $89\frac{1}{2}$°F.
26	22 SE	J. T. Baber	Dodd	1912	1,700	8	-------	-------	1- 3-30	Cf, G 20	D, S, I	55	44	110	Flowing on Jan. 3, 1930. Log.
27	15 SE	H. A. Dillon	The Texas Co	1946	4,809	------	-------	-------	-------	-------	------	-------	-------	-------	Oil test.
S4-1	$14\frac{1}{4}$ SW	W. W. McRory	-------	1914	600	6	200	145±	1927	C, W	D, S	30	0	-------	Sand reported from 380 to 400 ft. Reported, in 1938, no irrigation since 1932.
2	$14\frac{1}{4}$ SW	McRory Estate	A. E. Eardley	1911	960	10	-------	174	2- 7-28	C, W	D, S	-------	-------	-------	Log.
3	$15\frac{1}{4}$ SW	Dentonio School Board.	L. Simpson	1925	515±	6	250	181.7	11-12-29	C, W	N	-------	-------	-------	Sand reported from 450 to 475 ft.

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
S5-1	$13\frac{1}{2}$ SW	Catarina Farms	------	------	------	4	------	------	------	C, W	S	------	------	------	
2	$13\frac{3}{4}$ SW	-----do-----	------	------	1,375	10	1,056	194.8	12-10-29	C, W	S	------	------	------	Casing: 394 ft of 10-in.; 662 ft of $8\frac{1}{4}$-in.
3	$16\frac{1}{2}$ SW	-----do-----	------	1928	1,422	10	1,044	122.2	---do---	------	N	------	------	------	
4	$16\frac{1}{2}$ S	-----do-----	------	------	------	6	------	115.1	12-12-29	C, W	S	------	------	------	
*5	$18\frac{1}{2}$ S	-----do-----	------	1928	1,374	12	1,083	73.2	12-10-29	C, W	D, S	------	------	------	Casing: 380 ft of 12-in.; 703 ft of 10-in.
6	$18\frac{1}{2}$ S	Dr. E. A. Gilson Estate.	------	1928	1,524	10	1,344	72.0	12-11-29	C, W	S	120	0	0	Reported, in 1938, no irrigation since 1935.
7	19 SE	E. C. Smith	------	1928	1,655	10	------	------	------	C, W	S	------	------	------	Yielded 312 gpm on test of Nov. 20, 1928.
8	$17\frac{1}{2}$ SE	Alex Durst	------	------	1,632	------	------	------	------	------	N	------	------	------	Casing pulled.
9	19 SE	Catarina Farms	------	1928	1,540	10	------	------	------	------	N	------	------	------	Do.
10	$19\frac{1}{4}$ SE	-----do-----	------	------	1,615	10	------	85.9	12-11-29	C, W	S	------	------	------	
S6-1	19 SE	Fred Reyher	J. Culberson	------	1,302	10	977	------	------	T, G, 44	D, S, I	20	115	7	Casing: 300 ft of 10-in.; 677 ft of 8-in.
2	20 SE	R. H. Sims	------	------	1,170	10	1,026	69.0	12-11-20	------	N	80	0	0	Casing: 305 ft of 10-in.; 721 ft of 8-in. Reported, in 1938, no irrigation since 1937.

3	In Catarina	H. R. Andrea	--------	1928	1,351	10	1,028	110.8	11- 5-29	T, E, 60	I	165	0	375	Reported, in 1938, no irrigation since 1935.
*4	21 SE	O. V. Ray	Fred Poole	--------	1,432	10	1,071	a/23.0 22.3	11- 1-48 9-15-48	--------	N	--------	--------	--------	Temp 94°F.
5	23 SE	C. E. Luker	Seward	1929	1,816	10	1,760	49.5	10-21-30	--------	N	--------	--------	--------	Casing: 1,170 ft of 10-in.; 590 ft of $8\frac{1}{4}$-in. perforated from 1,555 to 1,618 ft.
6	20 SE	J. S. Pearce	Floyd Trimm	1931	1,362	$8\frac{1}{4}$	1,014	--------	--------	T, G, 20	S, I	--------	70	70	Casing: 1,014 ft of $8\frac{1}{4}$-in. Surface water sand 70 to 97 ft. Other sands 1,014 to 1,358 ft with several lenses of shale.
*7	$21\frac{1}{4}$ SE	Catarina Farms	--------	1912	60-70	6	--------	--------	5-16-40	--------	S	--------	--------	--------	Sand. Flowing May 16, 1940.
*8	$23\frac{1}{2}$ SE	R. W. Briggs	McKinley	1946	1,800	10	1,800	80	1946	T, G, 125	D, S, I	--------	--------	5	
T1-1	$22\frac{1}{2}$ SE	W. Herbst	Floyd Trimm	--------	--------	--------	--------	--------	2- 1-28	T, G, 15	D, S, I	0	149	60	Flowing Feb. 1, 1928.
*2	26 E	Jack Ward	Jack Ward	1909	--------	6	--------	--------	--------	C, W	D, S	--------	--------	--------	Temp 102°F.
4	$22\frac{1}{2}$ SE	Hendricks & Archery.	Floyd Trimm	1911	175	8	--------	--------	1- 3-30	T, G, 20	D, S, I	40	110	110	Flowing Jan. 3, 1930. Temp 100°F.
*5	$24\frac{3}{4}$ SE	R. W. Wilson	--------	1913	1,710	8	--------	a/3.5 29.3	1- 6-30 9-21-48	T, G	I	--------	--------	--------	Reported flowing Feb. 1928. Temp 86°F.
*6	$26\frac{1}{4}$ SE	Silverlake Ranch	--------	1910	--------	--------	--------	--------	10-26-30	C, W	D, S	--------	--------	--------	
*7	$28\frac{1}{4}$ SE	W. L. Moody	--------	--------	--------	6 5/8	--------	37.1	5-16-40	C, W	S	--------	--------	--------	Estimated yield: 6 gpm.
T4-1	$27\frac{3}{4}$ SE	G. E. Light	--------	1910	2,040	--------	--------	58	10-26-30	T, G, 35	D, S	--------	0	--------	

Table 9.—*Records of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

Well	Distance, in miles, from--	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Depth cased (feet)	Water level: Below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Land irrigated (acres) for season--: 1929-30	1937-38	1947-48	Remarks
	Carrizo Springs:														
T4-2	27¼ SE---	G. E. Light----	--------------	------	-------	5 3/16	-------	57.8	5-16-40	C, W	S	-------	-------	-------	
3	28 SE----	-----do--------	Wilcox Oil & Gas Co.	------	8,048	-------	-------	--------	---------	--------	------	-------	-------	-------	Oil test.

a/ Water level reported by owner or driller.

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*

H7-10

[J. N. Wheeless, 4¾ miles northwest of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand and gravel	32	112
Clay	27	30	Sand, water-bearing	28	140
Clay, gravel and sand	50	80	Shale, blue, sandy	4	144

H7-12

[Scott, 5 miles northwest of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, white, dry	28	108
Clay	17	20	Sand, water-bearing	57	165
Clay and hardpan	50	70	Sand and red clay	5	170
Clay and gravel	5	75	Sand	5	175
Sand and clay	5	80			

H7-20

[O. V. Vickery, 5¼ miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, dry	18	85
Clay, yellow	22	25	Clay, light-colored	8	93
Clay and gravel	38	63	Sand, water-bearing	37	130
Gravel, water-bearing	4	67			

H7-21

[O. V. Vickery, 5½ miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Sand, water-bearing	94	144
Clay, yellow	46	50	Shale	20	164

H7-22

[O. V. Vickery, 5¼ miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, yellow	17	137
Clay, yellow	52	55	Shale, sandy	3	140
Gravel, coarse-grained	10	65	Sand, gray	37	177
Sand	35	100	Shale, brown	15	192
Gumbo	20	120			

H7-23

[O. V. Vickery, 4¾ miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Gumbo	13	128
Clay, yellow	33	37	Sand, hard	14	142
Sand, white, loose	73	110	Sand, gray, loose	25	167
Sand, yellow	5	115	Gumbo	15	182

H7-30

[A. R. Hibdon, 5½ miles northwest of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	3	3	Water seep	3	133
Clay	3	6	Shale, dark	47	180
Sand and clay	44	50	Shale, blue, sandy	10	190
Clay, white	10	60	Shale, dark	9	199
Shale, blue	70	130			

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

M3-6

[M. Rambie, $16\frac{3}{4}$ miles west of La Pryor]

	Thickness (feet)	Depth (feet)
Sand, white	40	40
"Basalt" rock, black	$1\frac{1}{2}$	$41\frac{1}{2}$
Sand, white, water-bearing	10	$51\frac{1}{2}$
Sand, yellow to red, water-bearing	$48\frac{1}{2}$	100

M3-20

[Gus Black Estate, $16\frac{3}{4}$ miles west of La Pryor]

	Thickness (feet)	Depth (feet)
Sand, dry	50	50
"Shell"	2	52
Sand, water-bearing	28	80

M3-24

[C. F. Jackson, $16\frac{1}{2}$ miles west of La Pryor]

	Thickness (feet)	Depth (feet)
Sand, dry	48	48
Sand, water-bearing	12	60
Sand, yellow, dry	20	80
Hard rock	10	90
Sand, water-bearing	12	102

M9-3

[Fred Erskine, $11\frac{1}{2}$ miles west of Crystal City]

	Thickness (feet)	Depth (feet)
Rock	40	40
Clay, blue	10	50
Sandrock and blue clay	10	60
Hard rock	2	62
Shale, blue, tough	18	80
Clay, sandy	47	127
Sand, water-bearing, sweet	13	140
Hard rock	7	147
Shale	11	158
Sandrock	57	215
Clay and sandy clay	65	280
Pack sand (some water), contained particles of lignite and rotten wood	56	336
Sand, white, coarse-grained, water-bearing	90	426
Sand, gray, fine-grained	6	432

N1-5

[Grant, $3\frac{3}{4}$ miles northwest of La Pryor]

	Thickness (feet)	Depth (feet)
Soil	$2\frac{1}{2}$	$2\frac{1}{2}$
Clay, brown and light-colored	$52\frac{1}{2}$	55
Gravel and clay	20	75
Sand, dry; and clay	28	103
Sand, water-bearing	$74\frac{1}{2}$	$177\frac{1}{2}$

N1-7

[D. H. Monkhouse, $4\frac{1}{4}$ miles northwest of La Pryor]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Clay	67	70
Gravel and clay	5	75
Sand and clay	5	80
Sand, white; and clay	31	111
Sand, (water)	54	165
Clay and sand	10	175

N1-16

[Mathews Ranch, 6 miles west of La Pryor]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Clay	12	15
Clay and gravel	20	35
Shale, blue	20	55
Rock	1	56
Shale, blue	14	70
Sand and yellow clay	20	90
Sand	67	157

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N1-17

[Mathews Ranch, 5 miles west of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Top sand and clay	10	10	Shale, blue	5	115
Sand and sandrock	82	92	Sand, gray	10	125
Sand, water-bearing	18	110	Shale, blue or dark	9	134

N1-21

[A. R. Hibdon, 3 miles northwest of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, water-bearing	13	115
Clay, light-colored	32	35	Sandstone, blue	5	120
Hardpan	10	45	Shale, dark-colored	5	125
Sandstone	2	47	Shale, blue	5	130
Sand, blue	5	52	Sand, water-bearing	7	137
Sand, yellow	18	70	Shale, blue	38	175
Shale, blue	15	85	Sand, water-bearing	20	195
Sand, blue; and shale	10	95	Clay, yellow	5	200
Shale, blue	7	102	Sand, water-bearing	64	264

N1-25

[J. A. Lanning, 3¼ miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Clay, light-blue	26	120
Clay, light-colored	27	30	Sand and clay	45	165
Clay and hardpan	40	70	Sand, water-bearing	35	200
Gravel and clay	24	94			

N1-30

[J. P. Warren, 3 miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Lignite and shale	3	63
Clay	9	12	Shale, brown	8	71
Sandstone	2	14	Sand and shale	9	80
Sand and clay	6	20	Shale, dark-colored	20	100
"Joint" clay	5	25	Shale, light-blue	17	117
Clay, light-blue	15	40	Clay, yellow; and sand	3	120
Shale, sandy	20	60	Sand, water-bearing	60	180

N1-38

[Earl Harvey, 1½ miles north of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, dark, sandy	35	195
Clay	37	40	Sandstone, soft	1	196
Sand and clay	20	60	Shale, dark, sandy	14	210
Clay, light-colored	40	100	Shale, gray, sandy	24	234
Clay, blue	20	120	Shale, black; and coal	11	245
Shale and pyrites	1	121	Sand, gray; small amount of water	15	260
Clay, dark-colored	4	125	Shale, light-blue	15	275
Clay, brown	5	130	Shale, dark-colored	5	280
Shale, sandy	10	140	Sand, gray, fine-grained, water-bearing	45	325
Sandstone	5	145	Sand, water-bearing	50	375
Shale, gray, hard	5	150	Shale, blue, sticky	5	380
Shale, gray, sandy	10	160			

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N1-45

[Paul Jessee, ½ mile northwest of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, clay and sand	80	80	Sand, water-bearing	15	215
Clay, red, sandy	15	95	Shale, dark-colored and blue	33	248
Clay, blue	25	120	Sand, water-bearing	67	315
Sand, water-bearing	20	140			
Shale, blue	60	200			

N1-51

[Wilson, in La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, gray	20	195
Clay	17	20	Lignite and shale	10	205
Clay and hardpan	20	40	Shale, dark-colored	45	250
Clay	55	95	Shale, sandy	25	275
Sand, blue	5	100	Shale, dark-colored	105	380
Rock shell	1	101	Shale, sandy, dark-colored	50	430
Clay, light-blue	19	120	Shale, blue	40	470
Sandstone	3	123	Sand and pyrites	49	519
Shale, sandy, water-bearing	47	170	Sand, water-bearing	51	570
Shale, dark-colored	5	175			

N1-53

[J. A. Michalk, 1½ miles south of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, blue	123	200
Clay-loam, silty	10	13	Clay, blue	10	210
Clay, sandy	64	77	Sand, water-bearing	35	245

N1-55

[I. T. Pryor Estate, 1½ miles south of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	94	94	Hard rock	7	505
Red sand and clay	6	100	Shale, "soapstone" and asphalt	15	520
Shale, blue; and boulders	111	211	Hard rock	4	524
Sand, blue	8	219	Shale and "soapstone"	26	550
Hard rock	2	221	Packed sand	50	600
Sand, blue	8	229	Shale, hard	120	720
Shale, blue	144	373	Sand, white, water-bearing	60	780
Shale, blue, streaked with asphalt	18	391	Shale	20	800
Shale, "soapstone" and asphalt	107	498			

N1-56

[T. L. Pitts, 2 miles south of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, dark-colored, sandy, water-bearing	10	150
Clay	84	87	Shale, blue	35	185
Gravel	3	90	Shale, sandy	15	200
"Joint" clay	10	100	Pepper sand and gravel, water-bearing	30	230
Clay, light-colored	15	115			
Clay, blue	25	140			

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N1-57

[T. J. Dube, 2¼ miles south of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand and clay	46	86
Clay, light-colored	17	20	Gravel, water-bearing	11	97
Hardpan and clay	20	40			

N1-62

[Mathews Ranch, 4 miles southwest of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	3	3	Shale, dark-blue	220	400
Clay	29	32	Shale, sandy	70	470
Clay and gravel	3	35	Shale, dark-blue	60	530
Clay, yellow	67	102	Sand, gray, water-bearing	10	540
Sand, dry	18	120	Shale, blue	15	555
Shale, blue	8	128	Sand, fine-grained, hard	30	585
Sand, dry	17	145	Shale, blue	5	590
Shale, blue	7	152	Sand	20	610
Sand, dirty gray, water-bearing	28	180	Shale, blue	20	630

N1-66

[Mrs. Emma Mangum, 4 miles south of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	3	3	Shale, dark	40	300
Clay	27	30	Shale, dark, sandy	35	335
Gravel and sand	5	35	Sandrock	3	338
Clay	50	85	Shale, dark, sandy	112	450
Shale, light-blue	35	120	Sand, gray	15	465
Sand, gray, water-bearing	5	125	Shale, gray, sandy	115	580
Shale, light-blue	40	165	Sand	15	595
Sandrock	2	167	Shale, dark	5	600
Shale, blue	83	250	Sand, water-bearing	55	655
Shale, dark; some coal	10	260			

N1-75

[Sam Kone, 2¾ miles west of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	3	3	"Paratish" rock	1	131
Clay	37	40	Shale, hard, sandy	9	140
Clay and hardpan	27	67	Shale, blue	4	144
Gravel and clay	11	78	Sandrock, gray	2	146
Clay, streaked with blue and yellow	12	90	Lignite	1	147
Shale, blue	31	121	Sandrock	1	148
Sandrock, gray	1	122	Shale, brown	8	156
Shale, brown; some coal	8	130	Sandrock	1	157
Shale, blue	10	186	Shale, blue	11	168
Lignite; and some coal	2	188	Shale, sandy	8	176
Sand, gray, fine, water-bearing	5	193	Sand, gray, water-bearing	60	318
Shale, blue	6	199	Shale-tuff, brown	5	323
Rock or mud rock	2	201	Shale, brown, sandy	7	330
Shale, blue	14	215	Sand, gray	12	342
Shale, brown	10	225	Sandrock	1	343
Sand, gray, hard rock	1	226	Shale, blue	17	360
Shale, blue	6	232	Shale, light-blue, sticky	15	375
Shale, brown	21	253	Shale, sandy	5	380
Shale-tuff, dark-brown	5	258	Shale, light-blue, sticky	5	385
			Sand	8	493
			Shale, blue	1	494

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N2-24

[Kirby Attwood, ¾ mile southeast of La Pryor]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	3	3	Shale, chocolate-brown	10	165
Clay	12	15	Shale, gray	4	169
Hardpan and clay	10	25	Sandrock, gray	2	171
Clay	23	48	Shale, gray	5	176
Clay, yellow	6	54	Shale, gray, sandy	7	183
Hardpan (dark)	2	56	Sand, gray (water) or pepper sand	29	212
Shale, yellow and blue	9	65	Shale, blue	3	215
Shale, blue and green	8	73	Sand, gray, water-bearing or pepper sand	11	226
Shale, black	2	75	Shale, dark, sticky	3	229
Hardpan and yellow shale	2	77	Shale, blue	17	246
Sandrock	1	78	Shale, black; coal and lignite	2	248
Shale, blue and gray	2	80	Shale, blue	18	266
Shale, light-gray	14	94	Rock, gray	2	268
Shale, gray	11	105	Shale, brown	4	272
Sandrock	1	106	Shale, blue, sticky	13	285
Shale, gray	4	110	Shale, brown	5	290
Shale, dark-gray	6	116	Shale, blue, sticky	35	325
Shale, gray	5	121	Shale, dark-brown	5	330
Lignite, black	1	122	Gumbo; some coal	17	347
Shale, chocolate-brown	8	130	Shale, brown	17	364
Shale, gray	5	135	Shale, brown, sticky	3	367
Shale, brown	2	137	Shale, brown and gray, sandy	18	385
Coal (water seep)	1	138	Shale, brown and gray	4	463
Shale, chocolate-brown	8	146	Sandrock	2	465
Rock	1	147	Shale, brown and gray, streaked with sand	7	472
Shale, gray	8	155	Shale, light-blue, sticky	7	479
Shale, blue, sticky	3	388	Sandrock, gray	1	480
Rock and sand	1	389	Shale, light-blue, sticky	6	486
Shale, brown	17	406	Mud rock	2	488
Shale, blue, little rock	2	408	Shale, light-blue, sticky	8	496
Shale, blue	4	412	Sandrock	4	500
Shale, dark (lignite)	3	415	Sand, gray, (water)	17	517
Shale, brown, streaked with gray	9	424	Shale, light-blue, sticky	6	523
Shale, brown, sticky	13	437	Shale, light-blue, hard	2	525
Shale, blue, sticky	3	440	Sand, (water)	91	616
Shale, blue	9	449	Shale, blue	1	617
Sandrock, gray	1	450			
Shale, blue	5	455			
"Paratish" rock, hard and mud rock	2	457			
Shale, dark (lignite)	2	459			

N3-2

[J. B. Reeves, 1¼ miles north of Batesville]

Clay, yellow	40	40	Sand, fine, water-bearing	75	120
Gravel	5	45	Clay, blue	12	132

N4-4

[R. A. Nash, 10 miles north of Crystal City]

Soil, red, sandy	30	30	Rock	1	490
Boulders, hroken	10	40	Shale, sandy, and rock	34	524
Clay, yellow	30	70	Sand, water-bearing	26	550
Shale, hard, gray and blue	40	110	Shale, blue	12	562
Sand, yellow	23	133	Rock, very hard	3	565
Shale, blue	70	203	Shale and boulders	7	572
Rock	29	232	Rock	5	577
Shale	38	270	Shale and rock	13	590

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N4-4--Continued

	Thickness (feet)	Depth (feet)
Shale, hard, streaked with thin rock strata	88	358
Shale and boulders	90	448
Shale, soft	41	489
Rock	5	670
Sand and shale, broken	6	676
Sand, coarse-grained, water-bearing	84	760
Sand, black, hard	4	764
Shale, brown	29	619
Rock	5	624
Shale and boulders, sandy	19	643
Sand, water-bearing	15	658
Shale and sand	7	665
Shale, soft	12	776
Rock	1	777
Shale, sticky	25	802
Rock	1	803

N4-13

[S. B. Carr Estate, 7 miles west of Crystal City]

	Thickness (feet)	Depth (feet)
Soil	5	5
Clay, yellow	25	30
Shale, blue	30	60
Water, bearing sand	20	80
Shale, blue	50	130
Shale, brown	5	135
Shale, blue	85	220
Sand, water-bearing	10	230
Shale, blue	25	255
Lime	3	258
Shale, blue	32	290
Shale, brown	13	303
Shale, blue	27	330
Shale, brown	7	337
Shale, blue	7	344
Shale, brown	26	370
Sand	10	380
Shale, blue	25	405
Sand, hole full of water	10	415
Lime	2	417
Shale, brown, sandy	13	430
Lime	3	433
Sand, water-bearing	7	440
Shale, brown	40	480
Shale, sandy	10	490
Lime	3	493
Shale, sandy	7	500
Sand, water-bearing	8	508
Lime	2	510
Shale, brown	20	530
Sand, coarse-grained	13	543
Lime	5	548
Shale, blue	2	550
Sand	10	560
Shale, brown	14	574
Sand, big	46	620
Sand, loose	146	766

N4-36

[John W. Laird, 3¼ miles north of Crystal City]

	Thickness (feet)	Depth (feet)
Clay, yellow	60	60
Limestone, white, soft	20	80
Shale, blue; and hard sandrock	70	150
Gumbo, tough	125	275
Shale, blue	225	500
Broken shale, hard; and boulders	290	790
Sandrock, hard	20	810
Sandrock, water-bearing	70	880
Sand, fine-grained, water-bearing	10	890
Sand, coarse-grained, water-bearing	76	966

N4-55

[D. C. Mandell, 7 miles west of Crystal City]

	Thickness (feet)	Depth (feet)
Soil	3	3
Clay, yellow	22	25
Shale, blue	155	180
Shale, brown	10	190
Shale, blue	20	210
Shale, brown	5	215
Shale, blue	73	288
Lime, hard	2	290
Shale, blue	6	296
Shale, brown, sandy, water-bearing	17	313
Lime "shell"	1	314
Shale, brown	21	335
Sand, light-colored, water-bearing	15	350
Shale, blue	50	400
Shale, sandy	15	415
Shale, blue	25	440
Shale, sandy	7	447
Limestone	3	450
Gumbo, blue	10	460
Gumbo, brown	60	520
Sand	165	685
Gumbo, brown	18	703

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N4-58

[D. C. Mandell, $8\frac{3}{4}$ miles northwest of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	6	6	Sand, water-bearing, tasted sweet	30	370
Clay, yellow	34	40	Shale, blue	40	410
Shale, blue	60	100	Gumbo, brown	40	450
Sand, salty--4 bailers water in 14 hours	5	105	Sand	10	460
Shale, blue	75	180	Gumbo	35	495
Shale, brown	10	190	Sand	45	540
Shale, blue	100	290	Gumbo	45	585
Shale, light	50	340	Sand, loose	90	675
			Gumbo	5	680

N5-9

[W. E. Richardson, 7 miles north of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	30	30	Shale, brown	10	240
Sand, yellow	45	75	Shale, blue	11	251
Clay, yellow	15	90	Lime "shell," hard	3	254
Gumbo, blue	35	125	Shale, blue	41	295
Shale, sandy	10	135	Lime	5	300
Shale, brown	10	145	Shale, blue	20	320
Shale, blue	60	205	Shale, brown	5	325
Shale, sandy	10	215	Sand, water-bearing	25	350
Shale, blue	15	230	Gumbo, blue	60	410
Shale, sandy	5	415	Lime "shell"	1	565
Sand, water-bearing	25	440	Sand, water-bearing	15	580
Shale, blue	35	475	Gumbo, brown	95	675
Lime	5	480	Sand, water-bearing	100	775
Shale, blue	50	530	Lime and iron pyrites	5	780
Sand, water-bearing	5	535	Sand, water-bearing	73	853
Gumbo, brown	29	564	Gumbo, red	5	858

N5-19

[I. C. Cribbs, 6 miles northeast of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, brown; and boulders	52	541
Clay, yellow	33	36	Sandrock	1	542
Gravel	5	41	Shale, blue; and boulders	71	613
Clay, yellow	39	80	Sandrock	6	619
Clay, blue	62	142	Shale, blue; and boulders	62	681
Sandrock, soft	1	143	Shale, blue with layers of hard sandrock	15	696
Shale, streaked with rock	20	163	Shale and boulders	29	725
Shale	48	211	Shale, blue with layers of sandrock	39	764
Shale, streaked with rock	29	240	Shale, blue, soft; and gumbo	122	886
Sandstone, hard	1	241	Sandrock, soft	2	888
Gumbo	9	250	Sand, water-bearing	66	954
Sandrock	1	251	Gumbo, blue	10	964
Shale, hard, with layers of sandrock	31	282	Sandrock, soft	1	965
Shale, hard	8	290	Gumbo, blue	42	1,007
Sandstone	5	295			
Shale, hard	3	298			
Sandrock	18	316			
Shale, blue, with layers of rock	17	333			
Shale, blue, soft	61	394			
Sandrock	1	395			
Shale, blue, soft	48	443			
Shale, blue, hard, with layers of sandrock	46	489			

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N5-67

[W. B. Gates, 5 miles northeast of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Shale, sandy	13	585
Clay, yellow	66	70	Shale, blue	15	600
Shale, blue	85	155	Gumbo, brown	45	645
Shale, brown	10	165	Gumbo, blue	25	670
Shale, gray	30	195	Gumbo, brown	45	715
Sand, water-bearing	25	220	Limestone	1	716
Shale, light-colored	20	240	Gumbo, brown	22	738
Shale, brown	20	260	Limestone	2	740
Shale, blue	33	293	Gumbo, brown	17	757
Shale, brown	7	300	Sand, broken	22	779
Shale, blue	15	315	Lime "shell"	2	781
Sand, water-bearing	18	333	Shale and gumbo, sandy	35	816
Shale, brown	27	360	Limestone	2	818
Shale, blue	35	395	Shale, sandy	7	825
Sand; small amount of water	5	400	Limestone	3	828
Shale, blue	50	450	Gumbo, brown	17	845
Shale, brown	10	460	Sand	45	890
Sand, hard, water-bearing	5	465	Gumbo, brown	37	927
Shale, light-colored	45	510	Pyrites	3	930
Hard "shell"	2	512	Sand	60	990
Shale, sandy	8	520	Gumbo	15	1,005
Sand, water-bearing	33	553	Sand	52	1,057
Shale, gray	19	572	Shale, brown	3	1,060

N5-69

[C. F. Jackson, 6½ miles east of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Shale, brown	35	360
Shale, brown	25	30	Hard rock "shell"	4	364
Sand, yellow	20	50	Shale, brown	31	395
Clay, yellow	20	70	Shale, blue	55	450
Shale, blue	10	80	Shale, brown	10	460
Shale, brown	10	90	Shale, blue	5	465
Shale, blue	80	170	Shale, sandy, water-bearing	7	472
Shale, brown	30	200	Shale, brown	13	485
Shale, blue	75	275	Shale, blue	55	540
Shale, brown	20	295	Shale, brown	20	560
Shale, blue	28	323	Sand, water-bearing	10	570
Limestone	2	325	Shale, blue	200	770
Shale, sandy	27	797	Shale, brown, sandy	21	975
Limestone	3	800	Sand	160	1,135
Shale, blue	10	810	Shale and iron	25	1,160
Shale, brown	30	840	Sand	15	1,175
Sand	30	870	Sand, broken	22	1,197
Shale, sandy	45	915	Sand	30	1,227
Gumbo, brown	35	950	Shale	1	1,228
Limestone and iron	4	954			

N5-72

[Mrs. C. L. Coleman, 6½ miles northeast of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, gray	20	660
Clay, yellow	77	80	Gumbo, brown	8	668
Shale, blue	120	200	Gumbo, blue	42	710
Sand, hole full of water	20	220	Sand, gray	8	718
Limestone	5	225	Hard lime and iron	3	721
Shale, blue	25	250	Sand, gray	11	732
Lime "shells"	5	255	Sandrock, hard	8	740
Shale, blue	25	280	Sand, gray	25	765
Sand, water-bearing	30	310	Shale, brown	30	795
Shale, blue	50	360	Sand, hard	25	820

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N5-72--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Shale, brown	20	380	Shale, brown	20	840
Shale, blue	40	420	Lime, hard	4	844
Shale, brown	20	440	Shale, brown	38	882
Shale, blue	43	483	Lime, hard	2	884
Sand; small amount of water	5	488	Gumbo, brown	8	892
Lime "shells" and shale	25	513	Lime, hard	3	895
Sand, hole full of water	17	530	Gumbo, brown	9	904
Shale, brown	5	535	Sand	7	911
Sand, water-bearing	15	550	Lime, hard	3	914
Lime	2	552	Gumbo, brown	11	925
Sand, water-bearing	48	600	Shale, sandy	10	935
Gumbo, blue	15	615	Sand, water-bearing	101	1,036
Sand, gray	20	635	Lime and iron	10	1,046
Gumbo	5	640	Sand	111	1,157
			Gumbo, brown	3	1,160

N5-79

[City of Crystal City, in Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Shale, sandy	20	450
Clay, yellow	36	40	Shale, brown	50	500
Sand, yellow	40	80	Shale, blue	45	545
Gumbo, blue	25	105	Sand	10	555
Shale, brown	10	115	Shale, blue	45	600
Shale, blue	65	180	Shale, light	20	620
Shale, brown	65	245	Shale, brown	110	730
Sand, water-bearing	10	255	Shale, light	25	755
Shale, brown	35	290	Sand	15	770
Sand, water-bearing	25	315	Gumbo	15	785
Shale, brown	15	330	Sand	110	895
Sand	10	340	Gumbo	10	905
Shale	90	430	Sand	85	990

N5-88

[California Packing Corp., 8 miles northeast of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Rotary space	5	5	Shale, streaked with lime	37	900
Surface soil and clay	53	58	Shale, soft	9	909
Boulders	2	60	Boulders, hard	2	911
Shale, sandy	161	221	Shale	13	924
Shale, sticky and streaked with sand	212	433	Sand	29	953
			Sandstone with hard streaks	24	977
Shale, sandy	36	469	Sand	28	1,005
Rock	6	475	Shale, streaked with sand	60	1,065
Shale with hard streaks	118	593	Sand	85	1,150
Shale, streaked with sand	140	733	Shale, brown	5	1,155
Lime, hard	10	743			
Shale, streaked with lime and hard sand	120	863			

N5-92

[California Packing Corp., $9\frac{1}{4}$ miles northeast of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil and clay	43	43	Shale; and shell streaks	30	300
Shale, sticky and streaked	167	210	Sand, hard; and shale	10	310
Shale, sandy	60	270	Shale; and streaks of shells	58	368
Shale; and streaks of hard sand	226	594	Shale, sandy	55	815
Sand, hard	3	597	Sand, hard	5	820
Shale, sandy; and hard sand streaks	143	740	Shale, sandy; and hard sand streaks	227	1,047
Sand, hard	2	742	Sand (good water)	77	1,124
Shale, sandy	13	755	Shale, sandy	31	1,155
Sand, hard	5	760	Shale, sticky	8	1,163

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N5-98

[Robert S. Yantis, 6¾ miles northeast of Crystal City]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	7	7	Sand, water-bearing	10	530
Clay, yellow	73	80	Shale, brown	85	615
Shale, blue	75	155	Sand, water-bearing	15	630
Sand, water-bearing, fresh	29	184	Shale, brown	50	680
Shell, hard	2	186	Sand, water-bearing	35	715
Sand, water-bearing, salty	14	200	Shale, brown	10	725
Shale, blue	115	315	Shell, hard	5	730
Sand, water-bearing	10	325	Gumbo	45	775
Shale, blue	5	330	Sand	200	975
Sand, water-bearing	100	430	Gumbo	5	980
Shale, brown	90	520			

N6-3

[L. G. Gates, 12 miles east of Crystal City]
Deepened from 1,287 to 1,313 feet in 1929

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, yellow	30	30	Gumbo, hard	30	907
Coal (lignite)	6	36	Shale, rocky	34	941
Shale, hard	122	158	Gumbo, blue	56	997
Rock (sandstone)	4	162	Rock, very hard	5	1,002
Gumbo, shaly	190	352	Hard gumbo and shale	60	1,062
Hard rock (sandstone)	6	358	Shale and rock	20	1,082
Soft gumbo and shale	152	510	Rock	5	1,087
Rock	5	515	Shale and gumbo	20	1,107
Rock, shale, and gumbo	89	604	Shale and sand	30	1,137
Gumbo	117	721	Shale	22	1,159
Rock and shale	5	726	Sand, fine	120	1,279
Gumbo	73	799	Shale and gumbo	8	1,287
Rock and gumbo	5	804	Deepened to 1,313 in 1929		
Gumbo	60	864	Blue sticky gumbo or shale	26	1,313
Gumbo, hard	9	873			
Sandrock	4	877			

N7-6

[Carl Reiker, 8½ miles north of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Shale, gray, sandy	33	522
Clay, red	5	7	Lime	3	525
Clay, yellow	17	24	Shale, brown, hard	58	583
Sand, yellow	8	32	Shale, sandy	15	598
Clay, white	12	44	Sand, water-bearing	52	650
Sand, hard	14	58	Sand, hard, fine, water-bearing	25	675
Sand, dry	27	85	Shale, brown	35	710
Shale, brown	160	245	Shale, sandy with lenses of sand	48	758
Lime, hard	2	247	Sand, water-bearing	32	790
Shale, sandy	23	270	Clay, black	4	794
Sand, water-bearing	12	282	Sand, coarse-grained, water-bearing	223	1,017
Shale, gray	173	455	Shale, green	4	1,021
Shale, dark	34	489			

N7-40

[Lynch Bros., 6½ miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Caliche and white sand	25	25	Sand, yellow, medium-fine	24	76
Shale, gray and blue	27	52	Sand, coarse, water-bearing	112	188

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N7-46

[State of Texas, 7¾ miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, brown	26	370
Clay	17	20	Sand, water-bearing	37	407
Sand, yellow	20	40	Shale, blue	53	460
Gumbo, yellow	20	60	Shale, brown	10	470
Gumbo, blue	37	97	Lime	2	472
Coal	3	100	Sand; some water	13	485
Shale, blue	127	227	Shale, blue	45	530
Sand, water-bearing	10	237	Sand, water-bearing	5	535
Coal	2	239	Shale, brown	5	540
Shale, brown, sandy	16	255	Sand, water-bearing	15	555
Shale, blue	20	275	Lime	5	560
Sand, water-bearing	25	300	Shale, brown	75	635
Shale, blue	44	344	Sand, water-bearing	5	640
Shale, brown	23	663	Sand	55	845
Sand	1	664	Iron and sand	15	860
Shale, brown	71	735	Sand, coarse	40	900
Sand, water-bearing	15	750	Gumbo	20	920
Shale, brown, sandy	30	780	Sand	102	1,022
Sand, hard	10	790	Gumbo		1,022

N7-51

[Sam McKnight, 6 miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Gumbo, blue; with pyrites	67	165
Caliche	20	24	Sand, water-bearing	40	205
Sand, dry	70	94	Clay, blue	77	282
Sand, water-bearing	4	98			

N7-65

[L. A. Warren, 4 miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	7	7	Sand and clay	35	105
Sandrock	40	47	Sand, water-bearing	20	125
Sand, water-bearing	23	70	Sand, clay and shale	105	230

N7-66

[J. A. Heyman, 3¾ miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and caliche	20	20	Sand, water-bearing	15	255
Sandrock, soft	35	55	Shale, brown	5	260
Shale, gray	15	70	Sand, water-bearing	20	280
Sand, water-bearing	145	215	Shale, brown	52	332
Shale, gray	25	240			

N7-77

[Sam McKnight, 3 miles west of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sandstone	61	73
Clay	9	12	Shale, blue	29	102
Shale, gray, sandy	22	124	Sand and shale, water-bearing	37	252
Sandstone, hard	3	127	Shale, gray	38	290
Sand, water-bearing	18	145	Shale, white	15	305
Shale, gray	43	188	Shale, gray	113	418
Sandstone, hard	7	195	Shale, gray, sandy	2	420
Shale, sandy	5	200	Shale, gray	16	436
Shale, gray	15	215			

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N7-96

[Central Securities Co., 3¾ miles west of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale, brown	2	120
Clay	5	8	Sand, water-bearing	4	124
Sandstone	32	40	Shale, brown	2	126
Sand	25	65	Sand, water-bearing	19	145
Shale, brown	15	80	Shale, sandy	20	165
Sand, water-bearing	16	96	Sand, water-bearing	13	178
Shale, brown	2	98	Shale, gray	54	232
Sand, water-bearing	12	110	Sand, water-bearing	8	240
Lignite	1	111	Shale, gray	32	272
Sand, water-bearing	7	118			

N7-148

[J. H. Long, in Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	1	1	Coal (lignite)	7	126
Clay and sand, brown	5	6	Shale, brown, sandy	2	128
Sand, brown	4	10	Shale, blue, sandy	6	134
Clay, white, sandy	12	22	Shale, blue	4	138
Sand, white, dry	20	42	Shale, blue, sandy	30	168
Clay, yellow, sandy,			Shale, blue	4	172
water-bearing	8	50	Shale, blue, sandy	14	186
Shale, blue	3	53	Shale, blue	7	193
Shale, brown, sandy	14	67	Shale, brown	5	198
Shale, blue, sandy	7	74	Shale, brown; and coal	7	205
Shale, brown, sandy	11	85	Shale, brown	4	209
Sand, blue, water-bearing,			Rock, gray	3	212
salty	8	93	Sand, blue	14	226
Coal; and brown mud	3	96	Shale, blue	3	229
Shale, brown	10	106	Sand, blue	11	240
Shale, brown, sandy	13	119	Shale, blue	10	250
Shale, brown	3	253	Sand, blue, fine-grained	38	345
Sand, blue	5	258	Sand, blue, medium	12	357
Shale, blue, sandy	26	284	Shale, brown	2	359
Sand, blue, fine	15	299	Sand, blue, fine	8	367
Shale, blue	1	300	Shale, blue, sandy	25	392
Sand, blue, fine	5	305	Granite, blue	5	397
Shale, brown	2	307			

N7-151

[E. Goodwin, 3½ miles north of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	2	2	Shale, blue	12	160
Clay, yellow	17	19	Shale, brown	45	205
Clay, yellow, sandy	17	36	Shale, blue, sandy	7	212
Shale, dark-brown	6	42	Sand, gray	16	228
Shale, blue	24	66	Shale, blue, sandy	18	246
Shale, brown	6	72	Shale, brown	12	258
Shale, blue, sandy	20	92	Shale, blue	32	290
Sand, blue, water-bearing,			Sand	65	355
salty	22	114			
Shale, brown	34	148			

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Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N7-153

[L. H. Upchurch, 1 mile west of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	1½	1½	Shale, blue, sandy	32	83
Clay, yellow	3½	5	Sand, light-blue	22	105
Sand, yellow	19	24	Sand, gray, coarse	17	122
Sand, gray	4	28	Sand, light-blue	46	168
Clay, yellow	18	46	Sand, blue, hard	3	171
Rock, brown	3	49	Shale, dark-brown	11	182
Coal	2	51	Shale, light-brown	33	215

N7-157

[H. Rouw, 4 miles north of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand; soil	3	3	Shale, brown	10	270
Caliche	47	50	Shale, white	30	300
Shale, blue, fresh	90	140	Sand, white, water-bearing, tasted sweet	12	312
Shale, sandy	10	150	Shale, white	18	330
Shale, brown	50	200	Shale, brown	10	340
Shale, blue	40	240	Sand, water-bearing	10	350
Sand; small amount of water, tasted sweet	20	260	Gumbo	15	365
			Sand	200	565

N7-164

[H. Rouw, 3¾ miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Sand	155	305
Caliche	11	15	Gumbo	25	330
Shale, blue	25	40	Sand, gray	40	370
Shale, brown	30	70	Shale, gray	25	395
Shale, blue	80	150			

N7-168

[G. E. Whitney, 3½ miles northwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Caliche	35	35	Shale, blue	25	295
Shale, brown	45	80	Shale, brown, sandy	13	308
Shale, blue	50	130	Sand, coarse	22	330
Shale, sandy	45	175	Gumbo	25	355
Shale, blue	15	190	Sand	30	385
Shale, gray	10	200	Sand, broken	5	390
Shale, brown	10	210	Sand	40	430
Shale, sandy	20	230	Gumbo, brown	48	478
Sand	40	270			

N7-170

[H. Rouw, 3 miles north of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Shale, sandy	10	224
Caliche	8	12	Sand, water-bearing	4	228
Sand, yellow	13	25	Shale, brown	62	290
Shale, dark	55	80	Shale, sandy	10	300
Shale, brown	20	100	Sand	10	310
Shale, blue	20	120	Sand, broken	10	320
Shale, sandy	35	155	Sand	75	395
Sand; small amount of water	10	165	Shale, sandy	15	410
Shale, blue	35	200	Gumbo, brown	5	415
Shale, sandy	12	212	Shale, blue	45	460
Shell, hard	2	214			

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N7-173

[City of Carrizo Springs, ½ mile north of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Caliche	20	20	Shale, gray; tight sand	15	270
Sand, dry	92	112	Sand	55	325
Shale	3	115	Sand, bottom of well	13	338
Rock	3	118			
Sand	137	255			

N8-10

[Sam Ward, 4½ miles east of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, water-bearing, salty	30	465
Clay, yellow, hard	17	20	Shale, sandy	120	585
Packsand	40	60	Shale, blue; with ledges of		
Blue and black shale	75	135	hard lime	202	787
Shale, pink, sandy	6	141	Sand, water-bearing, streaked		
Sand, blue, hard	9	150	with iron pyrites	148	935
Sand, brown	5	155	Shale, blue	77	1,012
Blue shale and clay	108	263	Pyrite of iron	2	1,014
Lime, hard	5	268	Quartz sand, white, very		
Shale, blue, sandy	97	365	coarse-grained	46	1,060
Sand, water-bearing, salty	15	380	Gumbo, brown	20	1,080
Shale, blue, sandy	55	435			

N8-43

[A. N. Box, 2¾ miles northeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	24	24	Sand, water-bearing, salty	8	168
Quicksand	6	30	Clay, blue	203	371
Clay, blue	50	80	Sand, fine to gradually coarse-		
Sand, water-bearing, salty	2	82	grained	87	458
Clay, blue	46	128	Clay, bluish-gray, tough	18	476
Sand, water-bearing, tasted			Sand, coarse-grained	46	522
salty	2	130			
Clay, blue	30	160			

N8-102

[Marrs McLean, 9¼ miles east of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	15	15	Sand, water-bearing	5	795
Sand and gravel, water-bearing	15	30	Shale, blue	15	810
Sand	25	55	Shale, gray, sandy	57	867
Shale, blue	120	175	Shale, blue	23	890
Quicksand, water-bearing,			Sand, water-bearing	55	945
salty	73	248	Shale, blue	10	955
Shale, blue	7	255	Shale, sandy	25	980
Sand, water-bearing	13	268	Sand, water-bearing	9	989
Shale, hard, sandy	102	370	Shale, blue	46	1,035
Sand, hard	20	390	Sand, water-bearing	7	1,042
Shale, blue	30	420	Shale, blue	8	1,050
Sand, hard	20	440	Sand, water-bearing	10	1,060
Shale, brown	20	460	Shale, blue	3	1,063
Shale, sandy	35	495	Sand, water-bearing	7	1,070
Lime rock, hard	10	505	Shale, blue	35	1,105
Shale, sandy	55	560	Sand, water-bearing	60	1,165
Shale, blue	32	592	Shale, blue	10	1,175
Shale, sandy	10	602	Shale, sandy	22	1,197
Shale, gray, soft	16	618	Sand, water-bearing	8	1,205
Shale, hard, sandy	67	685	Shale, blue	5	1,210
Sand, water-bearing	85	770	Sand, water-bearing	7	1,217
Gumbo	20	790	Shale, blue	7	1,224

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N8-104

[Hiram G. Hines, $3\frac{3}{4}$ miles northeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	1	1	Shale, brown	8	135
Clay, yellow	2	3	Shale, blue, sandy	16	151
Clay, yellow, sandy	46	49	Pyrites and rock	2	153
Yellow sand and gravel; water-bearing, salty	5	54	Shale, blue, sandy	28	181
Blue sand and rock	2	56	Shale, brown	2	183
Shale, blue, sandy	18	74	Shale, blue	13	196
Blue "soapstone"	5	79	Sand, blue, water-bearing	$13\frac{1}{2}$	$209\frac{1}{2}$
Shale, blue, sandy	8	87	Rock, blue, hard	$4\frac{1}{2}$	214
Shale, blue	27	114	Sand, blue, water-bearing	26	240
Shale, brown	7	121	Shale, blue	11	251
Sand, gray, water-bearing	6	127	Rock, blue	1	252
Shale, blue	27	312	Shale, blue, sandy	33	285
Shale, brown	25	337	Sand, white, fine-grained	12	463
Shale, brown, sandy	61	398	Shale, brown	4	467
Boulders, blue	2	400	Sand, white, fine-grained	18	485
Shale, brown	5	405	Shale, blue	7	492
Shale, blue	10	415	Sand, white, fine-grained	16	508
Boulders, blue	1	416	Sand, white, medium-grained	43	551
Shale, blue	18	434	Sand, white, coarse-grained	10	561
Pyrite and rock	1	435	Pyrite, coal and coarse-grained sand	7	568
Sand, white, coarse-grained	5	440	Sand, white, medium-grained	9	577
Shale, blue, sandy	11	451	Shale, brown	5	582

N8-106

[John Stahl, $2\frac{3}{4}$ miles northeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	1	1	Shale, gray, sandy	38	172
Clay, yellow	2	3	Blue mud and rock	51	223
White clay (caliche)	6	9	Shale, brown, sandy	14	237
Sand, yellow, fine-grained, water-bearing	10	19	Shale, blue, sandy	33	270
Clay, yellow, sandy	19	38	Granite boulder, blue	2	272
Mud, blue	3	41	Shale, blue, sandy	20	292
Sand, blue	15	56	Sand, white	12	304
Shale, blue, sandy	21	77	Shale, brown	10	314
Shale, light-brown	14	91	Sand, white	21	335
Sand, blue	3	94	Sand, white, fine-grained	53	388
Shale, blue, sandy	10	104	Sand, white, coarse-grained	58	446
Shale, dark-brown	4	108	Blue "soapstone"	4	450
Shale, blue, sandy	26	134			

N8-109

[Sam Ward, $10\frac{1}{2}$ miles northeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	6	6	Shale, gray	16	220
Mud, sandy	82	88	Lime	10	230
Shale, blue	6	94	Shale, gray	42	272
Shale, gray	66	160	Shale, brown	15	287
Shale, blue	25	185	Shale, gray	38	325
Mud, blue	7	192	Shale, brown	7	332
Sand, water-bearing	12.	204	Shale, blue	18	350
Shale, brown	30	380	Shale, brown	6	757
Shale, blue	10	390	Shale, blue	19	776
Shale, brown	20	410	Lime	1	777
Shale, blue	12	422	Shale, brown	23	800
Lime	3	425	Sandrock	12	812
Shale, blue	26	451	Shale, blue	23	835
Lime	13	464	Sand and shale	15	850
Shale, brown	6	470	Shale, blue	19	869
Shale, gray	37	507	Lime	5	874

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N8-109--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Shale, brown	6	513	Shale, brown	22	896
Shale, gray	37	550	Lime	2	898
Shale, brown	10	560	Sand, water-bearing	6	904
Lime, blue	45	605	Shale, brown	44	948
Sand, water-bearing	6	611	Lime	8	956
Shale, brown	19	630	Sand, brown	39	995
Shale, gray	14	644	Sand	16	1,011
Lime	3	647	Sand, hard; iron	39	1,050
Shale, gray	21	668	Sand, loose	10	1,060
Shale, sandy	2	670	Sand, hard	4	1,064
Lime	4	674	Sand, loose	126	1,190
Sand, water-bearing	16	690	Shale, sandy	3	1,193
Shale, blue	43	733	Pyrites	10	1,203
Sand	18	751	Gumbo	1	1,204

N8-118

[S. C. Freed, 10¼ miles northeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Shale, blue	45	560
Clay, yellow	35	40	Sand, water-bearing	15	575
Sand, water-bearing	25	65	Shale, blue	45	620
Shale, sandy	15	80	Shale, brown	80	700
Sand, water-bearing	10	90	Shale, blue	20	720
Shale, blue	175	265	Shale, brown	70	790
Shale, brown	15	280	Shale, sandy	25	815
Shale, blue	55	335	Sand	125	940
Sand, water-bearing	20	355	Gumbo	10	950
Shale, blue	135	490	Sand	180	1,130
Sand, water-bearing, salty	25	515			

N9-20

[City of Big Wells, in Big Wells]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, yellow	20	20	Shale, gray	8	606
Shale, blue	140	160	Sand, water-bearing	26	632
Sand, water-bearing	30	190	Shale, gray	18	650
Shale, blue	17	207	Shale, brown	5	655
Shale, gray	15	222	Shale, gray	10	665
Shale, blue	8	230	Shale, sandy	5	670
Shale, brown	30	260	Sand, hole full of water	25	695
Shale, gray	50	310	Shale, blue	29	724
Shale, sandy; small amount of water	10	320	Shale, gray, sandy	26	750
Sand, hole full of water	10	330	Shale, brown, sandy	8	758
Shale, blue	66	396	Shale, red	7	765
Shale, red	4	400	Sand, broken	30	795
Shale, blue	45	445	Shale, sandy	17	812
Shale, gray, hard	20	465	Shale, blue	13	825
Lignite, brown	14	479	Shale, brown	18	843
Shale, gray, sandy	19	498	Shale, blue	10	853
Shale, brown	17	515	Gumbo, gray	42	895
Shale, gray	35	550	Sand, broken, water-bearing	55	950
Shale, brown	15	565	Shale, gummy	45	995
Shale, gray	15	580	Shale, sandy	15	1,010
Shale, blue	18	598	Shale, brown	160	1,170
			Sand, water-bearing	90	1,260
			Shale, brown	95	1,355

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

N9-24

[C. W. Barker, 14 miles east of Carrizo Springs]

	Thickness (feet)	Depth (feet)
Soil	2	2
Gumbo, yellow	23	25
Lime	3	28
Shale, brown and blue	282	310
Lime	5	315
Sand, water-bearing	5	320
Shale, blue	75	395
Sand, water-bearing	5	400
Gumbo, brown and blue; or shale	145	650
Shale, sandy	10	660
Sand, water-bearing	18	678
Shale, brown and blue	72	750
Sand, water-bearing	25	775
Shale, brown	3	778
Shale, brown and blue	25	425
Sand, water-bearing	5	430
Shale, light	15	445
Sand, water-bearing	10	455
Shale, blue	17	472
Sand, water-bearing	5	477
Shale, sandy	13	490
Sand, water-bearing	15	505
Sand, water-bearing	20	798
Shale, brown	237	1,035
Artesian sand	175	1,210
Shale, brown	40	1,250
Sand	5	1,255
Shale, brown	50	1,305

N9-33

[P. J. Lewis, 17¾ miles east of Carrizo Springs]

	Thickness (feet)	Depth (feet)
Soil	4	4
Clay, yellow	34	38
Gravel, yellow, coarse-grained	2	40
Shale, soft-blue	12	52
Shale, blue to dark-colored; small boulders and pyrites	73	125
Shale and few boulders	681	806
Shale	111	917
Sand, dark-colored, medium-grained	7	924
Shale, dark-colored specks, hard	96	1,020
Sand; small amount of water	7	1,027
Hard sand and pyrite	253	1,280
Boulders	1	1,281
Gumbo, dark-blue, sticky	16	1,297
Lenses of white sand and shale	174	1,471
Sandrock, hard	1	1,472
Sand, hard	5	1,477
Shale, black, hard	17	1,494
Lime "shell", hard	5	1,499
No record	8	1,507
Sand, white, coarse-grained, water-bearing	16	1,523

S1-18

[J. C. Johnson, 4¼ miles southwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)
Soil	4	4
Clay, gray, sandy	26	30
Sandstone, brown	70	100
Sand, gray and white, water-bearing	220	320

S1-50

[H. Rouw, 4½ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)
Soil	5	5
Caliche	25	30
Shale, blue	70	100
Sand	50	150
Shale, brown	95	245
Sand, white, water-bearing, fresh	30	275
Shale	45	320
Sand	80	400
Shale, gray	35	435
Sand, gray	20	455
Shale, gray	20	475
Sand, gray	45	520
Shale, gray	40	560
Sand, gray	20	580
Gumbo, brown	40	620
Sand, gray	30	650
Gumbo	20	670

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

S2-4

[B. Bounds, 3¾ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Sand, water-bearing	50	540
Clay, brown	10	15	Gumbo	28	568
Lime	2	17	Lime	2	570
Shale, blue	83	100	Sand, hard	5	575
Shale, brown	130	230	Shale, brown, sandy	15	590
Shale, sandy	65	295	Sand, water-bearing	10	600
Sand, water-bearing	10	305	Gumbo	20	620
Sand, brown	42	347	Sand	50	670
Gumbo	56	403	Gumbo	7	677
Sand, water-bearing	77	480	Sand, water-bearing	15	692
Gumbo, brown	10	490	Gumbo	2	694

S2-94

[Catarina Farms, 13½ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	8	8	Shale, blue	45	390
Clay, yellow	67	75	Shale, gray, sandy	113	503
Shale, blue	103	178	Sand, water-bearing, salty	22	525
Lime	5	183	Shale, red	28	553
Shale, gray	130	313	Sand	74	627
Shale, sandy	32	345	Shale, brown; with some coal	5	632
Sand	54	686	Sand	35	1,118
Shale, red	8	694	Shale, dark-brown	10	1,128
Sand	36	730	Sand	37	1,165
Shale, brown and gray	76	806	Shale, brown	15	1,180
Shale, hard, sandy	19	825	Sand	22	1,202
Shale, blue; and sand	57	882	Shale, brown	13	1,215
Shale, brown, gray and red	107	989	Sand, water-bearing	209	1,424
Shale, sandy	16	1,005			
Shale, brown	65	1,070			
Sand, hard	13	1,083			

S2-113

[H. Rouw, 4¾ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	10	10	Shell, hard	5	490
Caliche	30	40	Shale, brown, sandy	40	530
Shale, blue	60	100	Sand, dark-gray	15	545
Sand, water-bearing	60	160	Shale, blue	25	570
Sand, blue	70	230	Sand, dark-gray	80	650
Sand	30	260	Shale, sandy	25	675
Shale, brown	44	304	Sand, broken	35	710
Carrizo sand	81	385	Shale, blue	90	800
Shale, gray	35	420	Shale	100	900
Sand, gray	20	440			
Shale, blue, sandy	10	450			
Shale, blue	35	485			

S2-115

[H. Rouw, 5 miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shell, gray	5	240
Caliche, yellow	17	20	Sand	90	330
Shale, brown	30	50	Shale, brown	15	345
Shale, blue	70	120	Sand, gray	60	405
Shale, sandy	50	170	Gumbo, brown	45	450
Shale, brown	60	230	Sand, gray	20	470
Shale, hard	5	235	Gumbo, gray	36	506

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

S2-128

[William Volbrect, 5½ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, light-red; and clay	3	3	Sandstone, fine-grained	15	312
Clay, pale-blue	6	9	Sand and clay	20	332
Sand and yellow clay	25	34	Clay, blue	45	377
Clay, yellow	30	64	Clay, dark-blue	40	417
Clay, pale to dark-blue	35	99	Sand and clay	45	462
Sandstone, water-bearing, salty	3	102	Sandrock, fine-grained, water-bearing	60	522
Clay, blue, sticky	50	152	Sandstone, water-bearing	160	682
Clay, blue; with thin lenses of coal	100	252	Fine-grained sand and clay	38	720
Sand and clay	45	297			

S2-132

[J. C. Oelkers, 2¾ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, fine-grained	10	340
Sandrock	2	5	Broken sand and shale	30	370
Clay, yellow	25	30	Shale, loose	80	450
Shale, blue	40	70	Shale	15	465
Shale, gray	80	150	Sand	10	475
Shale, brown	50	200	Shale, brown, sandy	65	540
Shale, gray	45	245	Sand, loose	20	560
Sand and shale	10	255	Gumbo	5	565
Sand and shale	75	330			

S2-137

[H. Rouw, 4¾ miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand	105	400
Sandrock	13	15	Sand, gray	40	440
Clay, yellow	25	40	Shale, brown	10	450
Shale, blue	50	90	Shale, gray	20	470
Shale, brown	10	100	Gumbo	95	565
Shale, sandy	80	180	Sand, gray	25	590
Sand, water-bearing	10	190	Sand, broken	50	640
Shale, blue	50	240	Gumbo, blue	10	650
Sand	20	260	Sand, gray	8	658
Shale, brown	35	295	Gumbo	17	675

S3-26

[J. T. Baber, 22 miles southeast of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	45	45	Brown "shell"	43	955
Gravel	40	85	Sand	22	977
Shale, black	25	110	Lignite	2	979
Sand	8	118	Shale, brown	13	992
Shale, white	27	145	Sand, water-bearing	33	1,025
Sand	20	165	Shale, white	10	1,035
Shale, white	20	185	Sand, green	30	1,065
Sand, water-bearing, salty	25	210	Shale, brown	10	1,075
Shale, white	105	315	Sand	20	1,095
Sand "shells"	15	330	Shale, lignite and asphalt?	25	1,120
Shale, white	113	443	Sand, 50 gpm flow	48	1,168
Sand, water-bearing	22	465	Shale, white; and "shell"	17	1,185
Shale, white	45	510	Sand and "shell"	40	1,225
Sand; some water	8	518	Shale, sand, and "shell"	130	1,355
Shale, white; and "shell"	37	555	Sand	10	1,365
Sand	20	575	Shale, sand, and "shell"	53	1,418
Shale, white	41	616	Sand	7	1,425
Sand	7	623	Shale, sand, and "shell"	12	1,437

Table 10.—*Drillers' logs of wells in Dimmit and Zavala Counties and eastern Maverick County, Tex.*—Continued

S3-26--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Shale, brown	15	638	Sand	21	1,458
Sand; some water	20	658	Sand, very hard	7	1,465
Shale, brown	17	675	Sand; some water	25	1,490
Sand; small flow of soda water	45	720	Shale, brown	15	1,505
Shale, brown and white	75	795	Sand, water-bearing	40	1,545
Sand	35	830	Sand, good	90	1,635
Shale, white	10	840	Sand and shale	25	1,660
Sand	35	875	Sand, hard	5	1,665
Shale, brown	37	912	Sand, water-bearing	35	1,700

S4-2

[McRory Estate, 14¼ miles southwest of Carrizo Springs]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Clay, brown; and sand	25	422
Clay, yellow, soft	57	60	Sandrock with good water	18	440
"Soapstone", blue	7	67	Clay, brown; sand and gravel	154	594
Sandrock, hard	6	73	Clay, brown; and sand	186	780
Coal, black, hard	3	76	Sandrock, blue	3	783
Clay, blue	62	138	Clay, brown	42	825
Sandrock, soft	8	146	Sandrock with good water	20	845
Coal, black	1	147	Clay, blue; and sand	16	861
Clay, blue and brown	50	197	Sandrock with good water	30	891
Sandrock, soft	10	207	Clay, blue; and sand	9	900
Coal	2	209	Sand, white, water-bearing	41	941
"Soapstone", blue	25	234	"Soapstone"	19	960
Clay, brown	3	237			
Coal	2	239			
Sandrock, water-bearing, salty	25	264			
Clay, white; and sand	13	277			
Clay, blue and brown	90	367			
Sandrock, water-bearing, bitter taste	30	397			

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*

H7-20

[O. V. Vickery. 5¼ miles north of La Pryor. Used drilled domestic and stock well, diameter 6 inches, depth 130 feet. Measuring point, top of 1-inch board cover, 0.5 foot above land-surface datum and 765.46 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 13, 1929	72.85	692.11	Aug. 31, 1932	74.25	690.71
Jan. 3, 1930	72.80	692.16	Apr. 11, 1933	74.25	690.71
Feb. 28	72.90	692.06	July 21	74.00	690.96
Mar. 13	72.90	692.06	Jan. 10, 1938	74.65	690.31
Apr. 9	72.85	692.11	Apr. 9, 1939	75.19	689.77
Apr. 18	73.20	689.76	July 31, 1940	76.18	688.78
May 20	73.03	691.93	Aug. 2, 1941	76.55	688.41
June 23	73.00	691.96	Aug. 1, 1942	77.38	687.58
July 22	73.30	691.66	July 6, 1944	76.17	688.78
Aug. 27	73.30	691.66	July 21, 1945	75.88	589.08
Sept. 29	73.35	691.61	July 11, 1946	75.40	689.56
Dec. 17	73.40	691.56	July 25, 1947	75.66	689.30
May 14, 1931	74.30	690.66	Aug. 27, 1948	72.08	692.88
Oct. 30	73.85	691.11	Sept. 15	76.08	688.95
Jan. 13, 1932	74.20	690.76			
Apr. 2	74.20	690.76			

M3-29

[R. W. Norton. 13½ miles west of La Pryor. Used drilled stock well, diameter 6 inches, depth 150 feet. Measuring point top of 4 by 4-inch wood pipe clamp, 0.5 foot above land-surface datum and 755.65 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 25, 1930	96.70	658.45	Sept. 22, 1933	96.40	658.75
Feb. 22	97.05	658.10	Aug. 24, 1936	96.65	658.50
Apr. 18	96.30	658.85	July 11, 1937	96.76	658.39
May 20	96.20	658.95	Aug. 12	96.64	658.51
June 20	95.30	659.85	Jan. 10, 1938	96.66	658.49
July 16	96.20	658.95	Aug. 26	96.74	658.41
Aug. 25	96.30	658.85	July 12, 1946	97.60	657.55
Sept. 29	96.35	658.80	July 25, 1947	97.61	657.54
Feb. 10, 1932	96.10	659.05	Sept. 16, 1948	97.75	657.40
Aug. 28	96.25	658.90			
Dec. 21	95.95	659.20			

M6-10

[W. M. Van Cleve. 16¼ miles northwest of Crystal City. Used drilled domestic and stock well, diameter 5-5/8 inches, depth 150 feet. Measuring point, top of pipe clamp, 1.5 feet above land-surface datum and 653.15 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 21, 1930	70.15	581.50	Dec. 21, 1932	70.90	580.75
Feb. 19	71.90	579.75	Mar. 18, 1933	70.25	581.40
June 17	73.45	578.20	Sept. 21	68.65	583.00
July 11	71.30	579.35	Aug. 27, 1934	73.10	578.55
Aug. 26	70.60	581.05	Aug. 26, 1936	73.81	577.84
Sept. 25	70.35	581.30	July 14, 1937	73.51	578.14
Dec. 11	68.60	583.05	Aug. 16	73.41	578.24
Feb. 7, 1931	69.50	582.15	Jan. 12, 1938	74.97	576.68
Mar. 4	69.10	582.55	Aug. 24	72.55	579.10
Apr. 25	69.20	582.45	Apr. 6, 1939	76.90	574.75
June 28	68.20	583.45	Aug. 2, 1940	73.17	578.48
July 2	67.45	584.20	Aug. 2, 1941	73.37	578.28
Oct. 2	65.60	586.05	Aug. 7, 1942	76.17	575.48
Nov. 6	67.60	584.05	Aug. 9, 1943	79.58	572.07
Dec. 4	71.25	580.40	July 10, 1944	79.44	572.21
Jan. 7, 1932	72.20	579.45	July 23, 1945	79.28	572.37
Feb. 11	73.25	578.40	July 12, 1946	83.78	567.87
Mar. 18	73.35	578.30	Sept. 16, 1948	97.08	554.57
July 6	73.02	578.63			
Aug. 29	71.20	580.45			

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

M6-16

[J. W. Stuart. 14¾ miles northwest of Crystal City. Used drilled domestic and stock well, diameter 5-3/16 inches, depth 300 feet. Measuring point, hole in side of casing, at land-surface datum and 626.55 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 17, 1930	43.90	582.65	July 6, 1932	41.90	584.65
Feb. 19	42.70	584.55	Aug. 29	41.75	584.80
Mar. 17	42.85	583.70	Dec. 21	41.76	584.79
Apr. 16	42.80	583.75	Mar. 18, 1933	41.80	584.75
May 19	42.00	584.55	Aug. 27, 1934	42.35	584.20
June 17	41.40	585.15	Mar. 13, 1935	43.70	582.85
July 15	41.10	585.45	Jan. 26, 1936	42.70	583.85
Aug. 26	40.90	585.65	Aug. 26	41.05	585.50
Sept. 25	40.85	585.70	July 14, 1937	39.67	586.88
Nov. 4	40.40	586.15	Aug. 16	39.69	586.66
Dec. 11	40.25	586.30	Jan. 12, 1938	38.40	588.15
Feb. 6, 1931	40.55	586.00	Aug. 24	40.74	585.15
Mar. 4	40.55	586.00	Apr. 6, 1939	41.55	585.00
Apr. 25	40.75	585.80	Aug. 14	42.00	584.55
June 8	40.80	585.75	Aug. 2, 1940	42.66	583.89
July 3	40.70	585.85	Aug. 7, 1942	47.13	579.42
Oct. 2	40.05	586.50	Aug. 9, 1943	46.40	580.15
Nov. 6	40.35	586.20	July 10, 1944	47.11	579.44
Dec. 4	40.95	585.60	July 23, 1945	46.82	579.73
Jan. 7, 1932	41.10	585.45	July 12, 1946	47.40	579.15
Feb. 11	41.50	585.05	July 23, 1947	49.41	577.14
Mar. 18	41.60	584.95	Oct. 16, 1948	49.62	576.93

M6-18

[N. E. Ware. 14 miles northwest of Crystal City. Used drilled domestic and stock well, diameter 5-5/8 inches, depth 530 feet. Measuring point, top of pipe clamp, 0.7 foot above land-surface datum and 612.90 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 17, 1930	35.80	576.40	Sept. 20, 1933	32.95	579.25
Feb. 19	40.00	572.90	Aug. 27, 1934	38.45	573.75
Mar. 17	40.80	571.40	Jan. 26, 1936	39.80	572.40
Apr. 16	41.90	570.30	July 14, 1937	39.49	572.71
May 19	41.65	570.55	Aug. 16	39.15	573.05
June 17	38.40	573.80	Jan. 12, 1938	40.08	572.12
July 15	36.80	575.40	Aug. 24	37.26	574.94
Aug. 26	38.65	573.45	Apr. 6, 1939	44.00	568.20
Sept. 25	40.00	572.20	Aug. 12	41.39	570.81
Nov. 4	34.20	578.00	Aug. 2, 1940	38.06	574.14
Mar. 4, 1931	35.85	576.35	Aug. 2, 1941	38.06	574.14
June 8	32.20	580.00	Aug. 7	41.51	570.69
July 3	31.40	580.80	Aug. 9, 1943	46.55	566.65
Oct. 2	29.65	582.55	July 10, 1944	44.78	567.42
Nov. 6	33.35	578.85	Aug. 14	44.80	567.40
Dec. 4	37.75	574.65	July 23, 1945	44.74	567.76
Jan. 7, 1932	37.40	574.80	July 12, 1946	51.66	560.54
Feb. 11	40.10	572.10	July 23, 1947	56.43	555.77
Mar. 18	38.40	573.80	Sept. 16, 1948	66.94	545.26
July 6	38.15	574.05			
Aug. 29	35.67	576.53			
Dec. 21	35.92	576.28			
Mar. 18, 1933	34.70	577.50			

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

M6-19

[L. D. Van Cleve. 14 miles west of Crystal City. Used drilled domestic and stock well, diameter 5-5/8 inches, depth 180 feet. Measuring point, top of pipe clamp, 0.5 foot above land-surface datum and 632.55 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 17, 1930	49.15	582.90	Mar. 18, 1933	50.95	581.10
Feb. 19	50.40	581.65	Sept. 21	51.30	580.75
Mar. 17	50.45	581.60	Mar. 13, 1935	56.80	575.25
Apr. 16	51.60	580.45	July 31	55.10	576.85
May 19	50.60	581.45	Jan. 26, 1936	51.90	580.15
June 17	49.60	582.42	Aug. 26	57.20	574.85
July 15	49.60	582.42	July 14, 1937	55.63	576.42
Aug. 26	50.15	581.90	Aug. 16	55.38	576.67
Sept. 25	50.30	581.75	Jan. 12, 1938	57.13	580.92
Nov. 4	49.40	582.65	Aug. 24	56.01	581.04
Dec. 11	49.35	582.70	Apr. 6, 1939	59.30	572.75
Feb. 4, 1931	49.55	582.50	Aug. 14	55.23	576.82
Mar. 4	49.30	582.75	Aug. 2, 1940	56.00	576.05
Apr. 25	52.05	580.00	Aug. 2, 1941	58.26	573.79
June 8	53.80	578.25	Aug. 7, 1942	59.55	572.50
July 3	48.70	583.35	Aug. 9, 1943	61.65	570.40
Oct. 2	48.50	583.55	July 10, 1944	61.60	570.45
Nov. 6	50.20	581.85	Aug. 14	61.92	570.13
Dec. 4	51.10	580.95	July 23, 1945	62.41	569.64
Jan. 7, 1932	51.15	580.90	July 12, 1946	64.99	567.07
Feb. 10	51.90	580.15	July 23, 1947	66.98	565.07
Mar. 18	51.65	580.40	Aug. 9, 1948	67.95	564.10
Aug. 29	51.78	580.27	Sept. 16	68.98	563.07
Dec. 21	51.52	580.53			

M9-1

[T. B. Mear. 11¾ miles west of Crystal City. Used drilled domestic and stock well, diameter 6 inches, depth 335 feet. Measuring point, top of pipe clamp, 1.0 foot above land-surface datum and 633.30 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Feb. 6, 1928	45.20	587.10	Aug. 29, 1932	55.85	576.45
Dec. 18, 1929	58.20	574.10	Dec. 21	56.45	576.85
Jan. 16, 1930	61.20	571.10	Mar. 18, 1933	56.60	576.70
Feb. 19	59.80	572.50	Sept. 21	54.75	577.55
Mar. 17	60.80	571.50	Aug. 27, 1934	64.10	568.20
Apr. 16	70.70	561.60	Aug. 26, 1936	63.71	568.59
May 19	57.00	575.30	July 14, 1937	60.05	572.25
June 17	54.30	578.00	Aug. 16	67.48	564.82
July 15	53.75	578.55	Aug. 24, 1938	66.78	565.52
Aug. 26	55.25	577.05	Apr. 6, 1939	77.66	554.64
Sept. 25	57.25	575.05	Aug. 14	70.61	561.69
Nov. 4	52.65	579.65	Aug. 2, 1940	62.78	569.52
Dec. 11	51.25	581.05	Aug. 2, 1941	64.44	567.86
Mar. 4, 1931	51.50	580.80	Aug. 7, 1942	71.59	560.79
Apr. 25	53.35	578.85	Aug. 7, 1943	72.12	560.18
July 2	50.65	581.65	Dec. 19	68.23	564.07
Nov. 6	57.15	575.15	July 10, 1944	68.43	563.87
Dec. 4	59.75	572.55	Aug. 14	69.44	562.86
Jan. 7, 1932	56.40	575.90	July 23, 1945	75.49	556.81
Feb. 11	63.70	568.60	July 23, 1947	79.54	553.76
Mar. 18	61.15	571.15	Aug. 9, 1948	92.14	540.16
July 6	57.10	575.20	Sept. 15	86.95	545.35

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

M9-9

[Myers. 12¼ miles southwest of Crystal City. Used drilled stock well, diameter 10 inches, depth not available. Measuring point, top of casing, 3.0 feet above land-surface datum and 688.65 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 12, 1929	75.10	610.55	Mar. 22, 1933	76.75	608.90
Feb. 19, 1930	75.15	610.50	Mar. 13, 1935	77.85	607.80
Aug. 26	75.50	610.15	Aug. 26, 1936	78.30	607.35
Feb. 6, 1931	75.55	610.10	July 14, 1937	78.44	607.21
Mar. 4	75.60	610.05	Aug. 15	78.52	607.13
Apr. 25	75.60	610.05	Jan. 11, 1938	79.56	606.09
June 8	75.75	609.90	Aug. 24	84.43	601.22
July 3	75.85	609.80	Apr. 6, 1939	83.34	602.31
Aug. 5	75.80	609.85	Aug. 14	82.30	603.35
Oct. 2	75.90	609.75	Aug. 3, 1941	83.31	602.34
Nov. 6	76.00	609.65	Aug. 7, 1942	85.83	600.32
Dec. 4	76.05	609.60	Aug. 9, 1943	85.84	599.81
Jan. 7, 1932	76.15	609.50	July 23, 1945	85.55	600.10
Feb. 11	76.35	609.30	July 12, 1946	87.34	598.31
Mar. 17	76.40	609.25	July 23, 1947	87.60	598.05
July 6	76.49	609.16	Sept. 16, 1948	87.48	598.17
Aug. 29	76.38	609.27			

N1-24

[J. C. Williams. 2½ miles west of La Pryor. Used drilled irrigation well, diameter 12 inches, depth 350 feet. Measuring point, top of iron water pipe clamp, 0.3 foot above land-surface datum and 754.00 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 23, 1929	120.20	633.50	July 27, 1935	123.80	629.90
Feb. 22, 1930	122.88	630.90	Jan. 22, 1936	128.52	625.18
Mar. 26	120.80	632.90	Aug. 24	122.42	631.28
Apr. 18	120.50	633.90	July 9, 1937	122.72	630.98
May 20	119.10	634.60	Aug. 12	125.38	628.12
June 20	117.85	635.85	Jan. 10, 1938	125.78	627.92
July 16	116.20	637.50	Aug. 25	121.33	632.37
Aug. 25	116.00	637.70	Apr. 9, 1939	126.06	627.64
Sept. 30	117.45	636.25	July 21	125.32	628.38
Dec. 18	121.60	632.10	Aug. 21	126.54	627.16
Feb. 11, 1931	118.30	635.40	July 31, 1940	122.99	630.71
June 9	116.30	638.40	Aug. 6, 1941	123.83	629.87
July 6	114.70	639.00	Aug. 6, 1942	126.05	627.65
Oct. 15	117.60	636.10	Aug. 14, 1943	133.43	620.27
Jan. 8, 1932	126.60	627.10	Dec. 18	129.39	624.31
Feb. 10	126.10	627.60	July 6, 1944	130.88	622.82
July 7	118.80	634.90	Aug. 9	132.14	621.56
Aug. 28	117.35	636.35	July 21, 1945	133.58	620.12
Dec. 21	123.50	630.20	July 11, 1946	141.20	612.50
Mar. 21, 1933	119.50	633.80	July 24, 1947	159.74	593.96
Mar. 15, 1935	130.55	623.45	Aug. 3, 1948	177.30	576.40
			Sept. 15	168.70	585.00

N1-39

[R. W. Norton. 8½ miles west of La Pryor. Used drilled stock well, diameter 6 inches, depth 300 feet. Measuring point, top of water pipe clamp, 1.4 feet above land-surface datum and 732.90 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 25, 1930	74.40	657.10	Jan. 8, 1932	78.20	653.30
Feb. 22	74.70	656.80	Feb. 10	80.20	651.30
July 16	75.00	656.50	Mar. 23	75.90	655.60
Aug. 25	77.75	653.75	Mar. 24, 1933	74.93	656.57
Sept. 29	76.75	654.75	July 12, 1946	78.45	652.95
Dec. 18	77.40	654.10	July 25, 1947	79.79	651.71
Feb. 11, 1931	78.10	653.40	Aug. 10, 1948	83.26	648.24
July 6	76.30	655.20	Sept. 16	81.99	649.51
Oct. 15	75.00	656.50			

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N1-40

[I. T. Pryor. 2 miles southwest of La Pryor. Used drilled stock well, diameter 10 inches, depth not available. Measuring point, top of 6 by 6 pipe clamp, 1.5 feet above land-surface datum and 726.45 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 4, 1930	122.30	612.65	Mar. 15, 1935	123.90	601.05
Feb. 22	115.70	609.25	July 27	114.10	610.85
May 20	113.50	611.45	July 9, 1937	110.51	614.44
June 20	111.40	613.55	Aug. 12	105.36	619.59
July 16	119.50	615.45	Jan. 10, 1938	109.44	615.51
Aug. 25	118.50	616.45	Aug. 25	101.44	623.51
Sept. 30	108.65	616.30	July 21, 1939	112.98	611.97
Dec. 18	113.75	604.30	July 31, 1940	103.55	621.40
Feb. 11, 1931	111.50	613.45	Aug. 16, 1941	104.07	620.88
June 9	105.00	619.95	Aug. 6, 1942	107.87	617.08
July 6	103.25	621.70	Aug. 14, 1943	115.58	609.37
Feb. 10, 1932	119.85	605.10	July 6, 1944	114.12	610.83
Mar. 23	116.00	608.95	Aug. 9	114.63	610.32
July 7	109.50	615.45	July 11, 1946	123.82	601.13
Aug. 28	106.95	618.00	July 24, 1947	146.68	578.01
Dec. 21	114.83	610.12	Sept. 16, 1948	166.48	558.47
Mar. 24, 1933	109.90	615.05			
Sept. 21	104.40	620.55			

N5-39

[Richie Bros. 2¼ miles northeast of Crystal City. Used drilled irrigation well, diameter 12½ inches, depth 940 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 584.40 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 26, 1929	74.58	508.82	Sept. 15, 1933	45.65	537.75
Dec. 18	88.55	495.05	Aug. 29, 1934	56.10	527.30
Mar. 25, 1930	101.90	481.50	Mar. 7, 1935	116.10	467.30
Apr. 19	105.90	477.50	Aug. 1	57.60	525.80
May 24	75.90	507.50	Jan. 25, 1936	90.18	493.22
June 20	63.25	520.15	Aug. 23	61.22	522.18
July 17	58.20	525.20	July 11, 1937	56.44	526.96
Aug. 20	63.20	520.20	Aug. 17	58.02	525.38
Sept. 25	77.35	506.05	Jan. 14, 1938	60.12	523.28
Oct. 30	59.80	523.60	Aug. 18	49.68	533.72
Dec. 9	67.30	516.10	Apr. 7, 1939	76.80	506.60
Jan. 8, 1931	89.90	493.50	July 20	63.94	519.46
Feb. 4	59.30	524.10	Aug. 16	59.61	522.79
Mar. 2	49.50	533.90	Aug. 1, 1940	40.87	542.53
Apr. 23	60.10	523.30	Aug. 2, 1941	41.03	542.37
May 23	44.80	538.60	Aug. 11, 1942	59.72	523.68
Dec. 1,	128.90	454.50	Aug. 11, 1943	73.19	510.21
Jan. 4, 1932	85.60	497.80	Dec. 20	71.98	511.42
Feb. 2	97.15	486.25	July 6, 1944	67.60	515.80
Mar. 17	78.70	504.70	Aug. 9	79.98	503.42
May 5	74.55	508.85	July. 21, 1945	77.89	505.51
Aug. 26	48.10	535.30	July 11, 1946	93.21	490.19
Dec. 19	81.65	501.75	July 24, 1947	105.15	478.25
Mar. 17, 1933	59.10	524.30	Aug. 11, 1948	146.33	437.07

N5-40

[Richie Bros. 2½ miles east of Crystal City. Used drilled irrigation well, diameter 12½ inches, depth 1,070 feet. Measuring point, top of pump base, at land-surface datum and 578.74 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 26, 1929	81.38	497.36	July 17	57.65	521.09
Dec. 18	88.85	489.89	Aug. 20	61.30	517.44
Feb. 20, 1930	122.70	456.04	Sept. 25	77.10	501.64
Mar. 25	102.50	476.24	Oct. 30	58.70	520.04
Apr. 19	101.40	477.34	Dec. 9	68.75	509.99
May 24	74.85	503.89	Jan. 8, 1931	89.10	489.64
June 20	62.80	515.94	Feb. 4	58.80	519.94

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
		N5-40--Continued			
Mar. 2, 1931	48.75	529.99	July 11, 1937	54.94	523.80
Apr. 23	57.75	520.99	Aug. 17	55.10	523.64
July 24	33.30	545.44	Jan. 14, 1938	59.24	519.50
Sept. 28	46.35	532.39	Aug. 18	49.97	528.77
Dec. 1	130.60	448.14	Apr. 7, 1939	76.10	502.64
Jan. 4, 1932	85.00	493.74	July 20	62.57	516.17
Feb. 2	96.90	481.84	Aug. 16	55.92	522.82
Mar. 17	75.30	503.44	Aug. 1, 1940	39.70	539.04
May 5	72.65	506.09	Aug. 2, 1941	38.80	539.94
Aug. 26	47.10	531.64	Aug. 11, 1942	57.88	520.86
Dec. 19	81.95	496.79	Aug. 11, 1943	69.73	509.01
Mar. 17, 1933	57.05	521.69	July 6, 1944	65.38	513.36
Sept. 15	42.55	536.19	Aug. 9	76.54	502.20
Aug. 29	56.50	522.24	July 21, 1945	75.11	502.63
Mar. 7, 1935	116.30	462.44	July 11, 1946	85.79	492.95
Aug. 1	54.90	523.84	July 24, 1947	102.46	476.28
Aug. 23, 1936	58.33	520.41	Sept. 13, 1948	144.09	434.65

N5-55

[Warren Wagner. 2 miles east of Crystal City. Used drilled irrigation well, diameter 10 inches, depth 1,070 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 578.15 feet above mean sea level]

Nov. 27, 1929	81.63	495.52	Dec. 19, 1932	84.86	492.29
Dec. 18	111.70	465.45	Mar. 17, 1933	59.40	517.75
Feb. 20, 1930	120.80	456.35	Sept. 15	44.40	532.75
Mar. 25	106.40	470.75	Aug. 29, 1934	56.55	520.60
Apr. 19	104.00	473.15	Mar. 7, 1935	116.60	460.55
May 24	79.25	497.90	July 20	57.70	519.45
June 20	66.40	510.75	Jan. 25, 1936	85.85	491.30
July 17	61.00	516.15	Aug. 25	58.51	518.64
Aug. 20	64.70	512.45	July 11, 1937	56.16	520.99
Sept. 25	79.75	497.40	Aug. 17	55.80	521.35
Oct. 30	63.70	513.45	Jan. 14, 1938	61.98	515.17
Dec. 9	70.75	506.40	Aug. 17	48.87	528.28
Jan. 8, 1931	91.30	485.85	Apr. 7, 1939	81.59	495.56
Feb. 4	61.90	515.25	July 18	62.98	514.17
Mar. 2	51.55	525.60	Aug. 16	58.02	519.13
Apr. 23	60.10	517.05	Aug. 1, 1940	42.55	534.60
May 23	46.50	530.65	Aug. 2, 1941	42.23	534.92
June 24	42.40	534.75	Aug. 11, 1942	61.40	515.75
July 24	35.50	541.65	Aug. 11, 1943	75.43	501.72
Sept. 28	46.05	531.10	Dec. 20	76.48	500.67
Dec. 1	131.95	445.20	July 7, 1944	71.20	505.95
Jan. 4, 1932	85.55	491.60	Aug. 9	82.37	494.78
Feb. 2	97.15	480.00	July 21, 1945	80.28	496.87
Mar. 17	76.95	500.20	July 11, 1946	88.82	488.33
May 5	75.90	501.25	July 24, 1947	107.50	469.65
Aug. 26	50.10	527.05	Sept. 13, 1948	149.91	427.24

N5-60

[Julius DeWinnie. 4 miles east of Crystal City. Unused drilled irrigation well, diameter and depth not available. Measuring point, top of casing, at land-surface datum and 582.85 feet above mean sea level]

Nov. 16, 1929	81.00	501.85	Sept. 25, 1930	89.70	493.15
Jan. 21, 1930	109.40	473.45	Oct. 30	64.95	517.90
Mar. 25	111.20	471.65	Feb. 4, 1931	66.70	516.15
Apr. 19	99.60	483.25	Mar. 2	56.35	526.50
May 24	81.55	501.30	Apr. 23	59.10	523.75
June 20	71.15	511.70	May 23	48.85	534.00
July 17	63.00	519.85	June 24	44.25	538.60
Aug. 20	64.25	518.60	July 24	38.80	544.05

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N5-60--Continued

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Sept. 28, 1931	58.75	524.10	July 18, 1939	62.43	520.42
Mar. 17, 1932	83.25	499.60	Aug. 16	58.29	524.56
May 5	77.30	505.55	Dec. 12	67.00	515.85
Aug. 26	51.70	531.15	Aug. 1, 1940	49.67	533.18
Dec. 19	95.90	486.95	Aug. 2, 1941	41.43	541.42
Jan. 25, 1936	114.10	468.75	July 6, 1944	66.73	516.12
Aug. 23	61.51	521.34	Aug. 9	76.61	506.24
July 11, 1937	54.29	528.56	July 11, 1945	90.33	492.52
Jan. 14, 1938	61.13	521.72	July 24, 1947	116.17	466.68
Aug. 18	51.09	531.76	Aug. 8	168.51	414.34
			Sept. 13	148.46	434.39

N7-34

[Byrd Cattle Co. 8 miles north of Carrizo Springs. Unused drilled irrigation well, diameter 8 inches, depth not available. Measuring point, top of casing, at land-surface datum and 576.40 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 7, 1929	50.70	525.70	Sept. 15, 1933	35.90	540.50
Feb. 5, 1930	64.60	511.80	Aug. 29, 1934	41.85	534.55
Apr. 18	60.15	516.25	July 28, 1935	44.25	532.15
May 24	50.70	525.70	Jan. 24, 1936	58.95	517.45
June 21	46.80	529.60	Aug. 24	46.75	529.65
July 26	45.20	531.20	July 12, 1937	44.54	531.86
Aug. 20	47.10	529.30	Aug. 15	45.96	530.44
Sept. 25	50.50	525.90	Jan. 11, 1938	45.81	530.59
Oct. 30	49.40	527.00	Aug. 18	40.72	535.68
Dec. 9	45.70	530.70	Apr. 7, 1939	69.62	506.78
Jan. 8, 1931	51.60	524.80	July 15	48.46	527.94
Feb. 4	44.00	532.40	Aug. 16	44.84	531.56
Mar. 2	37.80	538.60	July 31, 1940	34.13	542.27
Apr. 23	44.90	531.50	Aug. 2, 1941	34.70	541.70
May 23	35.80	540.60	Aug. 8, 1942	47.23	529.17
June 24	35.50	540.90	Aug. 12, 1943	60.45	515.95
July 24	28.65	547.75	Dec. 19	58.44	517.96
Sept. 28	33.35	543.05	July 9, 1944	55.65	520.75
Nov. 3	50.60	525.80	July 21, 1945	62.81	513.59
Dec. 1	56.65	519.75	July 12, 1946	64.53	511.87
Jan. 4, 1932	45.85	530.55	July 23, 1947	55.85	520.55
Feb. 2	46.55	529.85	May 14, 1948	57.24	519.16
Mar. 17	44.15	532.25	Aug. 10	58.19	518.21
May 5	45.00	531.40	Sept. 14	58.92	517.43
July 5	41.70	534.70			
Aug. 26	41.70	534.70			
Dec. 19	45.05	531.35			
Mar. 17, 1933	40.15	536.25			

N7-78

[C. Schmitt. 2 miles northwest of Carrizo Springs. Used drilled irrigation well, diameter 10 inches, depth 300 feet. Measuring point, top of casing, 1.0 foot above land-surface datum and 676.00 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 6, 1930	91.70	583.30	July 2, 1931	94.00	581.00
Feb. 19	91.95	583.05	Oct. 2	94.20	580.80
Mar. 17	92.00	583.00	Nov. 6	94.70	580.30
June 17	92.40	582.60	Dec. 4	94.30	580.70
July 15	92.65	582.35	Jan. 7, 1932	94.30	580.70
Aug. 26	92.80	582.20	Mar. 19	95.00	580.00
Sept. 25	92.90	582.10	June 30	95.85	579.15
Oct. 20	93.00	582.00	Aug. 28	96.47	578.53
Dec. 11	93.05	581.95	Dec. 22	96.40	578.60
Jan. 9, 1931	93.90	581.10	Mar. 18, 1933	96.20	578.80
Feb. 6	93.15	581.85	Sept. 20	97.10	577.90
Apr. 25	93.70	581.30	July 31, 1935	99.70	575.30
June 8	93.70	581.30	Jan. 24, 1936	99.55	575.45

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N7-78--Continued

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
July 14, 1937	101.36	573.64	Aug. 8, 1942	107.86	567.14
Aug. 18	101.69	573.31	Aug. 7, 1943	109.22	565.78
Jan. 11, 1938	101.57	573.43	July 8, 1944	106.88	568.12
Aug. 23	101.72	573.28	Aug. 14	108.13	566.87
Apr. 5, 1939	103.62	571.38	July 23, 1945	107.90	567.10
July 19	103.61	571.39	July 12, 1946	108.99	565.01
Aug. 13	103.92	571.08	July 23, 1947	111.28	562.72
Aug. 2, 1940	103.32	571.68	Sept. 14, 1948	112.35	561.65
Aug. 3, 1941	105.52	569.48			

N7-95

[M. E. Cook. 3¼ miles west of Carrizo Springs. Unused drilled irrigation well, diameter 10¾ inches, depth 232 feet. Measuring point, top of casing, 0.5 foot above land-surface datum and 696.60 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 6, 1930	69.45	626.65	Dec. 22, 1932	74.00	622.10
Feb. 19	69.50	626.60	Mar. 18, 1933	74.15	621.95
Mar. 17	69.60	626.50	Aug. 27, 1934	73.55	622.55
Apr. 16	70.20	625.90	July 31, 1935	77.30	618.80
May 19	71.45	624.65	Jan. 24, 1936	72.35	623.75
June 17	70.24	625.85	Aug. 26	73.20	622.90
July 15	69.40	626.70	July 14, 1937	72.00	624.10
Aug. 26	71.10	625.00	Aug. 18	72.32	623.78
Sept. 25	71.05	625.05	Jan. 11, 1938	71.37	624.73
Oct. 20	70.85	625.25	Aug. 23	74.28	621.82
Dec. 11	69.35	626.75	Apr. 5, 1939	74.99	621.11
Jan. 9, 1931	69.35	626.75	July 14	74.51	621.59
Feb. 7	68.20	627.90	Aug. 13	74.48	621.62
Mar. 4	68.30	627.80	Aug. 2, 1940	74.17	621.93
Apr. 25	67.95	628.15	Aug. 3, 1941	74.22	621.88
June 8	71.75	624.35	Aug. 8, 1942	74.70	621.40
July 2	72.20	623.90	Aug. 7, 1943	76.50	619.60
Nov. 6	72.65	623.45	Dec. 19	75.14	620.96
Dec. 4	74.10	622.00	July 8, 1944	75.36	620.74
Jan. 7, 1932	73.10	623.00	Aug. 14	75.49	620.61
Mar. 19	73.60	622.50	July 23, 1945	76.32	619.78
July 1	79.75	616.35	July 10, 1946	75.98	620.12
Aug. 27	78.80	617.30			

N7-125

[A. J. Knaggs. In Carrizo Springs. Unused drilled well, diameter 6 inches, depth 133 feet. Measuring point, top of casing, 1.0 foot above land-surface datum and 613.54 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Feb. 26, 1930	57.50	555.04	Jan. 11, 1938	64.00	548.54
Sept. 12	58.50	554.04	Aug. 23	64.78	547.76
Feb. 6, 1931	58.30	554.24	Apr. 5, 1939	65.57	546.97
Apr. 25	58.75	553.79	July 19	65.68	546.86
June 8	58.35	554.19	Aug. 13	65.51	547.03
Oct. 3	58.60	553.94	Aug. 2, 1940	65.97	546.57
Dec. 4	59.00	553.54	Aug. 3, 1941	66.82	545.72
Jan. 7, 1932	58.85	553.69	Aug. 8, 1942	67.47	545.07
Feb. 11	58.65	553.89	Aug. 7, 1943	68.05	544.49
Mar. 19	59.55	552.99	Dec. 19	68.23	544.31
July 1	60.08	552.46	July 8, 1944	69.05	543.49
Aug. 29	59.83	552.71	Aug. 14	69.24	543.30
Dec. 22	58.78	553.76	July 23, 1945	69.52	543.02
Aug. 26, 1936	63.88	548.66	July 9, 1946	69.39	543.15
July 14, 1937	64.19	548.35	July 23, 1947	72.14	540.40
Aug. 13	64.03	548.51	Sept. 14, 1948	71.79	540.75

508883 O—60——15

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N8-7

[Walter Bidelspach. $10\frac{3}{4}$ miles northeast of Carrizo Springs. Used drilled irrigation well, diameter $15\frac{1}{2}$ inches, depth 1,085 feet. Measuring point, top of casing, 1.2 feet above land-surface datum and 571.45 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 27, 1929	78.15	492.10	Aug. 26, 1932	48.80	521.45
Dec. 18	86.05	484.20	Dec. 19	83.65	486.60
Jan. 21, 1930	91.90	478.35	Mar. 17, 1933	56.95	513.30
Feb. 20	113.00	457.25	Sept. 15	42.00	428.25
Mar. 25	103.00	467.25	Aug. 29, 1934	56.60	513.65
Apr. 19	96.20	474.05	Mar. 6, 1935	114.45	455.80
May 24	77.25	493.00	July 30	56.20	514.05
June 20	67.05	503.20	Jan. 25, 1936	80.25	490.00
July 15	60.30	509.95	Aug. 23	55.12	515.13
Aug. 20	61.70	508.55	July 11, 1937	52.29	517.96
Sept. 25	76.45	493.80	Aug. 17	52.00	518.25
Oct. 30	62.55	507.70	Jan. 14, 1938	59.63	510.62
Dec. 9	70.20	500.05	Aug. 17	50.35	519.90
Jan. 8, 1931	88.40	481.85	Apr. 7, 1939	75.14	495.11
Feb. 4	60.50	509.75	July 18	60.54	509.71
Mar. 2	50.15	520.10	Aug. 16	54.58	515.67
Apr. 23	65.20	514.05	Aug. 2, 1941	39.63	530.62
May 23	44.15	526.10	Aug. 11, 1942	58.51	511.74
June 24	39.70	530.55	Aug. 11, 1943	70.08	500.17
July 24	33.60	536.65	Dec. 20	74.39	495.86
Sept. 28	40.15	530.10	July 7, 1944	68.24	502.01
Nov. 3	96.05	474.20	Aug. 9	77.25	493.00
Jan. 4, 1932	80.80	489.45	July 21, 1945	75.42	494.83
Feb. 2	91.85	478.40	July 11, 1946	94.95	485.30
Mar. 17	71.75	498.50	July 24, 1947	102.50	467.75
May 5	71.90	498.35			

N8-19

[E. L. Omera. $5\frac{1}{4}$ miles northeast of Carrizo Springs. Used drilled irrigation well, diameter about 10 inches, depth not available. Measuring point, hole in pump base, at land-surface datum and 602.60 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 18, 1929	94.50	508.10	Jan. 4, 1932	87.98	514.62
Jan. 21, 1930	92.70	509.90	Feb. 2	88.80	513.80
Feb. 20	106.20	496.40	Mar. 17	82.13	520.47
Mar. 20	107.10	495.50	Apr. 13	92.45	510.15
Apr. 18	111.20	491.40	May 5	87.06	515.54
May 24	93.80	508.80	May 27	81.40	521.20
June 27	80.00	522.60	July 5	79.00	523.60
July 16	78.50	524.10	Aug. 26	77.10	525.50
Aug. 20	82.05	520.55	Dec. 19	87.01	515.59
Sept. 25	89.75	512.85	Mar. 17, 1933	71.25	531.35
Oct. 30	78.00	524.60	July 12, 1937	77.30	525.30
Dec. 9	77.00	525.60	Aug. 16	80.15	522.45
Jan. 8, 1931	88.60	514.00	Jan. 11, 1938	78.52	524.08
Feb. 4	75.35	527.25	Aug. 18	75.99	526.61
Mar. 2	68.15	534.45	Apr. 7, 1939	91.39	511.21
Apr. 23	77.20	525.40	July 19	82.70	519.90
May 23	65.30	537.30	Aug. 12	79.64	522.96
June 24	63.30	539.30	Aug. 1, 1940	69.33	533.27
July 8	60.98	541.62	Aug. 2, 1941	82.03	520.57
July 24	58.08	544.52	Aug. 8, 1942	83.42	519.18
Aug. 15	56.75	545.85	Aug. 12, 1943	85.03	517.57
Sept. 28	61.48	541.12	July 23, 1947	90.45	512.15
Nov. 3	87.89	514.71	Aug. 10, 1948	93.15	509.45
Dec. 1	102.80	499.80	Sept. 14	93.61	508.98

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N8-26

[G. C. Rheia. 5½ miles northeast of Carrizo Springs. Used drilled irrigation well, diameter 8 inches, depth 818 feet. Measuring point, top of casing, at land-surface datum and 548.80 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 18, 1929	62.95	485.85	Aug. 26, 1932	50.77	498.03
Dec. 19	70.40	478.40	Mar. 17, 1933	47.70	501.10
Jan. 21, 1930	73.40	475.40	Aug. 29, 1934	57.40	491.40
Feb. 20	85.00	463.80	Mar. 6, 1935	80.30	468.50
Mar. 25	93.75	455.05	Aug. 23, 1936	51.60	497.20
Apr. 19	86.80	462.00	July 11, 1937	47.45	501.35
May 24	76.50	472.30	Aug. 17	48.54	500.26
July 17	60.10	488.70	Jan. 14, 1938	57.17	491.63
Aug. 20	59.90	488.90	Aug. 17	47.13	501.67
Sept. 25	67.55	481.25	Apr. 9, 1939	66.21	482.59
Oct. 30	63.60	485.20	July 20	56.15	492.65
Dec. 9	54.60	494.20	Aug. 16	53.48	495.32
Jan. 8, 1931	64.45	484.35	July 31, 1940	37.97	510.83
Feb. 4	57.50	491.30	Aug. 2, 1941	39.38	509.42
Mar. 2	48.70	500.10	Aug. 11, 1943	73.47	475.33
Apr. 23	50.70	498.10	Dec. 19	79.23	469.57
May 23	43.50	505.30	July 8, 1944	66.84	481.96
June 24	37.40	511.40	Aug. 11	74.55	474.25
July 24	33.20	515.60	July 22, 1945	65.79	483.01
Sept. 28	30.80	518.00	July 11, 1946	74.07	474.73
Nov. 3	50.70	498.10	May 14, 1948	138.89	409.91
Dec. 1	82.20	466.60	Aug. 10	130.15	418.65
Jan. 4, 1932	65.80	483.00	Sept. 14	136.30	412.50
Feb. 2	65.80	483.00			
Mar. 17	60.10	488.70			

N8-28

[J. S. Ward. 5¾ miles northeast of Carrizo Springs. Used drilled domestic and stock well, diameter 6 inches, depth 1,008 feet. Measuring point, top of pipe clamp, 1.5 feet above land-surface datum and 548.51 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 18, 1929	63.30	483.71	Mar. 17, 1933	45.05	501.96
Dec. 19	70.85	476.16	Sept. 15	45.25	501.76
Jan. 21, 1930	73.75	473.26	Aug. 29, 1934	56.90	490.11
Feb. 20	85.50	461.51	Mar. 6, 1935	80.96	466.05
Apr. 19	86.55	460.46	July 31	54.30	492.71
May 24	76.70	470.31	Jan. 25, 1936	54.62	492.39
July 17	59.80	487.21	Aug. 28	50.12	496.89
Aug. 20	60.05	486.96	July 11, 1937	45.59	501.42
Sept. 25	64.55	482.46	Aug. 17	46.82	500.19
Oct. 30	63.40	483.61	Jan. 14, 1938	57.90	489.11
Dec. 9	54.35	492.66	Aug. 17	45.75	501.26
Jan. 8, 1931	64.85	482.16	Apr. 9, 1939	66.41	480.60
Feb. 4	57.10	489.91	July 20	55.02	491.99
Mar. 2	47.90	499.11	Aug. 16	53.36	494.65
Apr. 23	49.45	497.56	July 31, 1940	36.66	510.35
May 23	42.30	504.71	Aug. 2, 1941	37.84	509.17
June 24	35.30	511.71	Aug. 8, 1942	56.64	490.37
July 24	30.85	516.16	Aug. 11, 1943	73.16	473.85
Sept. 28	28.50	518.51	Dec. 19	79.65	467.36
Nov. 3	49.40	497.61	July 8, 1944	66.01	481.00
Dec. 1	81.30	465.71	Aug. 11	75.69	471.32
Jan. 4, 1932	66.00	481.01	July 22, 1945	64.25	482.76
Feb. 2	68.10	478.91	July 10, 1946	72.74	474.27
Mar. 18	58.65	488.36	July 23, 1947	88.35	458.66
May 5	69.40	477.61	May 14, 1948	134.95	412.06
Aug. 26	49.45	497.56	Aug. 10	126.06	420.95
Dec. 19	61.30	485.71	Sept. 13	131.61	415.40

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N8-40

[John Stahl. 2½ miles northeast of Carrizo Springs. Unused drilled irrigation well, diameter 5½ inches, depth 380 feet. Measuring point, top of casing, at land-surface datum and 557.59 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 5, 1929	51.50	506.09	Aug. 26, 1932	46.95	510.64
Dec. 19	43.65	513.94	Dec. 19	33.80	523.79
Jan. 21, 1930	51.90	505.69	Mar. 17, 1933	26.30	531.29
Feb. 20	75.70	481.89	Sept. 15	45.45	512.14
Mar. 24	58.90	498.69	Mar. 6, 1935	47.50	510.09
Apr. 18	84.20	473.39	July 30	33.30	524.29
May 24	54.35	503.24	Jan. 24, 1936	41.40	516.19
June 21	34.50	523.09	July 12, 1937	41.50	516.09
July 16	41.00	516.59	Aug. 16	63.05	494.54
Aug. 20	55.50	502.09	Jan. 11, 1938	32.25	525.34
Sept. 25	68.00	489.59	Aug. 17	57.30	500.29
Oct. 30	31.70	525.89	Apr. 7, 1939	47.88	509.71
Dec. 9	37.00	520.59	July 15	36.18	521.41
Jan. 8, 1931	53.00	504.59	Aug. 12	34.89	522.70
Feb. 4	26.85	530.74	Aug. 1, 1940	43.34	514.25
Mar. 2	25.40	532.19	Aug. 2, 1941	40.06	517.53
Apr. 23	33.30	524.29	Aug. 8, 1942	49.87	507.72
May 23	22.85	534.74	Aug. 11, 1943	79.13	478.46
June 24	32.60	524.99	Dec. 19	48.54	509.05
July 24	19.45	538.14	July 8, 1944	47.58	510.01
Sept. 28	37.70	519.89	Aug. 11	78.34	479.25
Nov. 3	72.60	484.99	July 24, 1945	67.74	489.85
Dec. 1	47.75	509.84	July 11, 1946	80.90	476.69
Jan. 4, 1932	32.80	524.79	July 24, 1947	96.72	460.87
Feb. 2	42.05	515.54	May 15, 1948	92.80	464.79
Mar. 17	35.75	521.84	Sept. 14	108.46	449.13
July 5	38.54	519.05			

N8-103

[Marrs McLean. 10½ miles east of Carrizo Springs. Used drilled irrigation well, diameter 10 inches, depth 780 feet. Measuring point, top of pump base, at land-surface datum and 501.60 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 26, 1929	40.25	461.35	July 30, 1935	25.15	476.45
Dec. 24	42.00	459.60	Aug. 27, 1936	28.71	472.89
Jan. 21, 1930	51.05	450.55	July 13, 1937	20.49	481.11
Mar. 20	66.35	435.25	Aug. 15	35.41	466.19
Apr. 17	71.50	430.10	Jan. 13, 1938	26.51	475.09
June 17	41.15	460.45	Aug. 25	28.00	473.60
Dec. 10	36.80	464.80	Apr. 7, 1939	58.98	442.62
Feb. 9, 1931	26.20	475.40	July 20	29.25	472.35
Mar. 3	22.10	479.50	Aug. 15	32.42	469.18
Apr. 24	27.00	474.60	Dec. 8	27.73	473.87
June 4	16.55	485.05	Aug. 3, 1940	12.94	488.66
July 27	10.10	491.50	Aug. 5, 1941	11.90	489.70
Sept. 29	12.00	489.60	Aug. 10, 1942	28.77	472.83
Feb. 4, 1932	53.10	448.50	July 11, 1946	39.80	461.80
May 6	41.20	460.40	July 24, 1947	49.72	451.88
July 5	27.38	474.22	Aug. 11, 1948	71.92	429.68
Aug. 27	25.48	476.12	Sept. 14	80.00	421.60
Dec. 20	23.67	477.93			

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N9-12

[Federal Land Bank. 17 miles northeast of Carrizo Springs. Used irrigation well, diameter 10 inches, depth 1,469 feet. Measuring point, top of casing, 1.5 feet above land-surface datum and 494.79 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Oct. 18, 1929	17.10	476.19	Feb. 3, 1932	12.30	480.99
Nov. 18	20.20	473.09	Mar. 29	21.80	471.49
Dec. 5	19.00	474.29	July 2	13.94	479.35
Dec. 17	19.85	473.44	Aug. 27	13.45	479.84
Jan. 17, 1930	21.00	472.29	Dec. 22	13.90	479.39
Feb. 24	30.00	463.29	Mar. 23, 1933	22.60	470.69
Mar. 20	29.00	464.29	Sept. 19	11.70	481.59
Apr. 21	34.50	458.79	Aug. 28, 1934	28.35	464.94
May 21	28.15	465.14	Mar. 14, 1935	26.64	466.65
June 21	17.40	475.89	July 30	16.20	477.09
July 17	17.30	475.99	Jan. 27, 1936	24.35	468.94
Aug. 26	18.30	474.99	Aug. 24	22.20	471.09
Sept. 24	23.30	469.99	July 10, 1937	13.23	480.06
Oct. 27	15.35	477.94	Aug. 17	21.08	472.21
Oct. 31	15.15	478.14	Jan. 15, 1938	17.03	476.26
Dec. 12	17.40	475.89	Aug. 22	18.27	475.02
Jan. 9, 1931	20.90	472.39	Apr. 8, 1939	30.53	462.76
Feb. 5	10.30	482.99	July 18	17.90	475.39
Mar. 5	16.00	477.29	Aug. 11	20.17	473.12
Apr. 29	11.15	482.14	Dec. 11	19.21	474.08
May 27	6.55	486.74	July 30, 1940	9.91	483.38
June 24	9.30	483.99	Aug. 5, 1941	9.65	484.64
July 28	6.30	486.99	Aug. 11, 1942	17.71	475.58
Sept. 30	7.40	485.89	Aug. 10, 1943	24.70	468.59
Nov. 4	15.25	478.04	May 14, 1948	51.56	441.73
Dec. 2	16.30	476.99	Sept. 14	53.87	439.42
Jan. 5, 1932	12.35	480.94			

N9-16

[N. Boyd. 19½ miles northeast of Carrizo Springs. Used drilled irrigation well, diameter 6 inches, depth 1,640 feet. Measuring point, top of railroad rail, 1.0 foot above land-surface datum and 552.05 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 18, 1929	74.00	477.05	Aug. 27, 1932	61.80	489.25
Dec. 17	67.25	483.80	Dec. 22	66.35	484.70
Feb. 24, 1930	72.55	478.50	July 30, 1935	66.00	485.05
May 21	71.15	479.90	July 10, 1937	64.84	486.21
June 21	66.75	484.30	Aug. 11, 1939	67.73	483.32
July 18	65.40	485.65	Aug. 11, 1942	65.04	486.01
Oct. 31,	64.75	487.30	Aug. 10, 1943	77.88	473.17
Jan. 13, 1931	63.65	487.40	July 11, 1944	75.50	475.55
Feb. 5	59.90	491.15	Aug. 10	80.51	470.54
Mar. 5	59.30	491.75	July 25, 1945	75.73	475.32
Apr. 30	60.10	490.95	July 9, 1946	72.27	478.78
May 27	56.65	494.40	July 22, 1947	77.16	473.89
June 25	56.70	494.35	May 15, 1948	97.64	453.41
July 28	53.80	497.25	Aug. 11	97.72	453.33
Dec. 5	61.75	489.30	Sept. 14	98.89	452.16
July 2, 1932	63.70	487.35			

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

N9-25

[C. W. Barker. 14½ miles east of Carrizo Springs. Used drilled irrigation well, diameter 10 inches, depth about 1,300 feet. Measuring point, top of casing, 1.0 foot above land-surface datum and 488.40 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 29, 1929	17.70	469.70	July 2, 1932	12.60	474.80
Dec. 17	20.95	466.45	Aug. 27	11.65	475.75
Jan. 17, 1930	21.85	465.55	Dec. 22	11.03	476.37
Feb. 21	30.95	456.45	Sept. 19, 1933	3.50	483.90
Mar. 20	35.65	451.75	Mar. 14, 1935	22.98	464.42
Apr. 21	37.15	450.25	July 30	11.80	475.60
May 17	28.80	458.60	Jan. 27, 1936	20.30	467.10
June 21	19.45	467.95	July 10, 1937	10.39	477.01
July 10	17.15	470.25	Aug. 17	25.11	462.29
Aug. 23	17.30	470.10	Jan. 15, 1938	17.53	469.87
Sept. 24	23.30	464.10	Dec. 11, 1939	15.38	472.02
Oct. 31	15.65	471.75	July 30, 1940	5.15	482.25
Dec. 12	11.75	475.65	July 11, 1944	30.61	456.79
Jan. 9, 1931	16.00	471.40	Aug. 10	36.84	450.56
Feb. 5	8.40	479.00	July 25, 1945	29.92	457.48
Mar. 6	6.20	481.20	July 11, 1946	24.97	462.43
Apr. 30	7.40	480.00	May 14, 1948	55.37	432.03
May 27	2.85	484.55	Sept. 14	57.50	429.90
June 24	3.45	483.95			

N9-32

[P. J. Lewis. 17 miles east of Carrizo Springs. Used drilled irrigation well, diameter 8 inches, depth 1,428 feet. Measuring point, top of casing, at land-surface datum and 499.20 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 3, 1929	22.85	476.35	Sept. 30, 1931	16.40	482.80
Dec. 17	23.50	475.70	Dec. 5	25.55	473.65
Jan. 17, 1930	23.10	476.10	Jan. 12, 1932	20.90	478.30
Feb. 24	26.80	472.40	Feb. 12	25.15	474.05
Apr. 21	39.55	459.65	Mar. 20	26.60	472.60
May 21	32.60	466.60	July 2	24.80	474.40
June 21	27.35	471.85	Aug. 27	24.38	474.82
July 18	28.20	471.00	Dec. 22	22.83	476.37
Aug. 23	29.25	469.95	Mar. 23, 1933	24.50	474.70
Sept. 24	32.15	467.05	July 10, 1937	23.19	476.01
Oct. 31	28.50	470.70	Jan. 15, 1938	25.82	473.38
Dec. 12	25.25	473.95	July 18, 1939	27.06	472.14
Jan. 13, 1931	26.25	472.95	Aug. 11	28.88	470.32
Feb. 5	22.00	477.20	July 30, 1940	18.68	480.52
Apr. 29	21.35	477.85	Aug. 5, 1941	18.75	480.45
May 27	19.30	479.90	July 22, 1947	40.80	458.40
June 24	19.30	479.90	Sept. 14, 1948	62.39	436.81
July 28	15.50	483.70			

N9-33

[P. J. Lewis. 17¾ miles east of Carrizo Springs. Used drilled stock well, diameter 6 inches, depth 1,523 feet. Measuring point, top of casing, 0.5 foot above land-surface datum]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Aug. 12, 1932	16.00		July 30, 1940	17.09	
Dec. 22	13.76		Aug. 5, 1941	17.55	
Aug. 24, 1936	35.52		Aug. 11, 1942	30.66	
July 10, 1937	21.61		Aug. 10, 1943	43.55	
Aug. 17	34.94		July 11, 1944	38.97	
Jan. 15, 1938	23.48		Aug. 10	43.79	
Aug. 22	35.78		July 25, 1945	40.25	
Apr. 9, 1939	43.06		July 11, 1946	35.12	
July 18	26.44		July 22, 1947	38.61	
Aug. 11	27.53		May 14, 1948	39.55	
Dec. 11	24.08		Aug. 11	42.85	
			Sept. 14	46.19	

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

07-3

[G. W. Hatch. 26½ miles northeast of Carrizo Springs. Used drilled stock well, diameter 12 inches, depth 1,800 feet. Measuring point, top of casing, 0.5 foot above land-surface datum and 604.65 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 18, 1929	96.10	508.05	Mar. 24, 1932	91.40	512.75
Dec. 17	94.05	510.10	July 2	92.74	511.41
Jan. 17, 1930	95.00	509.15	Aug. 27	92.93	511.22
Feb. 24	94.45	509.70	Dec. 22	92.25	511.90
Apr. 22	96.05	508.10	Mar. 23, 1933	91.90	512.25
May 21	96.40	507.75	Sept. 16	92.25	511.90
June 26	96.15	508.00	Aug. 28, 1934	99.25	504.90
July 18	95.65	508.50	July 30, 1935	90.30	505.85
Aug. 23	95.20	508.95	Aug. 25, 1936	97.25	506.18
Sept. 24	95.15	509.00	July 10, 1937	94.44	508.99
Oct. 31	95.50	508.65	Jan. 15, 1938	97.43	506.00
Dec. 12	94.40	509.75	Apr. 8, 1939	97.59	505.84
Jan. 13, 1931	94.20	509.95	Aug. 11	98.37	505.06
Feb. 5	93.50	510.65	July 30, 1940	93.31	510.12
Mar. 5	92.80	511.35	Aug. 5, 1941	93.34	510.09
Apr. 30	92.95	511.20	Aug. 11, 1942	96.12	507.31
May 27	92.35	511.80	Aug. 10, 1943	102.23	501.20
June 25	91.75	512.40	July 11, 1944	103.38	500.05
July 28	91.05	513.10	Aug. 10	103.56	499.87
Oct. 5	90.10	514.05	July 24, 1945	102.49	500.94
Dec. 5	91.00	513.15	July 9, 1946	105.38	498.05
Jan. 12, 1932	90.70	513.45	July 22, 1947	108.13	495.30
Feb. 12	91.10	513.05	Sept. 14, 1948	118.01	485.42

S1-15

[J. C. Johnson. 5½ miles southwest of Carrizo Springs. Used drilled stock well, diameter 10 inches, depth 270 feet. Measuring point, top of pump base, 1.5 feet above land-surface datum]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Apr. 1, 1930	51.90		June 30, 1932	52.65	
May 19	52.20		Aug. 29	52.65	
July 15	52.20		Dec. 22	52.46	
Aug. 26	51.30		Mar. 18, 1933	52.40	
Sept. 25	52.15		Sept. 20	53.00	
Oct. 20	52.45		Aug. 27, 1934	53.30	
Dec. 11	52.20		Jan. 11, 1938	54.08	
Jan. 9, 1931	52.40		Aug. 23	55.50	
Feb. 7	52.25		Apr. 5, 1939	54.56	
Mar. 4	52.15		July 17	54.75	
Apr. 25	52.15		Aug. 12	54.90	
June 8	52.25		Aug. 2, 1940	55.14	
July 2	52.35		Aug. 6, 1941	55.47	
Oct. 3	52.30		Aug. 6, 1943	56.21	
Nov. 6	52.60		July 8, 1944	56.72	
Dec. 4	52.40		July 24, 1945	57.01	
Jan. 7, 1932	52.70		July 9, 1946	57.24	
Feb. 11	52.45		July 21, 1947	57.56	
Mar. 18	52.40				

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S1-16

[C. W. Gilfillan & Son. 4½ miles southwest of Carrizo Springs. Used drilled irrigation well, diameter 10 inches, depth 295 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 670.20 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Mar. 1, 1930	54.90	614.30	Jan. 24, 1936	56.75	612.45
June 13	55.00	614.20	Aug. 26	57.61	611.59
July 15	55.00	614.20	July 14, 1937	57.38	611.82
Aug. 26	55.10	614.10	Aug. 13	59.67	609.53
Sept. 25	55.20	614.00	Jan. 11, 1938	57.86	611.34
Oct. 20	55.25	613.95	Aug. 23	59.18	610.02
Mar. 4, 1931	55.35	613.85	Apr. 5, 1939	57.38	611.82
Apr. 25	55.50	613.70	July 17	58.41	610.79
July 2	55.50	613.70	Aug. 12	58.61	610.59
Oct. 3	55.60	613.60	Dec. 9	58.72	610.48
Nov. 6	55.90	613.30	Aug. 2, 1940	58.63	610.57
Dec. 4	55.65	613.55	Aug. 3, 1941	59.09	610.13
Jan. 7, 1932	55.75	613.45	Aug. 9, 1942	59.87	609.33
Feb. 11	55.85	613.35	Aug. 6, 1943	59.92	609.28
Mar. 18	56.00	613.20	Dec. 20	60.19	609.01
June 30	56.05	613.15	Aug. 11, 1944	61.82	607.38
Aug. 29	56.15	613.05	July 24, 1945	60.92	608.28
Dec. 22	55.25	613.95	July 10, 1946	61.52	607.68
Mar. 18, 1933	55.40	613.80	May 15, 1948	63.54	605.66
Sept. 20	55.90	613.30	Aug. 10	63.89	605.31
Mar. 12, 1935	56.80	612.40	Sept. 14	65.08	604.12
July 28	56.90	612.30			

S1-18

[J. C. Johnson. 4¼ miles southwest of Carrizo Springs. Unused drilled well, diameter 10 inches, depth 320 feet. Measuring point, top of casing, 2.0 feet above land-surface datum and 706.10feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Mar. 18, 1930	99.00	605.10	July 28, 1935	103.25	600.85
May 19	101.80	602.30	Jan. 24, 1936	103.42	600.68
June 16	101.60	602.50	Aug. 26	104.22	599.88
July 15	101.60	602.50	July 14, 1937	103.14	600.96
Aug. 26	101.85	602.25	Aug. 13	104.00	600.10
Sept. 26	102.00	602.10	Jan. 11, 1938	104.01	600.09
Oct. 20	102.00	602.10	Aug. 23	104.48	599.62
Dec. 11	102.00	602.10	Apr. 5, 1939	104.74	599.36
Jan. 9, 1931	102.20	601.70	July 17	104.74	599.36
Feb. 7	101.90	602.20	Aug. 12	104.94	599.16
Mar. 4	101.80	602.30	Dec. 9	105.06	599.04
Apr. 25	102.20	601.90	Aug. 2, 1940	104.90	599.20
June 8	101.80	602.30	Aug. 3, 1941	105.29	598.81
July 2	101.90	602.20	Aug. 8, 1942	105.83	598.27
Oct. 3	101.70	602.40	Aug. 6, 1943	107.37	596.73
Nov. 6	102.15	601.95	July 8, 1944	108.22	595.88
Dec. 4	102.15	601.95	Aug. 11	108.85	595.25
Jan. 7, 1932	102.25	601.85	July 24, 1945	109.50	594.60
Feb. 11	102.30	601.80	July 9, 1946	109.93	594.17
Mar. 18	102.20	601.90	July 21, 1947	111.72	592.38
June 30	102.21	601.89	May 16, 1948	113.04	591.06
Aug. 29	102.53	601.57	Aug. 10	113.86	590.24
Dec. 22	102.03	602.07	Sept. 14	114.07	590.03
Sept. 20, 1933	102.45	601.65	Oct. 11	114.47	589.63
Aug. 27, 1934	103.10	601.00	Nov. 9	114.20	589.90
Mar. 12, 1935	103.55	600.55	Dec. 23	114.25	589.85

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S2-24

[G. S. Gay. 6 miles southeast of Carrizo Springs. Used drilled irrigation well, diameter 12 inches, depth 667 feet. Measuring point, top of pump base, 2.0 feet above land-surface datum and 583.70 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 1, 1928	136.00	445.70	Jan. 23, 1936	90.98	490.72
Nov. 15	138.00	443.70	July 12, 1937	91.38	490.32
July 14, 1930	105.15	476.55	Aug. 14	109.23	472.47
Oct. 31	106.62	475.08	Jan. 13, 1938	88.10	493.60
Dec. 10	96.40	485.30	Aug. 18	104.82	476.88
Jan. 15, 1931	106.60	475.10	Apr. 9, 1939	126.50	455.20
Feb. 9	91.40	490.30	July 16	96.14	485.56
Mar. 3	87.00	494.70	Aug. 13	97.69	484.01
Apr. 24	101.90	479.80	Dec. 9	106.05	475.65
May 26	84.40	497.30	Aug. 3, 1940	95.57	486.13
June 26	78.55	503.15	Aug. 4, 1941	90.32	491.38
Dec. 3	109.15	472.55	Aug. 9, 1942	102.83	478.87
Jan. 6, 1932	94.40	487.30	Aug. 12, 1943	140.29	441.41
May 6	106.10	475.60	Dec. 19	124.96	456.74
July 3	97.40	484.30	July 10, 1946	120.01	461.69
Aug. 29	99.00	482.70	July 22, 1947	125.22	456.48
Dec. 20	93.50	488.20	May 15, 1948	146.35	435.35
Sept. 18, 1933	92.65	489.05	Sept. 14	163.70	418.00
July 29, 1935	91.35	490.35			

S2-27

[Mrs. J. A. McDonald. 9¾ miles southeast of Carrizo Springs. Used drilled domestic and stock well, diameter 8 inches, depth 1,000 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 529.35 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 26, 1929	75.20	453.15	Aug. 30, 1932	56.10	472.25
Dec. 24	76.45	451.90	Dec. 20	52.20	476.15
Jan. 15, 1930	81.40	446.95	Mar. 21, 1933	47.00	481.35
Feb. 18	89.40	438.95	Sept. 18	45.00	483.35
Mar. 20	100.70	427.65	Mar. 11, 1935	56.55	471.80
Apr. 17	98.10	430.25	July 30	51.40	476.95
May 16	86.45	441.90	Jan. 23, 1936	49.45	478.90
June 18	71.10	457.25	Aug. 27	56.74	471.61
July 14	65.15	463.20	July 13, 1937	47.37	480.98
Sept. 23	79.55	448.80	Jan. 13, 1938	53.51	474.84
Dec. 10	59.40	468.95	Aug. 19	52.09	476.26
Feb. 9, 1931	56.10	472.25	Apr. 12, 1939	72.83	455.52
Mar. 3	49.60	478.75	Aug. 11	56.50	471.85
Apr. 24	60.10	468.25	Dec. 8	54.43	473.92
June 4	46.70	481.65	Aug. 4, 1941	50.41	477.94
June 26	44.90	483.45	Aug. 10, 1942	52.42	475.93
July 27	39.00	489.35	Aug. 13, 1943	60.41	467.94
Sept. 29	39.60	488.75	July 11, 1944	65.76	462.59
Dec. 3	66.45	461.90	Aug. 11	65.50	462.85
Jan. 11, 1932	54.10	474.25	July 24, 1945	64.43	463.92
Feb. 4	61.35	467.00	July 11, 1946	68.66	459.69
Mar. 22	56.60	471.75	July 24, 1947	68.07	460.28
May 6	67.90	460.45	May 15, 1948	71.70	456.65
July 5	56.30	472.05	Sept. 14	74.21	454.14

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S2-78

[McClendon. 10¾ miles southeast of Carrizo Springs. Used drilled domestic and stock well, diameter 12 inches, depth 1,000 feet. Measuring point, top of casing, 0.5 foot above land-surface datum and 637.05 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 7, 1929	190.75	455.80	Sept. 18, 1933	153.00	483.55
Jan. 15, 1930	200.90	435.65	Mar. 10, 1935	162.25	474.30
Mar. 19	210.70	425.85	July 29	153.15	483.40
Apr. 17	216.15	420.40	Jan. 23, 1936	153.95	482.60
May 16	193.60	442.95	Aug. 25,	159.61	476.94
June 18	186.70	449.85	July 12, 1937	151.54	485.01
July 14	174.65	461.90	Aug. 14	164.84	471.71
Aug. 22	172.90	463.65	Jan. 13, 1938	156.04	480.51
Sept. 23	191.10	445.45	Aug. 19	157.24	479.31
Oct. 31	173.50	463.05	Apr. 8, 1939	170.41	466.14
Dec. 10	173.70	462.85	July 15	156.70	479.85
Jan. 15, 1931	181.45	455.10	Aug. 15	158.02	478.53
Feb. 9	163.25	473.30	Dec. 10	164.96	471.59
Apr. 24	175.70	460.85	Aug. 3, 1940	145.23	491.32
May 26	157.65	478.90	Aug. 4, 1941	143.20	493.35
June 26	151.40	485.15	Aug. 10, 1942	159.77	476.78
July 27	146.35	490.20	Aug. 12, 1943	184.11	452.44
Sept. 29	149.30	487.25	Dec. 18	187.28	449.27
Dec. 3	170.55	466.00	July 11, 1944	176.11	460.44
Jan. 6, 1932	162.25	474.30	Aug. 12	190.57	445.98
Feb. 4	165.60	470.95	July 24, 1945	182.54	454.01
May 6	173.35	463.20	July 10, 1946	176.47	460.08
July 3	167.75	468.80	July 22, 1947	178.23	458.32
Aug. 30	163.18	473.37	May 16, 1948	201.69	434.86
Dec. 20	158.30	478.25	Aug. 10	202.34	434.21
Mar. 21, 1933	159.55	477.00	Sept. 15	211.97	424.58

S2-94

[Catarina Farms. 13½ miles southeast of Carrizo Springs. Used drilled stock well, diameter 10 inches, depth 1,424 feet. Measuring point, top of pump base, 0.5 foot above land-surface datum and 694.60 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 10, 1929	190.70	503.40	July 3, 1932	181.90	512.20
Jan. 15, 1930	192.00	502.10	Aug. 30	183.50	511.10
Feb. 18	191.70	502.40	Dec. 20	177.30	516.80
Mar. 19	192.30	501.70	Mar. 21, 1933	176.90	517.20
Apr. 17	191.60	502.50	Sept. 18	174.50	519.60
May 16	191.10	502.60	Mar. 10, 1935	172.95	521.15
June 19	189.60	504.50	July 29	174.20	519.90
July 14	189.50	504.60	Jan. 23, 1936	172.35	521.75
Aug. 22	189.80	504.30	July 12, 1937	171.63	522.47
Sept. 23	192.30	501.80	Aug. 14	171.78	522.32
Oct. 31	192.05	502.05	Jan. 13, 1938	176.60	517.50
Dec. 10	188.70	505.40	Aug. 24	176.96	517.14
Jan. 15, 1931	189.90	504.20	Aug. 15, 1939	176.01	518.09
Feb. 9	188.35	505.75	Aug. 4, 1940	171.28	522.82
Mar. 3	187.10	507.00	Aug. 4, 1941	168.84	525.26
Jan. 11, 1932	193.70	500.40	Dec. 18, 1943	195.55	498.55
Feb. 4	190.60	503.50	Aug. 12, 1944	191.54	502.56
Mar. 22	182.50	511.60	July 24, 1945	187.26	506.84
May 6	187.60	506.50	July 10, 1946	193.04	501.06

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S2-102

[J. P. Giles. 15½ miles southeast of Carrizo Springs. Unused drilled irrigation well, diameter 10 inches, depth 1,185 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 582.95 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Oct. 25, 1929	109.80	472.15	July 29, 1935	102.00	479.95
Nov. 19	119.90	462.05	Jan. 23, 1936	106.60	475.35
Feb. 18, 1930	140.80	441.15	Aug. 27	114.32	467.63
Mar. 19	148.50	433.45	July 13, 1937	110.14	471.81
May 16	133.60	448.35	Jan. 13, 1938	107.48	474.47
June 19	123.80	458.15	July 15, 1939	110.31	471.64
July 14	119.60	462.35	Aug. 15	110.08	471.87
Sept. 23	125.80	456.15	Dec. 8	110.07	471.88
Oct. 31	118.85	463.10	Aug. 3, 1940	103.80	478.15
Feb. 9, 1931	112.10	469.85	Aug. 4, 1941	100.82	481.13
Mar. 3	116.40	465.55	Aug. 10, 1942	105.11	476.84
Apr. 24	120.20	461.75	Aug. 13, 1943	113.45	468.50
June 26	103.75	478.20	Dec. 18	114.77	467.18
July 27	99.50	482.45	July 11, 1944	113.99	467.96
Sept. 29	98.85	483.10	Aug. 12	113.14	468.81
Jan. 11, 1932	105.10	476.85	July 21, 1945	112.55	469.40
Mar. 22	115.35	466.60	July 10, 1946	112.45	469.50
May 6	119.00	462.95	July 22, 1947	110.91	471.04
July 5	116.75	465.20	Aug. 10, 1948	113.60	468.35
Aug. 30	113.90	468.05	Sept. 14	113.87	468.08
Dec. 30	106.25	475.70	Oct. 11	114.31	467.64
Mar. 21, 1933	100.00	481.95	Nov. 9	114.87	467.08
Sept. 18	100.00	481.95	Dec. 23	115.52	466.43
Mar. 11, 1935	106.45	475.50			

S3-10

[H. H. Coffield. 19¾ miles southeast of Carrizo Springs. Used drilled irrigation well, diameter 8 inches, depth 1,419 feet. Measuring point, top of casing, 0.5 foot above land-surface datum and 545.35 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 17, 1929	83.50	461.35	Dec. 20, 1932	67.70	477.15
Jan. 15, 1930	83.05	461.80	Mar. 21, 1933	64.50	480.85
Feb. 18	86.40	458.45	Aug. 27, 1936	75.13	469.72
Mar. 19	92.65	452.20	July 13, 1937	69.56	475.29
June 19	83.50	461.55	Aug. 14	72.73	472.12
July 14	79.45	465.40	Jan. 13, 1938	74.96	469.89
Aug. 22	79.10	465.75	Aug. 25	83.09	461.76
Feb. 9, 1931	74.30	470.55	July 16, 1939	76.36	468.49
Mar. 3	71.10	473.75	Aug. 15	73.96	470.89
May 26	69.90	474.95	Aug. 3, 1940	65.34	479.51
June 26	68.10	476.75	Aug. 4, 1941	64.59	480.26
July 27	65.75	479.10	Aug. 10, 1942	72.84	472.01
Sept. 29	63.60	481.25	Aug. 13, 1943	83.93	459.92
Dec. 3	69.95	474.90	July 7, 1944	88.87	455.98
Jan. 11, 1932	67.85	477.00	Aug. 12	88.33	456.52
Feb. 4	67.90	476.95	July 24, 1945	85.06	459.79
Mar. 22	67.90	476.94	July 10, 1946	88.67	456.18
May 6	73.70	471.15	July 22, 1947	90.16	454.69
July 5	72.80	472.05	May 14, 1948	107.94	436.91
Aug. 30	71.75	473.10	Sept. 16	102.03	442.82

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S3-16

[Catarina Farms. 17 miles southeast of Carrizo Springs. Unused drilled irrigation well, diameter 10 inches, depth not available. Measuring point, top of pump base, 1.0 foot above land-surface datum]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Aug. 27, 1936	137.80		Aug. 3, 1940	125.32	
July 13, 1937	128.24		Aug. 4, 1941	124.59	
Aug. 14	134.82		Aug. 13, 1943	140.42	
Jan. 13, 1938	130.55		July 24, 1945	145.93	
Aug. 25	132.64		July 10, 1946	143.62	
Apr. 8, 1939	139.56		July 22, 1947	141.43	
July 15	132.41		Sept. 16, 1948	152.53	
Aug. 15	133.11				

S5-3

[Catarina Farms. 16½ miles southwest of Carrizo Springs. Unused drilled irrigation well, diameter 10 inches, depth 1,422 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 598.20 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 10, 1929	121.70	475.50	Mar. 21, 1933	97.50	499.70
Jan. 15, 1930	126.40	470.80	Sept. 18	97.50	499.70
Feb. 18	128.90	468.30	Mar. 10, 1935	97.55	499.65
June 19	126.30	471.00	July 29	98.10	499.10
July 14	122.70	474.50	Jan. 23, 1936	97.75	499.45
Aug. 22	117.75	479.45	July 13, 1937	97.19	500.01
Sept. 23	118.25	478.95	Aug. 14	99.34	497.86
Oct. 31	117.40	479.80	Jan. 13, 1938	102.39	494.81
Dec. 10	113.80	483.40	Aug. 24	100.18	497.02
Jan. 15, 1931	118.40	478.80	July 16, 1939	102.88	494.32
Feb. 9	112.10	485.10	Aug. 15	103.10	494.10
Mar. 3	107.50	489.70	Aug. 4, 1940	96.62	500.58
Apr. 24	115.40	481.80	Aug. 4, 1941	94.21	502.99
May 26	109.00	488.20	Aug. 10, 1942	104.57	492.63
June 26	106.00	491.20	Aug. 13, 1943	116.23	480.97
July 27	100.35	496.85	Dec. 18	131.24	465.96
Sept. 29	96.65	500.55	July 7, 1944	119.40	477.80
Dec. 3	106.35	490.85	Aug. 12	120.89	476.31
Jan. 11, 1932	102.15	495.05	July 21, 1945	138.52	459.68
Feb. 4	103.40	493.80	July 10, 1946	139.60	457.60
Mar. 22	104.15	493.05	July 22, 1947	137.95	459.25
May 6	111.80	485.40	May 15, 1948	143.55	453.65
July 3	110.50	486.70	Aug. 10	144.67	452.53
Aug. 30	109.85	487.35	Sept. 15	147.87	450.33
Dec. 20	103.90	493.30			

S5-5

[Catarina Farms. 18½ miles south of Carrizo Springs. Used drilled domestic and stock well, diameter 12 inches, depth 1,374 feet. Measuring point, top of pump base, 1.0 foot above land-surface datum and 613.70 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 10, 1929	72.45	540.25	Feb. 9, 1931	70.15	542.55
Jan. 15, 1930	72.15	540.55	Mar. 3	69.40	543.30
Feb. 18	73.70	539.00	Apr. 24	68.85	543.85
Mar. 19	74.20	538.50	May 26	68.70	544.00
Apr. 17	75.60	537.10	June 26	68.20	544.50
May 16	92.80	519.90	July 27	67.00	545.70
June 19	74.60	538.10	Sept. 29	65.00	547.70
July 14	73.85	538.85	Dec. 3	65.10	547.60
Aug. 22	72.70	540.00	Jan. 11, 1932	65.00	547.70
Sept. 23	71.80	540.90	Feb. 4	65.40	547.30
Dec. 10	70.80	541.90	Aug. 30	67.20	545.50

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S5-5--Continued

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 20, 1932	65.60	547.10	Aug. 13, 1943	75.17	537.53
Sept. 18, 1933	64.40	548.30	Dec. 18	75.26	537.44
Aug. 27, 1936	68.30	544.40	July 7, 1944	78.37	534.33
Aug. 14, 1937	62.67	550.03	Aug. 12	77.18	535.52
Aug. 24, 1938	63.72	548.98	July 24, 1945	75.96	536.73
Aug. 15, 1939	66.34	546.36	July 10, 1946	80.13	532.57
Aug. 4, 1940	66.08	546.62	July 22, 1947	77.14	535.56
Aug. 4, 1941	64.58	548.12	Aug. 10, 1948	82.05	530.65
Aug. 10, 1942	68.23	544.47	Sept. 16	80.92	531.78

S5-10

[Catarina Farms. 19¼ miles southeast of Carrizo Springs. Used drilled domestic and stock well, diameter 10 inches, depth 1,615 feet. Measuring point, top of concrete block, 0.5 foot above land-surface datum and 571.70 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Dec. 11, 1929	85.90	485.30	July 3, 1932	85.75	485.45
Jan. 15, 1930	86.50	484.70	Aug. 30	85.50	485.70
Feb. 18	96.15	475.05	Dec. 20	79.64	491.56
Mar. 19	97.45	473.75	Mar. 21, 1933	75.25	495.95
May 16	100.90	470.30	Sept. 18	77.90	493.30
July 14	95.85	475.35	July 29, 1935	77.15	494.05
Aug. 22	94.10	477.10	Jan. 23, 1936	76.90	494.30
Sept. 23	93.65	477.55	Aug. 27	75.13	496.07
Oct. 31	92.20	479.00	July 12, 1937	75.89	495.31
Dec. 10	89.05	482.15	Aug. 14	78.79	492.41
Jan. 15, 1931	91.25	479.95	Jan. 13, 1938	82.38	488.82
Feb. 9	88.85	482.35	Aug. 24	79.48	491.72
Mar. 3	85.75	485.45	July 16, 1939	83.71	487.49
Apr. 24	89.40	481.80	Aug. 15	81.87	489.33
June 26	83.65	487.55	July 7, 1944	96.56	474.64
July 27	81.20	490.00	Aug. 12	96.76	474.44
Sept. 29	77.80	493.40	July 24, 1945	95.34	475.86
Dec. 3	81.85	489.35	July 10, 1946	97.27	473.93
Jan. 11, 1932	80.70	490.50	July 22, 1947	96.13	475.07
Feb. 4	80.00	491.20	Sept. 16, 1948	104.37	466.83
Mar. 22	79.90	491.30			
May 6	85.25	485.95			

S6-4

[O. V. Ray. 21 miles southeast of Carrizo Springs. Unused drilled irrigation well, diameter 10 inches, depth 1,432 feet. Measuring point, top of pump base, at land-surface datum and 482.26 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Nov. 1, 1928	23.00	459.26	Jan. 11, 1932	9.60	472.66
Nov. 15	20.00	462.26	Feb. 4	11.60	470.66
Jan. 15, 1930	24.65	457.61	Mar. 22	13.15	469.11
Mar. 19	37.20	445.06	May 6	18.60	463.66
Apr. 17	38.80	443.46	July 3	17.75	464.51
May 16	33.15	449.11	Aug. 30	14.75	467.51
June 19	24.90	457.36	Dec. 20	8.38	473.88
July 14	23.80	458.46	Mar. 21, 1933	1.05	481.21
Aug. 22	24.80	457.46	Mar. 10, 1935	10.10	472.16
Sept. 23	26.30	455.96	July 29	6.80	475.46
Oct. 31	20.43	461.83	Jan. 23, 1936	10.50	471.76
Dec. 10	18.60	463.66	Aug. 27	17.92	464.34
Feb. 9, 1931	16.70	465.56	July 13, 1937	7.84	474.42
Mar. 3	14.00	468.26	Aug. 14	13.68	468.58
Apr. 24	20.80	461.46	Jan. 13, 1938	10.21	472.05
May 26	13.80	468.46	Aug. 25	11.04	471.22
June 26	12.00	470.26	July 15, 1939	9.84	472.42
July 27	7.30	474.96	Aug. 15	10.71	471.55
Sept. 29	7.10	475.16	Dec. 8	9.39	472.87
Dec. 3	12.15	470.11	May 16, 1940	9.08	473.18

Table 11.—*Water levels in observation wells in Dimmit and Zavala Counties, Tex.*—Continued

S6-4--Continued

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Aug. 3, 1940	7.09	475.17	July 24, 1945	20.39	461.87
Aug. 4, 1941	7.00	475.26	July 10, 1946	20.62	461.64
Aug. 10, 1942	10.66	471.60	July 22, 1947	19.86	462.40
Aug. 13, 1943	21.25	461.01	May 15, 1948	19.52	462.74
July 7, 1944	22.55	459.71	Aug. 10	21.80	460.46
Aug. 12	21.57	460.69	Sept. 15	22.32	459.94

T1-5

[R. W. Wilson. 24¾ miles southeast of Carrizo springs. Used drilled irrigation well, diameter 8 inches, depth 1,710 feet. Measuring point, top of pipe clamp, at land-surface datum and 484.25 feet above mean sea level]

Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)	Date	Water level below land-surface datum (feet)	Altitude of water surface (feet)
Jan. 6, 1930	3.50	480.75	July 2, 1932	0.71	483.54
Feb. 24	3.50	480.75	Aug. 30	1.05	483.20
Apr. 22	6.80	477.45	Mar. 23, 1933	Flowing	------
May 21	6.90	477.35	Sept. 16	Flowing	------
June 26	4.90	479.35	Aug. 28, 1934	7.50	476.75
July 18	4.05	480.20	Aug. 25, 1936	8.15	476.10
Aug. 23	4.30	479.95	July 30, 1937	4.05	480.20
Sept. 24	4.85	479.40	Aug. 17	9.19	475.06
Oct. 31	3.80	480.45	Jan. 15, 1938	6.17	478.08
Dec. 12	2.95	481.30	Aug. 22	8.51	475.74
Jan. 13, 1931	2.95	481.30	July 14, 1939	6.93	477.32
Feb. 5	1.65	482.60	Aug. 11	7.95	476.30
Mar. 5	Flowing	------	July 30, 1940	1.79	482.46
Apr. 30	1.75	482.50	Aug. 5, 1941	2.58	481.67
May 27	Flowing	------	Aug. 10, 1943	13.75	470.50
June 25	Flowing	------	Aug. 10, 1944	14.42	469.83
July 28	Flowing	------	July 25, 1945	15.19	469.06
Oct. 5	Flowing	------	July 10, 1946	17.48	466.77
Dec. 5	Flowing	------	July 22, 1947	16.45	467.80
Jan. 12, 1932	Flowing	------	May 14, 1948	25.77	458.48
Feb. 12	Flowing	------	Sept. 21	29.34	454.91
Mar. 24	Flowing	------			

Table 12.—*Analyses of ground waters in the Winter Garden district, Texas*

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	pH	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)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium
CARRIZO SAND																			
H7-13	Roy Cornett	172	Apr. 9, 1930	---	---	16	4.9	110	20	20	2.8	372	33	44	---	1.1	422	357	12
20	O. V. Vickery	130	May 20, 1930	---	---	---	---	130	19	20		457	29	18	---	.20	450	403	10
21	-----do-----	164	Dec. 10, 1937	---	---	---	---	101	17	42		343	34	67	0.1	1.9	390	321	22
23	-----do-----	182	-----do-----	---	---	---	---	---	---	---	---	388	30	39	.2	.20	---	*285	---
H8-17	A. W. West	234	Apr. 9, 1930	---	---	32	.43	128	17	35	3.8	361	69	71	---	1.2	549	390	17
68	A. D. Walker	84	Dec. 27, 1948	856	---	12	---	107	29	24		262	54	117	---	3.5	512	386	12
H9-1	---	58	Nov. 26, 1930	---	---	---	69	222	25	90		548	5	282	---	.20	894	658	23
2	Kincaid Bros	250	Apr. 17, 1930	---	---	30	.15	111	9.1	50	4.5	281	45	94	---	22	516	315	27
I7-3	---	---	May 21, 1930	---	---	---	---	135	20	53		344	113	93	---	4.0	588	420	21
M3-3	Ingram	---	Jan. --- 1913	---	---	---	---	---	---	---	---	214	32	226	---	---	---	*232	---
6	M. Rambie	100	Apr. 18, 1930	---	---	55	.06	88	13	97	4.5	287	78	120	---	10	623	273	44
36	Willie Clark	263	---	---	---	---	---	---	---	---	---	309	149	98	.6	.20	---	*156	---
M6-10	W. M. Van Cleve	150	Apr. 16, 1930	---	---	25	.13	21	8.6	172	6.1	341	92	73	---	.70	559	88	81
M9-1	T. B. Mear	335	-----do-----	---	---	16	.29	40	12	75	4.2	293	41	26	---	.52	345	149	53
14	B. H. Erskine	410	Apr. 6, 1939	---	---	---	---	---	---	---	---	286	37	20	---	---	---	*150	---

See footnotes at end of table

Table 12.—*Analyses of ground waters in the Winter Garden district, Texas*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	pH	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)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium
								CARRIZO SAND--Continued											
N1-7	D. H. Monkhouse	161	Feb. 9, 1928	-----------	---	20	0.54	91	17	17	2.1	324	33	23	------	0.22	360	297	12
8	W. Richey ------	180	Mar.--- 1913	-----------	---	-----	----	-----	-------	------	------	254	25	32	------	-------	------	*186	-------
17	Mathews Ranch--	134	Oct. 18, 1930	-----------	---	-----	.06	60	19	60		248	66	60	------	3.3	390	228	37
49	R. K. Miller----	520	Apr. 3, 1930	-----------	---	20	5.6	70	15	12	2.8	280	13	14	------	.15	270	236	11
49	-----do---------	520	May 9, 1945	499	7.1	18	.03	85	14	3.0		283	21	15	0.4	.2	303	270	24
58	R. W. Norton ---	202	Apr. 18, 1930	-----------	---	26	.15	34	15	154	5.6	332	82	94	------	.30	569	146	70
62	Mathews Ranch--	630	Oct. 18, 1930	-----------	---	-----	4.6	74	22	36		322	48	28	------	.0	367	275	22
66	Emma Mangum--	655	-----do-----	-----------	---	-----	1.6	78	18	22		312	36	16	------	.0	324	269	15
68	Shaw -----------	300	May 4, 1939	-----------	---	-----	----	-----	-------	------	------	200	49	75	------	5.8	------	*292	-------
70	J. A. Lanning, Sr	240	Dec. 27, 1948	751	---	16	----	105	24	15		356	41	40	------	1.8	418	360	8
75	Sam Kone-------	494	-----do-----	640	---	20	----	91	20	23		348	38	24	------	.5	388	309	14
N2-4	Stanfield--------	338	Oct. 25, 1930	-----------	---	-----	2.0	281	54	75		353	88	500	------	.42	1,170	924	15
19	I. T. Pryor Estate	2,680	------- 1930	-----------	---	-----	1.6	99	27	136		345	150	152	------	.30	734	358	45
37	C. F. Mang-----	470	Dec. 27, 1948	571	---	14	----	88	19	2.1		312	27	13	------	.0	316	298	2
N4-34	W. Y. Giesler---	1,035	Feb. 6, 1928	-----------	---	19	.24	54	15	61	3.6	265	46	45	------	.21	366	196	41
38	F. M. Dunkle ---	450	Jan. 5, 1949	596	---	14	----	42	17	65		288	40	27	------	.0	348	175	45

55	D. C. Mandell	703	Dec. 1, 1937									249	24	17	.3	.3		*153	
55	-----do-----	703	Apr. 27, 1939									290	31	17		.10		*248	
56	Owen Williams	520	Dec. 10, 1937									278	24	21	.3	.10		*147	
N5-7	Sol Freed	1,001	Oct. 25, 1930				4.6	92	20	122		366	92	128		.10	634	312	46
9	W. E. Richardson	858	Apr. 19, 1930			17	.29	92	26	202	7.2	306	118	296		.58	922	337	57
42	E. B. Taylor	1,082	Mar. --- 1947	944				97	22	56		336	87	62		.5	503	332	27
48	City of Crystal City.	1,050	Apr. 26, 1930			22	.48	66	18	57	5.6	306	66	38		.13	411	239	35
48	-----do-----	1,050	May 4, 1939									298	109	36		.0		*278	
58	Marrs McLean	1,038	June 20, 1930			26	1.1	96	21	56	6.0	344	94	53		.62	528	326	28
59	-----do-----	970	Jan. --- 1913									289	65	49				*191	
67	W. B. Gates	1,060	Apr. 29, 1939									334	87	36		.0		*382	
72	Mrs. C. L. Coleman.	1,160	Dec. 9, 1937									316	100	38	.2	.10		*279	
72	-----do-----	1,160	Apr. 11, 1939									346	79	41		.0		*352	
76	Ira Cribbs	950	Apr. 26, 1939									332	90	37		.0		*338	
81	R. L. Guyler	990	Dec. 27, 1948	1,060		17		68	25	121		304	88	138		.0	610	272	49
92	California Packing Corp.	1,163	Dec. 27, 1948	754		16		98	25	24		320	83	36		.0	448	348	13
N6-2	Wiegand Bros		1930					44				294	60	30		.05		*132	
N7-27	Eardley Estate	472	Apr. 4, 1930			16	0.06	32	11	75	4.2	259	38	31		.0	326	125	57
40	Lynch Bros	188	June 26, 1930			44	.02	39	11	53	4.4	124	41	80		6.4	345	143	46
46	State of Texas	1,022	July 24, 1930			21	.02	44	14	59	3.0	267	37	28		.05	335	167	44

See footnotes at end of table.

Table 12.—*Analyses of ground waters in the Winter Garden district, Texas*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	pH	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)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium
									CARRIZO SAND--Continued										
N7-46	-----do---------	1,022	Nov. 29, 1938	-----------	---	-----	-----	-----	-------	------	------	310	92	108	0.3	0.20	------	*69	-------
46	-----do---------	1,022	Dec. 28, 1948	537	---	19	-----	45	14	55		260	38	26	------	.0	325	170	41
56	H. H. Herrington-	600	Dec. ----1938	-----------	---	-----	-----	30	-------	------	------	288	50	105	------	.15	------	99	-------
67	Dr. B. F. Smith--	310	Feb. 2, 1928	-----------	---	21	0.21	38	12	76	5.5	282	40	30	------	.15	355	144	54
69[1]	G. E. Whitney---	504	Jan. 4, 1949	590	---	18	-----	40	15	70		276	41	32	------	.2	353	162	48
74	Sam McKnight---	-------	Mar. 28, 1930	-----------	---	26	1.4	111	22	56	6.6	265	81	141	------	.23	604	368	26
74	-----do---------	-------	Apr. 14, 1939	-----------	---	-----	-----	-----	-------	------	------	239	61	95	------	-------	------	*315	-------
75	F. Kirk---------	306	June----1913	-----------	---	-----	-----	-----	-------	------	------	254	82	16	------	-------	------	*100	-------
99	Mobley Bros ----	410	Dec. 21, 1938	-----------	---	-----	-----	60	20	122		222	123	132	------	.25	567	232	53
110	Ward & Conn----	312	Mar.----1913	-----------	---	-----	-----	-----	-------	------	------	260	82	16	------	-------	------	*100	-------
125	A. J. Knaggs----	133	Feb. 27, 1928	-----------	---	37	.08	69	14	110	3.7	214	107	130	------	4.0	584	230	51
126	City of Carrizo Springs.	322	Mar. 15, 1930	-----------	---	23	.06	39	14	127	5.8	221	94	113	------	.26	515	155	65
142	L. B. Huth -----	420	Apr. 6, 1939	-----------	---	-----	-----	-----	-------	------	------	206	43	37	------	-------	------	*100	-------
145	Mobley Bros ----	340	Dec. 21, 1938	-----------	---	-----	-----	37	12	127		266	76	85	------	.0	468	142	66
146	Wilson----------	300	Apr. 26, 1939	-----------	---	-----	-----	-----	-------	------	------	121	402	720	------	-------	------	*938	-------
149	W. L. Measles--	280	Feb. 20, 1939	-----------	---	-----	-----	-----	-------	------	------	288	52	46	------	-------	------	*92	-------
152	Tisdell ---------	375	Mar. 13, 1939	-----------	---	-----	-----	-----	-------	------	------	220	85	95	------	-------	------	*75	-------
153	L. H. Upchurch -	215	Dec. 7, 1937	-----------	---	-----	-----	----	-------	------	------	197	112	195	.1	2.4	------	*321	-------

N7-173	City of Carrizo Springs.	338	May 10, 1945	1,050	7.5	24	.18	58	16	117	24	221	113	136	.6	4.0	606	210	51
N8-8	Wagner	1,212	Mar. -- 1913	--	--	--	--	--	--	--	--	280	84	48	--	--	--	*180	--
9	A. Wagner	1,094	Mar. -- 1913	--	--	--	1.6	24	12	260		265	130	228	--	--	866	109	84
29	J. C. & O. E. Bookout.	1,005	May 24, 1930	--	--	19	.10	25	9.3	535	7.2	383	173	585	--	.10	1,550	101	92
42	W. Wilcox	425	Mar. 15, 1939	--	--	--	--	--	--	--	--	306	139	136	--	--	--	*112	--
56	John Ivey	700	Jan. 4, 1949	738	--	24	--	39	19	97		284	63	62	--	.0	446	176	55
61	T. W. Courtney	1,170	June -- 1914	--	--	--	0.40	44	15	92		287	50	60	--	--	423	172	54
64	City of Brundage	1,170	May 11, 1945	770	7.8	23	.73	36	11	112	9.1	323	54	47	1.0	.8	454	135	62
66	A. A. Swindell	408	Mar. 29, 1930	--	--	23	.71	23	9	107	5.0	284	47	38	--	.36	386	94	72
67	S. P. Spalding	495	Dec. 7, 1937	--	--	--	--	--	--	--	--	292	60	82	.5	.0	--	*58	--
75	Ehlers Bros	440	Nov. 23, 1938	--	--	--	--	--	--	--	--	295	90	56	--	1.8	--	*102	--
82	R. N. Mitchell	660	Mar. -- 1913	--	--	--	--	--	--	94		265	46	40	--	--	--	*118	63
82	do	660	June 26, 1930	--	--	27	.22	27	9.2	--	--	281	48	38	--	.30	--	105	--
101	Marrs McLean	1,135	Feb. 7, 1928	--	--	20	.04	17	6.5	133	5.4	318	51	44	--	.18	427	69	81
102	do	1,224	Feb. 11, 1928	--	--	24	.27	18	9.4	493	3.2	499	154	420	--	.0	1,380	84	93
104	Hiram G. Hines	582	Dec. 4, 1937	--	--	--	--	--	--	--	--	130	491	1,320	1.7	.0	--	*22	--
104	do	582	Sept. 1, 1941	--	--	--	--	39	44	1,130		390	633	1,210	--	--	3,250	228	91
104	do	582	Dec. 19, 1943	--	--	--	--	--	--	--	--	376	887	1,380	--	--	--	--	--
104	do	582	July 26, 1945	--	--	--	--	70	45	985		365	597	1,120	--	.5	3,000	360	86
104	do	582	Mar. -- 1947	3,730	--	--	--	46	34	714		326	402	795	--	.8	2,150	255	86
106	John Stahl	450	Dec. 6, 1937	--	--	--	--	--	--	--	--	330	335	435	.0	.2	--	*348	--
108	F. Webb	564	Dec. 2, 1937	--	--	--	--	--	--	--	--	280	133	185	.0	.2	--	*162	--

See footnotes at end of table.

Table 12.—*Analyses of ground waters in the Winter Garden district, Texas*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	pH	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)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium
CARRIZO SAND--Continued																			
N8-122	B. R. Guyler	912	Jan. ----1913	-----	---	---	---	---	---	---	---	261	42	38	---	---	---	*168	---
N9-3	H. A. Moore	1,236	Dec. ----1913	-----	---	---	---	---	---	---	---	389	50	119	---	---	---	*184	---
3	-----do-----	1,236	June 21, 1930	-----	---	29	0.58	38	12	96	6.4	303	55	37	---	0.25	410	144	60
6	O. H. Nance	1,448	Dec. 1, 1938	-----	---	---	---	---	---	---	---	222	40	29	0.10	.4	---	---	---
7	J. T. Kinnard	1,600	Mar.----1912	-----	---	---	---	---	---	---	---	246	67	36	---	---	---	*130	---
8	H. Brown	1,412	Dec. 1, 1938	-----	---	---	---	---	---	---	---	347	85	340	---	1.0	---	*156	---
15	City of Big Wells	1,580	Mar.----1913	-----	---	---	---	---	---	---	---	294	50	60	---	---	---	*100	---
20	-----do-----	1,355	Dec. 9, 1937	-----	---	---	---	---	---	---	---	361	91	85	.8	.70	---	*10	---
20	-----do-----	1,355	Feb. 27, 1939	-----	---	---	---	---	---	---	---	343	96	85	---	---	---	*16	---
20	-----do-----	1,355	May 11, 1945	1,060	8.4	17	.42	4.3	1.6	228	8.6	361	90	85	1.6	.2	612	17	95
25	C. W. Barker	1,300	Dec. 30, 1948	723	---	20	---	30	16	110	—	300	61	50	---	.0	442	141	63
37	Frito Co	1,500	May 15, 1940	-----	---	---	---	27	10	119	—	304	59	40	---	.0	405	108	70
45	Federal Land Bank	---	Feb. 27, 1939	-----	---	---	---	---	---	---	---	266	72	49	---	---	---	*69	---
S1-18	J. C. Johnson	320	Mar. 18, 1930	-----	---	38	.32	67	13	64	6.2	202	73	89	---	.05	456	221	40
32	H. C. Umburn	---	Nov. 19, 1938	-----	---	---	---	---	---	---	---	175	75	125	---	.15	---	*231	---
37	O. P. Leonard	---	Mar. 21, 1939	-----	---	---	---	---	---	---	---	154	76	118	---	---	---	*213	---

S2-1	F. Guerrera	510	Oct. ----1913	---	---	---	---	---	---	---	---	268	168	272	---	---	---	*100	---
3	Stennitt & Oelkers	600	Nov. 21, 1938	---	---	---	---	---	---	---	---	281	111	80	---	.25	---	*102	---
4	B. Bounds	694	-----do-----	---	---	---	---	---	---	---	---	282	90	72	.20	.3	---	*105	---
5	-----do-----	634	-----do-----	---	---	---	---	---	---	---	---	292	90	116	---	.25	---	*132	---
8	Eardley Estate	670	Nov. 22, 1938	---	---	---	---	---	---	---	---	302	60	49	---	.10	---	*90	---
18	J. Kinney	670	Dec. 7, 1938	---	---	---	---	---	---	---	---	290	172	190	---	.0	---	*87	---
24	G. S. Gay	667	Apr. 14, 1930	---	---	23	0.08	26	7.3	152	6.4	281	84	86	---	.12	513	95	78
24	-----do-----	667	Dec. 23, 1948	967	---	21	---	28	13	170		270	107	113	---	.0	585	124	75
25	Oscar Pollard	677	June 4, 1930	---	---	26	.26	350	207	1,610	23	321	1,610	2,350	---	3.0	6,400	1,720	67
62	Central Power & Light Co.	640	Mar. 28, 1930	---	---	20	.08	53	14	172	6.8	246	198	123	---	.13	704	190	67
62	-----do-----	640	May 11, 1945	1,190	7.8	17	.34	60	15	158	20	242	200	122	.8	.0	716	211	59
78	McClendon	1,000	Apr. 8, 1947	1,460	---	---	---	---	---	---	---	240	340	208	---	---	---	*180	---
83	G. Grisham	1,100	Mar.----1947	970	---	---	---	24	9.4	171		288	81	105	---	1.0	537	98	79
86	D. J. Hill	1,021	May 23, 1930	---	---	23	.09	35	11	207	7.0	242	195	148	---	.21	742	133	78
86	-----do-----	1,021	Apr.----1943	---	---	---	---	72	37	726		280	558	780	---	---	2,310	332	83
96	L. Hester	1,081	June 25, 1945	---	---	---	---	17	9.9	136		299	50	57	---	.0	463	83	78
103	M. W. Fardwell	512	Nov. 21, 1938	---	---	---	---	---	---	---	---	304	129	87	.4	.15	---	*165	---
110	E. F. Simpson	---	Mar. 28, 1939	---	---	---	---	---	---	---	---	238	195	261	---	---	---	*183	---
111	J. H. Long	---	May 17, 1940	---	---	---	---	28	11	286		248	225	212	---	---	884	115	84
116	J. T. Stennitt	572	Jan. 4, 1949	829	---	16	---	29	14	136		282	92	70	---	.0	506	130	69
133	J. W. Walthall	420	Nov. 21, 1938	---	---	---	---	---	---	---	---	287	108	74	.20	.2	---	*192	---
135[2]	H. Rouw	---	Jan. 4, 1949	975	---	26	---	57	15	141		292	127	96	---	.0	607	204	60

See footnotes at end of table.

Table 12.—*Analyses of ground waters in the Winter Garden district, Texas*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	pH	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)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium
								CARRIZO SAND--Continued											
S3-1	William O'Brien	1,800	Dec. 7, 1938	------	---	-----	-----	-----	-------	------	------	378	111	165	------	0.0	------	*68	-------
1	----do---------	1,800	Jan. 15, 1949	3,250	---	58	-----	8.6	6.7	745		704	314	540	------	3.7	2,020	49	97
4	Rasmussen and others.	1,776	Dec. 7, 1938	------	---	-----	-----	-----	-------	------	------	398	115	165	------	.0	------	*58	-------
10	H. H. Coffield--	1,419	Apr. 17, 1930	------	---	20	0.4	9.5	4.2	195	4.8	205	102	116	------	.29	576	41	91
22	Catarina Farms-	1,140	May 11, 1945	2,090	7.9	18	.30	16	6.9	392	25	240	212	378	1.0	1.2	1,170	68	89
S5-5	----do---------	1,374	Mar. 19, 1930	-------	---	46	.15	22	10	201	8.8	248	243	71	------	.32	720	96	82
S6-4	O. V. Ray ------	1,432	Apr. 17, 1930	-------	---	14	.15	68	34	2,620	26	333	956	3,460	------	2.3	7,430	309	95
8	R. W. Briggs ---	1,800	Dec. 12, 1948	1,120	---	53	-----	5.5	2.6	245		282	131	133	------	2.0	711	24	96
T1-2	Jack Ward ----	-------	Dec.----1914	------	---	-----	-----	-----	-------	------	------	272	63	32	------	-------	------	*53	-------
5	R. W. Wilson -	1,710	Mar.----1913	------	---	-----	-----	-----	-------	------	------	280	67	42	------	-------	------	--------	-------
5	-----do-------	1,710	Apr. 4, 1930	------	---	23	0.54	11	5.8	153	4.6	282	72	60	------	.73	474	51	87
6	Silverlake Ranch	-------	May 16, 1940	------	---	-----	-----	-----	-------	------	------	786	132	178	------	.50	------	*20	-------
7	W. L. Moody--	-------	-----do-----	------	---	-----	-----	310	114	------	------	178	1,960	1,760	------	-------	------	1,240	-------
								COOK MOUNTAIN FORMATION											
N6-1	Norman Gates -	48	Dec. 7, 1949	661	7.4	39	-----	82	17	23		271	41	41	------	1.2	406	274	15

BIGFORD MEMBER OF MOUNT SELMAN FORMATION

N1-28	A. R. Hibdon----	222	Jan. ----1913	------------	---	-----	-----	-----	-------	------	------	387	32	20	------	-------	------	*167	-------
56	T. L. Pitts -----	230	Feb. 8, 1928	------------	---	29	2.0	48	16	66	5.1	338	38	16	------	0.05	376	186	45
N2-11	W. M. Clark----	123	Feb. 9, 1928	------------	---	35	.07	82	24	32	4.0	300	93	24	------	.15	446	303	20
N5-22	H. Britton------	1,000	June 28, 1919	------------	---	38	.25	145	65	------	------	139	805	2,900	------	4.8	------	*613	-------
N7-137	G. A. Hero Estate	31	Mar.----1913	------------	---	-----	-----	-----	-------	------	------	366	574	1,580	------	-------	------	*1,210	-------
N8-24	H. P. Bailey----	66	Apr. 7, 1930	------------	---	14	1.8	69	53	1,440	22	372	806	1,710	------	2.9	4,260	390	89
30	I. J. New-------	435	May 6, 1930	------------	---	12	1.1	385	218	3,390	50	278	4,070	3,420	------	2.1	11,800	1,856	80
N9-42	Wallace Rogers--	120	Mar.----1913	------------	---	-----	-----	-----	-------	------	------	158	574	564	------	-------	------	*1,200	-------
O7-6	Jim Standifer----	140	Dec. 7, 1949	7,880	7.7	16	-----	418	294	1,310		234	3,100	1,190	------	0	6,440	2,250	56
S6-7	Catarina Farms -	60-70	May 16, 1940	------------	---	-----	-----	32	15	1,830		384	680	2,190	------	-------	4,930	142	97

INDIO FORMATION

H7-3	E. B. Flowers --	100	May 20, 1930	------------	---	-----	3.1	140	47	203		483	313	185	------	0.60	1,130	543	45
H8-1	A. W. West-----	120	Apr. 9, 1930	------------	---	12	15	401	265	431	25	666	1,540	642	------	1.1	3,740	2,089	32
M3-2	J. C. & C. B. Fenley	130	Jan. ----1913	------------	---	-----	-----	-----	-------	------	------	278	205	482	------	-------	------	*156	-------
M9-4	Chittem Estate---	200	Nov. 18, 1938	------------	---	-----	-----	-----	-------	------	------	238	75	153	------	11	------	*255	-------
16	Ed Gardner -----	-------	July 28, 1949	5,030	7.8	18	-----	158	61	964		330	1,750	460	------	.80	3,570	646	76
17	-----do---------	-------	-----do-----	1,080	7.8	26	-----	36	15	187		456	76	75	------	.20	664	152	73
18	-----do---------	-------	-----do-----	4,640	7.5	22	-----	180	71	800		404	1,170	660	------	.50	3,100	741	70

See footnotes at end of table.

Table 12.—*Analyses of ground waters in the Winter Garden district, Texas*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	pH	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)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium
									INDIO FORMATION--Continued										
M9-19	Ben Patterson	200	----do----	3,530	7.7	19	----	52	34	624		414	126	820	----	0.0	1,880	270	83
20	Ed Gardner	----	----do----	1,590	8.1	28	----	132	41	40		434	228	172	----	1.2	972	498	40
21	----do----	----	----	1,320	7.9	36	----	52	29	197		474	158	86	----	3.2	832	249	63
N7-38	J. A. Webb	900	Nov. 21, 1938	----	---	----	----	----	----	----	----	162	1,090	139	----	.25	----	*892	----
70	C. M. Burns	530	Nov. 20, 1938	----	---	----	----	----	----	----	----	183	1,000	875	----	1.6	----	*675	----
182	Joe Gardner	247	July 18, 1949	1,680	7.7	34	----	184	41	115		310	302	220	----	.0	1,050	628	29
183	----do----	183	----do----	1,350	7.9	54	----	69	22	170		236	81	246	----	9.5	816	262	58
184	Ben Patterson	200	----do----	2,130	7.8	28	----	184	63	216		380	665	130	----	.80	1,470	718	40
R3-6	W. C. Ammann	475	May 20, 1930	----	---	33	0.10	116	25	291	9.5	502	385	169	----	.12	1,280	392	62
9	Hal A. Hamilton	50	Nov. 20, 1938	----	---	----	----	----	----	----	----	302	165	123	----	1.0	----	*108	----
									LEONA FORMATION										
N1-57	T. J. Dube	97	Feb. 9, 1928	----	---	27	0.40	131	26	19	2.5	373	39	90	----	1.3	536	434	9
N2-28	I. T. Pryor, Jr	70	Dec. 27, 1948	631	---	13	----	97	21	9.7		372	19	12	----	9.2	368	328	6
N3-4	E. W. King	45	Feb. 9, 1928	----	---	25	.06	125	18	30	2.9	364	90	33	----	7.3	520	386	15

5	R. Willoughby----	60	May 3, 1939	------------	---	-----	-----	-----	-------	------	------	477	108	52	------	1.9	------	*502	-------
6	-----do----------	60	-----do-----	------------	---	-----	-----	-----	-------	------	------	428	159	62	------	6.2	------	*532	-------
7	-----do----------	60	-----do-----	------------	---	-----	-----	-----	-------	------	------	454	112	91	------	2.8	------	*555	-------
8	-----do----------	60	-----do-----	------------	---	-----	-----	-----	-------	------	------	432	141	67	------	5.0	------	*510	-------

1/ Boron (B)--Well N7-69, 1.0.
2/ Boron (B)--Well S2-135, 0.82.
* Hardness determined by the soap method.

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