

TEXAS BOARD OF WATER ENGINEERS

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BULLETIN 5603

GROUND-WATER RESOURCES OF THE EL PASO DISTRICT, TEXAS  
PROGRESS REPORT NO. 7

By

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United States Geological Survey

Prepared in cooperation with the Geological Survey  
United States Department of the Interior  
and the  
City of El Paso

February 1956



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ABSTRACT

The El Paso district is divided, for this report, into four areas: (1) The Hueco bolson, (2) the city artesian area, (3) the Upper Valley, and (4) the Lower Valley. In 1954 the average daily pumpage in the Hueco bolson and city artesian areas was 38,800,000 gallons. Most of this water was used for public supplies. Industrial use of water has decreased slightly since 1948. The pumpage in the Upper and Lower Valleys was 40,000 and 120,000 acre-feet, or about 36 and 107 million gallons per day, respectively; most of the water was used for irrigation.

Water levels in wells in the Hueco bolson have declined generally since 1936, at an increasing rate in some places. The greatest decline in the 6-year period 1949-55 occurred near Biggs Air Force Base and near the middle of the Mesa well field. In the city artesian area during the period 1949-55, the greatest change in artesian pressure occurred between January 1954 and January 1955, as shown by water levels in 10 wells in which the declines ranged from 6.7 feet to 14.4 feet. Most of the decline in water levels in the Upper Valley between January 1953 and January 1955 occurred during the latter half of that period. Water-level measurements were made in 19 wells in the Lower Valley in January 1954 and January 1955; the decline during that year ranged from half a foot to 8.5 feet.

Of the daily average of 28,700,000 gallons of water removed from the Hueco bolson and city artesian areas in the El Paso district from 1949 through 1954, about 7,400,000 gallons per day was removed from storage and about 21,300,000 gallons per day was intercepted from natural discharge to the Rio Grande Valley.

The yearly increase in chloride content of the water in the city artesian area was less from 1949 to 1954 than from 1935 to 1949. No definite trend of increase in mineralization has been observed in water from wells in the Hueco bolson area.

## INTRODUCTION

## Location and Extent of District

The city of El Paso is in the extreme western part of Texas on the Rio Grande at the southern end of the Franklin Mountains. The Mexican city, Ciudad Juarez, lies across the river at the northern end of the Sierra del Paso del Norte. The population of El Paso recently has been estimated to be about 182,000 and that of Juarez to be about 123,000.

For the purpose of discussion, the El Paso district is divided into four areas (pl. 1):

(1) The Hueco bolson, known locally as the Mesa. The Hueco bolson is bounded on the north by the Tularosa Basin in New Mexico. The bolson is separated from Tularosa Basin by a low, indefinite divide a few miles north of the State line. The eastern margin of the bolson extends southeastward along the west side of the Hueco, Finlay, Malone, and Quitman Mountains to the vicinity of Fort Quitman in Hudspeth County. The bolson is bounded on the west by the Franklin Mountains and on the southwest by the northeastern wall of the El Paso Valley of the Rio Grande.

(2) The city artesian area, consisting of that part of the city of El Paso and the adjoining part of the city of Juarez in the valley of the Rio Grande below the pass between the Franklin Mountains and Cerro de Muleros.

(3) The Upper Valley, the term used locally to refer to the lower Mesilla Valley, consisting of the Rio Grande Valley from the vicinity of Anthony, New Mexico-Texas, to the pass between the Franklin Mountains and Cerro de Muleros.

(4) The Lower Valley, consisting of the Rio Grande Valley in Texas from the present city limits of El Paso to the vicinity of Fort Quitman.

## Purpose and Scope of this Report

The present progress report is the seventh of a series of reports presenting information on the ground-water resources of the El Paso district, and was prepared by the United States Geological Survey in cooperation with the city of El Paso and the Texas Board of Water Engineers. It brings up to date information concerning pumpage, fluctuations of water levels, removal of water from storage, and changes in chemical quality of the water in the Hueco bolson and city artesian areas. The report summarizes briefly the ground-water development in the Upper and Lower Valley areas and discusses recent fluctuations of water levels in those areas.

Additional information concerning the geology and ground-water conditions in the El Paso district may be obtained by consulting the preceding progress report (Scalapino, 1949), Texas Board of Water Engineers' Bulletins 5206 and 5417, and other references listed in the bibliography. For convenience in referring to previous reports, table 1 shows both old and new numbers of observation wells for which the designation has been changed.



The field work and preparation of this report were under the administrative direction of A. N. Sayre, Chief of the Ground Water Branch, U. S. Geological Survey, and under the direct supervision of R. W. Sundstrom, District Engineer in charge of ground-water investigations in Texas.

## PUMPAGE AND FLUCTUATION OF WATER LEVELS

### Hueco Bolson and City Artesian Areas

The average pumpage from deep wells in the Hueco bolson and city artesian areas combined was 38,800,000 gallons per day (gpd) in 1954. This compares with pumpage of 22,000,000 gpd in 1948. Figure 1 shows graphically the total average daily pumpage in the Hueco bolson and city artesian areas since 1906. Graphs of pumpage in the two areas for the period 1936-54 are shown separately.

The city of El Paso is the largest user of ground water in the Hueco bolson and city artesian areas. In 1954, the city used approximately 16,800,000 gpd from deep wells; the city of Juarez used about 8,900,000 gpd; the United States Army at Fort Bliss and the United States Air Force at Biggs Air Force Base, about 4,300,000 gpd; industries, about 4,400,000 gpd; suburban supply wells southeast of El Paso, about 2,600,000 gpd; and irrigators on the Mesa, about 1,800,000 gpd.

Table 1.- Index of previously published well numbers and corresponding numbers in this report.

Old no.	New no.	Old no.	New no.	Old no.	New no.
6	V-64	55	V-72	78	V- 9
7	V-65	57	V-78	78c	R-53
8	V-66	64	V-42	79	V- 3
10	V-63	65a	V-39	82a	R-56
19	V-61	67	V-34	112	V- 2
21	V-62	67a	V-35	126	R-47
30a	V-54	67b	V-36	128b	R-40
32a	V-59	68	V-37	128c	R-42
40	V-30	72	V-27	128d	R-34
42	V-53	75	V-24	130	R-36
44	V-51	75a	V-23	136	R-22
48a	V-50	75b	V-22	138	S- 6
48b	V-69	75d	V-19	139a	R-11
49	V-49	76	V-11	140	M- 6
50	V-47	77	V- 5	143a	R- 2
52	V-45	77b	V- 7		
53	V-46	77c	V- 9		



FIGURE 1.—Average daily pumpage from all deep wells in the Hueco bolson and city artesian areas, 1906-54.

The increase in ground-water pumpage since 1948 is due largely to increase in use for public supply. The use by military installations increased slightly when the wells at Biggs Air Force Base were put in use in 1951. The use by industry has decreased slightly since 1948, principally because of the conversion of the railroads from steam to diesel power and more efficient use of water by other industries. Since 1950, small-scale irrigation has been started in the Hueco bolson area, where an average of about 1,800,000 gpd was pumped in 1954 for this purpose.

In 1954 approximately 40 wells equipped with turbine pumps were in operation in the Hueco bolson area. Of these wells, 25 have been drilled since 1948, including 11 for municipal and military supplies, 6 for industrial use, 6 for irrigation, and 2 to supply water for swimming pools.

Water levels in wells in the Hueco bolson area have shown steady net annual declines since 1936, and the rate of decline has accelerated, at least in parts of the area, since 1951. Hydrographs showing fluctuations of water levels in selected observation wells in the Hueco bolson area are shown in figure 2. Table 2 includes all previously unpublished records of water-level measurements in observation wells in this area. The locations of the wells are shown on plate 1.

Figure 3 shows the decline in water levels in the bolson between January 1949 and January 1955. The maximum decline of 10 feet has occurred near the Biggs Air Force Base wells and near the middle of the city's Mesa well field. The cone of influence extends about 9 miles to the north and 6 miles to the east from the principal areas of withdrawal.

Since 1948, 4 new industrial wells have been drilled in the city artesian area and at least 2 wells have been abandoned. In 1954 about 30 large-capacity wells were in operation in this area.

Fluctuations of water levels in 2 observation wells in the city artesian area are shown graphically in figure 4. Although water levels have fluctuated as much as 25 feet during one year, it is only since the end of 1950 that a relatively persistent yearly downward trend in the artesian pressure has been indicated. The drop in artesian pressure in 1954 is especially noticeable and is further substantiated by comparative measurements made in eight other wells in the artesian area. Declines in water levels in the 10 observation wells ranged from 6.7 feet to 14.4 feet during 1954. The declines probably are due to an increase in pumpage in the city artesian area.

#### Upper Valley

The Upper Valley is primarily an irrigated farming area. Irrigation with ground water began in about 1904 and continued, although on a small scale, until 1916, when the dams forming Elephant Butte and Caballo reservoirs on the Rio Grande in central New Mexico were completed. From this time until about 1943 surface water was used for most of the irrigation. Owing to the continued decline in the

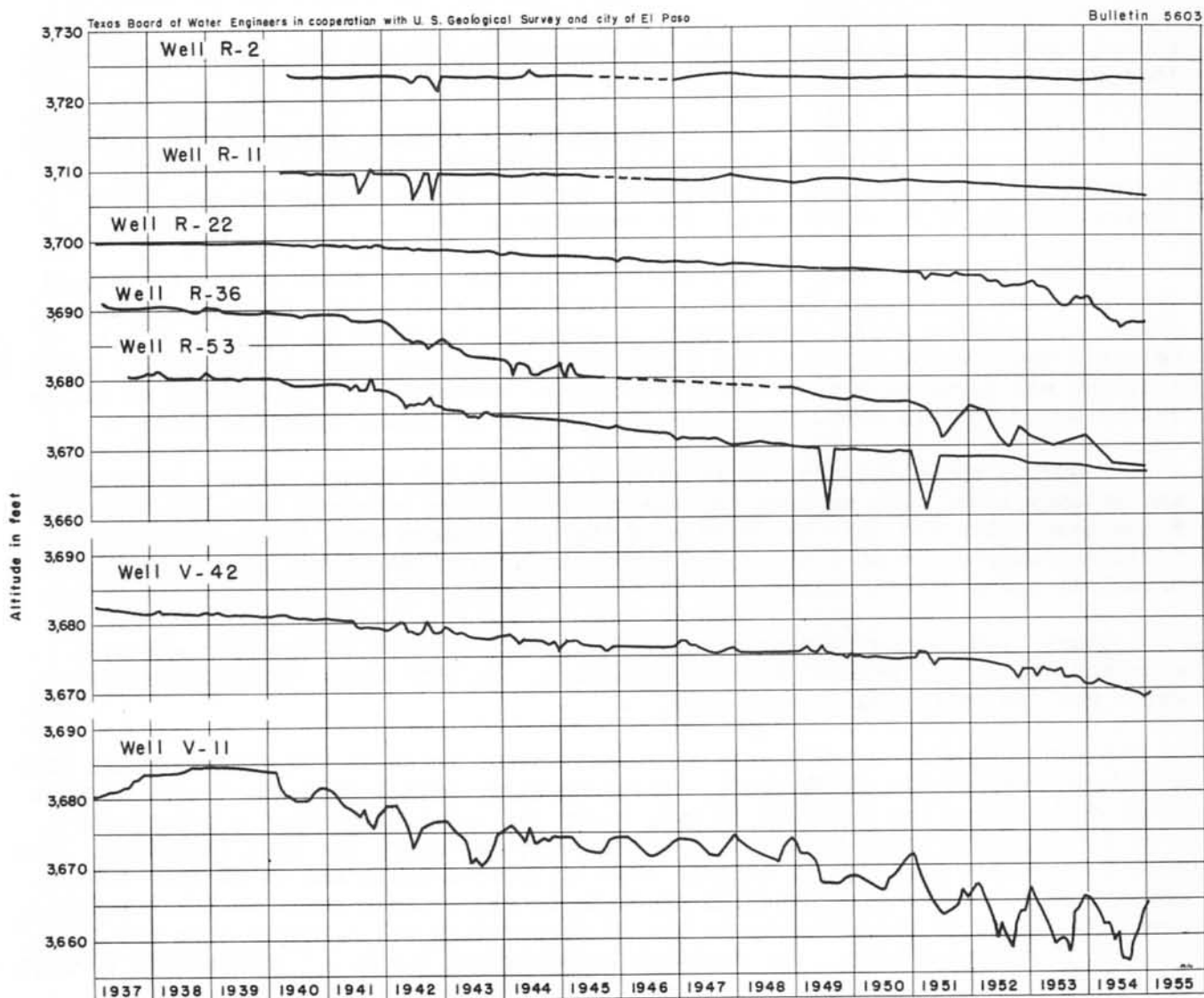


FIGURE 2.- Water levels in observation wells in the Hueco bolson area, El Paso, Tex.

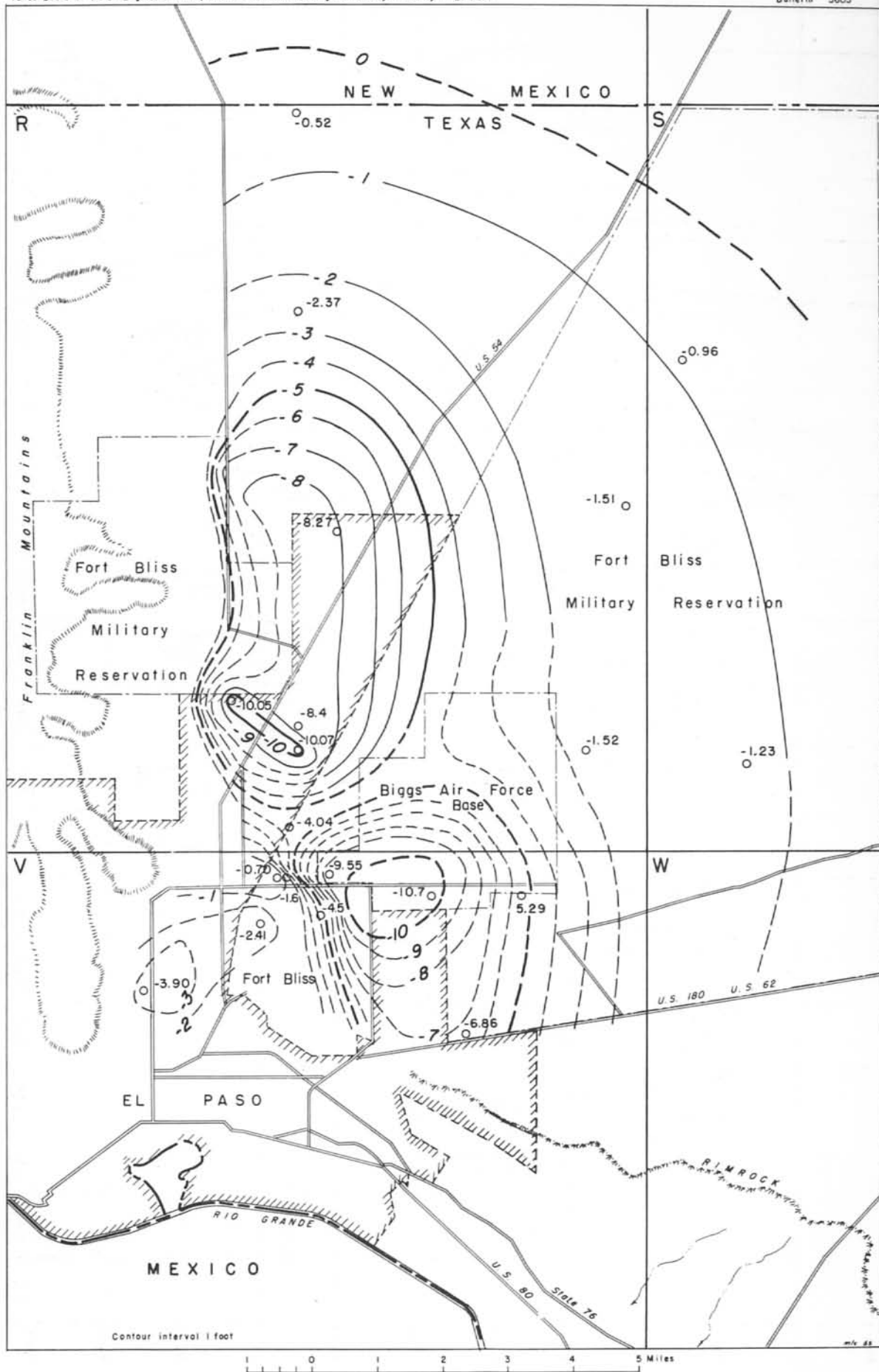


FIGURE 3.- Map of part of Hueco bolson showing declines of water levels in observation wells between January 1949 and January 1955.

Texas Board of Water Engineers in cooperation with the U. S. Geological Survey and the city of El Paso

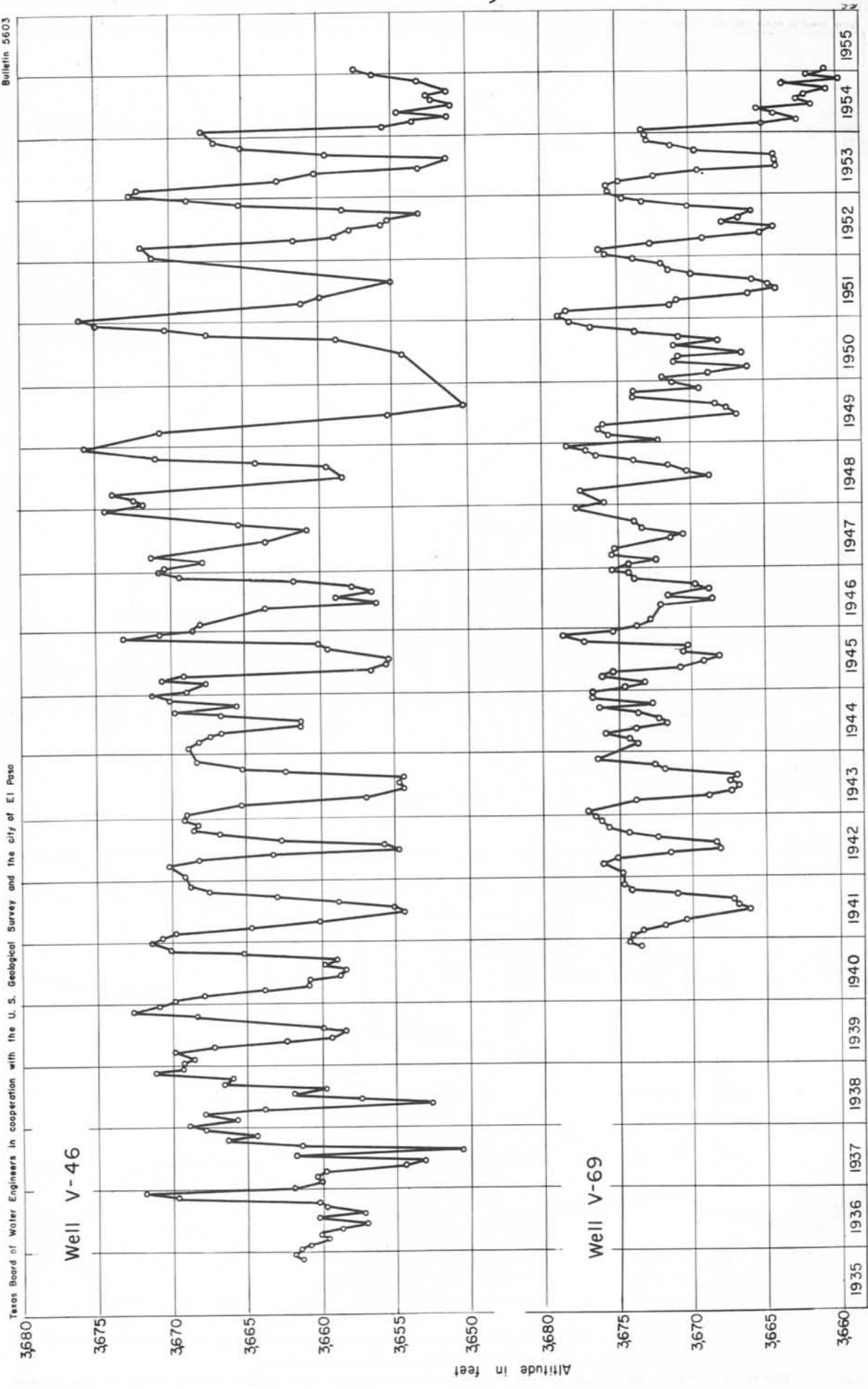


FIGURE 4.-Water levels in observation wells in the city artesian area, El Paso, Tex.

quantity of water stored in the Elephant Butte reservoir during the drought years, most of the water used for irrigation in the Upper Valley in the past few years has been taken from ground-water sources. In 1954 about 40,000 acre-feet of water was pumped from approximately 250 wells to irrigate 15,000 acres of cotton and alfalfa.

In 1951 and 1952 the city of El Paso drilled six wells near Canutillo to supplement the city supply. In 1954 about 30 wells were in operation for public supply and industrial use in the Upper Valley.

In 1953 an observation-well program was established by the U. S. Geological Survey to measure fluctuations of water levels in the Upper Valley. The locations of observation wells in the Upper Valley are shown on plate 1. In January 1955, measurements in 73 observation wells showed a maximum decline in water levels of 3.8 feet since 1953. The area of greatest decline was about 3 miles northwest of Canutillo. Very slight declines took place in the northern and southern parts of the area. Water-level measurements in eight wells indicate that more than four-fifths of the decline between January 1953 and January 1955 occurred during 1954. Records of water-level measurements in observation wells in the Upper Valley are shown in table 2.

#### Lower Valley

The Lower Valley below the city of El Paso also is an irrigated farming area, and the history of the source of water used for irrigation is similar to that of the Upper Valley. Owing to the decrease in water supply from the upstream reservoirs on the Rio Grande, more wells were drilled to supplement the surface-water supply. About 500 wells were in use in 1954, and about 120,000 acre-feet of water was pumped to irrigate approximately 45,000 acres. About 10 wells were producing water for public and industrial supply.

In January 1954 and January 1955, water levels were measured in 19 wells in the Lower Valley between the city of El Paso and Esperanza in Hudspeth County. The locations of observation wells in the Lower Valley are shown on plate 1. The declines in water level for the 1-year period ranged from about 0.5 foot to 8.5 feet, and in 10 of the wells were more than 3 feet. Records of water-level measurements in all observation wells in the Lower Valley are given in table 2.

#### REMOVAL OF WATER FROM STORAGE IN THE HUECO BOLSON

Changes in water levels in water-bearing formations reflect changes in ground-water storage. However, changes in water levels in the city artesian area represent very small changes in storage as compared to changes in the Hueco bolson reservoir, in which the water is unconfined (under water-table conditions). Therefore, because the coefficient of storage of an unconfined aquifer is much larger than that of an artesian aquifer, computations of depletion of storage in the water-table area should approach closely the total change in storage for the Hueco bolson and city artesian areas combined.

The volume of material unwatered in the Hueco bolson area for the 6-year period 1949 through 1954 was estimated from figure 3 to be 283,000 acre-feet. Based on a coefficient of storage of  $17\frac{1}{2}$  percent, as estimated in previous progress reports, the average rate of depletion for the 6-year period is 7,400,000 gpd. This figure compares with an average depletion rate for the entire period of record, 1936-54, of 5,800,000 gpd. The total volume unwatered during the entire period is estimated at 707,000 acre-feet.

A comparison of the depletion rates with the pumping rates for the Hueco bolson-city artesian area for various periods indicates that the difference between the pumping rate and the depletion rate has increased as the cone of depression became larger. The differences between these rates were 13,300,000 gpd from 1936 to 1942, 16,000,000 gpd from 1943 to 1944, 17,000,000 gpd from 1945 to 1948, and 21,300,000 gpd from 1949 through 1954.

These differences were previously reported to be the rate of "recharge or lateral movement of water toward the well fields from beyond the Mesa" (Scalapino, 1949, p. 6). To clarify this statement, the following explanation is offered. In an aquifer undisturbed by artificial discharge, water moves from a place of recharge to a place of discharge, and, if the rate of recharge is constant, the discharge tends to equal the recharge. When a group of wells are installed and pumping begins, a cone of depression develops, and, until the cone intersects the recharge or discharge area, the volume of the cone multiplied by the coefficient of storage equals the quantity of water pumped. When the cone of depression intersects either the recharge area or the place of natural discharge, either the recharge will increase or the natural discharge will decrease. The rate of development of the cone is retarded and the aforementioned equality no longer exists.

Sayre and Livingston (1945) have described the areas of recharge in the El Paso district. Their studies indicate that a 70-square-mile belt along the eastern edge of the Franklin and Organ Mountains is the major intake area. In this area, the water table is far enough beneath the land surface that discharge by evaporation and transpiration is negligible. Except for possible changes in climatic conditions, recharge rates are not changed even though the cone of depression reaches the recharge area.

The only apparent feature in the district that would account for retarded development of the cone of depression is the area of natural discharge in the Rio Grande Valley. The coarse alluvial fill in the valley (shallow aquifer) and the underlying bolson deposits (deep aquifer) may be considered as two separate aquifers, although they are hydraulically connected by material of irregular thickness and relatively low permeability. Prior to the development of ground-water resources in the area, the head in the deep aquifer exceeded the head in the shallow aquifer and water was discharged from the deep aquifer to the shallow aquifer. As pumping causes the head in the deep aquifer to decrease, discharge to the shallow aquifer decreases, and, in places where the head in the deep aquifer is below the head in the shallow aquifer, the flow is reversed.

The recharge-discharge relationship between the two aquifers has changed progressively because the head has decreased in the deep aquifer more rapidly than in the shallow aquifer. The progressive differences between the pumping rates and depletion rates previously mentioned probably are directly related to the changing recharge-discharge relationship in the valley.



## SALT-WATER ENCROACHMENT

Since 1935, salt-water encroachment has been observed in the city artesian area where salt water overlies and underlies the fresh-water sands. Water samples from observation wells have been analyzed periodically to determine the extent of the contamination. Although the increase in total mineralization of the water includes increases in several of the mineral constituents, the increase in chloride is the most important change occurring in the district. Consequently, graphs have been prepared showing fluctuations of the chloride content in the water from several observation wells in the city artesian area (fig. 5). The graphs show a nearly steady increase in chloride content since 1935, although the rate of increase since 1949 appears to be less than it was prior to 1949. A notable exception is the increase in mineralization observed in the T & N O Railroad wells near the edge of the Hueco bolson (fig. 6). Although only one of the T & N O wells (V-38) has been available for observation since 1951, the chloride content has increased 500 parts per million in the period between September 1951 and June 1954.

Observations have been made in several wells in the Hueco bolson area to detect changes in mineral content of the water. Although no definite trend of increase in mineralization has been observed, the program should be continued and expanded because it is known that salt water underlies the fresh water and is a potential source of contamination.

Analyses of all samples taken since 1949 in the Hueco bolson and city artesian areas are shown in table 3.

## SUMMARY AND CONCLUSIONS

It can be assumed that there will be an increase each year in total pumpage from the Hueco bolson and city artesian areas. However, it can be expected that the rate of increase in the volume of unwatered material of the Hueco bolson will be less than the rate of increase in pumping because the shallow aquifer in the valley will furnish water to the main aquifer of the Hueco bolson and city artesian areas.

Although chemical analyses indicate that the mineral content of ground water in the Hueco bolson and city artesian areas did not increase as rapidly during the period 1949-54 as it did previously, continued unwatering in the areas increases the probability of salt-water encroachment from below into the Hueco bolson and city artesian areas and from the shallow aquifer into the city artesian area.

Continued pumping in the Upper and Lower Valleys will cause the annual decline of static water levels in the wells to continue until there is an increase in the quantity of surface water introduced into the areas.

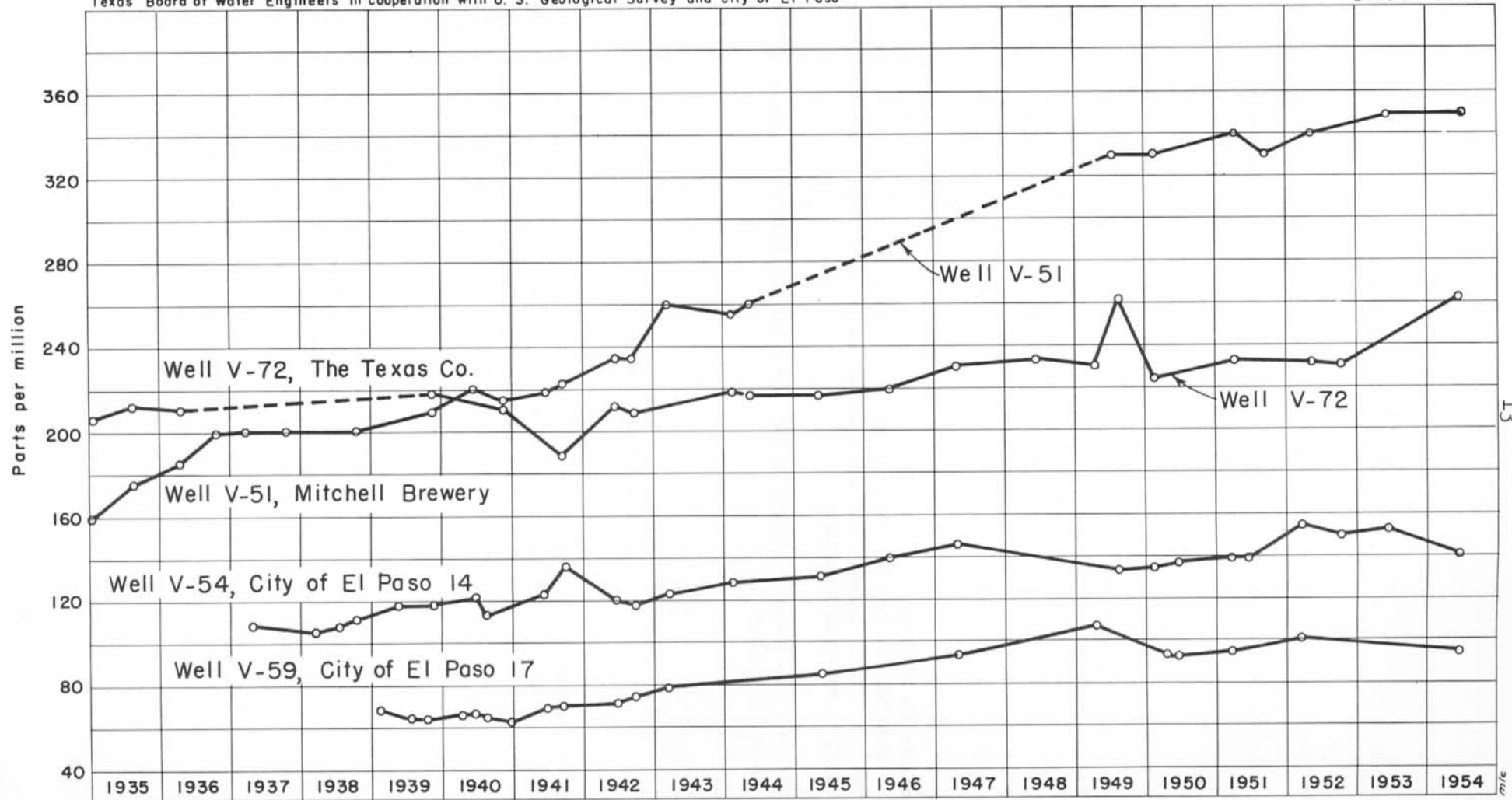
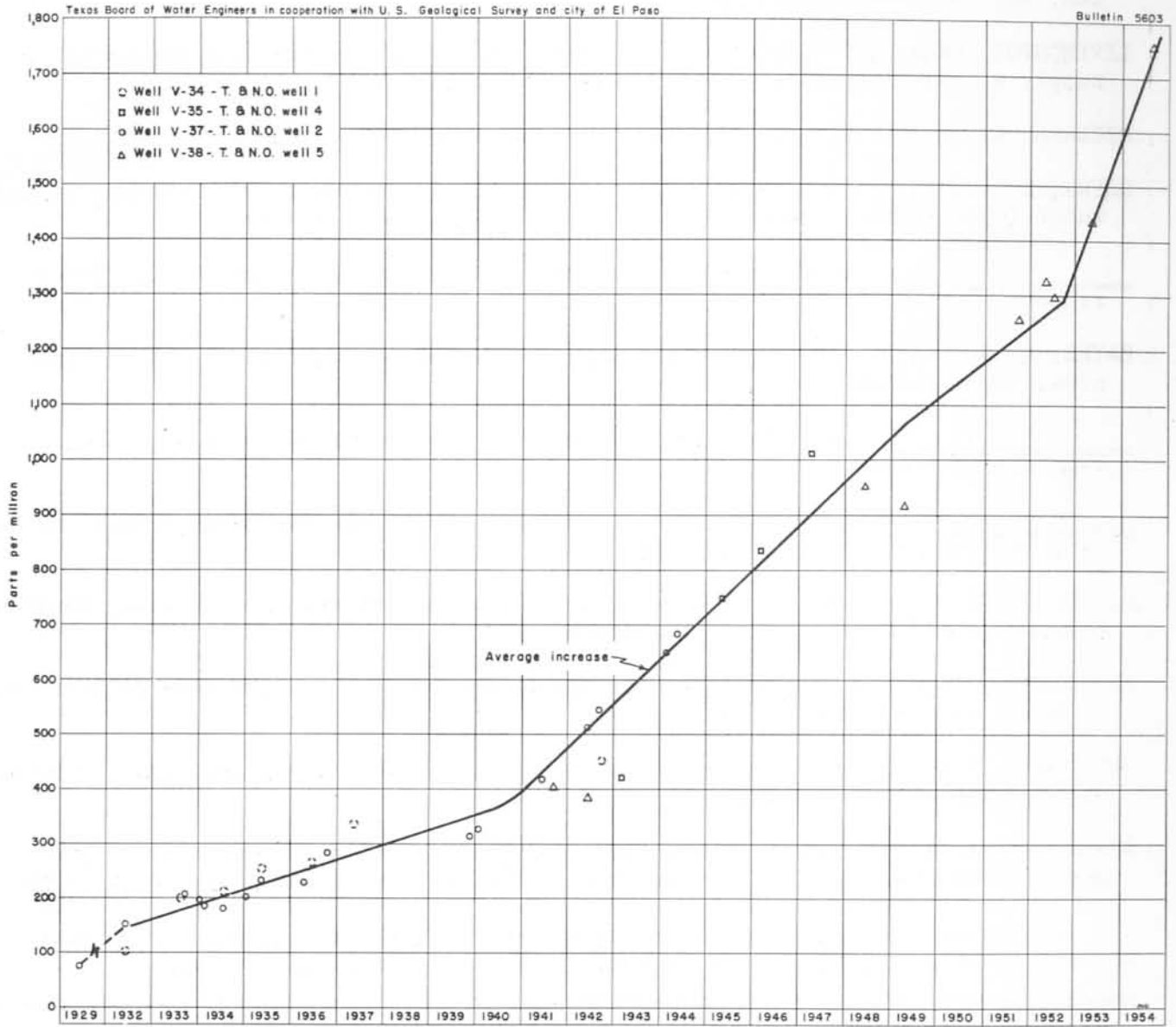


FIGURE 5.- Chloride content of water from wells in the city artesian area, El Paso, Tex.



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Following are listed the water-supply papers of the Geological Survey that contain records of water levels in wells in the El Paso district, Texas:

Water-Supply		Water-Supply	
Paper	Year	Paper	Year
817	1934	1019	1944
817	1935	1026	1945
817	1936	1074	1946
840	1937	1099	1947
845	1938	1129	1948
886	1939	1159	1949
909	1940	1168	1950
939	1941	1194	1951
947	1942	1224	1952
989	1943		

Table 2.- Records of water levels in observation wells, 1951-55.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-16	C. C. Woodward	3785.24	Jan. 11, 1952	9.75	
			Feb. 12, 1953	11.01	
			Nov. 9, 1954	11.06	
			Jan. 20, 1955	10.63	
Q-18	Anna L. Andreas	3798.91	Jan. 10, 1952	22.90	
			Feb. 12, 1953	20.17	
			Nov. 9, 1954	22.55	
			Jan. 20, 1955	21.83	
Q-27	U. S. Bureau of Prisons	3821.12	June 2, 1952	43.88	
			Feb. 10, 1953	44.19	
			Jan. 20, 1955	44.44	
Q-37	M. R. Hemley	3779.80	Aug. 28, 1951	16.29	
			Feb. 16, 1953	9.29	
			Nov. 9, 1954	15.87	
			Jan. 19, 1955	10.14	
Q-38	Gus Eminger	3777.64	Jan. 17, 1952	5.16	
			Feb. 16, 1953	7.64	
			Nov. 9, 1954	9.96	
			Jan. 19, 1955	8.45	
Q-65	M. R. Hemley	3774.92	Aug. 28, 1951	6.77	
			Feb. 16, 1953	6.67	
			Nov. 10, 1954	7.00	
			Jan. 20, 1955	6.78	
Q-68	E. & V. Holquin	3825.42	Apr. 28, 1951	61.40	
			Jan. 10, 1952	57.68	
			Feb. 12, 1953	58.14	
			Jan. 8, 1954	58.95	
			Nov. 10, 1954	60.62	
Q-69	---	3844.84	Jan. 20, 1955	60.08	
			Feb. 12, 1953	76.99	
			Nov. 10, 1954	79.73	
Q-71	Gomez & Hernandez	3819.61	Jan. 20, 1955	79.08	
			Jan. 10, 1952	54.13	
			Feb. 12, 1953	54.53	
			Jan. 8, 1954	55.94	
			Nov. 10, 1954	62.71	
			Jan. 20, 1955	62.03	

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-82	City of El Paso well 103	3769.81	Apr. 18, 1952	5.63	Pumping 1,250 gpm
			May 22, 1952	5.50	
			June 16, 1952	4.54	
			July 15, 1952	8.56	
			Feb. 16, 1953	6.94	
			Oct. 4, 1954	66.40	
			Oct. 15, 1954	9.58	
			Nov. 10, 1954	8.13	
Jan. 20, 1955	7.38				
Q-83	City of El Paso well 102	3769.57	Apr. 18, 1952	5.51	Pumping 1,200 gpm
			May 22, 1952	5.32	
			June 16, 1952	5.03	
			July 10, 1952	6.22	
			Feb. 16, 1953	6.55	
			Oct. 4, 1954	59.79	
			Oct. 15, 1954	8.67	
			Nov. 10, 1954	7.60	
Jan. 20, 1955	7.07				
Q-84	City of El Paso well 101	3767.78	Jan. 10, 1952	5.80	
			Feb. 28, 1952	5.81	
			Apr. 18, 1952	4.99	
			May 22, 1952	4.88	
			June 16, 1952	4.66	
			July 8, 1952	4.70	
			Feb. 16, 1953	6.06	
			Oct. 4, 1954	10.15	
			Nov. 10, 1954	6.92	
Q-85	City of El Paso well 106	3763.21	Apr. 25, 1952	2.85	Pumping 1,100 gpm
			May 22, 1952	2.37	
			June 13, 1952	2.26	
			July 11, 1952	2.76	
			Feb. 16, 1953	2.73	
			Oct. 4, 1954	79.70	
			Oct. 15, 1954	4.94	
			Nov. 10, 1954	4.43	
Jan. 20, 1955	3.72				
Q-86	City of El Paso observation well	--	May 28, 1954	9.87	
			May 31, 1954	9.92	
			June 4, 1954	9.88	
			June 18, 1954	9.87	
			July 22, 1954	9.75	
			Aug. 17, 1954	9.70	
			Sept. 7, 1954	9.49	
			Oct. 7, 1954	9.47	
			Nov. 11, 1954	8.46	
			Dec. 20, 1954	7.17	
			Jan. 20, 1955	6.88	

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-87	City of El Paso observation well	3769.13	Feb. 28, 1952	3.47	
			Apr. 18, 1952	3.07	
			May 22, 1952	3.84	
			June 16, 1952	3.45	
			July 15, 1952	6.40	
			Apr. 21, 1953	3.84	
			June 11, 1953	5.51	
			June 30, 1953	6.53	
			Jan. 8, 1954	9.73	
			June 23, 1954	10.67	
			Oct. 15, 1954	6.38	
			Nov. 10, 1954	6.05	
			Jan. 20, 1955	5.59	
Q-88	City of El Paso observation well	3766.57	Feb. 28, 1952	3.56	
			May 29, 1952	3.60	
			July 31, 1952	10.42	
			Sept. 30, 1952	11.71	
			Feb. 16, 1953	3.82	
Q-89	City of El Paso observation well	3766.29	May 29, 1952	3.11	
			June 16, 1952	3.24	
			July 15, 1952	3.00	
			Feb. 16, 1953	2.74	
			Nov. 10, 1954	4.59	
			Jan. 20, 1955	3.84	
Q-90	City of El Paso well 104	3768.63	Apr. 18, 1952	5.48	
			May 22, 1952	5.60	
			June 16, 1952	5.81	
			July 11, 1952	5.43	
			Feb. 16, 1953	5.36	
			Oct. 4, 1954	69.08	
			Oct. 15, 1954	7.69	
			Nov. 10, 1954	7.08	
			Jan. 20, 1955	7.52	
Q-91	City of El Paso well 105	3769.38	Apr. 18, 1952	6.50	
			May 22, 1952	7.72	
			June 13, 1952	6.94	
			July 11, 1952	6.43	
			Feb. 16, 1953	6.60	
			Oct. 4, 1954	77.49	
			Oct. 15, 1954	8.35	
			Nov. 10, 1954	8.01	
			Jan. 20, 1955	8.14	

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-92	Sam B. Gillette, Jr.	3768.00	Jan. 10, 1952 Oct. 3, 1952 Feb. 16, 1953 Jan. 20, 1955	7.75 9.80 7.89 10.84	
Q-93	I. T. Gillette	3767.98	Jan. 10, 1952 Feb. 16, 1953 Nov. 10, 1954 Jan. 20, 1955	9.19 9.23 11.95 11.21	
Q-96	W. S. Wallace	3775.51	Feb. 18, 1953 Nov. 10, 1954 Jan. 20, 1955	15.96 18.48 17.53	
Q-111	C. T. Tallmon	3759.75	Mar. 26, 1952 Feb. 19, 1953 Nov. 11, 1954 Jan. 21, 1955	13.65 9.79 11.34 10.66	
Q-113	H. L. Cordell	--	Feb. 19, 1953 Jan. 8, 1954	10.23 10.82	
Q-122	C. L. Ezell	3762.72	Oct. 31, 1951 Feb. 18, 1953	5.66 6.80	
Q-123	W. E. Jackson	3763.58	June 11, 1952 Feb. 18, 1953 Nov. 11, 1954 Jan. 21, 1955	8.72 8.62 9.19 8.86	
Q-129	I. Singh	3758.07	Mar. 26, 1952 Jan. 16, 1953 Nov. 11, 1954 Jan. 21, 1955	7.48 7.37 8.49 8.43	
Q-133	--	3781.90	Apr. 28, 1951 Mar. 12, 1953 Nov. 11, 1954 Jan. 21, 1955	31.16 30.61 31.08 31.14	
Q-135	Barry Hagedon	3753.27	Jan. 16, 1953 Nov. 11, 1954 Jan. 21, 1955	4.31 5.23 5.15	
Q-136	-- Thomas	3754.29	Apr. 28, 1951 Jan. 16, 1953 Nov. 11, 1954 Jan. 21, 1955	5.48 6.05 7.30 7.44	
Q-137	Erich Brandes	3752.66	June 10, 1952 Jan. 16, 1953 Nov. 11, 1954 Jan. 21, 1955	6.94 7.41 9.90 8.22	

(Continued on next page)



Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-139	Ord Gary	3757.10	Feb. 18, 1953	7.47	
			Jan. 8, 1954	7.91	
			Nov. 11, 1954	15.67	
			Jan. 21, 1955	10.70	
Q-145	Willard Deerman	3751.26	Apr. 28, 1951	7.59	
			Feb. 19, 1953	7.58	
			Jan. 8, 1954	8.54	
			Nov. 11, 1954	9.61	
			Jan. 21, 1955	9.27	
Q-146	M. M. Friedmann	3750.88	Jan. 16, 1953	7.54	
			Nov. 11, 1954	7.17	
			Jan. 21, 1955	6.82	
Q-147	M. M. Friedmann	--	Apr. 28, 1951	7.76	
			Feb. 21, 1953	7.70	
Q-150	L. T. Cox	3746.70	Mar. 14, 1952	8.34	
			Jan. 15, 1953	7.66	
			Nov. 12, 1954	8.17	
			Jan. 21, 1955	8.04	
Q-153	Idor Singh	3750.88	Jan. 16, 1953	7.29	
			Nov. 11, 1954	7.15	
			Jan. 21, 1955	7.11	
Q-154	J. H. Padgett	3750.10	Mar. 14, 1952	9.45	
			Jan. 16, 1953	8.73	
			Jan. 8, 1954	8.45	
			Nov. 12, 1954	8.76	
Q-156	U. S. Bureau of Reclamation observation well	--	Mar. 12, 1952	8.87	
			June 10, 1952	7.91	
			Jan. 15, 1953	8.66	
			Apr. 21, 1953	7.63	
			June 11, 1953	7.66	
			Jan. 8, 1954	8.64	
			Nov. 12, 1954	9.46	
Jan. 21, 1955	9.16				
Q-157	Country Club	3747.06	Jan. 15, 1953	10.41	
			Nov. 12, 1954	11.43	
			Jan. 21, 1955	11.09	
Q-158	Western Lodge	3841.28	Jan. 16, 1953	104.72	
			Jan. 8, 1954	104.79	
			Nov. 12, 1954	105.00	
Q-160	Penn's Dairy	3979.73	Jan. 16, 1953	246.01	
			Nov. 12, 1954	246.10	
			Jan. 21, 1955	246.28	

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
R-2	City of El Paso test well 30	4041.19	Jan. 24, 1955	318.75	
R-11	City of El Paso test well 29	4046.22	Jan. 26, 1955	340.73	
R-15	U. S. Army observation well 1	3972.50	Jan. 25, 1955	273.29	
R-16	U. S. Army observation well 2	3972.30	Jan. 25, 1955	274.94	
R-22	City of El Paso test well 3	3944.11	Nov. 19, 1954 Dec. 20, 1954 Jan. 22, 1955	256.63 256.90 256.72	
R-28	U. S. Geological Survey	4120.10	Jan. 7, 1954 Jan. 24, 1955	423.08 425.08	
R-36	McDonald Leighton	3936.17	Jan. 27, 1955	267.14	
R-40	City of El Paso well 21	3880.40	Jan. 28, 1955	213.52	
R-42	City of El Paso test well 23	3881.58	Jan. 28, 1955	211.50	
R-49	U. S. Army (City of El Paso observation well A)	--	Jan. 18, 1955	254.45	
R-53	City of El Paso test well 4	3869.34	Jan. 25, 1955	203.18	
R-56	City of El Paso well 20	3873.58	Jan. 28, 1955	211.68	
S-6	U. S. Army	--	Jan. 24, 1955	269.28	
S-13	U. S. Army (City of El Paso observation well B)	--	Jan. 26, 1955	317.10	
U-23	U. S. Bureau of Reclamation observation well	3736.87	Mar. 12, 1952 June 10, 1952 Jan. 15, 1953 Apr. 21, 1953 June 11, 1953 Jan. 8, 1954 Nov. 12, 1954 Jan. 21, 1955	6.50 6.28 6.95 6.11 6.28 6.96 7.43 7.30	
U-24	--	3738.91	June 10, 1952 Jan. 15, 1953 Nov. 12, 1954 Jan. 21, 1955	7.75 8.46 9.07 8.93	

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
V-2	City of El Paso well 32	--	Jan. 28, 1955	209.20	
V-3	City of El Paso well 8	3871.05	Jan. 28, 1955	212.99	
V-5	City of El Paso well 12	3879.78	Jan. 28, 1955	224.45	
V-11	City of El Paso (U.S.G.S. test well 2)	3919.40	Nov. 19, 1954 Dec. 20, 1954 Jan. 22, 1955	258.93 255.76 254.88	
V-14	U. S. Air Force observation well 1	3947.50	Jan. 18, 1955	271.60	
V-15	U. S. Air Force observation well 2	3947.50	Jan. 18, 1955	272.02	
V-22	City of El Paso test well 10	3879.15	Nov. 19, 1954 Dec. 20, 1955 Jan. 22, 1955	222.86 222.62 222.35	
V-27	U. S. Army - Ft. Bliss well 2	--	Jan. 25, 1955	227.32	
V-30	Mrs. W. L. Mooney	3995.79	Jan. 27, 1955	308.45	
V-33	U. S. Army (U.S.G.S.)	3884.84	Apr. 15, 1953 Jan. 5, 1954 Jan. 27, 1955	229.59 232.34 232.28	
V-39	City of El Paso Airport well 1	--	Nov. 19, 1954 Dec. 18, 1955	251.34 251.07	
V-42	City of El Paso test well 1	3942.88	Nov. 19, 1954 Dec. 20, 1954 Jan. 27, 1955	273.76 274.02 273.84	
V-45	City of El Paso well 3	3780.26	Jan. 27, 1955	124.21	
V-46	Loretto College	3807.11	Nov. 15, 1954 Dec. 20, 1954 Jan. 28, 1955	153.82 150.90 150.14	
V-47	City of El Paso well 1	--	Nov. 19, 1954 Jan. 28, 1955	97.96 96.29	
V-49	City of El Paso well 4	3743.76	Jan. 27, 1955	89.43	
V-61	El Paso Milling Co.	3707.07	Jan. 27, 1955	36.23	
V-62	City of El Paso well 10	3705.85	Jan. 27, 1955	33.82	
V-63	City of El Paso	3707.85	Jan. 27, 1955	26.81	Former drainage well

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

## EL PASO COUNTY, TEXAS

Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
V-64	El Paso Electric Co. well 2	3709.27	Jan. 27, 1955	29.20	
V-65	El Paso Electric Co. well 1	3709.12	Jan. 27, 1955	29.74	
V-66	El Paso Electric Co. well 4	3708.32	Jan. 27, 1955	39.89	
V-69	City of El Paso test well 33	3696.63	Oct. 21, 1954 Nov. 19, 1954 Dec. 20, 1954 Jan. 22, 1955	33.00 36.66 35.59 34.53	
V-87	El Paso-Ysletta FFA	--	Mar. 9, 1953 Jan. 18, 1954 Jan. 29, 1955	15.02* 15.40* 21.56*	
V-88	Ascarte Park	--	Feb. 26, 1953 Jan. 18, 1954	10.43 14.06	
W-11	R. R. Delgado	--	Mar. 9, 1953 Jan. 12, 1954	12.72 12.15	
W-12	--	--	Mar. 10, 1953 Jan. 18, 1954 Jan. 29, 1955	13.93 13.76 14.14	
Y-3	--	--	Mar. 10, 1953 Jan. 18, 1954 Jan. 29, 1955	11.75 11.25 15.36	
Y-4	--	--	Mar. 10, 1953 Jan. 18, 1954 Jan. 29, 1955	10.98 10.61 11.46	
Y-5	--	--	Mar. 9, 1953 Jan. 18, 1954 Jan. 30, 1955	9.52 8.94 13.81	
Y-6	Vince Baier	--	Mar. 9, 1953 Jan. 18, 1954 Jan. 30, 1955	10.57 10.55 13.66	
Y-7	--	--	Mar. 10, 1953 Jan. 18, 1954 Jan. 30, 1955	11.07 8.91 17.45	
AA-1	Paul Thomas	--	Mar. 10, 1953 Jan. 18, 1954 Jan. 30, 1955	9.24 9.20 13.71	

\* From measuring point.

(Continued on next page)

Table 2.- Records of water levels in observation wells, 1951-55-- Cont'd.

EL PASO COUNTY, TEXAS					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
AA-2	--	--	Mar. 10, 1953	12.45	
			Jan. 18, 1954	15.50	
			Jan. 30, 1955	18.45	
BB-1	R. T. Hoover	--	Mar. 9, 1953	10.42	
			Jan. 18, 1954	9.06	
			Jan. 30, 1955	13.79	
BB-2	--	--	Mar. 10, 1953	7.77	
			Jan. 18, 1954	7.53	
			Jan. 30, 1955	13.33	
BB-3	--	--	Mar. 10, 1953	10.13	
			Jan. 18, 1954	10.43	
			Jan. 30, 1955	14.04	
BB-4	D. H. Bailey	--	Mar. 19, 1953	5.05	
			Jan. 18, 1954	3.80	
			Jan. 30, 1955	8.91	
HUDSPETH COUNTY, TEXAS					
U-1	R. M. Sellers	--	Mar. 9, 1953	9.65	
			Jan. 19, 1954	10.17	
			Jan. 30, 1955	14.00	
AA-1	--	--	Mar. 9, 1953	25.84	
			Jan. 19, 1954	25.75	
			Jan. 30, 1955	27.11	
AA-2	Wade H. Miller	--	Mar. 9, 1953	9.39	
			Jan. 19, 1954	9.50	
			Jan. 30, 1955	11.23	
AA-3	B. E. Walker	--	Mar. 9, 1953	12.41	
			Jan. 19, 1954	14.48	
			Jan. 30, 1955	18.67	
FF-1	S. W. Cowan?	--	Mar. 9, 1953	10.78	
			Jan. 19, 1954	10.60	
			Jan. 31, 1955	11.45	
FF-2	Fort Quitman Land Co.	--	Mar. 9, 1953	7.68	
			Jan. 19, 1954	7.47	
			Jan. 31, 1955	8.27	

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Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

OTERO COUNTY, NEW MEXICO					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
M-6	Southern Pacific RR.	3999.17	Jan. 24, 1955	283.69	
DONA ANA COUNTY, NEW MEXICO					
J-1	Mrs. M. L. Sommerville	3815.03	June 16, 1952 Feb. 13, 1953 Nov. 8, 1954 Jan. 19, 1955	27.13 27.39 28.02 27.66	
J-2	Jack Cox	3801.22	June 16, 1952 Feb. 13, 1953 Nov. 8, 1954 Jan. 19, 1955	15.19 15.21 15.87 15.38	
J-3	Mrs. W. H. Haas	3792.38	June 16, 1952 Feb. 13, 1953 Jan. 19, 1955	9.07 9.66 10.27	
K-1	E. W. Moore	3795.54	Feb. 13, 1953 Nov. 8, 1954 Jan. 19, 1955	10.04 11.36 10.71	
K-3	Dairy Farm Co.	3793.62	Jan. 18, 1952 Feb. 12, 1953 Jan. 19, 1955	9.84 17.79 11.29	Pumped recently
K-4	--Colquitt	3790.64	June 18, 1952 Feb. 12, 1953 Nov. 8, 1954 Jan. 19, 1955	7.45 10.40 8.75 8.51	Pumped recently
K-6	Landers & Amos	3810.55	Jan. 8, 1952 Feb. 10, 1953	24.69 24.77	
K-7	--	3817.92	Feb. 10, 1953 Nov. 8, 1954	32.32 36.75	
K-8	Landers & Amos	3817.16	Jan. 18, 1952 Feb. 10, 1953 Jan. 19, 1955	31.59 32.01 33.14	
K-10	Anthony Cemetery	3812.51	Feb. 10, 1953 Nov. 8, 1954 Jan. 19, 1955	28.63 28.57 28.34	
L-12	U. S. Geological Survey	4045.80	Jan. 6, 1953 Jan. 15, 1954 Jan. 24, 1955	322.85 323.59 323.63	
P-2	C. D. Little	3792.74	Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	10.90 11.76 11.48	

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Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

DONA ANA COUNTY, NEW MEXICO					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
P-4	--Thomas	3797.18	Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	18.49 19.83 18.98	
Q-1	Ralph Haas	3791.62	June 16, 1952 Feb. 13, 1953 Nov. 8, 1954 Jan. 10, 1955	9.61 9.64 11.35 10.68	
Q-3	Mrs. Whip Robinson	3794.41	June 12, 1952 Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	13.74 13.28 15.28 14.59	
Q-6	L. G. Little	--	June 16, 1952 Feb. 13, 1953	12.47 11.92	
Q-9	T. S. White	3791.87	Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	13.19 14.05 13.99	
Q-10	E. Tellez	3790.53	Jan. 17, 1952 Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	12.41 12.04 13.62 13.61	
Q-11	J. W. Edmunsen	3790.96	Feb. 12, 1953 Apr. 21, 1953 June 11, 1953 Jan. 8, 1954 Nov. 8, 1954 Jan. 19, 1955	11.19 10.56 10.36 10.46 11.79 11.06	
Q-12	Ed Alvarez	3783.00	Jan. 11, 1952 Feb. 12, 1953 Nov. 8, 1954 Jan. 19, 1955	5.47 5.80 4.96 5.91	
Q-39	W. C. Huber	3778.73	Jan. 17, 1952 Feb. 13, 1953 Jan. 8, 1954 Nov. 9, 1954 Jan. 19, 1955	8.79 8.72 8.62 11.41 11.12	
Q-41	H. A. Sexton	3784.61	Jan. 17, 1952 Feb. 13, 1953 Nov. 9, 1954	10.59 10.43 13.28	
Q-46	Caroline Hayes	3785.88	Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	12.91 14.81 12.99	

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Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

DONA ANA COUNTY, NEW MEXICO					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-47	Marvin Hayes	3784.33	Feb. 13, 1953 Nov. 9, 1954 Jan. 19, 1955	10.41 13.56 12.77	
Q-48	Beckley & Whittington	3782.59	Feb. 13, 1953 Nov. 19, 1954 Jan. 19, 1955	10.68 13.74 13.36	
Q-50	--Lamar	3782.87	Feb. 16, 1953 Nov. 10, 1954 Jan. 20, 1955	11.65 12.72 12.12	
Q-51	J. R. Alvarez	3780.88	Feb. 16, 1953 Nov. 9, 1954 Jan. 20, 1955	14.07 14.50 13.98	
Q-52	L. K. Thompson	3780.31	June 13, 1952 Feb. 18, 1953 Nov. 9, 1954 Jan. 20, 1955	14.57 14.07 16.12 15.62	
Q-53	E. N. Crossett	3816.52	June 13, 1952 Feb. 16, 1953 Jan. 20, 1955	46.30 46.46 45.32	
Q-55	L. K. Thompson	3774.82	June 13, 1952 Feb. 18, 1953 Jan. 8, 1954 Nov. 10, 1954 Jan. 20, 1955	14.01 12.15 12.48 16.02 15.12	
Q-58	Mrs. J. F. Bennett	3777.12	Feb. 18, 1953 Nov. 10, 1954 Jan. 20, 1955	12.21 15.67 15.96	
Q-59	M. E. Garcia	3781.49	June 13, 1952 Nov. 9, 1954 Jan. 20, 1955	14.50 16.09 15.58	
Q-60	Louis H. Brandt	3776.33	Feb. 16, 1953 Nov. 9, 1954 Jan. 20, 1955	8.97 12.09 11.36	
Q-94	--	3767.60	Feb. 18, 1953 Nov. 10, 1954 Jan. 20, 1955	8.96 12.05 11.80	
Q-97	Horton Miller	3773.21	June 13, 1952 Feb. 18, 1953 Jan. 20, 1955	13.25 13.62 16.18	
Q-98	H. Casad	3774.96	June 13, 1952 Feb. 18, 1953 Nov. 10, 1954 Jan. 20, 1955	13.14 12.56 16.32 15.05	

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Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

DONA ANA COUNTY, NEW MEXICO					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-100	F. Guerrero	3794.62	June 13, 1952	30.92	
			Feb. 18, 1953	29.88	
			Jan. 20, 1955	32.07	
Q-102	B. L. Hall	3773.51	June 13, 1952	12.54	
			Feb. 18, 1953	11.73	
			Nov. 10, 1954	15.93	
			Jan. 20, 1955	14.94	
Q-103	Charlie Deerman	3773.21	June 13, 1952	12.25	
			Feb. 18, 1953	11.56	
			Nov. 10, 1954	15.56	
			Jan. 20, 1955	14.67	
Q-105	Joe Deerman	3770.14	June 11, 1952	11.02	
			Feb. 18, 1953	10.40	
			Nov. 10, 1954	13.93	
Q-106	C. M. Tallmon	3768.15	Feb. 18, 1953	9.66	
			Nov. 10, 1954	12.93	
			Jan. 20, 1955	12.09	
Q-108	D. D. McFaul	3765.75	June 11, 1952	9.65	
			Feb. 18, 1953	8.91	
			Nov. 10, 1954	12.97	
			Jan. 21, 1955	12.07	
Q-109	Mary Groggin	3764.76	June 11, 1952	10.65	
			Feb. 19, 1953	10.30	
			Nov. 10, 1954	12.55	
			Jan. 21, 1955	11.97	
Q-141	Cathcart & Mason	3759.51	June 11, 1952	8.59	
			Feb. 19, 1953	7.31	
			Nov. 11, 1954	9.81	
			Jan. 21, 1955	9.40	
Q-142	Cathcart & Mason	3758.05	June 11, 1952	7.42	
			Feb. 19, 1953	7.25	
			Nov. 11, 1954	7.34	
			Jan. 21, 1955	6.94	
Q-148	Payne-Taylor	3748.22	Apr. 28, 1951	8.23	
			Feb. 16, 1953	8.90	
			Nov. 11, 1954	9.63	
			Jan. 21, 1955	9.53	
Q-149	Payne-Taylor	3745.31	Jan. 15, 1953	4.79	
			Nov. 12, 1954	5.61	
			Jan. 21, 1955	5.50	

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Table 2.- Records of water levels in observation wells, 1951-55--Cont'd.

DONA ANA COUNTY, NEW MEXICO					
Well	Owner	Altitude of land surface (ft.)	Date of measurement	Water level below land surface (ft.)	Remarks
Q-164	L. G. Little	--	Jan. 8, 1954 Nov. 9, 1954 Jan. 19, 1955	11.17 14.05 13.70	
U-9	Paul Harvey	3741.57	Mar. 14, 1952 Jan. 15, 1953	6.91 4.85	
U-10	Paul Harvey	3741.98	Mar. 14, 1952 Jan. 15, 1953	8.33 7.53	
U-35	El Paso Electric Co. observation well A	--	Jan. 15, 1953 Nov. 12, 1954 Jan. 21, 1955	39.53 49.77 47.23	
U-38	El Paso Electric Co. observation well B	--	Nov. 12, 1954 Jan. 21, 1955	63.54 58.09	

Table 3.- Analyses of water from wells in the Hueco bolson and city artesian areas of the El Paso district, Texas, 1949-54

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

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO <sub>2</sub> )	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Chloride (Ca)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Dissolved solids	Hardness as CaCO <sub>3</sub>	Percent sodium	Specific conductance (micromhos at 25°C)	pH		
R-6	El Paso Natural Gas Co. Compressor station well 4	750	Mar. 1, 1954	32	0.02	24	5.6	69	118	33	70	-	4.5	-	312	83	64	505	7.7		
R-7	El Paso Natural Gas Co. Compressor station well 2	771	do.	30	.09	19	4.5	57	111	29	46	-	5.1	-	257	66	65	409	-		
R-15	Ft. Bliss observation well 1	450	Feb. 6, 1952	27	-	31	8.7	132	122	34	187	-	5.0	-	510	114	72	889	7.9		
			Mar. 28, 1952	-	-	-	-	-	125	-	178	-	-	-	-	-	108	-	872	7.6	
			Aug. 26, 1952	-	-	-	-	-	-	129	-	177	-	-	-	-	-	114	-	876	7.7
			Jan. 12, 1953	-	-	-	-	-	-	132	-	177	-	-	-	-	-	116	-	876	7.9
			June 5, 1953	-	-	-	-	-	-	133	-	180	-	-	-	-	-	124	-	877	8.0
			Feb. 25, 1954	-	-	-	-	-	-	133	-	177	-	-	-	-	-	111	-	851	8.2
R-16	Ft. Bliss observation well 2	550	Feb. 13, 1952	27	-	62	16	248	90	23	465	-	4.5	-	984	220	71	1,690	7.8		
			Mar. 28, 1952	-	-	-	-	-	90	-	460	-	-	-	-	-	212	-	1,680	7.6	
			Aug. 26, 1952	-	-	-	-	-	93	-	484	-	-	-	-	-	277	-	1,760	7.5	
			Jan. 12, 1953	-	-	-	-	-	94	-	462	-	-	-	-	-	220	-	1,700	7.5	
			June 5, 1953	-	-	-	-	-	94	-	472	-	-	-	-	-	234	-	1,720	8.0	
			Feb. 25, 1954	-	-	-	-	-	-	98	-	470	-	-	-	-	224	-	1,700	8.0	
R-34	City of El Paso well 23	814	Oct. 6, 1952	30	-	40	13	50	207	42	29	1.2	6.6	-	314	154	42	514	7.7		
R-40	City of El Paso well 21	806	Feb. 9, 1950	-	-	-	-	-	199	-	50	-	-	-	-	162	-	589	8.1		
			Mar. 24, 1951	-	-	-	-	-	195	-	53	-	-	-	-	-	169	-	595	7.5	
R-56	City of El Paso well 20	909	Feb. 9, 1950	-	-	-	-	-	178	-	29	-	-	-	-	139	-	457	8.1		
			Mar. 24, 1951	-	-	-	-	-	176	-	32	-	-	-	-	-	139	-	460	7.5	
V-3	City of El Paso well 8	715	Feb. 10, 1950	-	-	-	-	-	192	-	48	-	-	-	-	182	-	596	8.3		
			Mar. 27, 1951	40	-	48	19	51	194	65	52	-	11	-	401	198	36	608	8.1		
V-4	City of El Paso well 11	736	Apr. 5, 1951	36	-	56	21	78	202	90	92	-	8.7	-	509	226	43	797	7.9		
V-7	City of El Paso well 15	1,078	Aug. 2, 1949	-	-	-	-	-	-	91	86	-	-	-	-	-	-	799	-		
			Feb. 10, 1950	-	-	-	-	-	195	-	87	-	-	-	-	-	99	-	779	8.1	
			Mar. 24, 1951	-	-	-	-	-	196	-	86	-	-	-	-	-	97	-	778	7.8	
V-8	Biggs Air Force Base well 2	780	Mar. 4, 1952	29	-	21	7.1	107	174	75	68	-	2.5	-	429	82	74	665	8.1		
			Dec. 30, 1952	33	.02	20	7.5	113	174	78	69	1.0	3.0	-	411	81	75	667	8.0		
V-9	City of El Paso well 16	909	Aug. 3, 1949	42	-	18	6.4	108	181	69	57	-	5.4	-	399	72	77	641	8.3		
			Nov. 23, 1949	-	-	-	-	-	180	-	58	-	-	-	-	-	72	-	621	8.0	
			June 23, 1950	-	-	-	-	-	181	-	56	-	-	-	-	-	78	-	627	8.0	
			Mar. 27, 1951	45	-	20	7.4	116	168	74	83	-	2.5	-	440	80	76	688	8.2		
V-10	Biggs Air Force Base well 1	780	Dec. 30, 1952	34	.03	19	7.2	102	168	68	61	.8	2.8	-	378	77	74	610	7.9		

Table 3.- Analyses of water from wells in the Hueco bolson and city artesian areas of the El Paso district, Tex., 1949-54--Continued

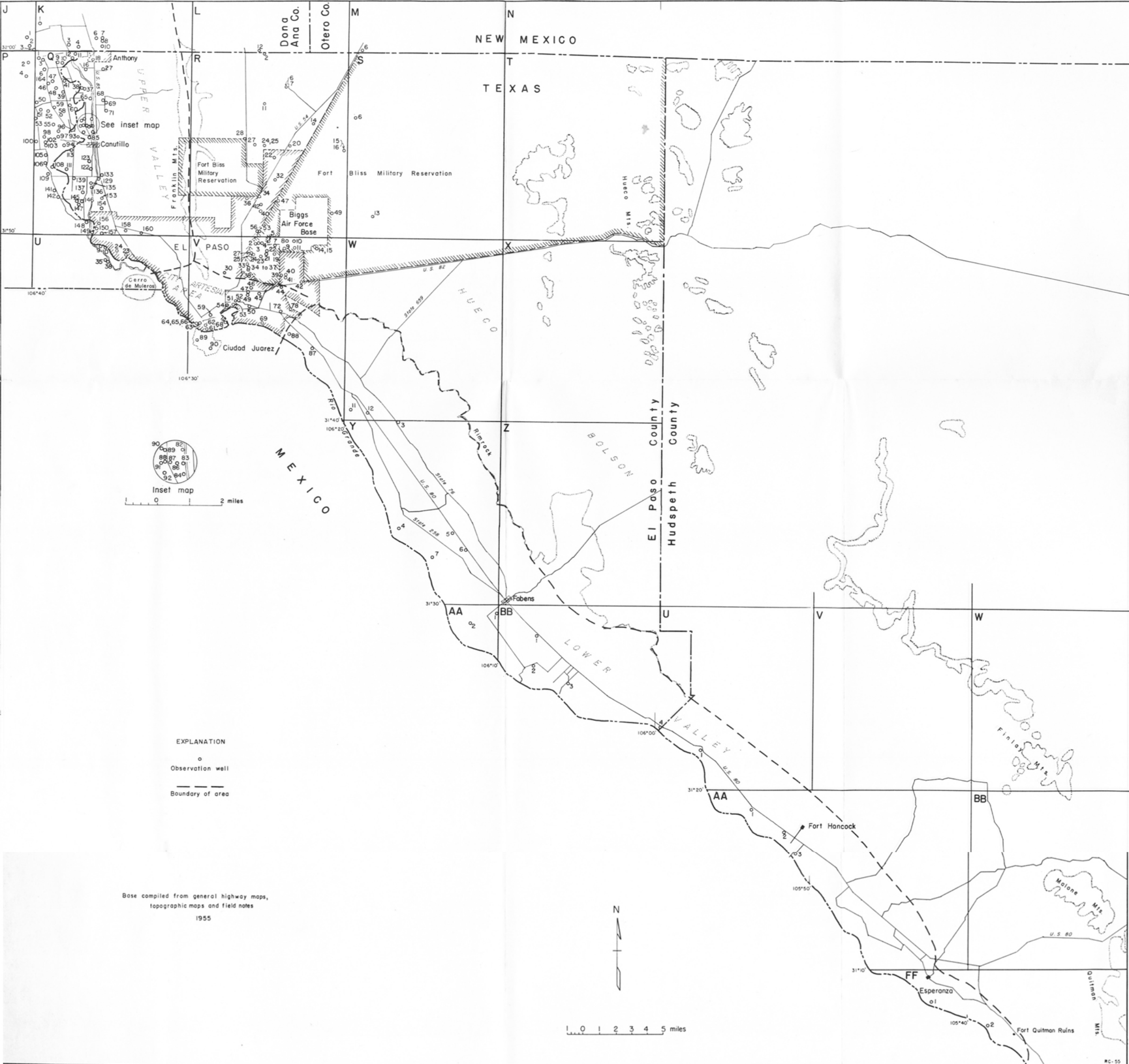
Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO <sub>2</sub> )	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Dissolved solids	Hardness as CaCO <sub>3</sub>	Percent sodium	Specific conductance (microhos at 25°C)	pH
V-14	Biggs Air Force Base observation well 1	500	Dec. 15, 1951 Mar. 28, 1952 Sept. 2, 1952 Feb. 3, 1953 Feb. 4, 1954	26	-	17	6.4	76	167	53	26	0.0	5.5	-	301	69	71	475	8.3
				-	-	-	-	-	169	25	25	-	-	-	-	66	-	476	7.9
				-	-	17	6.7	76	170	51	26	-	6.8	-	304	66	70	472	8.1
				-	-	-	-	-	176	25	25	-	-	-	-	62	-	461	8.4
V-15	Biggs Air Force Base observation well 2	750	Jan. --, 1952 Mar. 28, 1952 Sept. 2, 1952 Aug. 17, 1954	29	-	16	4.9	79	135	54	50	-	2.5	-	329	60	74	511	7.9
				-	-	-	-	-	138	-	54	-	-	-	-	61	-	536	7.8
				-	-	-	-	-	133	-	58	-	-	-	-	65	-	542	8.0
				-	-	-	-	-	138	-	55	-	-	-	-	63	-	520	8.0
V-19	City of El Paso well 19	950	Mar. 24, 1951	-	-	-	-	-	198	-	80	-	-	-	-	96	-	762	7.6
V-21	Ft. Bliss well 7	778	May 14, 1951 May 23, 1952 Apr. 29, 1953 June --, 1954	33 34 36 32	0.08 .00 .01 .00	48 48 50 49	22 20 22 19	100 100 102 104	194 191 197 195	92 91 100 93	118 115 116 116	.9 1.2 1.1 1.1	4.5 4.5 5.6 4.3	0.00	528 517 542 530	210 202 216 200	51 52 51 53	879 882 884 885	7.7 7.7 7.8 7.8
V-23	Ft. Bliss well 6	784	May 14, 1951 May 23, 1952 Apr. 29, 1953 June --, 1954	30 32 32 32	.12 .03 .02 .00	53 45 48 45	20 16 17 15	73 63 68 67	189 177 179 181	72 58 65 57	97 74 83 75	.7 1.0 .9 .9	4.5 5.0 5.4 5.1	.02	461 388 422 394	214 178 190 174	43 44 44 46	762 658 688 655	7.8 7.9 7.8 7.8
V-24	Ft. Bliss well 5	770	Aug. 5, 1949 Apr. 24, 1951 May 14, 1951 May 23, 1952 Apr. 29, 1953 June --, 1954	- 31 42 33 39 39	- - .06 .03 .01 .01	34 42 34 41 43	16 18 13 16 16	61 41 56 52 46	204 186 182 187 184	41 48 48 39 51	48 50 41 46 42	- - 9 9 9 1.0	5.0 7.5 4.5 7.5 9.2	-	338 340 321 346 354	151 179 138 168 174	47 33 47 40 36	539 533 542 537 564 548	7.5 7.5 7.6 7.8 7.9
V-25	Ft. Bliss well 9	653	May 14, 1951 Sept. 22, 1951 May 23, 1952 Apr. 29, 1953 June --, 1954	46 - 42 45 40	.08 - .02 .01 .01	41 - 40 42 40	24 - 20 22 20	45 - 47 45 48	237 226 229 232 227	52 - 48 50 48	28 26 27 28 28	.5 - 8 7 7	12 - 7.8 12 12	.13	366 - 349 376 349	201 184 182 196 182	33 - 36 33 37	573 548 568 566 553	7.7 7.8 7.8 7.8 7.9
V-34	Texas & New Orleans R.R. well 8 (Later redesignated well 1)	869	Feb. 10, 1950 Mar. 22, 1951	34 32	- -	332 352	143 148	159 170	155 155	115 125	1,070 1,130	- -	7.5 5.5	- -	1,940 2,040	1,420 1,490	20 20	3,660 3,820	7.3 7.2
V-38	Texas & New Orleans R.R. well 5	852	Sept. 22, 1951 Mar. 25, 1952 May 26, 1952 May 19, 1953 June 23, 1954	32 32 36 36	- - - -	328 398 393 426	170 179 172 188	244 187 195 224	154 150 150 150	135 141 143 159	1,260 1,320 1,300 1,440	- - - .2	5.0 4.0 8.0 5.5	- -	2,250 2,340 2,360 2,550	1,520 1,730 1,690 1,840	26 19 20 21	4,210 4,370 4,390 4,770 5,510	7.3 7.3 7.7 7.3 7.7
V-39	City of El Paso Airport well 1	530	Aug. 7, 1949	-	-	-	-	-	-	106	72	-	-	-	-	-	-	827	-
V-40	City of El Paso Airport well 2	680	May 26, 1952	50	-	20	8.0	110	204	75	48	1.2	8.3	-	440	83	74	671	8.5
V-41	City of El Paso well 22	754	do.	39	-	18	7.3	115	188	77	61	1.2	3.0	-	422	75	77	680	7.9

Table 3.- Analyses of water from wells in the Hueco bolson and city artesian areas of the El Paso district, Tex., 1949-54--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO <sub>2</sub> )	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Dissolved solids	Hardness as CaCO <sub>3</sub>	Percent sodium	Specific conductance (micromhos at 25°C)	pH		
V-45	City of El Paso well 3	862	Aug. 2, 1949	-	-	-	-	-	-	66	279	-	-	-	-	-	-	1,310	-		
			Feb. 15, 1950	-	-	-	-	-	159	-	288	-	-	-	-	-	250	-	1,320	8.0	
			June 22, 1950	-	-	-	-	-	160	-	292	-	-	-	-	-	242	-	1,310	8.0	
			Mar. 22, 1951	29	-	48	16	200	147	77	298	-	-	0.8	-	-	741	186	70	1,330	7.6
			Oct. 3, 1952	-	-	-	-	-	160	-	308	-	-	-	-	-	259	-	-	1,350	7.9
			June --, 1953	-	-	-	-	-	160	-	301	-	-	-	-	-	255	-	-	1,360	8.1
			June 24, 1954	34	-	71	29	167	160	64	325	0.8	2.0	-	-	-	772	296	55	1,340	7.7
V-49	City of El Paso well 4	882	Aug. 2, 1949	28	-	39	18	184	169	57	266	-	0	-	684	172	70	1,240	8.0		
			Feb. 9, 1950	-	-	-	-	-	159	-	268	-	-	-	-	-	-	-	1,240	7.9	
			May 31, 1950	34	-	49	18	173	160	58	268	7	1.0	-	-	688	196	66	1,250	7.6	
			June 23, 1950	-	-	-	-	-	160	-	260	-	-	-	-	-	180	-	-	1,210	7.9
			Oct. 4, 1950	-	-	-	-	-	160	-	262	-	-	-	-	-	192	-	-	1,230	7.9
			Sept. 18, 1951	-	-	-	-	-	-	56	278	-	-	-	-	-	200	-	-	1,270	8.2
			Sept. 30, 1952	32	-	48	17	187	159	56	286	6	3.0	-	-	-	736	190	68	1,280	8.1
			June 24, 1954	-	-	-	-	-	159	-	288	-	-	-	-	-	182	-	-	1,260	7.9
V-50	City of El Paso well 18	643	Aug. 2, 1949	28	-	50	24	123	169	70	197	-	1.8	-	590	224	54	1,060	7.9		
			Feb. 28, 1950	-	-	-	-	-	159	-	230	-	-	-	-	229	-	-	1,140	8.0	
			June 22, 1950	-	-	-	-	-	166	-	201	-	-	-	-	153	-	-	1,030	8.0	
			May 3, 1951	28	-	56	23	146	162	90	230	-	5	-	-	719	234	58	1,170	8.1	
			Oct. 17, 1952	-	-	-	-	-	160	-	220	-	-	-	-	-	189	-	-	1,100	7.9
			May 19, 1953	-	-	-	-	-	163	-	208	-	-	-	-	-	181	-	-	1,090	7.9
			June 23, 1954	33	-	38	16	147	168	70	190	6	0	-	-	-	161	66	1,020	7.9	
V-51	Mitchell Brewery well 1	353	Feb. 9, 1950	28	-	71	27	190	169	93	329	-	1.0	-	878	288	59	1,500	7.8		
			Apr. 24, 1951	29	-	75	30	188	172	94	340	-	1.0	-	934	310	57	1,530	8.1		
			Sept. 24, 1951	-	-	-	-	-	169	-	330	-	-	-	-	295	-	-	1,510	7.9	
			May 27, 1952	-	-	-	-	-	168	89	340	-	-	-	-	284	-	-	1,520	7.6	
			June 3, 1953	-	-	-	-	-	167	-	348	-	-	-	-	298	-	-	1,540	7.7	
			June 24, 1954	-	-	-	-	-	169	-	348	-	-	-	-	278	-	-	1,550	7.8	
V-52	Mitchell Brewery well 2	354	Apr. 24, 1951	28	-	47	20	136	171	80	193	-	5	-	601	200	60	1,040	8.1		
V-53	City of El Paso well 9	802	Aug. 3, 1949	-	-	-	-	-	-	77	137	-	-	-	-	-	-	901	-		
			Feb. 9, 1950	-	-	-	-	-	181	-	133	-	-	-	-	74	-	-	895	8.1	
			Aug. --, 1950	-	-	-	-	-	182	-	132	-	-	-	-	74	-	-	880	8.3	
			Mar. 22, 1951	-	-	-	-	-	182	-	131	-	-	-	-	76	-	-	864	7.7	
			Oct. 16, 1952	-	-	-	-	-	181	-	130	-	-	-	-	74	-	-	872	8.1	
			June 3, 1953	-	-	-	-	-	184	-	134	-	-	-	-	74	-	-	884	8.2	
June 23, 1954	-	-	-	-	-	184	-	135	-	-	-	-	70	-	-	837	8.0				
V-54	City of El Paso well 14	703	June 27, 1949	-	-	20	7.2	147	168	69	134	-	0	-	489	80	80	859	8.2		
			Feb. 9, 1950	-	-	-	-	-	168	-	135	-	-	-	-	95	-	-	868	8.1	
			June 22, 1950	-	-	-	-	-	168	-	137	-	-	-	-	92	-	-	858	8.2	
			Mar. 23, 1951	-	-	-	-	-	167	-	139	-	-	-	-	99	-	-	855	7.6	
			June 13, 1951	34	0.00	26	10	138	1.6	170	70	139	-	0	-	503	106	74	867	7.9	
			Mar. 24, 1952	-	-	-	-	-	163	-	155	-	-	-	-	94	-	-	943	7.5	
			Oct. 15, 1952	-	-	-	-	-	167	-	149	-	-	-	-	101	-	-	911	7.8	
			June 3, 1953	-	-	-	-	-	165	-	152	-	-	-	-	105	-	-	934	8.0	
			June 23, 1954	-	-	-	-	-	168	-	140	-	-	-	-	93	-	-	869	8.0	

Table 3.- Analyses of water from wells in the Hueco bolson and city artesian areas of the El Paso district, Tex., 1949-54--Continued

Well	Owner	Depth of well (ft.)	Date of collection	Silica (SiO <sub>2</sub> )	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO <sub>3</sub> )	Sulfate (SO <sub>4</sub> )	Chloride (Cl)	Fluoride (F)	Nitrate (NO <sub>3</sub> )	Boron (B)	Dissolved solids	Hardness as CaCO <sub>3</sub>	Percent sodium	Specific conductance (micromhos at 25°C)	pH	
V-59	City of El Paso well 17	750	Feb. 9, 1950	-	-	-	-	-	187	-	93	-	-	-	-	169	-	798	8.1	
			June 23, 1950	-	-	-	-	-	184	-	92	-	-	-	-	-	166	-	790	8.0
			Mar. 24, 1951	-	-	-	-	-	184	-	95	-	-	-	-	-	184	-	789	7.5
			Mar. 24, 1952	-	-	-	-	-	196	-	102	-	-	-	-	-	241	-	876	7.7
			June 23, 1954	-	-	-	-	-	208	-	96	-	-	-	-	-	242	-	884	7.8
V-72	The Texas Co.	694	Aug. 7, 1949	29	-	46	19	181	163	79	262	-	1.2	-	706	193	67	1,290	8.0	
			Feb. 10, 1950	-	-	-	-	-	155	-	224	-	-	-	-	-	134	-	1,140	8.1
			Apr. 24, 1951	36	-	39	13	178	160	76	232	-	1.5	-	663	151	72	1,160	8.2	
			May 26, 1952	-	-	-	-	-	155	73	231	-	-	-	-	-	133	-	1,150	7.8
			Oct. 2, 1952	-	-	-	-	-	155	-	230	-	-	-	-	-	132	-	1,120	8.0
			June 23, 1954	35	-	41	13	192	150	75	262	0.9	-	.5	-	702	156	73	1,240	7.8
V-89	Juarez, Mex., well 1	499	Feb. 23, 1950	-	-	-	-	-	205	-	128	-	-	-	-	370	-	1,120	7.6	
			Apr. 16, 1951	24	-	124	21	87	211	212	135	-	.5	-	715	396	32	1,140	7.9	
V-90	Juarez, Mex., well 3	660	Feb. 9, 1950	-	-	-	-	-	304	-	170	-	-	-	-	542	-	1,470	7.7	
			Apr. 16, 1951	27	-	178	29	111	314	284	178	-	1.0	-	962	563	30	1,500	8.0	



MAP OF EL PASO DISTRICT, TEX., SHOWING THE PRINCIPAL AREAS AND LOCATION OF OBSERVATION WELLS