Geology and Ground-Water Resources of Galveston County Texas

By BEN M. PETITT, Jr., *and* ALLEN G. WINSLOW

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CONTENTS

ILLUSTRATIONS

[All plates in pocket]

TABLES

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ABSTRACT

Galveston County, on the Texas gulf coast, is underlain by alternating beds of sand and clay. These sand and clay strata crop out in belts that roughly parallel the coastline and dip gently southeastward at an angle greater than the slope of the land, thereby creating artesian aquifers. The formations that yield potable water to wells are the Lissie formation, the "Alta Loma" sand and other sands of the Beaumont clay, and beach and dune sands of Recent age. Most of the potable water is obtained on the mainland of Galveston County. The water from most wells on Galveston Island is highly mineralized.

Before 1948, water for all public use and nearly all industrial use was derived from wells. Most ground water now used in the county is pumped from areas around Alta Loma and Texas City. The average daily pumpage in these areas increased from 6 million gallons in 1938 to 17.8 million gallons in 1940 and reached a peak of about 34 million gallons in 1945. Between 1945 and 1948 the rate of pumpage was nearly constant, but in 1948 surface water was diverted from the Brazos River to supply some of the Texas City industries and, as a result, the use of ground water was reduced about 30 percent.

Water levels declined in county wells as the pumpage increased during the years prior to 1948. Since water from the Brazos River has been utilized the levels have risen in many wells and tended to become constant in others.

Subsidence of the land in a large part of the county, particularly in the Texas City area, is attributed to the excessive withdrawal of ground water.

Salt-water encroachment has been a problem in the county for many years. Salt water was present in the lower part of the "Alta Loma" sand in the Alta Loma and Texas City areas and throughout that sand on Galveston Island when the first wells were drilled. Encroachment from either below or downdip took place with the lowering of artesian pressure in the aquifer in the vicinity of Alta Loma and Texas City.

Pumping tests reveal that the average coefficient of transmissibility of the "Alta Loma" sand is 102,000 at Alta Loma and 153,000 at Texas City. The coefficients of transmissibility of sands in the upper part of the Beaumont clay around Texas City average 27,300.

Surface water from the Brazos River, used for the irrigation of rice since 1942, was made available in 1948 to industries in Texas City as a substitute for ground water. The water from the Brazos River is variable in quality, but probably can be utilized on a somewhat larger scale than at present.

Much additional ground water could be obtained from both the "Alta Loma" sand and the upper part of the Beaumont clay, especially in the northern and

western parts of the county. Before large developments of supplies are planned, however, these areas should be explored by test drilling. The problems of well spacing and pumping rates should be thoroughly studied in order to determine the maximum development permitted by the ground-water supply. Current observations should be continued with special emphasis on the progress of salt-water encroachment.

INTRODUCTION

PURPOSE AND SCOPE OF INVESTIGATION

The need for basic data in seeking solutions to hydrologic problems in Galveston County has been apparent for a long time. Increased development of ground-water resources in the middle 1930's brought about an increasing decline in artesian pressure in the aquifers, and the accompanying increase in salinity of waters in some parts of the county became a matter of great concern to water users. Therefore, in 1938 the United States Geological Survey, as a supplement to the ground-water investigations made in cooperation with the Texas State Board of Water Engineers, began an intensive ground-water study, in cooperation with the city of Galveston, to obtain information from which an intelligent program of ground-water development could be evolved. Much of this work was discontinued during World War II because the emphasis was on defense investigations, although periodic water-level measurements were made and water samples collected during and after the war years. In 1950 the cooperative program of investigation was revived.

The investigation included study of the following: (1) The areal extent, depth, and thickness of the water-bearing beds; (2) the hydrologic properties of the aquifers; (3) the average daily withdrawals of ground water in Galveston County for municipal and industrial purposes; (4) the relation between the rate of ground-water withdrawal and the rate of decline of artesian pressure; (5) the chemical character of the water and data on the encroachment of salt water; (6) the availability and chemical character of surface water and the extent of its use; and (7) the subsidence of the land surface.

This report contains records of 474 wells and 1,017 chemical analyses of water from 314 wells (tables 12, 13, and 14). A part of these records was published in 1941 (Barnes).

LOCATION AND AREAL EXTENT

Galveston County is on the upper or northeastern gulf coast of Texas, about 25 miles south of Houston (fig. 1). It is bounded on the north by Harris and Chambers Counties, on the east and south by the Gulf of Mexico, and on the west by Brazoria County. The county encompasses about 710 square miles, including about 430 square miles of land and 3 water areas—Galveston Bay, East Bay, and West Bay.

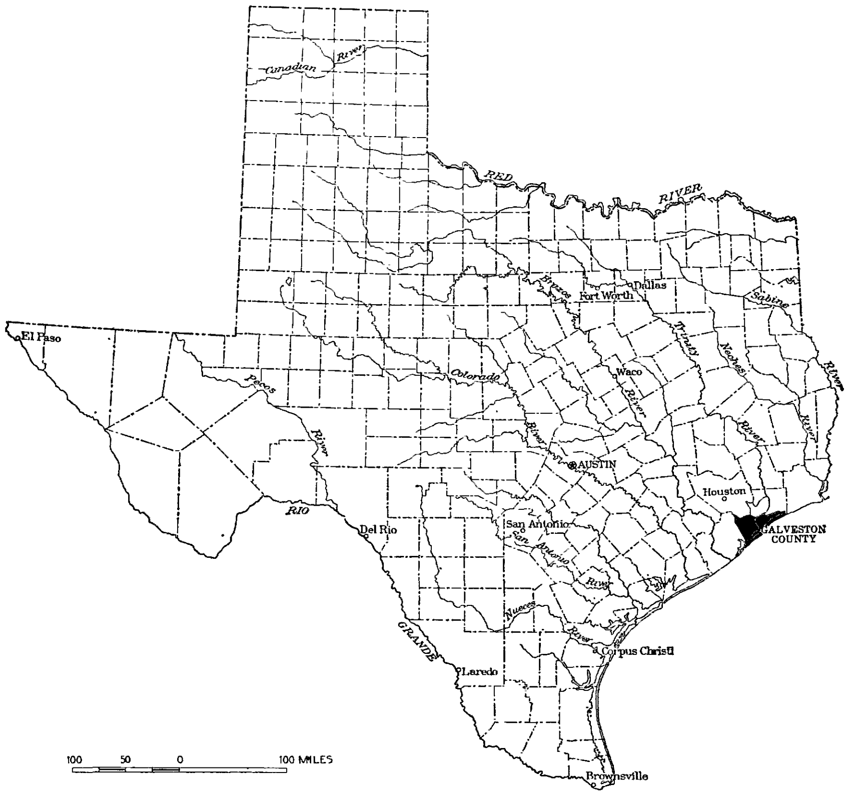

FIGURE 1.—Map of Texas showing location of Galveston County.

ECONOMIC DEVELOPMENT

Galveston County was one of the first areas to be settled on the Texas gulf coast. It was organized in 1839 and, according to the Texas Almanac, had a population of 4,529 in 1850. According to the United States Bureau of the Census, the population in 1950 was 113,066. Galveston, the county seat, had a population of 65,898 in 1950. Other cities and towns, with their 1950 population, include: Texas City, 16,577; La Marque, 7,358; Dickinson, 2,650; League City, 1,346; and Hitchcock, 1,100. The rural population was 13,044.

Galveston, the oldest port in Texas, was used as a stronghold by the pirate Jean Lafitte in the early part of the 19th century. Later it was used as a port of entry. During those times the depth of water at the outer bar entrance was about 9 feet, making it necessary to use vessels of light draft for loading and unloading ships outside the harbor. After the War Between the States, the channel was deepened to permit entry of deep-draft vessels. Galveston has since become one of the leading ports in the Nation, handling a total of 6,953,452 tons in 1950.

The chief exports are cotton, sulphur, grain and grain products, and sugar. Besides shipping, the principal activities of the city center around shipyards, grain elevators, machine shops, cotton compresses, a brewery, a pipe mill, commercial fisheries, a tea-processing plant, and a nail and wire plant. Many tourists are attracted annually by the fine beaches and other seashore facilities.

Texas City is the industrial center of Galveston County. Several oil refineries, chemical plants, and a tin smelter are in the area. Texas City is an even larger port than Galveston and in 1950 handled 10,928,000 tons consisting primarily of petroleum, petroleum products, and chemicals. Coastal barges carried most of this tonnage.

Galveston County is one of the large oil-producing counties of the prolific Texas gulf coast region, and much drilling is still being done. Oil production during 1950 was 8,416,585 barrels, and many millions of cubic feet of natural gas were produced. Farming, livestock raising, and dairying are practiced throughout the county. The principal crops are rice, hay, figs, and vegetables. The amount of ground water used for irrigation of these crops is not significant.

PREVIOUS INVESTIGATIONS

A large amount of investigative work has been done on the occurrence of ground water in Galveston County. The first published report (Singley, 1893, p. 85–114) describes ground-water conditions in the county, with particular reference to the municipal wells on Galveston Island. Taylor (1907, p. 27–30) described briefly the artesian wells of Galveston County, including the new municipal wells that were drilled at Alta Loma (on the mainland) in 1893 and 1894 for the city of Galveston. A more detailed report by Deussen (1914, p. 154–176) described the geology and contained well records giving information on yield, artesian pressure, and chemical character of the water.

An investigation of the ground-water resources of Galveston County by the U. S. Geological Survey in cooperation with the Texas Board of Water Engineers has been in progress intermittently since 1931. A preliminary study of ground-water conditions was made in 1931–32 by Penn Livingston and S. F. Turner (1932). From 1932 to 1938, periodic measurements were made of water levels in observation wells; the results were published in 1939 (White, Livingston, and Turner). An intensive investigation of the ground-water resources of the county was made from the spring of 1939 until the summer of 1942 by B. A. Barnes. During the investigation, the records of water wells in the county were brought up to date and ground-water conditions were studied in the Alta Loma, Texas City, and Galveston areas. The well records were published in 1941 (Barnes, 1941). Reports prepared by Barnes, relating to test drilling in the Alta Loma area and adjacent territory, were released in manuscript form by the Board in April 1941 [1] and July 1943.[2] In 1943 a report on the occurrence of ground water in the Texas City area also was published by the Board (Rose, 1943). Records of water-level measurements in observation wells in Galveston County have been published for the period 1935–52 in U. S. Geological Survey Water-Supply Papers.[3]

ACKNOWLEDGMENTS

The writers are indebted to many persons for contributed information and assistance in the field work, but especially to Marshall McNeel, Jr., Commissioner of Water Works at Galveston; and to well drillers, and representatives of the Pan American Refining Corp. and the Carbide and Carbon Chemicals Corp.

CLIMATE

The climate in Galveston County is humid and mild. According to records of the United States Weather Bureau, the average annual precipitation at Galveston during a period of 80 years (1871–1951) was 45.79 inches. The annual precipitation ranged from 21.40 inches in 1948 to 78.39 inches in 1900 (fig. 2). September is the month of greatest precipitation, having an average of 5.69 inches; February has the least, with an average of 2.82 inches. Table 1 gives the precipitation by months at Galveston from 1871 to 1951, as reported by the U. S. Weather Bureau.

The mean annual temperature at Galveston is 69.9°F. The highest temperature recorded during the period of record was 101°F, and the lowest was 8°F. The average monthly temperature ranges from 54.1°F in January to 83.3°F in August.

PHYSIOGRAPHY AND DRAINAGE

Galveston County may be divided into two units—the land surface and the bay. The land surface consists of a mainland area west of Galveston Bay, Galveston Island, and Bolivar Peninsula which extends southwestward from Chambers County. The bay area includes East Bay, West Bay, and a part of Galveston Bay.

The mainland of Galveston County is an almost featureless plain that slopes southeastward at slightly less than 1 foot per mile from the highest altitude of 40 feet in the northwest part. The surface is

[1] Barnes, B. A., 1941, Results of test drilling by city of Galveston and conclusions: Tex. Board Water Engineers, typewritten report, 13 p.

[2] Barnes, B. A., 1943, Results of test drilling by city of Galveston, Nov. 1941 to June 19[illegible]: Tex. Board Water Engineers, typewritten report, 34 p.

[3] Water-Supply Papers 777, 817, 840, 845, 886, 909, 939, 947, 989, 1019, 1026, 1074, 1099, 1129, 1159, 1168, 1194, and 1224.

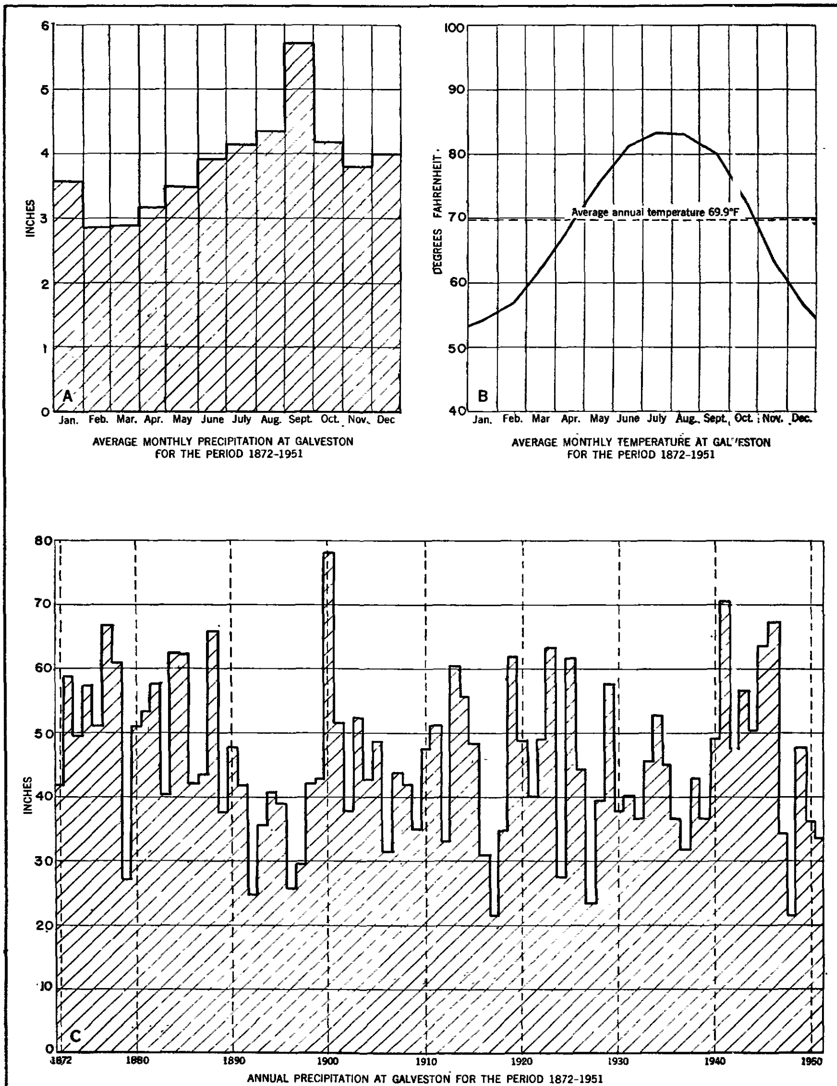

FIGURE 2.—Graphs showing precipitation and temperature at Galveston: A, average monthly precipitation at Galveston for the period 1872–1951; B, average monthly temperature at Galveston for the period 1872–1951; C, annual precipitation at Galveston for the period 1872–1951.

drained by sluggish, low-gradient streams, principally Clear Creek, Dickinson Bayou, and Highland Bayou. All streams are affected by tidewater in their lower reaches.

Galveston Island and Bolivar Peninsula are long, narrow sandbars, forming the outer coastline of Galveston County. These sandbars have an average width of about 2 miles and an altitude generally less

TABLE 1.—*Precipitation, in inches, at Galveston, Tex., 1871 to 1951*

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1871	----	----	----	----	3.79	11.89	2.63	4.32	3.66	17.78	5.67	2.38	-------
1872	4.62	2.27	2.77	5.96	2.21	3.39	.34	2.63	2.33	1.86	7.98	5.37	41.73
1873	3.43	.50	2.80	2.27	5.36	8.61	6.83	8.04	7.37	2.26	8.91	2.53	58.91
1874	1.35	3.11	3.09	3.38	5.80	1.68	9.30	7.19	5.84	.12	1.58	6.92	49.36
1875	4.31	2.93	3.51	2.55	1.50	.89	1.11	6.10	18.41	1.41	4.88	9.71	57.32
1876	1.49	4.79	5.94	2.65	10.27	2.63	3.22	10.19	.64	1.41	3.98	3.71	50.92
1877	4.53	1.12	1.35	8.36	1.80	2.68	1.89	1.27	13.85	17.39	6.77	5.86	66.87
1878	4.66	3.88	1.03	3.50	3.90	3.48	7.70	7.58	5.08	3.61	7.31	9.07	60.80
1879	1.88	1.36	.91	2.55	1.91	1.96	3.09	7.18	1.47	.60	1.95	2.07	26.93
1880	.66	2.13	6.54	1.71	4.09	8.33	2.48	1.62	10.20	2.20	8.85	2.16	50.97
1881	3.94	8.29	1.47	4.76	3.50	.03	4.92	5.98	3.66	10.38	2.85	3.50	53.28
1882	8.15	5.57	1.58	.83	3.75	6.16	4.34	9.85	4.68	6.79	2.20	3.78	57.68
1883	6.46	1.15	3.93	1.26	6.01	1.04	1.38	1.09	3.22	6.78	4.88	2.91	40.11
1884	5.10	.89	4.84	5.55	8.42	6.84	1.16	1.77	7.04	7.37	4.25	9.44	62.67
1885	6.97	2.04	3.17	4.12	6.41	3.28	2.20	1.74	26.01	2.20	2.32	2.10	62.56
1886	3.45	2.31	3.19	2.15	.03	6.19	1.20	3.46	13.31	1.93	2.65	2.10	41.97
1887	1.19	1.86	1.98	.01	4.84	8.28	1.62	6.43	2.52	4.37	.05	10.28	43.43
1888	2.70	7.54	2.84	3.13	5.18	9.77	1.54	14.46	3.32	5.67	6.73	3.00	65.88
1889	7.81	2.94	3.31	1.40	1.81	4.79	.75	5.11	3.98	T	5.39	.23	37.52
1890	2.86	.92	4.96	5.14	5.38	7.42	1.82	5.09	4.79	4.38	2.37	1.67	47.80
1891	6.79	4.35	2.55	1.73	.25	3.52	4.31	4.01	7.01	1.06	3.44	2.49	41.51
1892	1.99	1.52	1.45	1.14	.33	4.26	1.50	5.29	.58	1.69	2.80	2.23	24.78
1893	.54	1.99	.88	5.70	2.98	7.45	2.96	5.02	5.02	.55	3.92	1.72	35.43
1894	2.41	2.69	1.96	1.42	1.00	9.89	6.32	9.49	2.64	.51	1.59	.72	40.64
1895	1.24	4.93	2.77	.33	5.13	1.91	3.07	4.51	1.86	2.93	5.95	4.28	38.91
1896	1.91	2.70	3.59	1.49	.82	.34	3.90	.35	2.20	2.14	3.84	2.33	25.61
1897	2.97	2.25	4.59	1.24	1.27	.37	.78	4.65	2.40	5.12	1.02	2.58	29.24
1898	4.48	4.03	4.10	3.04	1.58	1.94	3.62	3.68	6.78	.84	5.65	2.26	42.00
1899	10.39	2.83	.53	2.80	T	5.61	6.02	2.52	1.85	1.86	3.48	4.87	42.76
1900	3.18	3.59	6.87	4.65	4.53	5.51	18.74	6.94	11.80	5.54	1.64	5.40	78.39
1901	1.39	2.24	1.96	2.86	.46	.85	6.11	6.58	7.84	15.00	2.06	3.98	51.33
1902	.92	2.12	.92	2.85	2.72	8.22	2.81	.00	7.11	1.48	6.59	1.93	37.67
1903	4.55	6.84	8.11	1.14	.79	3.14	13.79	5.45	2.76	3.60	.03	2.27	52.47
1904	1.01	.99	.57	11.04	5.20	4.03	3.41	4.03	5.43	.80	4.14	2.00	42.65
1905	5.40	5.23	2.21	7.62	1.70	7.48	2.39	2.00	2.41	1.07	5.77	5.32	48.60
1906	1.17	2.92	2.05	.19	.14	1.73	5.85	1.47	2.68	10.88	.45	1.63	31.16
1907	1.44	2.09	2.28	4.00	6.80	T	1.49	.94	7.56	6.96	6.33	4.04	43.93
1908	2.15	3.35	.69	1.44	3.40	.54	7.28	4.16	14.64	.34	1.28	2.74	42.01
1909	.02	1.46	1.97	3.39	5.85	3.08	.61	4.06	2.50	7.61	1.89	2.51	34.95
1910	2.05	4.41	1.48	.92	5.10	6.70	6.19	2.01	4.74	9.36	.95	3.58	47.49
1911	.90	.69	3.88	7.63	1.90	1.45	4.73	5.48	3.50	5.92	5.06	9.99	51.13
1912	2.44	1.91	2.00	4.29	1.50	4.03	.16	1.59	1.04	2.04	.41	8.61	33.02
1913	2.92	3.27	1.43	2.46	3.87	2.51	1.48	3.88	18.68	15.37	2.49	2.11	60.47
1914	.34	3.31	4.63	8.54	7.54	.12	1.29	8.17	5.20	2.95	9.19	4.43	55.71
1915	4.52	2.65	1.43	3.37	2.70	.08	2.45	19.08	2.12	2.81	1.47	5.69	48.37
1916	.86	.19	.25	1.37	8.08	3.15	4.64	4.14	4.24	.69	2.16	.79	30.86
1917	2.21	2.51	.91	1.45	3.47	.65	.46	3.60	3.60	1.49	.97	1.00	21.43
1918	.54	1.11	1.65	6.63	.22	2.79	2.24	3.04	3.04	2.78	8.15	3.46	35.64
1919	6.22	2.43	2.20	2.17	9.96	15.49	3.73	2.17	5.29	8.30	1.97	2.02	61.95
1920	7.09	1.80	1.77	.70	3.86	6.68	6.68	2.65	2.86	7.92	3.64	6.49	48.67
1921	2.77	2.30	3.59	2.47	2.04	4.97	5.77	1.42	8.37	3.83	1.61	2.76	39.90
1922	4.84	3.03	2.69	1.66	4.93	8.96	1.60	2.53	8.89	4.78	2.54	2.56	49.01
1923	6.99	5.09	4.53	4.45	3.56	3.24	5.80	4.61	9.91	3.11	4.11	7.84	63.24
1924	5.87	5.67	1.43	1.14	3.33	2.51	T	.49	.04	.03	1.52	5.33	27.36
1925	4.54	.20	.07	1.58	1.37	12.95	3.90	2.78	11.06	17.34	3.42	2.63	61.84
1926	4.36	1.27	9.39	5.49	4.08	1.53	5.00	.92	3.89	2.02	1.81	4.37	44.13
1927	1.17	1.74	.96	2.58	.12	3.09	3.61	.02	2.00	.50	1.43	6.18	23.40
1928	.41	5.41	.70	1.43	1.54	4.23	1.14	5.24	7.20	3.82	3.87	4.20	39.19
1929	5.53	2.73	3.57	9.92	10.50	1.96	7.17	.94	.44	4.02	7.68	3.28	57.74
1930	5.07	2.74	1.05	3.99	2.69	.01	.31	2.73	4.41	6.92	4.45	3.26	37.63
1931	5.58	4.23	2.01	2.26	3.14	1.74	1.02	4.23	.94	3.40	3.74	7.81	40.10
1932	6.67	4.46	1.10	2.17	1.56	.82	1.89	4.85	5.47	1.30	2.51	2.82	36.62
1933	3.32	4.34	5.52	.46	1.43	.98	8.66	2.06	3.65	4.80	4.76	5.54	45.52
1934	8.42	2.95	7.29	5.67	.62	.01	4.55	9.35	3.04	1.56	6.01	3.42	52.89
1935	2.83	5.00	1.00	4.17	.71	3.89	5.36	3.61	7.40	1.86	1.97	7.22	45.02
1936	2.75	1.42	1.89	1.93	8.90	.88	4.57	2.52	4.10	1.68	2.74	8.11	36.49
1937	3.34	1.22	3.32	1.07	.10	1.18	2.02	3.24	6.10	2.95	2.93	4.41	31.88
1938	3.63	1.91	1.82	4.41	5.03	1.29	4.00	6.03	7.13	1.26	3.78	2.71	43.00
1939	3.75	1.38	.31	.68	1.97	2.58	13.55	1.99	3.28	2.22	2.50	2.31	36.52
1940	1.59	3.02	1.20	2.43	.83	2.42	1.53	1.95	6.87	2.97	16.18	8.08	49.07
1941	2.33	2.59	6.65	8.38	4.41	4.27	9.11	3.16	15.32	11.47	1.52	1.38	70.59
1942	.77	7.05	3.19	2.44	.35	3.06	13.79	5.56	1.86	2.82	4.20	2.21	47.30
1943	4.24	2.40	3.62	.33	1.05	2.62	17.96	2.85	6.49	.65	9.24	5.23	56.60
1944	9.92	1.11	8.79	1.98	7.34	.47	.79	4.32	4.21	2.92	2.02	6.46	50.33
1945	3.52	4.45	3.60	4.30	1.01	9.01	4.08	13.18	6.95	5.62	2.51	5.08	63.31
1946	8.12	3.24	4.41	2.17	8.85	4.31	7.24	3.22	11.55	2.93	8.90	2.26	67.20
1947	2.83	.45	3.46	1.24	7.88	.60	.59	4.85	1.48	2.11	3.66	5.19	34.34
1948	3.43	2.06	1.40	.78	1.73	.46	.38	2.62	4.83	.31	2.47	.93	21.40
1949	3.27	2.61	3.04	5.76	2.56	3.54	5.95	3.32	1.21	8.37	.47	7.86	47.96
1950	.85	2.24	1.52	5.27	2.29	11.86	2.75	2.01	5.08	.07	.70	1.50	36.14
1951	3.45	.34	3.12	.63	2.86	1.72	4.75	.38	11.64	1.61	.53	2.48	33.51
Mean	3.57	2.82	2.84	3.15	3.47	3.89	4.12	4.32	5.69	4.17	3.77	3.98	45.79

than 15 feet. However, a hill marking the presence of a salt dome rises to 25 feet at High Island on the extreme northeastern end of Bolivar Peninsula. Galveston Island extends northeastward from the Brazoria County line for a distance of about 28 miles and is separated from Bolivar Peninsula by Bolivar Roads, the outlet from Galveston Bay to the Gulf of Mexico. Bolivar Peninsula extends from Bolivar Roads northeastward into Chambers County.

Galveston Bay is a shallow, rather flat-bottomed depression con-

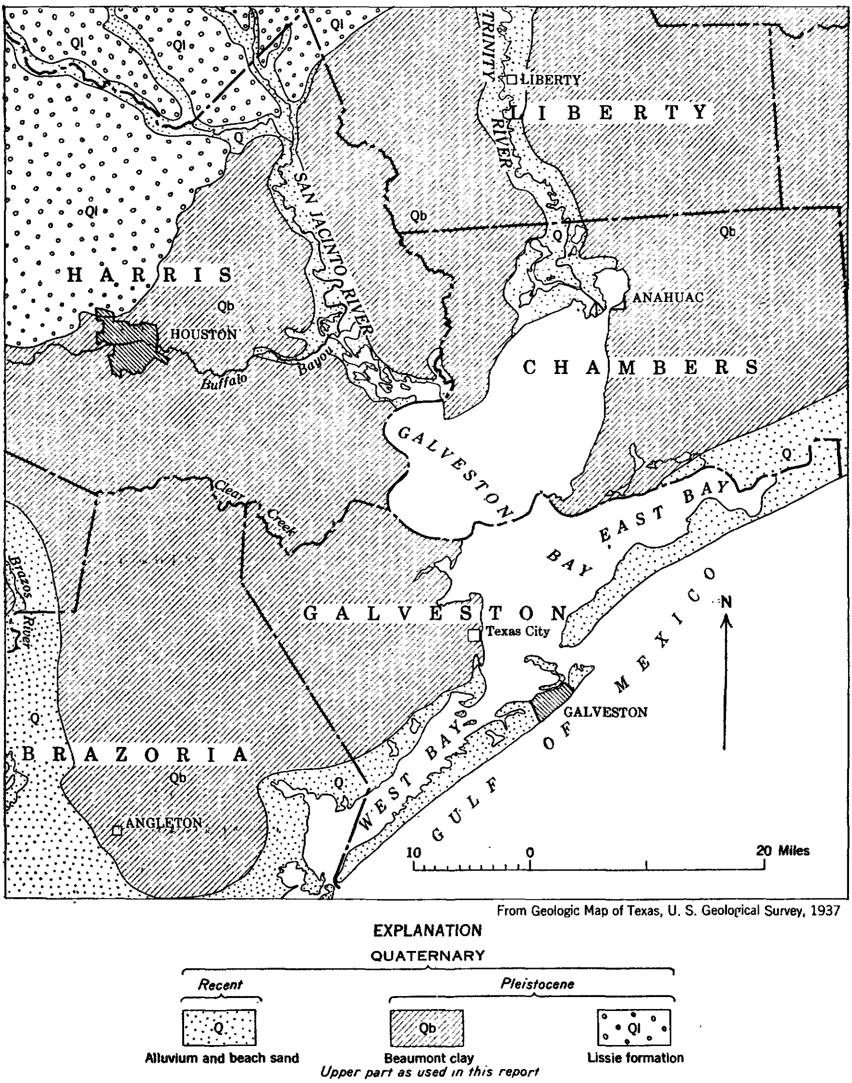

FIGURE 3.—Geologic map of Galveston County and surrounding area.

taining many small, low-lying islands and shell reefs. The Bay has been divided into three parts: Galveston Bay proper, West Bay, and East Bay. Galveston Bay lies north of the city of Galveston and extends northward into Chambers County. West Bay forms a narrow arm approximately 3 miles wide, extending southwestward into Brazoria County. East Bay is a narrow northeastward-extending arm paralleling the coast and ending near High Island.

GENERAL GEOLOGY

Galveston County is underlain by sequences of unconsolidated sands and clays. The sediments are mostly of alluvial or deltaic origin. Some of the material has been reworked by littoral currents to form beach deposits. The strata crop out in belts roughly parallel to the coast and dip gently toward the coast (fig. 3). Because the dip of the beds is greater than the slope of the land surface, the formations lie at progressively greater depths toward the southeast (pl. 1). The formations extend indefinitely under the Gulf of Mexico but because the edge of the continental shelf is about 100 miles offshore, the sands are assumed to pinch out or grade into shale within that distance.

Successively older strata crop out inland from the gulf and at progressively higher altitudes (pl. 2). These conditions, and the occurrence of permeable sands interbedded with relatively impermeable clays, have formed an ideal aquifer for artesian water. Rain that falls on the outcrops of the sand beds is the principal source of recharge to the underground reservoir.

The geologic formations that contain fresh water in Galveston County are the Lissie formation, the basal ("Alta Loma" sand) and upper parts of the Beaumont clay, all of Pleistocene age; and beach and dune sands and coastal marsh deposits of Recent age (table 2).

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

LISSIE FORMATION

The Lissie formation is unimportant as an aquifer in Galveston County. The water is generally of poor quality, although some potable water might be found in the upper beds of the formation in the northern part of the county. In this report the name "Lissie" as used by Doering (1935) is employed. Recent work by Bernard (1950), and work in progress, indicate that the correlation of the Lissie with the Pleistocene section of southwestern Louisiana is uncertain.

According to Plummer (Sellards, Adkins, and Plummer, 1932, p. 784), the Lissie formation was laid down principally as floodplain and

TABLE 2.—*Stratigraphic outline of the Quaternary system in Galveston County, Tex.*

Series	Formation		Approximate thickness (feet)	Lithologic character	Water-bearing properties
Recent			0-50±	Beach and dune sand and coastal marsh deposits.	Yields small supplies of water of good to poor quality to wells on Galveston Island and Bolivar Peninsula.
Pleistocene	Beaumont clay	Upper part	400-1,150	Red, yellow, and brown calcareous clay that produces a black or gray soil. Lenses of fine-grained sand and sandy clay. Some shell beds and nodules of calcium carbonate.	Yields moderate to large supplies of water of good to poor quality to wells throughout most of the county. The sands have relatively low permeabilities but are heavily pumped in the Texas City area. South of the Texas City area the water becomes saline.
		"Alta Loma" sand	80-370	Fine- to medium-grained, massive, gray to tan well-sorted sand of quartz grains, and chert and limestone fragments. A beach deposit(?) which may be correlated for long distances in a belt parallel to the coast.	Highly permeable sand. Yields abundant supplies, but in the southern part of the county the water is saline. Salt water has encroached in the Texas City and Alta Loma areas.
	Lissie formation		1,100+	Lenses of alternating beds of sand, sandy clay, and clay. Sands are fine to coarse; largely fluvial and deltaic deposits.	Not an important aquifer in Galveston County. Yields potable water to wells only in the extreme northern part. Contains saline water throughout most of the county.

deltaic deposits on a nearly featureless coastal plain. During Pleistocene time, large streams eroded tremendous quantities of sand, gravel, clay, and silt from the upland areas and deposited the material as they shifted laterally over the coastal plain. This type of deposition resulted in a series of alternating beds of sand, sandy clay, and clay. The sands are fine to coarse, and generally gray in the subsurface sections; they are red, orange, or buff on outcrop. Although most of the sand bodies consist of relatively small lenses, some sandy and clayey zones can be traced long distances in electric logs.

The Lissie lies unconformably on older formations and is in turn overlain, perhaps unconformably, by the "Alta Loma" sand at the base of the Beaumont clay. The thickness of the Lissie in Galveston County was not measured, but it is estimated as greater than 1,100 feet. The Lissie crops out in northern Harris County, where it is recharged by rainfall. In southern Harris County the Lissie is overlain by the "Alta Loma" sand. The Lissie is reached in wells in northern Galveston County at a depth of about 600 feet.

The Lissie yields large supplies of potable water to wells in much of Harris County and is the most important aquifer in the heavily industrialized Houston district, but only a few wells in the extreme north part of Galveston County tap the aquifer. In most of the county it contains highly mineralized water.

BEAUMONT CLAY

The name Beaumont clay was first used by Hayes and Kennedy (1903, p. 27) in describing the clay deposits lying between the sandy Lissie formation and the coastal deposits of Recent age in Jefferson County, Tex. The name has been widely used in describing the formation along the gulf coast in both Texas and Louisiana. The Beaumont clay was mapped in Jasper, Newton, and Orange Counties, Tex., by Bernard [4] but he substituted the name Prairie formation, after Fisk's classification (1940) for the Beaumont clay in Louisiana. The Hayes and Kennedy classification is followed in this report.

According to Plummer (Sellards, Adkins, and Plummer, 1932, p. 790) the Beaumont clay was deposited, mainly by rivers, in the form of deltas and natural levees. Between the deltas and natural levees, lagoonal, and in some places marine, deposits were laid down. The resulting formations show a rapid lateral change of facies. A small foraminiferal fauna, indicating marine or brackish-water deposition, was found in a set of drill cuttings from a well at Dickinson. The sediments of the upper part of the Beaumont are much finer grained than those of the Lissie formation or the "Alta Loma" sand.

"ALTA LOMA" SAND

Immediately overlying the Lissie formation in Galveston County is a bed of sand 84 to 370 feet thick which Rose (1943, p. 3) called the "Alta Loma" sand. Deussen (1914, p. 154–155), in describing wells in Galveston County, includes the sand with the Lissie formation. Other writers (White, Livingston, and Turner, 1932), believe the sand to be basal Beaumont, and that usage is followed in this report. Bernard (1950, p. 131) describes a sand in the subsurface of Orange County that is probably the equivalent of the "Alta Loma." This sand is tentatively correlated by Bernard with the basal part of the Prairie formation of Louisiana, but later information (Meyer, R. R., personal communication) suggests that the Louisiana classification may have to be revised extensively. Any correlation between Pleistocene units in Texas and Louisiana is highly tentative at present.

Although the "Alta Loma" sand has not been identified in the outcrop, it appears to be a definite stratigraphic unit and can be mapped long distances in its subsurface position by use of well logs. The sand differs both lithologically and hydrologically from the underlying Lissie formation and the overlying part of the Beaumont clay; ultimately it may deserve ranking as a separate formation. It is the principal aquifer in Galveston County.

The name "Alta Loma" was suggested because of the occurrence of the sand in the subsurface section near the town of Alta Loma in the

[4] Bernard, H. A., 1950, Quaternary geology of southeast Texas: Ph. D. thesis, La. State Univ.

vicinity of the Galveston well field. Extensive test drilling by the city of Galveston has yielded much hydrologic and lithologic information concerning the formation in the Alta Loma area. The sand is well known also in the eastern Ship Channel area of the Houston district and in southeastern Harris County.

The "Alta Loma" probably represents a beach sand laid down unconformably on the Lissie formation. Its distribution suggests littoral deposition roughly parallel to the present shoreline. It extends as a belt northeast along the coast from at least as far southwest as Freeport in Brazoria County to Galveston Bay, where it swings inland around and roughly parallel to the bay; and thence along the coast of Chambers, Jefferson, and Orange Counties into Louisiana. The sand is much more uniform than other individual sand bodies in the Pleistocene section of the Texas gulf coast and may be correlated in electrical logs of wells for long distances, especially along the strike (pl. 2). Because of the comparatively narrow belt-like distribution of the formation, correlation up the dip cannot be carried as far as correlation along the strike. Inland from the coast, the formation may change from the beach sand facies to the lagoonal type of deposit which commonly occurs on the shoreward side of beach sands along the present gulf coast. The apparent change in facies, shown on the cross section (*A–A′*, pl. 1) between the Ethyl Corp. No. 2L well and the Texas Water Co. Greens Bayou No. 1 well, seems to confirm this interpretation.

The "Alta Loma" sand has not been identified in outcrop; if the apparent facies change described above is extensive, the sand would not crop out, but its equivalent, a lagoonal, deltaic, or flood-plain deposit, should do so. The similarity of this part of the formation to the underlying sands of the Lissie makes it very difficult to distinguish between the two formations in outcrop. If the beach facies of the formation were present at the surface, it probably could be identified.

The position and thickness of the "Alta Loma" sand in most of Galveston County have been well established through study of well logs. However, in the area east of Dickinson identification is uncertain because the vertical continuity of the sand is broken by beds of clay (indicated by electric logs of oil tests). In the northeastern part of the county the sand has not been mapped because there are few well logs. For the rest of the county, maps showing the approximate thickness and the elevation of the top of the sand have been prepared (pls. 3 and 4). Along the northern boundary of the county the sand is found in wells at a depth of about 400 feet, whereas the top of the sand in well N–9 on Galveston Island is at about 1,180 feet. The dip of the formation averages about 20 feet per mile on the mainland and steepens to about 30 feet per mile southward to Galveston

Island. However, the steepening may not represent the true dip because the sand thins in this direction. The dip in Harris County, as shown in the cross section, is about 10 feet per mile beginning at the Harris-Galveston County line where there appears to be a fault (pl. 1). The dip in the northern part of this area is slightly steeper than that shown because the sketch is not strictly a dip section.

The "Alta Loma" sand extends under the Gulf of Mexico, but its actual extent in this direction is not known. The electrical log of an oil test well drilled about 7 miles offshore from Freeport shows a sandy section from about 1,070 feet to about 1,390 feet. If this section correlates with the "Alta Loma" and if the strike is approximately parallel to the shoreline, the dip of the top of the formation is about 12.5 feet per mile. Another well drilled about 8 miles off Galveston Island shows a sandy section from about 1,110 feet to about 1,430 feet, which indicates, when correlated with the "Alta Loma" as shown in the log of the Humble-Houston Farms Development Co. No. 2 well (pl. 2), a dip of about 18 feet per mile for the top of the formation. Correlation of the "Alta Loma" in the Sun-State 340 well (pl. 2) with a sandy section from about 1,360 to about 1,490 feet in an oil test well drilled about 10 miles off Bolivar Peninsula shows a dip of about 23 feet per mile for the top of the formation.

Admitting that the correlations are questionable, it still appears probable that the rate of dip, at least for a short distance under the gulf, is about 20 feet per mile. Farther offshore, the rate of dip would become less and possibly would approach zero.

Considering the possible structural relations of the beds under the gulf and the facies changes observed in older beds on the gulf coast, it seems probable that the "Alta Loma" sand may pass into a marine facies and then grade into shale without ever cropping out on the floor of the gulf.

The "Alta Loma" in Galveston County consists of a massive, gray to tan, fine- to medium-grained, well-sorted sand. The size of most of the sand grains is between 0.1 and 0.3 millimeter. Quartz is by far the dominant constituent, but chert and limestone fragments are common and shell fragments and reworked fossils of Cretaceous age have been reported.

Plate 4 is an isopach map showing the approximate thickness of the "Alta Loma" sand in Galveston County. The most striking feature revealed by this map is the thickening of the formation both east and southwest of Alta Loma. The thickening has special significance in relation to the occurrence of salt water—a problem discussed in a later section of this report.

The "Alta Loma" sand is one of the most permeable aquifers of the Texas gulf coast. In Galveston County permeabilities ranging from

580 to 700 gallons per day (gpd) per square foot (Meinzer units) and averaging 645 gpd per square foot have been determined from pumping tests made at Alta Loma and at Texas City. Similar permeabilities have been determined for the sand in Harris County. According to N. A. Rose (personal communication, 1952), a permeability of 2,000 Meinzer units was determined by a pumping test in Orange County.

Wells that obtain water from the "Alta Loma" sand generally yield between 500 and 2,000 gpm within practical limits of drawdown. The newer city of Galveston wells near Alta Loma can yield more than 1,000 gpm. Wells tapping this aquifer near Texas City yield between 1,200 and 1,500 gpm. On Galveston Island the well at Galveston-Houston Breweries, Inc., which yields mineralized water used only for cooling purposes, originally yielded 2,200 gpm.

UPPER PART OF THE BEAUMONT CLAY

In Galveston County the upper part of the Beaumont clay consists principally of red, yellow, or brown calcareous clay that weathers to bluish gray or black. The clay strata are interbedded with fine-grained grayish sand, sandy clay, and a few beds of shells. Nodules of calcium carbonate are common. The individual sands are, for the most part, extremely lenticular and can be traced only short distances. Some of the sand is so fine that it is difficult to screen wells properly. Pumping tests at Texas City have indicated permeabilities ranging from 173 to 423 gpd per square foot and averaging 300. The typical upper part of the Beaumont crops out in southeastern Harris County and in all of Galveston County, except for a narrow strip along the coast where it is mantled by marsh deposits and beach and dune sand. The clay ranges in thickness from about 400 feet in northern Galveston County to about 1,150 feet on Galveston Island. The average dip is about 20 feet per mile throughout the county, but it appears to be greater in the southern part (pl. 1) of the county.

Although most wells in Galveston County are screened in sands of the upper Beaumont, the pumpage from this aquifer has not been so great as that from the "Alta Loma" sand. Even so, it is an important source of water throughout the county, and in the Texas City area it is at present the only formation that yields water containing less than 1,000 parts per million (ppm) of dissolved solids.

Large wells that obtain water from sands of the upper Beaumont usually yield between 100 and 600 gpm; all yield relatively small quantities of water, with correspondingly large drawdowns, as compared to the large wells drawing from the "Alta Loma" sand.

RECENT BEACH AND DUNE SAND AND MARSH DEPOSITS

The Recent beach and dune sand deposits and silts and clays of the marsh deposits overlie the Beaumont clay on Galveston Island, Bolivar Peninsula, and in a narrow strip bordering the north shore of West Bay. These sands are thin, reaching a maximum thickness of about 50 feet on Galveston Island. They are of minor importance as an aquifer, although a few domestic and stock wells (K–2, K–4, H–4, Q–7, and Q–18) draw small quantities of poor-quality water from the sands on Bolivar Peninsula and on Galveston Island.

HISTORY OF WATER SUPPLIES

GROUND WATER

The first published records of wells in Galveston County were those of Singley (1893, p. 85–114), who described 45 flowing wells within the county. There was only a gradual increase in the use of ground water between 1893 and 1935, but its use increased rapidly between 1935 and 1944 when industry was expanding in the Texas City area. The use of ground water remained nearly constant from 1944 until 1948, when the introduction of surface water into the Texas City area caused a decrease in total ground-water pumpage. Since that time the pumpage has been nearly constant. At present there are about 1,500 operating wells in the county.

The first significant withdrawals of ground water, as reported by Singley (1893, p. 85–114), were on Galveston Island and in the vicinity of Dickinson and Hitchcock. Development of the Alta Loma area by the city of Galveston in 1894 resulted in a widespread use of ground water. Accurate records are not available to determine the amounts of these early withdrawals, but, according to Deussen (1914, p. 94, 154–176), most of the wells throughout the county flowed and water was used extensively for irrigating truck farms and fruit orchards. It is assumed that as the artesian pressure declined, the rate of withdrawal of ground water from flowing wells also declined.

The two major areas of ground-water withdrawal in Galveston County are at Alta Loma, where the city of Galveston has its well fields, and the industrial area of Texas City. The principal water users in the Texas City area are the Pan American Refining Co., Carbide and Carbon Chemicals Corp., Republic Oil Refining Co., Monsanto Chemical Co., Tin Processing Corp., Texas City Refining Co., Inc., Sid Richardson Refining Co., and the Texas City Terminal Railway.

Water is also withdrawn by water districts at League City, Dickinson, La Marque, Kemah, and Hitchcock for public supply; by oil companies for the development and operation of the many oil fields in the county; by the small truck farms in the League City and Dickinson areas; and for all the rural, domestic, and stock uses.

The estimated average daily withdrawal of ground water for public and industrial supplies in the Alta Loma and Texas City areas during 1947 and 1951 is given in table 3. The table, subdivided to show pumpage separately for public supply and the different classes of industries that use more than 5,000 gpd, emphasizes the decrease in pumpage caused by the use of Brazos River water for industrial purposes since 1948.

TABLE 3.—*Estimated average daily ground-water pumpage, in million gallons per day, for public and industrial use at Alta Loma and Texas City in 1947, and in 1951 after the introduction of Brazos River water into Galveston County*

Consumers	Number of plants		Number of wells		Pumpage	
	1947	1951	1947	1951	1947	1951
City of Galveston	1	1	13	13	11. 92	10. 71
Texas City [1]	1	1	4	5	. 75	1. 30
Oil refineries	3	4	18	17	14. 04	6. 98
Chemical plants	3	3	12	11	4. 70	2. 66
Tin smelter	1	1	3	3	1. 14	. 92
Railroads	1	1	2	1	. 13	. 13
Total	10	11	52	50	32. 68	22. 70

[1] Community Public Service Co.

It is estimated that in 1951 the average daily withdrawal of ground water in Galveston County was approximately 28 million gallons, distributed as follows:

Public supply	13, 500, 000
Industrial	13, 700, 000
Domestic, stock, and irrigation	800, 000
Total	28, 000, 000

Comparison of the 28,000,000 gpd for the entire county (1951) with the 22,700,000 gpd for the Alta Loma and Texas City areas in 1951 (table 3) shows that all but 5,300,000 gpd of the total water consumed was used by these 2 areas.

CITY OF GALVESTON

By 1891, according to Singley (1893), the city of Galveston had put down 13 wells on Galveston Island. The wells ranged in depth from 810 to 840 feet, except for one which was 1,346 feet deep. All these wells produced highly mineralized water. In 1891, in a final effort to obtain a supply of fresh water on the island, the city authorized the drilling of a well 3,070 feet deep. The driller's record of this well (see log N–8) shows several water sands, but in each successive sand the water became increasingly salty, and the well was abandoned. Chemical analyses of the water are not available.

In 1893 the city, having abandoned hope of obtaining a suitable supply of water on Galveston Island, authorized the drilling of 33 wells on the mainland near Alta Loma, about 20 miles northwest of Galveston and 13 miles north of West Bay. Although the contract called for 33 wells, with a guarantee of 5 million gpd, only 30 wells (E–96 to E–105, and L–40 to L–59) were completed because the combined flow of the 30 wells was 9 million gpd.

The 30 wells were arranged in a north-south line and spaced from 300 to 900 feet apart. (See inset map of Alta Loma area on pl. 5.) They range in depth from 726 to 868 feet and are screened in the "Alta Loma" sand. When the wells were drilled, the artesian pressure was sufficient to raise the water level 28 feet above the land surface. However, the pressure steadily declined until the wells ceased to flow naturally, and it was necessary to maintain the flow by injecting compressed air (air-lift pumping).

The quality of water from the wells varied with depth. An analysis of water in 1899 from well L–50, which is screened from 756 to 796 feet, showed a chloride content of 244 ppm; whereas well L–40, which is 860 feet deep, had a chloride content of 1,014 ppm. In general, the water from these wells was moderately soft, mildly alkaline, and slightly saline.

In 1895 the average withdrawl from the Alta Loma field was 1.62 mgd, increasing gradually to 4.68 mgd in 1930. As the withdrawals increased, the water levels in the wells declined.

Between 1914 and 1935, the original municipal wells at Alta Loma were gradually abandoned and replaced by 8 wells (L–60, L–61, L–62, L–63, L–65, L–66, L–67, and L–68) along the railroad southeast of Alta Loma (see inset, pl. 5). These wells, equipped with deep-well turbine pumps, are in use at the present time. By 1939 the pumpage had reached the rate of 5.82 mgd and the water levels ranged from 45 to 50 feet below the land surface. The decline of artesian pressure which accompanied the increase in pumping accelerated the encroachment of salt water.

To meet the increasing demands of the city and to improve the quality of its supply, it was imperative that the city of Galveston start an exploration program. Test drilling was undertaken to determine the character and thickness of the sands and clays and the quality of water at selected horizons near Alta Loma. The test-drilling program consisted of two parts: first, the drilling of test wells 1 (L–63), 2 (E–93), and 3 (L–10) (see fig. 4); and, second, the drilling of 12 additional test wells and 6 production wells.

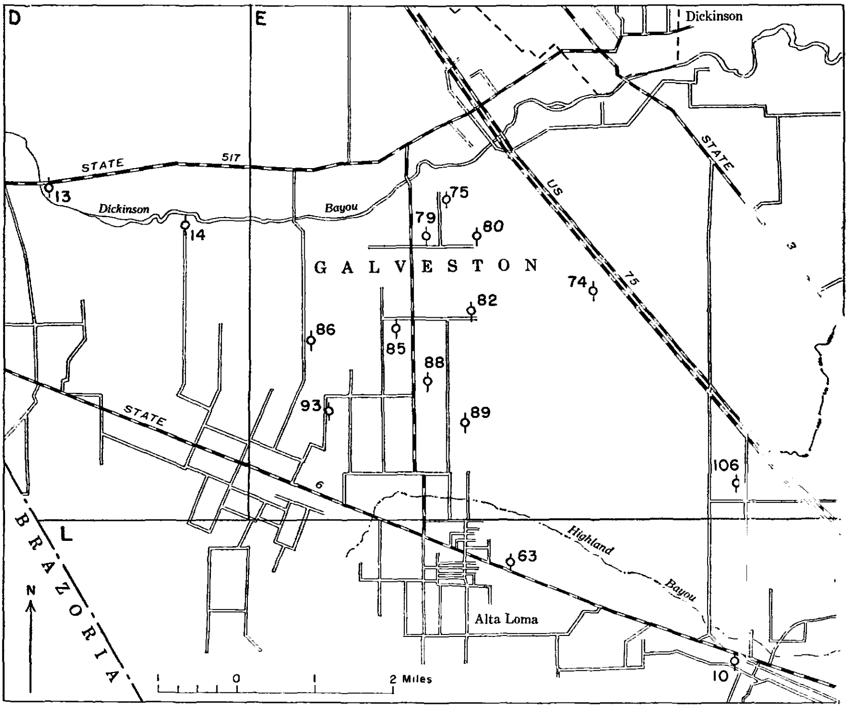

FIGURE 4.—Location of city of Galveston's test wells.

The original plans and main objectives, according to Barnes,[5] were as follows:

(1) In the Alta Loma well field: the exploration of the sands above the "Alta Loma" sand.

(2) Northwest of Alta Loma: the exploration of the sands above the "Alta Loma" sand, the "Alta Loma" sand, and the sands below the "Alta Loma" sand. The head, the depth and thickness and the quality of water was to be determined for each sand. It was considered especially important to test the thickness of the clays immediately underlying the "Alta Loma" sand which might serve to protect the "Alta Loma" from encroachment of possible salt-water sands below.

(3) Southeast of Alta Loma: the exploration of possible aquifers above the "Alta Loma" sand in areas adjacent to the city water main. Three test wells approximately 600 feet deep along the pipeline southeast of Alta Loma were deemed sufficient to obtain this information.

Test well 1 (L–63) was drilled at Alta Loma, test well 2 (E–93) northwest of Alta Loma, and test well 3 (L–10) at Hitchcock, about 3½ miles southeast of Alta Loma (fig. 4). Barnes [6] reports that by the

[5] Barnes, B. A., 1941, Results of test drilling by city of Galveston and conclusions: Tex. Board Water Engineers, typewritten report, p. 2.

[6] Barnes, B. A., 1941, Results of test drilling by city of Galveston and conclusions: Tex. Board Water Engineers, typewritten report, p. 2, 3.

time the third test well had been completed, it became apparent that the chances were poor for locating shallow sands above the "Alta Loma" that would yield a municipal supply. The upper sands were thin and lenticular. It was decided that the information needed was the depth and thickness of the "Alta Loma" sand and the quality of water contained in it, and the position, head, and quality of water in the sands underlying the "Alta Loma." The thickness and stratigraphic position of the clays separating the "Alta Loma" sand from the underlying sands were thought to be of special importance because of the possibility that these clays might retard upward movement of salt water into the "Alta Loma." To obtain this information, the test wells at the Alta Loma well field and at Hitchcock were deepened to about 1,200 feet.

The data obtained from the three test wells drilled in the first part of the program showed that: 1. The clay underlying the main sand body of the "Alta Loma" sand was not everywhere an effective barrier to the upward encroachment of salt water because of the interfingering of sands and sandy clays. 2. Salt water was present in the lower part of the "Alta Loma" sand, perhaps because of excessive withdrawal within the small area of development. 3. Small-diameter wells should be drilled north and northwest of the Alta Loma field. Electric logs and drill-stem tests should be made. 4. Withdrawals should be discontinued in or near the Alta Loma field.

On the basis of the information obtained from the 3 wells, the second part of the program was formulated for exploration and development in the area north and northwest of Alta Loma. As outlined initially, 1 production well was to be drilled at the location of test well 2 (E–93) northwest of Alta Loma (fig. 4); 4 test wells were to be drilled as a guide to determine the best locations for 4 additional wells for municipal supply; and 1 test well was to be drilled as an exploratory well.

Twelve test wells were drilled during this part of the program. Three of these were cased for purposes of water sampling and water-level observations; the remainder were plugged and abandoned.

According to Barnes,[7] the test-drilling program disclosed conditions that were not previously known and confirmed much of the indicative data that had been previously collected. One of the most unexpected conditions revealed was the wide variation of the quality of water in the "Alta Loma" sand and the lack of uniformity of the underlying clay layer. It revealed that the "Alta Loma" sand is widespread and continuous. The thickness ranged from 84 to 250 feet, increasing in a southeasterly direction. No other sands comparable to the "Alta Loma" were found anywhere in the area from the surface down to a

[7] Barnes, B. A., 1943. Results of test drilling by city of Galveston, November 1941 to June 1942: Tex. Water Engineers, typewritten report, p. 21.

depth of 1,200 feet. The clay immediately underlying the "Alta Loma" ranged in thickness from 3 to 4 feet in test well 12–15 (E–75) to about 186 feet in test well 10–13 (E–89). It was assumed, therefore, that in some places the clay might be absent.

Wide variation in the chloride content of water from the "Alta Loma" existed both laterally and vertically. The chloride contents of samples of water collected from drill-stem tests near the base of the "Alta Loma" sand ranged from 134 ppm in test well 7–10 (E–74) to 458 and 460 ppm in test wells 2–5 (D–13) and 12–15 (E–74), respectively. Theoretically, the chloride content decreases toward the outcrop and although the water in well 2–5 (D–13) updip had a higher chloride content than was expected, the theory was not disproved, but it was shown that there was a greater variation in salinity than had been expected. A study of the electric logs of the test wells indicates that in general the chloride concentration increases with depth. This was further shown by analyses of water collected from the upper part of the "Alta Loma." (See table 14 of chemical analyses.)

As a result of the information obtained in the test-drilling program, five new production wells (E–78, E–81, E–83, E–84, and E–87) were drilled and placed in service in 1943.

After the installation of the new wells, the pumpage at Alta Loma increased to 11.5 mgd in 1944. From 1944 through 1948, the pumpage rate in the Alta Loma area was fairly constant; in 1949 it dropped to 10.7 mgd—a rate which has been maintained according to the most recent records (1952).

TEXAS CITY AREA

According to Rose (1943, p. 7), the withdrawal of ground water in the Texas City area began about 1893, although little accurate information is available regarding this early use. In 1920, 4 wells were in use by the Texas City Terminal Railroad, 3 by the Pierce Oil Co. at the present site of the Sid Richardson Refining Co., and 3 wells belonging to the Texas City Electric Light and Water Co., now the Community Public Service Co. These wells were all between 850 and 1,030 feet deep and obtained water from the "Alta Loma" sand. The average withdrawal at that time was about 1 mgd.

Few data are available concerning the early artesian pressures in the Texas City area, but it is reported that, as late as 1920, the pressure was sufficient to raise the water level above the land surface.

In 1930, the industrial plants that were operating in the Texas City area included those of the Southport Petroleum Co. (now the Sid Richardson Refining Co. and the Texas City Refining Co.), Stone Oil Co. (now the Pan American Chemical Co.), Texas City Sugar Refinery, and Texas City Terminal Railroad. The Pan

American Refining Co. began operating in 1934, the Republic Oil Refining Co. in 1937, the Carbide and Carbon Chemicals Co. in 1941, the Tin Processing Corp. in 1942, and the Monsanto Chemical Co. in 1943.

Before 1948, all water used in the Texas City area was ground water. The larger wells range in depth from 550 feet to slightly more than 1,000 feet. The principal aquifers are the "Alta Loma" sand and the upper part of the Beaumont clay. Wells in this area, screened in the "Alta Loma" sand, yield water of poor quality, but large quantities are withdrawn for industrial use. It is estimated that more than 75 percent of the ground water pumped in the Texas City area before 1948 was from the "Alta Loma" sand. Wells in this area screened in sands in the upper part of the Beaumont clay yield smaller amounts, but the water is of much better quality.

The withdrawal of ground water for public supply and industry in the Texas City area gradually increased from approximately 1 mgd in 1920 to slightly less than 2 mgd in 1930. The pumpage continued to increase slowly between 1930 and 1933, but after that period industrial expansion made the pumpage increase rapidly until in 1937 the average daily pumpage was slightly more than 10 mgd. From 1937 to 1941 the pumpage gradually increased to 10.5 mgd. Between 1941 and the end of 1944 the pumpage increased to 23.3 mgd—more than a 100 percent increase in 3 years. The pumpage decreased to 20 mgd after the close of World War II and then started upward again, so that by the close of 1948 the withdrawal was 23 mgd.

In 1948, surface water from the Brazos River was diverted to Texas City, resulting in a sharp reduction in ground-water pumpage. In 1950 the average ground-water pumpage was 11.3 mgd, a reduction of nearly 12 mgd in withdrawals from the "Alta Loma." In 1952 the pumpage was about 11.5 mgd.

Artesian pressure before 1920 was sufficient to cause wells to flow that were screened in the "Alta Loma" sand, but the decline in artesian pressure resulting from development between 1920 and 1930 caused the water levels to sink below the land surface. The hydrograph of well F–34 (pl. 13), 4 miles west of Texas City, is indicative of the general lowering of water levels in the area. In 1931 the water level was 4.2 feet below the surface, and in 1941 the water level was 55.5 feet below. The decline appears to have occurred uniformly. From 1941 to 1945 the water level declined rapidly until it was 94 feet below the surface. From 1945 to 1947 the water levels showed a slight rise. In 1947 the water level again began to decline, and in May 1948 the water level was 102.4 feet, a decline of approximately 10 feet. After the reduction in pumping at Texas City, recovery started immediately, and between May 1948 and May 1951 recovery amounted to 24.5 feet.

NORTHWESTERN PART OF THE COUNTY

In the northwestern part of Galveston County the available ground-water supply has not been widely exploited. Although it is the source of all water for domestic use, stock, industry, and public supply, there are few large-yield wells.

Most of the smaller domestic and stock wells are screened in sands of the upper Beaumont at depths ranging from 30 to 200 feet and averaging about 130 feet. Although there is a wide range in the quality of water from these wells, in general the water is fair, though slightly hard; at places it contains objectionable quantities of iron. In 1952 the water levels in these wells ranged from 7 to 25 feet below the land surface.

Although most wells are screened in sands of the upper Beaumont clay, some of the wells withdraw water from the "Alta Loma" sand at depths ranging from about 400 feet to slightly more than 700 feet. The water from these wells is soft and of good quality. The static (nonpumping) water levels in 1952 ranged from 84 feet below the land surface in well A–7 to 113 feet in well E–15.

Electric logs of oil test wells in the area indicate that some of the upper sands of the Lissie formation may contain fresh water. Very little information is available, however, on the few wells that may tap the formation.

NORTHEASTERN PART OF THE COUNTY

Wells in the northeastern part of the county obtain water from the upper sands of the Beaumont clay and from the "Alta Loma" sand. Water from the upper sands of the Beaumont clay supplies wells ranging in depth from less than 100 feet to slightly more than 400 feet, but a large number of wells withdraw water from the "Alta Loma" sand at depths ranging from 500 to 750 feet.

League City and Dickinson have 2 wells each and Kemah has 1 well. These 5 wells supply a population of about 4,500 persons. Some ground water is used for irrigation of truck gardens in the areas adjacent to League City and Dickinson. However, most of this area is grazing land and only a small amount of water is required for stock.

GALVESTON ISLAND

Although the city of Galveston failed to find a suitable public supply, a considerable quantity of ground water from both the upper Beaumont clay and the "Alta Loma" sand has been used for industrial purposes on Galveston Island. Wells tapping the upper Beaumont have had yields as great as 400 gpm. Well N–9 at the Galveston-Houston

Brewery was reported yielding 2,200 gpm from the "Alta Loma" sand in May 1947, but the water is highly mineralized. A few wells on the island, including well N–9, are still in use, but most of them have been abandoned.

Large supplies of fresh ground water are not available on Galveston Island, but small supplies suitable for domestic or stock use might be obtained from shallow wells tapping the beach and dune sand deposits, especially in the southwestern part of the island.

BOLIVAR PENINSULA

Bolivar Peninsula is sparsely populated, and its few wells are mostly shallow dug wells which yield only small supplies of moderately to highly mineralized water from Recent deposits of beach sand. A few wells between 130 and 350 feet in depth have been drilled in the vicinity of Caplen to supply water for domestic use and for drilling oil tests. Analyses of water from these wells show that the water is moderately to highly mineralized. Cisterns furnish most of the water for domestic use in this area.

Electric logs made on Bolivar Peninsula show no large supplies of fresh water. Small supplies might be developed by the use of properly constructed installations in the beach and dune sands where a small amount of fresh water floats on the salt water. The installations might consist of a line of shallow wells or a central collecting sump with radial horizontal drains. Such installations should be designed to skim off the fresh water at slow rates of withdrawal.

SURFACE WATER

IRRIGATION

Surface water from Clear Creek and Dickinson Bayou has been used for many years on a small scale for irrigating rice and figs in Galveston County, but since 1948 the main source of surface water in Galveston County has been the Brazos River.

The Brazos is one of the largest rivers in Texas. The average flow at Richmond for the period of record (1903–05, 1922–52) was 4,886 mgd, according to records of the U. S. Geological Survey (U. S. Geological Survey, 1954, p. 136). A large part of the total flow occurs shortly after heavy rains; prolonged periods of drought reduce the discharge to relatively small flows. Plate 6 shows the average flow, by months, of the Brazos River at Richmond in Fort Bend County, about 65 miles northwest of Galveston.

The quality of water from the Brazos River varies greatly with the rate of flow. During periods of low flow, the dissolved solids content may be relatively high; during periods of high flow, the dissolved solids content is relatively low. Plate 7 shows the relation of dissolved solids to flow for 1949 and 1950.

In 1942 the American Canal Co. and the Briscoe Irrigation Co. extended their Brazoria County canal systems and began channeling water from the Brazos River into Galveston County for rice irrigation. This water enabled farmers to plant more and more acreage in rice; in 1951 more than 20,000 acres was being irrigated. Table 4 shows by years the rice acreage irrigated with water diverted from the Brazos River and gives an estimate of the quantity of water used. It is estimated that about 2.5 acre-feet [8] of water is needed for each acre, but loss by seepage and evaporation between the points of diversion on the Brazos River and the users requires the diversion of 3 to 5 acre-feet of water for each acre irrigated.

TABLE 4.—*Rice irrigation in Galveston County with water diverted from the Brazos River*

Year	*American Canal Co. (acres)*	*Briscoe Irrigation Co. (acres)*	*Total acres*	*Estimated water used (acre-feet)*
1942	7, 700	1, 000	8, 700	22, 000
1943	7, 700	1, 500	9, 200	23, 000
1944	7, 300	4, 000	11, 300	28, 000
1945	4, 700	5, 400	10, 100	25, 000
1946	2, 900	6, 400	9, 300	23, 000
1947	4, 600	6, 400	11, 000	27, 500
1948	5, 500	7, 500	13, 000	32, 500
1949	7, 500	12, 000	19, 500	49, 000
1950	4, 100	12, 000	16, 100	40, 000
1951	5, 300	15, 000	20, 300	51, 000

INDUSTRIAL USE

Industrial expansion at Texas City put too heavy a drain on the ground-water reservoirs and created a widespread cone of depression that resulted in salt-water intrusion and subsidence of the land surface. In 1945 the conditions compelled the industries to investigate the possibilities of obtaining a supplementary supply of surface water. The two most logical sources of surface water were the San Jacinto River and the Brazos River. After extensive investigation the Brazos River was selected to supply water to this area through an extension of the canal system of the Briscoe Irrigation Co. The Galveston County Water Co. was formed and is jointly owned by the companies operating in the Texas City area.

Water from the Brazos River thus became available to the industries in July 1948. At the end of 1951 the average daily industrial use of surface water was 16.7 million gallons.

In order to get the best quality of water and to assure an adequate supply, the Galveston County Water Co. constructed a 1,000-acre

[8] One acre-foot of water equals 325,829 gallons.

reservoir capable of impounding 2.7 billion gallons of water. Insofar as possible water of the best quality available (table 5) is diverted from the Brazos River to this reservoir through a controlled operation based upon the result of analyses of daily samples collected at Richmond, Tex.

TABLE 5.—*Quality of Brazos River water delivered to the Texas City industries (1949–51)* [1]

Constituents, in parts per million		*1949*	*1950*	*1951*
Dissolved solids	Minimum	291	276	416
	Average	732	452	748
	Maximum	1, 298	865	1, 440
Chloride	Minimum	32	46	76
	Average	186	84	200
	Maximum	450	223	410
Sulfate	Minimum	8	23	48
	Average	134	54	119
	Maximum	374	142	176

[1] Information supplied by Gus Thornton, Galveston County Water Co.

GROUND-WATER HYDROLOGY

The fundamental principles of the occurrence and movement of ground water have been presented in papers by Meinzer (1923a, 1923b, and 1931), Meinzer and others (1942), and others. The discussion that follows is a brief outline of these general principles that are essential to an understanding of the problems under consideration.

SOURCE AND MOVEMENT OF GROUND WATER

The replenishment of all ground-water reservoirs in Galveston County depends on rainfall. When precipitation occurs, a part of the water runs off in streams, a part is returned to the atmosphere by evaporation and by transpiration of plants, and a small part sinks downward to the zone of saturation and becomes ground water.

Ground water occurs under two conditions: It has either passed beneath a relatively impermeable body so that it is confined and under pressure, or the water-bearing strata are unconfined and the water is not under pressure. If the water is under pressure, it will rise above the level at which it is reached by wells, and the water is said to occur under artesian conditions. If the water in a well tapping an artesian aquifer rises above the surface of the ground, the well is called a flowing well. When the water is unconfined, no appreciable rise takes place in the well reaching it, and the water is said to be under water-table conditions. The level at which unconfined water stands in wells is called the water table. Although water-table conditions exist in the Recent beach and dune sands of Galveston Island and Bolivar Peninsula, most of the water in Galveston County is under artesian pressure.

Water from precipitation moves downward through the permeable soil until its progress is retarded by relatively impermeable beds. It then moves laterally through the water-bearing beds between the confining clays and into the artesian reservoir. The force which provides this movement and maintains pressure in the artesian reservoir is gravity. The water at the outcrop feeding the artesian aquifer is unconfined, and the water table is as high as, or higher than, the water levels in wells in the artesian area.

In the ground-water reservoirs supplying the greater part of Galveston County, the interstices in the sands through which the water percolates perhaps cause a relatively high frictional loss and a slow rate of movement. The beds forming the aquifers were deposited in salty or brackish water. Much of the original salty water has been replaced by fresh water from rainfall on the outcrop. This change in water quality could not have taken place unless there was some way for the water to move out. Outlets may exist through the clays, silts, and sands which overlie the main artesian reservoir. Although the confining beds are often regarded as entirely impermeable under conditions of natural hydraulic gradient, there is evidence that water may move very slowly even through clays.

The relatively large area of slow leakage along the contact of the overlying beds may offset the low permeability and allow water to escape from the aquifer.

The withdrawal of water from a well causes a decline in artesian pressure at the well, creating a hydraulic gradient which increases in slope toward the well. The hydraulic gradient or pressure surface forms an inverted cone centered at the well, known as the cone of depression. The cone becomes larger as the discharge continues. Two or more wells in the same area may compete for the available water.

Other factors being equal, the quantity of water moving toward a well is proportional to the gradient of the cone of depression. Where two or more expanding cones of depression overlap, a ridge or divide forms on the pressure surface between the wells; across a vertical section coinciding with the ridge no flow exists because the gradient reverses and flow is limited by the quantity of water released from storage as the ridge is lowered. As a result, the wells receive less water from the direction of the ridge and the discharge of the wells decreases as the pumping levels are lowered. In an area where a cone of depression lies between a salt-water source and another cone of depression, the ridge between the two cones might be important in limiting the flow of salt water into the cone farther from the salt water.

CAPACITY OF THE SANDS TO TRANSMIT AND YIELD WATER

The amount of water that can be withdrawn perennially from an artesian reservoir depends mainly upon the capacity of the aquifers to serve as conduits from the areas of recharge to the points of withdrawal, the amount of water available for recharge to replace the water that moves toward the points of withdrawal, and the amount of water available from storage as the artesian pressure declines.

The rate at which water is transmitted depends on the transmissibility of the aquifer and the hydraulic gradient. The amount of water released from storage in an artesian aquifer depends mainly on the elasticity and compressibility of the sands and their associated confining clays, and of the contained water.

The coefficient of transmissibility used by the Geological Survey is expressed as the number of gallons of water, at the prevailing temperature, that will move in 1 day through a vertical strip of the aquifer 1 foot wide and of a height equal to the full thickness of the aquifer, under a hydraulic gradient of 100 percent, or 1 foot per foot. It may be expressed also as the number of gallons a day moving across a vertical section of the aquifer 1 mile wide and having a hydraulic gradient of 1 foot per mile.

The amount of water yielded from storage as artesian pressure declines is dependent on the coefficient of storage. This coefficient for an artesian aquifer is defined as the volume of water, in cubic feet, that is released from storage in each column of the aquifer having a base of 1 square foot and a height equal to the thickness of the aquifer when the artesian head is lowered 1 foot.

Several pumping tests have been made in the Alta Loma and Texas City areas. These tests consisted of pumping a well at a uniform rate and observing the rate of drawdown in an observation well nearby, or of stopping the pump and observing the rate of recovery in the pumped well and other observation wells nearby. The results of the tests were analyzed using an equation developed under the direction of Theis (1935):

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

where

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

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 per day; r is the distance, in feet, from the discharging well to the point of observation; S is the coefficient of storage; and t is the time, in days, that the well has been pumped.

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RELATION OF SALT WATER TO FRESH WATER IN SANDS

The basic principles of the relation of salt water to fresh water in a water-bearing sand have been well established. The earliest scientific work on this problem was done in Europe where the principles of the flotation of fresh water on salt water within the permeable rocks of an island were first investigated and discussed by Badon Ghyben (1889) and by Herzberg (1901), working independently of each other. The result of this early work is commonly called the Ghyben-Herzberg theory; more recent investigators have studied and applied the theory to coastal aquifers with such favorable results that to many workers the theory is now a principle. The theory must be applied judiciously, however, to conditions found in nature.

RELATION UNDER STATIC CONDITIONS

Any body that floats in a liquid will displace a volume of the liquid equal in weight to the weight of the floating body. The volume of the floating body in excess of the volume of liquid displaced will rest above the level of the host liquid. The Ghyben-Herzberg theory is basically this principle.

Plate 8*A* represents a cross section of an island composed of permeable sand and surrounded entirely by sea water. Fresh water is lighter than salt water and will float on the salt water with most of its volume submerged, in a manner similar to that in which ice floats in water. In an island of this type, the resistance of the sand to the flow of water causes the fresh water from rainfall to build up a head above sea level sufficient to cause the water to flow slowly into the ocean at or near the shores of the island, and to form a lens-shaped mass whose greater part is below sea level. This resistance to flow also prevents the mixing by wave action of the salt and fresh waters in the sand below sea level. As the sand is assumed to be uniformly permeable in all directions, the fresh-water head will cause a downward flow of fresh water until it fills the sand to the depth at which its head is balanced by the head of the salt water. Therefore, when essential equilibrium has been reached, the depth of fresh water below sea level at any point on the island will be proportional to the fresh-water head above sea level. This will depend also upon the relation of the specific gravities of fresh and salt water. Although the specific gravity of sea water varies somewhat from place to place, the average value is about 1.025 and that value is generally used in computations.

An explanation by Brown (1925) of the relation between fresh water and salt water under a small sand island, similar to that in plate 8*A*, is summarized by the following equation.

$$h=\frac{t}{g-1}$$

where h=depth of fresh water below sea level
t=height of fresh water above sea level
g=specific gravity of sea water as compared to the assumed specific gravity of 1 for fresh ground water.

This equation may be verified if it is assumed that the upper and lower limits of fresh water represent the total thickness of fresh water (H); it follows that

$$H=h+t$$

and when balanced by the same weight of sea water

$$H=hg=h+t$$

and

$$h=\frac{t}{g-1}$$

If the specific gravity of sea water is 1.025, then from the equation ($h=40t$) fresh water will be present 40 feet below sea level for each foot it is above sea level. If the specific gravity of sea water is less than 1.025, then fresh water will be present to a proportionally greater depth.

The Ghyben-Herzberg theory has been applied by many workers in describing the relation between fresh and salt water in aquifers. It has been shown by Hubbert (1940, p. 924), however, that the theory is strictly valid only under conditions in which static equilibrium exists between the fresh and salt water—a condition that exists rarely, if ever, in nature. Fresh ground water is continually in motion in aquifers, and a state of dynamic equilibrium exists which slightly modifies the application of the Ghyben-Herzberg theory.

Plate 8*B* represents a section of an ideal artesian aquifer composed of uniformly permeable sand underlain and covered by an impermeable clay and which has an exposed intake area and a submarine outcrop. If the principles of the Ghyben-Herzberg theory are applied, the position of the zone of contact between fresh water and salt water in the aquifer can be established. If it is assumed that the density of sea water is 1.025 and that of fresh ground water is 1.0, then fresh water would be present to a depth below sea level of 40 times the height of the fresh water head above sea level after sufficient time has elapsed for complete flushing of salt water from the aquifer.

The nature of the zone of diffusion between salt and fresh waters is a subject of considerable debate. It is believed by many, notably

Pennick (1905), D'Andrimont (1905), Barksdale, Sundstrom, and Brunstein (1936), and Byers,[9] that the zone of diffusion is relatively narrow. Other writers, notably Krul and Liefrinck (1946) and Wentworth (1951), imply that the zone is wide. Because the width is affected by the permeability of the rocks, the rates of recharge and flow, and the effects of tidal and seasonal fluctuations of water level, a considerable variation should be expected.

EFFECT OF PUMPING

The principles of the behavior of fresh water and salt water in a state of relative equilibrium in water-bearing sands have just been presented. With these principles in mind, it is possible to withdraw a continuous supply of fresh water from sands exposed in part to salt water. The amount of water that can be withdrawn will be influenced by the methods used, by local conditions, and by the amount of water available for recharge. The effect of pumping and the rate of withdrawal will have a significant influence upon the continuity of the supply.

As the depth of fresh water is directly related to the fresh-water head above sea level, any general lowering of the head in a sand exposed for a part of its extent to the ocean will permit salt water to encroach upon the fresh-water portion of the aquifer. Where water is under water-table or shallow artesian conditions the lowering of the fresh-water head may result from such natural conditions as a dry year or a series of dry years. Natural lowering of the fresh-water head is likely to be small and of little consequence in a geologic and hydrologic setting such as that in Galveston County; in the deeper artesian aquifers, the natural conditions leading to the lowering of the fresh-water head are generally insignificant. The lowering of the fresh-water head by pumping will generally have the greatest effect on the inland encroachment of salt water.

The rate of movement of the zone of contact between fresh and salt water will be governed mostly by the rate of pumping, for it will be necessary to remove, by pumping, the fresh water between the original position of the zone of contact and the position that it would occupy when equilibrium between recharge and discharge was established.

Salt water fills the sand around and beneath the lens of fresh water under a small island composed entirely of sand. The effect of pumping a well in such a sand is shown in plate 9. As the depth of the zone of contact is determined theoretically by the head of fresh water at any point, any lowering of the water table should cause a

[9] Byers, A. C., 1941, Results of electrical resistivity prospecting for salt-water contacts in the Hawaiian Islands: U. S. Geol. Survey unpublished paper presented at conference on salt-water conditions and problems and methods of investigation.

proportional rise of the salt water underlying the fresh water. Plate 9*A* shows a shallow well that is being pumped at a rate sufficient to draw down the level of fresh water to a few feet above sea level. The cone of depression created by pumping this well causes the salt water to rise from beneath the island in a shape similar to the cone of depression, but inverted and proportionally much greater in its vertical dimension. The distance the salt water rises as the water level drops is determined by the relation between the specific gravities of the fresh water and the salt water. The position of the zone of contact is not affected beyond the influence of the cone of depression by pumping the well.

In an artesian sand, pumping does not ordinarily draw the head down to such a depth that the sand around the well is drained, as it is under water-table conditions. The removal of pressure at and around a pumped well creates a hydraulic gradient between the sand from which water is being withdrawn and underlying sands. If the pumped sand is separated from the underlying salt-water sands by clay layers of low permeability, the clay retards the upward movement so that only small quantities of salt water rise from below. If not enough salt water can move through the confining clays of an idealized artesian aquifer to cause contamination, then the only possibility of contamination will be by lateral migration of salt water through the aquifer.

If the cone of depression does not extend to the zone of diffusion, a ground-water divide will be established and the zone of diffusion will not move toward the well. As long as the artesian pressures between the pumped well and the zone of diffusion are maintained at a sufficient elevation to hold back the salt water (Ghyben-Herzberg principle), there will be no encroachment of salt water. If the cone of depression extends to the zone of diffusion, it is only a matter of time until the salt water enters the pumped well (pl. 9*B*).

SALT WATER IN GALVESTON COUNTY

The ideal geologic and hydrologic conditions arbitrarily assumed in the preceding discussion rarely occur in nature. The fresh-water aquifers in Galveston County must have had some areas of discharge so that circulation could flush out the saline water trapped during deposition. The method of flushing has long been a subject for speculation. Some of the more logical theories are given here.

It is possible that the aquifers are continuous in the offshore direction and that their dip continues at the same rate as in Galveston County. This would place the submarine outcrop of the "Alta Loma" sand about 160 miles offshore at a depth of about 4,300 feet below sea level, as shown in plate 10*A*. The head at Alta Loma, before any appreciable amount of ground water was withdrawn, was approximately 48 feet above sea level. On the basis of the head in the probable outcrop area (at least 48 feet and probably 50 or 60 feet above sea level), and assuming that all movement of water downdip was through the submarine outcrop, the fresh-water head would have been adequate to displace salt water to a depth of at least 2,000 feet below sea level; this would have put the contact beyond Galveston Island. Water from the "Alta Loma" sand on Galveston Island, however, has always been highly mineralized and at present contains about 3,400 ppm of chloride. Because of its high salinity and the improbability that permeable sand extends all the way to the continental slope, this method of natural flushing appears unlikely.

Perhaps the dip of the formations flattens in the seaward direction and the sands continue to a submarine outcrop at a depth much less than 4,300 feet, as is shown in plate 10*B*. If this is true, the heads that existed before ground-water withdrawals began were sufficient to cause circulation and account for whatever flushing occurred.

Another possible method of flushing is based on the assumption that the clays overlying the "Alta Loma" are not continuous. Many sandy zones are present in the upper part of the Beaumont clay, and it is not unreasonable to believe that deviously interconnected sandy zones connect the "Alta Loma" with the floor of the Gulf of Mexico, as shown in plate 10*C*. Flushing could be accomplished through the sandy zones, and fresh water could not exist beyond the limit of this discharge area.

In the foregoing, it is assumed that the "Alta Loma" sand is continuous beneath the continental shelf either to the continental slope or to some break in the overlying clays that allows discharge of water to the floor of the gulf. If the sand is not continuous but instead grades into a marine shale, some other exit must be provided. Although the overlying clays have generally been regarded as impermeable when compared to the sands, they are not entirely impermeable. The surface area of the clays in contact with the "Alta Loma" is very large when compared to the cross-sectional area of the sand. The gradient upward at the contact between the sand below and the clay above is high, and much time has elapsed since their deposition. It is possible that flushing of the formation occurred through these overlying clays in the manner shown in plate 10*D*.

As long as there is a seaward gradient in the piezometric surface, ground water must move seaward and the process of flushing continues. The same points or areas of egress become points or areas of encroachment, however, when the gradient is reversed; obviously, the gradient depends on the relative position of land and sea levels.

Changes in sea level occurred in Pleistocene and Recent time but details are not known.

Some flushing has occurred, but how complete this flushing has been is not known. However, the salinity of the water in the basal few feet of the "Alta Loma" sand indicates that only partial flushing of the aquifer has occurred as far inland as Alta Loma.

Before test drilling by the city of Galveston in 1940 and 1941, it was believed that the "Alta Loma" was underlain by a thick, continuous clay. The test-drilling program revealed a layer of clay at each location, but the thickness ranged from only 3 feet to 186 feet. The clay is underlain by or interbedded with sands which contain highly mineralized water. The wide range in thickness indicates the clay may pinch out altogether in places and permit the upward movement of saline water into the "Alta Loma" and a subsequent lateral movement to wells. The fact that the artesian head in the underlying sands is approximately the same as that in the "Alta Loma" and has declined at the same rate as wells screened in the "Alta Loma" (see fig. 11) suggests that the clay beds offer little protection against the upward encroachment of salt water.

Apparently salt water is encroaching from both downdip and from below. The analytical treatment of each of these conditions separately is comparatively simple; however, the complexities involved when both conditions exist are such that much more detailed data must be obtained before making any attempt to evaluate the problem. It is noteworthy that with a decrease in pressure in the "Alta Loma" sand the chloride content tends to increase, but once equilibrium is attained the chloride content remains relatively constant.

Salt water in the "Alta Loma" sand appears to occur in the form of a wedge in the lower part of the formation, thickening downdip. Within the zone of diffusion between the fresh water and saline water, the salinity appears to increase rapidly with depth; however, the vertical range between fresh water and water as saline as that of the ocean probably extends through a considerable depth. Any encroachment resulting from the movement of water updip would probably bring gradual rather than abrupt increases in the chloride content of the water withdrawn.

Details of the encroachment of salt water into the Galveston well field are given in the section on the quality of water in the "Alta Loma" sand.

LISSIE FORMATION

The Lissie formation has little value as an aquifer in Galveston County. Although electric logs of oil test wells indicate that the upper part may contain fresh water in the extreme northern part of the county, it is believed that—with the natural hydraulic gradient already reversed by heavy pumping in Harris County—salt-water encroachment would occur in a relatively short time. The artesian pressures have declined to the extent that wells completed in this formation would have no advantage over wells completed in the overlying "Alta Loma" sand or in sands of the upper Beaumont. In addition, it is unlikely that the quality of water from the upper Lissie would be superior to that of the "Alta Loma."

The few wells that tap the Lissie formation were probably drilled to take advantage of the once higher pressures in this formation. Well E–22, drilled in 1924 to furnish water for a privately owned swimming pool, was completed in the Lissie. The water was salty when the well was completed, but there was sufficient pressure to make it flow and fill the swimming pool. When this well was visited in 1932 it was still flowing, but by March of 1939 the water level had declined to 13.1 feet below the land surface; in July 1941 it was 20.3 feet below the land surface; and in November 1951, 64.6 feet below.

The decline of artesian pressure in this well has continued without large withdrawals from the Lissie in Galveston County. Two possible causes of this decline are: (1) The large withdrawal of water from the Lissie formation in Harris County has created a widespread cone of depression, or (2) the "Alta Loma" and Lissie are interconnected and the decline reflects pumping from the "Alta Loma" sand.

BEAUMONT CLAY

"ALTA LOMA" SAND

SPECIFIC CAPACITY OF WELLS

Pumping causes a drop or drawdown in the water level in a well. The relation that exists between the discharge and the drawdown of a well is known as the specific capacity and is usually expressed in gallons per minute per foot of drawdown. For example, if a well is pumped at the rate of 500 gpm and the water level is lowered 50 feet, its specific capacity is 10 gpm per foot of drawdown. In a like manner, if the specific capacity of a well is 10 gpm per foot of drawdown, there is an implication that, within certain limits, the yield of the well will be increased 10 gpm for every foot of increased drawdown.

The specific capacity of a well is controlled by several factors, principally the coefficients of transmissibility and storage, the effective radius of the well, the well construction, and the degree to which the well has been developed. The yield, drawdown, screen diameter, and specific capacity of wells in Galveston County screened in the "Alta Loma" sand are given in table 6.

TABLE 6.—*Yield and specific capacities of wells screened in the "Alta Loma" sand in Galveston County, Tex.*

Well	Owner	Screen diameter (inches)	Yield (gallons per minute)	Drawdown (feet)	Specific capacity (gallons per minute per foot)
B-38	Galveston County Water Control and Improvement District 2, well 1	6	150	14	10.7
E-78	City of Galveston well 10	10¾	1,025	45	22.8
E-81	City of Galveston well 13	10¾	1,040	32	32.5
E-83	City of Galveston well 12	10¾	1,025	42	24.4
E-84	City of Galveston well 9	10¾	1,002	53.4	18.8
E-87	City of Galveston well 11	10¾	1,012	49	20.7
E-92	City of Galveston well 14	10¾	1,040	30	34.7
F-51	Carbide and Carbon Chemicals Co. well 3	10	1,500	47	31.9
F-53	Pan American Refining Corp. well 6	10	1,500	49	30.6
F-55	Pan American Refining Corp. well 3	8	1,240	98	12.7
F-57	Pan American Refining Corp. well 9	10¾	1,515	57	26.6
L-21	Galveston County Water Control and Improvement District 7	6⅝	620	33	18.8
L-64	City of Galveston well 2	7	720	90	8.0
L-65	City of Galveston well 3	7	780	46	17.0
L-67	City of Galveston well 5	8	729	64	11.4
L-68	City of Galveston well 8	12	2,550	82	31.1
M-1	Galveston County Water Control and Improvement District 3, well 4	10¾	831	25	33.2
M-2	Galveston County Water Control and Improvement District 3, well 3	10¾	805	31	26.0
M-23	Carbide and Carbon Chemicals Corp. well 7	10¾	1,420	59	24.1
M-25	Carbide and Carbon Chemicals Corp. well 2	10	1,500	49	30.6
M-26	Carbide and Carbon Chemicals Corp. well 1	10¾	1,500	50	30.0
M-28	Pan American Refining Corp. well 7	10	1,550	40	38.8
M-29	Pan American Refining Corp. well 8	10	1,535	57	26.9
M-33	Pan American Refining Corp. well 10	10¾	1,500	49	30.6
M-35	Republic Oil Refining Co. well 4	12¾	1,225	40	30.6
M-37	Republic Oil Refining Co. well 2	10¾	1,435	39	36.8
M-38	Texas City Refining Co., Inc. well 2	10¾	800	34	23.5
M-39	Texas City Refining Co., Inc. well 1	10¾	800	27	29.6
N-9	Galveston-Houston Breweries, Inc	10¾	2,200	60	36.7

ARTESIAN PRESSURES

In 1895, according to Taylor (1907), the artesian pressure in 2 wells tapping the "Alta Loma" sand in Texas City was sufficient to raise the water 28 feet above the land surface. About 1900, an artesian head of 32 feet above the land surface was reported in a well near Dickinson and 30 feet in 3 wells near Hitchcock. At Alta Loma the pressure was sufficient in 1895 to raise the water 28 feet above the land surface. Taylor (p. 27) states that there were about 90 flowing wells in the county. It is reported that the last of the flowing wells screened in the "Alta Loma" ceased flowing about 1930.

The greatest declines in water levels in wells screened in the "Alta Loma" sand occurred between 1941 and 1948 as a result of the rapid development. Plate 11 illustrates the declines in artesian pressure that occurred from 1941 to 1948.

Because of the reduction in pumping in the Texas City area, resulting from the introduction of surface water in 1948, water levels in wells screened in the "Alta Loma" sand began to rise. The recovery was noticed over a large area around Texas City. This is illustrated in plate 12, which shows the net changes in artesian pressure from 1948 to 1952.

Because all wells at Alta Loma and Texas City in Galveston County, and at Baytown, La Porte, Pasadena, and Deer Park in Harris County, withdraw water from the "Alta Loma" sand, the artesian pressures have been influenced to varying degrees by pumping throughout the region.

Measurements of the water levels in observation wells screened in the "Alta Loma" sand in Galveston County have been made periodically since 1931. Most of the measurements have been published annually in U. S. Geological Survey Water-Supply Papers.[10] Hydrographs of selected observation wells screened in the "Alta Loma" are shown in plates 13 and 14.

The change in water levels between 1939 and 1951 in observation wells screened in the "Alta Loma" sand in different areas of Galveston County is shown in table 7. Measurements were made during the spring of each year.

Two profiles of the piezometric surface of the "Alta Loma" sand have been prepared (pl. 15). One extends from north of Pasadena in Harris County through Alta Loma to the Gulf of Mexico, and the other extends across the mainland of Galveston County in a westerly direction north of Alta Loma through Texas City. These illustrate the piezometric surface as it must have been before any significant withdrawals and as it was during the springs of 1941, 1948, and 1952.

PUMPAGE

The "Alta Loma" sand is the most productive aquifer in Galveston County. Wells of the city of Galveston at Alta Loma, of the industrial plants at Texas City, and wells at La Marque, Hitchcock, League City, and Kemah, all withdraw water from this aquifer. Also, many of the wells of the industrial plants at Baytown, La Porte, and along the Houston Ship Channel in Harris County pump large quantities of water from this aquifer.

The largest withdrawals of ground water in Galveston County are made in the Alta Loma and Texas City areas. As early as 1892, wells were drawing water from the "Alta Loma" sand, although use on a large scale probably did not begin until 1894–95 when the city of Galveston located its well field at Alta Loma.

The average daily pumpage from this aquifer in the Alta Loma and Texas City areas increased gradually from 1.5 mgd in 1896 to 5.4 mgd in 1930, and then increased rapidly until it reached 29.6 mgd in 1944. Just after World War II there was a slight reduction in pumpage; the

[10] Water Supply Papers 777, 817, 840, 845, 886, 909, 939, 947, 989, 1019, 1026, 1074, 1099, 1129, 1159, 1168, 1194, 1224, and 1268 for the period through 1953.

TABLE 7.—*Net decline or rise (+) of artesian pressures in wells screened in the "Alta Loma" sand in Galveston County, Tex.*

[For location of wells, see plate 1]

Well	Depth of well (feet)	1939 to 1941	1941 to 1945	1945 to 1946	1946 to 1947	1947 to 1948	1948 to 1949	1949 to 1950	1950 to 1951	1951 to 1952	1941 to 1952
Alta Loma area											
E-104	790±	17.76	36.09	4.49	2.47	2.38	+6.12	+2.85	+.33	.62	36.75
L-68	884			2.87	2.88			+4.72	1.86	4.89	
L-63	874		35.70	5.78	1.35	.09	+10.97	2.20	1.39	+.43	35.11
E-92	805			2.30	1.40	6.00	+1.45	+1.35	.10	1.20	
L-11	940		36.75	2.58	1.38	5.04	+6.36	+7.36	.62	1.54	34.19
E-79	780		44.89	1.66	4.27	4.61	+.05	+.83	+.93	1.00	54.62
E-88	770			.85	5.43	2.85	+3.03	.55	+2.44	.60	
D-14	680			2.42	4.18	3.60	1.91	.01	1.59	1.07	
D-18	642	8.76			15.58	3.57	.83	1.50			
L-25	744		26.59	3.97	2.03	4.01	+3.38	+3.61	.09	2.31	32.01
L-33	923	13.62								1.81	30.58
Texas City area											
M-39	1,006				2.87	6.84	+7.98	+15.97	1.10		
F-50	1,005		43.23	+4.14	3.37	9.05	+17.77	+16.29	+.54	+5.28	11.63
F-34	914	11.24	38.35	+1.84	.79	9.94	+8.95	+15.13			
M-15	794	22.17	29.10	3.03	+2.36	8.76	+5.71	+7.83	+.79	+.79	23.38
Dickinson area											
F-2	665		24.99	3.90	2.11	4.42	2.03	+1.32	.90	2.50	39.53
E-41	625		22.90	4.02	.63	2.27				5.21	41.01
E-44	615	2.20	23.61	2.88	.40	2.63	4.68	+.66	3.83	5.61	42.98
E-47	740				+.53	2.16	+.07	.95			
E-35	750	1.90	25.14			2.21					
E-65	700		16.27	3.23				+5.08	+.69	2.32	32.73
F-23	672		40.70	+9.23	2.43	3.28	9.08	+8.53	.61	3.86	42.20
League City area											
D-7	600		21.55	2.30	4.64	2.30	3.36	2.17	3.01	2.39	41.72
E-15	700		17.31	2.59	4.37	1.50	3.25			1.77	34.58
E-7	680	1.31	17.05	+1.57	8.33	1.45	3.09	2.25	2.27	2.05	34.92
B-45	600							2.32	4.69	3.86	
B-10	500	4.31	16.87	3.27	4.43	2.69	3.22	2.69	3.48	2.29	38.94
Friendswood area											
A-6	560	4.78					4.80				
A-7	562	4.51						2.40	6.25	2.26	55.75
D-3	600	8.05	27.72			2.30	6.09	2.00	2.55	2.49	51.16

introduction of surface water to the Texas City industries in 1948 resulted in a large reduction. The average daily pumpage in the Alta Loma and Texas City areas from the "Alta Loma" sand from 1890 to 1951 is shown in figure 5.

PUMPING TESTS

Several pumping tests have been made in Galveston County to determine the coefficients of transmissibility and storage of the "Alta Loma" sand. Table 8 gives a summary of the results of tests made from 1939 to 1951.

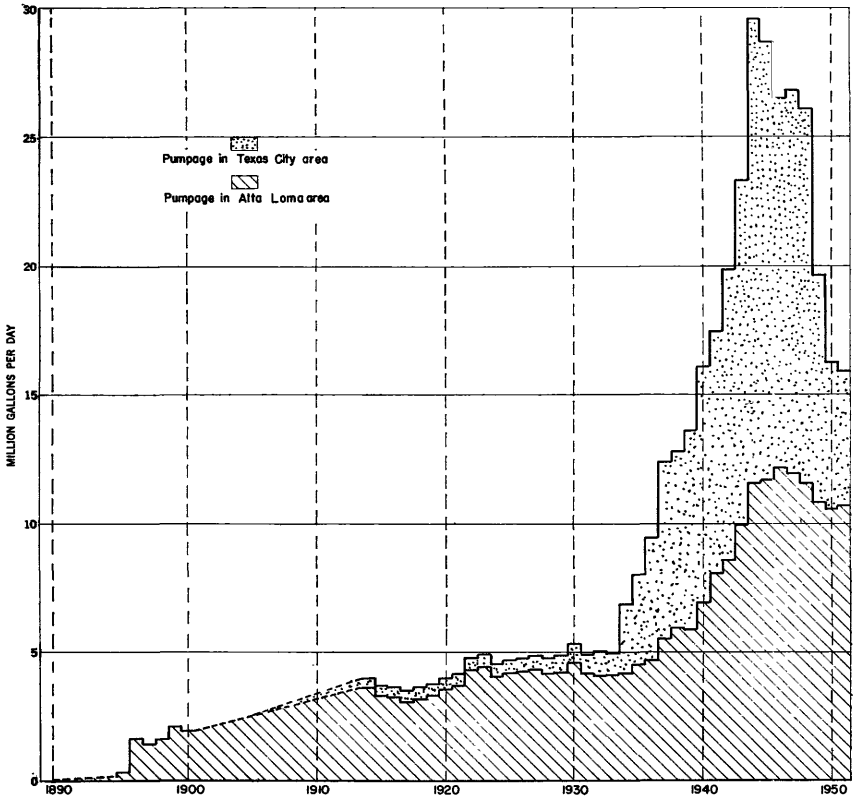

FIGURE 5.—Average daily pumpage from the "Alta Loma" sand in the Alta Loma and Texas City areas, 1890–1951.

TABLE 8.—*Coefficients of transmissibility and storage as determined from pumping tests in the "Alta Loma" sand, 1939–51*

Area	*Well*	*Coefficient of transmissibility (gallons per day per foot)*	*Coefficient of storage*	*Remarks*
Alta Loma	------	100,000	0.0006	Average value (1939) of several tests of the city of Galveston's old well field.
	E–84	102,500	.00048	Pumping well E–83.
	E–84	106,000	.0003	Pumping well E–87.
	E–78	110,000	.00059	Pumping well E–83.
	E–78	94,500	--------	Recovery in well E–78.
	E–87	101,000	.00044	
	E–83	115,000	--------	Pumping well E–83.
	E–81	106,000	.00059	Pumping well E–83.
	E–81	90,000	--------	Recovery in well E–81.
Texas City	F–50a	165,000	.0006	Pumping well F–5.
	F–50a	146,000	.00048	Pumping well M–25.
	F–50a	158,000	.00019	Recovery in well M–26.
	F–50	149,000	.00023	Pumping well F–5.
	F–50	153,000	.00055	Pumping well M–25.
	F–50	145,000	.00047	Recovery in well M–26.

The coefficients of transmissibility and storage may be used to compute future drawdown in water levels if geologic and hydrologic conditions are favorable. Usually, the average of the coefficients, obtained from several tests, is used in such computations. Because of the varying thickness of the "Alta Loma," it is better to use the average of the tests at Alta Loma for the area adjacent to that locality, and the values determined from the tests at Texas City for that area. Plate 16 is presented to show the theoretical drawdowns that would be produced by pumping 1 mgd from ideal aquifers having coefficients of transmissibilities of 102,000 and 153,000 gpd per ft and coefficients of storage of 0.0005 and 0.0004, respectively.

THE SHAPE OF THE PIEZOMETRIC SURFACE AND ITS RELATION TO THE MOVEMENT OF WATER

Maps of Galveston County and parts of Harris and Chambers Counties, prepared periodically, illustrate the altitude of water levels as measured during the spring in wells screened in the "Alta Loma" sand. Maps for the years 1941, 1948, and 1952 (pls. 17, 18, and 19) show the position and areal extent of the cones of depression as they existed at those times.

These maps of the piezometric surface indicate the direction of movement of water, which is normal to the contour lines. They also indicate the altitude to which the water level in each well screened in the "Alta Loma" sand would have risen at the time shown.

The piezometric surface of the "Alta Loma" sand in 1941 (pl. 17) shows three large cones of depression. These cones are centered at Baytown, Texas City, and Alta Loma. Although the oldest of the cones is at Alta Loma, the one at Baytown was the largest in 1941.

By 1948, the shape of the piezometric surface had changed materially. Additional declines of 50 feet at Baytown, 70 feet in the Pasadena-Deer Park area, 46 feet in the Alta Loma area, and 33 feet in the Texas City area had been observed. The pumping along the Houston Ship Channel between Pasadena and Deer Park had become sufficient to create a separate cone of depression and a separate cone was created in the vicinity of La Porte. This pumping formed a ground-water divide a short distance north of Alta Loma; another divide previously formed between Alta Loma and Texas City was moving slowly toward Alta Loma. The greatest movement of water toward Alta Loma at that time appeared to be largely from the south and west.

Between 1948 and 1952 more changes occurred. The recovery of water levels resulting from a large reduction in pumpage at Texas City in 1948 was sufficient to remove almost completely the cone of depression that had been formed there. Pumpage along the Houston Ship Channel, between Pasadena and Deer Park, had become so great that the individual cones of depression at Baytown and La Porte became subsidiary cones on the larger cone centered at Deer Park. The influence of this large cone extended far into Galveston County. The ground-water divide north of Alta Loma had become sharply accentuated. It appears that water may now move toward Alta Loma from almost any direction except that the movement of water from the north probably will be reduced as the ground-water divide is lowered.

UPPER PART OF THE BEAUMONT CLAY

The upper part of the Beaumont clay is an important source of water in Galveston County. Wells throughout the county tap this aquifer, and at Texas City it is heavily pumped to supply water for public and industrial use. As early as 1892, wells were drawing water from this aquifer both on the mainland and on Galveston Island. Most of the domestic and stock wells on the mainland yield small to moderate quantities of water from sands of this unit. The use of ground water from it has increased gradually for more than 60 years. Large-scale use began in the Texas City area about 1933, and by 1948 more than 7 mgd was being withdrawn there. Since 1948, the average withdrawal in that area has fluctuated between 7.4 and 5.2 mgd.

SPECIFIC CAPACITIES OF WELLS

Because sands in the upper part of the Beaumont clay yield only small to moderate amounts of water to wells in the county, wells that withdraw water from those sands generally have a greater amount of drawdown at a given yield (see tables 6 and 9) than do wells of comparable size screened in the "Alta Loma" sand.

ARTESIAN PRESSURES

Although not all early wells screened in sands in the upper Beaumont flowed originally, the evidence indicates that most of them had some flow. Few measurements of the original head are available; however, according to Deussen (1914) the head in two wells, about 4 and 6 miles east of Alta Loma, was 15 and 30 feet, respectively, above the land surface.

The decline in artesian head began with the first withdrawals. The water levels have declined constantly since that time as the pumpage has increased. This decline in water levels has been much greater, in proportion to the quantity of water withdrawn, than that in wells tapping the "Alta Loma." This is due to the lower permeability and lenticular character of the sands in the upper part of the Beaumont.

Hydrographs of selected observation wells screened in sands in the upper Beaumont are shown in figure 6.

TABLE 9.—*Yield and specific capacity of wells screened in sands of the upper part of the Beaumont clay in Galveston County*

Well	Owner	Screen size (inches)	Yield (gallons per minute)	Drawdown (feet)	Specific capacity (gallons per minute per foot)
B-51	Bradshaw Nursery	6	250	30	8.3
B-26	Galveston County Water Control and Improvement District 1, well 2	5	343	68	5.0
E-27	Galveston County Water Control and Improvement District 1, well 1	5	310	90	3.4
F-33	Galveston County Water Control and Improvement District 3, well 2		300	53	5.7
F-41	Community Public Service Co. well 8	8⅝	586	54	10.9
F-42	Community Public Service Co. well 6	10¾	350	79	4.4
F-43	Community Public Service Co. well 4	8⅝	440	57	7.7
F-44	Community Public Service Co. well 3	4½	302	79	3.8
F-45	Community Public Service Co. well 5	10¾	500	48	10.4
F-46	Community Public Service Co. well 7	8⅝	524	63	8.3
F-47	Galveston County Water Control and Improvement District 4, well 4	8⅝	515	88	5.9
F-48	Galveston County Water Control and Improvement District 4, well 3	8⅝	614	57	10.8
F-49	Galveston County Water Control and Improvement District 4, well 2	5	157	75	2.1
F-52	Carbide and Carbon Chemicals Corp., well 4	10¾	640	64	10.0
F-54	Pan American Refining Corp., well 2	13	850	56	15.2
F-59	Republic Oil Refining Co., well 1	8⅝	508	50	10.2
F-60	Pan American Chemical Plant well 2	8⅝	690	46	15.0
F-62	Monsanto Chemical Co., well 3	6⅝	475	53	9.0
F-63	Monsanto Chemical Co., well 5	16	340	56	6.1
F-64	Monsanto Chemical Co., well 2	6⅝	465	58	8.0
F-66	Monsanto Chemical Co., well 1	6⅝	475	53	9.0
M-21	H. M. Cohen	6	280	120	2.3
M-24	Carbide and Carbon Chemicals Corp., well 6	10¾	542	55	9.9
M-27	Carbide and Carbon Chemicals Corp., well 5	10¾	500	111	4.5
M-32	Pan American Refining Corp., well 1	10¾	535	80	6.7
M-36	Republic Oil Refining Co., well 3	8⅝	600	46	13.0
M-40	Texas City Refining Inc., well 3	8⅝	325	28	11.6
M-45	Tin Processing Corp., well 1	10¾	650	59	11.0
M-46	Tin Processing Corp., well 2	10¾	600	45	13.3
N-5	Galveston Ice and Cold Storage Co	6	125	21	6.0
Q-5	Galveston Country Club	8	400	70	5.7

PUMPAGE

Many of the wells in Galveston County are screened in sands in the upper part of the Beaumont clay and are of small capacity. Only in the Texas City area have there been large-scale withdrawals of water from these sands.

In 1930 and 1931 the average pumpage from the upper Beaumont in the Texas City area was about 800,000 gpd. The pumpage increased during 1932 and 1933 to slightly more than 1,500,000 gpd. In 1934 this figure was reduced to about 950,000 gpd. From 1935 to 1941 the pumpage gradually increased to slightly less than 2,000,000 gpd. Expansion of the existing industries and introduction of new ones early in 1940 to meet war needs caused the pumpage to increase at a phenomenal rate until in 1945 more than 6,300,000 gpd was being withdrawn. In 1946 there was a slight decrease, followed by increases in 1947 and 1948. The use of surface water caused the ground-water pumpage to drop to 5,250,000 gpd in 1949. The pumpage increased in 1950 and 1951, reaching slightly more than 7,300,000 gpd in 1951. Increased use of surface water lowered the rate of pumpage to 5,800,000

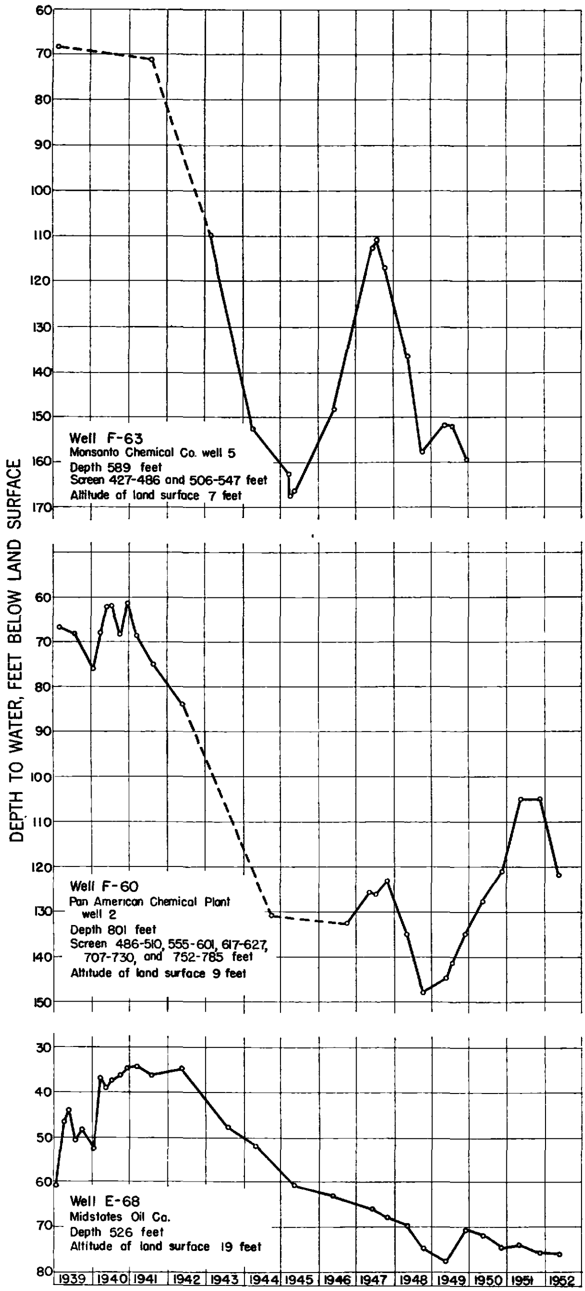

Figure 6.—Graphs showing the fluctuation of artesian pressure in wells in the sands of the upper part of the Beaumont clay.

gpd in 1952. The estimated average daily withdrawal of ground water from the upper part of the Beaumont clay in the Texas City area is shown in figure 7.

RESULTS OF PUMPING TESTS

Two pumping tests have been made in wells screened in the upper part of the Beaumont clay in the Texas City area to determine the coefficients of transmissibility and storage. These tests were of short duration because it was difficult to control the rate of pumping sufficiently to avoid interference. Table 10 shows the wide range in coefficients of transmissibility and storage determined from the pumping tests.

TABLE 10.—*Coefficients of transmissibility and storage determined from pumping tests in the upper part of the Beaumont clay in the Texas City area*

Well	*Coefficient of transmissibility (gallons per day per square foot)*	*Coefficient of storage*	*Remarks*
F-43	16, 800	0. 00019	Pumping well F-42.
F-63	29, 000	. 0004	Recovery in well F-66.
F-63	36, 000	. 00058	Pumping well F-66.

Plate 20 is presented to show the theoretical drawdowns that would be produced by pumping water at 500 gpm from ideal aquifers having coefficients of transmissibility of 16,800 and 32,500 gpd per foot and coefficients of storage of 0.00019 and 0.0005, respectively. Use of the coefficients to determine the drawdown in wells screened in sands of the upper Beaumont must be done with caution because of the differences between the characteristics of the ideal aquifer upon which the nonequilibrium formula is based and the characteristics of the aquifer tested.

The coefficients, as determined, show that the productivity of the aquifer is not enough to permit large withdrawals of ground water within relatively small areas without large declines in water levels. Because of the relatively low transmissibility and the lenticular character of the sands of the upper Beaumont, the wells that withdraw water from those sands are characterized by moderate to low yields and low specific capacities.

SUBSIDENCE OF THE LAND SURFACE

Evidence of land subsidence in Galveston County was first obtained in 1938 when some leveling was done before construction at the plant site of the Carbide and Carbon Chemicals Corp. Some small discrepancies were noted between altitudes determined at this time and those previously determined at the adjoining plant of the Pan American Refining Corp. These differences were attributed to

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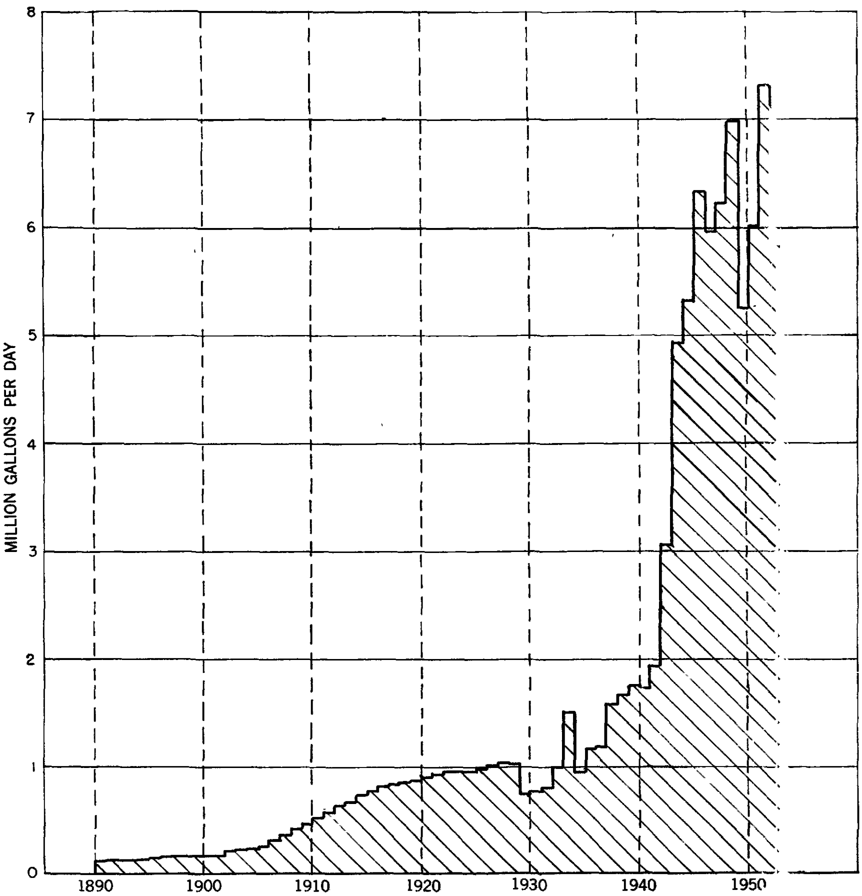

FIGURE 7.—Estimated average daily withdrawal of water from the upper part of the Beaumont clay in the Texas City area, 1890–1952.

faulty instrument work. In 1944, when the Pan American Refining Corp. plant was enlarged, additional discrepancies were noted. Extensive releveling by both companies proved that subsidence had occurred. Leveling by these two firms has been continued periodically since 1944, a benchmark (U. S. Coast and Geodetic Survey A–9) about 2 miles west of the plants being the reference point. It was believed then that this benchmark had not been affected by the subsidence.

Releveling of the first-order lines showed that subsidence had occurred throughout the county (pl. 21) between 1943 and 1951 when the releveling was done by the U. S. Coast and Geodetic Survey. The amount of subsidence on the mainland of Galveston County, based on the benchmarks that were releveled in 1951, ranged from

0.207 foot at Hitchcock to 2.641 feet at La Marque. The benchmark upon which all subsidence at the Carbide and Pan American plants was based had subsided 1.286 feet. On Galveston Island, some of the benchmarks showed as much as 0.345 foot of subsidence, but a few of the tidal benchmarks showed some rise in altitude.

The greatest subsidence took place in the Texas City industrial area, particularly in the vicinity of the Pan American Refining Corp. and the Carbide and Carbon Chemicals Corp. plants. This subsidence amounted to as much as 4 feet and apparently is continuing, but data furnished by the companies indicate that the rate of subsidence is decreasing with the decrease in pumping.

Subsidence of the land coincident with large declines in artesian pressure has been observed in California in the Santa Clara Valley (Tolman and Poland, 1940), the Livermore Valley (Tolman, 1937), and at Terminal Island (Harris and Harlow, 1947), and in Texas at Goose Creek (Pratt and Johnson, 1926).

As shown by Meinzer (1928, p. 263–291), the hydraulic pressure in an artesian aquifer supports part of the weight of the overlying material. As the pressure decreases the load on the skeleton of the aquifer increases, causing compaction and subsidence. According to Tolman (1937, p. 470), the degree of compaction depends upon the weight of the overlying material. Water must be evacuated before reduction of pore space is possible; the process of compaction is slow because of resistance to the passage of water through the compacting aquicludes.

Tolman and Poland (1940) report a maximum subsidence of 5.5 feet at San Jose in the Santa Clara Valley between 1915 and 1935, largely in silt and clay aquicludes. Poland, Garrett, and Sinnott (1948) state in reference to the subsidence in the vicinity of Terminal Island that:

> As more examples of fluids or gases are studied in detail, it will be found that there is considerable range in the proportion of compaction of the coarse-grained, permeable deposits to that of the fine-grained, relatively impermeable deposits. For each, the compressibility must be in part a function of the physical character; for the fine-grained deposits the rate of compaction will also be a function of permeability, which determines the rate at which pressure differentials may be equalized—that is, the rate at which fluid can escape from the fine-grained deposits to the more permeable reservoir rocks and permit compaction of the former.

In Galveston County most subsidence of the land is apparently related to withdrawals of water from the upper part of the Beaumont clay. Although some subsidence may result from the withdrawal of water from the "Alta Loma" sand, it is probably small compared to that resulting from pumpage from the upper Beaumont. The transmissibility of the "Alta Loma" permits the lateral movement of water at a much lower hydraulic gradient and less loss in artesian pressure at the points of withdrawal. The sands of the upper part of the Beaumont clay are lenticular and of low permeability, and large declines in pressure occur after comparatively small withdrawals.

The average ratio of sand to clay in the "Alta Loma" is about 6 to 1. The upper Beaumont, however, consists mainly of clay with relatively thin beds of sand. The average sand-to-clay ratio of the upper Beaumont is about 1 to 8. It seems that the clays are more likely to be compacted than the sands, and, because of the high ratio of clay to sand in the upper part of the Beaumont clay, subsidence probably has been caused by pumping from this formation.

There is a tendency for clays to be compacted naturally with age. The upper Beaumont is a relatively young geologic unit and offers greater opportunity for compaction than the older formations.

It has been suggested that because the plant sites at Texas City are underlain by a thin bed of "quicksand," some subsidence has taken place as a result of the load imposed by the structures on the sand. No specific evidence on this point is available, however.

How much the land surface would rise in the event a large reduction in pumpage is effected cannot be calculated. In a discussion of the subsidence at Terminal Island, Gilluly and Grant (1949, p. 497) noted during a short test of a shallow aquifer that substantial recovery of benchmark altitudes occurred with recovery of water levels in observation wells during periods of reduced pumping rates and also immediately after cessation of pumping. The recovery of benchmark altitudes ranged from 14 to 78 percent and averaged about 42 percent. From these facts, Gilluly and Grant concluded that half or more of the subsidence due to the drawdown of the piezometric level was caused by mineral-grain rearrangement and the rest to elastic compression. The benchmarks that subsided the most recovered the least.

QUALITY OF WATER

The value of a water supply depends in part upon the character and quantity of dissolved mineral matter in the water and the use for which the water is intended. Most of the development of ground water in Galveston County has been for industrial use and public supply. Requirements vary greatly from one industry to another, and the requirements for some industries may be even more rigid than those for municipal supplies.

The chemical quality of water used for municipal supplies commonly is judged by standards promulgated by the United States Public Health Service for water used by common carriers in interstate commerce. However, the average individual can become adjusted to drinking water considerably higher in content of most of the listed constituents than the values specified in these standards. The standards of the Public Health Service for certain common constituents are given here.

Iron (Fe) and manganese (Mn) together should not exceed 0.3 ppm.
Magnesium (Mg) should not exceed 125 ppm.
Chloride (Cl) should not exceed 250 ppm.
Sulfate (SO_4) should not exceed 250 ppm.
Dissolved solids should not exceed 500 ppm for a water of good chemical quality. However, if such a water is not available, a dissolved-solids content of 1,000 ppm may be permitted.

More than a thousand samples of water from 314 wells in Galveston County have been analyzed in the laboratory of the Geological Survey in Austin. Other analyses were made at other laboratories as noted in the tables. The more comprehensive analyses have been studied to determine the position and extent of the aquifers containing potable water. A large percentage of the analyses represent periodic sampling from selected wells, as a part of a continuing program to study the pattern of salt-water encroachment. The determination of the chloride ion is sufficient for this purpose.

In Galveston County the quantity of dissolved solids in the ground water depends on the geographic location and depth from which the water is withdrawn. In general, the dissolved-solids content is lower in the north and northwest, increasing gradually toward the south and southeast.

LISSIE FORMATION

The only potable water from the Lissie formation in Galveston County comes from its upper sands that lie north of Dickinson Bayou. Because fresh water is available in relatively large quantities in sands above the Lissie in this area, very few water wells actually penetrate it. However, electrical logs of oil test wells indicate the presence of relatively fresh water to a depth of about 1,000 feet in the extreme north and northwest parts of Galveston County. This evidence is supplemented by analyses of samples from a few wells in the League City-Friendswood area. Analyses of samples taken in 1927, 1933, and 1939 from a well 950 feet deep in League City showed chloride contents of 72, 97, and 196 ppm, respectively. Well B–50, about 800 feet deep, near League City, yielded water having a chloride content of 225 ppm in 1939. According to records from Deussen (1914, p. 110), well B–37, at League City, screened from 944 to 1,020 feet, yielded water containing 870 ppm of chloride. These analyses further substantiate the evidence of electrical logs that water is salty below 1,000 feet. Deussen's records indicate also that the salinity of the water at this depth is not the result of salt-water encroachment caused by pumping because there had been very little pumping from these sands before the samples were taken.

Available data indicate the presence of highly mineralized water in all sands below the "Alta Loma" south of Dickinson Bayou. Test drilling near Alta Loma by the city of Galveston in 1941 and 1942 showed the presence of highly mineralized water in all sands below the main sand body of the "Alta Loma." In the city of Galveston test well 2, water containing 1,030 ppm of chloride was found in the first sand below the main sand body of the "Alta Loma" at a depth of 850–870 feet. Water containing 1,860 ppm of chloride was found in a sand from 1,175 to 1,202 feet in the same well. In test well 3 at Hitchcock, water containing 3,820 ppm of chloride was found in a sand from 1,130 to 1,155 feet deep. In test well 1–4, about 4 miles north of Alta Loma, water obtained from a sand between 870 and 880 feet contained 770 ppm of chloride. The sands from which the samples were obtained underlie the main sand body of the "Alta Loma" and some of them probably belong to the Lissie formation.

In the Texas City area and on Galveston Island, deep wells have yielded highly mineralized water from sands of the Lissie formation. An abandoned well of the Texas City Terminal Railway at Texas City, screened from 1,078 to 1,136 feet, yielded salt water, and well N–8 on Galveston Island, drilled to a depth of 3,070 feet by the city of Galveston, became increasingly salty with depth.

BEAUMONT CLAY

"ALTA LOMA" SAND

The "Alta Loma" sand is the principal aquifer in Galveston County. Water of good quality is available in relatively large quantities on most of the mainland. Salt water is known to occur in the lower part of the "Alta Loma" sand in the southern part of the county and throughout the sand beneath Galveston Island.

Many samples of water from wells screened in the "Alta Loma" have been collected and analyzed, and many of the wells have been resampled periodically to show the trend in salinity and the position of the salt-water interface. The analyses show that the water varies greatly in the amount of dissolved mineral matter present. Chloride and bicarbonate are the predominant anions. Sulfate is present only in very small quantities. All waters in which the concentration of the chloride ion is high are sodium chloride waters. The hardness of the water is of the carbonate or "temporary" type. Sodium and calcium are the predominant cations.

Analyses of representative waters from the "Alta Loma" sand are shown in figure 8. The heights of the several sections of the diagrams correspond to the quantities of the constituents reported in the table of analyses.

The relation between the dissolved-solids content and the individual ions is shown in figure 9. The most notable characteristic of water from the "Alta Loma" sand is that the concentration of bicarbonate is relatively constant regardless of the increase in dissolved solids caused by an increase in sodium, potassium, and chloride ions.

The earliest analyses of water from the "Alta Loma" sampled on Galveston Island showed the presence of highly mineralized water, although the salinity did not approach that of sea water. In the Alta Loma-Texas City area the chloride content increases down the dip of the formation and vertically downward in the sand section. From a study of the electrical logs of wells (pls. 1 and 2) and analyses of water samples, it appears that the salt water forms a wedge in the lower part of the sand at Alta Loma and Texas City. Because the sand thickens downdip and along the strike in both directions from Alta Loma, a higher percentage of salty water is drawn into the wells that penetrate the thicker sections; wells that penetrate only the thinner sections yield water lower in chloride content.

Water in the "Alta Loma" sand updip from Galveston County is of excellent quality. The chloride content in wells along the Houston Ship Channel averages about 40 ppm. A well at the Humble pump station (Harris County well 1367), just north of the Galveston County line near League City, yields water from the "Alta Loma" sand containing about 96 ppm of chloride. The graph of this well (pl. 22) shows no appreciable increase in chloride content from 1939 to 1951. This stability is in direct contrast to the trends shown by the graphs of wells at Alta Loma and Texas City (pl. 23 and fig. 10), where there has been salt-water encroachment. This evidence, together with a study of electrical logs of wells in the area, indicates that the salt-water wedge in the deeper part of the "Alta Loma" sand does not extend so far north as the League City area.

Wells in the Friendswood area tap the part of the "Alta Loma" sand that is farthest updip in Galveston County, and consequently the water is the least highly mineralized in this area. Water from both wells A-7 and B-3 had a chloride content of 39 ppm in 1939. In 1951 the wells yielded water having 42 and 38 ppm of chloride, respectively, indicating that salt water has not encroached in this area.

In the League City area, downdip from Friendswood, the water in the "Alta Loma" sand is a little more highly mineralized. Water from well B-45 had a chloride content of 74 ppm in 1941 as compared to 75 ppm in 1951. Water from other wells tapping the "Alta Loma"

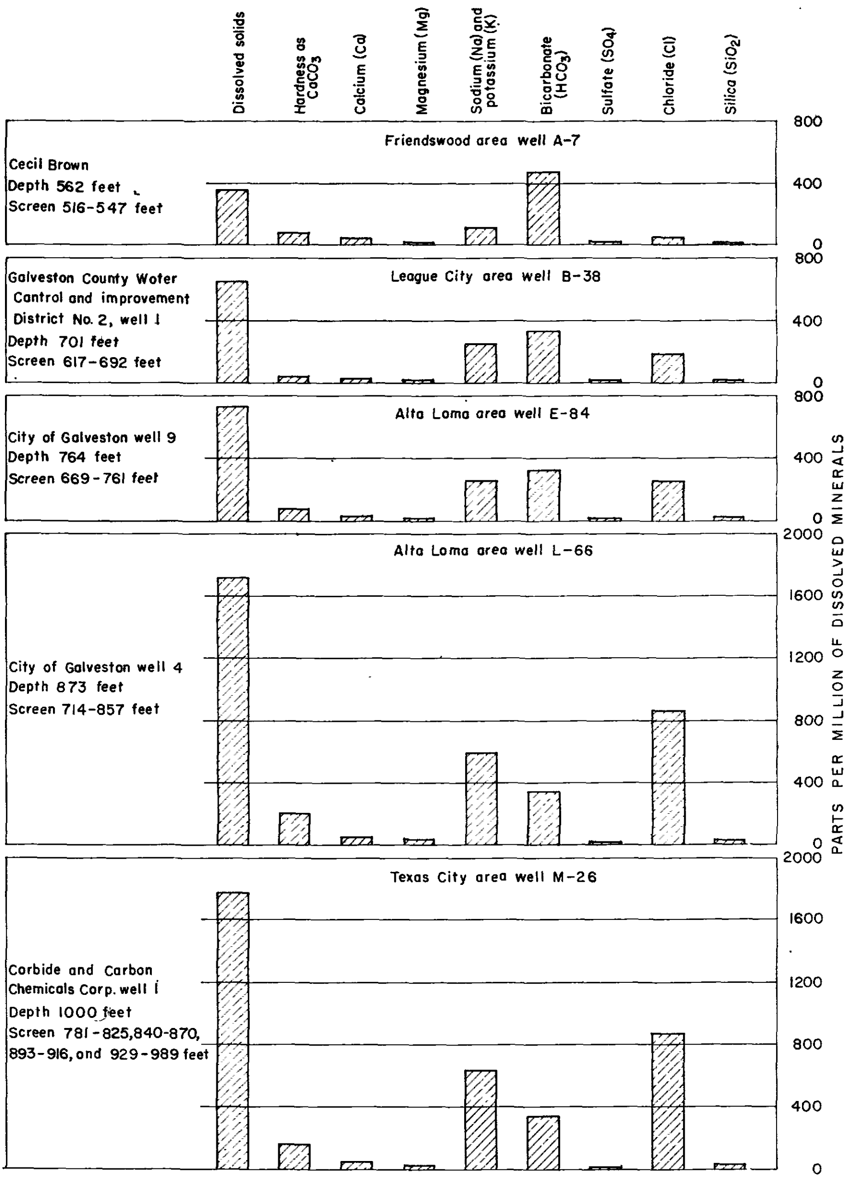

FIGURE 8.—Quality of water from typical wells in the "Alta Loma" sand, Galveston County, Tex.

sand in this area had a range in chloride content of 86 to 108 ppm in 1939. The available records indicate stability in this area.

In the Dickinson area the "Alta Loma" sand appears to be broken up by many clay lenses. Water from wells tapping the sands here ranges in chloride content from about 80 to about 200 ppm. This

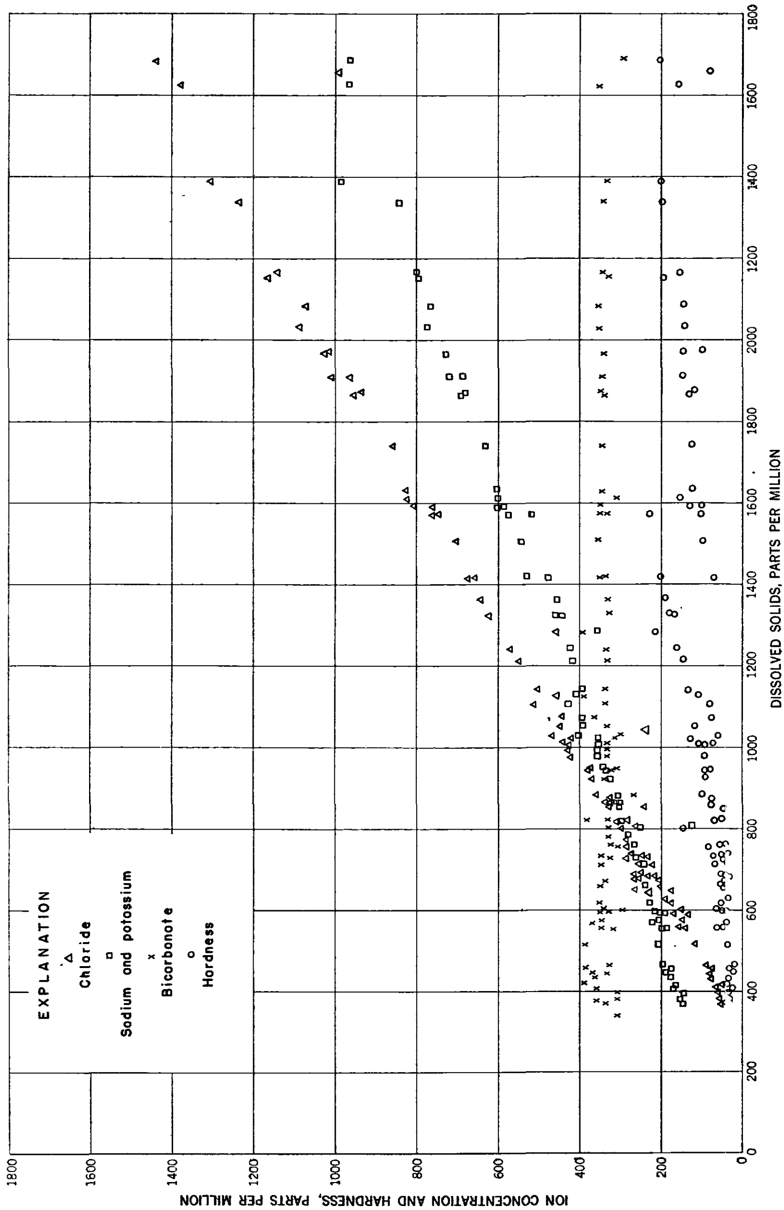

FIGURE 9.—Relation between dissolved solids content and chloride, sodium and potassium, bicarbonate and hardness in water from wells in the "Alta Loma" sand, Galveston and Harris Counties, Tex.

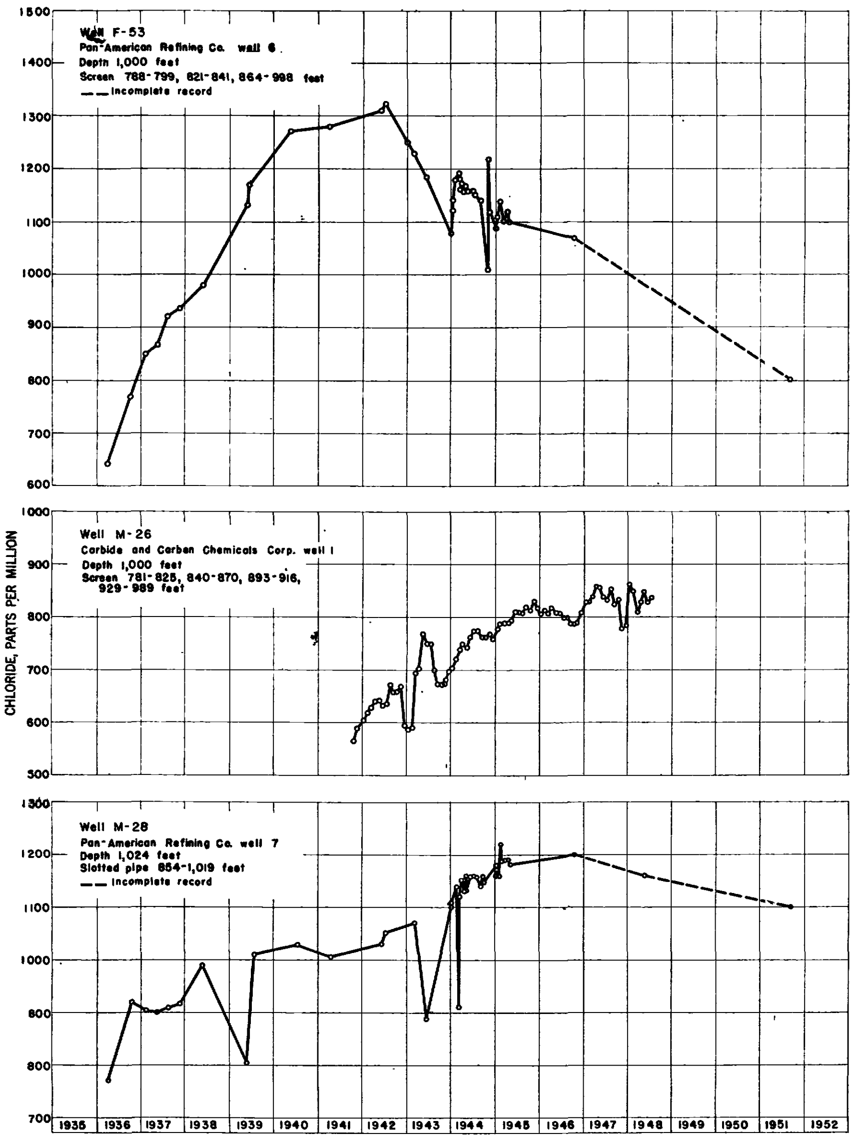

FIGURE 10.—Graphs showing fluctuation of chloride content of the water from wells in the "Alta Loma" sand in the Texas City area, Galveston County, Tex.

wide range may be caused by inequalities in the flushing of the sands, due to the presence of the clay lenses, or differences in permeability in different parts of the sand. Although the chloride content is variable in water from different wells in this area, the lower part of the sand appears to yield water slightly higher in chloride content than the upper part.

The salt-water wedge in the deeper part of the "Alta Loma" sand becomes apparent first in the Alta Loma area, which is downdip from the Dickinson area. The earliest indication of the vertical gradient of chloride content in the sand is found in analyses made in 1916 of water taken from the original city of Galveston wells, which were drilled in 1893 and 1894. The chloride content of water from 24 of the 25 wells, all screened at about the same interval, ranged from 191 to 443 ppm. The remaining well, L–40, yielded water having a chloride content of 992 ppm. However, this well was screened much deeper than the others; a study of the electrical log of the nearest well on which one was made shows that L–40 was probably screened in the lowest part of the main sand body. This well was sampled again in 1899 and the analysis at that time showed a chloride content of 1,014 ppm. Thus, it appears that the salty water has always been present in the lower part of the sand, for there was very little pumping in the area before that date.

From 1914 to 1927, 7 new wells were drilled to replace the old wells at Alta Loma (pl. 5). These wells were located southeast of the original field, downdip, and toward the thicker sand section. The rate of pumping in the well field increased slowly from 3.28 mgd in 1915 to 4.5 mgd in 1935; the chloride content of the water increased very little during that period. The record is not complete for the period from 1915 to 1932, but it appears that from 1932 to 1935, well 3 yielded water having the highest chloride content, 431 ppm. This was to be expected, as the pumping was centered near well 3 during that period. Lowering of the head in that vicinity allowed more and more of the deeper and saltier water to enter that well.

In 1935 well 8 was drilled farther to the southeast. When this well went into operation the center of pumping was shifted toward the southeast, and the chloride content in the water in well 4 increased until it was the highest in the field. During this period, water from wells 1, 2, 6, and 7 showed increases in chloride content, but the content did not become so high as that in wells 3, 4, 5, and 8. Water from well 8 showed a rapid increase in chloride content (pl. 23), and in May 1951 it contained about 800 ppm of chloride. Although the center of pumping is northwest of well 8, this well taps a thicker section of sand than the other wells and is of much higher yield. Consequently, a higher percentage of the deeper, saltier water is drawn into it.

From 1940 to 1942 the city of Galveston was engaged in a test-drilling program designed to determine the position and extent of salt water in the "Alta Loma" sand in the Alta Loma area. It was found that in the area north of Alta Loma the main sand body is relatively thin and contains water lower in chloride content, but even in this area a vertical chloride gradient within the sand body is apparent. Although wide variations in chloride content were found both laterally and vertically, results of the test-drilling program apparently strengthen the "salt-water wedge" theory.

The information obtained was used in drilling 6 new wells (nos. 9–14) north of Alta Loma in 1942. These wells constitute the "new field," in contrast to the "old field" consisting of wells 1 to 8. The locations of all these wells are shown in figure 4. Wells 9 to 13 were put in operation in 1943 and have been operated more or less continuously since then. Well 14 has not yet been put in use. When the new field began operation, production from the old field was curtailed. Water from wells in the "new field" has shown slight increases in chloride content, but at a rate not nearly as great as that in the old field.

From a study of the graphs of wells 9 through 13 in the "new field" (pl. 22), it can be seen that well 12 shows the greatest amount of salt-water encroachment of any of the "new wells." This may be attributed to its position on the downdip side of the cone of depression because most of the saltier water is coming from the southeast.

Except for a short, rapid rise in chloride content just after the well was put in operation, well 9 has shown an actual improvement in the quality of its water. It is located on the updip side of the cone of depression, where a larger proportion of better quality water is being drawn into the cone.

Because the water is saline in the deeper parts of the "Alta Loma" sand at the Alta Loma well fields and still more saline a short distance downdip from Alta Loma, and because a hydraulic gradient has been established toward Alta Loma, the encroachment of salt water is expected to continue. However, if separate cones of depression are maintained at the "old field" and in the Texas City area, the resultant protective pumping may slow down the rate of encroachment in the "new field."

Before the test-drilling program by the city of Galveston between 1940 and 1942, the "Alta Loma" sand was believed underlain by thick, persistent beds of clay. The test wells showed that the clay beds are not very thick or persistent and that they are underlain by or interbedded with sands that contain salty water. The extreme variation in thickness of the individual beds of clay suggests that they may be absent in some places. It seems possible, therefore, that some salt water could move upward from these lower sands into the main sand body of the "Alta Loma." That the artesian head in the underlying salt-water sands has remained about the same as that in the main sand body is further evidence of interconnection. The relation is shown in the hydrograph of well E–92, which is screened from 661 to 775 feet in the main sand body of the "Alta Loma" sand (fig. 11), and of well E–93, which is screened from 850 to 870 feet in the first underlying sand. There has been no significant pumping from these lower sands in Galveston County. In order for the large decline in the water level in well E–93 to have occurred, there must have been some connection with the main sand body. Between 1942 and 1945 the city of Galveston, withdrawing water from the "Alta Loma" sand, increased its pumpage from 8.6 mgd to 11.7 mgd. Approximately the same decline in water levels that occurred throughout the area adjacent to the city's well fields in the "Alta Loma" sand was observed in well E–93.

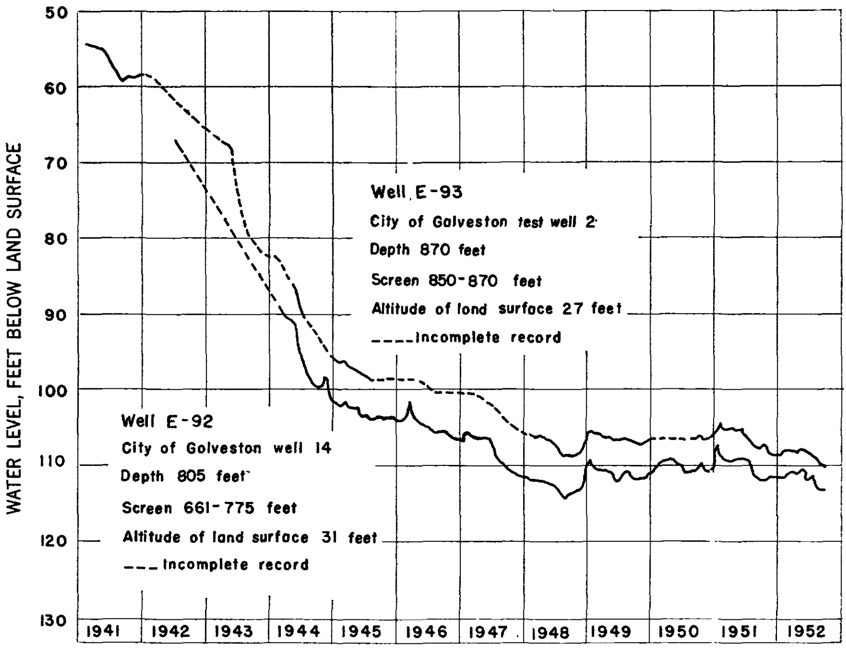

FIGURE 11.—Comparison of decline of artesian pressure in a well screened in the main sand body of the "Alta Loma" sand and a well screened in the underlying sand.

If there are interconnections between the main sand body of the "Alta Loma" sand and the underlying sand, there is probably some recharge of salty water to the main sand body from the underlying sand; but because the vertical permeabilities are probably less than horizontal permeabilities and the interconnection in some places may be remote, it seems probable that only a small part of the encroachment in the main sand body has come from below.

UPPER PART OF THE BEAUMONT CLAY

Except for beach sands near the coast on Galveston Island and Bolivar Peninsula, the upper part of the Beaumont clay is the youngest aquifer in Galveston County. It is believed that the unit was laid down as a deltaic and flood-plain deposit except along the coast, where it was deposited in lagoons, bays, or in the open gulf. The deltaic and flood-plain facies probably contained fresh water at the time of deposition. Under the force of gravity, this water gradually moved downdip, replacing the saline water in the lagoonal or marine facies. Simultaneously, precipitation entered the sandy zones at the outcrop, thus providing a driving force to accelerate the flushing action.

The sands of the upper part of the Beaumont are very lenticular, and limited in areal extent. Therefore, the quality of the water from these sands varies somewhat from place to place in the county. In general, the quality of water in the upper Beaumont is superior to that of water in the "Alta Loma" sand in the southern part of Galveston County, whereas the water from the "Alta Loma" is superior in northern Galveston County and in Harris County. In the Texas City area, sands of the upper Beaumont form the only aquifer from which water containing less than 1,000 ppm of dissolved solids may be withdrawn.

Water from the upper Beaumont is relatively soft; the hardness is of the carbonate or "temporary" type. Bicarbonate and chloride are the predominant acidic constituents. Sulfate and nitrate are present in only small amounts. The predominant basic constituents are sodium and calcium.

The quality of water from wells screened opposite sands in the upper Beaumont varies according to the depth and geographic location of the wells. The dissolved-solids content of the water as a rule increases downdip, although the range in concentration is far less than that in the "Alta Loma" sand. This variation in quality with depth and location in the Dickinson and the Texas City-La Marque areas is shown in figure 12.

A large number of samples of water from the upper Beaumont have been analyzed at the Geological Survey laboratory at Austin. Other samples have been analyzed by other chemists as noted in the tables. Analyses of representative waters from the upper part of the Beaumont clay are shown in figure 13. The heights of the several sections of the diagrams correspond to the quantities of the constituents reported in the table of analyses.

CONCLUSIONS AND RECOMMENDATIONS

Much ground water is obtainable from both the "Alta Loma" sand and the upper part of the Beaumont clay on the mainland of Galveston County. Although the "Alta Loma" contains salty water in the southern part of the county, the aquifer will still supply large quantities of

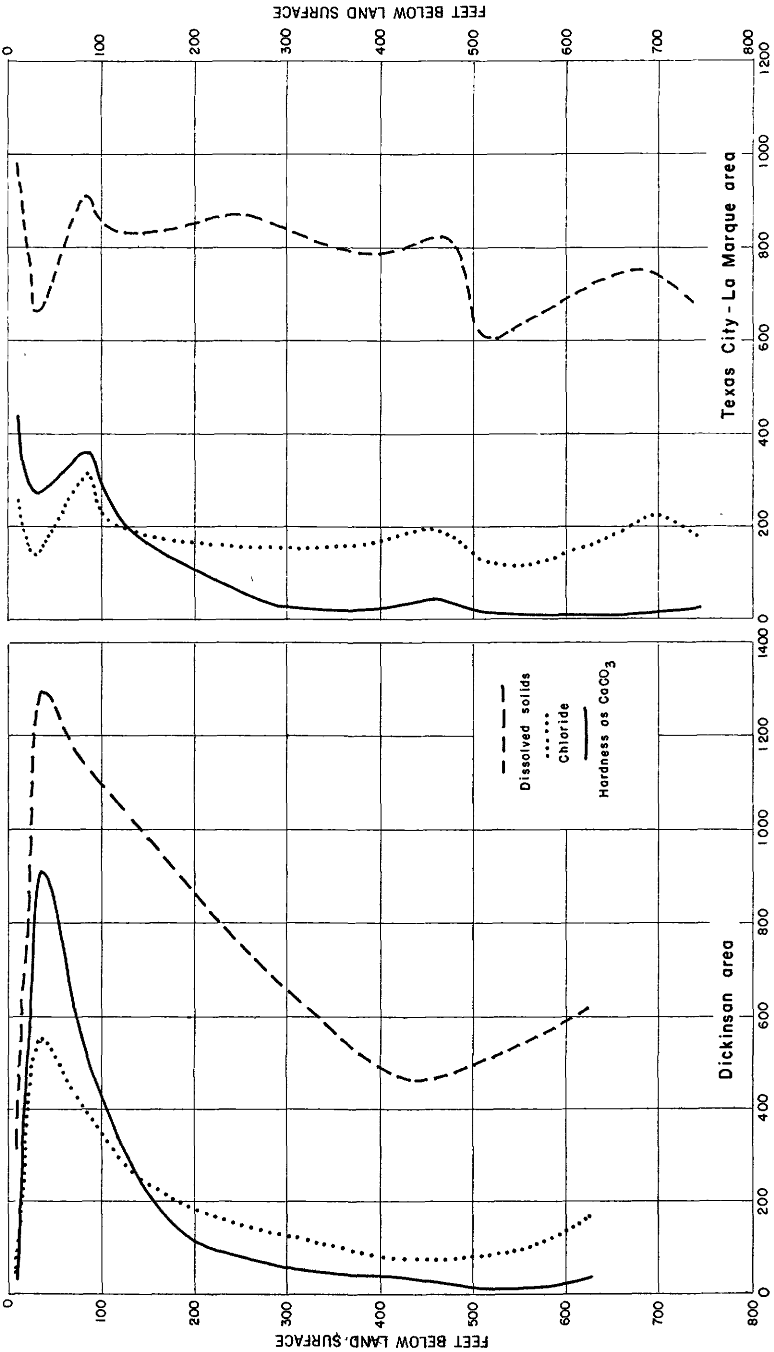

FIGURE 12.—Generalized relation between mineral character of ground water and depth in the Dickinson and Texas City-La Marque areas.

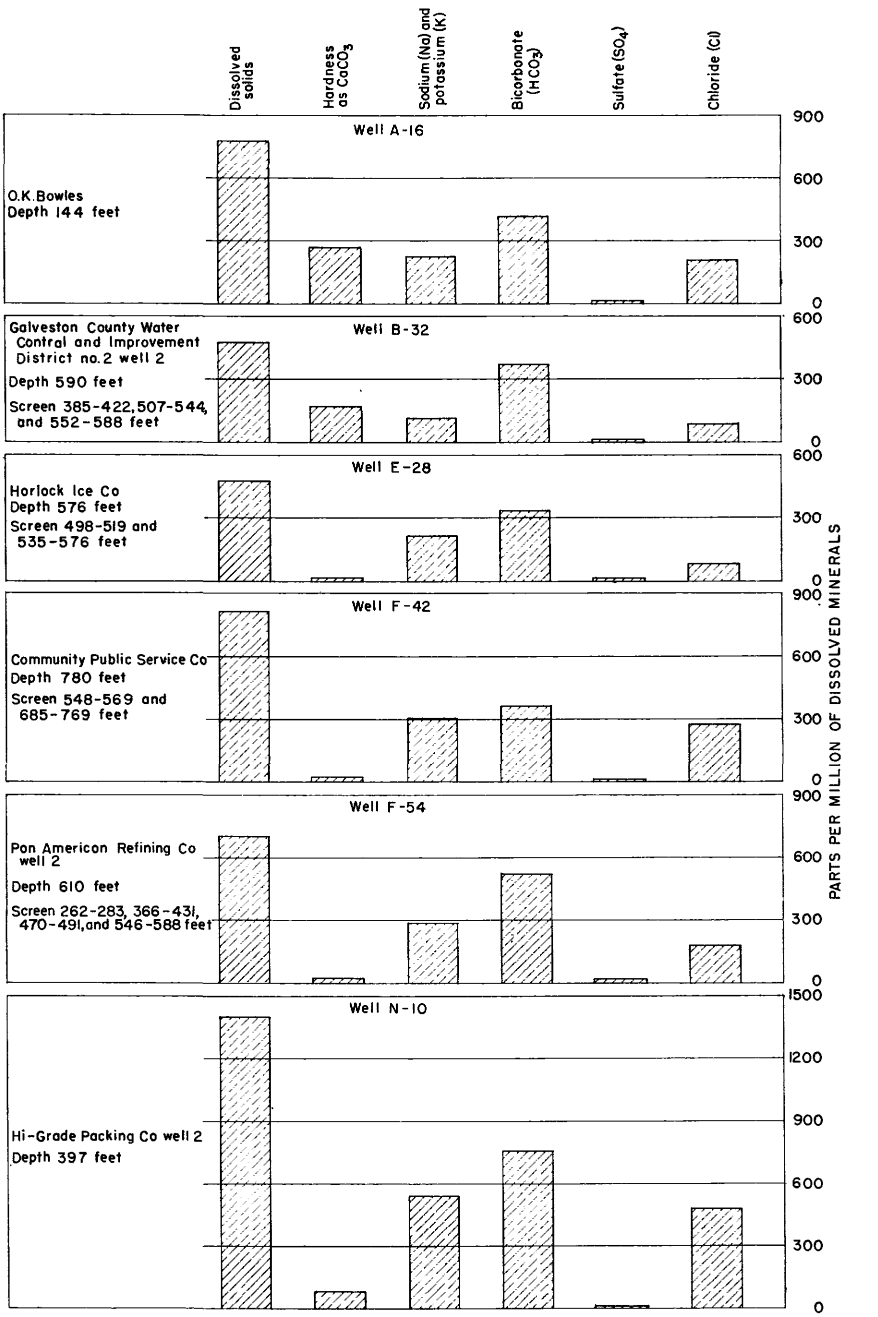

FIGURE 13.—Quality of water from typical wells in the sands of the upper part of the Beaumont clay in Galveston County, Tex.

potable water, particularly in the northern and western parts of the county. Although the sands in the upper Beaumont are very fine grained, they are capable of yielding moderate supplies of water throughout the county. The upper part of the Lissie formation appears to contain fresh water in the extreme northern part of the county; however, it is believed that, with any significant withdrawal, salt water would encroach rapidly.

Water levels throughout the county have declined until, at present, they are below sea level in most of the county. There are indications that the water levels are approaching equilibrium as a result of the stabilization of pumping in the Alta Loma area. Water levels have recovered to a large degree in the Texas City area since the reduction in pumping. Any increase in pumping will, however, cause farther lowering of the water levels.

Salt water is present in the lower part of the "Alta Loma" sand from the town of Alta Loma southward. The city of Galveston has obtained water of relatively low salinity by tapping the thinner and shallower section of the sand north of Alta Loma. The salt water apparently is in the form of a wedge, thickening downdip and occupying only the lower part of the formation updip. Salt water is present also in the sands underlying the "Alta Loma," except in the extreme northern and northwestern parts of the county. The encroachment of salt water probably occurred simultaneously from downdip and from beneath and is expected to continue. A ground-water divide between Texas City and Alta Loma has acted as a partial barrier to the movement of salty water from the east, but this divide has been partially removed or reduced in height by the large reduction of pumping in the Texas City area.

The city of Galveston's old well field, which still supplies part of the water for public use, has been encroached by salt water. Water from these wells is too salty to be desired for human consumption, but by blending this water with water from the new well field the old field can be kept in use and a slight ground-water divide between the two well fields can be retained. Such a ground-water divide will delay the ingress of salt water into the new well field from the downdip direction. Spreading the pumping in the new field to prevent excessive local drawdown will reduce the amount of encroachment from below.

Subsidence of the land surface has occurred to some extent in most of the county, and to a large extent in the Texas City area.

Subsidence may be attributed to compaction of aquifers and aquicludes after large-scale development and removal of ground water from storage, but sufficient data for proper overall quantitative interpretation of this phenomenon are not available.

419189—57——5

TABLE 11.—*Index of previously published well numbers and corresponding numbers in this report*

Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.
1	A-5	85	D-21	165	F-45	265	L-64	360	M-41	427	Q-12	541	D-22	665	L-51	705	B-5
3	A-17	86	D-4	169	F-5	266	L-65	370	M-9	429	N-15	544	D-23	666	L-52	706	E-12
4	A-1	87	D-5	174	F-6	267	L-66	372	M-7	432	N-10a	545	D-24	667	L-56	708	E-16
5	A-2	89	D-7	177	C-11	268	L-67	381	M-14	450	A-13	547	D-19	668	L-57	709	E-15
7	A-3	92	D-8	178	F-16	269	L-47	382	M-15	451	A-14	549	D-25	669	L-59	710	L-25
10	A-4	94	D-6	180	F-17	270	L-48	388	M-16	452	A-15	560	E-33	670	L-46	711	L-26
11	A-5	100	D-10	181	F-12	271	L-49	389	M-17	454	A-16	561	E-39	671	L-45	714	L-34
15	A-8	105	E-20	184	F-11	272	L-50	390	M-18	457	A-18	562	E-40	672	L-44	715	L-35
16	A-7	106	E-22	186	F-10	273	L-53	392	L-29	458	A-20	563	E-41	673	L-43	721	N-3
17	A-10	108	E-28	187	F-9	274	L-54	393	L-30	460	A-19	564	E-42	674	L-42	724	H-4
18	A-9	111	E-34	191	F-14	275	L-55	394	L-31	461	A-21	565	E-45	675	L-41	726	K-9
19	A-11	112	E-35	192	F-13	276	L-58	396	L-33	466	B-22	566	E-44	676	L-40	728	K-8
21	B-41	113	E-32	195	F-24	278	L-22	401	N-11	467	B-23	569	E-38	677	L-105	729	K-6
26	B-37	115	E-68	202	F-31	279	L-3	402a	N-7b	472	B-19	570	E-37	678	L-104	730	K-7
28	B-40	116	E-69	205	F-34	280	L-2	402b	N-7c	474	B-18	572	E-24	679	E-103	731	K-5
29	B-39	118	E-94	206	F-37	284	L-6	402c	N-7d	475	B-36	574	E-23	680	E-102	735	K-3
36	B-28	119	E-95	227	F-44	285	L-7	402d	N-7e	476	B-35	575	E-19	681	E-101	736	K-2
37	C-2	120	E-1	229	F-58	287	L-8	402e	N-7f	477	B-20	585	E-17	682	E-100	737	J-12
39	B-25	121	E-4	233	F-63	289	L-9	402f	N-7g	481	B-34	586	E-58	683	E-99	738	J-11
41	B-11	125	E-2	234	F-68	294	L-14	402g	N-7h	482	B-33	587	E-18	684	E-98	742	J-8
42	B-10	127	E-6	235	F-67	295	L-12	402h	N-7i	484	B-31	588	E-57	685	E-97	743	J-7
44	B-9	128	E-5	241	F-56	297	L-13	402i	N-7j	485	B-29	591	E-56	686	E-96	744	J-6
46	B-7	130	E-7	243	F-60	301	L-18	402j	N-7k	489	B-30	593	E-55	687	L-68	745	J-5
47	B-6	135	E-43	244	F-61	302	L-19	402k	N-7l	491	B-52	594	E-60	688	L-63	746	J-3
49	B-4	137	E-31	245	F-59	305	L-27	402l	N-7m	494	B-50	596	E-53	689	E-93	750	F-43
51	B-12	143	E-9	246	F-54	306	L-32	403	N-7a	496	B-43	597	E-52	690	L-10	751	F-45
52	B-13	144	E-10	247	F-55	310	L-38	404	N-8	497	B-42	600	E-64a	691	L-11	752	F-64
53	B-14	145	E-11	248	F-53	311	L-36	410	N-6	498	B-44	601	E-49	692	F-50	753	F-66
55	B-15	146	E-13	249	M-28	312	L-37	411	N-6b	499	B-48	603	E-48	694	F-51	754	F-62
56	B-2	147	E-14	250	M-30	320	L-17	411a	N-6a	502	B-46	604	E-47	695	F-52	756	M-39
57	B-1	148	E-25	251	M-31	321	L-5	412	N-5a	503	B-47	608	E-73	696	M-25	757	M-36
60	B-17	149	E-30	252	M-29	322	L-4	413	N-5	506	D-2	610	E-67	697	M-26	758	M-35
63	C-7	150	E-29	259	M-4	323	L-1	416	N-1	507	D-1	611	E-65	698	M-37	759	M-33
73	C-9	158	F-1	260	M-3	344	L-28	417	Q-3	516	D-11	612	E-62	699	F-23	760	F-57
75	C-4	160	F-8	261	L-39	351	M-13	419	Q-7	533	D-15	617	E-76	700	A-12	766	M-46
80	C-10	161	F-7	262	L-60	353	M-12	422	Q-9	535	D-16	618	E-77	701	B-45	767	M-45
81	D-3	162	F-2	263	L-61	356	M-5	425	Q-11	536	D-17	629	E-72	703	B-38	787	D-14
82	D-18	164	F-3	264	L-62	358	M-34	426	M-20	540	D-20	630	E-71	704	B-16		

The diversion of water from the Brazos River for the irrigation of rice in the county and for industrial use in the Texas City area has been beneficial in stabilizing water levels in wells in the Texas City area. The Brazos River appears capable of supplying sufficient water for other uses with the proper development of off-channel storage reservoirs to store floodwaters. The operation of the new Whitney Dam in north Texas should improve the overall quality of the Brazos River water by regulating the flow.

Wider spacing of wells to reduce pumping lifts and to retard salt-water encroachment should be considered if any large developments are contemplated. Long-range planning and care in the operation of existing wells and well fields will do much to assure the future availability of usable ground-water supplies. Exploration by test drilling and test pumping is advisable before new locations are selected for any large-scale developments.

The inventory of pumpage, the observations of water levels, and the collection of water samples for quality studies, should be continued to provide additional information on the status of salt-water encroachment. The interpretation of these data will aid materially in preventing accelerated encroachment when additional development is undertaken.

INDEX TO OLD WELL NUMBERS

The numbers of many wells have been changed to conform to a grid system designed to facilitate the location of wells. The identifying numbers for all wells listed in previously published reports on the area and the corresponding numbers in this report are given in table 11.

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TABLE 12.—*Records of wells in Galveston County, Texas*

[All wells are drilled unless otherwise noted in remarks column. Asterisk in well column indicates chemical analysis given in table 14. Method of lift: A, air lift; B, bucket; C, cylinder; Cf, centrifugal; D, diesel; E, electric; G, gasoline; H, hand; J, jet; T, turbine; W, windmill. Number indicates horsepower. Use of water: D, domestic; Ind, industrial; Irr, irrigation; N, not used; P, public supply; S, stock]

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level		Method of lift	Use of water	Remarks
								Below land surface datum (feet)	Date of measurement			
*A-1	J. L. Jones		1920	34	90	4	Upper part of Beaumont clay.			C, W	S	
*A-2	do		1908	32	500±	4	"Alta Loma" sand			J, E, 1	D, S	
*A-3	do	Pat O'Day	1924	30	505	4, 2	do			A, E, ¾	D, S	Casing: 20 ft of 4-in. and 485 ft of 2-in. Screen from 485 to 505 ft.
*A-4	Mrs. Mary Baker	F. W. Knaak	1939	30	90	4	Upper part of Beaumont clay.	13.4	Nov. 21, 1951	J, E	D, S	
A-5	Chester Eignus	Layne-Texas Co. Ltd.	1908	34	600	24, 9⅝	"Alta Loma" sand	62.6	July 21, 1941	T, D, 75	Irr	Casing: 50 ft of 24-in. and 550 ft 9⅝ in. Screen from 474 to 576 ft. Irrigated 80 acres of rice in 1951. See log.
A-6	L. J. Lindley	Pat O'Day	1933	32	560	4	do	110.6	May 7, 1951	J, E, 1	D	
*A-7	Cecil Brown	Layne-Texas Co. Ltd.	1938	32	562	6, 4	do	61.1 113.3	July 21, 1941 May 5, 1952	T, E, 7½	D, S	Casing: 163 ft of 6-in. and 388 ft of 4-in. Screen from 516 to 547 ft. See log.
*A-8	H. Allman	F. W. Knaak	1937	32	120	2½	Upper part of Beaumont clay.	17.5	Dec. 21, 1951	C, E	D, S	
*A-9	E. A. Glines	do	1937	32	123	2	do			C, E	D	
*A-10	Old Friendswood School.	Pat O'Day	1927	32	440	4, 2½	"Alta Loma" sand	60.8 112.9	July 21, 1941 May 5, 1952	None	N	
*A-11	Friendswood School District.	do	1938	31	560	4	do			C, E, 3	D	Screen from 540 to 560 ft. Supplies water for school.
A-12	Chester Eignus	Seagraves Oil Co.	1940	33	425	4	do	113.5	Nov. 6, 1951	C, W	S	Supplied water for drilling oil test.
*A-13	Friends Church	Chas. Ellis	1927	31	113	4	Upper part of Beaumont clay.			Cf, E	D, S	
*A-14	H. W. Bales	F. W. Knaak	1938	29	140	4	do			C, G, H	S	
*A-15	H. F. Schelling	Jim Plumbley	1909	27	160	4	do			C, E	D, S	Screen from 140 to 160 ft.
*A-16	O. K. Bowles	Pat O'Day	1938	27	144	4	do			Cf, E	D	
*A-17	Mrs. Annette Voss.	Layne-Texas Co. Ltd.	1910	28	763	24, 11⅝	"Alta Loma" sand and Lissie	29.0	Nov. 6, 1951	C, W	S	Casing: 55 ft of 24-in. and 713 ft of 11⅝-in.

							formation.					Screens from 550 to 648 and 700 to 755 ft. See log.
A-18	Galveston County	Chas. Ellis	----	30	90	3	Upper part of Beaumont clay.	13.0	Nov. 21, 1951	None	N	
*A-19	G. G. Anderson	Sam Mercer	1910	31	635	2	"Alta Loma" sand.			C, E	D	Screen from 599 to 635 ft
*A-20	E. D. Altemus	— Moore	1911	20	170	4	Upper part of Beaumont clay.			J, E	D, S	Screen from 138 to 158 ft.
A-21	do	E. D. Altemus	1931	23	150	4, 2	do	10.9	Nov. 20, 1951	None	N	Formerly used for irrigation.
*B-1	Hall J. McConnell.	Wiley Burns	1927	14	514	4, 2		54.7 97.6	Aug. 4, 1941 May 24, 1948	A, E	D, P	Casing: 40 ft of 4-in. and 474 ft of 2-in.
*B-2	D. D. McDonald	— Piazzo	1931	13	60	4	Upper part of Beaumont clay.			C, H	D	
*B-3	R. E. Ketchey	McMasters & Pomeroy.	1941	12	562	6, 4		[1] 51.5	Aug. 1941	T, E, 5	P	Casing: 147 ft of 6-in. and 415 ft of 4-in. Screen from 542 to 562 ft. Reported drawdown 66 ft while pumping 140 gpm when drilled. See log.
*B-4	J. S. Gissel		1928	11	655	3				None	N	
*B-5	J. M. Robinson	M. R. Pretty	1939	12	545	6, 4				J, E, 2	D	Casing: 102 ft of 6-in. and 443 ft of 4-in. Screen from 523 to 545 ft. See log.
*B-6	J. E. Haviland		1915	12	600	4				C, W	D	Flowed until 1930.
*B-7	E. W. Platzer	Wiley Burns	1933	7	368	2	Upper part of Beaumont clay.			J, E, 2	--	Screen from 348 to 368 ft.
B-8	H. T. James		1939	12	664	6, 4	Upper part of Beaumont clay and "Alta Loma" sand.	[1] 30 92.0	Sept. 1939 May 2, 1950	T, E, 5	P	Casing: 191 ft of 6-in. and 570 ft of 4-in. Screens from 474 to 487, 544 to 556, and 643 to 658 ft.
*B-9	do		1938	12	605	6, 4		26.2	May 5, 1952	A, —	N	
B-10	T. H. Windfield		1937	12	500+	2		31.6 77.2	Mar. 22, 1939 Nov. 6, 1951	None	N	
*B-11	Bayshore Lumber Co.	Chas. Ellis	1938	17	106	2½	Upper part of Beaumont clay.	14.9	Nov. 29, 1951	None	N	
*B-12	Clear Lake Shores	Wiley Burns	1928	8	578	4				J, E		
*B-13	A. L. Schmidt	do	1937	13	467	4				J, E, 1	D, S	
B-14	Will Dick		----	14	85	2	Upper part of Beaumont clay.			C, W		
B-15	League Estate		----	16	55	2	do			C, W	S	
B-16	do	Continental Oil Co.	1940	19	552	4		58.1	July 25, 1941	C, W	S	Screen from 530 to 551 ft.
*B-17	Charles A. Davis	Pat O'Day	----	12	570	4, 2		53.4 102.7	July 25, 1941 May 5, 1952	C, W	D, S	Casing: 60 ft of 4-in. and 510 ft of 2-in.
*B-18	I. M. Singeltary	— Dunland	1934	15	35	4	Upper part of Beaumont clay.			C, H	D	
*B-19	W. L. Price		1931	18	48	4	do			C, W	D, S	
B-20	Jhiradi Bros	Pat O'Day	1924	21	190	4	do			J, E, 3	D, S	Screen from 175 to 190 ft.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*B-21	Waters Davis	Palmo Drilling Co.	1948	19	707	4	"Alta Loma" sand.			J, E, 5	D, S	Screen from 667 to 707 ft.
*B-22	H. A. Sawyer	J. E. Hewitt	1909	15	25	8	Upper part of Beaumont clay.	6.7	Nov. 29, 1951	C, H	N	Bored. Casing: 25 ft of 8-in. tile.
*B-23	H. F. Thompson	Chas. Ellis	1934	16	74	3½	do			C, W	S	
B-24	P. J. Salvato	Palmo Drilling Co.	1951	17	630	4				T, E, 5	D	Screen from 610 to 630 ft.
*B-25	Texas Corinthian Yacht Club.			18	163	6	Upper part of Beaumont clay.			T, E, 5	D, P	
B-26	H. R. Cullen	Layne-Texas Co. Ltd.	1940	17	603	10¾, 6⅝				T, E	D	
B-27	Chas. Dunwoody	Palmo Drilling Co.	1949	18	590	3				J, E, 1	D	Screen from 570 to 590 ft.
*B-28	H. Beckman	Wiley Burns	1937	16	202	2	Upper part of Beaumont clay.			J, E, ½	D	
B-29	League Estate	Pat O'Day	1938	22	135	2	do	8.3	Feb. 19, 1952	None	N	Formerly used for irrigation.
*B-30	John Vaglienti	Fred Standard	1914	21	160	6	do	18.2	do	J, E, 1	D, S	
*B-31	R. E. McQuirk	do	1910	21	152	4	do	17.7	Nov. 29, 1951	C, E, ¼	D	Screen from 128 to 152 ft.
*B-32	Galveston County Water Control & Improvement District No. 2 well 2.	Layne-Texas Co. Ltd.	1948	24	590	10¾, 5	do	103.1	Nov. 7, 1950	T, E, 30	P	Screens from 385 to 422, 507 to 544, and 552 to 588 ft. Pump set at 260 ft. Reported drawdown 53 ft. while pumping 305 gpm in 1948. Well drilled to 703 ft. Gravel-walled well.
*B-33	J. S. Matlock		1925	20	500+	4	"Alta Loma" sand.	53.7 101.3	July 23, 1941 May 5, 1952	A, E	N	
*B-34	F. A. Reynolds	Nick Altemus	1933	19	275	3	Upper part of Beaumont clay.	16.0	Nov. 29, 1951	None	N	Screen from 265 to 275 ft.
*B-35	W. G. Hall	Pat O'Day	1938	15	200	4	do			J, E, 2	Irr	
*B-36	H. W. Thompson			19	550	6		51.1 98.4	July 23, 1941 May 5, 1952	None	N	
*B-37	Galveston, Houston & Henderson R. R.	Layne-Texas Co. Ltd.	1905	22	1,020	8	Lissie formation			None	N	Casing: 1,020 ft. of 8-in. Screen from 944 to 1,020 ft. See log.

*B-38	Galveston County Water Control & Improvement District No. 2 well 1.	do	1940	21	701	8, 6	"Alta Loma" sand.	[1]48.8 107.6	Apr. 1940 Nov. 8, 1951	T, E, 10	P	Casing: 585 ft. of 8-in. and 117 ft. of 6-in. Screen from 617 to 692 ft. Gravel-walled well. Reported drawdown 14 ft. while pumping 150 gpm in 1940. See log.
*B-39	Emil Schenk	Fred Standard	1908	21	575	3	do	54.0 101.5	July 23, 1941 May 5, 1952	None	N	Flowed until about 1922.
B-40	Galveston, Houston & Henderson R. R.			22	560	4	do	25.3 55.1 102.2	Apr. 15, 1931 July 23, 1941 Nov. 6, 1951	None	N	
*B-41	Mrs. M. M. Summers.	Pat O'Day	1938	23	210	3	Upper part of Beaumont clay.			C, E, 1	D	Screen from 201 to 210 ft. Formerly supplied 24 families.
*B-42	John Best	C. W. Alberson	1928	19	208	2	do	15.1	Dec. 17, 1951	C, E, ¼	D	Screen from 196 to 208 ft.
*B-43	W. F. McKibben	Pat O'Day	1937	21	200	3	do			C, W	S	Screen from 142 to 152 ft.
*B-44	F. Wallrab		1925	17	150	3	do			J, E, ¼	D	
*B-45	J. H. Ross	Pat O'Day	1939	10	600	6, 4	"Alta Loma" sand.	99.4	May 5, 1952	J, E, 3	D	Casing: 426 ft. of 6-in. and 174 ft. of 4-in. Screen from 568 to 590 ft. See log.
*B-46	O. Haardt		1918	13	65	10	Upper part of Beaumont clay.	12.4	Nov. 9, 1951	J, E, ⅓	D, S	Casing: 65 ft. of 10-in. tile.
*B-47	Stewart Hervey		1937	20	165	3	do			Cf, E, ¼	D	
*B-48	J. F. Thomson	Chas. Ellis	1936	22	74	2½	do			C, E, ¼	D	
B-49	J. H. Butler	Palmo Drilling Co.	1951	24	442	4, 3		[1]96	Nov. 1951	J, E, 1	D	Casing: 120 ft. of 4-in. and 322 ft. of 3-in. Screen from 428 to 442 ft.
*B-50	Zelda Smith		1897	25	800	4	Lissie formation(?)			None	N	
B-51	Bradshaw Florists	McMasters & Pomeroy.	1951	26	150	6	Upper part of Beaumont clay.	[1]26	Aug. 1951	T, E, 7½	Irr	Screen from 132 to 150 ft Reported drawdown, 30 ft. while pumping 250 gpm in 1951.
*B-52	D. Moratto	Pat O'Day	1931	24	170	4	do			Cf, E	D	Screen from 160 to 170 ft.
C-1	Joe Genitempo	Palmo Drilling Co.	1951	17	614	3				J, E, 2	D	Screen from 493 to 614 ft. Pump set at 126 ft.
C-2	Fritz Gaido		1938	17	105	3	Upper part of Beaumont clay.	14.8	Feb. 19, 1952	C, E, ¼	D	
C-3	Dan M. Bell	Pat O'Day	1951	17	617	4				J, E, 2	D	Screen from 602 to 617 ft. See log.
*C-4	W. P. Derrick	Chas. Ellis	1935	15	140	2	Upper part of Beaumont clay.	20.2	Feb. 14, 1952	None	N	
*C-5	C. D. Voss	do	1948	17	614	3, 2		[1]85	Mar. 1948	J, E, 3	D	Casing: 200 ft of 3-in. and 2-in. to bottom. Screen from 580 to 614 ft.
*C-6	Grogan & Curry	Palmo Drilling Co.	1949	17	541	4				J, E, 2	D	Screen from 520 to 541 ft. Pump set at 126 ft.
*C-7	Bay Shore Investment Co.	— Martin	1924	17	555	4		40.8 73.9	July 25, 1941 Feb. 18, 1952	None	N	Screen from 535 to 555 ft.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-8	Humble Oil & Refining Co.	L. Patterson	1950	16	748	7, 4		[1] 115	Feb. 1952	T, E, 7½	D	Casing: 726 ft of 7-in. with 4-in. from 696 to 748 ft. Screen from 727 to 748 ft. Supplies water for Galveston Bay District Camp. See log.
*C-9	A. F. Richter	Chas. Ellis	1937	17	163	4	Upper part of Beaumont clay.			J, E, ½	D	
*C-10	J. R. Heckendorn	do	1938	17	150	2	do	15.5	Feb. 18, 1952	C, W	D, S	
*C-11	F. G. Eidman	Wiley Burns		17	687	4		54.4	Feb. 8, 1941	C, W	D, S	
D-1	L. Z. Pledger	Layne-Bowler Co.	1910	38	800			70.8	Nov. 4, 1947	T, —	N	Formerly used for irrigation.
*D-2	do	do	1910	37	800	6				J, E, 3	D, S	
*D-3	J. M. West			31	600	6	"Alta Loma" sand	109.0	May 5, 1952	C, W	D, S	
D-4	do			25	600	4	do	102.3	Dec. 18, 1951	None	N	
*D-5	Otto Letzerich	O. Eberspatcher	1935	24	500	4, 2		20.6	do	None	N	Screen from 490 to 500 ft.
D-6	J. H. Butte	— Caldwell	1938	28	90	3	Upper part of Beaumont clay.	16.8	Nov. 9, 1951	C, H	D	
*D-7	P. V. Leavenworth.	Pat O'Day	1927	27	600	4	"Alta Loma" sand	94.0	do	A, —	N	
*D-8	Geo. S. Taylor	do	1938	26	127	4, 2	Upper part of Beaumont clay.			J, E, ½	D, S	
*D-9	Gerald Mora	do	1949	26	550	4	"Alta Loma" sand			T, E, 3	D, Irr	
*D-10	J. H. Butte	do	1912	30	360	4	Upper part of Beaumont clay.			J, E, 1	D, S	
D-11	J. M. West	P. McFadden	1919	33	20	2	do			C, W	S	
*D-12	Dillard-Waltermire Inc.	L. Patterson	1951	35	676	4	"Alta Loma" sand			None	N	Screen from 654 to 674 ft. Casing pulled. Supplied water for drilling oil test. See log.
D-13	City of Galveston test well 2-5.	Layne-Texas Co. Ltd.	1941	25	1,218		do			None	N	Test well drilled for city of Galveston. See log and analyses of drill stem tests.
D-14	City of Galveston test well 8-11.	do	1942	22	1,200	4	do	102.3 107.8	May 25, 1949 Sept. 24, 1952	None	N	Screen from 669 to 677 ft. Test hole drilled to 1,200 ft. See log.
*D-15	John Rezuk	John Rezuk	1915	29	32	3				C, W	D, S	

*D-16	C. W. Van Dyke	C. W. Van Dyke	1911	30	42	6	Upper part of Beaumont clay.			C, H	D	Screen from 16 to 42 ft.
*D-17	Mrs. A. F. Winton	Lodge Perry	1931	35	103	3	do	12.0	Nov. 18, 1951	Cf, E, ½	D, S	
*D-18	Missouri Pacific R. R.	L. Patterson	1926	35	650	6	"Alta Loma" sand	108.3	May 5, 1950	None	N	Well filled and abandoned. See log.
*D-19	R. McPeters	R. Smith	1927	36	70	1¼	Upper part of Beaumont clay.			C, W	D, S	
*D-20	W. A. Barber		1917	34	325	6	do	10.3	Dec. 28, 1951	Cf, E, ¼	D	
D-21	Algoa Townsite Co.	— Miller	1907	33	705	8	Upper part of Beaumont Clay and "Alta loma" sand.			T, —	N	Drilled to 1,362 ft., but plugged back to 705 ft. Screens from 459 to 481 and 626 to 686 ft. See log.
*D-22	T. C. Scruggs	do	1928	34	32	4	Upper part of Beaumont clay.	[1] 8	Dec. 1951	C, E, ¼	D, S	
*D-23	C. E. Holbert		1910	29	160	4	do	11.5	Nov. 27, 1951	C, E, ¼	D	Screen from 152 to 160 ft.
*D-24	L. C. Williams	— Conklin	1915	30	226	6	do			C, E	D, S	Casing: 226 ft of 6-in. with screen at bottom.
*D-25	J. A. Unger	A. D. Drum	1904	32	360	4	do	12.3	Nov. 27, 1951	None	N	
*E-1	M. B. Butler	Joe Piazzo	1936	26	125	3, 2½	do			C, E, ½	D	
*E-2	do		1938	25	109	2½	do			C, W	S	
E-3	Bradshaw Florists	McMasters & Pomeroy.	1951	24	163	6	do	[1] 23.0	Aug. 1951	T, G, 6	Irr	Screen from 150 to 163 ft. Reported drawdown 30 ft while pumping 250 gpm in 1951.
*E-4	Joe Daro	Pat O'Day	1928	25	168	3	do			A, E, 3	Irr	Screen from 158 to 168 ft. Irrigated 8 acres in 1951.
*E-5	O. M. Trippodo	Joe Piazzo	1927	21	105	3	do	15.6	Dec. 19, 1951	C, E	Irr	
*E-6	Mrs. Lena Ferro	Pat O'Day	1935	20	100+	2	do	16.1	Dec. 18, 1951	J, E, ½	D	
E-7	— Patton		1938	25	680±	5	"Alta Loma" sand	50.5 82.8	Aug. 4, 1941 May 5, 1952	None	N	Supplied water for drilling oil test.
E-8	Phillips Petroleum Co.	Phillips Petroleum Co.	1939	25	3,106					None	N	Oil test well. Owner's Brittnacher No. 1. For partial electric log see plate 1.
*E-9	do	Pat O'Day	1939	24	432	4	Upper part of Beaumont clay.			T, E, 3	D	Screen from 412 to 432 ft.
*E-10	Midstates Oil Co.			22	650±	4	"Alta Loma" sand.	81.2	Nov. 27, 1951	C, W	D	Supplied water for drilling oil test well.
E-11	Maco Stewart	Pat O'Day		22	700±	4	do	78.6	Nov. 27, 1951	J, E, 1	Ind	
E-12	Ross Stewart		1938	23	680±	8	do			None	N	Supplied water for drilling oil test.
*E-13	do			23	716	4	do			C, W	D	Do.
E-14	do			24	700±	4	do			C, G	Ind	
E-15	Phillips Petroleum Co.		1939	27	700±	6	do	49.0 83.6	Aug. 2, 1941 May 12, 1952	None	N	Supplied water for drilling oil test.
E-16	Glenn H. McCarthy.	L. Patterson	1941	21	731	4	do	53.5	May 5, 1952	None	N	Screen from 709 to 731 ft. Well drilled to 743 ft but plugged back to 731 ft. See log.
*E-17	E. P. Howell		1890	16	694	6	do			J, E	D, S	

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*E-18	Magliola & Salvato.	....	1913	13	750	2	"Alta Loma" sand.	....	....	A, E, 1	D	
*E-19	Carl Kobarg	Joe Piazzo	1932	14	160	3	Upper part of Beaumont clay.	8.7	Nov. 28, 1951	C, E	D, S	Screen from 150 to 160 ft.
E-20	R. E. Newell	....	1915	14	240	4	do	8.8 9.6	July 29, 1941 Nov. 28, 1951	C, E, ¼	D, S	
E-21	— Barnes	Palmo Drilling Co.	1947	11	725	3	"Alta Loma" sand.	....	....	J, E, 2	D	Screen from 705 to 725 ft.
*E-22	Mrs. Hans Guildman	....	1924	13	1,200±	3	Lissie formation	13.1 20.3 64.6 26.4	Mar. 28, 1939 July 28, 1941 Nov. 28, 1951 Nov. 29, 1951	None	N	Flowing Oct. 20, 1932.
*E-23	Paul Lobit	— Conklin	1918	7	250	2½	Upper part of Beaumont clay.			None	N	
*E-24	— Reicher	McMasters & Pomeroy.	1938	12	463	4	do	....	....	T, E, 7½	D	Screen from 423 to 463 ft.
E-25	Jim Wiley	Wiley Burns	1927	15	576	4	do	102.6	Dec. 19, 1951	J, E, 1	D, S, Irr	
E-26	Galveston County Water Control & Improvement District No. 1 well 1.	Layne-Texas Co. Ltd.	1950	16	594	10¾, 5	do	....	....	T, E, 25	P	Casing: 530 ft of 10¾-in. and 188 ft of 5-in. with 104 ft of lap in 10¾-in. Screen from 536 to 582 ft. Drawdown, 68 ft while pumping 343 gpm in 1950. Gravel-walled well. See log.
E-27	Galveston County Water Control & Improvement District No. 1 well 2.	do	1952	16	597	10¾, 5	do	....	....	T, E	P	Casing: 481 ft of 10¾-in. 5-in. from 382 to 597 ft. Screen from 491 to 522 ft, and 540 to 570 ft. Reported drawdown, 90 ft while pumping 310 gpm in 1952. Gravel-walled. See log.
*E-28	do	do	1920	17	576	6	do	....	....	A,—	Ind	Screens from 498 to 519 and 535 to 576 ft. Water level reported as 3 ft below land surface in 1920. See log.
E-29	do	Southern Engine & Pump Co.	1935	17	576	6	do	....	....	T, E, 15	Ind	Screens from 498 to 519 and 535 to 576 ft.

E-30	Galveston County Water Control & Improvement District No. 1.	do	1936	17	576	6	do	110.3	May 6, 1952	None	N	Do.
*E-31	G. Marselli			19	600	6	do			A, G	Irr	
*E-32	E. Menotti		1925	20	504	6	do	14.4 36.9 59.8	Oct. 20, 1932 July 28, 1941 Dec. 19, 1951	J, E, ¼	D, S	
E-33	B. Samartino	Pat O'Day		19	200	4	do	15.6 35.4	Apr. 6, 1939 Jan. 21, 1952	None	N	Formerly used for irrigation.
*E-34	Mineral Oil Refining Co.			20	230	8	do			T, E, 15	Ind	Originally drilled to 875 ft, but plugged back to 230 ft. Screen from 210 to 230 ft.
E-35	Galveston, Houston & Henderson R. R.	Gus Warnecke		16	750	3	"Alta Loma" sand.	17.9 58.8	Apr. 15, 1931 July 28, 1941	None	N	Water level reported 3 ft above land surface in 1907–08.
E-36	T. Smith	Palmo Drilling Co.	1946	12	640	3				C, E, 1	D, Irr	Screens from 620 to 640 ft.
*E-37	C. L. Dobbins		1939	11	940	6	Upper part of Beaumont clay, "Alta Loma" sand, and Lissie formation.	46.8 84.4	July 28, 1941 May 6, 1952	A, E, 1½	D	Screens from 483 to 522; 586 to 609; 840 to 880; and 902 to 923 ft. Well drilled to 1,167 ft, but plugged back to 940 ft. See log.
*E-38	do			14	201	4	Upper part of Beaumont clay.	[1] 26	Mar. 1948	J, E, ¾	D, S	
E-39	G. O. Anderson	Otis Dower		13	620±	4		54.3 94.1	July 28, 1941 Jan. 17, 1952	C, W	D	Formerly used to supply water for drilling oil test.
*E-40	Izaac Lippman	Luther Patterson.	1938	13	626	4				C,—	D	Screen from 581 to 603 ft. Supplied water for drilling oil test well. See log.
E-41	Three Bee Investment Co.			11	625±	4		94.4	May 6, 1952	A,—	N	Supplied water for drilling oil test well.
E-42	Pure Oil Co	Luther Patterson.	1938	12	651	7				A, G	N	Supplied water for drilling oil test well. See log.
E-43	E. R. Strong			13	630±	4				None	N	Supplied water for drilling oil test well.
E-44	Stanolind Oil & Gas Co.			6	615±	4		45.5 88.4	July 29, 1941 May 6, 1952	None	N	Do.
*E-45	Pure Oil Co			10	620	5½				J, E, 1	D	
E-46	Humble Oil & Refining Co.	L. Patterson	1944	10	643	4				T, E	Ind	Screen from 621 to 643 ft. See log.
*E-47	Humble Oil & Refining Co.	do	1934	11	605			92.8	Nov. 7, 1951	A, G	Ind	Screen from 541 to 605 ft. Well drilled to 740 ft, but plugged back to 605 ft. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*E-48	Midstates Oil Co.	L. Patterson		18	434		Upper part of Beaumont clay.			A, —	D	
*E-49	D. J. Corbett			14	820	6				J, E, 2	D	
E-50	Erwin Biegert	H. H. Ellis	1951	20	210	2	Upper part of Beaumont clay.	40.5	Jan. 21, 1952	J, E, ½	D	Screen from 200 to 210 ft.
*E-51	— Burpee	H. L. Jackson	1948	15	601	3	do	[1] 90	Apr. 1948	J, E, 2	D	Screen from 571 to 601 ft.
E-52	Glen Ray	Fred Standard	1916	18	480	3	do	97.4	Feb. 11, 1952	None	N	
*E-53	Ed Salzman	— Conklin	1917	7	256		do	5.0 [1] 38	Mar. 22, 1939 June 1949	J, E	D, S	Screen from 236 to 256 ft. Flowed until 1928.
*E-54	Mrs. Otilla Collogne.	Palmo Drilling Co.	1950	12	825	2½		[1] 110	Aug. 1950	J, E, 1	D	Screen from 805 to 825 ft.
*E-55	C. M. Wolston	Chas. Ellis	1937	15	210	2½	Upper part of Beaumont clay.			J, E, ⅓	D	
*E-56	Will Horwitz Estate.	Pomeroy & McMasters.	1939	15	608	4				T, E, 2	D, Irr	
*E-57	C. J. Palmo	Joe Piazzo	1930	13	90	3	Upper part of Beaumont clay.	9.6	Mar. 15, 1951	C, E, ⅙	D	
*E-58	R. L. Allen		1923	17	208	6	do	24.9	Nov. 28, 1951	None	N	Formerly used for irrigation.
E-59	J. W. Edge	Palmo Drilling Co.	1946	18	205	3	do			J, E, ½	D	Screen from 185 to 205 ft.
*E-60	Mrs. C. B. Benson.	H. H. Ellis	1938	19	100	2	do			J, E, ¼	D	
E-61	— Long	Palmo Drilling Co.	1951	18	213	3	do			J, E, ½	D	Screen from 203 to 213 ft.
*E-62	E. Harris	Chas. Ellis	1938	19	100	3	do	10.5	Mar. 23, 1939	C, E	Irr	Screen from 83 to 100 ft.
*E-62a	do	Palmo Drilling Co.	1951	19	477	3	do	[1] 70	Jan. 1952	J, E, 2	D	
E-63	Hassie Hunt Trust.	do	1949	20	460	4	do	77.6	Nov. 7, 1951	None	N	Supplied water for drilling oil test well.
E-64	G. D. Butler	H. H. Ellis	1951	21	176	2	do	[1] 27	Apr. 1951	J, E, ½	D, S	
*E-64a	do	Chas. Ellis	1935	21	96	3	do	12.9	Jan. 18, 1951	None	N	
*E-65	Three Bee Investment Co.			21	700±	4	"Alta Loma" sand.	78.1	May 6, 1942	None	N	Supplied water for drilling oil test well.
E-66	Prince Drilling Co.	L. Patterson	1947	21	472	5, 4	Upper part of Beaumont clay.			A, G	N	Supplied water for drilling oil test well. Screen from 452 to 472 ft. See log.

*E-67	Midstates Oil Co.			20	700	4	"Alta Loma" sand.			C, G	S	Supplied water for drilling oil test wells.
E-68	do	C. Anauschewts	1925	19	526	4	Upper part of Beaumont clay.	15.4 37.8 76.2	Oct. 20, 1932 July 30, 1941 May 6, 1952	None	N	
*E-69	Mrs. M. Moore	John Palmer	1912	16	64	4	do	9.7 8.2 9.9	Oct. 20, 1932 Mar. 23, 1939 Jan. 21, 1952	C, E	D, S	
E-70	Pan American Production Co.	Palmo Drilling Co.	1949	18	790	4	"Alta Loma" sand.			J, E, 1	D	
*E-71	O. E. Coleman		1933	17	110	2½	Upper part of Beaumont clay.			C, E, 4	D	
E-72	Pan American Production Co.	Pomeroy & McMasters.	1936	17	498	4	do			A, G	N	Supplied water for drilling oil test well. Well drilled to 524 ft., but plugged back to 498 ft. See log.
*E-73	Humble Oil & Refining Co.	L. Patterson	1936	18	828	7, 4	"Alta Loma" sand.			None	N	Supplied water for drilling oil test well. Well drilled to 858 ft, but plugged back to 828 ft. See log.
*E-74	City of Galveston test well 7-10.	Layne-Texas Co. Ltd.	1942	26	1,200		do			None	N	Test well. Filled and abandoned. See analyses of drill stem tests. See log.
*E-75	City of Galveston test well 12-15.	do	1942	17	1,180		do			None	N	Test well. Filled and abandoned. See analyses of drill stem tests. See log.
*E-76	Frank Drees	H. H. Ellis	1938	18	88	3	Upper part of Beaumont clay.	7.0	Nov. 27, 1951	C, E	D	
*E-77	Ed H. Dues	Joe Piazzo	1930	18	150	3	do	11.3	do	C, E	D	Screen from 140 to 150 ft.
*E-78	City of Galveston well 10.	Layne-Texas Co. Ltd.	1942	19	770	18⅝, 10¾	"Alta Loma" sand.	55.6 115.2	May 28, 1942 Nov. 5, 1951	T, E, 75	P	Casing: 639 ft of 18⅝-in. and 10¾-in. from 537 to 770 ft. Screen from 647 to 767 ft. Reported drawdown 45 ft while pumping 1,025 gpm in 1942. Gravel-walled well. See log.
*E-79	City of Galveston test well 1-4.	do	1941	18	1,212	4	do	54.5 111.1	Dec. 29, 1941 May 12, 1952	None	N	Casing: 931 ft of 4-in. with screens from 721 to 731 and 760 to 770 ft. See log.
*E-80	City of Galveston test well 11-14.	do	1942	22	1,205	4	do			None	N	Test hole. Filled and abandoned. See analyses of drill stem tests. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*E-81	City of Galveston well 13.	Layne-Texas Co. Ltd.	1942	21	810	18⅝, 10¾	"Alta Loma" sand	66.3 116.9	May 5, 1943 Nov. 5, 1951	T, E, 75	P	Casing: 631 ft of 18⅝-in.; 10¾-in. from 525 to 770 ft, and 47 ft of 6⅝-in. Screen from 640 to 763 ft. Reported drawdown 32 ft while pumping 1,040 gpm in 1942. Gravel-walled well. See log.
*E-82	City of Galveston test well 6-9.	do	1942	22	1,200		do					Test hole. Filled and abandoned. See analyses of drill stem tests. See log.
*E-83	City of Galveston well 12.	do	1942	22	781	18⅝, 10¾	do	66.2 122.9	May 28, 1942 Nov. 5, 1951	T, E, 75	P	Casing: 635 ft of 18⅝-in. and 10¾-in. from 525 to 781 ft. Screen from 636 to 776 ft. Reported drawdown, 42 ft while pumping 1,025 gpm, Apr. 17, 1942. Gravel-walled well. See log.
*E-84	City of Galveston well 9.	do	1942	23	764	18⅝, 10¾	do	63.1	May 28, 1942	T, E, 75	P	Casing: 662 ft of 18⅝-in. and 10¾-in. from 556 to 764 ft. Screen from 669 to 761 ft. Reported drawdown 53.4 ft while pumping 1,002 gpm Mar. 13, 1942. Gravel-walled well. See log.
*E-85	City of Galveston test well 5-8.	do	1942	24	1,201		do			None	N	Uncased test hole. Filled and abandoned. See analyses of drill stem tests. See log.
*E-86	City of Galveston test well 4-7.	do	1942	24	1,200		do			None	N	Do.
*E-87	City of Galveston well 11.	do	1942	25	771	18⅝, 10¾	do	67.2 120.8	May 28, 1942 Nov. 5, 1951	T, E, 75	P	Casing: 657 ft of 18⅝-in. and 10¾-in. from 551 to 771 ft. Screen from 656 to 767 ft. Reported

												drawdown 49 ft while pumping 1,012 gpm Apr. 7, 1942. Well drilled to 794 ft, but plugged back to 771 ft. Gravel-walled well. See log.
*E-88	City of Galveston test well 3-6.	do	1942	25	1, 200	4	do	67. 2 128. 7	May 28, 1942 May 12, 1952	None	N	Casing: 760 ft of 4-in. Screen from 760 to 770 ft. See log.
*E-89	City of Galveston test well 10-13.	do	1942	25	1, 200		do					Uncased test hole. Filled and abandoned. See analyses of drill stem tests. See log.
*E-90	G. Novelli	Pat O'Day	1948	25	800	3	do			J, E, 2		Screen from 780 to 800 ft.
*E-91	Penrod Drilling Co.	Palmo Drilling Co.	1951	28	439	4	Upper part of Beaumont clay.					Supplied water for drilling oil test well. Screen from 419 to 439 ft. Reported yield 100 gpm. Casing pulled and well abandoned.
E-92	City of Galveston well 14.	Layne-Texas Co. Ltd.	1942	31	805	18⅝, 10¾	"Alta Loma" sand.	110. 5 113. 3	Jan. 9, 1950 Sept. 24, 1952	None	N	Casing: 652 ft of 18⅝-in. and 10¾-in. from 547 to 805 ft. Screen from 661 to 775 ft. Reported drawdown, 30 ft while pumping 1,040 gpm July 2, 1942. Gravel-walled well. See log.
*E-93	City of Galveston test well 2.	do	1941	27	870	4	do	106. 3 110. 1	May 10, 1949 Sept. 24, 1952	None	N	Casing: 870 ft of 4-in. Screen from 850 to 870 ft. Well drilled to 1,174 ft, but plugged back to 870 ft. See log.
*E-94	Dairy Farmers Co-op Assn.		1930	30	96	4	Upper part of Beaumont clay.			C, E	Ind	
E-95	Santa Fe School		1928	30	68	2	do			C, E	P	
E-96	City of Galveston well 33-N.		1893-1894	25	790±	9	"Alta Loma" sand.			None	N	Screen from 756 to 796 ft. Water level reported 26 ft above land surface in 1893-94. Filled and abandoned.
E-97	City of Galveston well 31-N.		1893-1894	23	790±	9	do			None	N	Screen from 755 to 795 ft. Filled and abandoned.
E-98	City of Galveston well 29-N.		1893-1894	21	790±	7	do			None	N	Screen from 754 to 794 ft. Filled and abandoned.
E-99	City of Galveston well 27-N.		1893-1894	22	790±	7	do			None	N	Screen from 755 to 795 ft. Filled and abandoned.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
E-100	City of Galveston well 25-N.		1893-1894	21	790±	7	"Alta Loma" sand.			None	N	Screen from 754 to 794 ft. Filled and abandoned.
E-101	City of Galveston well 23-N.		1893-1894	19	790±	7	do			None	N	Screen from 753 to 793 ft. Filled and abandoned.
E-102	City of Galveston well 21-N.		1893-1894	19	790±	7	do			None	N	Screen from 752 to 792 ft. Filled and abandoned.
E-103	City of Galveston well 19-N.		1893-1894	18	790±	7	do			None	N	Do.
E-104	City of Galveston well 17-N.		1893-1894	18	793	7	do	[1]1 [1]7 47.5 64.2 102.8	Aug. 1911 Nov. 1913 June 24, 1939 Aug. 9, 1941 Nov. 7, 1951	None	N	Screen from 753 to 793 ft. Water level reported as 26 ft above land surface when drilled and 2.9 ft above land surface, Dec. 10, 1907.
E-105	City of Galveston well 15-N.		1893-1894	19	790	7	do			None	N	Screen from 753 to 793 ft. Filled and abandoned.
E-106	City of Galveston test well 9-12.	Layne-Texas Co. Ltd.	1942	17	1,200		do			None	N	Uncased test hole. Filled and abandoned. See analyses of drill stem tests. See log.
F-1	D. C. Richards	D. C. Richards	1930	16	170	8	Upper part of Beaumont clay.			None	N	Screen from 150 to 170 ft. Formerly used for irrigation.
*F-2	V. T. Bounds	— Morton	1924	10	665	4		84.6	May 6, 1952	None	N	
F-3	Wm. Hodges	Chas. Ellis	1930	10	175	2½	Upper part of Beaumont clay.			C, W	D	
*F-4	R. F. Zelinek	do	1929	10	225	2½	do			J, E	D	Screen from 213 to 225 ft.
*F-5	T. W. Saunders	do	1929	9	225	4	do	8.9	May 17, 1939	C, E	D, S	Screen from 202 to 222 ft.
F-6	R. E. Breeding	do	1928	6	227	4, 2½	do			C, W	D	Screen from 207 to 227 ft.
F-7	Roy Moore	do	1924	8	666	4		36.5 68.8	May 17, 1939 May 10, 1945	J, E, 3	D	Screen from 646 to 666 ft.

*F-8	C. J. Blume	— Morton	1923	10	557	4		36.3 72.6 55.2	July 26, 1941 May 6, 1952 Feb. 18, 1952	None	N	Screen from 537 to 557 ft.
*F-9	A. L. Swank	Wiley Burns	1913	7	487	2	Upper part of Beaumont clay.			None	N	
*F-10	Adams Preserving Co.	— Martin	1924	10	656			43.0 78.3 82.0	May 15, 1939 Oct. 24, 1946 July 9, 1947	J, E, —	Ind	
*F-11	Southern Pacific R. R.	— Wright	1900	10	601	4				C, G	D	Flowed until 1928.
*F-12	Mrs. — Butterfield.	Wiley Burns	1912	12	480	2	Upper part of Beaumont clay.			C, W	D, S	
F-13	Stanolind Oil & Gas Co.			7	520	6				A, G	Ind	Supplied water for drilling oil test well.
F-14	Humble Oil & Refining Co.	L. Patterson	1934	12	666	7, 4				A, G	N	Casing: 148 ft of 7-in and 435 ft of 4-in. Screen from 581 to 661 ft. Supplied water for drilling oil test wells. See log.
F-15	do	do	1949	12	435	7⅝, 4½	Upper part of Beaumont clay.	[1] 58	Dec. 1949	T, E	D	Screen from 411 to 434 ft. Supplies Dickinson camp site. See log.
*F-16	W. H. Sutton	Chas. Ellis	1925	10	200	3	do			C, W	D, S	
*F-17	do			7	100	3	do			C, W	S	
*F-18	Superior Oil Co	Henry Lane	1950	5	692	4		93.8	July 2, 1952	A, G	N	Supplied water for drilling oil test wells.
F-19	do	Superior Oil Co	1950	5	11, 582					None	N	Oil test. Owner's State fee no. 1 For partial electric log, see plate 2.
F-20	Pan American Production Co.		1951	5	645	4		93.8	Dec. 6, 1951	A, G	N	Supplied water for drilling oil test well.
*F-21	Edwards Drilling Co.	Palmo Drilling Co.	1951	10	645	4		94.0	Dec. 13, 1951	A, G	N	Supplied water for drilling oil test well. Screen from 624 to 645 ft.
*F-22	Humble Oil & Refining Co.	L. Patterson	1951	11	650	4				A, G	N	Supplied water for drilling oil test well. Screen from 608 to 650 ft.
F-23	Pure Oil Co	do	1940	15	672	6		55.4 97.6	Aug. 8, 1941 May 6, 1952	A, G	Ind	Supplied water for drilling oil test well. Screen from 641 to 671 ft. See log.
F-24	do	do	1939	7	641	7		42.3 95.7	Sept. 15, 1939 May 6, 1952	None	N	Supplied water for drilling oil test well. Screen from 599 to 640 ft. See log.
*F-25	Edwards Drilling Co.	Palmo Drilling Co.	1952	7	329	4	Upper part of Beaumont clay.	81.8	July 2, 1952	None	N	Supplied water for drilling oil test well. Screen from 309 to 329 ft.
*F-26	John W. Mecom	do	1952	5	656	4				A, G	N	Supplied water for drilling oil test well. Screen from 636 to 656 ft.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
F-27	Galveston County Water Control & Improvement District No. 4.			5	674	4		105.0	July 2, 1952	None	N	
*F-28	Mainland Co.		1944	5	181	4	Upper part of Beaumont clay.			C, W	S	
F-29	Pan American Production Co.		1949	10						None	N	Oil test well. Owner's Josie Kohfeldt D-2. For partial electric log see plate 2.
*F-30	Galveston County Hospital.	Big State Drilling Co.	1950	16	680	13⅜, 6⅝	Upper part of Beaumont clay.	91.6	Nov. 14, 1950	T, E	P	Casing: 436 ft of 13⅜-in. and 6⅝-in. from 336 to 680 ft. Screens from 593 to 602 and 611 to 678 ft. Well drilled to 815 ft but plugged back to 680 ft. Gravel-walled well. See log.
*F-31	Frank Bell	John Anazan	1927	16	110	3	do	10.4	Feb. 18, 1952	None	N	
F-32	Galveston County Water Control & Improvement District No. 3 well 1.	H. H. Ellis	1940	15	500±		do			T, E, 10	P	
*F-33	Galveston County Water Control & Improvement District No. 3 well 2.	Layne-Texas Co. Ltd.	1943	15	708		do			T, E	P	Screens from 578 to 610 and 665 to 700 ft. Reported drawdown 53 ft. while pumping 300 gpm. Gravel-walled well. See log.
*F-34	Galveston, Houston, & Henderson R. R.	do	1915	19	914	9⅝	"Alta Loma" sand.	78.3	Nov. 7, 1951	T, E	N	Screen from 873 to 914 ft. See log.
F-35	Edwards Drilling Co.	Palmo Drilling Co.	1950	10	730	4				A, G	N	Supplied water for drilling oil test wells. Screen from 719 to 730

											ft. Reported yield 120 gpm.
F-36	do	do	1951	12	650	4				A, G	N	Supplied water for drilling oil test well. Screen from 629 to 650 ft.
F-37	A. J. Biron	Layne-Texas Co. Ltd.	1907	11	926	11⅝	"Alta Loma" sand.					Well filled and abandoned. See log.
*F-38	Edwards Drilling Co.	Palmo Drilling Co.	1952	9	326	4	Upper part of Beaumont clay.	78.8	July 2, 1952	None	N	Supplied water for drilling oil test well. Screen from 306 to 326 ft. Temperature 74½° F.
F-39	Homer Decker			7	119	2½	do	33.0	June 30, 1952	None	N	
*F-40	K. Farley	Landriault	1941	8	248	3, 2	do	[1] 38	May 1951	C, W	Irr	Screen from 230 to 245 ft.
F-41	Community Public Service Co. well 8.	Layne-Texas Co. Ltd.	1952	9	772	16, 8⅝	do				P	Casing: 553 ft of 16-in. and 219 ft of 8⅝-in. Screens from 659 to 705 and 714 to 760 ft. Reported drawdown 63 ft while pumping 524 gpm, June 4, 1952. Gravel-walled well. See log.
*F-42	Community Public Service Co. well 6.	do	1944	8	780	20, 10¾	do	116.6 128.7 121.8	May 15, 1945 May 18, 1948 Nov. 7, 1951	T, E, 50	P	Casing: 442 ft of 20-in. and 336 ft of 10¾ in. Screens from 548 to 569 and 685 to 769 ft. Reported drawdown 79 ft while pumping 350 gpm, Feb. 22, 1944. Gravel-walled well. Temperature 82½° F. See log.
*F-43	Community Public Service Co. well 4.	do	1937	8	772	16, 8⅝	do	67.4 128.7	Aug. 7, 1941 Nov. 7, 1947	T, E, 25	P	Casing: 420 ft of 16-in. and 352 ft of 8⅝-in. Screens from 503 to 513, 544 to 559, 637 to 652, 675 to 699, and 732 to 764 ft. Reported drawdown 57 ft while pumping 440 gpm in 1951. Gravel-walled well. See log.
*F-44	Community Public Service Co. well 3.	do	1934	10	760	12, 6, 4½	do			T, E, 20	P	Casing: 243 ft of 12-in., 317 ft of 6-in. and 200 ft of 4½-in. Screens from 679 to 701 and 712 to 758 ft. Reported drawdown 79 ft while pumping 302 gpm in 1951. Gravel-walled well. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*F-45	Community Public Service Co. well 5.	Layne-Texas Co. Ltd.	1942	9	764	20, 10¾	Upper part of Beaumont clay.	136.1 141.6 131.4	May 5, 1945 May 6, 1949 May 8, 1951	T, E, 40	P	Casing: 452 ft of 20-in. and 312 ft of 10¾-in. Screens from 552 to 573 and 675 to 759 ft. Reported drawdown 48 ft while pumping 500 gpm, Jan. 24, 1942. Gravel-walled well. See log.
*F-46	Community Public Service Co. well 7.	do	1948	9	763	16, 8⅝	do	149.6 127.7 131.9	Nov. 22, 1948 May 4, 1950 May 8, 1951	T, E, 50	P	Casing: 406 ft of 16-in. and 357 ft of 8⅝-in. Screens from 511 to 527, 532 to 575, 640 to 655 and 695 to 760 ft. Reported drawdown 54 ft while pumping 584 gpm in 1948. Gravel-walled well. See log.
*F-47	Galveston County Water Control & Improvement District No. 4 well 4.	do	1951	12	728	16 10¾, 8⅝	do	[1] 141	May 1951	T, E, 25	P	Casing: 217 feet of 16-in. 92 ft of 10¾-in. and 398 ft of 8⅝-in. Screens from 309 to 315, 317 to 318, 373 to 383, 429 to 439, 454 to 464, 490 to 499, 504 to 513, 524 to 544, 595 to 604, 630 to 645, and 652 to 695 ft. Reported drawdown 88 ft while pumping 515 gpm in 1951. See log.
F-48	Galveston County Water Control & Improvement District No. 4 well 3.	do	1949	12	870	10¾, 8⅝	Upper part of Beaumont clay and "Alta Loma" sand.	[1] 100	Dec. 1949	None	N	Screens from 597 to 617, 670 to 710, 780 to 815, and 830 to 859 ft. Reported drawdown 57 ft while pumping 614 gpm in 1949. Water reported too highly mineralized for public

											use. Filled and abandoned. See log.
*F-49	Galveston County Water Control & Improvement District No. 4 well 2.	do	1947	14	723	8⅝, 5	Upper part of Beaumont clay.	[1] 130	Mar. 1947	T, E, 20	P	Casing: 364 ft of 8⅝-in. and 359 of 5-in. Screens from 503 to 604 and 658 to 700 ft. Reported drawdown 75 ft while pumping 157 gpm in 1947. Well drilled to 780 ft, but plugged back to 723 ft. See log.
*F-50	Carbide & Carbon Chemicals Corp. test well 1.	do	1942	13	1,031	3	"Alta Loma" sand.	59.9 111.5 71.6	Aug. 12, 1941 May 18, 1948 May 6, 1952	None	N	Casing: 1,005 ft of 3-in. Screen from 983 to 998 ft. See log.
*F-51	Carbide & Carbon Chemicals Corp. well 3.	do	1941	10	1,016	18, 10	do	[1] 43.1 [1] 71.5	Jan. 1941 Mar. 1951	T, E	Ind	Casing: 740 ft of 18-in. and 279 ft of 10-in. Screen from 858 to 1,008 ft. Reported drawdown 47 ft while pumping 1,500 gpm Aug. 12, 1940. Temperature 83.5° F. See log.
*F-52	Carbide & Carbon Chemicals Corp. well 4.	do	1940	12	690	18, 10¾	Upper part of Beaumont clay	47.7 [1] 138	Jan. 21, 1941 June 1950	do	Ind	Casing: 188 ft of 18-in. and 504 ft of 10¾-in. Screens from 302 to 312, 376 to 391, 423 to 433, 466 to 475, 492 to 512, 533 to 541, 550 to 560, 573 to 593, 624 to 633, and 642 to 682 ft. Reported drawdown 64 ft while pumping 640 gpm Sept. 6, 1940. See log.
*F-53	Pan American Refining Corp. well 6.	do	1936	12	1,000	20, 10	Upper part of Beaumont clay and "Alta Loma" sand.	[1] 18 65.5 73.7	Mar. 1936 Aug. 11, 1941 May 9, 1952	T, E, 125	Ind	Casing: 694 ft of 20-in. and 306 ft of 10-in. Screens from 788 to 799, 821 to 841, and 864 to 996 ft. Reported drawdown 49 ft while pumping 1,500 gpm in 1936. See log.
*F-54	Pan American Refining Corp. well 2.	do	1933	14	610	22½, 13	Upper part of Beaumont clay.	[1] 41 112.9 131.4	Sept. 1933 Mar. 10, 1943 May 9, 1952	T, E, 40	Ind	Casing: 195 ft of 22½-in. and 415 ft of 13-in. Screens from 262 to 283, 366 to 431, 470 to 491, and 546 to 588 ft. Reported drawdown 56 ft while pumping 850 gpm in 1933. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*F-55	Pan American Refining Corp. well 3.	Layne-Texas Co. Ltd.	1933	14	965	16, 8	Upper part of Beaumont clay and "Alta Loma" sand.	[1] 8 74.1	Nov. 1933 May 9, 1952	T, E, 125	Ind	Casing: 571 ft of 16-in. and 389 ft of 8-in. Screens from 683 to 704, 796 to 815, and 888 to 938 ft. Reported drawdown 78 ft while pumping 900 gpm in 1933. See log.
*F-56	B. Ashworth	Chas. Ellis	1937	15	700	4	Upper part of Beaumont clay.	13.2	July 2, 1941	None	N	Formerly used to supply part of Texas City Heights.
*F-57	Pan American Refining Corp. well 9.	Layne-Texas Co. Ltd.	1943	13	957	18⅝, 10¾	Upper part of Beaumont clay and "Alta Loma" sand.	[1] 80	Jan. 1943	T, E, 200	Ind	Casing: 554 ft of 18⅝-in. and 403 ft of 10¾-in. Screens from 666 to 691, 711 to 786, and 834 to 944 ft. Reported drawdown 57 ft while pumping 1,515 gpm in 1943. See log.
*F-58	Knox Process Co.	Stoner & Conklin.	1924	13	574	12	Upper part of Beaumont clay.			T, E, 2	N	Screen at 540 to 568 ft.
*F-59	Republic Oil Refining Co. well 1.	Layne-Texas Co. Ltd.	1937	8	857	16, 8⅝	do	[1] 68	Aug. 1937	T, E, 40	Ind	Casing: 358 ft of 16-in. and 499 ft of 8⅝-in. Screens from 462 to 498, 568 to 578, 605 to 619, 651 to 680, 697 to 707, and 731 to 785 ft. Reported drawdown 50 ft while pumping 508 gpm in 1937. See log.
*F-60	Pan American Chemical Plant well 2.	do	1938	9	801	8⅝	do	68.0 97.9	July 19, 1939 Mar. 12, 1943	A, G	Ind	Screens from 486 to 510, 555 to 601, 617 to 627, 707 to 730, and 752 to 785 ft. Drawdown, 46 ft while pumping 690 gpm in 1938. See log.
F-61	Pan American Chemical Plant well 1.	do	1922	9	788	6	do	68.6 154.4	Feb. 21, 1939 May 8, 1951	None	N	Screens at 564 to 581, and 738 to 781 ft. Filled and abandoned. See log.

*F-62	Monsanto Chemical Co. well 3.	do	1942	8	658	12¾, 6⅝	do	[1] 93	Oct. 1942	None	N	Casing: 289 ft of 12¾-in. and 334 ft of 6⅝-in. Screens from 398 to 406, 432 to 442, 496 to 531 and 584 to 619 ft. Drawdown, 53 ft while pumping 475 gpm in 1942. See log.
*F-63	Monsanto Chemical Co. well 5.	Southern Well Drilling Co.	1929	7	589	16	do	71.1 166.3 157.5	Aug. 11, 1941 May 9, 1945 Nov. 2, 1949	None	N	Screens from 427 to 486 and 506 to 547 ft. Reported drawdown, 56 ft while pumping 340 gpm when drilled. See log.
*F-64	Monsanto Chemical Co. well 2.	Layne-Texas Co. Ltd.	1942	8	625	12¾, 6⅝	do	[1] 92	Sept. 1942	None	N	Casing: 305 ft of 12¾-in. and 322 ft of 6⅝-in. Screens from 412 to 427, 504 to 539 and 600 to 623 ft. Reported drawdown 58 ft while pumping 465 gpm in 1942. See log.
*F-65	Monsanto Chemical Co. well 4.	do	1946	7	536	14, 8, 7	do	[1] 160	Feb. 1949	T, E, 40	Ind	Casing: 102 ft of 14-in., 203 ft of 8-in., and 231 ft of 7-in. Screens from 202 to 223, 237 to 248, 275 to 281, 320 to 331, 405 to 476 and 512 to 533 ft. Well drilled to 616 ft, but plugged back to 536 ft. See log.
*F-66	Monsanto Chemical Co. well 1.	do	1942	8	625	12¾, 6⅝	do	[1] 85	Aug. 1942	T, E, 40	Ind	Casing: 289 ft of 12¾-in. and 340 ft of 6⅝-in. Screens from 395 to 415, 495 to 535 and 585 to 615 ft. Reported drawdown, 53 ft while pumping 475 gpm in 1942. Well drilled to 747 ft, but plugged back to 625 ft. See log.
*F-67	Texas City Terminal Ry. well 1.	Layne-Bowler Co.	1922	7	547	8	do			None	N	Screens from 442 to 460 and 500 to 541 ft.
*F-68	Texas City Terminal Ry. well 2	do	1922	7	550	8¼	do	[1] 167	June 1950	T, E, 20	Ind	Screens from 440 to 480 and 501 to 540 ft. See log.
*G-1	Sun Oil Co.	Sun Oil Co.	1948	0	243	4	do			A, —	Ind	Screen from 221 to 243 ft. Supplied water for drilling oil test well.
G-2	do	do	1951	0	9,415							Oil test well. Owner's State tract 340 no. 1. For partial electric log see plate 2.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*H-1	Sun Oil Co.	Sun Oil Co.	1951	0	337	4	Upper part of Beaumont clay.			A, —	Ind	Screen from 312 to 337 ft. Supplied water for drilling oil test well.
*H-2	John W. Mecom	John W. Mecom	1952	0	933	4	"Alta Loma" sand			A, —	Ind	Screen from 893 to 933 ft. Supplied water for drilling oil test well. Temperature 80½° F.
H-3	Standard of Texas & Salt Dome Oil Co.		1940	0	7,718					None	N	Oil test well. Owner's State tract no. 234-1. For partial electric log, see plate 2.
*H-4	E. W. Boyt		1940	10	12	2	Beach sand			C, W	S	
*H-5	do		1945	10	460	4	Upper part of Beaumont clay.	8.7	Feb. 13, 1951	C, W	S	
*H-6	Flora Diamond		1946	7	50	1¼	Beach sand			C, E	D	
J-1	Sun Oil Co. & Phillips Petroleum Co.		1951	0	9,447					None	N	Oil test. Owner's State 175, well no. 1. For partial electric log, see plate 2.
J-2	Humble Oil & Refining Co.		1950	5	8,011					None	N	Oil test. Owner's M. Kahla no. 1. For partial log, see plate 2.
*J-3	Joe Ackins Estate		1937	5	283	6	Upper part of Beaumont clay.			C, W	S	
J-4	Oil Drilling Inc.			7	134	4	do	3.2	Apr. 9, 1952	A, —	N	Supplied water for drilling oil test well.
*J-5	Sun Oil Co.	Sun Oil Co.	1939	7	270	5	do			A, G	N	Supplied water for drilling oil test well. See log.
J-6	do	do	1940	5	257	5	do			A, G	N	Do.
J-7	do	do	1939	8	208	4	do			A, —	N	Supplied water for drilling oil test well.
*J-8	do	do	1939	10	321	5	do			A, —	N	Screen from 221 to 305 ft. Supplied water for drilling oil test well. See log.
*J-9	Ed Linn		1940	8	12	48	Beach sand	3.2	Apr. 8, 1952	J, E, ⅛	D	Dug. Concrete casing.
J-10	Sun Oil Co.			8	132	4	Upper part of Beaumont clay.	4.8	Apr. 9, 1952	A, —	N	Supplied water for drilling oil test well.

*J-11	Mrs. J. Frank Keith.		1939	5	264	1¼	do			C, E, ¼	D	Screen from 256 to 264 ft.
*J-12	Roy Kennedy		1940	5	258	1¼	do			C, E, ¼	D	Screen from 250 to 258 ft.
*K-1	A. C. Odem			6	286	1½	do	[1]2	Nov. 1950	C, E, —	D	
*K-2	— Kade		1940	6	8	48	Beach sand	0.4	Apr. 15, 1952	C, E, —	D	Dug. Wood casing.
*K-3	Pierce Estate	John Gunn	1916	7	260	2½	Upper part of Beaumont clay.			None	N	
*K-4	Clyde Hawsey	Clyde Hawsey	1952	4	14	48	Beach sand	2.9	Apr. 10, 1952	Cf, E, ⅙	D	Dug. Concrete casing.
K-5	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	1946	5	6,380					None	N	Oil test well. Owner's Cade no. A-69. For partial electric log, see plate 2.
*K-6				5	(2)			+		Flows	N	Seepage in fine sand.
*K-7				5	(2)					None	N	Formerly used by railroad. Covered and destroyed.
*K-8	Geo. Smith	— Derby	1939	20	61	2½		10.1	Apr. 16, 1952	None	N	
*K-9	do	Geo. Smith	1884	23	32	54, 8		0.6	do	None	N	Dug. Casing: 22 ft of 54-in. concrete, and 12 ft of 8-in.
*L-1	H. Sayko	H. Sayko	1937	24	35	3	Upper part of Beaumont clay.	7.3	Jan. 16, 1952	C, W	D, S	
L-2	A. L. Dodge	Fred Conklin	1907	25	190	4	do	6.2	do	C, E—	D, S	
*L-3	N. J. Morena	Ed Metzler	1912	25	120	3	do	12.8	Nov. 27, 1952	C, H	D, S	
*L-4	John Ghino	Louis Cange	1924	19	108	4	do			J, E, ½	D, S, Irr	Used for irrigating small truck farm.
L-5	J. M. Tacquard	J. Tacquard	1933	14	105	2½	do	8.4	Jan. 17, 1952	C, E, ¼	D, S	
*L-6	W. F. Reitmeyer	do	1888	16	693	4	do	80.9	do	J, E, 1	D	
L-7	do	do	1893	16	470	1½	do	2.5 13.3	Apr. 12, 1939 Jan. 17, 1952	None	N	
*L-8	J. D. Moody	do	1911	17	720	6	do	81.7	Jan. 11, 1952	C, E, 3	D	
*L-9	Fred Johnson	L. Cange	1924	16	260	4	do	12.9	Jan. 18, 1952	C, H	D	
*L-10	City of Galveston test well 3.	Layne-Texas Co. Ltd.	1941	15	1,178		"Alta Loma" sand			None	N	Test hole. Filled and abandoned. See log.
*L-11	City of Galveston test well 3-A.	do	1941	15	940	2	do	42.1 76.3	Mar. 14, 1941 May 7, 1952	None	N	Screen from 930 to 940 ft.
*L-12	Galveston County Water Control & Improvement District No. 7.	Fred Standard	1913	16	689	8	Upper part of Beaumont clay.	[1]86.0	Feb. 1950	T, E	P	Screen from 637 to 689 ft. Formerly used by railroad. See log.
*L-13	Charles Schiro	J. Tacquard	1911	15	720±	6	do	84.3	Nov. 5, 1951	J, E, 3	D	
*L-14	H. L. Roberts	do	1911	15	710	4	do	79.5	Dec. 15, 1951	C, E,—	D	
L-15	E. S. McClarty	Palmo Drilling Co.	1949	13	770	4	do			J, E, 5	D, P	Screen from 730 to 770 ft. Supplies water for 10 families.
L-16	Carbide & Carbon Chemical Co.	Palmo Drilling Co.	1948	13	357	3	do			J, E	P	
*L-17	Galveston Memorial Park.	J. B. Johnson	1938	12	510	6	do			A, E, 1	Irr	
*L-18	J. Hacker	Louis Cange	1889	9	763	4, 2	do			C, W	D, S	
*L-19	Joe Tarrasso	do	1928	10	790	4, 2½				T, E,—	N	Formerly used for irrigating small truck farm.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*L-20	Galveston County Water Control & Improvement District No. 7.	Layne-Texas Co. Ltd.	1942	18	220	4½	Upper part of Beaumont clay.	[1] 12	Dec. 1942	None	N	Screen from 91 to 108 ft. Reported drawdown, 35 ft while pumping 10 gpm, Dec. 30, 1942. See log.
*L-21	do	do	1943	18	756	12¾, 6⅝		81.9	Nov. 5, 1951	T, E, 40	P	Screen from 690 to 752 ft. Reported drawdown 33 ft while pumping 620 gpm, Feb. 1943. See log.
*L-22	Mrs. H. Huntington.		1920	26	38	3	Upper part of Beaumont clay.	2.4	Jan. 18, 1939	C, E, ⅓	D, S	
*L-23	Fritz Huntington	Palmo Drilling Co.	1949	26	725	4	"Alta Loma" sand			J, E, 2	D, S	
L-24	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	1940	20	8,466						N	Oil test well. For partial electric log, see plate 2.
*L-25	do	L. Patterson	1940	20	744	4	"Alta Loma" sand	80.5	May 7, 1952	A, G	N	Supplied water for drilling oil test well. Temperature 79½° F. See log.
L-26	do	do	1940	21	720±	5		28.5	do	None	N	Supplied water for drilling oil test well.
L-27	H. G. Tacquard	L. Cange		17	450±	4	Upper part of Beaumont clay.	6.7	Nov. 27, 1951	C, E, ⅙	D, S	
*L-28	do			17	42	4	do			C, W	D, S	
*L-29	Sun Oil Co	Homer Wright	1936	6	869	7, 4	Upper part of Beaumont clay and "Alta Loma" sand.	57.1	Nov. 5, 1951	None	N	Screens from 458 to 479, 537 to 580, and 754 to 867 ft. Supplied water for drilling oil test well. See log.
L-30	Sun Oil Co	do	1936	5	643	8, 4	Upper part of Beaumont clay.	13.3	Nov. 5, 1951	None	N	Screens from 112 to 128 and 565 to 640 ft. Supplied water for drilling oil test well. Flowing Jan. 16, 1939. See log.
L-31	do	do	1936	5	629	4	do	14.8	do	None	N	Screen from 548 to 629 ft. Supplied water for drilling oil test well. See log.
L-32	Coon well 1	The Texas Co	1925	6	1,100							Oil test well. See log.

*L-33	Sun Oil Co.	Homer Wright	1936	4	923	7, 5	"Alta Loma" sand	55.5	Nov. 7, 1951	None	N	Screens from 804 to 827 and 873 to 923 ft. See log.
L-34	do	do	1940	2	937	5	do	38.9	do	None	N	Screen from 878 to 909 ft. Supplied water for drilling oil test well. See log.
L-35	do	do	1940	4	934	6	do			None	N	
*L-36	L. M. Still	— Mosso	1938	24	102	2½	Upper part of Beaumont clay.	12.4	Jan. 16, 1952	None	N	
L-37	Alta Loma School District.	Palmo Drilling Co.	1947	27	137	3	do	20.8	do	J, E, ½	P	
L-38	Joe Tromballe	S. Mosso		23	150	4	do	6.7	do	A, —	Irr	
L-39	F. A. Bartlett	F. A. Bartlett	1929	23	120	4	do	13.0	do	C, E, ⅓	D	
*L-40	City of Galveston well 13-N.		1893-1894	22	865±	7	"Alta Loma" sand			None	N	Screen from 823 to 863 ft. Reported to have always yielded water of high chloride content. Filled and abandoned.
*L-41	City of Galveston well 11-N.		1893-1894	19	794	7	do	46.5 71.1	June 24, 1939 Aug. 9, 1941	None	N	Screen from 754 to 794 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-42	City of Galveston well 9-N.		1893-1894	20	797	7	do	47.5 75.4	June 24, 1939 Aug. 9, 1941	None	N	Screen from 756 to 796 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-43	City of Galveston well 7-N.		1893-1894	21	796	7	do	47.4 77.5	June 24, 1939 Aug. 9, 1941	None	N	Screen from 757 to 797 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-44	City of Galveston well 5-N.		1893-1894	22	797	7	do	48.0 79.6	June 24, 1939 Aug. 9, 1941	None	N	Do.
*L-45	City of Galveston well 3-N.		1893-1894	22	798	7	do			None	N	Screen from 758 to 798 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-46	City of Galveston well 1-N.		1893-1894	23	797	7	do			None	N	Screen from 757 to 797 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-47	City of Galveston well 2-S.		1893-1894	22	793	7	do	35.0 49.0	Sept. 23, 1932 June 24, 1939	None	N	Screen from 757 to 793 ft. Formerly used to supply city of Galveston. Filled and abandoned. See log.
*L-48	City of Galveston well 4-S.		1893-1894	23	868	7	do	[1] +26.0 [1] 2.6 [1] 13.4 31.4 49.5 79.7	1894 Dec. 1907 Jan. 1914 Sept. 23, 1932 June 24, 1939 Aug. 9, 1941	None	N	Screen from 750 to 790 ft. Formerly used to supply city of Galveston. Filled and abandoned. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*L-49	City of Galveston well 6-S.		1893-1894	23	797	7	"Alta Loma" sand.	32.7 49.4 78.0	Sept. 23, 1932 June 24, 1939 Aug. 9, 1941	None	N	Screen from 757 to 797 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-50	City of Galveston well 8-S.		1893-1894	23	796	7	do	31.8 47.4	Sept. 23, 1932 June 24, 1939	None	N	Screen from 756 to 796 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-51	City of Galveston well 10-S.		1893-1894	23	794	7	do	[1] 11 48.2 73.9	Jan. 1914 June 24, 1932 Aug. 9, 1941	None	N	Screen from 754 to 794 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-52	City of Galveston well 12-S.		1893-1894	23	797	7	do	48.5 72.0 100.9	June 24, 1939 Aug. 9, 1941 June 10, 1946	None	N	Screen from 757 to 797 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-53	City of Galveston well 14-S.		1893-1894	23	796	7	do	28.0 48.3 70.1 94.0	Oct. 23, 1932 June 24, 1939 Aug. 9, 1941 May 16, 1945	None	N	Screen from 756 to 796 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-54	City of Galveston well 16-S.		1893-1894	22	795	7	do	21.4	Sept. 23, 1932	None	N	Screen from 755 to 795 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-55	City of Galveston well 18-S.		1893-1894	23	795	7	do	23.8	do	None	N	Do.
*L-56	City of Galveston well 20-S.		1893-1894	23	795	7	do	46.6 62.1 94.0	June 24, 1939 Aug. 9, 1941 June 10, 1946	None	N	Do.
*L-57	City of Galveston well 22-S.		1893-1894	23	795	7	do	46.8 61.7 72.9	June 24, 1939 Aug. 9, 1941 Apr. 19, 1944	None	N	Do.
*L-58	City of Galveston well 24-S.		1893-1894	22	796	7	do	22.3 46.4 61.7	Sept. 23, 1932 June 24, 1939 Aug. 9, 1941	None	N	Screen from 756 to 796 ft. Formerly used to supply city of Galveston. Filled and abandoned.

*L-59	City of Galveston well 26-S.		1893-1894	22	794	9	do	39.0 61.3	June 24, 1939 July 9, 1941	None	N	Screen from 754 to 794 ft. Formerly used to supply city of Galveston. Filled and abandoned.
*L-60	City of Galveston well 1.	Layne-Texas Co. Ltd.	1914	22	840	24, 12	do	49.9 99.3	June 24, 1939 Nov. 18, 1949	T, E, 50	P	Casing: 80 ft of 24-in. and 759 ft of 12-in. Screen from 713 to 815 ft. See log.
*L-61	City of Galveston well 6.	do	1922	24	850	12	do			T, E, 50	P	Casing: 850 ft of 12-in. Screen from 744 to 844 ft.
*L-62	City of Galveston well 7.	do	1927	24	843	24, 17, 12.	do	47.8 104.7	June 24, 1939 May 12, 1952	T, E, 60	P	Casing: 151 ft of 24-in. 17-in. from 139 to 301 and 12-in. from 144 to 843 ft. Screen from 739 to 840 ft. See log.
*L-63	City of Galveston test well 1.	do	1941	21	1,065	4	do	68.9 104.0	Mar. 15, 1941 May 12, 1952	None	N	Casing: 874 ft of 4-in. Screen from 864 to 874 ft. See log.
*L-64	City of Galveston well 2.	do	1914	21	855	16, 12	do	103.4	May 12, 1952	T, E, 75	P	Casing: 80 ft of 16-in. and 775 ft of 12-in. Screens from 724 to 754, and 762 to 846 ft. See log.
*L-65	City of Galveston well 3.	do	1916	21	866	12	do			T, E, 50	P	Casing: 866 ft of 12-in. Screen from 714 to 857 ft. See log.
*L-66	City of Galveston well 4.	do	1916	20	873	24	do	104.0	May 12, 1952	T, E, 60	P	Casing: 90 ft of 24-in. and 783 ft of 12-in. Screen from 714 to 857 ft. See log.
*L-67	City of Galveston well 5.	do	1916	20	888	12	do	92.3	Nov. 6, 1951	T, E, 50	P	Casing: 888 ft of 12-in. Screen from 714 to 767 ft. See log.
*L-68	City of Galveston well 8.	do	1935	19	884	20, 13	do	48.3	June 24, 1939	T, E, 150	P	Casing: 665 ft of 20-in. and 13-in. from 610 to 884 ft. Screen from 703 to 884 ft. See log.
M-1	Galveston County Water Control & Improvement District No. 3 well 4.	do	1952	16	858	18, 10¾	Upper part of Beaumont clay and "Alta Loma" sand.	[1] 90	Mar. 1952	T, E	P	Casing: 406 ft of 18-in. and 10¾-in. from 304 to 858 ft. Screens from 412 to 422, 462 to 472, 496 to 526, 456 to 571, 610 to 615, 630 to 665, 675 to 705, 735 to 745, and 810 to 840 ft. Drawdown, 25 ft while pumping 831 gpm, Mar. 16, 1952. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*M-2	Galveston County Water Control & Improvement District No. 3 well 3.	Layne-Texas Co. Ltd.	1949	13	857	18, 10¾	Upper part of Beaumont clay and "Alta Loma" sand.	[1]113	July 1949	T, E, 50	P	Screens from 321 to 343, 390 to 400, 480 to 540, 594 to 604, 639 to 649, 689 to 704, and 800 to 850 ft. Reported drawdown, 31 ft while pumping 805 gpm, July 14, 1949. Well drilled to 958 ft, but plugged back to 857 ft. Temperature 80.5° F. See log.
*M-3	Houston Lighting & Power Co.	H. H. Ellis	1939	15	520	4, 2	Upper part of Beaumont clay.			C, E, ¾	N	Screen from 510 to 520 ft.
*M-4	R. R. Armstrong		1938	16	202	2	do	15.9 29.2	Apr. 14, 1939 Feb. 18, 1950	None	N	
*M-5	R. L. Whitburn	John Anezan	1930	12	117	3	do	7.4 9.2 9.9	Sept. 21, 1932 July 19, 1939 Feb. 18, 1952	C, H	D, S	
M-6	Galco Country Club.	H. H. Ellis	1949	10	120	4	do			J, E, 5	D, Irr	
*M-7	J. H. N. Adams	M. R. Pretty	1938	8	100	2	do	4.1	Feb. 18, 1952	C, E, ¼	N	
M-8	Mabel Stallings	Palmo Drilling Co.	1948	16	280	2	do			J, E, ½	D	Screen from 270 to 280 ft.
*M-9	W. Perthuis	P. Clark	1918	15	60	4	do	3.4	Feb. 16, 1952	Cf, E, ⅓	D	
*M-10	Hamilton Ford	Palmo Drilling Co.	1951	14	558	3	do			J, E, 2	D	Pump set at 126 ft.
M-11	Whitsett & Co	H. L. Jackson Co	1948	9	595	4	do	[1]80	Feb. 1948	J, E, 5	P	Supplies water for small subdivision.
*M-12	J. Perthuis	L. Cange	1895	10	590	3	do			A, G	D, S, Irr	
*M-13	R. S. Wesmoreland.		1928	10	533	6, 4	do	23.7	Apr. 25, 1941	None	N	Screen from 493 to 533 ft.
*M-14	Stewart Production Co.	L. Patterson	1937	6	773	8, 6		22.9 33.0	Apr. 29, 1939 May 25, 1943	A, G	N	Casing: 78 ft of 8-in. and 695 ft of 6-in. Screen from 734 to 773 ft. Supplied water for drilling oil test wells. See log.

M-15	do			3	794	6, 4		24.2 69.7	Jan. 25, 1939 May 7, 1952	None	N	Screen from 753 to 794 ft. Supplied water for drilling oil test wells.
*M-16	Joe Robinson	A. L. Moller	1938	2	80	4, 2	Upper part of Beaumont clay.			C, W	S	
*M-17	do	do	1938	2	205	4, 2	do			C, W	S	
*M-18	do	do	1938	5	180	4, 2	do			C, W	S	
M-19	Eddie Delaney	Palmo Drilling Co.	1948	4	378	3	do			J, E, ½	D	Screen from 358 to 378 ft.
*M-20	H. Homrighaus	H. Homrighaus	1937	6	16	1½	Beach sand			C, W	S	
M-21	H. M. Cohen	McMasters & Pomeroy.	1947	4	468	8, 6	Upper part of Beaumont clay.	[1] 3.0	Nov. 1947	C, W	S	Screen from 448 to 468 ft. Reported drawdown, 120 ft while pumping 280 gpm, Nov. 1947.
M-22	do	do	1947	6	360	4	do	[1] 9.0	Oct. 1947	T, E, 3	D	
M-23	Carbide & Carbon Chemieals Corp. well 7.	Layne-Texas Co. Ltd.	1947	15	1,028	18, 10¾	"Alta Loma" sand.			T, E, 20	Ind	Casing: 786 ft of 18-in. and 10¾-in. from 686 to 1,025 ft. Screens from 801 to 823 and 873 to 1,013 ft. Reported drawdown, 59 ft while pumping 1,420 gpm in 1947. See log.
*M-24	Carbide & Carbon Chemicals Corp. well 6.	do	1946	15	713	10¾	Upper part of Beaumont clay.	[1] 124	Nov. 1950	T, E, 100	Ind	Screens from 314 to 325; 380 to 402; 429 to 471; 498 to 520; 576 to 598; 627 to 638, and 657 to 699 ft. Reported drawdown, 55 ft while pumping 542 gpm, Oct. 30, 1947. See log.
*M-25	Carbide & Carbon Chemicals Corp. well 2.	do	1940	15	1,025	18, 10	"Alta Loma" sand	[1] 82.0	Mar. 1951	T, E, 20	Ind.	Casing: 743 ft of 18-in, and 274 ft of 10-in. Screen from 856 to 1,007 ft. Reported drawdown, 49 ft while pumping 1,500 gpm, July 24, 1940. See log.
*M-26	Carbide & Carbon Chemicals Corp. well 1.	do	1940	15	1,000	18, 10¾	do	[1] 84.0	do	T, E, 200	Ind.	Casing: 665 ft of 18-in and 335 ft of 10-in. Screens from 781 to 825; 840 to 870; 893 to 916; and 929 to 989 ft. Reported drawdown, 50 ft while pumping 1,500 gpm, Sept. 30, 1947. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*M-27	Carbide & Carbon Chemicals Corp. well 5.	Layne-Texas Co. Ltd.	1942	14	700	18⅝, 10¾	Upper part of Beaumont clay.	------	------	T, E, 75	Ind.	Casing: 225 ft of 18⅝-in. and 475 ft of 10¾-in. Screens from 335 to 359; 369 to 389; 399 to 419; 443 to 449; 470 to 480; 501 to 531; 619 to 624; and 647 to 682 ft. Reported drawdown, 111 ft while pumping 500 gpm, Dec. 24, 1942. See log.
*M-28	Pan American Refining Corp. well 7.	do	1936	15	1,024	20, 10	"Alta Loma" sand	72.9	May 9, 1952	T, E, 125	Ind.	Casing: 709 ft of 20-in. and 310 ft of 10-in. Slotted pipe from 854 to 1,019 ft. Reported drawdown, 40 ft while pumping 1,550 gpm in 1936. See log.
*M-29	Pan American Refining Corp. well 8.	do	1937	15	1,000	20, 10	do	74.7	do	T, E, 150	Ind.	Casing: 717 ft of 20-in. and 280 ft of 10-in. Screen from 806 to 872 ft. Reported drawdown, 63.5 ft while pumping 1,150 gpm in 1937. See log.
*M-30	Pan American Refining Corp. well 4.	do	1933	15	974	16, 8	Upper part of Beaumont clay and "Alta Loma" sand.	17.0 95.2	Dec. 1933 May 9, 1952	None	N	Casing: 603 ft of 16-in. and 351 ft of 8-in. Screens from 665 to 706, 800 to 824, and 888 to 934 ft. Yield 900 gpm in 1933. See log.
*M-31	Pan American Refining Corp. well 5.	do	1934	15	965	16, 8	do	96.9	do	T, E, 75	Ind.	Casing: 599 ft of 16-in. and 357 ft of 8-in. Screens from 664 to 685, 788 to 807, and 875 to 933 ft. Yield, 600 gpm in 1943. See log.
*M-32	Pan American Refining Corp. well 11.	do	1944	12	910	20, 10¾	Upper part of Beaumont clay.	------	------	T, E, 150	Ind.	Casing: 340 ft of 20-in and 495 ft of 10¾-in. Screens from 440 to 490;

													519 to 539; 569 to 579; 621 to 631; 650 to 710; and 790 to 825 ft. Reported drawdown, 80 ft while pumping 535 gpm in 1944. See log.
*M-33	Pan American Refining Corp. well 10.	do	1942	13	1,007	18⅝, 10¾	Upper part of Beaumont clay and "Alta Loma" sand.				T, E, 200	Ind.	Casing: 578 ft of 18⅝-in. and 387 ft of 10¾-in. Screens from 671 to 704, 729 to 749, 804 to 824, and 849 to 959 ft. Reported drawdown, 49 ft while pumping 1,500 gpm, Nov. 8, 1942. See log.
*M-34	Pan American Refining Corp.	J. A. Walling	1920	11	993	10, 6, 4	"Alta Loma" sand				T, E, 25	Ind.	Screen set opposite sand at bottom of well. Flowed about 30 gpm in 1920. Known as Tank farm well. See log.
*M-35	Republic Oil Refining Co. well 4.	Layne-Texas Co. Ltd.	1942	8	1,017	20, 12¾	do	[1] 56	Nov.	1942	T, E, 250	Ind	Casing: 741 ft of 20-in. and 276 ft of 12¾-in. Screen from 852 to 1,007 ft. Reported drawdown, 40 ft while pumping 1,225 gpm, Nov. 16, 1942. See log.
*M-36	Republic Oil Refining Co. well 3.	do	1942	7	759	16, 8⅝	Upper part of Beaumont clay.	[1] 100	Dec.	1942	T, E, 50	Ind	Casing: 343 ft of 16-in. and 406 ft of 8⅝-in. Screens from 450 to 490, 548 to 562, 570 to 577, 587 to 598, 672 to 677, and 688 to 738 ft. Reported drawdown, 46 ft while pumping 600 gpm in 1942. See log.
*M-37	Republic Oil Refining Co. well 2.	do	1939	7	1,009	18⅝, 10¾	"Alta loma" sand.	[1] 36	Jan.	1940	T, E, 125	Ind	Casing: 716 ft of 18⅝-in. and 297 ft of 10¾-in. Screens from 824 to 835, 888 to 899, and 909 to 989 ft. Reported drawdown, 39 ft while pumping 1,435 gpm, Jan. 6, 1940. See log.
*M-38	Texas City Refining Inc. well 2.	Texas Water Wells, Inc.	1943	14	1,015	16, 10¾	do	[1] 75 66.4	Nov. May	1943 8, 1952	T, E	Ind	Screen from 897 to 1,004 ft. Reported drawdown, 34 ft while pumping 800 gpm, Nov. 30, 1943. See log.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*M-39	Texas City Refining Inc. well 1.	Texas Water Wells, Inc.	1943	8	1,050	16, 10¾	"Alta loma" sand	[1] 90 72.2	Jan., 1943 Nov. 7, 1951	T, E, 75	Ind	Casing: 800 ft of 16-in. and 206 ft of 10¾-in. Screen from 900 to 1,006 ft. Reported drawdown, 27 ft while pumping 800 gpm, Jan. 1943. See log.
*M-40	Texas City Refining Inc. well 3.	Layne-Texas Co. Ltd.	1948	8	655	8⅝	Upper part of Beaumont clay.	147.3	Nov. 14, 1950	T, S	Ind	Screens at 475 to 505, 550 to 580, and 630 to 650 ft. Reported drawdown, 28 ft while pumping 325 gpm in 1948. See log.
*M-41	Sid Richardson Refining Co. well 1.	----------	1919	6	1,030	10	"Alta Loma" sand.	86.5	July 10, 1947	None	N	
*M-42	Sid Richardson Refining Co. well 2.	Henry Lane	1947	6	974	10¾	Upper part of Beaumont Clay and "Alta Loma" sand.	70.6 [1] 94 67.1	Nov. 8, 1951 Nov., 1947 May 8, 1952	T, S	Ind	Screens from 484 to 508 and 851 to 911 ft.
M-43	Carbide & Carbon Chemicals Corp.	Layne-Texas Co. Ltd.	1948	4	513	6⅝, 4½	Upper part of Beaumont clay.	[1] 156	July, 1948	T, E, 10	Ind	Screen from 480 to 510 ft. Owner's Dock well. See log.
M-44	Pan American Production Co. University of Texas No. 1.	----------	----	----	----	----	----------	----	----------	None	N	Oil test well. For partial electric log, see plate 1.
*M-45	Tin Processing Corp. well 1.	Layne-Texas Co. Ltd.	1941	12	702	18⅝, 10¾	Upper part of Beaumont clay.	[1] 65	Sept., 1941	T, E, 75	Ind	Casing: 200 ft of 18⅝-in. and 430 ft of 10¾-in. Screens from 288 to 297, 327 to 337, 360 to 365, 377 to 382, 402 to 417, 457 to 464, 466 to 476, 491 to 501, 526 to 547, 561 to 566, 568 to 586,

											and 606 to 616 ft. Reported drawdown, 59 ft while pumping 650 gpm in 1941. See log.
*M-46	Tin Processing Corp. well 2.	do	1941	12	696	18⅝, 10¾	do	[1] 65	do	T, E, 75	Ind	Casing: 230 ft of 18⅝-in. and 406 ft of 10¾-in. Screens from 336 to 342, 354 to 363, 374 to 383, 394 to 403, 414 to 423, 481 to 488, 496 to 516, 522 to 532, 542 to 552, 562 to 581, 583 to 587, and 613 to 622 ft. Reported drawdown, 45 ft while pumping 600 gpm in 1941. See log.
*M-47	Tin Processing Corp. well 3.	do	1945	10	643	18, 10¾	do	[1] 155	Oct. 1945	T, E, 100	Ind	Casing: 196 ft of 18-in. and 408 ft of 10¾-in. Screens from 309 to 329, 350 to 410, 458 to 500, and 558 to 580 ft. See log.
*N-1	Gulf, Coast & Santa Fe R. R.	do	1913	8	1,088	10, 8, 6		10.8	June 18, 1941	None	N	Formerly used by railroad. Screens from 819 to 862 and 974 to 1,018 ft. See log.
N-2	E. V. Boyt			5	8	2½	Beach sand	3.2	Apr. 9, 1952	C, W	D	
*N-3	Fort Travis		1926	12	600	6		41.5	Dec. 14, 1951	T, E, 5	N	Formerly used to supply Fort Travis.
N-4	Todd Shipbuilding Corp.	Layne-Texas Co. Ltd.	1952	15	1,350		"Alta Loma" sand.			None	N	Test hole. See log.
*N-5	Galveston Ice & Cold Storage Co.	McMasters & Pomeroy.	1940	10	458	6	Upper part of Beaumont clay.	[1] 7.0	Apr. 1952	A, E	Ind	Screen from 245 to 287 ft. Reported drawdown 21 ft while pumping 125 gpm in 1940. Temperature 74° F. See log.
*N-5a	do	Layne & Bowler	1912	10	1,345	10	"Alta Loma" sand.			None	N	Filled and abandoned. See log.
N-6	Frazier Ice & Cold Storage Co.	Layne-Texas Co. Ltd.	1914	10	1,346	6	Upper part of Beaumont clay and "Alta Loma" sand.	10.9	May 8, 1951	None	N	Screens from 840 to 884, and 1,261 to 1,336 ft. Caved and abandoned. See log.
*N-6a	do	McMasters & Pomeroy.	1929	10	800	6	Upper part of Beaumont clay.	27.2	May 7, 1952	None	N	
*N-6b	do	do	1929	10	400±	3	do			A, S	Ind	Water used for cooling purposes.
N-6c	do	do		10	299	6	do			A, S	Ind	Do.

See footnotes at end of table.

TABLE 12.—*Records of wells in Galveston County, Texas*—Continued

Well	Owner	Driller	Date completed	Altitude of land surface (feet)	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Water level: Below land surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
N-7a	City of Galveston		1888	8	1,346		"Alta Loma" sand			None	N	Formerly used for Galveston City water supply.
N-7b	do		1888	8	840		Upper part of Beaumont clay.			None	N	Do.
N-7c	do		1888	8	835		do			None	N	Do.
N-7d	do		1888	8	830		do			None	N	Do.
N-7e	do		1888	8	840		do			None	N	Do.
N-7f	do		1888	8	835		do			None	N	Do.
N-7g	do		1888	8	820		do	17.5	May 7, 1952	None	N	Do.
N-7h	do		1888	8	810		do			None	N	Do.
N-7i	do		1888	8	830		do			None	N	Do.
N-7j	do		1888	8	826		do			None	N	Do.
N-7k	do		1888	8	819		do			None	N	Do.
N-7l	do		1888	8	965		do			None	N	Do.
N-7m	do		1888	8	973		do			None	N	Do.
N-8	do	Galveston Artesian Well Co.	1893	8	3,070	26				None	N	Test well for better supply but driller's record states water was saltier at each succeeding sand. Each water sand had flow. See log.
*N-9	Galveston-Houston Breweries Inc.	Layne-Texas Co. Ltd.	1947	10	1,317	24	"Alta Loma" sand	[1] 51.0	May 1947	T, E, 150	Ind	Screen from 1,185 to 1,310 ft. Reported drawdown of 60 ft. while pumping 2,200 gpm, May 1947.
*N-10	Hi-Grade Packing Co.	McMasters & Pomeroy.	1948	5	397	8	Upper part of Beaumont clay.	[1] 24.0	Dec. 1948	T, E, 15	Ind	Owner's No. 2
*N-10a	do	do	1935	5	435	10	do			None	N	Owner's No. 1
N-11	Galveston Wharf Co.	Layne-Texas Co. Ltd.	1928	4	1,498					None	N	Filled and abandoned. See log.
*N-12	C. J. Blume	H. H. Ellis	1951	4	181	2	Upper part of Beaumont clay.	[1] 5.0	May 1951	J, E, 1	D, P	Supplies fishing camp. Temperature 74° F.
*N-13	H. L. Broome	Palmo Drilling Co.	1952	5	279	2	do			J, E	D	
N-14	A. H. Scharper	do	1946	12	325	4	do			J, E, 1	S	Water used for dairy.
*N-15	Lilly Harris	R. Harris	1933	5	15	1½	do			C, W	S	

P-1	S. E. Kempner	S. E. Kempner		7	12	1½	Beach sand			C, W	S	
*P-2	do	Palmo Drilling Co.	1948	5	620	3	Upper part of Beaumont clay.			J, E, 2	D, S	Screen from 600 to 620 ft.
Q-1	Maco Stewart	McMasters & Pomeroy.	1947	5	419	6	do	[1] 0.0	Aug. 1947	C, W	S	Reported drawdown 50 ft. while pumping 200 gpm in 1947.
Q-2	do	do	1947	5	406	6	do			T, E, 3	D	
Q-3	do	Layne-Texas Co. Ltd.	1929	5	1,000	10, 8, 6	do	15.5	May 7, 1952	T, E, —	D	Screen from 587 to 640 ft. See log.
Q-4	Galveston Country Club.	McMasters & Pomeroy.	1948	10	412	4	do			T, E, 3	P	Screen from 392 to 412 ft.
Q-5	do	do	1946	10	412	8	do	[1] 0.0	June 1946	T, E, 10	Irr	Screen from 390 to 412 ft. Reported drawdown 70 ft. while pumping 400 gpm in 1946.
Q-6	do	do	1946	10	414	6	do	[1] 0.0	Sept. 1946	T, E, 10	Irr	Screen from 392 to 412 ft. Reported drawdown 60 ft. while pumping 300 gpm in 1946.
*Q-7	C. D. Tellefson	C. D. Tellefson	1929	5	7	1½	Beach sand			C, W	D, S	
*Q-8	J. W. Wayman	J. W. Wayman	1936	7	11	1½	do			C, W	D, S	
*Q-9	do	do	1935	7	11	1½	do			C, E, ⅓	D, S	
*Q-10	Steve Jenkins	Baggett Drilling Co.	1948	7	476	2	Upper part of Beaumont clay.	[1] 5.0	July 1948	J, E, ⅓	D, S	Screen from 461 to 476 ft. Temperature 75° F.
*Q-11	O. L. Auston	O. L. Auston	1935	5	18	48	Beach sand	12.3	Apr. 8, 1952	C, W	D, S	Dug. Concrete casing.
*Q-12	Fritz Forste	Fritz Forste	1907	5	12	2	do			C, W	S	

[1] Reported by owner or driller. [2] Spring. *For chemical analyses, see table 14.

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*

Well A-5

[Owner: Chester Eignus. Driller: Layne-Texas Co. Ltd. Reported altitude 34 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	40	40	Shale, soft	60	155
Sand	11	51	Shale, hard	41	196
Clay	19	70	Gumbo	30	226
Sand	10	80	Shale	70	296
Clay	10	90	Clay	104	400
Sand	5	95	Sand	200	600

Well A-7

[Owner: Cecil Brown. Driller: Layne-Texas Co. Ltd. Reported altitude 32 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	3	3	Clay	2	127
Clay, white	5	8	Sand, fine	32	159
Clay, red	79	87	Shale, soft gray	36	195
Clay, sandy	5	92	Shale	14	209
Clay	5	97	Shale, soft	37	246
Sand	2	99	Shale	131	377
Clay	9	108	Sand, gray, fine	27	404
Sand	3	111	Shale	5	409
Clay	7	118	Sand	3	412
Sand	2	120	Shale	19	431
Clay	2	122	Sand	131	562
Sand	3	125			

Well A-17

[Owner: Mrs. Annette Voss. Driller: Layne-Texas Co. Ltd. Reported altitude 28 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	128	128	Gumbo	25	441
Sand	6	134	Sand	41	482
Clay	23	157	Clay	6	488
Sand	12	169	Sand	9	497
Clay and shells	14	183	Clay	9	506
Gumbo	36	219	Sand	149	655
Clay	43	262	Clay	13	668
Gumbo	97	359	Sand	23	691
Sand	11	370	Clay	14	705
Gumbo	31	401	Sand	50	755
Clay and shells	12	413	Clay	8	763
Hard layer	3	416			

Well B-3

[Owner: R. E. Ketchey. Driller: McMasters & Pomeroy. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	6	6	Sea mnd	23	318
Clay, yellow	6	12	Shale, blue and red	57	375
Sand	9	21	Clay	5	380
Clay, tough	31	52	Shale	43	423
Sand	36	88	Gumbo	61	484
Gumbo	82	170	Sand, packed	28	512
Shale, blne and red	30	200	Clay	13	525
Sand, packed	41	241	Sand	8	533
Clay	11	252	Sand, good	29	562
Shale	43	295			

Well B-5

[Owner: J. M. Robinson. Driller: M. R. Pretty. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	24	24	Shale	57	161
Sand	2	26	Gumbo	10	171
Clay	2	28	Shale, sandy	15	186
Sand	3	31	Sand	12	198
Clay	36	67	Shale	32	230
Sand	18	85	Sand	16	246
Shale	13	98	Clay	30	276
Sand	6	104	Shale, sandy	32	308

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well B-5—Continued

[Owner: J. M. Robinson. Driller: M. R. Pretty. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	13	321	Shale	19	432
Shale	4	325	Shale, sandy	17	449
Sand	19	344	Gumbo	36	485
Shale	10	354	Sand	6	491
Sand	15	369	Shale	32	523
Shale, sandy	36	405	Sand	22	545
Sand	8	413			

Well B-37

[Owner: Galveston, Houston and Henderson Railroad. Driller: Layne-Texas Co. Ltd. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	8	8	Clay, blue	30	500
Clay, yellow	92	100	Sand, blue	8	508
Shale, blue	10	110	Clay, hard	15	523
Sand, fine	4	114	Rock	1	524
Clay, blue	46	160	Clay	121	645
Sand	5	165	Clay, sandy	45	690
Clay and gravel	5	170	Rock	3	693
Clay, hard	10	180	Clay	7	700
Clay	22	202	Sand	30	730
Sand	8	210	Clay	30	760
Clay and gravel	15	225	Clay, blue	40	800
Clay, blue	37	262	Clay, sandy	130	930
Sand, fine	23	285	Clay and gravel	5	935
Clay, blue	105	390	Sand, coarse	40	975
Clay, sandy	60	450	Sand and gravel	45	1,020
Sand	20	470			

Well B-38

[Owner: Galveston County Water Control and Improvement District No. 2, well 1. Driller: Layne-Texas Co. Ltd. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	1	1	Shale and sandy shale	45	290
Clay, yellow	19	20	Shale	114	404
Sand	4	24	Shell	20	424
Clay	22	46	Shale and shell	14	438
Clay, sandy, and shell	38	84	Sand and shale	20	458
Shale, sandy blue, and shell	15	99	Shale	37	495
Shale, sandy	30	129	Shale and sandy shale	32	527
Sand	12	141	Shale	27	554
Shale and shell	6	147	Shale, sandy	18	572
Sand, fine, with thin shale breaks	34	181	Shale	43	615
Sand, coarse	17	198	Sand	75	690
Shale and shell	5	203	Shale, sandy	8	698
Clay, sticky	42	245	Shale	3	701

Well B-45

[Owner: J. H. Ross. Driller: Pat O'Day. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	46	46	Clay	44	342
Shale, sandy	44	90	Shale, sandy	43	385
Clay	19	109	Gumbo	41	426
Shale, sandy	19	128	Sand, fine	20	446
Clay	41	169	Clay	4	450
Shale	66	235	Sand, fine	118	568
Sand, fine	63	298	Sand	32	600

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well C-3

[Owner: Dan M. Bell. Driller: Pat O'Day. Reported altitude 17 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	2	2	Shale, sandy	44	287
Clay, white	17	19	Gumbo	43	330
Sand	6	25	Sand	16	346
Gumbo	35	60	Gumbo	109	455
Sand	4	64	Sand	2	457
Gumbo	26	90	Gumbo	10	467
Sand	34	124	Sand	11	478
Gumbo, red	36	160	Gumbo	4	482
Sand	10	170	Shale, sandy	66	548
Gumbo	49	219	Gumbo	21	569
Sand	24	243	Sand	48	617

Well C-8

[Owner: Humble Oil & Refining Co. Driller: Luther Patterson. Reported altitude 16 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	24	24	Sand	16	513
Shale	54	78	Shale	92	605
Sand	21	99	Sand	15	620
Shale	49	148	Shale	107	727
Sand	25	173	Sand	21	748
Shale	324	497			

Well D-12

[Owner: Dillard-Waltermire, Inc. Driller: Luther Patterson. Reported altitude 35 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	25	25	Sand	10	275
Shale	55	80	Shale	33	308
Sand	29	109	Sand	12	320
Shale	8	117	Shale	16	336
Sand	35	152	Sand	14	350
Shale	21	173	Shale	256	606
Sand	8	181	Sand	70	676
Shale	84	265			

Well D-13

[Owner: City of Galveston test well 2-5. Driller: Layne-Texas Co. Ltd. Reported altitude 25 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, sandy and sticky	56	56	Shale, sticky	36	756
Clay and sandy clay streaks	19	75	Sand	17	773
Sand and sandy clay	14	89	Shale, sticky	37	810
Clay and sandy clay, sand streaks	76	165	Sand, broken	7	817
			Sand	34	851
Sand, fair	13	178	Shale, sticky	47	898
Sand and sandy clay	60	238	Shale, sticky, and layer or rock	2	900
Clay, with streak of sand	33	271	Shale, sticky, some shell	22	922
Sand, poor	7	278	Sand, broken, and shale	6	928
Shale, some shell	60	338	Sand, few shale streaks	23	951
Shale	40	378	Shale, layers, and sand	33	984
Sand and shale	6	384	Sand, fine; soft streaks shale	22	1,006
Sand and blue clay	54	438	Sand, shale, and shell	17	1,023
Clay and sandy clay	35	473	Shell and small streaks shale	33	1,056
Sand, hard	27	500	Sand with shell	15	1,071
Clay and shells	53	553	Shale, hard	7	1,078
Sand and shells	25	578	Shale, hard ,and shells	90	1,168
Sand	1	579	Shale, few thin sand breaks	11	1,179
Shale	29	608	Shale, hard, and shell	11	1,190
Sand, broken shale and shell	17	625	Sand	20	1,210
Sand, good	92	717	Sand, hard, and shale, some shell	8	1,218
Clay	3	720			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well D-14

[Owner: City of Galveston, test well 8-11. Driller: Layne-Texas Co. Ltd. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	26	26	Clay	12	747
Sand, red	4	30	Clay, sandy	8	755
Clay	7	37	Sand	5	760
Sand	6	43	Clay, sandy	7	767
Clay	34	77	Clay, soft	6	773
Clay, sandy, shells and sand	33	110	Clay, sandy	35	808
Clay, shale, and shell	90	200	Shale	34	842
Clay and layers of shell	76	276	Shale, sandy	8	850
Clay, layers, and shell	54	350	Shale	20	870
Sand	30	380	Sand	25	895
Clay	24	404	Shale	12	907
Sand and sandy clay	11	415	Shale, sandy	11	918
Sand	48	463	Shale	2	920
Clay, hard	27	490	Shale, sandy	17	937
Clay, sandy, and shell	15	505	Clay, sandy, and shell	28	965
Clay and layers of shell	20	525	Sand, fine	3	968
Clay, sticky	35	560	Shale, sandy	11	979
Clay	20	580	Shale and shell	16	995
Clay, sandy, and sand	20	600	Shale with sandy streaks	65	1,060
Sand	4	604	Shale, sandy, and sand	30	1,090
Clay	6	610	Sand, sandy shale and shell	40	1,130
Clay and thin sand layers	23	633	Shale, sandy, and shell	34	1,164
Sand	87	720	Shale	16	1,180
Clay	14	734	Shale, sandy, and shell	20	1,200
Clay, sandy	1	735			

Well D-18

[Owner: Missouri Pacific Railroad. Driller: L. Patterson. Reported altitude 35 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	36	36	Gumbo	15	325
Sand	6	42	Clay, red and blue	38	363
Clay	78	120	Rock	2	365
Rock	3	123	Sand	5	370
Clay, sandy	6	129	Rock	3	373
Rock and sand, hard	4	133	Gravel and clay	13	386
Clay and sand	5	138	Clay and gumbo	97	483
Gumbo	103	241	Clay, sandy	11	494
Clay, sandy	20	261	Clay, gumbo	128	622
Shale, blue	19	280	Sand	21	643
Clay, sandy	10	290	Clay	7	650
Shale, blue	20	310			

Well D-21

[Owner: Algoa Townsite Co. Driller: — Miller. Reported altitude 33 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay and soil	36	36	Sand rock	5	783
Sand	14	50	Shale and gumbo	9	792
Clay	45	95	Sand rock	4	796
Sand	5	100	Gumbo	77	873
Clay, red	92	192	Gravel	8	881
Gumbo	6	198	Gumbo	2	883
Rock	11	209	Sand rock	34	917
Sand	12	221	Clay, hard	10	927
Rock	6	227	Gumbo	56	983
Clay, hard and soft	49	276	Sand	13	996
Clay and gumbo	147	423	Gumbo	8	1,004
Sand rock	17	440	Rock, soft	6	1,010
Sand, packed	9	449	Gravel	19	1,029
Sand rock, hard	4	453	Gumbo	10	1,039
Sand	45	498	Sand, coarse	33	1,072
Gumbo	51	549	Rock, hard	3	1,075
Sand rock	6	555	Gumbo	4	1,079
Gumbo	62	617	Sand, coarse	6	1,085
Sand	60	677	Gumbo	22	1,107
Rock	2	679	Sand, gravel, and shell	21	1,128
Sand	14	693	Gumbo	10	1,138
Gravel	43	736	Sand	42	1,180
Gumbo	20	756	Gumbo	37	1,217
Clay and boulders	5	761	Sand	9	1,226
Gumbo	17	778	Gumbo	30	1,256

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well D-21—Continued

[Owner: Algoa Townsite Co. Driller: — Miller. Reported altitude 33 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Rock	5	1,261	Sand, hard	14	1,333
Sand	37	1,298	Gumbo, soft	3	1,336
Gumbo	4	1,302	Sand, soft	19	1,355
Sand, hard	14	1,316	Sand, hard	4	1,359
Rock, very hard	3	1,319	Rock	3	1,362

Well E-16

[Owner: Glenn H. McCarthy. Driller: L. Patterson. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	15	15	Shale, sandy	7	657
Sand	9	24	Shale	35	692
Shale	45	69	Sand	9	701
Sand	22	91	Shale	6	707
Shale	347	438	Sand	24	731
Sand	14	452	Shale, sandy	21	743
Shale	198	650			

Well E-26

[Owner: Galveston County Water Control and Improvement District No. 1, well 1. Driller: Layne-Texas Co. Ltd. Reported altitude 16 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	3	3	Sand	16	414
Clay	14	17	Clay	6	420
Sand	6	23	Sand and sandy clay	22	442
Clay	56	79	Clay	4	446
Sand	12	91	Clay, sandy	23	469
Clay, sandy	12	103	Clay	5	474
Clay	21	124	Sand and sandy clay	14	488
Clay, sandy, and sand	46	170	Clay	5	493
Clay	16	186	Sand and sandy clay	9	502
Clay, sandy	69	255	Clay	3	505
Clay	6	261	Sand and sandy clay	9	514
Clay, sandy, and sand	67	328	Clay	8	522
Clay	8	336	Sand	60	582
Sand and sandy clay	52	388	Clay	12	594
Clay	10	398			

Well E-27

[Owner: Galveston County Water Control and Improvement District No. 1, well 2. Driller: Layne-Texas Co. Ltd. Reported altitnde 16 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	2	2	Shale, sandy, shale, and shell	154	452
Clay	72	74	Shale	25	477
Sand, broken	36	110	Shale, sandy	34	511
Clay	38	148	Sand	10	521
Sand	15	163	Shale	11	532
Clay, broken	51	214	Sand and shale breaks	40	572
Shale, sandy	54	268	Shale, tough	25	597
Shale	30	298			

Well E-28

[Owner: Galveston County Water Control and Improvement District No. 1, well 2. Driller: Layne-Texas Co. Ltd. Reported altitude 17 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	10	10	Sand, fine	41	497
Sand	20	30	Sand	20	517
Clay	50	80	Gumbo	14	531
Sand	90	170	Sand	41	572
Clay	40	210	Gumbo	4	576
Shale	246	456			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-37

[Owner: C. L. Dobbins. Reported altitude 11 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	16	16	Sand	14	723
Sand	10	26	Shale, sticky, and shell	28	751
Shale	18	44	Sand	5	756
Sand	21	65	Sand, shale, and shell	17	773
Shale, hard, sticky	80	145	Sand	18	791
Sand	26	171	Shale, sticky	8	799
Shale, hard, sticky	30	201	Sand	16	815
Shale, sandy	14	215	Shale, sticky	18	833
Shale, sticky	45	260	Shale, hard, and sand	8	841
Shale, and shell	20	280	Sand and shale	17	858
Shale, sticky	87	367	Shale, sandy	10	868
Shale, hard, and boulders	27	394	Sand	6	874
Sand and hard sticky shale	36	430	Shale, sandy	40	914
Sand, shale, and shell	6	436	Sand	10	924
Shale, sticky, and boulders	47	483	Shale, sticky	40	964
Sand, hard	38	521	Shale, sandy	15	979
Shale, sticky	27	548	Sand	21	1,000
Shale, sandy	15	563	Shale, hard	21	1,021
Sand	10	573	Shale, sandy	23	1,044
Shale	14	587	Shale, sticky	45	1,089
Sand	23	610	Shell and sandy shale	16	1,105
Shale	9	619	Shale, sticky	26	1,131
Sand	4	623	Sand	5	1,136
Shale, sandy sticky	22	645	Shale	3	1,139
Shale, sticky	45	690	Sand	16	1,155
Shale, sandy, and shell	19	709	Shale and boulders	12	1,167

Well E-40

[Owner: Izaak Lippman. Driller: L. Patterson. Reported altitude 13 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	30	30	Sand	8	262
Sand	4	34	Shale	98	360
Shale	43	77	Sand	12	372
Sand	10	87	Shale	73	445
Shale	53	140	Sand	10	455
Sand	8	148	Shale	81	536
Shale	106	254	Sand	90	626

Well E-42

[Owner: Pure Oil Co. Driller: L. Patterson. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	65	65	Shale	378	551
Sand	43	108	Sand	98	649
Shale	22	130	Shale	2	651
Shale, sandy	43	173			

Well E-46

[Owner: Humble Oil & Refining Co. Driller: L. Patterson. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	22	22	Sand	5	170
Shale	8	30	Shale	297	467
Sand	13	43	Sand	15	482
Shale	27	70	Shale	16	498
Sand	20	90	Sand	16	514
Shale	45	135	Shale	58	572
Sand	17	152	Sand	71	643
Shale	13	165			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-47

[Owner: Humble Oil & Refining Co. Driller: L. Patterson. Reported altitude 11 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	32	32	Shale and sandy shale	133	541
Sand	5	37	Sand	19	560
Shale	40	77	Shale	4	564
Sand	14	91	Sand	16	580
Shale	46	137	Shale	14	594
Shale and sandy shale	160	297	Sand	11	605
Sand	22	319	Shale	85	690
Shale	67	386	Sand	14	704
Sand	22	408	Shale	36	740

Well E-66

[Owner: Prince Drilling Co. Driller: L. Patterson. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	24	24	Shale	31	190
Shale	15	39	Sand	20	210
Sand	9	48	Shale	92	302
Shale	20	68	Sand	24	326
Shale, sandy	28	96	Shale	96	422
Shale	53	149	Sand	50	472
Sand	10	159			

Well E-72

[Owner: Pan American Production Co. Driller: McMasters & Pomeroy. Reported altitude 17 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	80	80	Shell	15	456
Sand	34	115	Gumbo	20	476
Gumbo	93	208	Sand	20	496
Clay, sandy	40	248	Gumbo	11	507
Gumbo	117	365	Boulders	2	509
Clay, sandy	24	389	Sand, packed	7	516
Gumbo	22	411	Gumbo	8	524
Clay	30	441			

Well E-73

[Owner: Humble Oil & Refining Co. Driller: L. Patterson. Reported altitude 18 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	20	20	Shale	33	745
Sand	5	25	Sand	10	755
Shale	62	87	Shale	15	770
Sand	23	110	Sand	50	820
Shale	590	700	Shale, sandy	20	840
Sand	12	712	Shale	18	858

Well E-74

[Owner: City of Galveston, test well 7-10. Driller: Layne-Texas Co. Ltd.]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	3	3	Clay and sandy layers	2	690
Clay	5	8	Sand	82	772
Clay, sandy	10	18	Clay	26	798
Clay and shells	15	33	Clay and sandy clay	10	808
Clay, red	38	71	Sand	5	813
Clay, blue	11	82	Clay and sandy clay	15	828
Sand	19	101	Clay, sandy, and shell	14	842
Sand and sandy clay	15	116	Clay	16	858
Clay and shells	74	190	Sand and shell	10	868
Clay and sandy clay	26	216	Clay	28	896
Sand and sandy clay	10	226	Clay, sandy, and shell	14	910
Clay, soft, and shells	54	280	Shale, sandy	30	940
Clay and layers of sandy clay and shell	290	570	Shale	70	1,010
Sand	9	579	Shale and sandy shale	50	1,060
Clay, sand layers	55	634	Clay, sandy clay, and sand	25	1,085
Clay	43	677	Sand, fine	56	1,141
Clay and sandy clay	11	688	Clay and shells	43	1,184
			Clay, sandy clay, and shells	16	1,200

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-75

[Owner: City of Galveston, test well 12-15. Driller: Layne-Texas Co. Ltd. Reported altitude 17 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand	4	633
Clay, yellow	10	12	Clay and sand layers	4	637
Clay, red	52	64	Sand	20	657
Sand, fine	33	97	Clay	1	658
Clay, sandy	14	111	Sand	5	663
Clay	37	148	Clay	1	664
Sand	4	152	Sand	121	785
Clay and sandy layers	8	160	Clay and shells	6	791
Clay and sandy clay	13	173	Clay, sandy	7	798
Clay and shells	31	204	Sand	8	806
Clay, sandy clay, and shells	152	356	Clay	4	810
Sand	33	389	Sand and sandy clay	7	817
Clay, sandy	10	399	Sand	21	838
Clay	39	438	Sand and sandy clay	28	866
Clay, sandy	9	447	Clay and sandy clay	62	928
Sand	16	463	Clay	11	973
Clay and sandy clay	67	530	Clay and sandy clay	31	1,004
Clay, sandy	3	533	Clay and shale	18	1,022
Sand	5	538	Sand, fine, and shell	28	1,050
Clay and sandy clay	6	544	Sand	10	1,060
Sand	4	548	Clay and shells	16	1,088
Clay, sandy	11	559	Sand and sandy clay	24	1,112
Clay	38	597	Clay	46	1,158
Clay and thin sand layers	28	625	Clay and sandy clay	22	1,180
Clay, sandy	4	629			

Well E-78

[Owner: City of Galveston well 10. Driller: Layne-Texas Co. Ltd. Reported altitude 19 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	15	15	Sand and soft shale	66	361
Clay, hard, sandy	37	52	Shale and sand	13	374
Clay, soft, sandy	5	57	Sand and sandy shale	18	392
Sand	31	88	Shale and sandy shale	11	403
Sand and clay streaks	24	112	Sand and shale	7	410
Shale, sandy	11	123	Shale	23	433
Sand	5	128	Sand and sandy shale, and shell	19	452
Shale, sandy	15	143	Shale	8	460
Sand	21	164	Shale and sandy shale breaks	68	528
Shale, sandy, and layers of sand	25	189	Sand and sticky shale breaks	38	566
Clay, hard	25	214	Shale and sticky sand breaks	50	616
Sand, soft, and shale	58	272	Shale, sticky, and sandy shell	22	638
Shale, hard	16	288	Sand	125	763
Shale, sandy	7	295	Shale, sticky	7	770

Well E-79

[Owner: City of Galveston, test well 1-4. Driller: Layne-Texas Co. Ltd. Reported altitude 18 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Clay and sandy clay	9	785
Clay, red and yellow	14	19	Clay, sandy	5	790
Clay, red	31	50	Clay, few shells and lime rocks	20	810
Clay, sandy	24	74	Clay, sandy	12	822
Sand	28	102	Clay	14	836
Clay, red	48	150	Sand	18	854
Sand	21	171	Clay	4	858
Clay, sandy	7	178	Sand	30	888
Clay	34	212	Clay	4	892
Clay, sandy, and shell	56	268	Sand	10	902
Clay and shells	28	296	Clay	84	986
Clay, sandy clay, and shells	90	386	Clay, sandy	9	995
Sand	8	394	Clay	9	1,004
Clay and sandy clay	18	412	Clay, sandy, and clay	24	1,028
Clay, blue	25	437	Clay	15	1,043
Sand	17	454	Clay, sandy, and clay	19	1,062
Clay, sandy	18	472	Sand	18	1,080
Clay, sandy, and sand	28	500	Clay, hard	17	1,097
Clay and layers of shell	52	552	Clay, sandy	40	1,137
Clay and shells	33	585	Clay and shells	38	1,175
Sand and clay	19	604	Clay and sandy clay	21	1,196
Clay and shells	31	635	Sand	14	1,210
Clay and sand	18	653	Clay	2	1,212
Sand	114	767			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-80

[Owner: City of Galveston, test well 11-14. Driller: Layne-Texas Co. Ltd. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand	74	718
Clay, gray	4	7	Clay	1	719
Clay, brown	13	20	Sand	86	805
Sand, red	15	35	Clay	1	806
Clay, red	15	50	Sand	1	807
Clay, sticky	20	70	Clay	9	816
Clay, red	16	86	Clay and thin sand layers	4	820
Sand	30	116	Clay, sandy	8	828
Clay, red	44	160	Clay	34	862
Sand	16	176	Clay, sandy	3	865
Clay, sandy, and shells	69	245	Sand	21	886
Clay	45	290	Clay	8	894
Clay, sandy	58	348	Clay and sandy clay	84	978
Clay and sandy clay	23	371	Clay and sandy layers	34	1,018
Sand and shells	26	397	Clay	11	1,029
Clay and shells	44	441	Sand, fine	14	1,043
Sand	5	446	Clay, sandy, and clay	23	1,066
Sand and sandy clay	10	456	Sand	34	1,100
Sand	23	479	Clay	13	1,113
Clay	20	499	Clay, sandy	14	1,127
Clay, sandy	15	514	Clay and sandy clay	48	1,175
Clay	43	557	Clay and shells	14	1,189
Clay, sandy	17	574	Sand and sandy clay	14	1,203
Clay, hard	70	644	Clay	2	1,205

Well E-81

[Owner: City of Galveston, well 13. Driller: Layne-Texas Co. Ltd. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Shale, sandy	15	362
Clay	6	8	Shale, hard	5	367
Clay, sandy	20	28	Shale, sandy	1	368
Clay	36	64	Sand and shell	30	398
Clay, sandy	22	86	Sand, hard, shale and shell	3	401
Sand	18	104	Sand	9	410
Clay	55	159	Shale, sandy	28	438
Sand	11	170	Sand and layers of shell	42	480
Shale	20	190	Shale and layers of sand and shell	74	554
Shale, sandy, and sand breaks	64	254	Sand and layers of shell	14	568
Shale and layers of sand	22	276	Shale, sticky, and layers of shell and sand	73	641
Shale	20	296	Sand	162	803
Sand	11	307	Clay	7	810
Shale, sandy, and shell	24	331			
Sand and shale breaks	16	347			

Well E-82

[Owner: City of Galveston, test well 6-9. Driller: Layne-Texas Co. Ltd. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	3	3	Sand	13	682
Clay and gravel	5	8	Clay	2	684
Sand, red	7	15	Sand	108	792
Clay and sandy clay	77	92	Clay	35	827
Sand, fine, white	24	116	Clay and sand layers	6	833
Clay, sandy, and shell	29	145	Sand	7	840
Clay and sandy clay	315	460	Shale, sandy	20	860
Clay, sandy	10	470	Shale, sticky	6	866
Clay	30	500	Shale, sandy	32	898
Clay, shell, and sandy clay	18	518	Shale, sticky	46	944
Clay and shells	60	578	Shale, sandy	37	981
Clay, sandy	9	587	Shale	34	1,015
Clay and shells	25	612	Shale, sandy	35	1,050
Clay, sandy	3	615	Sand, fine, and shell	67	1,117
Sand	11	626	Shale and shell	5	1,122
Clay and shells	11	637	Sand, shale, and shell	49	1,171
Clay and sandy clay	5	642	Shale, sticky	15	1,186
Clay, sandy	6	648	Shale, sandy	6	1,192
Clay and sandy clay	18	666	Shale, sticky	8	1,200
Clay and sand layers	3	669			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-83

[Owner: City of Galveston, well 12. Driller: Layne-Texas Co. Ltd. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	2	2	Clay	30	322
Clay	4	6	Sand and streaks of clay	62	384
Clay, sandy	69	75	Clay and layers of sand	118	502
Sand, gray	49	124	Clay, tough	52	554
Sand and clay streaks	10	134	Clay, sandy	52	606
Sand	13	147	Clay, hard	38	644
Sand and clay streaks	65	212	Sand	133	777
Clay, sandy	80	292	Shale, sticky	4	781

Well E-84

[Owner: City of Galveston, well 9. Driller: Layne-Texas Co. Ltd. Reported altitude 23 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	30	30	Shale	17	341
Sand	10	40	Sand and shale layers	27	368
Clay and sand	10	50	Clay	26	394
Clay	39	89	Clay and sand layers	38	432
Sand and clay	32	121	Sand	36	468
Clay and sand layers	35	156	Clay	82	550
Sand	15	171	Sand	11	561
Clay and sand	16	187	Clay and layers of sand	45	606
Clay	24	211	Clay, sandy	28	634
Clay, sandy	82	293	Clay	29	663
Clay	15	308	Sand	98	761
Sand	16	324	Clay	3	764

Well E-85

[Owner: City of Galveston, test well 5-8. Driller: Layne-Texas Co. Ltd. Reported altitude 24 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
No record	39	39	Shale, sandy	27	655
Clay, sticky	53	92	Shale, sticky	3	658
Clay, sandy	61	153	Shale, sandy	15	673
Sand	13	166	Sand	91	764
Shale, tough sticky	83	249	Shale, sticky	3	767
Clay, sandy	112	361	Sand	2	769
Shale, tough blue	35	396	Shale, sticky	11	780
Sand	4	400	Shell and sand	7	787
Shale and sandy shale	30	430	Shale, sticky	7	794
Sand, good	39	469	Shale, soft sticky, and layers of shell	78	872
Clay, hard sticky	68	537	Shale, sandy	43	915
Shale, hard sticky	9	546	Shale, soft sticky	95	1,010
Sand	6	552	Sand	26	1,036
Shale, sticky	14	566	Shale, soft	23	1,059
Sand	13	579	Sand, fine	47	1,106
Shale, sticky	20	599	Shale, soft and sandy	69	1,175
Shale, sandy	8	607	Sand	2	1,177
Sand	5	612	Shale, soft and sandy	6	1,183
Shale, sticky	16	628	Sand and sticky shale	18	1,201

Well E-86

[Owner: City of Galveston, test well 4-7. Driller: Layne-Texas Co. Ltd. Reported altitude 24 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Clay and sandy clay	90	657
Clay, red and yellow	6	10	Clay, sandy	9	666
Clay, sandy	12	22	Sand and clay layers	4	670
Sand	16	38	Sand	95	765
Clay, sandy	27	65	Clay	10	775
Clay and sandy clay	15	80	Shale, hard	20	795
Clay	6	86	Shale, sandy	45	840
Clay, sandy and sand	14	100	Clay, sandy	2	842
Clay	6	106	Sand	11	853
Clay, sandy	24	130	Clay	12	865
Clay	95	225	Clay, sandy clay, and shell	17	882
Clay, sandy	30	255	Clay and shell	64	946
Clay and layers of shell	35	290	Clay, sandy clay, and shell	46	992
Clay and shell layers	25	315	Clay and shell	46	1,038
Clay and sandy clay	23	338	Sand, fine	51	1,089
Clay	42	380	Clay	7	1,096
Clay, sandy, and clay	30	410	Shale, sandy	64	1,160
Clay, sandy, and sand	20	430	Sand, shell, and some shale	11	1,171
Sand	43	473	Clay, sandy	21	1,192
Clay	84	557	Clay	8	1,200
Sand and sandy clay	10	567			

419189—57——8

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-87

[Owner: City of Galveston, well 11. Driller: Layne-Texas Co. Ltd. Reported altitude 25 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	12	12	Shale, hard	38	665
Sand and clay	138	150	Sand	80	745
Clay	12	162	Shale, hard layers	4	749
Clay, sandy	44	206	Sand	22	771
Clay and layers of sand	300	506	Clay	11	782
Clay	24	530	Sand	9	791
Clay, sandy	45	575	Clay	3	794
Sand, and layers of clay	52	627			

Well E-88

[Owner: City of Galveston, test well 3-6. Driller: Layne-Texas Co. Ltd. Reported altitude 25 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	85	85	Shale, sticky	9	615
Sand, fine	40	125	Shale, sandy	49	664
Clay, broken with shell	65	190	Sand	2	666
Sand, fine	5	195	Sand and shell	117	783
Shale, broken sand streaks	8	203	Shale	3	786
Shale, sticky	15	218	Sand	10	796
Sand and shale breaks	9	227	Shale, sticky	35	831
Shale, tough, and shell	104	331	Shale, sandy layers	3	834
Shale, broken, and sand	17	348	Shale, soft sticky	25	859
Shale, sandy	48	396	Shale, tough sticky	28	887
Shale, sticky	17	413	Shale, sticky	19	906
Sand, fine	15	428	Shale, sandy	15	921
Shale	19	447	Sand, fine	58	979
Sand, good	26	473	Shale, sandy	69	1,048
Sand, fair	28	501	Sand	14	1,062
Sand, shell, and shale breaks	7	508	Sand and shale	23	1,085
Shale, sticky	53	561	Sand	30	1,115
Shale, sandy	6	567	Sand and shale	32	1,147
Shale, sticky	3	570	Sand, hard	1	1,148
Sand, and shale	14	584	Sand	41	1,189
Sand, fine	10	594	Boulders	1	1,190
Shale, sandy	12	606	Shale, sticky	10	1,200

Well E-89

[Owner: City of Galveston, test well 10-13. Driller: Layne-Texas Co. Ltd. Reported altitude 25 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
No record	20	20	Sand	3	591
Clay, red and yellow	9	29	Clay, sandy	14	605
Sand, red	9	38	Clay	19	624
Clay, blue	47	85	Clay, sandy	9	633
Sand, fine, white	28	113	Clay and sandy clay	70	703
Sand and clay layers	8	121	Sand	6	709
Clay	15	136	Clay	1	710
Sand	8	144	Sand	1	711
Clay, sandy	6	150	Clay	6	717
Clay	53	203	Clay, sandy	6	723
Clay, sandy	7	210	Sand and clay layers	9	732
Clay	37	247	Sand	59	791
Sand, fine, and layers of shell	45	292	Clay and thin sand layers	9	800
Clay with shell	22	314	Sand	21	821
Shale, sandy, and clay	36	350	Clay	61	882
Clay, sandy, and clay	48	398	Sand	6	888
Sand	6	404	Clay	29	917
Clay, sandy	9	413	Clay, sandy	4	921
Sand	7	420	Clay, sticky	14	935
Clay, sandy layers	13	433	Clay, sandy	44	979
Clay and shells	32	465	Clay, sticky	30	1,009
Clay, sandy	17	482	Sand, fine	21	1,030
Clay and sandy clay	15	497	Sand	1	1,031
Sand	3	500	Clay and sandy clay	44	1,075
Clay	2	502	Clay, hard	21	1,096
Sand	8	510	Clay, sandy	7	1,103
Clay	52	562	Sand	24	1,127
Clay, sandy	6	568	Clay and sandy clay	61	1,188
Sand, good	11	579	Clay and shells	12	1,200
Clay	9	588			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well E-92

[Owner: City of Galveston, well 14. Reported altitude 31 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, black	5	5	Clay and sand breaks	114	526
Clay	11	16	Clay, tough	20	546
Sand	25	41	Clay, sand breaks	54	600
Clay, sandy	45	86	Sand	5	605
Sand and clay streaks	35	121	Clay, sandy	11	616
Clay, sandy	51	172	Shale, hard; streaks of sand and shell	12	628
Sand, clay streaks	17	189	Sand, shale and shell	15	643
Clay, tough	11	200	Sand, hard; streaks of shale and shell	11	654
Sand, streaks of shale and shell	19	219	Sand	12	666
Shale, sandy	17	236	Shale, hard, sand and shell streaks	11	677
Shale, hard	5	241	Sand, hard, and shale breaks	23	700
Sand, shale and shell	44	285	Sand, good	98	798
Shale, hard streaks of sand and shell	98	363	Clay, tough	7	805
Sand	49	412			

Well E-93

[Owner: City of Galveston, test well 2. Driller: Layne-Texas Co. Ltd. Reported altitude 27 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	5	5	Clay	13	605
Clay	6	11	Clay and lime rocks	30	635
Sand	2	13	Clay, sandy	8	643
Clay	4	17	Clay and limestone	11	654
Sand	26	43	Clay and sandy clay	21	675
Clay	18	61	Sand, coarse, gray	73	748
Sand and sandy clay	15	76	Shale, sandy	6	754
Clay	17	93	Sand	24	778
Sand, streaks of sandy clay	28	121	Clay	6	784
Clay, sandy	11	132	Sand	17	801
Clay and shells	79	211	Clay and sandy clay	59	860
Clay and sandy clay and shells	91	302	Sand and clay	8	868
Clay	18	320	Sand	27	895
Clay and shells	76	396	Sand and clay	22	917
Clay, sandy	17	413	Sand	8	925
Clay, sandy clay, and shells	48	461	Sand and clay	46	971
Clay	20	481	Clay, sandy	10	981
Clay, sandy	11	492	Clay and sandy clay	47	1,028
Clay and shells	20	512	Clay	13	1,041
Clay, sandy, and shells	14	526	Sand and sandy clay	20	1,061
Clay	55	581	Sand and clay	73	1,134
Clay, sandy, and small limestones	11	592	Rock	1	1,135
			Clay and sandy clay	39	1,174

Well E-106

[Owner: City of Galveston, test well 9-12. Reported altitude 17 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Clay, sticky	49	745
Clay, soft	11	15	Clay, sandy	10	755
Clay, sandy	12	27	Clay, sandy, and sand	7	762
Clay, soft	8	35	Sand	134	896
No record	46	81	Clay, sticky	10	906
Sand	33	114	Shale, sticky	7	913
Clay	16	130	Sand	4	917
Clay, shell, and gravel	100	230	Shale	10	927
Clay	10	240	Sand	1	928
Clay, sandy	17	257	Shale, sandy	5	933
Shale, sandy, and shell	28	285	Shale	21	954
Shale	27	312	Shale, sandy	6	960
Sand, fine	8	320	Sand	15	975
Shale, sandy	74	394	Shale, sandy	5	980
Shale	36	430	Clay, sandy	42	1,022
Shale, blue	23	453	Clay and sand layers	19	1,041
Sand	63	516	Sand	9	1,050
Shale	6	522	Clay, sandy clay, and sand	30	1,080
Sand, hard	22	544	Sand	25	1,105
Shale and shell	36	580	Clay, sandy	5	1,110
Clay and shells	68	648	Sand	15	1,125
Clay, sandy	8	656	Clay, sandy, and sand	39	1,164
Clay and thin sand layers	20	676	Clay	36	1,200
Sand	20	696			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-14

[Owner: Humble Oil & Refining Co. Driller: L. Patterson. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	65	65	Shale	30	480
Sand	22	87	Sand, fine	25	505
Shale	44	131	Shale	75	580
Shale, sandy	45	176	Sand, coarse	84	664
Shale	229	405	Shale	2	666
Shale, sandy	45	450			

Well F-15

[Owner: Humble Oil & Refining Co. Driller: L. Patterson. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	24	24	Shale	222	394
Shale	57	81	Sand	5	399
Sand	28	109	Shale	4	403
Shale	42	151	Sand	32	435
Sand	21	172			

Well F-23

[Owner: Pure Oil Co. Driller: L. Patterson. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	23	23	Sand	15	487
Sand	4	27	Shale	7	494
Shale	190	217	Sand	12	506
Sand	22	239	Shale	134	640
Shale	233	472	Sand	32	672

Well F-24

[Owner: Pure Oil Co. Driller: L. Patterson. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	20	20	Sand	15	425
Sand	22	42	Shale	85	510
Shale	18	60	Sand and shale	25	535
Sand	24	84	Shale	20	555
Shale	326	410	Sand	86	641

Well F-30

[Owner: Galveston County Hospital. Driller: Big State Drilling Co. Reported altitude 16 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Shale	7	442
Clay	10	14	Sand, shell, and shale	20	462
Sand	8	22	Sand and shale	3	465
Clay, sandy	35	57	Sand, shell, and shale	5	470
Sand	10	67	Sand and shale	8	478
Clay	25	92	Shale, hard	7	485
Sand	35	127	Sand	7	492
Shale	5	132	Shale, sandy	10	502
Shale and sandy shale	19	151	Shale, sandy, and shells	18	520
Sand, layers of sand and shale	45	196	Shale	8	528
Shale, hard, sticky	15	211	Sand	6	534
Shale	41	252	Shale	38	572
Shale, sandy, and shale	69	321	Sand	7	579
Shale, sandy	18	339	Sand and shale layers	24	603
Sand	11	350	Sand	72	675
Shale, layers of hard sand and sandy shale	69	419	Shale	1	676
Shale	3	422	Shale, sandy	20	696
Sand and shale	5	427	Shale	23	719
Shale, sandy	6	433	Sand and sandy shale	36	755
Sand	2	435	Sand	60	815

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-33

Owner: Galveston County Water Control & Improvement District No. 3 well 2. Driller: Layne-Texas Co. Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Shale	12	465
Sand	17	22	Sand	10	475
Clay	14	36	Shale	8	483
Shale, sandy	30	66	Sand	12	495
Shale	17	83	Shale	7	502
Shale, sandy	8	91	Sand and layers of shale	50	552
Sand, fine, gray	14	105	Shale, hard	31	583
Shale	62	167	Sand	24	607
Shale, sandy	14	181	Sand and hard shale	7	614
Shale, sticky	98	279	Shale, hard, and shell	23	637
Shale, sandy, and shell	34	313	Sand	13	650
Sand	3	316	Sand and shale	6	656
Shale	12	328	Sand, shale, and shell	12	668
Sand, shale and shell	37	365	Sand	39	707
Shale and shell	69	434	Shale	1	708
Sand	19	453			

Well F-34

[Owner: Galveston, Houston & Henderson Railroad. Driller: Layne-Texas Co. Ltd. Reported altitude 19 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	1	1	Sand, fine	23	514
Clay	50	51	Gumbo	104	618
Sand	15	66	Shell	20	638
Gumbo	185	251	Gumbo	138	776
Shell	25	276	Sand, fine, dark	44	820
Gumbo	85	361	Sand, gray	40	860
Shell	20	381	Sand, coarse	49	909
Gumbo	110	491	Gumbo	5	914

Well F-37

[Owner: A. J. Biron. Driller: Layne-Texas Co. Ltd. Reported altitude 11 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Clay and gumbo	49	554
Clay	18	22	Sand with hard layers	15	569
Clay and sand	20	42	Gumbo	30	599
Clay	46	88	Sand	12	611
Sand	14	102	Clay	5	616
Clay	62	164	Sand	3	619
Sand	10	174	Clay	10	629
Clay	33	207	Sand	3	632
Clay and gumbo	65	272	Clay	20	652
Clay, soft, and sand	22	294	Sand, fine	35	687
Sand	54	348	Clay and gumbo	34	721
Clay	15	363	Clay and shell	98	819
Sand	21	384	Sand	3	822
Clay	42	426	Clay and sand	6	828
Sand	29	455	Sand, fine	16	844
Clay	21	476	Sand	51	895
Sand	14	490	Clay and shell	16	911
Clay	12	502	Clay, hard	1	912
Sand	3	505	Clay and shell	14	926

Well F-41

[Owner: Community Public Service Co., well 8. Driller: Layne-Texas Co., Ltd. Reported altitude 9 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	4	4	Shale, sandy, and shell	39	485
Clay	20	24	Shale	54	539
Sand and shells	20	44	Sand, fine	12	551
Clay and sandy clay	153	197	Shale	30	581
Shell	14	211	Sand, fine	7	588
Shale	14	225	Shale	42	630
Shale, sandy, sand streaks and shells	135	360	Sand	20	650
Shells	30	390	Shale, sandy	10	660
Sand	16	406	Sand, fine	51	711
Sand and shell	10	416	Shale and sandy shale	6	717
Shale, sand and shell streaks	30	446	Sand	45	762
			Shale	10	772

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-42

[Owner: Community Public Service Co. well 6. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	11	11	Shale, sandy	5	462
Sand and clay	50	61	Sand	15	477
Clay	21	82	Shale, sandy	49	526
Sand	29	111	Shale	12	538
Clay	109	220	Sand	27	565
Sand and shell	26	246	Shale, tough	55	620
Sand, shale, and shell	18	264	Sand and shale	16	636
Shale	8	272	Shale	10	646
Shale, sandy	10	282	Shale, tough	15	661
Shale and sand	20	302	Shale, sandy	5	666
Shale	10	312	Shale	14	680
Shale, sandy	32	344	Sand	17	697
Sand and shale	44	388	Shale and shell	8	705
Sand	9	397	Sand	66	771
Shale and sand breaks	54	451	Shale	9	780
Shale, tough	6	457			

Well F-43

[Owner: Community Public Service Co., well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	14	14	Sand and shell	14	479
Sand	36	50	Sand and layers of shale	58	537
Clay, sandy	43	93	Sand	29	566
Sand	8	101	Shale, tough	43	609
Shale, sandy	52	153	Sand	7	616
Shale	79	232	Shale, tough	21	637
Sand	10	242	Sand	21	658
Shale, sandy	71	313	Shale, tough	5	663
Sand	12	325	Sand	47	710
Shale, sandy	33	358	Shale, tough	10	720
Shale, tough	14	372	Sand	45	765
Shale, sandy	93	465	Shale, tough	7	772

Well F-44

[Owner: Community Public Service Co., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Shale, sticky	16	513
Clay	12	14	Sand, not so good	19	532
Sand	32	46	Shale, sticky	12	544
Clay	15	61	Sand, good, some gravel	20	564
Clay, layers of sand	30	91	Shale	45	609
Clay	40	131	Sand	10	619
Clay and sand	84	215	Shale	19	638
Clay	27	242	Sand, good	16	654
Sand	11	253	Gumbo	18	672
Clay	11	264	Sand, good	23	695
Sand and clay	59	323	Sand	7	702
Clay, streaks of sand	100	423	Clay	8	710
Shale, sticky	13	436	Sand with shale breaks	48	758
Shale, sandy	29	465	Gumbo	2	760
Sand, good	32	497			

Well F-45

[Owner: Community Public Service Co., well 5. Driller: Layne-Texas Co., Ltd. Reported altitude 9 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	11	11	Shale and sandy breaks	47	445
Sand, clay and layers of shell	48	59	Shale, tough	13	458
Clay	23	82	Sand	4	462
Sand	28	110	Shale and sand breaks	10	472
Clay	34	144	Shale, sandy	6	478
Sand	6	150	Shale	20	498
Clay	74	224	Shale, sticky	42	540
Sand	22	246	Sand, fine, gray	27	567
Shale	26	272	Shale	5	572
Sand	10	282	Sand	4	576
Shale and sand	27	309	Shale, tough	61	637
Shale	5	314	Sand and shale	15	652
Shale, sandy	21	335	Shale	19	671
Sand	9	344	Sand	30	701
Shale and layers of shell	15	359	Shale	8	709
Sand and sand breaks	29	388	Sand	50	759
Sand	10	398	Shale	5	764

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-46

[Owner: Community Public Service Co., well 7. Driller: Layne-Texas Co., Ltd. Reported altitude 9 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand	60	560
Clay	8	10	Shale and shell	20	580
Sand, fine, gray shell	20	30	Sand	15	595
Shale, soft, sandy layers	54	84	Shale and shell	9	604
Sand, fine, gray	20	104	Sand, hard	16	620
Shale, few sandy layers	86	190	Shale, hard, few thin sandy layers	12	632
Sand, poor	15	205	Shale, sandy layers, and layers of sand	55	687
Shale	20	225	Sand, cut clean	70	757
Sand, few clay layers	140	365	Shale	6	763
Sand and shell	60	425			
Clay, sandy, and sand	75	500			

Well F-47

[Owner: Galveston County Water Control & Improvement District No. 4, well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale	7	417
Clay	27	30	Shale and sand, laminated	48	465
Sand with shells and clay	35	65	Gravel with shale	14	479
Shale, sandy	25	90	Shale and sand, laminated	22	501
Sand, broken	28	118	Sand, laminated	9	510
Shale	21	139	Shale	7	517
Shale with sand	20	159	Sand, laminated	9	526
Shale, sticky	27	186	Shale	13	539
Shale, sandy	13	199	Sand	7	546
Shale	4	203	Shale, sticky	57	603
Shale, sandy, laminated	30	233	Sand, laminated	10	613
Shale, sticky	30	263	Shale, sticky	19	632
Sand, laminated	42	305	Sand, laminated	21	653
Shale	7	312	Shale	8	661
Sand, laminated	17	329	Sand	43	704
Shale	5	334	Shale	3	707
Shale and sand, laminated	76	410	Sand, laminated	21	728

Well F-48

[Owner: Galveston County Water Control & Improvement District No. 4, well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Shale, sandy	79	600
Clay	26	28	Sand	19	619
Sand	22	50	Shale	17	636
Clay	42	92	Sand	16	652
Sand	18	110	Shale	9	661
Clay, sandy	42	152	Sand	34	695
Sand	32	184	Sand, broken	30	725
Clay, sandy	93	277	Shale	55	780
Shale, sandy	186	463	Sand, broken	36	816
Sand	5	468	Shale	12	828
Shale	45	513	Sand, good	42	870
Sand	8	521			

Well F-49

[Owner: Galveston County Water Control & Improvement District No. 4, well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 14 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Sand, shale streaks	15	478
Clay	17	19	Shale, sandy layers	17	495
Sand	12	31	Shale	12	507
Clay	8	39	Sand, hard	12	519
Sand	19	58	Shale	14	533
Clay	15	73	Sand	13	546
Sand	8	81	Shale	16	562
Clay	9	90	Sand, broken and shale	7	569
Sand	21	111	Shale	7	576
Clay, sand streaks	23	134	Sand, broken and shale	15	591
Clay	64	198	Sand	13	604
Sand	11	209	Shale	27	631
Shale, few sandy breaks	186	395	Sand	22	653
Sand	10	405	Shale, sandy	12	665
Clay	8	413	Sand, cut clean	31	696
Sand	2	415	Shale	12	708
Clay	5	420	Shale, sandy, sand streaks	22	730
Sand, shale streaks	24	444	Sand	6	736
Shale	4	448	Shale	16	752
Sand, shale streaks	10	458	Shale, sandy, sand streaks	18	770
Shale, sandy	5	463	Shale	10	780

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-50

[Owner: Carbide & Carbon Chemicals Corp. Pilot well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 13 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	3	3	Clay	43	651
Clay with thin sand layers	16	19	Sand with thin clay layers	20	671
Sand	7	26	Clay	7	678
Clay, soft, brown	55	81	Sand	2	680
Sand, fine, white	23	104	Clay and sand	13	693
Clay with thin sand layers	116	220	Clay	18	711
Clay and sand	38	258	Sand	7	718
Clay, soft, and sand	91	349	Clay	61	779
Sand with thin layers of clay	13	362	Sand	13	792
Clay and sand	18	380	Clay	3	795
Clay	65	445	Sand	19	814
Sand	7	452	Clay	3	817
Clay	19	471	Sand	24	841
Clay with thin sand layers	19	490	Clay	3	844
Sand	9	499	Sand, hard	184	1,028
Clay	56	555	Clay	3	1,031
Sand and clay	53	608			

Well F-51

[Owner: Carbide & Carbon Chemicals Corp., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Shale	9	560
Clay	16	21	Sand, fine, hard, with shale layers	34	594
Sand	7	28	Shale	17	611
Clay, sandy	42	70	Shale with sand layers	21	632
Shale, gray	14	84	Shale, tough	12	644
Sand, fine, gray	18	102	Shale, sandy	27	671
Shale, red and blue	94	196	Sand	9	680
Shale, sticky	32	228	Shale, tough	8	688
Shale	18	246	Sand	19	707
Shale, sandy, with layers of sand	58	304	Shale	39	746
Shale, pink, white, and gray, with shell and gravel	56	360	Sand	8	754
Sand with shale layers	25	385	Shale, sandy, with sand layers	31	785
Shale	47	432	Shale	7	792
Shale with sand layers	60	492	Sand with few shale breaks	152	944
Sand	11	503	Sand	71	1,015
Sand with shale layers	48	551	Shale, hard	1	1,016

Well F-52

[Owner: Carbide & Carbon Chemicals Corp., well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand	3	377
Clay, red and white	16	19	Shale, soft	2	379
Sand, fine, red	13	32	Sand	3	382
Clay	5	37	Shale, soft, and shell	34	416
Clay and fine sand	12	49	Shale, hard	5	421
Clay, red	21	70	Shale, soft, with sandy layers	68	489
Sand, fine, with few shale breaks	80	150	Sand	15	504
Shale	22	172	Sand and shale	8	512
Shale, sandy, and shell	49	221	Shale, tough	5	517
Shale, sticky	11	232	Sand and shale	39	556
Shale, loose	63	295	Sand, fine, with few shale breaks	37	593
Shale	8	303	Shale	18	611
Shale with few layers of fine sand	59	362	Shale with streaks of fine sand	30	641
Shale, soft	12	374	Sand	40	681
			Shale	9	690

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-53

[Owner: Pan American Refining Corp., well 6. Driller: Layne-Texas Co., Ltd. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and sand	56	56	Shale	9	651
Clay and sand	28	84	Sand	37	688
Sand	60	144	Shale	46	734
Clay and sand	26	170	Shale, tough	43	777
Sand	40	210	Sand and shale	31	808
Clay	32	242	Shale, tough	15	823
Sand	52	294	Shale, sandy	16	839
Clay	25	319	Shale	20	859
Sand, fine, clayey	51	370	Sand	83	942
Sand	22	392	Shale, sandy, and sand	32	974
Shale	231	623	Sand	26	1,000
Sand	19	642			

Well F-54

[Owner: Pan American Refining Corp., well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 14 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Shale, sandy, gray	30	285
Clay	26	28	Shale, sandy	80	365
Sand	10	38	Sand, gray, and shale	65	430
Clay with streaks of sand	57	95	Shale	36	466
Clay	30	125	Sand	13	479
Sand	30	155	Sand and shale	104	583
Shale, loose	80	235	Gumbo	12	595
Gumbo	20	255	Shale, sandy	15	610

Well F-55

[Owner: Pan American Refining Corp., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 14 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand	13	469
Clay	26	28	Shale with streaks of sand	96	565
Sand, red	10	38	Gumbo	68	633
Clay with streaks of sand	67	105	Shale with streaks of sand	23	656
Clay	84	189	Sand	40	696
Shale, sticky	41	230	Shale, sticky	81	777
Gumbo	23	253	Sand	27	804
Shale, sandy, gray	32	285	Shale, sticky	15	819
Shale	65	350	Sand with streaks of shale	36	855
Sand, gray	70	420	Sand	110	965
Shale, sticky	36	456			

Well F-57

[Owner: Pan American Refining Corp., well 9. Driller: Layne-Texas Co., Ltd. Reported altitude 13 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Shale, sandy	20	588
Clay	8	10	Shale, layers of shell and sand	28	616
Clay, sandy	84	94	Shale, hard, sticky	14	630
Sand, white	20	114	Shale, sandy	25	655
Clay, tough	22	136	Shale, sticky	15	670
Clay and sand breaks	94	230	Sand	35	705
Sand, fine	20	250	Shale, sticky	16	721
Shale	20	270	Sand	28	749
Sand, fine	20	290	Shale, sticky	48	797
Shale and sand	176	466	Sand, breaks of shell and shale	27	824
Shale, shell, and sand breaks	55	521	Shale, sandy	24	848
Shale, hard, sticky	13	534	Sand, layers of shell and shale	40	888
Sand and shell layers, fine	34	568	Sand, cut good	69	957

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-59

[Owner: Republic Oil Refining Co., well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	15	15	Shale, tough	38	546
Clay, red	10	25	Shale, tough, red and blue	22	568
Clay, yellow	22	47	Shale, soft	6	574
Sand	12	59	Sand	10	584
Clay, soft, and shell	43	102	Shale, hard, brown and blue	23	607
Sand	15	117	Shale, soft	7	614
Shale, soft, sticky, blue	29	146	Sand and layers of shale	11	625
Sand, fine	19	165	Shale, hard brown	32	657
Shale, soft, blue, and layers of sandy shale	81	246	Shale, sandy	6	663
Sand, fine, and layers of sandy shale and shell	32	278	Shale, soft sandy and layers of fine sand	22	685
Shale, soft, sandy	41	319	Shale	17	702
Shale, soft blue, and layers of sandy shale and shell	77	396	Sand	6	708
Shale, soft sandy layers of fine sand	25	421	Shale	27	735
Shale	32	453	Sand, fine, and layers of shale	17	752
Shale, hard	19	472	Sand, fine	15	767
Sand, soft, and layers of shale	14	486	Sand, good	23	790
Sand	22	508	Shale	40	830
			Sand	20	850
			Shale	7	857

Well F-60

[Owner: Pan American Chemical Plant, well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 9 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	5	5	Shale	46	552
Sand	32	37	Sand	30	582
Clay, white	37	74	Shale, sandy	17	599
Clay, red	22	96	Shale	13	612
Clay and sand	57	153	Sand	15	627
Sand	16	169	Shale	29	656
Clay and sand	54	223	Shale, sandy	26	682
Shale	20	243	Shale	17	699
Shale and sand	77	320	Sand and shale	27	726
Shale, sandy	136	456	Shale	13	739
Shale	13	469	Sand	46	785
Sand	37	506	Shale	16	801

Well F-61

[Owner: Pan American Chemical Plant, well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 9 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	8	8	Gumbo	7	606
Sand	13	21	Sand	19	625
Sand, soft clay, and shell	181	202	Gumbo	32	657
Gumbo	80	282	Sand	20	677
Clay	181	463	Gumbo	20	697
Sand, fine	49	512	Sand	6	703
Gumbo	47	559	Gumbo	24	727
Sand	26	585	Sand	53	780
Gumbo	8	593	Gumbo	8	788
Sand	6	599			

Well F-62

[Owner: Monsanto Chemical Co., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	15	15	Shale, sandy	48	442
Sand	16	31	Shale, sticky	19	461
Clay and sand	86	117	Sand, fine	15	476
Sand and shell layers	58	175	Shale, sticky, and shell layers	52	528
Clay, tough	27	202	Sand	38	566
Shale, sandy	42	244	Shale, sticky	30	596
Clay	20	264	Shale and sand streaks	23	619
Clay, tough	43	307	Sand	35	654
Shale and sand streaks	52	359	Shale, sticky	4	658
Shale, sticky	35	394			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well F-63

[Owner: Monsanto Chemical Co., well 5. Driller: Southern Well Drilling Co. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand	41	195
Clay	5	8	Clay	10	205
Sand, red	10	18	Shale, blue	215	420
Clay	22	40	Sand	58	478
Sand	20	60	Clay	25	503
Shale, red	30	90	Sand	44	547
Sand and shale	52	142	Gumbo	42	589
Clay	12	154			

Well F-64

[Owner: Monsanto Chemical Co., well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	4	4	Shale, sticky	36	404
Clay fill	15	19	Sand	21	425
Sand	16	35	Shale, sticky	67	492
Clay and sand layers	86	121	Shale and hard layers of sand	10	502
Sand and shell layers	58	179	Sand	35	537
Clay, tough	27	206	Shale, sticky	13	550
Shale, sandy	32	238	Shale	19	569
Sand	10	248	Shale, hard layers	18	587
Clay	20	268	Shale and hard layers of sand	11	598
Clay, tough	43	311	Sand	23	621
Shale and sand streaks	57	368	Shale, sticky	4	625

Well F-65

[Owner: Monsanto Chemical Co., well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, streaks of sandy clay	75	75	Sand with light shale streaks	37	349
Clay, sandy	35	110	Shale	15	364
Sand, hard streaks	11	121	Sand	6	370
Clay, sandy	4	125	Shale, sandy	32	402
Sand	33	158	Sand	24	426
Shale, sticky	37	195	Shale, sandy shale streaks	85	511
Sand	23	218	Sand	24	535
Shale, sandy	7	225	Shale, sandy	50	585
Shale	20	245	Sand	31	616
Shale, sandy, with sand streaks	67	312			

Well F-66

[Owner: Monsanto Chemical Co., well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay fill	17	17	Shale, sticky	57	596
Sand	14	31	Shale, sandy	8	604
Clay and sand	86	117	Sand	10	614
Sand layers and layers of shell	58	175	Shale	2	616
Clay	6	181	Sand	4	620
Clay, tough	21	202	Shale, sticky	16	636
Shale, sandy	32	234	Shale	9	645
Sand	14	248	Shale, sticky	16	661
Clay, tough	106	354	Sand	8	669
Shale and sand streaks	26	380	Shale and small layers of sand	29	698
Shale, hard, sticky	23	403	Shale, tough, sticky	18	716
Shale, sandy	22	425	Shale, sandy	10	726
Shale, sticky	61	486	Shale	5	731
Shale, hard, sticky	16	502	Shale, sticky	6	737
Shale, sandy	10	512	Shale	10	747
Sand and shell layers	27	539			

Well F-68

[Owner: Texas City Terminal Railroad well 2. Driller: Layne-Bowler Co. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, sandy	100	100	Sand	60	475
Shale	10	110	Clay and shale	25	500
Sand	11	121	Sand	45	545
Clay	294	415	Clay	5	550

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well J-5

[Owner: Sun Oil Co. Driller: Sun Oil Co. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand and clay	199	199	Clay	2	253
Sand	52	251	Sand	17	270

Well J-6

[Owner: Sun Oil Co. Driller: Sun Oil Co. Reported altitude 5 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	4	4	Clay	46	146
Sand	6	10	Sand	14	160
Sand and shell	16	26	Clay	45	205
Clay	2	28	Sand	38	243
Sand	25	53	Gravel	10	253
Clay and sandy clay	43	96	Clay	4	257
Sand	4	100			

Well J-8

[Owner: Sun Oil Co. Driller: Sun Oil Co. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand	30	30	Clay, sandy	55	208
Clay	21	51	Clay	15	223
Clay, sandy	34	85	Sand	30	253
Clay	36	121	Clay	11	264
Sand	5	126	Sand	4	268
Clay	13	139	Clay, sandy	9	277
Sand	5	144	Sand	44	321
Clay	9	153			

Well L-10

[Owner: City of Galveston, Test Well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	5	5	Sand and sandy clay	12	561
Clay	13	18	Clay and sandy clay	16	577
Clay and sandy clay	27	45	Sand	19	596
Clay	12	57	Clay and sandy clay	34	630
Sand	20	77	Sand and sandy clay	9	639
Clay, soft, and sandy clay	67	144	Sand and clay layers	22	661
Clay, soft	39	183	Clay	16	677
Sand	5	188	Sand	242	919
Clay and sand layers	41	229	Sand and sandy clay	42	961
Rock	1	230	Clay and sand layers	12	973
Clay, soft, and sand layers	140	370	Clay, sandy	28	1,001
Sand and sandy clay	8	378	Sand, coarse	22	1,023
Clay and sandy clay	18	396	Clay, sandy	4	1,027
Clay, sandy	34	430	Sand	3	1,030
Sand and sandy clay	11	441	Clay	43	1,073
Clay and sandy clay	25	466	Sand	5	1,078
Clay, sandy	21	487	Clay and sandy clay	10	1,088
Clay	11	498	Sand	4	1,092
Clay, sandy	6	504	Clay and sandy clay	21	1,113
Sand	8	512	Sand	4	1,117
Clay, sandy	7	519	Clay and sandy clay	11	1,128
Clay	18	537	Sand	20	1,148
Clay and sandy clay	12	549	Clay	30	1,178

Well L-12

[Owner: Galveston County Water Control & Improvement District No. 7. Driller: Fred Standard. Reported altitude 16 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	38	38	Sand, fine	14	504
Sand	12	50	Clay, blue	49	553
Clay and gumbo	201	251	Sand	22	575
Sand, fine, and clay	73	324	Clay	33	608
Clay, blue and white	66	390	Rock	4	612
Rock and clay	4	394	Sand	14	626
Sand and clay	44	438	Clay	5	631
Clay, blue	45	483	Rock	4	635
Rock	7	490	Sand	54	689

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well L-20

[Owner: Galveston County Water Control & Improvement District No. 7. Driller: Layne-Texas Co., Ltd. Reported altitude 18 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Sand, fine, white	30	115
Clay	8	10	Clay	90	205
Sand	5	15	Sand	5	210
Clay	70	85	Clay	10	220

Well L-21

[Owner: Galveston County Water Control & Improvement District No. 7. Driller: Layne-Texas Co., Ltd. Reported altitude 18 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Sand, shale, and breaks of sand	46	281
Clay	12	14	Shale and streaks of sand	90	371
Sand	10	24	Sand and shale layers	20	391
Sand and clay	68	92	Shale, sandy	36	427
Sand and shell	22	114	Shale, sticky	266	693
Shale, sticky	106	220	Sand, good, with layers of shell	63	756
Sand	15	235			

Well L-25

[Owner: Stanolind Oil & Gas Co. Driller: L. Patterson. Reported altitude 20 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	25	25	Shale	206	311
Shale	5	30	Sand and shale	10	321
Sand	10	40	Shale	369	690
Shale	60	100	Sand	54	744
Sand	5	105			

Well L-29

[Owner: Sun Oil Co. Driller: Homer Wright. Reported altitude 6 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	36	36	Gumbo	5	484
Sand	26	62	Sand	18	502
Clay	32	94	Shale	35	537
Sand	18	112	Sand	45	582
Shale	96	208	Gumbo	2	584
Shell	14	222	Shale, sandy, sticky	44	628
Gumbo	43	265	Gumbo	10	638
Shale, sandy, and shell	8	273	Sand, fine	32	670
Gumbo, brown	14	287	Gumbo	15	685
Sand	115	402	Sand	14	699
Gumbo, brown	35	437	Shale, sandy, and shell	55	754
Sand and shell	8	445	Gravel	11	765
Gumbo, blue	13	458	Sand, fine, white	93	858
Sand	21	479	Gravel	11	869

Well L-30

[Owner: Sun Oil Co. Driller: Homer Wright. Reported altitude 5 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, gravel, and clay	31	31	Gumbo	8	466
Gumbo, brown	12	43	Sand	11	477
Sand	21	64	Gumbo	4	481
Gumbo	30	94	Sand and shell	13	494
Sand	34	128	Gumbo, blue	66	560
Gumbo, brown	32	160	Sand	14	574
Shale, sandy, brown and pink	92	252	Gumbo	12	586
Gumbo, hard, brown	19	271	Sand	15	601
Sand	13	284	Gumbo	8	609
Shale, brown and pink, sandy	124	408	Sand, fine	31	640
Gumbo	36	444	Gumbo	3	643
Sand and shell	14	458			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well L-31

[Owner: Sun Oil Co. Driller: Homer Wright. Reported altitude 5 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	39	39	Sand	13	448
Sand	23	62	Gumbo	8	456
Clay	32	94	Sand	21	477
Sand	25	119	Gumbo	8	485
Shale	104	223	Sand	9	494
Sand, fine	13	236	Gumbo	41	535
Gumbo	19	255	Sand	45	580
Shale, sandy	114	369	Gumbo	6	586
Gumbo	11	380	Sand	18	604
Sand	16	396	Gumbo	5	609
Gumbo, brown	39	435	Sand	20	629

Well L-32

[Owner: Coon Well No. 1. Driller: The Texas Co. Reported altitude 6 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, yellow	20	20	Sand	21	324
Sand, gray	47	67	Gumbo, blue	160	484
Gumbo, soft, blue	31	98	Sand, blue	10	494
Sand, gray	24	122	Gumbo, blue	152	646
Gumbo, blue	41	163	Sand, gray	20	666
Sand	20	183	Gumbo, blue	162	828
Gumbo, blue	34	217	Sand, gray	268	1,096
Sand	22	239	Gumbo, blue	4	1,100
Gumbo, blue	64	303			

Well L-33

[Owner: Sun Oil Co. Driller: Homer Wright. Reported altitude 4 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay, sandy	45	45	Shale and shell	22	506
Sand	30	75	Sand	30	536
Clay	32	107	Gumbo	23	559
Sand	42	149	Sand	23	582
Shale	98	247	Shale	15	597
Shell	22	269	Sand	48	645
Gumbo	29	298	Shale, sandy, sticky	47	692
Shale, sandy, and shell	26	324	Gumbo	27	719
Gumbo	17	341	Sand	35	754
Sand	41	382	Shale, sandy, and shell	40	794
Gumbo	17	399	Sand	42	836
Sand	20	419	Sand and shell	27	863
Gumbo, brown	65	484	Sand	60	923

Well L-34

[Owner: Sun Oil Co. Driller: Homer Wright. Reported altitude 2 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	93	93	Gumbo	13	590
Sand, fine	15	108	Sand, fine, and shale	78	668
Shale, sand, and shell	315	423	Shale, sandy	189	857
Sand, fine	40	463	Sand, fine	80	937
Shale and shell	114	577			

Well L-47

[Owner: City of Galveston well 2-S. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
No record	60	60	Shell, hard	1	489
Clay, red and white	40	100	Sand, water-bearing, cased off	5	494
Sand, water-bearing, cased off	23	123	Clay, hard, white	6	500
Clay, white	27	150	Clay, soft, white	14	514
Clay, red	23	173	Clay, hard and soft, white	46	560
Clay, hard, red	17	190	Clay, hard, white	30	590
Clay, red, hard and soft in places	18	208	Quicksand	21	611
Clay, soft, red	10	218	Clay, hard	9	620
Clay, hard, white	12	230	Clay, soft	11	631
Quicksand	155	385	Clay, hard and soft	72	703
Clay, hard and soft, white	50	435	Sand and clay	32	735
Clay, hard, white	43	478	Clay, hard, white	5	740
Sand and clay	10	488	Sand, water-bearing	53	793

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well L-48

[Owner: City of Galveston well 4-S. Reported altitude 23 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	4	4	Clay, soft, white	43	478
Clay	8	12	Sand, white and clay	10	488
Quicksand	6	18	Shell rock, hard	1	489
Clay, red	7	25	Sand, white, water-bearing; first flow	5	494
Quicksand, red	10	35	Clay, hard, white	6	500
Clay	2	37	Clay, soft, white	14	514
Quicksand	3	40	Clay, white, hard and soft	46	560
Clay, red and white	60	100	Clay, white, hard	30	590
Sand, water-bearing, no flow	23	123	Quicksand	21	611
Clay, white	27	150	Clay, hard	9	620
Clay, red	23	173	Clay, soft	11	631
Clay, hard, red	17	190	Clay, hard and soft	72	703
Clay, hard and soft	18	208	Sand and clay	32	735
Clay, soft, red	10	218	Clay, hard, white	5	740
Clay, hard	12	230	Sand, water-bearing	128	868
Quicksand	155	385			
Clay, hard and soft, white	50	435			

Well L-60

[Owner: City of Galveston, well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 22 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Clay, blue	42	288
Clay	4	6	Gumbo	19	307
Sand	5	11	Clay and shale	58	365
Clay	59	70	Clay	47	412
Sand	10	80	Sand	12	424
Clay	10	90	Clay	291	715
Sand	41	131	Sand	102	817
Clay	61	192	Clay	23	840
Gumbo	54	246			

Well L-62

[Owner: City of Galveston, well 7. Driller: Layne-Texas Co., Ltd. Reported altitude 24 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Clay, soft	213	625
Clay	99	102	Clay with streaks of sand	44	669
Sand, loose	23	125	Clay, tough	29	698
Clay, tough	116	241	Sand, coarse, hard	141	839
Clay, soft	161	402	Gumbo	4	843
Gumbo	10	412			

Well L-63

[Owner: City of Galveston, test well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand, sandy shale and shell	21	441
Clay and lime	5	7	Clay, soft, sandy clay and shell	170	611
Sand	7	14	Sand and clay	26	637
Clay	22	36	Sand	10	647
Clay and sandy clay	67	103	Clay	49	696
Sand, fine, white	11	114	Clay and sand layers	32	728
Clay	1	115	Sand	110	838
Sand, fine, white	9	124	Clay	10	848
Clay and shell	56	180	Clay, sand streaks	9	857
Clay, sandy, and shell	98	278	Sand	15	872
Sand	18	296	Clay	105	977
Sand, broken	57	353	Clay and sand streaks	6	983
Clay	7	360	Clay	59	1,042
Clay, soft, sandy clay and thin sand layers	60	420	Sand	10	1,052
			Clay and sand	13	1,065

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well L-64

[Owner: City of Galveston, well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Clay	374	510
Clay	13	15	Sand	13	523
Sand	6	21	Clay	68	591
Clay, sandy	48	69	Sand	26	617
Clay	14	83	Clay	104	721
Sand	8	91	Sand	32	753
Clay	15	106	Clay	9	762
Sand	22	128	Sand	83	845
Shell and clay	8	136	Clay	10	855

Well L-65

[Owner: City of Galveston, well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 21 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	10	10	Gumbo	68	304
Sand	8	18	Clay and shale	46	350
Clay	58	76	Clay, soft	151	501
Clay and shale	10	86	Sand	10	511
Sand	44	130	Gumbo	184	695
Clay and shale	50	180	Hard layers	2	697
Clay, soft	26	206	Sand, muddy, fine	30	727
Gumbo	10	216	Sand	133	860
Clay and shale	20	236	Gumbo	6	866

Well L-66

[Owner: City of Galveston, well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 20 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	10	10	Clay and shale	21	457
Clay, sandy	123	133	Gumbo	230	687
Clay, soft	118	251	Sand, muddy, fine	25	712
Clay and shale	48	299	Sand	145	857
Gumbo	137	436	Gumbo	16	873

Well L-67

[Owner: City of Galveston, well 5. Driller: Layne-Texas Co., Ltd. Reported altitude 20 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	16	16	Sand	6	151
Sand	12	28	Clay	277	428
Clay	3	31	Sand	17	445
Sand	12	43	Clay	138	583
Clay, sandy	39	82	Sand, white	27	610
Clay	20	102	Clay	95	705
Sand	26	128	Sand	167	872
Clay	17	145	Clay	16	888

Well L-68

[Owner: City of Galveston, well 8. Driller: Layne-Texas Co., Ltd. Reported altitude 19 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Clay	61	416
Clay	20	24	Sand	32	448
Sand	45	69	Clay	66	514
Clay	107	176	Gumbo	18	532
Sand	20	196	Sand	8	540
Clay	22	218	Gumbo	106	646
Sand	10	228	Sand	4	650
Clay	22	250	Gumbo	21	671
Sand	41	291	Sand	209	880
Clay	30	321	Gumbo	4	884
Sand	34	355			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-1

[Owner: Galveston County Water Control & Improvement District No. 3, well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 16 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	5	5	Shale, tough	17	501
Clay, red	93	98	Sand and shale breaks	48	549
Clay and sandy blue clay	60	158	Shale and sandy shale	30	579
Shale and shell	34	192	Shale, tough	29	608
Sand and sandy shale	30	222	Sand and sandy shale	15	623
Shale and shell	25	247	Shale, sandy	15	638
Shale, sandy, and shell	27	274	Sand and shale breaks	70	708
Sand, shale, and shell layers	61	335	Shale and sandy shale	20	728
Shale, sandy, and shell	53	388	Sand and sandy shale	26	754
Shale and sandy shale breaks	28	416	Shale, sandy	29	783
Shale, sandy shale, and sand breaks	46	462	Sand and sandy shale breaks	35	818
Sand and shale breaks	22	484	Sand, hard, coarse	40	858

Well M-2

[Owner: Galveston County Water Control & Improvement District No. 3, well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 13 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil and clay	56	56	Shale and shells	27	597
Sand, fine	14	70	Shale, sandy	16	613
Clay	30	100	Shale and streaks of sand	12	625
Shell, fine, gray, sandy	40	140	Sand, fine	30	655
Shale and sandy shale	70	210	Shale	8	663
Sand, fine, and shell	22	232	Shale, sandy, and shale	27	690
Shale	21	253	Sand, fine	17	707
Shale, sandy and streaks of sand and shale	66	319	Shale, sandy, and shale	10	717
Sand, fine, gray	21	340	Shale	51	768
Shale, sandy and shale and shell	53	393	Sand, black specks; shale breaks	106	874
Sand, fine	23	416	Sand, fine, hard and shale, sandy	76	950
Shale and sandy shale	53	469	Shale	8	958
Sand with black specks	101	570			

Well M-14

[Owner: Stewart Production Co. Driller: L. Patterson. Reported altitude 6 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	21	21	Shale	47	546
Sand	3	24	Sand, fine	30	576
Clay	83	107	Shale	52	628
Sand, fine	20	127	Sand, fine	21	649
Clay	84	211	Shale	47	696
Sand, fine	22	233	Sand, fine	34	730
Shale	243	476	Shale	4	734
Sand, fine	23	499	Sand, medium coarse	39	773

Well M-23

[Owner: Carbide & Carbon Chemicals Corp., well 7. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Clay	10	454
Clay, pink and white	48	50	Sand	46	500
Sand, fine, gray, some clay	60	110	Clay	21	521
Clay, sand streaks	36	146	Clay, sandy, and clay	40	561
Clay, pink	33	179	Sand	13	574
Sand	5	184	Clay, few sand breaks	73	647
Clay	24	208	Sand, clean cut	66	713
Clay, sandy	18	226	Clay	22	735
Clay	18	244	Sand, clay streaks	51	786
Sand, some clay	46	290	Sand, cut clean	40	826
Clay	11	301	Clay, sandy, clay streaks	6	832
Sand	89	390	Sand, shale layers	26	858
Clay, sandy, clay streaks	33	423	Sand, cut hard	158	1,016
Sand	21	444	Shale	12	1,028

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-24

[Owner: Carbide & Carbon Chemicals Corp., well 6. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Sand	21	387
Clay, sandy clay	12	16	Sand and shale breaks	50	437
Sand	10	26	Sand	8	445
Clay, red	50	76	Sand and shale	51	496
Sand, fine, gray	34	110	Sand, fine, gray	11	507
Shale	28	138	Sand, shale and shell	18	525
Sand	10	148	Sand	20	545
Shale	8	156	Shale	24	569
Sand, fine, gray, and a few shale breaks	51	207	Sand, cut good	19	588
Shale	45	252	Shale and sandy shale	29	617
Shale, sandy, and shale	40	292	Sand and shale breaks	17	634
Shale, sticky	3	295	Shale and streaks of sand	17	651
Sand, cut good	15	310	Sand, cut good	53	704
Sand, breaks of shale	56	366	Shale	9	713

Well M-25

[Owner: Carbide & Carbon Chemicals Corp., well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	1	1	Shale	9	463
Clay	15	16	Sand	19	482
Sand and clay	38	54	Shale, sandy	10	492
Clay, red and white	22	76	Sand with shale layers	16	508
Sand	2	78	Shale	12	520
Clay	12	90	Sand and shale layers	65	585
Sand, fine	12	102	Sand	4	589
Clay, soft gray, and sand	23	125	Shale	26	615
Shale, soft gray	15	140	Sand with shale layers	15	630
Shale, tough gray	37	177	Shale with sand layers	33	663
Shale, sandy	44	221	Shale	6	669
Shale	29	250	Sand, fine	63	732
Sand, fine, with shale layers	39	289	Shale	18	750
Shale	10	299	Sand	33	783
Shale, sandy	9	308	Shale	7	790
Shale, hard	10	318	Sand with shale layers	36	826
Shale, sandy	44	362	Sand	14	840
Sand with shale layers	33	395	Sand with thin shale layers	15	855
Shale	49	444	Sand	170	1,025
Sand, gray	10	454			

Well M-26

[Owner: Carbide & Carbon Chemicals Corp., well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	2	2	Shale, sandy	21	464
Clay, white	6	8	Shell and gravel	10	474
Clay, brown	24	32	Shale, tough	10	484
Sand and clay	30	62	Sand and shell	32	516
Clay	47	109	Sand	27	543
Sand and clay	16	125	Shale with layers of sand	41	584
Sand	11	136	Shale	21	605
Shale	42	178	Shale with sandy layers	40	645
Shale, sandy	46	224	Sand	44	689
Shale, sticky	20	244	Shale with layers of fine sand	36	725
Shale with layers of sand	51	295	Shale, tough	29	754
Shale, loose	18	313	Shale, sandy	14	768
Shale, sticky	13	326	Sand	54	822
Shale, sandy, and shell	33	359	Sand with thin shale layers	121	943
Shale	72	431	Sand	44	987
Sand, fine, gray	12	443	Shale, hard	13	1,000

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-27

[Owner: Carbide & Carbon Chemicals Corp., well 5. Driller: Layne-Texas Co., Ltd. Reported altitude 14 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand, good	6	449
Clay	8	11	Shale, hard	13	462
Sand, red	10	21	Shale, sandy	22	484
Clay, sandy, and sand	89	110	Shale, hard	12	496
Sand, fine, gray	24	134	Shale and sand	40	536
Shale and sand breaks	130	264	Shale	6	542
Sand and shale	45	309	Shale and some sand breaks	77	619
Shale, tough	16	325	Sand	5	624
Sand, shale, and shell	94	419	Shale, sandy	13	637
Shale, hard	11	430	Shale	10	647
Shale, sandy	8	438	Sand, good	35	682
Shale, hard	5	443	Shale, sandy	18	700

Well M-28

[Owner: Pan American Refining Corp., well 7. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Shale	70	518
Clay, red	7	9	Sand	118	636
Sand with layers of clay	30	39	Shale	10	646
Clay, sandy	23	62	Sand	37	683
Sand, fine	50	112	Shale	91	774
Sand and clay	40	152	Sand and shale	32	806
Clay	28	180	Shale	14	820
Clay, blue and shell	70	250	Shale, sandy	17	837
Sand, fine, blue	42	292	Shale	24	861
Clay	11	303	Sand	47	908
Sand	8	311	Shale	5	913
Clay	6	317	Sand	102	1,015
Sand, fine	71	388	Sand and shale	9	1,024
Shale and sand	60	448			

Well M-29

[Owner: Pan American Refining Corp., well 8. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand	33	550
Sand and clay	180	182	Shale	76	626
Clay, sandy	18	200	Sand	21	647
Shale	140	340	Shale	78	725
Sand and shale	25	365	Sand	12	737
Shale	16	381	Shale	68	805
Sand	29	410	Sand and shale	84	889
Sand and shale	28	438	Sand	91	980
Shale	17	455	Shale	20	1,000
Sand and shale	62	517			

Well M-30

[Owner: Pan American Refining Corp., well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand, gray	67	427
Clay	5	7	Shale, sticky	36	463
Sand, red	17	24	Sand	20	483
Sand, gray, with streaks of clay	63	87	Shale, sandy	92	575
Sand, gray	34	121	Gumbo	88	663
Shale, sandy	114	235	Sand, coarse	118	781
Gumbo	20	255	Gumbo	5	786
Shale, sandy, gray	35	290	Sand	35	821
Shale	44	334	Sand with streaks of shale	42	863
Shale and shell	26	360	Sand	111	974

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-31

[Owner: Pan American Refining Corp., well 5. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand and shale	104	587
Clay	5	7	Shale, sticky	58	645
Sand, red	17	24	Gumbo	23	668
Sand and clay	211	235	Sand	36	704
Clay	20	255	Sand and shale	87	791
Shale, sandy	35	290	Sand	32	823
Shale and shell	70	360	Sand and shale	47	870
Sand, gray	67	427	Sand	86	956
Shale, sticky	36	463	Sand and shale	9	965
Sand	20	483			

Well M-32

[Owner: Pan American Refining Corp., well 11. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Shale	20	472
Clay, sandy	8	10	Sand	5	477
Clay, brown, sandy	41	51	Shale	17	494
Clay	39	90	Shale, hard	28	522
Sand, gray	20	110	Shale, sandy	11	533
Clay and sand breaks	37	147	Shale	4	537
Clay	38	185	Sand	5	542
Clay, tough	18	203	Shale and shell	29	571
Sand	10	213	Sand	8	579
Clay	36	249	Shale and strips of shell	38	617
Clay, tough	14	263	Shale, sandy	5	622
Clay, sandy	7	270	Sand, good	8	630
Sand and sandy clay	24	294	Shale	13	643
Clay, sandy, and clay	24	318	Sand and shale	24	667
Clay and sand breaks	36	354	Sand, good	42	709
Shale	14	368	Shale, hard	10	719
Shale, sandy	8	376	Sand, no gravel	33	752
Shale	5	381	Shale, hard, sand and shell breaks	26	778
Sand and shale	6	387	Shale and sand breaks	16	794
Sand	10	397	Sand, good	29	823
Shale	31	428	Shale	18	841
Shale, hard, and sand	19	447	Sand	69	910
Sand	5	452			

Well M-33

[Owner: Pan American Refining Corp., well 10. Reported altitude 13 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Shale	54	641
Clay	14	17	Shale, sandy	22	663
Sand	19	36	Shale, hard	8	671
Shell, sand, and clay	12	48	Shale, sandy	6	677
Clay, soft, sandy	115	163	Sand, good	32	709
Shale	70	233	Shale, sandy	2	711
Sand, shale, and shell	165	398	Shale	11	722
Sand	7	405	Shale, sandy	19	741
Shale and sand	26	431	Sand, good	26	767
Sand	6	437	Shale and a few sand layers	40	807
Shale	19	456	Sand and shale breaks	24	831
Sand	9	465	Shale, sandy	17	848
Shale, sandy	29	494	Sand and a few shale breaks	26	874
Shale, tough	31	525	Sand, cut good	128	1,002
Sand, good	38	563	Shale	5	1,007
Sand and shale layers	24	587			

Well M-34

[Owner: Pan American Refining Corp. Driller: J. A. Walling. Reported altitude 11 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, yellow	10	10	Gumbo, blue	107	473
Sand	5	15	Clay, blue	231	704
Clay, white	45	60	Sand, white	31	735
Sand, red	20	80	Clay, blue	165	900
Clay, blue	286	366	Sand, white	93	993

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-35

[Owner: Republic Oil Refining Co., well 4. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	4	4	Clay, tough	12	600
Clay and sand	20	24	Sand, fine	25	625
Clay	69	93	Shale, hard, sticky	29	654
Sand, white	26	119	Shale, sandy	31	685
Clay, sand and shell breaks	61	180	Shale and sand breaks	25	710
Clay, tough	47	227	Sand	23	733
Shale and sand layers	29	256	Shale, sandy	7	740
Shale, sticky	13	269	Sand	10	750
Sand and shale breaks	44	313	Sand and shale	20	770
Shale, sticky, and layers of sand	75	388	Shale and sand layers	35	805
Shale, sandy	17	405	Sand and shale layers	17	822
Shale, shell, and sand layers	50	455	Shale, sticky and sand breaks	20	842
Sand and layers of shale	47	502	Sand and shale breaks	20	862
Shale, sticky	17	519	Sand, good	44	906
Shale, sandy	39	558	Sand and shale layers	23	929
Clay, tough	10	568	Sand, good	54	983
Sand, fine	20	588	Sand and shale layers, cut good	34	1,017

Well M-36

[Owner: Republic Oil Refining Co., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	3	3	Sand and shale	4	580
Clay	4	7	Clay, tough	8	588
Sand and clay breaks	84	91	Sand	7	595
Sand	20	111	Clay, tough	10	605
Clay and sand breaks	75	186	Sand, fine	11	616
Clay, tough	22	208	Shale, sandy	18	634
Shale and sand breaks	48	256	Shale, hard, sticky	30	664
Shale and sandy shale	104	360	Shale	12	676
Shale, sticky	29	389	Shale, sticky	14	690
Shale, shell, and sand layers	32	421	Sand	5	695
Shale, sticky	40	461	Shale, sticky	11	706
Sand	47	508	Sand	29	735
Shale, sticky	58	566	Sand and shale breaks	24	759
Sand	10	576			

Well M-37

[Owner: Republic Oil Refining Co., well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 7 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	6	6	Shale, soft, and shell	72	346
Clay, red	5	11	Shale, sandy, and sand	31	377
Sand, red	10	21	Shale, soft blue and brown	82	459
Clay, soft, red	55	76	Sand with layers of sandy shale	37	496
Clay, soft, blue	20	96	Shale	60	556
Sand, white	25	121	Sand	20	576
Clay, blue	10	131	Shale	84	660
Sand	15	146	Sand	10	670
Clay	10	156	Sand with a few shale layers	113	783
Sand, shell, and blue clay	20	176	Shale, tough	33	816
Clay, tough	25	201	Sand	28	844
Sand	13	214	Shale	5	849
Shale	14	228	Sand	6	855
Sand	6	234	Shale	10	865
Shale	40	274	Sand	144	1,009

Well M-38

[Owner: Texas City Refining Inc., well 2. Driller: Texas Water Wells Inc. Reported altitude 14 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, surface	30	30	Shale and sand streaks	22	424
Shale, sandy	30	60	Shale, sticky	23	447
Shale, hard blue	30	90	Shale, hard	71	518
Shale, sandy	20	110	Shale, sticky	57	575
Shale	25	135	Sand, hard	15	590
Shale, sticky	25	160	Shale and shell	60	650
Sand, fine, and shale	20	180	Shale, hard	20	670
Shale, sticky	65	245	Shale, sandy	45	715
Shale, hard	25	270	Sand	30	745
Shale, sandy	10	280	Shale, sticky	25	770
Sand, hard, fine	20	300	Shale, hard, sandy	20	790
Shale, sandy	25	325	Lime, hard, sandy	40	830
Sand, coarse	15	340	Shale, sandy	45	875
Shale, sandy	40	380	Sand, medium	21	896
Shale, sticky	22	402	Sand, coarse	119	1,015

419189—57——10

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-39

[Owner: Texas City Refining Inc., well 1. Driller: Texas Water Wells, Inc. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay and fine sand	90	90	Sand	19	727
Shale, sandy	35	125	Shale, hard	40	767
Shale, sticky	115	240	Shale, soft	15	782
Sand, fine, hard	40	280	Shale, sticky	23	805
Shale, sticky	80	360	Sand	10	815
Shale, soft, sandy	68	428	Shale	9	824
Shale, hard	32	460	Sand	20	844
Sand, hard	44	504	Shale	20	864
Sand, medium	71	575	Sand, poor	30	894
Shale, sticky	25	600	Sand, fine	22	916
Shale with sand streaks	30	630	Sand	100	1,016
Sand, medium	20	650	Shale, sticky	2	1,018
Shale, hard, with sand streaks	20	670	Sand, silty	32	1,050
Shale, sticky	38	708			

Well M-40

[Owner: Texas City Refining Inc., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	3	3	Clay, sandy	55	410
Clay, soft	27	30	Sand	12	422
Clay, sandy, and sand	23	53	Sand, sandy clay and clay	50	472
Clay, sandy	32	85	Sand, good	38	510
Clay	12	97	Clay	15	525
Sand	20	117	Sand	5	530
Clay and sandy clay	52	169	Clay	19	549
Clay, sticky	28	197	Sand	37	586
Clay and layers of sand	81	278	Clay, hard	20	606
Clay, sandy and fine	40	318	Sand	22	628
Clay	7	325	Clay	5	633
Sand	10	335	Clay, hard	22	655
Sand and clay	20	355			

Well M-43

[Owner: Carbide & Carbon Chemicals Corp. Driller: Layne-Texas Co., Ltd. Reported altitude 4 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	4	4	Shale	107	392
Clay and sand	50	54	Shale, sandy	18	410
Sand, fine	42	96	Shale	56	466
Shale and sand	101	197	Sand	44	510
Shale	73	270	Shale	3	513
Shale, sandy	15	285			

Well M-45

[Owner: Tin Processing Corp., well 1. Driller: Layne-Texas Co., Ltd. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand	8	383
Clay	30	32	Clay	10	393
Sand and shell	10	42	Sand and clay breaks	24	417
Sand and clay breaks	64	106	Clay and sand breaks	65	482
Sand, shell and clay	46	152	Clay	7	489
Clay	40	192	Sand	16	505
Clay and sand	15	207	Clay	15	520
Sand	14	221	Clay, shell, and sand	22	542
Clay and sand layers	53	274	Clay	13	555
Sand	22	296	Sand	30	585
Sand and clay	24	320	Clay	12	597
Clay	12	332	Clay and sand layers	26	623
Sand and clay	26	358	Clay	5	628
Clay	17	375	Shale, hard, tough	74	702

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well M-46

[Owner: Tin Processing Corp., well 2. Driller: Layne-Texas Co., Ltd. Reported altitude 12 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Sand and clay breaks	72	420
Clay	8	10	Clay	57	477
Clay, sandy	14	24	Sand	6	483
Clay, sand, and shell	22	46	Clay	8	491
Clay and shell breaks	53	99	Sand and shell, good	19	510
Sand and clay breaks	42	141	Sand, shell, and shale	43	553
Clay	71	212	Sand	28	581
Sand, fine, muddy	12	224	Shale	13	594
Clay	46	270	Shale and thin layers of sand	33	627
Sand and clay	68	338	Shale, tough	69	696
Clay	10	348			

Well M-47

[Owner: Tin Processing Corp., well 3. Driller: Layne-Texas Co., Ltd. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	3	3	Clay and sandy clay	40	285
Clay, white	7	10	Sand and clay layers	56	341
Sand, red	11	21	Sand	107	448
Clay, red, and sand	12	33	Clay	11	459
Clay	19	52	Sand	11	470
Clay, sandy	53	105	Clay, sandy	21	491
Clay	19	124	Clay and sand streaks	41	532
Sand and sandy clay	31	155	Clay and sand breaks	38	570
Clay	17	172	Sand	24	594
Sand and clay breaks	28	200	Clay and sand streaks	19	613
Clay	15	215	Shale, tough	30	643
Sand and sandy clay	30	245			

Well N-1

[Owner: Gulf Coast & Santa Fe Railroad. Driller: Layne-Texas Co., Ltd. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand	120	120	Gumbo, blue	7	605
Sand and shell	172	292	Shale, hard	16	621
Rock	2	294	Sand, gray	27	648
Shale, gray, sand and shell	124	418	Shale and gumbo	324	972
Gumbo, blue	28	446	Sand, gray	35	1,007
Shale, blue	53	499	Gumbo	56	1,063
Clay	93	592	Shale, hard, and sulfur	25	1,088
Sand, fine, and shell	6	598			

Well N-4

[Owner: Todd Shipbuilding Corp. Driller: Layne-Texas Co., Ltd. Reported altitude 15 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay	3	3	Sand, fine, gray	28	584
Sand	9	12	Shale and sandy shale	121	705
Sand, shell, and mud	53	65	Shale	116	821
Clay with shale streaks	5	70	Shale, sandy	34	855
Shale	75	145	Clay and sand	21	876
Shale, sandy	21	166	Shale	40	916
Sand with shale streaks	14	180	Clay	10	926
Sand, fine, white	48	228	Shale and streaks of sand	40	966
Shale	11	239	Shale	76	1,042
Clay	61	300	Shale, sandy	58	1,100
Sand	15	315	Shale	15	1,115
Shale	71	386	Shale, sandy, and shale	35	1,150
Shale with shale streaks	18	404	Shale, sandy	20	1,170
Shale with thin streaks of sand	50	454	Shale, sandy, and shale	36	1,206
Sand	11	465	Shale, sandy	20	1,226
Shale	39	504	Sand	114	1,340
Shale with sand streaks	52	556	Clay	10	1,350

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well N-5

[Owner: Galveston Ice & Cold Storage Co. Driller: McMasters & Pomeroy. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface and sand	40	40	Sand	50	295
Clay	50	90	Clay	29	324
Mud, sea	20	110	Sand	33	357
Clay	29	139	Shale	10	367
Sand	39	178	Shale, sandy	19	386
Shale, sandy	31	209	Gumbo	32	418
Sand	15	224	Sand	40	458
Clay	21	245			

Well N-5a

[Owner: Galveston Ice & Cold Storage Co. Driller: Layne-Bowler Co. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	33	33	Sand	5	783
Clay and shale	118	151	Gumbo	35	818
Sand, fine	35	186	Sand	65	883
Clay	81	267	Gumbo	38	921
Sand	24	291	Sand	17	938
Clay	122	413	Gumbo	57	995
Sand	39	452	Shale and rock	10	1,005
Gumbo	9	461	Gumbo	54	1,059
Sand, packed	9	470	Shale and sand	40	1,099
Gumbo and shale	79	549	Gumbo	23	1,122
Sand rock	27	576	Sand rock	6	1,128
Gumbo	75	651	Gumbo	89	1,217
Shale	26	677	Sand rock	125	1,342
Gumbo	78	755	Gumbo	3	1,345
Sand	10	765			
Gumbo	13	778			

Well N-6

[Owner: Frazier Ice & Cold Storage Co. Driller: Layne-Texas Co., Ltd. Reported altitude 10 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface	10	10	Clay	91	652
Sand	31	41	Sand	11	663
Clay, soft	26	67	Clay	88	751
Sand	13	80	Sand, muddy	17	768
Clay and shale	38	118	Clay	57	825
Clay	58	176	Sand, white	57	882
Sand	36	212	Gumbo	114	996
Shale	62	274	Rock	1	997
Sand	20	294	Gumbo	130	1,127
Clay	60	354	Clay	23	1,150
Gumbo	62	416	Sand, hard	20	1,170
Clay	43	459	Gumbo	84	1,254
Shale	62	521	Sand, hard	83	1,337
Gumbo	20	541	Gumbo	9	1,346
Shale and clay	20	561			

TABLE 13.—*Drillers' logs of wells in Galveston County, Tex.*—Continued

Well N-8

[Owner: City of Galveston. Driller: Galveston Artesian Well Co. Reported altitude 8 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, gray	46	46	Clay and sand	28	2,425
Clay, red with shell	17	63	Clay, red	8	2,433
Clay, red and blue	21	84	Sand, water	10	2,443
Sand, fine	16	100	Clay, blue	5	2,448
Sand and clay	205	305	Clay, red	3	2,451
Clay, red and shell	13	318	Lignite	2	2,453
Clay, red	20	338	Sand, gray	12	2,465
Sand	102	440	Clay, red	11	2,476
Sand and clay	387	827	Clay, blue	9	2,485
Sand	8	835	Sand, gray	19	2,504
Sand, water	47	882	Sand, water	17	2,521
Clay and sand	207	1,089	Clay and sand	31	2,552
Sand rock	1	1,090	Clay, blue	15	2,567
Sand and clay	170	1,260	Sand, hard	31	2,598
Sand, water	28	1,288	Clay, blue and red	33	2,631
Sand and clay, hard sandstone	205	1,493	Sand, hard, gray	6	2,637
Clay	17	1,510	Clay, red and blue	16	2,653
Clay, shell, and gravel	10	1,520	Clay, yellow	45	2,698
Sand and clay	234	1,754	Clay, blue and yellow	9	2,707
Sandstone, hard	4	1,758	Sand, gray	10	2,717
Sand	104	1,862	Clay, blue	16	2,733
Clay and sand	291	2,153	Clay, soft blue	48	2,781
Clay and shell	43	2,196	Sand, hard gray	102	2,883
Sand and clay	92	2,288	Clay, soft blue	37	2,920
Limestone	3	2,291	Sand, hard gray	65	2,985
Sand, clay, and shell	58	2,349	Clay, blue	40	3,025
Sand, water	48	2,397	Sand, gray	45	3,070

Well N-11

[Owner: Galveston Wharf Co. Driller: Layne-Texas Co., Ltd. Reported altitude 4 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand and clay	29	29	Gumbo	220	1,028
Clay	97	126	Sand	178	1,206
Sand	147	273	Gumbo	78	1,284
Clay	59	332	Sand	15	1,299
Sand	70	402	Gumbo	36	1,335
Sand, clay layers	41	443	Sand	44	1,379
Gumbo	291	734	Shale, sand layers	44	1,423
Sand	32	766	Sand	68	1,491
Gumbo	28	794	Gumbo	7	1,498
Sand	14	808			

Well Q-3

[Owner: Maco Stewart. Driller: Layne-Texas Co., Ltd. Reported altitude 5 feet]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand	52	52	Sand	23	414
Clay	11	63	Shale	175	589
Sand	3	66	Sand	53	642
Sand, shell, and shale	154	220	Shale	358	1,000
Shale	171	391			

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*

[Analyses given are in parts per million except specific conductance, pH, and percent sodium]

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
A-1	J. L. Jones	90	Feb. 15, 1939					176	385	12	272		0.0	773	330
A-2	do	500±	do					212	410	5	212		1.0	689	180
A-3	do	505	do					106	310	1	36		.1	318	75
A-4	Mrs. Mary Baker	90	do					165	399	13	197		.0	666	262
A-7	Cecil Brown	562	do					104	297	1	39		.1	311	74
A-7	do	562	Aug. 8, 1941		22	20	4.9	116	316	2	42	0.7	.0	351	70
A-7	do	562	Mar. 30, 1951	588					298		42				72
A-8	H. Allman	120	Feb. 21, 1939					159	401	10	295	.5	2.8	825	412
A-9	E. A. Glines	123	Feb. 17, 1939					177	374	12	308		.0	821	368
A-10	Old Friendswood School	440	Feb. 16, 1939					101	284	1	33	.5	.4	293	63
A-11	Friendswood School District	560	do					215	370	31	370		.0	944	390
A-13	Friends Church	113	Feb. 22, 1939					242	346	35	450			1,060	428
A-14	H. W. Bales	140	Feb. 20, 1939					204	382	27	348		1.5	915	390
A-15	H. F. Schelling	160	do					221	378	44	450			1,100	510
A-16	O. K. Bowles	144	Feb. 23, 1939					195	425	1	260		.5	772	292
A-17	Mrs. Annette Voss	763	May 7, 1951	1,450					561		175				138
A-19	G. G. Anderson	635	Feb. 24, 1939					121	304	1	41		.3	321	45
A-19	do	635	Mar. 29, 1951	612					310		43				54
A-20	E. D. Altemus	170	Feb. 23, 1939					286	444	1	320		1.5	886	195
B-1	Hall J. McConnell	514	Mar. 16, 1939					171	344	1	82			419	27
B-1	do	514	Apr. 10, 1951	778					330		84				30
B-2	D. D. McDonald	60	Mar. 17, 1939					348	456	23	755			1,620	705
B-3	R. E. Ketchey	562	Apr. 10, 1951	1,060	29	7.6	3.2	221	383	0	141		.2	590	32
B-4	J. S. Gissel	655	Mar. 17, 1939					258	416	1	175			629	28
B-4	do	655	Mar. 28, 1940					259	426	1	177			640	36
B-5	J. M. Robinson	545	do					210	375	1	131			524	36
B-6	J. E. Haviland	600	Mar. 17, 1939					227	384	1	150			561	33
B-7	E. W. Platzer	368	Mar. 22, 1939					195	404	1	92			485	38
B-9	H. T. James	605	Mar. 21, 1939					212	472	1	96			549	63
B-11	Bay Shore Lumber Co	106	Mar. 17, 1939							4	172				
B-12	Clear Lake Shores	578	do					222	380	1	140			542	28
B-13	A. L. Schmidt	467	do					212	364	1	138			526	34
B-17	Chas. A. Davis	570	Mar. 16, 1939					176	342	1	100			446	40
B-18	I. M. Singeltary	35	Mar. 14, 1939					129	498	12	150		.3	672	352
B-19	W. L. Price	48	do					130	440	8	170		3.1	655	330
B-21	Waters Davis	707	Jan. 30, 1952	1,450	14	10	3.2	311	408	.2	270		.2	855	38
B-22	H. A. Sawyer	25	Mar. 15, 1939					174	494	3	200		.7	771	345
B-23	H. F. Thompson	74	do					100	358	7	85		.1	444	204
B-25	Texas Corthinian Yacht Club	163	Mar. 22, 1939					241	580	1	150			726	165
B-28	H. Beckman	202	Mar. 23, 1939					287	592	1	171			768	104

B-30	John Vaglienti	160	Mar. 16, 1939					177	319	20	210			630	195
B-31	R. E. McQuirk	152	do					229	514	30	197			786	232
B-32	Galveston County Water Control & Improvement District No. 2 well 2	590	May 5, 1951	839					354		96				32
B-33	J. S. Matlock	500+	Mar. 13, 1939					187	333	1	108			470	38
B-34	F. A. Reynolds	275	do					251	490	30	242			838	228
B-35	W. G. Hall	200	Mar. 14, 1939					256	500	1	212			757	154
B-36	H. W. Thompson	550	Mar. 13, 1939					167	328	1	86			412	27
B-37	Galveston, Houston, & Henderson RR	1,020	Prior to 1914		12	21	9.2	739	560		870			2,020	
B-38	Galveston County Water Control & Improvement District No. 2 well 1	701	July 24 1941		22	8.9	3.4	242	344	3	195	.9	0	645	36
B-38	do	701	Aug. 5, 1951	1,540					643		195				37
B-39	Emil Schenk	575	Mar. 14, 1939					173	330	1	85			426	28
B-41	Mrs. M. M. Summers	210	do					244	556	1	195			777	202
B-42	John Best	208	Mar. 13, 1939					225	514	1	131			639	117
B-43	W. F. McKibben	200	do					243	538	1	178			735	165
B-44	F. Wallrab	150	Mar. 11, 1939					249	509	4	282			457	278
B-45	J. H. Ross	600	July 25, 1941				21	87	320	2	74		.0	379	179
B-45	do	600	May 7, 1951	710					318		75				46
B-45	do	600	May 4, 1954		32	11	3.1	144	312	1.0	68	.2	.5	415	40
B-46	O. Haardt	65	Mar. 8, 1939					215	426	30	250		3.0	801	267
B-47	Stewart Hervey	165	do					159	436	15	166			650	262
B-48	J. F. Thompson	74	Mar. 13, 1939					192	430	30	365			984	480
B-50	Zelda Smith	800	do					236	512	2	225			789	225
B-52	D. Moratto	170	Mar. 15, 1939					278	568	1	215			819	165
C-4	W. P. Derrick	140	Mar. 19, 1939			38	20	261	555	20	190			802	177
C-5	C. D. Voss	614	Feb. 14, 1952	1,160					404		175				36
C-6	Grogan & Curry	541	do	1,100					412		155				32
C-7	Bay Shore Investment Co.	555	Apr. 20, 1939			8.4	2.7	244	427	2	149			616	32
C-9	A. F. Richter	163	do						653	15	250			947	
C-10	J. R. Heckendorn	150	Apr. 21, 1939			58	35	383	744	15	350			1,210	286
C-11	F. G. Eidman	687	May 16, 1939					199	398	1	86	1.2		473	20
D-2	L. Z. Pledger	800	Feb. 27, 1939					146	346	1	55			378	45
D-2	do	800	Feb. 29, 1951	679					331		55				42
D-3	J. M. West	600	Feb. 28, 1939					109	298	1	39			312	64
D-3	do	600	Mar. 30, 1951	560					264		38				42
D-5	Otto Letzerich	500	Mar. 1, 1939					112	300	1	39			314	58
D-7	P. V. Leavenworth	600	Mar. 6, 1939					197	412	2	252			749	267
D-8	Geo. S. Taylor	127	Mar. 3, 1939					215	330	2	250			679	159
D-9	Gerald Mora	550	Dec. 18, 1951	705	22	15	3.4	143	334	.2	62		.0	445	52
D-10	J. H. Butte	360	Mar. 1, 1939					257	373	7	340			865	234
D-12	Dillard Waltermire, Inc.	676	Aug. 15, 1951	1,790	18	25	11	342	337	.7	408		.0	971	108
D-15	John Rezuk	32	Apr. 25, 1939			23	28	85	543	3	42			503	322
D-16	C. W. Van Dyke	42	Apr. 26, 1939			116	16	30	445	1	38			420	355
D-17	Mrs. A. F. Winton	103	Apr. 25, 1939			107	44	186	390	16	365	.9		910	447
D-18	Missouri Pacific R. R.	650	May 1, 1939					203	334	1	158			533	57
D-19	R. McPeters	70	Apr. 26, 1939						476	1	36			448	
D-20	W. A. Barber	325	do			89	21	78	427	8	84	.4		490	308

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
D-22	T. C. Scruggs	32	Mar. 4, 1939							2	36				
D-23	C. E. Holbert	160	May 2, 1939					70	490	4	44			484	315
D-24	L. C. Williams	226	do			19	11	241	561	1	110	0.8		658	92
D-25	J. A. Unger	360	Apr. 27, 1939			98	24	56	500	3	38			465	345
E-1	M. B. Butler	125	Mar. 13, 1939					272	484	18	332			960	292
E-2	do	109	do					273	458	54	428			1,140	442
E-4	Joe Daro	168	Mar. 17, 1939					162	502	2	138			642	255
E-5	O. M. Trippodo	105	Apr. 5, 1939			88	57	293	470	66	452			1,190	455
E-6	Mrs. Lena Ferro	100+	Mar. 17, 1939					302	556	36	340			1,060	315
E-9	Phillips Petroleum Co.	432	Sept. 15, 1939		14	8.1	2.7	176	378	.2	74		0.0	462	31
E-10	Midstates Oil Co.	650±	Mar. 24, 1939			11	2.4	165	378	3	58			425	37
E-13	Ross Stewart	716	do					154	344	1	54			375	24
E-17	E. P. Howell	694	Mar. 27, 1939			12	2.7	212	317	2	170			555	42
E-18	Magliola & Salvato	750	Mar. 28, 1939			4.8	3.6	182	378	1	78		1.0	457	27
E-19	Carl Kobarg	160	Mar. 27, 1939			106	58	362	531	61	559			1,410	501
E-22	Mrs. Hans Guildman	1,200±	do			33	11	775	506	1	990			2,060	127
E-23	Paul Lobit	250	do			25	12	312	634	1	192			857	113
E-24	——Reicher	463	May 18, 1939			1.6	3.2	178	372	1	70			437	17
E-28	Galveston County Water Control & Improvement District No. 1 well 2	576	Mar. 29, 1935			5.0	1.5	181	370	1.7	75		.6	447	19
E-28	do	576	Nov. 2, 1937						370	1	76				
E-28	do	576	Feb. 20, 1939					181	366	1	77		.9	431	16
E-28	do	576	Apr. 20, 1944	838	14	5.4	1.3	186	370	2	79	1.0	.2	471	19
E-31	G. Marselli	600	Apr. 5, 1939			6.0	2.0	211	390	1	108			518	23
E-32	E. Menotti	504	do			3.2	3.4	203	415	1	86			501	22
E-34	Mineral Oil Refining Co.	875	Aug. 16, 1926			15	7.0	736	344	1.7	985			1,920	66
E-34	do	230	July 18, 1933			20	12	296	600	.8	175			832	99
E-37	C. L. Dobbins	940	May 13, 1939					286	396	5	232			708	36
E-38	do	201	Apr. 10, 1939			29	11	323	671	1	190			887	117
E-40	Izaac Lippman	626	Mar. 23, 1939					247	392	1	175			609	32
E-45	Pure Oil Co.	620	do					253	396	1	175			611	22
E-47	Humble Oil & Refining Co.	605	Apr. 11, 1939			11	2.4	255	415	1	177			650	37
E-47	do	605	Nov. 9, 1950	1,520					630		190				97
E-48	Midstates Oil Co.	434	Mar. 23, 1939					261	500	1	135			634	34
E-49	D. J. Corbett	820	1941					461	472	3	495			1,290	86
E-51	— Burpee	601	Jan. 24, 1952	1,010					428		112				20
E-53	Ed Salzmann	253	Mar. 22, 1939					305	630	1	180			814	108
E-54	Mrs. Otilla Collogne	825	Feb. 6, 1952	2,100	18	14	4.9	438	390	8.4	480	1.0	.2	1,110	55

E-55	C. M. Wolston	210	Mar. 22, 1939					295	582	1	198			803	117
E-56	Will Horwitz Estate	608	Apr. 11, 1939			4.8	3.6	173	366	1	72			435	27
E-57	C. J. Palmo	90	Mar. 24, 1939							120	430				
E-58	R. L. Allen	208	do					268	626	2	123			721	105
E-60	Mrs. C. B. Benson	100	do					327	582	44	330			1,080	278
E-62	E. Harris	100	Mar. 23, 1939					199	526	2	255			849	360
E-62a	do	477	Apr. 3, 1952	1,120	16	11	6.4	233	460	.2	130		1.2	642	54
E-64a	G. D. Butler	96	Mar. 31, 1939			78	41	155	512	11	192			729	366
E-65	Three Bee Investment Co.	700±	do						451	1	117			553	
E-67	Midstates Oil Co.	700	Apr. 11, 1939			6.8	2.4	264	500	1	134			654	27
E-69	Mrs. M. Moore	64	Mar. 23, 1939					195	524	1	230			806	330
E-71	O. E. Coleman	110	do					98	467	25	74			543	300
E-73	Humble Oil & Refining Co.	828	Mar. 21, 1939			96	63	328	537	37	520			1,310	499
E-74	City of Galveston test well 7-10	[1] 763	Feb. 7, 1942		18	13	3.9	205	350	15	134	.7	.0	591	48
E-74	do	[2] 800	Feb. 12, 1942		7.2	15	5.7	296	430	18	237		.0	851	61
E-75	City of Galveston test well 12-15	[3] 742	May 8, 1942		26	20	6.4	254	348	6.0	238	.7	.0	731	76
E-75	do	[4] 783	May 9, 1942		14	27	10	401	390	9.9	460	.8	.0	1,130	108
E-76	Frank Drees	88	Mar. 29, 1939			64	32	305	604	8	318		1.5	1,030	290
E-77	Ed H. Dues	150	do			11	11	275	634	1	106			723	72
E-78	City of Galveston well 10	770	May 28, 1943		24	12	3.6	208	347	2	148	.8	0	576	45
E-78	do	770	Apr. 18, 1944			12	3.9	215	352	2	158		0	572	46
E-78	do	770	Oct. 7, 1944			14	4.0	210	347	2	157		.2	583	52
E-78	do	770	Jan. 29, 1945								158				
E-78	do	770	Jan. 16, 1946			16	4.8	218	353	1	172		0	586	60
E-78	do	770	June 7, 1946								178				
E-78	do	770	Sept. 3, 1946								181				
E-78	do	770	May 9, 1947								192				
E-78	do	770	July 11, 1947	1,140		20	4.4	228	352	2	194		0	637	68
E-78	do	770	Nov. 10, 1947	1,120		21	6.4	229	348	2	205		.5	635	79
E-78	do	770	Jan. 15, 1948	1,140							198				
E-78	do	770	Mar. 4, 1948	1,120							198				
E-78	do	770	May 21, 1948	1,170					358		202				
E-78	do	770	Nov. 17, 1948	1,160							200				
E-78	do	770	May 9, 1949	1,180	28	14	6.1	235	355	.8	198		0	656	60
E-78	do	770	Nov. 18, 1949	1,170					338		207				
E-78	do	770	May 9, 1950	1,190							206				
E-78	do	770	Nov. 10, 1950	1,130					346		210				71
E-78	do	770	May 7, 1951	1,210							218				
E-78	do	770	Nov. 6, 1951	1,180					345		215				
E-78	do	770	Apr. 29, 1952	1,230							218				
E-78	do	770	Nov. 4, 1952	1,200	26	19	5.6	236	347		210	.6	.0	680	70
E-79	City of Galveston test well 1-4	720-730	Dec. 12, 1941		33	16	6.1	188	332	2	140	.6	.0	558	65
E-79	do	760-770	Dec. 16, 1941		20	14	4.9	229	364	2	178	.5	.0	617	55
E-79	do	870-880	Apr. 7, 1942		14	30	11	597	400	.8	770	.8	.0	1,630	120
E-80	City of Galveston test well 11-14	[5] 805	Apr. 28, 1942		14	20	7.1	396	365	9.4	445	1.2	.0	1,070	79
E-81	City of Galveston well 13	810	Apr. 18, 1944			17	5.1	250	340	2	230		1.8	703	64

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25°C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
E-81	City of Galveston well 13	810	Oct. 7, 1944			17	5.3	247	348	2	223			686	64
E-81	do	810	Jan. 29, 1945								210				
E-81	do	810	Jan. 16, 1946			16	4.6	241	350	2	209			662	59
E-81	do	810	June 7, 1946								211				
E-81	do	810	Sept. 3, 1946								210				
E-81	do	810	May 9, 1947								214				
E-81	do	810	July 11, 1947	1,190		22	3.5	242	356	2	214		0.2	686	70
E-81	do	810	Nov. 10, 1947	1,170		17	5.6	245	348	2	220		.5	662	66
E-81	do	810	Jan. 5, 1948	1,190							216				
E-81	do	810	Mar. 4, 1948	1,180							214				
E-81	do	810	May 21, 1948	1,210					348		218				
E-81	do	810	Nov. 17, 1948	1,200							215				
E-81	do	810	May 9, 1949	1,210	26	15	6.1	237	343	1.6	210		.2	685	62
E-81	do	810	Nov. 18, 1949	1,200					341		216				
E-81	do	810	May 9, 1950	1,210							214				
E-81	do	810	Nov. 1950	1,190					347		210				56
E-81	do	810	May 7, 1951	1,230					352		220				64
E-81	do	810	Nov. 7, 1951	1,190					356		216				47
E-81	do	810	Apr. 29, 1952	1,200					337		213				
E-82	City of Galveston test well 6-9	[6] 769	Jan. 21, 1942		18	19	5.0	204	347	6.6	154	0.8	.0	603	68
E-83	City of Galveston well 12	781	May 27, 1943		25	13	3.7	198	347	2	134	.6		557	48
E-83	do	781	Dec. 28, 1943	1,020					347	2	154				
E-83	do	781	Oct. 7, 1944			15	5.0	222	349	2	179			595	58
E-83	do	781	Jan. 29, 1945								186				
E-83	do	781	Jan. 16, 1945			17	4.9	233	353	1	197			652	62
E-83	do	781	June 7, 1946								200				
E-83	do	781	May 9, 1947								209				
E-83	do	781	July 11, 1947	1,190		22	3.7	236	352	3	206		.0	669	70
E-83	do	781	Nov. 10, 1947	1,160		18	6.2	241	352	2	215		.5	667	70
E-83	do	781	Jan. 15, 1948	1,190							210				
E-83	do	781	Mar. 4, 1948	1,180							214				
E-83	do	781	May 21, 1948	1,180					328		214				
E-83	do	781	Nov. 17, 1948	1,200							210				
E-83	do	781	May 9, 1949	1,210	28	15	6.3	242	350	3	212			678	64
E-83	do	781	Nov. 18, 1949	1,200					348		214				
E-83	do	781	May 9, 1950	1,220							216				
E-83	do	781	Nov. 10, 1950	1,[illegible]					352		212				66
E-83	do	781	May 7, 1951	1,220							220				
E-83	do		Nov. 5, 1951	1,210					357		219				
E-83	do	781	Apr. 29, 1952	1,210					343		215				44

E-84	City of Galveston well 9	764	May 28, 1943		25	19	5.5	248	352	2	224	.7	.8	711	70
E-84	do	764	Dec. 28, 1943	1,390					341	2	281				
E-84	do	764	Apr. 18, 1943			22	6.6	272	338	3	278		1.8	780	82
E-84	do	764	Oct. 7, 1944			22	6.5	269	351	2	266		1.8	752	82
E-84	do	764	Jan. 29, 1945								264				
E-84	do	764	Jan. 16, 1946						349	2	262			738	
E-84	do	764	June 7, 1946								259				
E-84	do	764	Sept. 3, 1946								253				
E-84	do	764	May 9, 1947								258				
E-84	do	764	July 11, 1947	1,310		22	2.8	268	344	2	258		.2	728	66
E-84	do	764	Nov. 10, 1947	1,300		25	7.9	262	344	2	270		.8	737	95
E-84	do	764	Jan. 15, 1948	1,310							256				
E-84	do	764	Mar. 4, 1948	1,290							256				
E-84	do	764	May 21, 1948	1,290					312		260				
E-84	do	764	Nov. 17, 1948	1,310							250				
E-84	do	764	May 9, 1949	1,320		17	7.5	257	339	2.1	250		.2	729	74
E-84	do	764	Nov. 18, 1949	1,300					334		252				
E-84	do	764	May 9, 1950	1,350							262				
E-84	do	764	Nov. 10, 1950	1,300					337		248				77
E-84	do	764	May 7, 1951	1,310							250				
E-84	do	764	Nov. 6, 1951	1,280					335		252				
E-84	do	764	Apr. 29, 1952	1,310							250				
E-85	City of Galveston test well 5-8	[7] 764	Feb. 2, 1942		18	18	6.4	297	382	1.9	284	.5	.2	822	72
E-86	City of Galveston test well 4-7	[8] 749	Jan. 10, 1942		20	27	8.7	306	310	5	360	.5		886	103
E-87	City of Galveston well 11	771	May 28, 1943		24	17	4.8	261	338	3	245	.9	1.2	728	62
E-87	do	771	Dec. 28, 1943	1,310					331	2	257				
E-87	do	771	Apr. 18, 1944			17	5.7	268	331	2	265		1.2	734	66
E-87	do	771	Oct. 7, 1944			18	5.8	263	334	3	258		.2	712	69
E-87	do	771	Jan. 29, 1945								252				
E-87	do	771	Jan. 16, 1946						341	1	246			722	
E-87	do	771	June 7, 1946								250				
E-87	do	771	Sept. 3, 1946								247				
E-87	do	771	May 9, 1947								248				
E-87	do	771	July 11, 1947	1,310		19	3.3	264	342	2	250		.0	718	61
E-87	do	771	Nov. 10, 1947	1,260		18	6.4	264	336	2	260		.8	717	72
E-87	do	771	Jan. 5, 1948	1,280							248				
E-87	do	771	Mar. 4, 1948	1,270							250				
E-87	do	771	May 21, 1948	1,290					318		252				
E-87	do	771	Nov. 17, 1948	1,360					334		272				
E-87	do	771	May 9, 1949	1,310	28	16	6.9	257	333	.8	250		.2	731	68
E-87	do	771	Nov. 18, 1949	1,290					330		250				
E-87	do	771	May 9, 1950	1,310							250				
E-87	do	771	Nov. 10, 1950	1,300					336		252				67
E-87	do	771	May 1, 1951	1,320					338		255				64
E-87	do	771	Nov. 16, 1951	1,290					334		253				
E-87	do	771	Apr. 29, 1952	1,310					318		255				

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
E-88	City of Galveston test well 3-6	[9] 770	Dec. 6, 1941		20	25	8.3	334	346	2	380	0.6	0.0	946	96
E-88	do	[10] 791	Dec. 27, 1941		12	19	7.8	341	342	9.4	375	.7	.0	950	80
E-89	City of Galveston test well 10-13	[11] 825	Apr. 15, 1942		10	17	6.5	393	334	12	450	1.0	.0	1,050	69
E-90	G. Novelli	800	Feb. 11, 1952	979					313		158				50
E-91	Penrod Drilling Co	439	Mar. 16, 1951	980	17	9.4	4.4	212	451		94		.2	565	42
E-93	City of Galveston test well 2	[12] 801	Jan. 4, 1941		9.6	22	7.5	264	304	5.2	288	.9	.5	758	86
E-93	do	[13] 895	Jan. 17, 1941			29	13	592	332	26	790			1,660	126
E-93	do	[14] 873	Jan. 26, 1941		12	39	86	728	354	1	1,030	.9		2,020	163
E-93	do	[15] 1,206	Jan. 22, 1941			45	21	999	314	26	1,480			2,770	199
E-93	do	1,206	Jan. 26, 1941					1,340	528	36	1,860			3,470	182
E-93	do	807	July 5, 1951	3,440	10	26	7.4	690	256	1.6	990	.4	.2	1,850	96
E-94	Dairy Farmers Co-op Association	96	Jan. 26, 1939					122	420	18	63		.2	476	186
F-2	V. T. Bounds	665	May 17, 1939					206	430	1	79	1.2	.6	835	20
F-4	R. F. Zelinek	225	do					353	684	1	218	.0		920	102
F-5	T. W. Saunders	225	do					370	717	1	223	.0		956	99
F-8	C. J. Blume	557	do					333	472	1	100	1.3		557	26
F-9	A. L. Swank	487	May 15, 1939					316	108	5	167			781	52
F-10	Adams Preserving Co	656	do					282	452	1	190			683	28
F-11	Southern Pacific R. R	601	do					263	427	1	180			645	34
F-11	do	601	May 2, 1951	1,220					428		185				32
F-12	Mrs. — Butterfield	480	May 15, 1939					271	472	1	168			664	36
F-16	W. H. Sutton	200	do					335	677	2	210			901	123
F-17	do	100	do					746	412	162	1,870			3,560	1,520
F-18	Superior Oil Co	692	Aug. 21, 1951	1,300	16	7.2	2.8	238	445	.6	198			727	30
F-21	Edwards Drilling Co	645	do	1,270	16	6.5	2.7	271	397	.7	206		.2	698	27
F-22	Humble Oil & Refining Co	650	Jan. 22, 1952	1,180	15	7.0	2.0	257	392	.2	190		.2	687	26
F-25	Edwards Drilling Co	329	Apr. 16, 1952	1,300					502		170				36
F-26	John W. Mecon	656	do	1,280					470		178				30
F-28	Mainland Co	181	July 28, 1952	1,760					616		278				91
F-30	Galveston County Hospital	680	Nov. 13, 1950	1,290	8.0	9.2	3.5	286	498	6.8	173		1.0	745	38
F-31	Frank Bell	110	Apr. 12, 1939			55	27	235	598	8	184			803	247
F-33	Galveston County Water Control & Improvement District No. 3 well 2	708	Apr. 19, 1944	1,270	15	7.7	2.2	268	430	2	178	1.0	1.2	698	28
F-34	Galveston, Houston & Henderson R. R	914	Aug. 2, 1941		25	25	10	574	352	3	750	.8	.0	1,570	104
F-38	Edwards Drilling Co	326	Apr. 16, 1952	1,190					491		140				37
F-40	K. Farley	248	July 28, 1952	1,670					704		170				68

F-42	Community Public Service Co. well 6	780	Oct. 8, 1944	1,460	19	8.0	3.1	313	366	2	285	1.0	.5	819	33
F-42	do	780	May 8, 1951	1,390					446		265				32
F-43	Community Public Service Co. well 4	772	Feb. 21, 1939						446	1	250	1.1	.5	775	32
F-43	do	772	Feb. 10, 1943		18	7.0	2.5	322	490	1	228	1.0	.5	821	28
F-43	do	772	Apr. 14, 1944								248				
F-43	do	772	Oct. 29, 1946								263				
F-43	do	772	May 18, 1948	1,600					446		305				
F-44	Community Public Service Co., well 3	760	Feb. 21, 1939					334	503	1	250		.0	821	40
F-44	do	760	Mar. 10, 1943						496		235				
F-44	do	760	Oct. 29, 1946								228				
F-44	do	760	May 18, 1948	1,470					548		208				
F-44	do	760	May 8, 1951	1,480					530		235				38
F-45	Community Public Service Co., well 5	764	Mar. 10, 1943						476		210				
F-45	do	764	Apr. 14, 1944			6.1	2.0	309	485	2	210		.0	778	23
F-45	do	764	Oct. 29, 1946								207				
F-45	do	764	May 18, 1948	1,410					492		216				
F-45	do	764	Nov. 8, 1951	1,390					478		215				28
F-46	Community Public Service Co., well 7	763	June 27, 1951	1,370					486		210				26
F-47	Galveston County Water Control & Improvement District 4, well 4	728	Sept. 6, 1951	1,160					338		205				40
F-49	Galveston County Water Control & Improvement District 4, well 2	723	May 20, 1948	1,430					498		218				
F-49	do	723	Sept. 6, 1951	1,420	16	4.5	2.2	318	475	2.1	227		.2	843	20
F-50	Carbide & Carbon Chemical Corp., test well 1	1,031	Mar. 16, 1941			48	20	969	335	3	1,440			2,690	202
F-51	Carbide & Carbon Chemical Corp., well 3	1,016	Aug. 11, 1941		29	48	19	842	346	2	1,240	.7		2,340	198
F-51	do	1,016	June 19, 1942		31	46	18	843	342	2	1,230	.4	2.0	2,310	189
F-51	do	1,016	Oct. 29, 1946								800				
F-51	do	1,016	May 8, 1948	2,920					358		765				
F-52	Carbide & Carbon Chemical Corp., well 4	690	Aug. 11, 1941		18	4.9	2.3	278	456	2	175	.8	.5	706	22
F-52	do	690	June 19, 1942		19	5.8	2.0	275	444	2	178	.8	.5	702	22
F-52	do	690	Mar. 11, 1943			6.4	2.4	285	450	1	195		.2	712	26
F-52	do	690	Apr. 12, 1944	1,530		6.5	2.4	283	517	2	152		.2	728	26
F-52	do	690	Oct. 29, 1946								180				
F-52	do	690	May 8, 1948	1,270					470		180				
F-52	do	690	Sept. 6, 1951	1,270					453		189				26
F-53	Pan American Refining Corp. well 6	1,000	July 14, 1939					797	346	1	1,170			2,150	195
F-53	do	1,000	June 1, 1942		24	48	19	885	337	2	1,310	.6	1.0	2,390	198
F-53	do	1,000	Mar. 10, 1943						331		1,230				
F-53	do	1,000	Jan. 1, 1944								1,080				

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
F-53	Pan American Refining Corp. well 6	1,000	Jan. 10, 1944								1,120				
F-53	do	1,000	Jan. 18, 1944								1,140				
F-53	do	1,000	Feb. 18, 1944								1,180				
F-53	do	1,000	Mar. 1, 1944								1,180				
F-53	do	1,000	Mar. 16, 1944								1,190				
F-53	do	1,000	Mar. 30, 1944								1,160				
F-53	do	1,000	Apr. 6, 1944								1,170				
F-53	do	1,000	Apr. 13, 1944								1,160				
F-53	do	1,000	Apr. 28, 1944								1,160				
F-53	do	1,000	May 4, 1944								1,170				
F-53	do	1,000	May 13, 1944								1,160				
F-53	do	1,000	May 18, 1944								1,160				
F-53	do	1,000	June 17, 1944								1,160				
F-53	do	1,000	July 6, 1944								1,160				
F-53	do	1,000	July 27, 1944								1,150				
F-53	do	1,000	Sept. 7, 1944								1,140				
F-53	do	1,000	Nov. 9, 1944								1,010				
F-53	do	1,000	Nov. 16, 1944								1,220				
F-53	do	1,000	Nov. 23, 1944								1,120				
F-53	do	1,000	Nov. 30, 1944								1,120				
F-53	do	1,000	Jan. 20, 1945								1,090				
F-53	do	1,000	Jan. 27, 1945								1,110				
F-53	do	1,000	Feb. 22, 1945								1,140				
F-53	do	1,000	Mar. 14, 1945								1,100				
F-53	do	1,000	Apr. 19, 1945								1,120				
F-53	do	1,000	Apr. 26, 1945								1,100				
F-53	do	1,000	May 3, 1945								1,100				
F-53	do	1,000	Oct. 29, 1946								1,070				
F-53	do	1,000	Sept. 6, 1951	3,050					356		800				94
F-54	Pan American Refining Corp. well 2	610	July 14, 1939					279	531	1	140			668	28
F-54	do	610	June 1, 1942		21	6.2	2.9	277	524	2	140	0.6	0.0	708	28
F-54	do	610	Mar. 10, 1943			6.8	3.2	266	491	1	145		.5	664	30
F-54	do	610	Jan. 1, 1944								141				
F-54	do	610	Jan. 10, 1944								139				
F-54	do	610	Jan. 18, 1944								139				
F-54	do	610	Mar. 1, 1944								146				
F-54	do	610	Mar. 16, 1944								141				
F-54	do	610	Mar. 30, 1944								138				
F-54	do	610	Apr. 6, 1944								145				
F-54	do	610	Apr. 13, 1944								141				

F-54	do	610	Apr. 28, 1944								139				
F-54	do	610	May 4, 1944								145				
F-54	do	610	May 13, 1944								142				
F-54	do	610	May 18, 1944								142				
F-54	do	610	June 17, 1944								144				
F-54	do	610	July 6, 1944								139				
F-54	do	610	July 27, 1944								142				
F-54	do	610	Sept. 7, 1944								149				
F-54	do	610	Sept. 21, 1944								140				
F-54	do	610	Sept. 28, 1944								140				
F-54	do	610	Oct. 5, 1944								138				
F-54	do	610	Nov. 9, 1944								146				
F-54	do	610	Nov. 16, 1944								140				
F-54	do	610	Nov. 23, 1944								142				
F-54	do	610	Jan. 6, 1945								140				
F-54	do	610	Jan. 13, 1945								142				
F-54	do	610	Jan. 20, 1945								142				
F-54	do	610	Jan. 27, 1945								148				
F-54	do	610	Feb. 22, 1945								142				
F-54	do	610	Mar. 1, 1945								154				
F-54	do	610	Mar. 8, 1945								142				
F-54	do	610	Apr. 19, 1945								142				
F-54	do	610	Apr. 26, 1945								140				
F-54	do	610	May 3, 1945								140				
F-54	do	610	May 19, 1948	1,250					530		148				
F-54	do	610	Sept. 6, 1951	1,230	22	5.2	3.5	275	511	1.2	146		.2	704	28
F-55	Pan American Refining Corp. well 3	965	July 14, 1939					626		1	830			1,640	117
F-55	do	965	June 1, 1942		30	28	11	643	352	2	865	.0	1.2	1,760	115
F-55	do	965	Jan. 1, 1944								875				
F-55	do	965	Jan. 10, 1944								875				
F-55	do	965	Jan. 18, 1944								845				
F-55	do	965	Feb. 18, 1944								860				
F-55	do	965	Mar. 1, 1944								855				
F-55	do	965	Mar. 16, 1944								820				
F-55	do	965	Mar. 30, 1944								835				
F-55	do	965	Apr. 6, 1944								825				
F-55	do	965	Apr. 13, 1944								840				
F-55	do	965	Apr. 28, 1944								810				
F-55	do	965	May 4, 1944								810				
F-55	do	965	May 13, 1944								820				
F-55	do	965	May 18, 1944								820				
F-55	do	965	June 17, 1944								830				
F-55	do	965	July 6, 1944								830				
F-55	do	965	July 27, 1944								830				
F-55	do	965	Sept. 7, 1944								875				
F-55	do	965	Sept. 21, 1944								870				
F-55	do	965	Sept. 28, 1944								860				
F-55	do	965	Oct. 5, 1944								830				
F-55	do	965	Nov. 9, 1944								870				
F-55	do	965	Nov. 16, 1944								870				

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
F-55	Pan American Refining Corp. well 3	965	Nov. 23, 1944								820				
F-55	do	965	Nov. 30, 1944								800				
F-55	do	965	Jan. 6, 1945								870				
F-55	do	965	Jan. 13, 1945								850				
F-55	do	965	Jan. 20, 1945								840				
F-55	do	965	Feb. 22, 1945								860				
F-55	do	965	Mar. 1, 1945								880				
F-55	do	965	Mar. 8, 1945								900				
F-55	do	965	Apr. 19, 1945								880				
F-55	do	965	May 19, 1948	3,280					318		910				
F-55	do	965	Sept. 6, 1951	3,490					302		960				101
F-56	B. Ashworth	700	Dec. 15, 1938					313	456	1	226		1.2	746	15
F-56	do	.700	Mar. 11, 1943			6.0	2.2	316	450	1	240		1.0	788	24
F-57	Pan American Refining Corp. well 9.	957	Jan. 1, 1944								775				
F-57	do	957	Jan. 10, 1944								780				
F-57	do	957	Jan. 18, 1944								785				
F-57	do	957	Feb. 18, 1944								815				
F-57	do	957	Mar. 1, 1944								820				
F-57	do	957	Mar. 16, 1944								820				
F-57	do	957	Mar. 30. 1944								840				
F-57	do	957	Apr. 6, 1944								835				
F-57	do	957	Apr. 13, 1944								830				
F-57	do	957	Apr. 28, 1944								810				
F-57	do	957	May 4, 1944								820				
F-57	do	957	May 13, 1944								825				
F-57	do	957	May 18, 1944								835				
F-57	do	957	June 17, 1944								840				
F-57	do	957	July 6, 1944								840				
F-57	do	957	July 27, 1944								855				
F-57	do	957	Sept. 7, 1944								845				
F-57	do	957	Sept. 21, 1944								835				
F-57	do	957	Sept. 28, 1944								835				
F-57	do	957	Oct. 5, 1944								835				
F-57	do	957	Nov. 9. 1944								850				
F-57	do	957	Nov. 16, 1944								835				
F-57	do	957	Nov. 23, 1944								835				
F-57	do	957	Nov. 30, 1944								840				
F-57	do	957	Jan. 6. 1945								870				
F-57	do	957	Jan. 13, 1945								880				
F-57	do	957	Jan. 20, 1945								850				

F-57	do	957	Jan. 27, 1945								860				
F-57	do	957	Feb. 22, 1945								890				
F-57	do	957	Mar. 1, 1945								880				
F-57	do	957	Mar. 8, 1945								880				
F-57	do	957	Apr. 19, 1945								910				
F-57	do	957	Apr. 26, 1945								880				
F-57	do	957	May 3, 1945								880				
F-57	do	957	May 10, 1945								880				
F-57	do	957	Oct. 29, 1946								920				
F-57	do	957	May 19, 1948	3, 640					306		1, 010				80
F-57	do	957	Sept. 6, 1951	3, 730					294		1, 060				110
F-58	Knox Process Co.	574	Mar. 2, 1939					328	600	1	177			785	30
F-59	Republic Oil Refining Co. well 1.	857	Feb. 21, 1939					339	548	1	220		0	810	24
F-59	do	857	Mar. 12, 1943			6. 4	2. 9	336	528	1	230		0	836	28
F-59	do	857	Apr. 13, 1944			5. 4	2. 0	336	498	3. 0	240		2. 8	834	22
F-59	do	857	Oct. 30, 1946								218				
F-59	do	857	May 18, 1948	1, 540					546		245				
F-59	do	857	Sept. 6, 1951	1, 500					502		242				22
F-60	Pan American Chemical Plant well 2.	801	Feb. 21, 1939					347	592	1	205		2. 5	826	24
F-60	do	801	Mar. 12, 1943			6. 2	2. 9	328	512	1	225		1. 0	816	28
F-60	do	801	Apr. 13, 1944							2	209				
F-60	do	801	Oct. 29, 1946								209				
F-60	do	801	May 18, 1948	1, 540					592		225				
F-60	do	801	May 8, 1941	1, 510					552		220				24
F-62	Monsanto Chemical Co. well 3.	658	Mar. 9, 1943						580		425				
F-62	do	658	Apr. 13, 1944			8. 6	3. 3	466	586	2	400		2. 0	1, 170	35
F-62	do	658	Oct. 30, 1946								347				
F-63	Monsanto Chemical Co. well 5.	589	Sept. 6, 1951	1, 690					625		250				32
F-64	Monsanto Chemical Co. well 2.	625	Mar. 9, 1943			11	5. 0	508	571	1	485		0	1, 290	48
F-64	do	625	Apr. 13, 1944			10	4. 2	504	573	2	472		1. 8	1, 280	42
F-65	Monsanto Chemical Co. well 4.	536	Oct. 30, 1946								220				
F-65	do	536	Sept. 6, 1951	1, 950					662		320				70
F-66	Monsanto Chemical Co. well 1.	625	Mar. 9, 1943						552		510				
F-66	do	625	Apr. 13, 1944			10	4. 4	509	567	2	482		3. 2	1, 290	43
F-66	do	625	Oct. 30, 1946								420				
F-66	do	625	May 18, 1948	2, 390					562		500				
F-66	do	625	Sept. 6, 1951	2, 280					566		468				40
F-67	Texas City Terminal Railway well 1.	547	Feb. 22, 1939					412	614	2	305		0	1, 000	39
F-67	do	547	Mar. 10, 1943						577		375				
F-67	do	547	Apr. 14, 1944								275				

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
F-68	Texas City Terminal Railway well 2.	550	Feb. 22, 1939					389	649	1	245	0.9	0.0	936	36
F-68	do	550	Mar. 10, 1943			9.0	4.2	396	643	1	270		0	992	40
F-68	do	550	May 18, 1948	2,060					662		450				
G-1	Sun Oil Co	243	Apr. 22, 1952	3,800					476		990				177
H-1	do	337	do	3,740					500		950				105
H-2	John W. Mecom	933	May 5, 1952	2,630	32	16	6.6	531	345	3.1	660	.8	1.0	1,420	67
H-4	E. W. Boyt	12	June 18, 1941			331	171	948	323	296	2,140	.1		4,050	1,530
H-5	do	460	Feb. 13, 1951	3,780					584		940				93
H-6	Flora Diamond	50	Apr. 11, 1952	2,410					240		525				300
J-3	Joe Ackins Estate	283	June 18, 1941			58	46	999	531	2	1,460		12	2,840	333
J-5	Sun Oil Co	270	July 11, 1941					1,400	600	2	2,080			3,860	363
J-8	do	321	June 18, 1941			90	47	1,350	622	2	2,010			3,800	419
J-8	do	321	Apr. 22, 1952	6,990					443		2,050				262
J-9	Ed Linn	12	June 18, 1941			56	19	63	268	27	75			372	217
J-11	Mrs. J. Frank Keith	264	May 29, 1941			226	124	3,410	372	2	5,800			9,740	1,080
J-12	Roy Kennedy	258	do			204	131	3,330	329	2	5,650			9,480	1,000
K-1	A. C. Odem	286	Apr. 10, 1952	16,300					373		5,580				1,080
K-2	— Kade	8	June 17, 1941			80	47	338	525	50	458			1,230	394
K-3	Pierce Estate	260	do			212	127	3,460	336	4	5,880	.6		9,850	1,050
K-4	Clyde Hawsey	14	Apr. 10, 1952	3,630					417		840				400
K-6		Spring	June 17, 1941			51	25	97	79	18	248	.3	9	487	230
K-7		Spring	do						55	3	240		4	430	
K-8	George Smith	61	do			14	5.4	37	79	27	32			154	58
K-9	do	32	do			312	30	62	134	795	71			1,340	904
L-1	H. Sayko	35	Jan. 26, 1939					72	462	2	58		1.1	483	308
L-3	N. J. Morena	120	July 22, 1933			42	30	229	626	12	140		3.8	765	228
L-3	do	120	Jan. 18, 1939					225	570	20	143		3	737	204
L-4	John Ghino	108	Jan. 26, 1939					233	626	16	124		2.7	747	201
L-6	W. F. Reitmeyer	693	Apr. 22, 1939			7.2	4.9	238	433	1	141			605	38
L-8	J. D. Moody	720	Feb. 3, 1939					254	336	1	235			658	56
L-8	do	720	Apr. 9, 1951	1,100					316		193				58
L-9	Fred Johnson	260	July 22, 1933			23	18	398	598	4.5	355		.2	1,100	131
L-9	do	260	Apr. 12, 1939			26	17	403	616	12	350			1,110	136
L-10	City of Galveston test well 3.	1,001–1,023	Feb. 11, 1941			33	17	969	356	20	1,380			2,630	152
L-10	do	1,130–1,150	do						268		3,280				
L-10	do	1,130–1,178	do			109	55	2,320	306	20	3,740			6,540	498
L-11	City of Galveston test well 3A	94.0	Feb. 28, 1941		33	13	3.8	212	318	2	175		.0	596	48

L-12	Galveston County Water Control & Improvement District No. 7	689	Mar. 12, 1943						348		115				
L-12	do	689	Apr. 8, 1951	854					334		106				27
L-13	Charles Schiro	720±	Apr. 9, 1950	861					346		101				30
L-14	H. L. Roberts	710	Feb. 3, 1939					183	348	1	99			450	27
L-17	Galveston Memorial Park	510	Apr. 26, 1939					407	694	166	335	.7		1,350	330
L-18	J. Hacker	763	Apr. 25, 1939					196	351	1	102	.8		483	32
L-19	Joe Tarrasso	790	Apr. 19, 1939					262	476	1	155	.4		648	42
L-20	Galveston County Water Control & Improvement District No. 7	220	do	2,670		24	45	483	847	8	418		5.0	1,440	245
L-21	do	756	Apr. 18, 1944		34	17	5.2	240	327	2	222	.6	1.8	684	64
L-22	Mrs. H. Huntington	38	Jan. 18, 1939					52	372	2	35		.9	370	243
L-23	Fritz Huntington	725	Jan. 16, 1952	1,020					436		106				23
L-25	Stanolind Oil & Gas Co	744	Jan. 20, 1951	1,150					365		185				54
L-28	H. G. Tacquard	42	Jan. 19, 1939					99	478	1	76		6.6	531	338
L-29	Sun Oil Co	869	Jan. 16, 1939					353	608	4	210		.7	850	33
L-33	do	923	July 16, 1939					424	336	1	515	.7		1,110	82
L-33	do	923	Dec. 1, 1950	1,720					342		380				100
L-36	L. M. Still	102	Feb. 22, 1939					134	500	7	100			586	267
[16] L-40	City of Galveston No. 13-N	865±	Dec. 18, 1899								1,010			1,970	101
[17] L-40	do	865±	Sept. 4, 1916								992			2,660	80
[17] L-41	City of Galveston No. 11-N	794	do								273			740	35
[17] L-42	City of Galveston No. 9-N	797	do								234			674	35
[17] L-43	City of Galveston No. 7-N	796	do								255			698	42
[17] L-44	City of Galveston No. 5-N	797	do								242			736	52
[17] L-45	City of Galveston No. 3-N	798	do								255			716	37
[17] L-46	City of Galveston No. 1-N	797	do								241			852	50
[17] L-47	City of Galveston No. 2-S	793	do								234			660	51
[17] L-48	City of Galveston No. 4-S	868	do								288			728	46
[16] L-49	City of Galveston No. 6-S	797	Dec. 18, 1899								244			693	52
[17] L-49	do	797	Sept. 4, 1916								266			652	44
[17] L-50	City of Galveston No. 8-S	796	do								288			776	44
[17] L-51	City of Galveston No. 10-S	794	do								209			672	45
[17] L-52	City of Galveston No. 12-S	797	do								234			644	39
[17] L-53	City of Galveston No. 14-S	796	do								191			624	39
[17] L-54	City of Galveston No. 16-S	795	do								269			680	45
[17] L-55	City of Galveston No. 18-S	795	do								269			688	48
[17] L-56	City of Galveston No. 20-S	795	do								443			1,010	75
[17] L-57	City of Galveston No. 22-S	795	do								426			1,010	96
[17] L-58	City of Galveston No. 24-S	796	do								322			876	75
[17] L-59	City of Galveston No. 26-S	794	do								215			684	50
L-60	City of Galveston well 1	840	Jan. 14, 1939						330	1	265				58
L-60	do	840	Mar. 18, 1941								280				
L-60	do	840	Aug. 6, 1941		26	15	5.6	273	329	2	270	.7	.0	754	60
L-60	do	840	Jan. 13, 1943			24	4.4	276	342	2	280			755	78
L-60	do	840	Mar. 11, 1943						321		290				
L-60	do	840	May 27, 1943		23	17	5.2	271	322	2	272	.7	1.0	760	64
L-60	do	840	Dec. 28, 1943	1,400					326	2	290				
L-60	do	840	Apr. 18, 1944			18	5.9	282	325	2	293		1.8	763	70
L-60	do	840	Oct. 7, 1944			20	6.5	292	333	3	307		1.8	794	76

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
L-60	City of Galveston well 1	840	Jan. 29, 1945								306				
L-60	do	840	Jan. 16, 1946			21	6.6	298	338	2	318		0.8	812	80
L-60	do	840	June 7, 1946								317				
L-60	do	840	Sept. 3, 1946								316				
L-60	do	840	May 9, 1947								328				
L-60	do	840	July 11, 1947	1,570		22	4.4	308	338	2	328			853	73
L-60	do	840	Nov. 10, 1947	1,520		22	7.1	305	340	2	330		.2	834	84
L-60	do	840	Jan. 15, 1948	1,630							340				
L-60	do	840	Mar. 4, 1948	1,520							335				
L-60	do	840	May 21, 1948	1,570					342		340				
L-60	do	840	Nov. 17, 1948	1,560							340				
L-60	do	840	Nov. 18, 1949	1,590					332		338				
L-60	do	840	May 9, 1950	1,620							355				
L-60	do	840	Nov. 10, 1950	1,610					334		348				90
L-60	do	840	May 1, 1951	1,660					342		365				94
L-60	do	840	Nov. 7, 1951	1,670					336		365				
L-60	do	840	May 8, 1953	1,700							382				
L-61	City of Galveston well 6	850	Jan. 15, 1939						332	1	330				75
L-61	do	850	Mar. 18, 1941								370				
L-61	do	850	Aug. 6, 1941		19	23	8.4	327	338	2	370	.5	1.0	917	92
L-61	do	850	Jan. 13, 1943			30	13	310	348	2	366			892	128
L-61	do	850	Mar. 11, 1943						333		380				
L-61	do	850	May 27, 1943		25	23	7.2	317	331	2	355	.7	.8	908	87
L-61	do	850	Dec. 28, 1943	1,710					331	2	385				
L-61	do	850	Apr. 18, 1944			26	8.6	322	323	2	410		1.5	929	100
L-61	do	850	Oct. 7, 1944			27	9.1	342	335	2	405		1.8	952	105
L-61	do	850	Jan. 16, 1946			29	9.7	350	338	3	420		.8	991	112
L-61	do	850	June 7, 1946								435				
L-61	do	850	Sept. 3, 1946								415				
L-61	do	850	May 9, 1947								425				
L-61	do	850	July 11, 1947	1,810		33	8.7	352	336	2	430		.0	1,000	118
L-61	do	850	Jan. 15, 1948	1,890							455				
L-61	do	850	May 21, 1948	1,910					340		450				73
L-61	do	850	Nov. 21, 1949	1,650					329		362				
L-61	do	850	May 1, 1951	1,760					304		395				81
L-61	do	850	Nov. 7, 1951	1,770					328		410				
L-61	do	850	May 13, 1952	1,730					304		380				71
L-62	City of Galveston well 7	843	July 22, 1933		27	20	6.6	306	331	1.2	330		.1	852	77
L-62	do	843	Nov. 28, 1937						336	1	390				99
L-62	do	843	Jan. 15, 1939						328	1	395				84
L-62	do	843	Feb. 6, 1940		27	27	9.9	353	334	1	425	.6	.0	1,010	108

L-62	do	843	Mar. 18, 1941								480				
L-62	do	843	Aug. 6, 1941		23	34	12	393	338	2	502	.6	.0	1,140	134
L-62	do	843	Jan. 13, 1943			26	12	407	342	2	506			1,120	112
L-62	do	843	Mar. 11, 1943						325		520				
L-62	do	843	May 27, 1943		23	33	11	393	332	2	500	.6	1.0	1,130	128
L-62	do	843	Dec. 28, 1943	2,120					334	3	532				
L-62	do	843	Apr. 18, 1944			35	12	402	327	2	525		1.8	1,140	137
L-62	do	843	Jan. 29, 1945								530				
L-62	do	843	Jan. 16, 1946								530				
L-62	do	843	do			41	13	411	318	2	548		.8	1,180	156
L-62	do	843	June 7, 1946								570				
L-62	do	843	Sept. 3, 1946								560				
L-62	do	843	May 9, 1947								570				
L-62	do	843	July 11, 1947	2,240		38	9.2	433	346	2	560		.0	1,210	133
L-62	do	843	Mar. 4, 1948	2,270							590				
L-62	do	843	Nov. 18, 1949	2,260					327		555				
L-62	do	843	May 9, 1950	2,240							565				
L-62	do	843	Nov. 10, 1950	2,340					330		595				166
L-62	do	843	May 1, 1951	2,370					336		605				162
L-62	do	843	Nov. 7, 1951	2,320					333		582				
L-62	do	843	May 8, 1952	2,360							605				
L-63	City of Galveston test well 1	282-360	Dec. 23, 1940		7.6	20	14	330	531	24	258		1.2	916	107
L-63	do	850-875	Mar. 14, 1941			23	9.7	549	358	4	705			1,510	97
L-64	City of Galveston well 2	855	Jan. 13, 1939						350	1	208				45
L-64	do	855	Apr. 2, 1939			17	4.9	233	354	1	198			628	63
L-64	do	855	Apr. 20, 1939					236	356	5	191			609	52
L-64	do	855	Feb. 6, 1940		27	12	4.6	240	344	1	202	.8		657	49
L-64	do	855	Aug. 6, 1941		19	10	4.1	242	348	2	198	.8		647	42
L-64	do	855	Jan. 13, 1943			22	3.2	229	342	2	200			624	67
L-64	do	855	Mar. 11, 1943						339		215				
L-64	do	855	May 27, 1943		26	13	3.8	241	346	2	202	.8	0	670	48
L-64	do	855	Dec. 8, 1943	1,180					347	3	208				
L-64	do	855	Oct. 7, 1944			14	4.7	241	348	3	205		.5	640	54
L-64	do	855	Jan. 16, 1946						354	2	212			678	
L-64	do	855	June 7, 1946						310	1	248				60
L-64	do	855	Sept. 3, 1946								232				
L-64	do	855	May 9, 1947								230				
L-64	do	855	July 11, 1947	1,280		22	7.0	249	348	2	240		.2	722	84
L-64	do	855	Nov. 10, 1947	1,410		22	7.4	281	340	2	295		.8	777	86
L-64	do	855	Jan. 15, 1948	1,510							320				
L-64	do	855	Mar. 4, 1948	1,430							298				
L-64	do	855	May 21, 1948	1,530					352		330				
L-64	do	855	Nov. 17, 1948	1,630							358				
L-64	do	855	Nov. 18, 1949	1,610					336		345				
L-64	do	855	May 9, 1950	1,770							410				
L-64	do	855	May 7, 1951	1,750					341		395				109
L-64	do	855	Nov. 7, 1951	1,790					336		412				
L-64	do	855	May 8, 1952	1,820					290		422				83

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
L-65	City of Galveston well 3	866	Dec. 18, 1938						338		550				129
L-65	do	866	Feb. 7, 1940		31	48	17	457	332	1	645	0.5	0.0	1,370	190
L-65	do	866	Aug. 6, 1941		13	59	20	520	332	2	768	.5	.0	1,570	229
L-65	do	866	Mar. 9, 1942			59	20	532	328	2	790		.0	1,590	229
L-65	do	866	Jan. 13, 1943			64	15	521	348	2	774			1,550	224
L-65	do	866	Mar. 11, 1943						330		775				
L-65	do	866	May 27, 1943		18	57	18	510	328	3	745	.4	1.0	1,510	216
L-65	do	866	Dec. 28, 1943	2,900					336	2	775				
L-65	do	866	Jan. 29, 1945								810				
L-65	do	866	Jan. 16, 1946			68	21	537	342	2	808		.8	1,610	256
L-65	do	866	June 7, 1946								830				
L-65	do	866	Sept. 3, 1946								810				
L-65	do	866	May 9, 1947								845				
L-65	do	866	Nov. 10, 1947	3,140		73	24	586	344	2	900		.8	1,760	280
L-65	do	866	July 11, 1947	3,020		76	21	536	344	2	820			1,680	276
L-65	do	866	Jan. 15, 1948	3,060							870				
L-65	do	866	May 21, 1948	3,020					228		810				
L-65	do	866	Nov. 18, 1949	2,960					341		858				
L-65	do	866	May 7, 1951	2,920							800				
L-65	do	866	Nov. 7, 1951	2,880					331		778				
L-65	do	866	May 13, 1952	2,980							790				
L-66	City of Galveston well 4	873	Dec. 18, 1938						336	1	605				165
L-66	do	873	Feb. 7, 1940		29	47	16	447	332	1	625	.5	.0	1,330	183
L-66	do	873	Aug. 6, 1941		26	51	17	478	340	2	675	.7	2.5	1,420	198
L-66	do	873	Nov. 10, 1947	2,990		59	20	564	344	2	830		.8	1,650	229
L-66	do	873	Jan. 15, 1948	3,140							870				
L-66	do	873	Mar. 4, 1948	3,160							910				
L-66	do	873	May 21, 1948	3,330							920				
L-66	do	873	May 9, 1949	3,270	32	58	22	590	340	1.2	878		.2	1,750	235
L-66	do	873	Nov. 21, 1949	2,950					334		788				
L-66	do	873	Nov. 10, 1950	3,020					343		830				211
L-66	do	873	May 1, 1951	3,170							840				
L-66	do	873	May 8, 1952	3,180							882				
L-67	City of Galveston well 5	888	Jan. 14, 1939						332	1	465				111
L-67	do	888	Aug. 6, 1941		25	41	14	424	334	2	570	.7	.0	1,240	160
L-67	do	888	Jan. 13, 1943			58	14	439	332	4	620			1,300	204
L-67	do	888	Mar. 11, 1943						332		650				
L-67	do	888	May [illegible], 1943		28	46	14	469	335	2	648	.5	.2	1,370	172
L-67	do	888	Dec. 28, 1943	2,330					333	3	590				
L-67	do	888	Apr. 18, 1944			42	13	433	327	2	588		1.8	1,240	158
L-67	do	888	Jan. 29, 1945								630				
L-67	do	888	Jan. 16, 1946						336	1	648				

L-67	do	888	June 7, 1946						327	1	702				
L-67	do	888	Sept. 3, 1946								715				
L-67	do	888	May 9, 1947								750				
L-67	do	888	July 11, 1947	2,690		52	11	534	338	2	750			1,520	175
L-67	do	888	Nov. 10, 1947	2,710		60	18	505	336	2	740		.5	1,490	224
L-67	do	888	Jan. 15, 1948	2,660							705				
L-67	do	888	Mar. 4, 1948	2,530							685				
L-67	do	888	May 21, 1948	2,660					338		690				
L-67	do	888	Nov. 18, 1949	2,870					328		760				
L-67	do	888	May 9, 1949	2,570	30	44	13	467	330	2.5	642		.2	1,360	164
L-67	do	888	May 9, 1950	2,920							780				
L-67	do	888	Nov. 10, 1950	2,930					336		800				226
L-67	do	888	May 1, 1951	2,860							780				
L-67	do	888	May 8, 1952	2,510							648				
L-68	City of Galveston well 8	884	Jan. 20, 1939						336	1	510				120
L-68	do	884	Feb. 7, 1940		28	37	13	416	332	1	550	.6	.0	1,210	146
L-68	do	884	Aug. 6, 1941		19	41	15	458	336	2	625	.5	.0	1,330	164
L-68	do	884	Jan. 13, 1943			46	15	492	348	3	682			1,410	179
L-68	do	884	Mar. 11, 1943						324		705				
L-68	do	884	May 27, 1943		18	46	15	502	332	3	702	.5	1.0	1,450	176
L-68	do	884	Oct. 7, 1944			49	17	532	334	3	760		1.8	1,530	192
L-68	do	884	Jan. 16, 1946								790				
L-68	do	884	Feb. 1, 1946			50	17	544	335	2	780		.8	1,560	195
L-68	do	884	June 7, 1946						330	2	790				192
L-68	do	884	Sept. 3, 1946								760				
L-68	do	884	July 11, 1947	2,870		54	11	545	338	2	770			1,550	180
L-68	do	884	Mar. 4, 1948	2,250							575				
L-68	do	884	May 21, 1948	2,990					252		800				
L-68	do	884	Nov. 17, 1948	2,900							775				
L-68	do	884	May 9, 1949	3,070	28	50	19	561	332	.8	815		.2	1,640	203
L-68	do	884	Sept. 22, 1949	2,900					334		775				
L-68	do	884	May 15, 1951	2,910					340		760				174
L-68	do	884	May 24, 1951	2,980					339		800				180
L-68	do	884	Nov. 7, 1951	2,960					333		802				
L-68	do	884	May 8, 1952	2,920							770				
M-2	Galveston County Water Control & Improvement District No. 3, well 3.	857	May 16, 1951	1,090	25	6.8	3.3	234	379	.0	162		.0	618	30
M-3	Houston Lighting & Power Co.	520	Apr. 17, 1939			3.6	.2	245	451	3	121			595	10
M-4	R. R. Armstrong	202	Apr. 14, 1939			28	17	357	689	32	226			999	141
M-5	R. L. Whitburn	117	July 18, 1933			49	18	274	664	2.2	171		4.5	846	196
M-7	J. H. N. Adams	100	Apr. 18, 1939			61	36	321	616	1	351			1,070	303
M-9	W. Perthuis	60	Apr. 23, 1939					98	528	6	61	.2		546	312
M-10	Hamilton Ford	558	Jan. 16, 1952	985					335		160				42
M-12	J. Perthuis	590	Apr. 18, 1939			10	1.2	224	445	3	106			563	31
M-13	R. S. Wesmoreland	533	July 22, 1933			7.1	2.8	226	431	1.5	118		.1	569	29
M-13	do	533	Apr. 25, 1939					227	428	5	115	.7		549	26
M-14	Stewart Production Co	773	Apr. 29, 1939					236	394	1	149		.2	568	21
M-14	do	773	Aug. 8, 1941		19	4.4	2.5	245	400	2	158	.8	.0	629	22
M-16	Joe Robinson	80	Dec. 21, 1938					663	708	15	945			2,260	592

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
M-16	Joe Robinson	80	Jan. 25, 1939					5,770	538	2,000	11,700			22,000	6,530
M-17	do	205	Dec. 21, 1938					389	548	4	348		0.4	1,020	99
M-18	do	180	do					479	794	262	212		.5	1,370	183
M-20	H. Homrighaus	16	May 15, 1939					847	302	260	1,630			3,220	975
M-24	Carbide & Carbon Chemical Corp. well 6	713	May 18, 1948	1,260					528		158				
M-25	Carbide & Carbon Chemical Corp. well 2	1,025	Aug. 12, 1941		25	31	13	691	344	4	955	0.6	.0	1,890	131
M-25	do	1,025	Apr. 12, 1944	3,980		32	13	684	338	2	950		1.8		134
M-25	do	1,025	Oct. 29, 1946								1,010				
M-25	do	1,025	May 18, 1948	3,600							1,020				
M-26	Carbide & Carbon Chemical Corp. well 1	1,000	Apr. 12, 1944	3,330		33	12	560	350	3	750		1.5	1,530	132
M-26	do	1,000	May 18, 1948	3,100					304		850				
M-27	Carbide & Carbon Chemical Corp. well 5	700	Apr. 1, 1944	6,520		6.0	2.1	287	460	2	190		.2	734	24
M-27	do	700	Oct. 29, 1946								167				
M-27	do	700	May 18, 1948	1,270					454		184				
M-27	do	700	Sept. 6, 1951	1,230					443		185				19
M-28	Pan American Refining Corp. well 7	1,024	July 14, 1939					721	353	1	1,010			1,910	147
M-28	do	1,024	June 1, 1942		27	34	15	729	343	2	1,030	.1	1.2	1,970	146
M-28	do	1,024	Mar. 10, 1943						308		1,070				
M-28	do	1,024	Jan. 1, 1944								1,100				
M-28	do	1,024	Jan. 10, 1944								1,110				
M-28	do	1,024	Jan. 18, 1944								1,100				
M-28	do	1,024	Feb. 19, 1944								1,140				
M-28	do	1,024	Mar. 16, 1944								1,120				
M-28	do	1,024	Mar. 30, 1944								1,150				
M-28	do	1,024	Apr. 6, 1944								1,150				
M-28	do	1,024	Apr. 13, 1944								1,150				
M-28	do	1,024	Apr. 28, 1944								1,130				
M-28	do	1,024	May 4, 1944								1,160				
M-28	do	1,024	May 13, 1944								1,130				
M-28	do	1,024	June 17, 1944								1,160				
M-28	do	1,024	July 6, 1944								1,160				
M-28	do	1,024	July 27, 1944								1,160				
M-28	do	1,024	Sept. 7, 1944								1,140				
M-28	do	1,024	Sept. 21, 1944								1,160				
M-28	do	1,024	Sept. 28, 1944								1,150				
M-28	do	1,024	Jan. 6, 1945								1,160				
M-28	do	1,024	Jan. 13, 1945								1,180				

M-28	do	1,024	Jan. 20, 1945								1,170				
M-28	do	1,024	Jan. 27, 1945								1,160				
M-28	do	1,024	Feb. 22, 1945								1,220				
M-28	do	1,024	Mar. 1, 1945								1,190				
M-28	do	1,024	Mar. 8, 1945								1,190				
M-28	do	1,024	Mar. 14, 1945								1,190				
M-28	do	1,024	Apr. 19, 1945								1,190				
M-28	do	1,024	Apr. 26, 1945								1,190				
M-28	do	1,024	May 3, 1945								1,180				
M-28	do	1,024	Oct. 29, 1946								1,200				
M-28	do	1,024	May 19, 1948	4,100					242		1,160				
M-28	do	1,024	Sept. 6, 1951	3,890	30	34	16	775	345	1.0	1,100		.5	2,130	151
M-29	Pan American Refining Corp. well 8	1,000	July 14, 1939					602	358	1	810			1,600	129
M-29	do	1,000	June 1, 1942		30	31	12	632	346	2	860	.5	1.0	1,750	127
M-29	do	1,000	Mar. 10, 1943						330		865				
M-29	do	1,000	Jan. 1, 1944								880				
M-29	do	1,000	Jan. 10, 1944								890				
M-29	do	1,000	Jan. 18, 1944								895				
M-29	do	1,000	Feb. 19, 1944								905				
M-29	do	1,000	Mar. 1, 1944								915				
M-29	do	1,000	Mar. 16, 1944								910				
M-29	do	1,000	Mar. 30, 1944								890				
M-29	do	1,000	Apr. 6, 1944								920				
M-29	do	1,000	Apr. 13, 1944								920				
M-29	do	1,000	Apr. 28, 1944								910				
M-29	do	1,000	May 4, 1944								910				
M-29	do	1,000	May 13, 1944								905				
M-29	do	1,000	June 17, 1944								910				
M-29	do	1,000	July 6, 1944								930				
M-29	do	1,000	July 27, 1944								915				
M-29	do	1,000	Sept. 7, 1944								910				
M-29	do	1,000	Sept. 21, 1944								915				
M-29	do	1,000	Sept. 28, 1944								920				
M-29	do	1,000	Nov. 9, 1944								910				
M-29	do	1,000	Nov. 16, 1944								920				
M-29	do	1,000	Nov. 23, 1944								925				
M-29	do	1,000	Nov. 30, 1944								920				
M-29	do	1,000	Jan. 6, 1945								950				
M-29	do	1,000	Jan. 13, 1945								950				
M-29	do	1,000	Feb. 22, 1945								950				
M-29	do	1,000	Mar. 1, 1945								960				
M-29	do	1,000	Mar. 8, 1945								950				
M-29	do	1,000	Mar. 14, 1945								940				
M-29	do	1,000	Apr. 19, 1945								950				
M-29	do	1,000	Apr. 26, 1945								940				
M-29	do	1,000	May 3, 1945								940				
M-29	do	1,000	May 10, 1945								940				
M-29	do	1,000	May 19, 1948	3,650					290		1,040				
M-29	do	1,000	Sept. 6, 1951	3,850					280		1,080				120

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
M-30	Pan American Refining Corp. well 4	974	July 14, 1939					513	363	1	650			1,340	99
M-30	do	974	June 1, 1942		29	18	7.4	437	388	2	498	0.1	1.0	1,220	76
M-30	do	974	Mar. 10, 1943						379		480				
M-30	do	974	Jan. 1, 1944								518				
M-30	do	974	Jan. 10, 1944								505				
M-30	do	974	Jan. 18, 1944								508				
M-30	do	974	Feb. 18, 1944								570				
M-30	do	974	Mar. 1, 1944								555				
M-30	do	974	Mar. 16, 1944								755				
M-30	do	974	Mar. 30, 1944								565				
M-30	do	974	Apr. 6, 1944								550				
M-30	do	974	Apr. 13, 1944								575				
M-30	do	974	May 4, 1944								735				
M-30	do	974	May 13, 1944								595				
M-30	do	974	May 18, 1944								585				
M-30	do	974	June 17, 1944								598				
M-30	do	974	July 6, 1944								648				
M-30	do	974	July 27, 1944								612				
M-30	do	974	Sept. 7, 1944								610				
M-30	do	974	Sept. 21, 1944								640				
M-30	do	974	Sept. 28, 1944								618				
M-30	do	974	Oct. 5, 1944								630				
M-30	do	974	Nov. 16, 1944								600				
M-30	do	974	Nov. 23, 1944								640				
M-30	do	974	Jan. 6, 1945								625				
M-30	do	974	Jan. 13, 1945								635				
M-30	do	974	Jan. 20, 1945								635				
M-30	do	974	Jan. 27, 1945								635				
M-30	do	974	Feb. 22, 1945								665				
M-30	do	974	Mar. 1, 1945								620				
M-30	do	974	Mar. 8, 1945								665				
M-30	do	974	Mar. 14, 1945								705				
M-30	do	974	Apr. 19, 1945								680				
M-30	do	974	Apr. 26, 1945								645				
M-30	do	974	May 3, 1945								660				
M-30	do	974	Oct. 29, 1946								750				
M-30	do	974	May 19, 1948						344		820				
M-31	Pan American Refining Corp. well 5	965	July 14, 1939					353	412	1	330	.7		874	39
M-31	do	965	June 1, 1942		26	10	3.9	361	400	2	350	.6	1.5	952	41
M-31	do	965	Mar. 10, 1943						376		375				

M-31	do	965	Feb. 18, 1944								410				
M-31	do	965	Mar. 6, 1944								525				
M-31	do	965	Mar. 16, 1944								400				
M-31	do	965	Mar. 30, 1944								395				
M-31	do	965	Apr. 6, 1944								525				
M-31	do	965	Apr. 13, 1944								495				
M-31	do	965	Apr. 28, 1944								370				
M-31	do	965	May 4, 1944								390				
M-31	do	965	May 13, 1944								370				
M-31	do	965	May 18, 1944								385				
M-31	do	965	June 17, 1944								388				
M-31	do	965	July 6, 1944								378				
M-31	do	965	July 27, 1944								390				
M-31	do	965	Sept. 7, 1944								379				
M-31	do	965	Sept. 21, 1944								387				
M-31	do	965	Sept. 28, 1944								381				
M-31	do	965	Oct. 5, 1944								380				
M-31	do	965	Nov. 16, 1944								382				
M-31	do	965	Nov. 23, 1944								382				
M-31	do	965	Nov. 30, 1944								375				
M-31	do	965	Jan. 6, 1945								415				
M-31	do	965	Feb. 22, 1945								500				
M-31	do	965	Mar. 1, 1945								550				
M-31	do	965	Mar. 8, 1945								495				
M-31	do	965	Mar. 14, 1945								455				
M-31	do	965	Apr. 19, 1945								415				
M-31	do	965	Apr. 26, 1945								540				
M-31	do	965	May 3, 1945								455				
M-31	do	965	May 19, 1948	2, 210					362		545				
M-31	do	965	Sept. 6, 1951	2, 130					386		502				70
M-32	Pan American Refining Corp. well 11	910	June 17, 1944								222				
M-32	do	910	Jan. 6, 1945								240				
M-32	do	910	Jan. 13, 1945								220				
M-32	do	910	Jan. 20, 1945								222				
M-32	do	910	Jan. 27, 1945								218				
M-32	do	910	Feb. 22, 1945								218				
M-32	do	910	Mar. 8, 1945								222				
M-32	do	910	Apr. 19, 1945								218				
M-32	do	910	May 3, 1945								216				
M-32	do	910	May 10, 1945								216				
M-32	do	910	Oct. 29, 1946								228				
M-32	do	910	May 19, 1948	1, 450					486		230				
M-32	do	910	Sept. 6, 1951	1, 510	19	4.5	2.3	331	462	0.2	257		0	841	20
M-33	Pan American Refining Corp. well 10	1, 007	Jan. 1, 1944								730				
M-33	do	1, 007	Jan. 10, 1944								822				
M-33	do	1, 007	Jan. 18, 1944								735				
M-33	do	1, 007	Feb. 18, 1944								840				
M-33	do	1, 007	Mar. 1, 1944								780				

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
M-33	Pan American Refining Corp. well 10.	1,007	Mar. 16, 1944								760				
M-33	do	1,007	Mar. 30, 1944								770				
M-33	do	1,007	Apr. 6, 1944								770				
M-33	do	1,007	Apr. 13, 1944								760				
M-33	do	1,007	Apr. 28, 1944								760				
M-33	do	1,007	May 13, 1944								845				
M-33	do	1,007	May 18, 1944								775				
M-33	do	1,007	June 17, 1944								880				
M-33	do	1,007	July 6, 1944								790				
M-33	do	1,007	July 27, 1944								790				
M-33	do	1,007	Sept. 7, 1944								790				
M-33	do	1,007	Sept. 21, 1944								800				
M-33	do	1,007	Sept. 28, 1944								775				
M-33	do	1,007	Oct. 5, 1944								780				
M-33	do	1,007	Nov. 9, 1944								780				
M-33	do	1,007	Nov. 16, 1944								790				
M-33	do	1,007	Nov. 23, 1944								790				
M-33	do	1,007	Nov. 30, 1944								770				
M-33	do	1,007	Jan. 6, 1945								900				
M-33	do	1,007	Jan. 13, 1945								860				
M-33	do	1,007	Jan. 20, 1945								850				
M-33	do	1,007	Jan. 27, 1945								840				
M-33	do	1,007	Feb. 22, 1945								840				
M-33	do	1,007	Mar. 1, 1945								850				
M-33	do	1,007	Mar. 8, 1945								840				
M-33	do	1,007	Apr. 19, 1945								830				
M-33	do	1,007	Apr. 26, 1945								840				
M-33	do	1,007	May 3, 1945								850				
M-33	do	1,007	May 10, 1945								840				
M-33	do	1,007	Oct. 29, 1946								920				
M-33	do	1,007	May 19, 1948	3,400					326		950				
M-33	do	1,007	Sept. 6, 1951	3,490					348		950				
M-34	Pan American Refining Corp.	993	Mar. 11, 1943			25	11	601	304	1	825		0.0	1,610	108
M-35	Republic Oil Refining Co. well 4.	1,017	Apr. 13, 1944			27	11	623	332	3	845		.5	1,670	112
M-35	do	1,017	Oct. 30, 1946								810				
M-35	do	1,017	May 18, 1948	3,130					308		840				
M-35	do	1,017	Sept. 6, 1951	3,400					296		940				96
M-36	Republic Oil Refining Co. well 3.	759	Apr. 13, 1944			5.7	2.4	333	565	2	200		.2	850	24

M-36	do	759	Oct. 30, 1946								212				
M-36	do	759	May 18, 1948	1,510					574		225				
M-36	do	759	Sept. 6, 1951	1,470					526		222				22
M-37	Republic Oil Refining Co. well 2.	1,009	Aug. 6, 1941		31	23	11	585	352	2	765	.7	2.5	1,600	102
M-37	do	1,009	Mar. 12, 1943			29	12	604	330	1	825			1,630	122
M-37	do	1,009	Apr. 13, 1944			6.0	9.8	659	324	3	865		.2	1,700	56
M-37	do	1,009	Oct. 30, 1946								990				
M-37	do	1,009	Sept. 6, 1951	3,830					299		1,080				116
M-38	Texas City Refining Inc. well 2	1,015	Apr. 12, 1944	4,560		39	15	797	350	2	1,100		1.2	2,130	159
M-38	do	1,015	May 19, 1948	3,290					326		900				
M-39	Texas City Refining Inc. well 1	1,050	Aug. 12, 1943	3,430	34	38	13	689	348	2	962	.6	2.2	1,910	148
M-39	do	1,050	Oct. 30, 1946								1,020				
M-39	do	1,050	May 19, 1948	3,670					370		1,010				
M-40	Texas City Refining Inc. well 3	655	do	1,490					610		205				
M-40	do	655	May 8, 1951	1,500					599		195				28
M-41	Sid Richardson Refining Co. well 1	1,030	July 19, 1933		30	28	12	684	350		940	1.2	.5	1,870	119
M-41	do	1,030	Nov. 30, 1937						352	1	1,080				140
M-41	do	1,030	Feb. 21, 1939					774	353	1	1,090	.7		2,030	140
M-41	do	1,030	Aug. 6, 1941		29	32	15	766	356	2	1,070	.7	.0	2,090	142
M-41	do	1,030	Mar. 12, 1943			35	16	801	347	1	1,140		2.5	2,170	154
M-41	do	1,030	Apr. 12, 1944	4,690		36	16	810	355	2	1,150		1.8	2,190	156
M-41	do	1,030	Oct. 30, 1946								1,020				
M-41	do	1,030	May 19, 1948	3,830					324		1,070				
M-42	Sid Richardson Refining Co. well 2	974	do	2,580					378		645				
M-45	Tin Processing Corp. well 1	702	Mar. 11, 1943			6.2	2.5	263	462	1	155		.2	656	26
M-45	do	702	Apr. 13, 1944								138				
M-45	do	702	May 20, 1948	1,130					470		138				
M-46	Tin Processing Corp. well 2	696	Mar. 11, 1943						464		140				
M-46	do	696	Apr. 13, 1944								128				
M-46	do	696	Oct. 30, 1946								137				
M-47	Tin Processing Corp. well 3	643	do								131				
M-47	do	643	May 20, 1948	1,150					470		140				
N-1	Gulf Coast & Santa Fe R. R	1,088	June 18, 1941			17	7.8	697	464	2	855	.9		1,810	75
N-3	Fort Travis	600	do			32	10	950	641	2	1,180	.6		2,490	121
N-5	Galveston Ice & Cold Storage Co.	458	Apr. 24, 1952	2,880	20	23	22	589	857	1.1	505		15	1,600	148
N-5a	do	1,345	May 10, 1932		35	90	54	2,120	331	.6	3,380			5,840	446
N-6a	Frazier Ice & Cold Storage Co.	800	May 18, 1939					1,350	416	1	1,940			3,480	171
N-6b	do	400±	do					643	825	1	620			1,680	153
N-9	Galveston-Houston Breweries Inc	1,317	Apr. 10, 1951	10,500	35	87	53	2,130	330	.0	3,400			5,870	435
N-10	Hi-Grade Packing Co.	397	Apr. 24, 1952	2,670	17	18	14	562	745	1.8	490		7.8	1,480	102
N-10a	do	435	May 18, 1939					555	746	1	490			1,410	98
N-12	C. J. Blume	181	May 9, 1952	2,860					791		568				181
N-13	H. L. Broome	279	Jan. 15, 1952	4,370	13	47	48	837	542	57	1,160		1.0	2,430	315

See footnotes at end of table.

TABLE 14.—*Analyses of water from wells and springs in Galveston County, Tex.*—Continued

Well	Owner	Depth of well (feet)	Date of collection	Specific conductance (micromhos at 25° C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$
N-15	Lilly Harris	15	May 13, 1939					1,850	492	500	3,660			6,970	2,070
P-2	S. E. Kempner	620	Apr. 8, 1952	6,130					575		1,740				250
Q-7	C. D. Tellefson	7	May 16, 1939					314	190	72	512			1,080	270
Q-8	J. W. Wayman	11	May 15, 1939					169	246	36	330			783	338
Q-9	do	11	do					97	246	30	182			538	278
Q-10	Steve Jenkins	476	Apr. 8, 1953	3,090	28	17	12	630	735	1.8	608			1,660	92
Q-11	O. L. Auston	18	May 15, 1939					346	116	300	765			1,740	735
Q-12	Fritz Forste	12	do					1,670	315	320	3,440			6,210	1,820

1 Drill stem test from 756 to 763 ft.
2 Drill stem test from 793 to 800 ft.
3 Drill stem test from 732 to 742 ft.
4 Drill stem test from 773 to 783 ft.
5 Drill stem test from 794 to 805 ft.
6 Drill stem test from 762 to 769 ft.
7 Drill stem test from 758 to 764 ft.
8 Drill stem test from 738 to 749 ft.
9 Drill stem test from 788 to 791 ft.
10 Drill stem test from 760 to 770 ft.
11 Drill stem test from 812 to 825 ft.
12 Drill stem test from 784 to 801 ft.
13 Drill stem test from 868 to 895 ft.
14 Drill stem test from 853 to 873 ft.
15 Drill stem test from 1,177 to 1,206 ft.
16 Analysis by Frazier & Co., New York.
17 Analysis by Felix Paquin, Galveston.

INDEX