Geology and Ground-Water Resources of Winkler County, Texas

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1582

Prepared in cooperation with the Texas Board of Water Engineers and Winkler County

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By SERGIO GARZA *and* JOHN B. WESSELMAN

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GEOLOGY AND GROUND-WATER RESOURCES OF WINKLER COUNTY, TEXAS

By SERGIO GARZA and JOHN B. WESSELMAN [1]

ABSTRACT

Winkler County, in west Texas, is adjacent to the southeast corner of New Mexico. Most of the county lies in the Pecos Valley; the remainder, in the northeastern part of the county, is part of the Llano Estacado, or the High Plains. Its principal industries are those related to the production and refining of oil, but ranching also is an important occupation. The county has an arid to semiarid climate, an area of about 887 square miles, and a population of about 12,000 in 1957.

The principal fresh-water-bearing formations in Winkler County are the Cenozoic alluvium, which mantles the surface of most of the county, and the Santa Rosa sandstone of Late Triassic age. The alluvium is saturated at a depth ranging from a few feet below the land surface to about 150 feet, and the water is under water-table conditions. The Santa Rosa sandstone is fully saturated throughout most of the county, the water occurring under both unconfined (water-table) and confined (artesian) conditions. The underlying older formations contain water too highly mineralized for most uses, but they are important because water from these underlying beds, which is produced with the oil, is a source of pollution to the fresh-water aquifers. The formations also are a source of water to waterflooding projects for the secondary recovery of oil.

The alluvium is replenished chiefly by precipitation, throughout the county. The sand-dune area in the eastern part is the most favorable area of natural recharge. The Santa Rosa sandstone is recharged through the alluvium where the two formations are in contact.

Infiltration of saline water, which with oil and waste water has been produced from industrial plants, has been taking place through surface earthen pits. About 18 mgd (million gallons per day) of saline water was being produced from the many oil fields throughout the county during August 1957, and almost all this water was placed in surface pits. The Hendrick oil field alone produced about 14.5 mgd during that month, and an estimated 800,000 acre-feet from 1937 to 1957.

About 20 million acre-feet of fresh water is stored in the explored ground-water aquifers of Winkler County, of which an estimated 5 to 7 million acre-feet can be practicably recovered. A daily average of about 8.2 million gallons (9,200 acre-feet per year) of fresh water was used in the county during 1956. Public and industrial use accounted for about 6.8 mgd; irrigation, domestic, and stock uses accounted for 1.4 mgd. Projects engaged in the secondary recovery

[1] Geologist, Texas Board of Water Engineers.

of oil were the largest consumers, using an average of about 3 mgd of fresh water and about 2.7 mgd of saline water during 1956.

Water wells drilled in the deep trough of Cenozoic alluvium south of Wink may yield 1,000 gpm (gallons per minute) or more. A pumping test of the alluvium in that area indicated a coefficient of transmissibility of about 25,000 gpd (gallons per day) per foot. Wells, other than windmill wells, drawing water from thinner sections of alluvium in the rest of the county yield between 100 and 300 gpm. Most of the wells in the Santa Rosa sandstone yield 30–400 gpm. Two municipal wells at Kermit that tap the Santa Rosa sandstone were tested at 1,200 and 1,875 gpm. The large yield of these wells probably results from the presence of fractures in the structurally deformed aquifer. Pumping tests in the Kermit area indicate that locally a full section of the Santa Rosa sandstone has an average coefficient of transmissibility of about 25,000 gpd per foot and a coefficient of storage of about 0.0003. The transmissibility in two other tested areas is much less.

The chemical quality of the water in the principal aquifers is generally acceptable for industry and for public supply. About two-thirds of the samples collected from fresh-water wells had a dissolved-solids content of less than 1,000 ppm (parts per million); however, some samples in a few areas were hard and were high in fluoride and silica. Samples from wells in polluted areas contained dissolved solids ranging from about 1,400 to 71,100 ppm. Two comprehensive analyses of water samples from the Rustler formation showed a dissolved-solids content of 18,400 ppm. and 157,000 ppm. In most of the water produced with the oil in the Hendrick oil field, the content of dissolved solids ranged from about 4,000 to about 10,000 ppm. The water produced with the oil in the rest of the oil fields in Winkler County was mainly brine.

INTRODUCTION

PURPOSE AND SCOPE

In 1956 an investigation of the ground-water resources of Winkler County was begun through a cooperative agreement among the U.S. Geological Survey, the Texas Board of Water Engineers, and the Commissioners' Court of Winkler County. The purpose was to obtain information as to the source, occurrence, utilization, quantity, and quality of ground water in the county. As the work progressed, the pollution of ground water by oil-field waste water through surface pits became a principal subject of study.

Field data were gathered from September 1956 through September 1957. The report contains records of 747 wells (table 7) and 176 drillers' logs (table 8). The table of well records includes 189 altitudes of water wells determined by the U.S. Geological Survey, 198 altitudes of oil and water wells furnished by oil companies, and records of 136 oil tests and oil wells. All electric and radioactivity logs used in this study have been placed in the permanent file of well logs maintained by the Texas Board of Water Engineers. Pumping tests were made on wells to determine the hydraulic properties of the aquifers. The water samples collected in 1956 and 1957 were analyzed

in the laboratory of the Geological Survey in Austin, Tex. The table of 167 chemical analyses (table 9) includes 25 made by the Works Progress Administration in 1940 (Forbes and others, 1941, p. 31–35), though they were made by methods that were not sufficiently accurate for results to be closely comparable to those of later analyses. Chemical analyses of saline water produced by oil wells, mostly made by commercial laboratories, are compiled in table 6.

The study was made under the supervision of R. W. Sundstrom, district engineer in charge of ground-water investigations in Texas.

ACKNOWLEDGMENTS

Appreciation is expressed to all who contributed information and assistance in the field and in the preparation of the report. City officials of Kermit and the Commissioners' Court of Winkler County provided manpower and equipment on several occasions; the Court also furnished office space. Oil companies furnished records, including pumpage data and altitudes of both water and oil wells. Particular recognition is due the geologic staff of Magnolia Oil Co.'s Midland office for technical assistance and access to its log file. The waterwell drillers and the ranchers of the area gave free access to their records.

PREVIOUS INVESTIGATIONS

An inventory of water wells in Winkler County was made in 1940 as a project of the Works Progress Administration in cooperation with the Texas Board of Water Engineers and the U.S. Geological Survey (Forbes and others, 1941).

A. H. Dunlap of the State Board of Water Engineers, in 1939, and J. W. Lang of the U.S. Geological Survey, in 1947, made brief field investigations of ground water in the vicinity of Kermit, but formal reports of the investigations were not made. The results of those studies are incorporated in this report.

WELL-NUMBERING SYSTEM

In the report by Forbes and others (1941) the wells were numbered consecutively in one series. Those well numbers have since been changed to conform to a grid system designed to facilitate location of the wells (see table 1). In this report the county is divided into separate units by means of grids. Lines of latitude and longitude were used to determine the grids, which constitute a modified 10-minute grid system. The grids are identified by letters of the alphabet, from A through H, starting with the northwest grid and moving in a west-to-east, north-to-south succession. Inside the grids the individual wells are numbered consecutively, beginning in the northwest corner.

Table 1 is an index of previously published well numbers and corresponding numbers in this report.

TABLE 1.—*Index of previously published well numbers and corresponding numbers in this report*

[Old numbers were published in Forbes and others (1949)]

New	Old	New	Old	New	Old	New	Old
B-10	143	D-181	31	F- 2	287	G-21	193
B-15	139	D-185	20	F- 3	286	G-49	265
B-20	146	D-186	74	F- 5	283	G-66	202
C-2	4	D-204	126	F- 6	274	G-76	191
C-18	58	D-205	122	F-11	273	G-78	189
C-20	7	D-208	120	F-15	264	G-112	255
C-21	11	D-209	2	F-16	259	G-120	207
C-22	8	D-235	21	F-22	275	G-122	206
C-25	43	D-236	27	F-23	281	G-129	188
C-33	41	D-257	271	F-25	288	G-136	212
C-34	32	D-269	76	F-26	279	G-138	213
D-4	66	D-270	77	F-27	278	G-139	210
D-5	64	D-273	90	F-29	289	G-140	209
D-9	135	D-275	87	F-30	276	G-141	208
D-23	52	D-279	83	F-32	262	G-146	251
D-39	57	D-285	85	F-41	277	G-150	214
D-41	49	D-307	196	F-43	291	H-15	181
D-42	46	D-309	127	F-44	292	H-16	183
D-57	70	E-22	148	G- 7	270	H-24	187
D-101	132	E-23	150	G-11	267	H-25	186
D-135	73	E-24	151	G-18	195	H-26	182
D-180	29	E-32	156	G-19	194	H-80	216

LOCATION AND ECONOMIC DEVELOPMENT

Winkler County occupies an area of 887 square miles in west Texas, immediately adjoining the southeast corner of New Mexico. (See fig. 1.) Like Andrews County on the north, Ward County on the south, and Ector County on the east, Winkler County owes its economic importance to the production of oil. Kermit, the county seat and center of the oil industry in the county, had an estimated population of more than 10,000 in 1957; the total county population was estimated at about 12,000.

New oil fields are being developed, and old ones are being restored by new processes of recovery. (See fig. 2.) The production of oil in Winkler County, according to the Railroad Commission of Texas, was 15,661,412 barrels in 1956. Other industries are the production of natural gas, gasoline, liquefied gas products, carbon black, and sulfur.

Most of the land in the county has been used for grazing cattle. Although the severe drought from 1947 to 1957 resulted in the destocking of much rangeland, cattle raising is still an important industry.

PHYSICAL FEATURES

Winkler County occupies parts of two sections of the Great Plains physiographic province—the High Plains and the Pecos Valley (Fenneman, 1931, pl. 1). The highest land surface (about 3,400 feet above

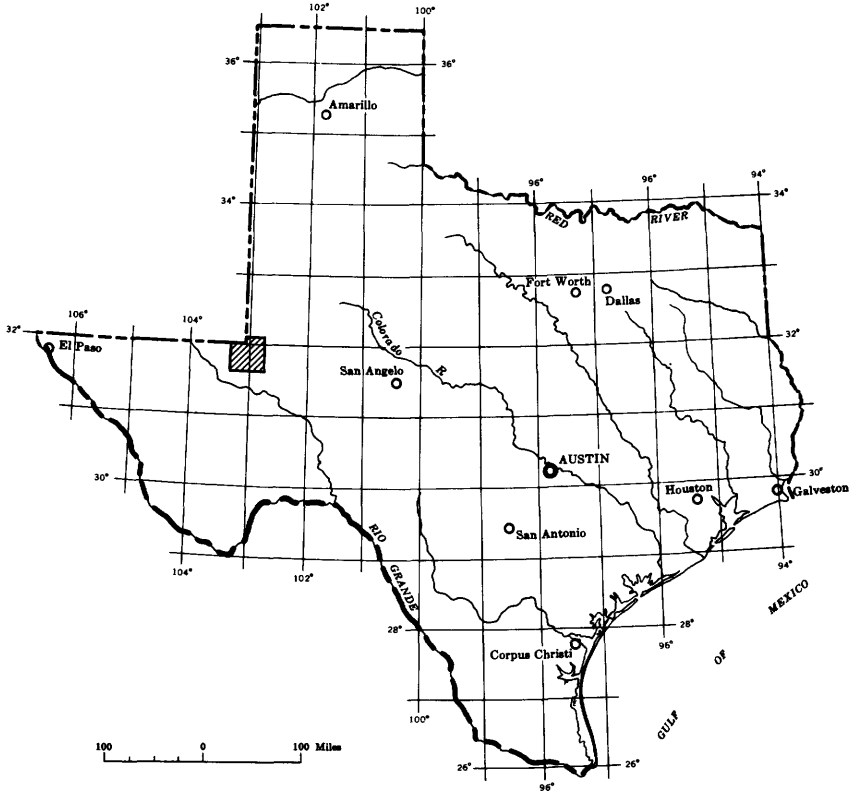


FIGURE 1.—Map of Texas showing location of Winkler County.

mean sea level) in Winkler County is in the High Plains section, or Llano Estacado, which includes the northeastern part of the county. The High Plains area is bounded by a west-facing escarpment called Concho Bluff, whence the land slopes gently southeastward. The nearly flat surface is poorly drained; large depressions called playas are common, and there are many smaller ones.

The surface of the rest of the county, the Pecos Valley section, slopes to the southwest and south from Concho Bluff. The altitude in the county is lowest (about 2,670 feet) near the south edge, in the Pecos Valley section.

Surface drainage leaving Winkler County is insignificant. Small gullies head along Concho Bluff, extending to the sandy belt in front of the bluff, where storm waters quickly infiltrate the sand. Cheyenne Draw and Monument Draw in central and west-central Winkler County are ephemeral and discontinuous. Eolian (windblown) sand has nearly filled Cheyenne Draw where it heads into New Mexico. West of Wink a part of Monument Draw has been dammed, forming

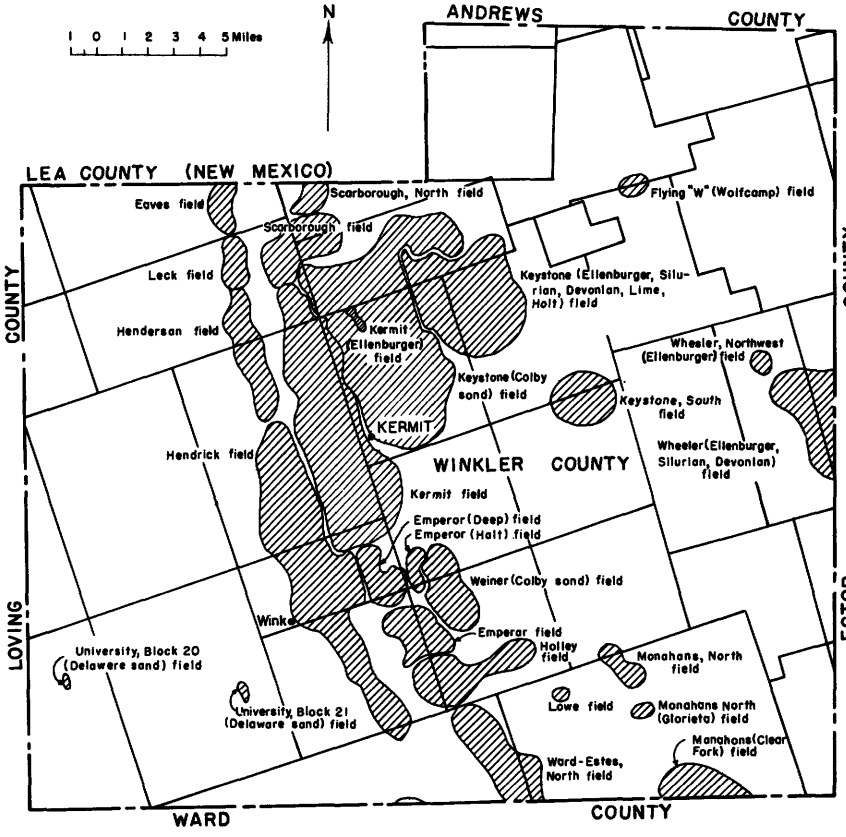


FIGURE 2.—Map showing location of oil fields in Winkler County, Tex.

a lake into which saline water produced with oil at the Hendrick field has been placed (pl. 1).

A striking physcial feature is the "blow sand" that forms a belt of high, shifting dunes 2–4 miles wide, extending from the southeast corner of New Mexico to the southeast corner of Winkler County. This is a part of a wider sandy belt, 8–15 miles wide in Winkler County, that extends into New Mexico and into Crane County, Tex. Among the active sand dunes and westward, captured dune sand supports sparse vegetation. In some places wind action has removed all free sand from caliche-indurated surfaces, leaving shallow depressions known as "blowouts." The sand dunes rise as much as 30–40 feet above the surrounding land surface. At many places along the west flank of the area, where the dune surface and the water table almost intersect, growths of willow trees and wild plum thickets abound. Waterholes are excavated below the water table in these areas to provide water for drilling.

The surface west of the belt of sand dunes is gently rolling to level and consists of caliche-indurated sand and some silt and gravel. The gravel is found principally in small lag-gravel deposits. Large sinkholes are present in the High Plains part of the county and near the west border. A discontinuous ridge along the west boundary is attributed to the burial of an escarpment of Triassic rock by Cenozoic alluvium.

CLIMATE

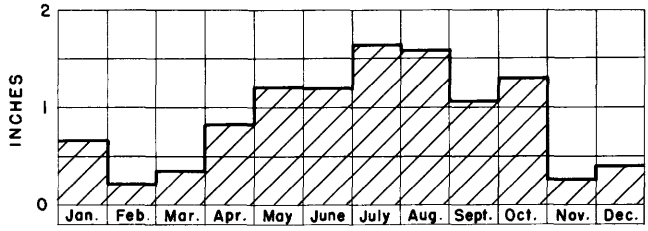
The climate of Winkler County is arid to semiarid; it is too dry for farming without irrigation. The mean annual temperature is 63 °F. The mean annual precipitation is only about 13 or 14 inches. Precipitation data for the stations at Wink, Tex., and Jal., N. Mex. (18 miles north of Kermit), are shown on figures 3 and 4. In order to assume a complete record for the Wink station in 1941, 5 inches of precipitation was estimated for the month of June by comparing with the Jal, N. Mex., record for that month.

The short period of record (1941–56) includes the drought years 1945–56. In order to relate the averages obtained for the short periods of record to longer, more representative averages for the county, the averages at the Fort Stockton (Pecos County) and Pecos (Reeves County) stations for the same period (1941–56) were compared to averages for longer periods of record at this stations. The average precipitation for the shorter period (1941–56) was found to be approximately 2 inches less at the Fort Stockton station and approximately 3 inches less at the Pecos station. The averages shown for the Wink and Jal stations probably are between 2 and 3 inches below what they would be if longer, more representative periods of record were available.

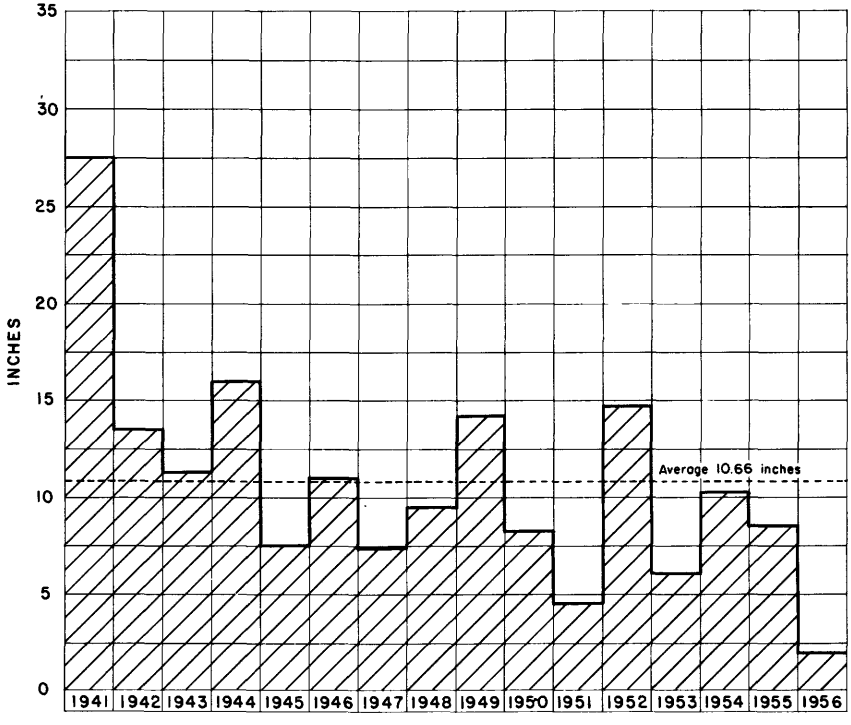
GENERAL GEOLOGY

The oldest explored rocks in Winkler County are igneous rocks about 10,000 feet below the surface in the Keystone oil field, about 4 miles northeast of Kermit. Sedimentary rocks of Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, Permian, Triassic, Cretaceous, and Tertiary ages are shown by Jones and others (1949) to be present beneath the surface.

Only the Permian and younger formations are discussed in detail in this report, as they are the principal sources of ground water in Winkler County. Their age, thickness, physical characteristics, and importance as sources of water supply are summarized in table 2. All water-bearing formations are discussed in greater detail in the section on geologic formations and their water-bearing properties. The areas of outcrop of the Cretaceous and younger rocks are shown on plate 1.

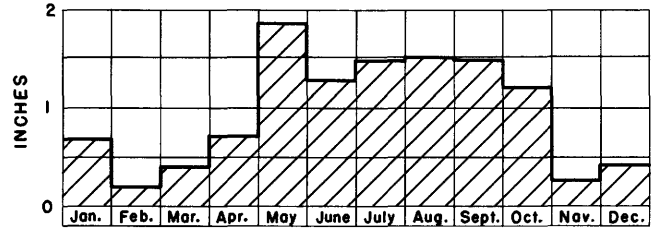


A. Average monthly precipitation, Wink, Texas

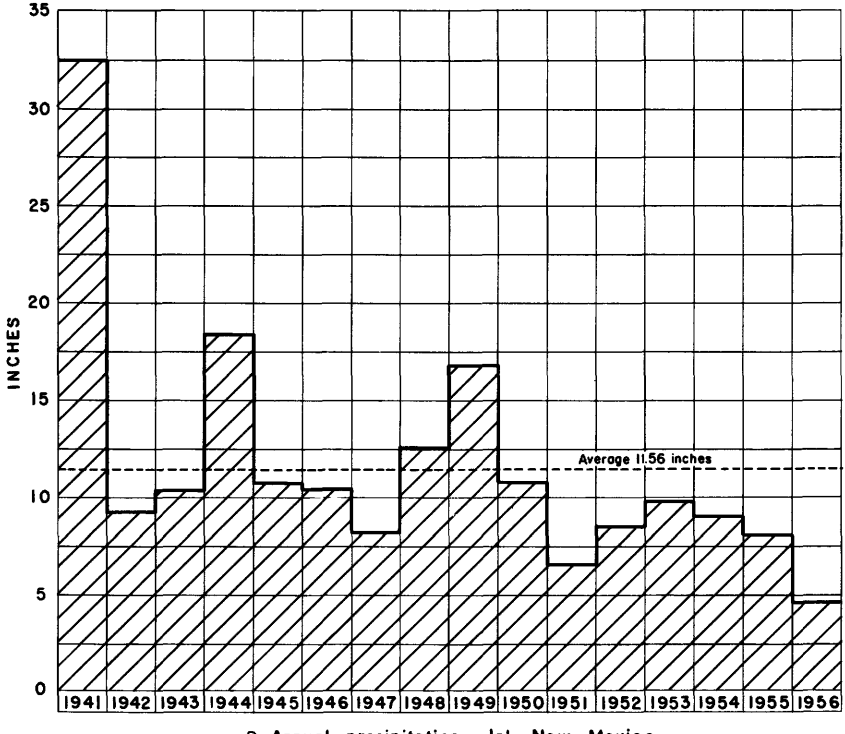


B. Annual precipitation, Wink, Texas

FIGURE 3.—Graphs showing monthly and annual precipitation (1941–56) at Wink, Tex. (from records of U.S. Weather Bureau).



C. Average monthly precipitation, Jal, New Mexico



D. Annual precipitation, Jal, New Mexico

FIGURE 4.—Graphs showing monthly and annual precipitation (1941–56) at Jal, N. Mex. (from records of U.S. Weather Bureau).

TABLE 2.—*Stratigraphic units and their water-bearing properties in Winkler County, Tex.*

Era	System	Series or group	Stratigraphic unit	Approximate thickness (feet)	Character of rocks	Water-bearing properties
Cenozoic	Quaternary		Dune sand	0– 250	Windblown sand	Principally a recharge facility for underlying formations. Furnishes small supplies of fresh water, principally from pits.
	Quaternary and Tertiary		Alluvium	0– 1,050	Unconsolidated sand, gravel, silt, clay, and caliche.	Water ranges from fresh to slightly saline. Yields range from few gallons per minute to more than 1,000 gpm.
Mesozoic	Cretaceous	Lower Cretaceous: Fredericksburg group		0– 0	Gray to cream and brown hard to earthy fossiliferous sandy marine limestone.	Not an aquifer in Winkler County.
		Lower Cretaceous: Trinity group		0– 100	Sandstone, siltstone, conglomerate, and gravel.	Yields small quantities of water of good chemical quality in extreme northeastern part of county.
	Triassic	Dockum group	Chinle formation equivalent	0– 1,000	Brick-red to maroon and purple shale, thin beds of fine red or gray sandstone and siltstone.	Not known to yield water to wells in Winkler County.
			Santa Rosa limestone	0– 350	Reddish-brown and gray medium- to coarse-grained crossbedded arkosic, micaceous, and conglomeratic sandstone, interbedded with red and green shale.	Yields small to large quantities of fresh to slightly saline water.

			Tecovas formation	0– 270	Red shale, siltstone, and very fine-grained sandstone.	Not known to yield water to wells in Winkler County.
Paleozoic	Permian	Ochoa series	Dewey Lake red beds	230– 580	Thin-bedded siltstone cemented with gypsum and calcite.	Do.
			Rustler formation	300– 500	Dolomite, anhydrite, and limestone; basal zone of sand, conglomerate, and variegated shale.	Yields highly saline water or brine.
			Salado formation	400–2,000	Mostly salt (halite); subordinate amounts of anhydrite, sylvite, and orange polyhalite.	Not known to yield water to wells in Winkler County.
			Castile formation	0–1,700	Calcareous anhydrite, some salt	Do.
		Whitehorse group of Guadalupe series.	Capitan limestone: Tansill formation	0– 200	Dolomite, some anhydrite and salt	Do.
			Capitan limestone: Yates sandstone	0– 300	Gray and red sandstone, a few thin beds of dolomite, and red and gray shale.	Yields small quantities of brine in conjunction with oil production.
			Capitan limestone: Seven Rivers formation	0– 550	Anhydrite, red sandstone, shale, and dolomite.	Yields large quantities of moderately saline water.
			Capitan limestone: Queen formation	0– 400	Red and gray sandstone interbedded with dolomite and some anhydrite and salt.	Not known to yield water to wells in Winkler County.
			Capitan limestone: Grayburg formation	0– 300	Dolomite, red and gray sandstone, and some anhydrite.	Probable source of large quantities of moderately saline water to deep wells between Kermit and Wink.
			Capitan limestone	0–2,000	Reefy limestone and dolomite	Not known to yield water to wells in Winkler County. Probably capable of yielding large quantities of moderately saline water.

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A southward-trending structural high, which Cartwright (1930, p. 970) designated as the "Central Basin Platform," divides the Permian basin of west Texas into two subbasins—the Delaware on the west and the Midland on the east. The western quarter of Winkler County overlies the east rim of the Delaware basin. The rest of the county overlies part of the central basin platform. (See fig. 5.)

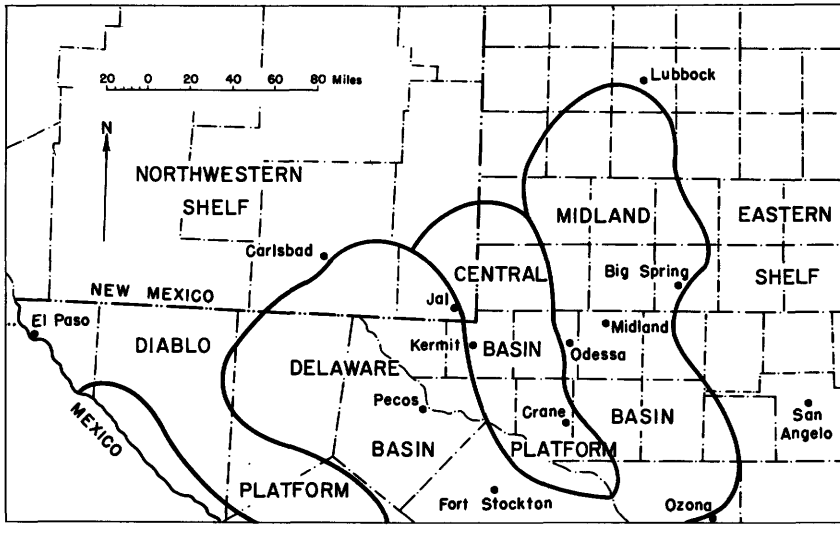

FIGURE 5.—Map of parts of west Texas and New Mexico showing Permian structural features.

A large reef known as the Capitan, deposited along the margins of the Delaware basin in late Guadalupe time, caused contemporaneous deposition of three different sequences of rocks: a deep-water marine facies in the Delaware basin, represented by sandstone, shale, and limestone; a reef zone, represented by massive crystalline dolomite or limestone; and shelf or lagoonal deposits, represented by fossiliferous limestone and shale, dolomitic limestone, saline evaporites, and onshore clastics. The shelf deposits are characteristically thin-bedded dolomite or limestone near the reef, grading into evaporites and clastics away from the reef. The Capitan limestone represents the reef deposits. The back-reef deposits are represented by the Grayburg, Queen, and Seven Rivers formations, and the Yates sandstone and the Tansill formation of the Whitehorse group. In the Delaware basin the sandstones of Guadalupe age are succeeded by the anhydrite of the Castile formation of Ochoa age.

The Castile, Salado, and Rustler formations and the Dewey Lake redbeds of the Ochoa series record the end of Permian deposition in

the Delaware basin. The central basin platform and other back-reef areas were probably above or near sea level during the deposition of the Castile formation, a sequence of evaporite rocks in front of the Capitan reef. After the deposition of the Castile, the sedimentary rocks of the Salado formation were deposited in the Delaware basin and across the central basin platform. This widespread deposition of evaporites, alternating at intervals with limestone, dolomite, shale, and sand, continued through Salado and Rustler time. Like the Salado, the Rustler formation was deposited in both the Delaware basin and the shelf areas. The evaporites were overlain by the Dewey Lake redbeds, the youngest rocks of the Ochoa series.

According to King (1942, p. 763), "After Ochoa time, a long interval of non-deposition ensued in West Texas, and the region was probably land. Deposition did not begin again until late Triassic time, when the Dockum group was laid down."

The deposition of the Dockum group is recorded by the terrestrial sediments of the Tecovas and Santa Rosa formations, and the Chinle formation equivalent. The Dockum sediments are the last record of Triassic deposition in the area.

Rocks of Early Cretaceous age record the next deposition in Winkler County. Sands of the Trinity group unconformably overlie rocks of the Triassic Dockum group. The youngest Cretaceous beds are marine limestones of the Fredericksburg group, which overlie the basal Trinity group. The Cretaceous rocks crop out in Concho Bluff in northeastern Winkler County and underlie the High Plains, but in the rest of the county they have been removed by erosion.

A mantle of alluvium and dune sand of Cenozoic age overlies the older rocks in all but the High Plains part of the county. The deposits range in thickness from a few feet to about 1,050 feet.

Plates 2 to 5 show the structural relations of the water-bearing rocks of the county. The sharp lithologic break at the contact of the anhydrite bed at the top of the Rustler formation with the overlying Dewey Lake redbeds is readily distinguishable in mechanical and drillers' logs. This contact was used in preparing the structural contour map of the top of the Rustler formation (pl. 5).

The base of the Santa Rosa sandstone, 300–850 feet above the top of the Rustler formation, marks the deepest occurrence of fresh water in most of Winkler County. Its contact with the underlying Tecovas formation is readily distinguished in mechanical logs. By using the altitudes determined from the mechanical logs and by interpolating from the Rustler structure where control was lacking, a structure contour map of the base of the Santa Rosa sandstone (pl. 6) was prepared.

Drillers' log and mechanical logs were used in preparing two east-west cross sections (pls. 2 and 3) and one north-south cross section (pl. 4) showing the structure from the surface to the Rustler formation. Two other cross sections (pl. 7), drawn to an expanded horizontal scale, show the same stratigraphic interval in the vicinity of Kermit.

The contour map and the cross sections show two major structural features that are probably related to the same crustal deformation. Post-Triassic crustal movements formed a structural high along the east rim of the Delaware basin and fractured the rocks overlying the soluble salts of the Ochoa series. The rock fractures provided channels for ground water to circulate in the underlying sediments and thus dissolve part of them. The overlying beds collapsed into the voids created by the removal of the soluble salts, forming a slumpage trough (Adams and Frenzel, 1950, p. 301). The trough, about 5–10 miles wide in Winkler County, is shown on the cross sections and structural maps (pls. 2, 3, 5, 6). The east edge of the trough approximately overlies the buried Capitan reef. The axis of the trough trends generally southward, extending from New Mexico through the western part of Winkler County into Ward County on the south.

Because the collapsed beds in the trough were more susceptible to erosion than those away from the trough, a stream channel developed in them before the Cenozoic alluvium was deposited. The head of the channel was to the north and the channel drained to the south. This is seen by comparison of cross sections *A–A′* (pl. 2) and *B–B′* (pl. 3). The deepest erosional surface separating the Cenozoic rocks from the Triassic rocks on the northernmost cross section *A–A′* is 2,270 feet above sea level at well C–3. The deepest erosional surface in the southernmost cross section *B–B′* is about 1,670 feet above sea level at well G–144. Buried tributary channels in the erosional surface drain toward the slumpage trough. One such tributary channel or system of channels is suggested by the formational relation shown by the logs of well D–10 and the adjoining wells on cross section *A–A′* and by the logs of well G–79 and its adjoining wells on cross section *B–B′*.

The second major structural feature is a structural high, the axis of which extends southwestward from near the corner of New Mexico through the central part of the county to a point just west of Kermit, where it curves southeastward, the high disappearing about 12 miles southeast of Kermit. East of the axis of the high, the rocks dip slightly to the east or northeast. Kermit lies nearly across a saddle on the high between locally higher areas to the northeast and south.

This regional high overlies the back-reef sediments of the Permian reef complex. On the west side of the high, the Santa Rosa sandstone plunges into the slumpage trough. Farther west the Santa Rosa rises from the trough and again assumes a fairly level attitude.

There is little doubt that the rocks in Winkler County are faulted, but no faults are shown on the geologic map, the structural maps, or the cross sections. The cross sections and structural maps show deformation of the rocks on the southwestward-trending high and in the slumpage trough in west-central Winkler County, but the sand mantle prevents the detection at the surface of any fault traces.

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

PALEOZOIC ERA

PERMIAN SYSTEM

GUADALUPE SERIES

Guadalupe time in Winkler County and vicinity was characterized by a restriction of the areas of marine environment. This condition resulted partly from the general retreat of the Permian seas from the continent and partly from the growth of reefs around the Delaware basin. The reefs caused large lagoonal areas to be shut off from free access to the sea, so that the salinity of the lagoons was greatly increased by evaporation. In late Guadalupe time sedimentation was continuing at different levels simultaneously: in the lagoon behind the reef barrier, on the reef itself near sea level, and on the floor of the sea.

In the following discussion of the individual formations of the Guadalupe series, only the Capitan limestone and its back-reef equivalents are considered. The equivalents in the Delaware basin in Winkler County are not known to yield water and are not here discussed.

CAPITAN LIMESTONE

The Capitan limestone, 1,500—2,000 feet thick (Newell and others, 1953, p. 105), is late Guadalupe in age. The sediments, originally deposited as a reef, consist of limestone, dolomite, and talus characteristic of reefs. Adams and Frenzel (1950, p. 295, fig. 1) show the Capitan as a north-south-trending belt of rocks approximately 6 miles wide near the center of the west half of Winkler County. The Capitan is found at depths greater than 2,000 feet throughout its extent in the county; it interfingers with rocks of the Whitehorse group to the east.

There is no known production of water from the Capitan limestone in Winkler County. However, the Capitan yields about 1,000 gpm of moderately saline water to an irrigation well in Pecos County, and possibly it would yield similar supplies in Winkler County.

WHITEHORSE GROUP

The five formations of the Whitehorse group—the Grayburg, Queen, Seven Rivers, Yates, and Tansill—are back-reef equivalents of the Capitan reef sediments. Along the west side of the central basin platform, the Whitehorse is predominantly dolomite interbedded with sand and some anhydrite and salt, the proportion of anhydrite and salt increasing to the east.

Grayburg formation

The Grayburg formation (Dickey, 1940, p. 44–47), about 300 feet thick in Winkler County, is the lowest formation of the Whitehorse group. It consists of dolomite and sandy dolomite interbedded with red and gray sandstone; some anhydrite is present locally. The depth to the Grayburg ranges from about 3,200 to 4,000 feet in Winkler County.

The Grayburg yields large quantities of moderately saline water, which is used for waterflooding at Goldsmith in Ector County.

Queen formation

The Queen formation (Lang, 1937, p. 856–859; King, 1942, p. 705, 707), about 400 feet thick in Winkler County, overlies the Grayburg formation. It consists of red and gray sandstone interbedded with dolomite and some anhydrite and salt. The Queen is found at depths ranging from about 2,800 to 3,600 feet in the county.

The Queen formation is not known to yield water to wells in Winkler County.

Seven Rivers formation

The Seven Rivers formation (Lang, 1937, p. 856–860), about 550 feet thick in Winkler County, overlies the Queen formation. The Seven Rivers consists of anhydrite and some red sandstone, shale, and dolomite. Toward the reef the dolomite content of the formation increases as the anhydrite content decreases. The depth to the Seven Rivers in Winkler County ranges from about 2,500 to 3,000 feet.

Large quantities of moderately saline water are produced with the oil from this formation, and some of it is used for waterflooding.

Yates sandstone

The Yates sandstone was named by Cartwright and Adams (Gester and Hawley, 1929, p. 487) from the type locality in the Yates oil field in Pecos County. It is about 300 feet thick in Winkler County

and overlies the Seven Rivers formation. The Yates consists of gray and red sandstone having scattered large frosted quartz grains, a few thin beds of dolomite, and beds of red and gray shale. The depth to the Yates in Winkler County ranges from about 2,300 to 2,800 feet.

The Yates yields small quantities of brine in conjunction with oil production in the county.

Tansill formation

The Tansill formation (DeFord and Riggs, 1941), about 200 feet thick in Winkler County, overlies the Yates sandstone and is the top formation in the Whitehorse group. The rocks are predominantly dolomite near the reef, grading away from the reef into anhydrite and to anhydrite and salt. The Tansill is found at depths ranging from about 2,100 to 2,700 feet in the county.

The Tansill formation is not known to yield water to wells in Winkler County.

OCHOA SERIES

Throughout Permian time a deep embayment linked the broad shallow seas of the Permian basin with the ocean to the south. In the Capitan stage a continuous barrier reef separated the deep seaward waters from the shallow back-reef lagoons. At the close of Capitan deposition the lagoonal sea expanded when the Delaware basin was uplifted and tilted slightly eastward. The first deposits in the expanded lagoon were anhydrite, and these were followed by a thick section of salt interbedded in places with potash salts and other late-stage evaporites. The Dewey Lake redbeds, the last in the Ochoa series, mark the end of marine deposition in the Permian basin.

CASTILE FORMATION

The Castile formation, about 1,700 feet thick in Winkler County (Lang, 1937, p. 876), is the bottom formation of the Ochoa series. The evaporites of the Castile formation filled the basin in front of the previously deposited Capitan reef sediments. The Castile is not present on the central basin platform. The evaporites consist largely of calcareous anhydrite and some fairly widespread salt beds. The Castile is found at depths greater than 3,000 feet in Winkler County.

The Castile formation is not known to yield water in the county.

SALADO FORMATION

The Salado formation (Lang, 1935, p. 262–270), about 400–2,000 feet thick in Winkler County, overlies the Castile formation in the Delaware basin and the Tansill formation on the central basin platform. The Salado is thinnest where it underlies the slumpage trough

of west-central Winkler County. The difference in thickness is due principally to the removal of salts by subsurface solution (Maley and Huffington, 1953, p. 543). The Salado in the Delaware basin was truncated and overlapped by the Rustler formation. The upper salt beds extend northeastward from the reef rim of the Delaware basin across most of the central basin platform.

The Salado formation differs from the Castile formation in that it is composed mostly of salt (halite) and a subordinate amount of anhydrite. Another important difference is the presence in the Salado, of potash minerals such as sylvite and orange polyhalite, instead of calcite as in the Castile. The Salado has small amounts of dolomite and magnesite. The depth to the Salado in Winkler County ranges from 1,100 to about 2,300 feet.

The formation is not known to yield water in the county.

RUSTLER FORMATION

Deposition of the Rustler formation (Richardson, 1904, p. 44) was preceded by a period of uplift and erosion. The Rustler, 300–500 feet thick in Winkler County, unconformably overlies the Salado formation. It consists largely of dolomite and anhydrite and has a basal zone of sand, conglomerate, and variegated shale. Locally the Rustler contains minor amounts of salt, and in places limestone replaces the dolomite. The dolomite and limestone contain many of the openings known as vugs, and cavernous conditions are reported in many places. The altitude of the top of the Rustler is shown in plate 5.

Production of water from the Rustler is sporadic, owing to the irregular occurrence of cavernous openings; however, yields up to 800 gpm have been reported. Most wells drilled into or through the Rustler in Winkler County yield artesian water. The water is either highly saline or briny and is used for waterflooding.

DEWEY LAKE REDBEDS

The Dewey Lake redbeds (Page and Adams, 1940, p. 62–63), 230–580 feet thick in Winkler County, is the youngest formation of the Ochoa series. The individual beds are uniformly thin and consist of siltstone cemented with gypsum and calcite. The contact between the red beds and the underlying Rustler formation is easily distinguished by the change in lithology between the red beds and the anhydrite member of the Rustler. On most radioactivity logs the top of the Dewey Lake is marked by a distinct zone, generally 10–20 feet thick, of decreased natural radioactivity as measured by the gamma-ray curve. In electric logs the same zone is outlined by the self-potential curve, which is sharply depressed opposite the zone. (See

wells H–34 and H–41, pl. 3.) The zone is considered to be the "zone of bleaching" noted by Page and Adams (p. 62). The Dewey Lake is found in the county at depths ranging from 250 to about 1,650 feet.

The Dewey Lake redbeds is not known to yield water to wells in Winkler County.

MESOZOIC ERA

TRIASSIC SYSTEM

DOCKUM GROUP

The Dockum group is exposed in scattered small outcrops in the southern High Plains and the Pecos River valley. The group has been divided into three formations: the lower red shale, siltstone, and very fine grained sandstone called the Tecovas formation; the middle reddish-brown and gray sandstone called the Santa Rosa sandstone; and the upper brick-red to maroon and purple shale with thin beds of fine red or gray sandstone and siltstone called the Chinle formation equivalent.

The Dockum group is almost the exact equivalent of the Chinle formation of the Colorado Plateau region (Reeside and others, 1957, p. 1476). However, local usage has included only the upper part of the Dockum group as equivalent to the Chinle formation of the type area. The term Chinle formation equivalent will be used in this report.

TECOVAS FORMATION

The Tecovas formation, ranging from 0 to 270 feet in thickness in Winkler County, is the bottom formation of the Dockum group. The Tecovas, laid down on an erosional surface in the Dewey Lake redbeds, consists of red shale, silt, and very fine grained sandstone grading into the overlying Santa Rosa sandstone. The Tecovas is readily distinguished in radioactivity logs by its high degree of natural radioactivity as measured by the gamma-ray curve. In electric logs it is distinguished by a higher self-potential than that of either the top zone of the underlying Dewey Lake redbeds or of the overlying Santa Rosa sandstone. (See wells H–34 and H–41, pl. 3.) The Tecovas is present in most places in Winkler County; however, in a small area southwest of Wink it has been removed, apparently by erosion (well F–31, pl. 3). The Tecovas is found at depths ranging from about 100 to 1,450 feet in the county.

The Tecovas formation is not known to yield water to wells in Winkler County.

SANTA ROSA SANDSTONE

The Santa Rosa sandstone, 200–350 feet thick where the full section is present in Winkler County, overlies the Tecovas formation and

underlies the Chinle formation equivalent, or the Cenozoic alluvium where that unit is absent. A full or partial section of Santa Rosa sandstone is present everywhere in the county except in the area southwest of Wink, where the entire Triassic section has been removed by erosion (well F–31, pl. 3). Plate 6 shows the altitude of the base of the Santa Rosa throughout the county.

The Santa Rosa sandstone consists of reddish-brown and gray medium- to coarse-grained, subangular arkosic, micaceous, and conglomeratic sandstone cemented with calcite and some silica. The sandstone is typically crossbedded and is interbedded with soft red and green shale and siltstone.

The Santa Rosa sandstone is the principal fresh-water aquifer in the county. The occurrence of ground water in the Santa Rosa and associated alluvial deposits is discussed in detail on pages 22–23.

CHINLE FORMATION EQUIVALENT

The Chinle formation equivalent, ranging in thickness from 0 to about 1,000 feet in Winkler County, is the top formation of the Dockum group. It conformably overlies the Santa Rosa sandstone and unconformably underlies Cretaceous and Cenozoic rocks. The Chinle formation equivalent crops out in a very narrow band near Concho Bluff; however, owing to the small extent of the outcrop, it is not shown on the geologic map. The formation is present in the subsurface of the eastern part of the county and much of the northern part, but owing to erosion it is absent in the southwestern part of the county and on the structural high in the west-central part (pls. 2, 4, 8).

The Chinle formation equivalent consists of brick-red to maroon and purple shale and thin beds of fine red or gray sandstone and siltstone. Green and gray mottling and yellow streaks are common in the shale. The beds of sandstone are of a finer texture than those of the underlying Santa Rosa. Locally, limestone beds several feet thick are found in the formation.

The Chinle formation equivalent is not known to yield water to wells in Winkler County.

CRETACEOUS SYSTEM

TRINITY GROUP

The Trinity group, which has a maximum thickness of about 100 feet where it crops out to form the base of Concho Bluff in northeastern Winkler County, unconformably overlies the Chinle formation equivalent. The Trinity consists of sandstone, siltstone, conglomerate, and gravel cemented with carbonate minerals. In a few places silica-cemented zones are found.

Although the Trinity group is the principal source of water in neighboring Ector County, it yields only small quantities of water of good chemical quality to a few wells in the extreme northeastern part of Winkler County. Most of the beds of the Trinity group lie above the water table in the county.

FREDERICKSBURG GROUP

The Fredericksburg group, 0–50 feet thick, overlies the Trinity group in northeastern Winkler County. The Fredericksburg consists of gray to cream and brown hard to earthy fossiliferous and sandy marine limestone. Solution cavities, some of which may be seen in the face of Concho Bluff, are common in the limestone.

Like most of the Trinity group, the rocks of the Fredericksburg group are not water bearing in Winkler County.

CENOZOIC ERA

TERTIARY AND QUATERNARY SYSTEMS

CENOZOIC ALLUVIUM

The Cenozoic alluvium unconformably overlies rocks of Permian, Triassic, and Cretaceous ages in Winkler County. The thickest alluvial sediments were deposited in the slumpage trough on the eroded surface of the rocks of Triassic age. The final establishment of the erosional surface took place in Cenozoic time prior to and during the deposition of the alluvium.

The alluvium consists of unconsolidated sand, silt, gravel, clay, and caliche and has an average thickness of about 100 feet except in the trough, where it has a maximum thickness of 1,050 feet. Thin beds of gravel are reported in the alluvium in the central basin platform, whereas in the slumpage trough in west-central Winkler County individual gravel beds have been found to be as much as 90 feet thick. Clay beds as much as 200 feet thick also occur in the deep alluvium.

The lower part of the alluvium is similar in color to the underlying Triassic and Permian red beds and is difficult to distinguish on the basis of color; however, the two may be distinguished readily by differences in radioactivity. Except where the Cenozoic rocks are in contact with the Santa Rosa sandstone, their radioactivity as measured by the gamma-ray curve of radioactivity logs is much less than that of the underlying Triassic and Permian rocks (wells D–10, E–14, and E–5, pl. 2). Where the Cenozoic and Santa Rosa are in contact, the drillers' logs generally are the best means of determining the contact.

The occurrence of water in the Cenozoic alluvium is discussed in detail on pages 22–23.

QUATERNARY SYSTEM

SAND DUNES

A belt of sand dunes 8–15 miles wide extends southeastward through the eastern part of Winkler County (pl. 1). A part of the belt (2–4 miles wide) consists of high shifting dunes, making up an area almost entirely devoid of vegetation. The remainder of the dunes are captured and support sparse vegetation. The dune sand ranges in thickness from 0 to about 250 feet, the thickness being greatest in the area of the high dunes.

Although the dune sand yields small quantities of water of good quality to pits and a few wells, its chief importance is as an excellent recharge facility to the underlying formations.

GROUND WATER

SOURCE AND OCCURRENCE

The principal fresh-water aquifers underlying Winkler County are the saturated zones in the Santa Rosa sandstone and the Cenozoic alluvium. They are part of extensive aquifers underlying a large area in west Texas and eastern New Mexico. The source of all fresh water to the aquifers is precipitation, part of the water being derived from precipitation within the county and part from areas to the north and northeast. The Santa Rosa obtains its water principally from water percolating through the Cenozoic deposits where the two formations are in contact; the base of the Santa Rosa is the lowest limit of fresh water in the county. The source of water to the older saline water-bearing formations, in addition to that entrapped at the time of their deposition, is underflow into the county from their outcrop areas and leakage from overlying formations.

The Santa Rosa sandstone and Cenozoic alluvium are separate aquifers where the relatively impermeable material of the Chinle formation equivalent is present between them. The Chinle formation equivalent confines water in the Santa Rosa under artesian pressure, whereas water in the Cenozoic alluvium is unconfined and occurs under water-table conditions. Where the Chinle formation equivalent is absent the Santa Rosa and alluvium are in contact, forming a single unconfined aquifer.

The Santa Rosa sandstone is the most extensive of the two aquifers and has no lateral boundaries in Winkler County. The Cenozoic alluvium extends into New Mexico and adjoining counties, but as an aquifer it is discontinuous in areas where it is not water bearing, and it is missing where older formations crop out (pl. 1).

Water fills the pore spaces of the granular material of the aquifers. The porosity is the proportion of pore space to the total volume of material and is independent of grain or pore size. Thus, a unit volume of clay or silt may contain as much water as, or more water than, a unit volume of sand or gravel. The ability of the aquifers to transmit water is called "permeability" and is largely a function of the pore size—the larger the pore spaces the more readily the material will transmit water. The Santa Rosa generally stores less water and is less permeable than the unconsolidated materials of the Cenozoic alluvium, because it is more compact and cementing material fills some of the pore space. However, in some places the Santa Rosa has been fractured and large openings have been created, which locally may make the aquifer more permeable than the coarsest material in the Cenozoic alluvium.

The occurrence of water in the older, saline-water-bearing formations is discussed in this report only as it pertains to the pollution of the fresh-water aquifers.

MOVEMENT OF GROUND WATER

Plate 8 shows by contours the configuration of the water table in the Cenozoic alluvium in Winkler County in 1956. Insufficient data are available to contour the piezometric surface of the water in the Santa Rosa, but the altitudes of water levels in a few wells in the Santa Rosa are shown.

The configuration of the water table is related to the direction of ground-water movement but is also a reflection of such things as differences in recharge rates and transmitting properties of the aquifer, of discharge areas, and of irregularities of the underlying confining beds. Hydrologic data indicate that ground water in Winkler County probably moves as follows: A relatively small amount of water moves into the county from the northeast. Recharge from the land surface increases the quantity as flow continues southwestward, the natural recharge being greatest in the sand-dune area in the eastern part of the county. The flow through the Cenozoic alluvium is decreased in an area north-northeast of Kermit, where a part of the water moves downward from the Cenozoic into the underlying Santa Rosa, forming the chief means of recharge of that formation in the report area. In the vicinity of Kermit, withdrawals from industrial and public-supply wells also tend to decrease the flow through the Cenozoic alluvium. A few miles west of Kermit the flow tends to be increased substantially by recharge from industrial wastes. Underflow from this area, where the contours on plate 8 are widely spaced, appears to be divided principally into two components—one toward the thick

deposits in the structural trough to the west, the other southward to the county line in the area east of the trough. The alluvium at the east edge of the county is not water bearing; consequently, the water moving into the trough is presumed to move southward through the trough.

The altitudes of water levels in wells tapping the Santa Rosa (pl. 8) in the area north-northeast of Kermit are higher than those in surrounding areas in the county east of the structural trough. Thus, water in the Santa Rosa appears to move in all directions away from the area where it enters the formation from the overlying Cenozoic alluvium.

Water from the Santa Rosa sandstone generally is more mineralized in the far northern and eastern parts of the county than in the central and southern areas. The higher mineralization suggests that the movement of water toward the east and north is very slow compared to movement toward and south of Kermit, where the quality of the water in the Santa Rosa sandstone is similar to that of the fresh water in the alluvium. The chemical quality of the water and its relative rate of movement in the Santa Rosa sandstone in the rest of the county, east of the structural trough, is unknown.

West of the trough the altitudes of water levels in wells in the Santa Rosa suggest that water moves into the trough and southeastward along it. Water west of the trough is of good quality.

RECHARGE

NATURAL RECHARGE

Most of the precipitation in Winkler County is evaporated or consumed by plants; only a small part recharges the aquifers. The aquifer is substantially recharged only when intense storms of long duration or of frequent occurrence moisten the soil enough that deep percolation takes place. However, such climatic conditions are infrequent.

The area most favorable for recharge is a belt of sand dunes 8–15 miles wide extending northwestward across the eastern part of the county (pl. 1). The thickness and permeability of the material in this area are such as to permit much of the water to percolate rapidly past the zone—the soil and shallow subsoil—from which water is discharged by evaporation and transpiration. Elsewhere in the county the sandy mantle absorbs water rapidly, but it may be underlain at shallow depths by finer material, which retards downward percolation. A determination of the amount of natural recharge in Winkler County is beyond the scope of this investigation.

ARTIFICIAL RECHARGE

In parts of the county, the Cenozoic alluvium is—and for some time has been—recharged at a substantial rate by oil-field waste water. The area most heavily recharged is about 4½ miles west-southwest of Kermit. Although the nature of the surface material does not make this area more favorable for recharge from precipitation than other areas in the county, plate 8 shows that the water table is mounded beneath the area. Waste water leaking from earthen disposal pits for many years appears to be the cause of the greater rate of recharge. Many pits, generally near the separators that gather fluid from producing oil wells in the Hendrick oil field, are the receptacles for the waste water. Ideally they lose water only by evaporation, but evaporation losses are retarded by the film of oil that floats on the surface of the water, and much of the water is lost by seepage through the bottoms and sides of the pits. Other areas in the county where oil is produced also are recharged with waste water, but to a lesser extent than in the Hendrick field. Further evidenec of recharge from industrial wastes is discussed on pages 44–49.

Generally, oil-well waste water is highly mineralized, and the amount of evaporation that does take place increases the concentration. Thus, recharge from this source pollutes the fresh water aquifer. The amounts and chemical quality of the produced waste water and its effect on the chemical quality of ground water are discussed on page 44.

The amount of artificial recharge from other sources, such as irrigation waste water and sewage, is not known but is probably small.

DISCHARGE

Ground water is discharged at the land surface in Winkler County through wells, and by evapotranspiration where the water table is close to the land surface. Underflow from the county southward ultimately is discharged in the Pecos River valley. There is no spring flow or effluent seepage to streams in the county.

In 1956, water wells discharged about 8 mgd of fresh water and about 3 mgd of saline water. More than half the fresh water and nearly all the saline water is pumped by the oil industry. In addition to the production from water wells, more than 20 mgd of saline water was produced with the oil from oil wells in 1956.

The fresh water is derived from both the Cenozoic alluvium and the Santa Rosa sandstone; the saline water is derived from many older formations, but principally those producing appreciable quantities of oil. A more detailed summary of withdrawals from wells by use and by location is included in following sections of this report.

The principal area of natural ground-water discharge is on the southwest side of the sand dunes, along the base where the water table is very close to the land surface. Large but undetermined quantities of water are evaporated from the soil and transpired by the vegetation, which is much denser here than elsewhere in the county. Ground water is discharged by evapotranspiration also in a few other scattered areas in the county where the water table is close to the land surface. The areas were not mapped nor was the quantity of discharge from them determined.

The concentration of withdrawals from wells in Kermit and the industrial area north-northwest of the city has noticeably depressed the water table in the Cenozoic alluvium. (See pl. 8.) Water moves laterally toward the pumped wells, and cone-shaped depressions are formed in the water table in the centers of withdrawal. The quantity of water pumped is directly related to the volume of the cones because practically all of it is derived from storage. The cones will continue to enlarge until they intercept an area where the recharge can be increased or the natural discharge can be decreased enough to equal the rate of pumping. This balanced condition is unlikly to occur within the foreseeable future, because of the slow rate of development of the cones and the remoteness of areas where enough water can be intercepted. Thus, water will continue to be withdrawn principally from storage except as it is replaced by oil-field waste water.

STORAGE OF FRESH WATER

Some tens of millions of acre-feet of fresh water is stored in the Cenozoic alluvium and Santa Rosa sandstone beneath Winkler County. Parts of the formations are unexplored, and accurate estimates of the quantity of water in them cannot be made with present data. However, the explored part of the aquifers contains about 20 million acre-feet. The deep alluvium and Santa Rosa sandstone in the structural trough form the largest unexplored part of the aquifers; the deposits of the Santa Rosa in the eastern third of the county also are unexplored. Part of the unexplored rocks may contain saline water, but a substantial part probably contains fresh water.

It is impractical to recover all the ground water in storage. The amount that will drain from the deposits by gravity may be as little as 50 percent of the total quantity, and the amount economically recoverable from wells may be only one-half to two-thirds of that amount. Thus, the quantity of water available for development from the explored rocks is probably about 5 to 7 million acre-feet.

UTILIZATION

Before the discovery of oil in 1926, fresh-water pits in the sand-dune area and shallow windmill wells scattered throughout the county supplied water to the population of less than 100 and to the stock on the extensive ranches. More and deeper wells were drilled to meet the demand for more water as the oil industry grew and the population increased. By 1956 most of the water was pumped from deep wells equipped with electrically powered turbine pumps. The following table shows the range in yields of wells and the estimated withdrawal of fresh water by use in Winkler County in 1956.

Yields of wells and withdrawal of fresh water in 1956, Winkler County, Tex.

Use	Number of wells	Yield per well (gpm)	Pumpage (mgd) Average	Pumpage (mgd) Total
Public supply:				
Kermit	9	160–400	1.67	
Wink	2	100–300	.08	
Oilfield camps	29	30–180	.18	
Schools	2	----------	.07	
				2.00
Industrial:				
Gasoline and other plants	77	30–300	1.82	
Waterflooding [1]	61	30–200	2.98	
				4.80
Irrigation:				
Includes parks and golf course	7	100–1,200	1.06	
				1.06
Stock and domestic	------	----------	.31	
				.31
Total (rounded)				8.2

[1] Waterflooding is the process of injecting water into oil-bearing formations to facilitate the recovery of the oil.

PUBLIC SUPPLIES

CITY OF KERMIT

In 1941 the city of Kermit assumed control of the municipal water system, which was formerly operated by the Community Public Service Co. The system at that time was supplied from two wells that tapped the Cenozoic alluvium. Well D–279, a well in the Santa Rosa sandstone, was incorporated into the system late in 1941.

In 1956 the city was using six wells that tapped both the alluvium and the Santa Rosa sandstone; the wells yielded 200–300 gpm each. All the wells are about 300 feet deep. In most of them the upper section of the saturated alluvium is cased off, because it contains large amounts of loose fine sand.

The wells that tapped only the Santa Rosa sandstone ranged in yield from 160–400 gpm in 1956. Well D–291, which was drilled 570 feet deep in the Santa Rosa sandstone by the city in 1957, yields about 400 gpm. Two other wells in the Santa Rosa (D–277 and D–299) drilled in 1957 were the most successful in the county, yielding on test

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1,200 and 1,875 gpm, respectively. Permanent pumps for the wells are designed to yield about 750 gpm.

In 1957 the capacity of the city's ground and overhead water-storage reservoirs was 1,655,000 and 150,000 gallons, respectively.

Figure 6 shows the increase in pumpage from the municipal wells

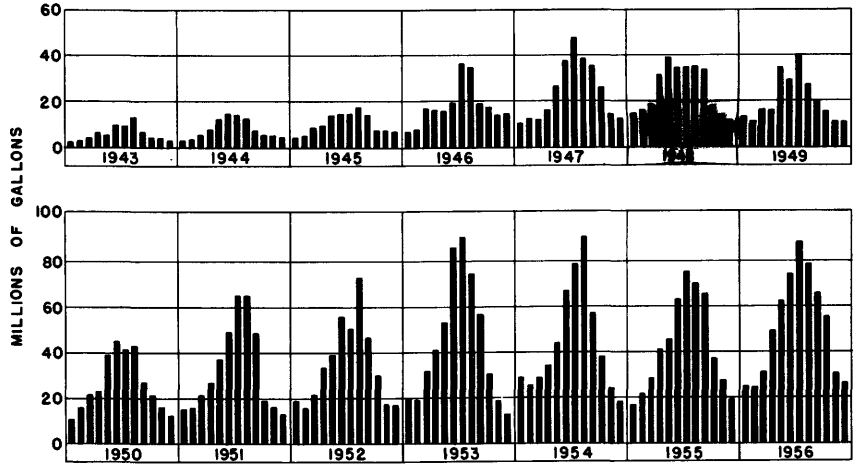

FIGURE 6.—Monthly pumpage from municipal wells in Kermit, Winkler County, Tex., 1943–56.

from 1943 through 1956. The large increase in withdrawals during the summer months is due chiefly to lawn irrigation and to cooling. The annual pumpage increased from 71 million gallons in 1943 to about 610 million gallons in 1956.

CITY OF WINK

From 1930 to 1953 the city of Wink had three wells that tapped the alluvium for its municipal water supply. The wells, 165–250 feet deep, yielded 30–210 gpm. Well G–109, the last of these wells to be used, was abandoned in April 1957 because of an increase in the mineralization of the water.

After April 1957 all the water for the city of Wink was supplied by wells G–110 and G–111, drilled in 1953. Both wells, 240 feet deep, are cased with 16-inch pipe to about 180 feet and uncased below that depth. Well G–110 yields about 300 gpm, whereas well G–111 yields only about 180 gpm with a drawdown of about 80 feet after pumping 2 hours.

In 1956 the total capacity of the overhead and ground-storage reservoirs was about 96,000 gallons. In 1957 the city installed another ground-storage tank having a capacity of 420,000 gallons.

The water system of the city of Wink had about 450 customers in 1956, and the pumpage for the year was about 30 million gallons.

OIL-FIELD CAMPS

Twelve large camps have been built in Winkler County for the families of oil-company personnel. Each camp has from 5 to 43 houses and its own water wells and distribution system. Smaller camps, serving as field offices and having housing facilities for employees, also have their own water wells and distribution systems. The combined withdrawal by the 12 major camps in Winkler County averaged about 180,000 gpd in 1956.

Of the 12 large camps, 9 are in the industrial area north-northwest of Kermit (grid D, pl. 1). Of the 24 wells, 13 serving the camps draw water from the Cenozoic alluvium, 2 draw water from the Santa Rosa sandstone, and 9 draw water from both aquifers. The wells yield 30–180 gpm and range in depth from 156 to 600 feet. The pumpage in 1956 for the 9 camps was about 53 million gallons of water—an average of about 145,000 gpd.

Of the 3 other camps at or in the vicinity of Wink, the camp at Wink has a field office and about 25 houses to which water is supplied from 2 wells that tap the alluvium, and a large camp 2 miles west-southwest of Kermit and another camp 5 miles east of Wink are supplied by 3 wells tapping both the alluvium and the Santa Rosa sandstone. About 12 million gallons of water was used by the 3 camps in 1956.

INDUSTRIAL SUPPLIES

Industry used more than half the fresh water pumped in Winkler County in 1956 and all the saline water. Most of the fresh water and all the saline water was used for waterflooding in connection with secondary-recovery projects in oil fields. The secondary-recovery projects used about as much saline water as fresh water in 1956.

INDUSTRIAL PLANTS

In Winkler County, plants were engaged in the extraction of gasoline from natural gas in 1956, of which 2 are about 3½ miles north-northwest of Kermit; 1 is about 6 miles north-northeast, and the other is about 4½ miles south. The combined rate of ground-water withdrawal by these plants in 1956 averaged about 660,000 gpd from 17 wells, 7 of which tap the Cenozoic alluvium and 10 the Santa Rosa sandstone. The wells range in depth from 110 to 275 feet and yield 30–300 gpm. Some have reciprocating cylinder pumps powered either by internal-combustion engines or by small electric motors, but most of the wells are equipped with turbine pumps powered by electricity.

A carbon-black plant about 4 miles north of Kermit used about 400,000 gpd in 1956 from 2 wells that tapped the alluvium (D–136 and D–137). Pipeline and compressor plants used an average of about 480,000 gpd. The 9 largest pipeline and compressor plants are scattered throughout areas D and G, shown on plate 1; the 2 largest plants are in the northern half of area D. In 1956 the 9 largest plants operated 17 water wells, most of which had turbine pumps powered by electric motors. Of the 17 wells, 8 tap the Cenozoic alluvium, 2 tap the Santa Rosa sandstone, and 7 tap both aquifers. The wells range in depth from 120 to 600 feet and yield 30–185 gpm.

WATERFLOOD PROJECTS

Waterflooding, one of the methods used in the secondary recovery of oil, involves injecting water under pressure through strategically spaced wells that tap the oil zone. The injected water raises the pressure head in the reservoir and displaces the oil, pushing it as a "front" or "bank" toward the oil-producing wells. Waterflooding projects were started in Winkler County in 1943, and only fresh water was used until 1952. By the end of 1950, 5 oil operators were using the process; in 1956, 17 operators were using it. One of them reports that a waterflooding project may last 9 or 10 years; others report that their projects may last longer.

Some of the operators consider waterflooding in Winkler County an economically successful venture; others are unsure and wish first to evaluate the results. Figure 7 shows that the use of fresh water for flooding has increased steadily since 1943. The use of highly saline water (10,000–35,000 ppm of dissolved solids) has remained relatively constant since 1953; moderately saline water (3,000–10,000 ppm of dissolved solids) was not used in appreciable quantities until 1956. Some of the oil operators report that, although their waterflooding programs will increase in scope, their use of fresh water will decrease because they plan to recycle the saline water that is produced with the oil. Table 3 shows that large quantities of saline water are available from oil wells.

FRESH WATER

About 3,340 acre-feet, or more than 1 billion gallons, of fresh water was used in waterflooding projects in Winkler County in 1956, making this industry the largest single consumer of fresh water. In 1956, 61 fresh-water wells were used as supply wells for waterflooding: 31 tap the Cenozoic alluvium, 5 tap the Santa Rosa sandstone, and 25 tap both aquifers. All the wells have turbine pumps powered by electric motors. Some wells are about 100 feet deep, but most are between 200 and 500 feet deep. Of the wells, 46 are in area D, 12 are in the northern half of area G, and 3 are in the western half of area C. (See pl. 1.)

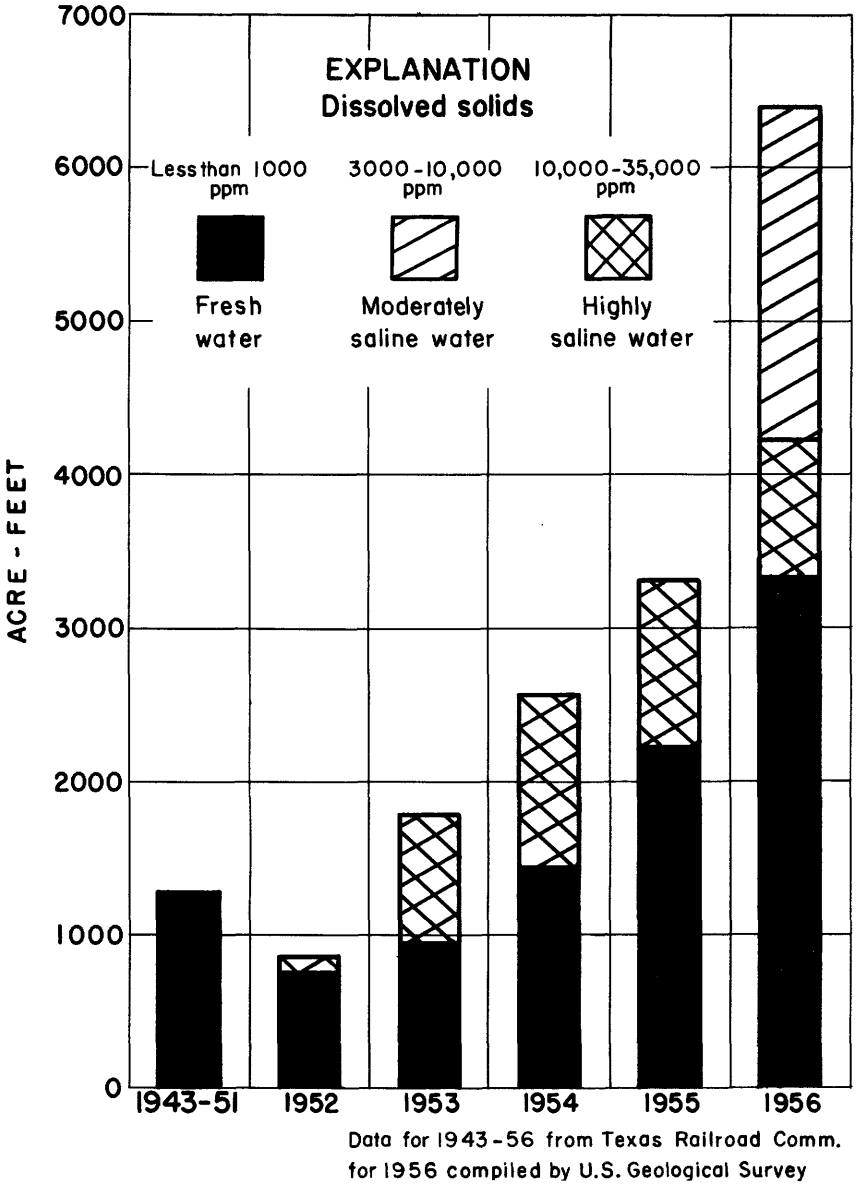

FIGURE 7.—Quantity and quality of water used in waterflooding projects in Winkler County, Tex.

TABLE 3.—*Quantity of water produced with oil in Winkler County, Tex., 1957*

[Data from operating companies]

Field name of well	*Number of wells in production*	*Water diverted to disposal pits (gallons per day)*
Block 20 (Delaware sand)	3	2, 650
Circle 2 (Fusselman)	2	5, 630
East Jasper (Mississippian)	?	210
Eaves	10	49, 000
Emperor	199	72, 800
Emperior (deep)	60	4, 830
Emperor (Holt)	46	12, 100
Flying "W"	4	7, 600
Halley	65	4, 840
Halley (Devonian)	5	24, 500
Halley (Ellenburger)	2	5, 370
Halley (Glorieta)	?	1, 770
Halley (Montoya)	4	20, 900
Henderson	37	1, 520, 000
Hendrick	255	14, 500, 000
Kermit	762	1, 100, 000
Kermit (Ellenburger)	9	630
Kermit (Fusselman)	2	6, 340
Kermit, South (Ellenburger)	3	2, 230
Keystone (Colby sand)	436	108, 000
Keystone (Devonian)	84	3, 280
Keystone (Ellenburger)	128	207, 000
Keystone (Holt)	109	24, 300
Keystone (Lime)	117	60, 300
Keystone (McKee)	?	504
Keystone (Silurian)	48	36, 400
Keystone, South	14	4, 370
Leck	18	141, 000
Monahans, North	7	1, 070
Monahans, North (Devonian)	5	232
Monahans, North (Ellenburger)	4	2, 500
Monahans, North (Glorieta)	3	2, 450
Monahans, North (Waddell)	1	581
Scarborough	117	19, 400
Scarborough, North	2	88
TXL (San Andres)	?	252
Ward-Estes, North	?	2, 310
Weiner (Colby sand)	64	14, 800
Wheeler (Devonian)	35	16, 000
Wheeler (Ellenburger)	29	153, 000
Wheeler (Silurian)	8	746
Wheeler, Northwest (Ellenburger)	1	9, 500
Wight Ranch (Clear Fork)	2	1, 680
Wight Ranch (Ellenburger)	1	7, 460
Totals (rounded)	2, 700	18, 000, 000

SALINE WATER

In 1952 several oil operators started using saline water for waterflooding. The water is treated before it is injected, to inhibit corrosion. Some operators use moderately saline water from the oil strata in the Seven Rivers and Grayburg formations; others use water from the Rustler formation. Most of the water from the Rustler formation used for waterflooding in 1956 was highly saline, some was

moderately saline, and a small part was considered a brine, having more than 35,000 ppm of dissolved solids.

Some test wells drilled to the Rustler formation have produced no water; others have produced as much as 800 gpm. The variation in yield from place to place results from the irregular occurrence of cavernous openings in the limestone formation. Six wells, 1,000–1,300 feet deep, in area D (pl. 1) produce water from the Rustler formation for waterflooding.

One oil company drilled wells G–9, G–37, G–40, G–41, and G–42 into the Grayburg formation in Winkler County, for waterflooding at Goldsmith in Ector County. The wells average about 3,550 feet in depth and are equipped with deep-well turbine pumps powered by electric motors. The water is piped from these wells in Winkler County about 30 miles to Goldsmith, where approximately 1 mgd was used for waterflooding in 1956. The same company also used more than 1 mgd for waterflooding in Winkler County in 1956. This supply came from several oil wells in the Hendrick field, which produce large amounts of water from the Seven Rivers formation.

OTHER INDUSTRIAL USES

Other industrial uses of fresh water include (a) water to make drilling fluid for the drilling of oil wells by the rotary method; (b) water to flush out underground salt deposits for storage of liquefied petroleum gases; (c) water to seal wooden tanks for storage of crude oil.

During 1956 several counts were made of the number of rotary drilling rigs in operation. The number ranged from about 30 to 40. Generally a water well is drilled close to the oil test, but in a few places several rigs are served from one well through a common distribution system. One driller estimated his daily use of water per well to be between 1,500 and 2,500 gallons. Some of the water wells have been abandoned because oil tests were unsuccessful, or because drilling was terminated when the field was fully developed; but most of the wells have been placed on "standby" to be used when drilling is resumed.

One oil operator uses water to flush salt from the ground to create storage space for liquefied gas. It was estimated that more than 30 million gallons of fresh water was used for this purpose in 1956.

Wooden oil-storage tanks are still used in Winkler County. Several oil operators use fresh water to expand the wood in order to keep the tanks leakproof.

IRRIGATION SUPPLIES

Irrigation in Winkler County is still in the experimental stage. In most of the county the root zone is deep and the soil has a low

moisture-holding capacity, moderate to low fertility, a high susceptibility to wind erosion, and a high water-intake rate, owing to its coarse texture (Soil Conserv. Service, 1953, p. 5). Because of the excellent subsurface drainage in most places, highly mineralized water may be used for irrigation with little danger of salts accumulating in the soils. Some farmers in the area report that they are able to use water having 1,000–2,000 ppm of dissolved solids.

Of four wells used to irrigate feed crops and vegetables in Winkler County in 1956, three (G–161, G–162, and G–163) tap the deep Cenozoic alluvium about 5 miles south of Wink, apparently producing enough water of suitable quality for irrigation of a few hundred acres of land. In 1956 the wells produced nearly 1,000 acre-feet of water. Well D–261, which taps the Santa Rosa sandstone near Kermit, yields considerably less water; it is used to irrigate 1 acre of feed crops and vegetables.

Wells F–8 and C–52 irrigate the Winkler County golf course and G–298 irrigates the Winkler County park, in the eastern part of Kermit. About 38 million gallons of water was used from these wells in 1956. The total use of water for irrigation in 1956 averaged only about 1 mgd.

STOCK AND DOMESTIC SUPPLIES

Most of the stock and domestic wells in Winkler County are equipped with windmills; the rest are equipped with pumps powered by electricity or gasoline.

Some of the wells are as much as 1,200 feet deep, but most are less than 300 feet. The yields range generally from 1 to 5 gpm. About 200 domestic and stock wells tap the Cenozoic alluvium, 18 tap the Santa Rosa sandstone, 12 tap both formations, and 2 (B–9 and B–14) in the northeastern part of the county draw water from rocks probably of Cretaceous age. The combined withdrawal for stock and domestic use in 1956 was small in comparison to the total withdrawal for all uses and is estimated to have been about 310,000 gpd.

PUMPING TESTS

Pumping tests were made on a few wells in Winkler County to determine locally the water-bearing properties of the fresh-water aquifers tapped by the wells. Owing to the lack of suitable wells, testing of a representative sample of wells throughout the county was impossible. The results of the tests are applicable only within a small area around the tested wells and should not be the basis for predictions of well-field performance over long periods of time.

The principal hydraulic characteristics of a water-bearing material are the coefficient of transmissibility and the coefficient of storage.

These characteristics, which govern the ability of aquifers to transmit and store water, may be determined from pumping tests.

The coefficient of transmissibility is expressed as the amount of water, in gallons per day at the prevailing temperature of the water, that will flow through a vertical strip of the aquifer 1 foot wide extending the full saturated height of the aquifer under a hydraulic gradient of 1 foot per foot (Theis, 1935, p. 520). It may also be expressed as the volume of water, in gallons per day, that will flow through a vertical strip of the aquifer 1 mile wide extending the height of the saturated aquifer under a hydraulic gradient of 1 foot per mile. The coefficient of storage is the volume of water released from or taken into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface. Under artesian conditions the volume of water released from or taken into storage is determined by the compressibility of the aquifer and expansion of the water. Under water-table conditions the coefficient of storage is practically equal to the specific yield, which is the volume of water involved in gravity drainage or refilling, divided by the volume of the material drained or filled.

The yield per unit drawdown of a well would be greater than that of a similarly constructed well if either or both of the coefficients of transmissibility and storage were greater. Other things being equal, well yield is approximately proportional to the coefficient of transmissibility.

In this investigation the Theis nonequilibrium formula (Theis, 1935, p. 519–524) was used to analyze the pumping tests and the Theis recovery method (Wenzel, 1942, p. 95–97) was used to analyze the recovery data of pumped wells.

CENOZOIC ALLUVIUM

Most of the large wells that tap the alluvium produce water only from the lower part of the saturated sand and gravel. The upper part in many places contains fine sand, which is difficult to screen, and in some areas the shallow alluvium contains polluted water. Wells that tap a representative section of the alluvium and that are suitable for testing were found only in the area of the slumpage trough.

A pumping test was made in March 1957 at well G–163, which taps the deep Cenozoic alluvium in the trough about 5 miles south of Wink (fig. 8). The well taps the Cenozoic alluvium at a depth interval of 320–400 feet. The radioactivity log of a nearby well (G–165) indicates that the section of alluvium is at least 600 feet thick, about 475–500 feet of which may be saturated. The coefficient of transmissi-

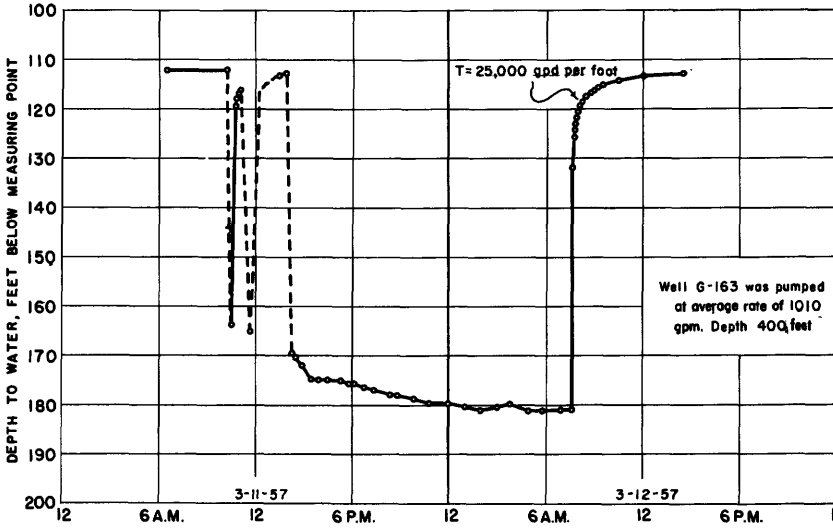

FIGURE 8.—Results of pumping test of well G–163, Winkler County, Tex.

bility as determined during the recovery of the water level in the well was 25,000 gpd per foot; however, this is not representative of the full thickness of the alluvium, which may be considerably greater than the screened section.

On the basis of the coefficient of transmissibility derived from the test, the theoretical drawdowns for different periods of continuous pumping at different distances from a well discharging 1,000 gpm have been computed, by assuming a coefficient of storage of 0.15 (fig. 9). The assumed coefficient of storage is typical of many areas where ground water occurs under water-table conditions. The figure illustrates conditions in an extensive and homogeneous aquifer. Because of inhomogeneities or boundaries, actual drawdowns may be appreciably greater or less than those indicated.

Wells yielding more than 1,000 gpm from the Cenozoic alluvium were found only in the deep trough south of Wink. The thickness of saturated deposits in the trough ranges from about 100 feet near the edge to more than 1,000 feet near the center (pl. 3).

Most of the wells, other than windmill wells, that tap thinner sections of Cenozoic alluvium yield between 100 and 300 gpm. The alluvium in Winkler County, excluding the area of the deep alluvial trough, has an average thickness of about 100 feet.

SANTA ROSA SANDSTONE

Pumping tests were made on 5 wells that tap the Santa Rosa sandstone—3 municipal wells in Kermit (D–277, 291, 299), 1 well 5½

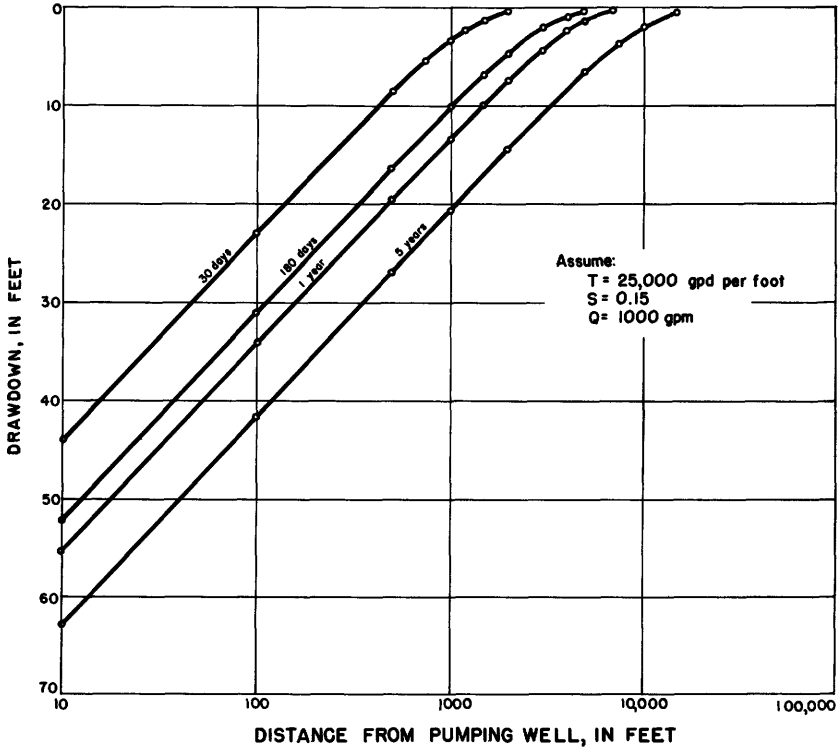

FIGURE 9.—Theoretical drawdown due to pumping, in an infinite aquifer.

miles north of Kermit (D–49), and 1 well 4 miles east of Wink (G–92). Water levels were observed in well D–293 while well D–299 was being tested, and in well D–279 while well D–291 was being tested. Coefficients of transmissibility were determined from all tests except the one on well G–92.

The data and results of the pumping tests on the city wells are summarized on figures 10 to 12 and in table 4. The entire thickness

TABLE 4.—*Results of pumping tests on wells tapping the Santa Rosa sandstone at Kermit, Winkler County, Tex.*

Discharge well	Observation well	Part of hydrograph analyzed	Coefficient of transmissibility (gpd per ft)	Coefficient of storage	Thickness of sandstone section as determined from electric logs (feet)
D–291	D–291	Recovery	25,000		192 (full section)
299	291	Drawdown	24,000	0.00025	192
299	291	Recovery	24,000	.00027	192
299	293	Drawdown	25,000	.00029	
299	293	Recovery	24,000	.00025	
299	299	do	37,000		66
277	279	Drawdown	13,000	.00025	192
277	279	Recovery	13,000	.00024	192
277	277	do	12,000		107

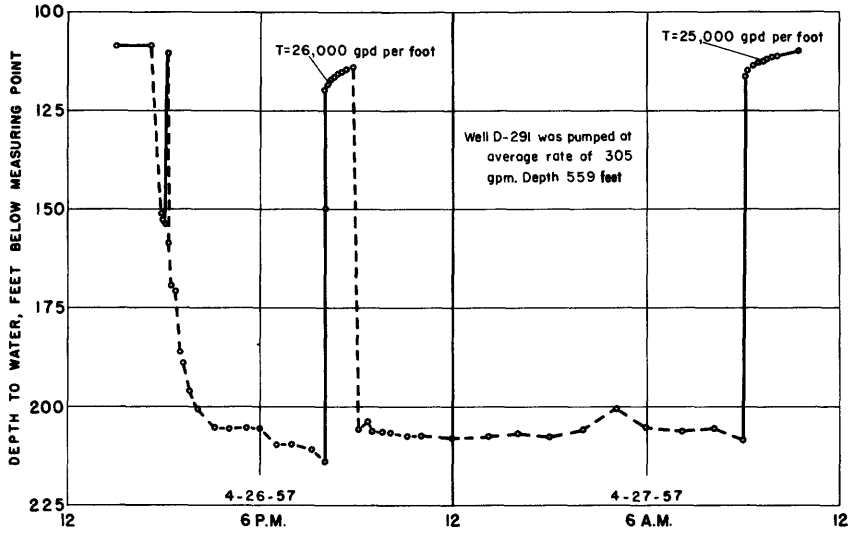

FIGURE 10.—Results of pumping test of well D–291, Winkler County, Tex.

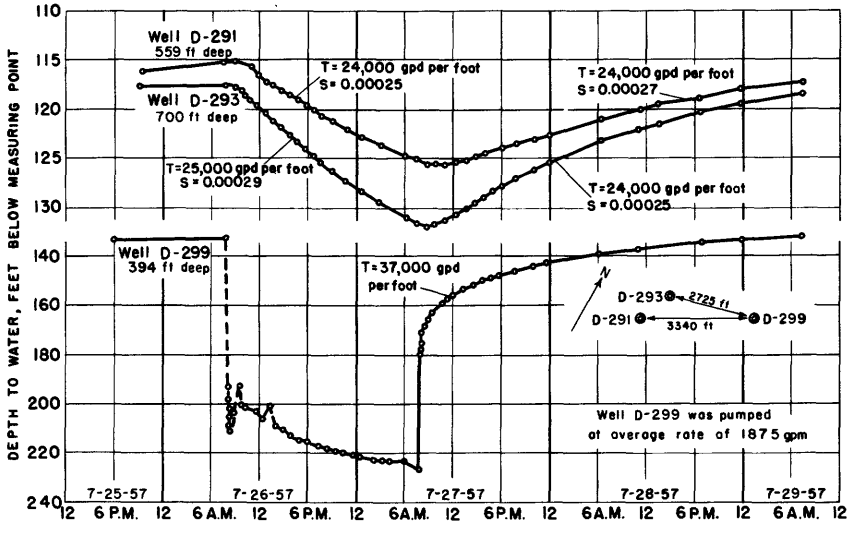

FIGURE 11.—Results of pumping test of well D–299, Winkler County, Tex.

of the Santa Rosa was tested only in well D–291; well D–277 penetrated about two-thirds of the formation, and well D–299 penetrated less than one-half. The results show that in the tested area the coefficient of storage ranges from 0.00024 to 0.00029, and the coefficient of transmissibility ranges from at least 37,000 gpd per foot at well D–299 at the east edge of the city to perhaps as little as 12,000 gpd per foot

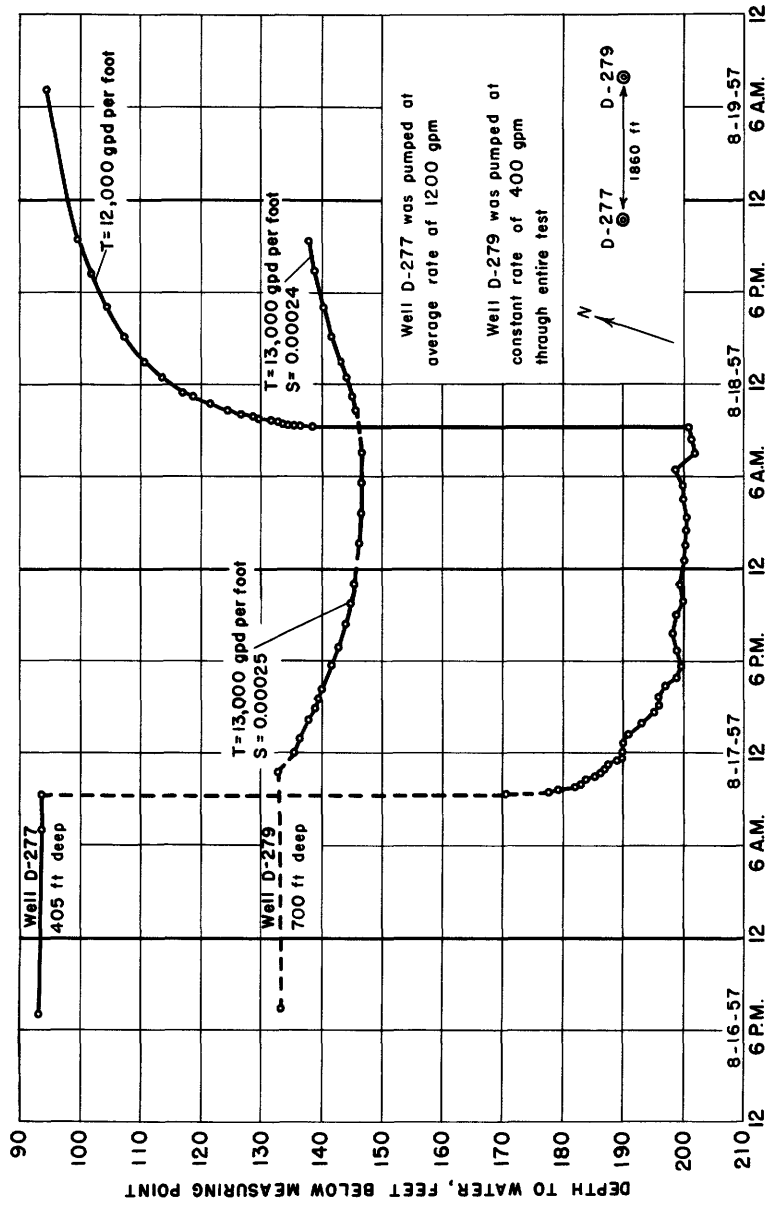

FIGURE 12.—Results of pumping test of well D-277, Winkler County, Tex.

at well D–277 on the west side of town. However, the large yield of well D–277 suggests that the computed value for transmissibility may be in error. The transmissibility at well D–299 was determined from the first half hour of the water-level-recovery data and reflects conditions close to the pumped well, whereas values from the observation wells were determined from later data and indicate average conditions over a more extensive area. The coefficient of transmissibility in the more extensive area is about 25,000 gpd per foot.

The pumping tests, electric logs, and yields of other wells in the Santa Rosa sandstone indicate that the highly productive zone found at Kermit is not extensive in all directions. A study of the electric logs of wells that tap the Santa Rosa suggests that the formation at Kermit is more permeable than it is north and south of Kermit. The yields of all other water wells that tap the Santa Rosa are much smaller than those of the three wells tested at Kermit. However, the water-bearing properties of the formation are unknown throughout most of Winkler County, informative data on this area southeast of Kermit being especially scarce.

The analysis of data from the pumping test suggests a hydrologic barrier, probably a less permeable portion of this aquifer, near pumped well D–299. Data from the two observation wells (D–291 and D–293) may be used to determine the position of a point on the boundary if the boundary actually does prevent the movement of water and if the aquifer has certain other idealized properties. Although conditions are not ideal and the boundary undoubtedly is only a less permeable part of the aquifer, the position as calculated from the data may be considered approximately correct.

The data were analyzed by the "method of images" described by Ferris (Wisler and Brater, 1949). The position of the point on the hypothetical boundary was determined by a graphical method devised by Moulder (Knowles and others, 1952, p. 94–95). Figure 13 shows the point to be about half a mile north of well D–299. Some of the test data from the other wells in the city also suggest that the highly productive zone in the Santa Rosa sandstone is limited in extent, but the data are not adequate for determining boundary locations.

Plates 4 and 6 show Kermit to be structurally lower than the area north and south. Whether the structure is related to the boundary condition is unknown. However, it is postulated that the permeable zone in the Santa Rosa at Kermit, which is probably due to fracturing, is associated with the structural pattern, and that the fractured zone is not extensive to the north. Further test drilling and test pumping are needed to define more accurately the extent and hydraulic characteristics of the highly productive fractured zone.

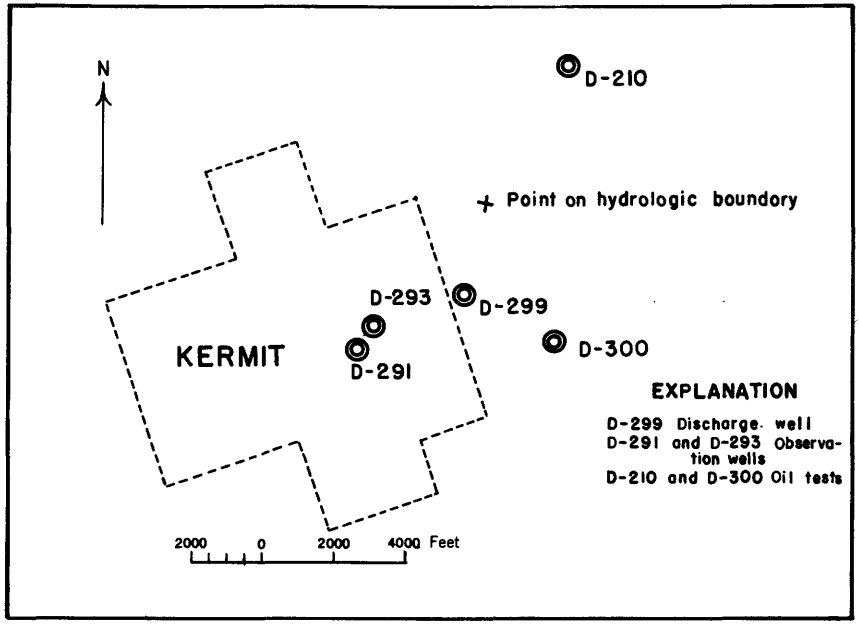

FIGURE 13.—Location of a point on a hypothetical hydrologic boundary near Kermit, Winkler County, Tex.

The pumping tests of wells D–49 and G–92 show that the transmissibilities at these sites are much less than those in Kermit.

QUALITY OF GROUND WATER

The quantity and character of the dissolved minerals in natural ground water depend on the physical structure and chemical composition of the rocks and soils that have been in contact with the water. The duration of contact, the temperature and pressure, and the minerals already dissolved are other factors that determine the chemical quality of the water. Contamination or pollution by various means may change the character of a water. Organic materials are the common polluting agents. However, pollution may result from mixing with highly mineralized water; such may be the case in some areas of Winkler County where highly mineralized water produced with oil is placed in earthen pits.

The largest use of ground water in Winkler County is that by industry and for public supply; consequently, importance is placed on the mineral constituents affecting the character of the water for such uses. Partial and preliminary analyses of 166 samples from 158 wells (table 9) include the determination, in parts per million, of silica, iron, calcium, magnesium, sodium and potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, nitrate, and dissolved solids. A

part per million is a unit weight of a constituent in a million unit weights of water.

An earlier investigation of the chemical character of ground water in Winkler County (Forbes, Lance, and Lang, 1941) gave results of analyses by chemists of the Works Progress Administration. The analytical methods used are not of the same order of accuracy as those of later analyses, but the results may be used to estimate the general quality of the water.

The chemical suitability of drinking water may vary from place to place. Standards set forth by the U.S. Public Health Service (1946) for water used by common carriers in interstate commerce, and generally accepted as standards for public supplies, are given below. The concentrations of chemical substances preferably should not exceed the following limits:

Constituent	*Parts per million*
Iron (Fe) and manganese (Mn) together	0.3
Magnesium (Mg)	125.
Sulfate (SO_4)	250.
Chloride (Cl)	250.
Fluoride (F)	1.5.
Nitrate (NO_3)	45.
Dissolved solids	500 (1,000 permitted).

Table 5 shows the chemical suitability, as compared to these standards, of the ground water of various formations in Winkler County. Samples were collected from particular areas throughout the county and are considered representative of such areas.

More than half the samples analyzed for fluoride had concentrations exceeding the limit of 1.5 ppm. Most of the public-supply wells, however, yielded water having concentrations within the limits, although some had water whose fluoride content was as high as 2.6 ppm. Data collected by various agencies have demonstrated that fluoride in the drinking water of children reduces the incidence of tooth decay (Dean, Arnold, and Elvove, 1942), but that concentrations exceeding 1.5 ppm may cause mottling of tooth enamel when the water is used continuously (Dean, Dixon, and Cohen, 1935).

Samples whose nitrate concentration exceeded 45 ppm came from 9 wells that were less than 150 feet deep. The high nitrate content may be the result of pollution from surface sources. In places where it is necessary to tap the extremely shallow water, special precautions should be taken during well construction to exclude possible seepage from surface sources. However, high nitrate content of some waters may be natural and not necessarily the result of pollution. Nitrate concentrations exceeding 45 ppm have sometimes caused the disease methemoglobinemia ("blue babies") in infants (Maxcy, 1950).

About two-thirds of the determinations from 158 wells show that the water contains less than 1,000 ppm of dissolved solids, and more than 80 percent of the analyses show less than 2,000 ppm of dissolved solids.

The principal constituents causing hardness of water are calcium and magnesium. An increase in hardness causes an increase of soap consumption in washing and laundering processes and of formation of scale in boilers and other equipment. About two-thirds of the samples from 148 wells for which hardness determinations were made show that the water needs to be softened for most domestic and many industrial uses. A hardness classification commonly used by municipalities is as follows: less than 60 ppm, soft; 61–120 ppm, moderately hard; 121 to 200 ppm, hard; and more than 200 ppm, very hard. Water whose hardness exceeds 200 ppm generally requires some softening before being used for most purposes.

Silica in certain concentrations forms a hard scale in boiler equipment. Moore (1940, p. 263) proposes the following permissible concentrations: Less than 150 psi (pounds per square inch of steam pressure), 40 ppm; 150–250 psi, 20 ppm; 251–400 psi, 5 ppm; and more than 400 psi, 1 ppm. Of 129 samples from wells of all formations, 46 contained more than 40 ppm.

Most of the ground water in the fresh-water aquifers of the county is suitable for irrigation. However, new supplies should be tested and compared with standards proposed by the U.S. Salinity Laboratory Staff (1954, p. 69–82) before using them for irrigation. These standards characterize irrigation water by the content of dissolved salts, the relative proportion of sodium to the other cations, the concentration of boron and other toxic elements, and sometimes the bicarbonate concentration in relation to the sum of the calcium and magnesium concentrations.

CENOZOIC ALLUVIUM

Most of the public-supply wells that tap the Cenozoic alluvium yield water of a chemical quality acceptable for drinking. However, table 9 shows that the fluoride content of public-supply wells D–47, D–137, D–138, D–278, D–294, E–15, and G–111 exceeds the limit set by the U.S. Public Health Service and may cause mottling of children's teeth.

Wells B–6, C–2, E–12, E–19, E–24, and H–64 in alluvium yield water having a nitrate content exceeding 45 ppm. These are shallow windmill wells that supply water to ranches, and may be polluted with organic matter from the surface.

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TABLE 5.—*Chemical suitability of ground water, by*

Geologic unit	Iron (Fe)		Magnesium (Mg)		Sulfate (SO_4)	
	Number of determinations	Number of values exceeding 0.3 ppm	Number of determinations	Number of values exceeding 125 ppm	Number of determinations	Number of values exceeding 250 ppm
All wells[1]	4	0	151	10	157	64
Cenozoic rocks	1	0	104	7	110	47
Cenozoic rocks and Santa Rosa sandstone	2	0	23	1	23	5
Cretaceous rocks	0	0	2	0	2	0
Santa Rosa sandstone	1	0	18	0	18	9
Rustler formation	0	0	2	2	2	2

[1] Includes 2 wells not identified with a formation.

About two-thirds of 102 samples collected from wells that tap alluvium had a hardness of more than 200 ppm, but most of the public-supply wells yield water having a hardness between 28 and 200 ppm. However, some wells tap alluvium in areas that have been polluted by oil-field wastes; they yield water having a hardness of as much as 6,330 ppm. Half of 86 water samples had silica concentrations of more than 40 ppm and in many of the remainder the concentrations exceeded 20 ppm.

Waterflooding projects in Winkler County use both fresh and saline water; much of the saline water is treated to reduce its corrosiveness. Most of the wells that tap the alluvium are used in waterflooding; they yield fresh water; however, well D–245, a polluted well, yields water having a dissolved-solids content of 71,100 ppm.

AREAS OF GROUND-WATER POLLUTION

The ground water in the Cenozoic alluvium seems to have been polluted in several areas in Winkler County. Probably most of the pollution has been caused by leakage from earthen disposal pits for saline water produced from oil wells. Plate 9 shows by a diagrammatic method (Stiff, 1951, p. 15–17) the relations of the principal ions in water from selected wells that tap the Cenozoic alluvium. The diagrams in figure 14 represent water from the oil-producing strata in the Hendrick field (table 5). The chemical constituents are represented by two diagrams. The shaded diagrams show the concentrations of cations and anions, in equivalents per million. The blank diagrams show the percentage relations of equivalents per million of the cations and the anions, commonly called "percentage reacting values."

The distinct similarity of the diagrams representing the water from Wells C–50, F–15, F–21, F–30, F–37, G–4, G–38, G–60, and G–109 (pl. 9), which tap the Cenozoic alluvium in the vicinity of the Hendrick oil field, and the diagrams representing the water produced with

geologic formation, in Winkler County, Tex.

Fluoride (F)		Chloride (Cl)		Nitrate (NO_3)		Dissolved solids			
Number of determinations	Number of values exceeding 1.5 ppm	Number of determinations	Number of values exceeding 250 ppm	Number of determinations	Number of values exceeding 45 ppm	Number of determinations	Number of values exceeding 500 ppm	Number of values exceeding 1,000 ppm	Number of values exceeding 2,000 ppm
106	64	158	38	134	9	158	86	56	24
71	45	111	29	89	6	111	61	40	17
17	6	23	4	21	1	23	9	6	3
2	2	2	0	2	1	2	1	0	0
13	8	18	1	18	1	18	11	7	2
2	2	2	2	2	0	2	2	2	2

the oil in the Hendrick field (fig. 14) suggests that the alluvium is being polluted. Chemical analyses of samples from the water wells (table 9) show that dissolved-solids range from 1,430 ppm at well G–109 to 4,670 ppm at well F–21. The wells range in depth from 90 to 210 feet and draw water from the top or near the top of the saturated alluvium section. The chloride content of the samples from the Hendrick oil field range from 1,190 to 15,600 ppm (table 6). A comparison of analyses of samples taken from well F–15 in 1940 and in 1956 (table 9) indicates that most of the pollution has taken place since 1940. Two other water wells in the area, F–14 and G–111, draw water from the alluvium below 180 feet and probably have not yet been polluted.

A short history of the Hendrick oil field will help to explain the source and extent of pollution in the area. Oil was found in the Seven Rivers formation in 1926, in the area that is now the Hendrick oil field. At first oil production was rapid, but within 2 years the annual production began to decrease, so that by 1956 the field had been classified as a "stripper field" (Phifer, 1956, p. 29). Some wells were producing water in late 1927, and 3 months later the wells were producing 0.5–98 percent water (Ackers, De Chicchis, and Smith, 1930). By 1930 all the 562 oil wells in the field were producing large amounts of water. Correlation between the yearly water production reported by some oil operators and the number of producing wells each year shows that about 800,000 acre-feet of water was produced from the field from 1937 to 1957—an average of about 36 mgd during this 20-year period. As oil production per well decreased, the water production per well probably increased; however, the total fluid production has decreased, and there have been fewer producing wells each year. In 1957 the operators of the Hendrick field reported a water-production rate of about 14.5 mgd (table 3), about 13.7 mgd of which was placed in surface pits or directed to a communal disposal lake, about 1.5 miles northwest of Wink; the rest was used in secondary-recovery projects.

TABLE 6.—*Analyses of ground water produced from oil wells, Winkler County, Tex.*

Analysis	Owner and source of sample	Oil field	Producing horizon	Analyst	Date of collection	Constituents, in parts per million									pH	Remarks
						Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Hardness as $CaCO_3$	Dissolved solids		
1	Ralph Lowe. Salt water disposal pit.	Block 21 (Delaware sand).	"Delaware" sand Permian.	U.S. Geol. Survey.	8-16-57	-------	-------	-------	-------	-------	-------	138,000	--------	--------	----	Two producing oil wells in this lease.
2	Ohio Oil Co. M. J. Hill well 1.	Halley-------	Devonian----	Dowell, Inc..	11-20-56	-------	4,470	975	25,600	623	1,180	49,700	--------	--------	----	
3	Stanolind Oil & Gas Co. Ida Hendrick well A-1.	Hendrick-----	Seven Rivers formation Permian.	U.S. Bur. Mines.	1935	-------	679	258	2,160	1,180	1,630	3,400	--------	9,320	----	Well depth 3,077 ft.
4	Gulf Producing Co. Hendrick well B-20.	-----do-------	-----do-------	-----do-------	1935	-------	709	243	1,150	372	2,350	1,700	--------	6,600	----	
5	Lion Oil Co. Ida Hendrick well D-1.	-----do-------	-----do-------	-----do-------	1935	-------	918	1,060	7,820	1,320	5,270	12,100	--------	28,600	----	Well depth, 2,885 ft.
6	J. W. Starr. Ida Hendrick well 1.	-----do-------	-----do-------	The Western Co.	1956	-------	1,400	510	9,950	763	4,520	15,600	--------	--------	7	
7	Atlantic Oil & Refining Co. Separator water going into pit on Hendricks "F" lease.	-----do-------	-----do-------	U.S. Geol. Survey.	6-28-57	15	710	236	1,720	615	2,310	2,520	2,740	7,820	7.1	Separator gathers fluid produced by oil wells on this lease.
8	Skelly Oil Co. Hendrick well 1.	-----do-------	-----do-------	-----do-------	5-15-47	-------	720	244	755	407	2,330	1,190	2,800	5,440	----	Well pumped 5,000 bbl of water to 25-30 bbl of oil in 1947.

9	Harlon Producing Co. Separator water going into pit on Central State Bank lease.	Kermit	Yates sandstone Permian.	do	6-26-57					566		40,900	6,560			Specific conductance 82,100 micromhos.
10	Prairie Oil & Gas. Co. J. B. Leck well 1.	Leck	Seven Rivers formation Permian.	U.S. Bur. Mines.	1931		176	156	2,020	1,320	95	3,050		6,817		H_2S present.
11	Superior Oil Co. Wheeler Devonian well 3.	Wheeler (Devonian).	Devonian	The Western Co.	1949	104	16,500	4,280	48,600	227	773	110,000		180,000	6.2	
12	Superior Oil Co. Wheeler Ellenburger well 1.	Wheeler (Ellenburger).	Ellenburger group Ordovician.	do	12-13-49	410	1,720	909	15,200	711	617	27,400		46,500	8.0	H_2S present.
13	Superior Oil Co. Wheeler Fusselman well 3.	Wheeler Northwest (Fusselman).	Fusselman limestone Silurian.	do	7-23-49	1,236	13,400	2,060	31,100	425	1,140	78,000		126,000	6.2	
14	Superior Oil Co. J. B. Walton well 1-A.	Wildcat	Ellenburger group Ordovician.	do	10-18-56		2,360	1,290	25,100	314	3,400	44,000			7	H_2S present.
15	Stanolind-Westbrook. Salt-water lake.	West of Hendrick field.		U.S. Geol. Survey.	10-10-56		893	297	5,390	91	3,090	8,420	3,450	18,300	7.9	Some oil operators divert the water produced with oil to this lake.

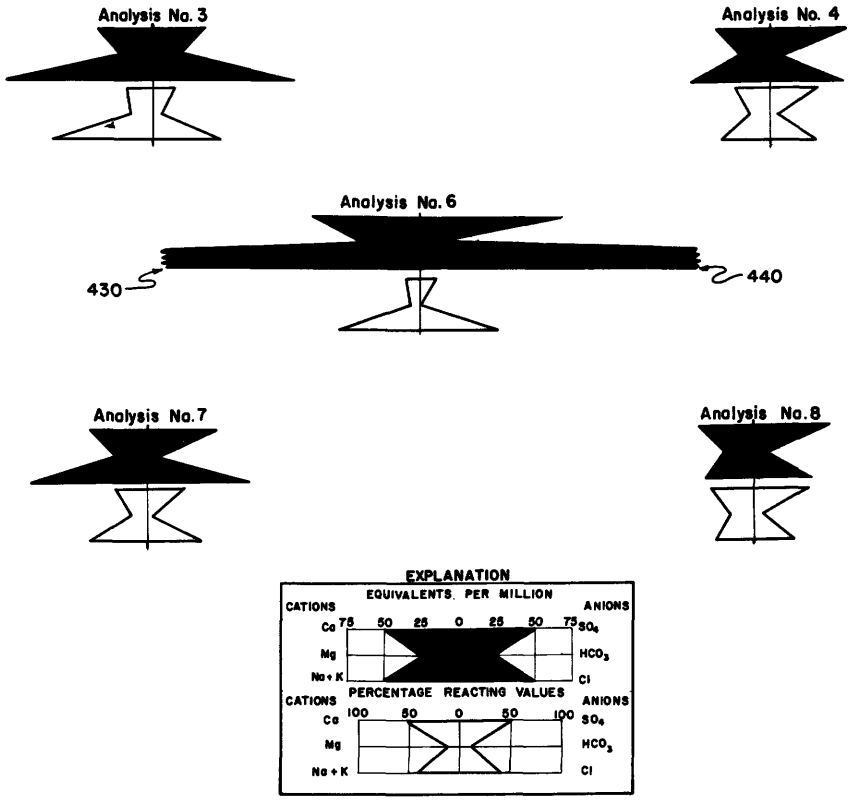

FIGURE 14.—Diagrams showing relations of the principal ions in water produced with the oil in the Hendrick oil field, Winkler County, Tex.

The production of saline waste water in the other oil fields of Winkler County was about 3.7 mgd (table 3), 3.4 mgd of which was placed in surface earthen pits. More than 1 mgd was placed in surface pits in the Kermit oil field, where chemical analyses show evidence of severe pollution in one area. A sample of water from well D–245 had a chloride concentration of 41,000 ppm and a specific conductance of 82,200 micromhos (pl. 9 and table 9). The oil-field water placed in a surface pit about 100 feet away had a concentration of 40,900 ppm of chloride and a specific conductance of 82,100 micromhos (table 6, analysis 9).

Well D–93 (pl. 9) was polluted, probably by brine associated with the project of dissolving underground salt sediments for storing liquified petroleum gases. Undoubtedly, other localized areas near surface sources of highly mineralized oil-field disposal water are being similarly polluted.

Other areas possibly polluted are shown on plate 9 by the diagrams for wells C–5, D–29, D–154, D–163, and H–81. However, it is un-

certain whether these wells are polluted from surface sources or if the water is naturally highly mineralized owing to poor circulation of water.

AREAS OF FRESH AND NATURALLY SALINE WATER

The water in some wells that tap the Cenozoic alluvium is naturally saline. Saline water is produced from wells C–39 and F–5 in the western part of the county, wells E–24, H–7, and H–35 in the eastern part, and wells A–1, B–6, B–14, B–17, B–18, and D–5 in the northern and northeastern parts, which either are remote from apparent sources of pollution or contain water of a different chemical character from that of the possible pollutants. In general, these wells are found in areas where the configuration of the water-table surface suggests a very slow rate of ground-water movement, and this slow rate is probably responsible for the salinity.

The remainder of the alluvium that is remote from polluting sources contains fresh water; most of the wells sampled yield water having a dissolved-solids content of less than 500 ppm. Several wells close to areas of probable pollution or naturally occurring saline water have a dissolved-solids content less than 1,000 ppm.

SANTA ROSA SANDSTONE

The analyses of water samples from 18 wells that tap the Santa Rosa sandstone (table 9) indicate that the water is more mineralized in the eastern half of the county than in the western half. Water having the least mineralization is found in the vicinity of Kermit, near the main recharge area to the Santa Rosa. The samples from 3 wells more than 1,000 feet deep in the eastern part of the county had dissolved-solids contents ranging from 1,110 to 4,090 ppm; samples from wells in the rest of the county generally contained less than 1,000 ppm dissolved solids. Well G–3, whose water contained 1,260 ppm of dissolved solids, may be polluted by waste water from a nearby oil field.

The samples from 23 wells tapping both the Cenozoic alluvium and the Santa Rosa sandstone ranged in dissolved solids from 128 ppm to 10,700 ppm (table 9). Six of the more mineralized samples came from wells that may have been polluted, probably through the Cenozoic alluvium, from saline water and brine from nearby oil fields. The other 17 samples contained less than 1,000 ppm of dissolved solids.

Hard water high in sulfate and fluoride apparently is common in the Santa Rosa sandstone. Nine samples had a hardness of more than 200 ppm and more than 250 ppm of sulfate. Eight of the 13 determinations made of fluoride exceeded 1.5 ppm. Concentrations of

fluoride and sulfate generally were lower in samples from wells tapping both the Santa Rosa and the alluvium.

OTHER AQUIFERS

The water samples collected from two wells tapping the Rustler formation were either highly saline or briny (table 9). The sample from well D–193 contained 18,400 ppm of dissolved solids, and the sample from D–160 contained 157,000 ppm.

Two samples from wells probably tapping Cretaceous formations in the northeastern part of the county contained less than 1,000 ppm of dissolved solids. The sample from well B–9 had a hardness of 186 ppm and the sample from well B–10, taken in 1957, had a hardness of 414 ppm and a nitrate content of 49 ppm.

Chemical analyses of water produced with oil from strata of Ordovician to Permian age are shown in table 6. The analyses are incomplete, but they evaluate the most important constituents. Nearly all the water produced from oil wells in the Hendrick and Leck fields is only moderately saline. The rest of the oil fields in Winkler County apparently produce brine with the oil.

CONCLUSIONS

Winkler County has a large supply of fresh ground water in storage. About 5–7 million acre-feet of stored ground water is available for recovery through wells in the explored area, and an unknown quantity of fresh water is available in the unexplored areas. A small amount of water from precipitation recharges the aquifers. The average rate of withdrawal from wells in 1956 was about 8.2 mgd, or about 9,200 acre-feet per year, most of the water being used by industry and for public supply.

Some of the water wells in the Santa Rosa sandstone at Kermit and in the alluvium south of Wink yield more than 1,000 gpm each. In the vicinity of Kermit the larger capacity wells, yielding 400–1,875 gpm, tap fractures in the Santa Rosa sandstone. In other areas the Santa Rosa is much less productive. The potential yield of the Santa Rosa sandstone in several areas, chiefly in the eastern part of the county, has not yet been determined.

The alluvium is more productive south of Wink, in the deep alluvium-filled trough, than elsewhere in the county. Most of the larger wells in the thinner alluvium are completed in the bottom gravels of the aquifer to avoid pumping excessively fine sand commonly found in the upper section. Wells in the alluvium should be constructed to screen the largest sections of the formation available. They will have the largest yields.

Fresh water has been displaced or has become polluted by mixing with saline water in areas where oil fields continually discharge waste water into earthen surface pits. The extent and significance of the pollution are chiefly dependent on the amount of the oil-field water being discharged and its degree of mineralization. Pollution will continue to be a serious threat to the fresh-water supplies in Winkler County until a more effective waste-disposal system is adopted.

Generally, water from the Cenozoic alluvium and the Santa Rosa sandstone in Winkler County has a moderate mineral content; however, the high content of fluoride and silica, and the high hardness in some areas make it undesirable for certain uses. Saline water from the Rustler formation is used only for waterflooding in the production of oil by secondary-recovery methods. Some oil operators are recycling the saline water being produced with the oil in such operations. The recycling, or injection of the saline water or brine back into the oil-producing formations, lessens the danger of ground-water pollution and also decreases the consumption of fresh water.

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WELL RECORDS

Table 7.—*Records of wells in Winkler County, Tex.*

All wells are drilled unless otherwise noted in remarks column. Electric and radioactivity logs and micrologs in files of Texas Board of Water Engineers.

Water level: Reported water levels and altitudes of land surface given in feet; measured water levels and altitudes of land surface given in feet and tenths.

Method of lift and type of power: A, airlift; B, butane; C, cylinder; E, electric; G, gasoline; N, none; Ng, natural gas; T, turbine; W, windmill. Number indicates horsepower.

Use of water: D, domestic; Ind, industrial; Irr, irrigation; N, none; P, public supply; S, stock.

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*A-1	Allen Cowden		3,064.7	Old	87	14	Cenozoic alluvium.	70.8	Nov. 1, 1956	C,W	S	Old well.
A-2	R. M. Evans well 1.	Humble Oil & Refining Co.	3,105	1951	13,615					N	N	Oil test. Electric log Q-17.[1]
*A-3	B. J. Jenkins				100	6	Cenozoic alluvium.	45.3	Jan. 12, 1957	G,W	S	
A-4	Tom Lineberry.		2,998.6	1952	80	5	----do----	36.7	Sept. 19, 1956	C,W	S	
B-1	Mary K. E. Bauer.			Old	90	6	----do----	73.6	Jan. 29, 1957	C,W	S	East Witcher well. Old well.
*B-2	-----do-----				75	6	----do----	64.1	----do----	C,W	S	Cased to bottom; slotted and gravel-packed.
B-3	-----do-----			1948?	75	6	----do----	69.7	----do----	N	N	Abandoned temporarily.
*B-4	-----do-----			1945?	75	6	----do----	67.7	----do----	C,W	S	Owner's "Double well."
B-5	-----do-----	Humble Oil & Refining Co.	3,165.2	1951	101	8	----do----	73.4	----do----	N	N	Supplied water for drilling oil-test well.

*B-6	Mary K. E. Bauer.	----------	--------	1945?	88	6	----do------	85.0	Jan. 29, 1957	C,W	S	Cased to bottom; slotted and gravel-packed. Water reported unfit for domestic use.
B-7	-----do------	----------	--------	1945?	85	6	----do------	-------	----------	C,W	S	Do.
B-8	R. M. Evans well C-2.	Humble Oil & Refining Co.	3,184	1952	8,872	-------	----------	-------	----------	N	N	Oil test. Electric log Q-19.[1]
*B-9	Ratcliff & Bedford.	----------	--------	1948	52	6	Trinity group(?)	44.9	Feb. 12, 1957	C,W	D,S	
*B-10	-----do------	----------	--------	Old	72	72, 6	----do------	56.5	Feb. 5, 1957	C,W	S	Consists of 2 wells connected at bottom by tunnel; one drilled with 6-in. casing, the other dug; 6 ft square at top. Old well.
B-11	Bedford & Cowden, well 1-3T.	B. F. Wiseman, Jr., and F. M. Jackson.	3,228	1955	9,236	------	----------	-------	----------	N	N	Oil test. Electric log Q-18.[1]
B-12	R. M. Evans well 1.	Humble Oil & Refining Co.	3,216	1951	11,745	------	----------	-------	----------	N	N	Oil test. Electric log Q-20.[1]
B-13	Mary K. E. Bauer.	----------	--------	1957	85	8	Cenozoic alluvium.	72.7	Jan. 29, 1957	C,W	S	Cased to bottom; slotted and gravel-packed.
*B-14	Allen Cowden.	----------	--------	Old	83	14	----do------	63.0	Nov. 1, 1956	C,W	S	Old well.
*B-15	B. F. Jenkins.	----------	--------	Old	80	6	----do------	49.4	Jan. 13, 1957	C,W	S	In sand dunes. Old well.
B-16	-----do------	----------	--------	------	115	6	Cenozoic alluvium.	54.6	Jan. 13, 1957	C,W	S,D	
*B-17	-----do-----	----------	--------	------	115	6	----do------	-------	----------	C,W	S,D	
*B-18	John Henry Wallace Estate.	----------	--------	------	115	6	----do------	-------	----------	C,W	S	Pumping level 78.5 ft, Feb. 4, 1957.
B-19	-----do------	----------	3,136.8	------	115	6	----do------	72.5	Jan. 31, 1957	C,W	S	

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level: Below land-surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*B-20	John Henry Wallace Estate.	C. F. Wheeler	--------	1940	1,025	8, 4	Santa Rosa sandstone.	-------	----------	C,W	S	Strong supply reported at 1,025 ft; tapped salt water at 828 ft. Cased off.
*B-21	J. M. Williams, and others.	Gulf Oil Corp.	3,348.3	1944	1,180	6	----do------	503.5	Apr. 14, 1957	C,W	S	
*C-1	J. B. Tubb Estate.	----------	2,938.3	Old	220	7	----do------	205 195.3	1940 Sept. 7, 1956	C,W -------	S ----	Old well.
*C-2	-----do------	----------	2,882.7	Old	140	5	Cenozoic alluvium.	119.7	Sept. 7, 1956	C,W	D,S	Do.
C-3	Cities Service Oil Co.	Cities Service Oil Co.	2,860	1952	3,743	------	----------	-------	----------	N	N	Oil test. Beckham well 1. Radioactivity log Q-128.[1]
C-4	W. L. Beckham	----------	--------	-----	150	6	Cenozoic alluvium.	128.8	Sept. 8, 1956	C,W	S	
*C-5	W. P. Edwards	----------	2,917.6	-----	260	6	----do------	151.0	----do-------	C,W	S	
C-6	The Texas Co.	The Texas Co.	2,910	1944	3,228	------	----------	-------	----------	N	N	Oil test. Daugherty well 2. Electric log Q-129.[1]
C-7	J. B. Walton--	----------	-------	-----	-----	6	----------	115.4	June 28, 1957	C,W	S	
C-8	Continental Oil Co.	Continental Oil Co.	2,934	1947	3,213	------	----------	-------	----------	-------	-----	In New Mexico. Oil test. Eaves well B-30-2. Electric log Q-130.[1]
C-9	S. G. Dunn, and others.	J. D. Cole----	--------	1956	160	6	Cenozoic alluvium.	99.1	Apr. 23, 1957	C,Ng	Ind	Cased to bottom; slotted from 140 to 160 ft. Supplied water for drilling oil-test wells.

C-10	Gulf Oil Corp.	J. R. Marshall	--------	1942	360	7	Santa Rosa sandstone.	-------	----------	C,B	Ind	Cased to 213 ft. Daugherty well 8. Supplied water for drilling oil-test well.[2]
C-11	-----do------	----do------	2,914.4	1944	128	10	Cenozoic alluvium.	100.5	Sept. 28, 1956	N	N	Cased to 104 ft. Daugherty well 9.[2]
C-12	-----do------	Gulf Oil Corp.	2,904	1956	3,037	-------	----------	------	----------	-------	-----	Oil test. Daugherty well 73. Radioactivity log Q-131.[1]
*C-13	W. D. Harrison	Bob Glynn	--------	1946	300	6	Cenozoic alluvium and Santa Rosa sandstone.	105.8	Sept. 10, 1956	T,E, 1	D,S	Cased to 200 ft.
C-14	Sinclair Oil & Gas Co.	Perkins & Reynolds.	--------	1928	222	6	Cenozoic alluvium.	-------	----------	N	N	Plugged. Leck well 2.[2]
C-15	-----do------	Reese & Griggs	--------	1928	230	8, 6	----do-------	-------	----------	N	N	Cased to 217 ft; plugged. Leck well 1.[2]
C-16	-----do------	----do------	--------	1928	340	8, 6	Santa Rosa sandstone.	-------	----------	N	N	Plugged. Daugherty well 2.[2]
*C-17	-----do------	----do------	2,882.3	1928	455	8	----do-------	109.1	Apr. 23, 1957	C,E, 5	D	Cased to 215 ft. Daugherty well 1.[2]
*C-18	Tom Lineberry	----------	--------	Old	130	5	Cenozoic alluvium.	103.8	Sept. 8, 1956	C,W	S	Old wells.
C-19	-----do------	----------	2,903.9	1948	150	7	----do-------	97.0	----do-------	C,W	D	
*C-20	W. L. Beckham	----------	2,856.2	------	134	6	----do-------	113.3	Sept. 7, 1956	C,W	D,S	
*C-21	J. B. Tubb Estate.	----------	2,875.3	Old	151	6	----do-------	144	March 1940	C,W	S	Old well.
								137.0	Sept. 7, 1956	-------	----	
*C-22	J. B. Walton---	----------	2,845.5	1935	118	6	----do-------	103	January 1940	C,W	S	
								103.0	Sept. 7, 1956	-------	----	
C-23	The Texas Co.	The Texas Co.	2,855	1955	7,515	-------	----------	-------	----------	N	N	Oil test. J. L. Desmond well 1. Electric log Q-132.[1]
C-24	Tom Lineberry	----------	2,860.9	1951	------	6	Cenozoic alluvium.	100.5	Sept. 7, 1956	C,W	S	
*C-25	J. B. Walton---	J. B. Marshall	2,860.5	1939	165	7	----do-------	68.9	Sept. 10, 1956	C,W	S	Cased to 161 ft.[2]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
C-26	Humble Oil & Refining Co.	Humble Oil & Refining Co.	2,871	1954	3,053	-------	----------	-------	----------	-------	----	Oil test. Walton well C-12. Radioactivity log Q-133.[1]
C-27	-----do------	C. W. Howard	---------	-----	-----	8	----------	81.8	Sept. 10, 1956	C,E, 5	Ind	Supplied water for drilling oil-test well.
C-28	J. B. Walton--	----------	---------	-----	-----	-------	----------	-------	----------	C,W	S	
C-29	Humble Oil & Refining Co.	Fannin Drilling Co.	---------	1956	196	7	Cenozoic alluvium.	-------	----------	T,E, 10	Ind	Cased to bottom; slotted from 110 to 196 ft. J. B. Walton well 10.[2]
C-30	-----do------	----do-------	---------	1955	198	7	----do-------	-------	----------	T,E, 10	Ind	Cased to bottom; slotted from 95 to 196 ft. J. B. Walton well 9.[2]
C-31	-----do------	----do-------	---------	1955	188	7	----do-------	107.7	Sept. 26, 1956	T,E, 10	Ind	Cased to bottom; slotted from 170 to 188 ft. J. B. Walton well 8.[2]
C-32	-----do------	Humble Oil & Refining Co.	2,899	1957	3,034	-------	----------	-------	----------	-------	----	Oil test. J. B. Walton well D-32. Radioactivity log Q-134.[1]
*C-33	J. B. Walton--	----------	---------	Old	95	8	Cenozoic alluvium.	92.3	Sept. 10, 1956	C,W	S	Old well.
C-34	-----do------	----------	2,872.9	Old	88	6	----do-------	77.3	Sept. 12, 1956	C,W	S	Do.
C-35	Sinclair Oil & Gas Co.	J. R. Marshall	2,871.7	1936	231	8, 6	----do-------	71.6 72.3	Sept. 12, 1956 June 11, 1957	C,W -------	Ind -----	Leck well A-1.[2]

C-36	Atlantic Refining Co.	----------	2,867.7	------	-----	6	----------	67.0	Sept. 23, 1956	N	N	
								67.5	June 11, 1957			
*C-37	Olsen Oil Co.	----------	--------	1952	250	7	----------	-------	----------	T,E, 2	D	
C-38	J. B. Walton--	J. R. Marshall	--------	1939	155	7	Cenozoic alluvium.	90.9	Sept. 12, 1956	C,W	S	Cased to 149 ft.[2]
*C-39	Tom Lineberry	----------	--------	------	-----	------	----------	-------	----------	T,E, 5	S	
*C-40	Evelyn Lineberry.	----------	2,840.3	------	125	6	Cenozoic alluvium.	103.9	Sept. 11, 1956	C,W	S	
								102.2	Apr. 1, 1957	-------	-----	
C-41	Tom Lineberry	----------	--------	------	-----	6	----------	-------	----------	C,W	S	
C-42	-----do------	----------	--------	Old	211	6	Santa Rosa sandstone (?)	190.7	Sept. 4, 1956	C,W	S	Old well.
								190.4	June 27, 1957	-------	-----	
C-43	Evelyn Lineberry.	----------	2,971.0	1947	-----	------	----do-------	215.6	Apr. 3, 1957	C,W	S	
								215.5	June 27, 1957	-------	-----	
C-44	-----do------	J. R. Marshall	2,945.1	Old	230	6	----do-------	218.5	Sept. 11, 1956	C,W	S	Do.
								217.8	June 27, 1957	-------	-----	
C-45	J. E. Haley---	Victor Brookfield.	2,890.5	Old	200	6	----do-------	175.6	Sept. 13, 1956	C,W	S	
								175.5	Apr. 11, 1957	-------	-----	
C-46	Jack Lineberry.	----------	2,838.7	------	230	6	Cenozoic alluvium.	84.3	Sept. 11, 1956	C,W	D,S	
*C-47	Stanolind Oil & Gas Co.	----------	--------	------	212	8	----do-------	-------	----------	T,Ng	D,Ind	
C-48	Sinclair Oil & Gas Co.	J. R. Marshall	2,861.9	1938	230	7	----do-------	52.6	Oct. 22, 1956	N	N	Cased to 227 ft; slotted from 87 to 106 ft, and 203 to 227 ft. Cummins well 1.[2]
								52.5	Nov. 15, 1956	-------	-----	
								52.0	June 11, 1957	-------	-----	
C-49	J. H. Elder---	J. H. Elder----	2,850	1953	3,045	------	----------	-------	----------	-------	-----	Oil test. Ida Hendrick well 7. Radioactivity log Q-135.[1]
*C-50	Jack Lineberry.	----------	2,858.2	1948	90	6	Cenozoic alluvium.	59.8	Sept. 11, 1956	C,W	S	

See footnotes at end of table.

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Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
C-51	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,869	1956	2,900	------	----------	------	----------	-------	-----	Oil test. T-88-N well 8. Radioactivity log Q-136.[1]
C-52	Winkler County Country Club.	I. O. Fannin Drilling Co.	-------	1955	200	7	Cenozoic alluvium.	119.5	Sept. 18, 1956	T,E, 10	Irr	
*C-53	J. E. Haley---	----------	2,871.2	1938	297	5	----do-------	162.5	-----do-------	C,W	S	
*D-1	Tom Lineberry.	----------	2,961.5	1947	-----	8	Santa Rosa sandstone(?)	172.1 178.2	Jan. 12, 1957 June 4, 1957	C,W -------	S -----	
D-2	Wood River Oil & Refining Co.	----------	-------	1948	432	7	Santa Rosa sandstone.	211.8	Feb. 27, 1957	C,B, 18	D,Ind	
*D-3	-----do------	J. D. Cole----	2,967.5	1956	540	15, 10	----do-------	164.0	Sept. 12, 1956	T,E, 20	Ind	Cased to bottom; slotted from 350 to 360 ft, and 398 to 535 ft; gravel-packed. Reported by pumped 80 gpm with water level at bottom of hole when completed.
D-4	Brooks & Ewing.	J. R. Marshall	-------	1938	110	8	Cenozoic alluvium.	-------	----------	N	N	(2)
*D-5	Tom Lineberry.	----------	2,928.2	Old	80	6	----do-------	48.9	Sept. 12, 1956	C,W	S	Old well.
D-6	W. F. Scarborough Estate.	J. D. Cole----	2,947.1	1951	110	8	----do-------	45.0 45.0	Jan. 7, 1957 June 6, 1957	N -------	N -----	Supplied water for drilling oil-test well.[2]
D-7	Ben J. Taylor	Ben J. Taylor	2,967	1952	3,804	------	----------	-------	----------	N	N	Oil test. Lineberry well 1. Radioactivity log Q-89.[1]

D-8	Tom Lineberry.			1941	146	8	Cenozoic alluvium.	69.5	Jan. 4, 1957	C,W	S	
D-9	B. F. Jenkins			Old	92	5	----do----	35.8 35.9	Sept. 19, 1956 Jan. 3, 1957	C,W	D,S	Old well.
D-10	The Texas Co.	The Texas Co.	2,983	1950	8,641							Oil test. H. T. Jones well 2. Electric log Q-90.[1]
D-11	Phillips Petroleum Co.			1949	174	7	Cenozoic alluvium.	38.2	Nov. 1, 1956	N	N	Cased to bottom, cemented; perforated from 152 to 174 ft. Reported to yield 31 gpm on test. Supplied water for drilling oil-test well.
D-12	B. F. Jenkins		2,981.9	Old	115	6	----do----	44.4	Nov. 5, 1956	C,W	S	Old well.
D-13	Zapata Petroleum Corp.	Zapata Petroleum Corp.	2,990	1956	4,261							Oil test. M. J. Bashara well 1. Radioactivity log Q-91.[1]
D-14	Stanolind Oil & Gas Co.		2,976.2		305	7, 5	Santa Rosa sandstone.	151.9 153.2	Nov. 5, 1956 Apr. 13, 1957	N	N	Cased to 270 ft. Reported to yield 15 gpm when drilled. Supplied water for drilling oil-test well.[2]
D-15	Richardson & Bass.		2,973.0		300	8	Cenozoic alluvium and Santa Rosa sandstone.	106.1 103.7	Nov. 5, 1956 June 10, 1957	N	N	Cased to 149 ft. Supplied water for drilling oil-test well.
D-16	Continental Oil Co.	Continental Oil Co.	2,975	1950	7,969							Oil test. B. F. Jenkins well 12-5-D. Electric log Q-92.[1]
D-17	----do----	J. D. Cole----	2,970.9	1950	300	10	Cenozoic alluvium and Santa Rosa sandstone(?)	63.5 63.9	Sept. 19, 1956 June 6, 1957	N	N	Cased to 149 ft. Supplied water for drilling oil-test well.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-18	B. F. Jenkins	----------	--------	------	149	6	Cenozoic alluvium.	64.7	Jan. 4, 1957	C,W	S	
D-19	Richardson & Bass.	----------	2,978.9	------	480	8	Santa Rosa sandstone.	153.5 153.4	Jan. 4, 1957 June 6, 1957	N -------	N -----	Supplied water for drilling oil-test well. Well is obstructed to measuring line at 174 ft.
D-20	-----do------	----------	--------	------	445	8	Santa Rosa sandstone and Cenozoic alluvium(?)	107.6	Sept. 13, 1956	N	N	Cased to 185 ft.
D-21	Sun Oil Co.	Flack Water Well Co.	--------	1936	175	8	Cenozoic alluvium.	67.9	Jan. 3, 1957	N	N	Cased to 142 ft.[2]
D-22	Texas-New Mexico RR. Co.	L. L. Dorn	2,951	1929	160	8, 6	-----do-------	70.3	Sept. 12, 1956	C,W	D	Cased to bottom. Screened from 139 to 159 ft.[2]
D-23	-----do------	L. F. Buchanan	2,952	1930	148	10, 8	-----do-------	75	1940	N	N	Hole filled to 30 ft by blow-sand in September 1956.[2]
D-24	Shell Oil Co.	Shell Oil Co.	2,917	1955	3,338	-------	----------	-------	----------	-------	-----	Oil test. Shell-Scarborough well 7. Radioactivity log, Q-93.[1]
D-25	Hudson & Hudson, Inc.	----------	2,913.2	------	300	8	Santa Rosa sandstone and Cenozoic alluvium(?)	107.2	Oct. 11, 1956	C,Ng	Ind,D	
D-26	Richardson Oils, Inc.	----------	--------	Old	167	8	Cenozoic alluvium.	82.0	Oct. 10, 1956	N	N	Old well.

D-27	---do---	----------	-------	-----	100	8	---do---	-----	----------	T,E, 5	D,Ind	Reported that water mottles childrens teeth. Cheyenne Camp well 1.
D-28	---do---	----------	-------	-----	231	8	---do---	-----	----------	C,E, 3	D,Ind	Cased to 151 ft. Cheyenne Camp well 2.
*D-29	Tom Lineberry.	----------	2,906.4	-----	100	6	---do---	49.2	Oct. 10, 1956	C,W	S	
D-30	Hudson & Hudson, Inc.	----------	-------	Old	165	6	---do---	-----	----------	C,Ng	D,Ind	Old well.
D-31	Ambassador Oil, Inc. well 3.	J. D. Cole	2,930	1956	225	8	---do---	80	June 1956	T,E, 7½	Ind	(2)
D-32	Ambassador Oil, Inc. well 2.	---do---	-------	1955	210	8	---do---	80	December 1955	T,E, 5	Ind	Cased to 152 ft; perforated from 124 to 140 ft. Reported that initial test pumped 60 gpm with 35 ft of drawdown.[2]
D-33	Sinclair Oil & Gas Co.	----------	2,933.9	-----	448	10	Santa Rosa sandstone.	129.3	Oct. 11, 1956	N	N	Cased to 191 ft. Intermittent use reported. Supplied water for drilling oil-test well.[2]
D-34	---do---	Darrell W. Smith.	2,931	1950	3,070	-----	----------	-----	----------	-----	-----	Oil test. Scarborough well 1. Electric log Q-94.[1]
D-35	Richardson Oils, Inc.	Richardson Oils, Inc.	2,907	1957	508	13, 7	Santa Rosa sandstone and Cenozoic alluvium.	76.2	Feb. 15, 1957	T,Ng	Ind	Oil test well converted to water well. Casing perforated from 97 to 133 ft; slotted 7-in. casing from 369 to 469 ft; gravel-packed.
D-36	---do---	----------	-------	-----	88	8	Cenozoic alluvium.	69.8	Oct. 8, 1956	N	N	Supplied water for drilling oil-test well.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

●Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level: Below land-surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
D-37	Richardson Oils, Inc.	Richardson Oils, Inc.	2,917	1956	3,010	-------	----------	-------	----------	-------	-----	Oil test. W. F. Scarborough well E-5. Radioactivity log Q-95.[1]
*D-38	----do-------	----do-------	2,921.3	1956	531	13	Santa Rosa sandstone and Cenozoic alluvium.	91.6	Nov. 5, 1956	T, E, 15	Ind	Drilled to Rustler formation at 1,280 ft. Plugged back to 531 ft; perforated casing from 113 to 148 ft; open hole from 250 to 531 ft.[2]
D-39	----do-------	J. R. Marshall	--------	1938	420	10	Santa Rosa sandstone.	104.8 104.0	Oct. 8, 1956 Feb. 15, 1957	N -------	N -----	Intermittent use reported. Open hole from 291 to 420 ft. Supplied water for drilling oil-test well.[2]
D-40	Magnolia Petroleum Co.	----------	--------	Old	165	8	Cenozoic alluvium.	80.2	Sept. 20, 1956	N	N	Supplied water for drilling oil-test well. Old well.
D-41	----do-------	J. R. Marshall	--------	1938	143	10, 6	----do-------	85.5	-----do-------	N	N	Supplied water for drilling oil-test well.[2]
D-42	J. B. Walton	----------	--------	Old	85	6	----do-------	76.0	-----do-------	C, W	S	Old well.
D-43	Humble Oil & Refining Co. well 7.	I. O. Fannin--	--------	1954	200	7	----do-------	109.8	Sept. 26, 1956	N	N	Cased to 188 ft.[2]
D-44	Humble Oil & Refining Co. well 2.	----do-------	--------	1954	205	7	----do-------	96.5	-----do-------	N	N	Cased to 180 ft.

D-45	Humble Oil & Refining Co. well 4.	J. J. Harrell and R. P. Tone.	2,897.8	1951	238	7	----do-------	95.5	Apr. 23, 1957	N	N	Cased to bottom; slotted from 124 to 238 ft.[2]
D-46	Humble Oil & Refining Co. well 6.	I. O. Fannin--	--------	1953	185	6	----do-------	-------	----------	T,E, 5	Ind	Cased to bottom; slotted.[2]
*D-47	El Paso Natural Gas Co. well 1.	J. D. Cole----	2,937.6	1949	166	16, 12	----do-------	64.5	Oct. 17, 1956	T,E, 5	Ind, P	Cased to bottom; slotted from 126 to 166 ft; 107 ft of 16-in. casing cemented; gravel-packed.[2]
*D-48	El Paso Natural Gas Co. well 2.	----do-------	2,938.1	1949	600	16, 10	Santa Rosa sandstone.	145.6 117.0	Oct. 17, 1952 Feb. 18, 1957	T,E, 15	P,Ind -----	Cased to 224 ft. Reportedly filled to 433 ft.[2]
D-49	El Paso Natural Gas Co. well 5.	----do-------	--------	1953	404	16	----do-------	115.7	Feb. 20, 1957	T,E, 20	Ind,P	Cased to 166 ft.[2]
D-50	El Paso Natural Gas Co.	----------	--------	-----	250	-------	----------	-------	----------	N	N	Test hole 3, sec. 18.[2]
D-51	----do-------	----------	--------	-----	219	-------	----------	-------	----------	N	N	Test hole 1, sec. 18.[2]
D-52	----do-------	----------	2,925.2	-----	219	8	Santa Rosa sandstone(?)	147.5 112.0	Oct. 18, 1956 Feb. 20, 1957	N -------	N -----	Reported static water-level 81 ft originally and produced 37 gpm. Supplied water for road building.
D-53	----do-------	J. D. Cole----	2,924.0	1949	260	10	Cenozoic alluvium and Santa Rosa sandstone.	116.2	Feb. 18, 1957	T,E, 15	Ind,P	Cased to 165 ft; slotted from 90 to 165 ft; gravel-packed from 80 to 165 ft.[2]
D-54	----do-------	----do-------	2,926.5	1949	224	16, 10	----do-------	98.4	----do--------	T,E, 10	Ind, P	Cased to bottom; slotted; gravel-packed.[2]
D-55	----do-------	----------	--------	------	280	-------	----------	-------	----------	N	N	Test hole 2, sec. 18.
D-56	----do-------	----------	--------	------	175	-------	----------	-------	----------	N	N	Test hole 1, sec. 19.[2]
D-57	J. B. Walton--	----------	--------	Old	80	6	Cenozoic alluvium.	70.4	Oct. 22, 1956	C,W	S	Old well.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-58	El Paso Natural Gas Co.	------	------	------	125	------	------	------	------	N	N	Test hole 4, sec. 3.[2]
D-59	----do------	------	------	------	220	------	------	------	------	N	N	Test hole 2, sec. 3.[2]
D-60	----do------	------	------	------	210	------	------	------	------	N	N	Test hole 3, sec. 3.[2]
D-61	----do------	------	------	------	220	------	------	------	------	N	N	Test hole 1, sec. 3.[2]
D-62	J. R. Sharp---	------	------	------	170	6	------	------	------	C,Ng	D,Ind	
D-63	El Paso Natural Gas Co.	------	------	------	160	------	------	------	------	N	N	Test hole 3, sec. 20.[2]
D-64	----do------	------	------	------	220	------	------	------	------	N	N	Test hole 3, sec. 2.[2]
D-65	----do------	------	------	------	200	------	------	------	------	N	N	Test hole 2, sec. 2.[2]
D-66	----do------	------	------	------	187	------	------	------	------	N	N	Test hole 1, sec. 2.[2]
D-67	----do------	------	------	------	234	------	------	------	------	N	N	Test hole 2, sec. 20.[2]
D-68	Sinclair Oil & Gas Co.	Sinclair Oil & Gas Co.	2,859	1956	10,023	------	------	------	------	------	-----	Oil test. J. B. Walton well A-7. Radioactivity log Q-96.[1]
D-69	J. B. Walton--	------	2,950.7	1953	185	4	Cenozoic alluvium.	65.7	Sept. 19, 1956	C,W	S	
								65.8	June 6, 1957	------	-----	
D-70	Sinclair Oil & Gas Co.	------	2,967	------	129	8	----do------	65.8	Nov. 8, 1956	N	N	Abandoned.
D-71	----do------	E. & L. Water Well Service.	2,972	1945	150	10	----do------	69.6	----do------	N	N	Cased to 135 ft.[2]
D-72	El Paso Natural Gas Co.	------	------	------	160	------	------	------	------	N	N	Test hole 4, sec. 20.[2]
D-73	----do------	------	------	------	252	------	------	------	------	N	N	Test hole 1, sec. 20.[2]
D-74	Sinclair Oil & Gas Co.	J. R. Marshall	2,964	1937	282	8, 7	Santa Rosa sandstone and Cenozoic alluvium.	72.1	Nov. 8, 1956	N	N	Cased to bottom; slotted.[2]

D-75	----do----	E. & L. Water Well Service.	2,965	1945	157	8	Cenozoic alluvium.	72.6	----do----	N	N	Cased to 133 ft.[2]
D-76	----do----	----do----	2,965	1945	202	10, 7	----do----	73.0	----do----	N	N	Cased to 197 ft; slotted.[2]
D-77	Richardson & Bass well 19.				220	10	----do----			T,E, 15	Ind,P	
D-78	Richardson & Bass.	Richardson & Bass.	2,955	1954	5,050							Oil test. J. B. Walton well 44-H. Radioactivity log Q-97.[1]
D-79	Richardson & Bass well 15.				188	8	Cenozoic alluvium.			T,E, 15	Ind,P	Cased to 164 ft.
D-80	Richardson & Bass well 16.				240	10	----do----			T,E, 10	Ind,P	
D-81	Richardson & Bass well 1.				325	10, 8	Cenozoic alluvium and Santa Rosa sandstone.			T,E, 15	Ind,P	Cased to 250 ft.
D-82	Richardson & Bass well 2.				210	8	Cenozoic alluvium.			T,Ng	Ind,P	Cased to 190 ft.
D-83	J. B. Walton				174	7	----do----	69.9	Oct. 22, 1956	C,W	S	
D-84	El Paso Natural Gas Co.				200					N	N	Test hole 1, sec. 1.[2]
*D-85	El Paso Natural Gas Co. well 5.	J. D. Cole		1953	250	16	Cenozoic alluvium and Santa Rosa sandstone(?)	65.5	Feb. 14, 1957	T,E, 10	Ind	Reportedly removed from camp system and used only in cooling towers, owing to increasing mineralization of water.
D-86	El Paso Natural Gas Co. well 4.			1953	164	10, 8	Cenozoic alluvium.			T,E	P,Ind	Cased to bottom; bottom 40 ft slotted.
D-87	El Paso Natural Gas Co. well 3.				160	10, 8	----do----	65	December 1954	T,E, 15	P,Ind	Cased to 157 ft; slotted from 135 to 157 ft.
D-88	Richardson & Bass.	Richardson & Bass.	2,951	1954	4,920							Oil test. J. B. Walton well 38-H. Radioactivity log Q-98.[1]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*D-89	El Paso Natural Gas Co.	----------	--------	------	156	10, 8	Cenozoic alluvium.	61.8 61.4	Nov. 5, 1956 Feb. 14, 1957	T,E, 5	P,Ind -----	Cased to bottom; slotted from 126 to 156 ft.
D-90	Richardson & Bass.	----------	--------	------	220	8	Cenozoic alluvium and Santa Rosa sandstone(?)	--------	----------	T,E, 15	P,Ind	Cased to 123 ft.
D-91	----do------	----------	--------	------	155	8	Cenozoic alluvium.	--------	----------	T,E, 15	N	Cased to 117 ft. Reportedly discontinued because of salt-water contamination.
D-92	----do------	----------	2,951.0	------	155	10	----do--------	65.9	Nov. 5, 1956	T,E, 15	N	Cased to 128 ft. Reportedly discontinued because of salt-water contamination.
*D-93	----do------	----------	--------	------	210	------	Cenozoic alluvium and Santa Rosa sandstone(?)	--------	----------	T,Ng	Ind	Cased to 135 ft. Reported that water tastes salty.
D-94	Richardson Gasoline Plant well 3.	----------	--------	------	200	13	----do--------	--------	----------	T,E, 20	Ind,D	(2)
D-95	Richardson Gasoline Plant well 1.	----------	--------	------	200	13	----do--------	--------	----------	-------	Ind	Cased to 130 ft.
D-96	Richardson Gasoline Plant well 2.	----------	2,962.9	------	200	13	----do--------	62.8	Nov. 7, 1956	T,E, 20	Ind,D	Cased to 130 ft; cemented.

D-97	Carter Foundation.	----------	--------	------	------	8	----------	-------	----------	C,Ng	Ind	Supplies water for Richardson Gasoline Plant.
*D-98	----do-------	----------	--------	------	200	8	Cenozoic alluvium and Santa Rosa sandstone(?)	50	September 1956	T,Ng	Ind	Do.
D-99	Stanolind Oil & Gas Co.	----------	--------	------	200	7, 4	----do-------	-------	----------	C,E, 3/4	Ind	(2)
D-100	Richardson & Bass.	----------	2,973.9	------	220	8	Cenozoic alluvium.	51.7 44.3	June 6, 1956 Nov. 3, 1956	N	N	
D-101	B. F. Jenkins	----------	--------	------	107	6	----do-------	38.0	Nov. 3, 1956	C,W	S	Cased to 100 ft. Reportedly producing from gravel at 100-107 ft.
D-102	Stanolind Oil & Gas Co.	----------	--------	------	170	8	----do-------	40.1	----do-------	N	N	Cased to bottom; slotted. Supplied water for drilling oil-test well.
D-103	Gulf Oil Corp.	J. D. Cole----	2,958	1947	300	10, 8	----do-------	55.5	Oct. 23, 1956	N	N	Casing: 156 ft of 10-in., cemented; slotted from 156 to 300 ft.[2]
D-104	Phillips Petroleum Co.	----------	--------	1946	190	6	----do-------	48.8	Nov. 1, 1956	N	N	
D-105	----do-------	----------	--------	1945	190	6	----do-------	52.3	----do-------	N	N	
D-106	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,978	1946	8,110	-------	----------	-------	----------	-------	-----	Oil test. Mack Taylor well B-1. Radioactivity log Q-99.[1]
*D-107	----do-------	----do-------	2,955.4	------	10	-------	Cenozoic alluvium.	6.0	June 7, 1957	N	S	Dug with bulldozer about 15 by 25 ft. Altitude of water level June 7, 1957, was 2,949.4 ft above mean sea level. Supplied water for drilling oil-test well.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*D-108	J. B. Walton	The Texas Co.	2,974.1	1952	11	-------	Cenozoic alluvium.	5.8	June 7, 1957	N	S	Dug. Altitude of water level June 7, 1957, was 2,968.3 ft. Supplied water for drilling oil-test well.
D-109	Stanolind Oil & Gas Co.	----------	--------	------	------	6	----do-------	52.6	Nov. 3, 1956	N	N	Supplied water for drilling oil-test well.
D-110	Gulf Oil Corp.	Gulf Oil Corp.	2,966	1956	8,310	-------	----------	-------	----------	-------	-----	Oil test. Keystone well 178-D. Radioactivity log Q-100.[1]
D-111	----do-------	J. E. Germiller.	2,963.1	1948	250	10, 8	Cenozoic alluvium.	64.3 64.4	Oct. 23, 1956 June 10, 1957	N -------	N -----	Cased to bottom; slotted from 192 to 250 ft. Keystone Cattle Co. well 9. Supplied water for drilling oil-test well. Maximum yield reported to be 40 gpm.[2]
D-112	J. R. Sharp	----------	--------	1945	------	8	----do-------	-------	----------	C,Ng	D,Ind	
D-113	Gulf Oil Corp.	G. S. Taylor	2,962	1947	250	10, 8	----do-------	67.4	Oct. 23, 1956	N	N	Cased to bottom; slotted from 162 to 240 ft. Keystone Cattle Co. well 13. Supplied water for drilling oil-test well.[2]
D-114	----do-------	J. E. Germiller.	2,953	1945	227	10, 8	----do-------	60.0 60.0	Oct. 23, 1956 June 8, 1957	T,Ng -------	Ind -----	Cased to bottom; slotted from 170 to 226 ft. Keystone Cattle Co. well 8.[1]

D-115	----do----	J. R. Marshall	2,952.4	------	270	10, 8	----do----	70.6 70.3	Oct. 23, 1956 June 8, 1957	N ------	N ------	Cased to bottom; slotted from 220 to 270 ft; gravel-packed. Keystone Cattle Co. well 3.[2]
D-116	Martex Oil & Gas Co. well 2.	----------	2,953	------	152	8	----do----	------	----------	C, E, 3	D, Ind	
*D-117	Humble Oil & Refining Co.	----------	---------	------	200	7	----do----	------	----------	C, E, 3	D, Ind	
D-118	----do----	----------	---------	------	216	8, 7	----do----	72.9	Nov. 6, 1956	N	N	
D-119	----do----	----------	---------	------	220	8, 7	----do----	71.8	Oct. 23, 1956	N	N	
D-120	S. W. Richardson well 17.	----------	---------	------	225	8, 7	----do----	------	----------	N	N	Cased to bottom; slotted from 193 to 215 ft.[2]
D-121	Phillips Petroleum Co.	----------	---------	1944	210	7	----do----	68.8	Nov. 1, 1956	C, E, 3	D, Ind	
D-122	S. W. Richardson well 18.	----------	---------	------	206	8, 6	----do----	------	----------	N	N	Cased to bottom.[2]
D-123	Gulf Oil Corp.	Gulf Oil Corp.	2,961	1947	7,732	------	----------	------	----------	------	------	Oil test. Keystone well 115-Si. Radioactivity log Q-101.[1]
D-124	----do----	Earl Scott----	---------	1946	250	10, 8	Cenozoic alluvium.	69.2	Nov. 6, 1956	N	N	Cased to bottom. Keystone Cattle Co. well 10.[2]
D-125	----do----	J. J. Bush----	---------	1935	357	10, 8	Cenozoic alluvium and Santa Rosa sandstone.	------	----------	T, Ng	Ind	Cased to bottom; slotted from 289 to 357 ft. Keystone Cattle Co. well 5.[2]
D-126	----do----	F. C. Ingham--	---------	1935	250	10, 8	Cenozoic alluvium.	------	----------	T, Ng	Ind	Cased to 195 ft. Keystone Cattle Co. well 7.[2]
D-127	----do----	G. S. Taylor--	2,941	1947	250	10, 8	----do----	65.2	Oct. 22, 1956	T, E, 25	Ind	Cased to bottom; cemented to 168 ft; slotted.[2]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-128	Gulf Oil Corp.	F. C. Ingham	2,942.0	1935	332	10, 8, 6	Cenozoic alluvium and Santa Rosa sandstone.	76.9 76.1 80.7	Oct. 23, 1956 Feb. 14, 1957 June 10, 1957	N --- ---	N --- ---	Keystone Cattle Co. well 1.[2]
*D-129	---do---	J. R. Marshall	2,940	1935	250	10, 8	Cenozoic alluvium.	---	---	T,E, 25	Ind	Cased to 216 ft; slotted from 179 to 216 ft. Keystone Cattle Co. well 2.[2]
D-130	Carter Foundation.	Cole & Powell	---	1953	248	10, 8	---do---	---	---	T,E, 25	P,Ind	Cased to bottom; slotted from 175 to 240 ft.[2]
D-131	J. B. Walton	---	2,933.6	---	188	6	---do---	80.3	Oct. 22, 1956	C,W	S	
D-132	Carter Foundation.	Carter Foundation.	2,932	1956	3,353	---	---	---	---	---	---	Oil test. Pure-Walton well 5. Radioactivity log Q-102.[1]
D-133	Standard of Texas.	Harry Bass	---	1938	202	8	Cenozoic alluvium.	86.8	Nov. 14, 1956	N	N	Baird well 1.[2]
D-134	---do---	---	---	---	130	10	---do---	76.0	Nov. 21, 1956	N	N	
*D-135	J. B. Walton	J. R. Marshall	---	1937	155	6	---do---	81.4	Oct. 20, 1956	C,W	S	Cased to 125 ft.
*D-136	Cabot Carbon Black Co.	---do---	---	---	180	12, 10	---do---	85.4	---do---	T,E, 25	Ind	Cased to bottom; slotted from 148 to 180 ft.[2]
*D-137	---do---	J. D. Cole	---	1947	230	16, 10	---do---	---	---	T,E, 20	Ind,P	Cased to bottom; slotted from 144 to 266 ft; gravel-packed.[2]
*D-138	---do---	---	2,908.83	---	215	10	---do---	75.5	Oct. 20, 1956	T,E, 10	P	

D-139	Magnolia Petroleum Co.	Bethel & Matthews.	2,899	1950	219	10, 7	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------	T,E, 25	P,Ind	Cased to bottom; slotted.[2]
D-140	----do-------	Magnolia Petroleum Co.	2,913	1955	8,131	-------	----------	-------	----------	-------	-----	Oil test. State-Walton well 25-E. Radioactivity log Q-103.[1]
*D-141	----do-------	J. R. Marshall	2,899	1934	225	10	Cenozoic alluvium and Santa Rosa sandstone(?)	89.1	Sept. 20, 1956	T,E, 5	P,Ind	
D-142	----do-------	Magnolia Petroleum Co.	2,896	1954	2,965	-------	----------	-------	----------	-------	-----	Oil test. J. B. Walton well 68. Radioactivity log Q-104.[1]
D-143	----do-------	H. U. Barnes.	--------	1955	274	20, 10	Cenozoic alluvium and Santa Rosa sandstone.	-------	----------	T,E, 25	Ind	Cased to bottom; three joints of casing slotted. Water flood well 2.[2]
*D-144	----do-------	J. R. Marshall	2,880	1936	250	12	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------	T,E, 25	P,Ind	
D-145	----do-------	----do-------	2,875	1934	245	10	----do-------	-------	----------	T,E, 15	P,Ind	Cased to 200 ft; slotted.
D-146	----do-------	----do-------	2,880	1936	250	12, 8	----do-------	-------	----------	T,E, 15	P,Ind	Cased to 225 ft; slotted.
D-147	----do-------	O. C. Reynolds	--------	1934	165	12	Cenozoic alluvium.	-------	----------	T,E, 15	P,Ind	Cased to bottom; slotted.
D-148	----do-------	H. R. Bethel--	2,872	1957	275	20, 10	Cenozoic alluvium and Santa Rosa sandstone.	95.9	Apr. 15, 1957	T,E, 25	P,Ind	Cased to bottom; slotted from 135 to 235 ft; gravel-packed.[2]
D-149	----do-------	----------	--------	1937	196	15	Cenozoic alluvium.	96.2	Sept. 22, 1956	T,E, 15	Ind	
D-150	----do-------	----------	2,879.2	1936	201	15, 12	----do-------	95.8 95.2	Sept. 20, 1956 June 11, 1957	N	N	Cased to 188 ft; plugged back to 183 ft; slotted from 118 to 183 ft.[2]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-151	Magnolia Petroleum Co.	O. C. Reynolds	2,870	1934	165	20	Cenozoic alluvium.	113.9	Sept. 20, 1956	N	N	
D-152	----do----	----do----	----	1935	168	12	----do----	100	September 1956	T, E, 15	P, Ind	Cased to 125 ft.
D-153	----do----	Magnolia Petroleum Co.	2,889	1956	3,000	----	----	----	----	----	----	Oil test. J. B. Walton well 242. Radioactivity log Q-105.[1]
*D-154	Sun Oil Co.	Dixon Well Service.	----	1953	143	----	Cenozoic alluvium.	105	May 1956	T, E, 5	Ind	
D-155	Amerada Petroleum Corp.	----	----	1956	200	12	----do----	----	----	T, E, 5	Ind, D	
D-156	Texas Pacific Coal & Oil Co.	Clark Drilling Co.	2,885	1954	1,305	10	Rustler formation.	375	March 1954	T, E, 37½	Ind	Yields salt water from open hole 1,135 ft. to 1,305 ft.[2]
D-157	----do----	----	----	----	187	8, 5	Cenozoic alluvium.	90.1	Sept. 24, 1956	N	N	Cased to bottom; slotted from 147 to 187 ft.
D-158	----do----	Texas & Pacific Coal & Oil Co.	2,885	1954	3,080	----	----	----	----	----	----	Oil test. Daugherty well 17. Radioactivity log Q-106.[1]
D-159	----do----	----	----	1937	204	8	Cenozoic alluvium.	----	----	T, E, 5	D, Ind	
*D-160	----do----	Atwood & Clark Drilling Co.	2,880	1954	1,234	13, 10	Rustler formation.	375	July 1954	T, E, 37½	Ind	Yields salt water from open hole 1,135 to 1,234 ft. Temp 67°F.[2]

D-161	D. H. Bolin		2,880	1935	200	8, 7	Cenozoic alluvium.			T,E, 7½	Ind	Cased to bottom; slotted from 140 to 200 ft.
D-162	do		2,879.8	1935	200	8, 7	do	92.4 98.2	Sept. 24, 1956 June 11, 1957	N	N	Do.
*D-163	Sinclair Oil & Gas Co. well 3.	F. C. Ingham		1934	200	10, 8	do	91	September 1956	T,E, 10	Ind	Cased to bottom; slotted.[2]
D-164	Sinclair Oil & Gas Co. well 4.				180	8				N	N	(2)
D-165	Sinclair Oil & Gas Co.	F. C. Ingham	2,870	1934	215	8	Cenozoic alluvium.	88.8	Oct. 22, 1956	C,G, 5	Ind	Cased to 165 ft.[2]
D-166	Atlantic Refining Co.	J. D. Cole	2,865	1956	190	10	do	91.2	Nov. 17, 1956	T,E, 5	Ind	Cased to 114 ft; cemented.[2]
D-167	do	do	2,862	1956	190	10	do	84.0	Sept. 25, 1956	T,E, 3		Cased to 103 ft; cemented.[2]
D-168	D. H. Bolin		2,868	1935	201	8, 7	do	84.5	Sept. 24, 1956	T,E, 7½	Ind	Cased to bottom; slotted from 139 to 201 ft. Reported to pump 118 gpm on 9-hr test.
D-169	D. D. Feldman Oil & Gas Co.	D. D. Feldman Oil & Gas Co.	2,872	1952	3,134							Oil test. Daugherty well 4-A. Electric log Q-107.[1]
D-170	Cabot Gasoline Plant.	J. D. Cole		1953	212	12	Cenozoic alluvium.			T,E, 30	Ind	Reported to yield 300 gpm.
D-171	do			1936	200	8	do			T,E, 10	P	Reported to yield 60 gpm.
D-172	J. B. Walton			Old	125	6	do	75.5	Nov. 17, 1956	C,W	N	Old well.
D-173	Gulf Oil Corp. well 7.	J. R. Marshall	2,883.2	1937	225	8	Cenozoic alluvium and Santa Rosa sandstone.	89.2 88.7	Nov. 16, 1956 June 11, 1957	T,Ng	Ind	(2)
D-174	do	Gulf Oil Corp.	2,882	1955	3,100							Oil test. Daugherty well 7. Radioactivity log Q-108.[1]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-175	Gulf Oil Corp. well 5.	R. E. Griggs		1937	218	8	Cenozoic alluvium and Santa Rosa sandstone.	89.5	Nov. 19, 1956	N	N	Cased to 117 ft.[2]
D-176	Gulf Oil Corp. well 6.	do		1937	216	8	do	91.3	do	N	N	Cased to 106 ft.[2]
D-177	Gulf Oil Corp. well 1.	J. R. Marshall		1936	180	8	Cenozoic alluvium.	91.8	do	N	N	Cased to 85 ft.[2]
D-178	Sunray Mid-Continent Oil Co.		2,885.5	1934	175	8	do	96.5	Nov. 16, 1956	T,E, 7½	Ind	
D-179	Humble Oil & Refining Co.	F. C. Ingham	2,894	1936	175	8, 6	do			T,E, 10	Ind	Cased to bottom; slotted. J. F. Howe well 2.[2]
D-180	do	do		1936	186	8, 6	do			T,E, 3	Ind	Cased to bottom; slotted. J. F. Howe well 3.[2]
D-181	do	do	2,894	1935	173	8, 6	do			T,E, 10	Ind	Cased to bottom; 45 ft slotted. J. F. Howe well 1.[2]
D-182	do	do		1936	195	8, 6	do			N	N	Cased to bottom; slotted. Abandoned. J. F. Howe well 4.
D-183	J. B. Walton		2,888.4		130	6	do	87.4	Nov. 17, 1956	C,W	S	
D-184	Standard Oil Co. of Texas.	Standard Oil Co. of Texas.	2,901	1957	10,642							Oil test. H. E. Lovett well 2. Radioactivity log Q-109.[1]
*D-185	J. B. Walton			Old	87	8	Cenozoic alluvium.	75.8 75.8	Oct. 20, 1956 Nov. 21, 1956	C,W	S	

*D-186	----do----	----------	-------	Old	87	------	----do----	72		1940	C,W	S	
D-187	Standard Oil Co. of Texas.	Standard Oil Co. of Texas.	2,916	1953	3,284	------	----------	-------	----------	-------	-------	-----	Oil test. W. E. Baird well 13-21. Radioactivity log Q-110.[1]
D-188	----do----	----------	-------	1956	160	8	Cenozoic alluvium.	78.4	June	25, 1957	T,B	Ind	Supplied water for drilling oil-test wells.
D-189	Quinette & Leiderman.	----------	-------	1948	200	7	----do----	-------	----------		C,E, 3	D	
D-190	----do----	----------	-------	Old	100	8	----do----	74.6	Nov.	21, 1957	N	N	Old well.
*D-191	Standard Oil Co. of Texas.	J. R. Marshall	2,905.4	1940	195	8	----do----	-------	----------		T,E, 5	D	Cased to 167 ft. Baird well 3.
D-192	J. B. Walton--	J. D. Cole ----	2,905.4	1955	150	6	----do----	67.2	Nov.	21, 1956	C,W	S	Cased to bottom; slotted.
*D-193	Standard Oil Co. of Texas.	Richardson Drilling Co.	-------	1953	1,062	13	Rustler formation.	-------	----------		T,E, 75	Ind	Cased to 902 ft.[2]
D-194	----do----	Sidwell & Imler.	2,906.5	1952	409	13, 9	Cenozoic alluvium and Santa Rosa sandstone.	100.7 103.7 108.0	Nov. Apr. June	14, 1956 15, 1957 10, 1957	T,E, 10	Ind	Cased to 387 ft; gravel-packed. Radioactivity log Q-111.[1,2]
D-195	----do----	Richardson Drilling Co.	-------	1953	1,023	13	Rustler formation.	189.9	Nov.	14, 1956	T,Ng	Ind	Cased to 815 ft.[2]
*D-196	----do----	----------	-------	1951	425	13	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------		T,E, 30	Ind	Cased to bottom; slotted.[2]
D-197	----do----	Sidwell & Imler.	-------	1952	412	13, 9	Santa Rosa sandstone.	123.1	Nov.	14, 1956	T,E, 20	Ind	Do.
D-198	Richardson Oils, Inc.	----------	-------	------	195	8	Cenozoic alluvium.	82.3	Nov.	21, 1956	N	N	Cased to 180 ft.
D-199	----do----	----------	-------	------	------	8	----do----	-------	----------		N	N	Cased to 154 ft.
D-200	----do----	Richardson Drilling Co.	-------	1954	1,020	9	Rustler formation.	-------	----------		T,E, 30	Ind	Cased to 895 ft.
D-201	----do----	Richardson Oils, Inc.	2,922	1954	3,353	------	----------	-------	----------	-------	-------	-----	Oil test. W. E. Baird well 4. Radioactivity log Q-1.[1]
D-202	Gulf Oil Corp.	Gulf Oil Corp.	2,918	1953	3,400	------	----------	-------	----------	-------	-------	-----	Oil test. Keystone Cattle Co. well 162. Radioactivity log Q-112.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level: Below land-surface datum (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
D-203	Gulf Oil Corp.	W. D. Holt	2,939	1935	220	10, 8	Cenozoic alluvium.	75.4	Oct. 23, 1956	N	N	Cased to 200 ft; slotted from 138 to 200 ft. Keystone Cattle Co. well 4.[2]
D-204	Seth Campbell	Hammett	2,919.0	1935	158	6	do	61.4	Oct. 7, 1956	C,W	S	Cased to bottom; slotted.
D-205	do	O. C. Reynolds		1940	178	6	do	61.1	do	C,W	S	Do.
D-206	do	do		1938	180	6	do	62.4	Dec. 6, 1956	C,W	S	Do.
D-207	The Texas Co.		2,909.1	1957	100	6	do	68.7	June 8, 1957	N	N	Supplied water for drilling oil-test well.
*D-208	Seth Campbell	Wade		1935	175	7	do	65.0	Oct. 24, 1956	C,W	S	
*D-209	The Texas Co.	Bob Glynn	2,885.5	1935	140	7	do	70.6	do	T,E, 3	D	
D-210	The Texas Co. well 1.	Martin Drilling Co.	2,888	1957	1,045	16, 11	Rustler formation.	181.3	Jan. 31, 1957	T,E, 50	Ind	Radioactivity log Q-113.[1]
D-211	do			Old	200		Cenozoic alluvium.	73.2	Nov. 21, 1956	N	N	Old well.
D-212	Seth Campbell		2,893.6		200	6, 4	do	74.0 74.0	Nov. 21, 1956 June 8, 1957	C,W	S	Cased to bottom; slotted.
D-213	Bashara & Protho Oil Co.	Pekoe Drilling Co.		1956	1,015	13, 9	Rustler formation.	177.2	Nov. 21, 1956	N	N	Reported to yield 290 gpm on 48-hr test.
D-214	do		2,877.0		160	6	Cenozoic alluvium.	68.8	do	T,E, 3	D,Ind	
D-215	J. B. Walton				180	6	do	68.2	Nov. 17, 1956	C,W	S	
D-216	Humble Oil & Refining Co.	Humble Oil & Refining Co.	2,866	1955	3,017							Oil test. W. A. McCutcheon well 9. Radioactivity log Q-114.[1]

D-217	----do----	R. E. Griggs	----	1936	300	8, 6	Santa Rosa sandstone.	----	----	T,E, 7½	Ind	Cased to bottom; slotted from 268 to 300 ft.[2]
D-218	----do----	F. C. Ingham	2,867.9	1936	301	8, 6	Cenozoic alluvium and Santa Rosa sandstone (?)	72.2	Nov. 22, 1956	T,E, 10	Ind	Cased to bottom; slotted from 274 to to 301 ft.[2]
D-219	J. M. Sharp Oil Co.	----	----	----	----	7	----	----	----	T,E, 10	Ind	
*D-220	Ambassador Oil, Inc.	J. D. Cole	2,876.7	1953	200	7, 5	Cenozoic alluvium and Santa Rosa sandstone (?)	79.3	Nov. 17, 1956	T,E, 7½	Ind	Cased to bottom.
D-221	Sinclair Oil & Gas Co.	Sinclair Oil & Gas Co.	2,872	1956	2,900	----	----	----	----	----	----	Oil test. J. B. Walton well C-8X. Radioactivity log Q-115.[1]
D-222	----do----	J. R. Marshall	2,875	1936	178	6	Cenozoic alluvium.	75.8	Oct. 19, 1956	T,E	Ind	Cased to 133 ft. J. B. Walton well 2.[2]
D-223	----do----	----do----	2,875	1936	165	6	----do----	----	----	T,E	Ind	Cased to 129 ft. J. B. Walton well 1.[2]
*D-224	Rock Hill Oil Co. well 2.	----	2,875	1936	150	8	----do----	65	October 1956	T,E, 5	D	Cased to 120 ft.
D-225	Rock Hill Oil Co. well 1.	----	2,875	1936	150	8	----do----	65	----do----	T,E, 7½	Ind	Do.
D-226	Tidewater Oil Co.	----	----	1936	300	8, 7	Cenozoic alluvium and Santa Rosa sandstone.	----	----	T,E, 5	Ind	Cased to 210 ft.
D-227	----do----	J. D. Cole	----	1952	355	7	----do----	----	----	T,E, 10	Ind	Cased to 160 ft.
D-228	----do----	Bob Glynn	----	1951	285	7	----do----	----	----	T,E, 5	Ind	Cased to 147 ft.[2]
D-229	J. B. Walton	J. D. Cole	----	1953	145	8	Cenozoic alluvium.	----	----	T,E, 5	D	
D-230	----do----	J. R. Marshall	----	1940	100	6	----do----	68.3	Mar. 18, 1957	C,W	D,S	
*D-231	----do----	J. D. Cole	----	1953	200	8	----do----	78.4	----do----	T,E, ½	D,S	

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-232	J. B. Walton	Bob Glynn		1949	200	8	Cenozoic alluvium.			T,E, 5	D	
D-233	Sunray-Mid-Continent Oil Co.				175	8	do			T,E, 7½	D,Ind	
D-234	do		2,858.0		175	7	do	59.4 59.5	Nov. 16, 1956 June 11, 1957	N	N	
D-235	Humble Oil & Refining Co.	R. E. Griggs		1936	300	10, 6	Cenozoic alluvium and Santa Rosa sandstone.			T,E, 15	Ind	Cased to bottom; slotted from 103 to 300 ft.[2]
D-236	do	do		1936	300	8, 6	do	59.5	Nov. 22, 1956	T,E, 7½	Ind	Cased to bottom; slotted from 124 to 300 ft.[2]
D-237	J. B. Walton	J. D. Cole		1955		8				T,E, 1	D	
D-238	Gulf Oil Corp.	R. E. Griggs		1937	205	8	Cenozoic alluvium.			N	N	Cased to 76 ft. Reportedly caved.[2]
D-239	Shell Oil Co.				230	8	do	60.9	Nov. 17, 1956	N	N	
D-240	J. B. Walton					6	do	29.7	Nov. 15, 1956	C,W	S	
D-241	Humble Oil & Refining Co.	I. O. Fannin		1955	195	6	do			T,E, 7½	D	Cased to bottom; slotted.[2]
D-242	Skelly Oil Co.	J. J. Bush		1936	185	8, 7	do			T,Ng	Ind	Cased to 153 ft; slotted from 105 to 153 ft.[2]
D-243	Maxwell Oil, Inc.			1936	110	7	do	55	November 1956	T,E, 5	D,Ind	Cased to 70 ft.
*D-244	Harlan Producing Co.			1935	230	7	Cenozoic alluvium and			C,Ng, 3	D	Cased to 230 ft; slotted from 175 to

							Santa Rosa sandstone.						230 ft.
*D-245	----do----	J. D. Cole	----	1957	148	7	Cenozoic alluvium.	44.3	Jan.	31, 1957	T,E, 5	Ind	Probably contaminated by salt water.
D-246	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,871	1955	2,950	----	----	----	----	----	----	----	Oil test. Hendrick T-88 well 2. Radioactivity log Q-116.[1]
D-247	Gulf Oil Corp.	Gulf Oil Corp.	2,846	1955	3,115	----	----	----	----	----	----	----	Oil test. O. Clapp well 19. Radioactivity log Q-117.[1]
D-248	----do----	J. R. Marshall	----	1937	200	8	Cenozoic alluvium and Santa Rosa sandstone (?)	----	----		C,Ng	Ind	Cased to 68 ft.[2]
D-249	----do----	----do----	2,846.5	1936	199	10	----do----	43.7 41.4	Nov. June	16, 1956 11, 1957	N ----	N ----	Cased to 85 ft.[2]
D-250	Ambassador Oil, Inc.	J. D. Cole	----	1954	150	8	----do----	47		1954	T,E, 10	Ind	Cased to 96 ft.
D-251	----do----	----	----	----	106	7	Cenozoic alluvium.	52.4	Oct.	19, 1956	N	N	
D-252	Texas & Pacific Coal & Oil Co.	Texas & Pacific Coal & Oil Co.	2,858	1957	3,083	----	----	----	----	----	----	----	Oil test. Duval Royalty well 2. Radioactivity log Q-118.[1]
D-253	Sinclair Oil & Gas Co.	J. R. Marshall	2,860	1936	250	8, 6	----	----	----	----	N	N	Abandoned.[2]
D-254	----do----	----	----	----	200	6, 5	----	----	----	----	N	N	Do.
D-255	----do----	----	----	1939	150	7	Cenozoic alluvium.	----	----	----	C,W	Ind	Cased to 136 ft.[2]
*D-256	Standard Well Service.	J. D. Cole	----	1951	200	7	----do----	----	----	----	T,E, ½	D	
D-257	Humble Oil & Refining Co.	R. E. Griggs	----	1937	300	10, 6	----	----	----	----	N	N	Abandoned.[2]
*D-258	Skelly Oil Co.	J. D. Cole	----	1954	210	7	Cenozoic alluvium and Santa Rosa sandstone.	----	----	----	C,E, 3	P	

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-259	J. W. Peery--	----------	--------	-------	100	5	Cenozoic alluvium.	30.0	Nov. 15, 1956	N	N	
D-260	Veterans of Foreign Wars.	J. D. Cole---	2,843.4	1954	200	7	Cenozoic alluvium and Santa Rosa sandstone (?)	42.6 42.4	Oct. 11, 1956 June 11, 1957	T,E -------	D -----	
D-261	Autry-------	Bob Glynn---	--------	1951	205	7	Santa Rosa sandstone.	35.5	Dec. 5, 1956	T,Ng	D,Irr	Cased to 150 ft. Irrigates 1 acre.
D-262	Eastland Oil Co.	----------	--------	-------	135	6	Cenozoic alluvium.	56.3	Nov. 7, 1956	C,Ng	D	
D-263	----do-------	Eastland Oil Co.	2,846	1953	3,162	-------	----------	-------	----------	-------	-----	Oil test. Clapp well 5. Radioactivity log Q-119.[1]
D-264	J. B. Walton--	----------	--------	-------	110	5	Cenozoic alluvium.	45.3	Nov. 7, 1956	C,W	S	
D-265	J. C. Maxwell Oil Co.	----------	--------	1935	150	7	----do-------	60.9	Nov. 16, 1956	N	N	
D-266	----do-------	----------	2,849.7	1935	190	6	----do-------	50.4 50.2	Nov. 15, 1956 June 11, 1957	N	N	
D-267	J. B. Walton--	----------	--------	-------	100	7	----do-------	59.1	Oct. 16, 1957	C,W	S	
D-268	Russ Imlec Drilling Co.	----------	2,858	1957	751	-------	----------	-------	----------	-------	-----	Oil test. Barton well 1. Electric log Q-152.[1]
D-269	Humble Oil & Refining Co.	R. E. Griggs-	--------	1936	300	8, 6	Cenozoic alluvium and Santa Rosa sandstone.	-------	----------	T,E, 10	Ind	Cased to bottom; slotted below 152 ft.[2]
D-270	----do-------	F. C. Ingham-	--------	1936	175	8, 7	Cenozoic alluvium.	-------	----------	T,E, 10	Ind	Cased to bottom; slotted.[2]

D-271	J. C. Maxwell Oil Co.	J. C. Maxwell Oil Co.	2,868	1952	3,390	------	----------	-------	----------	-------	-----	Oil test. Gartex well B-5. Radioactivity log Q-120.[1]
D-272	City of Kermit	Glynn & Wade	2,865.5	1948	312	13	Cenozoic alluvium and Santa Rosa sandstone (?)	67.7	Mar. 18, 1957	T,E, 20	P	Cased to 257 ft. Community well 2.[2]
D-273	----do-------	Wheeler----	--------	Old	265	------	Cenozoic alluvium.	71.3 69.7	Oct. 11, 1956 Apr. 18, 1957	T,E, 30	P -----	Cased to bottom; slotted. Community well 1.
D-274	Mrs. Underwood.	J. R. Marshall	2,855.5	1933	200	6	----do-------	62.8	Dec. 5, 1956	C,W	D	
D-275	Kermit Public School System.	----do------	--------	1936	235	8	----do-------	51.8	Apr. 25, 1957	T,E, 7½	N	Located in basement of school. Measuring point for depth to water about 20 ft below ground level.
D-276	----do-------	----------	--------	------	200	10	----do-------	-------	----------	T,E, 7½	P	
*D-277	City of Kermit	Homer Shutten	2,845.4	1957	405	16	Santa Rosa sandstone.	90.0 70.4	Aug. 16, 1957 Jan. 1, 1958	T,E -------	N -----	Cased to 230 ft; cemented; 15-in. open hole to total depth. Electric and radioactivity logs and microlog Q-121.[1] Santa Rosa well 3.
*D-278	----do-------	Bob Glynn---	--------	1949	300	13	Cenozoic alluvium and Santa Rosa sandstone.	62.1	Mar. 18, 1957	T,E, 25	P	Casing cemented at 220 ft. Reported to yield 278 gpm in 1954; pumping level 152.9 ft, Oct. 11, 1956. Underwood well 2.
*D-279	----do-------	Kermit Oil & Development Co.	--------	1929	700	12	Santa Rosa sandstone.	63.3	Oct. 7, 1939	T,E, 25	P	Cased to 274 ft; drilled as oil-test well converted to water well in 1939. Underwood well 1.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*D-280	City of Kermit	Permian Well Service.	2,853	1946	501	13	Santa Rosa sandstone.	68 90.9	1946 Nov. 23, 1956	T,E, 25	P -----	Cased to 236 ft. Underwood well 5.[2]
D-281	----do-------	J. D. Cole---	2,844.3	1957	300	13	Cenozoic alluvium and Santa Rosa sandstone.	54.9 57.5	Mar. 11, 1957 Jan. 3, 1958	T,E, 25	P -----	Cased to 171 ft; cemented.[2]
D-282	----do-------	----do------	--------	1952	300	13	----do-------	61.8	Mar. 18, 1957	T,E, 25	P	Cased to 173 ft; cemented. Underwood well 3.[2]
D-283	----do-------	Glynn & Wade-	2,851.7	1948	300	13	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------	T,E, 40	P	Cased to 197 ft; cemented. Underwood well 4.
D-284	C. B. Parker--	Bob Glynn---	--------	1954	200	7	Cenozoic alluvium.	-------	----------	T,E, 5	D	Cased to bottom; slotted.
*D-285	----do-------	Redman-----	--------	1938	200	5	----do-------	66.3	Dec. 5, 1957	C,W	D	
D-286	Westbrook Oil Corp.	----------	--------	Old	230	7	----do-------	57.9	Nov. 7, 1956	N	N	Old well.
D-287	Skelly Oil Co.	Skelly Oil Co.	2,846	1951	3,250	-------	----------	-------	----------	-------	-----	Oil test. F. Getty II – Brown Altman well 1. Radioactivity log Q-122.[1]
D-288	Gulf Oil Corp.	Gulf Oil Corp.	2,848	1954	3,230	-------	----------	-------	----------	-------	-----	Oil test. O. Clapp well 31. Radioactivity log Q-123.[1]
D-289	Skelly Oil Co.	----------	--------	Old	100	6	Cenozoic alluvium.	56.2	Nov. 7, 1956	N	N	Cased to 85 ft. Old well.
D-290	L. S. Bogart---	J. D. Cole---	--------	1950	209	7	----do-------	-------	----------	C,W	D	

*D-291	City of Kermit	Bud Carr & J. D. Cole.	2,858.2	1957	559	8	Santa Rosa sandstone.	107.7 97.9	Apr. 26, 1957 Jan. 4, 1958	T,E, 40	P -----	Cased to 262 ft. Santa Rosa well 1. Radioactivity and electric logs and micrologQ-16.[1]
*D-292	----do-------	Crandell, Osmond, & J.C. Marshall.	2,858.0	1935	545	12	Cenozoic alluvium and Santa Rosa sandstone(?)	76.9	Nov. 23, 1956	T,E, 25	P	Walton Station well 2.
D-293	----do-------	----------	--------	Old	700	-------	Santa Rosa sandstone.	115.9	July 9, 1957	T,E, 20	P	Converted oil test. Walton station well 1.
*D-294	----do-------	----------	--------	1946	471	20, 13	Cenozoic alluvium and Santa Rosa sandstone(?)	94.8	Nov. 23, 1956	T,E, 40	P	Walton station well 4.
D-295	Kermit High School.	J. D. Cole---	--------	1950	250	16, 10	Cenozoic alluvium.	-------	----------	T,E, 20	P,Irr	
D-296	City of Kermit-	Glynn & Wade	--------	1948	335	13, 9	Santa Rosa sandstone.	96.1	Feb. 15, 1957	N	N	Cased to bottom; slotted.[2]
D-297	J. A. Crossno -	J. D. Cole---	--------	1950	200	7	Cenozoic alluvium.	-------	----------	T,E, 5	D	Cased to 176 ft.
*D-298	Winkler County	----do------	--------	1953	252	16, 10	----do-------	62	1953	T,E, 15	Irr	Cased to bottom; slotted from 215 to 252 ft; gravel-packed.[2]
*D-299	City of Kermit-	Homer Shutten	2,861.6	1957	394	16	Santa Rosa sandstone.	129.5 105.4	July 28, 1957 Jan. 3, 1958	T,E -------	P -----	Cased to 265 ft; 14-in. hole from 265 to 394 ft. Drawdown 94 ft after pumping 24-hr. at 1,875 gpm. Santa Rosa well 2. Radioactivity and electric logs and micrologQ-124.[1]
D-300	Southern California Petroleum Corp.	Southern California Petroleum Corp.	2,860	1955	3,503	-------	----------	-------	----------	-------	-----	Oil test. C. A. Robinson well 1. Radioactivity log Q-125.[1]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
D-301	Skelly Oil Co.	Skelly Oil Co.	2,862	1955	3,357	-------	----------	-------	----------	-------	-----	Oil test. Seth Campbell well B-1,. Radioactivity log Q-7.[1]
*D-302	C. M. Chastain	Noll Drilling Co.	2,867.2	1957	375	6	Cenozoic alluvium and Santa Rosa sandstone.	66.3	Mar. 20, 1957	T,E, 1½	D	Cased to 210 ft.[2]
D-303	Southern California Petroleum Corp.	Southern California Petroleum Corp.	2,866	1955	3,485	-------	----------	-------	----------	-------	-----	Oil test. Brown and Altman well 1. Electric log Q-126.[1]
D-304	Earl Vest	----------	2,855.9	Old	165	6	Cenozoic alluvium.	62.0	Dec. 6, 1956	C,W	S	Cased to bottom; slotted. Old well.
D-305	Bettis & Shepherd.	Bettis & Shepherd.	2,881	1956	4,047	-------	----------	-------	----------	N	N	Oil test. Seth Campbell well 1. Electric log Q-127.[1]
D-306	Seth Campbell	Bob Beaty	2,880.3	Old	199	7	Cenozoic alluvium.	66.7	Oct. 24, 1956	C,W	D,S	Old well.
*D-307	----do-------	Wade	--------	1935	168	7	----do-------	61.2	----do-------	C,W	S	
D-308	----do-------	----do-------	--------	Old	175	7	----do-------	-------	----------	C,W	S	Do.
D-309	----do-------	O. C. Reynolds	--------	Old	160	6	----do-------	61.8	Dec. 7, 1956	C,W	S	Do.
E-1	Gulf Oil Corp.	G.S. Taylor	3,112.3	1948	135	12, 7	----do-------	65.3 65.0	Jan. 8, 1957 June 11, 1957	N -------	N -----	Supplied water for drilling oil-test well. Keystone Cattle Co. well 16.[2]
E-2	----do-------	----do-------	--------	1948	135	7	----do-------	-------	----------	N	N	Supplied water for drilling oil-test well. Keystone Cattle Co. well 19.[2]

E-3	----do----	J. D. Cole----	----	1948	135	8, 5	----do----	----	----	N	N	Supplied water for drilling oil-test well. Keystone Cattle Co. well 18.[2]
E-4	----do----	----do----	3,118.5	1948	890	7	Dockum group	311.4	Jan. 24, 1957	N	N	Cased to 700 ft. Top of Santa Rosa at 850 ft. Supplied water for drilling oil-test well. Keystone Cattle Co. well 15.[2]
E-5	----do----	Gulf Oil Corp.-	3,119	1949	9,744	----	----	----	----	----	----	Oil test. Keystone Cattle Co. well 135-E. Electric log Q-21.[1]
E-6	----do----	J. D. Cole----	----	1948	135	10	Cenozoic alluvium.	----	----	N	N	Reportedly dry when drilled. Keystone Cattle Co. well 17.[2]
E-7	----do----	Flack & Felton	----	1949	185	7	----do----	65.4	Jan. 24, 1957	N	N	Reportedly dry when drilled. Keystone Cattle Co. well 20.[2]
E-8	Chas. W. Hawkins well 1.	TXL Oil Co.--	3,225	1956	4,950	----	----	----	----	N	N	Oil test. Radioactivity log Q-11.[1]
E-9	M.B. Cochran well 1.	Macdonald Oil Corp.	3,342	1956	8,265	----	----	----	----	N	N	Oil test. Radioactivity log Q-22.[1] In Ector County.
E-10	John Henry Wallace Estate.	Richardson & Bass.	----	1948	138	8	Cenozoic alluvium.	60.3	Jan. 24, 1957	N	N	Supplied water for drilling oil-test well.
E-11	B.F. Jenkins--	----	----	----	115	8	----do----	----	----	C,W	S	
*E-12	John Henry Wallace Estate.	----	----	----	115	8	----do----	----	----	C,W	S	
E-13	B.F. Jenkins--	----	----	----	115	8	----do----	52.3	Jan. 31, 1957	C,W	S	
E-14	----do----	Signal Oil & Gas Co.	3,089	1955	7,160	----	----	----	----	N	N	Oil test. Hardie well 1. Electric log Q-23.[1]
*E-15	Texas State Highway Department.	----	3,051.2	1950	120	8	Cenozoic alluvium.	34.2 34.4	Sept. 12, 1956 June 11, 1957	C,W	P	Supplies water for Sandhills Park.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
E-16	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	3,036	1956	5,250	------	----------	------	----------	------	-----	Oil test. M.G. Damron well 1. Radioactivity log Q-24.[1]
E-17	----do------	J. D. Cole---	3,035.3	1955	105	8	Cenozoic alluvium.	27.3	Nov. 3, 1956	------	-----	Supplied water for drilling oil-test well.
								27.5	June 11, 1957	------	-----	
E-18	Larry Fernandes.	----------	--------	------	70	6	----do------	41.3	Nov. 2, 1956	C,W	S	
*E-19	Waddell Bros. & Co.	----------	3,089.3	------	75	6	----do------	47.9	Feb. 7, 1957	C,W	S	Open hole from 70 to 75 ft. North well.[2]
E-20	----do------	----------	3,098.7	1949	125	5	----do------	73.9	----do------	C,W	S	
E-21	Waddell Bros. & Co. well 13.	----------	3,109.4	1939	125	6	----do------	93.0	----do------	C,W	S	
*E-22	Waddell Bros. & Co.	----------	--------	1885	65	5	----do------	50.1	----do------	C,W	D,S	Originally dug. Casing and gravel placed in well in the 1920's. Reported water level 50 ft in 1940. Known as Old Place well.
E-23	----do------	----------	3,086.4	1907	98	6	----do------	83.0	----do------	C,W	D,S	Cased to 90 ft; gravel-packed. Reported water level 84 ft in 1940.
*E-24	----do------	----------	3,087.4	1907	96	6	----do------	84.3	----do------	C,W	D,S	Reported water level 84 ft in 1940.
E-25	Humble Oil & Refining Co.	Branhare Drilling Co.	--------	1956	102	7	----do------	54.2	Dec. 14, 1956	N	N	Bottom 25 ft slotted. Supplied water for drilling oil-test well.

E-26	----do-------	Humble Oil & Refining Co.	3,041	1956	11,432	------	----------	------	----------	------	----	Oil test. Waddell Bros. well 1. Electric log Q-25.[1]
E-27	----do-------	Branhare Drilling Co.	3,041.5	1956	108	12, 7	Cenozoic alluvium.	54.7	Mar. 31, 1957	N	N	Bottom 25 ft slotted; gravel-packed. Supplied water for drilling oil-test well.
*E-28	Larry Fernandes.	----------	--------	Old	60	6	----do-------	42.6	Nov. 2, 1956	C,W	S	Old well.
E-29	----do-------	----------	--------	1937	102	6	----do-------	62.0	----do--------	C,W	S	
E-30	Gulf Oil Corp..	J. D. Cole---	2,971.7	1947	426	10, 8	Santa Rosa sandstone.	55.6	----do--------	N	N	Supplied water for drilling oil-test well.[2]
E-31	----do-------	Gulf Oil Corp.	2,970	1948	11,502	------	----------	------	----------	------	----	Oil test. Keystone Cattle Co. well 125-T. Electric log Q-26.[1]
E-32	Waddell Bros. & Co.	----------	--------	1912	80	6	Cenozoic alluvium.	48.4	Feb. 7, 1957	C,W	S	
E-33	T.B. Harris and others.	----------	--------	Old	100	6	----do-------	58.4	Jan. 28, 1957	C,W	S	Old well.
E-34	W.B. Collins .	----------	--------	------	100	6	----do-------	59.4	Jan. 25, 1957	N	N	
E-35	Tidewater Oil Co.	Harry Bass .	3,027.7	1956	100	7	----do-------	54.2	----do--------	------	----	Supplied water for drilling oil-test well.
E-36	C.O. Wheeler-	----------	--------	------	90	6	----do-------	56.8	Dec. 12, 1956	C,W	S	
E-37	Phillips Petroleum Co.	Phillips Petroleum Co.	3,107	1950	10,775	------	----------	------	----------	------	----	Oil test. Waddell well 1. Electric log Q-3.[1]
E-38	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	3,074	1946	10,657	------	----------	------	----------	------	----	Oil test. R.A. Wheeler well 1. Radioactivity log Q-145.[1]
*E-39	----do-------	Noble Drilling Co.	--------	1943	1,113	7, 5	Santa Rosa sandstone.	------	----------	C,Ng	D	Pump set at 684 ft.
E-40	Sun Oil Co.---	B.L. Wheeler-	--------	1944	1,188	7	----do-------	------	----------	C,Ng	D	
E-41	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	3,060	1944	10,646	------	----------	------	----------	------	----	Oil test. Wheeler well B-1. Electric log Q-27.[1]
*E-42	Waddell Bros. & Co.	----------	-------	Old	75	6	Cenozoic alluvium.	50.7	Jan. 28, 1957	C,W	S	

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
E-43	Cosden Oil Co.	----------	-------	1955	115	6	Cenozoic alluvium.	72.5	Dec. 7, 1956	-------	-----	Supplied water for drilling oil-test well.
E-44	S.B. Wight----	----------	-------	1956	120	6, 5	----do-------	59.3	----do-------	-------	-----	Do.
E-45	C.O. Wheeler well 1.	Magnolia Petroleum Co.	2,997	1947	7,155	------	----------	-------	----------	N	N	Oil test. Electric log Q-28.[1]
E-46	C.O. Wheeler-	----------	-------	-----	100	6, 4	Cenozoic alluvium.	59.6	Dec. 7, 1956	C,W	S	
E-47	Larry Fernandes.	Hammett----	-------	1945	105	6	----do-------	63.9	Nov. 1, 1956	C,W	S	Good water reported.
E-48	----do-------	Pete Smith--	-------	Old	93	6	----do-------	63.5	----do-------	C,W	D	Do.
E-49	C.O. Wheeler-	----------	2,906.9	-----	100	6	----do-------	61.2	Dec. 17, 1956	C,W	D,S	Do.
E-50	----do-------	----------	-------	Old	90	6	----do-------	61.6	Jan. 28, 1957	C,W	S	Good water reported. Old well.
*E-51	----do-------	----------	2,925	1942	140	6	----do-------	57.1	Dec. 7, 1956	C,W	S	Oil test; plugged back and converted to water well.
E-52	Humble Oil & Refining Co.	----------	2,920.4	1953	100	7	----do-------	58.0	----do-------	-------	-----	Supplied water for drilling oil-test well.
E-53	C.O. Wheeler-	Frank & George Frankel.	2,932	1953	11,927	------	----------	-------	----------	N	N	Oil test. Driver well 1. Electric log Q-29.[1]
F-1	Hissom Drilling Co.	Hissom Drilling Co.	-------	1955	5,172	------	----------	-------	----------	N	N	In Loving County. Oil test. Tennessee Mac well 1. Radioactivity log Q-137.[1]
F-2	J.E. Haley ---	----------	2,869.4	Old	250	5	Santa Rosa sandstone.	188.7	Apr. 10, 1957	C,W	S	Old well.

F-3	----do-------	----------	2,855.6	------	-----	6	----------	158.6	Sept. 13, 1956	C,W	D,S	
F-4	----do-------	----------	2,855.3	1947	200	6	----------	156.5	----do--------	C,W	S	
*F-5	L.W. Anderson	J.O. Jarman -	2,846.9	1938	184	6	Cenozoic alluvium.	140.5	Sept. 12, 1956	C,W	S	Cased to bottom; slotted from 165 to 175 ft.[2]
								139.2	Apr. 1, 1957	-------	-----	
*F-6	C.E. Wilson --	O.C. Reynolds	--------	------	290	5	----do-------	127	April 1940	C,W	S	
								96.8	Sept. 13, 1956	-------	-----	
F-7	C.F. Garlitz --	C.F. Garlitz -	2,795	1952	3,285	-------	----------	-------	----------	N	N	Oil test. T.G. Hendricks well 1. Electric log Q-138.[1]
*F-8	Winkler County Country Club.	Bob Glynn---	--------	1946	190	7	Cenozoic alluvium.	-------	----------	T,E, 15	Irr	
*F-9	Jack Lineberry	----------	2,826.7	1953	130	6	----do-------	118.3	Sept. 12, 1956	C,W	S	
F-10	----do-------	C.F. Garlitz -	2,820	1953	130	7	----do-------	95.9	----do--------	C,W	S	Oil test. Hendrick well 2. Plugged back and converted to water well. Electric log Q-139.[1]
*F-11	Hulda J. Wilson.	----------	--------	Old	100	5	----do-------	-------	----------	N	N	Casing blocked. Abandoned. Old well.
F-12	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,845	1956	2,925	-------	----------	-------	----------	-------	-----	Oil test. T-88-M well 16. Radioactivity log Q-140.[1]
F-13	Humble Oil & Refining Co.	G.P. Mizell -	2,846.1	1928	240	8, 6	Cenozoic alluvium.	15.8	Nov. 15, 1956	N	N	Cased to bottom; slotted. Abandoned. Ida Hendrick well C-4.[2]
*F-14	Hulda J. Wilson.	----------	2,833.9	------	230	6	----do-------	47.3	Sept. 19, 1956	C,W	S	
*F-15	----do-------	----------	--------	Old	96	6	----do-------	63	April 1946	C,W	S	Old well.
								31.4	Nov. 15, 1956	-------	-----	
*F-16	Permian Ice Co.	----------	2,809	Old	219	6	----do-------	59.5	Sept. 19, 1956	C,W	N	Abandoned. Old well.
F-17	Atlantic Pipeline Co.	----------	--------	Old	120	6	----do-------	-------	----------	C,E, 2	D	

See footnotes at end of table.

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Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)				
*F-18	Pasotex Pipeline Co. well 4.	Layne-Texas Co.	2,804	1953	468	12, 6	Cenozoic alluvium.	47 70	September 1953 September 1956	C,E, 5	D,Ind -----	Casing: 408 ft of 12-in., cemented; screen from 418 to 438 ft.[2]
F-19	Pasotex Pipeline Co. well 1.	L. E. Buchanan.	2,804	1928	438	6	----do-------	-------	----------	J,A	D	(2)
F-20	Pasotex Pipeline Co. well 2.	----do-------	2,804	1928	542	6	----do-------	-------	----------	J,A	D	(2)
*F-21	Wink City Airport.	----------	2,807.7	1942	210	5	----do-------	110 99.8	July 1943 Sept. 19, 1956	C,E, 15	D -----	(2)
*F-22	L. W. Anderson	----------	-------	------	176	6	----do-------	137	April 1940	C,W	S	
F-23	Hulda J. Wilson.	J. R. Marshall	-------	1938	235	7	----------	159.1	Sept. 13, 1956	C,G	S	Bad water reported.
F-24	G. P. Mitchell	----------	-------	1948	------	6	----------	-------	----------	C,W	S	Do.
*F-25	-----do-------	----------	2,870.9	Old	300	7	Santa Rosa sandstone(?)	218.7	Sept. 13, 1956	C,W	D,S	Old well.
*F-26	D. P. Anderson	----------	2,829.4	Old	152	6	----------	135.5	Sept. 19, 1956	C,W	D,S	Do.
*F-27	University of Texas.	L. F. Buchanan.	2,794.0	1940	208	5	Santa Rosa sandstone(?)	123.7 123.8	Sept. 20, 1956 Apr. 1, 1957	C,W -------	S -----	Cased to 164 ft; slotted from 144 to 164 ft.[2]
F-28	----do-------	Magnolia Petroleum Co.	2,787	1953	5,260	-------	----------	-------	----------	N	N	Oil test. University well A-1. Electric log Q-141.[1]
F-29	----do-------	----------	2,775.6	Old	127	5	Santa Rosa sandstone(?)	112 107.4 107.9	September 1940 Sept. 20, 1956 Apr. 1, 1957	C,W -------	S -----	Old well.
*F-30	----do-------	----------	2,798.4	Old	136	6	Cenozoic alluvium.	121.3 121.0	Sept. 21, 1956 Apr. 1, 1957	C,W -------	S -----	Do.

F-31	Shell Oil Co.	Shell Oil Co.	2,763	1957	5,106	-------	----------	-------	----------	-------	-----	Oil test. University well 21-A-1. Radioactivity log Q-142.[1]
F-32	D. P. Anderson	J. R. Marshall	2,797.7	1938	160	6	Cenozoic alluvium.	98.5	Sept. 20, 1956	C,W	S	[2]
F-33	City of Wink	----------	2,787.8	Old	250	8	----do-------	48.3	Sept. 21, 1956	T,E, 7½	P	Used as standby well in September 1956. Old well.
F-34	Ralph Lowe	Ralph Lowe	2,760	1954	7,586	-------	----------	-------	----------	N	N	Oil test. University well C-1. Radioactivity log Q-143.[1]
F-35	----do-------	----do-------	2,752	1954	7,150	-------	----------	-------	----------	-------	-----	Oil test. University well 2-E. Radioacitivty log Q-144.[1]
F-36	----do-------	----do-------	2,750	1953	7,505	-------	----------	-------	----------	-------	-----	Oil test. Univeristy well E-1. Electric log Q-146.[1]
*F-37	University of Texas.	----------	2,740.6	1946	140	5	Cenozoic alluvium.	119.1	Sept. 21, 1956	C,W	S	
F-38	Ralph Lowe	----------	2,725.2	------	190	6	----do-------	112.9	Jan. 24, 1957	N	N	Supplied water for drilling oil-test well.
								112.6	Apr. 2, 1957	-------	-----	
F-39	----do-------	Ralph Lowe	2,725	1953	10,216	-------	----------	-------	----------	-------	-----	Oil test. University well 1-C. Electric log Q-147.[1]
F-40	Magnolia Petroleum Co.	Magnolia Petroleum Co.	2,770	1954	5,241	-------	----------	-------	----------	N	N	Oil test. University well D-1. Radioactivity log Q-148.[1]
*F-41	University of Texas.	----------	2,774.7	Old	128	-------	Santa Rosa sandstone(?)	116.2	Sept. 20, 1956	C,W	S	Old well.
F-42	----do-------	----------	2,778.0	1946	125	6	----do-------	114.1	Apr. 1, 1957	C,W	S	
*F-43	----do-------	L. F. Buchanan.	2,783.3	1940	151	6	----do-------	108.6	Sept. 20, 1956	C,W	S	Cased to 3 ft.
								108.5	Apr. 1, 1957	-------	-----	
F-44	----do-------	----------	2,731.6	1938	160	6	----do-------	78.8	Sept. 20, 1956	C,W	S	
								80.7	Apr. 1, 1957	-------	-----	
F-45	Gulf Oil Corp.	Gulf Oil Corp.	2,729	1954	5,145	-------	----------	-------	----------	N	N	Oil test. State GV well 1. Radioactivity log Q-149.[1]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*F-46	University of Texas.	J. D. Cole---	2,760.4	1955	200	10	Cenozoic alluvium(?)	162.5	Sept. 21, 1956	N	N	Supplied water for drilling oil-test well.
F-47	Shell Oil Co.	Shell Oil Co.	2,764	1955	8,187	------	----------	-------	----------	-------	-----	Oil test. University well 17-A-1. Radioactivity log Q-150.[1]
F-48	George Sealy Estate.	----------	-------	------	135	6	Cenozoic alluvium.	112.3	Sept. 21, 1956	C,W	S	Unused in September 1956.
G-1	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,852	1946	13,446	------	----------	-------	----------	-------	-----	Oil test. Hendricks T-88-M well 35-A. Radioactivity log Q-48.[1]
G-2	Sinclair Oil & Gas Co.	J. J. Bush---	2,847.0	------	217	8, 6	Cenozoic alluvium.	20.4	Nov. 20, 1956	N	N	Cased to bottom; slotted. J.G. Hendricks well 3.[2]
*G-3	Skelly Oil Co.	J. D. Cole---	2,837.8	1951	354	7	Santa Rosa sandstone(?)	33.1	Oct. 19, 1956	C,Ng	Irr	Cased to 237 ft.[2]
*G-4	----do-------	----------	-------	------	180	------	Cenozoic alluvium.	-------	----------	N	N	Abandoned.
G-5	J. H. Elder---	J. H. Elder--	2,835	1954	3,200	------	----------	-------	----------	-------	-----	Oil test. Ida Hendricks well D-1. Electric log Q-49.[1]
G-6	Buck Drilling Co.	Buck Drilling Co.	2,825	1955	3,031	------	----------	-------	----------	-------	-----	Oil test. Fields-Atlantic well G-2. Electric log Q-50.[1]
G-7	Humble Oil & Refining Co.	Roy Griggs--	-------	1937	250	10, 6	Cenozoic alluvium(?)	-------	----------	C,W	Ind	Cased to bottom; slotted from 214 to 250 ft.[2]
G-8	Atlantic Oil & Refining Co.	----------	2,831.0	Old	38	7	----do-------	27.4	Oct. 16, 1956	C,W	Ind	Old well.

G-9	Gulf Oil Corp.	----------	2,821	1954	3,550	20, 13, 9	Grayburg? formation.	-------	----------	T,E, 100	Ind	Grisham-Hunter well 2.[2]
*G-10	Humble Oil & Refining Co.	N. B. Oliver	2,838.4	1928	110	8, 6	Cenozoic alluvium.	43.9 43.8	Oct. 11, 1956 Apr. 15, 1957	C,E, 5	Ind	J. B. Walton well B-4.[2]
G-11	----do-------	----------	-------	1928	105	6	----do-------	38.4	Nov. 3, 1956	N	N	(2)
G-12	----do-------	----------	2,843	1956	3,090	------	----------	-------	----------	-------	-----	Oil test. J.B. Walton well A-2. Radioactivity log Q-51.[1]
G-13	Gulf Oil Corp.	J.R. Marshall	2,845	1931	200	10	Santa Rosa sandstone(?)	54.1	Nov. 7, 1956	N	N	(2)
*G-14	Earl Vest ----	----------	2,837.8	------	146	6	Cenozoic alluvium.	57.0	Jan. 27, 1957	C,W	S	
G-15	Delhi-Taylor Oil Corp.	Delhi-Taylor Oil Corp.	2,846	1955	3,284	------	----------	-------	----------	-------	-----	Oil test. Brown & Altman well 2. Radioactivity log Q-52.[1]
*G-16	Seth Campbell	Wheeler-----	--------	1935	155	7	Cenozoic alluvium.	60.5	Oct. 24, 1956	C,W	S	Reportedly cased almost to bottom.
G-17	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,849	1948	11,905	------	----------	-------	----------	-------	-----	Oil test. Campbell well 2. Radioactivity log Q-53.[1]
*G-18	Seth Campbell	----------	--------	1906	179	7, 4	Cenozoic alluvium.	69.6	Oct. 24, 1956	C,W	S	Cased to bottom; slotted; gravel-packed.
G-19	----do-------	Wade -------	--------	1935	168	7	----do-------	67.7	----do--------	C,W	S	Reportedly cased almost to bottom.
G-20	Sun Oil Co.---	Sun Oil Co.--	2,835	1954	8,796	------	----------	-------	----------	N	N	Oil test. F.H. Hogg well 1. Electric log Q-2.[1]
G-21	Seth Campbell	Wade -------	--------	Old	155	7	Cenozoic alluvium.	-------	----------	C,W	S	Reportedly cased almost to bottom.
G-22	D.D. Feldman Oil & Gas Co.	----------	--------	1956	303	7	Cenozoic alluvium and Santa Rosa sandstone.	85.6	Oct. 23, 1956	N	N	Cased to 210 ft.
G-23	Earl Vest ----	----------	--------	------	------	5	Cenozoic alluvium.	62.9	----do--------	C,W	S	

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*G-24	D.D. Feldman Oil & Gas Co.	Moore & Russell Drilling Co.	--------	1956	310	20, 10	Cenozoic alluvium and Santa Rosa sandstone.	-------	----------	T,E, 7½	Ind	Cased to 309 ft. Reported to yield 51 gpm with pump set at 200 ft.
G-25	----do-------	----do------	--------	1956	402	12, 7	Santa Rosa sandstone.	-------	----------	T,E, 20	Ind	Cased to bottom; slotted from 275 to 290 ft, and 395 to 402 ft.
G-26	Humble Oil & Refining Co.	I.O. Fannin--	2,838.3	1954	188	6	Cenozoic alluvium.	60.3	Feb. 7, 1957	N	N	Cased to bottom; slotted from 95 to 168 ft. Supplied water for drilling oil-test well.
G-27	Vest, Dorbrandt & Ross.	----do------	--------	1953	125	6	----do-------	60.7	Oct. 21, 1956	N	N	Supplied water for drilling oil-test well.
G-28	Humble Oil & Refining Co.	J.J. Harrell -	--------	1950	125	10, 7	----do-------	58.7	Oct. 24, 1956	N	N	Cased to bottom; two bottom joints of casing slotted. Supplied water for drilling oil-test well.[2]
G-29	Amerada Petroleum Corp.	Amerada Petroleum Corp.	2,811	1948	4,839	-------	----------	-------	----------	-------	----	Oil test. Brown well 2. Electric log Q-54.[1]
G-30	Earl Vest----	----------	2,811	Old	62	5	Cenozoic alluvium.	53.4	Oct. 23, 1956	C,W	S	Old well.
G-31	Humble Oil & Refining Co.	Parker------	--------	1955	200	8	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------	T,Ng	Ind	Supplied water for drilling oil-test wells.

G-32	----do----	----------	--------	Old	125	7	Cenozoic alluvium.	54.7	Nov. 7, 1956	N	N	Cased to bottom; slotted. Old well.
*G-33	Earl Vest	----------	--------	------	120	6	----do----	44.3	Oct. 23, 1956	C,W	S	
G-34	Shell Oil Co.	Shell Oil Co.	2,819	1955	11,624	-------	----------	-------	----------	N	N	Oil test. Shell-Phillips McCabe well 1. Radioactivity log Q-8.[1]
G-35	----do----	----------	--------	------	------	6	Cenozoic alluvium and Santa Rosa sandstone.	39.4	Nov. 3, 1956	N	N	Supplied water for drilling oil-test well.
G-36	Shell Oil Co. & The Texas Co.	----------	--------	------	------	6	----do----	31.6	----do----	N	N	Do.
G-37	Gulf Oil Corp.	----------	2,825	1954	3,550	13, 9, 8	Grayburg? formation.	-------	----------	T,E, 75	Ind	Grisham-Hunter well 3. Radioactivity log Q-55.[1,2]
*G-38	Wink Basin System.	H.E. Turbeville.	--------	1954	248	10, 8, 6	Cenozoic alluvium and Santa Rosa sandstone(?)	25	1954	T,E, 3	Ind	Reported 100 ft drawdown while pumping 100 gpm.[2]
*G-39	Shell Pipeline Co.	----------	2,838.1	------	200	8	Cenozoic alluvium.	41.2	Oct. 24, 1956	T,E, 5	Ind	Reported to yield 40 gpm.
G-40	Gulf Oil Corp.	----------	2,826	1954	3,550	13, 9, 8	Grayburg? formation.	-------	----------	T,E, 40	Ind	Grisham-Hunter well 5. Radioactivity log Q-56.[1,2]
G-41	----do----	----------	2,829	1953	3,550	20, 13, 9	----do----	-------	----------	T,E, 60	Ind	Grisham-Hunter well 1.[2]
G-42	----do----	----------	2,843	1954	3,551	13, 9, 8	----do----	-------	----------	T,E, 50	Ind	Grisham-Hunter well 4. Radioactivity log Q-57.[1,2]
G-43	----do----	----------	--------	------	160	6	Cenozoic alluvium.	29.3	Nov. 6, 1956	N	N	Supplied water for drilling oil-test well.
G-44	Lion Oil & Refining Co.	----------	--------	------	160	7	----do----	30.1	----do----	N	N	Reported that water smelled of hydrogen sulfide (H_2S) and left black residue on tape when water level was measured.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
G-45	Bradberry & Sasser.	Bradberry & Sasser.	2,848	1952	5,400	-------	----------	-------	----------	----------	-----	Oil test. Hendricks well A-4. Radioactivity log Q-58.[1]
G-46	Lion Oil & Refining Co.	----------	--------	-----	-------	-------	----------	-------	----------	C,E, 2	D	
*G-47	Gulf Oil Corp.	----------	2,818.7	1937	273	6, 5	Cenozoic alluvium.	20.7	Nov. 6, 1956	C,Ng	Ind	Cased to bottom; slotted from 173 to 273 ft.
G-48	----do------	Roy Griggs--	--------	1930	271	6	----do------	22.7	----do------	N	N	
G-49	Humble Oil & Refining Co.	----------	--------	1927	150	8, 6	----do------	-------	----------	C,W	Ind	Cased to bottom; slotted. Bad water reported.[2]
G-50	----do------	Humble Oil & Refining Co.	2,820	1956	2,863	-------	----------	-------	----------	----------	-----	Oil test. T.C. Hendrick well 2. Radioactivity log Q-59.[1]
G-51	Lion Oil & Refining Co.	----------	--------	------	100	5	Cenozoic alluvium.	36.9	Nov. 6, 1956	N	N	Supplied water for drilling oil-test well.
G-52	Humble Oil & Refining Co.	----------	--------	1927	185	6	----do------	13.8	----do------	N	N	Cased to bottom; slotted. Salt water reported.[2]
G-53	Stanolind Oil & Gas Co.	----------	2,815.0	Old	80	6	----do------	29.5	Nov. 5, 1956	N	N	Old well.
G-54	----do------	----------	--------	Old	90	6	----do------	34.0	----do------	N	N	Do.
G-55	----do------	Stanolind Oil & Gas Co.	2,812	1956	3,000	-------	----------	-------	----------	----------	-----	Oil test. T-88-G, well A-3. Radioactivity log Q-60.[1]
G-56	Earl Vest----	----------	--------	------	90	6	Cenozoic alluvium.	31.6	Oct. 23, 1956	C,W	S	

G-57	Bates-Reading Oil Co.	----------	--------	------	105	6	----do-------	32.9	Nov. 6, 1956	T,E, 1	D	Bad water reported.
*G-58	Rycade Oil Corp.	Permian Well Service.	--------	1945	110	6	----do-------	41.0	Oct. 24, 1956	C,G	Ind	Cased to bottom; slotted.
*G-59	----do-------	----do------	--------	1945	110	6	----do-------	-------	----------	C,E	Ind	Do.
*G-60	----do-------	----do------	--------	1945	200	10, 6	----do-------	-------	----------	T,G	Ind	Do.
*G-61	Earl Vest----	----------	--------	------	100	6	----do-------	-------	----------	C,W	S	
G-62	----do-------	----------	2,799.6	------	95	6	----do-------	38.1	Oct. 23, 1956	N	N	Do.
G-63	Continental Oil Co.	Continental Oil Co.	2,805	1956	2,930	------	----------	-------	----------	--------	-----	Oil test. E.W. Cowden well 27-6. Radioactivity log Q-61.[1]
G-64	Earl Vest----	----------	--------	Old	100	5	Cenozoic alluvium.	39.4	Oct. 23, 1956	N	N	Old well.
G-65	Bert Fields Oil Co.	----------	--------	Old	------	7	----------	-------	----------	J,Ng	D	Good water reported. Old well.
*G-66	----do-------	----------	2,810.3	1937	200	6	Cenozoic alluvium and Santa Rosa sandstone.	53.7	Oct. 23, 1956	C,W	D	Reportedly cased to about 100 ft.
G-67	Texas Pacific Coal & Oil Co.	----------	--------	------	120	6	Cenozoic alluvium.	69.8	Oct. 20, 1956	N	N	
G-68	Mabee Drilling Co.	----------	--------	Old	180	6	Cenozoic alluvium and Santa Rosa sandstone.	73.7	Mar. 18, 1957	N	N	Cased to bottom; slotted. Supplied water for drilling oil-test well. Old well.
G-69	Sun Oil Co.---	Hines-------	--------	1942	129	7	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------	J,E, 1	D	Cased to bottom; slotted. Good water reported.[2]
*G-70	Barron Kidd--	J. D. Cole---	--------	------	120	7	----do-------	100	Oct. 1956	T,E, 3	D	Cased to bottom; slotted.
G-71	Earl Vest----	----------	2,780.4	------	90	5	Cenozoic alluvium.	64.1	Oct. 16, 1956	C,W	S	Good water reported.
G-72	Barron Kidd--	----------	--------	Old	120	8	----do-------	69.9	Oct. 22, 1956	N	N	Old well.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (feet)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
G-73	Barron Kidd--	J.D. Cole ---	-------	1953	252	8	Cenozoic alluvium and Santa Rosa sandstone(?)	-------	----------	T,E, 7½	Ind	Cased to bottom; slotted. Good water reported.
*G-74	----do-------	----do------	-------	1953	251	8	----do-------	-------	----------	T,E, 7½	Ind	Cased to bottom; slotted.
G-75	Humble Oil & Refining Co.	I.O. Fannin--	-------	1956	142	12, 7	Cenozoic alluvium.	59.8	Mar. 19, 1957	N	N	Cased to bottom; slotted from 102 to 136 ft. Supplied water for drilling oil-test well.[2]
G-76	G.P. Mitchell-	Bill Batey---	2,810.9	------	284	6	----do-------	80.6	Dec. 12, 1956	C,W	S	Cased to bottom; slotted. Good water reported.
G-77	----do-------	Hunt Oil Co.-	2,805.3	1946	120	7	----do-------	70.2 70.4	Mar. 19, 1957 June 4, 1958	N	N	Supplied water for drilling oil-test well.
*G-78	----do-------	Roy Griggs--	-------	1934	85	6	----do-------	47.2	Oct. 5, 1956	N	N	Cased to 83 ft.
G-79	Skelly Oil Co. -	Skelly Oil Co.	2,772	1956	12,819	-------	----------	-------	----------	N	N	Oil test. S.M. Halley well 111. Radioactivity log Q-62.[1]
G-80	----do-------	J.D. Cole ---	2,773.2	1956	130	9, 6	Cenozoic alluvium and Santa Rosa sandstone(?)	54.7	Oct. 5, 1956	N	N	Cased to bottom; slotted from 90 to 130 ft. Supplied water for drilling oil-test well.[2]
G-81	The Texas Co.	----------	-------	Old	185	8	----do-------	56.7	Oct. 16, 1956	C,W	D	Good water reported. Old well.

G-82	Magnolia Pipeline Co.	----------	-------	Old	120	6	----do-------	60	Oct.	1956	C,E, 1½	D,Ind	Cased to bottom; slotted. Good water reported. Old well.
G-83	Skelly Oil Co.	J.D. Cole ---	-------	1953	325	8	Santa Rosa sandstone(?)	60	Feb.	1953	T,E, 15	Ind	Cased to 264 ft; slotted from 81 to 264 ft. Reported 56 ft drawdown at 70 gpm in 1-hr. bailer test.[2]
G-84	----do-------	----do------	-------	1954	316	8	----do-------	-------	----------		T,E, 15	Ind	Cased to bottom; slotted from 81 to 306 ft. Pumping level 73 ft, Sept. 27, 1956.[2]
G-85	----do-------	J.R. Marshall	-------	1944	111	8, 7	Cenozoic alluvium.	65	Oct.	1956	C,Ng	P	Open hole from 101 to 111 ft.[2]
*G-86	Earl Vest----	Bill Batey---	2,753.9	1950	110	6	----do-------	66.0	Oct.	8, 1956	T,E, 1½	D,S	Cased to bottom; slotted.
*G-87	----do-------	----------	-------	1944	110	6	----do-------	64.0	----do-------		T,E, 2	S	
G-88	F.W. Estill ---	----------	-------	1936	310	7	Santa Rosa sandstone.	60	Oct.	1956	T,E, 7½	Ind	Open hole from 230 to 310 ft.
G-89	Hudson & Hudson.	----------	-------	1951	106	6	Cenozoic alluvium(?)	-------	----------		T,E	D	
G-90	----do-------	Hudson & Hudson.	2,769	1954	2,905	-------	----------	-------	----------	-------	-------	-----	Oil test. S.M. Halley well 3. Radioactivity log Q-5.[1]
G-91	----do-------	----do------	2,760	1954	2,896	-------	----------	-------	----------	-------	-------	-----	Oil test. S.M. Halley well 3. Radioactivity log Q-4.[1]
*G-92	----do-------	Donnell Drilling Co.	2,774	1954	510	10	Cenozoic alluvium and Santa Rosa sandstone.	-------	----------		T,E, 7½	Ind	Cased to bottom; slotted from 100 to 150 ft; gravel-packed. Reported to yield 200 gpm with about 170 ft drawdown.[2]
G-93	----do-------	----do------	2,783	1954	310	10	----do-------	-------	----------		T,E, 7½	Ind	Cased to bottom; slotted.[2]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
G-94	Phillips Petroleum Co.	J.D. Cole	---	1955	154	8	Cenozoic alluvium and Santa Rosa sandstone.	---	---	T,E, 10	Ind	Cased to bottom; slotted from 84 to 154 ft. McCabe well 2. Reported to yield 150 gpm when drilled. Reported pumping level 138 ft.
G-95	Hudson & Hudson.	----do----	2,775	1956	325	10	----do----	---	---	T,E, 7½	Ind	Cased to bottom; slotted.
G-96	Phillips Petroleum Co.	---	---	Old	---	---	---	---	---	C,E, 3	D	Good water reported.
G-97	----do----	Phillips Petroleum Co.	2,785	1955	2,770	---	---	---	---	---	---	Oil test. McCabe well 11. Radioactivity log Q-63.[1]
G-98	----do----	J.D. Cole	2,785	1955	350	20, 10	Cenozoic alluvium and Santa Rosa sandstone.	60	Sept. 1955	T,E, 5	Ind	Cased to bottom; slotted from 85 to 350 ft. Reported to yield 52 gpm when drilled. McCabe well 1.
G-99	Champlin Oil & Refining Co.	---	---	1955	100	---	Cenozoic alluvium.	48.2	Oct. 23, 1956	N	N	Plugged when revisited Mar. 29, 1957.
G-100	Daniel & Clark.	Daniel & Clark.	2,771	1956	2,897	---	---	---	---	---	---	Oil test. Morton well 10. Radioactivity log Q-64.[1]

G-101	Montex Drilling Co.	Montex Drilling Co.	2,798	1954	2,945	------	----------	------	----------	-------	-----	Oil test. Cowden well 1. Radioactivity log Q-65.[1]
G-102	Noel & Rodman.	Noel & Rodman.	2,748	1955	2,786	------	----------	------	----------	-------	-----	Oil test. Hendricks well C-3. Radioactivity log Q-66.[1]
G-103	T.G. Hendricks	----------	2,755.0	------	175	6	Cenozoic alluvium.	59.6	Oct. 10, 1956	C,W	S	
G-104	Noel & Rodman.	J.D. Cole ---	2,765.4	------	200	8	----do-------	16.6	Nov. 23, 1956	N	N	Supplied water for drilling oil-test well.
G-105	----do-------	Noel & Rodman.	2,752	1956	3,000	------	----------	------	----------	-------	-----	Oil test. Hendricks well 3. Radioactivity log Q-67.[1]
G-106	----do-------	----do------	2,760	1956	3,003	------	----------	------	----------	-------	-----	Oil test. Ida Hendricks well E-1. Radioactivity log Q-68.[1]
G-107	Kelly--------	----------	2,795.8	Old	100	5	Cenozoic alluvium.	46.7	Nov. 14, 1956	C,W	D	Cased to bottom; slotted. Old well.
*G-108	City of Wink--	----------	--------	------	165	------	----do-------	------	----------	N	N	Plugged and abandoned.
*G-109	City of Wink well 3.	Taylor------	--------	1930	250	7	----do-------	------	----------	N	N	Abandoned in 1957 because well was contaminated after casing corroded at 130 ft.
G-110	City of Wink well 5.	J. D. Cole ---	2,789	1953	240	16, 10	----do-------	90	September 1956	T,E, 25	P	Casing: 180 ft of 16-in. cemented to surface, 10-in. to bottom; slotted. Reported to yield 300 gpm with pumping level 220 ft.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
*G-111	City of Wink well 6.	J. D. Cole---	2,789	1955	240	16, 7	Cenozoic alluvium.	90	Sept. 1956	T,E, 10	P	Casing: 183 ft of 16-in.; cemented to surface, 10-in. to bottom; slotted. Reported to yield 180 gpm with pumping level of 170 ft.
G-112	Humble Oil & Refining Co.	----------	-------	1927	212	8, 6	----do-------	94	Sept. 1956	T,E, 5	P	Cased to bottom; slotted. Pyote district campsite well 1.[2]
G-113	----do-------	I. O. Fannin--	-------	1955	188	10, 6	----do-------	98	Oct. 1956	T,E, 5	P	Cased to bottom; slotted. Pyote district campsite well 4.[2]
G-114	Tobe Morton -	----------	2,748.9	------	130	5	----do-------	52.7	Oct. 8, 1956	N	N	
*G-115	A. C. Morton and others.	----------	-------	------	90	6	----do-------	57.9	Oct. 11, 1956	C,W	S	
G-116	Humble Pipeline Co.	----------	2,747.2	1931	316	8	----do-------	38.9	Oct. 8, 1956	N	N	Cased to bottom; slotted from 296 to 316 ft.
*G-117	----do-------	----------	-------	1929	182	8	----do-------	45	Oct. 1956	T,E, 5	D,Ind	Do.
G-118	----do-------	----------	-------	1942	150	8	----do-------	33.5	Oct. 8, 1956	C,G	Ind	Cased to bottom; slotted. Hard water reported.
G-119	Humble Oil & Refining Co.	Humble Oil & Refining Co.	2,722	1954	2,904	------	----------	-------	----------	-------	-----	Oil test. T.G. Hendricks well 4. Radioactivity log Q-69.[1]

G-120	----do-------	Earnest Oliver.	--------	1929	290	6, 5	Cenozoic alluvium.	24.3	Oct. 4, 1956	C,W	Ind	Cased to bottom; perforated from 222 to 290 ft.
G-121	Noel & Rodman.	Noel & Rodman.	2,730	1956	3,000	-------	------------	-------	------------	-------	-----	Oil test. Hendricks well A-1. Radioactivity log Q-70.[1]
*G-122	Sinclair Oil Co.	Perkins & Perkins.	--------	------	151	6	Cenozoic alluvium.	48	Oct. 1956	C,E, 3	D	Cased to bottom; slotted.
G-123	A.C. Morton, and others.	----------	2,734.9	1948	90	5	----do-------	50.1	Oct. 4, 1956	C,W	S	Converted oil test.
G-124	Skelly Oil Co.	Skelly Oil Co.	2,749	1956	4,000	-------	------------	-------	------------	-------	-----	Oil test. S.M. Halley well 116. Radioactivity log Q-71.[1]
G-125	----do-------	----do------	2,774	1956	2,860	-------	------------	-------	------------	-------	-----	Oil test. S.M. Halley well 115. Radioactivity log Q-72.[1]
G-126	----do-------	Ken Woods Co.	--------	1956	1,220	9, 7	Rustler formation.	-------	------------	-------	-----	Reported to yield 136 barrels of water in 6 hrs after acidizing and fracturing.[2]
G-127	----do-------	J.D. Bush ---	--------	1935	280	10, 6	Santa Rosa sandstone(?)	55.2	Oct. 4, 1956	N	N	Cased to 238 ft. Supplied water for drilling oil-test well.[2]
G-128	Earl Vest----	----------	--------	------	100	5	Cenozoic alluvium.	49.9	Oct. 15, 1956	C,W	S	Good water reported.
*G-129	G.P. Mitchell-	Bill Batey---	2,756.5	1939	101	6	----do-------	51.6 52.4	Oct. 5, 1956 June 4, 1958	C,W	S	
G-130	Richardson Oils, Inc.	Bud Tone ---	--------	1955	260	10, 8	Santa Rosa sandstone.	44.8	Oct. 6, 1956	T,B	Ind	Cased to bottom; slotted. Reported to yield 60 gpm on 12-hr. test.[2]
G-131	----do-------	Richardson Oils, Inc.	2,750	1956	12,402	-------	------------	-------	------------	-------	-----	Oil test. M.F. Hill and G.P. Mitchell well 1. Radioactivity log Q-10.[1]
G-132	Stanolind Oil & Gas Co.	Stanolind Oil & Gas. Co.	2,750	1957	12,220	-------	------------	-------	------------	-------	-----	Oil test. G.P. Mitchell well B-3. Radioactivity log Q-15.[1]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
G-133	Gulf Oil Corp.	White Well Service.	2,714.7	1941	240	10, 5	Santa Rosa sandstone.	47.2	Oct. 3, 1956	T,G	Ind	Cased to 187 ft. Reported to yield 135 gpm when drilled. Yielded 45 gpm in 1956 with pump set at 82 ft.[2]
G-134	Skelly Oil Co.	J.J. Bush	-------	1934	275	8, 5	Cenozoic alluvium.	-------	-------	C,G	Ind	Cased to 270 ft; slotted.[2]
G-135	S.M. Halley	-------	-------	------	90	6	----do-------	50.2	Oct. 6, 1956	N	N	
*G-136	Sun Oil Co.	-------	-------	1936	205	7, 5	----do-------	52.7	----do-------	N	N	Abandoned.
G-137	----do-------	Sun Oil Co.	2,720	1955	2,889	-------	-------	-------	-------	-------	-----	Oil test. S.M. Halley well 11. Radioactivity log Q-73.[1]
*G-138	Earl Vest	-------	-------	------	82	6	Cenozoic alluvium.	38.5	Oct. 4, 1956	C,W	S	
*G-139	Texas–New Mexico RR Co.	-------	2,715.0	------	80	6	----do-------	51.5	Oct. 10, 1956	C,W	D	
*G-140	Tobe Morton	-------	2,743.5	------	110	7	----do-------	66.9	----do-------	C,W	S	
*G-141	----do-------	-------	2,730.7	Old	89	6	----do-------	49.5	Oct. 8, 1956	N	N	Old well.
								49.4	Mar. 28, 1957	-------	-----	
G-142	A.C. Morton, and others.	-------	2,755.0	------	170	-------	----do-------	110.3	Oct. 10, 1956	N	N	
								110.3	Mar. 28, 1957	-------	-----	
G-143	Ralph Lowe	J. D. Cole	-------	1953	169	6	----do-------	-------	-------	N	N	Supplied water for drilling oil-test well. Abundance of good water reported.

G-144	----do-------	Ralph Lowe	2,731	1953	3,540	-------	----------	-------	----------	--------	-----	Oil test. Tobe Morton well C-1. Electric log Q-74.[1]
G-145	----do-------	----do------	2,731	1953	3,510	-------	----------	-------	----------	--------	-----	Oil test. Tobe Morton well B-1. Electric log Q-75.[1]
*G-146	University of Texas.	Lang Buchanan.	2,719.9	Old	130	6	Cenozoic alluvium.	102.2	Sept. 21, 1956	C,W	D,S	Old well.
G-147	Gulf Oil Corp..	Gulf Oil Corp.	2,705	1956	2,875	-------	----------	-------	----------	--------	-----	Oil test. G.W. O'Brien, and others, well 451. Radioactivity log Q-76.[1]
G-148	----do-------	----do------	2,706	1957	2,896	-------	----------	-------	----------	--------	-----	Oil test. G.W. O'Brien, and others, well 507. Radioactivity log Q-77.[1]
G-149	----do-------	J.R. Marshall	--------	1940	201	8	Santa Rosa sandstone(?)	60	Sept. 1956	N	N	(2)
G-150	G.W. O'Brien, and others.	----------	--------	------	75	6	Cenozoic alluvium.	47.0	Oct. 3, 1956	C,W	S	
G-151	----do-------	----------	2,671.1	Old	62	7	----do-------	39.7	Oct. 4, 1956	C,W	S	Good water reported. Old well.
G-152	Gulf Oil Corp..	Gulf Oil Corp.	2,669	1950	3,230	-------	----------	-------	----------	--------	-----	Oil test. G.W. O'Brien, and others, well 300. Radioactivity log Q-78.[1]
G-153	----do-------	----do------	2,675	1956	2,800	-------	----------	-------	----------	--------	-----	Oil test. G.W. O'Brien, and others, well 501. Radioactivity log Q-79.[1]
G-154	G.W. O'Brien, and others.	----------	2,677.5	Old	90	6	Cenozoic alluvium.	58.7	Oct. 15, 1956	N	N	Abandoned. Formerly used as stock well. Old well.
G-155	Gulf Oil Corp..	Gulf Oil Corp.	2,687	1956	2,920	-------	----------	-------	----------	--------	-----	Oil test. G.W. O'Brien, and others, well 526. Radioactivity log Q-80.[1]

See footnotes at end of table.

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Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
G-156	Gulf Oil Corp.	Gulf Oil Corp.	2,690	1956	2,930	-------	----------	-------	----------	-------	-----	Oil test. G.W. O'Brien, and others, well 524. Radioactivity log Q-81.[1]
*G-157	Fay H. Hogg	Stanolind Oil & Gas Co.	2,726.6	1942	180	6	Cenozoic alluvium.	145.9	Oct. 18, 1956	C,W	S	Converted oil test.
G-158	----do-------	Sun Oil Co.--	2,720.5	1929	150	6	----do-------	130.8	Oct. 18, 1956	C,W	N	Do.
								131.1	Mar. 29, 1957	-------	-----	
G-159	Wink Industrial Corp. well 1.	Hamblin ----	--------	1956	485	4	----do-------	112	Sept. 1956	N	N	Abandoned. Electric log Q-82.[1]
G-160	Wink Industrial Corp. well 2.	Layne-Texas Co.	2,719.7	1956	396	12	----do-------	127.1	Feb. 26, 1957	N	N	Reported to yield 1,000 gpm with drawdown of 50 ft on 12-hr. pumping test. Electric log Q-83.[1]
G-161	John Witt ----	Hamblin ----	2,709.5	1956	400	12	----do-------	113.6	Nov. 7, 1956	T,B,	Irr	Cased to bottom;
								113.8	Feb. 2, 1957	75	-----	slotted from 320 to 400 ft.[2]
*G-162	----do-------	----do------	--------	1956	223	12	----do-------	110.2	Feb. 26, 1957	T,B, 90	Irr	Cased to bottom; slotted from 163 to 223 ft.
*G-163	----do-------	----do------	--------	1956	400	12	----do-------	109.1	Nov. 7, 1956	T,Ng	Irr	Cased to bottom;
								120.9	Jan. 4, 1958	72	-----	slotted from 320 to 400 ft.
G-164	George Sealy Estate.	----------	2,691.7	------	135	6	----do-------	105.6	Nov. 7, 1956	N	N	

G-165	Ralph Lowe --	Ralph Lowe -	2,710	1956	3,190	-------	----------	-------	----------	N	N	Oil test. University well H-1. Electric log Q-151.[1]
*G-166	J. D. Cole----	J. D. Cole---	--------	1956	300	-------	Cenozoic alluvium.	103.2	Nov. 7, 1956	T,B	Irr	
G-167	Fay H. Hogg--	----------	2,690.1	Old	125	6	----do-------	109.1 106.1	Nov. 16, 1956 Mar. 29, 1957	C,W	N	Old well.
G-168	City of Monahans.	Layne-Texas Co.	2,700	1957	433	-------	----do-------	110	May 1956	N	N	Test hole 9-A. Good water reported at 200 ft; below 200 ft quality deteriorates with depth. Electric log Q-84.[1,2]
G-169	----do-------	----do------	2,704	1957	402	-------	----do-------	117	May 1957	N	N	Test hole 8. Good water reported to 340 ft. Electric log Q-85.[1,2]
G-170	----do-------	----do------	2,715	1957	419	-------	----do-------	-------	----------	N	N	Test hole 7-A.[2]
G-171	Fay H. Hogg--	----------	--------	1937	180	7	----do-------	98	Oct. 1956	C,W	D	
G-172	Gulf Oil Corp..	Gulf Oil Corp.	2,728	1956	2,950	-------	----------	-------	----------	-------	-----	Oil test. G.W. O'Brien, and others, well 525. Radioactivity log Q-86.[1]
G-173	Gulf Oil Corp. well 18.	----------	2,721.6	1948	200	8	Cenozoic alluvium.	144.9	Mar. 28, 1957	N	N	Supplied water for drilling oil-test well.
G-174	Gulf Oil Corp..	Gulf Oil Corp.	2,718	1956	2,925	-------	----------	-------	----------	-------	-----	In Ward County. Oil test. G.W. O'Brien, and others, well 509. Radioactivity log Q-87.[1]
G-175	----do-------	----do------	2,706	1955	2,890	-------	----------	-------	----------	-------	-----	Oil test. G.W. O'Brien, and others, well 444. Radioactivity log Q-88.[1]
G-176	G.W. O'Brien, and others.	----------	2,699.7	Old	130	5	Cenozoic alluvium.	112.6	Oct. 15, 1956	C,W	N	Old well.
H-1	C.O. Wheeler -	----------	--------	------	100	6	----do-------	52.5	Dec. 11, 1956	C,W	S	

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
H-2	S. B. Wight---	----------	2,995.5	------	100	5	Cenozoic alluvium.	66.8	Dec. 7, 1956	C,W	S	
H-3	----do-------	----------	------	------	100	6	----do-------	69.1	Dec. 11, 1956	C,W	S	
H-4	Stanolind Oil & Gas Co.	Noble Drilling Co.	--------	1952	100	5	----do-------	70.4	Dec. 14, 1956	N	N	Supplied water for drilling oil-test well.
H-5	W.D. Amburgey.	----------	--------	Old	100	6	----do-------	61.7	Jan. 28, 1957	N	N	Old well.
H-6	Stanolind Oil & Gas Co.	Noble Drilling Co.	--------	1952	100	5	----do-------	68.3	Dec. 14, 1956	N	N	Supplied water for drilling oil-test well.
*H-7	W.D. Amburgey.	----------	2,969.2	Old	100	6	----do-------	61.5	----do-------	C,W	S	
H-8	----do-------	----------	2,968.8	------	100	6	----do-------	61.8	----do-------	C,W	S	Water of poor quality reported.
H-9	----do-------	----------	2,960.3	1953	115	6	----do-------	69.5	Dec. 10, 1956	N	N	Supplied water for drilling oil-test well.
H-10	----do-------	----------	2,957.9	------	100	5	----do-------	69.5	----do-------	C,W	S	
H-11	Sun Oil Co.---	Delta Gulf Drilling Co.	2,963.4	1953	120	8	----do-------	69.7	----do-------	N	N	Cased to bottom; slotted. Supplied water for drilling oil-test well.
H-12	W.D. Amburgey.	----------	--------	------	230	6	----do-------	63.6	Dec. 13, 1956	C,W	S	
H-13	W.D. Amburgey well 1-7.	Blackwood & Nichols Co.	2,941	1954	6,528	------	----------	-------	----------	N	N	Oil test. Electric log Q-30.[1]
H-14	W.D. Amburgey.	----do------	2,941.5	1954	90	6	Cenozoic alluvium.	68.6	Dec. 10, 1956	N	N	Supplied water for drilling oil-test well.
H-15	Fay H. Hogg--	----------	--------	Old	70	4	----do-------	51.4	Dec. 13, 1956	C,W	S	Cased to 50 ft. Reportedly can be pumped dry.

H-16	----do-------	George D. Hogg.	2,926.0	1939	114	8, 6	----do-------	60.2	Dec. 10, 1956	C,W	S	Casing: 6-in. to 107 ft.
H-17	----do-------	----------	-------	1943	120	6	----do-------	62.7	----do-------	C,W	D,S	Cased to bottom; slotted.
H-18	----do-------	Amon G. Carter.	2,859	1948	12,562	------	----------	-------	----------	N	N	Oil test. Fay H. Hogg Fee well 1. Radioactivity log Q-31.[1]
H-19	----do-------	----do------	-------	1948	110	7	Cenozoic alluvium.	63.2	Dec. 13, 1956	N	N	Cased to bottom; slotted. Supplied water for drilling oil-test well.
H-20	G.P. Mitchell-	----------	-------	------	90	8	----do-------	62.4	Feb. 8, 1957	C,W	S	Good water reported.
*H-21	Fay H. Hogg--	----------	2,838.5	------	105	5	----do-------	63.8	----do-------	C,W	S	
H-22	G.P. Mitchell-	White Eagle Oil Co.	2,821	1957	6,485	------	----------	-------	----------	N	N	Oil test. Cornell Hogg well 1. Radioactivity log Q-32.[1]
H-23	----do-------	----------	-------	------	------	------	Santa Rosa sandstone(?)	-------	----------	T,G	D,S, Ind	Triassic sediments reported in well cuttings.
H-24	----do-------	Roy Griggs--	-------	1938	260	6	Cenozoic alluvium and Santa Rosa sandstone(?)	60	1940	C,W	S	Cased to 115 ft.
*H-25	----do-------	Perkins-----	-------	1930	250	7	----do-------	50.5	Oct. 4, 1956	C,W	D,S	Cased to 140 ft.
H-26	----do-------	Bill Batey---	2,782.1	Old	90	7	Cenozoic alluvium.	51.8	Oct. 4, 1956	C,W	S	Cased to 75 ft. Old well.
								70.8	June 4, 1958	-------	-----	
H-27	W.D. Amburgey.	----------	2,908.9	Old	70	6	----do-------	65.0	Oct. 4, 1956	N	N	Old well.
								66.1	Jan. 4, 1958	-------	-----	
*H-28	----do-------	----------	2,939.7	------	100	6	----do-------	72.5	Dec. 10, 1956	C,W	S	
H-29	Earl Vest well 1.	Tidewater Oil Co.	2,946	1955	11,526	------	----------	-------	----------	N	N	Oil test. Radioactivity log Q-33.[1]
H-30	Humble Oil & Refining Co.	G.S. Taylor--	2,935.3	1947	610	9, 7	Santa Rosa sandstone.	202.0	Dec. 8, 1956	N	N	Cased to bottom; slotted. Supplied water for drilling oil-test well. In Ector County.[2]

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
H-31	Earl Vest	----------	2,941.2	Old	90	6	Cenozoic alluvium.	77.0	Feb. 7, 1957	C,W	S	In Ector County. Old well.
H-32	----do-------	----------	-------	Old	94	7	----do-------	67.2	----do-------	C,W	S	Good water reported. Old well.
H-33	----do-------	----------	2,918.2	Old	90	6	----do-------	60.6	----do-------	C,W	D,S	Good water reported.
H-34	Sealy & Smith Foundation well 7-A.	Stanolind Oil & Gas Co.	2,900	1945	6,500	------	----------	-------	----------	N	N	Oil test. Electric log Q-34.[1]
*H-35	Sealy & Smith Foundation.	Noble Drilling Co.	2,895.5	1945	120	8	Cenozoic alluvium.	64 8	Oct. 4, 1956	C,W	S	Supplied water for drilling oil-test well. Converted to ranch use.
H-36	----do-------	----------	-------	------	85	------	----do-------	55.8	Feb. 12, 1957	C,W	S	
H-37	----do-------	----------	-------	1947	90	8	----do-------	48.0	Feb. 8, 1957	N	N	Supplied water for drilling oil-test well.
H-38	----do-------	----------	-------	------	80	6	----do-------	51.6	----do-------	C,W	S	Good water reported.
H-39	----do-------	John Drilling Co.	-------	1956	130	6	----do-------	56.3	Jan. 4, 1958	N	N	Gravel-packed. Supplied water for drilling oil-test well.
H-40	Stanolind Oil & Gas Co. well 8.	G.S. Taylor -	2,762	1946	109	8	----do-------	49.6	Oct. 3, 1956	N	N	Supplied water for drilling oil-test well.
H-41	----do-------	Stanolind Oil & Gas Co.	2,767	1955	13,200	------	----------	-------	----------	-------	-----	Oil test. Sealy & Smith well A-20. Electric log Q-35.[1]
H-42	----do-------	----do------	2,760	1956	12,795	------	----------	-------	----------	-------	-----	Oil test. Sealy & Smith well A-23. Electric log Q-14.[1]

H-43	Stanolind Oil & Gas Co.	----do------	2,760	1944	6,305	------	----------	-------	----------	-------	-----	Oil test. Sealy & Smith well 4. Electric log Q-36.[1]
*H-44	Stanolind Oil & Gas Co. well 3.	Noble Drilling Co.	--------	1944	95	7	Cenozoic alluvium.	-------	----------	C,G	D,Ind	Cased to 83 ft. Supplied water for drilling oil-test well.
H-45	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,760	1956	12,025	------	----------	-------	----------	-------	-----	Oil test. Sealy & Smith well A-26. Radioactivity log Q-37.[1]
H-46	----do-------	----do------	2,760	1945	6,143	------	----------	-------	----------	-------	-----	Oil test. Sealy & Smith well 6. Electric log Q-12.[1]
H-47	----do-------	Noble Drilling Co.	2,760.8	1945	125	8	Cenozoic alluvium.	51.8	Oct. 3, 1956	N	N	Supplied water for drilling oil-test well.
H-48	The Texas Co.	----------	--------	------	120	6	----do-------	59.6	Dec. 13, 1956	N	N	Cased to bottom; slotted. Supplied water for drilling oil-test well.
H-49	Stanolind Oil & Gas Co.	Stanolind Oil & Gas Co.	2,752	1946	6,500	------	----------	-------	----------	-------	-----	Oil test. Sealy & Smith well A-16. Electric log Q-38.[1]
H-50	----do-------	Noble Drilling Co.	2,752	1946	145	7	Cenozoic alluvium.	53.9	Oct. 4, 1956	N	N	Supplied water for drilling oil-test well.
H-51	Sealy & Smith Foundation.	Stanolind Oil & Gas Co.	2,749	1946	5,320	------	----------	-------	----------	N	N	Oil test. Well A-13. Radioactivity log Q-39.[1]
H-52	Gulf Oil Corp.-	----------	--------	1957	------	8, 6	----------	-------	----------	C,G	Ind	Supplied water for drilling oil-test well.
H-53	Sealy & Smith Foundation.	----------	2,736.0	------	60	------	Cenozoic alluvium.	53.5	Oct. 4, 1956	C,W	S	
H-54	----do-------	----------	--------	------	100	6	----do-------	60.4	Dec. 17, 1956	N	N	Do.
H-55	----do-------	Stanolind Oil & Gas Co.	2,731	1946	5,366	------	----------	-------	----------	N	N	Oil test. Well A-12. Electric log Q-40.[1]
H-56	----do-------	----do------	--------	1945	120	7	Cenozoic alluvium.	47.6	Oct. 4, 1956	N	N	Supplied water for drilling oil-test well.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (inches)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
H-57	Sealy & Smith Foundation.	Stanolind Oil & Gas Co.	2,729	1946	6,501	------	----------	------	----------	N	N	Oil test. Well A-11. Electric log Q-41.[1]
H-58	----do-------	----------	------	------	------	6	----------	------	----------	C,W	S	
H-59	----do-------	Stanolind Oil & Gas Co.	2,745	1952	6,252	------	----------	------	----------	N	N	Oil test. Well A-25. Radioactivity log Q-9.[1]
H-60	Stanolind Oil & Gas Co.	----do------	2,744	1946	5,230	------	----------	------	----------	------	-----	Oil test. Sealy & Smith well 9. Electric log Q-42.[1]
H-61	----do-------	Noble Drilling Co.	2,738.4	1946	135	7	Cenozoic alluvium.	40.7	Sept. 27, 1956	N	N	Supplied water for drilling oil-test well.
H-62	Sealy & Smith Foundation.	----do------	------	1946	105	6	----do-------	50.9	Dec. 17, 1956	N	N	Do.
H-63	----do-------	Stanolind Oil & Gas Co.	2,802	1946	6,390	------	----------	------	----------	N	N	Oil test. Sealy & Smith well A-10. Electric log Q-43.[1]
*H-64	----do-------	----------	2,813.7	------	60	4	Cenozoic alluvium.	47.6	Feb. 12, 1957	C,W	S	
H-65	Glenn Allen --	----------	2,834.0	Old	75	6	----do-------	42.0	----do-------	C,W	S	Old well.
H-66	----do-------	----------	------	------	91	6	----do-------	62.9	----do-------	C,W	S	Water reported to have gypsum taste.
H-67	Sealy & Smith Foundation.	Stanolind Oil & Gas Co.	2,753	1947	9,000	------	----------	------	----------	N	N	Oil test. Sealy & Smith well A-14. Radioactivity log Q-44.[1] In Ward County.
*H-68	----do-------	Shell Oil Co. -	2,729.0	------	------	------	Cenozoic alluvium.	6.0	July 4, 1957	N	Ind	Dug with bulldozer about 20 by 50 ft and 1 to 10 ft deep. Altitude of water table

												July 4, 1957, was 2,723.0 ft above mean sea level. In Ward County.
*H-69	----do----	----do----	2,734.0	----	----	----	----do----	4.9	----do----	N	Ind	Dug with bulldozer about 20 by 20 ft and 1 to 4 ft deep. Altitude of water table July 4, 1957, was 2,729.1 ft above mean sea level.
H-70	----do----	----do----	2,712.0	----	----	----	----do----	5.9	----do----	N	Ind	Dug with bulldozer about 5 by 10 ft and 1 to 2 ft deep. Altitude of water table July 4, 1957, was 2,706.1 ft above mean sea level. In Ward County.
H-71	----do----	----do----	2,715.0	----	----	----	----do----	4.8	----do----	N	Ind	Dug with bulldozer about 20 by 30 ft and 1 to 6 ft deep. Altitude of water table July 4, 1957, was 2,710.2 ft above mean sea level.
H-72	Shell Oil Co. -	----do----	2,715	1956	4,885	----	----------	----	----------	----	----	Oil test. Sealy & Smith well 72. Radioactivity log Q-45.[1]
H-73	----do----	----do----	2,730	1954	4,968	----	----------	----	----------	----	----	Oil test. Sealy & Smith well 60. Radioactivity log Q-6.[1]
H-74	Sealy & Smith Foundation.	----do----	2,728.0	----	----	----	Cenozoic alluvium.	4.7	July 4, 1957	N	Ind	Dug with bulldozer about 20 by 50 ft and 1 to 10 ft deep. Altitude of water table July 4, 1957, was 2,723.3 ft above mean sea level.

See footnotes at end of table.

Table 7.—*Records of wells in Winkler County, Tex.*—Continued

Well No.	Owner	Driller	Altitude of land-surface (feet)	Date completed	Depth of well (feet)	Diameter of well (feet)	Water-bearing unit	Water level		Method of lift	Use of water	Remarks
								Below land-surface datum (feet)	Date of measurement			
H-75	Shell Oil Co.	----------	2,710.1	------	40	7	Cenozoic alluvium.	29.0	Nov. 8, 1956	N	N	
								29.1	Jan. 4, 1958	-------	-----	
H-76	----do-------	Shell Oil Co.	2,714.0	1952	60	7	----do-------	39.9	Oct. 9, 1956	N	N	
								41.2	Jan. 4, 1958	-------	-----	
H-77	----do-------	----do------	2,715	1952	4,952	------	----------	-------	----------	N	N	Oil test. Sealy & Smith well 52. Radioactivity log Q-46.[1]
*H-78	Sealy & Smith Foundation.	----------	--------	------	60	6	Cenozoic alluvium.	-------	----------	C,W	S	
H-79	----do-------	----------	--------	------	------	6	----------	-------	----------	C,W	S	
H-80	----do-------	----------	--------	Old	------	------	----------	33.5	May 16, 1940	C,W	S	Old well.
*H-81	----do-------	Frank Anthony.	2,675.9	1956	300	6	Cenozoic alluvium and Santa Rosa sandstone.	32.7	Oct. 8, 1956	C,W	S	
H-82	Sealy & Smith Foundation well 1.	Dunnigan Bros. & Brahaney.	2,673	1946	6,505	------	----------	-------	----------	N	N	Oil test. Radioactivity log Q-47.[1]
H-83	Magnolia Petroleum Co.	----------	--------	1935	155	6	Cenozoic alluvium.	55.8	Oct. 8, 1956	N	N	(2)
H-84	Sealy & Smith Foundation.	----------	--------	------	100	6	----do-------	-------	----------	C,W	S	Supplied water for drilling oil-test well. Good water reported.

[1]See log in files of Texas Board of Water Engineers.
[2]See table 8 for driller's log.
*See table 9 for chemical analysis of the water.

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]

Well C-10

[Owner: Gulf Oil Corp. Driller: J. R. Marshall]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface sand, red	10	10	Sand, red, and clay	5	205
Sand, gray	25	35	Red beds	40	245
Sand, red	65	100	Sand and clay	5	250
Sand, gray	12	112	Rock, red	26	276
Sand, red; water	3	115	Sand, brown; water	4	280
Sand, red	20	135	Red beds	60	340
Sand, gray	15	150	Sand, gray; water	10	350
Sand, red	50	200	Rock, red	10	360

Well C-11

[Owner: Gulf Oil Corp. Driller: J. R. Marshall]

Surface sand	8	8	Clay	7	112
Caliche	7	15	Sand; water	3	115
Sand	75	90	Sand, red	13	128
Sand and clay	15	105			

Well C-14

[Owner: Sinclair Oil & Gas Co. Driller: Perkins & Reynolds]

Surface sand	12	12	Quicksand, red	8	152
Caliche	8	20	Sand, red	9	161
Sandrock, red	10	30	Sand, red, hard	14	175
Sand, white	5	35	Shale, red	34	209
Sandrock, red	10	45	Sand and gravel; water	2	211
Sand, red	45	90	Sand and gravel; hard	8	219
Red beds	20	110	Gravel, soft	2	221
Shale, red	34	144	Rock, red, hard	1	222

Well C-15

[Owner: Sinclair Oil & Gas Co. Driller: Reese & Griggs]

Surface sand	3	3	Clay	10	190
Sand, white	10	13	Sand, red	5	195
Caliche	7	20	Shale, sandy	11	206
Sand, red	100	120	Gravel, hard	20	226
Sand; water	6	126	Clay, red	4	230
Quicksand	54	180			

Well C-16

[Owner: Sinclair Oil & Gas Co. Driller: Reese & Griggs]

Surface sand	5	5	Rock, red	5	260
Caliche	10	15	Sand	7	267
Sand, red	100	115	Rock, red	33	300
Quicksand	70	185	Sand	10	310
Red beds	25	210	Rock, red	10	320
Gravel	10	220	Sand; water	15	335
Red beds	30	250	Rock, red	5	340
Sand	5	255			

[1]Wording has been changed slightly to improve readability.

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well C-17					
[Owner: Sinclair Oil & Gas Co. Driller: Reese & Griggs]					
Surface sand	4	4	Sand, red	16	334
Caliche	12	16	Rock, red	2	336
Sand, red	108	124	Sand, red	12	348
Quicksand	66	190	Rock, red	2	350
Rock, red	22	212	Sand, red	27	377
Sand, red	12	224	Rock, red	8	385
Rock, red	41	265	Sand, gray	45	430
Sand, red	10	275	Rock, red	5	435
Rock, red	43	318	Sand, gray	20	455
Well C-25					
[Owner: J. B. Walton. Driller: J. B. Marshall]					
Surface sand	4	4	Sand, red	25	145
Caliche	16	20	Clay, red	15	160
Sand, red	60	80	Sand and gravel; water	5	165
Clay, red	40	120			
Well C-29					
[Owner: Humble Oil & Refining Co. Driller: Fannin Drilling Co.]					
Surface sand	5	5	Sand; water	45	160
Caliche	6	11	Sand and gravel; water	29	189
Rock, red	41	52	Shale, red	7	196
Sand, red	63	115			
Well C-30					
[Owner: Humble Oil & Refining Co. Driller: Fannin Drilling Co.]					
Surface sand	10	10	Gravel; water	20	190
Caliche	15	25	Rock, gray	4	194
Sand, red	85	110	Shale, red	4	198
Sand and gravel; water	60	170			
Well C-31					
[Owner: Humble Oil & Refining Co. Driller: Fannin Drilling Co.]					
Surface sand	2	2	Sand; water	15	155
Caliche	13	15	Sand and gravel	28	183
Sand, red	110	125	Shale, red	5	188
Shale, red	15	140			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well C-35					
[Owner: Sinclair Oil & Gas Co. Driller: J. R. Marshall]					
Surface sand	4	4	Sand, red	10	145
Caliche	18	22	Clay, red, sandy	20	165
Sand, white	13	35	Sand and gravel; water	5	170
Sand, red	45	80	Clay, red, sandy	45	215
Rock, red	15	95	Sand, red	10	225
Clay, red, sandy	30	125	Red beds	6	231
Sand, white	10	135			
Well C-38					
[Owner: J. B. Walton. Driller: J. R. Marshall]					
Surface sand	4	4	Sand, red	25	135
Caliche	16	20	Clay, red	15	150
Sand, red	50	70	Sand, gravel; water	5	155
Clay, red	40	110			
Well C-48					
[Owner: Sinclair Oil & Gas Co. Driller: J. R. Marshall]					
Surface sand	8	8	Sand, red	65	160
Caliche	15	23	Clay, red	15	175
Sand, red	52	75	Rock, red	35	210
Clay, red	12	87	Sand and gravel; water	10	220
Sand; water	8	95	Sand, red	10	230
Well D-4					
[Owner: Brooks & Ewing. Driller: J. R. Marshall]					
Sand	70	70	Rock, red	5	100
Clay, red, sandy	10	80	Sand; water	10	110
Sand; water	15	95			
Well D-6					
[Owner: W. F. Scarborough Estate. Driller: J. D. Cole]					
Sand	8	8	Shale, sandy	19	95
Caliche	10	18	Sand and gravel	15	110
Sand	58	76			
Well D-14					
[Owner: Stanolind Oil & Gas Co. Driller: —]					
Sand	120	120	Red beds	91	250
Red beds	20	140	Red beds and shale	30	280
Quicksand	10	150	Sand	12	292
Red beds	7	157	Red beds	8	300
Gravel	2	159	Red beds and shale	5	305

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-21

[Owner: Sun Oil Co. Driller: Flack Water Well Co.]

Sand	139	139	Sand; water	4	145
Clay	2	141	No record	30	175

Well D-22

[Owner: Texas-New Mexico RR. Co. Driller: L. L. Dorn]

Sand, loose	124	124	Gravel	11	158
Sand, hard	23	147	Red beds	2	160

Well D-23

[Owner: Texas-New Mexico RR. Co. Driller: L. F. Buchanan]

Sand	70	70	Sandstone, red	4	148
Quicksand	74	144			

Well D-31

[Owner: Ambassador Oil, Inc. Driller: J. D. Cole]

Sand	6	6	Clay, sandy, and gravel	27	112
Sand and caliche	12	18	Gravel, sandy; water	36	148
Sand, brown	37	55	Red beds	68	216
Sand	25	80	Sandstone	5	221
Sand, gravel; water	5	85	Red beds	4	225

Well D-32

[Owner: Ambassador Oil, Inc. Driller: J. D. Cole]

Surface sand	8	8	Sand, gravel	110	150
Sand, caliche	10	18	Red beds	60	210
Sand	22	40			

Well D-33

[Owner: Sinclair Oil & Gas Co. Driller: —]

Surface sand	15	15	Sand	80	220
Caliche	5	20	Rock, red	80	300
Sand	30	50	Shale, blue	10	310
Sand, red	10	60	Sand; water	12	322
Sand	70	130	Rock, red	22	410
Red beds	10	140	Sand; water	38	448

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-38

[Owner: Richardson Oils, Inc. Driller: Richardson Oils, Inc.]

Surface sand	7	7	Shale, blue	1	461
Caliche	12	19	Shale, red	627	1,088
Sand	129	148	Anhydrite	21	1,109
Shale, sandy	20	168	Shale, red	5	1,114
Shale, red	87	255	Anhydrite	71	1,185
Shale, red, sandy	38	293	Salt	32	1,217
Sand	13	306	Anhydrite, salt	3	1,220
Shale, red	6	312	Anhydrite	9	1,229
Sand	22	334	Limestone (Rustler)	36	1,265
Shale, sandy	36	370	Shale, red	15	1,280
Sand; water	90	460			

Well D-39

[Owner: Richardson Oils, Inc. Driller: J. R. Marshall]

Surface sand	10	10	Sand; water	5	310
Sand, red	130	140	Shale, red	60	370
Sand, gravel; water	6	146	Rock, red	10	380
Rock, red	44	190	Sand; water	15	395
Shale, red	30	220	Red beds	5	400
Sand; water	5	225	Sand; water	10	410
Red beds	65	290	Red beds	10	420
Rock, red	15	305			

Well D-41

[Owner: Magnolia Petroleum Co. Driller: J. R. Marshall]

Surface sand	10	10	Sand and clay	5	130
Caliche	10	20	Sand and gravel; water	11	141
Sand, red	105	125	Red beds	2	143

Well D-43

[Owner: Humble Oil & Refining Co. Driller: L. O. Fannin]

Surface sand	15	15	Sand and gravel; water	55	185
Caliche	10	25	Rock, gray	5	190
Sand, pink	100	125	Shale, red	10	200
Sand, red	5	130			

Well D-45

[Owner: Humble Oil & Refining Co. Driller: J. J. Harrell & R. P. Tone]

Surface sand	5	5	Shale, red	35	170
Caliche	15	20	Sand, brown	10	180
Sand, white	15	35	Sand, hard	2	182
Sand, red	25	60	Gravel	24	206
Gravel	10	70	Shale, red	9	215
Sand, brown	30	100	Gravel	10	225
Sand and red beds	15	115	Sand	7	232
Sand, white	5	120	Shale, red, sandy	6	238
Sand and red beds	15	135			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-46

[Owner: Humble Oil & Refining Co. Driller: I. O. Fannin]

Surface sand	10	10	Sand, red	40	165
Caliche	10	20	Gravel; water	15	180
Sand, red	100	120	Rock	4	184
Sand, white	5	125	Shale, red	1	185

Well D-47

[Owner: El Paso Natural Gas Co. Driller: J. D. Cole]

Surface sand	4	4	Sandstone, red	10	108
Caliche	3	7	Shale, pink, sandy	34	142
Sand, yellow	11	18	Sand, gravel	23	165
Quicksand, brown	55	73	Rock, red	1	166
Sand, pink	25	98			

Well D-48

[Owner: El Paso Natural Gas Co. Driller: J. D. Cole]

Surface sand	4	4	Shale, red, sandy	65	345
Sand, gypsum	8	12	Sand and gravel	23	368
Shale, yellow, sandy	6	18	Sand, coarse, and shale	3	371
Quicksand, brown	76	94	Shale, red	4	375
Rock and red sand	15	109	Sand	7	382
Shale, pink, sandy	37	146	Shale, white, sandy	22	404
Sand and gravel	16	162	Sand, white	11	415
Rock, red	27	189	Rock, red	10	425
Shale, brown, and lime shells	11	200	Sand, coarse, brown	3	428
Lime, brown	18	218	Rock, red, and lime shells	57	485
Rock, red, and lime shells	12	230	Shale, brown	33	518
Shale, red and yellow, sandy	10	240	Rock, red	34	552
Sand	9	249	Shale, brown	16	568
Shale	4	253	Rock, red	32	600
Sand	27	280			

Well D-49

[Owner: El Paso Natural Gas Co. Driller: J. D. Cole]

Sand	88	88	Rock, red	6	266
Clay, pink, sandy	30	118	Sandstone	22	288
Sand and gravel	12	130	Red beds	2	290
Red beds	37	167	Rock, red	36	326
Sandstone	63	230	Red beds	4	330
Red beds	20	250	Sandstone	44	374
Sand and clay	5	255	Rock, red	6	380
Clay, sandy	5	260	Red beds	24	404

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-50

[Owner: El Paso Natural Gas Co. Driller: —]

Surface sand	87	87	Sandstone, red	1	176
Clay, sandy	29	116	Clay, gray	4	180
Gravel	6	122	Sandstone, red	1	181
Clay, sandy, and gravel	32	154	Clay, gray, red streaks	3	184
Sandstone	1	155	Sandstone, brown	13	197
Gravel	1	156	Red beds and yellow clay	3	200
Limestone, gray	1	157	Sandstone	2	202
Sandstone	1	158	Red beds	3	205
Clay, blue and gray	1	159	Sandstone	4	209
Red beds, sandy	10	169	Clay, yellow	35	244
Sandstone, red	4	173	Sand	6	250
Clay, red	2	175			

Well D-51

[Owner: El Paso Natural Gas Co. Driller: —]

Surface sand	97	97	Gravel	2	178
Clay, sandy, and gravel	55	152	Red beds	19	197
Limestone, gray	9	161	Shale, gray	5	202
Red beds	12	173	Sandstone, red	3	205
Limestone	3	176	Clay, yellow	14	219

Well D-53

[Owner: El Paso Natural Gas Co. Driller: J. D. Cole]

Surface sand	4	4	Sandstone, red	1	158
Sand and caliche	10	14	Red beds, sandy	8	166
Sand	41	55	Sandstone, red	8	174
Clay, pink, sandy, and gravel	68	123	Red beds	4	178
Gravel; water	10	133	Clay, yellow	1	179
Clay, red, sandy	9	142	Sandstone, brown	8	187
Gravel; water	5	147	Clay, pink, sandy	4	191
Red beds	7	154	Sandstone, yellow	39	230
Gravel; water	3	157	Red beds	30	260

Well D-54

[Owner: El Paso Natural Gas Co. Driller: J. D. Cole]

Surface sand	5	5	Rock, red, and gravel	14	159
Caliche	14	19	Sandstone	15	174
Sand	61	80	Clay, yellow, sandy	3	177
Clay, pink, sandy	34	114	Clay, red	1	178
Shale, white, and gravel	5	119	Sandstone and red beds	17	195
Sand, red, and gravel	15	134	Sandstone, yellow	26	221
Red beds	11	145	Red beds	3	224

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-55					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	52	52	Sand	2	152
Sand; water	26	78	Limestone, gray	3	155
Sand, red	18	96	Sand and gravel	2	157
Clay, sandy	37	133	Gravel	4	161
Gravel	6	139	Red beds	6	167
Clay, sandy, and gravel	9	148	Gravel	6	173
Clay, gray	2	150	Sand, red	107	280
Well D-56					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	9	9	Clay, pink	1	166
Quicksand	107	116	Gravel	3	169
Clay, pink, sandy	45	161	Clay, pink, sandy	4	173
Gravel	4	165	Red beds	2	175
Well D-58					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	4	4	Quicksand	121	125
Well D-59					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	8	8	Red beds	21	207
Caliche	6	14	Sandstone, white	4	211
Quicksand	138	152	Clay, red	4	215
Clay, pink, and gravel	18	170	Sandstone, white	5	220
Gravel	16	186			
Well D-60					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	9	9	Gravel	5	165
Caliche	4	13	Clay and gravel	9	174
Sand	123	136	Red beds and blue clay	33	207
Clay, pink, sandy	24	160	Sandstone	3	210
Well D-61					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	6	6	Red beds	2	193
Caliche	2	8	Clay, white	3	196
Sand, red	13	21	Red beds	1	197
Quicksand	113	134	Sandstone, white	4	201
Clay, pink, sandy	25	159	Limestone	6	207
Gravel and red clay	13	172	Sandstone	7	214
Clay, pink, sandy	19	191	Sand	6	220

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-63					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	14	14	Gravel	2	146
Quicksand	123	137	Red beds	14	160
Clay, pink, sandy	7	144			
Well D-64					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	15	15	Gravel	4	194
Quicksand	139	154	Sand and gravel	17	211
Clay, pink, sandy	29	183	Clay, red, sandy	6	217
Clay, red	7	190	Red beds	3	220
Well D-65					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	12	12	Clay, red	3	188
Quicksand	139	151	Gravel	2	190
Clay, pink, sandy	14	165	Sand and gravel	8	198
Clay, red, sandy	17	182	Red beds	2	200
Gravel	3	185			
Well D-66					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	12	12	Clay, sandy	40	172
Caliche	4	16	Gravel	8	180
Quicksand	22	38	Clay, sandy	5	185
Sand, white; water	12	50	Red beds	2	187
Quicksand	82	132			
Well D-67					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	8	8	Clay, pink, sandy	19	143
Quicksand	116	124	Red beds	91	234
Well D-71					
[Owner: Sinclair Oil & Gas Co. Driller: E. & L. Water Well Service]					
Sand	130	130	Red beds	2	139
Red beds	3	133	Quicksand	2	141
Gravel; water	1	134	Red beds	2	143
Quicksand	2	136	Sand; water	4	147
Gravel; water	1	137	Red beds	3	150

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-72.					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	14	14	Gravel	2	146
Quicksand	123	137	Red beds	14	160
Clay, pink, sandy	7	144			
Well D-73					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	12	12	Gravel	10	181
Quicksand	124	136	Red beds	35	216
Clay, pink, sandy	21	157	Sandstone, red	10	226
Gravel	6	163	Red beds	25	251
Clay, pink, white streaks	8	171	Sandstone, gray	1	252
Well D-74					
[Owner: Sinclair Oil & Gas Co. Driller: J. R. Marshall]					
Surface sand	15	15	Sand, fine	5	195
Sand, white	55	70	Sand, red, hard	32	227
Quicksand	76	146	Clay, sandy, and gravel	8	235
Sand, red	14	160	Red beds	33	268
Sand, white, and clay	18	178	Rock, red	10	278
Sand, white	7	185	Sand; water	4	282
Sand; water	5	190			
Well D-75					
[Owner: Sinclair Oil & Gas Co. Driller: E. & L. Water Well Service]					
Surface sand	130	130	Sand, brown	12	154
Red beds	4	134	Red beds	3	157
Sand, white	8	142			
Well D-76					
[Owner: Sinclair Oil & Gas Co. Driller: E. & L. Water Well Service]					
Sand	150	150	Gravel	9	192
Red beds	18	168	Sand; water	8	200
Gravel	4	172	Red beds	2	202
Red beds	11	183			
Well D-84					
[Owner: El Paso Natural Gas Co. Driller: —]					
Surface sand	17	17	Clay, red, sandy	3	177
Quicksand	121	138	Gravel	17	194
Clay, white, sandy	9	147	Clay, red, sandy	4	198
Clay, pink, sandy	25	172	Red beds	2	200
Gravel	2	174			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-94					
[Owner: Richardson Gasoline Plant. Driller: —]					
Surface sand	6	6	Shale, red, sandy	11	135
Caliche	14	20	Sand and gravel	12	147
Sand, yellow	40	60	Rock, red	8	155
Quicksand	40	100	Sand and gravel	10	165
Sand, brown	18	118	Rock and red sand	15	180
Chalk, white	6	124	Shale, red	20	200
Well D-99					
[Owner: Stanolind Oil & Gas Co. Driller: —]					
Surface sand	25	25	Quicksand	10	155
Sand, yellow	30	55	Shale, red	11	166
Quicksand	15	70	Sand and gravel	9	175
Sand, red	50	120	Sand	25	200
Red beds	25	145			
Well D-103					
[Owner: Gulf Oil Corp. Driller: J. D. Cole]					
Surface sand	6	6	Rock, red, and gravel	24	185
Caliche	19	25	Rock, red	5	190
Sand, yellow	28	53	Rock, red and blue shale	5	195
Quicksand	69	122	Red beds	17	212
Sand, pink	8	130	Rock, red	6	218
Shale, red, sandy	15	145	Shale, red, blue and gray	7	225
Shale, pink, and gravel	8	153	Rock, red, and sand	10	235
Rock, red	5	158	Shale, red	25	260
Sand and gravel; water	3	161	Sand, brown	40	300
Well D-111					
[Owner: Gulf Oil Corp. Driller: J. E. Germiller]					
Surface sand	5	5	Red beds and chalk	7	172
Sand, yellow	20	25	Red beds	4	176
Shale, red	5	30	Sand and gravel; water	4	180
Red beds	14	44	Red beds	40	220
Sand, yellow	21	65	Clay, brown	4	224
Quicksand	76	141	Red beds	6	230
Red beds	3	144	Sand, brown; water	12	242
Caliche	9	153	Red beds	8	250
Caliche and gravel	12	165			
Well D-113					
[Owner: Gulf Oil Corp. Driller: G. S. Taylor]					
Sand	170	170	Sand and gravel; water	38	225
Red beds	17	187	Rock, red	25	250

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*'—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-114					
[Owner: Gulf Oil Corp. Driller: J. E. Germiller]					
Sand	145	145	Gravel; water	12	210
Chalk and gravel; water	35	180	Red beds	2	212
Gravel	5	185	Sand; water	12	224
Red beds	13	198	Red beds	3	227
Well D-115					
[Owner: Gulf Oil Corp. Driller: J. R. Marshall]					
Sand	150	150	Clay, red	20	220
Clay, red	20	170	Shale, blue	10	230
Sand and gravel; water	8	178	Rock, red	20	250
Clay, red	2	180	Red beds	20	270
Rock; red sand	20	200			
Well D-120					
[Owner: S. W. Richardson. Driller: —]					
Surface sand	40	40	Gravel; water	15	210
Quicksand	145	185	Red beds	15	225
Red beds	10	195			
Well D-122					
[Owner: S. W. Richardson. Driller: —]					
Sand	40	40	Red beds	48	193
Quicksand	105	145	Gravel; water	13	206
Well D-124					
[Owner: Gulf Oil Corp. Driller: Earl Scott]					
Surface sand	10	10	Sand, white	16	193
Caliche	5	15	Rock, red	1	194
Sand	130	145	Sand and gravel; water	26	220
Chalk	20	165	Rock, red	13	233
Rock, red	3	168	Sand; water	6	239
Sand, white; water	4	172	Rock, red	2	241
Rock, red	5	177	Sand and gravel; water	9	250
Well D-125					
[Owner: Gulf Oil Corp. Driller: J. J. Bush]					
Sand	86	86	Rock, red	26	228
Quicksand	64	150	Shale, red, sandy	102	330
Sand, white	20	170	Sand; water	12	342
Shale, red, sandy	20	190	Shale, red, sandy	15	357
Clay, red, and gravel	12	202			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-126					
[Owner: Gulf Oil Corp. Driller: F. C. Ingham]					
Quicksand	152	152	Rock, red	16	198
Clay, red, sandy	16	168	Clay, red	32	230
Sand; water	10	178	Rock, red	15	245
Clay, sandy	4	182	Clay, red	5	250
Well D-127					
[Owner: Gulf Oil Corp. Driller: G. S. Taylor]					
Sand	155	155	Sand and gravel	8	208
Clay, red, sandy	7	162	Red beds and sand	3	211
Red beds	12	174	Rock, red	39	250
Sand; water	26	200			
Well D-128					
[Owner: Gulf Oil Corp. Driller: F. C. Ingham]					
Surface sand	80	80	Rock and sand	30	240
Quicksand	60	140	Clay, red	10	250
Rock and sand	20	160	Rock, red	20	270
Clay, red	15	175	Clay, red	35	305
Sand and gravel; water	5	180	Sand; water	10	315
Shale, red, sandy	30	210	Clay, red, sandy	17	332
Well D-129					
[Owner: Gulf Oil Corp. Driller: J. R. Marshall]					
Sand	80	80	Sand and gravel; water	5	180
Quicksand	60	140	Sand and shale	30	210
Sand, red	20	160	Sandstone	30	240
Clay	15	175	Clay, red	10	250
Well D-130					
[Owner: Carter Foundation. Driller: Cole & Powell]					
Surface sand	5	5	Rock, red	7	177
Caliche	10	15	Gravel; water	8	185
Sand	127	142	Rock, red, and gravel	39	224
Rock, red	8	150	Rock, red	24	248
Sand, red	20	170			
Well D-133					
[Owner: Standard of Texas. Driller: Harry Bass]					
Red beds and sand	78	78	Sand and red rock	37	202
Red beds and shale	87	165			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-136					
[Owner: Cabot Carbon Black Co. Driller: J. R. Marshall]					
Surface sand	8	8	Clay, red	15	155
Caliche	12	20	Sand and gravel; water	10	165
Sand, red	45	65	Clay, red	10	175
Quicksand	75	140	Sand, coarse; water	5	180
Well D-137					
[Owner: Cabot Carbon Black Co. Driller: J. D. Cole]					
Surface sand	5	5	Rock, red	10	180
Caliche	13	18	Shale, red, yellow, and blue	5	185
Sand	112	130	Rock, red	25	210
Red beds	25	155	Shale, red	8	218
Rock, red	5	160	Sand; water	10	228
Sand and gravel; water	5	165	Red beds	2	230
Rock, red, and gravel	5	170			
Well D-139					
[Owner: Magnolia Petroleum Co. Driller: Bethel & Matthews]					
Surface sand	2	2	Sand and gravel; water	35	195
Caliche	33	35	Shale, red	5	200
Sand	90	125	Sand; water	16	216
Red beds	15	140	Red beds	3	219
Gravel	20	160			
Well D-143					
[Owner: Magnolia Petroleum Co. Driller: H. U. Barnes]					
Sand	75	75	No record	60	225
Shale, red, sandy	35	110	Shale, red	11	236
Sand; water	50	160	Sand	38	274
Rock	5	165			
Well D-148					
[Owner: Magnolia Petroleum Co. Driller: H. R. Bethel]					
Sand	6	6	Sand and gravel	30	150
Caliche	19	25	Red beds	40	190
Sand	81	106	Sand, brown	15	205
Red beds	9	115	Red beds	70	275
Rock	5	120			
Well D-150					
[Owner: Magnolia Petroleum Co. Driller: —]					
Sand	6	6	Gravel; water	17	145
Caliche	22	28	Gumbo	15	160
Quicksand	42	70	Sand and gravel	10	170
Sand, red	40	110	Rock and sand	20	190
Red beds	8	118	Sand, gravel and clay	11	201
Sand; water	10	128			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-156					
[Owner: Texas Pacific Coal & Oil Co. Driller: Clark Drilling Co.]					
Sand, caliche, white, soft	19	19	Shale, red, sandy, hard	10	643
Sand, red, soft	87	106	Rock, red, hard	47	690
Red beds, soft	79	185	Shale, red, sandy, hard	30	720
Rock, red, hard	25	210	Rock, red, hard	17	737
Sand, shells, white, hard	5	215	Sand and hard red shale	8	745
Sand, gravel, and red beds, soft	10	225	Rock, red, hard	15	760
Red beds, soft	5	230	Shale, red, hard	30	790
Rock, sandy, red, medium	5	235	Rock, red, hard	22	812
Rock, red, hard	8	243	Shale, red, sandy, hard	5	817
Sand, red, soft	2	245	Rock, red, hard	200	1,017
Rock and hard red sand	15	260	Sand; red, hard rock	20	1,037
Sand, white, soft	47	307	Rock, red, hard	18	1,055
Shale, gray, sandy, medium	10	317	Anhydrite, gray and white, hard	55	1,110
Rock, red, hard	18	335	Limestone, gray, hard (Rustler)	14	1,124
Shale, sandy, medium	70	405	Anhydrite, white, hard	59	1,183
Rock, red, hard	15	420	Lime, gray, hard	48	1,231
Sand, red, soft	15	435	Rock and red, hard anhydrite	4	1,235
Rock, red, hard	5	440	Rock, red, hard	5	1,240
Sand, red, soft	14	454	Lime, gray, hard	12	1,252
Rock, red, hard	36	490	Anhydrite, blue and white, hard	15	1,267
Lime, gray, hard	10	500	Lime, gray, hard	6	1,273
Rock, red, hard	25	525	Rock, red, hard	2	1,275
Shale, red, sandy, hard	25	550	Shale, red, sandy, hard	15	1,290
Rock, red, hard	40	590	Shale, gray, hard	15	1,305
Shale, red, hard	30	620			
Sand, brown, hard	13	633			
Well D-160					
[Owner: Texas Pacific Coal & Oil Co. Driller: Atwood & Clark Drilling Co.]					
Caliche and white, soft sand	40	40	Anhydrite and hard, white gypsum	55	1,135
Sand and red, soft gravel	70	110	Lime, gray, hard	10	1,145
Red beds and hard, red rock	672	782	Anhydrite, gray, hard	2	1,147
Anhydrite, red, hard shale, and rock	145	927	Lime, gray, hard	6	1,153
Anhydrite and red, hard rock	63	990	Anhydrite, white, hard	19	1,172
Red beds and red, hard rock	90	1,080	Lime, gray, hard	60	1,232
			Shale, brown, hard	2	1,234
Well D-163					
[Owner: Sinclair Oil & Gas Co. Driller: F. C. Ingham]					
Sand	8	8	Rock, red, sandy	20	145
Caliche	12	20	Rock, red	25	170
Sandrock	100	120	Sand and gravel	25	195
Sand	5	125	Rock, red	5	200

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-164					
[Owner: Sinclair Oil & Gas Co. Driller: —]					
Surface sand	6	6	Rock, red	20	140
Caliche	14	20	Gravel; water	5	145
Sand, red	75	95	Sand, red	25	170
Clay, red	10	105	Sand and gravel; water	8	178
Rock, red	10	115	Red beds	2	180
Sand; water	5	120			
Well D-165					
[Owner: Sinclair Oil & Gas Co. Driller: F. C. Ingham]					
Surface sand	8	8	Rock and sand	25	165
Caliche	17	25	Gravel	10	175
Sandrock	90	115	Rock and sand	20	195
Sand	5	120	Sand and gravel	20	215
Rock, red	20	140			
Well D-166					
[Owner: Atlantic Refining Co. Driller: J. D. Cole]					
Surface sand	8	8	Sand	7	112
Caliche	4	12	Red beds	8	120
Sand and caliche	20	32	Gravel and sand	48	168
Sand	36	68	Red beds	7	175
Clay, red, sandy	34	102	Sand and gravel	13	188
Red beds	3	105	Red beds	2	190
Well D-167					
[Owner: Atlantic Refining Co. Driller: J. D. Cole]					
Surface sand	6	6	Clay, red	8	108
Caliche	6	12	Sand and gravel	17	125
Sand	33	45	Red beds	45	170
Clay, red, sandy	10	55	Sand and gravel	15	185
Clay, red, sandy, and gravel	45	100	Rock, red	5	190
Well D-173					
[Owner: Gulf Oil Corp. Driller: J. R. Marshall]					
Surface sand	10	10	Rock, red, and sand	26	168
Caliche	15	25	Red beds	7	175
Sand	15	40	Gravel and sand; water	5	180
Rock, red, and sand	35	75	Rock, red	10	190
Rock, red	40	115	Red beds	10	200
Sand; water	5	120	Sand and rock, red	23	223
Sand, red	15	135	Gravel	2	225
Sand and gravel; water	7	142			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-175

[Owner: Gulf Oil Corp. Driller: R. E. Griggs]

Surface sand	7	7	Sand	36	184
Caliche	14	21	Sand and clay, red	4	188
Sand	69	90	Clay	10	198
Rock, red, sandy	10	100	Sand; water	5	203
Clay	20	120	Clay	10	213
Sand and gravel; water	3	123	Sand	2	215
Sand	7	130	Clay	3	218
Gravel; water	18	148			

Well D-176

[Owner: Gulf Oil Corp. Driller: R. E. Griggs]

Sand	6	6	Gravel; water	10	152
Caliche	14	20	Sand	8	160
Sand	65	85	Clay	2	162
Clay, sandy	13	98	Sand	14	176
Clay	15	113	Clay	10	186
Gravel; water	2	115	Sand; water	18	204
Sand	27	142	Clay	12	216

Well D-177

[Owner: Gulf Oil Corp. Driller: J. R. Marshall]

Sand	12	12	Rock, red	15	135
Caliche	8	20	Sand and gravel; water	5	140
Sand	60	80	Rock, red	25	165
Rock, red	35	115	Sand and gravel; water	5	170
Sand and gravel; water	5	120	Red beds	10	180

Well D-179

[Owner: Humble Oil & Refining Co. Driller: F. C. Ingham]

Caliche	20	20	Sand; water	32	170
Sand	90	110	Clay, red	5	175
Sand and rock	28	138			

Well D-180

[Owner: Humble Oil & Refining Co. Driller: F. C. Ingham]

Caliche	18	18	Sand and clay	10	135
Sand	57	75	Sand and gravel	25	160
Rock, red	35	110	Rock, red	26	186
Sand, red	15	125			

Well D-181

[Owner: Humble Oil & Refining Co. Driller: F. C. Ingham]

Surface sand	4	4	Red beds	22	110
Caliche	16	20	Sand; water	62	172
Sand	68	88	Red beds	1	173

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-191

[Owner: Standard Oil Co. of Texas. Driller: J. R. Marshall]

Red beds and sand	50	50	Red beds	10	170
Quicksand	110	160	Sand; water	25	195

Well D-193

[Owner: Standard Oil Co. of Texas. Driller: Richardson Drilling Co.]

Surface sand and caliche	15	15	Anhydrite and red rock	70	885
Caliche, sand, and shells	233	248	Anhydrite and red beds	19	904
Rock, red	226	474	Anhydrite and lime	61	965
Red beds and red rock	82	556	Sand, lime, and anhydrite	97	1,062
Red beds, red rock, and anhydrite	259	815			

Well D-194

[Owner: Standard Oil Co. of Texas. Driller: Sidwell & Imler]

Sand	12	12	Red beds and shale	35	265
Caliche	13	25	Red beds	35	300
Sand	120	145	Sand	35	335
Shale, red	28	173	Shale, red	25	360
Gravel	7	180	Sand	5	365
Shale, red, sandy and gravel	15	195	Shale, red	25	390
Red beds	16	211	Sand	13	403
Sand	4	215	Red beds	6	409
Gravel	15	230			

Well D-195

[Owner: Standard Oil Co. of Texas. Driller: Richardson Drilling Co.]

Surface sand	15	15	Gypsum and red rock	34	748
Sand, gravel, and red beds	235	250	Sand, red rock, and gypsum	22	770
Rock, red	278	528	Anhydrite	16	786
Sand and red rock	43	571	Rock, red	33	819
Anhydrite and red rock	78	649	Anhydrite and red rock	9	828
Sand, anhydrite, and red rock	37	686	Anhydrite	90	918
Anhydrite and red rock	28	714	Dolomite	32	950
			Sand and dolomite	73	1,023

Well D-196

[Owner: Standard Oil Co. of Texas. Driller: —]

Surface sand	8	8	Gravel and red rock	18	225
Caliche	10	18	Red beds and sandy shale	125	350
Sand	155	173	Rock, red	15	365
Red beds	7	180	Rock and red, sandy shale	15	380
Sand and gravel	5	185	Red beds and sandy shale	22	402
Red beds and gravel	5	190	Rock, red, sandy	8	410
Sand	4	194	Shale, sandy	8	418
Rock, red	9	203	Shale, brown	7	425
Sand and gravel	4	207			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-197					
[Owner: Standard Oil Co. of Texas. Driller: Sidwell & Imler]					
Caliche, surface sand	7	7	Red beds	6	218
Sand	168	175	Gravel, large	3	221
Rock, red	10	185	Sand and red rock	114	335
Gravel	5	190	Shale	15	350
Sand	22	212	No record	62	412
Well D-203					
[Owner: Gulf Oil Corp. Driller: W. D. Holt]					
Surface sand	22	22	Sand, shale, and gravel	33	190
Caliche and sand	18	40	Sandstone	4	194
Sand	117	157	Rock, red	26	220
Well D-217					
[Owner: Humble Oil & Refining Co. Driller: R. E. Griggs]					
Surface sand	5	5	Clay	4	204
Caliche	9	14	Sand, red	16	220
Sand	140	154	Clay, red	25	245
Clay, red	16	170	Sand, brown	10	255
Gravel	5	175	Clay, red	5	260
Clay, red	10	185	Sand, brown	24	284
Gravel	10	195	Clay, red	5	289
Sand, red	5	200	Sand, brown	11	300
Well D-218					
[Owner: Humble Oil & Refining Co. Driller: F. C. Ingham]					
Surface sand	6	6	Gravel	13	210
Caliche	15	21	Red beds	17	227
Sand	145	166	Sand and gravel	8	235
Sand and clay	8	174	Sand, red	22	257
Sand and gravel	6	180	Red beds	7	264
Red beds	3	183	Sand and gravel	21	285
Gravel and sand	10	193	Rock, red	16	301
Red beds	4	197			
Well D-222					
[Owner: Sinclair Oil & Gas Co. Driller: J. R. Marshall]					
Surface sand	10	10	Sand and gravel; water	2	145
Caliche	15	25	Rock, red	15	160
Sand	105	130	Sand and gravel; water	10	170
Red beds	13	143	Sand, red	8	178

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-223					
[Owner: Sinclair Oil & Gas Co. Driller: J. R. Marshall]					
Surface sand	10	10	Sand; water	5	135
Caliche	15	25	Rock, red	20	155
Sand	100	125	Sand; water	10	165
Red beds	5	130			
Well D-228					
[Owner: Tidewater Oil Co. Driller: Bob Glynn]					
Surface sand	5	5	Sand, red	15	180
Caliche	10	15	Rock, red	10	190
Sand	125	140	Sand	50	240
Red beds	15	155	Rock, red	20	260
Sand, red	5	160	Sand, brown	20	280
Gravel; water	5	165	Red beds	5	285
Well D-235					
[Owner: Humble Oil & Refining Co. Driller: R. E. Griggs]					
Surface sand	5	5	Sandstone	3	208
Caliche	9	14	Sand	7	215
Sand	76	90	Clay, red	3	218
Gravel; water	5	95	Sand, red	25	243
Sand and gravel	26	121	Gravel	5	248
Clay, red	6	127	Sand and gravel	17	265
Sand and gravel	68	195	Sand, brown	32	297
Clay, red	3	198	Clay, red	3	300
Sand, red	7	205			
Well D-236					
[Owner: Humble Oil & Refining Co. Driller: R. E. Griggs]					
Surface sand	8	8	Sand and gravel	23	256
Caliche	11	19	Sand, brown	8	264
Sand	68	87	Clay, red	4	268
Sand and gravel	55	142	Sand	12	280
Clay, red	6	148	Clay, red	4	284
Gravel and sand; water	10	158	Sand, red	16	300
Sand, clay	75	233			
Well D-238					
[Owner: Gulf Oil Corp. Driller: R. E. Griggs]					
Surface sand	8	8	Sand	24	134
Caliche	15	23	Clay, red	3	137
Sand	39	62	Sand, brown	12	149
Sand and shale	13	75	Clay, red, sandy	23	172
Clay, sandy	12	87	Clay, red	17	189
Clay	8	95	Sand	5	194
Gravel and sand; water	15	110	Clay, red	11	205

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-241

[Owner: Humble Oil & Refining Co. Driller: I. O. Fannin]

Rocky soil	5	5	Sand and gravel; water	80	150
Sand	50	55	Rock	15	165
Rock and sand	15	70	Shale, red	30	195

Well D-242

[Owner: Skelly Oil Co. Driller: J. J. Bush]

Sand	2	2	Sand and gravel; water	5	120
Caliche	13	15	Red beds	50	170
Sand	45	60	Sandstone	15	185
Red beds	55	115			

Well D-248

[Owner: Gulf Oil Corp. Driller: J. R. Marshall]

Surface sand	5	5	Rock, red	47	187
Caliche	20	25	Sand; water	8	195
Sand	115	140	Rock, red	5	200

Well D-249

[Owner: Gulf Oil Corp. Driller: J. R. Marshall]

Caliche	25	25	Rock, red	15	180
Sand	65	90	Red beds	5	185
Rock, red	70	160	Sand	5	190
Sand and gravel; water	5	165	Rock, red	9	199

Well D-253

[Owner: Sinclair Oil & Gas Co. Driller: J. R. Marshall]

Surface sand	6	6	Rock, red	20	165
Caliche	14	20	Sand and gravel	20	185
Sand	90	110	Rock, red	55	240
Clay, red, sandy	4	114	Sand; water	10	250
Sand; water	31	145			

Well D-254

[Owner: Sinclair Oil & Gas Co. Driller: —]

Surface sand	7	7	Sand; water	7	145
Caliche	13	20	Rock, red	35	180
Sand, red	45	65	Shale, red	10	190
Quicksand	60	125	Sand and gravel; water	7	197
Red beds	13	138	Red beds	3	200

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*'—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-255					
[Owner: Sinclair Oil & Gas Co. Driller: —]					
Surface sand	6	6	Red beds	15	140
Caliche	14	20	Sand and gravel; water	10	150
Sand	105	125			
Well D-257					
[Owner: Humble Oil & Refining Co. Driller: R. E. Griggs]					
Surface sand	6	6	Sand	45	209
Caliche	17	23	Sand and clay	41	250
Sand	61	84	Rock, red	50	300
Sand and clay	80	164			
Well D-269					
[Owner: Humble Oil & Refining Co. Driller: R. E. Griggs]					
Sand	5	5	Sand	107	125
Caliche	13	18	Sand and clay, alternating	175	300
Well D-270					
[Owner: Humble Oil & Refining Co. Driller: F. C. Ingham]					
Surface sand	7	7	Gravel and sand	21	164
Caliche	17	24	Red beds	6	170
Sand	119	143	Rock and sand	5	175
Well D-272					
[Owner: City of Kermit. Driller: Glynn & Wade]					
Surface sand	15	15	Sand	10	275
Caliche	10	25	Gravel; water	10	285
Sand	220	245	Sand; water	15	300
Red beds	20	265	Red beds	12	312
Well D-278					
[Owner: City of Kermit. Driller: Bob Glynn]					
Surface sand	5	5	Sand; water	5	235
Caliche	10	15	Gravel; water	10	245
Sand	200	215	Sand, red	50	295
Red beds	15	230	Red beds	5	300

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well D-280

[Owner: City of Kermit. Driller: Permian Well Service]

Caliche	44	44	Rock, red	8	308
Sand	156	200	Gravel and sand	7	315
Red beds	10	210	Red beds	15	330
Sand and gravel	13	223	Sand	5	335
Shale, red	3	226	Red beds	81	416
Red beds	16	242	Sand	19	435
Gravel; water	6	248	Red beds	21	456
Red beds	32	280	Sand	5	461
Sand	5	285	Red beds	40	501
Red beds	15	300			

Well D-281

[Owner: City of Kermit. Driller: J. D. Cole]

Caliche	28	28	Red beds and blue shale	5	168
Sand	32	60	Rock, red	8	176
Clay, sandy	70	130	Gravel and red beds	32	208
Red beds	8	138	Rock, red	2	210
Gravel and red beds	16	154	Gravel	10	220
Sandstone, red	9	163	Sandstone, red, broken	80	300

Well D-282

[Owner: City of Kermit. Driller: J. D. Cole]

Surface sand	4	4	Sandstone, red	11	166
Caliche	16	20	Shale, blue	3	169
Sand	43	63	Rock, red	6	175
Sandstone	7	70	Sand and gravel	12	187
Sand	48	118	Rock, red	33	220
Sandstone	14	132	Sandstone	18	238
Clay, pink, sandy	10	142	Rock, red	16	254
Red beds and gravel	13	155	Sandstone	46	300

Well D-296

[Owner: City of Kermit. Driller: Glynn & Wade]

Surface sand	5	5	Sand and gravel; water	20	315
Caliche	10	15	Red beds	15	330
Sand	215	230	Sand; water	5	335
Red beds	65	295			

Well D-298

[Owner: Winkler County. Driller: J. D. Cole]

Surface sand	6	6	Sand and gravel	3	220
Caliche	24	30	Rock, red	7	227
Sand	135	165	Sand and gravel	23	250
Clay, sandy	45	210	Rock, red	2	252
Red beds	7	217			

634592 O-62—10

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well D-302					
[Owner: C. M. Chastain. Driller: Noll Drilling Co.]					
Sand	15	15	Red beds, sand, and gravel	75	255
Caliche	20	35	Sandstone	36	291
Sand	95	130	Sand and gravel; water	4	295
Clay and sand, red	15	145	Clay and shale, red	3	298
Clay, red	15	160	Sand and gravel	16	314
Quicksand	15	175	Sandstone	29	343
Sand and clay, red	5	180	Sand, red	32	375
Well E-1					
[Owner: Gulf Oil Corp. Driller: G. S. Taylor]					
Surface sand	15	15	Sand and gravel	25	100
Gypsum and caliche	15	30	Gravel and red beds	18	118
Gravel and red rock	33	63	Red beds	17	135
Shale, red, sandy	12	75			
Well E-2					
[Owner: Gulf Oil Corp. Driller: G. S. Taylor]					
Surface sand	5	5	Rock, red	40	78
Sand and gypsum	15	20	Gravel and sand	22	100
Shale, sandy, pink	18	38	Rock, red	35	135
Well E-3					
[Owner: Gulf Oil Corp. Driller: J. D. Cole]					
Surface sand	20	20	Gravel and sand	25	100
Shale, red	30	50	Sand, red	20	120
Rock, red	25	75	Rock, red, and lime shells	15	135
Well E-4					
[Owner: Gulf Oil Corp. Driller: J. D. Cole]					
Surface sand	30	30	Red beds and shale	330	595
Shale, sandy	10	40	Sand	25	620
Rock, red	8	48	Rock, red	40	660
Gravel and red rock	17	65	Sand	75	735
Shale, sandy	10	75	Lime, sandy	5	740
Gravel and red rock	40	115	Shale	25	765
Shale, sandy	20	135	Rock, red	85	850
Rock, red, and shells	15	150	Sand	12	862
Shale and red rock	10	160	Rock, sandy	8	870
Red beds and shale	58	218	Sand	10	880
Shale, gray, and shells	47	265	Rock, red	10	890

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well E-6

[Owner: Gulf Oil Corp. Driller: J. D. Cole]

Surface sand	15	15	Rock, red, sandy	20	80
Caliche and sand	10	25	Sand and gravel	20	100
Sand and gravel	20	45	Rock, red, sandy	35	135
Rock, red	15	60			

Well E-7

[Owner: Gulf Oil Corp. Driller: Flack & Felton]

Sand	15	15	Clay	26	76
Sand and gravel	10	25	Rock, sandy, red	9	85
Clay	10	35	Sand and gravel	30	115
Sand	15	50	Rock, red	70	185

Well E-19

[Owner: Waddell Bros. & Co. Driller: —]

Sand	68	68	Sand; water	3	75
Clay, red	4	72			

Well E-30

[Owner: Gulf Oil Corp. Driller: J. D. Cole]

Sand	60	60	Rock, red, and shale, blue	72	260
Sand and shale	30	90	Rock, red	20	280
Shale, sandy	10	100	Shale, blue, sandy	35	315
Sand and gravel	1	101	Sand, brown	35	350
Rock, red; and gravel	16	117	Rock, red, sandy	35	385
Red beds	17	134	Sand, brown	39	424
Shale, red and blue	54	188	Rock, red	2	426

Well F-5

[Owner: L. W. Anderson. Driller: J. O. Jarman]

Surface material	3	3	Sand	136	158
Rock and lime	4	7	Shale, red	6	164
Caliche	12	19	Shale, red, sandy	10	174
Shells and lime	3	22	Sand; water	10	184

Well F-13

[Owner: Humble Oil & Refining Co. Driller: G. P. Mizell]

Sand, brown	5	5	Sand and clay	33	220
Caliche	20	25	Clay, red	20	240
Sand	162	187			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well F-18					
[Owner: Pasotex Pipeline Co. Driller: Layne-Texas Co.]					
Caliche	8	8	Sand; water	15	429
Sand	111	119	Shale, sandy	4	433
Clay, red	16	135	Sand; water	3	436
Sand	3	138	Shale	16	452
Shale, red	137	275	Sand	4	456
Sand	5	280	Shale, red	12	468
Shale	134	414			
Well F-19					
[Owner: Pasotex Pipeline Co. Driller: L. F. Buchanan]					
Surface soil	2	2	Clay, red, dense	352	420
Caliche	12	14	Sand, red	2	422
Sandstone	54	68	Clay, red	16	438
Well F-20					
[Owner: Pasotex Pipeline Co. Driller: L. F. Buchanan]					
Surface soil	2	2	Sand	2	484
Caliche	12	14	Clay, red	12	496
Sandstone	54	68	Gravel	6	502
Clay, red	352	420	Clay, red	14	516
Sand; water	2	422	Gravel	6	522
Clay, red	60	482	Clay, red	20	542
Well F-21					
[Owner: Wink City Airport. Driller: —]					
Surface soil	5	5	Caliche	30	70
Caliche	25	30	Sand	140	210
Sand	10	40			
Well F-27					
[Owner: University of Texas. Driller: L. F. Buchanan]					
Surface sand	4	4	Clay, gray	15	160
Caliche	11	15	Sandstone, brown; water	17	177
Sand, reddish-brown	50	65	Clay, gray	8	185
Sand, gray, fine	40	105	Rock, red sand, and red clay	23	208
Shale, yellow, sandy; water	40	145			
Well F-32					
[Owner: D. P. Anderson. Driller: J. R. Marshall]					
Surface sand	8	8	Quicksand	110	145
Caliche	12	20	Clay, red	8	153
Sand, white	15	35	Sand; water	7	160

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well G-2

[Owner: Sinclair Oil & Gas Co. Driller: J. J. Bush]

Surface sand	3	3	Sand, white	20	140
Gypsum and caliche	12	15	Clay, red	30	170
Sand, white	89	104	Sand, white	15	185
Clay, red	16	120	Clay, red	32	217

Well G-3

[Owner: Skelly Oil Co. Driller: J. D. Cole]

Surface sand	4	4	Rock, red	29	205
Caliche	14	18	Rock, gray, and sand	10	215
Sand	40	58	Red beds	5	220
Clay, red, sandy, and gravel	2	60	Rock, gray, and sand	8	228
Quicksand	22	82	Rock, red	13	241
Red beds	20	102	Sand; water	5	246
Sand and gravel	8	110	Red beds	22	268
Clay and gravel	10	120	Sand	7	275
Rock, red, and gravel	8	128	Sand and red beds	31	306
Sandstone, gray	39	167	Rock, red	16	322
Lime, gray, sandy	4	171	Red beds	22	344
Red beds	5	176	Sand	10	354

Well G-7

[Owner: Humble Oil & Refining Co. Driller: R. E. Griggs]

Surface sand	4	4	Sand	16	152
Caliche	14	18	Clay	9	161
Sand	66	84	Sand	53	214
Gravel	2	86	Clay	5	219
Sand	48	134	Sand	11	230
Gravel	2	136	Clay	20	250

Well G-9

[Owner: Gulf Oil Corp. Driller: —]

Sand and caliche	115	115	Anhydrite and lime	36	2,314
Red beds and shale	706	821	Anhydrite and gypsum	103	2,417
Red beds, anhydrite, and shale	481	1,302	Anhydrite and lime	738	3,155
Anhydrite and salt	976	2,278	Lime	395	3,550

Well G-10

[Owner: Humble Oil & Refining Co. Driller: N. B. Oliver]

Surface sand	6	6	Sand, red	53	91
Gypsum	12	18	Sand and gravel	7	98
Quicksand	20	38	Rock and red sand	12	110

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well G-11					
[Owner: Humble Oil & Refining Co. Driller: —]					
Surface sand	6	6	Sand, red	47	86
Gypsum	15	21	Sand and gravel; water	11	97
Quicksand	18	39	Rock and red sand	8	105
Well G-13					
[Owner: Gulf Oil Corp. Driller: J. R. Marshall]					
Sand	10	10	Rock, red	8	120
Caliche	15	25	Sand; water	4	124
Sand	87	112	Rock, red, sandy	76	200
Well G-28					
[Owner: Humble Oil & Refining Co. Driller: J. J. Harrell]					
Sand	6	6	Sand and gravel	30	100
Caliche	14	20	Shale, red	2	102
Sand and gypsum	25	45	Sand, red	19	121
Sand, red	25	70	Shale, red	4	125
Well G-37					
[Owner: Gulf Oil Corp. Driller: —]					
Caliche	24	24	Anhydrite and salt	1,260	2,131
Red beds	252	276	Anhydrite and lime	463	2,594
Anhydrite and red rock	595	871	Lime	956	3,550
Well G-38					
[Owner: Wink Basin System. Driller: H. E. Turbeville]					
Surface sand	6	6	Sand and shale streaks	144	215
Caliche	6	12	Rock	7	222
Quicksand	57	69	Sand; water	26	248
Rock	2	71			
Well G-40					
[Owner: Gulf Oil Corp. Driller: —]					
Sand and caliche	70	70	Anhydrite and lime	844	2,713
Red beds and anhydrite	750	820	Lime	151	2,864
Anhydrite and gypsum	615	1,435	Anhydrite and lime	206	3,070
Anhydrite and lime	233	1,668	Lime	480	3,550
Salt	201	1,869			
Well G-41					
[Owner: Gulf Oil Corp. Driller: —]					
Sand and red beds	227	227	Anhydrite, lime, and gypsum	810	2,963
Anhydrite, gypsum, and salt	1,787	2,014	Lime and sand	587	3,550
Anhydrite and lime	139	2,153			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well G-42					
[Owner: Gulf Oil Corp. Driller: —]					
Caliche	65	65	Anhydrite and salt	493	2,163
Red beds, sand, and shale	1,073	1,138	Anhydrite and lime	892	3,055
Anhydrite and shale	338	1,476	Lime	496	3,551
Anhydrite and lime	194	1,670			
Well G-49					
[Owner: Humble Oil & Refining Co. Driller: —]					
Rock, white	12	12	Sand, red	57	107
Quicksand	26	38	Sand, white; water	43	150
Sand, white	12	50			
Well G-52					
[Owner: Humble Oil & Refining Co. Driller: —]					
Sand	1	1	Sand	28	140
Gypsum	16	17	Shale, sandy	11	151
Sand	56	73	Gravel and sand	11	162
Shale	19	92	Sand and gravel	11	173
Sand	15	107	Shale	12	185
Sand and gravel; water	5	112			
Well G-69					
[Owner: Sun Oil Co. Driller: Hines]					
Sand	4	4	Sand; water	5	80
Caliche	16	20	Rock and sand	20	100
Sand	35	55	Red beds	10	110
Shale and sand	20	75	Sand	19	129
Well G-75					
[Owner: Humble Oil & Refining Co. Driller: I. O. Fannin]					
Sand and red beds	90	90	Sand; water	34	136
Sand and gravel	12	102	Sand and gravel	6	142
Well G-80					
[Owner: Skelly Oil Co. Driller; J. D. Cole]					
Surface sand	10	10	Sandstone, gravel, and shells	70	130
Caliche	18	28			
Sand	32	60			
Well G-83					
[Owner: Skelly Oil Co. Driller: J. D. Cole]					
Sand	2	2	Rock, red	25	150
Caliche	21	23	Sandstone, brown	22	172
Sand, brown	20	43	Red beds	4	176
Clay, red, sandy	22	65	Sandstone, brown	79	255
Red beds	18	83	Rock, red	10	265
Sand, red	5	88	Sandstone	30	295
Sand and gravel	14	102	Red beds	30	325
Gravel and red rock	23	125			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well G-84					
[Owner: Skelly Oil Co. Driller: J. D. Cole]					
Surface sand	4	4	Sandstone	50	148
Caliche	14	18	Red beds	3	151
Clay, red, sandy	57	75	Sandstone, brown	116	267
Rock, red	7	82	Red beds	38	305
Sandstone	8	90	Red beds and sand	11	316
Rock, red	8	98			
Well G-85					
[Owner: Skelly Oil Co. Driller: J. R. Marshall]					
Sand	3	3	Sand; water	3	81
Caliche	17	20	Clay, red	25	106
Sand, red	35	55	Sand and gravel; water	4	110
Clay, red	15	70	Clay, red	1	111
Sand and clay, red	8	78			
Well G-92					
[Owner: Hudson & Hudson. Driller: Donnell Drilling Co.]					
Sand	55	55	Sand and red shale	80	295
Sand and gravel	50	105	Red beds	30	325
Sand and red shale	25	130	Shale, red	130	455
Sand and gravel	27	157	Shale and sand	5	460
Sand	8	165	Sand, red	42	502
Sand and shale	50	215	Shale, red	8	510
Well G-93					
[Owner: Hudson & Hudson. Driller: Donnell Drilling Co.]					
Sand	3	3	Shale, sandy	45	245
Caliche	4	7	Shale, red	41	286
Sand	70	77	Shale and gravel	19	305
Sand and gravel; water	93	170	Shale, red	5	310
Gravel and red shale	30	200			
Well G-112					
[Owner: Humble Oil & Refining Co. Driller: —]					
Surface sand	1	1	Gravel; water	9	149
Caliche	8	9	Red beds	11	160
Caliche, sandy	33	42	Sand, red	4	164
Shale, red, sandy	60	102	Gravel	18	182
Gravel; water	5	107	Sand, red	30	212
Sand, red	33	140			
Well G-113					
[Owner: Humble Oil & Refining Co. Driller: I. O. Fannin]					
Caliche	10	10	Gravel	93	168
Red beds	65	75	Sand and gravel	20	188

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well G-126					
[Owner: Skelly Oil Co. Driller: Ken Woods Co.]					
Sand and caliche	12	12	Red beds and sand	99	800
Sand and red beds	100	112	Red beds	52	852
Red beds	264	376	Red beds and shale	134	986
Red beds and lime	72	448	Anhydrite	12	998
Red beds and sand	114	562	Red beds	69	1,067
Red beds	108	670	Anhydrite, gypsum, and shale	153	1,220
Red beds, sand, and gypsum	31	701			
Well G-127					
[Owner: Skelly Oil Co. Driller: J. D. Bush]					
Sand	4	4	Shale, red	5	135
Caliche	21	25	Rock, red	45	180
Sand	94	119	Sand, red	10	190
Shale and red rock	3	122	Rock, red	90	280
Sand; water	8	130			
Well G-130					
[Owner: Richardson Oils, Inc. Driller: Bud Tone]					
Caliche	20	20	Sand	5	155
Sand	35	55	Shale, sandy	37	192
Red beds	61	116	Sand	28	220
Shale, red	34	150	Shale, sandy	40	260
Well G-133					
[Owner: Gulf Oil Corp. Driller: White Well Service]					
Surface sand	8	8	Rock, red	11	210
Caliche	12	20	Sand; water	3	213
Sand	65	85	Rock, red	3	216
Sand and clay, red	25	110	Sand; water	4	220
Sand; water	3	113	Sand and clay, red	4	224
Rock, red	83	196	Red beds	16	240
Sand, coarse	3	199			
Well G-134					
[Owner: Skelly Oil Co. Driller: J. J. Bush]					
Sand, red	4	4	Sand, red	73	98
Caliche	2	6	Shale, red	22	120
Sand	2	8	Sand, brown	14	134
Caliche	17	25	No record	141	275
Well G-149					
[Owner: Gulf Oil Corp. Driller: J. R. Marshall]					
Caliche	20	20	Rock, red	20	160
Sand	65	85	Red beds	32	192
Rock, red	23	108	Sand; water	5	197
Red beds	32	140	Rock, red	4	201

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well G-161					
[Owner: John Witt. Driller: Hamblin]					
Caliche	30	30	Gravel, fine, and sand	40	310
Shale, sandy	85	115	Gravel, coarse	90	400
Sand and red clay streaks	155	270			
Well G-168					
[Owner: City of Monahans. Driller: Layne-Texas Co.]					
Surface soil	4	4	Gravel, large, and clay	15	195
Caliche	12	16	Gravel, medium-coarse, sand and red clay	13	208
Caliche, hard, and brown limerock	13	29	Clay, red, soft, and sand streaks	29	237
Sand, brown, hard, and sandy caliche	9	38	Clay, red, hard, and soft brown clay streaks	48	285
Sand, red, red sandrock, and sandy clay	27	65	Sand, brown, broken; red clay and small gravel	25	310
Caliche, hard, and cemented pea gravel	10	75	Sand and red clay layers	31	341
Sand, brown, sandy, yellow clay and gravel	11	86	Clay and sand layers	20	361
Clay, red	9	95	Sand and clay layers	21	382
Caliche, hard, lime and red clay streaks	31	126	Clay, red and brown streaked, and sandy streaks	26	408
Clay, sandy	3	129	Sand	6	414
Sand, coarse, and medium-coarse gravel	21	150	Sand, brown, broken; red clay and hard gravel layers	15	429
Gravel, large, and brown sand	30	180	Sandrock, layers, broken	4	433
Well G-169					
[Owner: City of Monahans. Driller: Layne-Texas Co.]					
Surface sand	2	2	Clay and dirty brown sand	32	209
Caliche	13	15	Sand, brown	20	229
Caliche, sandy, and red sandrock	16	31	Sand, brown, and clay streaks	18	247
Caliche, sandy, and hard sand	5	36	Clay, red, sandy	4	251
Caliche, red, and sandy clay	30	66	Clay and sand streaks	15	266
Sandrock and red sandy clay	11	77	Sand, medium brown	43	309
Clay, brown, soft, sandy, with hard layers	15	92	Sand, brown, coarse, and fine gravel	17	326
Clay, red, hard, tough	46	138	Sand, brown, coarse, fine gravel, and thin hard layers	5	331
Sand, brown, and small gravel	12	150	Sand, coarse, and fine gravel	40	371
Clay, red	2	152	Gravel and hard sand	24	395
Sand, brown, and small gravel	6	158	Lime, soft, gravel-cemented	7	402
Clay, red	19	177			

Table 8.—*Drillers' logs of wells in Winkler County, Tex.*[1]—Continued

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

Well G-170

[Owner: City of Monahans. Driller: Layne-Texas Co.]

Surface sand	1	1	Sand and soft clay; traces of gravel	12	180
Caliche	6	7	Sand and fine gravel	3	183
Sandrock, red, and sandy caliche	19	26	Clay, light-brown, sandy	11	194
Sand, red, hard, and sandy caliche	20	46	Clay, brown, tough	15	209
Clay, red, sandy, and sandrock	23	69	Clay and hard layers	3	212
Sandrock, red, and sandy clay	18	87	Clay, red and brown, sandy clay, and sand streaks	15	227
Clay, red, soft, sandy, with hard streaks	13	100	Lime rock, honeycombed, sand and clay	15	242
Clay, red, hard, tough	29	129	Sand, brown, coarse, broken, fine gravel, and clay	31	273
Clay, red, and soft sandy clay	14	143	Sand, coarse, packed, hard fine gravel	31	304
Clay, red, and fine gravel and sand	10	153	Sand, coarse, packed, fine gravel	43	347
Sand, medium-brown, soft light-brown clay, and some gravel	13	166	Sand, brown, coarse, broken, clay	56	403
Layers, medium, hard	2	168	Sand, broken, and red clay layers	16	419

Well H-30

[Owner: Humble Oil & Refining Co. Driller: G. S. Taylor]

Sand	30	30	Sand, red	5	290
Red beds and sand	10	40	Rock, red	5	295
Sand, red	20	60	Red beds and red rock	100	395
Red beds	15	75	Red beds	10	405
Sand	9	84	Rock, red	40	445
Red beds	6	90	Red beds	85	530
Sand	8	98	Sand; water	20	550
Red beds	187	285	Red beds	60	610

Well H-83

[Owner: Magnolia Petroleum Corp. Driller: —]

Sand	5	5	Sand; water	10	95
Caliche	40	45	Rock, red, sandy	15	110
Sand	20	65	Sand	25	135
Rock, red, sandy	10	75	Rock, red, sandy	20	155
Gravel and red sand	10	85			

Table 9.—*Analyses of water from*

[Water-bearing unit: C, Cenozoic alluvium; Ch, Chinle formation equivalent;

Well	Owner	Depth of well (feet)	Water-bearing unit	Date of collection	(Results in parts Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
A-1	Allen Cowden	87	C	Nov. 1, 1956	57	---	139	46	308	
A-3	B. F. Jenkins	100	C	Jan. 13, 1957	73	---	98	29	98	
B-2	Mary K. E. Bauer.	75	C	Jan. 29, 1957	68	---	100	21	145	
B-4	----do----------	75	C	-----do------	68	---	129	18	105	
B-6	----do----------	88	C	-----do------	38	---	468	47	389	
B-9	Ratcliff & Bedford.	52	T	Feb. 12, 1957	88	---	53	13	41	
*B-10	----do----------	72	T	Apr. 26, 1940	-----	---	112	16	191	
B-10	----do----------	72	T	Feb. 12, 1957	79	---	116	30	139	3.7
B-14	Allen Cowden	83	C	Nov. 1, 1956	54	---	267	115	228	
B-15	B. F. Jenkins	80	C	Jan. 13, 1957	45	---	101	23	77	
B-17	----do----------	115	C	-----do------	79	---	347	74	173	
B-18	John Henry Wallace Estate.	115	C	Feb. 4, 1957	52	---	429	78	198	7.0
B-20	----do----------	1,025	S	Feb. 2, 1957	11	---	21	13	936	
B-21	J. M. Williams, and others.	1,180	S	-----do------	12	---	57	27	1,380	
C-1	J. B. Tubb Estate.	220	S	Sept. 7, 1956	22	---	75	29	147	
C-2	----do----------	140	C	-----do------	44	---	82	41	100	
C-5	W. P. Edwards	260	C	Sept. 8, 1956	12	---	86	50	418	
C-13	W. D. Harrison.	300	C, S	Sept. 10, 1956	13	---	54	27	266	
C-17	Sinclair Oil & Gas Co.	455	S	Oct. 22, 1956	11	---	53	41	291	
*C-18	Tom Lineberry	130	C	Mar. 16, 1940	-----	---	102	50	313	
*C-20	W. L. Beckham	134	C	Apr. 1, 1940	-----	---	52	33	49	
*C-21	J. B. Tubb Estate.	151	C	Mar. 16, 1940	-----	---	-----	-----	-----	-----
*C-22	J. B. Walton	118	C	-----do------	-----	---	-----	-----	-----	-----
C-25	----do----------	165	C	Sept. 10, 1956	44	---	49	26	126	
*C-33	----do----------	95	C	Mar. 21, 1940	-----	---	189	42	233	
C-37	Olsen Oil Co.	250	------	Sept. 12, 1956	56	---	99	21	52	
C-39	Tom Lineberry	-----	------	Sept. 11, 1956	50	---	87	32	452	
C-40	Evelyn Lineberry.	125	C	-----do------	44	---	51	30	319	
C-47	Stanolind Oil & Gas Co.	212	C	Mar. 18, 1957	55	---	52	10	23	
C-50	Jack Lineberry	90	C	Sept. 11, 1956	70	---	646	100	481	
C-53	J. E. Haley	297	C	Sept. 18, 1956	48	---	211	149	1,100	
D-1	Tom Lineberry	-----	S	Jan. 12, 1957	1.5	---	5.6	5.1	208	
D-3	Wood River Oil & Refining Co.	540	S	Apr. 13, 1957	13	---	42	38	317	
D-5	Tom Lineberry	80	C	Oct. 17, 1956	58	---	102	44	234	
D-29	----do----------	100	C	Oct. 10, 1956	64	---	102	39	261	
D-38	Richardson Oils, Inc.	531	C, S	Jan. 8, 1957	54	---	125	48	245	

See footnotes at end of table.

wells in Winkler County, Tex.

R, Rustler formation; S, Santa Rosa sandstone; T, Trinity group]

per million)								Percent sodium	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$				
206	578	302	2.0	2.8	------	1,610	535	56	5.8	2,260	7.6
236	286	55	2.6	1.0	------	759	364	37	2.2	1,060	7.8
220	263	131	2.4	8.1	0.11	847	336	48	3.5	1,280	7.4
188	273	109	1.4	37	.18	833	396	37	2.3	1,200	7.4
137	1,420	370	3.0	107	.78	2,910	1,360	38	4.6	3,660	7.5
214	46	32	2.8	.2	-------	379	186	33	1.3	535	7.7
238	255	200	------	22	-------	913	345	-----	-------	-------	----
241	230	175	3.2	49	-------	972	414	42	3.0	1,420	7.7
212	1,140	175	2.4	28	-------	2,110	1,140	30	2.9	2,650	7.5
234	230	54	2.2	.8	-------	648	346	33	1.8	963	7.7
334	791	308	2.6	9.1	-------	1,950	1,170	24	2.2	2,690	7.4
161	1,460	138	2.8	14	-------	2,460	1,390	24	2.3	2,860	7.3
491	795	640	2.8	1.5	-------	2,660	107	95	39	4,180	8.2
352	1,180	1,230	1.8	.5	-------	4,060	254	92	38	6,310	8.1
180	395	45	------	4.5	-------	816	306	51	3.7	1,200	7.4
246	200	88	4.4	57	-------	749	373	37	2.3	1,140	7.8
253	854	165	------	.0	-------	1,710	420	68	8.9	2,500	7.5
231	440	120	2.8	.0	-------	1,040	246	70	7.4	1,620	7.4
325	465	130	------	.0	-------	1,150	300	68	7.3	1,790	7.9
268	561	230	4.4	------	-------	1,390	460	-----	-------	-------	----
220	120	43	2.9	------	-------	408	265	-----	-------	-------	----
220	220	98	------	------	-------	645	------	-----	-------	-------	----
177	154	76	------	------	-------	482	------	-----	-------	-------	----
242	152	103	------	4.0	-------	630	230	55	3.6	1,010	7.6
177	629	250	------	------	-------	1,430	646	-----	-------	-------	----
176	197	66	.9	1.5	-------	600	334	25	1.2	864	7.4
257	455	450	2.6	7.3	-------	1,660	348	74	11	2,660	7.8
325	435	158	------	3.0	-------	1,200	250	73	8.8	1,840	7.8
147	54	26	1.8	4.5	-------	308	171	23	.8	430	7.7
198	1,270	1,120	------	6.0	-------	3,790	2,020	34	4.6	5,300	7.1
245	2,180	740	3.2	1.5	-------	4,550	5,970	68	14	5,970	7.5
[1]283	129	80	3.4	.0	-------	572	35	93	15	974	9.1
343	507	100	------	1.8	-------	1,190	262	72	8.6	1,800	7.7
286	511	115	2.6	9.3	-------	1,220	435	54	4.9	1,720	7.7
278	383	242	4.0	5.0	-------	1,240	415	58	5.6	1,860	7.6
215	561	195	3.0	.8	-------	1,340	510	51	4.7	1,940	7.7

Table 9.—*Analyses of water from wells*

Well	Owner	Depth of well (feet)	Water-bearing unit	Date of collection	(Results in parts) Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
D-47	El Paso Natural Gas Co. well 1.	166	C	Oct. 17, 1956	44	---	94	19	41	
D-48	well 2.	600	S	Oct. 19, 1956	43	---	74	15	43	
D-85	well 5.	250	C, S	Feb. 14, 1957	34	---	87	9.8	27	
D-89	El Paso Natural Gas Co.	156	C	-----do------	34	---	133	16	44	2.2
D-93	Richardson & Bass.	210	C, S	Apr. 15, 1957	28	---	846	81	3,160	
D-98	Carter Foundation.	200	C, S	Feb. 14, 1957	30	---	21	2.9	9.4	1.5
D-107	Stanolind Oil & Gas Co.	10	C	June 25, 1957	----	---	-----	------	----	-----
D-108	J. B. Walton	11	C	Mar. 28, 1957	10	---	31	9.2	36	
D-117	Humble Oil & Refining Co.	200	C	Apr. 15, 1957	32	---	38	6.7	25	
D-129	Gulf Oil Corp.	250	C	Feb. 14, 1957	36	---	65	8.3	20	
*D-135	J. B. Walton	155	C	Mar. 21, 1940	----	---	28	11	9	
D-136	Cabot Carbon Black Co.	180	C	May 15, 1947	----	---	34	7.1	18	
D-137	----do------	230	C	Feb. 14, 1957	40	---	34	6.7	20	
D-138	----do------	215	C	Oct. 20, 1956	42	---	51	10	24	
D-141	Magnolia Petroleum Co.	225	C, S	Sept. 20, 1956	44	---	200	29	84	
D-144	----do------	250	C, S	Apr. 16, 1957	47	---	112	18	69	
D-154	Sun Oil Co.	143	C	Sept. 10, 1956	52	---	187	31	138	
D-160	Texas Pacific Coal & Oil Co.	1,234	R	Sept. 25, 1956	10	---	1,380	1,400	57,400	
D-163	Sinclair Oil & Gas Co. well 3.	200	C	Oct. 22, 1956	40	---	86	12	41	
*D-185	J. B. Walton	87	C	Mar. 21, 1940	----	---	-----	------	----	-----
*D-186	----do------	87	C	Apr. 21, 1940	----	---	-----	------	----	-----
D-191	Standard Oil Co. of Texas.	195	C	May 14, 1947	----	---	33	4.0	10	
D-193	----do------	1,062	R	Jan. 25, 1957	16	---	627	845	4,810	
D-196	----do------	425	C, S	-----do------	28	---	82	16	46	
D-208	Seth Campbell	175	C	May 14, 1947	----	---	44	5.7	20	
D-209	The Texas Co.	140	C	Oct. 24, 1956	32	---	39	6.1	22	
D-220	Ambassador Oil, Inc.	200	C, S	Oct. 19, 1956	36	---	34	3.4	11	
D-224	Rock Hill Oil Co. well 2.	150	C	-----do------	38	---	31	2.8	12	
D-231	J. B. Walton	200	C	Mar. 18, 1957	41	---	39	4.8	19	
D-244	Harlan Producing Co.	230	C, S	-----do------	39	---	75	7.7	15	2.0
D-245	----do------	148	C	-----do------	34	---	1,320	739	25,100	
D-256	Standard Well Service.	200	C	Oct. 17, 1956	40	---	53	4.9	18	
D-258	Skelly Oil Co.	210	C, S	Oct. 18, 1956	34	---	123	15	28	
D-277	City of Kermit	405	S	Aug. 18, 1957	32	---	34	5.1	12	1.7
D-278	----do------	300	C, S	Jan. 30, 1957	29	0.00	30	5.4	17	2.0

See footnotes at end of table.

in Winkler County, Tex.—Continued

per million)											
Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
192	188	27.	1.8	8.7	------	543	313	22	1.0	755	7.5
166	167	12	2.2	7.0	------	452	247	28	1.2	635	7.6
164	40	98	.6	1.5	------	436	258	18	.7	651	7.3
143	61	227	.8	3.5	------	591	398	19	1.0	1,070	7.4
68	70	6,520	------	-----	------	10,700	2,440	74	28	17,900	7.7
80	7.4	3.2	1.4	6.9	------	128	64	24	.5	175	7.7
86	------	4,080	------	-----	------	------	735	-----	-------	9,260	6.7
75	63	46	.6	.0	------	268	115	40	1.5	422	7.4
134	19	26	2.2	6.0	------	221	123	30	1.0	351	7.7
103	20	89	.8	7.0	------	334	196	18	.6	504	7.5
122	18	9	2.2	-----	------	137	117	-----	-------	-------	----
140	25	7.0	------	4.3	------	225	114	-----	-------	336	----
132	24	7.5	2.6	5.2	------	213	112	27	.8	303	7.8
145	48	29	2.2	5.1	------	290	168	23	.8	434	7.8
219	209	278	1.0	12	------	965	618	23	1.5	1,580	7.4
130	112	195	1.4	3.5	------	622	354	30	1.6	1,050	7.9
183	496	158	1.2	2.0	------	1,200	594	34	2.5	1,640	7.4
57	7,140	89,700	2.3	-----	------	157,000	9,200	93	260	-------	6.5
166	134	54	------	1.2	------	463	264	25	1.1	693	8.0
104	14	13	------	-----	------	125	-----	-----	-------	-------	----
122	16	19	------	-----	------	152	-----	-----	-------	-------	----
117	15	5.0	-----	3.8	------	215	99	-----	-------	250	----
133	4,320	7,720	2.8	-----	------	18,400	5,040	67	29	24,500	7.3
138	69	127	1.8	2.8	0.10	441	270	27	1.2	781	7.7
123	42	20	------	5.1	------	258	133	-----	-------	381	----
146	30	9.5	1.2	3.8	------	209	123	28	.9	369	7.7
102	16	14	------	4.0	------	165	99	20	.5	249	8.1
96	16	12	.4	1.5	------	157	88	23	.6	248	7.9
124	22	18	1.8	3.5	------	210	117	26	.7	305	7.6
94	32	101	.6	2.0	------	320	218	13	.4	554	7.5
221	2,820	41,000	------	-----	------	71,100	6,330	90	137	82,200	6.8
107	21	55	.6	.0	------	266	150	20	.6	390	7.5
84	138	152	.6	.0	------	532	368	14	.6	872	7.6
118	22	7.0	1.2	4.8	.06	178	106	19	.5	259	7.9
120	21	6.0	1.8	2.1	------	173	97	27	-------	263	7.7

Table 9.—*Analyses of water from wells*

Well	Owner	Depth of well (feet)	Water-bearing unit	Date of collection	(Results in parts					
					Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
D-278	City of Kermit	300	C, S	Mar. 18, 1957	30	---	31	5.3	22	
D-279	---do---	700	S	June 3, 1940	29	0.12	34	6.0	14	2.4
D-280	---do---	501	S	May 15, 1947	---	---	37	6.7	47	
*D-285	C. B. Parker	200	C	Apr. 18, 1940	---	---	---	---	---	---
D-291	City of Kermit	559	S	Apr. 27, 1957	28	---	36	6.8	20	
D-292	---do---	545	C, S	Mar. 18, 1957	32	---	85	14	29	
D-294	---do---	471	C, S	May 15, 1947	26	.02	40	7.2	25	4.6
D-298	Winkler County	252	C	Oct. 23, 1956	28	---	40	7.4	29	
D-299	City of Kermit	394	S	July 25, 1957	24	---	42	8.1	23	
D-302	C. M. Chastain.	375	C, S	Mar. 21, 1957	30	---	39	6.0	28	
D-307	Seth Campbell	168	C	Oct. 24, 1956	24	---	40	6.8	35	
E-12	John Henry Wallace Estate.	115	C	Feb. 12, 1957	49	---	161	28	86	5.5
E-15	Texas State Highway Dept.	120	C	Nov. 8, 1956	35	---	127	18	65	
E-19	Waddell Bros. & Co.	75	C	Feb. 7, 1957	34	---	84	21	34	6.5
*E-22	---do---	65	C	Mar. 7, 1940	---	---	---	---	---	---
*E-24	---do---	96	C	Mar. 14, 1940	---	---	581	103	319	
E-24	---do---	96	C	Feb. 7, 1957	28	---	596	110	232	12
E-28	Larry Fernandez.	60	C	Nov. 2, 1956	30	---	44	6.9	89	
E-39	Stanolind Oil & Gas Co.	1,113	S	Jan. 28, 1957	12	---	5.6	3.4	406	
E-42	Waddell Bros. & Co.	75	C	Feb. 7, 1957	37	---	33	7.5	18	
E-51	C. O. Wheeler	140	C	Jan. 28, 1957	34	---	48	12	49	
F-5	L. W. Anderson.	184	C	Apr. 23, 1940	---	---	138	94	1,380	
F-5	---do---	184	C	Sept. 12, 1956	40	---	139	118	1,410	
*F-6	C. E. Wilson	290	C	Apr. 23, 1940	---	---	373	288	2,090	
F-8	Winkler County Country Club.	190	C	Mar. 18, 1957	50	---	97	61	436	
F-9	Jack Lineberry.	130	C	Sept. 12, 1956	34	---	52	18	347	
*F-11	Hulda J. Wilson.	100	C	Apr. 23, 1940	---	---	198	43	257	
F-14	---do---	230	C	Mar. 16, 1957	18	---	52	25	104	6.4
*F-15	---do---	96	C	Apr. 23, 1940	---	---	137	39	69	
F-15	---do---	96	C	Nov. 5, 1956	27	---	610	130	301	
*F-16	Permian Ice Co.	219	C	May 1, 1940	---	---	97	25	114	
F-18	Pasotex Pipeline Co. well 4.	468	C	Sept. 19, 1956	16	---	51	18	94	
F-21	Wink City Airport.	210	C	Sept. 16, 1957	46	---	746	241	454	
F-22	L. W. Anderson.	176	C	Apr. 10, 1940	---	---	163	71	357	
F-25	G. P. Mitchell	300	S	Sept. 13, 1956	16	---	68	37	115	
F-26	D. P. Anderson.	152	---	Aug. 23, 1940	---	---	97	38	43	

See footnotes at end of table.

in Winkler County, Tex.—Continued

per million)								Per-cent sodium	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$				
127	24	7.2	1.8	3.0	------	186	99	32	0.9	273	7.8
96	44	6.0	1.1	3.4	0.2	197	110	21	--------	280	----
136	93	8.0	------	3.0	------	266	120	-----	--------	-------	----
171	45	23	------	------	------	240	------	-----	--------	-------	----
138	29	7.0	1.6	5.0	------	201	119	26	.8	307	7.8
127	94	86	1.2	6.3	------	410	270	19	.8	673	7.5
146	34	19	1.8	3.0	------	232	129	-----	--------	354	7.5
146	40	20	------	5.0	------	241	130	33	1.1	394	7.9
158	38	8.0	1.4	4.5	------	227	138	26	.8	358	8.0
127	42	18	1.8	6.9	------	234	122	34	1.1	367	7.6
150	58	12	------	5.0	------	255	128	37	1.4	413	8.0
181	310	43	2.2	213	------	1,030	516	26	1.6	1,350	7.6
166	292	59	2.0	5.0	------	729	392	26	1.4	1,010	7.9
167	109	26	1.8	104	------	498	296	20	.9	743	7.6
195	276	34	------	------	------	604	------	-----	--------	-------	-----
104	2,070	180	------	96	------	3,400	1,880	-----	--------	-------	-----
99	1,960	146	2.8	210	------	3,590	1,940	21	23	.3,720	7.4
192	64	44	4.4	42	------	418	138	58	3.3	599	7.8
459	342	119	4.4	.0	.79	1,110	28	97	33	1,760	7.2
137	20	7.0	1.6	7.2	------	209	113	26	.7	304	7.7
144	125	19	------	2.5	------	374	170	39	1.6	544	8.1
376	1,980	970	------	1.0	------	4,750	731	-----	--------	6,650	-----
356	2,110	1,000	------	2.5	------	4,990	832	79	21	6,950	7.6
281	3,930	1,650	------	------	------	8,470	2,120	-----	--------	-------	-----
270	810	262	1.8	2.5	------	1,850	493	66	8.5	2,660	7.5
297	543	105	------	1.0	------	1,250	204	79	11	1,860	8.1
159	696	265	------	------	------	1,540	671	-----	--------	-------	-----
231	184	56	3.0	5.0	------	567	232	48	3.0	885	7.6
140	219	220	------	------	------	753	504	-----	--------	-------	-----
115	1,200	970	------	.2	------	3,300	2,060	24	2.9	4,610	8.0
201	139	195	2.3	------	------	675	345	-----	--------	-------	-----
221	161	34	2.2	4.5	------	490	201	50	2.9	773	7.7
142	1,810	1,300	1.6	3.0	------	4,670	2,850	26	3.7	6,150	7.3
171	876	294	------	10	------	1,860	------	-----	--------	2,640	-----
278	276	37	1.2	1.0	------	696	322	44	2.8	1,040	7.4
256	189	53	------	12	------	636	------	-----	--------	951	-----

Table 9.—*Analyses of water from wells*

Well	Owner	Depth of well (feet)	Water-bearing unit	Date of collection	(Results in parts					
					Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
F-27	University of Texas.	208	S	Sept. 20, 1956	16	---	98	40	184	
F-30	---do---	136	C	Apr. 10, 1940	---	---	254	97	900	
F-37	---do---	140	C	Sept. 21, 1956	45	---	390	143	592	
F-41	---do---	128	S	Sept. 19, 1940	---	---	112	40	83	
F-43	---do---	151	S	Sept. 20, 1956	50	---	51	19	21	
F-46	---do---	200	C	Sept. 21, 1956	44	---	50	19	122	
G-3	Skelly Oil Co.	354	S	Oct. 18, 1956	26	---	198	50	144	5.0
G-4	---do---	180	C	May 15, 1947	---	---	608	85	379	
G-10	Humble Oil & Refining Co.	110	C	June 28, 1957	23	---	114	15	44	
G-14	Earl Vest	146	C	June 26, 1957	17	---	48	11	39	
G-16	Seth Campbell	155	C	Oct. 24, 1956	26	---	38	5.9	25	
G-18	---do---	179	C	---do---	33	---	60	6.0	18	
G-24	D. D. Feldman Oil & Gas Co.	310	C, S	Oct. 23, 1956	15	---	50	21	45	
G-33	Earl Vest	120	C	Oct. 24, 1956	31	---	58	9.6	29	
G-38	Wink Basin System.	248	C, S	Nov. 5, 1956	34	---	610	132	563	
G-39	Shell Pipeline Co.	200	C	Oct. 24, 1956	30	---	605	145	209	
G-47	Gulf Oil Corp.	273	C	Nov. 6, 1956	32	---	127	42	65	
G-58	Rycade Oil Corp.	110	C	Oct. 24, 1956	22	---	363	67	138	
G-59	---do---	110	C	---do---	26	---	374	70	194	
G-60	---do---	200	C	---do---	27	---	377	68	196	
G-61	Earl Vest	100	C	---do---	60	---	149	30	84	
G-66	Bert Fields Oil Co.	200	C, S	Oct. 23, 1956	35	---	75	12	32	
G-70	Barron Kidd	120	C, S	Oct. 20, 1956	38	---	665	92	280	
G-74	---do---	251	C, S	---do---	34	---	66	8.8	28	
*G-78	G. P. Mitchell	85	C	Apr. 9, 1940	---	---	33	12	42	
G-86	Earl Vest	110	C	Oct. 9, 1956	30	---	44	8.2	29	
G-87	---do---	110	C	---do---	42	---	203	42	156	
G-92	Hudson & Hudson.	510	C, S	Oct. 22, 1956	22	---	42	11	42	
G-108	City of Wink	165	C	June 3, 1940	35	0.10	43	13	30	3.3
G-109	City of Wink well 3	250	C	Sept. 23, 1956	40	---	230	63	161	
G-111	well 6	240	C	---do---	25	---	40	14	50	
G-115	A. C. Morton and others.	90	C	Oct. 11, 1956	48	---	78	19	67	
G-117	Humble Pipeline Co.	182	C	Oct. 8, 1956	32	---	36	9.4	33	
*G-122	Sinclair Oil Co.	151	C	Apr. 9, 1940	---	---	84	19	47	
*G-129	G. P. Mitchell	101	C	---do---	---	---	80	13	72	
G-129	---do---	101	C	Oct. 5, 1956	34	---	63	9.0	89	
*G-136	Sun Oil Co.	205	C	Apr. 9, 1940	---	---	46	10	39	
G-138	Earl Vest	82	C	Oct. 4, 1956	46	---	82	14	39	
*G-139	Texas & New Mexico RR.	30	C	Apr. 9, 1940	---	---	58	13	37	
*G-140	Tobe Morton	110	C	---do---	---	---	---	---	---	
*G-141	---do---	89	C	---do---	---	---	90	20	22	

See footnotes at end of table.

in Winkler County, Tex.—Continued

per million)											
Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
284	411	102	1.6	0.0	------	1,020	409	49	3.9	1,500	7.2
203	1,040	1,240	------	4.0	------	3,640	------	-----	-------	5,570	----
85	876	1,320	1.6	2.0	------	3,410	1,560	45	6.5	5,180	7.4
227	228	112	------	54	------	741	------	-----	-------	1,230	----
243	25	10	1.6	10	------	309	205	18	.6	464	7.4
227	157	75	2.2	7.7	------	596	203	57	3.7	916	7.7
115	451	330	.8	2.0	0.77	1,260	700	31	2.4	1,930	7.7
112	1,100	1,030	------	2.0	------	3,260	1,870	-----	-------	4,610	----
228	41	150	------	------	------	499	346	22	1.0	899	7.3
186	75	9.8	1.4	2.0	------	298	165	34	1.3	483	7.5
125	44	15	------	5.0	------	220	119	31	1.0	350	8.1
148	59	20	------	4.0	------	273	174	19	.6	421	8.0
214	99	21	------	2.0	------	358	212	32	1.4	593	7.8
180	54	29	.8	.2	------	301	184	25	.9	531	7.5
168	1,320	1,260	------	------	------	4,000	2,060	37	5.4	5,670	7.4
163	1,220	820	------	.2	------	3,110	2,110	18	2.0	4,290	7.4
146	130	265	------	3.2	------	834	490	22	1.3	1,290	7.6
73	332	760	.8	.5	------	1,720	1,180	20	1.7	2,920	7.5
113	621	640	.4	.2	------	1,980	1,220	26	2.4	3,010	7.5
114	623	640	.8	.5	------	1,990	1,220	26	2.4	3,020	7.7
173	144	268	1.6	3.8	------	825	495	27	1.6	1,530	7.9
149	58	84	1.0	2.8	------	388	236	23	.9	695	7.6
167	1,600	560	------	67	------	3,380	2,040	23	2.7	4,150	7.6
149	66	48	.4	2.8	------	330	201	23	.9	580	7.7
103	71	47	------	------	------	256	133	-----	-------	-------	----
147	42	27	1.4	.2	------	254	144	30	1.0	404	7.5
297	432	215	1.0	24	------	1,260	679	33	2.6	1,810	7.1
175	65	21	------	1.0	------	290	150	38	1.5	472	8.1
153	57	24	2.0	3.8	0.6	293	161	-----	------	446	----
154	412	438	1.4	7.2	------	1,430	833	30	2.4	2,270	7.4
191	68	22	2.6	2.0	------	318	158	41	1.7	513	7.5
240	121	62	2.2	2.0	------	518	272	35	1.8	778	8.2
148	46	19	1.4	.0	------	250	128	36	1.3	381	7.9
207	157	38	------	------	------	450	287	-----	------	-------	----
226	133	60	------	------	------	469	253	-----	------	-------	----
174	150	62	.8	.0	------	494	194	50	2.8	750	7.5
189	53	20	1.2	------	------	262	156	-----	------	-------	----
168	102	60	1.8	17	------	462	262	24	1.0	678	7.8
183	47	55	------	------	------	301	198	-----	------	-------	----
207	77	51	------	------	------	359	------	-----	------	-------	----
183	134	32	------	24	------	412	307	-----	------	-------	----

Table 9.—*Analyses of water from wells*

Well	Owner	Depth of well (feet)	Water-bearing unit	Date of collection	(Results in parts) Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
G-146	University of Texas.	130	C	Aug. 23, 1940	-----	---	82	47	183	
G-146	-----do-----	130	C	Oct. 8, 1956	47	---	55	30	177	
G-157	Fay H. Hogg---	180	C	Oct. 18, 1956	45	---	50	15	40	
G-162	John Witt -----	223	C	Jan. 25, 1957	42	---	211	93	331	14
G-163	-----do-----	400	C	Mar. 14, 1957	35	---	75	40	367	10
G-166	J. D. Cole -----	300	C	Oct. 21, 1956	48	---	211	102	400	
H-7	W. D. Amburgey.	100	C	Jan. 28, 1957	24	---	578	75	311	
H-21	Fay H. Hogg---	105	C	Feb. 8, 1957	33	---	47	12	61	
*H-25	G. P. Mitchell _	250	C, S	Apr. 9, 1940	-----	---	77	14	64	
H-25	-----do-----	250	C, S	Oct. 4, 1956	34	---	78	12	58	
H-28	W. D. Amburgey.	100	C	Oct. 8, 1956	44	---	128	13	100	
H-35	Sealy & Smith Foundation.	120	C	Oct. 4, 1956	52	---	207	28	175	
H-44	Stanolind Oil & Gas Co. well 3.	95	C	Oct. 3, 1956	44	---	89	10	56	
H-64	Sealy & Smith Foundation.	60	C	Feb. 12, 1957	73	---	153	33	95	5.3
H-68	-----do-----	-----	C	Apr. 26, 1957	4.2	---	53	7.5	11	
H-69	-----do-----	-----	C	Oct. 9, 1956	19	---	38	8.9	39	
H-78	-----do-----	60	C	Oct. 8, 1956	38	---	31	3.3	11	
H-81	-----do-----	300	C, S	-----do-----	40	---	198	24	137	

[1]Includes equivalent of 31 ppm carbonate (CO_3).

*Analyzed by Works Progress Administration.

in Winkler County, Tex.—Continued

per million)											
Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
308	367	110.	-----	6.8	------	948	398	50	-------	1,520	----
278	289	71	3.6	9.3	------	819	260	60	4.8	1,190	7.9
182	75	28	1.8	2.0	------	355	186	32	1.3	520	7.7
153	474	740	1.8	4.5	0.31	1,990	910	44	4.8	3,290	7.8
220	258	492	2.6	3.0	.37	1,390	352	69	8.5	2,310	7.6
186	531	780	2.6	3.2	------	2,170	945	48	5.7	3,470	7.5
123	1,810	290	2.2	32	------	3,180	1,750	28	3.2	3,670	7.4
203	82	27	2.6	1.5	------	370	166	44	2.0	583	7.7
195	165	40	-----	------	------	456	249	-----	-------	-------	----
186	136	49	1.4	2.8	------	462	244	34	1.6	692	7.7
168	314	77	1.2	18	------	789	373	37	2.2	1,080	7.8
171	546	199	1.2	25	------	1,320	632	38	3.0	1,810	7.8
204	135	49	1.0	6.2	------	490	263	32	1.5	720	7.7
165	288	180	.7	56	------	997	516	28	1.8	1,430	7.8
96	77	18	-----	1.2	------	237	162	12	.4	373	7.0
20	87	64	.4	.8	------	259	132	34	1.2	429	6.7
121	7.6	4.5	.4	.5	------	156	90	22	.5	210	7.9
210	390	220	.8	1.2	------	1,110	592	34	2.5	1,640	7.7

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