[redacted]

Thorkildsen

TEXAS BOARD OF WATER ENGINEERS

BULLETIN 6007

GROUND-WATER GEOLOGY OF KARNES COUNTY, TEXAS

Prepared in cooperation with the Geological Survey
United States Department of the Interior
and the
San Antonio River Authority

July 1960

TEXAS BOARD OF WATER ENGINEERS

BULLETIN 6007

GROUND-WATER GEOLOGY OF KARNES COUNTY, TEXAS

By

R. B. Anders, Geologist
United States Geological Survey

Prepared in cooperation with the Geological Survey
United States Department of the Interior
and the
San Antonio River Authority

July 1960

TABLE OF CONTENTS

	Page
ABSTRACT	1
INTRODUCTION	3
Purpose and Scope of Investigation	3
Location and Physical Features	3
Economic Development	5
Previous Investigations	5
Acknowledgments	5
Climate	8
GENERAL GEOLOGY	8
GEOLOGIC FORMATIONS AND THE OCCURRENCE OF GROUND WATER	21
Tertiary System	22
Paleocene Series	22
Midway Group, Undifferentiated	22
Eocene Series	23
Wilcox Group, Undifferentiated	23
Claiborne Group	23
Carrizo Sand	23
Mount Selman Formation	24
Reklaw Member	24
Queen City Sand Member	24
Weches Greensand Member	24
Sparta Sand	24
Cook Mountain Formation	25
Yegua Formation	25
Jackson Group, Undifferentiated	25
Oligocene(?) Series	26
Frio Clay	26

TABLE OF CONTENTS (Cont'd.)

	Page
Miocene(?) Series	26
Catahoula tuff	26
Miocene Series	27
Oakville Sandstone	27
Miocene(?) Series	27
Lagarto Clay	27
Pliocene Series	28
Goliad Sand	28
Tertiary(?) System	28
Pliocene(?) Series	28
Interstream Sand and Gravel Deposits	28
Quaternary System	29
Pleistocene and Recent Series	29
Alluvium	29
Aquifer Tests	29
GROUND-WATER DEVELOPMENT	29
Present	29
Withdrawals	29
Changes in Water Level	31
Potential	31
SURFACE-WATER DEVELOPMENT	41
QUALITY OF WATER	41
SUMMARY OF CONCLUSIONS	47
SELECTED REFERENCES	49

TABLE OF CONTENTS (Cont'd.)

TABLES

		Page
1.	Well and Spring Numbers Used in This Report and Corresponding Numbers Used in the Report by Shafer (1937)	6
2.	Stratigraphic Units and Their Water-Bearing Properties in Karnes County	14
3.	Results of Aquifer Tests	30
4.	Water Levels in Selected Wells in 1936 or 1937 and Water Levels in the Same Wells in 1955 or 1956	33
5.	Records of Wells in Karnes County	52
6.	Drillers' Logs of Wells in Karnes County	79
7.	Analyses of Water from Wells in Karnes County	88

ILLUSTRATIONS

Figures

1.	Index Map of Texas Showing Location of Karnes County	4
2.	Location of Climatological Stations, Aquifer-Test Sites, and Stream Gaging Stations in Karnes and Adjoining Counties	9
3.	Annual Precipitation at Karnes City and Runge	10
4.	Monthly Precipitation at Karnes City and Runge	11
5.	Annual Evaporation and Precipitation at Beeville, Bee County	12
6.	Mean Monthly Temperature, Precipitation, and Evaporation at Beeville, Bee County	13
7.	Geologic Section D-D'	15
8.	Geologic Section E-E'	17
9.	Geologic Section F-F'	19
10.	Monthly Pumpage from Municipal Wells at Falls City, Runge, Karnes City and Kenedy	32

TABLE OF CONTENTS (Cont'd.)

Page

11. Relation Between Drawdown and Transmissibility in an Aquifer of Infinite Areal Extent---------------------------- 36

12. Theoretical Drawdown Along a Profile Between a Pumping Well and a Line Source (Aquifer Outcrop)-- 37

13. Thickness of Sand Containing Fresh to Slightly Saline Ground Water-- 39

14. Monthly Mean Discharge of the San Antonio River Near Falls City-- 42

15. Monthly Mean Discharge of Cibolo Creek Near Falls City-- 43

Plates

Follows

1. Geologic Map of Karnes County Showing Location of Wells--Page 107

2. Geologic Section A-A'--Plate 1

3. Geologic Section B-B'--Plate 2

4. Geologic Section C-C'--Plate 3

GROUND-WATER GEOLOGY OF KARNES COUNTY, TEXAS

ABSTRACT

Karnes County in south-central Texas has an area of 758 square miles and had a population estimated at 18,000 in 1955. The county's principal sources of income are farming, ranching, and oil production.

The exposed rocks and those underlying Karnes County dip toward the Gulf of Mexico at average rates ranging from 20 to more than 200 feet per mile. The oil fields in the county are on structures associated with faulting; the effect of faulting on the occurrence of ground water has not been determined.

The principal water-bearing formations, from oldest to youngest, underlying the county are the Carrizo sand, Yegua formation, Jackson group, Catahoula tuff, Oakville sandstone, and Lagarto clay. These formations range in age from Eocene to Miocene and are all of sedimentary origin. About 40 million acre-feet of usable water (water containing less than 3,000 parts per million dissolved solids) is stored more than 2,500 feet below land surface in the Carrizo sand; 30 million acre-feet is stored in the younger formations at depths less than 1,000 feet.

Ground-water withdrawals for municipal, industrial, and domestic use averaged about 1.7 million gallons per day in 1957. Irrigation and stock supplies were derived from both ground- and surface-water sources. In general, water levels from 1936 through 1957 were not affected appreciably by withdrawals. Although recharge to the ground-water reservoir from precipitation represents only a small percentage of total precipitation, the rate of recharge exceeded the rate of ground-water withdrawal from wells in the county in 1957.

Most of the usable ground water in Karnes County is of substandard quality; whereas, the San Antonio River water is of excellent quality although it is hard. Wells tapping the Carrizo may yield as much as 1,000 gpm (gallons per minute) in the northwestern part of the county; wells in the shallower formations may yield as much as 600 gpm in the most favorable areas, but in some places may yield only a few gallons a minute of water suitable only for stock.

INTRODUCTION

Purpose and Scope of Investigation

This investigation to provide up-to-date information concerning the occurrence, quality, development, and availability of ground water in Karnes County was begun in the fall of 1955 by the United States Geological Survey at the request of and in cooperation with the San Antonio River Authority and the Texas Board of Water Engineers. The objectives of the investigation were (1) to study the geology as it pertains to the occurrence of ground water; (2) to determine the areal extent, depth, thickness, and water-bearing properties of the strata containing fresh to slightly saline water; (3) to determine the chemical quality of the ground water; (4) to estimate the quantity of water stored in the ground-water reservoir; (5) to determine the sources and areas of recharge to aquifers; (6) to determine the present and estimate the future development of ground water; and (7) to prepare a summary of the surface-water resources of the county.

This publication presents data collected from the fall of 1955 through the fall of 1956 and includes records of 404 wells, 11 drillers' logs, and 340 chemical analyses of water samples. Most of the water samples were analyzed in 1937 and reported by Shafer (1937).

A geologic map (pl. 1) based on a compilation of current studies and previously published maps was prepared for inclusion. The subsurface geology has been shown herein by six geologic sections prepared from electric logs. Tests were made at six sites to determine the water-yielding properties of the various formations.

For convenience in identifying the wells within the county, a grid based on lines of latitude and longitude was constructed on the geologic map (pl. 1). The quadrangles in the grid are identified by letters of the alphabet and the wells are numbered consecutively in each quadrangle.

This investigation was under the immediate supervision of R. W. Sundstrom, district engineer of the Geological Survey in charge of ground-water investigations in Texas, and under the administrative direction of S. W. Lohman, branch area chief, and A. N. Sayre, formerly chief of the Ground Water Branch of the Geological Survey.

Location and Physical Features

Karnes County is on the West Gulf Coastal Plain in south-central Texas (fig. 1) and has an area of 758 square miles. The county seat, Karnes City, is 55 miles southeast of San Antonio.

Parts of Karnes County are nearly flat, but most of the county is rolling to moderately hilly. The altitude ranges from about 550 feet in the northwestern part of the county to 170 feet in the southeastern part, where the San Antonio River crosses the Goliad county line. The county is drained mainly by the San Antonio River and its main tributary, Cibolo Creek, both of which are perennial streams. The southwestern part of the county is drained by intermittent tributaries of the Atascosa River, and a few areas in the northeastern part are drained by minor tributaries of the Guadalupe River.

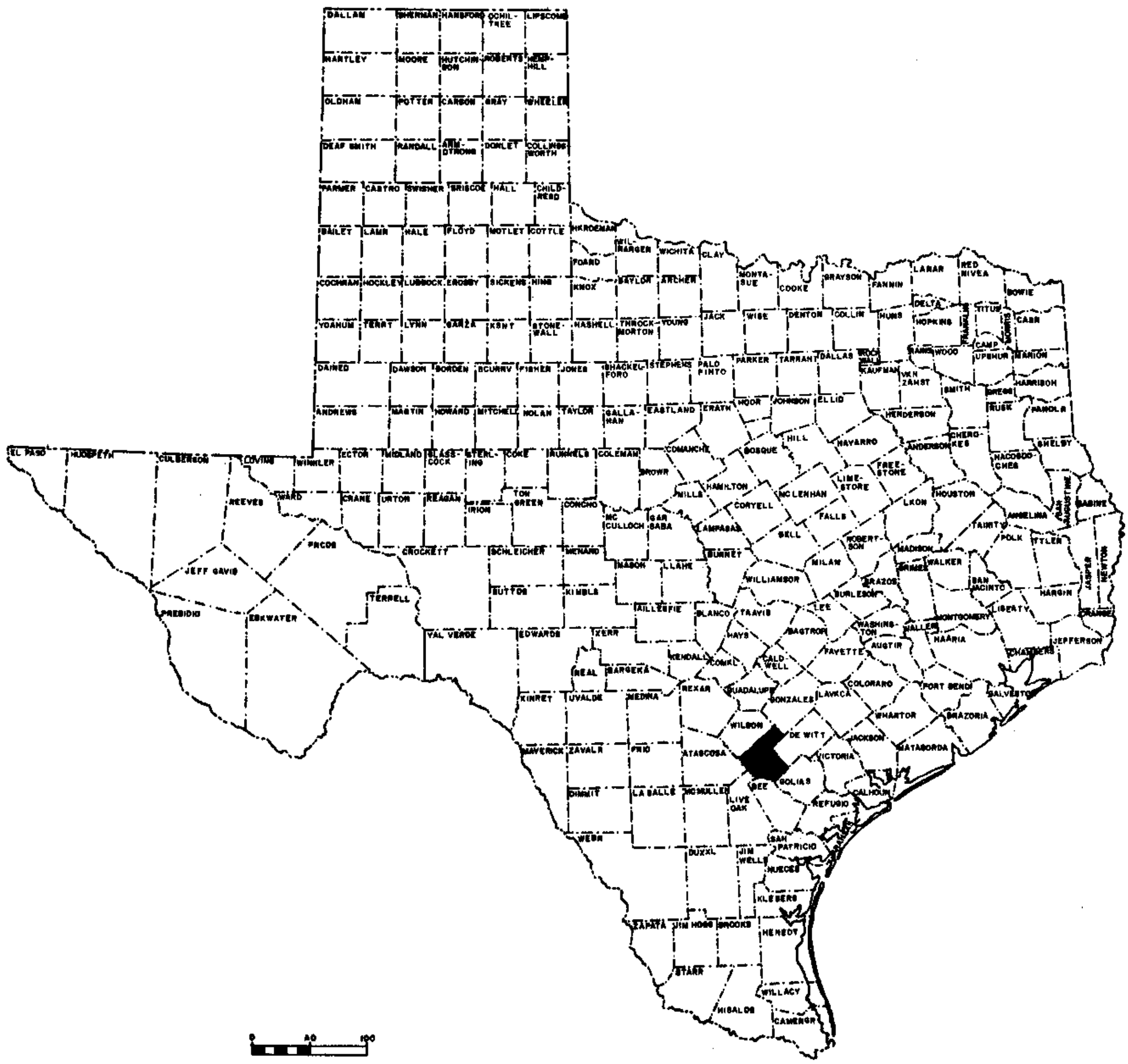

FIGURE 1. — Map of Texas showing location of Karnes County

The two largest towns in Karnes County, Karnes City and Kenedy, had populations estimated to be 3,000 and 5,100, respectively, in 1955. The total population of the county was estimated to be about 18,000 in 1955. The oldest Polish settlement, Panna Maria, was established in 1854, the same year the county was created. Other communities in Karnes County include Runge, Falls City, Helena, Gillett, Coy City, Hobson, Ecleto and Czestochowa.

Economic Development

The economy of Karnes County is based upon farming, ranching, and oil production. The principal crops are flax, corn, grain sorghums, and cotton. Other crops include peanuts, tomatoes, broomcorn, peas, beans, and several varieties of grasses. Ranching and dairying are practiced in the hilly areas and in areas where the soil is not suitable for cultivation. The production of oil in the county has risen steadily since it started in 1930; oil production in 1955 was 2.7 million barrels. Uranium ore was discovered near the western corner of the county early in 1955. Since then, several other small bodies of ore have been discovered in Karnes and nearby counties. The deposits were not being mined at the close of 1957.

Drought conditions became so severe in 1953 that a few farmers drilled wells for irrigation. Prior to the introduction of irrigation wells, irrigation was practiced only along the banks of the San Antonio River. Most of the farming in Karnes County still is dependent upon precipitation for its water requirements.

Previous Investigations

Previous investigations relating to the water resources of Karnes County include a report by Shafer (1937), which contains records of 369 wells, 384 chemical analyses of water samples, drillers' logs of 12 wells and 156 shallow test holes, and a map showing well locations. Some of the more pertinent data from Shafer's report is reproduced in this publication. Table 1 shows the well numbers used by Shafer and the corresponding numbers used in this report. Descriptions of geologic sections at several locations in Karnes and adjacent counties have been published in regional reports by Deussen (1924, p. 88, 92, 93) and Sellards, Adkins, and Plummer (1932, p. 688, 719, 720). A report by Eargle and Snider (1957) contains a description and geologic sections of the Jackson group in the western corner of the county; descriptions of the Frio clay, Catahoula tuff, and Oakville sandstone; and descriptions of major uranium deposits in Karnes, Atascosa, and Live Oak Counties. The public-water supplies of five towns in the county were described briefly by Broadhurst, Sundstrom, and Rowley (1950, p. 7-8, 75-79).

Acknowledgments

The writer expresses his appreciation for information and assistance furnished by officials of Kenedy, Karnes City, Runge, the United Pipeline Co., and by farmers and ranchers in the county. Considerable help also was received from well drillers George Gunther and Tom Moy and from officials of the Stanolind Oil Co., the Magnolia Petroleum Co., the Humble Oil and Refining Co., and the Southern Minerals Corp. The writer is indebted to D. Hoye Eargle of the Geologic Division of the Geological Survey, who mapped part of the contact between the Jackson group and the Catahoula tuff.

Table 1.--Well and spring numbers used in the report by Shafer (1937) and corresponding numbers used in this report.

Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.
2	C-43	121	B-12	226	D-25	349	E-3
3	C-44	122	B-11	227	D-26	352	E-4
4	C-47	126	B-21	228	C-32	355	E-7
8	C-40	128	B-22	229	C-33	358	E-8
10	C-26	130	B-23	230	C-31	361	E-10
11	C-25	131	B-20	231	C-30	362	E-9
13	C-24	133	B-41	233	C-27	363	E-55
14	C-52	134	B-19	234	C-36	366	E-14
15	C-53	136	B-16	235	C-35	367	E-15
17	C-56	137	B-15	237	F-3	376	E-17
19	C-4	138	B-14	239	C-38	377	E-18
21	C-5	139	B-9	243	F-18	385	E-43
23	C-8	140	B-6	244	F-4	388	E-39
24	C-11	143	B-3	245	F-5	391	E-23
25	C-10	144	B-2	248	F-9	395	E-38
28	C-23	148	B-1	250	G-1	396	E-37
29	C-18	150	B-57	251	G-4	398	H-16
32	C-12	152	B-56	252	C-3	399	H-15
34	C-7	154	B-55	253	F-12	400	H-8
35	D-20	157	B-53	257	G-52	401	H-3
36	D-19	159	B-49	262	G-50	404	E-44
39	C-6	160	B-50	264	G-49	405	E-45
45	C-3	167	B-45	265	G-26	406	E-46
52	D-15	170	B-36	267	G-10	408	E-49
53	D-18	171	B-38	268	G-54	409	E-50
54	D-17	173	B-40	270	G-14	411	D-38
55a	D-16	174	B-35	272	G-9	413	G-19
59	D-10	175	B-39	273	G-8	420	H-2
62	D-11	177	B-24	274	G-7	421	H-57
65	D-12	180	B-27	275	G-5	422	H-7
66	D-13	182	B-26	276	G-6	424	H-56
67	D-14	184	B-25	279	D-27	427	G-37
74	A-15	186	B-29	281	D-29	428	G-35
75	A-14	188	B-34	282	D-28	433	G-17
77	A-13	191	B-32	283	D-31	435	G-30
79	A-12	194	B-28	285	D-32	436	G-28
82	D-6	195	B-30	287	D-33	441	G-47
84	D-4	197	E-1	289	G-15	444	G-44
85	A-10	198	D-1	290	G-13	445	G-46
88	A-11	203	D-2	291	G-12	447	G-32
92	A-16	204	D-3	292	G-25	448	G-38
94	A-17	209	D-5	293	G-24	451	H-59
95	A-18	212	D-7	295	G-16	453	G-39
100	A-6	213	D-57	297	D-37	454	G-40
103	A-9	214	D-58	300	D-34	457	H-65
105	A-7	215	D-55	301	D-36	458	H-66
108	A-5	218	D-30	310	D-48	465	H-69
110	A-4	219	D-21	311	D-47	468	H-51
114	A-3	221	C-22	315	D-52	469	H-52
116	B-7	223	D-22	322	D-42	471	H-5
120	B-8	224	D-23	346	E-57	472	H-6

Table 1.--Well and spring numbers used in the report by Shafer (1937) and corresponding numbers used in this report--Continued

Old No.	New No.	Old No.	New No.	Old No.	New No.	Old No.	New No.
476	H-11	487	H-45	502	H-41	515	E-32
477	H-10	490	H-42	503	H-19	516	E-28
481	H-12	491	H-33	506	H-17	518	E-25
482	H-13	494	H-29	508	E-34	520	E-24
483	H-47	495	H-28	510	H-23	521	E-35
484	H-50	498	H-27	512	H-22	522	E-36
485	H-46	499	E-29	513	H-36		
486	H-44	501	H-38	514	H-25		

Climate

The climate of Karnes County is subhumid. The mean daily temperature at Runge averages 54°F in January and 84°F in July. The maximum recorded temperature was 106°F; the minimum was 6°F. The mean annual precipitation at Runge, the station having the longest period of record in Karnes County (1896-1956), is 28.94 inches. The only other record available in the area for a comparable period is from a station at Beeville in Bee County (fig. 2) where the record mean annual precipitation for 1896-1956 was 30.55 inches. Weather data from these stations and one at Karnes City are shown graphically in figures 3, 4, 5, and 6. Precipitation in Karnes County was below normal from 1950 through 1956. Although drought was relieved somewhat in 1952, when above-normal precipitation was recorded at Runge, the prolonged drought had been so severe that the county was declared a disaster area by the President on June 29, 1953. Dry farming continued through the drought, but many crops were damaged and several complete crop failures were reported.

One part of the county in a particular year may suffer from drought, while another part may have an abundance of rainfall. The amount of precipitation for periods of a few years may vary appreciably from station to station. The maximum recorded difference in annual precipitation between the stations at Beeville and Runge was 15.7 inches in 1925 and 1932, and between the stations at Beeville and Karnes City was 24.4 inches in 1935. Although the differences in precipitation between stations may be great for certain years, the greatest difference in the mean annual precipitation of record for the three stations is only 2.5 inches.

The severity of the drought is demonstrated by comparing the mean monthly precipitation for the period of record with the 8-year means from 1948 through 1955. Figure 4 shows that generally the mean monthly precipitation for the short period was substantially less than for the period of record.

Evaporation rates during a drought generally are higher than during a period of normal or above normal precipitation. Records of the rate of evaporation in Karnes County are not available; however, records from the Beeville station in the adjoining county, shown in figure 5, show that the annual evaporation was above normal from 1950 through 1954. The records from 1955 through 1956 are not comparable directly because the evaporation-measuring equipment was changed. These records do suggest, however, that the annual evaporation from 1955 through 1956 also was above normal.

GENERAL GEOLOGY

Geologic formations in Karnes County range in age from Paleocene to Recent. Thickness, lithology, and water-bearing characteristics of geologic formations are shown in table 2. Areal geology and location of selected wells are shown on plate 1. Structure, lithology, and thickness of the formations are shown on six geologic sections based on electric logs (pls. 2, 3, and 4, and figs. 7, 8 and 9).

The formations strike northward in the southwestern part of Karnes County and northeastward in the remainder of the county. The strike of younger formations is more nearly north than that of older formations.

The formations dip toward the Gulf of Mexico at average rates ranging from 20 to more than 200 feet per mile. The dip of the older formations is slightly greater than that of the younger.

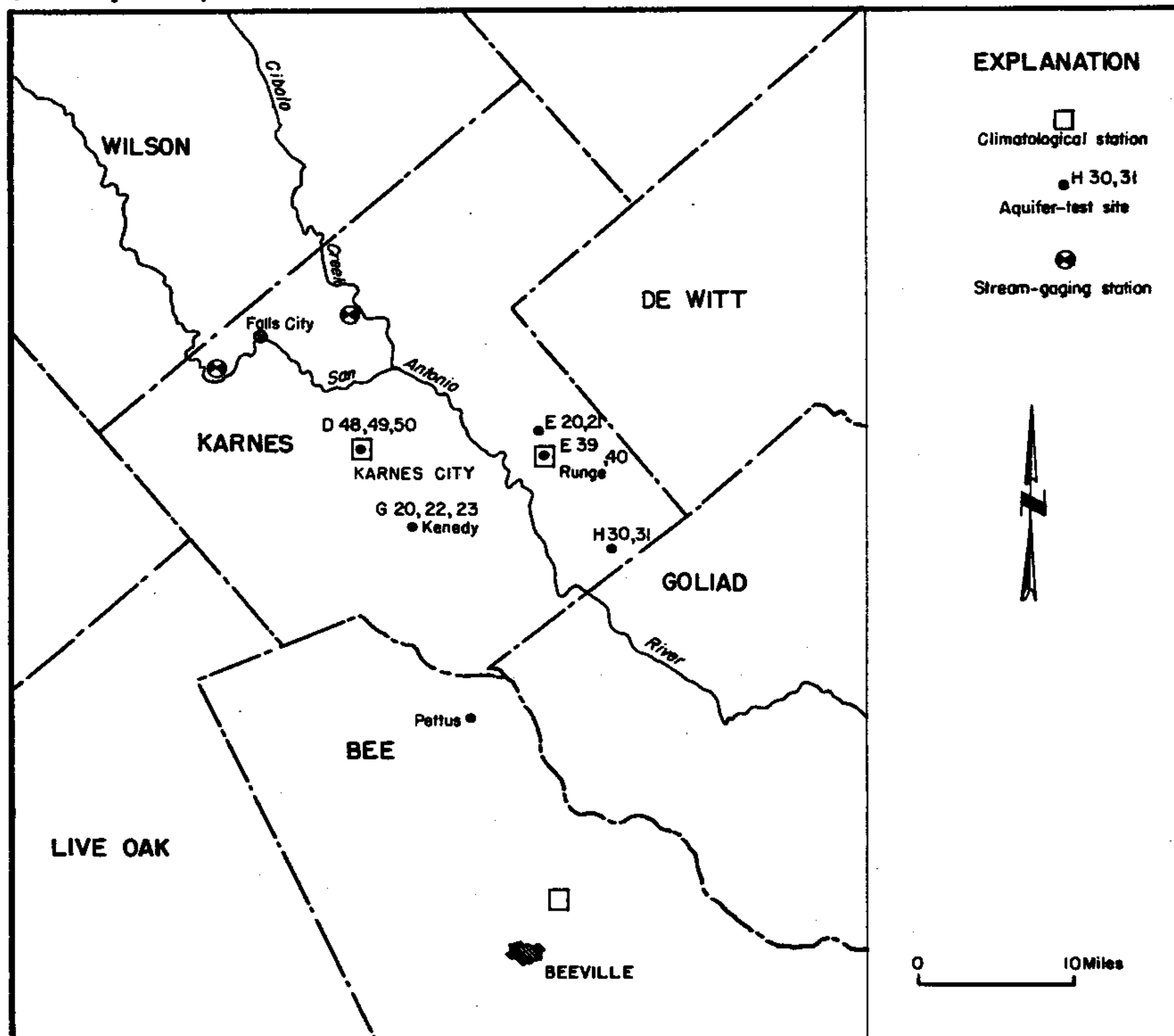

FIGURE 2.- Location of climatological stations, aquifer-test sites, and stream-gaging stations in Karnes and adjoining counties

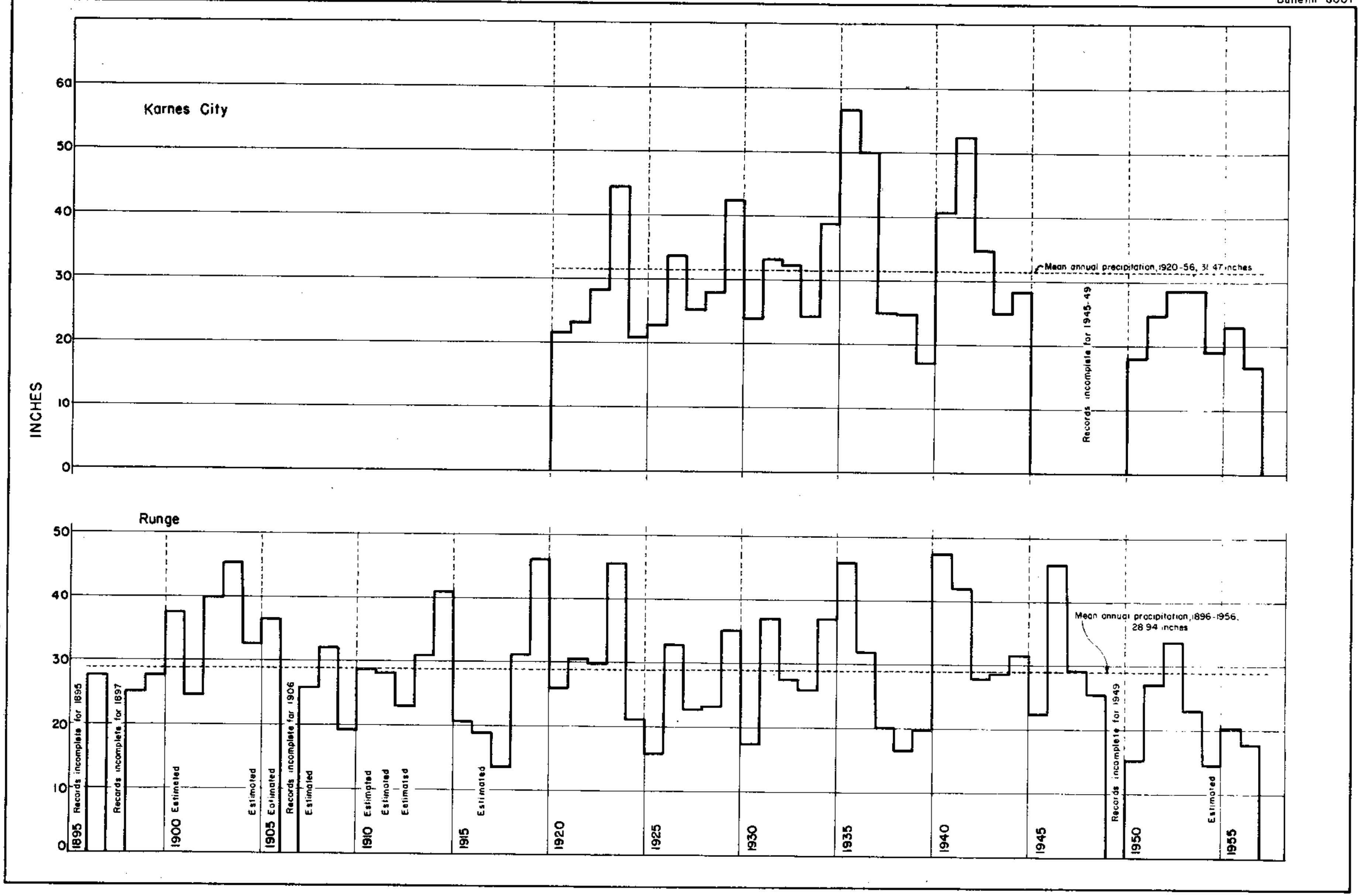

FIGURE 3.-Annual precipitation at Karnes City and Runge

(From records of the U. S. Weather Bureau)

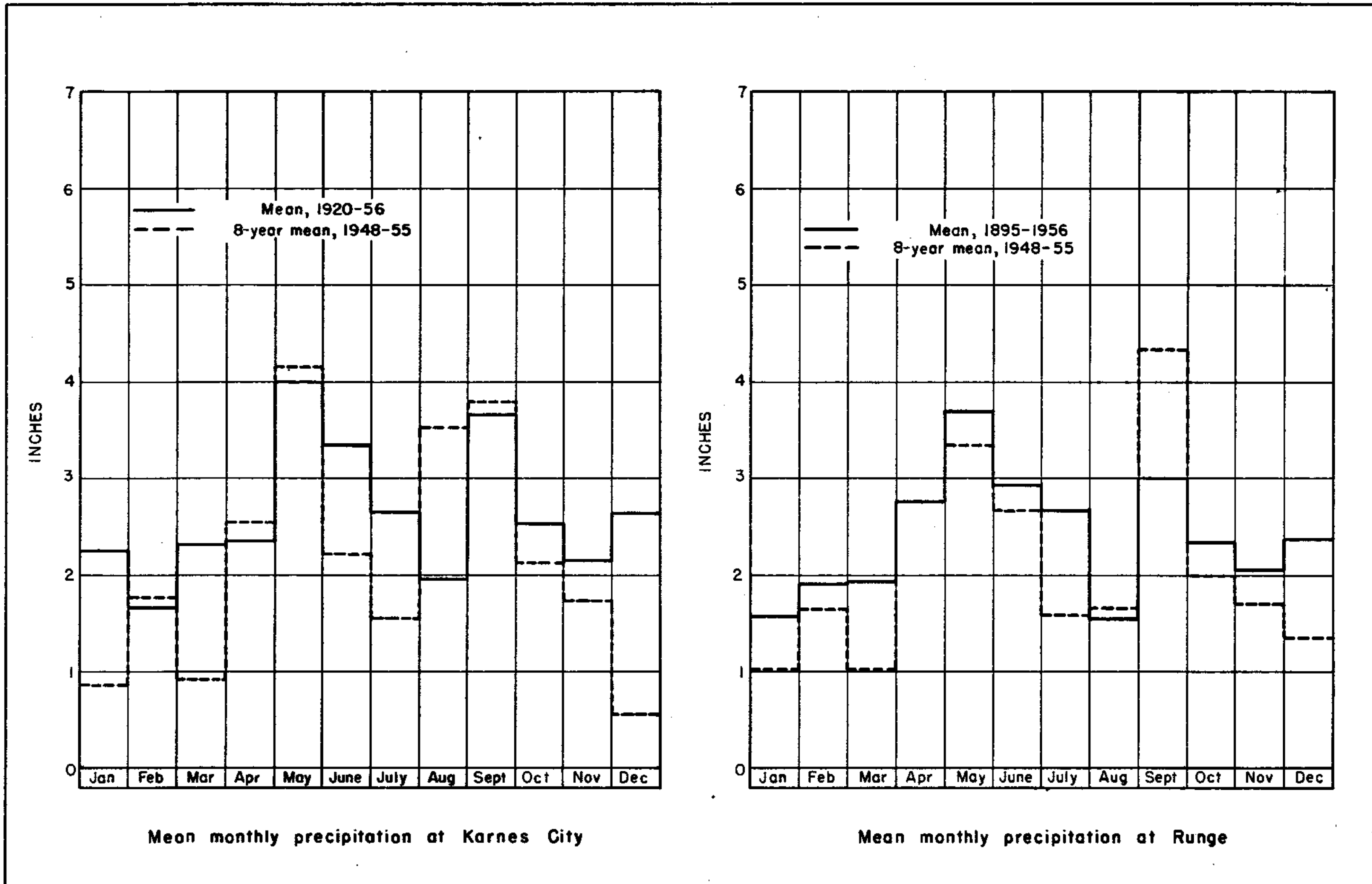

FIGURE 4.- Monthly precipitation at Karnes City and Runge
(From records of the U.S. Weather Bureau)

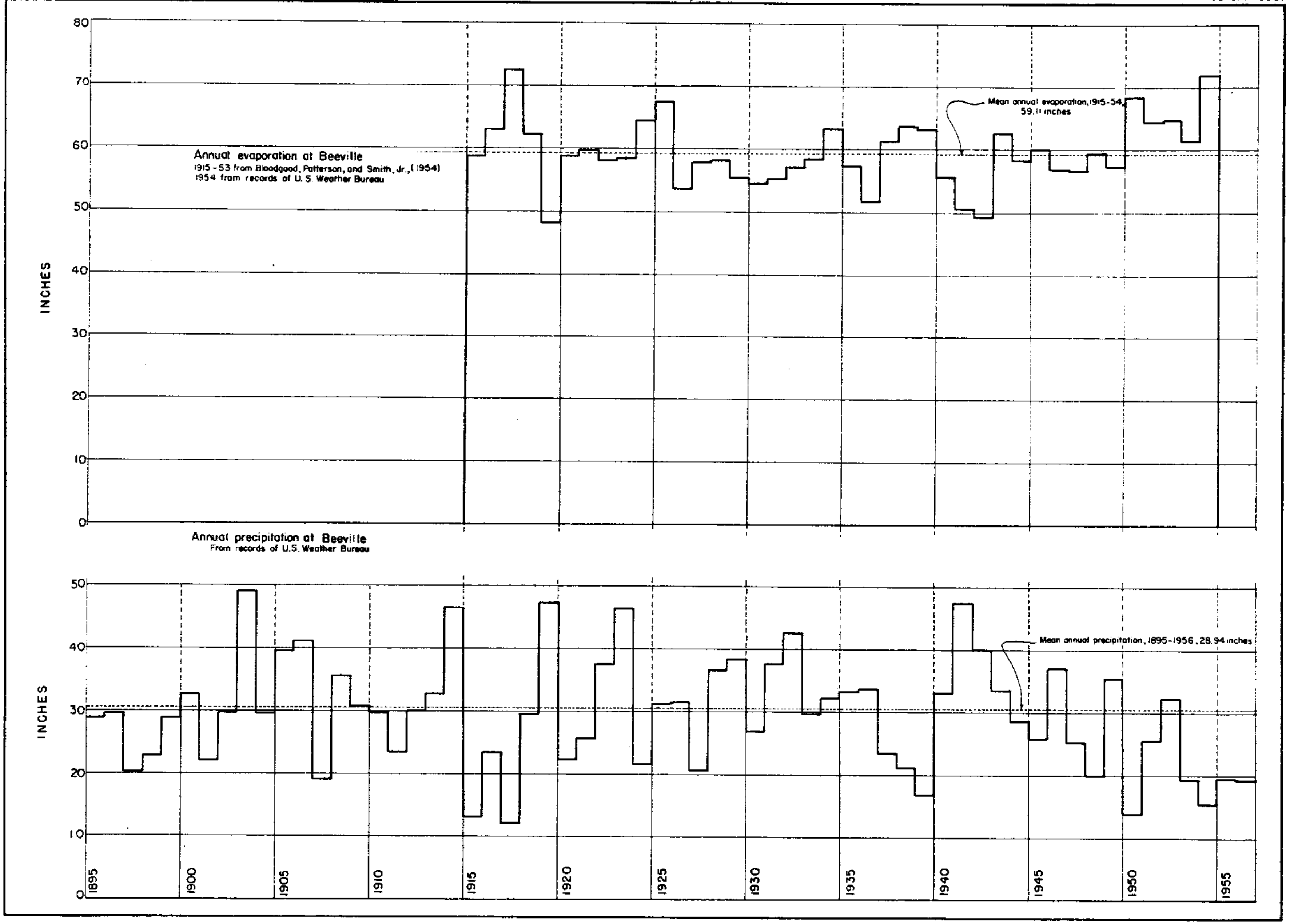

FIGURE 5. —Annual evaporation and precipitation at Beeville, Bee County

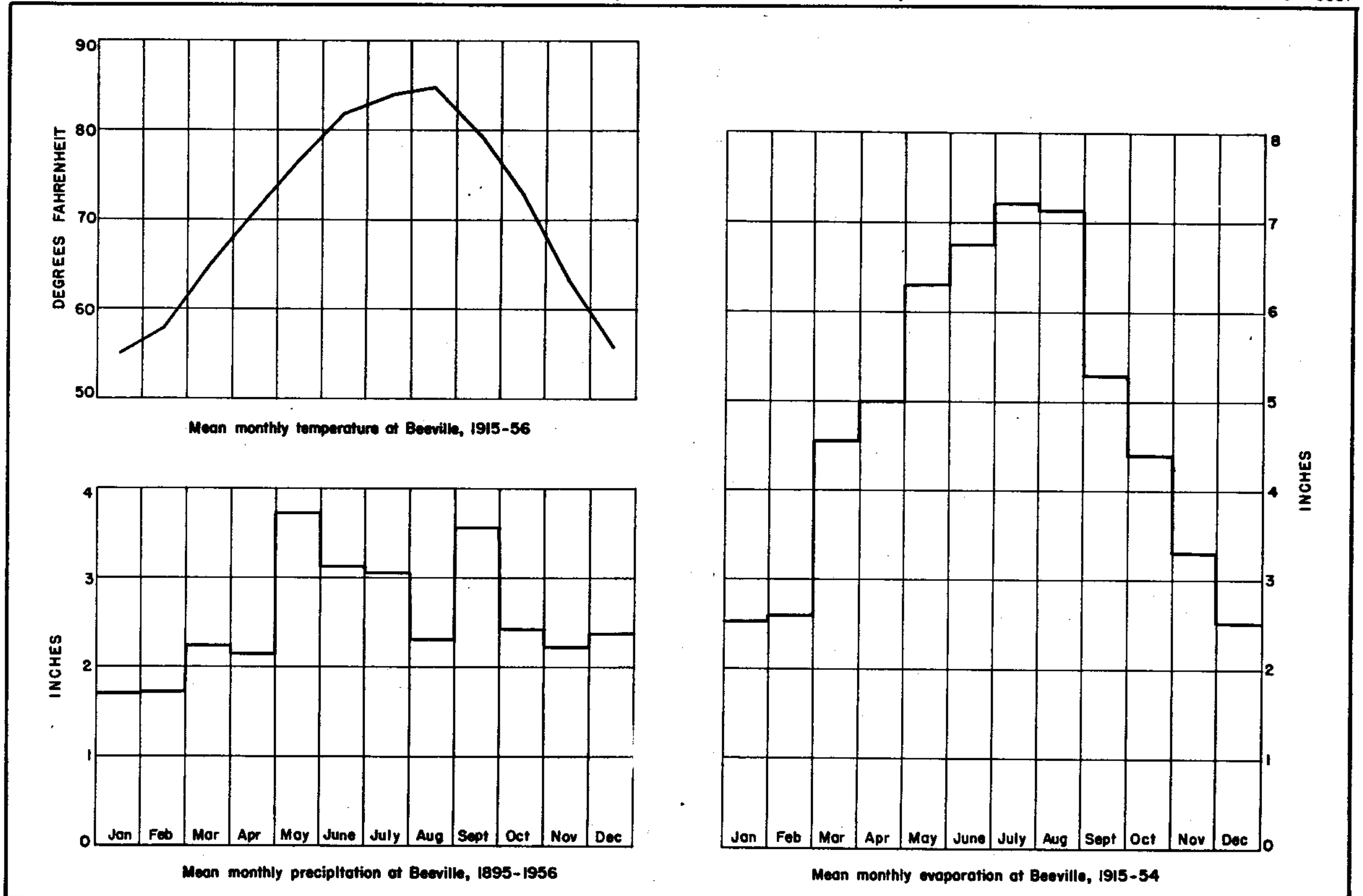

FIGURE 6.- Mean monthly temperature, precipitation, and evaporation at Beeville, Bee County

(From records of the U.S. Weather Bureau.)

Table 2.- Stratigraphic units and their water-bearing properties in Karnes County

System	Series	Group	Stratigraphic unit	Approximate thickness (feet)	Character of rocks	Water-bearing properties
Quaternary	Recent and Pleistocene		Alluvium	0--30	Terrace deposits composed of clay, silt, sand, and gravel.	Not an aquifer in Karnes County.
Tertiary(?)	Pliocene(?)		Interstream sand and gravel deposits	0--30	Predominantly gravel and sand.	do
			Unconformity			
Tertiary	Pliocene		Goliad sand	0-100	Sand and sandstone interbedded with clay, gravel, and caliche.	do
			Unconformity			
	Miocene(?)		Lagarto clay	0-500±	Clay and sandy clay, and intercalated beds of sand and sandstone.	Yields small to moderate quantities of fresh to slightly saline water.
	Miocene		Oakville sandstone	0-800	Medium to fine-grainged sand and sandstone, and sandy, ashy, and bentonitic clay beds.	Yields moderate to large quantities of fresh to slightly saline water.
			Unconformity			
	Miocene(?)		Catahoula tuff	0-500±	Predominantly tuff, tuffaceous clay, sandy clay, bentonitic clay, and sandstone.	Yields small to moderate quantities of fresh to moderately saline water
			Unconformity			
	Oligocene(?)		Frio clay	0-200	Clay, sand, and sandy silt.	Not an aquifer in Karnes County.
			Unconformity(?)			
	Eocene	Jackson	Undifferentiated	0-1,200	Clay, silt, tuffaceous sand, and volcanic ash.	Yields small quantities of fresh to moderately saline water.
		Claiborne	Yegua formation	500-1,000+	Sand, silt, and clay.	Yields small quantities of slightly to moderately saline water.
			Unconformity			
			Cook Mountain formation	400-(?)	Clay and shale containing small amounts of sand, silt, limestone, glauconite, and selenite.	Not an aquifer in Karnes County.
			Unconformity			
			Sparta sand	100-(?)	Medium to fine sand and clay.	do
			Mount Selman formation: Weches greensand member	130-(?)	Shale and sand.	do
			Mount Selman formation: Unconformity(?)			
			Mount Selman formation: Queen City sand member	800-(?)	Medium to fine sand, silt, and clay.	do
			Mount Selman formation: Reklaw member	200-400	Mainly marine clay and shale.	do
			Carrizo sand	800-1,000	Medium to fine sand, silt, and clay.	Capable of yielding moderate to large quantities of fresh to slightly saline water.
			Unconformity			
		Wilcox	Undifferentiated sand and clay	2,200	Silt, clay, fine to medium grained sandstone, sandy shale and clay and thin beds of lignite.	Not an aquifer in Karnes County.
	Paleocene	Midway	Undifferentiated clay, silt, and sand	Not determined	Mainly clay and silt.	do

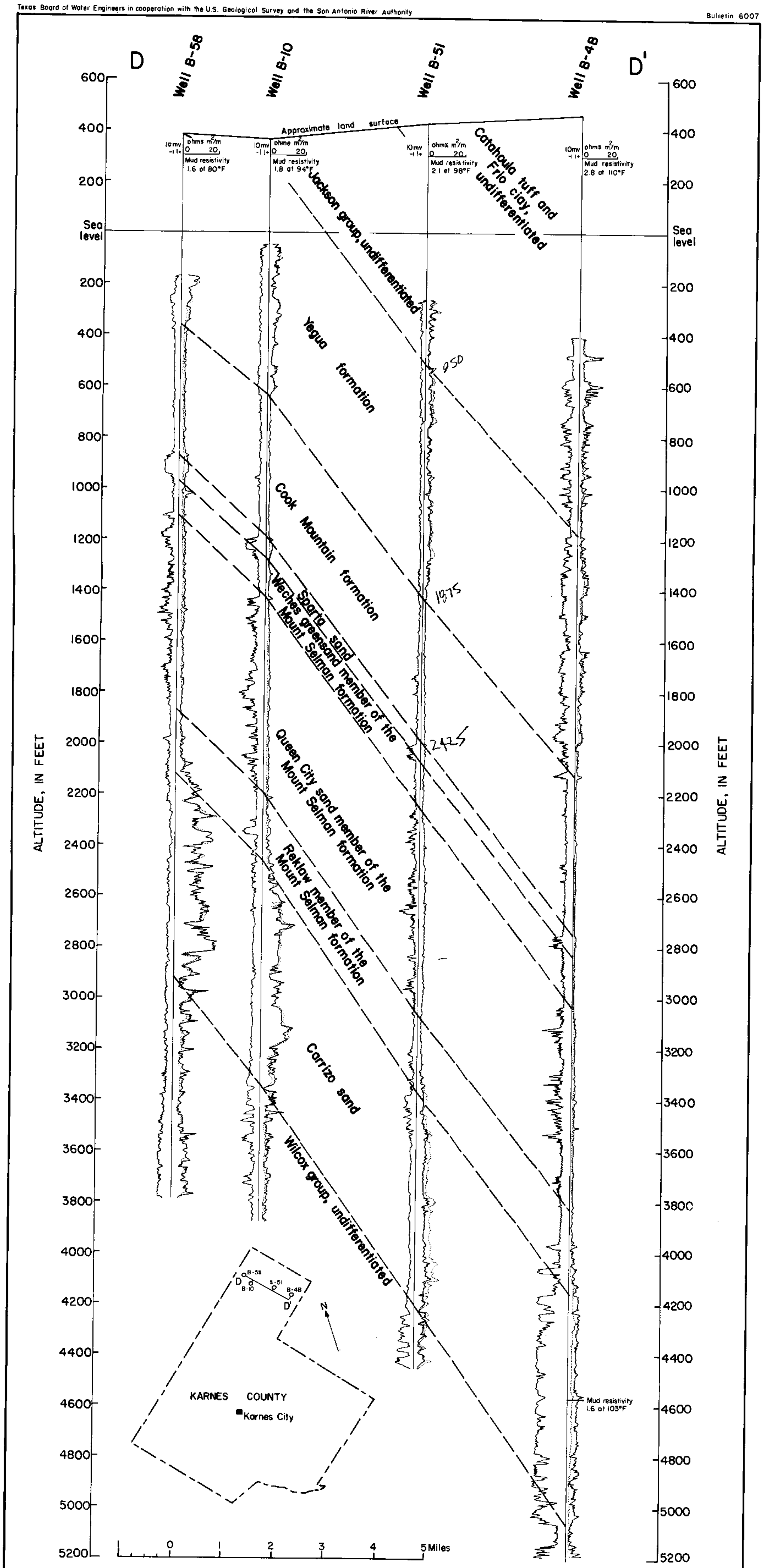

FIGURE 7.- Geologic section D-D'

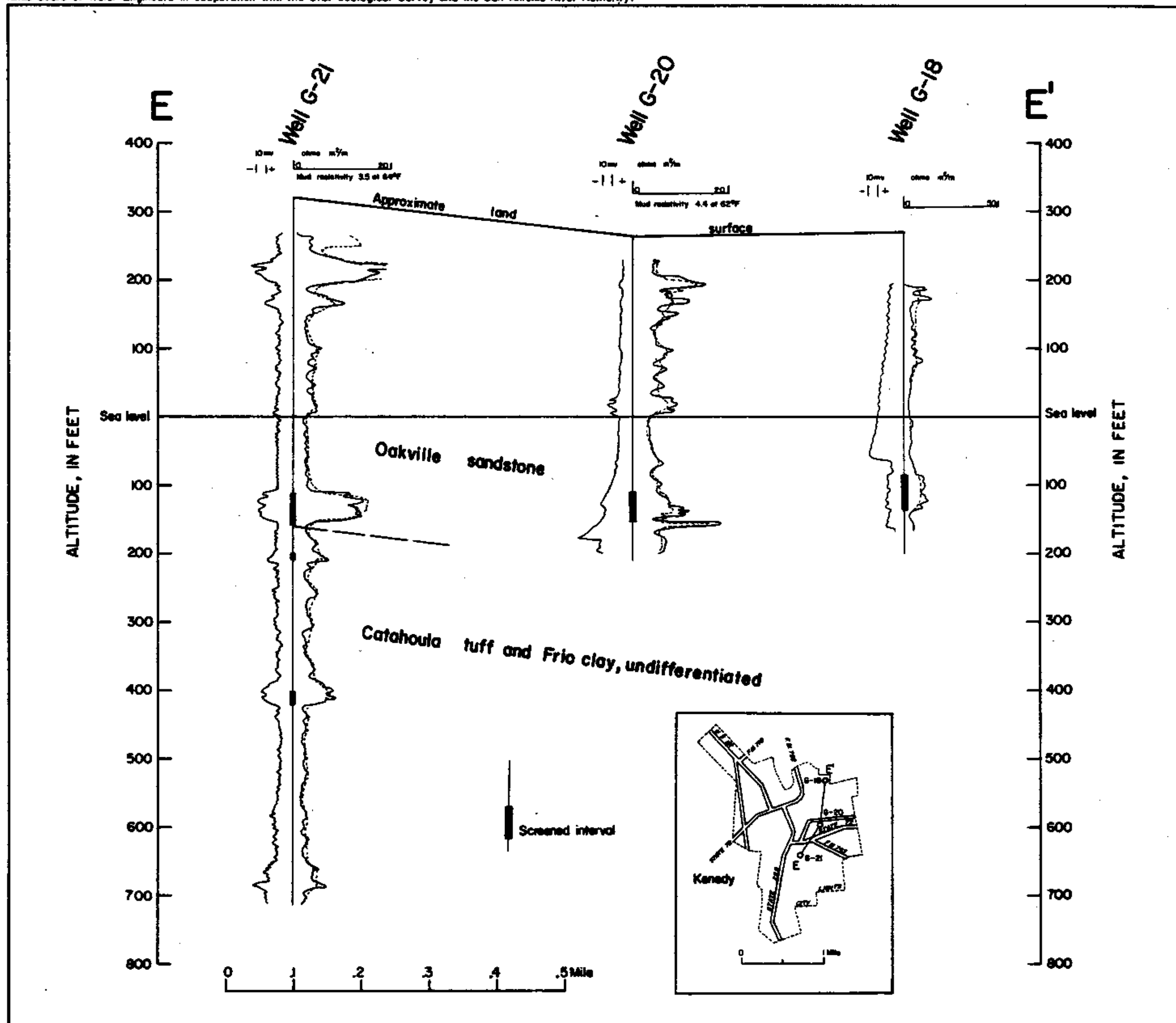

FIGURE 8.- Geologic section E - E'

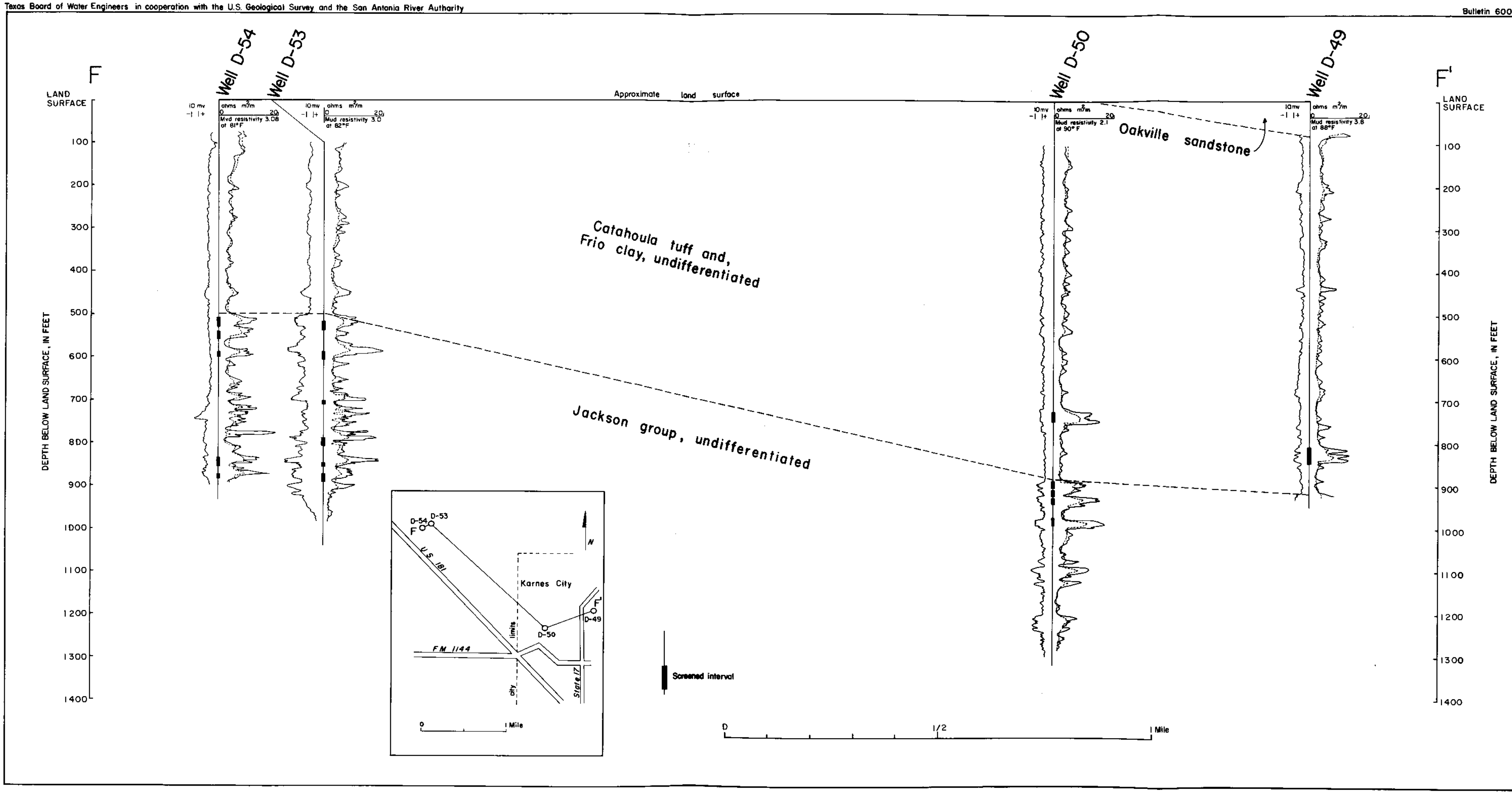

FIGURE 9.- Geologic section F-F'

Rocks in Karnes County are cut by many normal faults, only a few of which are shown on plate 1. Most of the faults strike approximately parallel to the strike of the beds; however, a few strike diagonally across the strike of the beds. The faults dip steeply and have throws of from a few feet to several hundred feet. Most of the oil fields in the county are on structures associated with faulting.

The Gulf Coastal Plain was submerged during much of Cenozoic time. In Paleocene time the sea advanced, and the Midway deposits were laid down on the sea floor. After Midway time, deposits were laid down in lagoons and embayments or along the seashore and in the sea. The sediments were deposited as detrital material at or near the oscillating shoreline. During the later part of the Tertiary period the sea withdrew from the region. The area has been above sea level since that time. In much of the area beds of volcanic ash and tuff were deposited at various times in the Tertiary period. Late in Pliocene time, after faulting and uplift, gravel and silt were spread over the land surface. Erosion then lowered the plain to the altitude of the present hilltops and divides. The gravel capping most of the hills and ridges is the remnant of flood-plain deposits laid down on the beveled surface of the older rocks. The lower and broader terraces are underlain by gravel, sand, and silt of Quaternary age.

GEOLOGIC FORMATIONS AND THE OCCURRENCE OF GROUND WATER

The water-bearing formations in Karnes County are being replenished continually by a small part of the precipitation on their outcrop areas. Most of the rainfall in and near Karnes County runs off in streams, evaporates, or is transpired by vegetation. Water that reaches the zone of saturation moves slowly through the rocks until it discharges through some natural outlet, is intercepted by wells, or escapes by slow movement into overlying beds downdip from the outcrop. Most of the formations in the county must have contained salty water at one time, either because they were deposited in the sea or in brackish-water zones near the sea or because the sea flooded the area shortly after their deposition. In Karnes County some beds of sand downdip from the outcrop are filled with fresh water, indicating that fresh water absorbed by the sand at the outcrop moved downdip and flushed out the salty water. At present, most of the sand beds contain fresh water near the outcrop and, generally, for some distance downdip. Farther downdip the water contains more mineral matter, the saline water having been only partly flushed. Still farther downdip the beds contain connate water, presumably water trapped in the sediments when they were deposited (Winslow and others, 1957, p. 387.)

In this report, water is classified according to its dissolved-solids content as follows (Winslow and Kister, 1956, p. 5):

Description	Dissolved solids ppm
Fresh--	Less than 1,000
Slightly saline------------------------------	1,000 to 3,000
Moderately saline----------------------------	3,000 to 10,000
Very saline----------------------------------	10,000 to 35,000
Brine--	More than 35,000

Water for public, irrigation, stock, and domestic supplies in the county is in either the fresh or the slightly saline range. Slightly saline water, although undesirable, may be used for drinking with no apparent ill effects. Water containing as much as 3,000 ppm (parts per million) of dissolved solids has been used for supplemental irrigation. Experiments have indicated that 10,000 ppm is the upper limit of salinity that can be tolerated by livestock (Smith and others, 1942, p. 15).

In general discussions of the yield of wells, the following rating is used in this report:

Description	Yield gpm
Very small	Less than 10
Small	10 - 50
Moderate	50 - 500
Large	More than 500

Water in the sandy outcrop areas generally is unconfined--that is, the surface of the zone of saturation, the water table, is in permeable materials and is subject only to atmospheric pressure.

Downdip from the outcrop, ground water in sandy formations commonly is confined by relatively impermeable overlying strata. Although the confining beds generally are regarded as impermeable, water may move very slowly even through clays. (See Winslow and others, 1957, p. 387.) Confined water is water under sufficient pressure to rise in tightly cased wells above the top of the aquifer. If the altitude to which water rises is greater than the altitude of the land surface, flowing wells result. The confined water is called artesian water whether or not it flows from wells.

The rocks of Tertiary and Quaternary age underlying Karnes County are mainly sandstone and sand interbedded with clay. Although all are saturated, only the sandy beds yield water freely to wells. The water table is at or near the surface in the valleys and as much as 100 feet below land surface along the interstream divides.

Tertiary System

PALEOCENE SERIES

Midway group, undifferentiated

Rocks of the Midway group are the oldest Tertiary rocks in south-central Texas. The Midway lies unconformably on rocks of Late Cretaceous age and unconformably below the Wilcox group. The Midway is at a depth of more than 5,000 feet along the Wilson County line and dips toward the Gulf of Mexico at an average rate of more than 200 feet per mile. The group, composed mainly of clay and silt, contains thin beds of sand near the top. The thickness of the Midway in Karnes County was not determined. Interpretation of electric logs indicates no fresh or slightly saline water in or below the Midway group.

EOCENE SERIES

Wilcox group, undifferentiated

Rocks of the Wilcox group, which unconformably overlie the Midway, do not crop out in Karnes County but are penetrated in deep oil wells and oil-test holes. The base of the Wilcox group dips toward the Gulf of Mexico at a rate of more than 200 feet per mile. In Karnes County the Wilcox is composed of thinly bedded silt, clay, fine- to medium-grained sandstone, sandy shale and clay, and thin beds of lignite. The top of the Wilcox is at a depth of about 3,300 feet in the northeast corner of the county, where the group is about 2,200 feet thick. Chemical analysis of water from well A-22 and interpretations of electric logs indicate that the Wilcox group contains only moderately to very saline water.

Claiborne group

The Claiborne group consists of an alternating series of marine and continental strata. Each change from sand to clay indicates a change in the depositional environment. The sands indicate episodes of continental deposition; the fossiliferous clays indicate marine deposition; and the brown lignites indicate deposition in swamps (Sellards and others, 1932, p. 610). The Claiborne group includes the Carrizo sand, the Mount Selman formation, the Sparta sand, the Cook Mountain formation, and the Yegua formation.

CARRIZO SAND

The Carrizo sand overlies the Wilcox group unconformably; the top of the Carrizo is about 2,500 feet below land surface in the northeast corner of Karnes County. The formation crops out in a northeastward-trending belt 2 to 5 miles wide in the northern and northwestern parts of Wilson County (Anders, 1957, p. 13), but it does not crop out in Karnes County. The Carrizo dips toward the coast at an average rate of about 170 feet to the mile. Drillers' logs and electric logs indicate that the Carrizo sand in Karnes County is composed of medium to fine sand, silt, and clay. Plates 2 and 4 show that the Carrizo is about 1,000 feet thick near the Wilson county line. In northwestern Karnes County, where the Carrizo is nearest the surface, the formation consists mostly of coarse material and contains only a small amount of clay. Downdip near the Goliad county line where the top of the Carrizo is about 7,000 feet deep, interpretations of electric logs indicate that the formation contains considerably more clay than it does updip near the Wilson county line.

The Carrizo sand contains the deepest fresh to slightly saline water known in Texas. The fresh water in the formation in most of Wilson County and all of Karnes County is under artesian pressure, enough in Karnes County to cause wells to flow. In southeastern Wilson and western Karnes Counties the hydraulic gradient of the confined water in the Carrizo sand is about 4 feet per mile in the direction of dip. The gradient elsewhere in the area probably is similar. Interpretations of electric logs and chemical analyses of samples of water from the formation indicate that the greatest depth of fresh to slightly saline water in the Carrizo sand is more than a mile below the land surface in southwestern Karnes County. The factors affecting the ability of the formation to yield water to wells are discussed on page 29.

MOUNT SELMAN FORMATION

The Mount Selman formation is subdivided into three members--the Reklaw member, Queen City sand member, and Weches greensand member.

Reklaw member

The Reklaw member conformably overlies the Carrizo sand in Karnes County. This member does not crop out in the county but is present in the subsurface in the northwestern part at depths of about 2,800 feet. The rocks dip southeastward. In Karnes County the Reklaw is composed mainly of marine clay and shale with a range in thickness from about 200 to 400 feet (pl. 2). The Reklaw is distinguishable on electric logs in areas where the underlying and overlying formations contain sand; farther downdip where the materials in the formations are more nearly alike, the Reklaw cannot be distinguished readily from the overlying deposits. The Reklaw is not an aquifer in Karnes County.

Queen City sand member

The Queen City sand member overlies the Reklaw member conformably. This member does not crop out in Karnes County but is present throughout the county in the subsurface--at a depth of about 2,000 feet in the northwestern part. Interpretations of electric and drillers' logs indicate that the Queen City in northwestern Karnes County is composed of medium to fine sand, silt, shale, and clay. In the southeastern part of the county, where the Queen City sand member is more than 5,000 feet below land surface, it consists mainly of silt and clay. Near the Wilson county line the formation is 800 feet thick. Interpretations of electric logs indicate that the Queen City does not contain fresh or slightly saline water in the county.

Weches greensand member

The Weches greensand member, the uppermost member of the Mount Selman formation, overlies the Queen City sand member conformably. This member does not crop out in Karnes County but is present in the subsurface at depths ranging from about 1,400 to more than 5,000 feet (pls. 2 and 4). The Weches is composed of fossiliferous glauconitic sand and shale and is about 100 feet thick where it crops out in Wilson County. Interpretations of electric logs of wells in northwestern Karnes County indicate that the Weches predominantly is clay and is about 130 feet thick.

The member appears to thicken somewhat downdip, but the apparent increase in thickness may be due to misinterpretation of electric logs, at least in part, because of the decrease in sand in the overlying and underlying rocks. The Weches greensand member is not an aquifer in the county.

SPARTA SAND

The Sparta sand conformably overlies the Mount Selman formation. It does not crop out in Karnes County but occurs in the subsurface at depths ranging from about 1,200 to more than 5,000 feet. Interpretations of electric logs indicate that in northwestern Karnes County the Sparta is about 100 feet thick and consists of fine sand and clay. The Sparta is predominantly sand in the northwest half of the county; farther downdip the sand grades into clay. The Sparta sand contains no fresh or slightly saline water in the county.

COOK MOUNTAIN FORMATION

The Cook Mountain formation unconformably overlies the Sparta sand. This formation does not crop out in Karnes County but is at depths of about 400 feet below land surface along the Wilson county line, where it is about 400 to 450 feet thick. It thickens downdip--southeastward. The formation consists of fossiliferous clay and shale that contains a few lenses of sandstone and limestone and small amounts of glauconite and selenite. Interpretations of electric logs indicate that the Cook Mountain is not an aquifer in the county.

YEGUA FORMATION

The uppermost formation of the Claiborne group, the Yegua, often referred to as the "Cockfield" (Sellards and others, 1932, p. 666), unconformably overlies the Cook Mountain formation. The upper part of the Yegua crops out along the north half of the Wilson County line (pl. 1). The Yegua dips toward the coast at about 155 feet per mile. It is composed of beds of medium to fine sand, silt, and clay, which generally weather light red and tan. Deussen (1924, p. 78) reported that on the San Antonio River, about 1,000 feet below the crossing 4 miles south of Poth (6 miles northwest of county line on U. S. Highway 81 in Wilson County), the Yegua consists of brown clay, gray plastic shale, and a lens of yellow indurated sand. The Yegua contains small amounts of gypsum, and, according to Lonsdale (1935, p. 41), contains beds of lignite and limestone. It thickens from about 500 feet along the Wilson County line, where part of the formation is missing, to more than 1,000 feet downdip (pls. 2 and 4). The Yegua is much finer grained downdip and not distinguishable readily on electric logs.

Generally, the Yegua yields small quantities of slightly to moderately saline water in the county. In some areas it yields moderate quantities of fresh water.

Jackson group, undifferentiated

The Jackson group in Texas includes all Eocene strata above the Claiborne group. In this publication the group has not been divided into formational units. It lies conformably above the Yegua and consists mainly of shallow-water marine, and beach deposits of sand, clay, and tuff. Some of the beds of sand and clay contain lignitic material. The Jackson crops out in a broad belt ranging in width from 4 to 10 miles, along and near the entire Wilson County line and dips gulfward an average of 150 feet per mile (pls. 1 and 2). The Jackson, which is about 900 feet thick at its surface contact with the Catahoula tuff, which overlaps it, thickens downdip. The group is about 2,400 feet below land surface near the Goliad county line.

The lower part of the Jackson group is composed predominantly of clay, bentonitic clay, and silt. Thin sand and ashy-sand strata separate some of the beds of clay and silty clay, and locally the lower part consists largely of sandy strata. The lower part yields small quantities of slightly to moderately saline water to wells that tap it at depths of less than 1,000 feet.

The upper part of the Jackson group is composed mainly of beds of tuffaceous sand interbedded with bentonitic clay. Locally, some of the sandstone and clay beds are fossiliferous. Volcanic ash was contributed in large amounts to the sediments at various times during the Eocene epoch. Some of the volcanic ash is composed of medium-grained glass shards, large enough to be seen with the naked eye. In a few places the interstices between the grains of sand and silt are partly filled by carnotite and small amounts of other uranium minerals (Eargle and Snider, 1957, p. 17-26).

The upper part of the Jackson group yields very small to moderate quantities of water to wells. Generally the water that is less than 1,000 feet below land surface is fresh to slightly saline, but some wells yield moderately saline water. B-61, an irrigation well, and D-50, one of the Karnes City municipal wells, may tap the Jackson group in part.

OLIGOCENE(?) SERIES

Frio clay

The Frio clay has not been differentiated in Karnes County because of lithologic similarity with the overlying Catahoula tuff with which it has been included in geologic sections. It does not crop out in Karnes County because it is overlapped by the Catahoula; however, it crops out 8 miles southwest of the Karnes County line in northwestern Live Oak County. Where exposed in Live Oak County it occupies a position between the Jackson group and the Catahoula tuff. In the subsurface the Frio lies unconformably upon the sands of the Jackson group. In Karnes County a layer of sand, conglomerate, and coarse detritus marks the upper contact of the Frio with the tuffaceous and ashy beds of the Catahoula (Sellards and others, 1932, p. 705). The Frio is composed of clay, sand, and sandy silt. The clay is bentonitic and slightly calcareous, with a reported thickness of about 200 feet in southern Karnes County. The Frio clay is not an aquifer in the county.

MIOCENE(?) SERIES

Catahoula tuff

In Karnes County the Catahoula tuff unconformably overlaps the Frio clay and the upper part of the Jackson group. The formation crops out in a belt that ranges in width from about 3 miles in the northeastern part of the county to about 10 miles in the southwestern part. The part of the Jackson-Catahoula contact represented by a solid line on plate 1 has been mapped in detail and is located more accurately than the part represented by a dashed line. The average dip of the base of the Catahoula tuff in Karnes County is about 120 feet per mile. The Catahoula consists predominantly of tuff, tuffaceous clay, sandy clay, bentonitic clay, and discontinuous lenses of sandstone. The formation also contains thin beds of lignite and a few beds of limestone. Some ash beds are interbedded with bentonitic clay. Conglomerate, irregularly distributed throughout the formation, contain chunks of scoriaceous lava, pebbles of other igneous rocks, opalized wood, irregular masses of chalcedony, quartz, and chert. Interpretations of drillers' logs and electric logs indicate that beds of sand and gravel are present many miles downdip. The Catahoula is about 700 feet thick at its contact with the overlying Oakville sandstone. The exact thickness of the Catahoula in the subsurface was not determined, because it cannot be distinguished on electric logs from the underlying Frio clay, which is included with it on the geologic sections. Both formations thicken in the southern part of the county. Generally, the beds of sand and conglomerate are not more than 10 feet thick at the outcrop, although interpretations of electric logs indicate that some water-bearing zones, mainly sand or sand and conglomerate interbedded with clay, are nearly 100 feet thick (pls. 2 and 4, and figs. 8 and 9).

The Catahoula tuff is one of the principal aquifers in Karnes County because it is the only shallow source of fresh to slightly saline water in its area of outcrop. Most of the municipal supply for Karnes City and part of the supply for Kenedy is obtained from wells tapping the Catahoula tuff. Five irrigation wells obtain part of or all their water from the Catahoula.

MIOCENE SERIES

Oakville sandstone

The Oakville sandstone, the principal aquifer in Karnes County, unconformably overlies and partly overlaps the Catahoula tuff. In some areas the contacts of the Catahoula and the Oakville cannot be distinguished by electric logs because relatively thick beds of sand near the top of the Catahoula are similar to those in the Oakville. The outcrop, 8 miles wide in the northeastern part of the county, broadens to 11 miles along the San Antonio River, and narrows to 7 miles in the southern part of the county (pl. 1). The base of the Oakville dips gulfward an average of 85 feet per mile. In Karnes County the Oakville is composed of cross-bedded medium- to fine-grained sand and sandstone and sandy, ashy, and bentonitic clay beds. Where the full section is present, the Oakville ranges in thickness from about 500 feet in southern Karnes County to 800 feet in the east-central part of the county (pls. 2 and 4).

The Oakville sandstone yields large quantities of fresh to slightly saline water to some irrigation wells and to the municipal wells at Runge and Kenedy. Small quantities of fresh to slightly saline water are obtained from many domestic and stock wells. The thin beds of sand yield only small supplies of moderately saline water about 5 miles southwest of Kenedy.

MIOCENE(?) SERIES

Lagarto clay

The Lagarto clay lies unconformably above the Oakville sandstone in a northeastward-trending belt in Karnes County (pl. 1). Because unaltered Lagarto clay is poorly exposed, its surface contact with the Oakville was mapped by differences in soils. The soil derived from the Oakville is residual dark-gray to dark-brown loam, which contains a large quantity of organic matter. Where the Lagarto is exposed, the beds of clay are reddish brown; no similar reddish-brown clay was found in the Oakville. Thick beds of sand, similar to those in the Oakville, make identification of the Lagarto difficult on electric logs. A prominent sand body, having a maximum thickness of about 40 feet, is well exposed about 2 miles southeast of Runge. This sand extends for about 10 miles from the San Antonio River to Nordheim, in De Witt County.

The Lagarto consists of clay and sandy clay that contains many calcareous nodules and intercalated beds of sand and sandstone. In general the beds of sand are most common near the outcrop and are replaced progressively by beds of clay downdip. At places the clay is capped by a bed of sand and gravel or by calcareous sandstone. No sharp distinction between the Oakville sandstone and Lagarto clay is indicated on electric logs (see geologic sections) because of the large amount of clay in the Oakville (as much as 50 percent locally) and the large amount of sand in the Lagarto (as much as 40 percent locally). At the downdip edge of the outcrop in Goliad County, the Lagarto is about 500 feet thick. The thickness of the formation in Karnes County has not been determined but probably is about 500 feet, where the full section of the formation is present. The dip is southeastward, ranging from 20 to 40 feet per mile.

The Lagarto yields small to moderate quantities of fresh to slightly saline water to many wells for domestic, stock, irrigation, and municipal supply. Water from the Lagarto generally is less mineralized than that from the Oakville.

PLIOCENE SERIES

Goliad sand

The Goliad sand overlies the Lagarto clay unconformably. It is difficult to distinguish the sand beds in the two formations; the contact in some areas is arbitrarily defined as the base of the first clay that contains grains of coarse sand. The soil developed on the Goliad bears a marked resemblance to the reddish-brown soil of the Lagarto clay. The Goliad crops out in several areas in southern and southeastern Karnes County (pl. 1). The formation dips and thickens coastward. The Goliad is reported to attain a maximum thickness of 500 feet in southeastern Goliad County, but its maximum thickness in Karnes County is about 100 feet. The Goliad consists predominantly of sand and sandstone interbedded with clay and gravel. The basal bed of sandstone, which is as much as 50 feet thick in places, contains clay and gravel. The gravel deposits include chert and quartz pebbles and calcareous fragments, which probably are redeposited caliche. The white color of the caliche is characteristic of the Goliad in the area of outcrop. The Goliad is, in most places, above the regional water table and contains very little water.

Tertiary(?) System

PLIOCENE(?) SERIES

Interstream sand and gravel deposits

Most of the divides on the higher parts of the Gulf Coastal Plain are remnants of an ancient plain. The name "Uvalde gravel" has been applied to the covering deposits--remnants of a formation that consisted of coarse and fine gravel. The interstream deposits lie unconformably on beds ranging in age from Late Cretaceous to middle Pliocene. In most places the original unit has been eroded to residual gravel, either loose or embedded in caliche. Some remnants consist of thin sheets of flint gravel. In Wilson County the Uvalde gravel occurs in a zone extending several miles on either side of the San Antonio River and Cibolo Creek.

Sand and gravel is found on the tops of hills in many places in Karnes County. One rather large deposit extends from a point 7 miles east-southeast of Gillett to a point 7 miles south-southeast. The interstream deposits dip gently gulfward as do the underlying older formations. Because the deposits cap the hills and spread down their sides, a result of erosion and weathering, the maximum thickness is not determined readily. Deussen (1924, p. 107) reported a thickness of 20 feet in Karnes County. Anders (1957, p. 18) stated that the Uvalde gravel is in most places less than 2 to 5 feet thick in Wilson County. The interstream deposits are as much as 30 feet thick in Karnes County. Locally, the deposits resemble materials found in the Goliad sand. Boulders and cobbles are interbedded with coarse sand. The interstream deposits are not aquifers in Karnes County. For that reason and because they are thin and difficult to distinguish in the field, they are not differentiated on the geologic map (pl. 1) or the geologic sections.

Quaternary System

PLEISTOCENE AND RECENT SERIES

Alluvium

Scattered alluvial terrace deposits found along many of the larger streams and creeks in Karnes County are composed of fine sand, silt, clay, and some gravel. The alluvium ranges in thickness from 0 to 30 feet. It is not a major source of water in Karnes County and is not differentiated from the underlying deposits on the geologic map (pl. 1) and sections.

Aquifer Tests

Six aquifer tests were made in Karnes County (fig. 2) to determine the ability of some beds of sand that contain fresh and slightly saline water to transmit and store water. The data from the pumping tests were analyzed by the Theis recovery method (Theis, 1935, p. 519-24) and the Theis nonequilibrium method as modified by Cooper and Jacob (1946, p. 526-534).

The results of the Karnes County tests and a test at Pettus in Bee County are shown in table 3.

The ability of an aquifer to transmit water is measured by its coefficient of transmissibility. The field coefficient of transmissibility is defined as the amount of water in gallons per day that will pass through a vertical strip of aquifer having a width of 1 foot and a height equal to the thickness of the aquifer under a hydraulic gradient of 1 foot per foot at the prevailing aquifer temperature. The coefficient of storage of an aquifer is defined as the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface, that is, the volume of water released by a column of the aquifer having a cross-sectional area of 1 square foot when the head is lowered 1 foot. The coefficients from these tests represent only the sand zones tested in the area in which they were tested and should not be used to predict yield or drawdown in untested areas. However, the order of magnitude of the coefficients generally are about what may be expected in a particular formation.

No tests were made of wells tapping the Carrizo sand, but tests made in Wilson County suggest that the transmissibility of the Carrizo is much greater than that of any formations tested in Karnes County.

GROUND-WATER DEVELOPMENT

Present

WITHDRAWALS

It is estimated that Karnes County has 1,000 water wells, and that the quantity of ground water discharged by these wells in 1957 averaged about 1,700,000 gpd (gallons per day). Of this, about 350,000 gpd was produced from the Carrizo sand; the remainder was from the younger water-bearing formations. Ground water was the only source of municipal and domestic supplies of water for about 18,000 persons and was the source for a large part of the irrigation and stock supplies. Estimated ground-water use for municipal, domestic, irrigation, and stock supplies in 1957 averaged about 700,000, 175,000, 650,000,

Table 3.- Results of aquifer tests

Well numbers	Owner	Length of well screen or slotted casing in pumped well (feet)	Formation tapped	Field coefficient of transmissibility (gpd/ft)	Coefficient of storage
H-30 and H-31	United Gas Pipeline Co.	40	Oakville sandstone and/or Lagarto clay	5,000	0.000074
E-39 and E-40	City of Runge	34	Oakville sandstone	10,000	.00024
D-48 and D-49	Karnes City	40	Catahoula tuff	1,400	.00004
D-50	Karnes City	93	Catahoula tuff and Jackson group	2,100	--
G-20, G-22, and G-23	City of Kenedy	62	Oakville sandstone	14,000	.00013
E-20 and E-21	Mrs. Ernest Yanta Henry Hedtke	61	Oakville sandstone	8,000	.00011
Pettus, Bee County	Stanolind Oil & Gas Co. Re-cycling Plant	150	Oakville sandstone	11,000	--

and 175,000 gpd, respectively. Figure 10 shows the monthly pumpage from the municipal supply wells at Falls City, Karnes City, Kenedy, and Runge based on data reported by city officials.

CHANGES IN WATER LEVEL

Table 4 compares the water levels in selected wells in Karnes County in 1936 or 1937 with the water levels in the same wells in 1956 or 1957. Of the 81 wells listed in the table, water levels in 41 declined less than 8 feet and in 24 rose less than 8 feet. Of the other wells, water levels in 12 declined 8.5 to 36.6 feet and in 4 rose from 9.1 to 24 feet.

The head in the aquifers in Karnes County responds mainly to changes in rates of withdrawal of ground water. However, the changes in water level of some of the wells in table 4 may be due to changes in the physical condition of the well caused by deepening, partial plugging, or leaking casing. Thus, the data probably are suggestive but are not controlled exclusively by changes in withdrawal rates and amount of ground water in storage.

Changes in water levels in wells may be due in part to local changes in withdrawal rates as many of the wells are used frequently everyday. Thus, a substantial rise in water level may indicate that withdrawals from the measured well or nearby wells were greater during the period immediately preceding the 1936-37 measurement than during the period immediately preceding the 1956-57 measurement. A substantial decline may indicate that withdrawals from the measured well were greater during the period immediately preceding the 1956-57 measurement.

Most of the water-level records show changes in artesian pressure rather than changes in the thickness of saturated material. Only a very small change in the total amount of ground water in storage is indicated despite the drought of 1950-56.

Potential

The potential development of ground water in Karnes County is small in comparison to that in Wilson County where the Carrizo sand is closer to the surface and in Goliad County, where the Goliad and younger formations crop out. However, the potential rate of withdrawal is large compared to the rate of withdrawal in 1957. In favorable locations, wells less than 1,000 feet deep yield as much as 600 gpm (gallons per minute), and deeper wells tapping the Carrizo sand in part of northwestern Karnes County may yield as much as 1,000 gpm. Water supplies suitable for watering stock can be obtained almost anywhere in the county, within a depth of 200 feet, but the water in several places may be too saline for domestic use. The quality of water differs from place to place, but it may be estimated in many places by comparing the analyses of samples from nearby wells of similar depth.

The development of ground water in a given area is limited by the cost of the water relative to its value. Two major factors affecting the unit cost of water are the initial cost of the well and the cost of pumping; the cost of the well is related to its depth and diameter, and the cost of pumping is related mainly to the pumping lift. Although wells tapping the Carrizo sand are capable of yielding large quantities of water in Karnes County, the cost of constructing wells deep enough to tap it, 4,000 to 5,000 feet, is prohibitive for most uses. Moderate to large supplies are available from some of the other water-bearing formations in the county, but several wells will be required for large supplies;

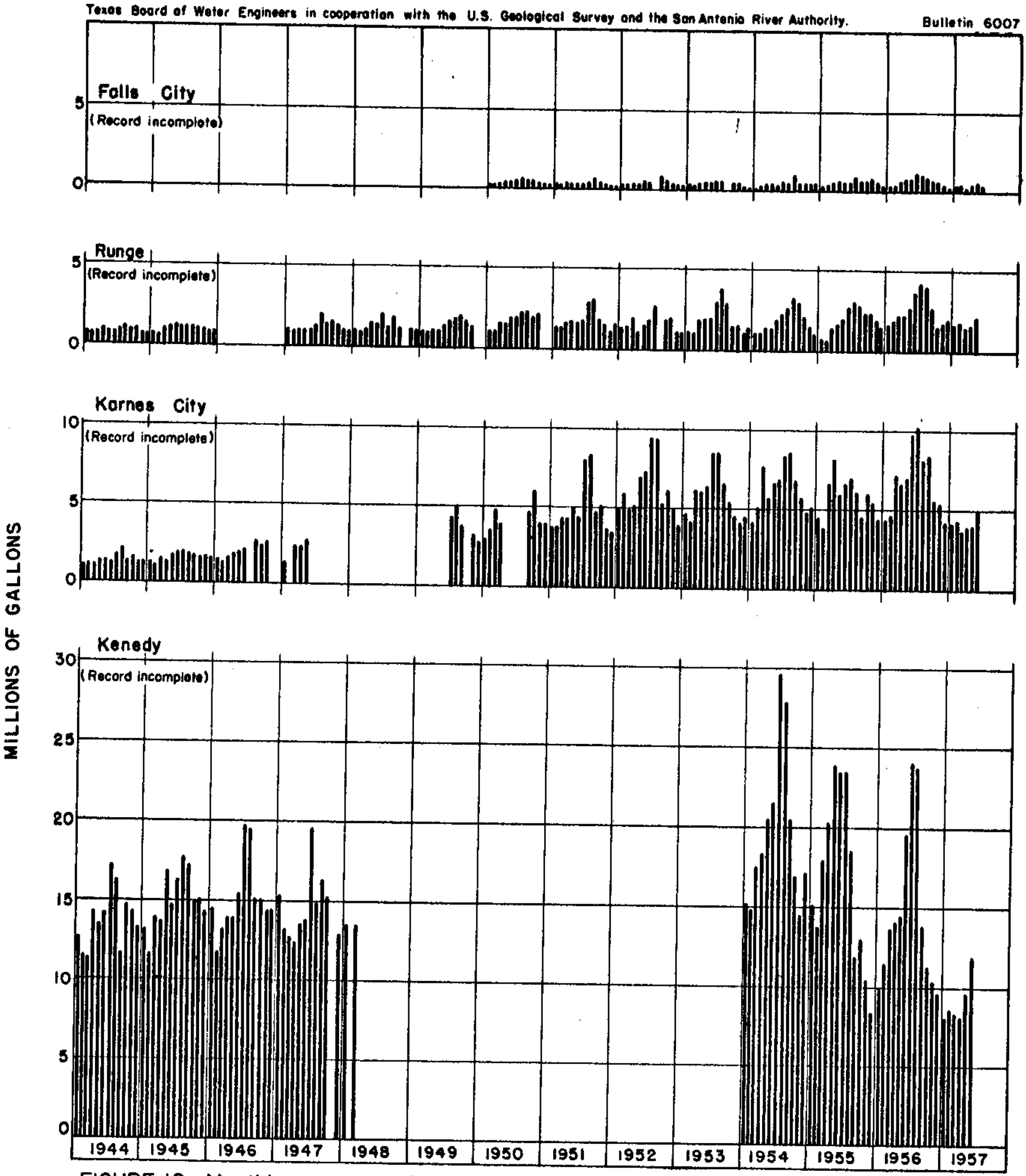

FIGURE 10.- Monthly pumpage from municipal wells at Falls City, Runge, Karnes City and Kenedy

Table 4.--Water levels in selected wells in 1936 or 1937 and water levels in the same wells in 1955 or 1956.

KARNES COUNTY

Well	Water level, in feet below land-surface datum	Date	Water level, in feet below land-surface datum	Date	Change in feet
A - 3	94.0	Dec. 14, 1937	95.6	May 2, 1956	- 1.6
5	27.6	Dec. 15, 1936	27.7	Apr. 30, 1956	- 0.1
9	90.0	Nov. 17, 1936	105.5	May 3, 1956	-15.5
12	35.9	Nov. 14, 1936	31.8	May 3, 1956	+ 4.1
13	56.7	Nov. 14, 1936	54.0	May 2, 1956	+ 2.7
15	54.0	Nov. 14, 1936	52.1	Apr. 27, 1956	+ 1.9
18	46.2	Nov. 19, 1936	48.8	Apr. 25, 1956	- 2.6
B - 2	98.7	Mar. 22, 1937	99.3	Apr. 16, 1956	- 0.6
9	103.5	Mar. 19, 1937	106.6	Jan. 10, 1956	- 3.1
15	70.9	Mar. 19, 1937	77.2	Jan. 12, 1956	- 6.3
16	92.0	Mar. 19, 1937	103.5	Apr. 16, 1956	-11.5
19	81.3	Jan. 7, 1937	81.6	Apr. 16, 1956	- 0.3
20	67.0	Jan. 7, 1937	72.9	Jan. 25, 1956	- 5.9
24	65.1	Jan. 8, 1937	71.7	Jan. 10, 1956	- 6.6
28	24.6	Dec. 17, 1936	27.7	May 22, 1956	- 3.1
29	65.5	Dec. 17, 1936	67.8	May 22, 1956	- 2.3
32	67.0	Dec. 18, 1936	57.9	May 23, 1956	+ 9.1
35	47.1	Jan. 5, 1937	46.5	May 22, 1956	+ 0.6
38	35.4	Jan. 5, 1937	35.6	May 22, 1956	- 0.2
50	130.0	Mar. 18, 1937	139.1	Jan. 13, 1956	- 9.1
53	64.5	Mar. 12, 1937	63.8	Jan. 16, 1956	+ 0.7
56	50.0	Nov. 13, 1936	51.3	Jan. 10, 1956	- 1.3
57	56.5	Mar. 12, 1937	56.4	Jan. 27, 1956	+ 0.1
C -26	67.1	Oct. 19, 1936	63.8	Oct. 12, 1956	+ 3.3
D - 4	37.5	Nov. 18, 1936	41.8	Apr. 20, 1956	- 4.3
6	74.3	Nov. 13, 1936	73.8	May 3, 1956	+ 0.5
13	71.1	Nov. 14, 1936	70.2	May 3, 1956	+ 0.9
16	71.3	Nov. 13, 1936	74.6	Apr. 18, 1956	- 3.3
25	93.6	Feb. 6, 1937	91.1	May 24, 1956	+ 2.5
34	68.3	Feb. 12, 1937	68.6	May 25, 1956	- 0.3
41	71.0	Feb. 12, 1937	67.9	Mar. 21, 1955	+ 3.1
43	96.5	Feb. 17, 1937	99.7	Mar. 21, 1955	- 3.2
45	8.7	Feb. 19, 1937	35.8	Jun. 5, 1956	-27.1
46	90.5	Feb. 19, 1937	101.5	Jun. 5, 1956	-11.0
52	93.5	Feb. 3, 1937	102.0	Jun. 27, 1956	- 8.5
55	74.0	Dec. 8, 1936	71.7	Apr. 3, 1956	+ 2.3
57	67.3	Feb. 3, 1937	64.2	Jan. 13, 1956	+ 3.1
58	70.0	Feb. 3, 1937	65.6	Jan. 13, 1956	+ 4.4
E - 1	68.4	Dec. 18, 1936	44.4	May 4, 1956	+24.0
8	54.9	Jan. 2, 1937	62.6	Jun. 4, 1956	- 7.7
9	43.0	Jan. 2, 1937	51.9	May 22, 1956	- 8.9
10	52.0	Jan. 2, 1937	53.0	May 22, 1956	- 1.0
23	20.3	Apr. 5, 1937	25.6	Apr. 26, 1956	- 5.3
24	70.2	Apr. 5, 1937	69.3	Jan. 12, 1956	+ 0.9
25	38.5	Apr. 5, 1937	41.8	Jan. 11, 1956	- 3.3
28	80.6	Mar. 23, 1937	85.0	Jan. 11, 1956	- 4.4
29	62.9	Mar. 25, 1937	66.4	Jan. 11, 1956	- 3.5

Table 4.--Water levels in selected wells in 1936 or 1937 and water levels in the same wells in 1955 or 1956--Continued

KARNES COUNTY

Well	Water level, in feet below land-surface datum	Date	Water level, in feet below land-surface datum	Date	Change in feet
E -32	36.5	Mar. 23, 1937	34.4	Jan. 11, 1956	+ 2.1
34	28.6	Apr. 6, 1937	33.4	Nov. 4, 1955	- 4.8
35	37.8	Apr. 6, 1937	36.1	Apr. 26, 1956	+ 1.7
38	35.5	Apr. 5, 1937	42.6	Apr. 26, 1956	- 7.1
44	83.4	Feb. 24, 1937	89.0	Apr. 19, 1956	- 5.6
46	26.2	Feb. 23, 1937	28.3	May 1, 1956	- 2.1
49	26.1	Feb. 17, 1937	26.0	May 1, 1956	+ 0.1
55	53.2	Nov. 18, 1936	42.2	Mar. 16, 1956	+11.0
57	65.0	Nov. 18, 1936	60.9	Mar. 16, 1956	+ 4.1
F - 3	85.2	Feb. 5, 1937	83.6	Apr. 17, 1956	+ 1.6
12	96.3	Feb. 9, 1937	113.4	Jan. 27, 1956	-17.1
G - 9	94.4	Feb. 8, 1937	96.3	Jan. 13, 1956	- 1.9
24	80.0	Feb. 25, 1937	68.7	May 24, 1956	+11.3
38	148.1	Apr. 12, 1937	142.0	Jun. 6, 1956	+ 6.1
39	152.5	Apr. 12, 1937	149.6	Jun. 6, 1956	+ 2.9
H - 3	99.0	Mar. 2, 1937	114.3	Nov. 1, 1956	-15.3
5	77.3	Mar. 1, 1937	77.5	Jun. 6, 1956	- 0.2
10	87.0	Mar. 2, 1937	89.3	Jun. 6, 1956	- 2.3
11	36.7	Mar. 2, 1937	42.9	Nov. 2, 1955	- 6.2
13	31.6	Mar. 2, 1937	34.8	Feb. 17, 1956	- 3.2
15	30.2	Mar. 2, 1937	45.1	Nov. 2, 1955	-14.9
19	37.7	Mar. 26, 1937	44.3	Nov. 3, 1955	- 6.6
25	68.4	Mar. 23, 1937	73.4	Nov. 4, 1955	- 5.0
28	141.7	Mar. 25, 1937	140.7	Jun. 7, 1956	+ 1.0
33	34.7	Mar. 24, 1937	36.8	Apr. 18, 1956	- 2.1
36	44.6	Mar. 24, 1937	48.3	Nov. 3, 1955	- 3.7
41	33.9	Apr. 7, 1937	37.4	Nov. 3, 1955	- 3.5
42	11.4	Apr. 7, 1937	19.2	Nov. 3, 1955	- 7.8
44	38.0	Mar. 11, 1937	57.2	Jun. 7, 1956	-19.2
46	10.5	Mar. 10, 1937	47.1	Oct. 28, 1955	-36.6
47	78.7	Mar. 2, 1937	84.9	Nov. 1, 1955	- 6.2
50	61.0	Mar. 9, 1937	61.8	Nov. 1, 1955	- 0.8
59	58.0	Apr. 9, 1937	55.7	Jun. 6, 1956	+ 2.3
69	134.3	Apr. 10, 1937	139.2	Nov. 2, 1955	- 4.9

and the cost of construction and the great pumping lifts may prohibit their economic development.

Pumping lifts are related to the hydraulic properties of the aquifer and casings, the rate of withdrawals, and the number and spacing of wells. Figure 11 shows that for a given pumping rate the drawdown of water levels is inversely proportional to transmissibility and distance from the point of withdrawal. The range of transmissibilities shown in figure 11 is typical of the water-bearing formations younger than the Carrizo sand in Karnes County. Drawdown is directly proportional to the pumping rate. The addition of each pumping well increases the pumping lift of each nearby well.

Drawdowns in artesian wells in the county are less than those indicated on figure 11, when the effects of pumping reach the recharge area of the aquifer which is generally the outcrop. The wells intercept water that otherwise would be discharged by evapotranspiration principally where the formations crop out in stream valleys resulting in little or no decline of water levels along the outcrop. Thus, the outcrop acts as a line source of recharge (Guyton, 1942, p. 47, and Theis, 1941, p. 734-737). If withdrawals exceed the amount of water intercepted, water levels will decline in the artesian wells at the same slow rate as they do in the recharge area under water-table conditions. Figure 12 shows, for example, that the drawdown 10,000 feet from a well pumping 300 gpm would be about 13 feet after 1 year if the well were 10 miles downdip from the outcrop. The drawdown in an infinite aquifer having the same transmissibility (10,000 gpd/ft) and discharge would be about 16 feet after 1 year of pumping. (See fig. 11.) The drawdown would be less if the well were nearer to the recharge area and greater if the well were farther from the recharge area.

The relative productivity of wells of similar size and construction in different areas is largely a function of the transmissibility, which is a function of the permeability and thickness of the water-bearing material. Interpretations of aquifer tests and subsurface geologic data indicate that materials of the Oakville sandstone and Lagarto clay are more permeable than those of the Catahoula tuff, Jackson group, and Yegua formation. With this in mind, the geologic map (pl. 1) and the map showing the thickness of sands containing fresh to slightly saline water (fig. 13) are useful in determining the relative productivity of different areas in the county. For example, the most productive area, excluding the area underlain by fresh water in the Carrizo, is the southeast corner of the county where sands in the Oakville and Lagarto are thickest. Wells in this area may yield as much as 600 gpm. The maximum yield from wells in favorable areas underlain by the Catahoula, Yegua, and Jackson should be considerably less--perhaps 50-400 gpm.

Potential development of ground water in the county is related to the quantity of water in storage and the potential rates of recharge to and discharge from the ground-water reservoir. The quantity of fresh to slightly saline water in storage above a depth of 1,000 feet is estimated to be about 30 million acre-feet assuming that the saturated sand has a porosity of 30 percent.

Streamflow records and soil textures indicate that recharge to the ground-water reservoir from infiltration at the land surface probably is small. The potential rate of recharge, however, probably exceeds the rate of discharge as of 1957; if reservoirs are built in the county on the San Antonio River or its tributaries, the potential rate of recharge may be increased substantially.

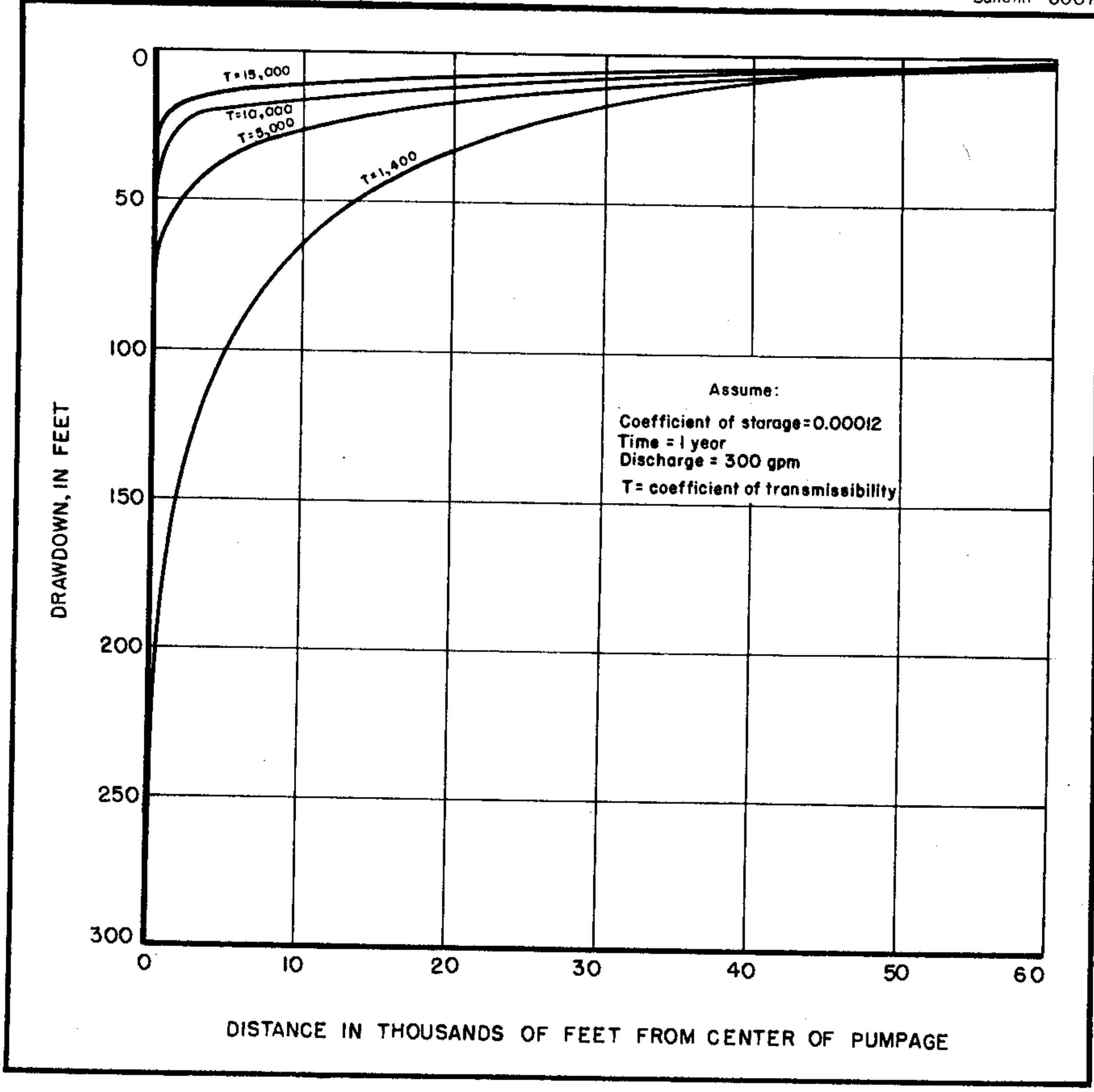

FIGURE 11.- Relation between drawdown and transmissibility in an aquifer of infinite areal extent

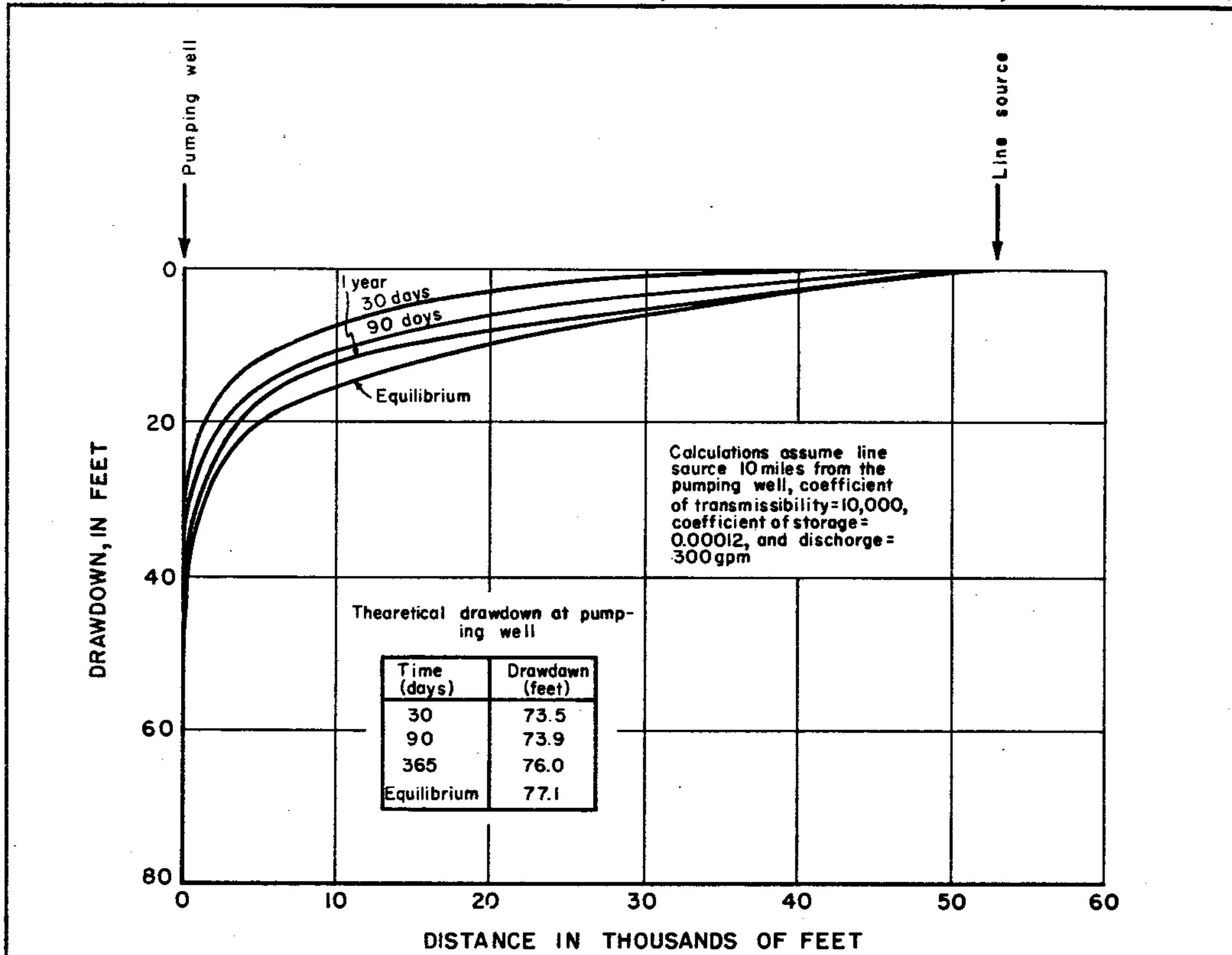

FIGURE 12.-Theoretical drawdown along a profile between a pumping well and a line source (aquifer outcrop).

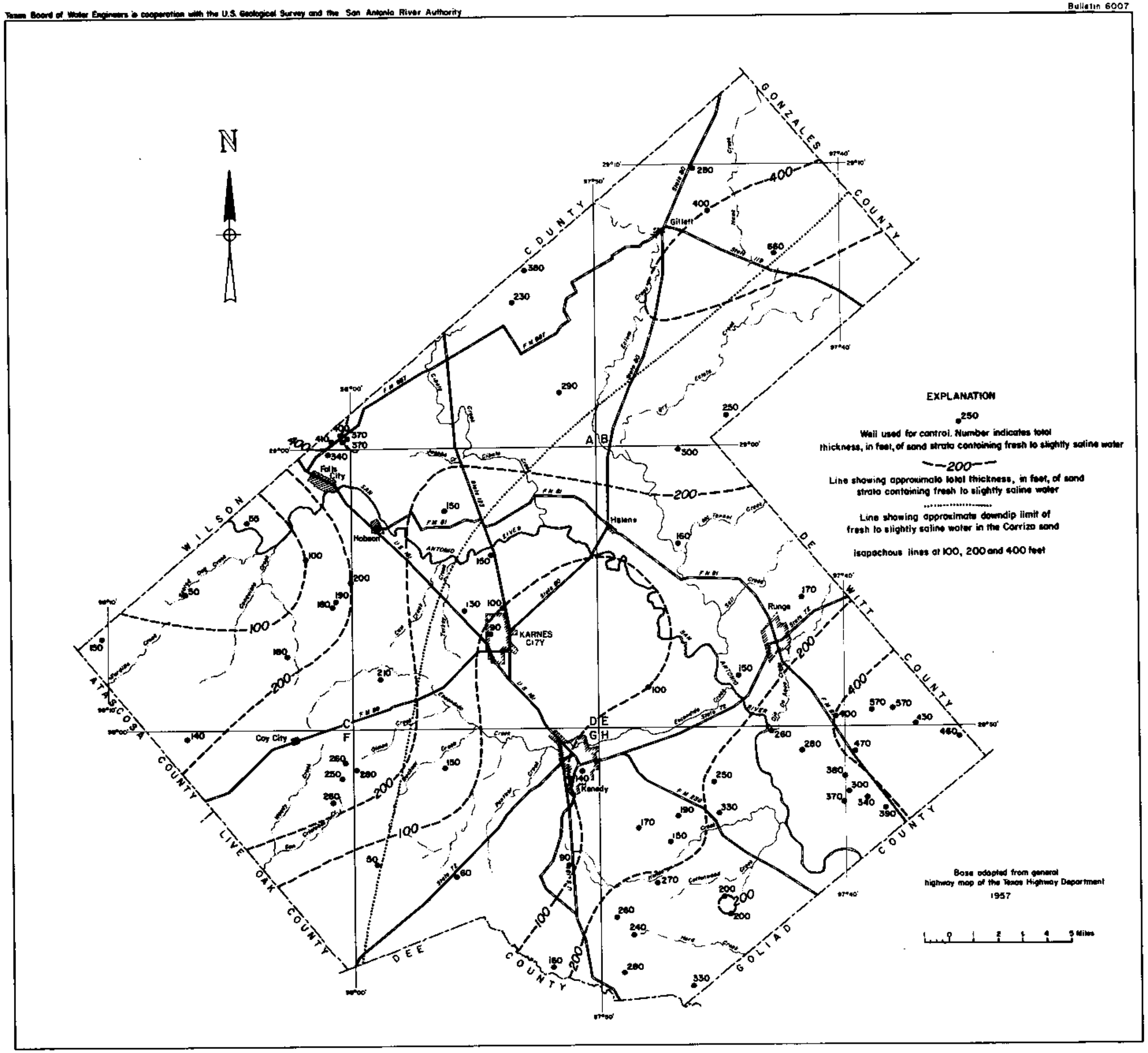

FIGURE 13.- Thickness of sand containing fresh to slightly saline ground water

Even though a large part of the water in storage may be impracticable to recover, discharge could be increased by several times the 1957 rate of about 2,000 acre-feet per year without depleting the available storage appreciably for many decades.

Detailed investigations of the hydrologic characteristics of aquifers and the chemical quality of ground waters should precede any large development of ground water in the county.

SURFACE-WATER DEVELOPMENT

The San Antonio River and Cibolo Creek are the only perennial streams in the county. For the 31-year period of record from April 1925 through September 1956, the San Antonio River near Falls City had a maximum flow of 47,400 cfs (cubic feet per second) on September 29, 1946; a minimum flow of 15 cfs on June 27-28, 1956; and an average flow of 288 cfs--208,500 acre-feet per year (U. S. Geological Survey, 1958, p. 227). Figure 14 shows the monthly mean discharge of the San Antonio River at the gaging station near Falls City, Tex. (about 3 miles southwest of Falls City, figure 2), where it has a drainage area of 2,071 square miles. For the 26-year period from November 1930 through September 1956, Cibolo Creek had a miximum flow of 33,600 cfs on July 6, 1942; had no flow July 30-31 and August 4-22, 1956; and an average flow of 106 cfs--76,740 acre-feet per year (U. S. Geological Survey, 1958, p. 229). Figure 15 shows the monthly mean discharge of Cibolo Creek at the gaging station near Falls City, Tex. (at a point about 5½ miles east-northeast of Falls City, which is about 9 miles above its junction with the San Antonio River, figure 2). The drainage area above the station is 831 square miles.

Water permits granted by the Texas Board of Water Engineers for Karnes County allow 1,837 acre-feet of water to be withdrawn annually from the San Antonio River to irrigate 909 acres. The maximum allowable rate of withdrawal from the San Antonio River in the county is 37.5 cfs. No permits have been issued for diverting water from Cibolo Creek in Karnes County, but in Wilson County, where the perennial flow of Cibolo Creek originates, permits have been issued to allow 585 acre-feet of water to be withdrawn each year to irrigate 503 acres at a maximum rate of withdrawal of 15 cfs. On July 30, 1956, Cibolo Creek near Falls City ceased flowing for the first time since the gaging station was installed in 1931 and possibly for the first time since the land was settled in 1854. Most of the flow of the creek was intercepted by upstream pumping, but some water was consumed by plants and some evaporated. Part of the water may have been lost by influent seepage.

Ground water in the shallow sands in the interstream areas moves generally toward the streams. Streamflow records indicate little or no gain in base flow across the county; it appears, therefore, that ground water moving toward the streams is consumed by evapotranspiration in the valleys.

QUALITY OF WATER

Data on chemical quality of ground water in this report are compiled from 95 analyses by the U. S. Geological Survey, from 245 analyses by the Works Progress Administration (WPA) working under the supervision of the Bureau of Industrial Chemistry, University of Texas (Shafer, 1937), and from interpretations and correlations of electric logs by the writer. Methods of analysis in use at

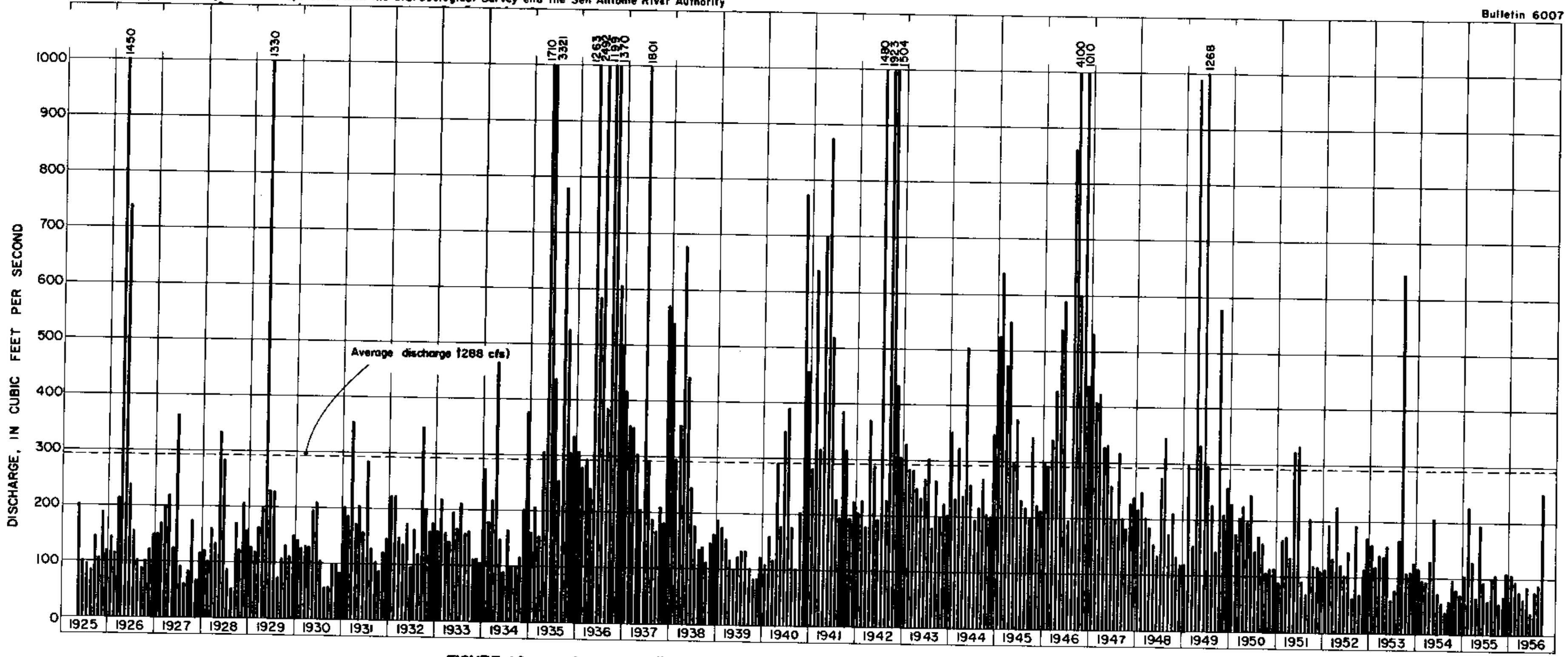

FIGURE 14.-Monthly mean discharge of the San Antonio River near Falls City
(Measurements by U. S. Geological Survey)

Texas Board of Water Engineers in cooperation with the U.S. Geological Survey and the San Antonio River Authority

Bulletin 6007

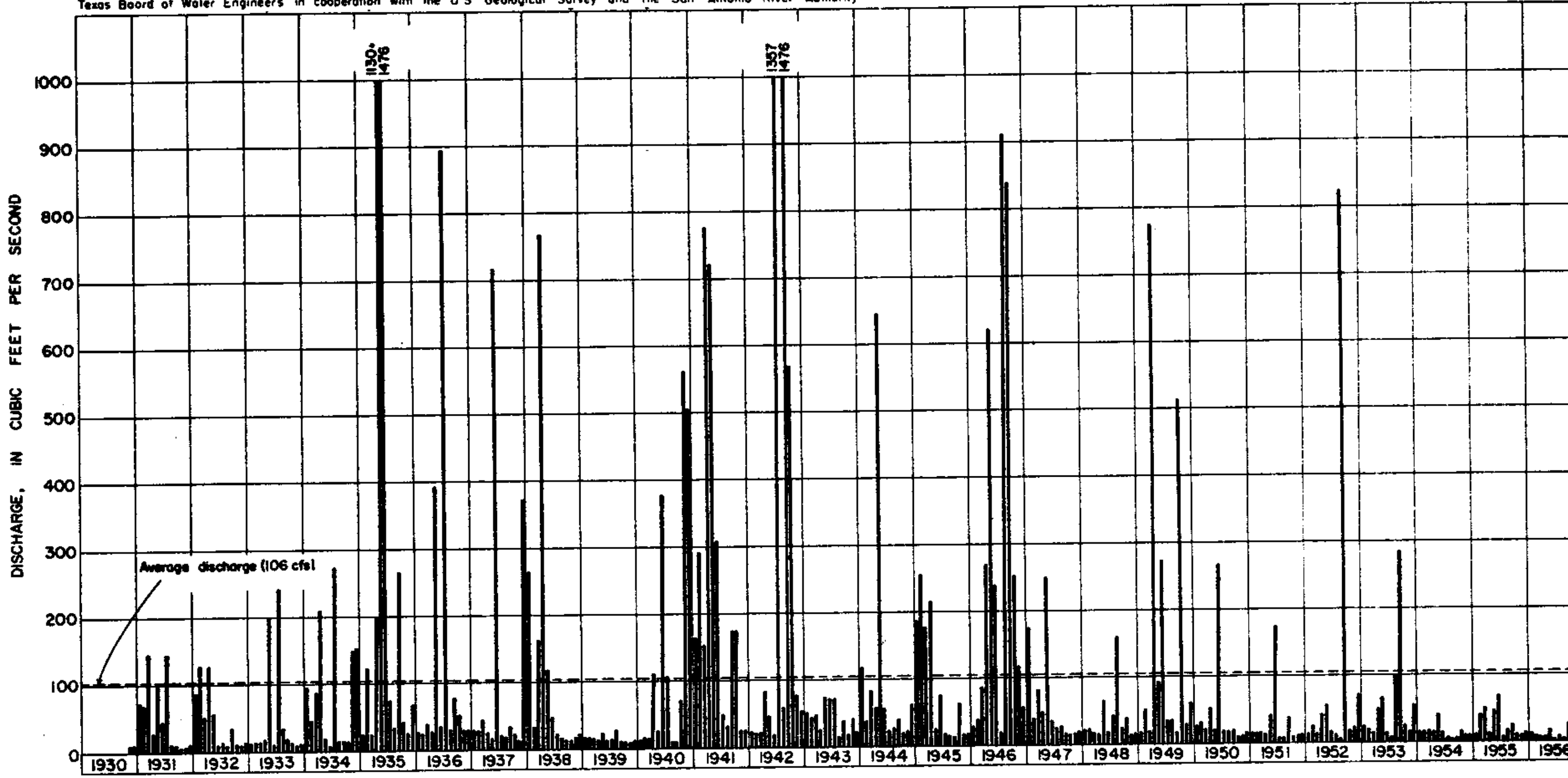

FIGURE 15. — Monthly mean discharge of Cibolo Creek near Falls City
(Measurements by U.S. Geological Survey)

the time the Works Progress Administration analyses were made do not conform to present day standards. Therefore, comparisons between the earlier analyses and those of later date cannot be used to show changes in water quality from time to time or place to place where a difference in reported results of individual constituents is small. However, despite a certain lack of exactness, the earlier analyses do show the general chemical character of the water analyzed. Analyses of 340 samples from 312 wells are listed in table 7.

Interpretation of chemical quality of water from electric logs based on changes in both the resistivity curves and the self potential curve gives a rough approximation of the mineralization of the water. The interpretations are largely a matter of judgment and experience (Jones and Buford, 1951, p. 115-139). In a few places in this publication interpretations were facilitated by a comparison between chemical analyses and electric logs. The results of a study of available logs are summarized in the "Remarks" column of table 5.

Water from the San Antonio River has not been sampled systematically in Karnes County, but the quality probably is similar to that 15 miles downstream, where samples were collected daily at Goliad from October 4, 1945, through September 29, 1946, according to Hastings and Irelan (1946).

Classification by the content of dissolved constituents; as shown on page 21, is only one of several criteria for judging the suitability of water for various uses. The following discussion of other criteria pertains to the most common uses of water in Karnes County.

Tolerances of individuals for drinking water of various quality ranges widely, but no one in Texas, is known to use water continually that contains more than 3,000 ppm of dissolved solids. Livestock have survived on water containing as much as 10,000 ppm, although water of considerably better quality is necessary for maximum growth and reproduction. The maximum concentrations of constituents considered important by the U. S. Public Health Service (1946, p. 13) for drinking water used on common carriers are as follows:

Magnesium (Mg) should not exceed 125 ppm.
Chloride (Cl) should not exceed 250 ppm.
Sulfate (SO_4) should not exceed 250 ppm.
Fluoride (F) must not exceed 1.5 ppm.
Dissolved solids should not exceed 500 ppm. However, if water of such quality is not available, a dissolved-solids content of 1,000 ppm may be permitted.

These limitations were set primarily to protect travelers from digestive upsets. Most people can drink water continually that contains substantially higher concentrations than the suggested limits, although some new users may suffer ill effects from the water until their digestive systems become accustomed to the change.

Water containing chloride in excess of 300 ppm has a salty taste, water containing magnesium and sulfate in excess of concentrations recommended in the standards tends to have a laxative effect, and water containing fluoride in excess of about 1.5 ppm may cause the teeth of children to become mottled. (Dean and Others, 1935.) Concentrations of about 1.0 ppm of fluoride, however, reduce the incidence of tooth decay. Water containing more than about 45 ppm nitrate has been related by Maxcy (1950, p. 271) to the incidence of infant cyanosis (methemoglobinemia or "blue baby" disease) and may be dangerous for infant feeding. A high nitrate content of water also may be an indication of pollution from organic matter. A well yielding water containing more nitrate than other nearby wells should be sampled and the water tested for bacterial content if the water is to be used for domestic purposes. Animal wastes from privies and barnyards commonly are the source of pollution, and such wastes will increase the nitrate content of the water.

Municipal water supplies in Karnes County are substandard because better water is not readily available. However, the regular users appear to be accustomed to the water and suffer no ill effects from it. The chloride content for all public supplies and many of the domestic supplies exceeds 250 ppm. The chloride content of water from municipal wells ranges from 315 ppm at Runge to 900 ppm at Kenedy. The concentrations of magnesium and sulfate in most of the samples of water are within the limits recommended in the standards. Samples from two municipal wells (D-47 and D-49) in Karnes City contained more than 1.5 ppm of fluoride. Only two other wells (C-1 and C-34) that supply drinking water yield water having a fluoride content greater than 1.5 ppm. Samples from 7 of 14 wells, for which the fluoride content was determined, contained more than 1.5 ppm of fluoride. The water from three of the wells is not used for drinking, however. Results of sixty-seven determinations of nitrate show only two samples (wells F-20 and H-63) that contained more than 45 ppm. The San Antonio River contains no undesirable concentrations of dissolved mineral matter that would restrict its use as drinking water.

Certain concentrations of magnesium, calcium, silica, iron, and manganese in water affect its use for industrial and domestic purposes. The characteristic of water called "hardness" is caused almost entirely by calcium and magnesium. As the hardness increases, soap consumption for laundering increases and incrustations (boiler scale) accumulate more rapidly on boilers, pipes, and coils. Hardness equivalent to the carbonate and bicarbonate is called carbonate hardness; the remainder of the hardness is called noncarbonate hardness. Two methods commonly are used to soften large quantities of water: The lime or lime-soda ash process, which in addition to softening reduces the mineralization; and the zeolite process, which involves the exchange of calcium and magnesium in the water for sodium in the exchange material. Carbonate hardness may be removed most economically by using lime as the precipitant.

Silica also forms hard scale in boilers. The deposition of scale increases with the pressure in the boiler. The following table shows the maximum allowable concentrations of silica for water used in boilers as recommended by Moore (1940, p. 263).

Concentration of silica (ppm)	Boiler pressure (pounds per square inch)
40	Less than 150
20	150-250
5	251-400
1	More than 400

Oxidation of dissolved iron and manganese in water forms a reddish-brown precipitate that stains laundered clothes and plumbing fixtures. The staining properties of water containing these minerals are especially objectionable in some manufacturing processes. Water containing more than 0.3 ppm of iron and manganese together is likely to cause appreciable staining.

Water from Karnes County may be compared with the following commonly accepted standard of hardness for public and industrial supplies (U. S. Geological Survey, 1959, p. 14).

Water classification	Hardness as $CaCO_3$ (ppm)
Soft	Less than 60
Moderately hard	61-120
Hard	121-200
Very hard	More than 200

The water analyses indicate that water from the San Antonio River and most of the ground water is hard or very hard. The public supplies of Karnes City and Falls City are notable exceptions--both having wells that yield soft water. The concentrations of silica in samples ranged from 1.9 to 96 ppm. Although the amount of silica was determined in relatively few samples, the data suggest that the concentrations of silica might be a major consideration in obtaining industrial water supplies. Only four of 39 determinations showed a content of iron and manganese together exceeding 0.3 ppm. Silica, manganese, and iron were not reported for samples from the San Antonio River.

Water becomes less suitable for irrigation as the salinity, sodium (alkali), and boron hazards increase. The salinity hazard commonly is measured by the electrical conductivity of the water, which is an indication of the concentration of dissolved solids. The conductivity in micromhos per centimeter at 25°C is about $1\frac{1}{2}$ times the dissolved solids content in parts per million, although the relation is somewhat variable. The sodium-adsorption-ratio (SAR) is an index of the sodium hazard of an irrigation water and is defined by the following equation, the concentration of the ions being expressed in epm (equivalents per million):

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

Percent sodium is another term used to express sodium hazard. It is determined as follows, all ions being expressed in epm:

$$\text{Percent sodium} = \frac{Na^{+} \times 100}{Na^{+} + Ca^{++} + Mg^{++} + K^{+}}$$

High concentrations of the bicarbonate ion in irrigation water may have a deleterious effect on both plants and soil. An excessive quantity expressed as RSC (residual sodium carbonate) is determined as follows, all ions in epm:

$$RSC = (CO_3^{--} + HCO_3^{-}) - (Ca^{++} + Mg^{++})$$

The boron hazard is measured by the concentration of dissolved boron in the water.

The U. S. Salinity Laboratory Staff (1954) treated in detail the effects of quality of irrigation water on soils and crops in arid and semiarid climates. Wilcox (1955, p. 16), a member of the staff, reported that, with respect to salinity and sodium hazard, water may be used safely for supplemental irrigation if its conductivity is less than 2,250 micromhos per centimeter at 25°C and its SAR value is less than 14. The maximum safe values for percent sodium, RSC, and boron have not been determined for subhumid or humid climates, thus the following values for arid climates represent safe values, but not maximum safe values for the subhumid climate of Karnes County.

Class	Percent sodium	RSC	Boron
Excellent to permissible	Less than 60 percent	Less than 2.5 epm	Less than 0.67 ppm

The standards for irrigation water are not strictly applicable to Karnes County, but they show which water is safe and which should be used with caution.

Of the 11 samples from wells used for irrigation in Karnes County, only one (well A-23) exceeded the limit for salinity hazard, and one (well G-2) exceeded the limit for sodium hazard for supplemental irrigation. Four samples (wells E-13, E-21, H-58, and H-68) were within all limits for an arid climate and the other 5 exceeded one or more of the limits for an arid climate. Although the boron content of water from the San Antonio River was not determined, it is believed to be well within irrigation water standards. Water from the San Antonio River otherwise is considered to be of excellent quality for irrigation in Karnes County.

The quality of ground water in Karnes County is extremely variable. Within a single formation, the quality of water in one strata may be considerably different than that in another strata. Within a single strata the quality may differ considerably from place to place. Because of the variations, the chemical characteristics of the water are not discussed by areas, formations, or depths, except in very general terms in previous sections of this publication. The best prediction of the probable quality of water in a particular location can be obtained by examining the quality-of-water data from nearby wells.

SUMMARY OF CONCLUSIONS

Public, industrial, and domestic water supplies in Karnes County depend solely on ground water, and irrigation and stock supplies depend on both ground and surface waters. Most of the ground water used in Karnes County in 1957 was of fair to poor quality; whereas, water from the San Antonio River is suitable in quality for most uses. Estimated ground-water withdrawals in 1957 averaged about 1,700,000 gpd from about 1,000 water wells; however, about 80 percent of the water was withdrawn from 21 municipal and irrigation wells. Withdrawals from 1936 through 1957 have not affected water levels in wells appreciably. The greatest decline recorded was 36.6 feet, but water levels either rose or declined less than 8 feet in 69 of the 81 wells measured. The amount of surface water used was not determined, but water permits allow 1,837 acre-feet (about 1,600,000 gpd) of water to be withdrawn from the San Antonio River in Karnes County.

About 70 million acre-feet of fresh to slightly saline ground water is stored in the county. About 40 million acre-feet is stored below a depth of 3,000 feet in the Carrizo sand in the northern and western parts of the county. The remainder is stored in younger formations throughout the county at depths less than 1,000 feet. Although it is impracticable to recover much of the stored water, the rate of withdrawal could be increased by several times over the 1957 rate (about 2,000 acre-feet per year) without depleting the available storage appreciably for many decades.

Recharge to the water-bearing formations probably is small, owing to unfavorable soil and topography, but probably it exceeds withdrawals in 1957.

Potential well yields range from a few gallons per minute, where permeabilities are low and the water-bearing materials are thin, to as much as 1,000 gpm from wells tapping the full thickness of the Carrizo sand. Other principal water-bearing formations in their approximate order of importance are the Oakville sandstone, Lagarto clay, Catahoula tuff, Jackson group, and Yegua formation. Wells yielding enough water of a quality satisfactory for livestock can be finished at depths of less than 200 feet anywhere in the county. By referring to the maps in this publication, favorable areas may be selected for developing moderate to large supplies of fresh to slightly saline water for other uses, although some such developments may not be feasible economically.

The water table in the divide areas slopes toward the streams, but records of streamflow show that very little or no ground water reaches the San Antonio River. The water is presumed to be discharged by evapotranspiration in the stream valleys.

The surface-water resources of Karnes County may be increased substantially by impounding storm flows. No firm plans have been made, however, to construct additional reservoirs on the San Antonio River or its tributaries. Surface reservoirs, if constructed, may increase ground-water recharge substantially.

SELECTED REFERENCES

Anders, R. B., 1957, Ground-water geology of Wilson County, Tex.: Texas Board Water Engineers Bull. 5710.

Bailey, T. L., 1926, The Gueydan, a new Middle Tertiary formation from the southwestern Coastal Plain of Texas: Texas Univ. Bull. 2645.

Broadhurst, W. L., Sundstrom, R. W., and Rowley, J. H., 1950, Public water supplies in southern Texas: U. S. Geol. Survey Water-Supply Paper 1070.

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

Dale, O. C., Moulder, E. A., and Arnow, Ted, 1957, Ground-water resources of Goliad County, Tex.: Texas Board Water Engineers Bull. 5711, p. 10.

Dean, H. T., Dixon, R. M., and Cohen, Chester, 1935, Mottled enamel in Texas: Public Health Reports, v. 50, p. 424-442.

Deussen, Alexander, 1924, Geology of the Coastal Plain of Texas west of Brazos River: U. S. Geol. Survey Prof. Paper 126.

Eargle, D. Hoye, and Snider, John L., 1957, A preliminary report on the stratigraphy of the uranium-bearing rocks of the Karnes County area, south-central Texas: Texas Univ. Rept. Inv. 30.

Ellisor, A. C., 1933, Jackson group of formations in Texas with notes on Frio and Vicksburg: Am. Assoc. Petroleum Geologists Bull., v. 17, no. 11, p. 1293-1350.

Follett, C. R., White, W. N., and Irelan, Burdge, 1949, Occurrence and development of ground water in the Linn-Faysville area, Hidalgo County, Texas: Texas Board Water Engineers dupl. rept.

Guyton, W. F., 1942, Results of pumping tests of the Carrizo sand in the Lufkin area, Texas: Am. Geophys. Union Trans. pt. 2, p. 40-48.

Hastings, W. W., and Irelan, Burdge, 1946, Chemical composition of Texas surface waters: Texas Board Water Engineers dupl. rept., p. 30-31.

Houston Geol. Society, 1951, Western Gulf Coast: Am. Assoc. Petroleum Geologists Bull., v. 35, no. 2, p. 385-392.

Jones, P. H., and Buford, T. B., 1951, Electric logging applied to ground-water exploration: Geophysics, v. 16, no. 1, p. 115-139.

Knowles, D. B., and Lang, J. W., 1947, Preliminary report on the geology and ground-water resources of Reeves County, Texas: Texas Board Water Engineers dupl. rept.

Lonsdale, J. T., 1935, Geology and ground-water resources of Atascosa and Frio Counties, Texas: U. S. Geol. Survey Water-Supply Paper 676.

Lowman, S. W., 1949, Sedimentary facies of the Gulf Coast: Am. Assoc. Petroleum Geologists Bull., v. 33, no. 12, p. 1939-1997.

Maxcy, Kenneth F., 1950, Report on the relation of nitrate nitrogen concentrations in well waters to the occurrence of methemoglobinemia in infants: Natl. Research Council Bull., Sanitary Eng. and Environment, app. D.

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

Renick, B. Coleman, 1936, The Jackson group and the Catahoula and Oakville formations in a part of the Texas Gulf Coastal Plain: Texas Univ. Bull. 3619.

Sellards, E. H., Adkins, W. S., and Plummer, F. B., 1932, The geology of Texas, v. 1, Stratigraphy: Texas Univ. Bull. 3232.

Shafer, G. W., 1937, Records of wells, drillers' logs, and water analyses, and map showing location of wells in Karnes County, Tex.: Texas Board Water Engineers dupl. rept.

Smith, Otto M., Dott, Robert A., and Warkentin, E. C., 1942, The chemical analyses of the waters of Oklahoma: Okla. A. and M. Coll., Div. Eng. Pub. No. 52, v. 12.

Theis, Charles V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: Am. Geophys. Union Trans., pt. 2, p. 519-524.

________________, 1941, The effect of a well on the flow of a nearby stream: Am. Geophys. Union Trans., p. 734-737.

Weeks, A. W., 1945, Oakville, Cuero, and Goliad formations of Texas Coastal Plain between Brazos River and Rio Grande: Am. Assoc. Petroleum Geologists Bull., v. 29, no. 12, p. 1721-1732.

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

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

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

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

U. S. Geological Survey, 1958, Surface-water supply of the United States, 1956, pt. 8, Western Gulf of Mexico basins: U. S. Geol. Survey Water-Supply Paper 1442.

_______________, 1959, Quality of surface waters of the United States, 1954, pts. 7-8, Lower Mississippi River basin and Western Gulf of Mexico basins: U. S. Geol. Survey Water-Supply Paper 1352.

U. S. Public Health Service, 1946, Drinking water standards: Public Health Repts., v. 61, no. 11, p. 371-384.

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

Table 5.- Records of wells in Karnes County, Tex.

All wells are drilled unless otherwise noted in remarks column.

Water level : Reported water levels given in feet; measured water levels given in feet and tenths.

Method of lift (includes type of power) : B, butane; C, cylinder; E, electric; G, Diesel or gasoline; H, hand; J, jet; Ng, natural gas; 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	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
A-1	Alex Pawelek well 1	Martin, Shelly & Thomas	1952	6,119	--	--	--	--	--	--	Oil test. Altitude of land surface 396 ft. Electric log 485-6,119 ft. Fresh or slightly saline-water sand zones 485-610; 2,400-3,230 ft. 1/
A-2	V. Cambers well 1	Dan & Jack Auld	1955	6,026	--	--	--	--	--	--	Oil test. Altitude of land surface 416 ft. Electric log 299-6,026 ft. Fresh or slightly saline-water sand zones 299-720; 2,630-3,400 ft. 1/
*A-3	R. M. Korth	--	1934	240	4	Yegua formation	95.6	May 2, 1956	N	N	
*A-4	A. W. Hyatt	--	1890	200	4	do	97.2	Apr. 30, 1956	C,W	D,S	
*A-5	L. S. Hyatt	--	1901	65	4	do	27.7	do	C,E	S	
*A-6	Theo. Labus	--	--	150	4	Jackson group	--	--	C,W	S	Reported weak supply.
*A-7	Robert Harper	--	--	100	6	do	--	--	J,E	S	
A-8	T. W. Roberts well 1	Earl Rowe	1951	5,272	--	--	--	--	--	--	Oil test. Altitude of land surface 363 ft. Electric log 402-5,272 ft. Fresh or slightly saline-water sand zones 402-1,680; 3,760-4,250 ft. 1/
*A-9	Otho Person	--	--	--	4	Jackson group	105.5	May 3, 1956	C,W	S	
*A-10	Frank Pawelek	--	1926	150	6	do	62.6	do	C,W	S	
*A-11	Henry Broll	--	1927	181	4	do	76.6	do	C,W	D,S	
*A-12	Ben Jendrusch	--	--	110	5	do	31.8	do	N	N	
*A-13	Joe Mzyk	--	--	170	4	do	54.0	May 2, 1956	C,W	S	
*A-14	W. H. Winkler	--	1917	240	4	do	--	--	C,W	S	
*A-15	Luke C. Krawietz	--	1910	200	6	do	52.1	Apr. 27, 1956	C,E	S	
*A-16	E. Jendrusch	--	1870	63	40	Yegua formation	--	--	C,W	D,S	Dug.
*A-17	Julian Lastowski	--	1928	200	4	do	--	--	C,W	S	

*See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*A-18	Mrs. Henry Kotara	--	1906	125	4	Yegua formation	48.8	Apr. 25, 1956	C,W	S	
A-19	V. T. Moczygemba well 3	Southern Minerals Corp.	1946	5,170	--	--	--	--	--	--	Oil test. Altitude of derrick floor 344 ft. Electric log 521-5,170 ft. Fresh or slightly saline water sand zones 521-1,030; 2,905-3,970 ft.1/
A-20	V. T. Moczygemba well 6	do	1946	6,066	--	--	--	--	--	--	Oil test. Altitude of derrick floor 343 ft. Electric log 532-6,066 ft. Fresh or slightly saline water sand zones 532-1,030; 2,900-3,940 ft.1/
A-21	V. T. Moczygemba well 4	do	1946	5,291	--	--	--	--	--	--	Oil test. Altitude of land surface 368 ft. Electric log 515-5,291 ft. Fresh or slightly saline water-sand zones 515-1,040; 2,920-3,990 ft.1/
*A-22	Martinez Mercantile well 4	Southern Minerals Corp.	1945	6,079	--	Wilcox group	--	--	--	--	Oil test. Water sample from "lower Bartosch sand" 4,677-4,681 ft. Altitude of derrick floor 371 ft. Electric log 530-6,079 ft. Fresh or slightly saline water-sand zones 530-1,050; 2,920-4,000 ft. 1/
*A-23	Vincent Mzyk	Tom Moy	1956	512	8	Yegua formation	75	1957	T,E, 30	Irr	Casing: 8-in. to 320 ft; 7-in. from 312 to 512 ft. Perforated 472-512 ft. Reported yield 450 gpm. Tested 625 gpm. Gravel-packed from 0 to 512 ft. Temp. 82°F.
*B-1	Mrs. M. B. Stuart	Ed Boone	1909	265	4	do	--	--	C,E	D,S	
*B-2	A. Hilscher	J. McCuller	1933	127	4	do	99.3	Apr. 16, 1956	C,W	N	
*B-3	Martina Pena	--	1928	120	5	do	84.0	do	C,W	D,S	
*B-4	J. M. Cooley	--	--	600	4	do	103.0	Jan. 10, 1956	C,E	D,S	
*B-5	do	--	--	300	4	do	109.8	do	C,W	S	
*B-6	M. A. Caraway	--	1928	160	4	do	100.5	do	C,W	S	
*B-7	Mrs. J. M. Golson	--	--	270	4	do	33.6	Jan. 27, 1956	C,E	D,S	
*B-8	E. J. Schneider	--	--	200	4	do	54.8	do	C,G	N	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*B-9	Lena Parke	--	1920	280	5	Yegua formation	106.6	Jan. 10, 1956	C,W	S	
B-10	W. S. Cochran, Jr. well 1	Producers Corp. of Nevada and Cosden Petroleum Corp.	1954	6,370	--	--	--	--	--	--	Oil test. Altitude of land surface 370 ft. Electric log 408-6,370 ft. Fresh or slightly saline water-sand zones 408-990 and 2,980-3,570 ft.1/
*B-11	J. A. Nelson	--	--	180	4	Yegua formation	--	--	C,E	D,Ind	
*B-12	John A. Lorenz	J. M. McCuller	1927	165	4	do	58	Apr. 1945	C,E	P	
*B-13	Gillett School	Glenn Barnett	--	263	--	do	85	1956	C,E	D	
*B-14	M. A. Zint	--	--	200	6	do	--	--	C,W	D,S	
*B-15	R. H. Metz	--	--	176	4	Jackson group	77.2	Jan. 12, 1956	C,W	S	
*B-16	Albert Treybig	--	1911	140	4	Jackson group	103.5	Apr. 16, 1956	C,E	S	
B-17	Louis Pawalek	--	--	--	--	do	--	--	C,W	S	
*B-18	Tom Lysse	--	--	--	5	do	183.3	May 20, 1956	C,W	S	
*B-19	Albert Treybig	--	--	--	4	do	81.6	do	C,-	N	
*B-20	Andrew Fritz	--	1901	180	4	do	72.9	Jan. 25, 1956	C,W	S	
*B-21	H. D. Wiley	--	1910	100	4	do	--	--	C,E	S	
*B-22	Walter Riedel	--	--	--	4	do	--	--	C,W	S	
*B-23	Joe Kunschik	--	--	--	4	do	43.2	May 20, 1956	N	N	
*B-24	A. M. Salinas	--	1894	150	4	do	71.7	Jan. 10, 1956	C,W	S	
*B-25	W. G. Riedel	--	1906	123	5	do	77.2	Jan. 26, 1956	C,W	D,S	
*B-26	Chas. Ford	--	1903	131	4	Catahoula tuff	51.2	May 22, 1956	C,W	D,S	
*B-27	Gussie Yanta	--	1936	69	--	do	--	--	C,W	D	
*B-28	Joe L. Dupnick	--	1929	84	6	do	27.7	May 22, 1956	C,W	D,S	
*B-29	Mrs. T. J. Brown	--	--	--	4	do	67.8	do	C,W	S	
*B-30	Geo. Sickenius, Jr.	--	1929	109	4	do	--	--	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*B-31	John Jannyseck	--	1910	219?	3	Catahoula tuff	45.1	May 22, 1956	C,W	D,S	
*B-32	Mike Jannyseck	--	1906	250	4	do	57.9	May 23, 1956	C,W	D,S	
B-33	Frank Moraweitz	--	1938	375	--	do	90	1956	C,W	D,S	
*B-34	Ed Jannyseck	--	1921	233	5	do	--	--	C,W	D,S	
*B-35	A. J. Kerlick	--	1936	100	--	do	46.5	May 22, 1956	C,W	D,S	
*B-36	Crews-Korth Mercantile Co.	--	1924	60	4	do	--	--	C,E	D	
B-37	R. M. Korth	Arthur Erdman	1949	210	--	do	87.5	June 5, 1956	C,W	S	Cased to bottom. Perforated from 160 ft. below land surface to bottom.
*B-38	Karnes County	--	1926	50	4	do	35.6	May 22, 1956	N	N	
*B-39	E. P. Williams	--	--	200	4	do	103.9	Jan. 26, 1956	C,E	D,S	
*B-40	S. E. Crews	--	--	--	--	do	71.2	Jan. 25, 1956	C,W	S	
*B-41	W. H. Lindsey	--	Old	--	4	do	--	--	C,E	S	
B-42	H. B. Ruckman well 1	H. J. Baker	1940	3,000	--	--	--	--	--	--	Oil test. Altitude of land surface 413 ft. Electric log 159-3,000 ft. Fresh or slightly saline water-sand zone 195-760 ft. 1/
*B-43	R. M. Korth	Arthur Erdman	1944	200	--	Catahoula tuff	--	--	C,W	S	Cased to bottom. Perforated from 160 ft. to bottom. In DeWitt Co.
*B-44	do	do	1953	640	--	do	123	1956	C,E	D,S	Cased to 520 ft. Perforated from 400 to 520 ft.
*B-45	do	--	1906	250	5	do	212.4	June 5, 1956	C,W	D,S	
*B-46	Fritz Korth	Arthur Erdman	1947	430	4	do	98.7	do	C,W	D,S	Cased to bottom. Perforated from 380 ft. to bottom.
B-47	D. G. Janssen	--	--	300	5	do	--	--	C,W	D,S	
B-48	Paul Seidel well 1	Tennessee Production Co.	1952	7,747	--	--	--	--	--	--	Oil test. Altitude of land surface 463 ft. Electric log 869-7,747 ft.
*B-49	Clayton Finch	Sam Cowe	--	226	4	Catahoula tuff	199.7	Jan. 13, 1956	N	N	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
							Below land surface datum (ft.)	Date of measurement			
*B-50	S. E. Crews	--	--	220	4	Catahoula tuff	139.1	Jan. 13, 1956	C,W	D,S	
B-51	G. P. Bridges well 1	Plymouth Oil Co.	1943	6,291	--	--	--	--	--	--	Oil test. Altitude of land surface 439 ft. Electric log 698-6,291 ft. Slightly saline water-sand zones 698-1,710; 3,990-4,530 ft. 1/
B-52	C. L. Finch Ranch	--	--	--	--	Catahoula tuff	126.7	Jan. 16, 1956	C,W	D,S	
*B-53	F. P. Cobb	--	1920	105	4	do	63.8	do	C,W	S	
B-54	Rudy Blaske	--	--	145	--	Jackson group	102.3	do	C,W,G	D,S	
*B-55	Homer Dennings	--	--	225	4	do	109.9	Jan. 10, 1956	C,W	S	
*B-56	Jim Holstein	Jim Cowey	1910	100	3	Yegua formation	51.3	do	C,W	D,S	
*B-57	B. M. Brockman	--	1915	165	4	do	56.4	Jan. 27, 1956	C,E	D,S	
B-58	do	Kirkpatric-Coates	1950	5,815	--	--	--	--	--	--	Oil test. Altitude of land surface 389 ft. Electric log 558-5,815 ft. Fresh or slightly saline water-sand zones 558-680; 2,570-3,325 ft. 1/
B-59	George H. Coates well 1	George H. Coates	1956	2,570	10	Carrizo sand	30	1957	T,E, 2½	D	Casing: 10-in. to 481 ft; 7-in. from 481 to 2,426 ft; 6-in. open hole 2,426 to 2,570 ft. Tested 1,300 gpm. Water contains gas. Altitude of land surface 418 ft. In Wilson County.
*B-60	George H. Coates well 2	do	1957	2,650	10	do	39	1957	N	N	Casing: 10-in. 481 ft; 7-in. from 481 to 2,472 ft; 6-in. open hole 2,472 to 2,650 ft. Tested 1,200 gpm. Flow estimated 250 gpm. Water contains gas. Temp. 124°F.
*B-61	William H. Lindsey	Thompson Well Service	1957	330	8	Catahoula tuff	75	1957	T,B	Irr	Casing: 8-in. to 330 ft. Perforated from 270 to 330 ft. Reported yield 200 gpm with 95 ft. drawdown. Reported maximum yield 432 gpm. Temp. 80°F.

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*C-1	Joe Bartosh well 1	Southern Minerals Corp.	1944	4,711	5	Carrizo sand	+	--	Flows	D	Cased to 4,681 ft. Perforated from 2,960 to 2,970 ft. Electric log 38 to 4,711 ft. Fresh or slightly saline water-sand zones 38-820; 2,955-3,990 ft. Flows 232 gpm from upper horizon and 20 gpm from lower horizon. Water contains gas. Altitude of derrick floor 338 ft. Temp. 138°F. 1/
*C-2	Falls City	Arthur Erdman	1948	610	7	Yegua formation	50	1955	T,E, 20	P	Cased to bottom. Perforated from 595-605 ft. Temp. 87°F.
*C-3	J. W. Mzyk	--	1914	160	4	Jackson group	51.0	Oct. 27, 1955	C,W	D,S	
*C-4	Leon Pawelek	Pete Dugi	1912	228	4	do	73.0	Oct. 13, 1955	C,W	D,S	Drilled to 310 ft. cased to 228 ft.
*C-5	Ed Jendrusch	--	1905	135	--	do	63.3	Oct. 14, 1955	C,W	D,S	
*C-6	Nick Gybrash	--	1894	140	4	do	96.4	Oct. 27, 1955	N	N	
*C-7	Mat Labus	--	1910	270	5	do	87.1	do	C,W	D,S	
*C-8	H. Jandt	--	1907	151	6	do	--	--	C,W	D,S	
C-9	P. J. Manka well 1	W. Earl Rowe & Glen Mortimer	1955	6,600	--	--	--	--	--	--	Oil test. Altitude of land surface 397 ft. Electric log 887-6,600 ft. Fresh or slightly saline water-sand zone 3,650 to 4,670 ft. 1/
*C-10	-- Swierc	--	1928	137	5	Catahoula tuff	--	--	C,G	D,S	
*C-11	Mary Stalle Mueller	Gus Kieke	1910	123	6	Jackson group	88.3	Nov. 13, 1955	C,W	D,S	
*C-12	Freida Mueller	--	1915	165	5	Catahoula tuff	--	--	C,W	D,S	
C-13	J. Kyselica well 1	H. R. Smith, et al	1949	4,114	--	--	--	--	--	--	Oil test. Altitude of derrick floor 395 ft. Electric log 110-4,114 ft. Fresh or slightly saline water-sand zones 110-590; 4,040-4,114 ft. 1/
C-14	R. J. Moczygemba well 3	Seaboard Oil Co.	1950	3,978	--	--	--	--	--	--	Oil test. Altitude of kelly bushing 365 ft. Electric log 407-3,978 ft. Slightly saline water-sand zone 407 to 500 ft. 1/

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
C-15	F. Huchlefield well 1	Seaboard Oil Co.	1943	4,121	--	--	--	--	--	--	Oil test. Altitude of land surface 354 ft. Electric log 380-4,121 ft. Slightly saline water-sand zones 380-510; 4,010-4,121 ft. 1/
C-16	Julia Rzeppa well 3	do	1943	4,018	--	--	--	--	--	--	Oil test. Electric log 383-4,018 ft. Slightly saline water-sand zone 383-570 ft. 1/
C-17	Julia Rzeppa well 1	do	1943	4,803	--	--	--	--	--	--	Oil test. Altitude of land surface 410 ft. Electric log 30-4,803 ft. Fresh or slightly saline water-sand zone 30-590; 4,030-4,803 ft. 1/
*C-18	Emil Swize	--	1910	300	5	Catahoula tuff	51.5	Oct. 26, 1955	C,W	D,S	
C-19	Emil Swize well 1	Forney & Winn	1951	4,047	--	--	--	--	--	--	Oil test. Altitude of land surface 394 ft. Electric log 374-4,047 ft. Fresh or slightly saline water-sand zone 374-470 ft. 1/
C-20	Tom Kolodziejezyk well 1	Seaboard Oil Co.	1943	7,455	--	--	--	--	--	--	Oil test. Altitude of land surface 445 ft. Electric log 1,047-7,455 ft. Fresh or slightly saline water-sand zone 4,170-5,110 ft. 1/
*C-21	-- Phleukan well 4	do	--	4,039	--	Carrizo sand	--	--	--	--	Oil test. Cased to bottom. Perforated 4,036-4039 ft.
*C-22	Joe F. Bludan	--	1914	250	4	Catahoula tuff	80.4	Oct. 25, 1955	C,W	D,S	
*C-23	Paul Kekie	--	--	85	--	do	--	--	C,W	D,S	
*C-24	W. N. Butler	--	1923	213	4	Jackson group	110.8	Oct. 26, 1955	C,W	N	
*C-25	W. Green	--	--	115	4	Catahoula tuff	70.8	Oct. 12, 1955	C,W	D,S	
*C-26	Bob Fopeau	--	1934	263	4	Jackson group	63.8	Oct. 12, 1955	C,W	D,S	
*C-27	E. P. Ruhmann	--	--	150	--	Catahoula tuff	97.4	do	C,W	D,S	
C-28	E. N. Hysaw well 4	Seaboard Oil Co.	--	4,003	--	Carrizo sand	--	--	--	--	Oil test. Cased to bottom. Perforated 4,001-4,003 ft. Temp. 138°F.

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*C-29	E. N. Hysaw well 8	Seaboard Oil Co.	1946	4,181	--	--	--	--	--	--	Oil test. Altitude of derrick floor 448 ft. Electric log 520-4,181 ft. Fresh or slightly saline water-sand zones 520-910; 4,110-4,181 ft. 1/
*C-30	Tom Gedion	--	--	180	6	Catahoula tuff	104.6	Oct. 26, 1955	C,W	D,S	
*C-31	J. H. Davidson	--	1934	200	6	do	104.5	Oct. 25, 1955	C,W	D,S	
*C-32	-- Rips	--	1920	156	--	do	93.3	do	C,W	S	
*C-33	H. L. Smith	--	--	145	5	do	--	--	C,W	D,S	
*C-34	Howard Stanfield	Arthur Erdman	1922	401	6	do	135.5	Apr. 17, 1956	C,W,E	D,S	Cased to 400 ft. Perforated from 360 to 400 ft.
*C-35	F. J. Scholz	--	1921	380	6	do	134.9	Oct. 26, 1955	C,W	N	
C-36	Milton I. Ryan	--	1914	98	12	do	--	--	C,W	D,S	
C-37	W. W. McAllister	--	--	125	4	do	91.0	Oct. 26, 1955	C,W	D,S	
*C-38	Bob Rosenbrock	--	1925	146	--	do	95	1936	C,W	D,S	
*C-39	Harry Weddington	--	--	325	4	Jackson group	--	--	C,E	S	Cased to 325 ft. Perforated from 305 to 325 ft.
*C-40	Harry Lieke	--	1920	--	4	do	91.4	Oct. 26, 1955	C,W	D,S	
*C-41	Fred Sickenius	--	--	400	5	do	80.2	Oct. 12, 1955	C,W	S	
*C-42	Harry Weddington	Arthur Erdman	--	809	4	Yegua formation	172.2	June 8, 1956	C,W	S	Cased to bottom. Perforated from 743 to 800 ft.
*C-43	F. M. Boso	--	1925	100	5	Jackson group	--	--	C,W	S	
*C-44	-- Jandt	--	1923	200	--	do	--	--	C,W	D,S	
C-45	Bryan Campbell well 1	Morris Cannan & R. D. Mebane	1954	6,651	--	--	--	--	--	--	Oil test. Altitude of land surface 395 ft. Electric log 461-5,718 ft. Fresh or slightly saline water-sand zones 461-680; 3,160-4,200 ft. 1/

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*C-46	Hugo Tessman	--	--	280	4	Jackson group	137.4	Oct. 11, 1955	C,W	N	
*C-47	A. H. Weller	--	1924	140	--	do	--	--	J,E	N	
*C-48	Hugo Tessman	Arthur Erdman	1950	305	4	do	107.8	Oct. 11, 1955	C,E	D,S	
C-49	A. J. Luckett Estate well 1	Texita Oil Co. & Morris D. Jaffe	1955	6,524	--	--	--	--	--	--	Oil test. Altitude of land surface 380 ft. Electric log 334-6,524 ft. Fresh or slightly saline water-sand zone 3,350-4,280 ft. 1/
C-50	W. T. Morris & W. F. Murphy	--	Old	300	5	Jackson group	113.3	Oct. 12, 1955	C,W	N	In Wilson County.
*C-51	Clemens Swierc	-- Oertli	--	197	5	do	108.9	Oct. 13, 1955	C,W	D,S	Cased to 100 ft.
*C-52	L. K. Sczpanik	--	--	--	--	do	--	--	C,E	D,S	
*C-53	Pawelek Bros.	--	--	60	--	do	46.6	Oct. 12, 1955	C,W	S	
*C-54	A. Pawelek	--	Old	--	--	do	59.0	Oct. 11, 1955	C,W	D,S	
C-55	Ben Korzekwa well 1	Shell Oil Co.	1950	6,430	--	--	--	--	--	--	Oil test. Altitude of land surface 344 ft. Electric log 87-6430 ft. Fresh or slightly saline water-sand zones 87-610; 3110-4,080 ft. 1/
*C-56	L. K. Sczpanik	--	--	186	5	Jackson group	71.0	Oct. 12, 1955	C,W	D,S	Cased to bottom.
*D-1	Jessie Mika	--	1929	231	4	Catahoula tuff	--	--	C,W	S	
*D-2	Ben Kruciak	--	1920	--	4	do	51.3	May 23, 1956	C,W	D,S	
*D-3	Jessie Mika	--	1894	204	6	do	38.2	Jan. 13, 1956	C,W	D,S	
D-4	David Banduch	--	1913	111	6	do	48.1	Apr. 20, 1956	C,W	D,S	
*D-5	Ben Pawelek	--	--	100	5	do	--	--	C,W	N	
*D-6	Raymond Brysch	--	1908	89	4	Jackson group	73.8	May 3, 1956	C,W	D,S	
*D-7	Mike Bednorz	--	--	240	6	Catahoula tuff	--	--	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
D-8	E. J. Moczygemba well 1	Blair-Vreeland	1953	6,519	--	--	--	--	--	--	Oil test. Altitude of land surface 335 ft. Electric log 556-6,519 ft. Slightly saline water-sand zone 4,370-4,710 ft. [1]
D-9	Henry Manka well 1	do	1954	4,047	--	--	--	--	--	--	Oil test. Altitude of land surface 344 ft. Electric log 140-4,047 ft. Slightly saline water-sand zone 140 to 330 ft. [1]
*D-10	Stanley F. Moczygemba	--	1906	155	10 6	Catahoula tuff	51.8	Apr. 19, 1956	C,W	D,S	Casing: 10-in. to 40 ft. 6-in. from 40 ft. to bottom.
*D-11	P. J. Manka	--	--	100	5	do	--	--	C,W	D,S	
*D-12	Louis Pawelek	--	1921	170	5	Jackson group	126.5	May 2, 1956	C,W	D,S	
*D-13	Ed Kyrish	--	1929	106	4	do	70.2	May 3, 1956	C,W	S	
*D-14	Mrs. J. Zarzambek	--	1913	169	6	do	--	--	C,W	S	
*D-15	L. T. Moczygemba	--	1894	100	6	do	--	--	C,W	D,S	
*D-16	Vincent Labus	--	1915	132	5	do	74.6	Apr. 18, 1956	C,W	D,S	
*D-17	Ben J. Bordovsky	--	1907	75	6	do	51	1956	C,E	S	
*D-18	R. J. Palasek Estate	--	1907	80	6	do	56.6	Apr. 3, 1953	C,W	D	
*D-19	John Drees	--	1921	87	6	do	--	--	C,E	D,S	
*D-20	H. L. Kunkel	--	1894	150	--	do	--	--	C,W	D,S	
*D-21	C. S. E. Henke	--	1900	300	4	Catahoula tuff	100.0	Apr. 4, 1956	C,W	D,S	
*D-22	Anton Hons	--	1928	206	5	do	119.2	Apr. 3, 1956	C,W	D,S	
*D-23	John A. Foegelle	--	--	--	4	do	--	--	C,W	D,S	
D-24	J. O. Faith well 1	Luling Oil & Gas Co.	1943	4,642	--	--	--	--	--	--	Oil test. Altitude of land surface 411 ft. Electric log 347-4,642 ft. Slightly saline water-sand zone 347-790 ft. [1]
*D-25	J. O. Faith	--	--	200	6	Catahoula tuff	91.1	May 24, 1956	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*D-26	Roman R. Groz	--	1928	315	4	Catahoula tuff	--	--	C,W	D,S	
*D-27	Fred Jauer	--	1906	481	5	do	--	--	C,W	S	
*D-28	Harry Jaeske	Max Otto	1901	383	4	do	73.4	May 24, 1956	C,W	D,S	
*D-29	Rud Coldewaw	--	1912	185	5	do	77.0	do	C,W	D,S	Cased to bottom.
*D-30	Ed Bueche	--	1910	200	5	do	100±	Apr. 3, 1956	C,W	D,S	
*D-31	Max Otto	Max Otto	1890	130	6	do	94.2	May 24, 1956	C,W	D,S	
*D-32	F. Bruns	--	1894	160	4	do	--	--	C,W	S	
*D-33	J. D. Klingeman	--	--	200	6	do	92.3	May 25, 1956	C,G 2	S	
*D-34	Mrs. Fritz Seeger	--	1920	100	5	Oakville sandstone	68.6	do	C,W	D,S	
*D-35	Dean Motel	Tom Moy	1950	400	4	Catahoula tuff	200.4	Nov. 23, 1955	C,E	D	Cased to bottom. Screened 380-400 ft.
*D-36	Fritz Seeger	--	1906	140	5	do	115	1954	C,W	D,S	
*D-37	Mrs. Ethyl Hysaw	--	1920	365	4	do	--	--	C,E 1	D,S	Cased to 220 ft.
*D-38	W. M. Brown	--	1895	133	4	Oakville sandstone	--	--	C,E	D,S	
*D-39	Mrs. J. Hoffman	--	--	100	4	do	--	--	C,W	D,S	
*D-40	A. E. & L. Korth	--	--	150	4	do	113.0	Mar. 21, 1956	C,W	N	
*D-41	John Smolik	--	--	100	6	do	67.9	do	C,W	S	
*D-42	J. B. White	--	1905	175	4	Catahoula tuff	--	--	C,E	D	
*D-43	A. M. Bailey	--	--	150	4	do	99.7	Mar. 21, 1956	C,W	S	
*D-44	Edna Wicker	--	1915	150	4	Oakville sandstone	--	--	C,W	D,S	
*D-45	Tom Dromgoole	--	--	44	3	do	35.8	June 5, 1956	C,W	S	
*D-46	Emil Sprencel	--	1906	190	4	do	101.5	do	C,E	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*D-47	Karnes City well 1	Fred E. Burkett	1922	860	12, 8	Catahoula tuff	254.0	Jan. 18, 1956	T,E, 20	P	Casing: 12-in. to 500 ft., 8-in. from 500 to 860 ft. Reported yield 92 gpm. Pumping level 320 ft. Temp. 91°F.
D-48	Karnes City well 2	--	1922	860	10	do	252.0	Jan. 17, 1956	N	N	Cased to bottom.
*D-49	Karnes City well 3	Layne-Texas Co.	1950	872	12, 6	Catahoula tuff	266.6	Jan. 17, 1956	T,E, 25	P	Casing: 12-in. to 804 ft., 6-in. 700-870 ft. Screened 810-850 ft. Hole reamed to 30-in. and gravel-packed 800 to 870 ft. Altitude of land surface 410 ft. Temp. 93°F.
*D-50	Karnes City well 4	do	1954	1,015	12, 6	Catahoula tuff and Jackson group	194.4	do	T,E, 40	P	Casing: 12-in. to 711 ft., 6-in. 610-726 ft. Screened 726-750; 790-905; 907-925; 927-945; 976-995 ft. Hole reamed to 30-in. and graveled from 610-1,015 ft. Reported yield 278 gpm with drawdown of 181 ft. Temp. 94°F.
D-51	Otis S. Wuest well 1-A	Texas Eastern Production Corp.	1954	8,347	--	--	--	--	--	--	Oil test. Altitude of land surface 332 ft. Electric log 100-8,347 ft. Fresh or slightly saline water-sand zone 100-930 ft. 1/
*D-52	Mrs. E. Sahm	--	1934	124	5	Catahoula tuff	102.0	Jan. 27, 1956	C,-	N	
*D-53	United Gas Pipeline Co. well 2	Layne-Texas Co.	1949	995	8,4	Catahoula tuff and Jackson group	112	1954	T,E, 15	Ind	Casing: 8-in. to 502 ft., 4-in. from 394-890 ft. Screened from 517-537; 587-607; 702-712; 787-807; 847-857; 872-892 ft. Hole reamed to 14-in. 502-890 ft., and gravel-packed. Reported yield 150 gpm.
*D-54	United Gas Pipeline Co. well 1	do	1949	910	8,4	do	--	--	T,E, 15	Ind	Casing: 8-in. to 504 ft., 4-in. 392-892 ft. Screened from 508-529; 539-560; 590-600; 835-856; 874-884 ft. Hole reamed to 14-in. 504-892 ft., and gravel-packed. Reported yield 150 gpm.
*D-55	Luis F. Rosales	--	--	100	4	Catahoula tuff	71.7	Apr. 3, 1956	C,W	D,S	
*D-56	Fred W. Klingeman	Tom Moy	--	150	--	do	53.8	Mar. 15, 1956	C,W	S	Cased to bottom.
*D-57	Alex G. Holm	--	--	100	5	do	64.2	Jan. 13, 1956	--	N	
*D-58	A. Holm	--	--	100	--	do	65.6	do	C,W	S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
D-59	J. B. Cannon well 1	F. William Carr	1952	7,819	--	--	--	--	--	--	Oil test. Altitude of land surface 263 ft. Electric log from 1,006-7,819 ft.
D-60	Paul Banduch well 1	Rowan & Hope	1947	4,898	--	--	--	--	--	--	Oil test. Altitude of land surface 280 ft. Electric log from 307 to 4,898 ft. Fresh or slightly saline water-sand zone 307-730 ft. 1/
*E-1	Mark L. Browne	--	--	--	6	Catahoula tuff	44.4	May 4, 1956	C,W	S	
E-2	Mary Yanta well 1	Federal Royalty Co. & Rio Grande Drilling Co.	1945	7,278	--	--	--	--	--	--	Oil test. Altitude of land surface 272 ft. Electric log 767-7,278 ft.
*E-3	Elmer Lee	--	--	100	5	Catahoula tuff	--	--	C,W	D,S	
*E-4	Z. A. Kruciak	--	1936	199	5	do	--	--	C,W	D	
*E-5	Louis Pawelek	Arthur Erdman	1954	458	4	do	39.3	June 8, 1956	C,W	S	Cased to 458 ft. Perforated from 423 to 458 ft.
E-6	Mary Mika well 1	Indiola Oil Co.	1943	6,514	--	--	--	--	--	--	Oil test. Altitude of land surface 335 ft. Electric log 681-6,514 ft. Fresh or slightly saline water-sand zone 681-945 ft. 1/
*E-7	Frank H. Ruckman	--	--	250	5	Catahoula tuff	76.2	June 4, 1956	C,W	N	
*E-8	T. R. Jannyseck	--	1906	85	4	do	62.6	do	C,W	D,S	
*E-9	D. B. Bowden	--	--	100	5	do	51.9	May 22, 1956	C,W	S	
*E-10	Felix Brysch	--	--	100	5	Oakville sandstone	53.0	do	C,W	D,S	
*E-11	Arnold Schendel	Slim Thompson	1954	450	8, 7	Oakville sandstone and Catahoula tuff	90	1954	T,G, 40	Irr	Casing: 8-in. to 300 ft., 7-in. 300-450 ft. Perforated 300-450 ft. Reported yield 400 to 450 gpm Temp. 79°F.
*E-12	Ray Schendel	do	1954	497	8, 7	do	100	1955	T,G, 55	Irr	Casing: 8-in. to 200 ft., 7-in. 200-497 ft. Reported yield 400-450 gpm.

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Contiaued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*E-13	Erwin H. Schendel	Slim Thompson	1956	500	8	Oakville sandstone and Catahoula tuff	135	1956	T,G, --	Irr	Cased to bottom. Perforated 185-205; 257-275; 461-500 ft. Reported yield 500 gpm. Tested at 735 gpm.
*E-14	D. B. Bowden	--	1911	126	--	Oakville sandstone	--	--	C,W	D,S	
*E-15	J. W. Zezula	--	1901	158	5	do	121.0	May 4, 1956	C,W	D,S	
E-16	John Yanta well 1	H. J. Baker	1941	2,609	--	--	--	--	--	--	Oil test. Altitude of land surface 270 ft. Electric log 56-2,609 ft. Fresh or slightly saline water-sand zone 56-410 ft. 1/
*E-17	C. H. Steves	--	--	200	6	Oakville sandstone	--	--	C,E, ½	D,S	
*E-18	LeRoy R. Belzung	--	1895	124	4	do	93.0	Apr. 19, 1956	C,E	S	
E-19	D. E. Lyons well 1	Geochemical Surveys, et al	1954	9,530	--	--	--	--	--	--	Oil test. Altitude of land surface 356 ft. Electric log 667-9,530 ft. Fresh or slightly saline water-sand zone 667-755 ft. 1/
E-20	Mrs. Ernest Yanta	--	1953	400	8	Oakville sandstone	51.1	Nov. 3, 1955	N	N	Cased to bottom.
*E-21	Henry Hedtke	--	1954	413	5	do	85	1956	T,G, 25	Irr	Cased to 380 ft. Perforated from 208-228; 292-312; and 356-377 ft. Measured yield 373 gpm. Temp. 77°F.
E-22	S. D. Staggs	--	--	30	4	do	13.0	Apr. 16, 1956	J,E	D,S	
*E-23	J. Sullivan	--	1917	35	4	do	25.6	do	C,H	D,S	
*E-24	B. Mueller	--	1900	100	4	Lagarto (?) clay	69.3	Jan. 12, 1956	C,G	D,S	
*E-25	R. Ammermann	--	--	89	4	Oakville sandstone and Lagarto clay, undifferentiated	41.8	Jan. 11, 1956	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
E-26	Y. Y. Wilbern well 1	Superior Oil Co.	1945	8,575	--	--	--	--	--	--	Oil test. Altitude of land surface 374 ft. Electric log 1,220-8,575 ft. Fresh or slightly saline water-sand zone 1,220-1,270 ft. [1]
E-27	M. E. Wolters well 2	-- Kirkwood et al.	1952	7,999	--	--	--	--	--	--	Oil test. Altitude of land surface 374 ft. Electric log 718-7,999 ft. Fresh or slightly saline water-sand zone 718-1,300 ft. [1]
*E-28	H. Schlenstedt	--	1911	107	4	Lagarto clay	85.0	Jan. 11, 1956	C,W	D,S	Cased to 105 ft.
*E-29	M. E. Wolters	--	--	93	--	do	66.4	do	C,W	D,S	
E-30	M. E. Wolters well 1	Bright & Schiff	1952	7,402	--	--	--	--	--	--	Oil test. Altitude of land surface 361 ft. Electric log 705-7,402 ft. Fresh or slightly saline water-sand zone 705-1,435 ft. [1]
E-31	Edwin Wolters well 1	Flournoy Drilling Co. et al.	1956	3,972	--	--	--	--	--	--	Oil test. Altitude of land surface 382 ft. Electric log 110-3,972 ft. Fresh or slightly saline water-sand zone 110-1,290 ft. [1]
*E-32	Fritz Berkenhott	--	Old	65	5	Goliad sand and Lagarto clay, undifferentiated	34.4	Jan. 11, 1956	C,W	N	
E-33	Paul Natho well 1	Backaloo, Kirkwood, & Fluornoy Drilling Co.	1955	3,794	--	--	--	--	--	--	Oil test. Altitude of land surface 333 ft. Electric log 104-3,794 ft. Fresh or slightly saline water-sand zone 104-1,100 ft. [1]
*E-34	George Moore	--	1937	39	5	Oakville sandstone and Lagarto clay, undifferentiated	33.4	Nov. 4, 1955	C,W	S	
*E-35	F. J. Matula	--	Old	50	4	do	36.1	Apr. 26, 1956	C,W	D,S	
*E-36	Mrs. Katie Lyons	--	1900	85	4	Oakville sandstone	49.6	Apr. 16, 1956	C,W	D,S	
*E-37	Paul Natho	--	Old	57	6	do	38.0	Apr. 21, 1956	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*E-38	Chas. J. Matula	--	--	43	40	Oakville sandstone	42.6	Apr. 21, 1956	C,W	S	Dug.
*E-39	City of Runge well 2	Layne-Texas Co.	1935	212	10	do	95	1935	T,E, 10	P	Reported yield, 132 gpm. Drawdown 26 ft. Screened from 156 to 190 ft. Temp. 77°F. 2/
*E-40	City of Runge well 1	--	1914	156	--	do	93.3	Dec. 20, 1955	T,E, 15	P	Temp. 77°F.
E-41	Mamie Tom well 1	W. Earl Rowe	1951	3,544	--	--	--	--	--	--	Oil test. Altitude of land surface 235 ft. Electric log 270-3,544 ft. Fresh or slightly saline water-sand zone 270-630 ft. 1/
*E-42	N. R. Douglas	George Guenther	1953	345	8	Oakville sandstone	20	1953	T,Ng, 25	Irr	Cased to 335 ft. Perforated 240-275 ft. Open hole from 335 to 345 ft. Reported yield, 125-150 gpm.
*E-43	J. F. Ryan	--	Old	100	2	do	42.0	May 4, 1956	C,W	S	
*E-44	N. R. McClane	--	1936	130	5	do	88.0	Apr. 19, 1956	C,E	S	
*E-45	L. W. Lawrence	--	1918	53	4	do	--	--	C,E	D,S	
*E-46	W. M. Perkins	--	--	30+	4	do	--	--	C,W	D,S	
*E-47	Mrs. G. C. Ruhmann	--	1937	220	--	do	--	--	C,E	S	Cased to bottom.
E-48	Bertha B. Ruhmann well 1	L. W. Callender	1938	3,302	--	--	--	--	--	--	Oil test. Altitude of land surface 345 ft. Electric log 42-3,302 ft. Fresh or slightly saline water-sand zone 42-610 ft. 1/
*E-49	C. C. Strawn	--	--	75	4	Oakville sandstone	26.0	May 1, 1956	C,W	D,S	
*E-50	Robert M. Adam	--	1916	60	4	do	--	--	C,E	D,S	
*E-51	Elmer Cox, Jr.	--	1936	100	6	do	--	--	C,E	D,S	
*E-52	Ted Aaron	--	1915	--	3	do	113.7	May 25, 1956	C,W	S	
*E-53	W. S. Pickett	--	--	140	6	do	--	--	C,W	D,S	
*E-54	Elmer Lee	--	1910	134	5	do	--	--	C,E	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*E-55	Modesto Franco	--	1884	80	8	Oakville sandstone	42.2	Mar.16, 1956	C,W	D,S	
*E-56	Mrs. H. A. Neal	--	1911	80	5	do	--	--	C,E	D	
*E-57	Antonio Guerrero	--	1890	77	5	do	60.9	Mar.16, 1956	C,E	D,S	
F-1	Mrs. A. Weddington well 1	H. R. Smith and Skinner & Eddy Corp.	1946	4,170	--	--	--	--	--	--	Oil test. Altitude of land surface 440 ft. Electric log 204-4,170 ft. Fresh or slightly saline water sand zones 294-920; and 4,020-4,170 ft.1/
*F-2	Prosper Pawelek	Arthur Erdman	1954	221	4	Jackson group	97.4	June 8, 1956	C,W	S	Cased to 221 ft. Perforated from 201-222 ft.
*F-3	Tom Polasek	--	1926	150	6	Catahoula tuff	--	--	C,-	N	
*F-4	Hebert Weigang	--	1933	116	5	do	83.6	Apr.17, 1956	C,W	D,S	
*F-5	C. T. Roberts	--	1926	335	6	do	--	--	C,E	D,S	
F-6	H. L. Smith	--	1955	530	6	--	--	--	N	N	Cased to 30 ft. Electric log shows water sands from 330 to 390; and 430 to 470 ft.
*F-7	H. L. Smith	--	--	360	6	Catahoula tuff	--	--	C,W	D,S	Cased to 10 ft.
*F-8	Rudolph Best	Ed Swierc	1954	450	8	do	125	1955	T,G, 50	Irr	Cased to bottom. Perforated from 290 to 450 ft. Reported yield 250 gpm with 55 ft. of drawdown. Temp. 84°F.
*F-9	do	--	1926	446	5	do	--	--	T,E, 3	D,S	
F-10	Rudolph Best well 2	Seaboard Oil Co.	1945	7,938	--	--	--	--	--	--	Oil test. Altitude of derrick floor 479 ft. Electric log 40-7,938 ft. Fresh or slightly saline water-sand zones 40-990; and 4,835-5,895 ft. 1/
F-11	Sallye Treadwell well 1	do	1945	7,998	--	--	--	--	--	--	Oil test. Altitude of derrick floor 451 ft. Electric log 38-7,998 ft. Fresh or slightly saline water-sand zones 38-930; and 4,770-5,800 ft. 1/
*F-12	Fritz Fenner	--	1911	193	6	Catahoula tuff	113.4	Jan.27, 1956	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
F-13	Sallye Treadwell well 3	Seaboard Oil Co.	1945	8,404	--	--	--	--	--	--	Oil test. Altitude of derrick floor 450 ft. Electric log 38-8,404 ft. Slightly saline water-sand zones 38-980; 4,840-5,810 ft. 1/
F-14	Ernest Poenisch	Arthur Erdman	--	423	--	Catahoula tuff	104.0	June 14, 1956	C,W	S	Cased to 423 ft. Perforated from 379 to 423 ft.
*F-15	do	do	--	323	4	do	--	--	C,W	S	Cased to 323 ft. Perforated from 279 to 323 ft.
*F-16	do	do	--	500	--	do	104.7	June 14, 1956	C,W,E	D,S	Cased to bottom. Perforated from 440 to 500 ft.
F-17	do	do	1954	428	--	do	--	--	C,W	S	Cased to bottom. Perforated from 384 to 428 ft.
*F-18	E. B. Hardt	--	1922	210	6	do	102.0	June 1, 1956	C,W	D,S	
*F-19	Ernest Poenisch	Arthur Erdman	--	500	4	Jackson group	118.3	June 14, 1956	C,W	S	Cased to bottom. Perforated from 440 to 500 ft.
*F-20	C. L. Kolinek	--	1942	32	48	Catahoula tuff	29.6	June 15, 1956	C,E	S	Dug.
*G-1	G. O. Daugherty	--	--	--	4	do	93.1	Apr. 6, 1956	C,W	D,S	
*G-2	Fred Klingeman well 1	Magnolia Petroleum Co.	1945	8,004	8	Carrizo sand	99.2	Apr. 6, 1956	T,G	Irr	Casing: 8-in to 8,004 ft. Perforated from 5,290-5,355 ft. Converted oil test. Reported yield 1,000 gpm. Electric log 39-8,004 ft. Fresh or slightly saline water-sand zones 39-1,040; 4,880-5,900 ft. Temp. 177°F. 1/
*G-3	F. Klingeman Estate	--	Old	365	6	Catahoula tuff	148.1	Jan. 27, 1956	C,W	S	
*G-4	Adolph Haner	--	1907	265	6	do	--	--	C,W	D,S	
*G-5	Otto Lieke	--	1910	300	6	do	142.4	May 24, 1956	C,W	D,S	
*G-6	David A. Culberson	--	1906	355	10, 4	do	245.4	do	C,W	D,S	Casing: 10-in. to 16 ft., 4-in. from 0 to bottom.
*G-7	William Dunn	--	1911	375	3	do	114.5	Jan. 13, 1956	C,W	D,S	
*G-8	Mrs. C. C. Cavanaugh	--	1916	275	--	do	--	--	C,E	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*G-9	Mrs. C. C. Cavanaugh	--	1915	105	5	Catahoula tuff	96.3	Jan. 13, 1956	C,W	S	
*G-10	Sons of Herman Lodge	--	1901	200	--	do	175.0	do	C,W	N	
G-11	Annie Zamzow well 1	Ernest Fletcher	1952	8,504	--	--	--	--	--	--	Oil test. Altitude of land surface 392 ft. Electric log 971 to 8,504 ft.1/
*G-12	J. T. Hailey	--	1945	10	36	Oakville sandstone	--	--	N	N	Dug. Flows during wet weather. Originally a spring.
*G-13	J. A. Smith	--	--	265	4	Catahoula tuff	--	--	C,W	D	
*G-14	Otto Fenner	--	--	200	4	do	145.6	Jan. 13, 1956	C,W	D,S	
*G-15	Ray Moody	--	--	--	--	do	--	--	C,-	N	
*G-16	W. W. McAllister	--	--	400	5	do	109.5	Jan. 13, 1956	C,E, 3/4	S	
*G-17	W. D. Barnes	--	--	210	4	Oakville sandstone	--	--	C,W	S	
*G-18	City of Kenedy well 7	Layne-Texas Co.	1951	422	16, 8	do	70.0	Jan. 24, 1956	T,E, 40	P	Casing: 16-in. to 300 ft.; 8-in. from 300 to 410 ft. Perforated from 360-410 ft. Reported yield 363 gpm. Altitude of land surface 271 ft. Temp. 80°F.
*G-19	Southern Pacific R.R. Co.	--	1915	3,000	8, 6	Yegua formation (?)	--	--	--	P	Casing: 8-in. to 866 ft.; 6-in. from 866 to 2,757 ft. Screened from 2,757-2,797 ft.
*G-20	City of Kenedy well 6	Layne-Texas Co.	1948	431	14, 8	Oakville sandstone	87.0	Jan. 24, 1956	T,E, 40	P	Casing: 14-in. to 375 ft., 8-in. from 268-417 ft. Reported yield 363 gpm with 100 ft. of drawdown. Slotted from 375-417 ft. Temp. 80°F.
*G-21	City of Kenedy well 4	do	1947	747	14, 7	Oakville sandstone and Catahoula tuff	148.9	do	T,E, 50	P	Casing: 14-in. to 427 ft., 7-in. from 330-747 ft. Screened 432-477; 520-530; 723-743 ft. Reported yield 385 gpm. Hole reamed to 30-in. Gravel-packed. Drawdown 109 ft. after pumping 250 gpm, pumping level 258 ft. Temp. 87°F.
*G-22	City of Kenedy well 5	do	--	416	12, 8	Oakville sandstone	86.2	do	T,E, 40	P	Reported yield 325 gpm with 65 ft. of drawdown. Temp. 80°F.

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
							Below land surface datum (ft.)	Date of measurement			
*G-23	City of Kenedy well 3	Layne-Texas Co.	1943	399	13, 6	Oakville sandstone	87.3	Jan. 24, 1956	T,E, 25	P	Measured yield, 350 gpm. Pumping level of 168 ft. Casing: 13-in. to 335 ft., 6-in. from 183 to 396 ft. Slotted from 334 to 396 ft. Hole reamed and graveled to 396 ft. Temp. 80°F.
*G-24	E. T. McDonald	--	--	100	4	do	68.7	May 24, 1956	C,W	D,S	
*G-25	Gus Rummel	--	--	--	4	Oakville (?) sandstone	--	--	--	D,S	
*G-26	R. E. Buegeler	--	1930	318	4	Catahoula tuff	147.4	Jan. 27, 1956	C,W	D,S	
*G-27	Phil Buegeler	George Guenther	1947	751	4	do	126.2	Apr. 5, 1956	C,W	S	Cased to 222 ft. Perforated from 171-222 ft.
*G-28	Otto Boehm	--	1911	190	6	Oakville sandstone	91.3	do	C,W	S	
*G-29	C. D. McAda	Arthur Erdman	1947	377	5	Catahoula tuff	135	1956	C,W	D,S	Cased to 358 ft. Perforated from 328-358 ft.
*G-30	do	--	1900	176	4	Oakville sandstone	72.4	Feb. 15, 1937	N	N	
*G-31	Fidelio G. Chamberlain	--	1945	365	4	do	--	--	C,W	D,S	Cased to 338 ft.
*G-32	W. S. Gruenwald	--	--	132	6	do	129	1956	C,W	D,S	
*G-33	W. T. Homeyer	Tom Moy	1940?	260	5	do	196.3	Apr. 4, 1956	C,W	D,S	Cased to bottom.
*G-34	H. H. Schuememann	--	--	Spring	--	do	7±	May 1, 1956	N	N	Dug to 11 ft. Flows during wet weather.
*G-35	R. A. David	--	--	71	--	do	--	--	C,E	D,S	
G-36	D. E. Smith well 1	The Chicago Corp.	1951	3,502	--	--	--	--	--	--	Oil test. Altitude of land surface 450 ft. Electric log 302-3,502 ft.
*G-37	Ford F. Gauntt	--	Old	175	4	Oakville sandstone	80.3	May 1, 1956	N	N	
*G-38	C. R. Murphy	--	1935	180	4	do	142.0	June 6, 1956	C,E	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*G-39	F. E. Juchelka	--	1920	210	5	Oakville sandstone and Lagarto clay, undifferentiated	149.6	June 6, 1956	C,W	D,S	
*G-40	Gilbert Johnson	--	1925	106	3	Lagarto clay	--	--	C,W	D,S	
G-41	A. O. Mudd well 1	McCarrick Oil Co.	1951	2,929	--	--	--	--	--	--	Oil test. Altitude of land surface 378 ft. Electric log 97-2,929 ft. Fresh or slightly saline water-sand zone 97-600 ft. 1/
*G-42	M. E. Holmes	--	1908	137	--	Oakville sandstone	--	--	C,W,E,	D,S	Cased to bottom.
*G-43	W. J. Stockton	Glen Burnett	1952	261	4	do	--	--	C,W	D,S	
*G-44	J. J. Ponish	--	1930	270	5	do	--	--	C,W	D,S	Cased to 267 ft. In Bee County.
G-45	Robert E. Goetz well 1	The Chicago Corp.	1951	2,350	--	--	--	--	--	--	Oil test. Altitude of land surface 488 ft. Electric log from 300-2,350 ft.
*G-46	Carl Fransen	--	1922	45	4	Oakville sandstone	--	--	J,E	D,S	
*G-47	O. L. Bagwell	--	1924	40	4	do	--	--	C,W	D,S	
*G-48	Bill Richter	Arthur Erdman	1955	240	4	do	212	1956	C,E	D,S	Cased to bottom. Perforated from 200-240 ft.
*G-49	Albert Esse	--	1925	400	6	Catahoula tuff	179.0	Apr. 25, 1956	C,E	S	
*G-50	do	--	1931	60	30	do	50	1956	J,E	S	Dug.
G-51	Ernest Esse well 1	John J. Coyle	1954	6,520	--	--	--	--	--	--	Oil test. Altitude of land surface 482 ft. Electric log 670-6,520 ft. Slightly saline water-sand zone 5,620-5,800 ft. 1/
*G-52	Minna Hoffman	--	1926	356	6	Catahoula tuff	--	--	N	N	
*G-53	E. H. Ladewig	--	--	210	7	do	135.9	Apr. 17, 1956	C,W	D,S	Cased to bottom.
*G-54	S. E. Crews	--	1929	92	30	do	--	--	N	N	Dug. Tile casing to bottom.

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*G-55	J. W. Berry	--	Old	137	4	Oakville sandstone	--	--	C,W	D,S	
*H-1	F. E. Moses	--	--	159	--	do	108	1956	C,E	D,S	
*H-2	C. H. Kreneck	--	1896	115	5	do	110.4	Nov. 2, 1955	C,W	D,S	
*H-3	Geo. Tips	--	1924	160	5	do	114.3	Nov. 1, 1955	C,W	S	
H-4	C. Burbank well 1	Edwin M. Jones, & Forney & Worrel	1955	6,815	--	--	--	--	--	--	Oil test. Altitude of land surface 298 ft. Electric log 715-6,815 ft. Fresh or slightly saline water-sand zone 715-930.[1]
*H-5	R. A. Hunt	--	--	--	--	Oakville sandstone and Lagarto clay, undifferentiated	77.5	June 6, 1956	C,W	D,S	
*H-6	Leo Kreneck	--	1908	160	4	do	100.2	do	C,W	D,S	
*H-7	Union Leader School	--	1920	120	4	Oakville sandstone	--	--	C,W	N	
*H-8	L. K. Thigpen	--	1906	160	4	Oakville sandstone and Lagarto clay, undifferentiated	142.7	June 6, 1956	C,W	D,S	
H-9	R. E. Grayson well 1	H. H. Howell	1955	7,012	--	--	--	--	--	--	Oil test. Altitude of land surface 249 ft. Electric log 105-7,012 ft. Fresh or slightly saline water-sand zone 105-1010 ft.[1]
*H-10	G. Roeben	--	1927	100	--	Lagarto clay	89.3	June 6, 1956	C,W	D,S	
*H-11	C. W. Boyce	--	1900	80	4	do	42.9	Nov. 2, 1955	C,W	S	
*H-12	Wiley Busby	--	1900	36	6	do	--	--	C,E	D,S	
*H-13	A. B. Copeland	--	1884	38	6	do	34.8	Feb. 17, 1956	C,W	S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
H-14	H. A. Diecher well 1	Forest Oil Corp.	1951	6,755	--	--	--	--	--	--	Oil test. Altitude of land surface 296 ft. Electric log 517-6,755 ft. Fresh or slightly saline water-sand zone 517-750 ft. 1/
*H-15	Tips Ranch	--	--	70	8	Oakville sandstone	45.1	Nov. 2, 1955	C,W	D,S	
*H-16	A. B. Russell	--	1927	70	5	do	--	--	C,W	D,S	
*H-17	A. W. Mixon	--	1936	83	4	Oakville sandstone and Lagarto clay, undifferentiated	77.2	Mar. 26, 1937	C,W	S	
H-18	D. C. Lyons well B-1	Jake L. Hamon, Edwin Cox, Rowe & Whitaker	1951	6,596	--	--	--	--	--	--	Oil test. Altitude of land surface 217 ft. Electric log 760-6,596 ft. Fresh or slightly saline water-sand zone 760-820 ft. 1/
*H-19	Annie & Fannie Boyce	--	--	86	4	Lagarto clay	44.3	Nov. 3, 1955	C,W	D,S	
H-20	Henry Koehler well 1	Dinero Oil & Gas Co. & Reynolds & Hickock	1937	4,151	--	--	--	--	--	--	Oil test. Altitude of land surface 264 ft. Electric log 189-4,151 ft. Fresh or slightly saline water-sand zone 189-1,120 ft. 1/
H-21	Warren Talk	--	1942	155	4	Lagarto clay	61.3	Nov. 4, 1955	C,W	D,S	
*H-22	D. G. Janssen	--	--	120	5	do	44.3	Nov. 3, 1955	C,W	D	
*H-23	Paul Dittfurth	--	--	120	4	do	--	--	C,W	D,S	
H-24	J. F. Janssen well 1	M. T. Buckaloo & J. B. Vassey	1954	4,106	--	--	--	--	--	--	Oil test. Altitude of land surface 315 ft. Electric log 92-3,130 ft. Fresh or slightly saline water-sand zone from 92-1,230 ft. 1/
*H-25	Fidel Escamilla	--	--	--	4	Lagarto clay	73.4	Nov. 4, 1955	C,W	D,S	
H-26	Mary Pargann well 1	Bright & Schiff	1952	7,469	--	--	--	--	--	--	Oil test. Altitude of land surface 263 ft. Electric log 1,387-7,469 ft.
*H-27	O. P. Talk	--	--	150	4	Lagarto clay	120.7	Jan. 11, 1956	C,W	D,S	In DeWitt County.

* See footnotes at end of table.

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*H-28	Karon McSmith	--	--	150	6	Lagarto clay	140.7	June 7, 1956	C,W	N	
*H-29	J. F. Taylor	--	1908	240	5	do	124.4	Jan. 11, 1956	C,W	D,S	
*H-30	United Gas Pipeline Co. well 1	Layne-Texas Co.	1954	600	8, 4	Oakville sandstone and Lagarto clay, undifferentiated	121.2	Jan. 26, 1956	T,E, 5	Ind	Casing: 8-in. to 505 ft., 4-in. from 505-600 ft. Screened from 515-535; 570-590 ft. Hole reamed to 19-in. and gravel-packed 505-600 ft. Measured yield 130 gpm. Drawdown: 153+ ft. after 2-hours pumping 130 gpm.
*H-31	United Gas Pipeline Co. well 2	do	1954	669	8, 4	do	110.5	do	T,E, 5	Ind	Drilled to 669 ft. Casing: 8-in. to 412 ft., 4-in. from 400-575 ft. Screened 510-535; 550-565 ft. Hole reamed to 19 in. and gravel-packed from 500-575 ft.
H-32	B. C. Butler et al. well 2	W. R. Quin	1948	4,146	--	--	--	--	--	--	Oil test. Altitude of land surface 268 ft. Electric log 456-4,146 ft. Fresh or slightly saline water-sand zone 456-1,170 ft. 1/
*H-33	Frank Davenport	--	1925	54	4	Lagarto clay	36.8	Apr. 18, 1956	C,E	D,S	
H-34	do	Thompson Well Service	--	500	10	Oakville sandstone and Lagarto clay, undifferentiated	44.6	do	N	N	Casing: 10-in. to 500 ft. Perforated from 300 to 320; 480-500 ft.
H-35	Mrs. B. Porter well 1	W. R. Quin	1947	4,200	--	--	--	--	--	--	Oil test. Altitude of derrick floor 293 ft. Electric log 332-4,200 ft. Fresh or slightly saline water-sand zone 332-1,200 ft. 1/
*H-36	John Janssen	--	--	60	--	Lagarto clay	48.3	Nov. 3, 1955	C,W	D,S	
H-37	John Janssen well 2	Beck Oil Co.	1956	4,086	--	--	--	--	--	--	Oil test. Altitude of land surface 270+ ft. Electric log 107-4,086 ft. Fresh or slightly saline water-sand zone 107-1,200 ft. 1/
*H-38	Porter Sellers	--	--	60	6	Lagarto clay	--	--	C,E	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
H-39	G. Schrade well 4	Superior Oil Co.	1943	4,070	--	--	--	--	--	--	Oil test. Altitude of derrick floor 285 ft. Electric log 410-4,070 ft. Fresh or slightly saline water-sand zone 410-1,200 ft. 1/
H-40	W. M. Porter well 1	Phillips Petroleum Co.	1943	4,005	--	--	--	--	--	--	Oil test. Altitude of land surface 250+ ft. Electric log 363-4,005 ft. Fresh or slightly saline water-sand zone 363-1,190 ft. 1/
*H-41	Alfredo Pizma	--	1900	51	6	Lagarto clay	37.4	Nov. 3, 1955	C,W	D,S	
*H-42	Mrs. D. Pargmann	--	--	114	4	do	19.2	do	C,W	D,S	
*H-43	Gaylord Westphal	Geo. Guenther	1953	292	8, 5	do	+1.0	Apr. 18, 1956	Flows, T,-	N	Casing: 8-in. to 180 ft., 5-in. from 180 to 292 ft. Slotted from 180-292 ft. Tested 800 gpm with drawdown of 50 ft. Reported yield 500 gpm.
*H-44	Collie Baker	--	1900	63	6	do	57.2	June 7, 1956	J,E	D,S	
*H-45	C. A. Atkinson	--	--	63	6	do	--	--	C,E	D,S	
*H-46	C. B. Hunt	--	1921	101	5	do	47.1	Oct. 28, 1955	C,E	D,S	
*H-47	C. Baker	--	--	100	5	do	84.9	Nov. 1, 1955	C,E	D,S	
H-48	M. I. Seitz	Brooks Morrow	1955	135	4	do	61.8	do	N	N	
H-49	O. M. Nance well 1	Jake L. Hamon & Gilmour Drilling Co.	1955	6,859	--	--	--	--	--	--	Oil test. Altitude of land surface 282 ft. Electric log 815-6,859 ft. Fresh or slightly saline water-sand zone 815-1,050 ft. 1/
*H-50	J. A. Sawey	--	Old	87	4	Lagarto clay	61.8	Nov. 1, 1955	C,E	D,S	Cased to bottom. Perforated from 67 to 87 ft.
*H-51	A. M. Korback	--	--	--	6	do	--	--	C,W	D,S	
*H-52	Mrs. R. L. Hunt	--	--	160	6	do	106.5	Nov. 1, 1955	C,W	N	
H-53	G. T. Beaham well 1	Phillips Petroleum Co.	1943	6,800	--	--	--	--	--	--	Oil test. Altitude of land surface, 265 ft. Electric log 690-6,800 ft. 1/
H-54	G. T. Beaham well 2	do	1944	6,608	--	--	--	--	--	--	Oil test. Altitude of land surface, 286 ft. Electric log 698-6,608 ft. 1/

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
H-55	L. L. Reasoner well 1	W. M. Averill, Jr.	1956	3,322	--	--	--	--	--	--	Oil test. Altitude of land surface, 321 ft. Electric log 130-3,322 ft. Fresh or slightly saline water sand zone 130 to 690 ft. 1/
*H-56	S. W. Borg	--	--	160	4	Oakville sandstone	144.5	June 5, 1956	C,W	D,S	
*H-57	E. Schroeder	--	1907	148	4	do	--	--	C,W	N	
*H-58	E. L. Vaughn	Ralph Letzinger	1956	375	8	do	--	--	T,G, 75	Irr	Casing: 8-in. to bottom. Perforated from 130 to 155, 200 to 210, 270 to 310, and 355 to 370 ft. Tested at 800 gpm with drawdown of 130 ft. Reported yield 500 gpm. Temp. 78°F.
*H-59	John W. Thames	--	--	--	4	Oakville sandstone and Lagarto clay, undifferentiated	55.7	June 6, 1956	C,W	D,S	
H-60	W. Nichols well 1	Kirkwood & Co.	1951	7,513	--	--	--	--	--	--	Oil test. Altitude of land surface, 335 ft. Electric log 517-7,513 ft. Fresh or slightly saline water sand zone from 517 to 940 ft. 1/
H-61	Russell-Atkinson well 1	Magnolia Petroleum Co.	--	6,543	--	--	--	--	--	--	Oil test. Altitude of derrick floor 402 ft. Electric log 204-6,543 ft. Fresh or slightly saline water sand zone from 204 to 790 ft. 1/
H-62	Annie Lee Lyons well 2	Stanolind Oil & Gas Co.	1946	6,885	--	--	--	--	--	--	Oil test. Altitude of derrick floor 462 ft. Electric log 40-6,885 ft. Fresh or slightly saline water sand zone from 40 to 840 ft. 1/
*H-63	Otto Von Roeder	--	--	58	5	Lagarto clay	55	1956	C,W	D,S	
H-64	-- Choate well 1	W. M. Marr & N. W. Norton	1934	3,540	--	--	--	--	--	--	Oil test. Altitude of land surface, 360 ft. Electric log 246-3,540 ft. Fresh or slightly saline water sand zone from 246 to 780 ft. 1/
*H-65	D. W. Vickers	--	1927	64	4	Lagarto clay	58.8	Oct. 27, 1955	C,W	D,S	

* See footnotes at end of table.

Table 5.- Records of wells in Karnes County--Continued

Well	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Water-bearing unit	Water level: Below land surface datum (ft.)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*H-66	J. E. Steed	--	1914	210	4	Lagarto clay	--	--	C,W	D,S	
H-67	Guy Porter well 20	Magnolia Petroleum Co.	1940	3,777	--	--	--	--	--	--	Oil test. Altitude of land surface, 385 ft. Electric log 235-3,777 ft. Fresh or slightly saline water sand zone from 235 to 1,120 ft. 1/
*H-68	George J. Jonischkies	H. & S. Drilling Co.	1956	345	10	Lagarto clay	68	Jan. 1957	T,E, 15	Irr	Casing: 10-in. to bottom. Slotted from 80 to 122, 155 to 170, 185 to 210, 300 to 310, and 323 to 336 ft. Reported yield 250 gpm with drawdown of 90 ft. Temp. 77°F.
*H-69	D. N. Livingston	--	1928	158	4	do	139.2	Nov. 2, 1955	C,W	D,S	
H-70	Delia Choate well 1	Sun-Ray Oil Co.	1947	4,011	--	--	--	--	--	--	Oil test. Altitude of land surface, 380 ft. Electric log 390-4,011 ft. Fresh or slightly saline water sand zone from 390 to 620 ft. 1/
H-71	Collie Baker well 1	L. G. Shelly & Hunt Drilling Co.	1956	8,032	--	--	--	--	--	--	Oil test. Altitude of land surface, 318 ft. Electric log 723-8,032 ft. 1/
*H-72	Mike Sikes	--	1937	80	4	Lagarto clay	56.8	Nov. 1, 1955	C,W	S	

1/ Electric log in files of Texas Board of Water Engineers.
2/ See table 6 for drillers' logs of wells in Karnes County.
* See table 7 for analyses of water from wells in Karnes County.

Table 6.- Drillers' logs of wells in Karnes County, Tex.

Well A-1

Owner: Alex Pawelek. Driller: Martin, Shelly, & Thomas.

	Thickness (feet)	Depth (feet)
Shale	480	480
Sand	127	607
Shale	529	1,136
Sand	85	1,221
Shale	89	1,310
Sand	192	1,502
Shale, sandy	131	1,633
Sand	89	1,722
Shale	182	1,904
Sand	74	1,978
Shale	238	2,216
Sand	12	2,228
Shale	15	2,243
Sand	1,287	3,530
Shale	365	3,895
Sand and shale streaks	1,457	5,352
Shale, sandy	156	5,508
Shale	142	5,650
Shale, sandy and sand	80	5,730
Shale	389	6,119

Well C-13

Owner: J. Kyselica. Well 1. Driller: H. R. Smith et al.

	Thickness (feet)	Depth (feet)
Caliche and sand, hard	65	65
Sand, hard, and shale streaks	135	200
Sand and shale streaks, sandy	621	821
Shale, sandy and hard streaks	199	1,020
Sand and hard streaks	141	1,161
Shale and shale streaks, sandy	269	1,430
Shale, sandy, and sand streaks	376	1,806
Shale and sand streaks, hard	941	2,747
Shale, hard and shale streaks, sandy	246	2,993
Sand and hard streaks	292	3,285
Rock, hard	9	3,294
Shale and hard streaks	126	3,420
Rock, hard	34	3,454
Shale, hard, and sand streaks	518	3,972
Shale and sand	5	3,977
Shale, sand, and laminated sand and shale	5	3,982
Shale, sandy, sand and shale	7	3,989

(Continued on next page)

Table 6.- Drillers' logs of wells in Karnes County--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well C-13--Continued					
Shale, firm, sandy ------	2	3,991	Shale, light-brown, sandy, and sand, brown, and gray, porous and shale, sandy ----------------	10	4,029
Shale, dark-brown to light-brown, sticky, and sand, firm, fine-grained, shaly ----------------	10	4,001	Shale, firm, brown and shale, hard, sandy ----	2	4,031
Shale, light-brown to dark-brown, sandy and sand streaks, thin, tight, shale and sand, firm, medium-grained, porous-	6	4,007	Shale, firm, brown and shale, sandy ----------	4	4,035
Sand, firm, medium-grained, porous ----------------	1	4,008	Sand, firm, fine-grained, silty ----------------	3	4,038
Sand, firm, brown, gray, porous, medium-grained, and shale, brown, sandy, and shale, dark-brown, sandy and sand streaks, thin, and sand, firm, brown, gray, porous, and shale streaks, sandy --	11	4,019	Sand, firm, fine-grained, brown and gray --------	10	4,048
			Sand, firm, fine-grained, brown, gray, and sand, firm, fine-grained, tight, shaly -----------------	10	4,058
			No record ---------------	56	4,114

Well C-45

Owner: Bryan Campbell well 1. Driller: Morris Cannan & R. D. Mebane.

Caliche ----------------	40	40	Shale and sand streaks --	29	3,035
Sand -------------------	40	80	Shale ------------------	228	3,263
Shale ------------------	209	289	Shale and sandy streaks -	250	3,513
Shale and sand streaks --	700	989	Shale ------------------	759	4,272
Shale ------------------	522	1,511	Shale and sand ----------	79	4,351
Shale and sand streaks --	405	1,916	Shale, hard ------------	24	4,375
Shale, sticky ----------	296	2,212	Sand -------------------	10	4,385
Shale ------------------	87	2,299	Shale, hard ------------	102	4,487
Shale and sand ----------	289	2,588	Shale and sand ----------	110	4,597
Shale ------------------	418	3,006	Shale ------------------	16	4,613

(Continued on next page)

Table 6.- Drillers' logs of wells in Karnes County--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well C-45--Continued					
Sand	4	4,617	Sand, hard	56	5,605
Shale	93	4,710	Shale, hard	70	5,675
Shale and lime streaks	61	4,771	Shale, hard, sandy	46	5,721
Shale and sand streaks	42	4,813	Shale, hard	154	5,875
Shale	160	4,973	Shale, hard, sandy	191	6,066
Shale and sand streaks	101	5,074	Shale, hard	165	6,231
Shale	134	5,208	Shale, sandy	3	6,234
Shale, sandy	156	5,364	Shale	32	6,266
Shale	72	5,436	Shale, sandy	8	6,274
Sand	66	5,502	Shale, hard	259	6,533
Shale	41	5,543	Shale, sandy	23	6,556
Sand	2	5,545	Shale	95	6,651
Shale	4	5,549			

Well D-53

Owner: United Gas Pipeline Co. well 2. Driller: Layne-Texas Co.

Soil	6	6	Sand and lime	20	463
Clay	5	11	Serpentine and shale	93	556
Clay and sand	14	25	Serpentine and lime breaks, hard	47	603
Clay and caliche	135	160	Rock	1	604
Caliche	102	262	Shale, green, iron pyrites	4	608
Clay and caliche	115	377	Shale, hard, sandy, rock, lime, and shale breaks, soft	89	697
Clay, sandy	18	395	Shale, sticky, black	29	726
Clay	28	423			
Shale, blue	20	443			

(Continued on next page)

Table 6.- Drillers' logs of wells in Karnes County--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-53--Continued					
Shale and boulders ------	97	823	Shale, and sandy shale --	75	973
Shale, sandy ------------	25	848	Shale, sandy ------------	15	988
Shale and rock ----------	23	871	Shale -------------------	7	995
Sand and shale, sandy ---	27	898			

Well D-54

Owner: United Gas Pipeline Co. well 1. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil --------------------	4	4	Sand, hard, and sand layers, rock and shale, tough--	39	694
Clay, sandy, and caliche-	196	200	Shale, tough, sticky ----	2	696
Sand --------------------	15	215	Shale -------------------	4	700
Caliche -----------------	50	265	Sand and sandy shale ----	15	715
Sand and caliche --------	48	313	Shale and caliche -------	40	755
Caliche -----------------	65	378	Shale, sandy, and shale boulders --------------	50	805
Sand, hard, fine --------	23	401	Shale, hard -------------	3	808
Shale -------------------	38	439	Shale, hard, sticky -----	7	815
Sand, hard, fine --------	29	468	Sand and shale break layers, hard ----------	45	860
Shale and lime ----------	41	509	Shale, hard -------------	5	865
Sand and shale layers, hard	49	558	Shale, sandy ------------	12	877
Sand and shale layers ---	7	565	Sand, broken ------------	28	905
Shale and caliche -------	28	593	Shale -------------------	5	910
Shale, sandy and caliche-	24	617			
Shale, tough and caliche-	7	624			
Sand --------------------	12	636			
Shale, tough ------------	19	655			

Table 6.- Drillers' logs of wells in Karnes County--Continued

Well E-39

Owner: City of Runge, well 2. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Surface soil	4	4
Clay, hard, yellow	62	66
Rock	1	67
Clay, hard	29	96
Clay and boulders	20	116
Clay	20	136
Clay, hard and boulders	18	154
Sand	34	188
Clay	24	212

Well G-19

Owner: Southern Pacific Railroad Co.

	Thickness (feet)	Depth (feet)
Clay	20	20
Clay, yellow	50	70
Sand, rock, and shell	70	140
Gumbo, brown	130	270
Sand, yellow	15	285
Gumbo, brown	50	335
Sand, gray	60	395
Gumbo, brown	62	457
Sand, yellow	105	562
Sandrock, soft, red	60	622
Sand, yellow, and rock shell	81	703
Gumbo	39	742
Shale, blue	39	781
Gumbo	12	793
Shale, blue	30	823
Gumbo	40	863
Rock	3	886
Sand, water	72	938
Rock	1	939
Shale, blue, rock and shell	74	1,013
Gumbo	56	1,069
Shale, blue, rock, and shell	120	1,189
Gumbo, rock, and shell	59	1,248
Rock	2	1,250
Gumbo and rock shell	37	1,287
Gumbo	67	1,354
Shale, rock, and shell	57	1,411
Rock	4	1,415
Shale and gumbo	51	1,466
Rock, soft	7	1,473
Shale	20	1,493

(Continued on next page)

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well G-19--Continued					
Gumbo	17	1,510	Shale, hard	5	2,277
Shale	60	1,570	Gumbo	35	2,312
Gumbo	10	1,580	Shale, hard, sandy	61	2,373
Rock	6	1,586	Rock	2	2,375
Gumbo	62	1,648	Sand, water	15	2,390
Shale, hard, blue	40	1,688	Gumbo	125	2,515
Gumbo	87	1,775	Shale, blue	55	2,570
Shale and gumbo	50	1,825	Rock	3	2,573
Shale, hard, blue	50	1,875	Shale, blue	22	2,595
Rock, soft	5	1,880	Gumbo	5	2,600
Shale, hard, sandy, and sandrock	101	1,981	Shale, blue	100	2,700
Rock, soft	5	1,986	Shale	5	2,705
Gumbo	5	1,991	Rock	5	2,710
Shale, hard, sandy, and sandrock	36	2,027	Shale and rock shell	32	2,742
Shale	20	2,047	Shale, blue	15	2,757
Shale, hard, sandy	60	2,107	Sand, blue	40	2,797
Rock	3	2,110	Shale, hard	23	2,820
Shale, hard	20	2,130	Shale, hard, blue	10	2,830
Shale, hard, sandy	136	2,266	Shale, hard	35	2,865
Gumbo	6	2,272	Gumbo	5	2,870
			Slate	10	2,880
			Slate, sandy	20	2,900
			Gumbo	100	3,000

Table 6.- Drillers' logs of wells in Karnes County--Continued

Well H-26

Owner: Mary Pargmann, well 1. Driller: Bright & Schiff.

	Thickness (feet)	Depth (feet)
Clay, surface, sand and shale	100	100
Shale and sandy shale	100	200
Sand, and shale, water	200	400
Sand, shale, and sand streaks, water	1,000	1,400
Sand, and shale, water	150	1,550
Sand	15	1,565
Sand, brackish, shale and shale streaks, sandy and sand shaly	665	2,230
Sand, limy, shaly	20	2,250
Shale and sand streaks, limy	470	2,720
Sand	40	2,760
Shale	340	3,100
Shale, shale streaks, sandy, and sand streaks, shaly	530	3,630
Sand, ashy, dry	15	3,645
Shale	55	3,700
Shale and sand streaks, shaly	550	4,250
Sand	40	4,290
Shale	105	4,395
Sand, broken and shale	615	5,010
Shale	2,080	7,090
Shale, and shale streaks, sandy and sand streaks, shale	150	7,240
Shale and sand streaks, shaly	148	7,388
Sand, shaly	10	7,398
Sand and shale streaks	34	7,432
Shale and sand streaks, shaly, and shale, sandy broken	25	7,457
Sand	12	7,469

Well H-30

Owner: United Gas Pipeline Co., well 1. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Surface soil	3	3
Sand, gravel and caliche	13	16
Clay, sandy and gravel	14	30
Sand, fine, reddish-brown	5	35
Sand streaks, fine, brown caliche, hard, and clay, red	28	63
Sand, fine, yellow, and clay breaks	29	92
Sand, yellow, caliche, hard, and clay breaks	23	115
Rock	1	116
Sand breaks, fine, yellow	22	138

(Continued on next page)

Table 6.- Drillers' logs of wells in Karnes County--Continued

Well H-30--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, fine, yellow, clay, and caliche breaks ----	32	170	Sand and shale breaks ---	26	423
Shale, sandy, and caliche ---------------	105	275	Shale, sandy ------------	14	437
Sand and shale, broken --	33	308	Shale, and sandy shale --	72	509
Sand and shale, sandy ---	47	355	Sand and shale breaks ---	36	545
Shale, sandy ------------	8	363	Shale and sandy shale ---	18	563
Shale, sandy, caliche, hard ------------------	16	379	Sand and shale breaks ---	22	585
Sand --------------------	18	397	Shale, sandy ------------	15	600

Well H-31

Owner: United Gas Pipeline Co., well 2. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface -----------------	3	3	Sand, fine, shale breaks ----------------	34	303
Caliche, sandy ----------	3	6	Shale, sandy ------------	60	363
Clay, red and white -----	15	21	Sand streaks and clay ---	22	385
Sand, red and white -----	14	35	Sand --------------------	28	413
Sand, fine --------------	6	41	Sand streaks and clay ---	20	433
Clay, and sandy breaks --	5	46	Shale and sandy shale ---	67	500
Clay, sand, and caliche breaks ----------------	20	66	Sand streaks and shale --	38	538
Sand, breaks and caliche-	42	108	Shale and sandy shale ---	36	574
Sand, fine, yellow, and clay breaks -----------	69	177	Sand streaks and clay ---	27	601
Clay, sandy, and caliche-	51	228	Sand, fine, brown -------	14	615
Shale -------------------	6	234	Shale -------------------	26	641
Shale and sandy shale ---	19	253	Sand and clay streaks ---	28	669
Shale, hard -------------	16	269			

Table 6.- Drillers' logs of wells in Karnes County--Continued

Well H-68

Owner: George J. Jonischkies. Driller: H. & S. Drilling Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay --------------------	35	35	Sand --------------------	25	210
Sand --------------------	20	55	Shale -------------------	45	255
Sand, fine, streaked ----	25	80	Sand and shale streaks --	35	290
Sand --------------------	42	122	Shale -------------------	10	300
Clay --------------------	33	155	Sand, shale streaks -----	10	310
Sand --------------------	15	170	Shale, hard streaks -----	13	323
Clay --------------------	15	185	Sand, shale streaks -----	22	345

Table 7.- Analyses of water from wells in Karnes County, Tex.

(Analyses given are in parts per million except specific conductance, pH, and percent sodium)

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*A-3	R. M. Korth	240	Dec. 14, 1936	-	-	254	33	331	220	880	280	-	-	-	1,890	770	-	-	-	-	-	-
*A-4	A. W. Hyatt	200	Dec. 15, 1936	-	-	-	-	-	183	200	250	-	-	-	824	-	-	-	-	-	-	-
*A-5	L. S. Hyatt	65	do	-	-	-	-	-	336	214	165	-	-	-	836	-	-	-	-	-	-	-
*A-6	Theo. Labus	150	do	-	-	-	-	-	214	2,530	1,260	-	-	-	5,730	-	-	-	-	-	-	-
*A-7	Robert Harper	100	Dec. 16, 1936	-	-	217	45	1,100	268	1,620	860	-	-	-	3,970	728	-	-	-	-	-	-
*A-9	Otho Person	-	Nov. 17, 1936	-	-	266	41	448	228	695	640	-	-	-	5,200	836	-	-	-	-	-	-
*A-10	Frank Pawelek	150	do	-	-	-	-	-	37	1,520	1,330	-	-	-	4,270	-	-	-	-	-	-	-
*A-11	Henry Broll	181	Nov. 19, 1936	-	-	-	-	-	372	852	440	-	-	-	2,200	-	-	-	-	-	-	-
*A-12	Ben Jendrusch	110	Nov. 14, 1936	-	-	-	-	-	476	648	620	-	-	-	2,280	-	-	-	-	-	-	-
A-13	Joe Mzyk	170	July 31, 1957	-	-	-	-	-	-	1,780	1,190	-	-	-	-	950	-	-	-	-	6,710	-
*A-14	W. H. Winkler	240	Nov. 16, 1936	-	-	-	-	-	268	1,420	820	-	-	-	3,520	-	-	-	-	-	-	-
*A-15	Luke C. Krawietz	200	Nov. 14, 1936	-	-	162	41	1,160	368	1,720	720	-	-	-	3,980	571	-	-	-	-	-	-
*A-16	E. Jendrusch	63	Nov. 19, 1936	-	-	-	-	-	232	149	78	-	-	-	523	-	-	-	-	-	-	-
A-17	Julian Lastowski	200	July 25, 1957	38	-	187	36	635 25	420	1,020	420	0	3.0	2.2	2,570	614	270	68	11	0	3,620	7.7
*A-18	Mrs. Henry Kotara	125	Nov. 19, 1936	-	-	-	-	-	122	1,200	1,200	-	-	-	3,680	-	-	-	-	-	-	-
A-22	Martinez Mercantile well 4	6,079	Feb. 23, 1956	-	-	-	-	-	1,830	-	3,820	-	-	-	-	63	0	-	-	-	13,000	8.0
A-23	Vincent Mzyk	512	July 30, 1957	35	1.6	160	33	386 25	329	644	310	.7	4.5	1.2	1,760	534	265	60	7.3	0	2,640	7.3

*See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*B-1	Mrs. M. B. Stuart	265	Mar. 22, 1937	-	-	-	-	-	323	259	56	-	-	-	723	-	-	-	-	-	-	-
*B-2	A. Hilscher	127	do	-	-	-	-	-	305	1,840	585	-	-	-	3,770	-	-	-	-	-	-	-
*B-3	Martina Pena	120	do	-	-	552	116	500	73	2,110	490	-	-	-	3,800	1,860	-	-	-	-	-	-
B-4	J. M. Cooley	600	Mar. 15, 1956	1.9	-	43	57	314 19	45	536	322	-	.0	.69	1,320	342	305	65	7.4	0	2,100	7.0
B-5	do	300	do	24	-	260	104	395 22	374	1,090	390	-	.4	.36	2,470	1,080	770	44	5.2	0	3,400	7.3
*B-6	M. A. Caraway	160	Mar. 19, 1937	-	-	-	-	-	220	1,470	1,450	-	-	-	4,530	-	-	-	-	-	-	-
*B-7	Mrs. J. M. Golson	270	do	-	-	194	71	340	250	851	300	-	-	-	1,880	774	-	-	-	-	-	-
*B-8	E. J. Schneider	200	Mar. 17, 1936	-	-	-	-	-	262	81	132	-	-	-	536	-	-	-	-	-	-	-
*B-9	Lena Parke	280	Mar. 19, 1937	-	-	-	-	-	268	1,550	730	-	-	-	3,550	-	-	-	-	-	-	-
*B-11	J. A. Nelson	180	Mar. 17, 1936	-	-	-	-	-	329	619	385	-	-	-	1,750	-	-	-	-	-	-	-
*B-12	John A. Lorenz	165	do	-	-	-	-	-	268	754	480	-	-	-	2,040	-	-	-	-	-	-	-
B-12	do	165	Apr. 17, 1945	11	1.2	280	73	440 60	337	891	585	0.6	4.0	-	2,510	999	723	47	6.1	0	3,870	7.5
1/B-12	do	165	Oct. 27, 1955	32	.00	196	43	385 29	361	676	380	.1	3.8	1.4	1,920	666	369	54	6.5	0	2,790	7.6
B-13	Gillette School	263	Sept. 1947	-	-	150	39	428	294	574	445	-	.0	-	1,780	535	294	64	8.0	0	2,850	-
*B-14	M. A. Zint	200	Mar. 19, 1937	-	-	-	-	-	238	929	470	-	-	-	2,250	-	-	-	-	-	-	-
*B-15	R. H. Metz	176	do	-	-	157	19	1,360	354	1,800	900	-	-	-	4,410	472	-	-	-	-	-	-
*B-16	Albert Treybig	140	do	-	-	336	66	1,280	232	2,550	740	-	-	-	5,090	1,110	-	-	-	-	-	-
*B-18	Tom Lysse	-	Jan. 6, 1937	-	-	-	-	-	43	1,350	585	-	-	-	2,860	-	-	-	-	-	-	-

* See footnotes at end of table.
1/ Manganese (Mn) 0.00; Phosphate (PO_4) 0.01

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*B-19	Albert Treybig	-	Jan. 7, 1937	-	-	-	-	-	256	1,240	256	-	-	-	2,360	-	-	-	-	-	-	-
*B-20	Andrew Fritz	180	do	-	-	259	52	570	79	1,100	630	-	-	-	2,650	862	-	-	-	-	-	-
*B-21	H. D. Wiley	100	Jan. 6, 1937	-	-	-	-	-	317	735	555	-	-	-	2,170	-	-	-	-	-	-	-
*B-22	Water Riedel	-	do	-	-	173	35	1,180	281	1,450	1,000	-	-	-	3,980	577	-	-	-	-	-	-
*B-23	Joe Kunschik	-	do	-	-	-	-	-	73	1,340	385	-	-	-	2,550	-	-	-	-	-	-	-
*B-24	A. M. Salinas	150	Jan. 8, 1937	-	-	179	20	734	306	1,160	470	-	-	-	2,720	528	-	-	-	-	-	-
*B-25	W. G. Riedel	123	Dec. 18, 1936	-	-	174	29	396	344	518	420	-	-	-	1,710	553	-	-	-	-	-	-
*B-26	Chas. Ford	131	Dec. 17, 1936	-	-	-	-	-	250	117	155	-	-	-	613	-	-	-	-	-	-	-
*B-27	Gussie Yanta	69	Dec. 16, 1936	-	-	-	-	-	299	74	125	-	-	-	545	-	-	-	-	-	-	-
*B-28	Joe L. Dupnick	84	Dec. 17, 1936	-	-	-	-	-	366	175	190	-	-	-	845	-	-	-	-	-	-	-
*B-29	Mrs. T. J. Brown	-	do	-	-	-	-	-	390	206	150	-	-	-	847	-	-	-	-	-	-	-
*B-30	Geo. Sickenius, Jr.	109	Jan. 4, 1937	-	-	-	-	-	464	273	260	-	-	-	1,170	-	-	-	-	-	-	-
*B-31	John Jannyseck	219	do	-	-	-	-	-	55	86	720	-	-	-	1,290	-	-	-	-	-	-	-
*B-32	Mike Jannyseck	250	Dec. 18, 1936	-	-	-	-	-	110	171	620	-	-	-	1,300	-	-	-	-	-	-	-
*B-34	Ed Jannyseck	233	Jan. 4, 1937	-	-	-	-	-	360	183	365	-	-	-	1,120	-	-	-	-	-	-	-
*B-35	A. J. Kerlick	100	Jan. 5, 1937	-	-	-	-	-	159	186	553	-	-	-	1,260	-	-	-	-	-	-	-
*B-36	Crews-Korth Mercantile Co.	60	do	-	-	-	-	-	128	50	30	-	-	-	223	-	-	-	-	-	-	-
*B-38	Karnes County	50	do	-	-	227	21	263	336	248	490	-	-	-	1,420	653	-	-	-	-	-	-

*See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*B-39	E. P. Williams	200	Jan. 5, 1937	-	-	-	-	-	110	294	196	-	-	-	813	-	-	-	-	-	-	-
*B-40	S. E. Crews	-	Jan. 7, 1937	-	-	-	-	-	73	58	236	-	-	-	511	-	-	-	-	-	-	-
*B-41	W. H. Lindsey	-	do	-	-	-	-	-	183	298	1,150	-	-	-	2,370	-	-	-	-	-	-	-
B-43	R. M. Korth	200	July 13, 1956	50	0	92	4.8	65	257	65	79	-	0.0	-	493	249	38	36	1.8	0	774	7.4
B-44	do	640	do	96	-	64	3.1	224	369	128	158	-	.0	-	881	172	0	74	7.4	2.6	1,320	7.3
*B-45	do	250	Jan. 5, 1937	-	-	-	-	-	159	47	35	-	-	-	251	-	-	-	-	-	-	-
B-46	Fritz Korth	430	July 13, 1956	94	-	125	6.2	168	319	109	232	-	1.5	-	932	338	76	52	4.0	0	1,440	7.3
*B-49	Clayton Finch	226	Mar. 18, 1937	-	-	-	-	-	171	190	104	-	-	-	572	-	-	-	-	-	-	-
*B-50	S. E. Crews	220	do	-	-	-	-	-	262	93	212	-	-	-	678	-	-	-	-	-	-	-
B-50	do	220	Aug. 1, 1957	92	-	100	6.0	174 15	332	87	218	-	.8	0.67	873	274	2	56	4.6	0	1,360	7.4
*B-53	F. P. Cobb	105	Mar. 12, 1937	-	-	118	9	77	348	58	108	-	-	-	546	330	-	-	-	-	-	-
*B-55	Homer Dennings	225	do	-	-	165	35	1,060	384	1,800	475	-	-	-	3,720	557	-	-	-	-	-	-
B-55	do	225	Aug. 1, 1957	-	-	-	-	643	420	1,020	378	-	-	-	-	542	198	72	12	0	3,630	7.8
*B-56	Jim Holstein	100	Mar. 12, 1937	-	-	246	71	426	323	557	700	-	-	-	2,160	904	-	-	-	-	-	-
*B-57	B. M. Brockman	165	do	-	-	-	-	-	293	843	530	-	-	-	2,260	-	-	-	-	-	-	-
B-60	George H. Coates	2,650	July 24, 1957	28	0.02	5.0	1.6	615 6.8	1,270	14	218	-	0.2	1.8	1,500	19	0	98	61	20.4	2,430	8.1
B-61	William H. Lindsey	330	July 30, 1957	88	.23	29	1.4	201 11	361	76	105	-	.0	.46	702	78	0	83	9.9	4.4	1,050	7.4

* See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
1/C-1	Joe Bartosh well 1	4,711	Feb. 17, 1955	28	.47	2.8	1.2	948 7.6	2,040	25	240	3.6	.2	2.2	2,260	12	0	99	120	31.9	3,600	8.5
2/C-1	do	4,711	do	36	.12	3.2	.6	277 4.0	573	44	70	.8	.0	.38	725	10	0	97	37	8.1	1,170	8.7
3/C-2	Falls City	610	Nov. 21, 1955	46	.27	18	1.5	1130 11	285	1,040	830	.4	2.3	1.7	3,220	51	0	97	69	3.6	4,920	7.7
*C-3	J. W. Mzyk	160	Oct. 1, 1936	-	-	-	-	-	415	476	350	-	-	-	1,560	-	-	-	-	-	-	-
*C-4	Leon Pawelek	228	do	-	-	5	3	970	738	643	610	-	-	-	2,590	25	-	-	-	-	-	-
*C-5	Ed Jendrusch	135	do	-	-	207	34	199	348	292	355	-	-	-	1,260	657	-	-	-	-	-	-
*C-6	Nick Gybrash	140	do	-	-	-	-	-	98	818	435	-	-	-	1,920	-	-	-	-	-	-	-
*C-7	Mat Labus	270	Oct. 2, 1936	-	-	-	-	-	122	133	370	-	-	-	867	-	-	-	-	-	-	-
*C-8	H. Jandt	151	Oct. 16, 1936	-	-	-	-	-	61	974	490	-	-	-	2,200	-	-	-	-	-	-	-
*C-10	-- Swierc	137	do	-	-	-	-	-	61	86	600	-	-	-	1,110	-	-	-	-	-	-	-
*C-11	Mary Stalle Mueller	123	do	-	-	-	-	-	110	62	255	-	-	-	577	-	-	-	-	-	-	-
*C-12	Freida Mueller	165	Oct. 5, 1936	-	-	158	34	349	104	39	830	-	-	-	1,460	536	-	-	-	-	-	-
*C-18	Emil Swize	300	do	-	-	-	-	-	116	222	445	-	-	-	1,100	-	-	-	-	-	-	-
C-21	-- Phleukan well 4	4,039	Mar. 16, 1956	-	-	2.2	1.6	1150 12	2,510	2	360	-	0.4	4.1	2,760	12	0	99	144	40.9	4,560	8.2
*C-22	Joe F. Bludan	250	Oct. 6, 1936	-	-	63	13	183	386	48	172	-	-	-	69	210	-	-	-	-	-	-
*C-23	Paul Kekie	85	Oct. 16, 1936	-	-	-	-	-	61	4/	910	-	-	-	1,470	-	-	-	-	-	-	-
*C-24	W. N. Butler	213	Oct. 15, 1936	-	-	42	10	257	202	183	405	-	-	-	1,100	152	-	-	-	-	-	-
*C-25	W. Green	115	do	-	-	222	40	278	178	183	700	-	-	-	1,510	719	-	-	-	-	-	-

* See footnotes at end of table.
1/Manganese (Mn), 0.00; phosphate (PO4), 0.20; bicarbonate (HCO3), includes equivalent of 39 ppm carbonate (CO3).
2/Manganese (Mn), 0.00; phosphate (PO4), 0.00; bicarbonate (HCO3), includes equivalent of 31 ppm carbonate (CO3).
3/Manganese (Mn), 0.02; phosphate (PO4), 0.11.
4/Sulfate less than 10 ppm.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*C-26	Bob Fopeau	263	Oct. 19, 1936	-	-	-	-	-	61	140	970	-	-	-	1,760	-	-	-	-	-	-	-
*C-27	E. P. Ruhmann	150	Oct. 13, 1936	-	-	99	22	335	209	168	510	-	-	-	1,240	338	-	-	-	-	-	-
C-29	E. N. Hysaw well 4	4,181	Mar. 16, 1956	-	-	-	-	-	2,390	-	270	-	.2	-	-	14	0	-	-	-	4,300	8.5
*C-30	Tom Gedioa	180	Oct. 12, 1936	-	-	-	-	-	201	121	455	-	-	-	1,050	-	-	-	-	-	-	-
*C-31	J. H. Davidson	200	do	-	-	-	-	-	201	51	350	-	-	-	784	-	-	-	-	-	-	-
*C-32	-- Ripps	156	Feb. 6, 1937	-	-	-	-	-	293	78	700	-	-	-	1,440	-	-	-	-	-	-	-
*C-33	H. L. Smith	145	do	-	-	-	-	-	226	-	870	-	-	-	1,550	-	-	-	-	-	-	-
C-34	Howard Stanfield	401	Apr. 1, 1956	89	-	197	33	342 23	204	55	830	1.8	18	0.71	1,690	627	460	53	6.0	0	3,030	7.7
*C-35	F. J. Scholz	380	Feb. 5, 1937	-	-	148	30	168	234	59	430	-	-	-	950	494	-	-	-	-	-	-
*C-38	Bob Rosenbrock	146	Oct. 19, 1937	-	-	214	28	150	277	145	425	-	-	-	1,100	652	-	-	-	-	-	-
C-39	Harry Weddington	325	Sept. 14, 1956	36	-	232	17	493	434	443	640	-	.3	-	2,070	648	292	62	8.4	0	3,270	7.0
*C-40	Harry Lieke	-	Oct. 19, 1936	-	-	136	31	548	79	585	700	-	-	-	2,040	469	-	-	-	-	-	-
C-41	Fred Sickeoius	400	Nov. 29, 1955	54	-	424	38	439	232	1,100	590	-	2.7	-	2,760	1,210	1,020	44	5.5	0	3,800	7.9
C-41	do	400	July 17, 1956	-	-	-	-	-	172	1,100	590	-	-	-	-	1,170	1,030	-	-	-	3,760	7.9
C-42	Harry Weddington	809	July 27, 1956	49	-	9.4	0.6	857	331	686	640	-	1.5	-	2,410	26	0	99	73	4.9	3,810	8.2
*C-43	F. M. Boso	100	Nov. 6, 1936	-	-	88	10	504	323	644	265	-	-	-	1,700	-	-	-	-	-	-	-
*C-44	-- Jandt	200	do	-	-	-	-	-	342	668	790	-	-	-	2,460	-	-	-	-	-	-	-

*See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
C-46	Hugo Tessman	280	July 12, 1956	-	-	-	-	-	266	-	910	-	-	-	-	740	530	-	-	0	6,190	7.9
*C-47	A. H. Weller	140	Nov. 6, 1936	-	-	110	9	475	289	711	260	-	-	-	1,710	314	-	-	-	-	-	-
C-48	Hugo Tessman	305	Nov. 29, 1955	16	-	145	15	1,010	204	914	1,060	-	1.2	-	3,260	424	256	84	21	0	5,170	7.7
C-48	do	305	July 12, 1956	-	-	-	-	-	173	-	1,060	-	-	-	-	404	262	-	-	0	5,090	7.9
C-51	Clemens Swierc	197	Nov. 29, 1955	68	-	260	26	584	297	1,210	370	-	1.1	-	2,670	756	512	63	9.2	0	3,620	8.3
C-51	do	197	July 17, 1956	-	-	-	-	-	248	1,250	400	-	-	-	-	712	509	-	-	0	3,710	8.0
*C-52	L. K. Sczpanik	-	Sept. 30, 1936	-	-	434	34	648	356	1,640	535	-	-	-	3,520	1,350	-	-	-	-	-	-
*C-53	Pawelek Bros.	60	do	-	-	802	102	566	250	1,910	1,030	-	-	-	4,530	2,420	-	-	-	-	-	-
C-54	A. Pawelek	-	July 17, 1956	-	-	-	-	-	592	-	370	-	-	-	-	133	0	-	-	7.0	3,280	8.2
*C-56	L. K. Sczpanik	186	Sept. 23, 1936	-	-	-	-	-	275	604	595	-	-	-	2,010	-	-	-	-	-	-	-
*D-1	Jessie Mika	231	Dec. 16, 1936	-	-	-	-	-	360	312	250	-	-	-	1,130	-	-	-	-	-	-	-
*D-2	Ben Kruciak	-	Nov. 18, 1936	-	-	-	-	-	415	326	650	-	-	-	1,820	-	-	-	-	-	-	-
*D-3	Jessie Mika	204	Nov. 12, 1936	-	-	148	25	646	498	279	840	-	-	-	2,180	476	-	-	-	-	-	-
D-3	do	204	July 31, 1957	78	-	73	10	579 31	454	216	650	-	0.8	6.3	1,870	223	0	83	17	3.0	3,070	7.8
*D-5	Ben Pawelek	100	Nov. 13, 1936	-	-	-	-	-	85	141	1,000	-	-	-	1,830	-	-	-	-	-	-	-
D-6	Raymond Brysch	89	July 13, 1957	-	-	-	-	-	-	66	78	-	-	-	-	191	-	-	-	-	715	-
*D-7	Mike Bednorz	240	Nov. 12, 1936	-	-	-	-	-	250	122	760	-	-	-	1,570	-	-	-	-	-	-	-

*See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*D-10	Stanley F. Moczygemba	155	Nov. 12, 1936	-	-	-	-	-	128	110	560	-	-	-	-	-	-	-	-	-	-	-
*D-11	P. J. Manka	100	Nov. 13, 1936	-	-	-	-	-	140	204	530	-	-	-	-	-	-	-	-	-	-	-
*D-12	Louis Pawelek	170	Nov. 9, 1936	-	-	-	-	-	85	668	425	-	-	-	-	-	-	-	-	-	-	-
*D-13	Ed Kyrish	106	Nov. 14, 1936	-	-	-	-	-	85	919	1,060	-	-	-	-	-	-	-	-	-	-	-
*D-14	Mrs. J. Zarzambek	169	Nov. 9, 1936	-	-	-	-	-	244	1,560	760	-	-	-	-	-	-	-	-	-	-	-
*D-15	L. T. Moczygemba	100	Nov. 13, 1936	-	-	-	-	-	256	59	205	-	-	-	-	-	-	-	-	-	-	-
*D-16	Vincent Labus	132	do	-	-	80	16	282	314	137	340	-	-	-	-	265	-	-	-	-	-	-
*D-17	Ben J. Bordovsky	75	Oct. 8, 1936	-	-	-	-	-	116	160	430	-	-	-	-	-	-	-	-	-	-	-
*D-18	R. J. Palasek Estate	80	do	-	-	-	-	-	85	47	190	-	-	-	-	-	-	-	-	-	-	-
*D-19	John Drees	87	do	-	-	-	-	-	92	74	630	-	-	-	1,160	-	-	-	-	-	-	-
D-19	do	87	July 31, 1957	92	-	275	35	334 39	304	222	780	-	3.2	-	1,930	830	581	45	5.0	0	3,210	7.7
*D-20	H. L. Kunkel	150	Oct. 14, 1936	-	-	-	-	177	97	410	410	-	-	-	924	-	-	-	-	-	-	-
*D-21	C. S. E. Henke	300	do	-	-	-	-	55	74	655	-	-	-	-	1,170	-	-	-	-	-	-	-
*D-22	Antoa Hons	206	Oct. 6, 1936	-	-	-	-	79	148	720	-	-	-	-	1,400	-	-	-	-	-	-	-
*D-23	John A. Foegelle	-	do	-	-	98	17	362	160	395	-	-	-	-	1,170	316	-	-	-	-	-	-
*D-25	J. O. Faith	200	Feb. 6, 1937	-	-	-	-	250	51	580	-	-	-	-	1,180	-	-	-	-	-	-	-
*D-26	Roman R. Groz	315	do	-	-	91	26	312	284	129	460	-	-	-	1,160	337	-	-	-	-	-	-

*See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*D-27	Fred Jauer	481	Feb. 5, 1937	-	-	-	-	-	329	117	380	-	-	-	1,030	-	-	-	-	-	-	-
D-27	do	481	July 31, 1957	-	-	-	-	-	-	161	448	-	-	-	-	236	-	-	-	-	2,110	-
*D-28	Harry Zaeske	383	Feb. 4, 1937	-	-	10	3	488	268	167	500	-	-	-	1,300	37	-	-	-	-	-	-
*D-29	Rud Coldewaw	185	do	-	-	84	17	454	398	327	425	-	-	-	1,500	281	-	-	-	-	-	-
*D-30	Ed Bueche	200	Dec. 8, 1936	-	-	-	-	-	226	63	750	-	-	-	1,450	-	-	-	-	-	-	-
*D-31	Max Otto	130	Feb. 4, 1937	-	-	-	-	-	311	128	350	-	-	-	983	-	-	-	-	-	-	-
*D-32	F. Bruns	160	Feb. 8, 1937	-	-	-	-	-	372	218	700	-	-	-	1,710	-	-	-	-	-	-	-
*D-33	J. D. Klingeman	200	do	-	-	-	-	-	165	187	1,040	-	-	-	2,030	-	-	-	-	-	-	-
*D-34	Mrs. Fritz Seeger	100	Feb. 12, 1937	-	-	-	-	-	275	1/	150	-	-	-	460	-	-	-	-	-	-	-
2/ D-35	Dean Motel	400	Nov. 23, 1955	61	-	152	16	681 34	371	309	940	0.7	6.2	1.8	2,380	445	141	75	14	0	3,920	7.3
*D-36	Fritz Seeger	140	Feb. 12, 1937	-	-	-	-	-	61	159	800	-	-	-	1,530	-	-	-	-	-	-	-
*D-37	Mrs. Ethel Hysaw	365	Feb. 15, 1937	-	-	148	22	662	423	290	890	-	-	-	2,180	459	-	-	-	-	-	-
*D-38	W. M. Brown	133	Feb. 23, 1937	-	-	74	15	170	293	74	210	-	-	-	687	244	-	-	-	-	-	-
*D-39	Mrs. J. Hoffman	100	do	-	-	-	-	-	287	43	139	-	-	-	513	-	-	-	-	-	-	-
*D-40	A. E. & L. Korth	150	Feb. 23, 1937	-	-	-	-	-	85	43	365	-	-	-	701	-	-	-	-	-	-	-
*D-41	John Smolik	100	Feb. 12, 1937	-	-	-	-	-	140	1/	240	-	-	-	490	-	-	-	-	-	-	-
*D-42	J. B. White	175	do	-	-	-	-	-	470	246	560	-	-	-	1,610	-	-	-	-	-	-	-

* See footnotes at end of table.
1/ Sulfate less than 10 ppm.
2/ Manganese (Mn), 0.01; phosphate (PO_4) 0.01.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*D-43	A. M. Bailey	150	Feb. 17, 1937	-	-	-	-	-	98	132	495	-	-	-	1,040	-	-	-	-	-	-	-
*D-44	Edna Wicker	150	do	-	-	-	-	-	92	1/	75	-	-	-	192	-	-	-	-	-	-	-
*D-45	Tom Dromgoole	44	Feb. 19, 1937	-	-	72	17	101	317	39	121	-	-	-	486	251	-	-	-	-	-	-
*D-46	Emil Sprencel	190	do	-	-	-	-	-	116	27	56	-	-	-	221	-	-	-	-	-	-	-
D-46	do	190	Aug. 1, 1957	-	-	-	-	-	357	-	73	-	-	-	-	257	0	-	-	0.7	846	7.8
D-47	Karnes City well 1	860	Apr. 17, 1945	72	0.03	6.7	0.6	433 21	292	109	420	2.2	1.8	-	1,230	19	0	95	43	4.4	2,170	8.2
2/D-47	do	860	Nov. 22, 1955	79	.23	10	.0	516 20	360	102	545	1.6	.1	3.3	1,450	25	0	96	45	5.4	1,450	8.0
3/D-49	Karnes City well 3	872	do	77	.03	6.4	.0	476 18	322	101	492	1.6	.1	2.7	1,320	16	0	96	52	5.0	2,230	8.0
D-49	do	872	Dec. 9, 1955	91	.07	7.2	.0	484 14	324	101	500	1.4	.6	-	1,360	18	0	97	50	5.0	2,290	8.2
4/D-50	Karnes City well 4	1,015	Nov. 22, 1955	56	0.24	10	0.0	770 23	831	1.4	740	1.2	0.3	9.5	2,020	25	0	97	67	13.1	3,360	7.7
*D-52	Mrs. E. Sahm	124	Feb. 3, 1937	-	-	-	-	-	110	74	338	-	-	-	723	-	-	-	-	-	-	-
5/D-53	United Gas Pipe-line Co. well 2	995	Nov. 23, 1955	68	.24	16	.0	752 25	641	1.8	830	3.2	.2	7.8	2,020	40	0	96	52	9.7	3,420	7.8
6/D-54	United Gas Pipe-line Co. well 1	910	do	74	.07	24	.0	534 26	360	98	598	1.6	3.9	2.7	1,530	60	0	93	30	4.7	2,690	7.6
D-55	Luis F. Rosales	100	Dec. 8, 1936	-	-	58	9	469	381	165	510	-	-	-	1,400	183	-	-	-	-	-	-
7/D-56	Fred W. Klingeman	150	Mar. 15, 1956	87	-	148	11	706 41	320	296	990	.4	13	2.5	2,450	414	152	77	15	0	4,040	7.9
*D-57	Alex G. Holm	100	Feb. 3, 1937	-	-	-	-	-	171	197	1,010	-	-	-	2,000	-	-	-	-	-	-	-

* See footnotes at end of table.
1/Sulfate less than 10 ppm.
2/Manganese (Mn), 0.00; phosphate (PO4), 0.03.
3/Manganese (Mn), 0.00; phosphate (PO4), 0.02.
4/Manganese (Mn), 0.00; phosphate (PO4), 0.07.
5/Manganese (Mn), 0.01; phosphate (PO4), 0.00.
6/Manganese (Mn), 0.04; phosphate (PO4), 0.03.
7/Manganese (Mn), Phosphate (PO4), 0.06.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*D-58	A. Holm	100	Feb. 3, 1937	-	-	-	-	-	43	155	640	-	-	-	1,260	-	-	-	-	-	-	-
*E-1	Mark L. Browne	-	Dec. 18, 1936	-	-	-	-	-	409	265	315	-	-	-	1,200	-	-	-	-	-	-	-
*E-3	Elmer Lee	100	do	-	-	-	-	-	457	257	265	-	-	-	1,150	-	-	-	-	-	-	-
*E-4	Z. A. Kruciak	199	Jan. 2, 1937	-	-	96	12	388	374	90	520	-	-	-	1,290	289	-	-	-	-	-	-
E-5	Louis Pawelek	458	July 13, 1956	92	-	39	3.2	759	453	319	750	-	1.5	-	2,190	110	0	94	31	5.2	3,620	7.8
*E-7	Frank H. Ruckman	250	Jan. 4, 1937	-	-	-	-	-	159	464	890	-	-	-	2,180	-	-	-	-	-	-	-
*E-8	T. R. Jannyseck	85	Jan. 2, 1937	-	-	-	-	-	226	199	485	-	-	-	1,220	-	-	-	-	-	-	-
*E-9	D. B. Bowden	100	do	-	-	-	-	-	323	121	190	-	-	-	733	-	-	-	-	-	-	-
*E-10	Felix Brysch	100	do	-	-	165	32	281	318	55	595	-	-	-	1,280	546	-	-	-	-	-	-
1/E-11	Arnold Schendel	450	Nov. 2, 1955	43	-	68	8.2	195 14	382	121	140	0.2	1.3	0.52	779	203	0	66	6.0	2.2	1,270	8.1
E-12	Ray Schendel	497	do	36	-	42	9.1	185 12	291	114	140	.4	.0	.47	682	142	0	72	6.7	1.9	1,240	7.9
E-13	Erwin H. Schendel	500	Apr. 19, 1956	36	-	153	13	133 6.4	367	33	270	-	17	.31	842	435	134	40	2.8	0	1,500	7.4
*E-14	D. B. Bowden	126	Dec. 22, 1936	-	-	-	-	-	165	16	66	-	-	-	261	-	-	-	-	-	-	-
*E-15	J. W. Zexula	158	do	-	-	-	-	-	73	39	230	-	-	-	475	-	-	-	-	-	-	-
*E-17	C. H. Steves	200	Apr. 8, 1937	-	-	190	32	130	207	87	445	-	-	-	986	605	-	-	-	-	-	-
*E-18	LeRoy R. Belzung	124	do	-	-	-	-	-	153	120	2,400	-	-	-	4,050	-	-	-	-	-	-	-
E-21	Henry Hedtke	413	Nov. 2, 1955	45	0.07	173	34	124 10	274	28	425	0.3	0.0	0.32	975	572	347	32	2.3	0	1,770	7.6
*E-23	J. Sullivan	35	Apr. 5, 1937	-	-	-	-	-	128	2/	44	-	-	-	174	-	-	-	-	-	-	-

* See footnotes at end of table.
1/Manganese (Mn), 0.01; phosphate (PO4), 0.02.
2/Sulfate less than 10 ppm.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*E-24	B. Mueller	100	Apr. 5, 1937	-	-	87	19	119	354	43	166	-	-	-	598	297	-	-	-	-	-	-
*E-25	R. Ammermann	89	do	-	-	-	-	-	177	31	97	-	-	-	341	-	-	-	-	-	-	-
*E-28	H. Schlenstedt	107	Mar. 25, 1937	-	-	-	-	-	323	31	120	-	-	-	496	-	-	-	-	-	-	-
E-28	do	107	July 25, 1957	-	-	-	-	-	370	-	115	-	-	-	-	254	0	-	-	1.0	1,000	7.7
*E-29	M. E. Wolters	93	Mar. 23, 1937	-	-	-	-	-	336	1/	56	-	-	-	363	-	-	-	-	-	-	-
*E-32	Fritz Berkenhott	65	do	-	-	-	-	-	55	93	780	-	-	-	1,400	-	-	-	-	-	-	-
*E-34	George Moore	39	Apr. 6, 1937	-	-	275	100	472	348	209	1,150	-	-	-	2,380	1,100	-	-	-	-	-	-
*E-35	F. J. Matula	50	do	-	-	-	-	-	207	81	405	-	-	-	918	-	-	-	-	-	-	-
E-35	do	50	July 25, 1957	-	-	-	-	-	-	79	375	-	-	-	-	500	-	-	-	-	1,700	-
*E-36	Mrs. Katie Lyons	85	Apr. 6, 1937	-	-	94	18	128	378	27	178	-	-	-	631	311	-	-	-	-	-	-
*E-37	Paul Natho	57	do	-	-	121	19	150	366	54	250	-	-	-	774	382	-	-	-	-	-	-
*E-38	Chas. J. Matula	43	Apr. 5, 1937	-	-	-	-	-	49	93	1,080	-	-	-	1,860	-	-	-	-	-	-	-
*E-39	City of Runge well 2	212	Mar. 31, 1937	-	-	54	32	129	104	23	312	-	-	-	601	265	-	-	-	-	-	-
E-39	do	212	Apr. 18, 1945	20	0.19	130	36	98 27	282	36	315	1.0	6.7	-	962	472	242	30	2.0	0	1,540	7.1
2/E-39	do	212	Oct. --, 1955	32	.01	121	30	128 7.9	286	35	312	.5	5.1	0.28	813	426	192	39	2.7	0	1,450	7.6
3/E-40	City of Runge well 1	156	Oct. --, 1955	35	.15	141	34	142 8.5	270	36	388	.5	5.6	.30	924	492	270	38	2.8	0	1,670	7.6
E-42	N. R. Douglas	345	Nov. 27, 1955	47	-	46	11	137 8.8	330	36	114	.8	2.5	.34	565	161	0	63	4.7	2.2	941	7.9

* See footnotes at end of table.
1/ Sulfate less than 10 ppm.
2/ Manganese (Mn), 0.00; phosphate (PO4),0.05.
3/ Manganese (Mn), 0.00; phosphate (PO4),0.03.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*E-43	J. F. Ryan	100	Apr. 7, 1937	-	-	147	37	135	342	50	340	-	-	-	877	518	-	-	-	-	-	-
*E-44	N. R. McClane	130	Feb. 24, 1937	-	-	-	-	-	232	1/	76	-	-	-	309	-	-	-	-	-	-	-
*E-45	L. W. Lawrence	53	Feb. 23, 1937	-	-	-	-	-	348	1/	90	-	-	-	426	-	-	-	-	-	-	-
*E-46	W. M. Perkins	30+	do	-	-	-	-	-	317	1/	97	-	-	-	412	-	-	-	-	-	-	-
E-47	Mrs. G. C. Ruhmann	220	Oct. 26, 1956	44	-	100	7.9	67 6.3	316	25	109	.4	2.2	.12	530	283	24	33	1.7	0	876	7.3
*E-49	C. C. Strawn	75	Feb. 17, 1937	-	-	32	14	81	187	39	84	-	-	-	343	139	-	-	-	-	-	-
*E-50	Robert M. Adam	60	do	-	-	-	-	-	153	27	74	-	-	-	279	-	-	-	-	-	-	-
*E-51	Elmer Cox, Jr.	100	Feb. 23, 1937	-	-	-	-	-	256	1/	68	-	-	-	316	-	-	-	-	-	-	-
*E-52	Ted Aaron	--	Feb. 17, 1937	-	-	-	-	-	250	1/	52	-	-	-	286	-	-	-	-	-	-	-
*E-53	W. S. Pickett	140	Feb. 18, 1937	-	-	158	24	342	506	250	400	-	-	-	1,420	495	-	-	-	-	-	-
*E-54	Elmer Lee	134	Feb. 19, 1937	-	-	110	16	374	460	101	475	-	-	-	1,300	340	-	-	-	-	-	-
*E-55	Modesto Franco	80	Nov. 18, 1936	-	-	-	-	-	403	322	590	-	-	-	1,710	-	-	-	-	-	-	-
*E-56	Mrs. H. A. Neal	80	Dec. 17, 1936	-	-	-	-	-	116	70	420	-	-	-	851	-	-	-	-	-	-	-
*E-57	Antonio Guerrero	77	Nov. 18, 1936	-	-	-	-	-	73	67	225	-	-	-	507	-	-	-	-	-	-	-
F-2	Prosper Pawelek	221	July 13, 1956	26	-	532	72	1,200	112	1,030	2,180	-	-	-	5,100	1,620	1,530	62	13	0	7,940	6.6
*F-3	Tom Polasek	150	Feb. 5, 1937	-	-	-	-	-	98	113	730	-	-	-	1,410	-	-	-	-	-	-	-
*F-4	Hebert Weigang	116	do	-	-	-	-	-	43	55	900	-	-	-	1,520	-	-	-	-	-	-	-

* See footnotes at end of table.
1/ Sulfate less than 10 ppm.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*F-5	C. T. Roberts	335	Feb. 5, 1937	-	-	-	-	-	159	55	125	-	-	-	403	-	-	-	-	-	-	-
F-7	H. L. Smith	360	Apr. 26, 1956	-	-	-	-	-	206	-	950	-	-	-	-	685	516	-	-	0	3,400	7.9
1/F-8	Rudolph Best	450	Apr. 6, 1956	89	-	52	2.4	258 24	317	123	231	0.7	22	1.9	966	140	0	77	9.5	2.4	1,490	7.4
*F-9	do	446	Feb. 11, 1937	-	-	7	4	250	220	66	230	-	-	-	665	-	-	-	-	-	-	-
*F-12	Fritz Fenner	193	Feb. 9, 1937	-	-	219	28	246	258	2/	700	-	-	-	1,320	663	-	-	-	-	-	-
F-15	Ernest Poenisch	323	July 12, 1956	82	-	34	1.7	410	381	164	338	-	30	-	1,250	92	0	91	19	4.4	2,040	8.0
F-16	do	500	do	-	-	-	-	-	392	-	288	-	-	-	-	83	0	-	-	2.4	1,830	8.2
*F-18	E. B. Hardt	210	Feb. 11, 1937	-	-	71	18	295	298	55	420	-	-	-	1,000	252	-	-	-	-	-	-
F-19	Ernest Poenisch	500	July 12, 1956	48	-	26	.4	658	327	.0	870	-	2.0	-	1,770	66	0	96	35	4.0	2,230	7.8
F-20	C. L. Kolinek	32	do	96	-	82	8.6	463	449	71	398	-	302	-	1,640	240	0	81	13	2.6	2,600	7.3
*G-1	G. O. Daugherty	-	Feb. 6, 1937	-	-	-	-	-	287	82	740	-	-	-	1,510	-	-	-	-	-	-	-
3/G-2	Fred Klingeman well 1	8,004	Apr. 26, 1956	50	0.05	30	0.6	454 6.6	997	31	108	2.4	0.2	0.74	1,150	10	0	98	62	16.1	1,810	8.0
*G-3	F. Klingeman Estate	365	Feb. 9, 1937	-	-	12	6	214	268	43	180	-	-	-	587	54	-	-	-	-	-	-
*G-4	Adolph Haner	265	Feb. 6, 1937	-	-	-	-	-	348	70	285	-	-	-	830	-	-	-	-	-	-	-
*G-5	Otto Lieke	300	Feb. 8, 1937	-	-	-	-	-	329	62	355	-	-	-	913	-	-	-	-	-	-	-
*G-6	David A. Culberson	355	do	-	-	-	-	-	214	218	450	-	-	-	1,190	-	-	-	-	-	-	-
*G-7	William Dunn	375	do	-	-	34	10	339	329	129	325	-	-	-	999	126	-	-	-	-	-	-

* See footootes at end of table.
1/ Manganese (Mn), 0.00; phosphate (PO_4), 0.05.
2/ Sulfate less than 10 ppm.
3/ Manganese (Mn), 0.01; phosphate (PO_4), 0.05.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$		Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
																Total	Noncarbonate					
*G-8	Mrs. C. C. Cavanaugh	275	Feb. 8, 1937	-	-	111	18	489	454	331	495	-	-	-	1,670	351	-	-	-	-	-	-
*G-9	do	105	do	-	-	-	-	-	232	43	800	-	-	-	1,500	-	-	-	-	-	-	-
*G-10	Sons of Herman Lodge	200	Feb. 9, 1937	-	-	-	-	-	232	515	2,360	-	-	-	4,610	-	-	-	-	-	-	-
*G-12	J. T. Hailey	10	Feb. 25, 1937	-	-	73	27	126	311	74	166	-	-	-	619	292	-	-	-	-	-	-
*G-13	J. A. Smith	265	do	-	-	92	17	461	238	51	750	-	-	-	1,490	301	-	-	-	-	-	-
*G-14	Otto Fenner	200	Feb. 9, 1937	-	-	-	-	-	281	327	1,110	-	-	-	2,430	-	-	-	-	-	-	-
G-14	do	200	July 24, 1957	-	-	-	-	-	-	324	1,130	-	-	-	-	410	-	-	-	-	4,420	-
*G-15	Ray Moody	-	Feb. 8, 1937	-	-	168	33	413	332	51	800	-	-	-	1,630	555	-	-	-	-	-	-
*G-16	W. W. McAllister	400	Feb. 25, 1937	-	-	-	-	-	177	179	1,110	-	-	-	2,130	-	-	-	-	-	-	-
*G-17	W. D. Barnes	210	do	-	-	308	46	826	226	413	1,520	-	-	-	3,220	959	-	-	-	-	-	-
1/G-18	City of Kenedy well 7	422	Oct. 26, 1955	59	0.11	128	14	660 35	366	277	900	0.6	13	1.9	2,270	378	78	77	15	0	3,690	7.7
*G-19	Southern Pacific RR. Co.	3,000	Mar. 30, 1937	-	-	6	-	2,990	1,510	2/	4,100	-	-	-	7,840	15	-	-	-	-	-	-
3/G-20	City of Kenedy well 6	431	Oct. 26, 1955	61	.01	124	13	565 32	362	214	775	0.7	9.2	1.6	1,970	362	66	75	13	0	3,240	7.6
4/G-21	City of Kenedy well 4	747	do	87	.04	36	.7	715 34	393	241	800	.5	11	2.4	2,120	94	0	92	32	4.6	3,410	7.9
G-22	City of Kenedy well 5	416	Apr. 28, 1948	57	.05	64	11	354 17	381	93	412	1.0	4.0	11	1,210	204	0	80	11	2.2	2,110	7.4
5/G-22	do	416	Oct. 26, 1955	61	.02	64	7.2	382 24	378	87	450	1.1	3.8	.93	1,270	190	0	79	12	2.4	2,090	7.7
6/G-22	do	416	Dec. 9, 1955	58	.05	65	6.8	374 20	378	85	442	.8	5.2	-	1,150	190	0	79	12	2.4	2,130	7.6

* See footnotes at end of table.
1/ Manganese (Mn), 0.00; phosphate (PO_4), 0.05.
2/ Sulfate less than 10 ppm.
3/ Manganese (Mn), 0.00; phosphate (PO_4), 0.07.
4/ Manganese (Mn), 0.00; phosphate (PO_4), 0.1.
5/ Manganese (Mn), 0.01; phosphate (PO_4), 0.1.
6/ Manganese (Mn), 0.00; alluminum (Al), 0.1.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
G-23	City of Kenedy well 3	399	Apr. 18, 1945	46	0.18	68	9.4	341 31	428	112	365	1.0	5.0	-	1,190	208	0	75	10	2.9	2,090	7.4
1/G-23	do	399	Oct. 26, 1955	59	.00	87	9.5	438 27	398	150	520	.9	5.9	1.1	1,490	255	0	77	12	1.4	2,470	7.7
*G-24	E. T. McDonald	100	Feb. 25, 1937	-	-	92	22	276	411	59	370	-	-	-	1,020	319	-	-	-	-	-	-
*G-25	Gus Rummel	-	do	-	-	-	-	-	220	721	2,070	-	-	-	4,440	-	-	-	-	-	-	-
*G-26	R. E. Buegeler	318	do	-	-	194	22	552	336	300	1,020	-	-	-	2,260	574	-	-	-	-	-	-
2/G-27	Phil Buegeler	751	Apr. 5, 1956	34	.00	852	116	1890 70	197	1,260	3,880	.3	-	3.9	8,200	2,600	2,440	60	16	0	12,600	7.4
*G-28	Otto Boehm	190	Feb. 15, 1937	-	-	377	51	880	250	515	1,650	-	-	-	3,600	1,150	-	-	-	-	-	-
G-29	C. D. McAda	377	Apr. 17, 1956	62	-	330	27	1,040	292	440	1,760	.2	13	-	3,820	934	695	71	15	0	6,390	7.7
*G-30	do	176	Feb. 15, 1937	-	-	571	68	1,357	299	803	2,610	-	-	-	5,600	1,810	-	-	-	-	-	-
3/G-31	Fidelio C. Chamberlain	365	Apr. 4, 1956	88	.25	84	10	452 28	365	154	580	.3	9.4	2.0	1,590	250	0	77	12	1.0	2,570	7.6
*G-32	W. S. Gruenwald	132	Feb. 16, 1937	-	-	-	-	-	262	54	186	-	-	-	582	-	-	-	-	-	-	-
4/G-33	W. T. Homeyer	260	Apr. 4, 1956	16	.00	210	38	868 31	235	657	1,250	.3	5.1	2.5	3,190	680	488	72	14	0	5,170	7.0
G-34	H. H. Schuememann	Spring	May 6, 1951	51	-	103	5.5	41	264	27	85	-	26	0.09	502	280	63	24	11	0	770	8.2
*G-35	R. A. David	71	Apr. 9, 1937	-	-	-	-	-	226	138	690	-	-	-	1,460	-	-	-	-	-	-	-
*G-37	Ford F. Gauntt	175	do	-	-	227	28	505	348	192	920	-	-	-	2,040	682	-	-	-	-	-	-
*G-38	C. R. Murphy	180	Apr. 12, 1937	-	-	191	29	189	244	119	485	-	-	-	1,130	598	-	-	-	-	-	-
*G-39	F. E. Juchelka	210	do	-	-	202	39	222	115	540	664	-	-	-	1,280	664	-	-	-	-	-	-

* See footnotes at end of table.
1/Manganese (Mn), 0.00, phosphate (PO_4), 0.08.
2/Manganese (Mn), 0.00, phosphate (PO_4), 0.01.
3/Manganese (Mn), 0.01, phosphate (PO_4), 0.05.
4/Manganese (Mn), 0.20, phosphate (PO_4), 0.48.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*G-40	Gilbert Johnson	106	Apr. 12, 1937	-	-	69	17	161	533	29	88	-	-	-	626	242	-	-	-	-	-	-
1/G-42	M. E. Holmes	137	Apr. 4, 1956	35	0.00	182	46	464 13	340	112	900	0.6	4.7	1.1	1,920	643	364	60	8.0	0	3,490	7.0
2/G-43	W. J. Stockton	261	do	40	.00	157	33	463 14	330	137	822	1.0	2.6	1.1	1,830	527	256	65	8.8	0	3,210	7.3
*G-44	J. J. Ponish	270	Feb. 16, 1937	-	-	-	-	-	122	294	1,240	-	-	-	2,460	-	-	-	-	-	-	-
*G-46	Carl Fransen	45	do	-	-	-	-	-	159	77	650	-	-	-	1,260	-	-	-	-	-	-	-
*G-47	O. L. Bagwell	40	Feb. 15, 1937	-	-	-	-	-	305	132	620	-	-	-	1,410	-	-	-	-	-	-	-
3/G-48	Bill Richter	240	Apr. 5, 1956	39	.02	546	76	1700 53	261	1,140	2,880	.6	-	2.6	6,570	1,680	1,460	68	18	0	10,100	7.2
*G-49	Albert Esse	400	Feb. 16, 1937	-	-	64	7	809	232	12	1,240	-	-	-	2,250	190	-	-	-	-	-	-
*G-50	do	60	Feb. 10, 1937	-	-	-	-	-	220	1,520	680	-	-	-	3,400	-	-	-	-	-	-	-
*G-52	Minna Hoffman	356	do	-	-	-	-	-	305	468	890	-	-	-	2,300	-	-	-	-	-	-	-
*G-53	E. H. Ladewig	210	Feb. 9, 1937	-	-	5	3	370	494	86	235	-	-	-	942	22	-	-	-	-	-	-
G-53	do	210	July 24, 1957	-	-	-	-	-	4/564	-	230	-	-	-	-	80	0	-	-	7.6	1,750	8.5
*G-54	S. E. Crews	92	Feb. 6, 1937	-	-	149	27	339	306	117	600	-	-	-	1,380	482	-	-	-	-	-	-
G-55	J. W. Berry	137	July 24, 1957	-	-	-	-	304	302	91	770	-	-	-	-	766	519	-	4.8	0	3,020	8.0
H-1	F. E. Moses	159	Apr. 28, 1948	31	0.05	190	35	252 6.8	312	110	560	0.6	3.8	0.40	1,340	618	362	47	4.4	0	2,400	7.4
*H-2	C. H. Kreneck	115	Mar. 1, 1937	-	-	110	10	42	256	5/	140	-	-	-	428	316	-	-	-	-	-	-
*H-3	Geo. Tips	160	Mar. 2, 1937	-	-	-	-	-	226	129	585	-	-	-	1,280	-	-	-	-	-	-	-

* See footnotes at end of table.
1/Manganese (Mn), 0.00, phosphate (PO4), 0.04.
2/Manganese (Mn), 0.14, phosphate (PO4), 0.02.
3/Manganese (Mn), 1.4, phosphate (PO4), 0.03.
4/Includes equivalent of 22 ppm carbonate (CO3)
5/Sulfate less than 10 ppm.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*H-5	R. A. Hunt	-	Mar. 1, 1937	-	-	-	-	-	397	105	290	-	-	-	927	-	-	-	-	-	-	-
*H-6	Leo Kreneck	160	do	-	-	-	-	-	268	90	600	-	-	-	1,280	-	-	-	-	-	-	-
H-6	do	160	July 24, 1957	40	-	166	39	270 9.3	352	90	555	-	1.8	.58	1,340	574	286	50	4.9	0	2,380	7.7
*H-7	Union Leader School	120	Mar. 1, 1937	-	-	134	37	288	391	86	500	-	-	-	1,240	488	-	-	-	-	-	-
*H-8	L. K. Thigpen	160	do	-	-	-	-	-	305	90	410	-	-	-	1,020	-	-	-	-	-	-	-
*H-10	G. Roeben	100	Mar. 2, 1937	-	-	-	-	-	268	105	410	-	-	-	1,010	-	-	-	-	-	-	-
*H-11	C. W. Boyce	80	do	-	-	-	-	-	329	39	170	-	-	-	591	-	-	-	-	-	-	-
*H-12	Wiley Busby	36	do	-	-	-	-	-	311	55	265	-	-	-	747	-	-	-	-	-	-	-
H-12	do	36	July 24, 1957	-	-	-	-	-	300	-	748	-	-	-	-	892	646	-	-	0	2,950	7.4
*H-13	A. B. Copeland	38	Mar. 2, 1937	-	-	-	-	-	281	74	535	-	-	-	1,170	-	-	-	-	-	-	-
*H-15	Tips Ranch	70	do	-	-	134	18	139	348	66	255	-	-	-	783	411	-	-	-	-	-	-
H-15	do	70	July 24, 1957	-	-	-	-	-	-	54	278	-	-	-	-	486	-	-	-	-	1,540	-
*H-16	A. B. Russell	70	Mar. 2, 1937	-	-	-	-	-	336	94	275	-	-	-	838	-	-	-	-	-	-	-
*H-17	A. W. Mixon	83	Mar. 26, 1937	-	-	-	-	-	305	47	278	-	-	-	751	-	-	-	-	-	-	-
*H-19	Miss Annie & Fannie Boyce	86	do	-	-	160	54	193	289	51	530	-	-	-	1,130	619	-	-	-	-	-	-
*H-22	D. G. Janssen	120	Mar. 24, 1937	-	-	126	47	175	159	66	490	-	-	-	982	509	-	-	-	-	-	-
*H-23	Paul Dittfurth	120	do	-	-	254	49	105	331	43	530	-	-	-	1,140	835	-	-	-	-	-	-
*H-25	Fidel Escamilla	-	Mar. 23, 1937	-	-	-	-	-	317	58	96	-	-	-	492	-	-	-	-	-	-	-

*See footnotes at end of table.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Noncarbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*H-27	O. P. Talk	150	Apr. 5, 1937	-	-	197	29	220	337	58	535	-	-	-	1,200	613	-	-	-	-	-	-
*H-28	Karon McSmith	150	Mar. 25, 1937	-	-	84	15	100	343	23	128	-	-	-	519	269	-	-	-	-	-	-
*H-29	J. F. Taylor	240	do	-	-	-	-	-	92	70	315	-	-	-	557	-	-	-	-	-	-	-
1/H-30	United Gas Pipeline Co. well 1	600	Oct. 26, 1956	24	0.01	39	14	210 9.3	367	92	162	0.6	1.0	0.61	733	155	0	73	7.3	2.9	1,230	7.7
2/H-31	United Gas Pipeline Co. well 2	669	do	19	.06	26	9.3	206 8.4	380	65	128	.4	.0	.51	650	102	0	80	8.9	4.2	1,100	8.0
*H-33	Frank Davenport	54	Mar. 24, 1937	-	-	-	-	-	226	35	100	-	-	-	391	-	-	-	-	-	-	-
*H-36	John Janssen	60	do	-	-	-	-	-	293	321	1,700	-	-	-	3,350	-	-	-	-	-	-	-
*H-38	Porter Sellers	60	Mar. 25, 1937	-	-	72	7	53	208	3/	110	-	-	-	345	210	-	-	-	-	-	-
*H-41	Alfred Pizma	51	Apr. 7, 1937	-	-	-	-	-	293	27	76	-	-	-	397	-	-	-	-	-	-	-
*H-42	Mrs. D. Pargmann	114	do	-	-	-	-	-	403	50	185	-	-	-	690	-	-	-	-	-	-	-
H-43	Gaylord Westphal	292	Apr. 18, 1956	36	-	68	16	204 8.3	339	37	262	-	3.5	0.45	802	235	0	64	5.8	0.9	1,420	7.6
*H-44	Collie Baker	63	Mar. 11, 1937	-	-	-	-	-	293	77	810	-	-	-	1,620	-	-	-	-	-	-	-
*H-45	C. A. Atkinson	63	Mar. 10, 1937	-	-	-	-	-	311	47	215	-	-	-	658	-	-	-	-	-	-	-
*H-46	C. B. Hunt	101	do	-	-	143	29	199	293	82	415	-	-	-	1,010	478	-	-	-	-	-	-
H-46	do	101	July 24, 1957	-	-	-	-	-	-	94	385	-	-	-	-	466	-	-	-	-	1,790	-
*H-47	C. Baker	100	Mar. 2, 1937	-	-	112	18	202	342	74	310	-	-	-	884	356	-	-	-	-	-	-
*H-50	J. A. Sawey	87	Mar. 9, 1937	-	-	-	-	-	390	62	285	-	-	-	854	-	-	-	-	-	-	-

* See footnotes at end of table.
1/Manganese (Mn), 0.01; phosphate (PO_4), 0.04.
2/Manganese (Mn), 0.02; phosphate (PO_4), 0.03.
3/Sulfate (SO_4) less than 10 ppm.

Table 7.- Analyses of water from wells in Karnes County--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Non-carbonate	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
*H-51	A. M. Korback	-	Mar. 10, 1937	-	-	96	49	285	482	77	415	-	-	-	1,160	440	-	-	-	-	-	-
*H-52	Mrs. R. L. Hunt	160	Mar. 9, 1937	-	-	-	-	-	146	66	630	-	-	-	1,200	-	-	-	-	-	-	-
*H-56	S. W. Borg	160	Mar. 1, 1937	-	-	-	-	-	305	51	185	-	-	-	611	-	-	-	-	-	-	-
*H-57	E. Schroeder	148	Apr. 9, 1937	-	-	103	19	182	281	77	300	-	-	-	819	337	-	-	-	-	-	-
H-58	E. L. Vaughn	375	Dec. 6, 1956	49	0.25	121	17	168 13	318	61	295	0.5	4.5	.45	855	372	112	48	3.8	0	1,520	7.5
*H-59	John W. Thames	-	Apr. 9, 1937	-	-	-	-	-	61	93	430	-	-	-	854	-	-	-	-	-	-	-
H-63	Otto Von Roeder	58	Nov. --, 1944	-	-	109	18	216	356	83	281	-	50	-	932	346	54	42	5.1	0	-	-
*H-65	D. W. Vickers	64	Apr. 12, 1937	-	-	74	17	99	421	27	68	-	-	-	492	255	-	-	-	-	-	-
*H-66	J. E. Steed	210	do	-	-	97	19	144	317	69	215	-	-	-	700	322	-	-	-	-	-	-
H-68	George J. Jonischkies	345	Jan. 23, 1957	56	0.25	146	24	118 5.4	327	39	265	0.7	41	0.34	856	464	196	35	2.4	0	1,450	7.2
*H-69	D. N. Livingston	158	Apr. 10, 1937	-	-	42	23	139	92	77	245	-	-	-	571	199	-	-	-	-	-	-
*H-72	Mike Sikes	80	Mar. 10, 1937	-	-	-	-	-	299	1/	46	-	-	-	317	-	-	-	-	-	-	-

1/Sulfate less than 10 ppm.
* The analyses by the W.P.A. were done by methods that were not sufficiently accurate for the results to be closely comparable to those of later analyses, but they may be used to estimate the general quality of the water.