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GROUND WATER IN THE VICINITY OF BRYAN AND COLLEGE STATION, TEXAS

By

Samuel F. Turner

PREPARED IN COOPERATION WITH THE UNITED STATES
DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY

JANUARY 1938

REPRINTED JULY 1951

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Report prepared in cooperation by the
Geological Survey, United States Department of the Interior
and the
State Board of Water Engineers

Purpose and scope of the investigation

The City of Bryan and the Texas Agricultural and Mechanical College obtain their water supplies from deep wells. The supplies, altough adequate in quantity, are of poor quality. In response to a request from Mr. R. G. Williams, City Manager at Bryan, the writer was assigned to conduct a brief investigation of the ground-water conditions in this area in order to determine the possibility of obtaining water of better quality than that in use at present. Information on the wells at Bryan and College Station, in the area northwest and north of Bryan, and in the Brazos River Valley, was collected by the writer November 11 to 14 and November 30 to December 2, 1937. On December 6 a pumping test was conducted on the deep well at Bryan by the writer, with the assistance of W. O. George, geologist with the Texas Board of Water Engineers, and E. W. Lohr, a chemist of the Geological Survey. The work was done by the Geological Survey in cooperation with the Texas State Board of Water Engineers, under the general supervision of W. N. White, of the Geological Survey, who is in charge of the ground-water work in Texas. Mr. Lohr made several analyses of well waters and assisted in interpretation of the chemical data.

Acknowledgments

Mr. R. G. Williams, City Manager, and Mr. C. M. Ramsey, of the Bryan City Water Department, furnished copies of records and logs of the water wells owned by the City of Bryan and copies of chemical analyses of water from the city wells. Mr. W. N. Howell contributed information about his own wells and made valuable suggestions as to the conduct of the investigation. Dr. C. L. Baker, of the Department of Geology at the Agricultural and Mechanical College, and Dr. H. B. Stenzel of the Bureau of Economic Geology of The University of Texas, made valuable suggestions and furnished information on the geology and well logs from their files.

Existing water supplies

Both Bryan and College Station appear to have sufficient water for their present needs, but the water is of poor quality. The city of Bryan obtains its water supplies from nine wells ranging in depth from 303 to 2,053 feet. The analyses of water from the various wells are given in the table of analyses on pages 36 to 41. A composite analysis of water from the City of Bryan supply shows an average mineral content of about 1,400 parts per million. The water is of the sodium bicarbonate type, with a chloride content of about 400 parts per million and a fluoride content of 2.3 parts per million. Most large city supplies contain less than 250 parts per million of dissolved mineral matter.

In standards for drinking water for use on trains and other common

carriers the United States Public Health service[1] has adopted limits of 1,000 parts per million of total dissolved solids and 250 parts per million of chloride as the maximum quantities ordinarily allowable in acceptable supplies. It is noted, however, that failure to conform to these requirements need not be considered ground for rejection of a supply unless there is available a better supply of equal safety with respect to bacterial contamination. In many places the drinking water in general use contains more than 1,000 parts per million of dissolved mineral matter and in some areas the residents have accustomed themselves to water containing as much as 2,500 parts.

Dean,[2] in an exhaustive study of the effects of fluoride in drinking water consumed by growing children has concluded

> "From the continuous use of water containing about 1 part per million (of fluoride) it is probable that the very mildest forms of mottled enamel may develop in about ten percent of the group. In water containing 1.7 or 1.8 parts per million the incidence may be expected to rise to forty or fifty percent, altough the percentage distribution of severity would be largely of the 'very mild' and 'mild' types. At 2.5 parts per million an incidence of about 75 to 80 percent might be expected, with possibly 20 to 25 percent of all cases falling into the 'moderate' or a severer type.,.....
> "At 4 parts per million the incidence is in general in the neighborhood of 90 percent and as a rule 35 percent or more of the children are generally classified as 'moderate' or worse."

1/ Drinking water standards -- standards adopted by the Treasury Department June 20, 1925, for drinking and culinary water supplied by common carriers in interstate commerce; Pub. Health Reports, reprint 1029, April 10, 1925.

2/ Dean, H. T., Chronic endemic dental fluorosis: Amer. Medical Assn. Journal, vol. 107, pp. 1269 to 1272, Oct. 17, 1936.

It is evident, therefore, that from the standpoint of fluoride content the present water supply of the City of Bryan is unsatisfactory. At the present time Well 89, the water from which contains 1.1 parts of fluoride, 502 parts of chloride and 1,649 parts total dissolved solids, furnishes a large part of the city supply and Well 85, which contains only 344 parts per million of total dissolved solids and 0.3 parts per million of fluoride but which has a smaller yield than Well 89, is pumped almost continuously. In periods when these two wells can supply the demand, the fluoride content of the mixed water probably does not exceed 1 part per million and the water is acceptable from the standpoint of fluoride content. However, when water from the other wells is added to that from Wells 85 and 89, the fluoride content is increased.

The Agricultural and Mechanical College, $2\frac{1}{2}$ miles south of Bryan, draws its water supply from eight wells ranging in depth from 352 to 1,400 feet. The records of these wells are included in the well tables at the back of this report. A composite sample of water from the Agricultural and Mechanical College supply is reported to have a mineral content of 1,640 parts per million. The water is of the sodium bicarbonate type. It is understood that this water must be used cautiously in watering shrubs and ornamental plants.

From the above discussion it is evident that altough the water supplies at Bryan and the Agricultural and Mechanical College ar usable, a supply that is less highly mineralized would be desirable.

Geology and the occurrence of ground water

No attempt was made to study the geology of the area in the field. The following statements on the geology and the water-bearing properties of the geologic formations are taken largely from the following reports:

(1) Renick, B. C., and Stenzel, H. B.: Lower Claiborne on the Brazos River, Texas: University of Texas Bull. 3101, Contributions to geology, pp. 73-108, 1931.

(2) Sellards, E. H., Adkins, W. S., and Plummer, F. B.: The geology of Texas: University of Texas Bull. 3232, vol. 1, 1932.

(3) Deussen, Alexander: Geology and underground water of the southeastern part of the Texas Coastal Plain: Geol. Survey Water-Supply Paper 335, 1914.

(4) Geologic map of Texas 1:500000: Geol. Survey, 1937.

(5) Records of wells, drillers' logs, and water analyses and map showing location of wells, Burleson County, Texas: mimeographed report published by the Works Progress Administration in cooperation with the Texas State Board of Water Engineers and the Geological Survey, Aug. 25, 1937.

The areas of outcrop of the geologic formations are shown on the geologic map and section accompanying this report. (See pl. 1.) The formations are of Tertiary age. They strike northeast-southwest and except where notable folds and faults occur dip toward the southeast at a rate of eighty to ninety feet per mile. The land surface slopes, also toward the southeast, at a lower rate. Thus, the beveled edges of successively younger formations are crossed in traveling from the northwest to the southeast and the Carrizo sand which crops out at the surface three miles northwest of Hearne occurs 1,720 feet below the surface at Bryan, 23 miles southeast of the outcrop (See fig. 2). The formations are discussed in the following pages in the order in which they would be encountered by a well drilled at Bryan.

Eocene series
Claiborne group,
Yegua formation.

The Yegua formation crops out in a northeast-southwest trending belt about 15 miles wide. Bryan is about in the middle of this belt. (See map, pl. 1.) At Bryan the base of the formation lies about 500 feet beneath the land surface and at College Station it lies about 750 feet beneath the surface. The basal part of the Yegua consists largely of marine clays. The upper part of the formation consists largely of deltaic deposits which are, in the main, fine-grained cross-bedded sands interbedded with clays. The formation is described in the Geology of Texas, as follows:[3/]

> ". . . In general the formation is a hetergeneous comples of layers of sand, clay, lignite, sandy clay, and carbonaceous clay lentils. None of the layers can be traced far or correlated from one core test to another, unless the tests are very close together."

The sands of the Yegua formation yield water to a large number of wells on the outcrop. Among the wells that derive their principal supplies from the sands of the Yegua formation are the following: 60-66, 80-83, 85, 88, 121-125, 132, 134, 136, and 137. The sands are, however, fine-grained and yield only small quantities of water. For example, well 80 yields 100 gallons a minute but the drawdown is about 90 feet. Thus the yield per foot of drawdown is only 1.1 gallons. In the vicinity of Tabot, eight miles north of Bryan, there are several wells in the Yegua that yield small flows of water.

3/ Sellards, E. H., Adkins, W. S., and Plummer, F. B., The Geology of Texas: University of Texas Bull. 3232, vol. 1, p. 669, 1932.

The sands of the Yegua furnish the best water obtained at either Bryan or College Station. Analyses of the water from wells 80, 81, 85, and 88 at Bryan and wells 121-125 and 132 at College Station are given on pages 36 to 37. These analyses show that in general the water from the shallower beds is of better quality than that from the deeper beds. Thus sands that yield water of good quality at Bryan yield rather highly mineralized water at College Station, but a shallower stratum, which probably crops out at the surface near Bryan, yields the best water obtainable at College Station.

It is believed that the shallow sands of the Yegua are likely to yield water of good quality in most places. Unfortunately, they are very fine-grained and probably will not furnish sufficient water for the city supply or the supply at College Station. Gravel-wall well construction which in many areas has considerably increased the yield of wells has not materially increased the yield from well 88, which was gravel walled, at Bryan.

Cook Mountain formation.

The Cook Mountain formation has been called the Crockett formation by Sellards.[4/] The name Cook Mountain is retained on the Geologic map of Texas, published by the Geological Survey in 1937, and this usage is followed in the present report. The Cook Mountain formation is primarily marine in character. Sellards states that it consists of 90 percent fine sediments: clay, shale, and sandy shale; 9 percent medium-grained sand and glauconite; and 1% rock limestone, and iron concretions. The thickness of the Cook Mountain

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4/ Sellards, Adkins, and Plummer, The Geology of Texas: University of Texas Bull. 3232, vol. 1, p. 655, 1932.

in this area varies from 110 to 125 feet. As far as is known, it does not contain any important water-bearing sands.

Sparta sand.

Sellards states that the sediments of the Sparta sand are thought to be mostly continental in origin. They consist of about 70% sand, 20% sandy shale or clay, 3% glauconitic sand, 1% limonite, and 1% lignite. The thickness varies from 325 to 375 feet.

The Sparta sand crops out in a belt three to four miles wide extending from about one mile northwest of Benchley, eight miles northwest of Bryan to about five miles northwest of Benchley. (See map, pl. 1.) The following wells derive their supply from the Sparta sand: 10, 11, 67, and 89. The chemical analyses of water from wells 10 and 11 show that the water from the Sparta sand near the outcrop area is of fair quality, altough somewhat hard. Tests for fluoride were not made. The analysis of the water from Well 89, 875 feet deep, in Bryan, shows that the water from the Sparta at Bryan is rather highly mineralized, and contains an objectionalbe amount of hydrogen sulphide gas so that this water has to be aerated and treated. It is probable that the water in the Sparta sands from four to six miles northwest of Bryan would be of fair quality and probably would not contain much hydrogen sulphide gas. This sand has been known to produce large quantities of water, especially in gravel-walled wells.

Mount Selman formation.

Weches Greensand member.

The Weches greensand consists of marine sediments, predominatly glau-

conite and glauconitic clay. It is 50 to 70 feet thick and does not contain important water-bearing sands.

Queen City sand member.

The Queen City sand is largely a continental fluviatile deposit laid down by meandering rivers on a flat plain. It consists of about 70% sand; 22% sandy, silty clay; and small amounts of lignite, bentonite, and glauconite. It crops our in a strip five to eight miles wide just south of Hearne. At Bryan, the top of this sand is about 1,250 feet below the surface. It is about 225 feet thick.

None of the wells at Bryan or College Station draw water exclusively from the Queen City sand. A part of the water in Well 84 at Bryan may come from the Queen City sand, but the principal supply of this well comes from the deeper Carrizo sand. The analysis of the water from Well 84 indicates that the water from the Queen City sand near Bryan is probably heavily mineralized.

Wells from 400-700 feet deep finished in the Queen City sand in the Brazos River bottoms yield rather large flows of good water. Examples of such wells are wells 22, 24-26, and 29. The flows from these wells indicate that the Queen City sand would furnish large quantities of water. Additional data on the flowing wells in the Queen City sand in Burleson County to the west indicate that the water is of good quality down to about 1,000 feet below the surface.

Thus the Burleson County data and the information obtained on the wells near Steele's Store and Stone City in the Brazos River bottoms indicate that good water in rather large quantities can probably be obtained from the Queen

City sand four to eight miles northwest of Bryan.

Reklaw member:

The Reklaw member consists of shallow water sediments containing 90% glauconitic clay, 8% glauconitic sand, and 2% impure lignite. This member is from 60-100 feet thick in this area. It does not contain any important water-bearing sands.

Carrizo sand

The Carrizo sand crops out in a belt about three miles wide, about two to three miles northwest of Hearne. It is a continental deposit laid down by streams and wind and consists of about 90% meduim-grained sand and 10% sandy clay. It is 100-130 feet thick. Wells 23 and 84 derive their principal supply from the Carrizo sand.

The Carrizo sand in Well 84, in the City of Bryan, was found at 1,722-1,800 feet. The principal supply of this well is derived from this sand. However, perforated casing was also set against a sand at 1,563 to 1,573 feet and against two sands in the Wilcox group below the Carrizo at 1,880 to 1,900 and at 1,930 to 1,950 feet. According to an analysis by the Allied Chemical Company of a sample collected October 13, 1924, the water then contained 1,777 parts per million of total dissolved solids. A recent analysis by the Geological Survey shows 2,481 parts per million of total dissolved solids. This would indicate that highly mineralized water is entering the well through an opening in the casing. On December 6, 1937, a 24-hour pumping test was made on the well.

The air lift pump that is used for pumping the well for city supply was used to pump the water during the test. From the time the pump was started samples of the water were collected at five to ten second intervals for several minutes, then the time interval between samples was increased to about ten minutes for about one hour. After the first hour the time interval was increased, first to about 30 minutes and then to about one hour. The temperature of the water discharged was taken at intervals varying from two or three minutes at the start of the test to 30 minutes at the end. At several times during the test the discharge of the well was measured.

The results of the test are shown graphically in Figure 1. The chloride content of the water was nearly constant from the time the pumping was started until about 19 minutes after pumping began. The chloride content then increased rapidly from about 560 to 620 parts per million during the next five minutes, then slowly for the next 55 minutes, and very slowly for the next 40 minutes. It remained constant at 645 parts per million for the succeeding 110 minutes and then very slowly declined at about 635 parts during the remainder of the test. The temperature of the water pumped rose from 82½ to 100 degrees Fahrenheit during the first 40 minutes and continued to rise slowly to 102½ degrees at the end of the test.

Since the well had not been pumped since the summer of 1937, it is believed that the water in the upper part of the well represents water of the chloride content of the water that was pumped last. Water that is more highly mineralized which enters the well tends to sink to the bottom. When pumping is started the water that is pumped comes from successively lower sections of the well and if the pumping rate and the diameter of the well are known the depth from which any sample comes up to the time all of the water is pumped from the well may be calculated. From the results of

the test it is evident that highly mineralized water is entering the well at about 1,400 feet beneath the surface presumably from the section in which the casing is reduced from eight inches to six inches in diameter. The chloride content of the water increased rapidly from 1,400 feet to the bottom of the well. The water from the bottom of the well reached the surface after about 25 minutes. It is evident that the chloride content from the four sands below 1,400 feet varies and that one or more sands yield water of better quality than the others, but that either the quality is only slightly better or that the quantity is so small in comparison with that from the other sands that it has only a small affect on the composition of the water from the well.

Well 23, halfway between Steele's Store and Stone City in the Brazos River bottoms, ten miles west of Bryan, penetrates the top of the Carrizo at 1,020 feet. It is reported to have 40 feet of pressure and a flow of 100 gallons a minute through a $2\frac{1}{2}$-inch casing. The water contains only 496 parts per millios of total solids. It is a sodium bicarbonate water with only 0.3 part per million fluoride. Well 345 in Burleson County, an oil test, two miles west of Snook and 14 miles south-southwest of Bryan was shot opposite what is probably the Carrizo sand at 1,550 feet. This well produced an estimated flow of 40 gallons a minute at about ten feet above ground. This water had a temperature of 102° F. Its mineral content was 1.102 parts per million with 1.0 part per million of fluoride.

An oil test (Well 50) drilled on the Casimo Conitella property, $3\frac{1}{2}$ miles northwest of Bryan, reached the top of the Carrizo at about 1,460 feet. The character of the water from this well is not known. One thousand, three hundred and twenty feet of 6-5/8-inch casing were set in the hole and none of it removed when the well was abandoned and covered at the top with a concrete slab.

It is probable that the mineralization of the water in the Carrizo sand increases with increasing distance from the outcrop and with increasing depth of the formation. The water at Bryan is probably too highly mineralized for municipal use. Likewise the water from Well 345 in Burleson County is too highly mineralized for municipal use. Well 23, however yields water of satisfactory quality and Well 50 may yield water of reasonably good quality and it is believed that tests should be made to determine the quality of the water from this sand in Well 50.

Wilcox group.

The Wilcox group underneath the Carrizo sand contains several water-bearing sands. These sands furnish water for the following wells: 1-3, and 21. The analyses of water samples from these wells indicate that some sands of the Wilcox group carry water of acceptable quality to a depth of 1,200-1,500 feet below the surface.

The top of the Wilcox group was encountered at 1,800 feet in Well 84 at Bryan and screens were set against two of the Wilxoc sands below this depth. It seems probable that the high mineralization of the water in this well is partly due to mineralized water from these two Wilcox sands. Data on flowing wells in Burleson County given in Clark's report substantiate this statement.

It is probable that a well to the Wilcox sands near Benchley or even two or three miles southeast of Benchley toward Bryan would find large quantities of water in the upper sands in the Wilcox that would barely exceed the accepted requirements of the U. S. Public Health Service; but since the Carrizo sand in the same localities would probably produce a much better

quality of water in sufficient quantities, development in the sands of the Wilcox group is not thought to be necessary.

Summary.

The best water thus far obtained at Bryan or College Station is from the sands of the Yegua formation. The permeability of the sands is low and it is believed that supplies obtained from them would not be sufficient for the needs of Bryan or College Station. Therefore, further development of the Yegua is not recommended.

The Sparta sand would probably furnish sufficient quantities of water at either Bryan or College Station for municipal supplies, but the water is of poor quality. However, water of satisfactory quality would probably be encountered by wells in the formation four to six miles northwest of Bryan and the quantity of water in that locality should be the same as that in these two cities.

The water in the Queen City sand member of the Mount Selman is probably heavily mineralized at both Bryan and College Station, but flowing wells in these sands in the Brazos River bottoms produce fairly large quantities of water of good quality. The same quality and quantity of water could probably be obtained from wells four to eight miles northwest of Bryan, along the strike of the formation from the wells in the Brazos Rivr bottoms.

The Carrizo sand would yield sufficient water for municipal use at either Bryan or College Station. The pumping test on Well 84 at Bryan indicates that large quantities of water could be obtained from the Carrizo sand, but that the water is probably of poor quality. Analysis of water

from Well 23 indicates that about six miles up the dip from Bryan the water from the Carrizo is probably of acceptable quality.

The sands of the Wilcox group have not been tested at either Bryan or College Station, but the water is probably too heavily mineralized for city use.

It is recommended that Well 50, the oil test on the Casimo Conitella property, 3½ miles northwest of Bryan, one-fourth miles southwest of the H. & T.C. Ry., on the Moses Bain survey, be opened and cased to the Carrizo sand. This casing should be cemented before the well penetrates the Carrizo sand; then screen or perforated pipe should be set in the Carrizo sand and the well pumped at least one week. During the pumping test, several water samples should be taken. The analyses of water samples taken during this test should give a fair indication of the quality of the water from the Carrizo sand at this location.

If this test shows that the water from the Carrizo sand is of good quality, containing only about 500 parts per million of total dissolved solids, and that the fluoride content does not exceed safe limits, a well to the Carrizo sand in this vicinity might be advisable. If, however, the pumping test on the Conitella oil test well indicates that the water is too highly mineralized, a test well should then be put down to the Carrizo sand about halfway between this property and Benchley. As this test well is put down, a thorough investigation should be made of the quantity and quality of water available in the Sparta sand and in the Queen City sand member of the Mount Selman, as well as that in the Carrizo sand; for it is believed that in this locality, an acceptable quantity and quality of water can probably be obtained from all three of these sands.

Records of wells near Bryan, Texas
(Unless otherwise noted all wells are drilled wells.)

No.	Distance from Bryan	Survey	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)
			Robertson County.				
1	19 miles northwest	Francisco Ruiz and G. A. Dixon	I. & G.N. R.R.	—	—	1,174	8
2	20 miles northwest	Francisco Ruiz	City of Hearne	—	1936	1,275	10
3	do.	do.	do.	—	—	748	8
10	8 miles northwest	—	J. G. Lightsey	J. E. Cook	1937	231	4
11	do.	—	R. H. Seale	T. J. McCallum	1911	300±	4
			Brazos County.				
21	10½ miles west	F. Ruiz	J. S. Mooring	Warren Oil Co.	—	4,135	12½
22	do.	do.	do.	—	Old	400±	2
23	11 miles west	do.	M. W. Sims	J. E. Cook	1936	1,050	5
24	do.	do.	do.	Charlie Morka	1933	650	2
25	do.	do.	do.	do.	1933	650	2

a/ T, turbine; A, air; C, cylinder; E, electric; D, diesel; W, windmill; number indicates horsepower.

Records obtained by Samuel F. Turner

No.	Principal water-bearing beds: Depth to top of bed	Thickness	Probable geologic horizon	Pump and power a/	Use of water b/	Remarks
Robertson County.						
1	740	30	Wilcox	Flows	RR.	At Valley Junction. Set 8-inch casing at 932 feet with 6-inch casing to bottom. Screens at 744 to 765, 897 to 909, and 1,092 to 1,174 feet. See log.
	896	14	do.			
	1,087	87	do.			
2	1,129	146	do.	Flows	P	At Hearne. Casing record: 10-inch to 640 feet, 8-inch to 1,110, 7-inch to 1,129, and 7-inch screen to bottom. See log.
3	670	78	do.	--	P	At Hearne. Casing record: 688 feet of 8-inch, with 6-inch screen from 688 to 748. See log.
10	200	31+	Sparta	C,W	D,S	Shallow water reported at 20 to 40 feet below surface.
11	--	--	do.	C,W	D,S	
Brazos County.						
21	1,383	77	Wilcox	Flows	S	At Steele's Store. Set 12½-inch casing at 1,002 feet, 10-inch at 1,515 feet, and 6¼ inch at 2,375 feet. Reworked in 1929 by Layne-Texas Co., and screen set opposite sands at 1,383 to 1,460 feet and well plugged below 1,500 feet. See log. Flow estimated at 200 gallons a minute, Nov. 13, 1937.
22	--	--	Queen City	Flows	P,D,S	At Steele's Store. Water from this well is bottled and sold in Bryan. Flow estimated at 5 gallons a minute, Nov. 13, 1937.
23	1,020	30+	Carrizo	Flows	D,S	Set 5-inch casing at 60 feet and 2½-inch to bottom. Open end of casing at bottom, no screen. Reported flow of 100 gallons a minute with 40 feet of pressure.
24	--	--	Queen City	Flows	D,S	Set 2-inch casing at 60 feet and 1¼-inch to bottom. Flow of this well combined with that of Well 25 estimated at 50 gallons a minute, Nov. 13, 1937.
25	--	--	do.	Flows	D,S	Set 2-inch casing at 60 feet and 1¼-inch to bottom.

b/ P, public; RR, railroad; Ind, industrial; I, irrigation; D, domestic; S, stock; N, not used.

Records of wells near Bryan, Texas--Continued

No.	Distance from Bryan	Survey	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)
Brazos County--Continued.							
26	11 miles west	F. Ruiz	M. W. Sims	--	1920	450	2
27	do.	A. De La Garza	A. J. Wallin	Stone City Oil Co.	1933	1,910	10
28	do.	W. Mathi	Addie Moseley	Dickerson & Wicklyne	--	1,284	--
29	10 miles west	do.	Peter Scarpinato	Charlie Morka	1928	504	2
50	3½ miles northwest	Moses Bain	Casimo Conitella	Bryan Brazos Oil Co.	1924	2,702	10
60	6 miles north	G. H. Coleman	J. H. Wilcox	J. H. Wilcox	1934	50	1¼
61	do.	G. W. Singleton	Frank Morrow	Parson Eaves	1860	60	8
62	7 miles north	do.	O. L. Wilcox	-- Tarver	1908	208	3
63	7½ miles north	do.	J. H. Wilcox	do.	1910	360	5
64	do.	Francis Quota	do.	J. H. Wilcox	1937	44	1¼
65	9 miles north	do.	J. S. Smith	Charlie Morka	1926	360	4
66	do.	do.	W. H. Benbow	--	--	100	8
67	12 miles north	W. C. Sparks	W. A. McKinney	McCashan & Fountain	1927	250	10

Records obtained by Samuel F. Turner

No.	Principal water-bearing beds: Depth to top of bed	Principal water-bearing beds: Thickness	Principal water-bearing beds: Probable geologic horizon	Pump and power a/	Use of water b/	Remarks
Brazos County--Continued.						
26	--	--	Queen City	Flows	D,S	Set 2-inch casing at 60 feet and 1¼-inch to bottom. Estimated flow, 2 gallons a minute, Nov. 13, 1937.
27	--	--	--	--	N	Set 10-inch casing at 80 feet. See log.
28	--	--	--	--	N	See log.
29	--	--	Queen City	Flows	D,S	At Bryan Junction. 2-inch casing with bottom joint perforated with ¼-inch holes. Estimated flow, 10 gallons a minute, Dec. 2, 1937.
50	--	--	--	--	N	Set 61 feet of 10-inch and 1,320 feet of 6-5/8-inch casing. See log. Drilled 1,400 feet deep, 100 feet south of this well. Stopped on rock and removed two joints of casing. Concrete slab over 1,400 feet well. Railroad ties and earth over deeper well.
60	--	--	Yegua	Flows	S	Set 25 feet of 1¼-inch casing, open hole to bottom. Estimated flow, 2 gallons a minute, Nov. 13, 1937. Reported original head, 16 feet above ground.
61	--	--	do.	Flows	S	Original wood casing still in well. Estimated flow, 1 gallon a minute, Nov. 13, 1937.
62	86	71	do.	C,W	D,S	Set 3-inch casing at 120 feet; drilled 1½-inch open hole to 208 feet. Partial log: sand, 86 to 157; rock and clay to 208 feet.
63	45	73	do.	C,W	D,S	Set 5-inch casing at 70 feet, open hole to bottom. Partial log: water sand, 45 to 118; shale to 360 feet.
64	35	9+	do.	Flows	S	Measured flow, 1½ gallons a minute, Nov. 13, 1937. This well weakened flow of 52-foot well, 200 feet northeast.
65	--	--	do.	C,W	D,S	Well sealed at top but appears to have very small flow.
66	--	--	do.	--	D,S	Reported weak supply of very hard water.
67	--	--	Sparta	Flows	S	Set 20 feet of 10-inch and 35 feet of 6-5/8-inch casing. Started as oil test but caving sand caused abandonment.

Records of wells near Bryan, Texas--Continued

No.	Distance from Bryan	Survey	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)
Brazos County--Continued.							
80	In Bryan	John Austin	W. S. Howell	J. E. Cook	1937	346	6
80A	do.	do.	do.	--	--	100	--
80B	do.	do.	do.	--	--	240	--
81	do.	In northwest corner city power house	City of Bryan	Layne-Bowler Co.	1911	503	--
82	do.	50 feet north of Well 81	do.	do.	1911	503	--
83	do.	100 feet north of Well 81	do.	do.	1911	346	--
84	do.	150 feet north of power house	do.	F. N. Allison	1915	2,053	8
85	do.	150 feet northeast of power house	do.	Rider and Allen	1925	303	--
86	do.	150 feet southeast of power house	do.	Pomeroy & McMasters	1930	750	--
87	do.	250 feet north of power house	do.	do.	1931	750	--
88	do.	125 feet north of power house	do.	Layne-Texas Co.	1933	300	8
89	do.	300 feet southeast of power house	do.	do.	1933	875	12
101	2½ miles southwest	Y. L. Jaques	Bankers Mortgage	Rio Bravo Oil Co.	1927	451	--
102	2 miles southwest	Zeno Phillips	C. C. Vick	J. A. Germany	1927	2,731	10
103	3 miles southwest	T. J. Wooten	Mary Lanza	Rio Bravo Oil Co.	1927	648	8
104	do.	do.	do.	do.	1927	2,635	3¼

Records obtained by Samuel F. Turner

No.	Principal water-bearing beds			Pump and power a/	Use of water b/	Remarks
	Depth to top of bed	Thickness	Probable geologic horizon			
Brazos County--Continued						
80	218	30	Yegua	T,E,-	D,I	Reported production, 100 gallons a minute with 90 feet drawdown. See log.
	258	23	do.			
	319	27	do.			
80A	--	--	do.	None	N	Old well; now unused. See partial chemical analysis.
80B	--	--	do.	None	N	do.
81	--	--	do.	None	N	Screens set at 205 to 217 and 366 to 335 feet. Drilled at 503 feet but filled back to 300 feet after each cleanout. Would produce 84 gallons a minute. Now plugged.
82	--	--	do.	None	N	Screens set at 183 to 204 and 244 to 235 feet. See log. Now plugged.
83	--	--	do.	None	N	Screens set at 168 to 191 and 251 to 271 feet. See log. Now plugged.
84	1,563	10	Queen City	A,E,-	N	Set 8-inch casing at 1,512 feet with 6-inch to bottom, perforated against sands indicated. See log and pumping test.
	1,722	78	Carrizo			
	1,880	20	Wilcox			
	1,930	20	do.			
85	--	--	Yegua	A,E,-	P	Reported maximum production, 100 gallons a minute. See log.
86	--	--	--	A,E,-	N	Set screens against all sands. Standby supply.
87	--	--	--	A,E,-	N	do.
88	--	--	Yegua	None	N	Gravel-walled from 200 feet to bottom. Mineralized water from Well 84 has ruined this well.
89	238	27	do.	T,E, 40	P	Set 875 feet of 12-inch casing with screens set at 232 to 254, 684 to 727, 772 to 793, and 811 to 870 feet. Well cemented at 200 feet with gravel wall to bottom. Reported water level, 262 feet below surface pumping 830 gallons a minute. See log.
	688	40	Sparta			
	768	112	do.			
101	--	--	--	None	N	Core test. See log.
102	--	--	--	None	N	Set 290 feet of 10-inch casing. See log.
103	--	--	--	None	N	Set 21 feet of 8-inch casing. See log.
104	--	--	--	None	N	Set 22 feet of 8¼-inch casing. See log.

Records of wells near Bryan, Texas--Continued

No.	Distance from Bryan	Survey	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)
Brazos County--Continued.							
121	2½ miles south	J. E. Scott	Texas Agricultural Experiment Sta.	J. E. Cook	1937	771	8
122	do.	do.	do.	--	--	495	--
123	3 miles south	do.	H.& T.C. R.R.	--	--	1,005	--
124	do.	do.	do.	--	--	756	8
125	do.	do.	do.	--	1926	773	8
131	do.	do.	A. & M. College	--	1892 (?)	1,400+	--
132	do.	do.	do.	--	1914 (?)	352	--
133	do.	do.	do.	--	1914 (?)	960	--
134	do.	do.	do.	Layne & Bowler	1917	639	12¼
136	do.	do.	do.	do.	1920	674	12
137	do.	do.	do.	Southern Well Drilling Co.	1922	451	--
138	do.	do.	do.	Layne-Texas Co.	1923	1,261	--

Records obtained by Samuel F. Turner

No.	Principal water-bearing beds			Pump and power a/	Use of water b/	Remarks
	Depth to top of bed	Thickness	Probable geologic horizon			
Brazos County--Continued						
121	--	--	Yegua	T,E, 15	P,S	Reported 90 feet drawdown pumping 100 gallons a minute. Temperature 84°F. Static water level reported as 152 feet.
122	--	--	do.	A,D, 15	P,S	Reported pumping 26 gallons a minute. Also 4-inch well, 400 feet deep, now unused.
123	--	--	--	A,D, 60	RR.	Well 1. See log.
124	319	35	Yegua	A,D, 60	RR.	Well 2. 400 feet north of Well 1. Screens set against sands at 319 and 674 feet. See log.
	674	84	do.			
125	686	83	do.	A,D, 60	RR.	Well 3. ¼ mile north of Well 1. Screen set against sand at 686 to 769 feet. See log.
131	--	--	--	--	--	Well 1. Main water sand at 700 feet. Water stood 100 feet below surface.
132	--	--	Yegua	--	--	Well 2. South of Well 1 and east of Mechanical Engineering Laboratory. See log.
133	--	--	--	--	--	Well 3. 60 feet west of Well 1.
134	147	18	Yegua	--	--	Well 4. Well made by reaming out test hole that went to 1,028 feet. Set 638 feet of 12¼-inch casing with screens at 119 to 157, 207 to 249, 323 to 365, 474 to 495, 509 to 518, 539 to 560, and 600 to 633 feet. See log.
	253	50	do.			
	367	40	do.			
	501	22	do.			
	519	10	do.			
	550	5	do.			
	565	15	do.			
136	115	14	do.	--	--	Well 6. On northwest line of campus. Set 12-inch casing to 250 feet and 8-inch to bottom. Screens set at 117 to 136, 194 to 213, 350 to 335, 413 to 473, 542 to 569, and 637 to 674 feet. Static level, 135 feet and production, 156 gallons a minute when completed. See log.
	200	6	do.			
	317	60	do.			
	404	27	do.			
	439	23	do.			
	535	5	do.			
	546	6	do.			
	556	5	do.			
	652	21	do.			
137	--	--	do.	--	--	See log.
138	--	--	--	--	--	do.

Records of wells near Bryan, Texas--Continued

No.	Distance from Bryan	Survey	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)
Burleson County. c/							
345	14½ miles southwest	Jas. Hollingsworth	W. H. Giesenschlag	Oliphant Caldwell Oil Co.	1926	3,616	8

a/ T, turbine; A, air; C, cylinder; E, electric; D, diesel; W, windmill; number indicates horsepower.

Records obtained by Samuel F. Turner

No.	Principal water-bearing beds			Pump and power a/	Use of water b/	Remarks
	Depth to top of bed	Thickness	Probable geologic horizon			
Burleson County c/						
345	1,451	129	Carrizo	Flows	D,S	Shot at 1,550 feet by J. E. Cook in 1937. Flowing 40 gallons a minute, 10 feet above ground, Dec. 2, 1937. Temperature, 102°F. See log.

b/ P, public; RR, railroad; Ind, industrial; I, irrigation; D, domestic; S, stock; N, not used.

c/ Records of other wells in Burleson County are contained in mimeographed report entitled "Records of wells, drillers' logs and water analyses, and map showing location of wells, Burleson County, Texas," released by Texas State Board of Water Engineers, Aug. 25, 1937.

Table of drillers' logs, Robertson County, Texas

	Thickness (feet)	Depth (feet)
Well 2		
Flowing well at Hearne, Texas.		
Surface soil	2	2
Yellow clay	14	16
Coarse sand	12	28
Hard shale	62	90
Sandy shale	25	115
Rock	1	116
Sandy shale	15	131
Sand	10	141
Shale	44	185
Sand	51	236
Sandy shale	53	289
Sand	22	311
Shale	57	368
Rock	1	369
Sand	20	389
Shale	48	437
Lignite	11	448
Sand	45	493
Shale	21	514
Well 2 continued		
Rock	2	516
Sand	35	551
Sandy shale	97	648
Rock	1	649
Hard shale	7	656
Rock	3	659
Shale and boulders	11	670
Sand	92	762
Sandy shale	57	819
Rock	3	822
Sand	62	884
Shale and lignite	53	937
Hard shale	113	1050
Sandy shale	18	1068
Sand	23	1091
Lignite	21	1112
Fine-grained sand	17	1129
Coarse-grained sand	146	1275
TOTAL DEPTH		1275

Table of drillers' logs, Brazos County, Texas

	Thickness (feet)	Depth (feet)
Well 21		
Warren Oil Company, F. Ruiz survey, J. S. Mooring farm, 2 leagues, 300 ft. E of R.R., 1-¾ miles west property line of Mooring lease.		
Sandy loam	15	15
Quicksand	40	55
Logs	3	58
Gravel	24	82
Black slate	42	124
Sand	6	130
Black slate	10	140
Water sand	35	225
Black slate	20	245
Sand	45	293
Black slate	42	335
White slate	15	350
Sand	12	362
White slate	18	380
Sand	20	400
Red rock	3	403
Sand	37	440
Black slate	40	480
Sand	38	518
Black slate	22	540
Sand showing oil	15	555
Black slate	34	589
Lime	1	590
Water sand	15	705
Slate	40	745
Water sand	5	750
Slate	35	785
Water sand, artesian	75	860
Slate	55	915
Sand	107	1022
Slate green	14	1036
Sand green, water	44	1080
Brown sand	12	1092
Lime	4	1096
Slate	71	1167
Lime	3	1170
Coal	2	1172
Slate brown	13	1185
Sand, no water	10	1195
Slate	23	1218
Water sand	18	1236
Black lime, hard	4	1240
Well 21 continued		
Brown slate and mud	57	1297
Lime	2	1299
Brown mud	81	1380
Lime	3	1383
Slate	67	1450
Mixed sand and shale	10	1460
Gray sand	50	1510
Brown slate	5	1515
Lime	1	1516
Brown slate	14	1530
Lime shell	2	1532
Sand	113	1645
Slate	35	1680
Water sand	85	1765
Hard shell	6	1771
Sand	29	1800
Brown slate	35	1835
Coal	3	1838
Brown slate	7	1845
Sand	52	1897
Slate	4	1901
Lime	19	1920
Slate	5	1925
Soft lime	8	1933
Slate	2	1935
Sand	20	1955
Slate	15	1970
Sand	13	1983
Slate	14	1997
Water sand, warm water	11	2008
Slate	204	2212
TOTAL DEPTH		4135
Well 28		
Dickerson & Wicklyne, operators; W. Mathis survey, Addie Moseley Well 1.		
Gumbo	255	255
Brown shale sticky with some clay	40	295
Brown shale	68	363
Gray sandy shale	5	368
Showing of oil and gas	6	374
Brown sandy shale	7	381
White sand with artesian water	67	447
Black shale and sand	8	455

(Continued on next page)

Table of drillers' logs, Brazos County—Continued

	Thickness (feet)	Depth (feet)
Well 28—Continued		
Gray sticky shale	45	500
Gray sand with artesian water	50	550
Black shale	5	555
Brown sandy shale	45	600
Gumbo	10	610
Gray sand with artesian water	56	666
Broken sand and shale	5	671
Brown sticky shale	149	820
Hard shale	60	880
Sand rock	5	885
Shale	4	889
Hard rock	5	894
Shale	3	897
Sand rock	3	900
Soft shale (1st fossils)	3	903
Hard rock	5	908
Green sand, dry	2	910
Soft shale and boulders	5	915
Brown shale, sticky	85	1000
Soft shale	30	1030
Broken sand and shale	60	1090
Hard brown shale	25	1115
Sand and lignite with fossils	40	1155
Black shale	5	1160
Brown shale	36	1196
Gumbo	34	1230
Broken sand and shale	47	1277
Hard rock	7	1284
Well 50		
Bryan Brazos Oil Company, Moses Bain survey, 600 ft. NL, 600 ft. WL, 113A tract Conitella farm.		
Surface	5	5
Red clay	7	12
Yellow clay	8	20
Sand clay	10	30
Water sand	4	34
Yellow clay sand	23	57
Light gumbo	4	61
Clay, calcareous concretions	29	90
Blue clay, light shale	15	105
Water sand	3	108
Blue clay, light shale	52	160
Well 50—Continued		
Shale	10	170
Shale, light gumbo	80	250
Shale	42	292
Gumbo	13	305
Lignite	2	307
Gumbo	43	350
Slate and shale	50	400
Shale	40	440
Sand and shale	40	480
Rock and sandstone	3	483
Packed sand	17	500
Shale	20	520
Shale gummy clay	40	560
Shale, packed sand	25	585
Sticky shale, clay	25	610
Gumbo	5	615
Packed sand, lignite, pyrites of iron	3	618
Gumbo	42	660
Shale, lime	63	723
Lime shell and sand	11	734
Rock	4	738
Gumbo	10	748
Sandy clay, beds of lignite	51	799
Shell, clay	19	818
Lime rock	3	821
Rock, gumbo, boulders	20	841
Sand, lime and shell	2	843
Gumbo	17	860
Shale, sandstone	40	900
Gumbo, boulders	10	910
Sandy shale	70	980
Gumbo	35	1015
Broken lime andshell	35	1050
Gumbo	15	1065
Lime rock	1	1066
Gumbo	26	1092
Shale	36	1128
Broken lime and shell	13	1141
Small gas and oil showing	33	1174
Gumbo	11	1185
Shale	25	1210
Blue sandy shale	20	1230
Packed sand	16	1246
Water sand dry	19	1265

(Continued on next page)

Table of Drillers' logs, Brazos County--Continued

	Thickness (feet)	Depth (feet)
Well 50--Continued		
Shale	15	1280
Shell, clay	30	1310
Sandy shale	30	1340
Shell, clay	20	1360
Blue shale	31	1391
Gumbo	9	1400
Sandy shale	40	1440
Gummy shale	15	1455
Sand	5	1460
Gas sand	23	1483
Blue shale	6	1489
Sand rock	11	1500
Sand gas showing	3	1503
Took core	3	1506
Sand rock	34	1540
Gumbo	40	1580
Sandy shale	22	1602
Gas, sand, shale	14	1616
Blue shale gas rock	2	1618
Sand rock	9	1627
Gas sand	9	1636
Gumbo	16	1652
Shale	14	1666
Gumbo, boulders	3	1669
Gumbo	18	1687
Gummy shale	11	1698
TOTAL DEPTH		2702

Well 84

City of Bryan Well 4, at Bryan.

Soil	5	5
Clay	5	10
Sand and clay	8	18
Water sand	4	22
Red clay	4	26
Yellow clay	54	80
Light shale	85	165
Red rock	3	168
Shale and sand	72	240
Gumbo	30	270
Shale	210	480
Rock	4	484
Shale	116	600
Gumbo	30	630
Sand	15	645
Shale	135	780
Sand	20	800
Shale	200	1000

	Thickness (feet)	Depth (feet)
Well 84--Continued		
Rock	20	1020
Shale	160	1180
Sand	35	1215
Shale	95	1310
Rock	2	1312
Shale	48	1360
Gumbo	25	1385
Shale	98	1483
Shells and lignite	8	1491
Shale	24	1515
Gumbo	13	1528
Sand and shale	12	1540
Rock	2	1542
Shale	18	1560
Rock	3	1563
Sand	10	1573
Rock	2	1575
Shale	55	1630
Rock	4	1634
Shale	26	1660
Rock	3	1663
Shale	59	1722
Sand	78	1800
Shale	80	1880
Sand	20	1900
Shale	30	1930
Sand	20	1950
Shale	68	2018
Gumbo	35	2053

Well 89

Drilled by Layne-Texas Company Well 2, City of Bryan, at Bryan.

Sandy soil	2	2
Clay	5	7
Sandy clay	12	19
Clay	32	51
Shale and sand	117	168
Brown clay and coal	34	202
Rock	1	203
Gumbo	14	217
Rock	1	218
Shale and boulders	20	238
Sandy shale	27	265
Shale	12	277
Sandy shale	15	292
Shale	19	311

(Continued on next page)

Table of drillers' logs, Brazos County--Continued

	Thickness (feet)	Depth (feet)
Well 89--Continued		
Hard sticky shale	12	323
Gumbo	15	338
Rock	1	339
Gumbo	16	355
Shale	19	374
Sand	15	389
Shale	22	411
Sand shale	18	429
Shale	5	434
Sticky shale	102	536
Soft shale and boulders	30	566
Shale and boulders	44	610
Shale	78	688
Sand	40	728
Shale	30	758
Sand	112	870
Sandy shale	3	873
Well 102		
J. A. Germany, Zeno Phillips survey, 150 feet SE line, 1,200 feet SW line, 150 acres. C. C. Vick farm.		
Yellow surface clay	17	17
Red sticky sand	7	24
Fine gray sand	157	181
Rock	1	182
Soft gray sand	19	201
Packed sand	32	233
Sticky sand	8	241
Shale	17	258
Rock	1	259
Sticky shale	7	266
Gumbo	11	277
Sticky shale	4	281
Sand	32	313
Rock	1	314
Soft shale, some gas, took core	4	318
Rock	1	319
Shale with streaks of sand	8	327
Broken shale with lignite	26	353
Soft shale	54	407
Rock	1	408
Sticky sandy shale	9	417
Gumbo	22	439
Streaks of sand	1	440
Tough gumbo	9	449
Shale	13	462
Streaks of shell	1	463
Sticky shale	6	469
Sandy shale	20	489
Shale and shell	10	499
Soft shale	10	509
Shale	58	567
Sandy shale	14	581
Thin streaks of shell	2	583
Sandy shale	47	630
Sandy shale and shell	5	635
Gumbo	7	642
Gumbo and boulders	8	650
Lime rock	1	651
Shale and boulders	19	670
Shale with streaks of shell	4	674
Sticky shale	28	702
Gumbo	21	723
Sandy shale	6	729
Gumbo	16	745
Packed sand, cored	3	748
Shale	19	767
Shale and shell	34	801
Gumbo and boulders	11	812
Shale and shell	138	950
Shale and pyrites	10	960
Gumbo	15	975
Shale	10	985
Gumbo	20	1005
Shale	55	1060
Tough gumbo	15	1075
Lime and gummyshell	14	1089
Lime and gummy shell, core	7	1096
Gumbo	21	1117
Shale	10	1127
Shale and shell	17	1144
Shale and boulders	10	1154
Hard shale	5	1159
Hard shale and shell	20	1179
Rock	3	1182
Lime and shell	10	1192
Rock	1	1193

(Continued on next page)

Table of drillers' logs, Brazos County--Continued

	Thickness (feet)	Depth (feet)
Well 102--Continued		
Hard shale	21	1214
Gumbo	18	1232
Rock	2	1234
Hard shale and shell	22	1256
Hard rock	1	1257
Shale	7	1264
Sandy shale	15	1279
Sand blue	14	1293
Water sand blackishcore		1293
Sand	99	1392
Sand and shell	20	1412
Rock	1	1413
Sand	10	1423
Hard shale and boulders	17	1440
Hard sandy shale	41	1481
Sand rock	12	1493
Broken shale, core	6	1499
Hard shale	15	1514
Gumbo	16	1530
Gumbo and boulders	13	1543
Toudh gumbo	22	1565
Shale streaked with sandy lime	35	1600
Lime rock	1	1601
Sandy lime	13	1614
Sand and hard shale	7	1621
Core showed trace of oil on chloroform text, hard shale and boulders	16	1637
Rock	1	1638
Hard shale	10	1648
Tough gumbo	25	1673
Gypsum	4	1677
Hard lime rock	1	1678
Gumbo and lime rock	26	1704
Gumbo	11	1715
Hard shale	17	1732
Rock	1	1733
Hard shale	10	1743
Gumbo	10	1753
Shale	27	1780
Gumbo and rock	18	1798
Brown rock with quartz	3	1801
Hard shale and streaks of rock	17	1818
Gumbo	19	1837
Rock	2	1839
Hard shale	20	1859
Hard shale and rock	12	1871
Well 102--Continued		
Fine sand	7	1878
Core brown and yellow sand with streaks of shale showed someoil on chloroform test.		
Sand and sandrock	5	1883
Hard shale and rock	6	1889
Sand	12	1901
Core coarse sand, clean sand	16	1917
Shale	12	1929
Hard shale and rock	12	1941
Green sand showing of gas	48	1989
TOTAL DEPTH		2731
Well 104		
Rio Bravo Oil Company, T. J. Wooten survey, 325 feet south line, 500 feet east line. Mary Lanza farm.		
Clay and gravel	25	25
Clay and sand	9	34
Sand	7	41
Sand and shale	9	50
Sand	9	59
Lignite and shale	9	68
Sand and shale	34	102
Sand	18	120
Sand and lignite	9	129
Sand	27	156
Sand and lignite	6	162
Sand, shaleand lignite	9	171
Sand and shale	45	216
Sand, shale and lignite	9	225
Sand and shale	135	360
Sand, shaleand lignite	2	362
Sand, shale	103	465
Sand, shaleand shell	9	474
Sand, shale	9	483
Sand, shaleand shell	36	519
Sand, shellandboulders	8	527
Sand and shale	33	560
Sand, shaleandboulders	9	569
Sand and shale	63	632
Sand, shaleandshell	18	650
Sand and shale	25	675
Sand, shaleandsticky shell	59	734

(Continued on next page)

Table of drillers' logs, Brazos County--Continued

	Thickness (feet)	Depth (feet)
Well 104--Continued		
Sand, shale and shell	12	746
Shale	10	756
Sand, shale and shell	10	766
Sand and shale	55	821
Sand	32	853
Sand and shale	58	911
Sand	41	952
Shale	8	960
Sand and shale	160	1120
Sand	57	1177
Sandy shale	32	1209
Sandy shale and boulders	10	1219
Sandy shale	10	1229
Sand	99	1328
Shale	3	1331
Sand and shale	45	1376
Sand	31	1407
Shale	70	1477
Sandy shale	106	1583
Sticky shale	10	1583
Sandy shale	67	1660
Hard sand	10	1670
Sand and shale	80	1750
Sticky shale	11	1761
Sand and shale	31	1792
Hard sand	1	1793
Hard shale and sand	11	1804
Sand	9	1813
Hard sand and shale	11	1824
Sand	5	1829
Sand and shale	118	1947
Sand, shale and boulders	51	1998
Sand and shale	195	2193
Hard shale and lime rock	25	2218
Sand and shale	63	2281
Sticky shale	2	2283
Shale	17	2300
Sand and shale	273	2573
Sticky shale	44	2617
Sandy shale	4	2621
Lime rock	5	2626
Sand	9	2635
TOTAL DEPTH		2635

Well 132

S. E. Andrews, College well 2, east of The Mechanical Engineering Laboratory

	Thickness (feet)	Depth (feet)
Well 132--Continued		
south of the well (No. 1) in the brick tower.		
Yellow-brown clay shale	55	55
Hard gumbo or blue clay	20	75
Hard blue clay shale	50	125
Strata of hard limestone (?) and hard clay	11	136
Hard blue clay, shale	16	152
Hard clay, shale	7	159
Hard limestone (?)	6	165
Hard clay, shale	13	178
Hard limestone	30	208
Soft rock	5	213
Hard rock	5	218
Soft rock	5	223
Hard rock	16	239
Hard blue clay	15	254
Hard blue shale	43	297
Rock	4	301
Hard clay, shale	11	312
Hard rock	3	315
Hard blue clay, shale	7	322
Hard rock	9	331
Clay and sand	21	352
The rock reported on this well is chiefly sandstone.		

Well 138

Layne-Texas Company, College well 8, north of the campus.

Soil and clay	58	58
Shale	5	63
Rock	1	64
Shale	133	197
Muddy sand	39	236
Shale	111	347
Sand and shale	68	415
Shale and gumbo	89	504
Rock	3	507
Muddy sand	68	575
Rock	3	578
Shale and sand	19	597
Sand	19	616
Rock	5	621
Hard sand	63	684
Gumbo and boulders	70	754

(Continued on next page)

Table of drillers' logs, Brazos County--Continued

	Thickness (feet)	Depth (feet)
Well 138--Continued		
Sand	29	783
Gumbo and boulders	200	983
Sandy shale	32	1015
Gumbo and boulders	29	1044
Sand	27	1071
Gumbo	41	1102
Well 138--Continued		
Rock	3	1105
Gumbo	10	1115
Sand	15	1130
Gumbo	21	1151
Sand	8	1257
Gumbo	4	1261

Table of drillers' logs, Burleson County, Texas

	Thickness (feet)	Depth (feet)
Well 345		
Oliphant Caldwell Oil Company, Jas. Hollingsworth survey, blk. 1, sec. 1, 550 yds. from east line, 400 yds. from south line. Well 1, Giesenschlag Estate.		
Clay	30	30
Shale	220	250
Gumbo	10	260
Shale	140	400
Water sand	90	490
Gumbo	15	505
Shale	95	600
Gumbo	25	625
Shale	55	680
Hard sand	5	685
Shale	15	700
Gumbo and boulders	30	730
Shale	50	780
Gumbo	20	800
Shale	80	880
Gumbo	20	900
Shale	100	1000
Water sand	30	1030
Shale	35	1065
Water sand	105	1170
Shale	48	1218
Gumbo	10	1228
Water sand	11	1239
Shale	21	1260
Water sand	90	1350
Shale	10	1360
Rock	3	1363
Shale	7	1370
Rock	3	1373
Gumbo	20	1393
Shale	32	1425
Hard sand	6	1431
Shale	14	1445
Gumbo	6	1451
Water sand	49	1500
Gumbo	5	1505
Shale	15	1520
Water sand	20	1540
Gumbo	6	1546
Water sand	34	1580
Shale	10	1590
Rock	5	1595
TOTAL DEPTH		3616

Analyses of water from wells in the vicinity of Bryan and College Station, Tex.

a/ Well number	1	2	3	10	11
Date	Sept.24, 1933	Dec. 31, 1935	June 30, 1931	Nov. 30, 1937	Nov. 30, 1937
Depth (feet)	1,174	1,275	748	231	300
Silica (SiO_2)	--	--	--	--	--
Iron (Fe)	--	--	--	--	--
Calcium (Ca)	0.8	2.7	6	48	68
Magnesium (Mg)	2.9	.6	3.5	13	20
Sodium and Potassium (Na+K)	129	246	172	69	89
Bicarbonate (HCO_3)	254	575	410	122	122
Sulphate (SO_4)	--	5	32	133	224
Chloride (Cl)	30	49	22	60	80
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	--	--	--	d/	d/
Total dissolved solids	333	612	464	383	541
Total hardness as $CaCO_3$	14	8	29	173	252
e/ Analyst	R.R.	A. & M.	R.R.	W.P.A.	W.P.A.

a/ Numbers correspond to well numbers in table of well records.
b/ Magnesium less than 5 parts per million.
c/ Fluoride determined by E. W. Lohr.
d/ Nitrate less than 20 parts per million.
e/ Analysts: R. R., Railroad laboratory.
A. & M., chemical laboratory at A. & M. Experiment Station.
W.P.A., chemists employed on W.P.A. Project, supervised by Dr. E. P. Shoch of Bureau of Industrial Chemistry.
H. Lab., Houston Laboratories, Houston, Texas.

Analytical results in parts per million

a/ Well number	21	21	22	23	24	25	26
Date	Nov. 13, 1937	Aug. --, 1925	Nov. 13, 1937	Nov. 13, 1937	Nov. 13, 1937	Nov. 13, 1937	Nov. 13, 1937
Depth (ft.)	1,600	1,700-2,700	400	1,050	650	650	450
SiO_2	--	29	--	--	--	--	--
Fe	--	trace	--	--	--	--	--
Ca	4	3.5	8	14	10	12	14
Mg	b/	trace	b/	b/	b/	b/	b/
Na+K	459	541	130	186	199	191	119
HCO_3	1,129	1,035	311	384	403	390	232
SO_4	11	6.2	25	73	73	73	73
Cl	50	250	14	34	36	35	19
F	c/2.2	--	c/ .4	c/ .3	c/ .3	c/ .3	c/ .4
NO_3	d/	--	d/	d/	d/	d/	d/
Tot. dissolved solids	1,079	1,375	330	496	516	503	339
Total hardness as $CaCO_3$	10	8.8	20	35	25	30	35
e/ Analyst	W.P.A.	H.Lab.	W.P.A.	W.P.A.	W.P.A.	W.P.A.	W.P.A.

Owners of wells

1. I. & G. N. R.R.
2, 3. City of Hearne
10. J. G. Lightsey
11. R. H. Seale
21. J. S. Mooring
22. Ward Mooring
23-26. M. W. Sims

Analyses of water from wells in the vicinity of Bryan and College Station, Tex.

a/ Well Number	29	60	61	62	63
Date	Dec. 2, 1937	Nov. 13, 1937	Nov. 13, 1937	Nov. 13, 1937	Nov. 13, 1937
Depth (feet)	504	50	60	208	360
Silica (SiO_2)	—	—	—	—	—
Iron (Fe)	—	—	—	—	—
Calcium (Ca)	9	111	111	15	16
Magnesium (Mg)	b/	45	54	2	b/
Sodium and Potassium (Na+K)	151	327	308	174	42
Bicarbonate (HCO_3)	268	207	220	244	104
Sulphate (SO_4)	90	226	223	29	11
Chloride (Cl)	26	545	535	138	24
Fluoride (F)	—	—	—	—	—
Nitrate (NO_3)	d/	d/	d/	d/	d/
Total dissolved solids	408	1,356	1,339	478	144
Total hardness as $CaCO_3$	22	463	498	47	40
e/ Analyst	W.P.A.	W.P.A.	W.P.A.	W.P.A.	W.P.A.

a/ Numbers correspond to well numbers in table of well records.
b/ Magnesium less than 5 parts per million.
d/ Nitrate less than 20 parts per million.
e/ Analysts: W.P.A., chemists employed on W.P.A. Project, supervised by Dr. E. P. Schoch of Bureau of Industrial Chemistry.
A. & M., chemical laboratory at A. & M. Experiment Station.
Fort Worth, The Fort Worth Laboratories, Fort Worth, Texas.
Allied Chem., Allies Chemical Co., Dallas, Texas
E.W.L., E. W. Lohr, U. S. Geological Survey, Austin, Texas.
f/ Composite sample.
g/ Iron and aluminum oxides ($Fe_2O_3+Al_2O_3$)

Analytical results in parts per million

a/ Well number	64	65	80	f/ A	f/ B	81	84
Date	Nov. 13, 1937	Nov. 13, 1937	--, 1937	Feb. 6, 1937	June 24, 1936	Oct. 13, 1924	Dec. 6, 1937
Depth (ft.)	44	360	346	—	—	503	2,053
SiO_2	--	--	60	25	24	62	--
Fe	--	--	.1	g/3.2	--	g/6.4	.06
Ca	67	47	14	11	11	22	4.2
Mg	21	10	3.8	3.8	3.5	6.0	2.6
Na+K	256	242	117	506	579	80	1,030
HCO_3	281	207	129	692	821	91	1,766
SO_4	69	132	44	16	20	33	3.5
Cl	360	265	109	398	431	103	568
F	--	--	--	2.3	--	--	.0
NO_3	d/	d/	--	--	--	--	3.0
Tot. dissolved solids	911	798	412	1,304	1,473	356	2,481
Total hardness as $CaCO_3$	253	156	51	44	42	79	21
e/ Analyst	W.P.A.	W.P.A.	A.&M.	Fort Worth	A.&M.	Allied Chem.	E.M.L.

Owners of wells

29. Peter Scarpinato
60. J. H. Wilcox
61. Frank Morrow
62. O. L. Wilcox
63, 64. J. H. Wilcox
65. J. S. Smith
80. W. S. Howell
A, B, 81, 84. City of Bryan

Analyses of water from wells in the vicinity of Bryan and College Station, Tex.

a/ Well Number	84	85	86	87	89
Date	Oct. 13, 1924	Dec. 7, 1937	Aug. 11, 1930	Mar. 31, 1931	Dec. 7, 1937
Depth (feet)	2,053	300	750	750	875
Silica (SiO_2)	21	--	28	84	--
Iron (Fe)	g/6.2	1.5	.4	2.9	.02
Calcium (Ca)	5.0	32	5.8	19	7.0
Magnesium (Mg)	3.4	9.3	2.1	.4	3.1
Sodium and Potassium (Na+K)	704	84	903	399	669
Bicarbonate (HCO_3)	751	90	1,871	887	939
Sulphate (SO_4)	--	48	8.8	16	4.1
Chloride (Cl)	667	125	323	121	502
Fluoride (F)	--	.3	--	--	1.1
Nitrate (NO_3)	--	.0	--	--	.0
Total dissolved solids	1,777	344	2,198	1,079	1,649
Total hardness as $CaCO_3$	26	118	23	49	30
e/ Analyst	Allied Chem.	E.W.L.	A.&M.	A.&M.	E.W.L.

a/ Numbers correspond to well numbers in table of well records.
b/ Magnesium less than 5 parts per million.
c/ Fluoride determined by E. W. Lohr.
d/ Nitrate less than 20 parts per million.
e/ Analysts: Allied Chem., Allied Chemical Co., Dallas, Texas.
E.W.L., E. W. Lohr, U. S. Geological Survey, Austin, Texas.
A.&M., chemical laboratory at A. & M. Experiment Station
W.P.A., chemists employed on W.P.A. Project, supervised by Dr. E. P. Schoch of Bureau of Industrial Chemistry.
R.R., Railroad laboratory.
g/ Iron and aluminum oxides (Fe_2O_3+Al_2O_3)
h/ Fluoride determined by C. H. Connell, State Health Department, Austin, Texas.

Analytical results in parts per million

a/ Well number	121	122	122	123-125	133	137	345
Date	Dec. 1, 1937	Dec. 1, 1937	Nov. 4, 1931	--	Mar. 10, 1937	Mar. 10, 1937	Dec. 2, 1937
Depth (ft.)	771	495	495	756-1,005	960	--	1,550
SiO_2	--	--	--	14	40	20	--
Fe	--	--	--	g/.9	.2	.2	--
Ca	13	11	6.4	3.1	16	4.0	5
Mg	b/	b/	1.0	.5	2.8	1.7	b/
Na+K	584	313	319	292	328	578	454
HCO_3	927	378	382	545	335	916	793
Sulphate (SO_4)	148	195	217	37	196	223	137
Cl	274	138	124	111	203	206	146
F	c/1.2	--	--	--	--	--	h/1.0
NO_3	2.5	d/	--	3.5	--	--	d/
Total dissolved solids	1,582	843	855	730	952	1,485	1,132
Total hardness as $CaCO_3$	33	27	20	10	51	17	12
e/ Analyst	W.P.A.	W.P.A.	A.&M.	R.R.	A.&M.	A.&M.	W.P.A.

Owners of wells

84-87, 89. City of Bryan.
121-122. Texas Agri. Experiment Station.
123-125, 133, 137. H. & T. C. R.R.
345. A. Geisenschlag

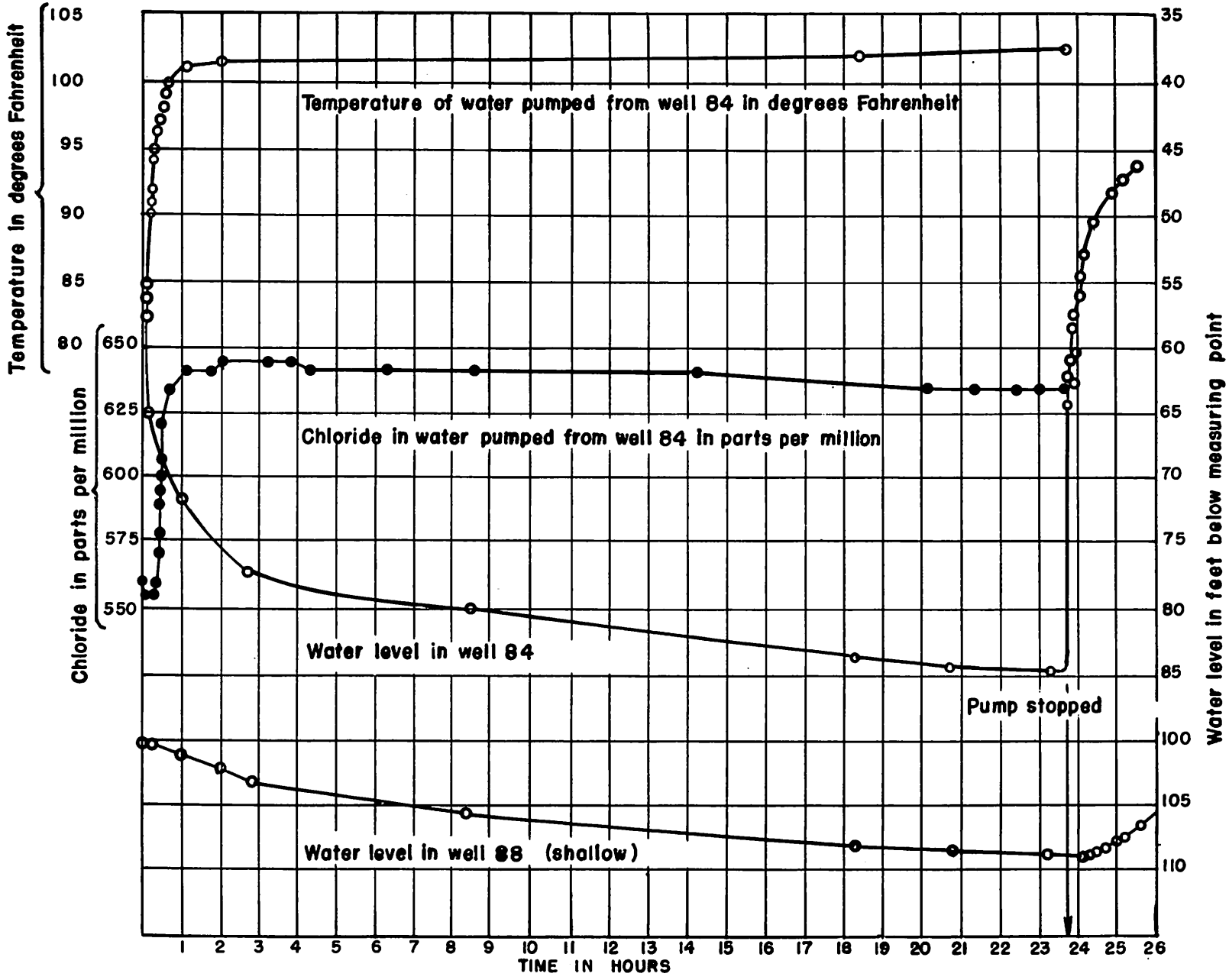
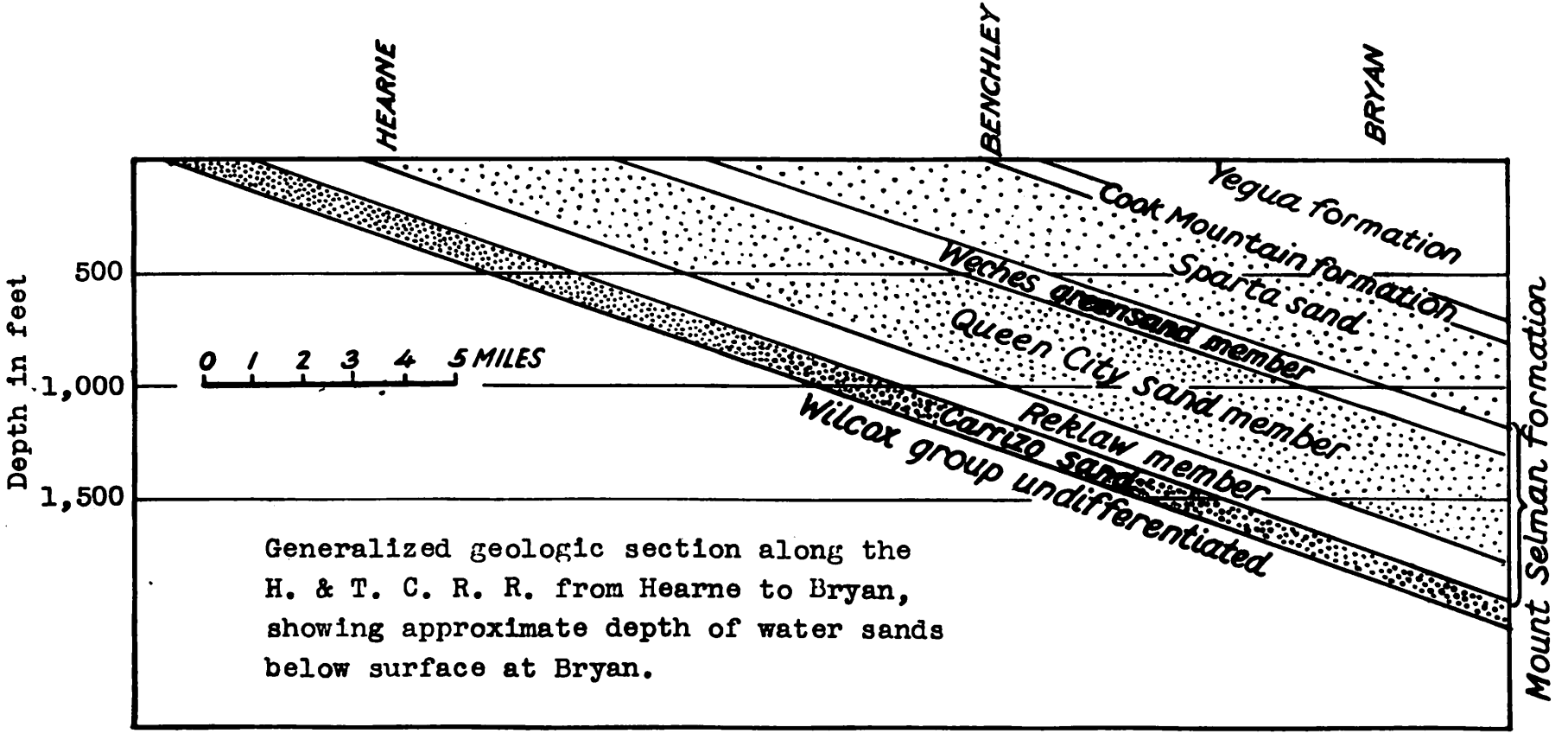
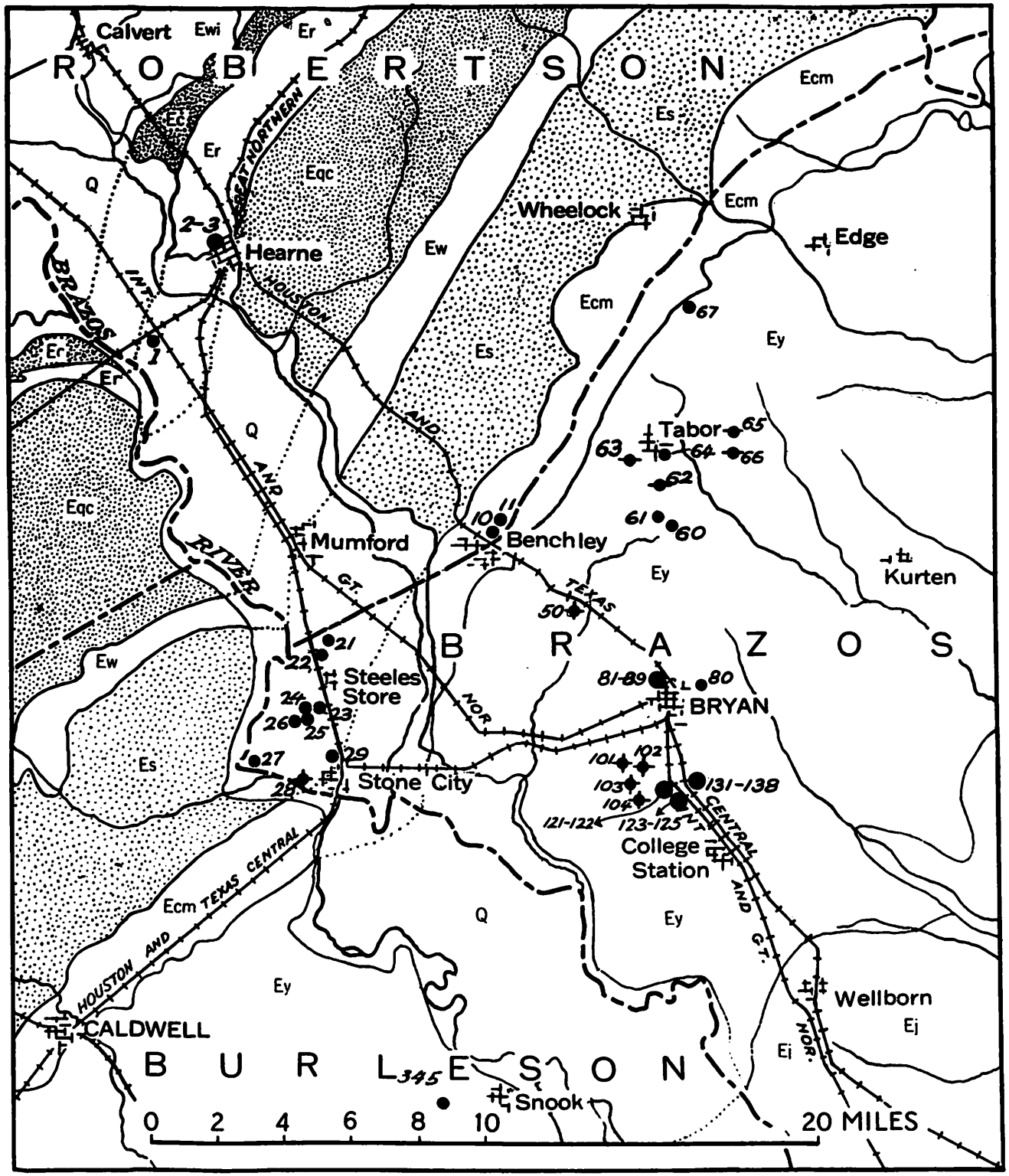


FIGURE 1.—WATER LEVEL, TEMPERATURE AND CHLORIDE OBSERVATIONS RECORDED DURING PUMPING TEST ON WELL 84.



Generalized geologic section along the H. & T. C. R. R. from Hearne to Bryan, showing approximate depth of water sands below surface at Bryan.

Figure 2.



EXPLANATION

QUATERNARY	RECENT	Q	Alluvium
TERTIARY	EOCENE	Ej	Jackson group undifferentiated
		Ey	Yegua formation
		Ecm	Cook Mountain formation
		Es	Sparta sand
	Mount Selman formation	Ew	Weches greensand member
		Eqc	Queen City sand member
		Er	Reklaw member
		Ec	Carrizo sand
		Ewi	Wilcox group undifferentiated

- O — Well with hand pump or wind mill
- ● — Flowing well
- ● — Group of wells
- ✦ — Test well, drilled for oil or gas

PLATE 1.—MAP OF PART OF BRAZOS, ROBERTSON AND BURLESON COUNTIES, TEXAS, SHOWING OUTCROP AREAS OF GEOLOGIC FORMATIONS AND LOCATION OF WELLS.

Taken from geologic map of Texas, Geological Survey, U. S. Department of Interior, 1937