GROUND-WATER CONDITIONS IN PREMONT-LAGLORIA-FALFURRIAS DISTRICT, TEXAS

By
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PREPARED IN COOPERATION BETWEEN THE GEOLOGICAL SURVEY, U. S. DEPARTMENT OF THE INTERIOR, AND THE TEXAS STATE BOARD OF WATER ENGINEERS

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Introduction

An investigation was made by the writer in the Fremont-LaGloria-Falfurrias district, Texas, during October and November 1943, in response to an inquiry to the Texas State Board of Water Engineers from representatives of a local committee of farmers and others interested in ground-water conditions. A pronounced decline of water levels has occurred in deep wells in the district during the last few years and the committee asked for information regarding the cause of decline and the effect it might have on the supply of ground water available for irrigation and municipal use in the future. The report that follows is based on information obtained in former years as well as data collected by the writer.

Previous investigations and reports

Records of wells in Brooks County including well logs, static water level measurements, use of water, and quality of water data were collected in the winter and spring of 1932-33 by Samuel F. Turner and James C. Cumley. A similar investigation was made in Jim Wells County in the summer and fall of 1933 by Turner and Cumley, and Walter A. Lynch. A. N. Sayre made a study of ground water conditions in Duval County, which adjoins Brooks County on the west, in 1931-32. Water level measurements in several observation wells have been made periodically during the last 10 years in all three counties. These investigations were undertaken as part of state-wide study of the ground waters of Texas, by the State Board of Water Engineers in cooperation with the Federal Geological Survey.

Sayre's report on Duval County 1/, was published as a Water-Supply Paper in 1937. Mimeographed reports giving most of the data obtained in Brooks County 2/, and Jim Wells County 3/ were published separately by counties in 1940. Sundstrom prepared a memorandum on December 6, 1943 giving some of the principal results of the investigation in October

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1/ Sayre, A. N., Geology and ground water resources of Duval County, Texas: U. S. Geol. Survey Water-Supply Paper 776, 1937.

2/ Turner, S. F., and Cumley, J. C., Records of wells, drillers' logs, water analyses and map showing locations of wells, Brooks County, Texas, Mimeographed report, Texas Board of Water Engineers, 1940.

3/ Turner, S. F. Lynch, W. A., and Cumley, J. C., Records of wells, drillers' logs, water analyses, and map showing locations of wells, Jim Wells County, Texas, Mimeographed report, Texas Board of Water Engineers, 1940.

and November 1943 4/.

Source and quality of ground water

The wells in the Premont area draw water from sands which occur at depths ranging from 400 to about 600 feet. These beds dip to the southeast and in the Falfurrias area are usually found at depths ranging from 500 to 900 feet. Shallower sands in the entire Premont-LaGloria-Falfurrias district usually yield highly mineralized water. According to electrical logs of three oil tests of which two are in the vicinity of Premont, and one about four miles northwest of Falfurrias, no other important sands occur within a depth of 1,200 to 1,500 feet below the producing sands.

The water in the producing sands is moderately low in dissolved minerals, and acceptable for most uses as shown by analyses of water from five representative wells on page 13. Little is known regarding the character of the deeper waters. Well 417, seven miles northwest of Premont, was drilled as an oil test in 1940 and the casing was set and cemented at 2,356 feet. Later the casing was reported by the owner to have been perforated at 2,300± feet and it then had a flow of 175 gallons of water a minute. An analysis of the water is given in the table of analyses. The water is too highly mineralized for most uses.

Comparative use of ground water, 1932-33 and 1943

Irrigation -- In 1932-33 a total of 850 to 950 acres of citrus fruit and vegetables was being irrigated from wells in the Premont-LaGloria-Falfurrias district of which about 350 acres were in Jim Wells County and 500 to 600 acres in Brooks County. In 1943 the total area irrigated was about the same as it was in 1932, but the centers of pumping had shifted, about 580 acres being irrigated in Jim Wells County and 380 acres in Brooks County. In Jim Wells County the irrigation development now is the heaviest between LaGloria and Premont and in an area recently developed several miles northwest of Premont, while in Brooks County the greater part is in the area east of Falfurrias. No accurate figures are available as to the total amount of ground water used for irrigation, but it is assumed that there has been no net increase since 1932-33. If, as seems probable, the average duty of water is of the order of magnitude of two-acre feet per acre the total annual withdrawals for irrigation would amount to about 1,900 acre-feet which is the equivalent of about 1,700,000 gallons a day throughout the year.

Public supply -- In 1932-33 Premont was considerably smaller than it is today and was served from privately owned comparatively shallow wells. In 1940 the city constructed a water system including a well 520 feet in depth. In 1943 the estimated average daily pumpage for the city was 50,000

4/ Sundstrom, R. W., 1943 Memorandum on the ground water supplies in the vicinity of the LaGloria Refinery, southern Jim Wells County, Texas. Manuscript report in files of Board of Water Engineers and Geological Survey at Austin.

gallons a day. At Falfurrias the daily pumpage averaged about 200,000 gallons a day in 1943 compared with about 125,000 a day in 1932-33.

Oil and gas development -- Oil and gas were discovered in the Premont-LaGloria-Falfurrias district in 1937 and since then about 250 oil and gas wells have been drilled. About 50 of these wells are in the LaGloria field between Falfurrias and Premont and about 200 are in the Premont field which starts at the city limits of Premont and extends several miles to the east and northeast. It is estimated that an average of about 12 wells a month are being drilled in the Premont field and from one to two wells a month in the LaGloria field, and that at least one million gallons of water is required to drill each well. On this basis an average of at least 500,000 gallons of water a day are being used for the drilling of oil. In addition each oil company has field headquarters or camps of which there are four or five and these use well water in considerable quantities for domestic use, oil treatment, washing equipment, etc. This probably raises the total to about 600,000 gallons of water a day.

In 1941 a recycling and gasoline plant was built about 1½ miles southwest of LaGloria and according to reports by plant operators this plant uses an average of about 600,000 gallons a day.

Increase in use of ground water 1932-33 to 1943 -- From the above figures it is estimated that ground water withdrawals in the Premont-LaGloria-Falfurrias district, exclusive of water used for individual family supply and stock, amounted to an average of about 3,150,000 gallons a day in 1943 as compared with about 1,825,000 gallons a day in 1932-33. This represents an increase of about 70 per cent. The figures are given in detail in the following table:

Estimated average daily withdrawals of ground water in Premont-LaGloria-Falfurrias district, Texas, in 1932-33 and 1943
(in gallons a day)

Use of water	1932-33	1943	Increase
Irrigation	1,700,000	1,700,000	0
Public supply	125,000	250,000	125,000
Oil well drilling and operation	0	600,000	600,000
Recycling plant	0	600,000	600,000
TOTAL	1,825,000	3,150,000	1,325,000

Decline of water levels in representative wells in the Premont-LaGloria-Falfurrias district and adjacent territory

Well No.	Owner	Depth of well (ft.)	Water level in feet below measuring point		Decline of water level in feet
			1932-33	1943	1932-33 to 1943
			Vicinity of Premont		
Jim Wells County					
244	Mrs. H. M. King Est.	474	57.5	74.4	16.9
269	R. P. Wynne	500±	37	64.0	27.0
272	Miguel Santos	400±	58.3	75.5	17.2
292	W. A. Cobb	524	45.5	72.5	27.0
307	A. R. Clark	390	43.8	61.4	17.6
314	H. S. Hewitt	500±	41.6	60.7	19.1
316	C. T. Hewitt	700	48.4	71.2	22.8
318	N. H. Zieger	489	55.4	78.9	23.5
329	T. & N. O. R. R.	553	44.4	67.3	22.9
330	L. H. Franz	540	42.5	63.3	20.8
357	Nelson English	532	36.4	58.6	22.2
418	City of Premont	520	a/46	71.1	25.1
429	Clyde Wright	480	a/37.8	58.4	20.6
430	Chris. Hansen	480	a/35.7	57.6	21.9
431	J. R. Friesen	515	a/43.8	64.3	20.5
432	W. R. Stewart	640	a/42.3	64.1	21.8

Decline of water levels in representative wells in the Premont-LaGloria-Falfurrias district and adjacent territory--Continued

Well No.	Owner	Depth of well (ft.)	Water level in feet below measuring point			Decline in water level in feet	
			1932-33	1939	1943	1932-33 to 1943	1939 to 1943
			Vicinity of LaGloria				
Jim Wells County							
346	Charlie Premont	482	28.5	--	47.1	18.6	--
359	F. J. Corrigan	488	30.0	--	52.2	22.2	--
374	E. G. Maun	475	16.8	b/28.2	32.0	15.2	3.8
377	Dale Maun	495	9.6	17.8	30.6	21.0	12.8
382	J. H. Patzakowsky	700+	21.1	--	46.2	24.1	--
392	B. W. Voght	650+	27.5	--	51.0	23.5	--
393	Dr. -- Padgett	540	26.7	--	47.3	20.6	--
397	John Minter	540	25.2	--	43.1	17.9	--
399	O. M. Boone	600	21.4	--	44.2	22.8	--

Decline of water levels in representative wells in the Premont-LaGloria-Falfurrias district and adjacent territory--Continued

Well No.	Owner	Depth of well (ft.)	Water level in feet below measuring point			Decline in water level in feet	
			1932-33	1939	1943	1932-33 to 1943	1939 to 1943
			Vicinity of Falfurrias				
Brooks County							
209	Lasater Est.	120±	28.0	--	34.5	6.5	--
211	do.	752	9.0	--	18.0	9.0	--
224	do.	810±	Flow	Flow	Flow	--	--
254	F. G. Maun	500±	11.0	15.9	27.5	16.5	11.6
265	A. B. Watts	770±	16.7	--	30.4	13.7	--
266	Col. J. E. McDonald	500±	12.0	18.3	24.6	12.6	6.3
270	I. W. Storey	770±	18.5	21.9	34.7	16.2	12.8
273	Geo. Franks	710	11.5	17.2	23.3	11.8	6.1
276	C. H. Hopper	865	19.6	--	26.2	6.6	--
280	Central Power Light Co.	755	14.0	--	26.4	12.4	--
281	do.	749	15.0	--	29.2	14.2	--
301	H. Hanson	808	12.3	--	23.3	11.0	--
304	J. H. Scaggs	950	13.8	--	26.3	12.5	--
307	Doris Taylor	604	12.1	--	23.1	11.0	--
308	Richard Miller	607	13.2	--	23.4	12.2	--
310	Val Stockton	590	14.1	--	25.3	11.2	--
311	J. R. Scott, Jr.	591±	14.2	--	23.7	9.7	--
337	John E. Boykin	900±	9.6	13.4	16.0	6.4	2.6
340	Dr. H. M. Bennett Est.	742	4.0	8.0	10.9	6.9	2.9
377	D. Longoria	--	15.4	--	31.0	15.6	--
381	R. B. Klump	670	20.8	--	37.6	16.8	--
390	Southern Pacific Lines	810	11.5	15.4	20.2	8.7	4.8
397	A. W. Dale	520	16.6	23.2	23.9	7.3	0.7
401	D. B. Fort	518	19.5	--	27.3	7.8	--
405	A. Rupp	612±	18.1	b/ 22.5	29.7	10.6	7.2
406	C. K. Russell	500±	14.1	--	22.3	8.2	--
451	T. S. Proctor	562	9.7	--	17.6	7.9	--
470	East Ward School	478	15.8	--	24.7	8.9	--
471	E. W. McKeaig	621	10.0	--	18.4	8.4	--
474	A. Rupp	472±	19.0	b/ 21.1	25.5	6.5	4.4
481	S. R. Boykin	720±	4.7	--	11.1	6.4	--
503	J. F. Dawson	607	6.5	--	15.1	8.6	--
504	Neal Rupp	488	21.8	25.5	29.8	8.0	4.3
505	do.	621	20.0	23.8	32.0	12.0	8.2
507	Elmer Rupp	499	28.5	--	35.7	7.2	--

Decline of water levels in representative wells in the Premont-LaGloria-Falfurrias district and adjacent territory--Continued

Well No.	Owner	Depth of well (ft.)	Water level in feet below measuring point		Decline of water level in feet	
			1934	1943	1934 to	1943
			Southwestern Kleberg County			
26	Cabeza Chica	477	32.5	50.8	18.3	
27	Cabeza	--	34.8	48.3	13.5	
29	Anagua	--	32.8	49.8	17.0	
37	Mesquite	586	15.5	30.1	14.6	
38	Escondido	--	25.6	40.5	14.9	
41	Alazan	465	21.5	29.3	7.8	
43	Bancero	--	19.9	34.9	15.0	
44	Media	475	38.6	55.7	17.1	
46	Ebonito	397	31.3	48.7	17.4	
49	Balancion	630	23.6	36.5	12.9	
51	Laguna Larga	--	18.4	28.1	9.7	
52	Saranpion	619	13.7	22.5	8.8	
53	Canelo	495	15.3	24.6	9.3	

Well No.	Owner	Depth of well (ft.)	Water level in feet below measuring point			Decline in water level in feet c/	
			1933	1939	1943	1933 to 1943	1939 to 1943
			Southeastern Duval County				
201	Maria Villareal	125	78.3	75.6	74.0	+ 4.3	+ 1.6
203	N. E. Martinez	200	49.1	51.3	58.1	9.1	6.8
204	Hilarie Saenz	310	61.4	70.7	73.8	12.4	3.1
319	San Antonio Loan and Trust Co.	340	24.8	27.8	36.3	11.5	8.5
325	Val Stockton	295	b/ 39.0	--	42.5	3.5	--

a/ Water level in nearby well. Altitude of measuring point adjusted to that used in 1943.
b/ Measurement made in 1938.
c/ Plus (+) indicates increase of water level.
d/ Measurement made in 1931.

Height of measuring point above ground, altitude of measuring point and altitude of water surface in November 1943 in wells in Premont-LaGloria-Falfurrias district.

Well No.	Height of measuring point above ground (ft.)	Altitude: Measuring point (ft.)	Altitude: Water surface, 1943	Well No.	Height of measuring point above ground (ft.)	Altitude: Measuring point (ft.)	Altitude: Water surface, 1943
			Vicinity of Premont				
Jim Wells County							
244	0.8	-	-	329	0.7	151.1	83.8
269	1.4	-	-	330	1.0	-	-
272	1.0	-	-	357	1.2	-	-
292	3.5	-	-	418	1.0	154.	83.
307	1.0	-	-	429	0.8	-	-
314	1.7	-	-	430	2.0	-	-
316	1.5	-	-	431	1.5	-	-
138	2.0	-	-	432	2.5	-	-
			Vicinity of LaGloria				
346	1.4	-	-	392	2.3	132.2	81.2
359	2.5	-	-	393	4.2	128.1	80.8
374	2.5	155.6	123.6	397	1.0	116.0	72.9
377	3.2	135.1	104.5	399	0.2	127.7	83.52
382	1.3	-	-				
			Vicinity of Falfurrias				
Brooks County							
209	0.6	151.8	117.3	340	1.7	111.4	100.5
211	1.5	140.6	122.6	377	1.5	107.7	76.7
224	0.0	-	-	381	1.0	118.3	80.7
254	3.0	131.3	103.8	390	0.0	107.6	87.4
265	1.0	117.3	86.9	397	0.0	104.6	80.8
266	0.8	129.5	104.9	401	1.8	100.7	73.5
270	2.2	-	-	405	2.0	100.0	70.3
273	0.8	128.4	105.2	406	1.0	91.4	69.1
276	1.5	126.4	100.2	451	1.2	103.5	85.9
280	0.9	114.7	88.3	470	1.0	94.5	69.1
281	3.5	111.5	82.4	471	0.8	84.3	65.9
301	1.0	131.4	108.0	474	1.0	93.4	67.9
304	3.2	127.6	101.3	481	0.5	109.5	98.4
307	1.5	122.0	98.9	503	1.5	86.6	70.5
308	2.0	122.3	96.9	504	5.3	-	-
310	3.0	118.0	82.7	505	7.5	-	-
311	1.2	118.8	95.1	507	1.8	105.2	69.5
337	1.0	115.7	99.7				

Height of measuring point above ground, altitude of measuring point and altitude of water surface in November 1943 in wells in Premont-LaGloria-Falfurrias district--Continued.

Well No.	Height of measuring point above ground (ft.)	Altitude		Well No.	Height of measuring point above ground (ft.)	Altitude	
		Measuring point (ft.)	Water surface, 1943			Measuring point (ft.)	Water surface 1943
			Southwestern Kleberg County				
26	1.0	-	-	44	1.0	-	-
27	1.2	-	-	46	2.0	-	-
29	1.7	-	-	49	2.8	-	-
37	1.7	-	-	51	1.0	-	-
38	1.5	-	-	52	1.0	-	-
41	1.0	-	-	53	1.5	-	-
43	1.0	-	-				
			Southwestern Duval County				
201	1.0	-	-	319	1.0	-	-
203	2.5	-	-	325	2.5	-	-
204	2.2	-	-				

Decline of water levels in wells

It is reported that the first deep well in the Premont-Falfurrias district was drilled at Falfurrias about 1900, and irrigation from wells was begun about 1910. Most of the early deep wells (500 to 900 feet) had a flow when drilled but the flow had ceased several years prior to the investigation in 1932-33. The decline in head has increased with the rate of pumping. The decline shown by periodic water level measurements in representative wells is discussed by areas below.

Vicinity of Premont -- In the 16 wells near Premont for which records are available the decline of water levels from 1932-33 to 1943 ranged from 16.9 to 27 feet and averaged 21.7 feet. No data are available to show how much of the decline occurred from 1939 to 1943. Two measurements in the city well at Premont show the decline from 1943 to 1943. The water level in the well was 61.28 feet below land surface in July 1942 according to records of John W. Duerksen, City Clerk, and on November 4, 1943 it was 70.08 feet or 8.80 feet below the level recorded in 1942.

Vicinity of LaGloria -- In nine wells in the vicinity of LaGloria the decline of water levels from 1932-33 to 1943 ranged from 15.2 to 24.1 feet and averaged 20.7 feet. One well (No. 374) showed a decline of 3.8 feet and another (No. 377) 12.8 feet from 1939 to 1943.

Vicinity of Falfurrias -- In 34 wells in the vicinity of Falfurrias the decline of water levels from 1932-33 to 1943 ranged from 6.4 to 16.8 feet and averaged 10.3 feet. In 12 of these wells the decline from 1939 to 1943 ranged from 0.7 to 12.8 feet and averaged 6.0 feet. Well 224, three miles south of Falfurrias, still had a small flow in 1943 but no previous data are available to determine the decrease of flow that has occurred during the last 10 years.

Southwestern part of Kleberg County -- Records of water levels in 1934 and 1943 are available for 13 wells in the southwestern part of Kleberg County within a few miles of the Premont-LaGloria-Falfurrias district. These wells showed a decline during the nine year period ranging from 7.8 to 17.4 feet and averaging 13.6 feet. No measurements were made between 1934 and 1943 and it is not possible to determine whether the rate of decline was fairly uniform or was accelerated in recent years by the increase in pumping in the Premont-LaGloria-Falfurrias district.

Southeastern part of Duval County -- Much of the outcrop area of the water-bearing beds that supply ground water to the Premont-LaGloria-Falfurrias district lies to the west and northwest in Duval County. In the southeastern part of that county, shown on the map, the beds are up dip and the wells, therefore, are not as deep as they are in the Premont-LaGloria-Falfurrias district. Periodic water level measurements were made in five wells in that territory from 1933 to 1943. Four of them showed a decline ranging from 3.5 to 12.4 feet and averaging 9.1 feet. Well 201 showed a rise of 4.3 feet. That well, however, is only 125 feet deep and may not draw from the same sands as those penetrated in the Premont-LaGloria-Falfurrias district. Three of the wells (Nos. 203, 204, and 219) had a decline of 6.8, 3.1, and 8.5 feet, respectively, from 1939 to 1943.

Tables are given on pages 6 to 9 showing the decline in water levels in 77 wells in the Premont-LaGloria-Falfurrias district and adjacent territory.

Summary

The fresh water-bearing sands in the Premont-LaGloria-Falfurrias district crop out in Duval County and dip toward the southeast to increasingly greater depths. They are penetrated by wells at about 400 to 600 feet in the Premont area and about 500 to 900 feet in the Falfurrias area. Nearly all the water used in the district comes from these sands, the principal withdrawals being for irrigation, for the production of oil and gas and for public supply. The water is comparatively low in dissolved minerals and is acceptable for most uses. Sands above and below the main water-bearing beds generally are thin and yield highly mineralized water.

It is estimated that the total draft on the ground water reservoir increased from about 1,825,000 gallons a day in 1931-32 to about 3,150,000 gallons a day in 1943, the increase amounting to about 70 per cent. This increase was due to the development of oil and gas which started about 1937, and to the accompanying growth in population. There was little change during the period in the total amount of water used for irrigation but the centers of irrigation pumping have shifted, the irrigated acreage having increased in the vicinities of Premont and LaGloria, and decreased in the vicinity of Falfurrias.

The cone of depression produced by the pumping has spread over a wide extent of territory. Measurements made in more than 70 wells in southern Jim Wells County, northern Brooks County, southwestern Kleberg County and southeastern Duval County show a general decline in water levels from 1932-33 to 1943, the average decline being 17.7 feet.

The decline has been greatest in the areas of heavy pumping near Premont and LaGloria and most of it in those areas is believed to have occurred since the start of the oil and gas development. In the Falfurrias area 14 observation wells, for which periodic measurements are available, showed an average decline of 11.4 feet from 1932-33 to 1943 of which an average of 5.1 feet occurred before 1939 and 6.3 feet between 1939 and 1943.

If the pumping is maintained at the same rate as it was in 1943 the decline in water levels will continued, but at a slower rate. If the pumping is increased the rate of decline will increase. If there is a material decrease in pumping there should be some recovery in the water levels. There is little immediate cause for concern over the decline thus far. Considerable

water has been taken from storage in the underground reservoir but it has not been seriously depleted. However, the proportionally large and wide spread decline in response to a comparatively small amount of pumping points to the conclusion that a very large increase would be inadvisable. The problem is largely economic. As the water levels decline the cost of pumping will increase. Pumps will have to be lowered and in some instances, where because of a reduction in the casing the pumps cannot be lowered, new wells will have to be drilled.

APPROVED:

DATE: May 20, 1944

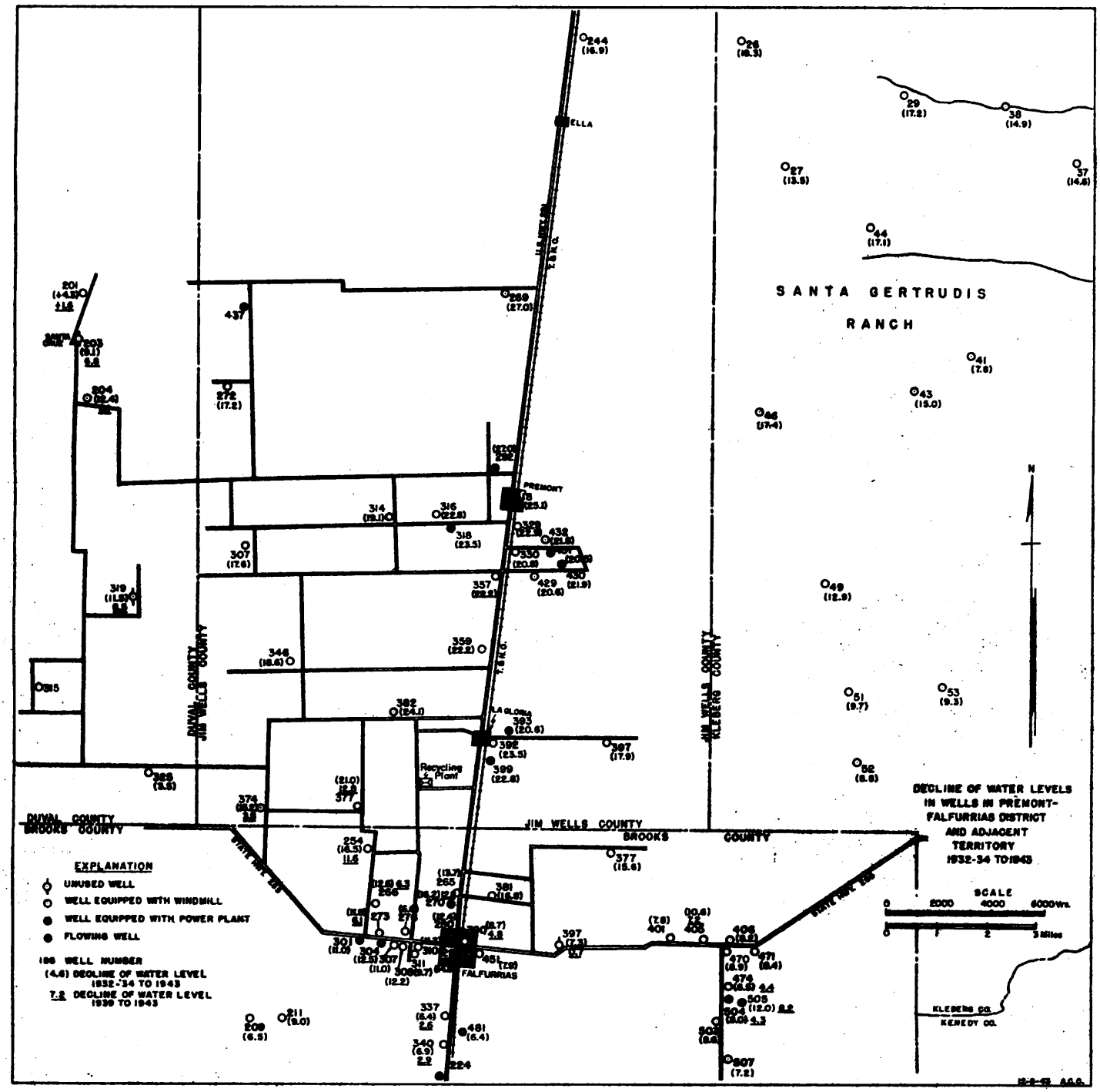
BY : _____
W. N. White
Senior Engineer

Partial chemical analyses of water from wells in the Premont-LaGloria-Falfurrias district, Texas

Analyzed by Margaret D. Foster, E. W. Lohr and J. H. Rowley, Chemists, Geological Survey, U. S. Department of the Interior. Results are in parts per million. Well Numbers correspond to numbers in table of well measurements.

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total hardness as $CaCO_3$ (calc.)
							Brooks County								
280	Central Power & Light Co.	755	Apr. 5, 1940 a/	571	-	-	39	18	162	285	b/ 24	188	-	-	171
507	Elmer Rupp	499	Apr. 7, 1933 a/	562	-	0.92	50	15	148	316	63	130	-	0.0	186
							Jim Wells County								
374	E. G. Maun	475	Apr. 7, 1933 a/	601	-	2.6	40	18	172	278	26	208	-	.5	174
399	O. M. Boone	600	Nov. 6, 1943	740	-	-	51	19	188	284	79	204	-	16	206
418	City of Premont	520	Oct. 14, 1943	764	14	.08	52	19	206	284	67	224	0.5	17	208
437	H. M. Engleking	2,356	Mar. 10, 1944	1,770	19	.02	14	0.7	610	140	656	396	2.3	1.2	38

a/ Calculated.
b/ By turbidity.


SANTA GERTRUDIS
RANCH
KELLA
FREMONT
LA GLORIA
FALFURRIAS
Recycling & Plant
DUVAL COUNTY
BROOKS COUNTY
JIM WELLS COUNTY
KLEBERG COUNTY
KENEDY CO.
EXPLANATION
UNUSED WELL
WELL EQUIPPED WITH WINDMILL
WELL EQUIPPED WITH POWER PLANT
FLOWING WELL
198 WELL NUMBER
(4.6) DECLINE OF WATER LEVEL 1932-34 TO 1943
7.2 DECLINE OF WATER LEVEL 1939 TO 1943
DECLINE OF WATER LEVELS IN WELLS IN FREMONT-FALFURRIAS DISTRICT AND ADJACENT TERRITORY 1932-34 TO 1943
SCALE
0 2000 4000 6000 Ft.
0 1 2 3 Miles
N