

Water Levels and Artesian Pressure in Observation Wells in the United States in 1947

Part 6. Southwestern States and Territory of Hawaii

Prepared under the direction of C. G. PAULSEN, Chief Hydraulic Engineer

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*Prepared in cooperation with the States
of Arizona, California, and New Mex-
ico, the Territory of Hawaii, and other
agencies*



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PREFACE

This report was prepared by the Geological Survey in cooperation with the States of Arizona, California, New Mexico, the Territory of Hawaii, and other agencies, by personnel of the Water Resources Division under the direction of:

C. G. Paulsen	Chief Hydraulic Engineer
A. N. Sayre	Chief, Ground Water Branch
S. F. Turner	District Engineer (Ground Water), Tucson, Ariz.
J. F. Poland	District Geologist (Ground Water), Long Beach, Calif.
G. A. Macdonald	District Geologist (Ground Water), Honolulu, Hawaii
C. V. Theis	District Geologist (Ground Water), Albuquerque, N. Mex.

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WATER LEVELS AND ARTESIAN PRESSURE IN OBSERVATION WELLS
IN THE UNITED STATES IN 1947

Part 6. SOUTHWESTERN STATES

INTRODUCTION

By A. N. Sayre and others

Significance of records of water level and artesian pressure

The rock formations of the earth are great natural reservoirs in which a part of the water derived from rain and snow is stored to supply wells and springs and to maintain the flow of streams during periods of fair weather. Water levels in wells register the stages of these natural reservoirs; they show the extent to which water supplies are depleted by drought or by heavy pumping, whether for public waterworks, irrigation, or industrial uses, and the extent to which they are replenished in seasons of abundant rainfall or melting snow. The changes in pressure recorded on flowing wells indicate depletion or replenishment of the artesian reservoirs.

Annual publication of records by Geological Survey

The regular publication of records of water level and artesian pressure in the United States was begun by the Geological Survey in 1935 and has continued yearly since. The records for the entire country were published in a single volume each year through 1939. Beginning with 1940 the records have been published in six volumes, covering the northeastern, southeastern, north-central, south-central, northwestern, and southwestern sections of the country. Hawaii is included in the southwestern section. (See fig. 1.) The following table gives the numbers of these reports. This series of water-supply papers is in a sense an inventory, year by year, of the ground-water supplies in such parts of the country as have been covered.

Water-supply papers on water levels and artesian pressure in observation wells in the United States

Year	North-eastern States	South-eastern States	North-central States	South-central States	North-western States	South-western States and Hawaii
1935	777	777	777	777	777	777
1936	817	817	817	817	817	817
1937	840	840	840	840	840	840
1938	845	845	845	845	845	845
1939	886	886	886	886	886	886
1940	906	907	908	909	910	911
1941	936	937	938	939	940	941
1942	944	945	946	947	948	949
1943	986	987	988	989	990	991
1944	1016	1017	1018	1019	1020	1021
1945	1023	1024	1025	1026	1027	1028
1946	1071	1072	1073	1074	1075	1076
1947	1096	1097	1098	1099	1100	1101

Scope of present volume

The present volume covers the southwestern States and gives records of water level and artesian pressure in about 2,277 observation wells of the Geological Survey and cooperating agencies in Arizona, California, Hawaii, and New Mexico. Of these wells, 50 are equipped with automatic water-stage recorders. For some wells not previously reported complete records of water level are given in this volume, including those of the years before 1947. For wells whose previous records have been published this volume gives only the current records. If a complete description of a well has been published in a previous report, only the well number or the well number and a brief identifying description are given in this report. The numbers in parentheses immediately following a well number are those of the water-supply papers in which earlier records of that well are given and the pages on which they appear. An asterisk indicates that a description of the well is given in the paper whose number is so marked. This report includes about 8,690 individual determinations of water level and artesian pressure.

Land-surface datum

Before 1943, in Geological Survey reports, the water levels and artesian pressures for some wells were given in feet above or below the measuring points and for other wells in feet above or below sea level or above or below various assumed datum planes. It had been considered inadvisable to adopt a standard procedure in expressing water levels and artesian heads until after a period of trial with datum planes of different kinds. In

1943, however, it was decided that uniform practice should be adopted. Accordingly, precise datum planes were established approximating the land surface at each well. The water levels and artesian heads for all wells listed in this report are given in reference to land-surface datum planes.

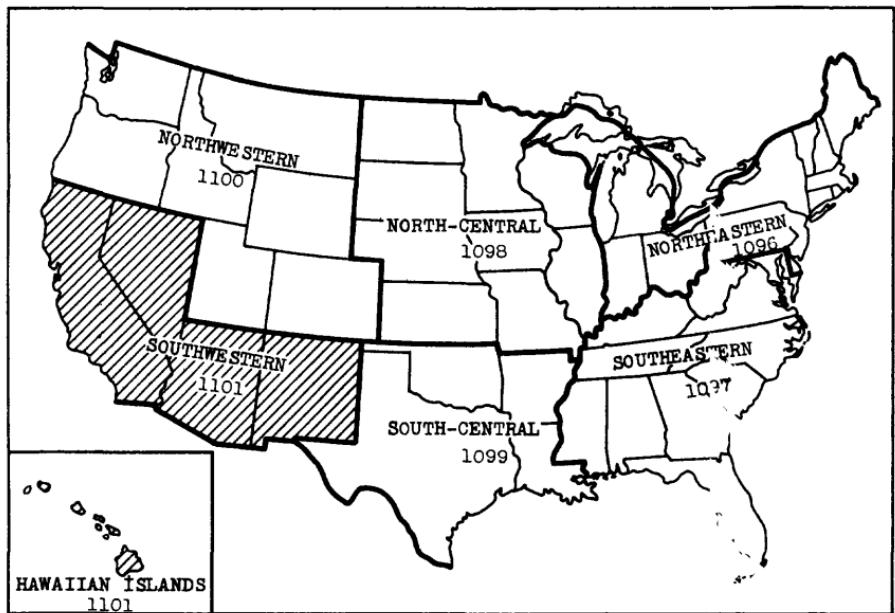


Figure 1.--Outline map of the United States showing sections of the country covered by the six water-supply papers on water levels and artesian pressure in observation wells in 1947. The shaded section represents the part of the country covered by this volume.

If the water levels or artesian heads are referred to land-surface datum for the first time, a conversion factor is given in the descriptive matter preceding them in order to facilitate comparison of the older and newer records. Wherever the conversion factor is given in earlier reports it is not repeated in this report. New data as to the positions of the measuring point and of the bench marks, in feet above or below land-surface datum planes, will be published in succeeding annual reports.

Network of key observation wells

During 1942 the Geological Survey established a network of key observation wells in order to make available current information on general ground-water conditions over the country. These wells were selected because the fluctuations of water level in them are believed to be typical

and they represent the general fluctuations that occur in the parts of the country in which the wells are situated. At the end of 1947 the network included about 160 wells in 45 States. About 40 of the wells were established expressly for the network in 1942 and about 20 were established in 1943; the other 100 were selected from wells measured regularly in connection with cooperative ground-water investigations. The coverage of the country is still far from adequate, and it is expected that some wells not now included will be added to the network from time to time.

Changes in ground-water level in 1947 in the southwestern part of the United States

The average precipitation in all of the States in the southwestern section of the country and in the Territory of Hawaii was below normal for the year. The fluctuations of both water level and artesian pressure in wells depend, however, on many factors besides the amount of precipitation. In certain of the observation wells there are fluctuations caused by differences in the rate of pumping or artesian flow from other wells in the area, but most of the observation wells are not noticeably affected by pumping or artesian flow. A summary of the changes in ground-water level is given in the chapter for each State.

Acknowledgments

Acknowledgments for effective services in the preparation of this water-supply paper are due Misses Dorothy M. Ireland and Beulah B. Brunson, and Mrs. Nauvoo Ragland, Mrs. Frances Dowell, and Rodney Hart. Miss Ireland had general charge of the assembling of the several reports and did the editing; Mr. Hart prepared the illustrations; and Miss Brunson, Mrs. Ragland, and Mrs. Dowell did the offset typing.

ARIZONA

PROGRAM OF WORK

By S. F. Turner and R. L. Cushman

Studies of the ground-water resources of Arizona were continued in 1947 in cooperation with the State Land Department. The 1947 program consisted of measuring water levels in selected wells throughout the State, making an inventory of the pumpage in the principal ground-water basins, and writing reports about the geology, ground-water resources, and quality of ground water in several of the important ground-water basins in the State.

List of reports issued in 1947

Ground-water resources of the Duncan Basin, by L. C. Halpenny, H. M. Babcock, R. B. Morrison, and J. D. Hem.
Geology and ground-water resources of Paradise Valley, Maricopa County, by H. R. McDonald, H. N. Wolcott, and F. I. Bluhm.
Ground-water resources of Peeples Valley, by H. M. Babcock and S. C. Brown.
Geology and ground-water resources of the Salt River Valley, Maricopa and Pinal Counties, by H. R. McDonald, H. N. Wolcott, and J. D. Hem.
Ground-water resources and problems of the Cactus Flat-Artesia area, San Simon Basin, by L. C. Halpenny and R. L. Cushman.
Ground-water resources of the Holbrook area, Navajo County, by H. M. Babcock and C. T. Snyder.
Further investigations of the ground-water resources of the Santa Cruz Basin, by S. F. Turner and others.
Geology and ground-water resources of the San Simon Basin, Cochise and Graham Counties, by R. L. Cushman and K. S. Jones.
Definitions of geologic, hydrologic, and chemical terms used in reports on the ground-water resources and problems of Arizona, by L. C. Halpenny, J. D. Hem, and I. I. Jones.
Geology and ground-water resources of the Wellton-Mohawk area, Yuma County, by H. M. Babcock and S. C. Brown.
Geology and ground-water resources of the Willcox Basin, Cochise and Graham Counties, by K. S. Jones and R. L. Cushman

PUMPAGE

The amount of water pumped from wells in Arizona during 1947 exceeded the 1946 pumpage by more than 125,000 acre-feet. The 1947 pumpage comprised about 68 percent of the total water used for irrigation. The following table contains a summary of the amounts of water pumped in the basins since 1940. The increase in pumpage in 1947 was used to make up for the scarcity of surface water and to irrigate newly cleared land.

Pumpage, in acre-feet, from wells in the principal ground-water areas of Arizona

Area	Pumpage			
	1940	1941	1942	1943
Cochise County:				
San Simon Basin	3,100	(a)	(a)	(a)
Willcox Basin	(a)	(a)	(a)	(a)
Douglas Basin	(a)	(a)	(a)	(a)
Graham County:				
Cactus Flat-Artesia area.	(a)	(a)	(a)	(a)
Safford Valley	24,600	8,685	18,900	35,000
Greenlee County:				
Duncan-Virden Valley ^b /	2,436	1,348	1,900	7,100
Pima County:				
Part of Santa Cruz River	(a)	68,500	85,500	100,000
Pinal County:				
Part of Santa Cruz and Gila River Basins	372,000	351,000	500,000	515,000
Maricopa County:				
Salt River Valley area ^c /	943,000	444,000	1,004,000	1,104,000
Gila Bend area	(a)	(a)	(a)	(a)
Santa Cruz County:				
Part of Santa Cruz River basin	(a)	11,500	14,500	15,000
Yuma County:				
DateLand area	(a)	(a)	(a)	(a)
Wellton-Mohawk area	(a)	(a)	(a)	(a)
South Gila Valley	(a)	(a)	(a)	(a)
	1944	1945	1946	1947
Cochise County:				
San Simon Basin	(a)	(a)	5,800	(a)
Willcox Basin	(a)	9,000	15,500	20,000
Douglas Basin	(a)	8,000	12,500	17,000
Graham County:				
Cactus Flat-Artesia area	(a)	(a)	5,600	(a)
Safford Valley	52,000	35,200	115,000	100,000
Greenlee County:				
Duncan-Virden Valley ^b /	9,500	8,300	21,000	26,000
Pima County:				
Part of Santa Cruz River	106,000	111,000	107,000	145,000
Pinal County:				
Part of Santa Cruz and Gila River basins	530,000	610,000	660,000	700,000
Maricopa County:				
Salt River Valley area ^c /	1,017,000	1,143,000	1,360,000	1,406,000
Gila Bend area	(a)	(a)	33,300	40,500
Santa Cruz County:				
Part of Santa Cruz River Basin	12,500	18,500	24,000	25,000
Yuma County:				
DateLand area	4,000	4,000	4,000	4,000
Wellton-Mohawk area	37,000	35,000	38,000	43,000
South Gila Valley	20,000	22,000	32,000	35,000
Total, 1946			2,434,700	2,561,500

a Not determined.

b Partly in Hidalgo County, N. Mex.

c Includes Queen Creek area, Maricopa and Pinal Counties.

FLUCTUATIONS OF WATER LEVEL

In 1947 the ground-water levels in the pumped areas and in the adjacent unpumped areas declined in amounts varying from 1 foot to more than 10 feet. The water levels in wells beyond the influence of pumping declined, in general, less than 1 foot. These small declines were caused by the below-normal recharge during 1947 and indicate that the larger declines in the pumped areas were only partially caused by the drought conditions. The following pages contain lists of 1,339 water-level measurements made in 457 wells in 1947.

Records of water levels prior to 1947 are given in U. S. Geological Survey Water-Supply Papers 911, 941, 949, 991, 1021, 1028, and 1076, for the years 1940-46, inclusive.

ACKNOWLEDGMENTS

Many irrigation districts, power companies, and individuals cooperated in furnishing the information contained in this report. The following organizations were particularly helpful in furnishing data on which the figures for pumpage were based: Arizona Edison Electric Company, Citizens Utilities Company, Duncan Utilities Company, Eloy Light and Power Company, Gila Water Commissioner, Goodyear Farms, Maricopa County Municipal Water Conservation District, Mohawk Municipal Water Conservation District, Rural Electrification Administration, Roosevelt Irrigation District, Roosevelt Water Conservation District, Salt River Valley Water Users' Association, San Carlos Irrigation District, Tucson Gas and Electric Company, and the Office of Indian Affairs, U. S. Department of Interior.

APACHE COUNTY

By G. E. Hazen

A total of 14 water-level measurements was made in 7 wells in Apache County during 1947. One well was measured at approximately monthly intervals and the other 6 wells were measured only once. There is very little ground water pumped for irrigation in Apache County. The water levels in wells in the county showed very little fluctuation.

Well descriptions and water-level measurements

3152 (*1076, p. 8). Petrified Forest National Monument. SE₄NW₄ sec. 5, T. 19 N., R. 24 E.

Water level, in feet below land-surface datum, 1947

Date	Water level						
Jan. 17	11.98	Mar. 24	10.92	July 20	10.35	Oct. 17	9.51
Feb. 20	10.61	May 10	- 11.11	Aug. 25	11.47	Nov. 15	7.73

6601 (*1076, p. 8). L. M. Farr. NE₄NE₄ sec. 26, T. 13 N., R. 27 E. Water level, in feet below land-surface datum, 1947: June 11, 26.38.

6709 (*1076, p. 9). Jacob Barth. SE₄NW₄ sec. 27, T. 13 N., R. 28 E. Water level, in feet above land-surface datum, 1947: June 11, 1.35.

6716 (*1076, p. 9). E. L. Johns. SW₄ sec. 30, T. 13 N., R. 28 E. Water level, in feet below land-surface datum, 1947: June 11, 24.35.

7414 (*1076, p. 9). B. Y. Peterson. NE₄NW₄ sec. 4, T. 12 N., R. 28 E. Measurements discontinued after Aug. 9, 1944.

7415 (*1076, p. 9). Max Romel. SE₄ sec. 18, T. 12 N., R. 28 E. Water level, in feet below land-surface datum, 1947: June 11, 17.10.

9007 (*1076, p. 9). E. C. Becker. SW₄NW₄ sec. 33, T. 9 N., R. 29 E. Water level, in feet below land-surface datum, 1947: June 10, 9.35.

10001 (*1076, p. 9). C. Traweek. NW₄ sec. 33, T. 9 N., R. 29 E. Water level, in feet below land-surface datum, 1947: June 10, 32.50.

COCHISE COUNTY

By R. L. Cushman

During 1947 a total of 235 water-level measurements was made in 58 wells in the San Pedro River Valley, Sulphur Springs Valley, and the San Simon Valley of Cochise County. More detailed information about the ground-water resources of the Sulphur Springs Valley and the San Simon Valley was released in 1947 in two reports entitled, "Geology and ground-water resources of the Willcox Basin, Cochise and Graham Counties, Arizona," and "Geology and ground-water resources of the San Simon Basin, Cochise and Graham Counties, Arizona."

ST. DAVID-BENSON-POMERENE AREA

The St. David-Benson-Pomerene area is a part of the San Pedro River Valley, and is an area in which most of the ground water developed from wells comes from artesian aquifers. In the low lands adjacent to the San Pedro River, water flows throughout the year from most wells tapping the artesian aquifers. There was no general decrease in pressure head of the water in five artesian wells in this area in 1947. The pressure head of the water in one artesian well decreased about 7 feet during the summer months because of heavy pumping in nearby artesian wells, but the pressure

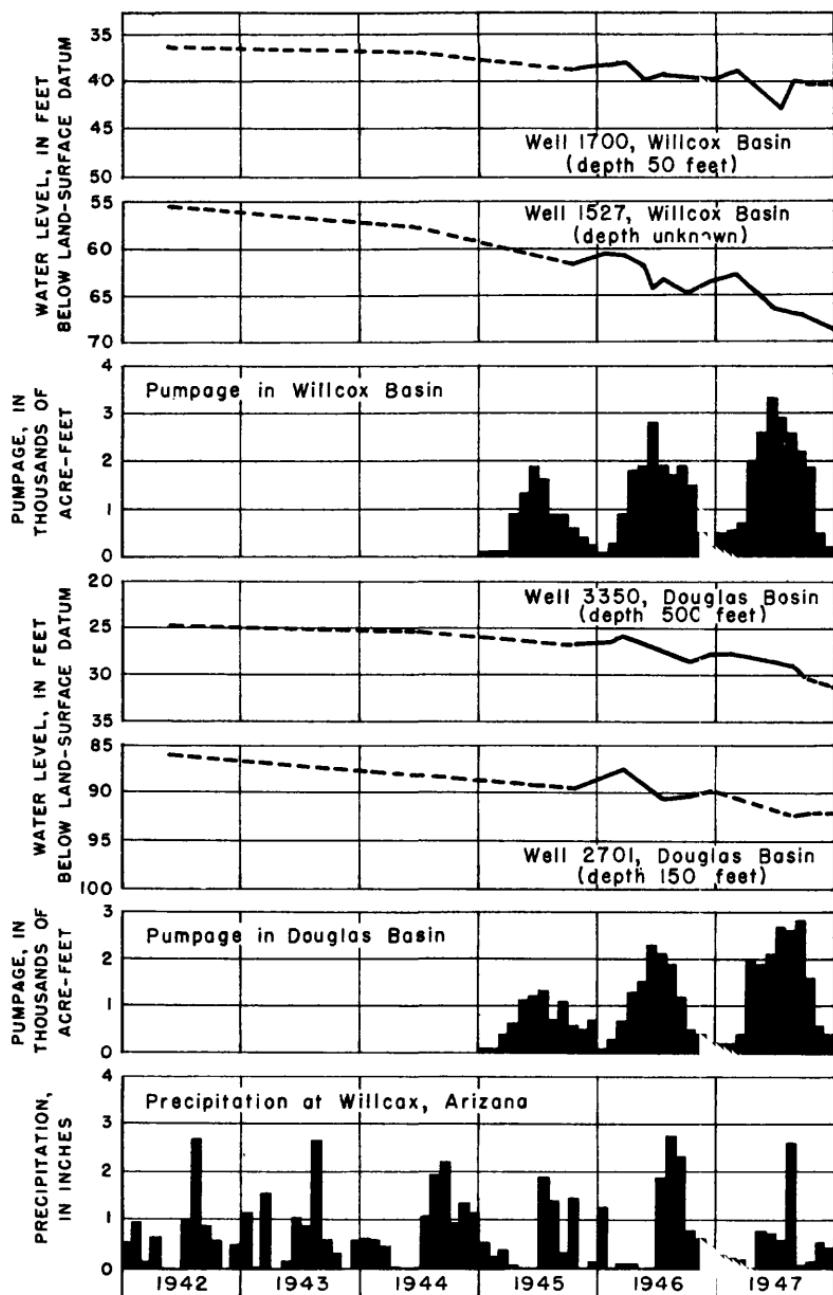


Figure 2.--Graphs showing fluctuations of water level in observation wells in Willcox and Douglas Basins, Cochise County, Arizona.

head recovered to about its former head after pumping decreased in the fall and winter.

There was no apparent net decline of the water level in four shallow (nonartesian) wells in this area in 1947.

FORT HUACHUCA-CHARLESTON AREA

The Fort Huachuca-Charleston area also is in the San Pedro Valley and is only a few miles upstream from the St. David-Benson-Pomerene area. Slight rises in water levels in wells in this area during the spring months were offset by greater declines, and the water level in most observation wells had a net decline in 1947 of about 0.25 foot.

SULPHUR SPRINGS VALLEY

The Sulphur Springs Valley is divided into two ground-water basins by a partially buried rock barrier near the town of Pearce. The ground-water basin north of the barrier is called the "Willcox Basin", and the ground-water basin south of the barrier is called the "Douglas Basin". The geology and ground-water resources and quality of the ground water of the Willcox Basin are discussed in a report referred to earlier in this paper.

Figure 2 shows graphs of water-level fluctuations in wells 1527 and 1700 in the Willcox Basin and in wells 2701 and 3350 in the Douglas Basin, the quantity of water pumped from wells in each basin, and the monthly precipitation at the town of Willcox in the Willcox Basin.

Well 1527 is a used stock well about 9 miles northwest of the town of Willcox in an area irrigated entirely from wells. The water level in this well declined about $4\frac{1}{2}$ feet during the 1947 irrigation season because of nearby pumping.

Well 1700 is a used domestic and stock well about 8 miles southwest of the town of Willcox and near the western margin of the "Willcox Playa". The low water level measured in July 1947 was caused by pumping for domestic use prior to making the water-level measurement. No ground water is pumped for irrigation in the vicinity of this well.

Well 2701 is an irrigation well 3 miles northeast of Elfrida in the Douglas Basin. The water level in this well had a net decline of 2 feet in 1947 caused by pumpage in this area.

Well 3350 is an unused irrigation well 13 miles northwest of Douglas. There was a net decline in water level of about 4 feet in this well in 1947 because of much pumping in this area.

Approximately 20,000 acre-feet of water was pumped from wells in the Willcox Basin in 1947, or about 4,500 acre-feet more water than was pumped in 1946. Pumpage in the Douglas Basin increased from about 12,500 acre-feet in 1946 to about 17,000 acre-feet in 1947. The increase in pumpage in both basins was caused by an increase in the acreage cultivated.

Precipitation at Willcox amounted to 6.65 inches in 1947--3.78 inches less than in 1946, and 4.85 inches below normal.

San Simon Valley

Most of the ground water developed by wells in the San Simon Valley comes from artesian aquifers. Water flows from wells at some places in the valley, the principal area of flowing wells being along the San Simon Creek near the town of San Simon. Several of the artesian wells in this flowing-well area have been equipped with pumps to produce water in quantities sufficient for irrigation. There was a fraction of a foot net loss in pressure head of the artesian water in observation wells near the town of San Simon. Pumping of some of the artesian wells for irrigation caused a seasonal decrease of 7 feet in pressure head in two wells in the pumped area in 1947. In the Bowie area, where artesian wells are pumped only for domestic and stock water, there was no apparent decrease in the pressure head of the artesian water in the observation wells.

Well descriptions and water-level measurements

St. David-Benson-Pomerene area

302 (*1028, p. 9; 1076, p. 13). W. N. East. SW_{1/4}SE_{1/4} sec. 27, T. 16 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, pumping; May 5, pumping; Sept. 22, dry.

305 (*1028, p. 9; 1076, p. 14). L. A. Scott. SW_{1/4}NE_{1/4} sec. 34, T. 16 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 76.97; May 5, 76.22; Aug. 26, 77.30; Sept. 22, 77.39.

475 (*1028, p. 9; 1076, p. 14). Earl M. Brown. NW_{1/4}NW_{1/4} sec. 12, T. 17 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 56.56; May 5, 56.80; Aug. 26, 56.59; Sept. 22, 56.52.

477 (*1028, p. 9; 1076, p. 14). City of Benson. SW_{1/4}SW_{1/4} sec. 10, T. 17 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 14.05; June 9, 17.73; Aug. 26, 15.13; Sept. 22, 14.85.

583 (*1028, p. 10; 1076, p. 14). Will Campbell. SE_{1/4}SW_{1/4} sec. 31, T. 17 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 18.40; May 5, 18.75; Aug. 26, 22.76; Sept. 22, 22.98.

594 (*1028, p. 10; 1076, p. 14). H. W. Busby. SE_{1/4}NE_{1/4} sec. 31, T. 17 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 51.16; May 5, 51.50. Measurements discontinued after Aug. 26, 1947.

599 (*1028, p. 10; 1076, p. 14). Boquillas Cattle Co. NW₄NW₄ sec. 32, T. 17 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 17.11; May 5, 17.53; Aug. 26, 17.65; Sept. 22, pumping.

600 (*1028, p. 10; 1076, p. 14). Mrs. E. M. Miller. SE₄SE₄ sec. 32 T. 17 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 5.29; Sept. 22, pumping.

601 (*1028, p. 10; 1076, p. 14). Mrs. Parley McPhee. SE₄SE₄ sec. 32 T. 17 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 3.27; May 5, 1.55; Sept. 22, 1.90, pumping.

701 (*1028, p. 10; 1076, p. 14). Leo Westfield. SE₄SE₄ sec. 1, T. 18 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 7.31; May 5, 7.30; Aug. 26, 5.41; Sept. 22, 8.63.

745 (*1028, p. 10; 1076, p. 14). Walter Haymore. NW₄NE₄ sec. 6, T. 18 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 29.07; May 5, pumping; Sept. 22, 35.80, pumping.

748 (*1028, p. 10; 1076, p. 15). F. J. Miller. NW₄SE₄ sec. 6, T. 18 S., R. 21 E. Pumping; no measurements made in 1947.

749 (*1028, p. 11; 1076, p. 15). A. L. Owens. SW₄NE₄ sec. 5, T. 18 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 28, 56.60; May 5, 55.55; Aug. 27, 56.65; Sept. 22, 56.96.

753 (*1028, p. 11; 1076, p. 15). Milton Curtis. SE₄ sec. 34, T. 18 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: May 5, 25.20; Sept. 22, 23.70.

Charleston area

950 (*1028, p. 11; 1076, p. 15). Lon Hunt. SE₄SW₄ sec. 32, T. 20 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 27, 88.62; June 9, 87.98; Sept. 22, 88.70.

951 (*1028, p. 11; 1076, p. 15). Lon Hunt. SW₄SE₄ sec. 32, T. 20 S., R. 20 E. Water levels, in feet below land-surface datum, 1947: Feb. 27, 81.24; June 9, pumping; Sept. 22, pumping.

1070 (*1028, p. 11; 1076, p. 15). Cochise County. SW₄SW₄ sec. 31, T. 21 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 27, 285.80; June 9, 286.00; Sept. 26, pumping.

1071 (*1028, p. 11; 1076, p. 15). E. Fry. SW₄SW₄ sec. 29, T. 21 S. R. 21 E. Water levels, in feet below land-surface datum, 1947: Feb. 27, 198.19; June 9, pumping.

1072. E. Fry. SE₄SE₄ sec. 22, T. 21 S., R. 21 E., 100 feet south of house, 0.8 mile south of country road, 4 miles southwest of Charleston. Used drilled domestic well, diameter 6 inches, depth 130 feet. Equipped with cylinder pump and windmill. Measuring point, top of casing, 0.8 foot above land-surface datum.

Water level, in feet below land-surface datum, 1941, 1944, 1946-47					
Date	Water level	Date	Water level	Date	
Apr. 2, 1941	56.15	Apr. 2, 1946	58.38	Dec. 10, 1946	59.40
June 23, 1944	59.29	June 22	59.90	Feb. 27, 1947	59.50
Feb. 4, 1946	58.04	Nov. 4	59.60	June 9	60.06

1074. J. L. Parker. NE₄NE₄ sec. 11, T. 21 N., R. 21 E., at rear of house, 100 yards west of San Pedro River, 0.4 mile southwest of Charleston. Unused dug well, diameter 48 inches, depth 36 feet. Measuring point, top of 6- by 6-inch beam, southeast side, 1.0 foot above land-surface datum.

1074--Continued.

Water level, in feet below land-surface datum, 1941, 1944-47

Date	Water level	Date	Water level	Date	Water level
Apr. 9, 1941	30.69	Apr. 2, 1946	30.18	Feb. 27, 1947	26.98
June 23, 1944	20.86	July 22	27.54	June 9	28.35
Oct. 22, 1945	29.02	Nov. 4	26.97	Sept. 22	27.84
Feb. 4, 1946	30.45	Dec. 10	26.94		

1126 (*1028, p. 12; 1076, p. 15). War Department. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 3, T. 22 S., R. 20 E. Water level, in feet below land-surface datum, 1947: Feb. 27, 490.33.

1226. H. F. Fletcher. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 8, T. 23 S., R. 21 E., beneath windmill tower, 1.9 miles east of State Highway 92, 10 miles south of Fry. Unused dug well, diameter 60 inches, depth 70 feet. Measuring point, top of 6- by 9-inch beam, at east side, 0.5 foot above land-surface datum; after June 23, 1944, at land-surface datum.

Water level, in feet below land-surface datum, 1941, 1944-47

Apr. 9, 1941	63.20	Apr. 2, 1946	64.20	Feb. 27, 1947	61.10
June 23, 1944	62.69	July 23	59.94	June 9	61.65
Oct. 22, 1945	58.76	Nov. 4	61.68	Sept. 22	61.90
Feb. 4, 1946	59.82	Dec. 10	60.85		

Sulphur Springs Valley

1500 (*1028, p. 12; 1076, p. 15). Frank R. Harris. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 12 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 67.68; June 11, 68.05; Aug. 27, 68.54; Sept. 24, 68.63.

1527 (*1028, p. 12; 1076, p. 16). Owner unknown. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, T. 12 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 62.86; June 11, 66.22; mill running; Aug. 27, 67.03; Sept. 24, 67.27.

1528 (*1028, p. 12; 1076, p. 16). Mrs. A. W. Towne. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 32, T. 12 S., R. 24 E. Measurements discontinued after Oct. 15, 1946.

1576 (*1028, p. 12; 1076, p. 16). J. D. Rutledge. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 13 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 59.50; June 11, 62.60, nearby well pumping; Sept. 24, 62.12.

1581. Paul Lely. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 13, T. 13 S., R. 24 E., beneath windmill tower, 200 yards west of county road, 3 miles north of Willcox. Used drilled domestic and stock well, diameter 6 inches, depth 55 feet. Equipped with cylinder pump and windmill. Measuring point, top of casing, at land-surface datum.

Water level, in feet below land-surface datum, 1942, 1946-47

May 13, 1942	29.71	June 10, 1946	34.11	Feb. 25, 1947	32.90
Jan. 24, 1946	32.87	July 26	33.37	June 11	35.75
Mar. 26	32.57	Oct. 15	33.17	Aug. 27	34.74
May 3	34.19	Dec. 12	32.15	Sept. 24	35.73

1582 (*1028, p. 12; 1076, p. 16). State of Arizona. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T. 13 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 33.60; June 11, 34.09; Aug. 27, 35.00; Sept. 24, 35.21.

1584 (*1028, p. 12; 1076, p. 16). J. J. Meyer. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 23, T. 13 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 38.14; June 11, 40.30, nearby irrigation well pumped recently; Aug. 27, 39.78; Sept. 24, 40.14, nearby irrigation well pumped recently.

1585 (*1028, p. 13; 1076, p. 16). W. A. Hines. SW $\frac{1}{4}$ S $\frac{1}{4}$ sec. 25, T. 13 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 24.78; June 11, 26.17, mill running; Aug. 27, 25.68; Sept. 24, 25.90.

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1588 (*1028, p. 13; 1076, p. 16). P. H. Pregenzer. NE₄SW₄ sec. 35, T. 13 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 22.85; June 11, 26.40, mill running; Aug. 27, 25.95; Sept. 24, 25.02.

1700 (*1028, p. 13; 1076, p. 16). Fay Proctor. NE₄NW₄ sec. 36, T. 14 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 38.95; June 11, 42.93; Aug. 27, 40.08; Sept. 24, 40.25.

1725 (*1028, p. 13; 1076, p. 17). C. A. Williamson. NW₄NW₄ sec. 13, T. 14 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 12.64; June 11, 14.02; Aug. 27, 13.97; Sept. 24, 14.21.

1726 (*1028, p. 13; 1076, p. 17). W. L. Woodrow. NW₄NW₄ sec. 14, T. 14 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 13.96; June 11, 19.26, mill running; nearby irrigation well pumping; Sept. 24, 14.70.

1728 (*1028, p. 13; 1076, p. 17). Fay Proctor. NW₄SE₄ sec. 30, T. 14 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 22.15; June 11, pumping; Aug. 27, 23.70; Sept. 24, pumping.

1776 (*1028, p. 13; 1076, p. 17). Dunlap Auto Court. NE₄SW₄ sec. 6, T. 14 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 13.92; June 11, 14.15; Aug. 27, 14.45; Sept. 24, 14.52.

1953 (*1028, p. 13; 1076, p. 17). B. B. Gibbons. NW₄NE₄ sec. 11, T. 16 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 43.08; June 12, 44.11; Aug. 27, 45.65; Sept. 24, 45.94.

1954 (*1028, p. 13; 1076, p. 17). Henry Gibbons. NW₄NW₄ sec. 13, T. 16 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 45.50; June 12, 45.84; Sept. 24, 47.18.

1956 (*1028, p. 14; 1076, p. 17). State of Arizona. SE₄NE₄ sec. 16, T. 16 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Feb. 25, 34.71; June 12, 45.23, mill running; Sept. 24, 35.62.

2700. M. L. Vineyard. NE₄NE₄ sec. 3, T. 20 S., R. 26 E., 100 feet west of house, south side of road, 1 mile east of State Highway 666, 3 miles north of Elfrida. Used dug and drilled irrigation well, diameter 48 to 12 inches, depth 140 feet. Equipped with turbine pump and gasoline engine. Measuring point, top of concrete curb, south side, 0.5 foot above land-surface datum.

Water level, in feet below land-surface datum, 1942, 1946-47

Date	Water level	Date	Water level	Date	Water level
May 27, 1942	70.94	July 25, 1946	75.67	June 10, 1947	(b)
Jan. 25, 1946	73.02	Oct. 15	74.40	Aug. 26	77.12
Mar. 27	77.06	Dec. 11	72.80	Sept. 23	76.87
May 2	a 108.62	Feb. 26, 1947	a 77.15	Oct. 23	75.93

a Nearby well pumping.

b Pumping.

2701 (*1028, p. 14; 1076, p. 17). W. H. Seaver. NE₄NW₄ sec. 12, T. 20 S., R. 26 E. Water levels, in feet below land-surface datum, 1947: June 10, pumping; Aug. 26, 92.25; Oct. 23, 91.50.

2702 (*1028, p. 14; 1076, p. 18). Gilbert Thompson. SE₄SE₄ sec. 11, T. 20 S., R. 26 E. Water levels, in feet below land-surface datum, 1947: Feb. 26, 71.02; June 10, 76.95, mill running; Sept. 23, 78.35; Oct. 23, 76.30.

2709 (*1028, p. 14; 1076, p. 18). F. O. Mackey. SF₄NE₄ sec. 33, T. 20 S., R. 26 E.

Water level, in feet below land-surface datum, 1947

Feb. 26	32.40	Aug. 26	(a)	Oct. 23	(a)
June 10	(a)	Sept. 23	(a)		

a Pumping.

3001. Owner unknown. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 24, T. 21 S., R. 26 E., in cemetery 100 feet south of cemetery road, 0.9 mile east of McNeal. Used drilled irrigation well, diameter 8 inches, depth 136 feet. Equipped with cylinder pump and windmill. Measuring point, top of casing, north side, 1.4 feet above land-surface datum.

Water level, in feet below land-surface datum, 1946-47

Date	Water level	Date	Water level	Date	Water level
Jan. 31, 1946	112.00	Oct. 15, 1946	112.57	Aug. 27, 1947	114.02
Mar. 27	112.70	Dec. 11	112.44	Sept. 23	113.92
May 2	113.03	Feb. 26, 1947	112.55	Oct. 23	114.05
July 25	112.27	June 10	114.30		

3350 (*1028, p. 14; 1076, p. 18). J. E. Brophy. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, T. 22 S., R. 26 E. (Erroneously reported in previous water-supply papers as NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 21).

Water level, in feet below land-surface datum, 1947

Feb. 26	27.52	Aug. 26	29.11	Oct. 24	30.21
June 10	28.35	Sept. 23	a 32.88		

a Pumping prior to measurement.

3650 (*1028, p. 14; 1076, p. 18). W. E. Mason. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 19, T. 23 S., R. 27 E. Measurements discontinued after Dec. 11, 1946.

3651. McGinty. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 27, T. 23 S., R. 27 E., 400 feet north of county road, 0.9 mile west of Highway 666, 4 miles northwest of Douglas. Unused dug well, diameter 62 inches, depth 45 feet. Measuring point, top of casing, west side, 1.8 feet above land-surface datum.

Water level, in feet below land-surface datum, 1943-44, 1946-47

May 13, 1943	53.23	May 2, 1946	53.21	Feb. 26, 1947	53.37
June 4	53.27	July 25	53.30	June 10	53.32
5, 1944	53.14	Oct. 14	53.27	Sept. 23	53.42
Feb. 5, 1946	53.13	Dec. 11	53.44	Oct. 21	53.46
Mar. 28	53.12				

3654. W. E. Mason. NE $\frac{1}{4}$ SL $\frac{1}{4}$ sec. 19, T. 23 S., R. 27 E., 200 feet west of county road, 3.5 miles north of U. S. Highway 80, 4 miles east of Douglas. Unused drilled well, diameter 6 inches, depth 85 feet. Measuring point, top of casing, 0.6 foot above land-surface datum.

Water level, in feet below land-surface datum, 1946-47

May 2, 1946	30.81	Dec. 11, 1946	31.40	Aug. 27, 1947	31.65
July 24	31.18	Feb. 26, 1947	31.33	Sept. 23	31.76
Oct. 14	31.35	June 10	31.34	Oct. 23	31.85

3800 (*1028, p. 14; 1076, p. 18). Walter Holland. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 1, T. 24 S., R. 26 E.

Water level, in feet below land-surface datum, 1947

Feb. 26	(a)	Aug. 26	b107.40	Oct. 23	c109.85
June 10	(a)	Sept. 23	c110.50		

a Pumping.

b Mill running prior to measurement.

c Nearby well pumping.

3803 (*1028, p. 14; 1076, p. 18). Cochise County Hospital. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 3, T. 24 S., R. 27 E.

Water level, in feet below land-surface datum, 1947

Feb. 26	68.23	Aug. 26	71.22	Oct. 23	71.77
June 10	73.86	Sept. 23	71.90		

3804 (*1028, p. 14; 1076, p. 18). L. L. Keith. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 5, T. 24 S., R. 27 E. Water levels, in feet below land-surface datum, 1947: Feb. 26, 56.80; June 10, 56.56; Sept. 23, 57.13; Oct. 24, 57.03.

3810 (*1028, p. 15; 1076, p. 18). Victor Nelson. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 17, T. 24 S., R. 27 E.

3810--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 26	52.32	Aug. 26	52.36	Oct. 24	52.32
June 10	52.42	Sept. 23	52.15		

a Mill running.

San Simon Valley

4200 (*1076, p. 18). A. R. Spikes. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 6, T. 13 S., R. 29 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 11.83; July 21, 12.37.

4201 (*1076, p. 19). U. S. Dept. of Agriculture. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 8, T. 13 S., R. 29 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 2.40; July 21, 2.51.

4250 (*1076, p. 19). U. S. Dept. of Agriculture. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 3, T. 13 S., R. 30 E. No measurements made in 1947.

4252 (*1076, p. 19). T. D. Garrett. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 9, T. 13 S., R. 30 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 27.40; July 21, 27.32.

4261 (*1076, p. 19). Woolston. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 25, T. 13 S. R. 30 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 59.24; July 21, 59.68.

4262 (*1076, p. 19). W. F. Lewis. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 30, T. 13 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 59.93; July 21, 60.13.

4366 (*1076, p. 19). Elmer Franklin. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 30, T. 13 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 60.70; July 21, 60.99.

4500 (*1076, p. 20). U. S. Dept. of Agriculture. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 1, T. 14 S., R. 30 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 69.46; July 21, 69.92.

4600 (*1076, p. 20). Otto Malone. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 3, T. 14 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 4.86; July 21, 11.88.

4606 (*1076, p. 20). Owner unknown. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 3, T. 14 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 20.21; July 21, 26.22.

4633 (*1076, p. 20). Marshall Barnes. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 14, T. 14 S., R. 31 E. No measurements made in 1947.

4661 (*1076, p. 20). M. Calloway. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 25, T. 14 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 1.83; July 21, 6.14.

GRAHAM COUNTY

By R. L. Cushman

A total of 322 measurements of water level was made in 102 selected wells in the Safford Valley portion of Graham County. Information about the ground-water resources in other parts of Graham County is contained in the following three reports released in 1947:

Ground-water resources and problems of the Cactus Flat-Artesia area, San Simon Basin.

Geology and ground-water resources of the San Simon Basin, Cochise and Graham Counties.

Geology and ground-water resources of the Wilcox Basin, Cochise and Graham Counties.

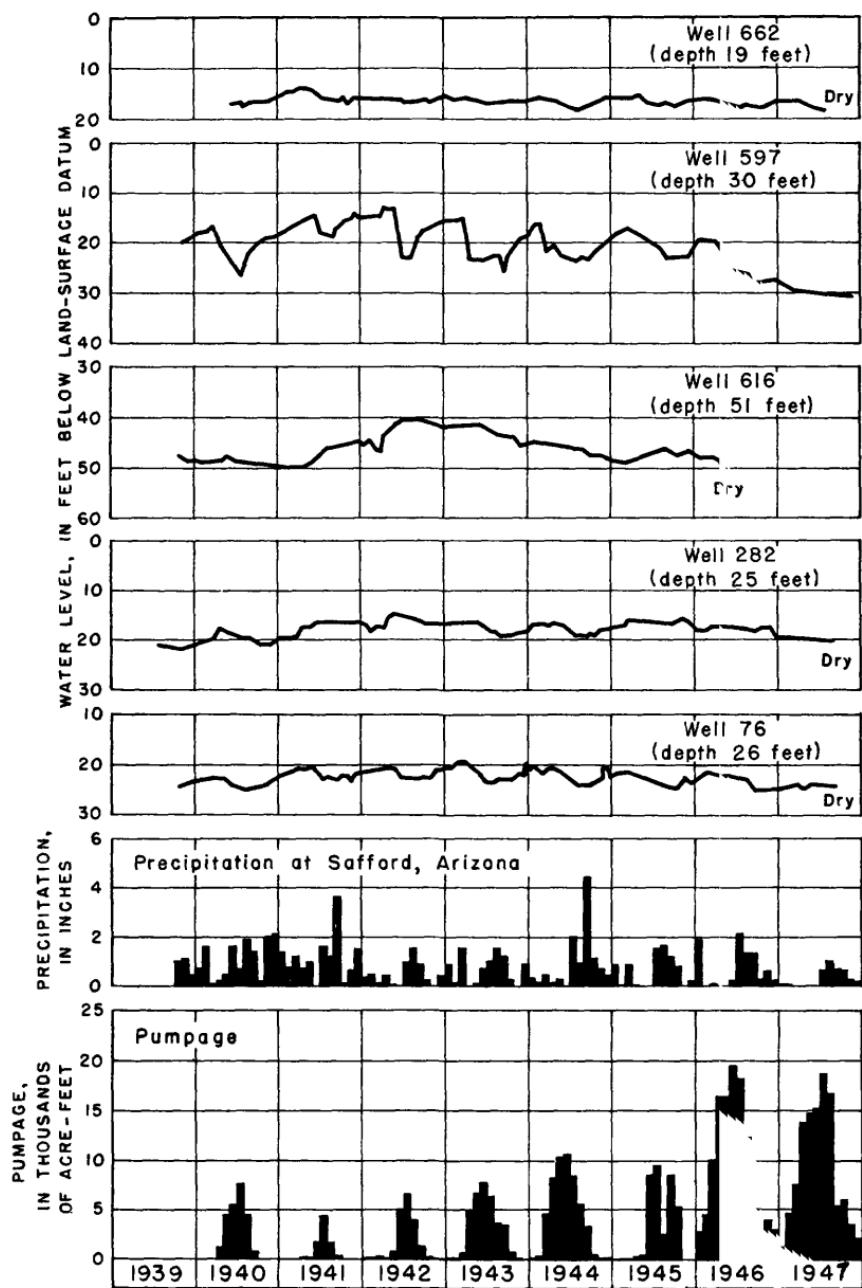


Figure 3.--Graphs showing fluctuations of water level in observation wells in the Safford Valley, Graham County, Arizona.

Figure 3 shows graphs of water-level fluctuations in wells 662, 616, 597, 282, and 76, monthly amounts of precipitation at Safford, and monthly quantities of water pumped from wells in the Safford Valley.

Well 662 is an unused dug well about 1,250 feet south of the Gila River and in the eastern part of the Safford Valley. An automatic water-stage recorder on the well made a continuous record of the water-level fluctuations until the well went dry in May. The well was deepened to 20 feet in June, but it went dry again in July. The water level in this well fluctuates in response to ground-water storage gains or losses that are regulated partially by the stage of the Gila River and partially by pumping in nearby irrigation wells. A prolonged period of low flow in the Gila River and an increase in pumping during 1947, caused a loss of ground water from storage near well 662, and the water level lowered below the bottom of the well.

Well 597 is an unused well about 100 feet south of a main irrigation canal and in the heavily pumped area near Solomonsville. The water level in this well declined steadily during 1947 because of heavy pumping nearby, and because of decreased recharge to the ground water resulting from the below normal flow in the canal.

Well 616 is an unused well just south of Safford in an irrigated area and is half a mile from the nearest irrigation well. The water level dropped below the bottom of the well in 1946 because heavy pumping in the valley withdrew large quantities of ground water from storage near this well. Heavy pumping continued and the well remained dry during 1947.

Well 282 is a used domestic well between Pima and Glenbar in an irrigated area and near a main irrigation canal. The water table declined steadily after pumping started in the spring and by the last of August the water table had dropped below the bottom of the well. The water table had not risen to the bottom of the well by the end of the year, although pumping for irrigation was greatly reduced after August.

Well 76 is a dug well north of Geronimo near the western edge of the irrigated area in Safford Valley. Debris dumped into the well may have sealed the bottom because water-level fluctuations graphed in figure are not typical. The well was filled in to a point above the water level after August.

Precipitation amounting to 3.82 inches was recorded at Safford in 1947. This is 5.81 inches below normal and is the lowest annual total shown in figure 3.

A total of 100,000 acre-feet of water was pumped from wells in the Safford Valley during 1947, or 15,000 acre-feet less than was pumped in 1946. This decrease in pumpage was caused mainly by the decreased productivity of the irrigation wells, which was a result of the decline in water levels. Many pumps were lowered during the year. The following table shows the amount of surface water diverted annually, the amount of ground water pumped annually, and the total annual supply of irrigation water available from surface diversions and wells for the years 1940-47. The information on surface water was obtained from annual reports of the Gila Water Commissioner.

Year	Surface water, acre-feet	Pumped water, acre-feet	Total, acre-feet
1940	99,693	24,600	124,293
1941	151,300	8,685	159,985
1942	172,005	18,900	190,905
1943	121,569	35,000	156,569
1944	128,027	52,000	180,027
1945	148,675	35,200	183,875
1946	69,909	115,000	184,909
1947	51,978	100,000	151,978

Well descriptions and water-level measurements

8 (*911, p. 13; *941, p. 11; 949, p. 11; *991, p. 12; 1021, p. 10; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 10.85.

9 (*911, p. 13; *941, p. 11; 949, p. 11; *991, p. 12; 1021, p. 11; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 8.88.

11 (*911, p. 14; *941, p. 11; 949, p. 11; *991, p. 12; 1021, p. 11; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 7.52.

12 (*911, p. 14; *941, p. 11; 949, p. 11; *991, p. 12; 1021, p. 11; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 7.73.

13 (*911, p. 14; *941, p. 12; 949, p. 12; *991, p. 13; 1021, p. 11; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 12.11.

14 (*911, p. 14; *941, p. 12; 949, p. 12; *991, p. 13; 1021, p. 12; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 12.60.

17 (*911, p. 15; *941, p. 12; 949, p. 12; *991, p. 13; 1021, p. 12; 1028, p. 17; 1076, p. 23). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 27, 8.68.

18 (*911, p. 15; *941, p. 12; 949, p. 12; *991, p. 13; 1021, p. 12; 1028, p. 17; 1076, p. 24). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 9.74.

19 (*911, p. 15; 941, p. 12; 949, p. 12; *991, p. 13; 1021, p. 12; 1028, p. 17; 1076, p. 24). Office of Indian Affairs, U. S. Dept. of Interior. Measurements discontinued after July 6, 1945.

20 (*911, p. 16; *941, p. 13; 949, p. 13; *991, p. 13; 1021, p. 13; 1028, p. 17; 1076, p. 24). Office of Indian Affairs, U. S. Dept. of Interior. Water level, in feet below land-surface datum, 1947: July 24, 10.18.

51 (*911, p. 16; 941, p. 13; 949, p. 13; *991, p. 14; 1021, p. 13; 1028, p. 18; 1076, p. 24). Bert Hinton. SW_{1/4}NE_{1/4} sec. 13, T. 4 S., R. 22 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	20.48	Apr. 29	19.28	Aug. 31	21.01	Nov. 28	22.10
Feb. 27	20.13	May 27	20.80	Sept. 28	21.23	Dec. 27	22.90
Mar. 31	19.54	June 30	20.92	Oct. 30	21.37		

52 (*911, p. 17; 941, p. 13; 949, p. 13; *991, p. 14; 1021, p. 13; 1028, p. 18; 1076, p. 24). Bert Hinton. SW_{1/4}NE_{1/4} sec. 13, T. 4 S., R. 22 E. Water level, in feet below land-surface datum, 1947: Mar. 13, 19.70; July 24, obstruction in well.

55A (*1021, p. 13; 1028, p. 18; 1076, p. 24). J. G. Willis. SW_{1/4}NW_{1/4} sec. 19, T. 4 S., R. 23 E.

Water level, in feet below land-surface datum, 1947

Jan. 31	31.98	Apr. 29	32.24	Aug. 31	33.81	Nov. 28	34.37
Feb. 27	31.80	May 27	33.64	Sept. 28	33.92	Dec. 27	34.51
Mar. 31	(a)	June 30	33.71	Oct. 30	34.11		

a Pumping.

56 (*911, p. 17; 941, p. 13; 949, p. 13; *991, p. 14; 1021, p. 14; 1028, p. 18; 1076, p. 24). Eliza Allen. SW_{1/4}NE_{1/4} sec. 24, T. 4 S., R. 22 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 37.65; July 24, 18.43.

60 (*941, p. 13; 949, p. 13; *991, p. 15; 1021, p. 14; 1028, p. 18; 1076, p. 24). Pat Hinton. SE_{1/4}SE_{1/4} sec. 35, T. 4 S., R. 22 E. Water level, in feet below land-surface datum, 1947: Mar. 13, 31.82, mill running.

71 (*911, p. 18; *941, p. 14; 949, p. 13; *991, p. 15; 1021, p. 14; 1028, p. 18; 1076, p. 24). Ed McEuen. SE_{1/4}SW_{1/4} sec. 7, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 16.76; July 24, dry.

72 (*911, p. 18; *941, p. 14; 949, p. 13; *991, p. 15; 1021, p. 14; 1028, p. 18; 1076, p. 24). Ed McEuen. SE_{1/4}SW_{1/4} sec. 7, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 4.62; July 24, 7.22.

76 (*911, p. 19; 941, p. 15; *949, p. 14; *991, p. 15; 1021, p. 14; 1028, p. 18; 1076, p. 24). E. W. Black. SW_{1/4}NW_{1/4} sec. 18, T. 4 S., R. 23 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	24.70	Apr. 29	24.81	Aug. 31	24.27	Nov. 28	(a)
Feb. 27	24.31	May 27	24.12	Sept. 28	(a)	Dec. 27	(a)
Mar. 31	24.21	June 30	24.22	Oct. 30	(a)		

a Dry.

77 (*911, p. 20; 941, p. 15; 949, p. 14; *991, p. 16; 1021, p. 15; 1028, p. 18; 1076, p. 24). E. M. Claridge. NW_{1/4}SW_{1/4} sec. 18, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 38.06; July 24, 39.10.

80 (*911, p. 20; 941, p. 15; 949, p. 14; *991, p. 16; 1021, p. 15; 1028, p. 18; 1076, p. 25). Fay Rabb. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 17, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 16.11; July 24, sealed.

81 (*911, p. 20; 941, p. 15; 949, p. 14; *991, p. 16; 1021, p. 15; 1028, p. 18; 1076, p. 25). Mrs. J. B. Blessing. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 19, T. 4 S., R. 23 E. Water level, in feet below land-surface datum, 1947: Mar. 13, dry at 40 feet, nearby well pumping.

82A (*1021, p. 16; 1028, p. 18; 1076, p. 25). Fay Rabb. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 35, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, July 22, 23.04.

91 (*911, p. 21; 941, p. 15; 949, p. 14; *991, p. 17; 1021, p. 16; 1028, p. 18; 1076, p. 25). Ben Montierth. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, T. 4 S., R. 23 E. Water level, in feet below land-surface datum, 1947: July 24, 59.68.

92 (*911, p. 21; 941, p. 15; 949, p. 14; *991, p. 17; 1021, p. 16; 1028, p. 19; 1076, p. 25). Wendell Montierth. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, pumping; July 24, 67.04, pumping prior to measurement.

93 (*911, p. 21; 941, p. 16; 949, p. 14; *991, p. 17; 1021, p. 16; 1028, p. 19; 1076, p. 25). Graham County. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 27, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 13.13; July 22, 17.09.

94 (*911, p. 21; 941, p. 16; 949, p. 15; *991, p. 17; 1021, p. 17; 1028, p. 19; 1076, p. 25). Graham County. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 27, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 9.40; July 22, 12.30.

95 (*911, p. 22; 941, p. 16; 949, p. 15; *991, p. 18; 1021, p. 17; 1028, p. 19; 1076, p. 25). Graham County. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 27, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 10.61; July 22, 13.50.

98 (*911, p. 23; 941, p. 16; 949, p. 15; *991, p. 18; 1021, p. 17; 1028, p. 19; 1076, p. 25). Graham County. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 35, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 5.15; July 22, 7.71.

100 (*911, p. 23; 941, p. 17; 949, p. 15; *991, p. 18; 1021, p. 17; 1028, p. 19; 1076, p. 25). C. N. Higgins. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 34, T. 4 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 12.37; July 22, windmill running.

107 (*911, p. 24; 941, p. 17; 949, p. 15; *991, p. 19; 1021, p. 18; 1028, p. 19; 1076, p. 25). Port McEuen. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 35, T. 4 S., R. 23 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	44.91	Apr. 29	45.50	Aug. 31	46.36	Nov. 28	47.21
Feb. 27	44.81	May 27	46.29	Sept. 28	46.67	Dec. 27	47.57
Mar. 31	44.69	June 30	46.31	Oct. 30	46.73		

108 (*911, p. 25; 941, p. 17; 949, p. 15; *991, p. 19; 1021, p. 18; 1028, p. 19; 1076, p. 25). W. O. Tyler. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 5 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 17.30; July 22, 19.15.

122A (*1021, p. 18; 1028, p. 19; 1076, p. 26). Elliot Montierth. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, T. 4 S., R. 23 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	36.34	Apr. 29	36.53	Aug. 31	39.34	Nov. 28	(a)
Feb. 27	36.21	May 27	39.28	Sept. 28	(a)	Dec. 27	(a)
Mar. 31	36.17	June 30	39.31	Oct. 30	(a)		

a Pumping.

124A (*991, p. 19; 1021, p. 18; 1028, p. 19; 1076, p. 26). Willis. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 27, T. 4 S., R. 23 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	(a)	Apr. 29	37.80	Aug. 31	39.11	Nov. 28	40.26
Feb. 27	(a)	May 27	38.38	Sept. 28	39.27	Dec. 27	40.73
Mar. 31	37.30	30	38.41	Oct. 30	39.41		

a Pumping.

126 (*991, p. 25; 941, p. 17; 949, p. 15; *991, p. 19; 1021, p. 18; 1028, p. 20; 1076, p. 26). YL Ranch. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 24, T. 5 S., R. 21 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 56.94; July 24, 62.20.

143 (*991, p. 25; 941, p. 18; 949, p. 16; *991, p. 19; 1021, p. 18; 1028, p. 20; 1076, p. 26). R. S. Snedigar. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 25, T. 5 S., R. 22 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 47.65; July 24, 50.26.

156 (*991, p. 25; 941, p. 18; 949, p. 16; *991, p. 29; 1021, p. 18; 1028, p. 20; 1076, p. 26). Roy Layton. SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 1, T. 5 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 14.00; July 22, 14.18.

157 (*991, p. 20; 1021, p. 19; 1028, p. 20; 1076, p. 26). M. J. Ferguson. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 2, T. 5 S., R. 23 E.

Water level, in feet below land-surface datum, 1947

Feb. 27	17.48	May 27	16.97	Sept. 29	18.01	Nov. 28	19.71
Mar. 31	17.37	June 30	17.37	Oct. 29	18.22	Dec. 27	19.99
Apr. 29	17.65	Aug. 31	17.47				

158 (*991, p. 26; 941, p. 18; 949, p. 16; *991, p. 20; 1021, p. 19; 1028, p. 20; 1076, p. 26). W. C. Rhodes. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 2, T. 5 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 49.70; July 22, pumping.

160 (*991, p. 26; *941, p. 18; 949, p. 16; *991, p. 20; 1021, p. 19; 1028, p. 20; 1076, p. 26). W. O. Tyler. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 5 S., R. 23 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 31.05; July 22, 33.29.

194A (*1028, p. 20; 1076, p. 26). Ed and Port McEuen. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 18, T. 5 S., R. 24 E. Water level, in feet below land-surface datum, 1947: July 22, 20.27.

198A (*991, p. 21; 1021, p. 20; 1028, p. 20; 1076, p. 26). C. J. Farrington. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 19, T. 5 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	22.67	Apr. 29	22.67	Aug. 31	24.57	Nov. 28	(a)
Feb. 27	22.60	May 27	24.43	Sept. 29	(a)	Dec. 27	(a)
Mar. 31	22.47	June 30	24.50	Oct. 29	(a)		

a DRY.

206 (*991, p. 28; 941, p. 19; 949, p. 16; *991, p. 22; 1021, p. 21; 1028, p. 21; 1076, p. 27). J. D. Colvin. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, T. 5 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	22.84	Apr. 29	23.35	Aug. 31	24.07	Nov. 28	24.79
Feb. 28	22.91	May 28	23.99	Sept. 28	24.13	Dec. 27	25.17
Mar. 30	23.17	June 30	24.03	Oct. 30	24.26		

208 (*991, p. 28; 941, p. 19; 949, p. 16; *991, p. 22; 1021, p. 21; 1028, p. 21; 1076, p. 27). L. W. Farrington. SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 30, T. 5 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 23.42; July 22, 30.38.

210 (*911, p. 28; *941, p. 19; 949, p. 16; *991, p. 23; 1021, p. 21; 1028, p. 21; 1076, p. 27). Boyd Hawkins. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 31, T. 5 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 32.94; July 22, 39.37.

211 (*911, p. 28; 941, p. 19; 949, p. 16; *991, p. 23; 1021, p. 21; 1028, p. 21; 1076, p. 27). Producers Ginning Co. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 31, T. 5 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	25.37	Apr. 29	25.27	Aug. 31	26.27	Nov. 29	27.08
Feb. 27	24.99	May 27	25.90	Sept. 29	26.69	Dec. 28	28.40
Mar. 31	24.93	June 30	26.20	Oct. 29	26.79		

214 (*911, p. 29; 941, p. 20; 949, p. 17; *991, p. 23; 1021, p. 22; 1028, p. 21; 1076, p. 27). Graham County. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 31, T. 5 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 13.40; July 22, dry.

220 (*911, p. 30; 941, p. 21; 949, p. 17; *991, p. 24; 1021, p. 22; 1028, p. 21; 1076, p. 27). Lionel Hancock. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 33, T. 5 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	15.10	Apr. 29	15.40	Aug. 31	15.51	Nov. 28	16.40
Feb. 28	15.30	May 28	15.42	Sept. 28	15.59	Dec. 27	16.76
Mar. 30	15.25	June 30	15.47	Oct. 30	15.74		

223A (*1021, p. 23; 1028, p. 21; 1076, p. 27). Ira Hancock. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 33, T. 5 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 32.80; July 22, 33.79.

259 (*1021, p. 23; 1028, p. 21; 1076, p. 27). Jess Udall. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 1, T. 6 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	28.26	Apr. 29	(a)	Aug. 31	(a)	Nov. 28	(a)
Feb. 28	29.31	May 28	(a)	Sept. 28	(a)	Dec. 27	(a)
Mar. 30	29.20	June 30	(a)	Oct. 30	(a)		

a Pumping.

264 (*911, p. 31; 941, p. 21; *949, p. 18; *991, p. 25; 1021, p. 23; 1028, p. 22; 1076, p. 27). J. Hancock. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 3, T. 6 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 13.92; July 22, 16.90.

267 (*911, p. 32; 941, p. 21; 949, p. 18; *991, p. 25; 1021, p. 24; 1028, p. 22; 1076, p. 28). Wm. Carpenter. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 4, T. 6 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	25.87	Apr. 29	25.83	Aug. 31	26.01	Nov. 28	27.70
Feb. 28	25.15	May 28	25.97	Sept. 28	26.80	Dec. 27	28.14
Mar. 30	25.60	June 30	25.99	Oct. 30	26.91		

269A (*991, p. 25; 1021, p. 24; 1028, p. 22; 1076, p. 28). Silas Jarvis. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 10, T. 6 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	25.28	Apr. 29	(a)	Aug. 31	(a)	Nov. 28	(a)
Feb. 27	25.09	May 28	(a)	Sept. 28	(a)	Dec. 27	(a)
Mar. 31	25.00	June 30	(a)	Oct. 30	(a)		

a Dry.

270A (*991, p. 26; 1021, p. 24; 1028, p. 22; 1076, p. 28). M. J. Ferguson. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 9, T. 6 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 51.42; July 22, 54.04.

273 (*911, p. 32; 941, p. 22; 949, p. 18; *991, p. 26; 1021, p. 24; 1028, p. 22; 1076, p. 28). Eldon Palmer. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 5, T. 6 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	42.51	Apr. 29	42.52	Aug. 31	(a)	Nov. 29	(a)
Feb. 27	42.41	May 28	(a)	Sept. 29	(a)	Dec. 28	54.67
Mar. 31	42.22	June 30	(a)	Oct. 29	(a)		

a Pumping.

275 (*911, p. 33; 941, p. 22; 949, p. 18; *991, p. 26; 1021, p. 25; 1028, p. 22; 1076, p. 28). Lamar Bellman. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 10, T. 6 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 23.88; July 22, pumping.

276A (*991, p. 26; 1021, p. 25; 1028, p. 22; 1076, p. 28). M. J. Ferguson. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 11, T. 6 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	37.41	Apr. 29	37.52	Aug. 31	(a)	Nov. 29	40.37
Feb. 27	37.37	May 27	(a)	Sept. 29	(a)	Dec. 28	(a)
Mar. 31	37.33	June 30	(a)	Oct. 29	(a)		

a Pumping.

279 (*911, p. 33; 941, p. 22; 949, p. 18; *991, p. 26; 1021, p. 25; 1028, p. 22; 1076, p. 28). Howard McBride. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 12, T. 6 S., R. 24 E. Water level, in feet below land-surface datum, 1947: Mar. 13, 6.06.

282 (*911, p. 33; 941, p. 22; 949, p. 18; *991, p. 27; 1021, p. 25; 1028, p. 22; 1076, p. 28). Guy Anderson. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 6 S., R. 24 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	19.53	Apr. 29	19.61	Aug. 31	19.92	Nov. 29	(a)
Feb. 27	19.41	May 28	19.77	Sept. 29	(a)	Dec. 28	(a)
Mar. 31	19.52	June 29	19.81	Oct. 29	(a)		

a Dry.

285 (*911, p. 33; 941, p. 22; 949, p. 18; *991, p. 27; 1021, p. 25; 1028, p. 22; 1076, p. 28). Guy Anderson. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 13, T. 6 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 34.56; July 22, pumping.

289 (*949, p. 18; *991, p. 27; 1021, p. 25; 1028, p. 22; 1076, p. 28). W. J. Preston. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 13, T. 6 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 39.36; July 22, 40.98.

298 (*911, p. 34; 941, p. 23; 949, p. 18; *991, p. 27; 1021, p. 26; 1028, p. 23; 1076, p. 28). Joe Rogers. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 25, T. 6 S., R. 24 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 14.40; July 22, mill running.

302A (*991, p. 28; 1021, p. 26; 1028, p. 23; 1076, p. 29). Mattice Bros. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 23, T. 6 S., R. 24 E.

Water levels, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	48.42	Apr. 29	48.37	Aug. 31	48.60	Nov. 29	49.07
Feb. 27	48.33	May 28	48.41	Sept. 29	48.77	Dec. 28	51.17
Mar. 31	48.21	June 29	48.50	Oct. 29	48.83		

313 (*911, p. 34; 941, p. 23; 949, p. 19; *991, p. 28; 1021, p. 26; 1028, p. 23; 1076, p. 29). Jack Bryce. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 6 S., R. 25 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	66.21	Apr. 29	(a)	Aug. 31	(a)	Nov. 29	(a)
Feb. 28	66.96	May 28	(a)	Sept. 29	(a)	Dec. 28	(a)
Mar. 30	67.09	June 29	(a)	Oct. 29	(a)		

a Dry.

318 (*941, p. 23; 949, p. 19; *991, p. 28; 1021, p. 26; 1028, p. 23; 1076, p. 29). Vance Marshall. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 17, T. 6 S., R. 25 E. Pumping; no measurements made in 1947.

320 (*911, p. 35; 941, p. 23; 949, p. 19; *991, p. 28; 1021, p. 26; 1028, p. 23; 1076, p. 29). Vance Marshall. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 17, T. 6 S., R. 25 E. Pumping; no measurements made in 1947.

321 (*911, p. 35; 941, p. 23; 949, p. 19; *991, p. 29; 1021, p. 27; 1028, p. 23; 1076, p. 29). Graham County. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 7, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 8.63; July 22, 11.10.

322 (*911, p. 35; *941, p. 24; 949, p. 19; *991, p. 29; 1021, p. 27; 1028, p. 23; 1076, p. 29). Bryce Bros. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 18, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 7.30; July 22, 10.02.

324 (*911, p. 36; 941, p. 24; 949, p. 19; *991, p. 29; 1021, p. 27; 1028, p. 23; 1076, p. 29). Graham County. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 18, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 4.92; July 22, 7.93.

325 (*911, p. 36; 941, p. 24; 949, p. 19; *991, p. 30; *1021, p. 27; 1028, p. 23; 1076, p. 29). Graham County. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 18, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 5.85; July 22, 9.75.

326 (*911, p. 36; 941, p. 24; 949, p. 19; *991, p. 30; 1021, p. 27; 1028, p. 23; 1076, p. 29). Graham County. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 18, T. 6 S., R. 25 E. Water level, in feet below land-surface datum, 1947: Mar. 11, 6.35.

342 (*911, p. 37; 941, p. 25; 949, p. 20; *991, p. 31; 1021, p. 28; 1028, p. 23; 1076, p. 29). Ed Howard. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 23, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 26.39; July 22, 32.08.

346 (*911, p. 37; 941, p. 25; 949, p. 20; *991, p. 31; 1021, p. 28; 1028, p. 23; 1076, p. 29). Graham County. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 27, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 8.11; July 22, 10.31.

347 (*911, p. 38; 941, p. 26; 949, p. 20; *991, p. 31; 1021, p. 28; 1028, p. 24; 1076, p. 29). Graham County. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 27, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 9.26; July 22, 10.65.

354 (*911, p. 40; *941, p. 27; 949, p. 20; *991, p. 32; 1021, p. 29; 1028, p. 24; 1076, p. 30). Ned Daley. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 27, T. 6 S., R. 25 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	8.11	Apr. 29	8.21	Aug. 29	11.91	Nov. 29	12.03
Feb. 28	8.24	May 28	9.29	Sept. 29	13.19	Dec. 28	12.23
Mar. 31	8.18	June 29	12.26	Oct. 29	13.27		

366 (*911, p. 40; 941, p. 27; 949, p. 21; *991, p. 32; *1021, p. 29; 1028, p. 24; 1076, p. 30). Charles M. Beals. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 30, T. 6 S., R. 25 E. Water levels, in feet below land-surface datum, 1947: Mar. 13, 19.33; July 22, 20.97.

408 (*991, p. 33; 1021, p. 29; 1028, p. 24; 1076, p. 30). Roy Saline. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 30, T. 6 S., R. 25 E.

Water level, in feet below land-surface datum, 1947

Jan. 30	62.19	Apr. 29	62.19	Aug. 31	62.93	Nov. 29	63.30
Feb. 27	62.07	May 28	62.81	Sept. 29	63.13	Dec. 28	65.01
Mar. 31	62.01	June 29	62.85	Oct. 29	63.17		

630 (*911, p. 57; 941, p. 39; 949, p. 26; *991, p. 40; 1021, p. 34; 1028, p. 27; 1076, p. 33). E. L. Claridge. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 24, T. 7 S., R. 26 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	31.57	Apr. 29	32.42	Aug. 31	32.87	Nov. 29	34.43
Feb. 28	31.60	May 28	32.51	Sept. 29	34.17	Dec. 29	34.79
Mar. 30	31.51	June 29	32.63	Oct. 29	34.21		

639 (*911, p. 57; 941, p. 39; 949, p. 26; *991, p. 40; 1021, p. 34; 1028, p. 27; 1076, p. 33). Amos Cook. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 31, T. 7 S., R. 26 E. Pumping; no measurements made in 1947.

661 (*911, p. 57; *941, p. 39; 949, p. 26; *991, p. 40; 1021, p. 34; 1028, p. 27; 1076, p. 33). Louis Michelena. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1, T. 7 S., R. 27 E. Measurements discontinued after Dec. 30, 1946; well dry.

662 (*911, p. 57; 941, p. 40; *949, p. 26; *991, p. 40; 1021, p. 34; 1028, p. 27; 1076, p. 33). Mrs. Jose Somora. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 7 S., R. 27 E. Deepened to 20.2 feet on June 10. Dry June 1-9 and Aug. 1-Dec. 31.

Daily noon water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July
1	16.52	16.38	16.38	16.55	16.87	.....	17.98
2	16.52	16.37	16.38	16.56	16.89	.....	17.99
3	16.52	16.36	16.38	16.58	16.91	.....	18.00
4	16.51	16.36	16.38	16.59	16.93	.....	18.01
5	16.50	16.35	16.39	16.61	16.96	.....	18.03
6	16.49	16.35	16.39	16.62	16.99	.....	18.07
7	16.49	16.35	16.40	16.63	17.01	.....	18.07
8	16.48	16.35	16.39	16.63	17.04	.....	18.10
9	16.48	16.34	16.40	16.64	17.06	.....	18.11
10	16.47	16.34	16.40	16.65	17.08	.....	18.11
11	16.46	16.34	16.39	16.66	17.10	17.71	18.12
12	16.45	16.34	16.40	16.67	17.12	17.72	18.14
13	16.45	16.34	16.40	16.68	17.14	17.73	18.15
14	16.44	16.34	16.40	16.69	17.16	17.75	18.16
15	16.44	16.34	16.41	16.69	17.18	17.77	18.18
16	16.44	16.34	16.41	16.70	17.20	17.78	18.19
17	16.43	16.34	16.40	16.71	17.23	17.80	18.20
18	16.43	16.34	16.41	16.72	17.25	17.81	18.21
19	16.43	16.34	16.41	16.73	17.27	17.82	18.22
20	16.42	16.35	16.41	16.74	17.29	17.84	18.22
21	16.42	16.35	16.42	16.75	17.31	17.85	18.22
22	16.41	16.35	16.42	16.75	17.34	17.87	18.23
23	16.41	16.35	16.43	16.76	17.35	17.88	18.23
24	16.40	16.35	16.44	16.78	17.37	17.89	(a)
25	16.40	16.35	16.45	16.79	17.39	17.90	(a)
26	16.40	16.36	16.46	16.80	17.41	17.91	(a)
27	16.39	16.36	16.47	16.81	17.43	17.92	(a)
28	16.38	16.37	16.48	16.82	17.45	17.93	(a)
29	16.39		16.49	16.84	17.47	17.95	(a)
30	16.38		16.51	16.85	17.48	17.96	(a)
31	16.38		16.53	17.49			(a)

a Too dry to measure.

664 (*911, p. 58; 941, p. 40; 949, p. 26; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). San Jose Canal Co. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 7 S., R. 27 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 18.56; July 22, 27.50.

674 (*911, p. 58; 941, p. 40; 949, p. 26; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). Louis Michelena. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 4, T. 7 S., R. 27 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 16.60; July 22, 29.74, nearby well pumping.

675 (*941, p. 40; 949, p. 26; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). Louis Michelena. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 4, T. 7 S., R. 27 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 14.30; July 22, pumping.

676 (*911, p. 58; 941, p. 41; 949, p. 26; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). Louis Michelena. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 4, T. 7 S., R. 27 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 16.47; July 22, 26.63.

683 (*911, p. 59; 941, p. 41; 949, p. 26; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). Tom Gardner. $NE\frac{1}{4}NW\frac{1}{4}$ sec. 10, T. 7 S., R. 27 E. Dry; no measurements made in 1947.

685 (*911, p. 59; 941, p. 41; 949, p. 27; *991, p. 41; *1021, p. 35; 1028, p. 28; 1076, p. 34). Brijido Carrasco. $SW\frac{1}{4}NW\frac{1}{4}$ sec. 11, T. 7 S., R. 27 E. Measurements discontinued after Dec. 30, 1946; well dry.

689 (*911, p. 59; 941, p. 41; 949, p. 27; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). San Jose Canal Co. $SW\frac{1}{4}SW\frac{1}{4}$ sec. 16, T. 7 S., R. 27 E. Water level, in feet below land-surface datum, 1947: Mar. 11, 62.80; nearby well pumping. Measurements discontinued after July 22, 1947; casing sealed.

696 (*911, p. 59; *941, p. 41; 949, p. 27; *991, p. 41; 1021, p. 35; 1028, p. 28; 1076, p. 34). Louis Carassco. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 18, T. 7 S., R. 27 E. Measurements discontinued after July 22, 1947; well dry.

708 (*911, p. 61; *941, p. 42; 949, p. 28; *991, p. 42; 1021, p. 35; 1028, p. 28; 1076, p. 34). Pete Bertaldo. $SE\frac{1}{4}NE\frac{1}{4}$ sec. 20, T. 7 S., R. 27 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	39.49	Apr. 29	40.49	Aug. 31	41.02	Mcv. 29	42.37
Feb. 28	40.27	May 28	40.62	Sept. 29	41.80	Dec. 28	42.49
Mar. 30	40.13	June 29	40.91	Oct. 29	42.32		

709 (*911, p. 61; 941, p. 42; 949, p. 28; *991, p. 42; 1021, p. 35; 1028, p. 29; 1076, p. 34). E. E. Taylor. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 30, T. 7 S., R. 27 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 23.59; July 22, 21.23.

791 (*911, p. 62; 941, p. 43; 949, p. 28; *991, p. 42; 1021, p. 36; 1028, p. 29; 1076, p. 34). Howard Olsen. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 16, T. 8 S., R. 27 E. No measurements made in 1947.

792 (*911, p. 62; *941, p. 43; 949, p. 28; *991, p. 42; 1021, p. 36; 1028, p. 29; 1076, p. 34). Howard Olsen. $NW\frac{1}{4}SW\frac{1}{4}$ sec. 15, T. 8 S., R. 27 E. No measurements made in 1947.

793 (*911, p. 62; *941, p. 43; 949, p. 28; *991, p. 43; 1021, p. 36; 1028, p. 29; 1076, p. 34). Howard Olsen. $SW\frac{1}{4}NE\frac{1}{4}$ sec. 16, T. 8 S., R. 27 E. No measurements made in 1947.

GREENLEE COUNTY (DUNCAN VALLEY)

By R. L. Cushman

The Duncan Valley is entirely within Greenlee County, and is a part of a larger valley that extends southeastward into New Mexico. That part of the larger valley extending from the Arizona-New Mexico line southeastward into Hidalgo County, N. Mex., for a distance of about 7 miles is known as the Virden Valley. Hydrologically there is no division between these two parts of the same large valley.

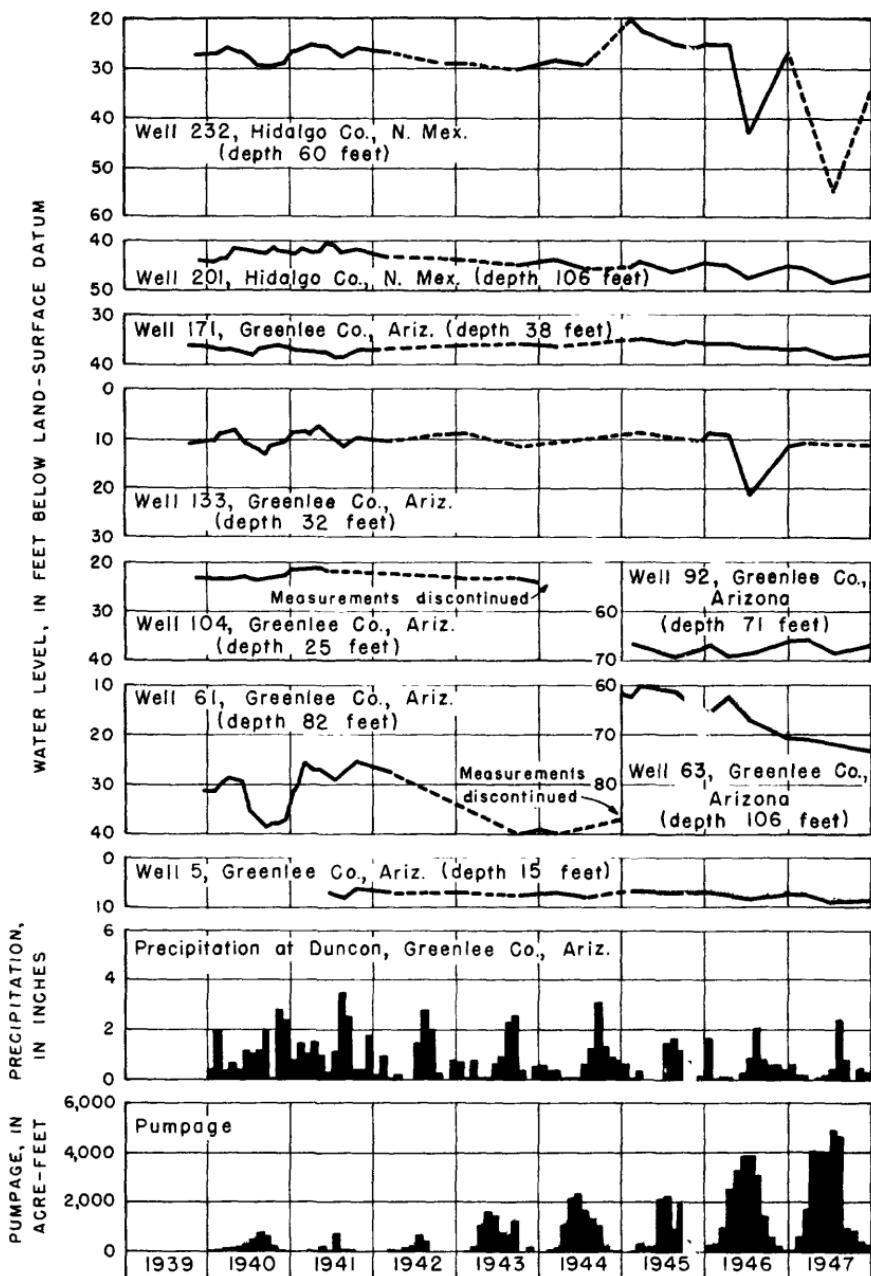


Figure 4.--Graphs showing fluctuations of water level in observation wells in the Duncan-Virden Valley, Greenlee County, Arizona, and Hidalgo County, New Mexico.

Figure 4 shows graphs of water-level fluctuations in wells 232 and 201 in the Virden Valley, and in wells 171, 133, 104, 92, 61, 63, and 5 in the Duncan Valley, monthly precipitation at Duncan, and monthly pumpage in the combined Duncan-Virden Valley.

The water-level fluctuations in wells 232 and 201 show the effect of increased pumping on the water levels in wells in the Virden Valley in 1947. The increased pumpage resulted through more hours of pumping in wells pumped in previous years and pumpage from additional wells constructed and operated in 1947. Pumping of a new irrigation well, about 100 yards from well 232, lowered the water level 28 feet in well 232 during the 1947 pumping season. Well 201 is away from the immediate effects of pumping of any particular irrigation well, and the 2 feet net lowering of the water level in this well reflects the downward trend in water levels in the valley.

Wells 171 and 92 are just outside of the irrigated area and are in the southeastern part of Duncan Valley. The water level declined during the spring and summer months of 1947 as ground water moved from storage in this area to replace the water pumped from beneath the irrigated area. There was a net lowering of 1 foot and 2 feet in the water levels in wells 171 and 92, respectively, in 1947.

Well 133 is an irrigation well in the southeastern part of Duncan Valley. Water-level measurements were not made in this well after March because the well was pumping during later visits.

Well 63 is an unused well near the Gila River and beside a large wash. The water level declined steadily during 1947 because of the lack of recharge.

Well 5 is in a heavy stand of mesquite near the Gila River. The large use of ground water by the mesquite and the prolonged period of low flow in the Gila River caused the water level to decline without an appreciable amount of recovery during 1947.

The total precipitation at Duncan in 1947 was 5.87 inches, the lowest annual total graphed in figure 4. The decreased precipitation reduced the runoff in 1947 and the supply of surface water was small. Ground water was pumped in larger quantities during 1947 to supplement the scarcity of surface water for irrigation. The following table shows the amount of surface water diverted and the amount of ground water pumped in the Duncan-Virden Valley each year since 1939. The information on surface water was obtained from annual reports of the Gila Water Commissioner.

Year	Surface water, acre-feet	Pumped water, acre-feet	Total, acre-feet
1940	39,935	2,436	42,371
1941	34,262	1,348	35,610
1942	36,439	1,900	38,339
1943	31,520	7,100	38,620
1944	27,225	9,500	36,725
1945	27,657	8,300	35,957
1946	14,419	21,000	35,419
1947	10,168	26,000	36,168

A total of 28 water-level measurements made in 17 wells in the Duncan Valley are listed below. Water-level measurements made in the Virden Valley are listed with Hidalgo County in the New Mexico section of this report.

Well descriptions and water-level measurements

5 (*941, p. 45; 949, p. 30; *991, p. 45; 1021, p. 36; 1028, p. 31; 1076, p. 37). Warner Foote. $SE\frac{1}{4}NW\frac{1}{4}$ sec. 7, T. 6 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 7.30; July 23, 9.03.

12 (*911, p. 65; 941, p. 45; 949, p. 30; *991, p. 45; 1021, p. 36; 1028, p. 31; 1076, p. 37), Mr. Wilton. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 20, T. 6 S., R. 31 E. No measurements made in 1947.

14 (*911, p. 65; *941, p. 45; 949, p. 30; *991, p. 45; 1021, p. 38; 1028, p. 31; 1076, p. 37). Victor Rowden. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 19, T. 6 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 38.98; July 23, 39.67.

31 (*911, p. 65; 941, p. 45; 949, p. 30; *991, p. 45; 1021, p. 38; 1028, p. 31; 1076, p. 37). J. C. Merritt. $SW\frac{1}{4}NW\frac{1}{4}$ sec. 4, T. 7 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 29.11; July 23, pumping.

36 (*911, p. 66; 941, p. 45; 949, p. 30; *991, p. 45; 1021, p. 38; 1028, p. 31; 1076, p. 37). M. M. Cosper. $NE\frac{1}{4}NW\frac{1}{4}$ sec. 16, T. 7 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 22.20; July 23, 25.87.

49 (*911, p. 66; 941, p. 45; 949, p. 30; *991, p. 45; 1021, p. 38; 1028, p. 31; 1076, p. 37). W. M. Zumwalt. $NE\frac{1}{4}NW\frac{1}{4}$ sec. 34, T. 7 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 11, 55.58; July 23, 62.02.

63 (*911, p. 67; 941, p. 46; 949, p. 30; *991, p. 45; 1021, p. 38; 1028, p. 31; 1076, p. 37). M. W. McKelvey. $NE\frac{1}{4}SE\frac{1}{4}$ sec. 3, T. 8 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 70.60; July 23, 71.77.

72 (*911, p. 67; 941, p. 46; 949, p. 30; *991, p. 45; 1021, p. 38; 1028, p. 31; 1076, p. 37). J. C. Campbell. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 12, T. 8 S., R. 31 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 49.32; July 23, pumping.

92 (*911, p. 68; 941, p. 46; 949, p. 30; *991, p. 46; 1021, p. 38; 1028, p. 31; 1076, p. 38). Raymond Davis. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 17, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 65.75; July 23, 68.34.

96 (*911, p. 68; 941, p. 46; 949, p. 30; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). L. Deane. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 19, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 28.87; July 23, dry.

111 (*911, p. 68; 941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). Franklin Irrigation District well 8. SE_4SW_4 sec. 28, T. 8 S., R. 32 E. Measurements discontinued after Mar. 13, 1944.

120 (*911, p. 69; 941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). D. E. Wilkins. NE_4NW_4 sec. 32, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 11.00; July 23, 11.96.

122 (*911, p. 69; 941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). Delbert Moyers. SE_4SW_4 sec. 32, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 25.72; July 23, 26.79.

125 (*911, p. 69; 941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). V. L. Crotts. SE_4SW_4 sec. 33, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 26.00. Measurements discontinued after Mar. 12, 1947.

131 (*911, p. 69; *941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). Franklin Irrigation District well 2. SW_4NE_4 sec. 34, T. 8 S., R. 32 E. Measurements discontinued after Mar. 13, 1944.

133 (*911, p. 71; 941, p. 47; *949, p. 31; *991, p. 46; 1021, p. 38; 1028, p. 32; 1076, p. 38). Floyd McDaniels. SE_4SW_4 sec. 34, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 10.57; July 23, pumping.

136 (*911, p. 71; 941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 39; 1028, p. 32; 1076, p. 38). Franklin Irrigation District well 1. SE_4NE_4 sec. 34, T. 8 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 44.90; July 23, 55.22.

160 (*911, p. 71; 941, p. 47; 949, p. 31; *991, p. 46; 1021, p. 39; 1028, p. 32; 1076, p. 38). Franklin Irrigation District well 7. NE_4NE_4 sec. 3, T. 9 S., R. 32 E. Pumping; no measurements made in 1947.

161 (*911, p. 71; 941, p. 48; 949, p. 31; *991, p. 47; 1021, p. 39; 1028, p. 32; 1076, p. 38). Franklin Irrigation District well 6. NE_4NE_4 sec. 3, T. 9 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, pumping; July 23, 24.78, nearby well pumping.

162 (*911, p. 72; 941, p. 48; 949, p. 31; *991, p. 47; 1021, p. 39; 1028, p. 32; 1076, p. 38). Franklin Irrigation District well 5. NE_4NE_4 sec. 3, T. 9 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 22.14; July 23, 38.67.

171 (*911, p. 72; 941, p. 48; 949, p. 31; *991, p. 47; 1021, p. 39; 1028, p. 32; 1076, p. 38). John Chapman. NE_4NW_4 sec. 9, T. 9 S., R. 32 E. Water levels, in feet below land-surface datum, 1947: Mar. 12, 37.02; July 23, 38.70.

MARICOPA COUNTY

By H. M. Babcock and others

The investigation of the ground-water resources of Maricopa County was continued during 1947. Measurements of water levels were continued in selected observation wells, and an inventory of the water pumped for irrigation was made. A total of 187 water-level measurements was made in 119 wells in the county.

Records of the quantity of water pumped have been supplied by the irrigation districts. The amount of water pumped by the privately owned wells was determined as follows: The discharge of each well was measured with a current meter or a sharp-crested weir, or by the trajectory method. Where electricity or natural gas was used for power, the rate of power consumption was measured for each pump and the period of operation was computed from the power records. The amount of water pumped was estimated on the basis of crop usage where other types of power were used.

The following table summarizes the amount of water pumped, in acre-feet, in Maricopa County.

Area	1946	1947
Salt River Valley	1,360,000	1,406,000
Gila Bend	33,300	40,500
Dendora Ranch	6,700	6,700
Total	1,400,000	1,453,200

Quantity of water pumped from wells and quantity of surface water diverted at Granite Reef Dam, Salt River Valley area, in acre-feet, 1933-47				
	1933	1934	1935	1936
Water pumped from wells	572,000	711,000	554,000	684,000
Water diverted at Granite Reef Dam	936,700	841,800	1,043,000	1,073,300
Ratio of water pumped from wells to total water used (percent)	38	46	35	39

	1937	1938	1939	1940
Water pumped from wells	665,000	905,000	739,000	943,000
Water diverted at Granite Reef Dam	1,277,900	1,067,800	777,000	603,800
Ratio of water pumped from wells to total water used (percent)	34	47	49	61

	1941	1942	1943	1944
Water pumped from wells	444,000	1,004,000	1,104,000	1,017,000
Water diverted at Granite Reef Dam	1,249,400	1,104,800	981,400	991,100
Ratio of water pumped from wells to total water used (percent)	26	48	53	51

	1945	1946	1947
Water pumped from wells	1,143,000	1,360,000	1,406,000
Water diverted at Granite Reef Dam	997,900	875,500	663,600
Ratio of water pumped from wells to total water used (percent)	53	61	68

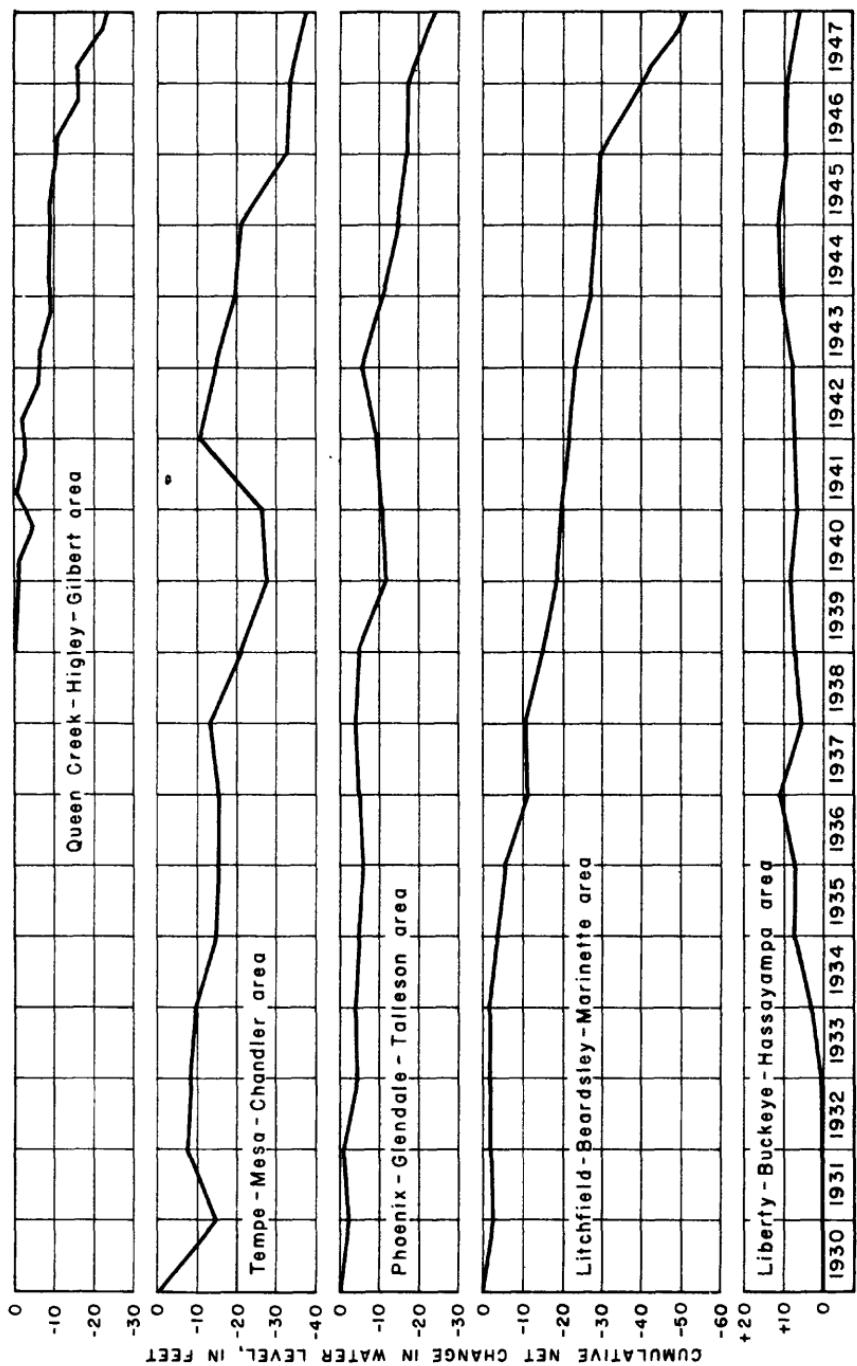


Figure 5.--Graphs showing cumulative net change in water level in various parts of the Salt River Valley, Maricopa County, Arizona.

For the 15-year period, 1933-47, the total amount of water pumped for irrigation in the Salt River Valley area was 13,250,000 acre-feet, and the total amount of water diverted at Granite Reef Dam was 14,495,000 acre-feet. The ratio of water pumped from wells to the total water used was 48 percent for the 15-year period.

Figure 5 shows the average cumulative net change in water levels in the five areas into which the Salt River Valley has been divided as follows:

Queen Creek-Higley-Gilbert area
Tempe-Mesa-Chandler area
Phoenix-Glendale-Tolleson area
Litchfield-Beardsley-Marinette area
Liberty-Buckeye-Hassayampa area

The Queen Creek-Higley-Gilbert area lies in the eastern part of the valley, and each succeeding area lies farther west. The graphs show that there has been a general decline in the water levels in the first four areas but a general rise in the water levels has occurred in the Liberty-Buckeye-Hassayampa area, at the extreme western and lower end of the valley. The decline in water levels has been the result of the generally increasing rate of pumping.

The Queen Creek-Higley-Gilbert area has little surface water available for irrigation in comparison with the water pumped. There has been a large increase in pumping with the development of new land during the past few years. This additional pumping has increased the rate of lowering of the water level. From the beginning of 1939 to the beginning of 1946, the average decline of the water levels was 10.2 feet or an average annual decline of 1.6 feet. From the beginning of 1946 to the end of 1947, the water levels declined an average of 12.8 feet in the area or an average annual decline of 6.4 feet. The average lowering of the water levels in the area was about 23 feet during the 9-year period between 1939 and 1947.

The fluctuations of water levels in wells in the Tempe-Mesa-Chandler area are caused mainly by pumping water for irrigation and by recharge from the irrigation water. During periods of deficient precipitation, when there is a shortage of surface water, large quantities of water are pumped from the area to supplement the surface-water supply. During these dry periods there is a decrease in recharge to the ground-water reservoir from infiltration of irrigation water. When more surface water is available for irrigation the need for supplemental pumped water is decreased and the recharge to the ground water is increased. Therefore, either a decrease or increase

in the supply of surface water is reflected in the ground-water levels. This is shown graphically in figure 5 by the decline of the water levels during the years 1938-39 and the abrupt rise during the wet year 1941, followed by the continued drop in water levels during the dry period after 1941. The trend of the water table in this area has been generally downward, the total decline being about 37 feet between 1930 and 1947.

The fluctuations of the water levels in the Phoenix-Glendale-Tolleson area are similar to those in the Tempe-Mesa-Chandler area, but they are not as great nor as abrupt. The trend of the water table in the area has been generally downward, the total decline being about 25 feet between 1930 and 1947.

In the Litchfield-Beardsley-Marinette area, as in the Queen Creek-Higley-Gilbert area, little surface water is available for irrigation as compared with the amount of water pumped. In the Litchfield-Beardsley-Marinette area the trend of the water table has been downward, and the rate of decline has increased greatly during the last 2 years. The average decline in water levels has been about 56 feet between 1930 and 1947. It is evident that the rate of pumping is in excess of the rate of recharge.

In the Liberty-Buckeye-Hassayampa area the trend of the water levels during the past has been generally upward, with an average rise of over 9 feet in the water table between 1930 and 1946 followed by a 3-foot decline of the water table during 1947. The upward trend was probably caused by the fact that during the past there has been little ground water pumped for irrigation in the area, and recharge to the ground-water reservoir from infiltration of irrigation water has exceeded the discharge. Most of the pumped water used for irrigation in the area has been obtained from wells outside the area. During 1947 there was an increase in the amount of water pumped within the area which caused the lowering of the water table.

Figure 6 shows the cumulative net change in water levels in the entire Salt River Valley area since 1930, and the total amount of water pumped for irrigation in the area since 1933. The water levels vary almost directly with the rate of pumping. The increase in amounts of water pumped during the past few years has caused a very rapid decline in the water levels. The average decline in the water table in the Salt River Valley area was 26.5 feet between 1930 and 1947, with 7.5 feet of this decline occurring during 1947.

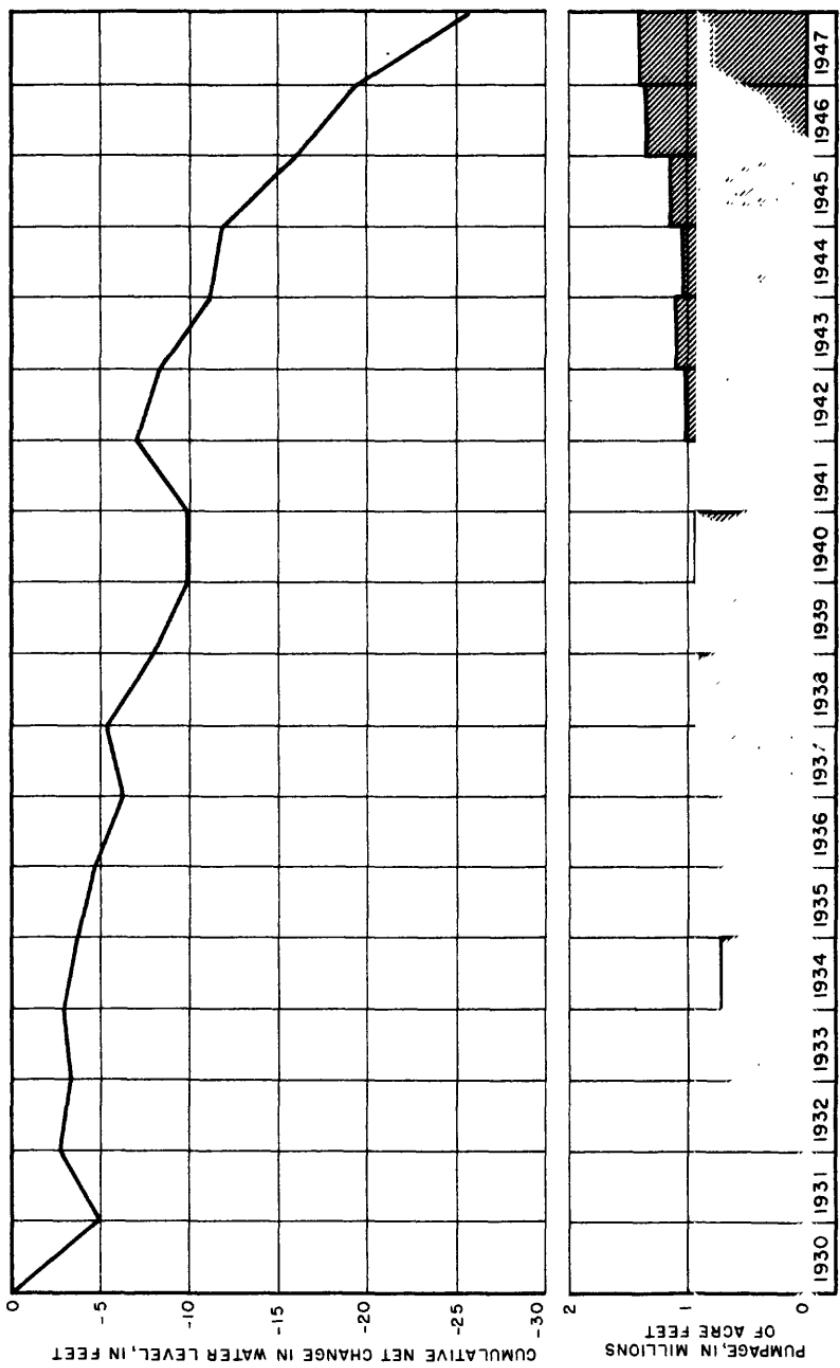


Figure 6.—Graph showing cumulative net change in water level and water pumped for irrigation in the Salt River Valley area, Maricopa County, Arizona.

Well descriptions and water-level measurements

19 (*911, p. 74; 941, p. 51; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). E. D. Edwards. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 28, T. 1 N., R. 6 E. Water levels, in feet below land-surface datum, 1947: Jan. 29, 152.17; Aug. 11, 172.35; Nov. 20, 164.37.

68 (*911, p. 75; 941, p. 51; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). Mr. Schmitt. $NW\frac{1}{4}SE\frac{1}{4}$ sec. 23, T. 1 N., R. 7 E. Water level, in feet below land-surface datum, 1947: Mar. 28, 306.06.

84 (*911, p. 75; 941, p. 51; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). W. A. Anderson. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 11, T. 1 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Mar. 28, 179.14; Nov. 26, 179.59.

87 (*911, p. 75; 941, p. 52; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). Mrs. Gardner. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 18, T. 1 S., R. 7 E. Water level, in feet below land-surface datum, 1947: Jan. 29, 128.96; Measurements discontinued after Jan. 29, 1947.

89 (*911, p. 75; 941, p. 52; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). D. Cole. $NE\frac{1}{4}SE\frac{1}{4}$ sec. 18, T. 1 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Jan. 30, 121.56; Aug. 14, 123.07; Nov. 26, 123.87.

94 (*911, p. 75; 941, p. 52; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). "Old Clifford Place." $NE\frac{1}{4}NE\frac{1}{4}$ sec. 21, T. 1 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Jan. 30, 139.36; Nov. 26, 140.60.

101 (*911, p. 76; 941, p. 52; 949, p. 34; *991, p. 50; 1021, p. 42; 1028, p. 35; 1076, p. 42). Mr. Gardiner. $NE\frac{1}{4}SE\frac{1}{4}$ sec. 25, T. 1 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Jan. 31, 168.86; Nov. 26, 170.28.

102 (*911, p. 76; 941, p. 52; 949, p. 34; *991, p. 51; 1021, p. 42; 1028, p. 35; 1076, p. 42). Florence McEntire. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 33, T. 1 S., R. 7 E. Water level, in feet below land-surface datum, 1947: Jan. 30, 125.60. Measurements discontinued after Jan. 30, 1947.

125 (*911, p. 77; 941, p. 52; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 35; 1076, p. 43). G. H. Dunn. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 12, T. 1 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Jan. 29, 176.44; Aug. 11, 176.47; Nov. 20, 179.13.

128 (*911, p. 77; 941, p. 52; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 36; 1076, p. 43). Roosevelt Water Conservation District. $SE\frac{1}{4}SW\frac{1}{4}$ sec. 14, T. 1 S., R. 6 E. Measurements discontinued.

136 (*911, p. 77; 941, p. 53; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 36; 1076, p. 43). Roosevelt Water Conservation District. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 25, T. 1 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Mar. 28, 108.10; Aug. 11, 108.90; Nov. 20, 108.84.

151 (*911, p. 77; 941, p. 53; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 36; 1076, p. 43). Roosevelt Water Conservation District. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 13, T. 2 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Jan. 30, 74.52; Aug. 11, 87.13; Nov. 20, 85.87.

164 (*911, p. 78; 941, p. 53; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 36; 1076, p. 43). Roosevelt Water Conservation District. $SE\frac{1}{4}NW\frac{1}{4}$ sec. 5, T. 2 S., R. 6 E. Measurements discontinued.

170 (*911, p. 78; 941, p. 53; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 36; 1076, p. 43). A. Sanford. $SE\frac{1}{4}SW\frac{1}{4}$ sec. 3, T. 2 S., R. 6 E. Water level, in feet below land-surface datum, 1947: Mar. 28, 109.96. Measurements discontinued after Mar. 28, 1947.

177 (*911, p. 78; 941, p. 53; 949, p. 35; *991, p. 51; 1021, p. 42; 1028, p. 36; 1076, p. 43). J. O. Power. $SE\frac{1}{4}NW\frac{1}{4}$ sec. 12, T. 2 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Aug. 11, 146.35; Nov. 20, 168.67.

205 (*911, p. 79; 941, p. 53; 949, p. 35; *991, p. 51; 1021, p. 43; 1028, p. 36; 1076, p. 43). J. E. Watson. $SE\frac{1}{4}SW\frac{1}{4}$ sec. 24, T. 2 S., R. 6 E. Water level, in feet below land-surface datum, 1947: Jan. 30, 141.11.

218 (*911, p. 78; 941, p. 54; 949, p. 35; *991, p. 52; 1021, p. 43; 1028, p. 36; 1078, p. 43). Clyde Fitzgerald. $SE\frac{1}{4}NW\frac{1}{4}$ sec. 34, T. 2 S., R. 6 E. No measurements made in 1947.

221 (*911, p. 79; 941, p. 54; 949, p. 35; *991, p. 52; 1021, p. 43; 1028, p. 36; 1076, p. 43). Roosevelt Water Conservation District. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 31, T. 2 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Jan. 28, 50.58; Nov. 20, 55.41.

252 (*911, p. 80; 941, p. 54; 949, p. 35; *991, p. 52; 1021, p. 42; 1028, p. 36; 1076, p. 43). Jack Barnes. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 9, T. 2 S., R. 7 E. Measurements discontinued.

254 (*911, p. 80; 941, p. 54; 949, p. 35; *991, p. 52; 1021, p. 43; 1028, p. 36; 1076, p. 43). W. J. German. $SE\frac{1}{4}NE\frac{1}{4}$ sec. 7, T. 2 S., R. 7 E. Water level, in feet below land-surface datum, 1947: Nov. 20, 152.10. Measurements discontinued after Nov. 20, 1947.

260 (*911, p. 80; 941, p. 54; 949, p. 35; *991, p. 52; 1021, p. 43; 1028, p. 36; 1076, p. 43). Lawrence Ellsworth. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 16, T. 2 S., R. 7 E. Measurements discontinued.

261 (*911, p. 80; 941, p. 54; 949, p. 35; *991, p. 52; 1021, p. 43; 1028, p. 36; 1076, p. 43). Higley Ward School. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 15, T. 2 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Jan. 31, 155.85; Aug. 11, 170.35.

271 (*911, p. 80; 941, p. 54; 949, p. 36; *991, p. 52; 1021, p. 43; 1028, p. 37; 1076, p. 43). Sossaman Bros. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 18, T. 2 S., R. 7 E. Measurements discontinued.

273 (*911, p. 81; 941, p. 55; 949, p. 36; *991, p. 52; 1021, p. 43; 1028, p. 37; 1076, p. 43). Leo Ellsworth. $SE\frac{1}{4}NE\frac{1}{4}$ sec. 28, T. 2 S., R. 7 E. Water level, in feet below land-surface datum, 1947: Nov. 26, 167.95.

512 (*1076, p. 44). Vernon Hughes. $NW\frac{1}{4}$ sec. 26, T. 4 N., R. 7 E. Measurements discontinued.

514 (*1076, p. 44). Vernon Hughes. $NW\frac{1}{4}$ sec. 34, T. 4 N., R. 7 E. Measurements discontinued.

540 (*1076, p. 44). Vernon Hughes. $NE\frac{1}{4}$ sec. 30, T. 4 N., R. 8 E. Measurements discontinued.

602 (*1076, p. 44). City of Phoenix. $NW\frac{1}{4}NE\frac{1}{4}$ sec. 30, T. 3 N., R. 7 E. Measurements discontinued.

926 (*1076, p. 44). O. H. Semon. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 31, T. 2 N., R. 6 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 93.34; Aug. 11, 95.48; Nov. 7, 101.00.

1061 (*1028, p. 38; 1076, p. 44). W. L. Brooks. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 29, T. 3 N., R. 5 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 181.20; Mar. 10, 183.40; Nov. 10, 185.12.

1086 (*1028, p. 38; 1076, p. 45). Salt River Valley Water Users' Association. $SE\frac{1}{4}SW\frac{1}{4}$ sec. 8, T. 2 N., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 101.90; Aug. 28, 102.90; Nov. 7, 103.52.

1087 (*1076, p. 45). Salt River Valley Water Users' Association. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 23, T. 2 N., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 10, 112.9; Aug. 28, 113.49; Nov. 7, 114.26.

1106 (*1076, p. 45). Charley Weak. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 25, T. 1 N., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 85.30; Aug. 11, 89.18; Nov. 13, 96.14.

1107 (*1076, p. 45). Frank E. Shill. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 2, T. 1 N., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 73.44; Nov. 7, 83.35.

1206 (*1076, p. 45). John Hoopes. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 16, T. 1 S., R. 5 E. Measurements discontinued.

1208 (*1076, p. 46). Salt River Valley Water Users' Association. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1, T. 1 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 76.11; Aug. 28, 83.59; Nov. 13, 91.39.

1210 (*1076, p. 46). Mrs. J. L. Cobb. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 32, T. 1 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 52.83; Nov. 13, dry.

1211 (*1076, p. 46). K. K. Skousen. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 35, T. 1 S., R. 5 E. Water level, in feet below land-surface datum, 1947: Nov. 13, 95.02.

1307 (*1076, p. 46). Bob Milan. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 22, T. 2 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 37.03; Nov. 13, 41.79.

1308 (*1076, p. 46). R. W. Hanna. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 30, T. 2 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 39.70; Nov. 13, 41.18.

1309 (*1076, p. 46). Travis Moseley. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 34, T. 2 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 49.50; Nov. 13, 55.35.

1456 (*1076, p. 47). G. R. Finch. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 15, T. 1 S., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 38.60; Aug. 4, 40.07; Nov. 13, 54.84.

1457 (*1076, p. 47). Ben Taylor. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 29, T. 1 S., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 67.20; Nov. 13, 76.54.

1458 (*1076, p. 47). C. W. Brooks. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 27, T. 1 S., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 23.00; Nov. 13, 37.60.

1459 (*1076, p. 47). F. H. Hall. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 29, T. 1 S., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 62.90; Nov. 13, 76.29.

1501 (*1076, p. 47). Elkins. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 24, T. 1 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 29.03; Aug. 3, 33.51; Nov. 18, 37.38.

1502 (*1076, p. 48). J. B. House. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 11, T. 1 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 39.51; Nov. 18, 44.88.

1503 (*1076, p. 48). M. P. Bearden. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 23, T. 1 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 25.54; Nov. 18, dry at 32.5 feet.

1504 (*1076, p. 48). Nelson Pritchard. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 35, T. 1 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 34.70; Aug. 27, dry at 42 feet.

1601A (*1076, p. 48). Stannards. SW_{1/4}NE_{1/4} sec. 19, T. 2 N., R. 4 E. (Erroneously reported in previous report as SE_{1/4}NE_{1/4} sec. 19, T. 2 N., R. 4 E.). Water levels, in feet below land-surface datum, 1947: Mar. 24, 17.05; Aug. 3, 16.52; Nov. 18, 17.37.

1603A (*1076, p. 48). Owner unknown. NW_{1/4}NW_{1/4} sec. 26, T. 2 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 78.80; Aug. 28, dry at 82 feet; Nov. 7, dry at 82 feet.

1619 (*1076, p. 49). Wm. Schrader. NE_{1/4}NE_{1/4} sec. 26, T. 2 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 20, 67.90; Aug. 28, 75.05; Nov. 7, 72.24.

1620 (*1076, p. 49). C. T. Sharp. NE_{1/4}NW_{1/4} sec. 29, T. 2 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Mar. 24, 10.80; Nov. 18, 12.63.

1701 (*1076, p. 49). K. C. Caswell. NW_{1/4}SW_{1/4} sec. 15, T. 3 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 170.18; Mar. 10, 170.71; Nov. 10, 170.45.

1711 (*1076, p. 49). Owner unknown. SE_{1/4}SE_{1/4} sec. 15, T. 3 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 165.99; Mar. 10, 166.04; Nov. 10, 166.15.

1712 (*1076, p. 49). Owner unknown. SE_{1/4}SE_{1/4} sec. 17, T. 3 N., R. 4 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 161.70; Mar. 10, 161.72; Nov. 10, 161.93.

1756 (*1076, p. 49). Christiansen. SE_{1/4}SE_{1/4} sec. 35, T. 4 N., R. 4 E. Measurements discontinued after June 20, 1946.

1887 (*1076, p. 50). Owner unknown. NE_{1/4}SW_{1/4} sec. 3, T. 4 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 27.70; Mar. 10, 29.08.

1891 (*1076, p. 50). Owner unknown. SE_{1/4}SE_{1/4} sec. 27, T. 4 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 212.61; Mar. 10, 214.27; Nov. 10, 216.83.

1896 (*1076, p. 50). A. J. Norris. SW_{1/4}SW_{1/4} sec. 35, T. 4 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 187.98; Mar. 10, 187.95. Measurements discontinued.

1906 (*1028, p. 38; 1076, p. 50). Maxwell. SW_{1/4}SW_{1/4} sec. 1, T. 3 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 182.47; Nov. 10, 183.40.

1906A (*1076, p. 50). Geo. K. Putnam. NW_{1/4}NW_{1/4} sec. 32, T. 3 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Mar. 24, 80.57; Aug. 27, 83.77; Nov. 18, 87.24.

1907. H. J. Love. SW_{1/4}NW_{1/4} sec. 2, T. 3 N., R. 3 E., about 25 feet east of Cave Creek Road, 5 miles north of Sunnyslope. Used drilled well, diameter 8 inches, depth 246 feet. Measuring point, hole in east side of well casing, 1 foot above land-surface datum. Equipped with cylinder pump and windmill. Water level, in feet below land-surface datum, 1947: Nov. 10, 176.69.

1920 (*1076, p. 50). Arizona Aeronautics Corporation. SW_{1/4} sec. 14, T. 3 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Jan. 2, 195.89; Mar. 10, 195.91; Nov. 10, 199.14.

1924 (*1076, p. 50). Owner unknown. NE_{1/4}NW_{1/4} sec. 5, T. 3 N., R. 3 E. Water level, in feet below land-surface datum, 1947: Mar. 25, 207.67.

1925 (*1076, p. 51). E. S. Stewart. NW_{1/4}NE_{1/4} sec. 32, T. 3 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Mar. 24, 91.86; Aug. 27, pumping; Nov. 18, pumping.

1957 (*1076, p. 51). A. Fieks. Formerly owned by P. B. Murphy. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 24, T. 2 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Mar. 24, 18.15; Nov. 18, 19.49.

1958 (*1076, p. 51). J. H. Forsyth. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 33, T. 2 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Aug. 27, dry at 42 feet; Nov. 18, dry at 42 feet.

2056 (*1076, p. 51). Godfrey. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 36, T. 1 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 30.10; Aug. 4, 37.92.

2058 (*1076, p. 51). W. A. Campbell. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 33, T. 1 N., R. 3 E. Water levels, in feet below land-surface datum, 1947: Aug. 28, 104.61; Nov. 25, 103.47.

2157 (*1076, p. 52). Bill Damon. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 9, T. 2 S., R. 3 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 52.58; Nov. 13, 52.89.

2256 (*1076, p. 52). W. R. Collier. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 36, T. 1 S., R. 3 E. Water levels, in feet below land-surface datum, 1947: Mar. 21, 81.10; Nov. 13, 89.01.

2301 (*1076, p. 52). A. Cheatum. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 8, T. 1 S., R. 2 E. Water levels, in feet below land-surface datum, 1947: Aug. 4, 14.48; Nov. 25, 14.13.

2351 (*1076, p. 52). W. E. Sorenson. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 3, T. 1 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 61.03; Aug. 4, 75.54; Nov. 25, 71.68.

2352 (*1076, p. 52). C. V. Hilburs. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 7, T. 1 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 57.88; Nov. 25, 63.19.

2353 (*1076, p. 53). C. Hobson. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28, T. 1 N., R. 2 E. Water level, in feet below land-surface datum, 1947: Mar. 25, 21.17.

2451 (*1076, p. 53). V. E. Messinger. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 8, T. 2 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 70.86; Aug. 5, 73.29; Nov. 25, 75.88.

2452 (*1076, p. 53). Leonard. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 13, T. 2 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 31.80; Aug. 5, 36.71; Nov. 25, 39.18.

2453 (*1076, p. 53). B. F. Reichenberger. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 20, T. 2 N., R. 2 E. Pumping; no measurements made in 1947.

2551 (*1076, p. 54). Charles Christopher. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 24, T. 3 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 24, 136.58; Aug. 27, 142.33; Nov. 18, 155.21.

2552 (*1076, p. 54). Lee Hopper. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 7, T. 3 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 117.30; Aug. 27, 118.45; Nov. 18, 125.62.

2553 (*1076, p. 54). American Institute for Foreign Trade. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 8, T. 3 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 18, 141.95; Aug. 27, 150.40; Nov. 18, 150.94.

2555 (*1076, p. 54). Salt River Valley Water Users' Association. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 26, T. 3 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 4, 118.10; Aug. 27, 120.50; Nov. 18, 126.12.

2651 (*1076, p. 54). Frank Echenique. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 27, T. 4 N., R. 2 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 216.26; Nov. 18, 226.58.

2781 (*1076, p. 54). C. F. Edwards. SW $\frac{1}{4}$ sec. 20, T. 5 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 17, 49.35; Aug. 27, 47.38; Nov. 4, 51.97.

2801 (published incorrectly as 2803 in *1076, p. 55). Owner unknown. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 4 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 17, 140.11; Nov. 4, 151.91; irrigation well, 25 feet northeast, pumping.

2802 (*1076, p. 54). J. G. Boswell. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 5, T. 4 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 17, 76.10; Aug. 27, 78.12; Nov. 4, 80.37.

2804 (*1076, p. 55). R. E. Grace. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 34, T. 4 N., R. 1 E. Water level, in feet below land-surface datum, 1947: Mar. 17, 162.68.

2851 (*1076, p. 55). Essley & Durby. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1, T. 3 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 17, 118.27; Nov. 4, well destroyed; measurements discontinued.

2852 (*1076, p. 55). J. G. Boswell. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 9, T. 3 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 107.99; Aug. 5, pumping; Nov. 4, 115.24.

2854 (*1076, p. 55). J. G. Boswell. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 7, T. 3 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 129.60; Aug. 27, pumping; Nov. 4, 130.28.

2856 (*1076, p. 55). Otis Cook. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 35, T. 3 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 60.85; Aug. 27, 62.13; Nov. 19, 66.78.

2951 (*1076, p. 55). Ray Fram. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 8, T. 2 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 58.80; Aug. 5, dry at 65 feet. Measurements discontinued.

2952 (*1076, p. 56). E. N. Jacobs. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 14, T. 2 N., R. 1 E. Measurements discontinued after Oct. 28, 1946.

3051 (*1076, p. 56). Roosevelt Irrigation District. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 12, T. 1 N., R. 1 E. No measurements made in 1947.

3053 (*1076, p. 56). Isabell-Hartner Co. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 4, T. 1 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, 69.30; Nov. 25, 69.52.

3054 (*1076, p. 56). Owner unknown. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 6, T. 1 N., R. 1 E. Water levels, in feet below land-surface datum, 1947: Mar. 25, pumping; Aug. 5, 72.09; Nov. 25, 68.12.

3366 (*1076, p. 57). D. E. Accomazzo. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 2, T. 1 S., R. 1 W. No measurements made in 1947.

3386 (*1076, p. 57). Goodyear Farms well 9B. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 9, T. 1 N., R. 1 W. Water level, in feet below land-surface datum, 1947: Nov. 4, 54.34.

3388 (*1076, p. 57). T. C. Rhodes. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 6, T. 1 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 74.46; Nov. 4, 79.76.

3389 (*1076, p. 57). A. R. Petri. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, T. 1 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 12.60; Aug. 27, 17.35; Nov. 6, 15.30.

3486 (*1076, p. 57). Goodyear Farms. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 2, T. 2 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Mar. 17, 94.01; Nov. 4, 108.72.

3487 (*1076, p. 57). Goodyear Farms well 19D. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 19, T. 2 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Mar. 17, 113.14; Aug. 5, 136.74; Nov. 4, pumping.

3489 (*1076, p. 58). R. E. McMurchy. $NW\frac{1}{4}SW\frac{1}{4}$ sec. 13, T. 2 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Mar. 17, 59.64; Nov. 4, 68.37.

3490 (published incorrectly as 3940 in *1076, p. 58). Goodyear Farms. $NE\frac{1}{4}NW\frac{1}{4}$ sec. 26, T. 2 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Aug. 5, 84.60; Nov. 4, 87.64.

3586 (*1076, p. 58). A. J. Reems. $SW\frac{1}{4}SW\frac{1}{4}$ sec. 5, T. 3 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Aug. 27, 207.15; Nov. 4, 209.95.

3587 (*1076, p. 58). Rancho Santa Maria. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 22, T. 3 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Feb. 5, 150.45; Nov. 4, 175.60.

3588 (*1076, p. 58). Maricopa County Municipal Water Conservation District No. 1. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 31, T. 3 N., R. 1 W. No measurements made in 1947.

3686 (*1076, p. 58). Maricopa County Municipal Water Conservation District No. 1. $NE\frac{1}{4}SE\frac{1}{4}$ sec. 8, T. 4 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Mar. 17, 200.91; Nov. 4, 205.22.

3786 (*1076, p. 59). Bard Ranch. Approximate location, $SW\frac{1}{4}$ sec. 36, T. 5 N., R. 1 W. Water levels, in feet below land-surface datum, 1947: Mar. 17, 165.68; Nov. 4, 168.20.

3956 (*1076, p. 59). Maricopa County Municipal Water Conservation District No. 1. $NW\frac{1}{4}NE\frac{1}{4}$ sec. 4, T. 3 N., R. 2 W. Water levels, in feet below land-surface datum, 1947: Mar. 17, 256.80; Aug. 27, 234.20; Nov. 4, 268.63.

4002 (*1076, p. 59). Maricopa County Municipal Water Conservation District No. 1. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 4, T. 2 N., R. 2 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 208.72; Nov. 4, 213.74.

4051 (*1076, p. 59). Roosevelt Irrigation District. $SW\frac{1}{4}SW\frac{1}{4}$ sec. 16, T. 1 N., R. 2 W. Water levels, in feet below land-surface datum, 1947: Feb. 13, 75.35; Aug. 27, pumping; Nov. 6, pumping.

4052 (*1076, p. 60). H. F. Hollingshead. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 3, T. 1 N., R. 2 W. Water levels, in feet below land-surface datum, 1947: Feb. 14, 137.37; Aug. 27, pumping; Nov. 6, 143.26.

4053. Owner unknown. $NW\frac{1}{4}SW\frac{1}{4}$ sec. 5, T. 1 N., R. 2 W., 10 feet east of dirt trail, 0.5 mile north of house, 1.5 miles north and 2 miles west of Perryville. Unused drilled well, diameter 20 inches, depth unknown. Measuring point, top of casing, at land-surface datum. Water levels, in feet below land-surface datum, 1947: Feb. 14, 169.79; Aug. 27, 181.34; Nov. 6, 168.95.

4054 (*1076, p. 60). Jettie Robinson. $NE\frac{1}{4}SE\frac{1}{4}$ sec. 12, T. 1 N., R. 2 W. Water levels, in feet below land-surface datum, 1947: Feb. 13, 63.61; Nov. 6, 82.32.

4055 (*1076, p. 60). H. T. Kiefer. $NE\frac{1}{4}SW\frac{1}{4}$ sec. 23, T. 1 N., R. 2 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 25.78; Nov. 6, 30.26.

4100. Roosevelt Irrigation District. $SW\frac{1}{4}NE\frac{1}{4}$ sec. 13, T. 1 N., R. 2 W., about 0.5 mile west and 0.5 mile south of intersection of old U. S. Highway 80 and gravel road, 3.5 miles west of Coldwater. Used drilled irrigation well, diameter 20 inches, depth 155 feet. Equipped with turbine pump and electric motor. Measuring point, bottom of pump base, at land-surface datum.

4100--Continued.

Water level, in feet below land-surface datum, 1923-31,
1934-41, 1944-45, 1947

Date	Water level	Date	Water level	Date	Water level
Apr. 30, 1928	39.0	Nov. 1, 1936	49.3	Feb. 1, 1939	50.5
Jan. 31, 1929	39.0	Dec. 1	49.0	Nov. 1	50.2
Nov. 12	49.7	Jan. 1, 1937	49.1	Feb. 3, 1940	56.5
Mar. 5, 1930	50.3	Feb. 1	49.7	Jan. 13, 1941	52.0
Jan. 15, 1931	50.2	Mar. 1	49.8	Feb. 10	52.0
Mar. 20, 1934	50.0	Dec. 1	49.0	Mar. 26	52.0
Jan. 13, 1935	49.8	Jan. 1, 1938	49.0	Nov. 15	49.0
Dec. 1	49.8	Feb. 1	49.0	July 1, 1944	53.0
Jan. 11, 1936	49.2	Mar. 1	48.0	Jan. 13, 1945	50.0
Feb. 15	49.3	Jan. 1, 1939	50.2	Nov. 6, 1947	55.7

4151 (*1076, p. 60). Lee Hunter. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 4, T. 1 S., R. 2 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 14.17; Nov. 6, 18.44.4352 (*1076, p. 60). Mrs. John Hughes. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 5, T. 1 S., R. 3 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 5.19; Nov. 4, 6.61.4401 (*1076, p. 60). Roosevelt Irrigation District. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 34, T. 1 N., R. 3 W. Water levels, in feet below land-surface datum, 1947: Feb. 13, 55.24; Aug. 5, 57.02; Nov. 6, 56.81.4402 (*1076, p. 61). Roosevelt Irrigation District. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 32, T. 1 N., R. 3 W. Water levels, in feet below land-surface datum, 1947: Feb. 13, 64.60; Nov. 6, 62.79.4616 (*1076, p. 61). Palmer. NE $\frac{1}{4}$ sec. 15, T. 6 N., R. 4 W. No measurements made in 1947.4665 (*1076, p. 61). Lawrence Narramore. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 13, T. 4 N., R. 4 W. No measurements made in 1947.4711 (*1076, p. 61). Roosevelt Irrigation District. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 1 N., R. 4 W. Water levels, in feet below land-surface datum, 1947: Mar. 11, 61.55; Nov. 4, 66.23.4712 (*1076, p. 61). Roosevelt Irrigation District. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 34, T. 1 N., R. 4 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 45.66; Aug. 5, 45.10; Nov. 4, 45.30.4713 (*1076, p. 62). D. E. Accomazzo. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 16, T. 1 N., R. 4 W. Water levels, in feet below land-surface datum, 1947: Feb. 12, 166.96; Nov. 6, 166.42.4714 (*1076, p. 62). Ben Youngker. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 19, T. 1 N., R. 4 W. Water levels, in feet below land-surface datum, 1947: Feb. 12, 55.03; Nov. 4, 56.74.4715 (*1076, p. 62). Owner unknown. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 25, T. 1 N., R. 4 W. Water levels, in feet below land-surface datum, 1947: Feb. 14, 66.66; Nov. 4, 68.23.4761 (*1076, p. 62). Blake. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 17, T. 1 S., R. 4 W. Water levels, in feet below land-surface datum, 1947: Feb. 18, 11.38; Nov. 4, 13.54.4762 (*1076, p. 62). George G. Sevey. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 11, T. 1 S., R. 4 W. Water levels, in feet below land-surface datum, 1947: Feb. 18, 3.94; Nov. 4, 3.64.5350 (*1028, p. 38; 1076, p. 62). Owner unknown. SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 13, T. 5 S., R. 5 W. Water levels, in feet below land-surface datum, 1947: Feb. 10, 30.65; June 4, 31.69; Aug. 26, 31.56.

5456 (*1076, p. 62). H. A. Kreager. SW_{1/4}NW_{1/4} sec. 8, T. 2 S., R. 5 W. Water level, in feet below land-surface datum, 1947: Mar. 11, 18.06.

5457 (*1076, p. 62). Bill Jagow. NE_{1/4} sec. 20, T. 2 S., R. 5 W. Water level, in feet below land-surface datum, 1947: Mar. 11, 23.50.

5502 (*1028, p. 38; 1076, p. 63). Gillespie Land & Irrigation Co. SE_{1/4}SW_{1/4} sec. 36, T. 2 S., R. 5 W. Water levels, in feet below land-surface datum, 1947: Feb. 10, 53.72; June 4, 56.93; Aug. 26, 63.22.

5506 (*1076, p. 63). Charles Yokum. NW_{1/4}NE_{1/4} sec. 1, T. 1 S., R. 5 W. (incorrectly published in Water-Supply Paper 1076 as NE_{1/4}NE_{1/4} sec. 1, T. 1 S., R. 5 W.). Water levels, in feet below land-surface datum, 1947: Feb. 11, 66.55; Nov. 4, 63.54.

5507 (*1076, p. 63). Owner unknown. NE_{1/4} sec. 11, T. 1 S., R. 5 W. Water levels, in feet below land-surface datum, 1947: Feb. 17, 26.64; Nov. 4, 27.67.

5606 (*1076, p. 63). Wheeler. SE_{1/4} sec. 4, T. 1 N., R. 5 W. Water level, in feet below land-surface datum, 1947: Mar. 11, 60.81.

5607 (*1076, p. 63). Spencer Wilson. NW_{1/4}NW_{1/4} sec. 22, T. 1 N., R. 5 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 5.75; Nov. 4, 6.90.

5731 (*1076, p. 63). Carl Arnold. NE_{1/4}SE_{1/4} sec. 26, T. 3 N., R. 5 W. Measurements discontinued after June 23, 1946.

5921 (*1076, p. 63). Owner unknown. SE_{1/4}SW_{1/4} sec. 20, T. 2 N., R. 6 W. No measurements made in 1947.

5971 (*1076, p. 63). Mitchell. SE_{1/4}SE_{1/4} sec. 16, T. 1 N., R. 6 W. No measurements made in 1947.

5972 (*1076, p. 63). Owner unknown. SE_{1/4}NE_{1/4} sec. 22, T. 1 N., R. 6 W. No measurements made in 1947.

6260 (*1028, p. 39; 1076, p. 64). Gillespie Land & Irrigation Co. NE_{1/4}NE_{1/4} sec. 4, T. 6 S., R. 6 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 119.97; June 4, 123.61; Aug. 26, 126.57.

6563 (*1076, p. 64). Dr. Ward. SE_{1/4} sec. 32, T. 1 S., R. 7 W. No measurements made in 1947.

6581 (*1076, p. 64). Owner unknown. NE_{1/4}NE_{1/4} sec. 26, T. 2 N., R. 7 W. No measurements made in 1947.

6733 (*1076, p. 64). Roy Davis. NE_{1/4} sec. 32, T. 1 S., R. 8 W. No measurements made in 1947.

6751 (*1076, p. 64). Owner unknown. NE_{1/4} sec. 1, T. 2 S., R. 8 W. No measurements made in 1947.

7201 (*1076, p. 64). Moser. NE_{1/4}NE_{1/4} sec. 31, T. 3 N., R. 9 W. No measurements made in 1947.

7241 (*1076, p. 64). R. E. Miller and Hodgeman. SE_{1/4}NW_{1/4} sec. 34, T. 7 N., R. 9 W. No measurements made in 1947.

NAVAJO COUNTY

By G. E. Hazen

Measurements of water level were made once during the year in 15 wells in Navajo County. Water-level measurements have been made in selected observation wells in the county since 1944. A report on the ground-water

resources of the Holbrook area, entitled "Ground-water resources of the Holbrook area, Navajo County, Arizona" was released in February 1947.

The main source of ground water in the county is the Coconino sandstone. Discharge of ground water from the Coconino sandstone takes place through springs and seeps, and from flowing and nonflowing wells. The main area of discharge is along the Little Colorado River between Holbrook and Joseph City. There has been very little change in the rate of discharge of ground water for several years.

Water levels in wells in the Coconino sandstone have also changed very little during the period of observation. However, the water levels in wells that penetrate the alluvial fill of the river fluctuate with the rise and fall of the surface flow.

Well descriptions and water-level measurements

2853 (*1076, p. 65). Simon Ranch. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 27, T. 19 N., R. 15 E. Water level, in feet below land-surface datum, 1947: June 13, 164.07.

5452 (*1076, p. 65). A. Smith. In Joseph City, on small knoll, one block north of store. Water level, in feet below land-surface datum, 1947: June 13, 40.97.

5652 (*1076, p. 65). Ben Hunt. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 30, T. 18 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 38.66.

5653 (*1076, p. 65). Ben Hunt. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 30, T. 18 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 21.89.

5654 (*1076, p. 65). Ben Hunt. SE $\frac{1}{4}$ sec. 32, T. 18 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 37.40.

7451 (*1076, p. 66). E. B. Neuman. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1, T. 17 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 1.91.

7470 (*1076, p. 66). R. E. Whiting. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 17 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 29.89, pumping.

7471 (*1076, p. 66). R. E. Whiting. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 17 N., R. 20 E. Pumping; no measurements made in 1947.

7478 (*1076, p. 66). Geo. McLaws. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 17 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 51.03.

7489 (*1076, p. 66). R. Henderson. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 11, T. 17 N., R. 20 E. Water level, in feet below land-surface datum, 1947: June 12, 13.58.

7493 (*1076, p. 67). F. J. McLaws. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 12, T. 17 N., R. 20 E. Pumping; no measurements made in 1947.

7651 (*1076, p. 67). Ambrosia Armijo. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 6, T. 17 N., R. 21 E. Water level, in feet below land-surface datum, 1947: June 12, 13.32.

7652 (*1076, p. 67). Ambrosia Armijo. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 6, T. 17 N., R. 21 E. Water level, in feet below land-surface datum, 1947: June 12, 8.02.

7653 (*1076, p. 67). State of Arizona. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 7, T. 17 N., R. 21 E. Water level, in feet below land-surface datum, 1947: June 12, 39.80.

7654 (*1076, p. 67). Roy Richards. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 7, T. 17 N., R. 21 E. No measurements made in 1947.

7655 (incorrectly published as 5655 in *1076, p. 67). John Mocko. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 10, T. 17 N., R. 21 E. Water level, in feet below land-surface datum, 1947: June 12, 51.80.

10500 (*1076, p. 67). McNeil. In small valley, 0.4 mile north of U. S. Highway 60, 1.9 miles west of Showlow. Dry; no measurements made in 1947.

11000 (*1076, p. 67). Office of Indian Affairs, U. S. Dept. of Interior. Unsurveyed land. In shed, behind house, at Forestdale Trading Post, 9 miles south of Showlow. Water level, in feet below land-surface datum, 1947: June 10, 9.12.

PIMA COUNTY

By R. L. Cushman

The ground-water resources of a part of Pima County were discussed in a report entitled, "Ground-water resources of the Santa Cruz Basin, Arizona," issued in 1943. An addendum to this earlier report, issued in 1947, entitled, "Further investigations of the ground-water resources of the Santa Cruz Basin, Arizona," contains a summary of the information obtained since the release of the earlier report.

During 1947, 216 water-level measurements were made in 44 wells in Pima County, and an inventory was made of the amount of water pumped from wells.

Figure 7 shows graphs of water-level fluctuations in four selected wells, precipitation by months at Tucson, and pumpage of ground water by months.

Well 1337 is an unused irrigation well 16 miles northwest of Tucson in an area heavily pumped for irrigation. Although there was a 14 $\frac{1}{2}$ feet seasonal lowering of the water level in this well caused by heavy pumping, the net decline of the water level was only about 4 feet in 1947.

Well 2823 is an unused dug well 500 feet north of Rillito Creek, in a moderately pumped area northeast of Tucson. The well was filled with trash above the water level and to within 20 feet of the land surface during 1946. A sand point was driven 9 feet into the bottom of the well and water-level measurements were made in the well in February and March. Sometime before April 28, 1947, an unknown party pulled the sand point from the well and filled the dug well with earth to the land surface.

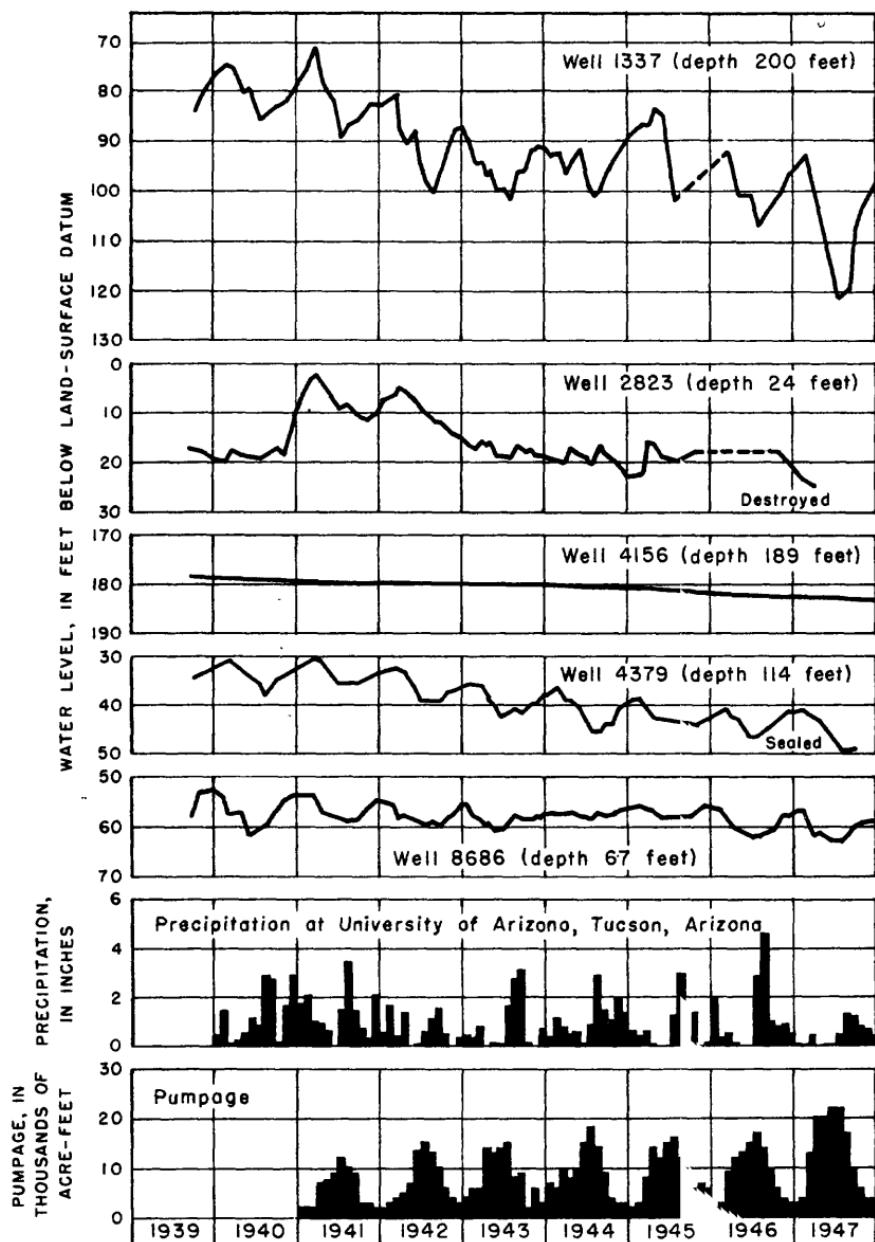


Figure 7.--Graphs showing fluctuations of water level in observation wells in the Santa Cruz Valley, Pima County, Arizona.

Well 4156 is an unused well about 6 miles east of Tucson in an area where ground water is pumped in small quantities for domestic and stock use. The water level declined steadily during 1947 because heavy pumping 6 to 10 miles west of the well caused ground water to move laterally from storage near well 4156 to the pumped area near Tucson.

Wells 4379 and 8686 are unused wells 4 miles and 20 miles, respectively, south of Tucson in areas where ground water is pumped for irrigation. The water levels in these wells declined during the spring and summer months because of heavy pumpage for irrigation. Well 4379 was sealed in October by installation of a pump.

Precipitation at Tucson amounted to 5.72 inches in 1947, or 5.70 inches below normal. This is the lowest annual precipitation graphed in figure 7.

The following table summarizes the amounts of water pumped from wells in Pima County each year since 1940. The increase in pumpage in 1947 is due to increased agricultural, industrial, and domestic use of ground water.

Year	Acre-feet
1941	68,500
1942	85,500
1943	100,000
1944	106,000
1945	111,000
1946	108,000
1947	145,000

Well descriptions and water-level measurements

454 (*949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 70). Cortaro Farms. $SE_4^NE_4^$ sec. 11, T. 11 S., R. 10 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 18	160.19	Apr. 29	155.10	Aug. 26	164.34	Oct. 29	158.88
Mar. 31	161.30	July 14	163.66	Sept. 25	163.08		

457 (*941, p. 57; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 70). T. J. Smith. $SE_4^NE_4^$ sec. 22, T. 11 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 146.20; May 8, 149.75; Oct. 9, 150.05.

460 (*941, p. 57; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 70). W. E. Anway. $NW_4^sec. 27$, T. 11 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 145.08; May 8, 145.29; Oct. 9, pumping.

461 (*941, p. 57; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 70). T. V. Valenzuela. $NE_4^SE_4^$ sec. 32, T. 11 S., R. 10 E. Well dry. Measurements discontinued after Feb. 18, 1947.

463 (*941, p. 57; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 70). Bud Parker. $SE_4^SE_4^$ sec. 36, T. 11 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, pumping; May 8, 170.41; Oct. 6, 171.36.

466. T. V. Valenzuela. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 32, T. 11 S., R. 10 E., about 80 feet south of well 461, 100 feet south of corral, 2 miles west of Silver Bell Road. Used drilled domestic and stock well, diameter 12 inches, depth 500 feet. Measuring point, top of casing, 1.0 foot above land-surface datum. Equipped with cylinder pump and gasoline engine. Water levels, in feet below land-surface datum: Aug. 22, 1946, 159.65; Feb. 18, 1947, 159.85; May 8, 1947, 159.08; Oct. 6, 1947, 159.48.

535 (*911, p. 85; 941, p. 58; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 70). Cortaro Farms. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 11 S., R. 11 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 18	176.66	Apr. 29	177.85	Aug. 26	180.20	Oct. 29	177.97
Mar. 31	176.25	July 14	178.63	Sept. 25	178.80		

a Well, 100 feet away, pumping.

1254 (*911, p. 85; *941, p. 58; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 71). Cortaro Farms. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 12 S., R. 13 E. No measurements made in 1947.

1337 (*911, p. 85; 941, p. 58; *949, p. 39; *991, p. 55; 1021, p. 47; 1028, p. 41; 1076, p. 71). Cortaro Farms. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T. 12 S., R. 12 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 18	92.14	Apr. 29	105.56	Aug. 27	119.23	Oct. 29	102.13
Mar. 31	99.49	July 14	121.35	Sept. 25	106.86		

a Nearby well pumping.

1367 (*911, p. 86; 941, p. 58; *949, p. 39; *991, p. 56; 1021, p. 47; 1028, p. 41; 1076, p. 71). Grady Adams. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 28, T. 12 S., R. 12 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 18	132.28	Apr. 29	136.61	Aug. 28	143.97	Oct. 29	142.91
Mar. 31	132.69	July 14	141.24	Sept. 25	144.94		

1428 (*1028, p. 42; 1076, p. 71). J. E. Glover. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 8, T. 12 S., R. 11 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 188.61; May 8, 188.88; Oct. 9, 189.45.

1430 (*941, p. 58; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 42; 1076, p. 71). J. E. Glover. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 18, T. 12 S., R. 11 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 196.45, nearby well pumping; May 8, 197.14, nearby well pumping; Oct. 9, 200.30.

1432 (*941, p. 59; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 42; 1076, p. 71). P. Johansen. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, T. 12 S., R. 11 E. Pumping; no measurements made in 1947.

1435 (*941, p. 59; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 42; 1076, p. 71). S. B. Niles. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 34, T. 12 S., R. 11 E. Pumping; no measurements made in 1947.

1503 (*941, p. 59; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 42; 1076, p. 71). V. Valenzuela. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 9, T. 12 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 165.25; May 8, 165.03; Oct. 9, 165.43.

1505 (*1028, p. 42; 1076, p. 72). Wirt Bowman. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 20, T. 12 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 185.90; May 8, 186.43; Oct. 9, 186.93.

1506 (*941, p. 59; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 42; 1076, p. 72). Harry Alexander. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 26, T. 12 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 196.00; Oct. 9, 200.97.

2651 (*1028, p. 42; 1076, p. 72). Pima County. SW_{1/4}NE_{1/4} sec. 7, T. 13 S., R. 12 E. Water levels, in feet below land-surface datum, 1947: Feb. 21, 32.40; May 7, 33.29; Oct. 3, 32.37.

2731 (*911, p. 88; 941, p. 60; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 42; 1076, p. 72). Ralph Wetmore. NE_{1/4}SE_{1/4} sec. 24, T. 13 S., R. 13 E. Well covered; measurements discontinued after June 18, 1946.

2738 (*911, p. 88; 941, p. 60; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 43; 1076, p. 72). Bruce Knapp. SE_{1/4}NE_{1/4} sec. 28, T. 13 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 18	43.20	Apr. 29	(a)	Aug. 27	48.90	Oct. 29	48.20
Mar. 31	42.16	July 14	48.78	Sept. 25	46.24		

a Pumping.

2808 (*911, p. 88; 941, p. 60; *949, p. 40; *991, p. 56; 1021, p. 48; 1028, p. 43; 1076, p. 72). Courtright Stables. SE_{1/4}SE_{1/4} sec. 25, T. 13 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 14	10.68	July 14	13.42	Sept. 25	11.09
Mar. 31	11.17	Aug. 28	10.61	Oct. 29	11.74

2823 (*911, p. 89; 941, p. 61; *949, p. 41; *991, p. 56; 1021, p. 48; 1028, p. 43; 1076, p. 72). Southern Arizona Polo Association. NE_{1/4}SW_{1/4} sec. 28, T. 13 S., R. 14 E. Water levels, in feet below land-surface datum, 1947: Feb. 21, 23.80; Feb. 26, 23.75; Mar. 31, 24.19; Apr. 28, sand point removed; measurements discontinued.

2903 (*911, p. 89; *941, p. 61; *949, p. 41; *991, p. 56; 1021, p. 48; 1028, p. 43; 1076, p. 72). E. L. Urquides. SE_{1/4}SE_{1/4} sec. 30, T. 13 S., R. 15 E. Well destroyed; measurements discontinued on Oct. 29.

Water level, in feet below land-surface datum, 1947

Feb. 14	11.99	Apr. 29	12.59	Aug. 28	12.83
Mar. 31	12.28	July 14	14.48	Sept. 25	14.28

2910 (*911, p. 90; 941, p. 61; *949, p. 41; *991, p. 57; 1021, p. 48; 1028, p. 43; 1076, p. 73). V. C. Crouch. SW_{1/4}SE_{1/4} sec. 36, T. 13 S., R. 15 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 14	35.60	Apr. 29	36.12	Aug. 28	36.74
Mar. 31	36.35	July 14	36.77	Sept. 25	36.40

4156 (*911, p. 90; 941, p. 62; *949, p. 41; *991, p. 57; 1021, p. 48; 1028, p. 43; 1076, p. 73). Charles Reynard. SW_{1/4}SE_{1/4} sec. 7, T. 14 S., R. 15 E.

Water level, in feet below land-surface datum, 1947

Jan. 27	182.22	Apr. 28	182.50	July 28	182.64	Oct. 29	182.95
Feb. 26	182.34	May 28	182.58	Aug. 28	182.70	Nov. 28	183.03
Mar. 27	182.42	June 26	182.61	Sept. 25	182.80	Dec. 29	183.02

4375 (*911, p. 91; 941, p. 62; *949, p. 41; *991, p. 57; 1021, p. 48; 1028, p. 43; 1076, p. 73). E. L. Rogers. SE_{1/4}SE_{1/4} sec. 34, T. 14 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	(a)	Apr. 29	46.00	Aug. 28	(a)	Oct. 28	50.10
Mar. 31	45.29	July 14	52.32	Sept. 26	52.27		

a Pumping.

4379 (*911, p. 91; 941, p. 62; *949, p. 41; *991, p. 57; 1021, p. 49; 1028, p. 43; 1076, p. 73). Hal Manning. $SE\frac{1}{4}NW\frac{1}{4}$ sec. 35, T. 14 S., R. 13 E. Sealed; measurements discontinued on Oct. 28.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 14	40.77	Apr. 29	43.33	Aug. 28	49.20
Mar. 31	42.68	July 14	48.65	Sept. 26	48.74

4450 (*941, p. 62; *949, p. 41; *991, p. 56; 1021, p. 49; 1028, p. 43; 1076, p. 73). Pima County. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 6, T. 14 S., R. 12 E. Water levels, in feet below land-surface datum, 1947: Feb. 21, 68.40; May 7, 69.67; Oct. 3, dry.

4452 (*941, p. 62; *949, p. 41; *991, p. 57; 1021, p. 49; 1028, p. 43; 1076, p. 73). Pima County. $NW\frac{1}{4}NW\frac{1}{4}$ sec. 17, T. 14 S., R. 12 E. Water levels, in feet below land-surface datum, 1947: Feb. 21, 68.00; Oct. 3, 71.00.

4453 (*941, p. 62; *949, p. 41; *991, p. 57; 1021, p. 449; 1028, p. 43; 1076, p. 73). Pima County. $NE\frac{1}{4}SW\frac{1}{4}$ sec. 21, T. 14 S., R. 12 E. Water levels, in feet below land-surface datum, 1947: Feb. 21, 58.10; May 7, 58.05; Oct. 3, 56.67;

4454 (*1028, p. 43; 1076, p. 73). State of Arizona. $SE\frac{1}{4}SW\frac{1}{4}$ sec. 21, T. 14 S., R. 12 E. Water levels, in feet below land-surface datum, 1947: Feb. 21, 62.20; May 7, 63.25; Oct. 3, 59.85.

4601 (*941, p. 63; *949, p. 42; *991, p. 57; 1021, p. 49; 1028, p. 44; 1076, p. 73). J. Burrell. Sec. 10, T. 14 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 17, 22.08; May 7, 21.50; Oct. 3, 21.12.

4602 (*941, p. 63; *949, p. 42; *991, p. 57; 1021, p. 49; 1028, p. 44; 1076, p. 74). J. Burrell. Sec. 10, T. 14 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 17, 13.12; May 7, 18.29, pumping prior to measurement; Oct. 3, 19.90.

4604 (*941, p. 63; *949, p. 42; *991, p. 57; 1021, p. 49; 1028, p. 44; 1076, p. 74). Frank R. Rendon. $SW\frac{1}{4}$ sec. 24, T. 14 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 17, 307.57; May 7, 306.62; Oct. 3, 306.73.

6404 (*941, p. 63; *949, p. 42; *991, p. 47; 1021, p. 49; 1028, p. 44; 1076, p. 74). Everett Inscho. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 29, T. 15 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 17, 144.14; May 7, 144.15; Oct. 3, 143.86.

6405 (*941, p. 63; *949, p. 42; *991, p. 57; 1021, p. 49; 1028, p. 44; 1076, p. 74). C. W. Van Camp. $NW\frac{1}{4}SE\frac{1}{4}$ sec. 33, T. 15 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 13, 150.40; Feb. 17, 150.18; May 7, 150.72; Oct. 3, 151.39.

6410 (*941, p. 63; *949, p. 42; *991, p. 57; 1021, p. 49; 1028, p. 44; 1076, p. 74). C. W. Van Camp. $NE\frac{1}{4}NE\frac{1}{4}$ sec. 35, T. 15 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 17, 213.24; May 7, 213.15; Oct. 3, 213.26.

6575 (*911, p. 91; 941, p. 63; *949, p. 42; *991, p. 58; 1021, p. 49; 1028, p. 44; 1076, p. 74). H. C. Barker. $NE\frac{1}{4}SW\frac{1}{4}$ sec. 1, T. 15 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	53.36	Apr. 28	54.94	July 31	55.63	Sept. 26	55.91
Mar. 31	54.64	June 17	55.25	Aug. 28	54.32	Oct. 28	55.26

6582 (*911, p. 91; 941, p. 64; *949, p. 42; *991, p. 58; 1021, p. 49; 1028, p. 44; 1076, p. 74). San Xavier School. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 15, T. 15 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	42.64	Apr. 29	43.17	Aug. 28	43.85	Oct. 28	43.26
Mar. 31	43.07	July 14	44.32	Sept. 26	43.95		

6593 (*911, p. 92; 941, p. 64; *949, p. 42; *991, p. 58; 1021, p. 49; 1028, p. 44; 1076, p. 74). Office of Indian Affairs, U. S. Dept. of Interior. San Xavier Reservation. SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 22, T. 15 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	29.83	Apr. 29	32.39	Aug. 28	33.77	Oct. 28	31.60
Mar. 31	30.65	July 14	33.52	Sept. 26	33.62		

6612 (*949, p. 42; *991, p. 58; 1021, p. 49; 1028, p. 44; 1076, p. 74). City of Tucson. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 2, T. 15 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Jan. 27	35.65	Apr. 28	37.27	July 28	43.61	Oct. 28	43.07
Feb. 26	36.74	May 28	39.46	Aug. 28	41.30	Nov. 28	42.14
Mar. 27	37.60	June 26	41.05	Sept. 25	42.29	Dec. 29	41.77

7152 (*911, p. 93; 941, p. 64; *949, p. 42; *991, p. 58; 1021, p. 50; 1028, p. 44; 1076, p. 75). State of Arizona. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 16 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	42.87	Apr. 28	43.23	July 31	44.11	Sept. 26	(a)
Apr. 1	43.17	June 17	43.78	Aug. 28	(a)		

a Dry.

7166 (*911, p. 93; 941, p. 65; *949, p. 42; *991, p. 58; 1021, p. 50; 1028, p. 44; 1076, p. 75). Lane Farms. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 16 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	49.30	Apr. 28	53.37	July 31	57.32	Sept. 26	53.95
Apr. 1	55.64	June 17	56.45	Aug. 28	54.79	Oct. 28	53.15

8578 (*911, p. 93; 941, p. 65; *949, p. 43; *991, p. 58; 1021, p. 50; 1028, p. 44; 1076, p. 75). Lane Farms. SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 13, T. 17 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 14	64.80	Apr. 28		66.80	July 31
Apr. 1	66.20	June 17		68.27	70.14

8686 (*911, p. 94; 941, p. 65; *949, p. 43; *991, p. 58; 1021, p. 50; 1028, p. 45; 1076, p. 75). State Highway Department. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 18, T. 17 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	56.55	Apr. 28	61.10	July 31	62.54	Sept. 26	59.20
Feb. 14	56.40	June 17	62.34	Aug. 28	61.30	Oct. 28	58.25
Apr. 1	61.52						

9230 (*911, p. 95; 941, p. 65; *949, p. 43; *991, p. 58; 1021, p. 50; 1028, p. 45; 1076, p. 75). J. B. Bull. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 1, T. 18 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	51.73	Apr. 28	(a)	July 31	(a)	Sept. 26	(a)
Apr. 1	(a)	June 17	(a)	Aug. 28	(a)	Oct. 28	54.34

a Pumping.

9238 (*911, p. 95; 941, p. 66; *949, p. 43; *991, p. 58; 1021, p. 50; 1028, p. 45; 1076, p. 75). Intercontinental Ranch Co. well E2. $SE\frac{1}{4}NE\frac{1}{4}$ sec. 26, T. 18 S., R. 13 E. Water levels, in feet below land-surface datum, 1947: Feb. 14, 47.59. Well destroyed; measurements discontinued on Apr. 1.

10477 (*911, p. 95; 941, p. 66; *949, p. 43; *991, p. 58; 1021, p. 50; 1028, p. 45; 1076, p. 75). Intercontinental Ranch Co. well W1. $SW\frac{1}{4}NW\frac{1}{4}$ sec. 3, T. 19 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	55.10	Apr. 28	57.33	July 31	60.27	Sept. 26	57.25
Apr. 1	57.40	June 17	59.38	Aug. 28	58.78	Oct. 28	57.20

10483 (*911, p. 96; 941, p. 66; *949, p. 43; *991, p. 58; 1021, p. 50; 1028, p. 45; 1076, p. 75). Gustavo Amado. $NW\frac{1}{4}SW\frac{1}{4}$ sec. 29, T. 19 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Feb. 14 a	32.60	Apr. 28	32.25	July 31	32.80	Sept. 26	32.74
Apr. 1	31.50	June 17 a	33.48	Aug. 28	32.49	Oct. 28 a	33.45

a Mill running.

PINAL COUNTY

By R. L. Cushman

A total of 210 water-level measurements was made in 64 wells in Pinal County in 1947, and an inventory was made of the total volume of ground water pumped. A mimeographed report entitled "Further investigations of the ground-water resources of the Santa Cruz Basin, Arizona", was released in May 1947 and contains graphs of water-level fluctuations, well records, logs, and analyses of water samples from typical wells in Pinal County. The report is an addendum to a report issued in 1943 entitled "Ground-water resources of the Santa Cruz Basin, Arizona", and summarizes the information obtained since the release of the earlier report.

Figure 8 shows graphs of water-level fluctuations in wells 890, 975, 1532, and 1795, the amount of monthly precipitation at Casa Grande Ruins National Monument, and the amount of monthly pumpage in Pinal County.

Well 890 is a used domestic well about 3.5 miles northwest of Casa Grande, at the edge of, but within, an area irrigated with surface water diverted from the Gila River and supplemented with water pumped from wells. The water-level fluctuations in this well reflect the trend of the regional water-level fluctuations as there are no irrigation wells close enough to well 890 to cause local water-level fluctuations that result from intermittent pumping. The hydrograph shows a net lowering of the water level of 4 feet in this well during 1947, indicating that discharge from the ground-water reservoir in this area exceeded the recharge. Increased pumpage to

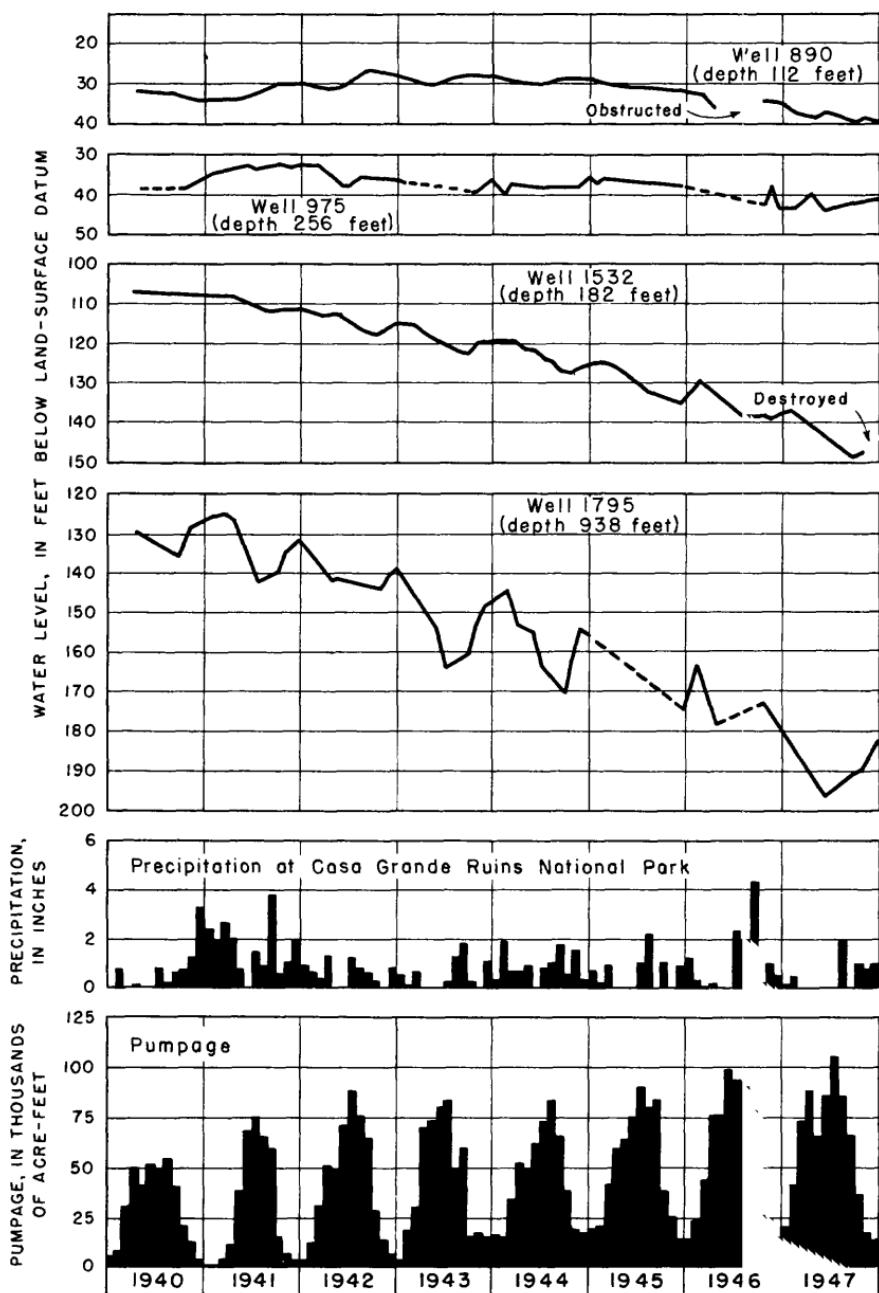


Figure 8.--Graphs showing fluctuations of water level in observation wells in the Casa Grande-Eloy area, Pinal County, Arizona.

make up for the scarcity of surface water has been a prime factor in making the discharge from the ground-water reservoir exceed the recharge. Rising water levels during May and October resulted when pumping decreased and ground water moved in laterally from outside the pumped area to fill the depression in the water table caused by heavy pumping.

Well 975 is an irrigation well about 1 mile northeast of Casa Grande in an area irrigated by both surface water and ground water. Unlike well 890, the water level in well 975 is affected by intermittent heavy pumping in the well and pumping in nearby irrigation wells. Heavy pumping depressed the water table during January, February, April, and June. The elevation to which the water level recovered at the end of the year suggests that pumping operations were greatly reduced during the last 3 or 4 months of the year in the vicinity of well 975.

Well 1532 is an irrigation well about 7 miles southwest of Casa Grande in an area irrigated entirely by pumped water. This well, unused in previous years, was deepened and equipped with a pump and motor in 1947. The total drawdown of the water table in the vicinity of this well was over 12 feet during the pumping season and the net lowering of the water table was estimated to be at least 4 feet in 1947.

Well 1795 is an irrigation well about 4.5 miles south of Eloy near the center of a heavily pumped area irrigated entirely from wells. Heavy pumping during the spring and summer months of 1947 lowered the water level in this well more than 24 feet. The water level rose in the fall after the rate of pumping decreased, but the water level did not recover completely to the prepumping season level.

Precipitation amounting to 5.46 inches during 1947 was 4.02 inches below normal. In recent years, as in 1947, the precipitation has been below normal, and the resulting decreased supply of surface water has necessitated that more and more ground water be pumped for irrigation. Increased annual pumpage, as shown in figure 8, is not entirely caused by the scarcity of surface water in the Gila River. Additional ground water is pumped to irrigate new acreages brought under cultivation each year. The following table summarizes the quantity of ground water pumped annually in Pinal County since 1940.

Year	Pumpage, in acre-feet
1940	372,000
1941	351,000
1942	500,000
1943	515,000
1944	530,000
1945	610,000
1946	660,000
1947	700,000

The following pages contain records of measurements of water level in wells in Pinal County for 1947. Wells 22 to 71, inclusive, are north of the Gila River in the Queen Creek area. The remainder of the wells listed are in the Casa Grande-Florence-Maricopa-Eloy areas, south of the Gila River.

Well descriptions and water-level measurements

22 (*911, p. 81; 941, p. 69; 949, p. 46; *991, p. 62; 1021, p. 55; 1028, p. 49; 1076, p. 78). Hart Mullins. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 35, T. 1 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Jan. 28, 15.49; Nov. 20, 18.17.

23 (*911, p. 81; 941, p. 69; 949, p. 47; *991, p. 62; 1021, p. 55; 1028, p. 49; 1076, p. 78). Hart Mullins. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 35, T. 1 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Jan. 28, 15.07; Nov. 20, 17.99.

32 (*911, p. 82; 941, p. 69; 949, p. 47; *991, p. 62; 1021, p. 57; 1028, p. 50; 1076, p. 79). L. C. Baldwin. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 34, T. 1 S., R. 10 E. Water level, in feet below land-surface datum, 1947: Jan. 28, 46.01. Measurements discontinued after Jan. 28, 1947.

35 (*911, p. 82; 941, p. 70; 949, p. 47; *991, p. 62; 1021, p. 57; 1028, p. 50; 1076, p. 79). E. M. Little. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 8, T. 2 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Jan. 28, 396.83; Nov. 20, 397.57.

41 (*911, p. 82; 941, p. 70; 949, p. 47; *991, p. 62; 1021, p. 57; 1028, p. 50; 1076, p. 79). W. A. Barkley. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 27, T. 2 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Jan. 31, 227.24; Nov. 26, 233.96.

71 (*911, p. 82; 941, p. 70; 949, p. 47; *991, p. 63; 1021, p. 57; 1028, p. 50; 1076, p. 79). Magma Arizona Railroad. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 35, T. 3 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Jan. 31, 159.35; Aug. 14, 162.97; Nov. 26, 163.39.

123 (*949, p. 47; *991, p. 63; 1021, p. 57; 1028, p. 50; 1076, p. 79). Office of Indian Affairs, U. S. Dept. of Interior well 61. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 36, T. 3 S., R. 4 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 26.14; June 4, 26.51; Sept. 29, 27.95.

174 (*949, p. 47; *991, p. 63; 1021, p. 57; 1028, p. 50; 1076, p. 79). G. W. Yancy. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 18, T. 4 S., R. 3 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 26.75; Apr. 9, 26.80; June 4, 27.35; Sept. 29, 28.14.

257 (*949, p. 48; *991, p. 63; 1021, p. 58; 1028, p. 51; 1076, p. 79). Office of Indian Affairs, U. S. Dept. of Interior well 44. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 19, T. 4 S., R. 7 E. Pumping; no measurements made in 1947.

258 (*949, p. 48; *991, p. 63; 1021, p. 58; 1028, p. 51; 1076, p. 79). Office of Indian Affairs, U. S. Dept. of Interior well 42. SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 20, T. 4 S., R. 7 E. No measurements made in 1947.

259 (*949, p. 48; *991, p. 63; 1021, p. 58; 1028, p. 51; 1076, p. 79). Office of Indian Affairs, U. S. Dept. of Interior well 43. SE₄NE₄ sec. 30, T. 4 S., R. 7 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 12	25.54	June 5	27.26	Oct. 1	29.56
Apr. 10	26.37	Aug. 26	28.92	Nov. 4	30.03

278 (*941, p. 70; 949, p. 48; *991, p. 63; 1021, p. 58; 1028, p. 51; 1076, p. 79). Arizona Ranches, Inc. SW₄SW₄ sec. 2, T. 4 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Jan. 31, 168.58; Aug. 14, 172.85; Nov. 26, 173.62.

324 (*949, p. 48; *991, p. 63; 1021, p. 58; 1028, p. 51; 1076, p. 80). Office of Indian Affairs, U. S. Dept. of Interior well 1. SE₄SW₄ sec. 21, T. 4 S., R. 10 E. No measurements made in 1947.

327 (*949, p. 48; *991, p. 64; 1021, p. 58; 1028, p. 51; 1076, p. 80). Office of Indian Affairs, U. S. Dept. of Interior well 4. NE₄SE₄ sec. 31, T. 4 S., R. 10 E.

Water level, in feet below land-surface datum, 1947

Feb. 12	104.87	June 5	108.22	Oct. 1	(a)
Apr. 10	105.32	Aug. 26	(a)		

a Pumping.

341 (*949, p. 48; *991, p. 64; 1021, p. 58; 1028, p. 51; 1076, p. 80). Office of Indian Affairs, U. S. Dept. of Interior well 7. SW₄SW₄ sec. 7, T. 4 S., R. 11 E.

Water level, in feet below land-surface datum, 1947

Feb. 12	39.27	June 5	43.09	Oct. 1	40.12
Apr. 10	40.13	Aug. 26	41.25	Nov. 4	40.44

437 (*949, p. 49; *991, p. 64; 1021, p. 58; 1028, p. 51; 1076, p. 80). Office of Indian Affairs, U. S. Dept. of Interior well 76. SE₄NE₄ sec. 29, T. 5 S., R. 9 E.

Water level, in feet below land-surface datum, 1947

Feb. 12	126.14	June 5	131.42	Oct. 1	(a)
Apr. 10	128.24	Aug. 26	134.48	Nov. 4	135.07

a Pumping.

493 (*949, p. 49; *991, p. 64; 1021, p. 58; 1028, p. 51; 1076, p. 80). H. R. Montierth. Formerly owned by S. H. Wynn. SW₄NW₄ sec. 32, T. 5 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 75.00; June 5, 83.65; Oct. 1, pumping.

503 (*949, p. 49; *991, p. 64; 1021, p. 58; 1028, p. 51; 1076, p. 80). L. D. Ulmer. NE₄NE₄ sec. 1, T. 5 S., R. 8 E.

Water level, in feet below land-surface datum, 1947

Feb. 12	43.52	June 5	45.93	Oct. 1	48.02
Apr. 10	45.17	Aug. 26	49.13	Nov. 4	48.50

554 (*949, p. 49; *991, p. 64; 1021, p. 59; 1028, p. 51; 1076, p. 80). Witcherly & Hancock. Formerly owned by S. B. Rial. SE₄NE₄ sec. 13, T. 5 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 65.20; June 5, 72.25; Aug. 26, 82.31, nearby well pumping; Oct. 1, dry.

556 (*1021, p. 59; 1028, p. 52; 1076, p. 80). Owner unknown. SE₄NE₄ sec. 24, T. 5 S., R. 7 E. Measurements discontinued after Aug. 1, 1945.

616 (*949, p. 49; *991, p. 64; 1021, p. 59; 1028, p. 52; 1076, p. 80). H. D. Murphy. SE₄NE₄ sec. 4, T. 5 S., R. 4 E.

Water level, in feet below land-surface datum, 1947

Feb. 10	78.18	June 4	84.50	Sept. 29	84.85
Apr. 9	80.35	Aug. 26	83.60	Nov. 5	86.41

618 (*949, p. 49; *991, p. 64; 1021, p. 59; 1028, p. 52; 1076, p. 80).
J. R. Ross. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 30, T. 5 S., R. 4 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 10	(a)	June 4	99.00	Nov. 4	101.20
Apr. 9	96.10	Sept. 29	b112.95		

a Roads impassable.

b Pumping prior to measurement.

653 (*949, p. 49; *991, p. 64; 1021, p. 59; 1028, p. 52; 1076, p. 80).
Bernice White. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 3, T. 5 S., R. 3 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 10	61.46	June 4	62.25	Sept. 29	66.00
Apr. 9	(a)	Aug. 26	63.98	Nov. 5	68.73

a Roads impassable.

724 (*1021, p. 59; 1028, p. 52; 1076, p. 81). Vester Branum.
NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 29, T. 6 S., R. 3 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, mill running. Sealed; measurements discontinued on Apr. 9.

738 (*949, p. 50; *991, p. 64; 1021, p. 59; 1028, p. 52; 1076, p. 81).
A. A. Wallace. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 9, T. 6 S., R. 3 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 10	140.12	June 4	(a)	Nov. 4	149.15
Apr. 9	(a)	Sept. 29	163.12		

a Pumping.

887 (*941, p. 71; 949, p. 50; *991, p. 65; 1021, p. 59; 1028, p. 52; 1076, p. 81). Paul Knobloch. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 9, T. 6 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 44.04; June 4, 45.20; Aug. 26, 45.52.

890 (*941, p. 71; 949, p. 50; *991, p. 65; 1021, p. 59; 1028, p. 52; 1076, p. 81). Mrs. Gus Dratzka. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 15, T. 6 S., R. 5 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 10	36.40	June 4	36.50	Nov. 5	38.65
Apr. 9	37.52	Sept. 29	39.22		

893 (*941, p. 71; 949, p. 50; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). P. H. Ethington. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 16, T. 6 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 50.16; June 4, 55.24; Sept. 29, 58.14.

906 (*949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). Office of Indian Affairs, U. S. Dept. of Interior well 100. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 23, T. 6 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 42.11; June 4, 45.04; Sept. 29, 43.30.

907 (*941, p. 72; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). Burris Bros. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 23, T. 6 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 46.17; June 4, 49.52; Sept. 29, 47.63.

961 (*941, p. 72; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). Floyd Smith. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 6 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 32.93; June 4, 38.76; Sept. 30, 40.30; Nov. 4, 37.13.

967 (*941, p. 73; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). E. E. Rosenberry. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 6 S., R. 6 E. No measurements made in 1947.

968 (*941, p. 73; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). C. L. Sherrill. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 13, T. 6 S., R. 6 E. Pumping; no measurements made in 1947.

975 (*941, p. 73; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 81). Gilbert Bros. SE₄SE₄ sec. 17, T. 6 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 43.65; Apr. 10, 39.22; June 5, 44.13, nearby well pumping; Sept. 30, 42.00.

981 (*941, p. 74; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 82). Gilbert Bros. SE₄SE₄ sec. 20, T. 6 S., R. 6 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 12	46.65	June 5	48.59	Sept. 30	50.18
Apr. 10	48.27	Aug. 26	50.06	Nov. 4	50.57

991 (*941, p. 74; 949, p. 51; *991, p. 65; 1021, p. 60; 1028, p. 53; 1076, p. 82). Mrs. Emma Pennington. SE₄SE₄ sec. 25, T. 6 S., R. 6 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 12	53.98	Aug. 26	(a)	Nov. 4	64.48
June 5	58.10	Sept. 30	68.72		

a Pumping.

1002 (*949, p. 52; *991, p. 66; 1021, p. 60; 1028, p. 53; 1076, p. 82). Office of Indian Affairs, U. S. Dept. of Interior well 103. SW₄SW₄ sec. 33, T. 6 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 45.47; June 4, pumping; Sept. 30, 47.70.

1066 (*941, p. 74; 949, p. 52; *991, p. 66; 1021, p. 60; 1028, p. 53; 1076, p. 82). Diwan Singh. SE₄NW₄ sec. 22, T. 6 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 73.70; June 5, pumping; Sept. 30, 84.30, pumping recently.

1072 (*949, p. 52; *991, p. 66; 1021, p. 60; 1028, p. 53; 1076, p. 82). Office of Indian Affairs, U. S. Dept. of Interior well 85. SE₄SE₄ sec. 27, T. 6 S., R. 7 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 12	77.69	Aug. 26	86.07	Nov. 4	89.31
June 5	81.82	Sept. 30	86.88		

1079 (*949, p. 52; *991, p. 66; 1021, p. 60; 1028, p. 54; 1076, p. 82). Office of Indian Affairs, U. S. Dept. of Interior well 84. NE₄NE₄ sec. 35, T. 6 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 99.60; June 5, 111.86; Sept. 30, pumping.

1118 (*941, p. 75; 949, p. 52; *991, p. 66; 1021, p. 60; 1028, p. 54; 1076, p. 82). Dick Shiflet. SE₄NE₄ sec. 4, T. 6 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 83.75; June 5, pumping; Oct. 1, pumping.

1153 (*949, p. 52; *991, p. 66; 1021, p. 60; 1028, p. 54; 1076, p. 82). Office of Indian Affairs, U. S. Dept. of Interior well 82. SW₄SW₄ sec. 30, T. 6 S., R. 8 E. Water level, in feet below land-surface datum, 1947: Feb. 12, 92.74.

1157 (*949, p. 52; *991, p. 66; 1021, p. 61; 1028, p. 54; 1076, p. 82). Office of Indian Affairs, U. S. Dept. of Interior well 78. NE₄NW₄ sec. 35, T. 6 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 42.94; June 5, 48.10; Oct. 1, 54.40.

1162 (*949, p. 52; *991, p. 66; 1021, p. 61; 1028, p. 54; 1076, p. 82). Mr. McFarland. SW₄NW₄ sec. 27, T. 6 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 82.02; June 5, 96.54; Oct. 1, 113.95; Nov. 4, 104.84.

1172 (*1021, p. 61; 1028, p. 54; 1076, p. 82). W. W. Ray. SW₄SW₄ sec. 20, T. 6 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 97.34; Apr. 10, 113.75; June 5, pumping; Oct. 1, 118.40.

1331 (*949, p. 52; *991, p. 66; 1021, p. 61; 1028, p. 54; 1076, p. 82). D. C. Roberts. $SE_4^1SE_4^2$ sec. 20, T. 7 S., R. 8 E. Sealed; measurements discontinued on Nov. 5.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 11	126.50	June 6	(a)	Sept. 29	(a)
Apr. 10	145.80	Aug. 27	(a)		

a Pumping.

1405 (*949, p. 53; *991, p. 66; 1021, p. 61; 1028, p. 54; 1076, p. 83). S. C. McFarland. $SE_4^1SW_4^2$ sec. 11, T. 7 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, 129.57; June 5, pumping; Sept. 30, 148.62.

1422 (*941, p. 75; 949, p. 53; *991, p. 66; 1021, p. 61; 1028, p. 54; 1076, p. 83). D. S. Cramer. $SE_4^1SW_4^2$ sec. 29, T. 7 S., R. 7 E. No measurements made in 1947.

1430 (*1021, p. 61; 1028, p. 54; 1076, p. 83). Les Milligan. $SW_4^1NE_4^2$ sec. 2, T. 7 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 12, pumping; April 10, 132.60; June 5, pumping; Sept. 30, 134.20.

1476 (*941, p. 75; 949, p. 53; *991, p. 66; 1021, p. 61; 1028, p. 54; 1076, p. 83). D. A. Trekkil. $NE_4^1SE_4^2$ sec. 7, T. 7 S., R. 6 E. Water level, in feet below land-surface datum, 1947: Feb. 11, 45.00.

1479 (*941, p. 76; 949, p. 53; *991, p. 67; 1021, p. 61; 1028, p. 55; 1076, p. 83). Paul Brophy. $SW_4^1SW_4^2$ sec. 12, T. 7 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: June 4, 74.05; Aug. 27, 79.83; Sept. 30, 82.42.

1485 (*941, p. 76; 949, p. 53; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 83). F. W. Shedd. $SE_4^1SE_4^2$ sec. 27, T. 7 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 71.94; Sept. 30, 98.65.

1489 (*949, p. 53; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 83). Albert Steinfield. $SE_4^1NE_4^2$ sec. 30, T. 7 S., R. 6 E.

Water level, in feet below land-surface datum, 1947

Feb. 11	60.26	Aug. 27	72.26	Nov. 5	66.45
June 4	66.04	Sept. 30	73.70		

1532 (*941, p. 76; 949, p. 53; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 83). Phoenix Church of Brethren. $SE_4^1NE_4^2$ sec. 7, T. 7 S., R. 5 E. Deepened and equipped with turbine and diesel pump unit. Measuring point beginning Sept. 29, 1947, top of casing, 2.0 feet above previous measuring point and 1.0 foot above land-surface datum. Water levels, in feet below land-surface datum, 1947: Feb. 10, 135.53; Sept. 29, 147.37; Nov. 4, 145.80.

1539 (*949, p. 54; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 83). W. S. Stephenson Estate. $SE_4^1SE_4^2$ sec. 22, T. 7 S., R. 5 E. Water levels, in feet below land-surface datum, 1947: Feb. 10, 98.17; Apr. 9, 101.05; June 4, 106.62; pumping nearby; Sept. 29, 99.69.

1716 (*941, p. 77; 949, p. 54; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 83). Smith-Thornburg Co. $SW_4^1NE_4^2$ sec. 29, T. 8 S., R. 6 E.

Water level, in feet below land-surface datum, 1947

Feb. 11	73.73	Aug. 27	75.22	Nov. 5	75.42
June 4	74.64	Sept. 30	75.34		

1725 (*949, p. 54; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 83). State of Arizona. $SE_4^1NW_4^2$ sec. 21, T. 8 S., R. 6 E. No measurements made in 1947.

1776 (*941, p. 77; 949, p. 54; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 84). S. C. Milligan. $SE_4^1NE_4^1$ sec. 9, T. 8 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 158.00; June 6, pumping; Sept. 29, 159.10.

1787 (*941, p. 77; 949, p. 54; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 84). Sam Phillips. $SE_4^1SE_4^1$ sec. 15, T. 8 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, pumping; June 6, pumping; Sept. 29, 170.90.

1791 (*941, p. 77; 949, p. 54; *991, p. 67; 1021, p. 62; 1028, p. 55; 1076, p. 84). S. G. Wilson. $SE_4^1NE_4^1$ sec. 22, T. 8 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 169.10; June 6, 178.70; Sept. 29, 176.35.

1795 (*941, p. 78; 949, p. 54; *991, p. 61; 1021, p. 62; 1028, p. 55; 1076, p. 84). Jack Pretzer, Jr. $SE_4^1SE_4^1$ sec. 25, T. 8 S., R. 7 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 11	(a)	June 6	197.30	Sept. 29	190.20
Apr. 10	(a)	Aug. 27	(a)	Nov. 5	189.30

a Pumping.

1855 (*949, p. 55; *991, p. 68; 1021, p. 65; 1028, p. 56; 1076, p. 84). D. A. Trekell. $SE_4^1SE_4^1$ sec. 7, T. 8 S., R. 8 E.

Water level, in feet below land-surface datum, 1947

Feb. 11	162.82	Aug. 27	194.40	Nov. 5	176.20
June 6	188.10	Sept. 29	177.85		

1864 (*1021, p. 63; 1028, p. 56; 1076, p. 84). John Arujo. $NW_4^1SE_4^1$ sec. 18, T. 8 S., R. 8 E. No measurements made in 1947.

1884 (*941, p. 78; 949, p. 55; *991, p. 68; 1021, p. 63; 1028, p. 56; 1076, p. 84). Arizona Farm Products Co., known locally as Jack Pretzer well 6. $SE_4^1SW_4^1$ sec. 33, T. 8 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 178.27; June 6, 185.85; Aug. 27, 190.88; Sept. 29, 191.34.

2104 (*941, p. 79; 949, p. 55; *991, p. 68; 1021, p. 63; 1028, p. 56; 1076, p. 84). P. G. Wolfe. $SE_4^1NE_4^1$ sec. 20, T. 9 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 213.52; June 6, pumping; Sept. 29, 213.32; Nov. 5, 198.20.

2108 (*949, p. 55; *991, p. 68; 1021, p. 63; 1028, p. 56; 1076, p. 84). J. F. Nutt. $SE_4^1SE_4^1$ sec. 26, T. 9 S., R. 8 E. No measurements made in 1947.

2173 (*949, p. 55; *991, p. 68; 1021, p. 63; 1028, p. 56; 1076, p. 84). Owner's well 2. R. W. Dickey. $SE_4^1SE_4^1$ sec. 15, T. 9 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 152.40; June 6, pumping; Sept. 29, 176.46.

2174 (*1021, p. 63). Carl West. $SE_4^1SE_4^1$ sec. 16, T. 9 S., R. 7 E.

Water level, in feet below land-surface datum, 1947

Feb. 11	141.16	Aug. 26	174.57	Nov. 5	164.86
June 6	174.97	Sept. 29	162.77		

2233 (*949, p. 55; *991, p. 68; 1021, p. 64; 1028, p. 56; 1076, p. 85). J. Sevak. $SE_4^1SE_4^1$ sec. 24, T. 9 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 92.08; June 6, 96.80; Sept. 29, 99.53.

2236 (*949, p. 56; *991, p. 68; 1021, p. 64; 1028, p. 56; 1076, p. 85). B. F. Nessen. $SW_4^1SE_4^1$ sec. 3, T. 9 S., R. 6 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 118.40; June 4, 120.05; Sept. 30, 122.44.

2311 (*941, p. 79; 949, p. 56; *991, p. 68; 1021, p. 64; 1028, p. 56; 1076, p. 85). J. C. Kinney. NW $\frac{1}{4}$ sec. 3, T. 10 S., R. 7 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 112.48; June 6, 118.40; Sept. 29, 118.98.

2332 (*941, p. 79; 949, p. 56; *991, p. 69; 1021, p. 64; 1028, p. 56; 1076, p. 85). J. C. Kinney. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 5, T. 10 S., R. 8 E. Water levels, in feet below land-surface datum, 1947: Feb. 11, 173.75; June 6, 177.13, mill running; Sept. 29, 183.10.

2351 (*949, p. 56; *991, p. 69; 1021, p. 64; 1028, p. 56; 1076, p. 85). J. C. Kinney. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 5, T. 10 S., R. 9 E. No measurements made in 1947.

2354 (*941, p. 79; 949, p. 56; *991, p. 69; 1021, p. 64; 1028, p. 57; 1076, p. 85). H. H. Cake. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 10, T. 10 S., R. 9 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 11	155.30	June 6	155.32	Sept. 29	155.98
Apr. 10	155.73	Aug. 27	160.40	Nov. 5	156.29

2363 (*941, p. 80; *949, p. 56; *991, p. 69; 1021, p. 64; 1028, p. 57; 1076, p. 85). H. B. Aguirre. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 36, T. 10 S., R. 9 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, pumping; May 8, pumping; Oct. 9, 151.70.

2383 (*991, p. 69; 1021, p. 64; 1028, p. 57; 1076, p. 85). Tom Soleng. SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 34, T. 10 S., R. 10 E. Water levels, in feet below land-surface datum, 1947: Feb. 18, 153.14; May 8, 153.47; Aug. 26, 153.91; Sept. 25, 153.77.

SANTA CRUZ COUNTY

By R. L. Cushman

The ground-water resources of Santa Cruz County were discussed in a report entitled, "Ground-water resources of the Santa Cruz Basin, Arizona," issued in 1943. An addendum to this earlier report entitled, "Further investigations of the ground-water resources of the Santa Cruz Basin, Arizona," containing a summary of the information gathered since the release of the earlier report, was issued in 1947.

During 1947, 61 water-level measurements were made in 9 wells in Santa Cruz County, and an inventory was made of the amount of ground water pumped from wells.

Figure 9 shows graphs of water-level fluctuations in wells 915 and 1525, monthly amounts of surface flow in the Santa Cruz River near Nogales, monthly amounts of precipitation at Nogales, and monthly pumpage.

Well 915 is an irrigation well near the Santa Cruz River and is within the upstream limits of an area heavily pumped for irrigation. The water level in this well fluctuates in response to ground-water discharge occurring as pumpage, and to ground-water recharge occurring as seepage losses from surface-water flows in the nearby river. The irregular downward trend

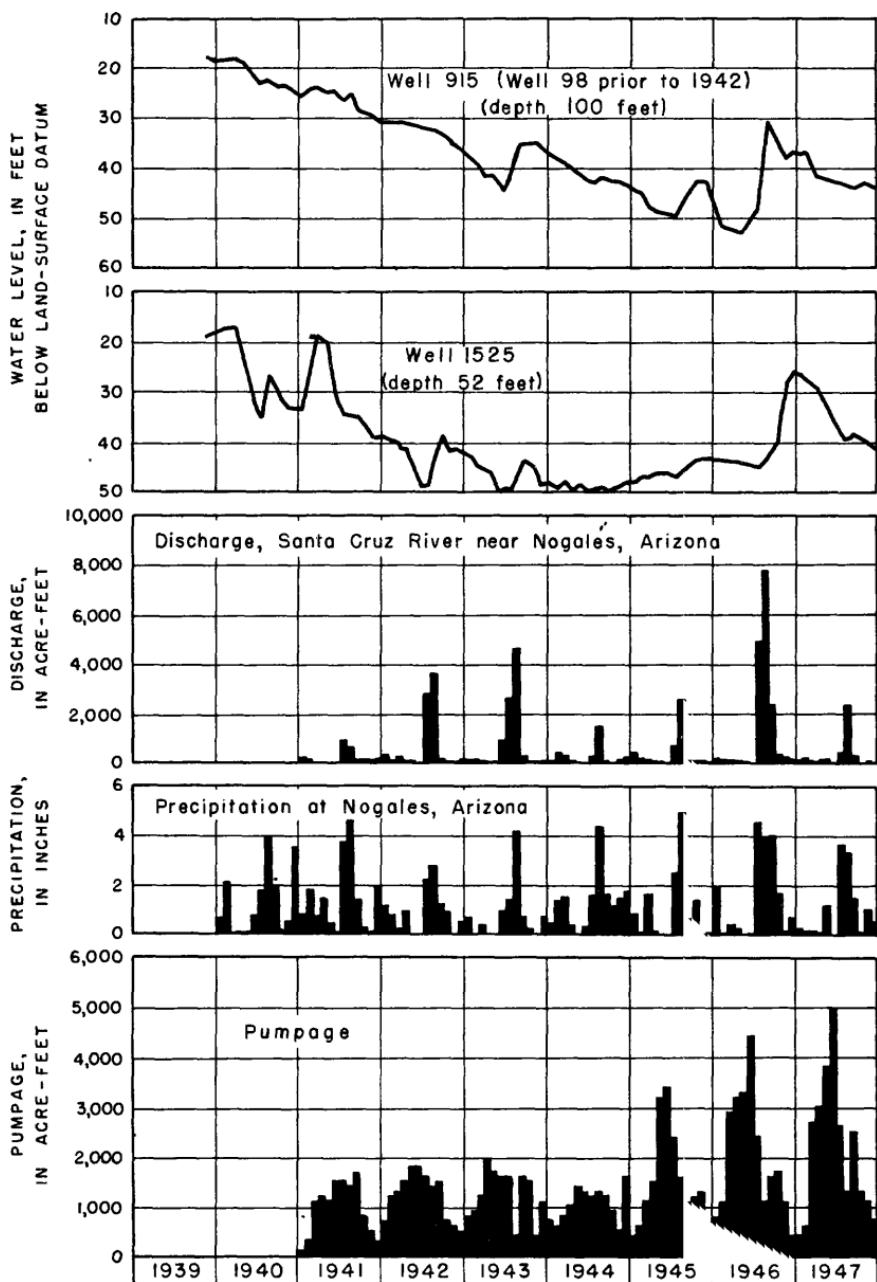


Figure 9.--Graphs showing fluctuations of water level in observation wells in the Santa Cruz Valley, Santa Cruz County, Arizona.

of the water level during 1947 was caused in part by pumping in or near the well. The small rise in water level in October could be the result of decreased pumping or the result of recharge from increased surface-water flows in August.

Well 1525 is a dug well at the edge of the Santa Cruz River flood plain near Nogales. The water level in this well fluctuates in response to gain or loss in ground-water storage near the well, the gain or loss in storage being regulated by the stage of the Santa Cruz River. The water level declined in this well during the first 7 months of 1947, indicating that water moved from storage near this well during the period. The surface water flow in August resulted in a small gain in ground-water storage.

Precipitation at Nogales amounted to 12.66 inches in 1947, or 2.66 inches below normal. The total pumpage of 25,000 acre-feet in 1947 was an increase of 1,000 acre-feet over the 1946 pumpage.

Well descriptions and water-level measurements

5 (*911, p. 96; 941, p. 81; *949, p. 57; *991, p. 70; 1021, p. 65; 1028, p. 59; 1076, p. 88). R. W. Littlejohn. $SE\frac{1}{4}NE\frac{1}{4}$ sec. 13, T. 20 S., R. 12 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	62.61	Apr. 28	63.47	July 31	64.48	Sept. 26	65.07
Apr. 1	62.97	June 17	64.29	Aug. 28	64.49	Oct. 28	(a)
a Dry.							

79 (*911, p. 97; 941, p. 81; *949, p. 57; *991, p. 70; 1021, p. 66; 1028, p. 59; 1076, p. 88). Mrs. Schenkel. $SW\frac{1}{4}NW\frac{1}{4}$ sec. 32, T. 20 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	28.86	Apr. 28	(a)	July 31	(a)	Sept. 26	30.55
Apr. 1	29.14	June 17	30.72	Aug. 28	(a)	Oct. 28	30.52

a Pumping.

908 (*911, p. 98; 941, p. 82; *949, p. 58; *991, p. 70; 1021, p. 66; 1028, p. 59; 1076, p. 88). T. T. Pendleton. $SW\frac{1}{4}SE\frac{1}{4}$ sec. 16, T. 22 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	22.13	Apr. 28	25.87	July 31	(b)	Sept. 26	(b)
Apr. 1	a 24.64	June 17	a 28.68	Aug. 28	31.00	Oct. 28	a 38.70

a Mill running.

b Pumping.

915 (*911, p. 99; 941, p. 82; *949, p. 58; *991, p. 70; 1021, p. 66; 1028, p. 59; 1076, p. 88). T. T. Pendleton. $SE\frac{1}{4}SE\frac{1}{4}$ sec. 35, T. 22 S., R. 13 E.

Water level, in feet below land-surface datum, 1947

Jan. 31	37.04	Apr. 28	(b)	Aug. 28	(b)	Sept. 26	43.85
Feb. 14	36.42	June 17	(b)	Sept. 10	(b)	Oct. 28	42.80
Apr. 1	a 41.35	July 31	(b)				

a Pumping prior to measurement.

b Pumping.

1504 (*911, p. 100; 941, p. 83; *949, p. 58; *991, p. 71; 1021, p. 66; 1028, p. 59; 1076, p. 88). J. F. Dalton. $SW\frac{1}{4}NW\frac{1}{4}$ sec. 19, T. 23 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	12.60	Apr. 28	15.20	July 31	14.12	Sept. 25	13.60
Apr. 1	12.44	June 17	13.24	Aug. 28	13.85	Oct. 28	14.25

1513 (*911, p. 100; 941, p. 83; *949, p. 58; *991, p. 71; 1021, p. 66; 1028, p. 59; 1076, p. 88). Dines Nelson. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 27, T. 23 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	18.00	Apr. 28	17.75	July 31	20.11	Sept. 26	19.70
Feb. 14	17.88	June 17	19.51	Aug. 28	19.51	Oct. 28	19.95
Apr. 1	17.70						

1525 (*911, p. 100; 941, p. 83; *949, p. 58; *991, p. 71; 1021, p. 66; 1028, p. 59; 1076, p. 88). Camberos Bros. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 36, T. 23 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Jan. 31	26.10	Apr. 28	30.87	July 31	38.90	Sept. 24	39.09
Feb. 14	26.67	June 17	35.24	Aug. 28	38.50	Oct. 28	39.82
Apr. 1	28.80						

1912 (*911, p. 101; 941, p. 84; *949, p. 59; *991, p. 71; 1021, p. 66; 1028, p. 60; 1076, p. 88). Simon Mastick. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 6, T. 24 S., R. 14 E.

Water level, in feet below land-surface datum, 1947

Feb. 14	18.08	Apr. 28	21.83	July 31	24.54	Sept. 26	24.30
Apr. 1	20.00	June 17	23.17	Aug. 28	24.42	Oct. 28	24.68

2007. Nelson Brown. Buena Vista Land Grant, approximately the SE $\frac{1}{4}$ sec. 7, T. 24 S., R. 15 E., at end of road to Brown Ranch, 50 yards east of Santa Cruz River, 200 yards north of stream-gaging station known as Santa Cruz River near Nogales, 5 $\frac{1}{2}$ miles east of Nogales. Tiled dug and drilled stock well, diameter 60 to 12 inches, depth 50 feet. Equipped with centrifugal pump and $\frac{1}{2}$ -horsepower gas engine. Measuring point, top of concrete casing, north side, 1.0 foot above land-surface datum. Water levels, in feet below land-surface datum, 1947: July 31, 11.40; Aug. 28, 10.07; Sept. 26, 10.86; Oct. 28, 10.57.

YUMA COUNTY

By H. M. Babcock

A total of 51 water-level measurements was made in 22 selected observation wells in Yuma County in 1947, and an inventory was made of the amount of water pumped for irrigation. Water-level measurements have been made in Yuma County, by the Geological Survey, since 1943. Records of the amount of ground water pumped for irrigation have been kept since 1944. A report on the ground-water resources of the Wellton-Mohawk Valley, entitled "Geology and ground-water resources of the Wellton-Mohawk area, Yuma County, Arizona" was released in April 1947.

About 82,000 acre-feet of water was pumped from wells for irrigation in the county in 1947. The following table shows the amount pumped, in acre-feet, during the period of record.

Year	1944	1945	1946	1947
Doteland area	4,000	4,000	4,000	4,000
Wellton-Mohawk area	37,000	35,000	38,000	43,000
South Gila Valley	20,000	22,000	32,000	35,000
Totals	61,000	61,000	74,000	82,000

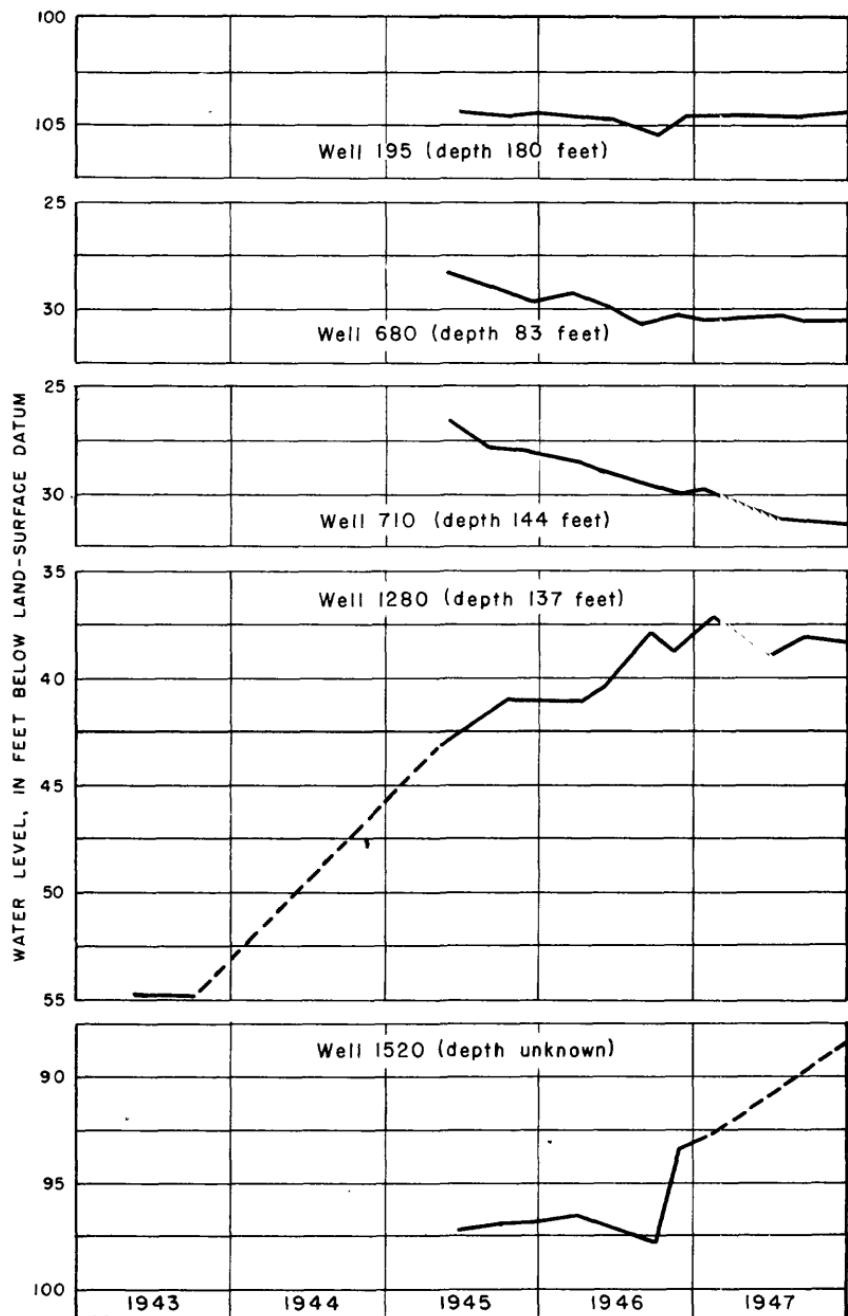


Figure 10.--Graphs showing fluctuations of water level in observation wells in the Lower Gila region, Yuma County, Arizona.

Figure 10 shows graphs of water-level fluctuations in selected wells in the Lower Gila region.

Well 195 is a drilled well at Aztec, on the desert plain about 5 miles south of the Gila River. There has been a slight downward trend in the water level since measurements began, probably as a result of the withdrawal of water by pumping from wells near the river channel to the north.

Well 680 is a drilled well 5 miles east and 2 miles north of Roll, in the river bottom near a group of large irrigation wells. The water level in this well is slowly lowering. There has been an average annual lowering of the water level in the Wellton-Mohawk area of about 0.8 foot for the past 21 years.

Well 710 is $6\frac{1}{2}$ miles east of Roll, in the river bottom a short distance from an area of heavy pumping. The water level in this well shows a continued lowering of the water table in that vicinity as a result of pumping water for irrigation.

Well 1280, a few hundred feet from a large irrigation canal, near Blaisdell, showed a steady rise in water level from 1943 until the summer of 1946. Since then the water level has remained fairly constant.

Well 1520 is in the Yuma Mesa Irrigation Project. The water level began rising in the fall of 1946, due to recharge from a nearby sandy area that was irrigated for the first time in 1946. The water level continued to rise in 1947. As additional land on the Yuma Mesa Project is put under irrigation, the water table will continue to rise. This will undoubtedly create a serious ground-water drainage problem in the adjacent Yuma Valley as the ground water moves away from the high water-table area.

Well descriptions and water-level measurements

155 (*1028, p. 60; 1076, p. 91). Western Farm Management Co. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 19, T. 6 S., R. 12 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 36.99; June 4, 37.17; Aug. 26, 37.95.

195 (*1028, p. 60; 1076, p. 91). H. P. Johnson. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 13, T. 7 S., R. 12 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 104.40; June 4, 104.36; Aug. 26, 104.49.

200 (*1028, p. 60; 1076, p. 91). Owner unknown. NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 18, T. 7 S., R. 12 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 20.67; June 4, 18.70; Aug. 26, 18.95.

248 (*1076, p. 91). Mr. Ludweid. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 22, T. 5 N., R. 13 W. No measurements made in 1947.

312 (*1028, p. 60; 1076, p. 91). Owner unknown. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 1, T. 7 S., R. 13 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 82.82; June 4, 81.90; Aug. 26, 81.45.

440 (*1028, p. 61; 1076, p. 91). Southern Pacific Railroad Co. NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 25, T. 6 S., R. 14 W. Measurements discontinued after May 29, 1946; casing pulled and hole filled.

502 (*1076, p. 91). J. S. Riley. NE $\frac{1}{4}$ sec. 8, T. 4 N., R. 15 W. Measurements discontinued after June 17, 1947.

575 (*1028, p. 61; 1076, p. 91). Mohawk Municipal Water Conservation District. NE $\frac{1}{2}$ SE $\frac{1}{4}$ sec. 30, T. 7 S., R. 15 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 29.72; June 5, pumping; Aug. 27, pumping.

680 (*1028, p. 61; 1076, p. 91). Mohawk Municipal Water Conservation District. NE $\frac{1}{2}$ NE $\frac{1}{4}$ sec. 33, T. 7 S., R. 16 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 30.50; June 5, 30.29; Aug. 27, 30.68.

710 (*1028, p. 61; 1076, p. 91). Western Farm Management Co. NE $\frac{1}{2}$ NW $\frac{1}{4}$ sec. 11, T. 8 S., R. 16 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 22.73; Aug. 26, 31.08.

722 (*1028, p. 61; 1076, p. 91). Smiley Air Field. NE $\frac{1}{2}$ NW $\frac{1}{4}$ sec. 28, T. 8 S., R. 16 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 83.22; June 5, 83.49; Aug. 26, 84.72.

758 (*1076, p. 92). Judge Bellows. NW $\frac{1}{4}$ sec. 22, T. 7 N., R. 17 W. Water level, in feet below land-surface datum, 1947: June 17, 36.60, pumping.

760 (*1076, p. 92). V. C. Tarpley. SW $\frac{1}{4}$ sec. 23, T. 7 N., R. 17 W. (incorrectly published in Water-Supply Paper 1076 as SW $\frac{1}{4}$ sec. 23, T. 7 S., R. 17 W.). Water level, in feet below land-surface datum, 1947: June 17, 43.79.

762 (*1076, p. 92). Owner unknown. NW $\frac{1}{4}$ sec. 23, T. 7 N., R. 17 W. (incorrectly published as NW $\frac{1}{4}$ sec. 23, T. 7 S., R. 17 W., in Water-Supply Paper 1076). Water level, in feet below land-surface datum, 1947: June 17, 56.90.

764 (*1076, p. 92). Julian M. Jones. Sec. 26, T. 7 N., R. 17 W. Water level, in feet below land-surface datum, 1947: June 17, 34.63.

784 (*1028, p. 61; 1076, p. 92). Mohawk Municipal Water Conservation District. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 8 S., R. 17 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 33.59; June 5, 35.63; Aug. 27, 35.80.

795 (*1028, p. 61; 1076, p. 92). Roy Killen. SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 8 S., R. 17 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 26.57; June 5, 28.12; Aug. 26, 28.33.

817 (*1028, p. 61; 1076, p. 92). Gust Svensen. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 33, T. 8 S., R. 17 W. Water levels, in feet below land-surface datum, 1947: Feb. 13, 107.53; June 6, 107.53; Aug. 27, 107.44.

865 (*1076, p. 92). R. B. Deason. NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 27, T. 8 S., R. 18 W. Water levels, in feet below land-surface datum, 1947: June 5, 22.24; Aug. 27, 22.52.

900 (*1028, p. 61; 1076, p. 92). Robert Welch. NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 5, T. 9 S., R. 18 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 57.20; June 5, 57.85; Aug. 27, 57.63.

975 (*1028, p. 61; 1076, p. 93). Owner unknown. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 4, T. 9 S., R. 19 W. Water levels, in feet below land-surface datum, 1947: Feb. 11, 21.94; June 5, 22.90; Aug. 27, 22.95.

1280 (*1028, p. 62; 1076, p. 93). Owner unknown. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 21, T. 9 S., R. 21 W. Water levels, in feet below land-surface datum, 1947: Feb. 12, 37.07; June 5, 38.75; Aug. 27, 37.88.

1474 (*1076, p. 93). J. L. Moorish. $SE_{\frac{1}{4}}SE_{\frac{1}{4}}$ sec. 25, T. 8 S., R. 22 W. Water levels, in feet below land-surface datum, 1947: June 5, 36.45; Aug. 27, 32.90.

1485 (*1028, p. 62; 1076, p. 93). Owner unknown. $NW_{\frac{1}{4}}NW_{\frac{1}{4}}$ sec. 34, T. 8 S., R. 22 W. Water levels, in feet below land-surface datum, 1947: Feb. 12, 27.88; June 5, 28.52; Aug. 27, 27.79.

1520 (*1028, p. 62; 1076, p. 93). Owner unknown. $SE_{\frac{1}{4}}SE_{\frac{1}{4}}$ sec. 17, T. 9 S., R. 22 W. Water level, in feet below land-surface datum, 1947: Feb. 12, 92.70.

CALIFORNIA

By A. A. Garrett, H. M. Stafford, H. G. Thomasson, Jr.,
M. A. Warren, and G. F. Worts, Jr.

SCOPE OF WATER-LEVEL PROGRAM

This report shows the progress made in 1947 in the measurement of water levels in California by the Geological Survey in cooperation or collaboration with several other Federal, State, and local agencies. Also, it reviews the general scope of certain other water-level programs in the State in which the Geological Survey did not participate, but concerning which general information is available.

The following table indicates the distribution of observation wells and the scope of water-level measurements covered by this report, arranged by counties in alphabetical sequence. As the table shows, the report covers 4,059 water-level measurements during 1947 in 560 observation wells distributed in 8 of the 58 counties in the State. One of these counties, San Joaquin, is in the central part of California but all the remaining seven for which water-level records appear in this report are in the southern part of the State, south of the Tehachapi Mountains. Among the eight, only for San Diego and Santa Barbara Counties do the water levels of this report cover all the principal ground-water areas; in the remaining six counties only scattered basins or areas are covered.

Distribution of observation wells in California in 1947
(for which water-level records are given in this report)

County	Number of obser- vation wells			Number of wells with records			Number of wells with water-stage recorders (R) or float gages (F)		
	Estab- lished during 1947 ^a	Discon- tinued in 1947	At year end	At levels in this report	Through- out 1947	Part of year end	At levels in this report	Through- out 1947	Part of year end
Kern County:									
Kern County: Antelope Valley, part	0	0	c 6	15	0	0	0	0	0
Los Angeles County:									
Los Angeles County: Antelope Valley, part	10	9	d 124	b 312	1R	3R	2R		

a Includes wells established prior to 1947 but for which water-level records are renewed or are given for the first time in this report.

b In 1947 only; previous water levels are also given in this report.

c 4 additional wells in which no measurements were made in 1947.

d 25 additional wells in which no measurements were made in 1947.

Distribution of observation wells in California in 1947--Continued
(for which water-level records are given in this report)

County	Number of obser-			Number of records of water levels in this report	Number of wells with water-stage recorders (R) or float gages (F)			
	Estab- lished during 1947	Discon- tinued in 1947	At year end		Through- out 1947	Part of 1947	At year end	
Los Angeles County--Continued								
San Gabriel River								
Basin	0	0	1	365	1R	0	1R	
Coastal plain	0	32	13	485	0	0	0	
Orange County:								
Coastal plain	0	1	22	533	0	0	0	
Riverside County:								
San Jacinto Valley	0	0	8	39	0	0	0	
San Bernardino County:								
Mojave River Basin	3	6	c 74	b 197	0	0	0	
Santa Ana River Basin	0	0	10	95	0	0	0	
San Diego County:								
San Luis Rey River Basin	0	1	16	114	0	0	0	
San Dieguito River Basin	0	0	6	27	0	0	0	
San Diego River Basin	0	0	20	96	0	0	0	
Sweetwater River Basin	0	0	d 1	3	0	0	0	
Otay River Basin	0	0	d 1	3	0	0	0	
Tia Juana River Basin	0	0	4	12	0	0	0	
San Joaquin County:								
Mokelumne River Basin	2	3	22	b 303	0	0	0	
Santa Barbara County:								
Carpinteria Basin	3	0	18	138	0	0	0	
Goleta Basin	2	3	25	308	1R, 1F	0	1R, 1F	
Middle Santa Ynez Valley	3	0	15	95	0	0	0	
Lower Santa Ynez Valley	29	6	59	368	0	2R, 2F	0	
San Antonio Valley	0	0	4	37	0	0	0	
Santa Maria Valley	5	0	41	446	1F	1F	1F	
Cuyama Valley	3	1	8	68	0	0	0	
The State	60	62	498	4,059	3R, 2F	5R, 3F	4R, 2F	

a Includes wells established prior to 1947 but for which water-level records are renewed or are given for the first time in this report.

b In 1947 only; previous water levels also given in this report.

c 2 additional wells in which no measurements were made in 1947.

d 1 additional well in which no measurements were made in 1947.

In addition to this program in which the Geological Survey participated, systematic measurements of water level were made by numerous agencies in widely scattered and extensive parts of California. For the southern part of the State, the following programs were carried forward. In Ventura County basins measurements were continued by the Ventura County Water Survey. In the East Mesa area between the Coachella Branch of the All American

Canal and the East High Line Canal of Imperial Irrigation District, in continuation of observations begun in 1942 by the Bureau of Reclamation, United States Department of the Interior, bimonthly measurements were made in about 80 observation wells by the Imperial Irrigation District in co-operation with the Division of Irrigation of the Soil Conservation Service, United States Department of Agriculture. The following table shows the number of wells measured and the frequency of measurements made by a number of local agencies in the South Coastal Basin which includes the drainage basins of the Los Angeles, San Gabriel, and Santa Ana Rivers and the coastal plain in Los Angeles and Orange Counties. From various agencies, the Division of Water Resources of the Department of Public Works, State of California, continued to assemble records of water levels in wells in the South Coastal Basin and in Antelope Valley. These assembled records for 1945 have been published in the Division's Bulletin 39-N which continues the series beginning with Bulletin 39, published in 1932.

Programs of water-level measurement by local agencies
in the South Coastal Basin in 1947

Subarea and agency	Frequency of measurements		
	Semi-annually	Quarterly	Monthly
<u>Coastal plain, Los Angeles County:</u>			
San Gabriel Valley Protective Association, city of Long Beach, and Los Angeles County Flood Control District			100+
Los Angeles County Flood Control District	470		
California Division of Water Resources (West Coastal Basin)			200+
<u>Coastal plain, Orange County:</u>			
Orange County Flood Control District	118	347	57
Orange County Water District (Santa Ana Gap)			16
<u>San Fernando Valley:</u>			
Los Angeles Department of Water and Power		96	45
Los Angeles County Flood Control District	140		58
Soil Conservation Service (Western part of valley)			65
<u>San Gabriel Valley:</u>			
Los Angeles County Flood Control District	260		50
San Gabriel Valley Protective Association			100+
<u>Upper Santa Ana Valley:</u>			
Chino Basin			
San Bernardino County Flood Control District	500		

Programs of water-level measurement by local agencies
in the South Coastal Basin in 1947--Continued

Subarea and agency	Frequency of measurements		
	Semi-annually	Quarterly	Monthly
San Bernardino Valley: San Bernardino Valley Water Conservation District			More frequently

Measurements in about 300 wells and fluctuations of ground-water level summarized in an annual mimeographed report.

In the central and northern parts of California a number of substantial water-level programs were maintained by irrigation districts and local water-conservation agencies, partly through collaboration with the Division of Water Resources in the Department of Public Works, State of California. The facilities available to the Geological Survey have not been adequate to coordinate these programs for coverage into this report.

RAINFALL AND SNOWFALL

The following general summary of precipitation in California for the calendar year 1947 is quoted from the annual report of climatological data issued by the Weather Bureau:^{1/}

"The outstanding feature of the weather for the year was the deficiency in precipitation. The average amount of precipitation was 13.74 inches, which is 10.24 inches less than the 51-year average. For the State as a whole, the year 1947 was the driest since 1898 when the average amount was only 10.35 inches. Good rains fell in December 1946 but precipitation was below normal every month in 1947 except for June, July, August, and October. These excesses in the summer months contributed little to the water supply, and in some cases did more harm than good so far as agriculture was concerned. For all practical purposes, therefore, it may be said that precipitation in 1947 was deficient in every month except October. Considering the State by drainage basins, total precipitation for the year, in percentage of normal, was as follows: North Coast Drainage, 73; Sacramento River Basin, 73; Northeastern Interior, 57; Central Coast, 53; San Joaquin River Basin, 48; South Coast, 33; Southeastern Desert Basins, 46. Northwestern California fared best in approaching normal rainfall. Many places in the southern half of the State received less rain in 1947 than in any previous year for which records are available. For example, at Paso Robles it was the driest year since 1887; at Fresno, since 1881; Hanford, 1899; Claremont, 1891; Cuyamaca, 1887; Los Angeles, 1877; Redlands, 1889; Santa Barbara, 1867. Snowfall in the mountains was likewise sadly lacking and, at the end of the year, the snow-pack was alarmingly deficient."

Because ground water is derived essentially from rain or snow, the volume in storage and the water levels in wells generally fluctuate in response to fluctuations in precipitation. Where there is a marked seasonal range in precipitation, such as prevails throughout California and the remainder of the Pacific Coast region, ground-water storage generally is

^{1/} U. S. Department of Commerce, Weather Bureau, Climatological data, California Section, vol. 51, No. 13, 1947.

greatest and natural ground-water levels are highest during or somewhat after the height of the wet season, but during the ensuing dry season the unconfined ground-water storage is depleted by natural discharge and water levels commonly recede in wells. This depletion goes on until soil-moisture deficiencies have been replenished by the first rains of the next wet season. Thus, for the climatic conditions of California the ground-water level commonly is related less closely to precipitation within the calendar year than to precipitation within a "water year" which spans one wet season and the following dry season--that is, which ends in mid-autumn. For this treatment of climatic conditions and for the following summary treatment of runoff the water year is taken as ending September 30, the most practicable average date for near-maximum depletion of unconfined ground-water storage and near-minimum runoff.

The first of two following tables shows the average monthly distribution of precipitation in California in the 51 years ending with 1947. The second table shows the relative wetness of the water-year ending September 30, 1947, at 15 representative stations in the State, both in inches and in percentage of the average for the 50 years ending September 30, 1891-1940. This second table brings out that precipitation during the water-year 1946-47 was considerably less than the average for the 50-year period ending with 1939-40.

The 15-station average was only 70 percent of the 50-year average, extremes in the table ranging from 52 percent at Indio to 100 percent at nearby San Bernardino. With the exception of Los Angeles and San Bernardino, the percentage of average rainfall was remarkably uniform at all of the stations shown. Over the area for which water levels are given in this report, the precipitation was about 10 percent greater, percentage-wise, than the average for all 15 stations. The range here was from about 65 percent in San Joaquin County to 100 percent at San Bernardino.

State-wide average monthly and yearly precipitation in California, in inches, based on the 51-year period 1897-1947 ^{2/}

October	1.26	April	1.66
November	2.47	May	.93
December	3.92	June	.33
January	4.66	July	.10
February	4.51	August	.10
March	3.68	September	.42
	20.50		3.54
The year			24.04

^{2/} From "Climatological Data", op. cit., monthly and seasonal precipitation for the season July 1946 to June 1947, inclusive, and for the season July 1947 to June 1948, inclusive.

Precipitation and relative wetness for the year ending September 30, 1947,
at 15 representative climatologic stations in California

Province	Station and county	Precipitation, 1946-47	
		Inches	Percentage of 50-year average/ a
Northern Coast Ranges	Eureka, Humboldt	22.83	59
Coast Ranges of central and southern California	San Francisco, San Fran- cisco	14.77	73
	San Luis Obispo, San Luis Obispo	14.25	68
	Santa Barbara, Santa Barbara	13.41	75
	Los Angeles, Los Angeles	12.74	88
	San Bernardino, San Ber- nardino	16.34	100
	San Diego, San Diego	6.51	66
Great Valley (California Trough)	Cuyamaca, San Diego	27.97	72
	Red Bluff, Tehama	14.65	63
	Stockton, San Joaquin	9.09	65
Sierra Nevada	Fresno, Fresno	6.51	69
	Nevada City, Nevada	33.61	69
Great Basin (South- western Bolson province)	West Point, Calaveras	28.25	71
	Indio, Riverside	1.69	52
	Needles, San Bernardino	2.91	65

a Average for years ending September 30, 1891, to 1940.

RUNOFF

The runoff in California streams during the water-year ending September 30, 1947, was generally below normal to deficient many months of the year. Representative of the runoff in the northern and central parts of the State, the year's total for Trinity River at Lewiston, in the north coastal drainage, was 76 percent of normal; for the combined flow of the Sacramento and San Joaquin Rivers and tributaries, about 55 percent; and for Kings River at Piedra, in the southern Sierra drainage, 74 percent.

In Southern California, the average seasonal runoff was exceeded only in three limited areas. These were the valley-floor areas of rising water in the Santa Ana River below San Bernardino and in the San Gabriel River near Pico, and the mountain drainage areas of West Fork of the San Gabriel River and Rock Creek. The runoff from most of the remaining portions of the San Gabriel Mountains, from frontal drainage areas of the San Bernardino Mountains, and from sections of the valley floor along the San Gabriel and Los Angeles Rivers and Ballona Creek ranged between 75 and 100 percent of the average. In a narrow belt surrounding this area it ranged between 50 and 75 percent of the average and in most of the remaining areas it was less than 50 percent, and for the most part, less than 25 percent of the average. At 10 gaging stations in San Diego County the runoff was the lowest recorded in the period of record.

SUMMARIES OF PROGRAMS, HYDROLOGIC CONDITIONS, AND WATER-LEVEL FLUCTUATIONS

Coastal plain in Los Angeles and Orange Counties

Program of work

Although no periodic measurements of water level for wells in the Long Beach-Santa Ana area were made by the Geological Survey in 1947, extensive programs for periodic measurements of observation wells in this area were continued by several local agencies. In Orange County measurements were made chiefly by the Orange County Flood Control District, and in Los Angeles County chiefly by the Los Angeles County Flood Control District, the San Gabriel Valley Protective Association, and the city of Long Beach. The water-level measurements tabulated in this report for the series of observation wells in the Long Beach-Santa Ana area were furnished to the Geological Survey by these agencies. For this area, measurements by the Geological Survey were made monthly on one and annually on six wells.

The Geological Survey also continued its ground-water investigation of the Torrance-Santa Monica area in cooperation with the Los Angeles County Flood Control District and certain municipalities. Although no factual or interpretive releases concerning the area were made in 1947, the final report was completed by the end of the year.

For the several wells in the Torrance-Santa Monica area, which were selected as "continuing" observation wells by the Geological Survey, measurements were made about monthly by the California Division of Water Resources as a part of that agency's program for collection of factual data for its use during adjudication of water rights within the West Basin. The records of the Division of Water Resources for these wells are published in this report.

The investigation was continued for the Corps of Engineers, United States Army, pertaining to ground-water conditions along the Rio Hondo and lower Los Angeles River, in connection with a proposed program for flood control.

In this report, records are included for 68 wells in the areas covered by the three cooperative projects in both Los Angeles and Orange Counties. Of these wells, records for 31 have been furnished solely by local agencies. Of the 37 wells measured by the Geological Survey, 1 was measured monthly, 28 were measured once in January or February, and once in April, and 2 were measured only once in the early part of the year. Of the 6 "permanent" observation wells of the Geological Survey, all were visited once during the year.

Of the 83 wells for which records for 1946 were published in Water-Supply Paper 1076, records for 68 are continued in this report. No additional wells have been included that were not reported in Water-Supply Paper 1076. The 15 wells discontinued at the end of 1946, or at some time during that year, are listed in the following table.

Wells in which water levels were measured in 1946 but not in 1947

Los Angeles County

3/12-8D3	3/15-25A1	4/13-33E6
3/13-20H4	25H2	4/14-28H1
28P1	4/12-27K2	36H1
32F2	4/13-11F1	5/12-2B1
3/14-35R1	26L1	

Orange County

6/10-11B2

Only 35 of the 68 wells for which records are given in this report were active at year-end. The remainder were discontinued early in the year, and of this group 29 wells were discontinued as of April 1. The following table lists these wells for which measurements are included in this report but which were discontinued at some time during the year.

Wells in which water-level measurements were discontinued before year-end, 1947

Los Angeles County

1/11-21B1	2/12-33L2	4/13-10F1	4/13-12H1
2/12-23G1	3/12-7A2	10R1	14F3
27B1	7N1	11B1	14P1
27H2	7P1	11B3	23F2
28J2	8F1	11D2	24M1
29R1	3/13-35B2	11K5	26P6
33B2	4/13-2K1	11L3	4/14-8E1
33B3	2P1	12E1	13F1

Orange County

5/12-13D2

Hydrologic conditions and water-level fluctuations

Records published by the United States Weather Bureau for three rainfall stations in the coastal plain of Los Angeles and Orange Counties--Los Angeles at the north edge, Long Beach near the southwest edge, and Santa Ana near the southeast edge--suggest that rainfall on this area for the calendar year 1947 was only about one-third of normal. For the water year ending September 30, 1947, however, rainfall on the area was about 90 percent of normal. Obviously, the large quantity of rain that occurred in

November 1946 caused the marked difference in rainfall for these two largely concurrent periods.

The use of the water year in summarizing rainfall records gives a more consistent basis for comparison than would a period ending in the middle of the rainy season. Also, the water year more nearly agrees with the period of seasonal ground-water low than does the calendar year. However, because water-level records are presented herein on a calendar-year basis, rainfall records are summarized for both 12-month periods. The table shows that for the period October 1946 to December 1947 the only months in which appreciable rain fell were November and December 1946, and December 1947. Rainfall in the other months was too small to benefit crops appreciably or to replenish ground-water supplies.

^{a/}
Average rainfall, in inches, for three stations on the coastal plain of Los Angeles and Orange Counties, Calif.
(From publications of the United States Weather Bureau)

Date	Normal	Current	Departure	Percent
October 1946	0.65	0.68	+0.03	+5
November	.92	6.64	+5.72	+622
December	2.76	3.04	.28	+10
January 1947	2.52	.26	-2.26	-90
February	3.19	.67	-2.52	-79
March	2.43	.72	-1.71	-70
April	1.00	.09	-.91	-91
May	.36	.41	.05	+14
June	.06	.02	-.04	-67
July	.01	0	-.01	-100
August	.04	.05	.01	+25
September	.21	.08	-.13	-62
The water-year 1946-47	14.15	12.66	-1.49	-10
October	.64	.10	-.54	-84
November	.97	.28	-.69	-71
December	2.82	1.74	-1.08	-38
The calendar-year 1947	14.25	4.42	-9.83	-69

^{a/} Los Angeles, Long Beach, and Santa Ana.

Note: U. S. Weather Bureau "normals" recomputed for publication in 1947 Climatological Data.

The following table summarizes water-level fluctuations in 30 selected observation wells in the coastal plain in Los Angeles and Orange Counties. In this table, water levels at year-end are compared to the year-end levels of 1946 and to those of the historic low-water year 1936. The data are tabulated separately in three groups: namely, the main coastal basin in Orange County, the main coastal basin in Los Angeles County, and the so-called West Basin southwest of the Newport-Inglewood uplift. Within the main coastal basin, 15 index wells in Orange County show an average drop of 8.1 feet in the year 1947 and an average rise of 5.5 feet since 1936,

and the 5 index wells in Los Angeles County show an average drop of 3.1 feet in the year 1947 and an average drop of 1.5 feet since 1936. Within the West Basin of Los Angeles County, 5 of the 8 index wells show an average drop of 4.9 feet during 1947 and an average drop of 26.1 feet since 1936. The drop of 4.9 feet during 1946-47 is probably misleading; included in the averages was the well 3/14-21B1 which showed an abnormal drop of 12.7 feet. Excluding this well an average drop of 2.9 feet is obtained.

Summary of water-level fluctuations in 30 selected observation wells on the coastal plain in Los Angeles and Orange Counties, Calif.

Well	Water level at end of December, in feet above (+) or below (-) sea level a/			Net rise (+) or net decline (-) in water level, in feet	
	1936	1946	1947	1936-47	1946-47
Wells in the main coastal basin--Orange County					
3/11-36Q2	18.2	36.7	26.1	+7.9	-10.6
4/9-7B1	11.2	54.8	37.4	+26.2	-17.4
4/10-22L2	10.2	29.9	21.9	+11.7	-8.0
4/11-19K1	10.9	20.8	14.3	+3.4	-6.5
5/10-9D1	10.0	24.5	16.7	+6.7	-7.8
5/10-28B1	7.8	18.7	10.2	+2.4	-8.5
5/11-2E1	4.4	22.9	8.1	+3.7	-14.8
5/11-16D2	2.0	11.2	4.7	+2.7	-6.5
5/11-25P1	3.5	10.1	4.9	+1.4	-5.2
5/11-28A1b/	.6	c 8.2	.7	+1.3	-7.5
5/11-29C4b/	...	7.2	1.5	...	-5.7
5/12-12P1	.9	7.0	2.1	+1.2	-4.9
6/10-1E1	.2	14.6	5.0	+4.8	-9.6
6/10-1L2	17.1	21.9	20.0	+2.9	-1.9
6/10-5C1	3.5	11.0	6.3	+2.8	-4.7
6/11-13G2	.8	1.9	.9	.1	-1.0
I-9F1	-1.8	17.7	3.1	+4.9	-14.6
Averages:	6.6	20.2	12.1	+5.5	-8.1
Wells in the main coastal basin--Los Angeles County					
2/12-13A1	133.5	159.8	152.8	+19.3	-7.0
3/12-8L3	62.6	70.1	64.5	+1.9	-5.6
3/13-8L2	35.4	19.6	9.9	-25.5	-9.7
4/11-5D1	14.5	15.7	28.1	+13.6	+12.4
4/12-8P1	-14.2	-25.2	-31.2	-17.0	-6.0
Averages:	46.4	48.0	44.9	-1.5	-3.1
Wells in the West (Coastal) Basin, tapping the Silverado water-bearing zone of Pleistocene age or its equivalent					
2/15-34H1	-0.8	-2.0	-4.1	-3.3	-2.1
3/13-18G2	13.4	-36.9	-36.1	-49.5	+.8
3/14-3K1b/	....	-29	-32.6	....	-3.6
3/14-21B1	-11	-26	-38.7	-27.7	-12.7
3/14-36M3d/	-13.5	-19.8	-22.1	-8.6	-2.3
4/13-14L1e/	.3	2.4	.1	.2	-2.3
4/13-23G2	-34.3	-56.8	-62.3	-28.0	-5.5
4/13-33D1	-30.5	-47.6	-52.4	-21.9	-4.8
Averages:	-12.6	-33.8	-38.7	-26.1	-4.9

a Chiefly interpolated.

b Excluded from averages.

c Flowing; measuring point is 8.2 feet above sea level.

d Taps shallow deposits of Pleistocene age; excluded from averages.

e Taps Gaspar water-bearing zone of Recent age; excluded from averages.

Mojave Desert region

Antelope Valley, Kern and Los Angeles Counties

Observations of water level in Antelope Valley by the Geological Survey and by the Los Angeles County Flood Control District were continued in 1947 in 132 wells. These included 10 wells of which 5 were established during 1947 and the remainder during earlier years, and for which water-level records are renewed or are given for the first time in this report. Levels in 3 wells were measured by continuous water-stage recorders; in 26 wells measurements were made at approximately monthly intervals; and in most of the remainder 1 measurement only was made in the fall of the year. The measurements indicate a continuation of the downward trend in levels of the past several years. For the entire valley the average decline in level from the fall of 1946 to the fall of 1947 was about 4.3 feet. The greatest declines were shown in township 7 north, ranges 10 and 11 west, where there is heavy pumping for irrigation.

Mojave River Basin, San Bernardino County

Observations of water level in the Mojave River Basin were continued in 1947 in 74 wells. These included three wells of which one was established during 1947 and the other two during earlier years, and for which water-level records are given for the first time in this report. Ordinarily the water levels in this basin are measured in both the spring and fall of the year as representing, respectively, the times of maximum and minimum stages. Heavy precipitation occurred in the mountain portion of the drainage area in November 1946, and the measurements of the water levels were not made until January 1947. During 1947, therefore, the levels in most of the wells were measured in January, May, and November.

During the water year ending September 30, 1947, the discharge of the Mojave River near Victorville was 55 percent of the 22-year average, and there was continuous flow at Barstow from December 22 to March 23.

Measurements of water level in nine wells in the area between the Forks and Hesperia Crossing showed an average net decline of 11.2 feet from January to November 1947. Because the recharge of ground water from the early rains of November 1946 was effective as far downstream as Hesperia Crossing, the January 1947 levels did not represent the minimum stages of the preceding fall, as in the case of the levels in the areas farther downstream. A better indication of the change in water levels in this area is

therefore given by a comparison of measurements made in the fall of 1945 with those made in the fall of 1947. During this 2-year period, the average net change in the water levels was a decline of 3.4 feet.

For the remainder of the basin, the measurements indicated generally a net decline in water levels from the fall of 1946 to the fall of 1947.

In wells in the vicinity of Verde Crossing, the average net decline was 1.7 feet; between Victorville and Hodge, 0.9 foot; downstream from Hodge Crossing and north to the Barstow-Mojave highway, 1.7 feet; and in the valley north of this highway, 0.1 foot.

Average net declines indicated by the measurements in other parts of the basin were: 1.7 feet in the Lenwood-Barstow area; 4.5 feet in the area between Barstow and Daggett; 1.9 feet in the sub-basin between Daggett and the Kouns-Newberry sand-dune belt; and 1.0 foot in the sand-dune belt. East of the sand-dune belt, changes in water level shown by the measurements were too slight to indicate a definite trend.

Mokelumne River Basin, San Joaquin County

During 1947 the East Bay Municipal Utility District continued monthly measurements of water level in selected observation wells of the Mokelumne area, in the central part of the Great Valley. Records for 24 of these wells have been used as an index to the changes in ground-water storage, and they have been published by the Geological Survey since 1935. In these index wells 303 measurements were made during the year.

Of the original 24 wells, one was destroyed in September 1946 and 3 more were destroyed or abandoned because of lowering water table before the end of 1947. As a rule, a nearby well has been measured to replace each abandoned well. Records for two of these replacement wells are included in this report. The following table correlates the average yearly water-level changes in the index wells (21 in 1947) with the fluctuations in yearly rainfall, beginning with 1943. In this table the accumulated changes begin with 1934, as shown in the report for 1945. The table shows that the water level in the Mokelumne area declined for the fifth consecutive year. For the period of record, 1934-47, the decline in 1947 was exceeded only by that of 1939, and the deficiency in rainfall during 1947 for the three index stations was larger than that of any other year.

Average yearly rise or decline of water level in 24 observation wells, and yearly rainfall in the Mokelumne area, 1943-47

Year	Water level		Rainfall	
	Yearly rise (+) or decline (-) (feet)	Accumulated rise (+) or decline (-) (feet)	Excess (+) or deficiency (-) (inches)	Accumulated excess (+) or deficiency (-) (inches)
1943	-0.19	+2.89	-2.93	+22.21
1944	-2.32	+.57	+.46	+22.67
1945	-.06	+.51	+9.50	+32.17
1946	c -2.24	c -1.73	-8.92	+23.25
1947	d -2.71	d -4.44	-14.69	+8.56

a Average of rainfall at Electra, West Point, and Twin Lakes, 1906-45. Average yearly rainfall at the 3 stations in this 40-year period was 38.74 inches.

b Accumulation dates from Jan. 1, 1934.

c Average based on 22 wells.*

d Average based on 21 wells.

The second table shows the average change in water level in 1947 during the periods of increasing and of diminishing withdrawals for irrigation, respectively. This table shows that recharge early in 1947 was insufficient to offset the heavy withdrawals for irrigation, as indicated by the average decline of almost $4\frac{1}{2}$ feet. During the last half of the year, water levels rose somewhat so that the average net change for the year was a decline of 2.8 feet.

Seasonal changes in water level, in feet, at 21 observation wells in the Mokelumne area, 1947

Period	Greatest rise	Greatest recession	Average change
Jan. 1 to May 31 (increasing withdrawal for irrigation)	+1.92	-11.88	-4.49
June 1 to Dec. 31 (diminishing withdrawal)	+9.20	-4.41	+1.69
The year	-.46	-5.16	-2.80

San Gabriel River Basin, Los Angeles County

A continuous water-stage recorder was in operation throughout 1947 on well 1S/10-18, at Baldwin Park, in the Upper San Gabriel Valley. The water level in this well rose from a mean daily stage of 304.22 feet above sea level on January 1 to a stage of 308.81 feet, the highest of the year, on March 11. Declining, then, it reached a stage of 291.58 feet, the lowest of the year, on December 31. On that date the stage was 17.23 feet below the highest stage of the year, 12.39 feet below the record high stage of 329.1 feet on December 31, 1946, 37.5 feet below the record high stage of 329.1 feet on May 19, 1916, and 34.5 feet above the record low stage of 257.1 feet on November 30, 1931.

Basins in San Diego County

The measurements of water level in 46 wells in San Diego County in 1947 indicate net declines during the year in all of the 6 principal river basins of the county except Otay River Basin. As shown in the following table, the average net decline in San Luis Rey, San Dieguito, San Diego, and Tia Juana River basins ranged from 2.75 feet in 4 wells in the Tia Juana River basin to 6.75 feet in 18 wells in the San Diego River basin. In Sweetwater and Otay River basins the net changes in water level are indicated by measurements made in one well only in each basin; well 17/1W-19a, in Sweetwater River basin, showed a net decline of 4.08 feet, and well 18/2W-22, in Otay River basin, a net rise of 0.11 foot. The only other net rise shown in any of the measured wells in the six basins was that of 2.63 feet in well 12/1W-32 in the San Dieguito River basin. The greatest net decline in any of the measured wells was 38.07 feet in well 15/1E-17H6 in the San Diego River basin.

Net changes in water level, in feet, in observation wells
in San Diego County, 1947

Basin	Number of wells	Number of measurements	Greatest net rise	Greatest net decline	Average net change
San Luis Rey River, Monserate Narrows to Oceanside	16	111	0	11.92	-3.31
San Dieguito River, San Pasqual Valley	6	27	a 2.63	12.76	-3.23
San Diego River, El Monte Park to coast	18	89	0	b 38.07	-6.75
Sweetwater River, at Sunnyside	1	3	0	4.08	-4.08
Otay River, at Otay	1	3	.11	0	+.11
Tia Juana River, near San Ysidro	4	12	0	4.61	-2.75

a Rise in well 12/1W-32.

b Decline in well 15/1E-17H6.

Santa Ana River Basin, Riverside and San Bernardino CountiesSan Bernardino area

Observations of water level in the San Bernardino area were continued in 1947 in 10 wells; in 8 of these, levels were measured in January, February, May, and November; in 1, the Williams well, at weekly intervals; and in well 18/3W-20B1, at monthly intervals.

The water level in well 1S/3W-17C1, the Williams well near Redlands, declined continuously from 12.4 feet below land-surface datum on January 4, the highest observed stage of the year, to 30.0 feet on November 29, the lowest observed stage of the year. On December 27 the level had risen to a stage of 28.2 feet below land-surface datum; thus, the net change in water level for the year is indicated to have been a decline of 15.8 feet.

The average net change in water level during the year in the other 9 wells distributed over the San Bernardino area, as indicated by the measurements of January 6, 1947, and February 4, 1948, was a decline of 8.2 feet. The net decline between those two dates, shown in all of the 9 wells, ranged from 23.1 feet in well 1S/3W-16L1 to 3.8 feet in well 1N/4W-36F1.

San Jacinto Valley

Observations of water level in the San Jacinto Valley were continued in 1947 in eight wells which were measured during January, February, April, August, and November.

The net change in water levels during the year is best indicated by comparison of the levels shown by the measurements made on January 9, 1947, and February 6, 1948. Excluding one well because of incomplete record, the average net change in water level between those dates in the other seven wells distributed over the valley was a decline of 5.7 feet. Net declines, shown in six of the wells, ranged from 21.7 feet in well 3/2W-35Q1 to 1.2 feet in well 4/4W-1L1. A net rise in water level of 0.3 foot was shown in well 4/3W-32E1.

Basins in Santa Barbara County

Program of work

Periodic water-level measurements in selected observation wells, made in connection with the investigation of the geology and ground-water resources of Santa Barbara County, were continued throughout 1947 in cooperation with the Santa Barbara County Water Agency. This work was started during the early part of 1941, and the measurements for 1941 through 1946 have been published in Water-Supply Papers 941, 949, 991, 1021, 1028, and 1076; and through 1947 have been released locally in duplicated form. The six principal ground-water basins in the county are: The Carpinteria, Goleta, Upper Santa Ynez, Lower Santa Ynez, Santa Maria, and Cuyama Valleys, briefly described in Water-Supply Paper 949. Comprehensive reports on the

geology and ground water resources of the Santa Ynez River Valley,^{3/} the south-coast basins,^{4/} which deals with the Carpinteria and Goleta areas, and the Santa Maria Valley,^{5/} have been released in duplicated form. These three reports are in the process of being published as water-supply papers. In addition, a report on the Cuyama Valley will soon be released.^{6/}

Water levels are also observed in the San Antonio Valley which is a narrow ground-water basin about 20 miles long in the western part of the county between the Santa Ynez River Valley and the Santa Maria River Valley. The development of ground water in this basin is small compared to the other basins, and no report has been prepared on the geology and ground-water resources of the area.

In 1947 water-level measurements were also made by the city of Santa Maria and the Santa Maria Valley Water Conservation District. These measurements were made available to the Geological Survey, and are included in this report, identified by footnotes. Of the 135 observation wells being maintained at the end of 1946, 10 were discontinued during 1947 and 45 new wells were established making a total of 170 active at the end of the year. During 1947 most of these wells were visited monthly; three were equipped with water-stage recorders and five were equipped with "high-low" float gages throughout at least part of the year.

General hydrologic conditions, pumping, and fluctuations of water level

Rainfall at two main stations in Santa Barbara County for the year ending September 30, 1947, was about 75 percent of the long-term average. At Santa Barbara the rainfall was 13.41 inches as compared with the 80-year average of 18.21 inches, and at Santa Maria it was 10.42 inches compared with the 62-year average of 14.27 inches. The average rainfall at eight stations maintained by the Geological Survey (see Water-Supply Paper 849, p. 182) was 10.7 inches--60 percent of that for the nearly average

^{3/} Upson, J. E., Thomasson, H. G., Jr., and others, Geology and water resources of the Santa Ynez River Valley, Santa Barbara County, California, U. S. Geol. Survey duplicated report, 1947.

^{4/} Upson, J. E., Thomasson, H. G. Jr., and others, Geology and ground-water resources of the south-coast basins of Santa Barbara County, California with a section on surface-water resources, U. S. Geol. Survey duplicated report, 1947.

^{5/} Worts, G. F. Jr., and Thomasson, H. G. Jr., Geology and ground-water resources of the Santa Maria Valley area, Santa Barbara County, California, with a section on surface-water resources, U. S. Geol. Survey duplicated report, 1947.

^{6/} Upson, J. E., and Worts, G. F. Jr., Ground water in the Cuyama Valley, California, U. S. Geol. Survey typewritten report, 1947.

year 1943-44. Also at these eight stations the rainfall for the year ending September 30, 1945, was 80 to 85 percent of the long-term averages; and for 1946 was 79 percent. Thus, rainfall was below average for the three consecutive water years, 1945, 1946, and 1947.

Because recharge is roughly proportional to rainfall, the low precipitation during these three years has produced little recharge to ground-water bodies in the county. During the winter months the observation wells in recharge areas reflect this condition by showing only slight rises in some areas and even marked declines in others. Low rainfall has necessitated an increase in winter pumpage for irrigation thereby placing an additional draft on ground-water bodies. As a result, in most areas there has been a substantial decline of water levels since 1944.

In 1947 the total pumpage for irrigation, and for municipal, industrial, domestic, and stock use in the county is estimated to have been nearly 200,000 acre-feet--about 40,000 more than that pumped in 1946. This total does not include the water consumed by the cities of Santa Barbara and Montecito whose supply is derived by the impounding and diversion of Santa Ynez River water. Pumpage for irrigation alone amounted to about 185,000 acre-feet. Because in some areas a part of the water applied to crops seeps downward and returns to storage, the figure for pumpage is not the total permanently removed from underground storage. The amount of return probably ranges from none to as much as 35 percent in the different areas. Accordingly, the net pumpage (total less the return of irrigation water) is estimated for the year 1947 as roughly 160,000 acre-feet. Very little of the pumpage for use other than irrigation returns to storage. Unless otherwise indicated, pumpage is estimated by dividing total kilowatt-hours of electric energy consumed in the year by factors for the number of kilowatt-hours required to pump 1 acre-foot of water. Data on electric energy consumed were very kindly supplied by the Pacific Gas and Electric Company and the Southern California Edison Company.

Figure 11 shows water-level fluctuations in 10 wells and yearly rainfall at 3 stations for the 7-year period 1941-47. The hydrographs show that in most areas there was a general rise of water levels through 1943, and that beginning in 1944 levels have declined. Again, this can be attributed to variations in rainfall, and hence to recharge and pumpage. Because hydrologic conditions differ considerably from one ground-water basin to another, the fluctuations of water level in each are discussed separately.

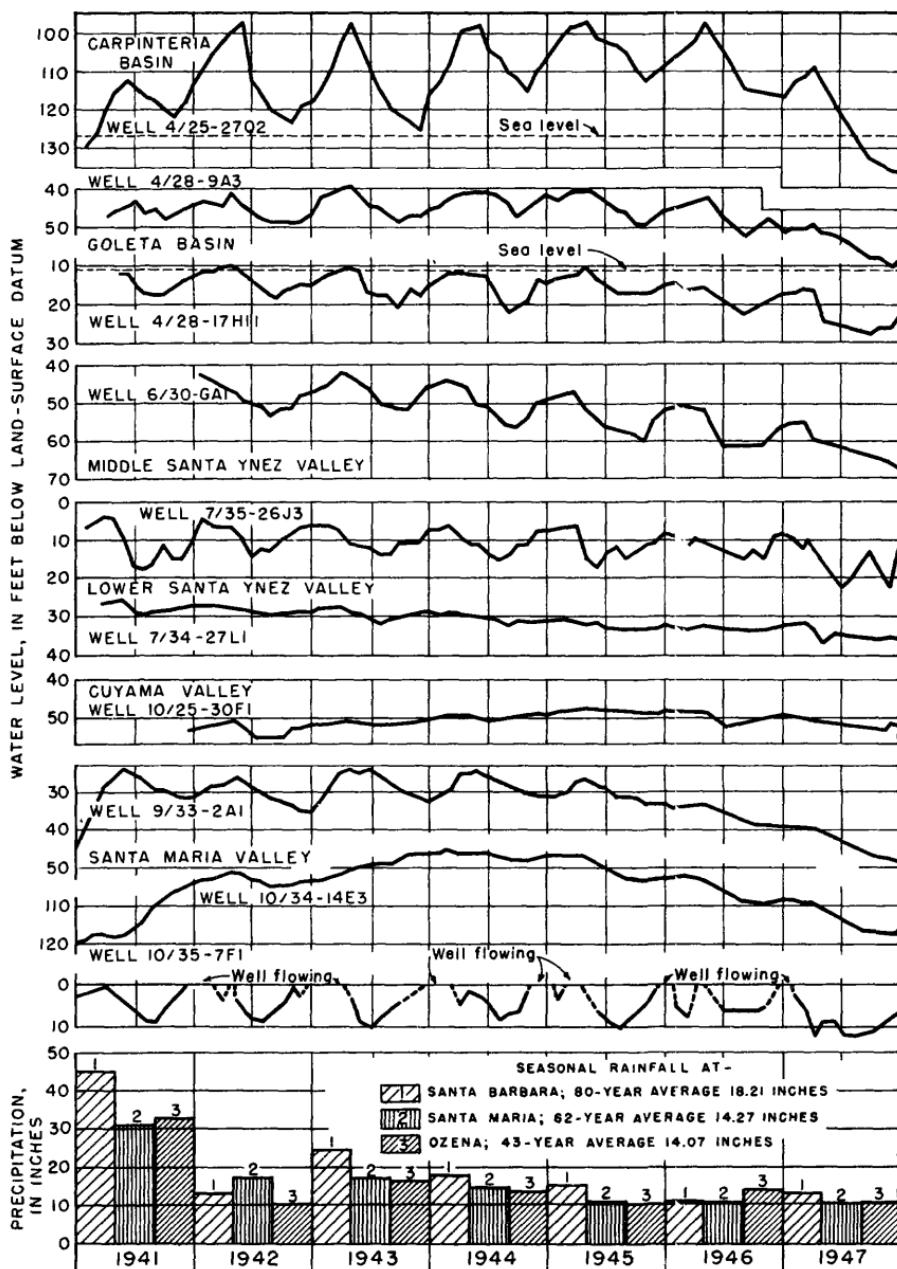


Figure 11.--Graphs showing water-level fluctuations in 10 wells in Santa Barbara County, California, and seasonal rainfall at Santa Barbara, Santa Maria, and Ozena for the years 1941-47.

Carpinteria Basin

Total ground-water pumpage during the calendar year 1947 in the Carpinteria Basin is estimated to have been about 5,500 acre-feet, which ^{7/} is about three times the estimated perennial yield of 1,700 acre-feet. Thus, unusually heavy pumpage combined with low recharge to the water-bearing formations, due to the third consecutive year of subnormal precipitation, resulted in an appreciable decline of the ground-water levels over the basin. In 1947 the maximum water levels, which occurred during the spring due to the decrease or cessation of irrigation during the winter months, were from 2 to 14 feet below the maximum water levels of 1946, and averaged about 6.5 feet lower throughout the basin. The decline in the extreme western part of the basin in T. 4 N., R. 26 W., secs. 23 and 24, was less than average.

The water levels at the end of 1947 were from 9 to 40 feet below the water levels at the end of 1946, and averaged about 21 feet lower for the entire basin. This large decline was due chiefly to low rainfall in the fall of 1947 and to the continuation of the irrigation season to the end of the year.

At the end of the year static water levels in wells in the southwestern and central part of the basin ranged from 0 to 30 feet below sea level--the water level being below sea level in most of the area of confined water. Well 4/25-27Q2 (fig. 11), in the area of confined water, shows a decline of 25 feet from April to December 1947, and the maximum water level for that year was about 12 feet below that of 1946.

Goleta Basin

The total ground-water pumpage in the Goleta Basin during 1947 is estimated to have been about 11,000 acre-feet, or about three times the estimated perennial yield of 3,100 acre-feet. ^{8/} Excessive pumpage combined with lack of recharge due to subnormal rainfall caused water levels to continue to decline, but the decline here was not as great as in the Carpinteria Basin. For wells perforated in the main water-bearing formation in the area of confined water, the maximum levels in 1947 averaged about $2\frac{1}{2}$ to 3 feet below the maximum levels in 1946, and the water level at the end of 1947 averaged about 7 feet below the levels at the end of

^{7/} Upson, J. E., Thomasson, H. G. Jr., and others, op. cit., p. 136.
^{8/} Upson, J. E., Thomasson, H. G. Jr., op. cit., p. 210.

1946. The greater decline for the year-end levels was probably due to the continuation of the irrigation season into the late fall of 1947. For wells in the recharge area the average decline from maximum levels in 1946 to maximum levels in 1947 was approximately $3\frac{1}{2}$ feet, and year-end levels averaged nearly 11 feet lower in 1947.

The net change in year-end water levels from 1941 to 1947 in the Goleta Basin is shown by the graphs for wells 4/28-9A3 and 4/28-17H11 (fig. 11). In well 9A3 the net decline was over 16 feet, and in well 17H11 it was over 10 feet. Both wells are in the area of confined water and heavy withdrawals. Nevertheless, the loss of head is comparable to the over-all average net decline of about 13 feet. In the recharge area the decline of water level was even greater during this period.

At the end of 1947, water levels were below mean sea level in nearly half the Goleta Basin. Water levels have been below sea level in some wells for nearly 20 years, but since 1944 the area in which the water levels are below sea level has grown as the water levels in the basin have declined.

In the Goleta Basin a few observation wells tap a shallow-water body from which there is essentially no pumpage. Fluctuations of water level in these wells show the natural balance between replenishment and discharge without the effect of pumping. From the maximum levels in 1946 to those in 1947 water levels had a net decline of between 1 and 2 feet; from 1941 to 1947 the net decline was about 5 feet. These figures clearly indicate a deficiency of replenishment.

Middle Santa Ynez Valley

Total ground-water pumpage in the middle Santa Ynez Valley during 1947 is estimated to have been about 18,000 acre-feet--about 15 percent more than that in 1946. However, water levels in wells along the Santa Ynez River declined only about 1 foot during the year. At the end of the year water levels were about 2 feet below the levels of January 1945. Even though 1947 was the third year of subnormal rainfall with increased amounts of water pumped for irrigation, the slight decline in water levels indicates that there was sufficient recharge to the ground-water bodies adjacent to the Santa Ynez River to nearly equal the quantity of water used.

In the Santa Ynez Upland, north of the Santa Ynez River, ground-water levels continued to decline during 1947. The decline in the northern and central parts of the upland was greater than in wells in the southern part. The water level in well 7/31-23Pl, in Los Olivos, declined about 7 feet during the year, and at the end of the year was 19 feet below the level of January 1945. Similarly, in well 7/31-25L1, 1 mile southeast of Los Olivos, the decline in water level was about 7 feet during 1947, and at the end of the year was 12 feet below the level of January 1945. The water level in well 6/30-6A1 (fig. 11), 3 miles southeast of Los Olivos and near the center of the Santa Ynez Upland, declined 10 feet during 1947, and declined approximately 18 feet from January 1945 to December 1947. Water levels in wells 6/30-7K1 and 6/31-13D1, about 2 miles and $1\frac{1}{2}$ miles, respectively, north of the Santa Ynez River, declined half a foot and 2 feet, respectively, during 1947, and about 1 foot and 6 feet from January 1945 to December 1947.

Lower Santa Ynez Valley

Total ground-water pumpage in the Lower Santa Ynez Valley during 1947 is estimated to have been about 22,000 acre-feet--an increase of about 50 percent over that in 1946, due to low rainfall which prolonged the irrigation season through the fall of 1947. However, the pumpage during the fall was less than that during the summer, and most wells recovered slightly near the end of the year. The maximum water levels in 1947 averaged less than half a foot below the maximum levels of 1946. For about half of the observation wells in the Lompoc Plain the maximum water levels occurred near the end of December 1946, or the first of January 1947, making the maximum water levels for these wells the same for both years. For 22 representative observation wells in the Lompoc Plain, the water levels at the end of 1947 averaged about 4 feet below the year-end levels for 1946. Hydrographs for wells 7/35-26J3 and 7/34-27L1 are shown on figure 11. Well 7/35-26J3 is in the western part of the Lompoc Plain where the principal ground-water body is confined. As shown by the hydrograph for this well the pumping of nearby irrigation wells have an appreciable effect on the water level. Well 7/34-27L1 is in the eastern part of the Lompoc Plain where the aquifer is not confined. Since the peak water levels in 1941 there has been a general decline of the levels in this area of about 10 feet.

San Antonio Valley

No estimates of pumpage have been made for the San Antonio Valley principally because the valley is relatively small and pumpage is low. In 1947 pumpage from the 15 to 20 irrigation wells in the valley probably did not amount to more than 2 to 3 thousand acre-feet. Water levels declined about 2 feet from the year-end levels in 1946 to those in 1947.

Santa Maria Valley

Total ground-water pumpage in the Santa Maria Valley during 1947 is estimated to have been nearly 120,000 acre-feet, which is more than twice the estimated perennial yield of 53,000 acre-feet.^{9/} Due to low rainfall there was very little recharge to the ground-water body; hence, most of the water pumped came from storage. During 1947 the average decline in 22 observation wells in the area of unconfined water was about 8½ feet which was about 25 percent greater than the decline during 1946. The decline in individual wells ranged from less than 5 feet to more than 16 feet. In the Sisquoc River Valley, from Fugler's Point to 4 miles upstream, the average decline, as indicated by three observation wells, was 11 feet during 1947. From Fugler's point for 5 miles downstream in the Santa Maria Valley, the average decline as indicated by 6 observation wells was 12 feet. In the vicinity of Santa Maria the average decline of 5 observation wells during 1947 was about 8 feet.

In the area of confined water, at the west end of the valley, the average decline of water levels in 9 observation wells was about 6½ feet from the end of 1946 to the end of 1947. The decline in individual wells ranged from 3 to 10 feet, and the average decline for these wells during 1946 averaged somewhat less than 2 feet. The extension of the irrigation season into the fall and winter months probably accounted for the greater decline during 1947.

Water levels in the Santa Maria Valley have been declining since 1944 when the highest levels since the late twenties were reached in most wells. Figure 11 shows hydrographs for three wells in the area. Well 9/33-2A1 is in the Sisquoc Valley, a tributary to the Santa Maria Valley, about 1 mile above Fugler's Point. The graph of this well shows a nearly steady decline from May 1945 to December 1947 which amounted to about 22 feet. The record

^{9/} Worts, G. F. Jr., and Thomasson, H. G. Jr., op. cit., p. 233.

for well 10/34-14E3, in Santa Maria at the city water works plant, was started in 1917, and the lowest stage recorded was 132.7 feet below land surface in October 1936. At the end of 1947 the water level in this well was 117.29 feet--only 15.4 feet above the record low. The decline in 1947 alone was nearly 9 feet. During the years 1941 to 1946 the water level in well 10/35-7FL, in the area of confined water near Guadalupe, recovered sufficiently at year end to cause the well to flow, but at the end of 1947 the water level was nearly 7 feet below the land surface, indicating a substantial drop in artesian pressure in this area.

Cuyama Valley

Pumping for irrigation in the Cuyama Valley, which began in 1939, has increased each year. No electrical energy data are available upon which to estimate the pumpage during 1947, but it probably increased over that for 1946 due to continued dry weather and further development of the valley. However, the estimate of ground-water pumpage in 1946 was about 17,000 acre-feet, and in 1947 was possibly on the order of 20,000 acre-feet. The greatest decline of water levels occurred in the upper part of the valley. Well 9/24-19Q1, near the Cuyama Ranger Station, declined about 7 feet during the year, which was slightly greater than the decline during the previous year. One well, 7/24-13C1, 11 miles upstream from the Cuyama Ranger Station at Apache School, in Ventura County, declined about 8 feet during the year.

In the heavily pumped part of the valley the decline in water levels during the year also was greater in the upper portion than in the lower portion and ranged from less than 1 foot to somewhat more than 3 feet. Well 10/25-30F1 (fig. 11), in the area of heavy pumping, shows fluctuations for the period 1941-47. The graph shows that from December 1941 to May 1945 the water level rose about 7 feet, and then to December 1947 declined about 6 feet. Thus, the net change from 1941 to the end of 1947 was nearly zero. However, the net decline in 1947 alone was $3\frac{1}{2}$ feet--considerably more than the total for the preceding two dry years.

SYMBOLS ASSIGNED TO OBSERVATION WELLS

In the following descriptions and records of water level, observation wells are identified by symbols or "numbers" that indicate their respective locations according to the rectangular system for subdivision of public land. In Water-Supply Paper 991 these symbols were assigned for the first time to all Geological Survey observation wells in the State, according to the system described in that water-supply paper and there accompanied by a cross-reference table of previous numbers and location symbols.

The descriptions and records are given by counties in alphabetical sequence, and for each county in numerical order of the location symbols. Thus, certain groups of the data each pertain to a distinct ground-water area as indicated by subheadings in the record. However, other groups of data each span two or more ground-water areas--under this circumstance, the area is indicated in the text statements that introduce the several records of individual wells.

WELL DESCRIPTIONS AND WATER-LEVEL MEASUREMENTS

Kern County

Antelope Valley

9/12-16R1 (*1076, p. 118). Robert Rubeen. About 0.6 mile east of Rosamond. No measurements made in 1947.

9/12-21D1 (*991, p. 100; 1021, p. 85; 1028, p. 79; 1076, p. 118). Southern Pacific Lands Agency. In Rosamond. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 2	41.7	Feb. 27	42.0	July 7	47.1
Feb. 3	(a)	Apr. 9	43.5	Nov. 19	47.8

a Pumping.

9/13-14H1 (*1076, p. 119). About 3 miles west of Rosamond. No measurements made in 1947.

9/13-20H1 (*991, p. 101; 1021, p. 86; 1028, p. 79; 1076, p. 119). Harry White. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 2	69.0	Apr. 9	65.4	Nov. 19	74.4
Feb. 13	66.5	July 7	a 79.0		

a Well 300 feet south pumping.

9/13-20H2 (*991, p. 101; 1021, p. 86; 1028, p. 80; 1076, p. 119). Harry White. No measurements made in 1947.

9/13-35P1 (*1028, p. 80; 1076, p. 119). P. D. Gaskill. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 57.6.

9/14-24K1 (*1076, p. 119). De Fone. About 8.5 miles west of Rosamond. No measurements made in 1947.

9/14-24Q1 (*1028, p. 80; 1076, p. 119). De Fone. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 104.6.

9/14-29M1 (*1028, p. 80; 1076, p. 119). Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: July 8, 177.3; Nov. 18, 177.2.

9/14-32D1 (*1028, p. 80; 1076, p. 119). Sears. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Apr. 9, 167.6.

Los Angeles County

Antelope Valley

5/9-6B1 (*1028, p. 80; 1076, p. 119). Water level, in feet below land-surface datum, 1947: Nov. 4, 35.3.

5/9-20J1 (*1021, p. 86; 1028, p. 81; 1076, p. 119). L. M. Nixon. Water level, in feet below land-surface datum, 1947: Nov. 4, 235.8.

5/9-28A1. R. C. Wiess. NE₄NE₄ sec. 28, T. 5 N., R. 9 W., about 17 miles southeast of Palmdale, 800 feet south of Avenue W, 50 feet west of 177th Street E., and 20 feet west of ranch house. Used domestic well, equipped with windmill and electrically driven pump, diameter 4 feet for 12 feet and 12-inch square redwood casing for 120 feet, total depth 132 feet. Measuring point, top of 4-foot circular concrete curb, at land-surface datum which is about 3,295 feet above sea level. Water level, in feet below land-surface datum, 1947: Nov. 4, 124.1.

5/10-6N1 (*1028, p. 81; 1076, p. 119). Little Rock Irrigation District. Water-stage recorder installed Apr. 10, 1947. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Mar. 5	88.6	May 15	88.8	Aug. 14	91.8	Oct. 15	96.6
18	88.4	June 5	89.5	Sept. 11	99.0	Nov. 12	91.5
Apr. 10	89.0	12	89.0	Oct. 2	93.1	Dec. 3	91.1
18	88.2	July 1	98.3				

5/10-7E1 (*1028, p. 81; 1076, p. 120). Calavalley. Equipped with water-stage recorder to Jan. 14, 1947. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 3	121.0	Mar. 18	120.7	May 15	121.4	Dec. 3	123.1
Feb. 13	120.8	Apr. 10	120.2	June 5	122.8		

5/10-7R1 (*1028, p. 81; 1076, p. 120). Tamarack Park. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 3, 206.8.

5/10-12B1 (*1028, p. 82; 1076, p. 120). Ed Sanner.

Water level, in feet below land-surface datum, 1947

Jan. 7	50.7	Apr. 2	50.8	July 7	51.0	Oct. 6	51.0
Feb. 5	50.8	May 6	50.8	Aug. 5	50.9	Nov. 4	51.2
Mar. 5	50.8	June 4	50.8	Sept. 4	51.0	Dec. 4	51.2

5/10-21J1 (*1028, p. 82; 1076, p. 120). Water level, in feet below land-surface datum, 1947: Nov. 4, 21.7.

5/10-26B1 (*1028, p. 82; 1076, p. 120). R. J. Darling. Water level, in feet below land-surface datum, 1947: Nov. 4, 47.7.

5/11-4R1 (*1028, p. 82; 1076, p. 120). Joe Martin. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 3, 146.0.

5/11-9Q1 (*1028, p. 82; 1076, p. 120). Well covered; measurements discontinued.

5/11-9R1 (*1028, p. 82; 1076, p. 120). Casing sealed; measurements discontinued.

5/11-10R1 (*1028, p. 83; 1076, p. 120). Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947							
Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 3	80.0	Apr. 10	80.7	July 7	84.5	Nov. 12	89.
Feb. 13	79.9	May 15	81.3	Sept. 11	85.8	Dec. 3	91.2
Mar. 15	79.5	June 5	83.2	Oct. 2	86.6		

5/11-12H1 (*1028, p. 83; 1076, p. 120). Wheelock. No measurements made in 1947.

5/11-12Q1 (*1028, p. 83; 1076, p. 120). Wheelock. Measurements by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 3, 131.4.

5/11-13J1 (*1028, p. 83; 1076, p. 120). Little Rock Irrigation District. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 3, 119.8.

5/11-22D1. Totem Pole Ranch. NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 22, T. 5 N., R. 11 W., about 2.5 miles southwest of Little Rock, 650 feet south of road along north end of section 22, 550 feet east of Little Rock Creek Canyon road. Used domestic well. Measuring point, top of wood cribbing under plank door, 0.5 foot above land-surface datum which is about 3,014 feet above sea level. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: July 1, 26.4; Dec. 3, 27.7.

6/8-10N1 (*991, p. 102; 1021, p. 86; 1028, p. 84; 1076, p. 120). Robert Barnett. Formerly owned by W. G. Baguet. Water level, in feet below land-surface datum, 1947: Nov. 7, 25.2.

6/8-10N2. Robert Barnett. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 6 N., R. 8 W., about 22 miles northeast of Palmdale, 260 feet east and 200 feet north of the southwest corner of section 10, 50 feet north of ranch house, and 30 feet northeast of well 6/8-10N1. Dug domestic well, equipped with windmill and pump jack, diameter 3 feet, depth 35 feet. Measuring point, top of 3-foot concrete tile casing, south side, at land-surface datum which is about 2,804 feet above sea level. Water level, in feet below land-surface datum, 1947: Nov. 7, 25.5.

6/8-18D1 (*991, p. 102; 1021, p. 86; 1028, p. 84; 1076, p. 120). Huff.

Water level, in feet below land-surface datum, 1947											
Jan.	7	158.5	Apr.	2	(a)	July	7	160.8	Oct.	6	159.5
Feb.	5	158.9	May	6	(a)	Aug.	5	(a)	Nov.	7	159.3
Mar.	5	15 ^a .0	June	4	b160.0	Sept.	4	159.1	Dec.	4	(a)

a Pumping.

b Pump shut off 15 minutes prior to measurement.

6/9-4H1 (*991, pp. 102-103; 1021, p. 87; 1028, p. 84; 1076, p. 121). Wilsona School. Water level, in feet below land-surface datum, 1947: Nov. 7, 113.6.

6/9-31R1 (*1028, p. 84; 1076, p. 121). Barlow. Water level, in feet below land-surface datum, 1947: Nov. 4, 28.9.

6/10-9C1 (*1028, p. 84; 1076, p. 121). No measurements made in 1947.

6/10-9E1 (*1028, p. 84; 1076, p. 121). No measurements made in 1947.

6/10-9Q1 (*1028, p. 84; 1076, p. 121). N. C. and O. C. Riley. Water level, in feet below land-surface datum, 1947: Nov. 6, 148.6.

6/10-10Q1 (*1028, p. 84; 1076, p. 121). Water level, in feet below land-surface datum, 1947: Nov. 6, 71.6.

6/10-20P1 (*1028, p. 85; 1076, p. 121). Mrs. Johnson.

Water level, in feet below land-surface datum, 1947

Date	Water level						
Jan. 7	151.1	Mar. 5	152.2	June 4	156.0	Nov. 7	163.0
Feb. 5	150.6	Apr. 2	153.6	Oct. 6	173.1	Dec. 4	162.8

6/10-27B1 (*1028, p. 85; 1076, p. 121). Water level, in feet below land-surface datum, 1947: Nov. 7, 150.0.

6/10-27B3 (*1028, p. 85; 1076, p. 121). Alternate for well 6/10-27B1. No measurements made in 1947.

6/10-32E1 (*1028, p. 85; 1076, p. 121). McAlester. Water level, in feet below land-surface datum, 1947: Nov. 7, 112.5.

6/10-32F1 (*1028, p. 85; 1076, p. 121). McAlester. Water level, in feet below land-surface datum, 1947: Nov. 7, 110.5.

6/11-4C1 (*1028, p. 85; 1076, p. 121). Lyons Bros. No measurements made in 1947.

6/11-5A1 (*991, p. 103; 1021, p. 87; 1028, p. 86; 1076, p. 121). Lyons Bros. No measurements made in 1947.

6/11-8E1 (*1076, p. 121). Palmdale Irrigation District. About 3.5 miles northeast of Palmdale. Water level, in feet below land-surface datum, 1947: Nov. 5, 190.9.

6/11-8R1 (*1028, p. 86; 1076, p. 121). Water level, in feet below land-surface datum, 1947: Nov. 5, 198.0, nearby well pumping.

6/11-9F1 (*1028, p. 86; 1076, p. 121). Elmer Benson. Water level, in feet below land-surface datum, 1947: Nov. 5, 186.6.

6/11-12M1 (*1028, p. 86; 1076, p. 122). E. J. Ball. Water level, in feet below land-surface datum, 1947: Nov. 6, 190.9.

6/11-12Q1 (*1021, p. 87; 1028, p. 87; 1076, p. 122). E. J. Ball. Water level, in feet below land-surface datum, 1947: Nov. 6, 187.9.

6/11-18P1. Elmer Richardson. Formerly owned by Charles Kichie. SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 18, T. 6 N., R. 11 W., about 1,400 feet east of 20th Street E., and 500 feet north of Avenue P. Drilled irrigation and domestic well, diameter 12 inches, depth 506 feet. Measuring point, plugged hole in north side of pump, 1.0 foot above land-surface datum which is about 2,562 feet above sea level. Measurements by Los Angeles County Flood Control District except on Nov. 5, 1947. Water levels, in feet below land-surface datum, Nov. 27, 1940, 202.5; Nov. 25, 1941, obstructed at 204 feet; Nov. 5, 1947, 234.9.

6/11-19E1 (*1028, p. 87; 1076, p. 122). Palmdale Irrigation District. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: Jan. 3, 243.3; Feb. 13, 242.4.

6/11-20P1 (*1028, p. 87; 1076, p. 122). Alternate for well 6/11-20R2. Mrs. F. C. Smith. No measurements made in 1947.

6/11-20R2 (*1076, p. 122). About 3 miles northeast of Palmdale. Water level, in feet below land-surface datum, 1947: Nov. 5, 237.4.

6/11-26J1. L. A. Hudson. NE₄SE₄ sec. 26, T. 6 N., R. 11 W., about 6 miles east of Palmdale, 400 feet south of Avenue Q8, 25 feet west of 70th Street E., 5 feet east of concrete reservoir south of ranch house. Used domestic well, equipped with windmill and pump jack, diameter 8 inches, depth about 200 feet. Measuring point, top of concrete slab bounded by steel tire rim at bottom of wood suction pipe clamp, 0.7 foot above land-surface datum which is about 2,642 feet above sea level. Water level, in feet below land-surface datum, 1947: Nov. 5, 143.9.

6/11-26R1 (*1028, p. 87; 1076, p. 122). Obstructed and dry at 107.2 feet on Nov. 5. Measurements discontinued. Replaced by well 6/11-26J1.

6/11-28N1 (*1028, p. 87; 1076, p. 122). Measurements by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 3, 94.3.

6/11-32P1 (578, p. 366, well 111; *1028, p. 88; 1076, p. 122). Palmdale Rancho. No measurements made in 1947.

6/11-33Q1 (*1076, p. 122). Pete Mikalivnas. About 4 miles southeast of Palmdale. No measurements made in 1947.

6/11-33R1 (*1028, p. 87; 1076, p. 122). Thornberg. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 3, 121.9.

6/12-25N1 (*1021, p. 87; 1028, p. 87; 1076, p. 122). Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947							
Date	Water level	Date	Water level	Date	Water level	Date	Water level
Apr. 10	289.9	June 5	290.0	Sept. 11	a290.9	Nov. 12	a293.6
May 15	290.0	July 7	290.6	Oct. 2	a292.3		

a Casing wet and muddy; measurement doubtful.

6/13-12J1 (*1028, p. 87; 1076, p. 122). Glick. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 247.5.

7/9-17N1 (*1028, p. 87; 1076, p. 122). Ernest Koch. Water levels, in feet below land-surface datum, 1947: Jan. 7, 133.4; Feb. 5, 134.0, well 200 feet east pumping; Apr. 2, 135.0.

7/9-28N1 (*1028, p. 87; 1076, p. 122). Tygeson. No measurements made in 1947.

7/10-5M1 (*991, p. 103; 1021, p. 87; 1028, p. 88; 1076, p. 123). Ella E. Cunningham. No measurements made in 1947.

7/10-5N3 (*1028, p. 89; 1076, p. 123). Ella E. Cunningham. Water level, in feet below land-surface datum, 1947: Nov. 5, 124.0.

7/10-6R1 (*1028, p. 89; 1076, p. 123). Mrs. Jessie Hollingsworth. Water level, in feet below land-surface datum, 1947: Nov. 5, 127.8.

7/10-7B1 (*991, p. 104; 1021, p. 88; 1028, p. 89; 1076, p. 123). Boege. Water level, in feet below land-surface datum, 1947: Nov. 5, 78.4.

7/10-12H1 (*1028, p. 89; 1076, p. 123). Water level, in feet below land-surface datum, 1947: Nov. 6, 123.2.

7/10-21A1 (*1028, p. 89; 1076, p. 123). Water level, in feet below land-surface datum, 1947: Nov. 6, 154.6.

7/10-30G1 (*1076, p. 123). E. J. Ball. About 10 miles east of Lancaster. Water level, in feet below land-surface datum, 1947: Nov. 6, 187.7.

7/10-31N1 (*1028, p. 89; 1076, p. 123). H. O. Bakken. Water level, in feet below land-surface datum, 1947: Nov. 6, 191.6.

7/11-1Q1 (*1021, p. 88; 1028, p. 89; 1076, p. 123). H. L. Gordon. No measurements made in 1947.

7/11-8P1 (*991, p. 105; 1021, p. 88; 1028, p. 89; 1076, p. 123). MacAvery. Water level, in feet below land-surface datum, 1947: Nov. 5, 70.1.

7/11-16B1 (*1028, p. 89; 1076, p. 123). Water level, in feet below land-surface datum, 1947: Nov. 5, 97.0.

7/11-19N1 (*1028, p. 89; 1076, p. 123). Water level, in feet below land-surface datum, 1947: Nov. 5, 143.4.

7/11-23L1 (*1028, p. 90; 1076, p. 123). Barnes. Water level, in feet below land-surface datum, 1947: Nov. 6, 135.9.

7/11-24C1 (*991, p. 105; 1021, p. 88; 1028, p. 90; 1076, p. 123). Stevenson.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	(a)	Apr. 2	131.5	July 7	142.5	Oct. 6	144.4
Feb. 5	127.8	May 6	(a)	Aug. 5	150.3	Nov. 6	141.2
Mar. 5	127.9	June 4	138.2	Sept. 4	151.2	Dec. 4	138.8

a Pumping.

b Pump shut off 15 minutes prior to measurement.

7/11-27F1. James N. Provonyance. SE₄NW₄ sec. 27, T. 7 N., R. 11 W., about 6.5 miles southeast of Lancaster, 0.5 mile south of Avenue K, 1,300 feet east of 50th Street E., and 25 feet north of dirt road. Drilled irrigation well in long, low pumphouse, equipped with turbine pump and 30 horse-power motor. Measuring point, 2-inch pipe plug, 0.5 foot above land surface datum which is about 2,452 feet above sea level.

Water level, in feet below land-surface datum, 1940-41, 1943, 1947

Date	Water level	Date	Water level	Date	Water level
Nov. 27, 1940	all 14.2	Dec. 13, 1943	all 26.8	Nov. 5, 1947	160.4
Dec. 2, 1941	all 16.3	Feb. 5, 1947	137.8		

a Measurement by Los Angeles County Flood Control District.

7/11-28E1 (*1028, p. 90; 1076, p. 123). Leshin. Water level, in feet below land-surface datum, 1947: Nov. 5, 159.1.

7/11-28L1 (*991, p. 106; 1021, p. 88; 1028, p. 90; 1076, p. 123). Water level, in feet below land-surface datum, 1947: Nov. 5, 142.5.

7/12-4P2 (*1028, p. 91; 1076, p. 124). Measuring point beginning Apr. 10, 1947, top of casing, 2.2 feet below land-surface datum. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: Feb. 27, 5.2; Apr. 10, 7.6; Nov. 19, 10.0.

7/12-6D1 (*1028, p. 91; 1076, p. 124). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 27.6.

7/12-6M1 (*1028, p. 91; 1076, p. 124). Measurement by Los Angeles County Flood Control District. Obstructed and dry at 24.5 feet on Nov. 26, 1947.

7/12-8D1 (*1028, p. 91; 1076, p. 124). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 16.0.

7/12-10P1 (*1076, p. 124). Antelope Valley Laundry. In Lancaster. Measurements discontinued.

7/12-15F1 (*1028, p. 91; 1076, p. 124). A. H. Powell. In Lancaster. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947							
Date	Water level	Date	Water level	Date	Water level	Date	
Apr. 10	36.4	Aug. 14	61.8	Oct. 2	62.5	Dec. 9	48.8
July 7	58.0	Sept. 11	62.3	Nov. 19	51.8		

7/12-15F2 (*1028, p. 91; 1076, p. 124). Los Angeles County Water District 4. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 82.7, pumping.

7/12-22J1 (*1028, p. 92; 1076, p. 124). F. La Horgue. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 10, 108.4.

7/12-29P1 (*1028, p. 92; 1076, p. 124). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 138.6.

7/12-34E1 (*1021, p. 88; 1028, p. 92; 1076, p. 124). G. Lane. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 180.2.

7/12-34H1 (*991, p. 106; 1021, p. 88; 1028, p. 92; 1076, p. 125). Morrison. Measurements by Los Angeles County Flood Control District. Measurements discontinued June 5.

Water level, in feet below land-surface datum, 1947					
Date	Water level	Date	Water level	Date	Water level
Jan. 2	185.6	Mar. 5	185.5	May 15	
Feb. 13	185.6	Apr. 10	185.6		(a)
a Dry.					

7/13-3D1 (*1028, p. 92; 1076, p. 125). F. Gorrindo. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 60.4.

7/13-3D2 (*1028, p. 92; 1076, p. 125). F. Gorrindo. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 51.6.

7/13-6A1 (*991, p. 107; 1021, p. 88; 1028, p. 92; 1076, p. 125). No measurements made in 1947.

7/13-11C1 (*1028, p. 92; 1076, p. 125). No measurements made in 1947.

7/13-11D1 (*1028, p. 93; 1076, p. 125). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 4.9.

7/13-11D3. Long. NW_{1/4} NW_{1/4} sec. 11, T. 7 N., R. 13 W., about 5 miles northwest of Lancaster, 325 feet east of 60th Street W., 200 feet south of Avenue H and southeast of reservoir. Used domestic well, original depth 60 feet. Measuring point, top of casing, 1.0 foot below land-surface datum which is about 2,357 feet above sea level. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1945, 1947			
July 24, 1945	Oct. 2, 1945	Dec. 9, 1947	
a 47.4	a 45.7	38.3	
Aug. 31 a 47.9	Nov. 14 33.7		

a Nearby well pumping.

7/13-11M1 (*991, p. 107; 1021, p. 88; 1028, p. 93; 1076, p. 125). John Payne. No measurements made in 1947.

7/13-16B1 (*1028, p. 93; 1076, p. 125). J. R. Harris. Well destroyed, measurements discontinued.

7/13-16B2 (*1028, p. 93; 1076, p. 125). J. R. Harris. Well destroyed, measurements discontinued.

7/13-17D1 (*991, p. 108; 1021, p. 88; 1028, p. 93; 1076, p. 125). G. Zaro. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 113.7.

7/13-21J1 (*1028, p. 93; 1076, p. 125). L. H. Benson. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 84.2.

7/13-21J2 (*1028, p. 93; 1076, p. 125). L. H. Benson. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 79.6.

7/13-21J3 (*1076, p. 125). L. H. Benson. About 7 miles west of Lancaster. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 86.8.

7/13-23N1 (*1028, p. 93; 1076, p. 125). No measurements made in 1947.

7/13-27N1 (*1028, p. 94; 1076, p. 125). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 143.2.

7/13-28P1 (*1028, p. 94; 1076, p. 126). Crenmer. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 185.6.

7/13-34H1 (*991, p. 108; 1021, p. 88; 1028, p. 94; 1076, p. 126). E. P. Wieman. Measurements discontinued.

7/13-35E1 (*991, p. 108; 1021, p. 88; 1028, p. 94; 1076, p. 126). George Lane. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 187.0.

7/14-10F1 (*1028, p. 94; 1076, p. 126). F. A. Ullman. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 28	186.0	July 8	186.7	Dec. 8	189.1
Apr. 9	(a)	Nov. 18	188.4		

a Pumping.

8/9-4N1 (*1021, p. 89; 1028, p. 94; 1076, p. 126). United States Army Reservation. Casing filled, measurements discontinued.

8/9-4N2 (*1028, p. 94; 1076, p. 126). United States Army Reservation. Water level, in feet below land-surface datum, 1947: Nov. 6, 14.2.

8/9-4P1 (*1028, p. 94; 1076, p. 126). United States Army Reservation. Water level, in feet below land-surface datum, 1947: Nov. 6, 23.7.

8/9-6N1 (*1028, p. 94; 1076, p. 126). United States Army Reservation. Water level, in feet below land-surface datum, 1947: Nov. 6, 12.2.

8/9-6R1 (*1028, p. 95; 1076, p. 126). United States Army Reservation. Water level, in feet below land-surface datum, 1947: Nov. 6, 12.5, roots in casing; poor measurement.

8/10-2P1 (*1028, p. 95; 1076, p. 126). United States Army Reservation. Water level, in feet below land-surface datum, 1947: Nov. 6, 17.2.

8/10-8R3. J. G. Walsh. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 8, T. 8 N., R. 10 W., about 1,200 feet west of 100th Street E., and 30 feet north of Avenue C. Used irrigation well, diameter 14-inches, depth 238 feet when drilled in August 1946. Measuring point, top of casing, 0.6 foot above land-surface datum which is about 2,318 feet above sea level. Water level, in feet below land-surface datum, 1947: Nov. 6, 40.3.

8/10-9M1 (*991, p. 109; 1021, p. 89; 1028, p. 95; 1076, p. 126). J. M. Hamilton.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	21.6	Apr. 2	22.6	July 7	22.9	Oct. 6	23.2
Feb. 5	22.4	May 6	22.7	Aug. 5	22.8	Nov. 6	23.2
Mar. 5	22.5	June 4	22.4	Sept. 4	23.1	Dec. 4	23.2

8/10-19Q1 (*991, p. 109; 1021, p. 89; 1028, p. 95; 1076, p. 126). Union Trust and Savings Bank. Water level, in feet below land-surface datum, 1947: Nov. 6, 81.3.

8/11-8P1 (*1028, p. 95; 1076, p. 126). Water level, in feet below land-surface datum, 1947: Nov. 4, 8.7.

8/11-10N1 (*1028, p. 95; 1076, p. 126). E. R. Siple. Water level, in feet below land-surface datum, 1947: Nov. 4, 19.4.

8/11-20L1 (*1028, p. 95; 1076, p. 126). Water level, in feet below land-surface datum, 1947: Nov. 4, 29.1.

8/11-22N2 (*991, p. 110; 1021, p. 89; 1028, p. 95; 1076, p. 126). Lewis Prothro. Water level, in feet below land-surface datum, 1947: Nov. 6, 66.8.

8/11-22N3 (*991, p. 110; 1021, p. 89; 1028, p. 96; 1076, p. 126). Lewis Prothro. Water level, in feet below land-surface datum, 1947: Nov. 6, 62.8.

8/11-30R1 (*1028, p. 96; 1076, p. 126). Water level, in feet below land-surface datum, 1947: Nov. 4, 36.2.

8/12-4K1 (*1028, p. 96; 1076, p. 127). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 13.1.

8/12-20B1 (*1028, p. 96; 1076, p. 127). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 19.8.

8/12-21C1 (*1076, p. 127). Hoffman Gun Club. About 5.5 miles north of Lancaster. No measurements made in 1947.

8/12-22A2 (*1028, p. 96; 1076, p. 127). I. B. Wibigler, Antelope Valley Gun Club. No measurements made in 1947.

8/12-22D1 (*1028, p. 96; 1076, p. 127). Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 2	0.6	Feb. 27	(a)	Apr. 9	(a)	Nov. 26	9.9
Feb. 13	(a)	Mar. 4	(a)	July 7	6.8		

a Flowing.

8/12-22M1 (*1028, p. 96; 1076, p. 127). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 8.8.

8/12-22M2 (*1028, p. 97; 1076, p. 127). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 9.1.

8/12-22RL. I. B. Wibigler. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 22, T. 8 N., R. 12 W., about 4.5 miles north of Lancaster, 100 feet north of Avenue E, and 60 feet west of Division Street. Diameter 6 inches, depth about 400 feet. Measuring point, top of casing, 2.5 feet above land-surface datum which is about 2,298 feet above sea level. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1941-47

Date	Water level	Date	Water level	Date	Water level
Dec. 5, 1941	(a)	May 2, 1944	(a)	Dec. 9, 1946	(b)
26, 1942	(a)	Mar. 1, 1945	(a)	Nov. 26, 1947	6.7
8, 1943	(a)	Nov. 7	(b)		

a Flowing.

b Pumping.

8/12-22R2 (*1076, p. 127). I. B. Wibigler, Antelope Valley Gun Club. About 4.5 miles north of Lancaster. No measurements made in 1947.

8/12-24R1 (*1028, p. 97; 1076, p. 127). Water level, in feet below land-surface datum, 1947: Nov. 4, 16.5.

8/12-30Q1 (*1028, p. 97; 1076, p. 127). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Nov. 26, 19.5.

8/13-2C1 (*1028, p. 97; 1076, p. 127). Alternate for well 9/13-35P1. No measurements made in 1947.

8/13-7H1 (*1076, p. 127). Lone Butte Ranch. About 10.5 miles northwest of Lancaster. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 114.2.

8/13-8C1 (*1028, p. 97; 1076, p. 128). A. Boulin. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: Feb. 27, 101.7; Apr. 9, 101.2; July 8, 108.0; Nov. 19, 107.3.

8/13-8D1 (*991, p. 110; 1021, p. 89; 1028, p. 97; 1076, p. 128). Rogers School. Alternate for well 8/13-7H1. No measurements made in 1947.

8/13-20M1 (*1028, p. 97; 1076, p. 128). O. T. Kelly & Son. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 117.8.

8/13-22K1 (*1028, p. 97; 1076, p. 128). A. G. Andrews. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 70.1.

8/13-23M1 (*1028, p. 98; 1076, p. 128). A. G. Andrews. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 64.7.

8/13-32N1 (*1028, p. 98; 1076, p. 128). Pedro Lizarraga. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 113.2.

8/13-33Q2. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 33, T. 8 N., R. 13 W., about 7 miles northwest of Lancaster, 75 feet north of Avenue G, 75 feet east of 75th Street W. extended, 30 feet west of reservoir, and back of wood wall in rear of concrete motor block. Used irrigation well, diameter 14 inches. Measuring point, top of casing, 1.0 foot above land-surface datum which is about 2,386 feet above sea level. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum: Dec. 10, 1946, 65.4; Dec. 9, 1947, 69.3.

8/14-2R1 (*1028, p. 98; 1076, p. 128). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 132.0.

8/14-12A1 (*1028, p. 98; 1076, p. 128). H. G. Ranch No. 1. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 125.7.

8/14-12D1 (*1028, p. 98; 1076, p. 128). H. G. Ranch No. 1. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 133.4.

8/14-14R1 (*1028, p. 98; 1076, p. 128). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 8, 149.4.

8/14-17Q1 (*1076, p. 128). Marl Craven, Tibola. About 4 miles northeast of Fairmont. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: Apr. 9, 158.9; July 8, 159.5; Dec. 8, 159.7, pumping.

8/14-23A1 (*1028, p. 98; 1076, p. 129). Alternate for well 8/14-14R1. No measurements made in 1947.

8/14-25C1 (*1028, p. 99; 1076, p. 129). Alternate for well 8/14-25C2. No measurements made in 1947.

8/14-25C2 (*1028, p. 99; 1076, p. 129). Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 9, 142.2.

8/14-25D1 (*1076, p. 129). About 6 miles east of Fairmont. No measurements made in 1947.

8/15-10P1 (*1028, p. 99; 1076, p. 129). Scott. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: Feb. 28, 140.5; Apr. 9, 140.3; Nov. 18, 139.2.

8/15-17R1 (*1076, p. 129). Canfield. About 4.5 miles northwest of Fairmont. Equipped with water-stage recorder. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947							
Date	Water level	Date	Water level	Date	Water level	Date	
Jan. 2	124.3	Feb. 28	123.5	May 14	122.5	Sept. 4	121.0
9	124.4	Mar. 25	123.3	June 12	122.1	Oct. 2	120.4
14	124.1	Apr. 9	123.1	July 3	121.9	Nov. 18	119.6
15	124.1	18	123.0	Aug. 7	121.3	Dec. 8	119.3
30	123.9	30	123.0				

8/15-20N1 (*1076, p. 129). About 4.5 miles northwest of Fairmont. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947				
Jan.	9	Mar.	25	June
	157.4		155.5	155.0
	15	156.5	155.3	155.2
	30	156.9	155.2	155.4
Feb. 28	156.4	May 14	155.1	Sept. 4

a Casing wet; measurement doubtful.

8/15-22N1 (*1076, p. 129). Barnes. About 3 miles northwest of Fairmont. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947				
Jan.	2	Apr.	9	July
	179.1		177.5	179.8
Feb. 28	178.8	May 14	181.4	176.2
Mar. 25	177.7	June 12	b188.1	Sept. 4

a Pump operating last 2 days; shut off 1 hour prior to measurement.

b Heavy pumping all week.

c Pumping; pump operated most of past week.

d Some pumping preceding measurement.

8/15-24B2 (*1076, p. 130). Charles L. Schneider. About 2.5 miles north of Fairmont. Measurements by Los Angeles County Flood Control District. Water levels, in feet below land-surface datum, 1947: July 8, 148.7; Nov. 18, 147.2.

8/15-27R1 (*1028, p. 99; 1076, p. 130). I. T. Brandt. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 28	141.3	July 8	140.8	Dec. 8	140.0
Apr. 9	141.2	Nov. 18	140.2		

8/15-29M1 (*1028, p. 99; 1076, p. 130). Soil Conservation Service, U. S. Dept. of Agriculture. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 9	184.0	Mar. 25	123.2	June 12	153.0	Oct. 2	172.2
15	170.6	Apr. 9	131.7	July 3	157.7	Nov. 18	177.8
30	147.6	18	135.1	Aug. 7	164.2	Dec. 8	180.7
Feb. 28	116.3	May 14	144.6	Sept. 4	168.5		

8/15-33G1 (*1076, p. 130). Correll. About 2.5 miles west of Fairmont. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Feb. 28	197.7	July 8	198.6	Sept. 4	198.8	Nov. 18	198.7
Apr. 9	197.8	Aug. 7	198.7	Oct. 2	198.8	Dec. 8	199.0

8/15-36M1 (*1021, p. 89; 1028, p. 99; 1076, p. 130). Fairmont School. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 8, 72.3.

8/16-5N1 (*1021, p. 89; 1028, p. 99; 1076, p. 130). Carpy (International Harvester Co.). Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 28	199.8	July 8	198.5	Dec. 8	190.6
Apr. 9	199.2	Nov. 18	197.8		

8/16-14K1 (*1076, p. 130). Snyder. About 7 miles northwest of Fairmont. Measurements by Los Angeles County Flood Control District.

Water level, in feet below land-surface datum, 1947

Feb. 28	106.5	July 8	110.6	Dec. 8	110.0
Apr. 9	106.1	Nov. 18	109.3		

8/16-14L1 (*1028, p. 99; 1076, p. 131). Snyder. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 8, 113.5, pumping recently.

8/16-18H1 (*1021, p. 90; 1028, p. 99; 1076, p. 131). Neenach School. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 8, 94.2.

8/17-14E1 (*1028, p. 99; 1076, p. 131). P. M. Barnes. Measurement by Los Angeles County Flood Control District. Water level, in feet below land-surface datum, 1947: Dec. 8, 32.9.

San Gabriel River Basin

18/10-18 (*817, p. 9; 840, p. 28; 845, p. 17; 886, p. 23; 911, p. 119; 941, p. 90; 949, p. 64; 991, p. 111; 1021, p. 90; 1028, p. 100; 1076, p. 131). Key well U. S. 75. At Baldwin Park. Equipped with water-stage recorder.

Water level, in feet, 1947

Day	January		February		March		April	
	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level
1	82.87	304.22	78.84	308.16	78.36	308.64	78.60	308.40
2	82.59	304.41	78.77	308.23	78.30	308.70	78.60	308.40
3	82.35	304.65	78.72	308.28	78.29	308.71	78.63	308.37
4	82.05	304.95	78.65	308.35	78.29	308.71	78.70	308.30
5	81.76	305.24	78.57	308.43	78.24	308.76	78.73	308.27
6	81.50	305.50	78.55	308.45	78.29	308.71	78.75	308.25
7	81.32	305.68	78.50	308.50	78.28	308.72	78.78	308.22
8	81.13	305.87	78.45	308.55	78.22	308.78	78.86	308.14
9	80.93	306.07	78.42	308.58	78.27	308.73	78.92	308.08
10	80.72	306.28	78.43	308.57	78.24	308.76	79.01	307.99
11	80.54	306.46	78.39	308.61	78.19	308.81	79.05	307.95
12	80.38	306.62	78.35	308.65	78.24	308.76	79.12	307.88
13	80.26	306.74	78.33	308.67	78.24	308.76	79.20	307.80
14	80.18	306.82	78.29	308.71	78.23	308.77	79.31	307.69
15	80.12	306.88	78.27	308.73	78.30	308.70	79.43	307.57
16	79.98	307.02	78.24	308.76	78.29	308.71	79.47	307.53
17	79.88	307.12	78.24	308.76	78.35	308.65	79.51	307.49
18	79.81	307.19	78.27	308.73	78.48	308.52	79.58	307.42
19	79.72	307.28	78.26	308.74	78.44	308.56	79.70	307.30
20	79.63	307.37	78.24	308.76	78.42	308.58	79.73	307.27
21	79.57	307.43	78.29	308.71	78.39	308.61	79.79	307.21
22	79.48	307.52	78.29	308.71	78.44	308.56	79.86	307.14
23	79.41	307.59	78.29	308.71	78.47	308.53	79.93	307.07
24	79.35	307.65	78.27	308.73	78.46	308.54	79.99	307.01
25	79.29	307.71	78.27	308.73	78.47	308.53	80.04	306.96
26	79.18	307.82	78.28	308.71	78.48	308.52	80.13	306.87
27	79.11	307.89	78.32	308.68	78.60	308.40	80.20	306.80
28	79.03	307.97	78.36	308.64	78.57	308.43	80.24	306.76
29	79.06	307.94			78.55	308.45	80.31	306.69
30	78.95	308.05			78.53	308.47	80.38	306.62
31	78.89	308.11			78.53	308.47		

Water level, in feet, 1947

Day	May		June		July		August	
	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level
1	80.50	306.50	82.95	304.05	a 85.70	a 301.30	88.77	298.23
2	80.58	306.42	83.09	303.91	85.62	301.18	88.85	298.15
3	80.70	306.30	83.20	303.80	85.92	301.08	88.93	298.07
4	80.80	306.20	83.24	303.76	85.98	301.02	88.99	298.01
5	80.94	306.06	83.30	303.70	86.15	300.85	89.07	297.93
6	81.02	305.98	83.37	303.63	86.22	300.78	89.16	297.84
7	81.15	305.85	83.50	303.50	86.38	300.62	89.27	297.73
8	81.24	305.76	83.57	303.43	86.46	300.54	89.44	297.56
9	81.28	305.72	83.63	303.37	86.54	300.46	89.55	297.45
10	81.34	305.66	83.72	303.28	86.62	300.38	89.60	297.40
11	81.45	305.55	83.82	303.18	86.73	300.27	89.70	297.30
12	81.53	305.47	83.91	303.09	86.88	300.12	89.79	297.21
13	81.61	305.39	84.02	302.98	86.95	300.05	89.85	297.15
14	81.71	305.29	84.16	302.84	87.05	299.95	89.90	297.10
15	81.80	305.20	84.23	302.77	87.18	299.82	89.99	297.01
16	81.82	305.18	84.34	302.66	87.30	299.70	90.08	296.92
17	81.92	305.08	84.42	302.58	87.38	299.62	90.16	296.84
18	81.95	305.05	84.51	302.49	87.48	299.52	90.24	296.76

a No gage height record; daily elevations computed on basis of 5 tape measurements.

1S/10-18--Continued.

Water level, in feet, 1947

Day	May		June		July		August	
	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level
19	82.03	304.97	84.60	302.40	87.59	299.41	80.30	296.70
20	82.10	304.90	84.65	302.35	87.66	299.34	80.38	296.62
21	82.17	304.83	84.74	302.26	87.76	299.24	80.44	296.56
22	82.25	304.75	84.84	302.16	87.88	299.12	80.51	296.49
23	82.32	304.68	84.92	302.08	87.97	299.03	80.58	296.42
24	82.40	304.60	a 85.05	a 301.95	88.03	298.97	80.65	296.35
25	82.47	304.53	a 85.18	a 301.82	88.10	298.90	80.70	296.30
26	82.55	304.45	a 85.24	a 301.76	88.24	298.76	80.78	296.22
27	82.60	304.40	a 85.29	a 301.71	88.33	298.67	80.91	296.09
28	82.63	304.37	a 85.38	a 301.62	88.38	298.62	81.00	296.00
29	82.70	304.30	a 85.47	a 301.53	88.51	298.49	81.03	295.97
30	82.80	304.20	a 85.55	a 301.45	88.59	298.41	81.10	295.90
31	82.89	304.11			88.68	298.32	81.17	295.83

a No gage height record; daily elevations computed on basis of 5 tape measurements.

Water level, in feet, 1947

Day	September		October		November		December	
	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level	Below land- surface datum	Above sea level
1	91.23	295.77	93.05	293.95	94.40	292.60	95.23	291.77
2	91.30	295.70	93.11	293.89	94.42	292.58	95.26	291.74
3	91.37	295.63	93.16	293.84	94.47	292.53	95.28	291.72
4	91.46	295.54	93.22	293.78	94.49	292.51	95.27	291.73
5	91.55	295.45	93.26	293.74	94.52	292.48	95.27	291.73
6	91.63	295.37	93.30	293.70	94.57	292.43	95.29	291.71
7	91.69	295.31	93.37	293.63	94.61	292.39	95.29	291.71
8	91.72	295.28	93.42	293.58	94.65	292.35	95.27	291.73
9	91.82	295.18	93.46	293.54	94.69	292.31	95.29	291.71
10	91.89	295.11	93.50	293.50	94.74	292.26	95.28	291.72
11	91.97	295.03	93.53	293.47	94.74	292.26	95.26	291.74
12	92.03	294.97	93.56	293.44	94.76	292.24	95.28	291.72
13	92.05	294.95	93.61	293.39	94.80	292.20	95.26	291.74
14	92.10	294.90	93.65	293.35	94.87	292.13	95.22	291.78
15	92.18	294.82	93.67	293.33	94.89	292.11	95.22	291.78
16	92.24	294.76	93.70	293.30	94.91	292.09	95.25	291.75
17	92.28	294.72	93.76	293.24	94.95	292.05	95.24	291.76
18	92.32	294.68	93.83	293.17	94.98	292.02	95.26	291.74
19	92.39	294.61	93.87	293.13	95.01	291.99	95.30	291.70
20	92.46	294.54	93.93	293.07	95.08	291.92	95.31	291.69
21	92.48	294.52	93.98	293.02	95.11	291.89	95.34	291.66
22	92.52	294.48	94.00	293.00	95.14	291.86	95.34	291.66
23	92.57	294.43	94.04	292.96	95.17	291.83	95.34	291.66
24	92.62	294.38	94.06	292.94	95.18	291.82	95.33	291.67
25	92.68	294.32	94.10	292.90	95.20	291.80	95.35	291.65
26	92.75	294.25	94.13	292.87	95.20	291.80	95.34	291.66
27	92.84	294.16	94.15	292.85	95.22	291.78	95.35	291.65
28	92.88	294.12	94.20	292.80	95.24	291.76	95.37	291.63
29	92.93	294.07	94.26	292.74	95.26	291.74	95.36	291.64
30	92.98	294.02	94.30	292.70	95.27	291.73	95.38	291.62
31			94.35	292.65			95.42	291.58

Coastal plain

28/12-13A1 (*941, p. 105; 949, p. 89; 991, p. 113; 1021, p. 92; 1028, p. 102; 1076, p. 133). Lycan Bros. About 1 mile east of Montebello. Records furnished by San Gabriel Valley Protective Association.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	20.88	Apr. 9	20.23	July 9	22.12	Oct. 8	28.08
8	20.63	16	20.39	16	22.47	15	28.17
15	20.49	23	20.40	23	22.89	22	28.55
22	20.40	30	20.43	30	23.40	29	28.79
29	20.37	May 7	20.58	Aug. 6	23.95	Nov. 5	28.94
Feb. 5	20.33	14	20.62	13	24.48	1z	29.04
12	20.32	21	20.74	20	25.01	19	29.12
19	20.31	28	20.84	27	25.56	26	29.07
26	20.29	June 4	20.95	Sept. 3	26.09	Dec. 3	28.94
Mar. 5	20.28	11	21.09	10	26.64	10	28.63
12	20.24	18	21.24	17	27.05	17	28.46
19	20.36	25	21.53	24	27.38	24	28.55
26	20.35	July 2	21.79	Oct. 1	27.72	31	28.25
Apr. 2	20.27						

28/15-34H1 (*1028, p. 105; 1076, p. 135). Don Benshcof. About 2.5 miles northwest of El Segundo. All water levels are below sea level. Records furnished by California Division of Water Resources.

Water level, in feet below land-surface datum, 1947

Jan. 29	132.7	Apr. 29	133.0	July 29	133.1	Oct. 28	132.9
Feb. 26	132.7	May 29	133.5	Aug. 27	135.3	Nov. 28	134.1
Mar. 27	132.8	June 20	138.5	Sept. 30	133.0	Dec. 29	135.5

38/12-8L3 (*941, p. 107; 949, p. 89; 991, p. 113; 1021, p. 92; 1028, p. 108; 1076, p. 136). Los Angeles County Farm. About 2 miles southwest of Downey. Records furnished by San Gabriel Valley Protective Association.

Water level, in feet below land-surface datum, 1947

Jan. 6	21.73	Apr. 7	25.86	July 7	36.45	Oct. 6	35.30
13	21.85	14	30.67	14	37.62	13	33.69
20	22.58	21	30.75	21	37.42	20	32.70
27	22.60	28	28.31	28	38.64	27	33.17
Feb. 3	22.43	May 5	31.59	Aug. 4	39.31	Nov. 3	32.21
10	22.47	12	31.54	11	39.15	10	32.21
17	22.34	19	31.96	18	38.54	17	32.02
24	23.43	26	31.24	25	37.88	24	30.75
Mar. 3	23.74	June 2	31.60	Sept. 1	37.66	Dec. 1	29.70
10	22.24	9	32.80	8	39.06	8	27.85
17	24.59	16	35.10	15	37.96	15	27.09
24	24.28	23	35.15	22	35.23	22	26.98
31	23.99	30	34.98	29	36.19	29	27.46

38/13-8L2 (*1028, p. 109; 1076, p. 136). H. N. Edison. About 2 miles southwest of Watts. Records furnished by California Division of Water Resources. Water levels, in feet below land-surface datum, 1947: Apr. 22, 111.3; Nov. 25, 118.6.

38/13-18G2 (*1028, p. 110; 1076, p. 136). Union Oil Co. About 2 miles northeast of Gardena. All water levels are below sea level. Records furnished by California Division of Water Resources.

Water level, in feet below land-surface datum, 1947

Jan. 29	172.2	Apr. 28	177.6	July 28	194.0	Oct. 24	171.6
Feb. 26	172.5	May 27	182.7	Aug. 25	193.8	Nov. 26	169.5
Mar. 26	174.2	June 20	189.9	Sept. 29	194.2	Dec. 29	167.5

38/13-35P2 (*949, p. 90; 991, p. 114; 1021, p. 93; 1028, p. 114; 1076, p. 137). H. Y. Sasaki. About 1.5 miles south of Compton. Records furnished by California Division of Water Resources. Well covered, measurements discontinued.

3S/13-35B2--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	a 20.94	Mar. 27	21.0	May 27	26.8	Aug. 22	31.3
29	20.5	Apr. 1	a 22.28	June 23	28.0	Sept. 24	29.4
Feb. 18	a 20.30	28	24.5	July 30	31.4		

a By Geological Survey.

3S/14-3K1 (*1028, p. 114; 1076, p. 137). Southern California Water Co., Yukon plant well 1. About 2 miles southeast of Inglewood. All water levels are below sea level. Records furnished by Southern California Water Co.

Water level, in feet below land-surface datum, 1947

Jan. 1	108	May 21	122	Aug. 7	112	Oct. 21	111
Feb. 1	108	28	122	14	115	28	110
Mar. 1	110	June 1	122	21	113	Nov. 7	110
Apr. 1	110	7	122	28	114	14	109
7	120	14	131	Sept. 7	114	21	109
14	124	21	131	14	115	28	108
21	124	28	131	21	114	Dec. 7	109
28	125	July 7	124	28	115	14	114
May 1	125	14	118	Oct. 7	114	21	108
7	121	21	124	14	111	28	106
14	122	28	124				

3S/14-21E1 (*1028, p. 117; 1076, p. 137). Southern California Water Co., Rosecrans plant well 1. About 1 mile south of Hawthorne. All water levels are below sea level. Records furnished by Southern California Water Co.

Water level, in feet below land-surface datum, 1947

Jan. 1	95	May 14	105	July 28	108	Oct. 21	106
Feb. 1	95	21	105	Aug. 7	108	28	106
Mar. 1	95	23	108	14	108	Nov. 7	105
Apr. 1	97	28	105	21	108	14	105
7	97	June 7	105	28	108	21	106
14	97	14	105	Sept. 7	107	28	106
15	104	21	105	14	108	Dec. 7	103
21	103	28	105	21	108	14	103
28	104	July 7	106	28	108	21	102
May 1	103	14	108	Oct. 7	106	28	102
7	105	21	108	14	106		

3S/14-36M3 (*139, Redondo quadrangle, well 560; *1021, p. 94; 1028, p. 119; 1076, p. 137). H. T. Potomkin. About 2 miles north of Torrance. All water levels are below sea level. Records furnished by California Division of Water Resources.

Water level, in feet below land-surface datum, 1947

Jan 29	70.6	Apr. 2	76.5	July 30	74.0	Oct. 28	73.5
Feb. 26	70.7	May 28	78.6	Aug. 25	74.0	Nov. 24	73.5
Mar. 27	71.4	June 23	73.5	Sept. 25	73.7	Dec. 30	72.7

4S/11-5D1 (*949, p. 91; 991, p. 114; 1021, p. 95; 1028, p. 121; 1076, p. 138). V. Capovilis. About 3.5 miles south of Norwalk. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 20	27.82	Apr. 22	a 45.75	July 29	a 59.67	Oct. 24	38.27
Feb. 18	26.95	May 20	a 47.89	Aug. 22	a 45.99	Nov. 28	28.35
Mar. 19	29.50	June 27	a 52.90	Sept. 26	40.60	Dec. 30	16.42

a Below sea level.

4S/12-8P1 (138, p. 74, well 934; *941, p. 110; 949, p. 93; 991, p. 114; 1021, p. 96; 1028, p. 121; 1076, p. 138). Montana Land Co. About 2 miles north of Signal Hill. All water levels are below sea level. The water levels for this well published in Water-Supply Paper 1076 are 0.12 foot too high. Records furnished by city of Long Beach.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 6	92.90	Apr. 7	90.27	July 7	106.49	Oct. 6	109.54
	91.88		93.46		108.33		106.12
	91.39		95.97		108.87		108.51
	90.69		95.58		108.79		105.18
Feb. 3	89.64	May 5	97.02	Aug. 4	109.70	Nov. 3	99.10
	89.81		98.26		109.14		97.50
	85.60		98.58		108.99		99.67
	83.17		99.07		110.89		101.60
Mar. 3	85.36	June 2	98.94	Sept. 1	110.86	Dec. 1	110.73
	86.12		99.55		111.33		98.46
	87.56		101.00		111.20		98.21
	88.23		102.68		110.40		101.50
31	89.10	30	103.65	29	110.97	29	99.44

4S/15-14L1 (*949, p. 101; 991, p. 116; 1021, p. 96; 1028, p. 123; 1076, p. 140). Southern California Edison Co., Ltd. In Long Beach. Records furnished by city of Long Beach.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 6	25.93	Apr. 7	26.50	July 7	28.09	Oct. 6	28.69
	25.91		26.45		28.02		28.63
	25.96		26.73		28.25		28.55
	26.03		27.09		28.20		28.52
Feb. 3	26.17	May 5	28.04	Aug. 4	a 28.64	Nov. 3	28.53
	26.19		27.67		a 28.69		28.66
	26.01		27.40		a 29.14		28.71
	26.09		27.53		a 29.01		28.69
Mar. 3	26.24	June 2	27.71	Sept. 1	a 28.72	Dec. 1	28.54
	26.26		27.65		a 28.62		28.46
	26.44		27.69		a 28.83		27.46
	26.51		27.68		a 28.72		28.48
31	26.38	30	27.64	29	a 28.63	29	28.38

a Below sea level.

4S/13-23G2 (*941, p. 115; 949, p. 105; 991, p. 116; 1021, p. 96; 1028, p. 123; 1076, p. 140). City of Long Beach. All water levels are below sea level. Records furnished by city of Long Beach.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	80.2	Apr. 7	87.2	July 7	94.6	Oct. 14	94.7
	79.5		91.7		98.4		93.8
	79.8		91.9		98.4		94.8
	80.8	May 1	90.9		100.6	Nov. 3	92.2
Feb. 3	82.4		92.4		101.0		95.4
	81.7		100.4		100.8		91.2
	82.7		92.1		100.2		90.2
	82.7	June 2	91.9	Sept. 2	100.6	Dec. 1	91.2
Mar. 10	82.9		93.4		100.4		85.9
	82.3		94.8		98.5		87.2
	83.6		96.6		98.7		85.4
	82.5		96.1		98.9		87.1
31	84.2						

4S/13-33D1 (*949, p. 109; 991, p. 116; 1021, p. 97; 1028, p. 124; 1076, p. 141). City of Los Angeles, Wilmington plant well 14. In Wilmington. All water levels are below sea level. Records furnished by California Division of Water Resources.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 29	80.6	Apr. 24	86.8	July 29	93.7	Oct. 29	91.3
Feb. 20	81.1	May 28	89.2	Aug. 26	94.6	Nov. 25	88.0
Mar. 26	82.3	June 24	90.5	Sept. 26	93.3	Dec. 30	85.1

4S/14-8E1 (*1021, p. 97; 1028, p. 124; 1076, p. 142). California Water Service Co., station 3. In Redondo Beach. All water levels are below sea level. Records furnished by California Division of Water Resources. Measurements discontinued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Apr. 24	166.7	July 28	167.3	Sept. 26	167.1
May 29	166.9	Aug. 27	167.6	Oct. 29	167.9

4S/14-13F1 (*1021, p. 99; 1028, p. 125; 1076, p. 142). David E. Crutcher. About 1 mile southeast of Torrance. All water levels are below sea level. Records furnished by California Division of Water Resources. Obstruction in casing, measurements discontinued.

Water level, in feet below land-surface datum, 1947

Jan. 29	83.2	Mar. 26	84.0	May 28	87.5
Feb. 26	83.7	Apr. 29	88.8	June 23	89.7

Orange County

Coastal plain

3S/11-36Q2 (*941, p. 117; 949, p. 116; 991, p. 117; 1021, p. 100; 1028, p. 127; 1076, p. 143). M. Del Giorgio. About 1 mile southeast of Puena Park. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	54.94	Apr. 10	62.39	July 10	79.09	Oct. 9	77.28
9	54.53	17	70.36	17	78.40	16	76.20
16	54.02	24	71.69	24	80.75	23	74.86
23	54.07	May 1	69.10	31	81.74	30	75.30
30	53.55	8	71.82	Aug. 7	83.38	Nov. 6	75.48
Feb. 6	53.48	15	70.32	14	83.08	13	74.21
13	53.46	22	68.38	21	81.07	20	72.13
20	53.52	29	68.97	28	81.88	26	70.74
27	53.93	June 5	69.64	Sept. 4	80.57	Dec. 3	68.19
Mar. 6	54.26	12	72.75	11	81.69	10	66.61
13	56.72	19	75.04	18	79.12	17	64.89
20	58.43	26	75.63	25	78.69	24	63.63
27	59.47	July 2	74.91	Oct. 2	78.93	31	65.52
Apr. 3	60.20						

4S/9-7B1 (*941, p. 120; 949, p. 117; 991, p. 117; 1021, p. 100; 1028, p. 127; 1076, p. 143). Dowling & Prentice. About 3 miles east of Anaheim. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 2	158.61	Apr. 3	154.53	July 2	161.75	Oct. 9	176.64
9	163.51	10	155.99	10	161.93	16	179.06
16	163.39	17	153.73	17	162.31	23	177.18
23	161.51	24	154.37	31	165.46	30	179.34
30	150.46	May 1	155.75	Aug. 7	168.53	Nov. 6	179.33
Feb. 6	158.58	8	156.69	14	169.74	13	180.63
13	162.93	15	158.72	21	170.19	20	181.89
20	150.26	22	150.61	28	174.82	26	182.16
27	151.77	29	160.56	Sept. 4	173.92	Dec. 3	177.35
Mar. 6	150.37	June 5	157.65	11	173.67	10	176.88
13	150.56	12	161.24	18	175.90	17	176.86
20	150.99	19	161.81	25	177.19	24	176.74
27	153.31	26	161.21	Oct. 2	175.87	31	176.64

4S/10-22L2 (*840, p. 28; 845, p. 18; 886, p. 24; 941, p. 123; 949, p. 117; 991, p. 118; 1021, p. 100; 1028, p. 127; 1076, p. 143). Halderman & Callens. About 2 miles south of Anaheim. Records furnished by Orange County Flood Control District.

4S/10-22L2--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 17	105.51	Apr. 8	120.37	July 15	114.07	Oct. 10	(a)
Feb. 5	104.46	May 9	110.13	Aug. 8	116.34	14	(a)
Mar. 7	106.23	June 16	111.51	Sept. 16	117.28	Dec. 11	114.22

a Pumping.

4S/11-19K1 (138, p. 83, well 1183; *941, p. 123; 949, p. 117; 991, p. 118; 1021, p. 101; 1028, p. 128; 1076, p. 144). Los Alamitos Sugar Co. About 0.5 mile north of Los Alamitos. Records furnished by city of Long Beach.

Water level, in feet below land-surface datum, 1947

Jan. 6	7.10	Apr. 7	16.63	July 7	b 30.78	Oct. 6	b 29.55
13	6.58	14	20.02	14	b 31.98	13	27.08
20	6.38	21	24.63	21	b 33.08	20	25.78
27	6.26	28	26.04	28	b 35.28	27	24.43
31	a 6.34	May 1	a 24.85	31	ab 35.34	31	a 23.74
Feb. 3	6.78	5	25.90	Aug. 4	b 34.30	Nov. 3	23.21
10	8.10	12	27.30	11	b 34.86	10	22.62
17	9.05	19	25.02	18	b 34.64	17	22.22
24	9.62	26	26.51	25	b 34.46	24	21.07
28	a 12.30	29	a 24.87	Sept. 1	b 34.09	28	a 20.48
Mar. 3	11.55	June 2	26.18	2	ab 34.53	Dec. 1	19.91
10	12.07	9	24.42	8	b 33.70	8	17.50
17	13.13	16	26.45	15	b 33.20	15	15.87
24	15.97	23	b 28.68	22	b 30.18	22	15.88
31	15.89	30	b 29.17	29	b 30.72	29	14.31
31	a 15.93	30	ab 29.30	Oct. 1	ab 30.65	31	a 14.20

a By Geological Survey.

b Below sea level.

5S/10-9D1 (*941, p. 126; 949, p. 118; 991, p. 118; 1021, p. 101; 1028, p. 128; 1076, p. 144). Julio Martinez. About 1 mile south of Garden Grove. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 17	49.18	Apr. 8	58.88	July 15	65.32	Oct. 10	65.57
Feb. 5	50.53	May 9	62.03	Aug. 8	69.79	Nov. 14	61.01
Mar. 7	57.09	June 16	(a)	Sept. 16	72.90	Dec. 11	56.46

a Pumping.

5S/10-28B1 (*949, p. 119; 991, p. 118; 1021, p. 101; 1028, p. 128; 1076, p. 144). John Sturtevant. About 3.5 miles southwest of Santa Ana. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 13	25.56	Apr. 9	28.93	July 16	31.86	Oct. 15	40.24
Feb. 10	25.11	May 12	27.78	Aug. 12	(a)	Nov. 18	37.46
Mar. 11	30.99	June 16	(a)	Sept. 17	36.52	Dec. 12	32.82

a Pumping.

5S/11-2E1 (*949, p. 121; 991, p. 119; 1021, p. 101; 1028, p. 128; 1076, p. 144). Western Trust & Savings Bank. About 1 mile north of Westminster. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 10	27.13	Apr. 7	42.23	Aug. 6	a 60.80	Nov. 12	45.06
Feb. 7	36.68	May 7	47.55	Sept. 12	a 53.30	Dec. 9	39.31
Mar. 5	40.76	June 11	46.59	Oct. 7	a 49.17		

a Below sea level.

5S/11-16D2 (*941, p. 127; 949, p. 124; 991, p. 119; 1021, p. 101; 1028, p. 128; 1076, p. 145). Anaheim Sugar Co. About 4 miles east of Seal Beach. Records furnished by Orange County Flood Control District.

5S/11-16D2--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	4.57	Apr. 10	13.14	July 10	a 19.12	Oct. 9	a 21.97
9	4.46	17	15.08	17	a 21.04	16	a 20.63
16	5.41	24	a 16.70	24	a 21.65	23	a 17.88
23	5.57	May 1	15.66	31	a 22.63	30	a 18.13
30	7.87	8	15.87	Aug. 7	a 23.01	Nov. 6	a 16.23
Feb. 6	10.70	15	14.98	14	a 21.38	13	a 17.35
13	12.76	22	14.68	21	a 21.31	20	15.77
20	15.60	29	14.87	28	a 21.21	26	14.99
27	15.64	June 5	14.76	Sept. 4	a 21.54	Dec. 3	13.11
Mar. 6	a 17.85	12	15.52	11	a 21.34	10	12.30
13	a 16.28	19	a 17.68	18	a 22.80	17	13.64
20	a 17.17	26	a 16.85	25	a 22.06	24	12.34
27	15.48	July 2	a 18.44	Oct. 2	a 22.21	31	11.26
Apr. 3	14.15						

a Below sea level.

5S/11-18N1 (*949, p. 125; 991, p. 119; 1021, p. 102; 1028, p. 129; 1076, p. 145). United States Naval Depot. About 2 miles southeast of Seal Beach. Water level, in feet below land-surface datum, 1947: Dec. 31, 3.80.

5S/11-18P1 (*949, p. 126; 991, p. 120; 1021, p. 102; 1028, p. 129; 1076, p. 145). United States Naval Depot. About 2 miles southeast of Seal Beach. Water level, in feet below land-surface datum, 1947: Dec. 31, 0.39.

5S/11-25P1 (*949, p. 131; 991, p. 120; 1021, p. 102; 1028, p. 129; 1076, p. 145). E. J. Lecrivain. About 3.5 miles north of Huntington Beach. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 13	37.22	Apr. 9	41.76	July 16	a 48.12	Oct. 15	45.89
Feb. 10	43.31	May 12	44.48	Aug. 12	a 50.18	Nov. 18	44.33
Mar. 11	45.99	June 16	44.64	Sept. 17	47.66	Dec. 12	41.94

a Below sea level.

5S/11-28A1 (*949, p. 133; 991, p. 120; 1021, p. 102; 1028, p. 129; 1076, p. 145). A. Kuoff. About 4 miles northwest of Huntington Beach. Records furnished by Orange County Flood Control District.

Water level, in feet with reference to land-surface datum, 1947

Jan. 13	-3.66	Apr. 9	(a)	July 16	(a)	Oct. 15	b-11.05
Feb. 10	-1.41	May 12	(a)	Aug. 12	(a)	Nov. 18	b-11.76
Mar. 11	(a)	June 16	+.98	Sept. 17	b-10.66	Dec. 12	-6.04

a Pumping.

b Below sea level.

5S/11-29C4 (*949, p. 135; 991, p. 121; 1021, p. 103; 1028, p. 129; 1076, p. 145). Sunset Land & Water Co. About 1 mile southeast of Sunset Beach. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 13	0.01	Mar. 11	7.77	Aug. 12	a 11.31	Oct. 15	14.03
Feb. 10	4.19	May 12	6.75	Sept. 17	a 14.80	Dec. 12	6.82

a Below sea level.

5S/11-29E1 (*949, p. 136; 991, p. 121; 1021, p. 103; 1028, p. 129; 1076, p. 145). United States Government. About 1 mile southeast of Sunset Beach. Water level, in feet below land-surface datum, 1947: Dec. 31, 4.91.

5S/11-29E2 (*949, p. 136; 991, p. 121; 1021, p. 103; 1028, p. 129; 1076, p. 145). United States Government. About 1 mile southeast of Sunset Beach. Water level, in feet below land-surface datum, 1947: Dec. 31, 4.58.

5S/12-12P1 (*949, p. 140; 991, p. 122; 1021, p. 103; *1028, p. 129; 1076, p. 146). United States Naval Depot. About 1 mile east of Seal Beach. Records furnished by city of Long Beach.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	9.51	Apr. 16	14.83	July 8	a 17.88	Oct. 1	a 20.50
22	10.28	May 7	15.70	Aug. 7	a 20.59	22	a 19.01
Feb. 11	11.31	28	15.93	20	a 19.69	Nov. 12	a 17.38
Mar. 5	14.00	June 18	a 17.11	Sept. 10	a 19.77	Dec. 3	15.86
25	15.56						

a Below sea level.

5S/12-13D1 (*949, p. 143; 991, p. 122; 1021, p. 103; 1028, p. 129; 1076, p. 146). United States Naval Depot. In Seal Beach. Water level, in feet below land-surface datum, 1947: Dec. 31, 22.79.

5S/12-13D2 (*949, p. 144; 991, p. 122; 1021, p. 103; 1028, p. 129; 1076, p. 146). United States Naval Depot. In Seal Beach. Measurements discontinued.

6S/10-1E1 (*949, p. 144; 991, p. 123; 1021, p. 104; 1028, p. 130; 1076 p. 146). Frank Ey. About 3.5 miles northeast of Costa Mesa. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 11	19.26	Apr. 12	32.10	July 14	a 44.01	Oct. 14	a 36.16
18	19.66	19	34.98	21	a 44.07	20	a 35.68
25	22.63	26	a 36.13	28	a 44.24	27	a 35.45
Feb. 1	27.37	May 3	33.82	Aug. 4	a 43.22	Nov. 3	a 34.73
8	31.00	10	a 34.96	11	a 43.94	10	a 36.02
15	a 34.82	16	a 35.61	18	a 44.17	17	33.46
21	a 36.08	23	a 36.61	25	a 42.54	24	33.33
Mar. 1	a 38.45	June 2	a 37.06	Sept. 2	a 43.15	Dec. 1	32.85
8	a 38.17	9	a 35.27	8	a 41.61	8	30.44
15	a 35.71	13	a 36.00	15	a 39.76	15	29.53
22	a 38.72	23	a 37.39	22	a 39.88	22	29.34
29	a 37.13	30	a 38.50	29	a 38.76	29	29.22
Apr. 5	a 34.89	July 7	a 41.60	Oct. 6	a 37.11		

a Below sea level.

6S/10-1L2 (137, p. 137, Santa Ana quadrangle, well 1356; *949, p. 147; 991, p. 123; 1021, p. 104; 1028, p. 130; 1076, p. 146). I. A. W. Henry. About 3.5 miles northeast of Costa Mesa. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 14	17.56	Apr. 11	20.30	July 22	22.01	Oct. 17	21.37
Feb. 11	17.87	May 13	19.76	Aug. 15	21.44	Nov. 19	19.95
Mar. 12	18.29	June 17	23.62	Sept. 19	21.79	Dec. 16	19.37

6S/10-5C1 (*941, p. 130; 949, p. 150; 991, p. 123; 1021, p. 104; 1028, p. 130; 1076, p. 146). Robert Gisler. About 3 miles northeast of Huntington Beach. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Jan. 11	7.88	Apr. 12	18.52	July 14	(b)	Oct. 14	17.78
18	8.35	19	18.85	21	(b)	20	17.05
25	9.49	26	17.70	28	17.93	27	16.72
Feb. 1	13.34	May 3	(b)	Aug. 4	(b)	Nov. 3	16.45
8	17.92	10	(b)	11	(b)	10	16.24
15	a 20.96	16	(b)	18	(b)	17	15.64
21	a 23.47	23	(b)	25	a 22.53	24	15.09
Mar. 1	a 24.94	June 2	(b)	Sept. 2	a 22.80	Dec. 1	14.49
8	a 25.11	9	(b)	15	a 21.05	8	13.39
15	a 24.18	13	17.02	22	(b)	15	13.09
22	(b)	23	17.69	29	a 20.41	22	12.88
29	(b)	30	17.75	Oct. 6	18.92	29	12.74
Apr. 5	(b)	July 7	(b)				

a Below sea level.

b Pumping.

6S/11-13G2 (*949, p. 163; 991, p. 124; 1021, p. 104; 1028, p. 131; 1076, p. 147). Surf Land & Water Co. About 1.5 miles east of Huntington Beach. Records furnished by Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	1.81	Apr. 10	a 5.05	July 10	a 4.88	Oct. 9	a 3.58
9	a 3.01	17	a 6.58	17	a 5.03	16	a 3.39
16	a 3.44	24	a 4.42	24	a 4.40	23	2.72
23	a 3.92	May 1	a 4.57	31	a 4.60	30	2.67
30	a 5.51	8	a 4.28	Aug. 7	a 4.90	Nov. 6	2.29
Feb. 6	a 7.95	12	a 3.94	14	a 5.44	13	2.85
13	a 10.25	15	a 5.36	21	a 5.47	20	2.75
20	a 11.04	22	a 6.07	28	a 5.59	26	2.55
27	a 11.87	29	a 3.95	Sept. 4	a 5.27	Dec. 3	1.93
Mar. 6	a 10.71	June 5	a 3.56	11	a 5.62	10	1.79
13	a 9.64	12	a 3.85	18	a 4.64	17	1.66
20	a 7.85	19	a 3.10	25	a 4.21	24	1.91
27	a 7.04	26	a 3.70	Oct. 2	a 4.41	31	1.97
Apr. 3	a 7.03	July 2	a 4.25				

a Below sea level.

I-9F1 (*941, p. 133; 949, p. 169; 991, p. 124; 1021, p. 105; 1028, p. 131; 1076, p. 147). The Irvine Co. About 3 miles south of Santa Ana. Records furnished by the Orange County Flood Control District.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	(a)	Mar. 20	(a)	June 26	b 53.12	Oct. 16	b 58.18
9	32.46	27	b 51.80	July 2	b 53.17	23	b 56.89
16	31.56	Apr. 3	(a)	10	b 60.14	30	b 55.30
23	31.23	10	(a)	31	b 68.57	Nov. 6	b 53.92
30	31.91	17	b 52.16	Aug. 7	b 69.04	13	b 56.53
Feb. 6	32.44	24	(a)	Sept. 11	b 58.21	20	b 52.65
13	33.81	May 1	(a)	18	b 58.04	26	b 51.29
20	34.30	8	(a)	25	b 58.19	Dec. 3	49.45
27	35.94	15	(a)	Oct. 2	b 58.06	10	48.34
Mar. 6	(a)	29	b 51.46	9	b 57.54	31	47.95
13	(a)	June 12	b 54.18				

a Pumping.

b Below sea level.

Riverside County

Santa Ana River Basin, San Jacinto Valley

3/2W-35Q1 (*1021, p. 105; 1028, p. 131; 1076, p. 147). I. E. Facemire.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 9	a 32.0	Apr. 29	50.6	Nov. 11	53.7
Feb. 5	30.4	Aug. 13	58.1		

a Casing wet; measurement poor.

4/2W-7J1 (*1021, p. 105; 1028, p. 131; 1076, p. 147). Albert McDonald.

Water level, in feet below land-surface datum, 1947

Jan. 9	76.2	Apr. 29	78.1	Nov. 11	88.1
Feb. 5	74.6	Aug. 13	87.1		

4/3W-32E1 (*817, p. 12; 840, p. 30; 845, p. 18; 886, p. 24; 911, p. 120; 941, p. 92; 949, p. 66; 991, p. 124; 1021, p. 106; 1028, p. 131; 1076, p. 147). James Malcomb. Key well. At Perris.

Water level, in feet below land-surface datum, 1947

Jan. 9	64.8	Apr. 29	62.9	Nov. 11	64.5
Feb. 5	62.7	Aug. 13	63.7		

4/4W-1L1 (*1021, p. 106; 1028, p. 131; 1076, p. 148). B. H. LeCont.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 9	38.8	Apr. 29	39.1	Nov. 11	a 64.4
Feb. 5	38.8	Aug. 13	40.0	21	40.3

a Measurement verified by 8 trials.

5/1W-2N1 (*1021, p. 107; 1028, p. 131; 1076, p. 148). J. A. Barger.

Water level, in feet below land-surface datum, 1947

Jan. 9	69.3	Apr. 29	70.2	Nov. 11	70.8
Feb. 5	69.3	Aug. 13	70.8		

5/2W-24A1 (*1021, p. 107; 1028, p. 131; 1076, p. 148). L. Wilhelm.

Water level, in feet below land-surface datum, 1947

Jan. 9	31.2	Apr. 29	39.1	Nov. 11	a 43.1
Feb. 5	31.6	Aug. 13	43.5		

a Windmill pumping slowly.

5/2W-27E2 (*1021, p. 108; 1028, p. 132; 1076, p. 148). L. L. Whiting.

Water levels, in feet below land-surface datum, 1947: Jan. 9, 30.2; Feb. 5, 30.2; Apr. 29, 30.8.

6/3W-4A2 (*1021, p. 108; 1028, p. 132; 1076, p. 148). Menifee School.

Water level, in feet below land-surface datum, 1947

Jan. 9	52.4	Apr. 29	54.3	Nov. 11	56.0
Feb. 5	52.3	Aug. 13	55.0		

San Bernardino County

Mojave River Basin

3/3W-6E1 (*886, p. 30; 911, p. 125; 941, p. 96; 949, p. 66; 991, p. 124; 1021, p. 109; 1028, p. 132; 1076, p. 148). Mike Spranger. Water levels, in feet below land-surface datum, 1947: Jan. 6, 5.4; May 28, 11.7; Nov. 11, dry at 29.5.

3/4W-12J1 (*886, p. 30; 911, p. 125; 941, p. 96; 949, p. 66; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). Water levels, in feet below land-surface datum, 1947: Jan. 6, 5.5; May 15, 5.6; Nov. 11, dry at 25.5.

3/4W-13B1 (*886, p. 30; 911, p. 125; 941, p. 96; 949, p. 66; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). Olive. Water levels, in feet below land-surface datum, 1947: Jan. 6, 66.6; May 15, 66.6.

4/3W-1M1 (*886, p. 33; 911, p. 126; 941, p. 96; 949, p. 66; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). E. D. S. Pope. Measuring point beginning May 16, 1947, hole in timber, 1.2 feet above land-surface datum. Water levels, in feet below land-surface datum, 1947: Jan. 6, 197.3, bv U. S. Bureau of Reclamation; May 16, 196.8; Nov. 11, 199.0.

4/3W-5P1 (*886, p. 34; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). Water levels, in feet below land-surface datum, 1947: Jan. 7, 168.2; May 15, 167.4; Nov. 12, obstruction at 167.1. Measurements discontinued.

4/3W-6B1 (*886, p. 35; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). A. J. Lintner. Water levels, in feet below land-surface datum, 1947: Jan. 6, 50.9; May 15, 51.4; Nov. 12, 52.8.

4/3W-6D1 (*886, p. 35; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). A. W. Phillips. Water levels, in feet below land-surface datum, 1947: Jan. 6, 52.5, by U. S. Bureau of Reclamation; May 15, 52.1; Nov. 12, 54.0.

4/3W-17M1 (*886, p. 34; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). Arrowhead Reservoir & Power Co. Water levels, in feet below land-surface datum, 1947: Jan. 7, 16.3; May 16, 13.3; Nov. 12, 19.0.

4/3W-18E1 (*886, p. 34; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). C. O. Evans. Water levels, in feet below land-surface datum, 1947: Jan. 6, 17.0, by U. S. Bureau of Reclamation; May 15, 18.8; Nov. 12, 24.2.

4/3W-19G1 (*886, p. 33; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 125; 1021, p. 109; 1028, p. 132; 1076, p. 148). G. W. McLister. Water levels, in feet below land-surface datum, 1947: Jan. 7, 16.1; May 15, 20.1; Nov. 12, 29.5.

4/3W-19R1 (*886, p. 31; 911, p. 126; 941, p. 96; 949, p. 66; 991, p. 125; 1021, p. 110; 1028, p. 132; 1076, p. 149). Arrowhead Reservoir & Power Co. Water levels, in feet below land-surface datum, 1947: Jan. 6, 15.0, by U. S. Bureau of Reclamation; May 15, 17.6; Nov. 11, 29.3.

4/3W-20K1 (*886, p. 32; 911, p. 126; 941, p. 96; 949, p. 66; 991, p. 125; 1021, p. 110; 1028, p. 132; 1076, p. 149). N. F. Marsh. Measurements discontinued.

4/3W-20L1 (*886, p. 32; 911, p. 126; 941, p. 96; 949, p. 66; 991, p. 125; 1021, p. 110; 1028, p. 132; 1076, p. 149). J. M. Allison. Water levels, in feet below land-surface datum, 1947: Jan. 7, 24.1; May 16, 21.4; Nov. 11, 30.0.

4/3W-21A1 (*886, p. 32; 911, p. 126; 941, p. 96; 949, p. 66; 991, p. 126; 1021, p. 110; 1028, p. 132; 1076, p. 149). W. G. Wade. Water levels, in feet below land-surface datum, 1947: Jan. 7, 249.5; May 16, 247.7; Nov. 11, 251.2.

4/3W-30E1 (*886, p. 30; 911, p. 126; 941, p. 96; 949, p. 66; 991, p. 126; 1021, p. 110; 1028, p. 132; 1076, p. 149). A. W. Cole. Water levels, in feet below land-surface datum, 1947: Jan. 6, 26.3; May 15, 27.2; Nov. 11, 38.9.

5/3W-9K1 (*886, p. 35; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). F. A. Fletcher. Water levels, in feet below land-surface datum, 1947: Jan. 6, 88.7, by U. S. Bureau of Reclamation; May 15, 88.8; Nov. 11, 88.6.

5/3W-18F1 (*886, p. 35; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). J. D. Humiston. Water levels, in feet below land-surface datum, 1947: Jan. 6, 106.1, by U. S. Bureau of Reclamation; May 15, 106.8; Nov. 11, 107.0.

5/4W-10M1 (*886, p. 36; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). In Victorville. Water levels, in feet below land-surface datum, 1947: Jan. 6, 44.3; Oct. 28, 44.6; Nov. 12, 44.6.

5/4W-11P1 (*886, p. 36; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). Lee Saul. Water levels, in feet below land-surface datum, 1947: Jan. 6, 53.8; May 15, 54.1; Nov. 12, 54.2.

5/4W-11P2 (*886, p. 36; 911, p. 126; 941, p. 96; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). Lee Saul. Water levels, in feet below land-surface datum, 1947: Jan. 6, 46.7; May 15, 48.3; Nov. 12, 48.0.

5/4W-35A1 (*886, p. 36; 911, p. 126; 941, p. 97; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). A. Sorenson. On Verde Ranch. No measurements made in 1947.

5/4W-36N1 (*886, p. 36; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). On Verde Ranch. No measurements made in 1947.

6/4W-19G1 (*886, p. 37; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). John Bennetts. Measurements discontinued.

7/4W-30C1 (*886, p. 37; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). Water levels, in feet below land-surface datum, 1947: Jan. 1, 56.9, by U. S. Bureau of Reclamation; May 20, 57.2; Nov. 12, 57.6.

8/3E-3E1 (*886, p. 43; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). C. W. Beaverstock. Water levels, in feet below land-surface datum, 1947: Jan. 2, 6.3, by U. S. Bureau of Reclamation; May 22, 5.9; Nov. 18, 7.0.

8/3E-3F1 (*886, p. 44; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). Water levels, in feet below land-surface datum, 1947: Jan. 9, 21.7; May 22, 21.1; Nov. 18, 21.1.

8/3E-4B1 (*886, p. 43; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 126; 1021, p. 110; 1028, p. 133; 1076, p. 149). Lyle Graham. Water levels, in feet below land-surface datum, 1947: Jan. 9, 3.2; May 22, 3.7; Nov. 18, 4.0.

8/3E-4B2 (*886, p. 43; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 126; 1021, p. 111; 1028, p. 133; 1076, p. 149). Lyle Graham. Water levels, in feet below land-surface datum, 1947: Jan. 9, 3.5; May 22, 4.2; Nov. 18, 4.4.

8/3W-4M1 (*886, p. 38; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 127; 1021, p. 111; 1028, p. 133; 1076, p. 150). Everett Swing. Water levels, in feet below land-surface datum, 1947: Jan. 1, 14.1, by U. S. Bureau of Reclamation; May 21, 13.4; Nov. 12, 15.3.

8/4E-7E1 (*1021, p. 111; 1028, p. 133; 1076, p. 150). Bodine. Water level, in feet below land-surface datum, 1947: Nov. 18, 23.4.

8/4E-12L1 (*886, p. 44; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 127; 1021, p. 111; 1028, p. 133; 1076, p. 150). Mojave Camp service station. Measuring point beginning Nov. 15, 1945, top of casing, 1.0 foot above land-surface datum which is 1,810.9 feet above sea level (levels by U. S. Bureau of Reclamation). Water levels, in feet below land-surface datum, 1947: Jan. 2, 30.4, by U. S. Bureau of Reclamation; May 22, 30.4; Nov. 18, 30.4.

8/4W-2Q1 (*886, p. 38; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 127; 1021, p. 111; 1028, p. 133; 1076, p. 150). Water levels, in feet below land-surface datum, 1947: Jan. 1, 25.0, by U. S. Bureau of Reclamation; May 20, 24.0; Nov. 12, 25.9.

8/4W-12Q1 (*886, p. 38; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 127; 1021, p. 111; 1028, p. 133; 1076, p. 150). Holcomb Bros. Water levels, in feet below land-surface datum, 1947: Jan. 1, 9.1, by U. S. Bureau of Reclamation; Nov. 12, 10.5.

8/4W-20N1 (*886, p. 37; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 127; 1021, p. 111; 1028, p. 134; 1076, p. 150). Lord. Measuring point beginning Jan. 8, 1947, top of 4-by-4-inch frame of horizontal hinged door in well cover, 3.3 feet above land-surface datum. Water level, in feet below land-surface datum, 1947: Jan. 8, 13.5.

8/4W-31D1 (*886, p. 37; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 127; 1021, p. 111; 1028, p. 134; 1076, p. 150). F. H. Merrell. Water levels, in feet below land-surface datum, 1947: Jan. 1, 44.2, by U. S. Bureau of Reclamation; May 20, 43.6; Nov. 12, 44.3.

8/4W-31R1 (*886, p. 37; 911, p. 127; 941, p. 97; 949, p. 67; 991, p. 127; 1021, p. 111; 1028, p. 134; 1076, p. 150). Water levels, in feet below land-surface datum, 1947: Jan. 1, 15.3; by U. S. Bureau of Reclamation; May 20, 15.4; Nov. 12, 16.4.

9/1E-2E1 (*1028, p. 134; 1076, p. 150). M. L. Goodwin. Measurements discontinued.

9/1E-12D1 (*886, p. 45; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 127; 1021, p. 111; 1028, p. 134; 1076, p. 150). Water levels, in feet below land-surface datum, 1947: Jan. 8, 39.3; May 21, 40.0; Nov. 17, 41.4.

9/1E-13E1 (*886, p. 45; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 127; 1021, p. 111; 1028, p. 134; 1076, p. 150). Water levels, in feet below land-surface datum, 1947: Jan. 2, 60.0, by U. S. Bureau of Reclamation; May 22, 60.7; Nov. 17, 62.3.

9/1E-13E2 (*886, p. 45; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 127; 1021, p. 111; 1028, p. 134; 1076, p. 150). Water levels, in feet below land-surface datum, 1947: Jan. 2, 60.9; by U. S. Bureau of Reclamation; May 22, 61.6; Nov. 17, 63.1.

9/1E-15L1 (*886, p. 45; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 128; 1021, p. 111; 1028, p. 134; 1076, p. 150). C. Linguenfelder. Water level, in feet below land-surface datum, 1947: Feb. 13, 63.4; Nov. 17, rock in casing at 59 feet. Measurements discontinued.

9/1E-18E1 (*886, p. 47; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 128; 1021, p. 112; 1028, p. 134; 1076, p. 150). B. A. Furk. Measuring point beginning Jan. 2, 1947, hole in east side of casing, 0.7 foot below top of casing, 0.8 foot below land-surface datum which is 1,696.0 feet above sea level (levels by U. S. Bureau of Reclamation). Water levels, in feet below land-surface datum, 1947: Jan. 2, 12.7, by U. S. Bureau of Reclamation; May 21, 15.3; Nov. 14, 17.6.

9/1E-24D1 (*886, p. 47; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 128; 1021, p. 112; 1028, p. 134; 1076, p. 150). Water levels, in feet below land-surface datum, 1947: Jan. 9, 64.9; May 22, 65.6; Nov. 17, 66.2.

9/1W-10A1 (*886, p. 42; 911, p. 128; 941, p. 98; 949, p. 68; 991, p. 128; 1021, p. 113; 1028, p. 134; 1076, p. 150). Gibbs. Measuring point beginning Nov. 13, 1947, chalk mark on suction pipe at top edge of railroad tie laid across well pit, 0.15 foot below land-surface datum. Water level, in feet below land-surface datum, 1947: Nov. 13, 12.9.

9/1W-10D2 (*1028, p. 134; 1076, p. 151). R. E. Hettick. Water levels, in feet below land-surface datum, 1947: Jan. 10, 6.1; Nov. 13, 8.9.

9/1W-10M1 (*886, p. 43; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 128; 1021, p. 113; 1028, p. 134; 1076, p. 151). Greystone Auto Camp. Measuring point beginning Feb. 13, 1947, top of concrete floor, 0.6 foot above land-surface datum. Water levels, in feet below land-surface datum, 1947: Feb. 13, 51.0, pump shut off prior to measurement; May 21, 51.5; Nov. 14, 53.5.

9/1W-13B1 (*886, p. 43; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 128; 1021, p. 113; 1028, p. 134; 1076, p. 151). F. Ryerse. Water levels, in feet below land-surface datum, 1947: Jan. 22, 8.8, by U. S. Bureau of Reclamation; May 21, 12.1; Nov. 14, 15.5.

9/2E-3A1 (*886, p. 46; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 128; 1021, p. 112; 1028, p. 134; 1076, p. 151). Bruce McCormick. Water levels, in feet below land-surface datum, 1947: Jan. 8, 12.2; May 21, 12.2; Nov. 17, 15.2.

9/2E-3A2 (*886, p. 46; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 128; 1021, p. 112; 1028, p. 134; 1076, p. 151). Bruce McCormick. Water levels, in feet below land-surface datum, 1947: Jan. 8, 15.6; May 21, 15.2; Nov. 17, 18.6.

9/2E-4D1 (*886, p. 46; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 128; 1021, p. 112; 1028, p. 135; 1076, p. 151). Water levels, in feet below land-surface datum, 1947: Jan. 2, 16.8, by U. S. Bureau of Reclamation; May 21, 17.4; Nov. 17, 18.3.

9/2E-8J1 (*886, p. 47; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 128; 1021, p. 112; 1028, p. 135; 1076, p. 151). Annie Escholtz. Water levels, in feet below land-surface datum, 1947: Jan. 2, 37.2, by U. S. Bureau of Reclamation; May 22, 37.4; Nov. 17, 39.0.

9/2E-12N1 (*886, p. 49; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 128; 1021, p. 112; 1028, p. 135; 1076, p. 151). Hunter. Water levels, in feet below land-surface datum, 1947: Jan. 9, 2.8; May 23, 4.4; Nov. 19, 4.0.

9/2E-14N1 (*886, p. 49; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 128; 1021, p. 112; 1028, p. 135; 1076, p. 151). Scobel & Haimut. Water levels, in feet below land-surface datum, 1947: Jan. 9, 21.7; Nov. 19, 22.6.

9/2E-14N2 (*886, p. 49; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). Scotel & Haimut. Water levels, in feet below land-surface datum, 1947: Jan. 9, 15.7; May 23, 16.4; Nov. 19, 16.8.

9/2E-14N3 (*886, p. 50; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). Scotel & Haimut. Water levels, in feet below land-surface datum, 1947: Jan. 9, 16.9; May 23, 18.6; Nov. 19, 17.1.

9/2E-18F1 (*886, p. 47; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). Water levels, in feet below land-surface datum, 1947: May 22, 51.5; Nov. 17, 52.4.

9/2E-20Q1 (*1021, p. 112; 1028, p. 135; 1076, p. 151). Daggett Airport. Water levels, in feet below land-surface datum, 1947: Jan. 2, 42.2, by U. S. Bureau of Reclamation; May 22, 43.3; Nov. 17, 44.0.

9/2W-19B1 (*886, p. 39; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). Shobel. Water levels, in feet below land-surface datum, 1947: Jan. 1, 62.8, by U. S. Bureau of Reclamation; May 21, 62.3; Nov. 12, 62.4.

9/3E-3D1 (*886, p. 50; 911, p. 130; 941, p. 99; 949, p. 70; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). Water levels, in feet below land-surface datum, 1947: May 23, 44.6; Nov. 18, 44.3.

9/3E-10D1 (*886, p. 50; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). Bozarth. Water levels, in feet below land-surface datum, 1947: Jan. 9, 35.4; May 23, 35.4; Nov. 18, 35.5.

9/3E-12E1 (*886, p. 51; 911, p. 130; 941, p. 99; 949, p. 70; 991, p. 129; 1021, p. 112; 1028, p. 135; 1076, p. 151). B. Nicholas. Water level, in feet below land-surface datum, 1947: Jan. 2, 28.3, by U. S. Bureau of Reclamation.

9/3E-19E1. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 19, T. 9 N., R. 3 E., 9.8 miles east of Daggett, and 3.0 miles northeast of Newberry. Unused drilled irrigation well, diameter 12 inches, depth 200 feet. Measuring point, top of casing, at land-surface datum which is about 1,860.1 feet above sea level.

Water level, in feet below land-surface datum, 1919, 1922, 1930-32, 1935, 1938-47

Date	Water level	Date	Water level	Date	Water level
Oct. 31, 1919	(a)	Jan. 30, 1935	3.6	Dec. 30, 1943	0.8
May 22, 1922	(a)	Nov. 26, 1938	1.6	Apr. 25, 1944	.3
8, 1930	1.4	May 15, 1939	1.0	Jan. 3, 1945	.2
22	1.5	9, 1940	.9	May 10	.5
Jan. 22, 1931	1.8	Nov. 27	2.8	Nov. 16	.7
May 7	2.4	June 11, 1941	2.1	May 2, 1946	.5
Feb. 26, 1932	2.2	Nov. 26	1.6	23, 1947	.9
Apr. 27	2.0	May 14, 1942	1.4	Nov. 19	.7
July 13	2.4				

a Flowing.

9/3E-19P1. Frey. SE₁SW₄ sec. 19, T. 9 N., R. 3 E., about 10 miles east of Daggett, and 2.4 miles northwest of Newberry. Unused drilled irrigation well, diameter 12 inches, depth 151 feet. Casing is split to about 1 foot below top. Measuring point, top of casing, 2 feet above land-surface datum which is about 1,854.8 feet above sea level.

Water level, in feet below land-surface datum, 1919, 1922, 1930-35, 1938-47

Date	Water level	Date	Water level	Date	Water level
Dec. 10, 1919	(a)	Feb. 14, 1934	3.3	Nov. 25, 1942	1.9
May 22, 1922	(a)	Jan. 30, 1935	3.7	May 18, 1943	1.4
8, 1930	1.6	Nov. 26, 1938	2.7	Dec. 30	1.1
22	1.7	May 15, 1939	2.5	Apr. 25, 1944	(a)
Oct. 9	2.2	9, 1940	2.2	Jan. 3, 1945	(a)
Jan. 22, 1931	2.2	Nov. 27	1.7	May 10	(a)
May 7	2.3	June 11, 1941	1.8	Nov. 16,	(a)
Apr. 27, 1932	2.2	Nov. 26	1.8	May 2, 1946	(a)
July 15	2.6	May 14, 1942	1.6	23, 1947	(a)
Jan. 11, 1933	2.7				

a Flowing.

9/3E-34D1 (*886, p. 48, 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 129; 1021, p. 113; 1028, p. 135; 1076, p. 151). Clinkenbeard. Water levels, in feet below land-surface datum, 1947: Jan. 9, 30.2; Nov. 18, 30.0.

9/3W-10P1 (*886, p. 39; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 129; 1021, p. 113; 1028, p. 135; 1076, p. 152). Water levels, in feet below land-surface datum, 1947: Jan. 1, 88.4, by U. S. Bureau of Reclamation; May 20, 88.3; Nov. 13, 88.3.

9/3W-10R1 (*886, p. 40; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 129; 1021, p. 113; 1028, p. 135; 1076, p. 152). Osborn. Water levels, in feet below land-surface datum, 1947: Jan. 7, 10.3; May 20, 8.9; Nov. 13, 12.3.

9/3W-14D1 (*886, p. 40; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 129; 1021, p. 113; 1028, p. 135; 1076, p. 152). Bullock. Water levels, in feet below land-surface datum, 1947: Jan. 1, 11.2, by U. S. Bureau of Reclamation; May 20, 9.2; Nov. 13, 13.8.

9/3W-28A1 (*886, p. 39; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 129; 1021, p. 113; 1028, p. 135; 1076, p. 152). J. Slagill. Water levels, in feet below land-surface datum, 1947: Jan. 1, 3.5, by U. S. Bureau of Reclamation; May 20, 8.4.

9/3W-34R1 (*886, p. 38; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 130; 1021, p. 113; 1028, p. 135; 1076, p. 152). Nellie Stcrey. Water levels, in feet below land-surface datum, 1947: Jan. 1, 125.6; by U. S. Bureau of Reclamation; May 20, 125.3; Nov. 12, 125.5.

9/4E-31K1 (*886, p. 44; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 130; 1021, p. 113; 1028, p. 136; 1076, p. 152). A. M. Monroe. Water levels, in feet below land-surface datum, 1947: Jan. 2, 13.1, by U. S. Bureau of Reclamation; May 22, 13.4; Nov. 18, 13.4.

10/1W-31C1 (*886, p. 42; 911, p. 128; 941, p. 98; 949, p. 68; 991, p. 130; 1021, p. 113; 1028, p. 136; 1076, p. 152). Nelson. Water levels, in feet below land-surface datum, 1947: Jan. 10, 46.8; May 21, 47.0; Nov. 13, 48.9.

10/2E-32P1 (*886, p. 45; 911, p. 128; 941, p. 98; 949, p. 69; 991, p. 130; 1021, p. 113; 1028, p. 136; 1076, p. 152). Yermo Mutual Water Co. Water levels, in feet below land-surface datum, 1947: Jan. 8, 24.8; May 21, 25.5; Nov. 17, 26.4.

10/2E-34L1 (*886, p. 46; 911, p. 129; 941, p. 99; 949, p. 70; 991, p. 130; 1021, p. 113; 1028, p. 136; 1076, p. 152). Water levels, in feet below land-surface datum, 1947: Jan. 2, 54.0, by U. S. Bureau of Reclamation; May 21, 54.7; Nov. 17, 56.3.

10/2W-19P1 (*886, p. 41; 911, p. 128; 941, p. 97; 949, p. 68; 991, p. 130; 1021, p. 114; 1028, p. 136; 1076, p. 152). Loftus. Water levels, in feet below land-surface datum, 1947: Jan. 7, 67.0; Nov. 13, 67.9; Pumping on May 20; no measurement made.

10/2W-30R1 (Formerly M-74 in *886, p. 41; 911, p. 128; 941, p. 97; 949, p. 68; and 10/2W-30N1 in *991, p. 130; 1021, p. 114; 1028, p. 136; 1076, p. 152). J. D. Rich. Water levels, in feet below land-surface datum, 1947: Jan. 7, 19.7; May 20, 21.2, pumping; Nov. 13, 23.0.

10/3E-34E1 (*886, p. 50; 911, p. 130; 941, p. 99; 949, p. 70; 991, p. 130; 1021, p. 113; 1028, p. 136; 1076, p. 152). Henderson. Water levels, in feet below land-surface datum, 1947: Jan. 9, 7.7; May 23, 7.8; Nov. 18, dry at 8.5. Measurements discontinued; replaced by 10/3E-34E2.

10/3E-34E2. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 34, T. 10 N., R. 3 E., about 9 miles east of Yermo, 400 feet north of bank at south edge of flood plain and 300 feet east of section line. Used irrigation well, diameter 16 inches, depth 30 feet. Measuring point, top of casing, 0.6 foot above land-surface datum. Water levels, in feet below land-surface datum, 1947: Nov. 18, 9.4.

10/3W-32C1 (*886, p. 39; 911, p. 127; 941, p. 97; 949, p. 68; 991, p. 130; 1021, p. 114; 1028, p. 136; 1076, p. 152). Water levels, in feet below land-surface datum, 1947: Jan. 7, 58.0; May 20, 56.1; Nov. 13, 58.1.

11/3W-28R1 (*1021, p. 114; 1028, p. 136; 1076, p. 152). S. F. Edwards. Water levels, in feet below land-surface datum, 1947: Jan. 7, 26.5; May 20, 26.6; Nov. 13, 26.8.

11/3W-34F1 (*886, p. 41; 911, p. 128; 941, p. 97; 949, p. 68; 991, p. 130; 1021, p. 114; 1028, p. 136; 1076, p. 152). Water levels, in feet below land-surface datum, 1947: Jan. 7, 33.9; May 20, 33.6; Nov. 13, 33.8.

Santa Ana River Basin, San Bernardino area

1N/4W-28R1 (*1021, p. 114; 1028, p. 136; 1076, p. 152). S. F. Kelley. Water levels, in feet below land-surface datum, 1947: Jan. 6, 46.5; Feb. 4, 46.4; May 7, 47.0; Nov. 6, 52.6.

1N/4W-36F1 (*1021, p. 115; 1028, p. 136; 1076, p. 153). G. M. Cooley. Measuring point beginning May 7, 1947, top of casing, 0.3 foot above land-surface datum. Water levels, in feet below land-surface datum, 1947: Jan. 6, 45.3; Feb. 4, 45.4; May 7, 46.1; Nov. 6, 50.1.

1S/3W-3N1 (*1021, p. 115; 1028, p. 136; 1076, p. 153). R. C. Gerber. Water levels, in feet below land-surface datum, 1947: Jan. 6, 65.1; Feb. 4, 63.9; May 7, 85.1; Nov. 6, 95.7.

1S/3W-16L1 (*1021, p. 116; 1028, p. 136; 1076, p. 153). S. Ronzone. Water levels, in feet below land-surface datum, 1947: Jan. 6, 65.7; Feb. 4, 64.2; May 7, 71.8; Nov. 6, dry.

1S/3W-17C1. Known as Williams well (*817, pp. 12-16; 840, p. 30; 845, p. 18; 886, p. 24; 911, p. 119; 941, p. 91; 949, p. 65; 991, p. 131; 1021, p. 116; 1028, p. 136; 1076, p. 153). Records furnished by Gage Canal Co.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 4	12.4	Mar. 8	14.3	May 10	19.0	July 12	23.7
11	12.4	15	14.7	17	19.4	19	23.9
18	12.5	22	15.3	24	20.1	26	24.4
25	12.9	29	15.9	31	20.7	Aug. 2	25.2
Feb. 1	13.0	Apr. 5	16.4	June 7	21.1	9	25.2
8	13.3	12	16.7	14	21.4	16	25.2
15	13.4	19	17.2	21	21.6	23	26.4
22	13.7	26	18.1	28	22.1	30	27.0
Mar. 1	14.0	May 3	18.4	July 5	22.9	Sept. 6	27.5

1S/3W-17C1--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Sept. 13	28.0	Oct. 11	29.0	Nov. 8	29.7	Dec. 6	29.7
20	28.5	18	29.2	15	29.9	13	29.4
27	28.7	25	29.4	22	30.0	20	28.9
Oct. 4	29.0	Nov. 1	29.5	29	30.0	27	28.2

1S/3W-20B1 (*1021, p. 116; 1028, p. 137; 1076, p. 153). Emmet Martin. Key well U. S. 101.

Water level, in feet below land-surface datum, 1947

Jan. 30	37.7	May 1	39.5	July 31	40.6	Oct. 30	41.7
Feb. 28	38.1	29	40.1	Aug. 29	41.1	Nov. 26	41.9
Mar. 31	38.6	June 30	40.5	Sept. 30	41.5	Dec. 30	42.0

1S/3W-28E1 (*1021, p. 117; 1028, p. 137; 1076, p. 153). George Hinckley. Water levels, in feet below land-surface datum, 1947: Jan. 6, 42.2; Feb. 4, 42.5; May 7, 44.8; Nov. 6, 46.7.

1S/3W-29K1 (*1021, p. 118; 1028, p. 137; 1076, p. 153). J. Yount. Water levels, in feet below land-surface datum, 1947: Jan. 6, 33.8; Feb. 4, 33.7; May 7, 35.4; Nov. 6, 38.0.

1S/3W-32C1 (*1021, p. 118; 1028, p. 137; 1076, p. 153). W. H. Martin. Water levels, in feet below land-surface datum, 1947: Jan. 6, 60.7; Feb. 4, 59.6; May 7, 61.8; Nov. 6, 67.8.

1S/4W-4K1 (*1021, p. 119; 1028, p. 137; 1076, p. 153). W. J. Walsh. Water levels, in feet below land-surface datum, 1947: Jan. 6, 4.7; Feb. 4, 5.2; May 7, 9.4; Nov. 6, 12.4.

San Diego County

San Luis Rey River Basin

10/3W-1 (*840, p. 35; 845, p. 42; 886, p. 27; 911, p. 123; 941, p. 94; 949, p. 73; 991, p. 131; 1021, p. 119; 1028, p. 137; 1076, p. 153). On San Luis Rey Ranch. About 4 miles west of Paia. Water levels, in feet below land-surface datum, 1947: Jan. 6, 6.2; Apr. 7, 7.1; July 7, 11.1; Oct. 6, 15.1.

10/3W-1a (*840, p. 36; 845, p. 42; 886, p. 27; 911, p. 123; 941, p. 94; 949, p. 73; 991, p. 131; 1021, p. 119; 1028, p. 137; 1076, p. 154). On San Luis Rey Ranch. Water levels, in feet below land-surface datum, 1947: Jan. 6, 8.2; Apr. 7, 8.8; July 7, 9.0; Oct. 6, 9.3.

10/3W-1b (*840, p. 36; 845, p. 43; 886, p. 28; 911, p. 124; 941, p. 94; 949, p. 73; 991, p. 131; 1021, p. 119; 1028, p. 137; 1076, p. 154). On San Luis Rey Ranch. Water levels, in feet below land-surface datum, 1947: Jan. 6, 6.6; Apr. 7, 7.1; July 7, 7.3; Oct. 6, 7.6.

10/3W-1c (*886, p. 28; 911, p. 124; 941, p. 94; 949, p. 74; 991, p. 131; 1021, p. 120; 1028, p. 137; 1076, p. 154). Fallbrook Public Utility District Observation well. On San Luis Rey Ranch. Water levels, in feet below land-surface datum, 1947: Jan. 6, 7.2; Apr. 7, 7.5; July 7, 8.5; Oct. 6, 11.3.

10/3W-15 (*840, p. 35; 845, p. 42; 886, p. 28; 911, p. 124; 941, p. 94; 949, p. 74; 991, p. 132; 1021, p. 120; 1028, p. 137; 1076, p. 154). On Gird Ranch. About 2.5 miles east of Bonsall. Water levels, in feet below land-surface datum, 1947: Jan. 6, 5.6; Apr. 7, 3.5; July 7, 6.3; Oct. 6, 8.5.

10/3W-16 (*845, p. 42; 886, p. 28; 911, p. 124; 941, p. 94; 949, p. 74; 991, p. 132; 1021, p. 120; 1028, p. 138; 1076, p. 154). Hart, Inc. About 2 miles east of Bonsall. Water levels, in feet below land-surface datum, 1947: Jan. 6, 3.3; Apr. 7, 3.9; July 7, 7.6; Oct. 6, pump installed, casing sealed tight, water surface inaccessible. Measurements discontinued.

10/3W-20 (*840, p. 35; 845, p. 42; 886, p. 28; 911, p. 124; 941, p. 94; 949, p. 74; 991, p. 132; 1021, p. 120; 1028, p. 138; 1076, p. 154). Bonsall School. At Bonsall. Water levels, in feet below land-surface datum, 1947: Jan. 6, 8.6; Apr. 7, 8.8; Oct. 6, 9.8.

10/3W-20a (*991, p. 132; 1021, p. 120; 1028, p. 138; 1076, p. 154). Sickler Ranch. At Bonsall. Water levels, in feet below land-surface datum 1947: Jan. 6, 15.6; Apr. 7, 15.6; July 7, 16.8; Oct. 6, 16.7.

10/3W-30 (*886, p. 28; 911, p. 124; 941, p. 94; 949, p. 74; 991, p. 132; 1021, p. 120; 1028, p. 138; 1076, p. 154). Fallbrook Public Utility District observation well. On property of San Diego County Water Co. Water levels, in feet below land-surface datum, 1947: Jan. 6, 10.8; Apr. 4, 10.8; July 7, 11.2; Oct. 6, 11.6.

11/4W-5 (*886, p. 28; 911, p. 124; 941, p. 94; 949, p. 74; 991, p. 132; 1021, p. 120; 1028, p. 138; 1076, p. 154). City of Oceanside observation well. On Stokes property. Measurements by city of Oceanside.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 11	14.2	Apr. 14	12.4	July 11	15.2	Oct. 13	19.1
Feb. 10	15.2	May 10	13.4	Aug. 9	16.9	Nov. 10	19.6
Mar. 10	13.7	June 14	14.2	Sept. 10	17.6	Dec. 13	19.6

11/4W-8 (*886, p. 29; 911, p. 124; 941, p. 95; 949, p. 74; 991, p. 133; 1021, p. 120; 1028, p. 138; 1076, p. 154). Carlsbad Mutual Water Co. observation well. At San Luis Rey. Measurements by Carlsbad Mutual Water Co. Water levels, in feet below land-surface datum, 1947: Jan. 6, 12.0; Apr. 8, 11.5; July 7, 14.0; Oct. 6, 16.7.

11/4W-9F1 (*911, p. 125; 941, p. 95; 949, p. 74; 991, p. 133; 1021, p. 120; 1028, p. 138; 1076, p. 154). City of Oceanside observation well. On Williams Ranch. Measurements by city of Oceanside.

Water level, in feet below land-surface datum, 1947

Jan. 11	13.6	Apr. 14	10.5	July 11	14.8	Oct. 13	18.6
Feb. 10	13.7	May 10	12.3	Aug. 9	16.7	Nov. 10	19.1
Mar. 10	13.3	June 14	14.3	Sept. 10	18.4	Dec. 13	18.8

11/4W-18 (*886, p. 29; 911, p. 125; 941, p. 95; 949, p. 75; 991, p. 133; 1021, p. 120; 1028, p. 138; 1076, p. 155). Carlsbad Mutual Water Co. observation well. Near San Luis Rey. Measurements by Carlsbad Mutual Water Co. Water levels, in feet below land-surface datum, 1947: Jan. 6, 14.9; Apr. 8, 21.4; July 7, 30.0; Oct. 6, 32.3.

11/5W-13a (*886, p. 29; 911, p. 125; 941, p. 95; 949, p. 75; 991, p. 133; 1021, p. 121; 1028, p. 138; 1076, p. 155). City of Oceanside. On city property, about 2 miles northeast of Oceanside. Measurements by city of Oceanside.

Water level, in feet below land-surface datum, 1947

Jan. 11	10.5	Apr. 14	12.0	July 11	15.9	Oct. 13	14.8
Feb. 10	10.8	May 10	13.7	Aug. 9	17.2	Nov. 10	17.0
Mar. 10	11.6	June 14	13.6	Sept. 10	16.5	Dec. 13	14.8

11/5W-13b (*886, p. 29; 911, p. 125; 941, p. 95; 949, p. 75; 991, p. 133; 1021, p. 121; 1028, p. 138; 1076, p. 155). City of Oceanside. On city property, about 2 miles northeast of Oceanside. Measurements by city of Oceanside.

Water level, in feet below land-surface datum, 1947

Jan. 11	11.5	Apr. 14	10.7	July 11	12.5	Oct. 13	15.3
Feb. 10	11.0	May 10	11.6	Aug. 9	13.8	Nov. 10	15.7
Mar. 10	10.8	June 14	11.9	Sept. 10	14.4	Dec. 13	15.2

11/5W-13c (*886, p. 29; 911, p. 125; 941, p. 95; 949, p. 75; 991, p. 133; 1021, p. 121; 1028, p. 139; 1076, p. 155). City of Oceanside. On city property, about 2 miles north of Oceanside. Measurements by city of Oceanside.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 11	10.1	Apr. 14	10.9	July 11	13.3	Oct. 13	13.8
Feb. 10	10.3	May 10	12.0	Aug. 9	14.1	Nov. 10	14.5
Mar. 10	10.8	June 14	12.5	Sept. 10	15.2	Dec. 13	13.2

11/5W-15 (*886, p. 29; 911, p. 125; 941, p. 95; 949, p. 75; 991, p. 133; 1021, p. 121; 1028, p. 139; 1076, p. 155). City of Oceanside. On city property, north of Oceanside. Measurements by city of Oceanside.

Water level, in feet below land-surface datum, 1947

Jan. 11	5.3	Apr. 14	5.9	July 11	7.8	Oct. 13	8.6
Feb. 10	5.3	May 10	6.9	Aug. 9	8.4	Nov. 10	9.0
Mar. 10	5.7	June 14	6.5	Sept. 10	8.9	Dec. 13	8.0

San Dieguito River Basin

12/1W-31H2 (*840, p. 38; 845, p. 42; 886, p. 27; 911, p. 123; 941, p. 93; 949, p. 73; 991, p. 134; 1021, p. 121; 1028, p. 139; 1076, p. 155). City of San Diego.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 3	8.6	July 17	9.9	Dec. 31	10.3
Apr. 4	7.4	Sept. 22	10.0		

12/1W-32 (*991, p. 134; 1021, p. 121; 1028, p. 139; 1076, p. 155). County Road Station.

Water level, in feet below land-surface datum, 1947

Jan. 3	23.0	July 17	23.1	Dec. 31	20.4
Apr. 4	18.9	Sept. 22	20.4		

12/1W-33 (*840, p. 39; 845, p. 42; 886, p. 27; 911, p. 123; 941, p. 93; 949, p. 73; 991, p. 134; 1021, p. 121; 1028, p. 139; 1076, p. 156). H. G. Fenton. Just west of San Pasqual. Windmill replaced by electrically driven centrifugal pump July 1947.

Water level, in feet below land-surface datum, 1947

Jan. 3	16.0	July 17	16.2	Dec. 31	17.5
Apr. 4	14.5	Sept. 22	17.2		

12/1W-33a (*991, p. 134; 1021, p. 122; 1028, p. 139; 1076, p. 156). F. B. Gierman.

Water level, in feet below land-surface datum, 1947

Jan. 3	1.5	July 17	4.3	Dec. 31	5.1
Apr. 4	1.4	Sept. 22	4.8		

12/1W-35K1 (*1028, p. 139; 1076, p. 156). June Chase. Water levels, in feet below land-surface datum, 1947: Jan. 3, 7.9; Apr. 4, 6.9; Dec. 31, 10.4.

12/1W-36D1 (*1028, p. 139; 1076, p. 156). Jorgensen. Measuring point beginning Dec. 31, 1947, top of track rail pump support, west side, 0.67 foot above land-surface datum. Water levels, in feet below land-surface datum, 1947: Jan. 3, 8.4; Apr. 4, 7.1; July 17, 15.4; Dec. 31, 21.2.

San Diego River Basin

15/1E-2 (*845, p. 26; 886, p. 25; 911, p. 121; 941, p. 92; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 139; 1076, p. 155). San Diego County. At El Monte Park. Water levels, in feet below land-surface datum, 1947: Jan. 2, 37.2; Dec. 30, 43.6.

15/1E-7 (*845, p. 28; 886, p. 25; 911, p. 122; 941, p. 93; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 139; 1076, p. 155). San Diego Products Co. Formerly owned by J. F. Rickerts. At Lakeside.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 2	11.6	June 13	12.5	Sept. 16	14.6
Apr. 9	11.5	July 10	12.9	Dec. 30	17.4

15/1E-16C1 (*845, p. 26; 886, p. 25; 911, p. 121; 941, p. 92; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 140; 1076, p. 155). Pratt test well. About 0.3 mile east of El Monte pumping plant.

Water level, in feet below land-surface datum, 1947

Jan. 2	13.8	July 10	28.2	Dec. 30	(a)
Apr. 9	17.8	Sept. 16	(a)		

a Dry.

15/1E-17a (*845, p. 27; 886, p. 25; 911, p. 121; 941, p. 93; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 140; 1076, p. 155). On Dr. Irey Ranch, east of Lakeside.

Water level, in feet below land-surface datum, 1947

Jan. 2	12.8	June 13	17.7	Sept. 16	(a)
Apr. 9	14.1	July 10	19.4	Dec. 30	(a)

a Dry.

15/1E-17b (*845, p. 27; 886, p. 25; 911, p. 121; 941, p. 93; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 140; 1076, p. 155). In San Diego County yard, east of Lakeside.

Water level, in feet below land-surface datum, 1947

Jan. 2	12.5	June 13	15.9	Sept. 16	20.3
Apr. 9	13.1	July 10	17.1	Dec. 30	23.5

15/1E-17B1 (*845, p. 26; 886, p. 25; 911, p. 121; 941, p. 93; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 140; 1076, p. 155). On Truttmann Ranch, about 0.5 mile northwest of El Monte pumping plant.

Water level, in feet below land-surface datum, 1947

Jan. 2	11.5	July 10	26.7	Dec. 30	40.1
Apr. 9	18.1	Sept. 16	30.3		

15/1E-17H6 (*845, p. 26; 886, p. 25; 911, p. 121; 941, p. 92; 949, p. 71; 991, p. 135; 1021, p. 122; 1028, p. 140; 1076, p. 155). Irrigation District well. About 1,000 feet north of El Monte pumping plant.

Water level, in feet below land-surface datum, 1947

Jan. 2	11.1	July 10	30.4	Dec. 30	49.1
Apr. 9	25.6	Sept. 16	34.4		

15/1E-19 (*845, p. 32; 886, p. 26; 911, p. 122; 941, p. 35; 949, p. 71; 991, p. 136; 1021, p. 123; 1028, p. 140; 1076, p. 155). Davidson & Brown. Formerly owned by Langdon. Near Benedict Avenue, Lakeside.

Water level, in feet below land-surface datum, 1947

Jan. 2	14.3	June 13	15.1	Sept. 16	17.1
Apr. 9	14.1	July 10	15.7	Dec. 30	16.8

15/LW-13N2 (*845, p. 34; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 72; 991, p. 136; 1021, p. 123; 1028, p. 140; 1076, p. 155). Riverview well 3. At Riverview.

Water level, in feet below land-surface datum, 1947

Jan. 2	7.6	July 10	9.7	Dec. 30	11.5
Apr. 9	7.7	Sept. 16	11.5		

15/1W-13R5 (*845, p. 32; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 71; 991, p. 136; 1021, p. 123; 1028, p. 140; 1076, p. 156). Levi.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 2	15.8	June 13	17.0	Sept. 16	20.0
Apr. 9	15.3	July 10	18.0	Dec. 30	18.1

15/1W-23H3 (*1076, p. 157). City of San Diego. At Riverview.

Water level, in feet below land-surface datum, 1947

Jan. 2	4.9	July 10	7.9	Dec. 30	10.1
Apr. 9	6.6	Sept. 16	8.6		

15/1W-24a (*1028, p. 141; 1076, p. 157). E. G. Squires. At Riverview.

Water level, in feet below land-surface datum, 1947

Jan. 2	a 13.0	July 10	17.0	Dec. 30	17.0
Apr. 9	13.0	Sept. 16	19.2		

a Pump reported removed.

15/1W-24D7 (*845, p. 33; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 72; 991, p. 136; 1021, p. 123; 1028, p. 141; 1076, p. 157). Riverview well 2. At Riverview.

Water level, in feet below land-surface datum, 1947

Jan. 2	6.6	July 10	15.6	Dec. 30	11.8
Apr. 9	9.2	Sept. 16	16.6		

15/1W-27 (*845, p. 36; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 72; 991, p. 136; 1021, p. 123; 1028, p. 141; 1076, p. 157). On County Farm. At Santee.

Water level, in feet below land-surface datum, 1947

Jan. 2	9.0	July 10	11.8	Dec. 30	11.9
Apr. 9	10.1	Sept. 16	10.7		

15-1W-28 (*845, p. 36; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 72; 991, p. 137; 1021, p. 123; *1028, p. 141; 1076, p. 157). Dr. Good. On El Cajon land grant. At Santee.

Water level, in feet below land-surface datum, 1947

Jan. 2	12.8	July 10	13.5	Dec. 30	14.0
Apr. 9	12.2	Sept. 16	14.4		

16/2W-16 (*845, p. 37; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 72; 991, p. 137; 1021, p. 123; 1028, p. 141; 1076, p. 157). Jaussaud. About 1,300 feet east of Old Mission San Diego, near Grantville.

Water level, in feet below land-surface datum, 1947

Jan. 2	15.0	July 10	18.9	Dec. 30	15.5
Apr. 9	16.5	Sept. 16	19.4		

16/2W-16a (*845, p. 38; 886, p. 26; 911, p. 122; 941, p. 93; 949, p. 72; 991, p. 137; 1021, p. 124; 1028, p. 141; 1076, p. 157). Jaussaud. About 1,300 feet east of Old Mission San Diego, near Grantville.

Water level, in feet below land-surface datum, 1947

Jan. 2	14.8	July 10	18.1	Dec. 30	15.4
Apr. 9	16.2	Sept. 16	18.9		

16/3W-22 (*845, p. 39; 886, p. 27; 911, p. 123; 941, p. 93; 949, p. 72; 991, p. 137; 1021, p. 124; 1028, p. 141; 1076, p. 157). H. Tatreau. On south side of Mission Valley.

Water level, in feet below land-surface datum, 1947

Jan. 2	13.7	July 10	15.3	Dec. 30	14.7
Apr. 9	13.8	Sept. 16	17.5		

16/3W-23 (*845, p. 39; 886, p. 27; 911, p. 123; 941, p. 93; 949, p. 72; 991, p. 137; 1021, p. 124; 1028, p. 141; 1076, p. 157). S. H. McIntosh. In Mission Valley, near Murray Canyon Road.

Water level, in feet below land-surface datum, 1947

Jan. 2	8.0	July 10	9.4	Dec. 30	9.2
Apr. 9	8.4	Sept. 16	10.1		

16/3W-24 (*845, p. 38; 886, p. 26; 911, p. 123; 941, p. 93; 949, p. 72; 991, p. 137; 1021, p. 124; 1028, p. 141; 1076, p. 157). R. I. Officer. About 1,600 feet west of city of San Diego pumping plant. Water levels, in feet below land-surface datum, 1947: Jan. 2, 10.0; July 10, 12.2; Sept. 16, 13.0; Dec. 30, 11.0.

Sweetwater River Basin

17/1W-19 (*845, p. 25; 886, p. 25; 911, p. 121; 941, p. 92; 949, p. 75; 991, p. 138; 1021, p. 124; 1028, p. 142; 1076, p. 157). L. C. Kincaid. At Sunnyside. Dry on Apr. 11 and July 14, 1947.

17/1W-19a (*991, p. 138; 1021, p. 124; 1028, p. 142; 1076, p. 157). California Water & Telephone Co. Formerly owned by L. C. Kincaid. At Sunnyside. In river bed, 200 yards south of well 17/1W-19. Water levels, in feet below land-surface datum, 1947: Apr. 11, 35.1; July 14, 33.9; Sept. 25, 34.6.

Otay River Basin

18/2W-22 (*845, p. 23; 886, p. 25; 911, p. 121; 941, p. 92; 949, pp. 70-71; 991, p. 138; 1021, p. 124; 1028, p. 142; 1076, p. 158). G. W. St. Clair. At Otay. Water levels, in feet below land-surface datum, 1947: Apr. 11, 22.2; July 14, 24.4; Sept. 25, 25.0.

18/2W-22a (*845, p. 23; 886, p. 25; 911, p. 121; 941, p. 92; 949, p. 70; 991, p. 138; 1021, p. 124; 1028, p. 142; 1076, p. 158). N. Bard. At Otay. No measurements made in 1947.

Tia Juana River Basin

18/2W-33 (*845, p. 20; 886, p. 24; 911, p. 120; 941, p. 92; 949, p. 76; 991, p. 138; 1021, p. 125; 1028, p. 142; 1076, p. 158). On Hewitt Bros. Hog Ranch. Water levels, in feet below land-surface datum, 1947: Apr. 11, 10.3; July 14, 14.1, nearby well pumping; Sept. 25, 14.6.

18/2W-34 (*845, p. 20; 886, p. 24; 911, p. 120; 941, p. 92; 949, p. 76; 991, p. 138; 1021, p. 125; 1028, p. 142; 1076, p. 158). G. R. Smalley. Water levels, in feet below land-surface datum, 1947: Apr. 11, 11.9; July 14, 15.9; Sept. 25, 18.3.

18/2W-34a (*845, p. 21; 886, p. 25; 911, p. 120; 941, p. 92; 949, p. 76; 991, p. 139; 1021, p. 125; 1028, p. 142; 1076, p. 158). On Evans Ranch. Near San Ysidro. Water levels, in feet below land-surface datum, 1947: Apr. 11, 8.5; July 14, 10.3; Sept. 25, 10.9.

19/2W-4 (*845, p. 21; 886, p. 25; 911, p. 120; 941, p. 92; 949, p. 76; 991, p. 139; 1021, p. 125; 1028, p. 142; 1076, p. 158). At Nestor Bridge. Water levels, in feet below land-surface datum, 1947: Apr. 11, 8.1; July 14, 12.4; Sept. 25, 14.7.

San Joaquin County

Mokelumne River Basin

3N/6-3K3 (*840, p. 45; 845, p. 44; 886, p. 53; 911, p. 132; 941, p. 137; *949, p. 171; 991, p. 139; 1021, p. 125; 1028, p. 142; 1076, p. 159). F. B. Mills. Measurements discontinued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	16.78	Apr. 2	20.19	July 1	(c)	Oct. 1	(a)
Feb. 3	a 17.33	May 1	(ac)	Aug. 1	(c)	Nov. 3	(d)
Mar. 3 ab	18.25	June 2	(ac)	Sept. 2	(c)		

a Water leaking into well.

b Estimated.

c Pumping.

d Pump house locked.

3N/6-17D1 (*840, p. 45; 845, p. 44; 886, p. 53; 911, p. 132; 941, p. 137; 949, p. 172; 991, p. 139; 1021, p. 125; 1028, p. 142; 1076, p. 159). Otto Helmie.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	14.07	May 1	16.67	Aug. 1	19.41	Nov. 3	16.82
Mar. 3	13.20	June 2	16.72	Sept. 2	19.38	Dec. 1	15.90
Apr. 2	12.91	July 1	18.53	Oct. 1	18.76		

3N/6-36R2 (*619, p. 311; *777, p. 28; *817, p. 18; 840, p. 46; 845, p. 44; 886, p. 53; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 139; 1021, p. 125; 1028, p. 143; 1076, p. 159). Leland W. Bunch.

Water level, in feet below land-surface datum, 1947

Jan. 3	22.18	Apr. 1	22.64	July 1	26.39	Oct. 3	29.78
Feb. 3	22.44	May 1	23.86	Aug. 1	27.89	Nov. 3	27.82
Mar. 3	22.51	June 2	24.92	Sept. 2	29.07	Dec. 1	27.40

3N/7-3C1 (*777, p. 28; *817, p. 18; 840, p. 46; 845, p. 44; 886, p. 53; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 139; 1021, p. 126; 1028, p. 143; 1076, p. 159). Jacob Knoll.

Water level, in feet below land-surface datum, 1947

Jan. 7	36.46	Apr. 2	36.97	July 17	37.03	Oct. 6	38.43
14	36.49	May 1	36.33	18	37.03	Nov. 3	38.69
Feb. 3	36.66	June 2	34.54	Aug. 1	37.37	Dec. 1	38.86
Mar. 3	35.62	July 1	36.46	Sept. 2	38.04		

3N/7-6M8 (*777, p. 28; *817, p. 18; 840, p. 46; 845, p. 44; 886, p. 53; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 140; 1021, p. 126; 1028, p. 143; 1076, p. 159). R. E. and Ruth F. Coker.

Water level, in feet below land-surface datum, 1947

Jan. 3	25.02	Apr. 1	26.30	July 1	27.72	Oct. 3	28.13
Feb. 3	24.88	May 1	28.98	Aug. 1	28.03	Nov. 3	28.13
Mar. 3	25.45	June 2	26.29	Sept. 2	28.17	Dec. 1	27.91

3N/7-7M1 (*777, p. 29; *817, p. 19; 840, p. 46; 845, p. 45; 886, p. 54; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 140; 1021, p. 126; 1028, p. 143; 1076, p. 159). J. and Rachel Goetken.

Water level, in feet below land-surface datum, 1947

Jan. 3	31.94	Apr. 1	37.43	July 1	39.08	Oct. 3	36.88
Feb. 3	32.56	May 1	40.19	Aug. 1	38.74	Nov. 3	35.28
Mar. 3	34.68	June 2	39.05	Sept. 2	37.43	Dec. 1	34.53

3N/7-10L3 (*777, p. 29; *817, p. 19; 840, p. 46; 845, p. 45; 886, p. 54; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 140; 1021, p. 126; 1028, p. 143; 1076, p. 159). Edward Preszler.

Water level, in feet below land-surface datum, 1947

Jan. 7	a 42.19	Apr. 15	49.82	July 1	50.34	Oct. 6	49.99
Feb. 3	44.52	24	47.28	Aug. 1	51.63	Nov. 3	48.00
Mar. 3	47.83	May 1	47.61	Sept. 2	52.39	Dec. 1	46.39
Apr. 2	a 50.43	June 2	48.93				

a Nearby well pumping.

3N/7-10L4 (*777, p. 29; *817, p. 19; *840, p. 46; 845, p. 45; 886, p. 54; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 140; 1021, p. 126; 1028, p. 143; 1076, p. 159). Edward Preszler.

Water level, in feet below land-surface datum, 1947

Jan. 7	41.19	Apr. 24	57.43	July 1	55.40	Oct. 6	48.47
Feb. 3	45.74	May 1	57.90	Aug. 1	54.50	Nov. 3	46.55
Mar. 3	46.36	June 2	53.07	Sept. 2	50.57	Dec. 1	45.30
Apr. 15	52.79						

3N/7-15P2 (*777, p. 29; *817, p. 19; 840, p. 47; 845, p. 45; 886, p. 54; 911, p. 133; 941, p. 138; *949, p. 172; 991, p. 140; 1021, p. 126; 1028, p. 143; 1076, p. 160). Eugene R. Hieb.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	44.50	Apr. 2	44.06	July 1	52.21	Oct. 6	52.89
Feb. 3	44.04	May 1	48.29	Aug. 1	(a)	Nov. 3	50.97
Mar. 3	43.94	June 2	51.60	Sept. 2	53.94	Dec. 1	49.77

a Dry 54.1 feet below land-surface datum.

3N/7-18N12. Joe Garner. About 2.5 miles southeast of Lodi, 180 feet east and 430 feet north of southwest corner of sec. 18, and about 500 feet north of well 3N/7-19D2 which it replaces. Domestic well, drilled in 1924, diameter 6 inches, depth 78 feet measured Nov. 1, 1946. Measuring point, top of casing east side, 0.3 foot above land-surface datum which is 47.44 feet above mean sea level. (Altitude by East Bay Municipal Utility District.)

Water level, in feet below land-surface datum, 1946-47

Date	Water level	Date	Water level	Date	Water level
Nov. 1, 1946	31.59	Apr. 1, 1947	34.23	Sept. 2, 1947	37.13
Dec. 3	30.72	May 1	38.06	Oct. 3	35.17
Jan. 3, 1947	30.42	June 2	a 41.92	Nov. 3	33.97
Feb. 3	30.14	July 1	b 40.72	Dec. 1	33.15
Mar. 3	31.68	Aug. 1	39.46		

a Pumping.

b Pumping recently.

3N/7-27F3 (*777, p. 30; *817, p. 20; 840, p. 47; 845, p. 45; 886, p. 54; 911, p. 133; 941, p. 139; *949, p. 173; 991, p. 141; 1021, p. 127; 1028, p. 144; 1076, p. 160). John F. Heitzmann.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 6	(a)	Apr. 25 bc	27.23	July 1	(bd)	Oct. 6	(d)
Feb. 3	(a)	May 1	42.83	Aug. 1	(d)	Nov. 3	48.63
Mar. 3	(a)	June 2	b 46.40	Sept. 2	(d)	Dec. 1	47.19
Apr. 2	40.31						

a Dry 39.9 feet below land-surface datum.

b Nearby well pumping.

c Cleaned out prior to measurement.

d Dry 50 feet below land-surface datum.

3N/7-30E2 (*619, p. 322; *777, p. 30; *817, p. 20; 840, p. 47; 845, p. 45; 886, p. 54; 911, p. 133; 941, p. 139; *949, p. 173; 991, p. 141; 1021, p. 127; 1028, p. 144; 1076, p. 160). W. L. Flanigan. Measurements discontinued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 15	25.98	Apr. 1	26.56	July 1	(a)	Oct. 3	34.07
Feb. 3	25.71	May 1	30.03	Aug. 1	36.04	Nov. 11	32.51
Mar. 3	25.66	June 2	33.50	Sept. 2	34.73	Dec. 1	(a)

a Pump house locked, unable to measure.

4N/6-12R1 (*619, p. 337; *777, p. 31; *817, p. 20; 840, p. 47; 845, p. 46; 886, p. 54; 911, p. 134; 941, p. 139; *949, p. 173; *991, p. 141; 1021, p. 127; 1028, p. 144; 1076, p. 160). G. A. Jahant.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	35.92	Apr. 10	34.26	July 1	41.39	Oct. 3	a 42.02
Feb. 3	35.16	May 1	36.22	Aug. 1	a 43.96	Nov. 3	40.13
Mar. 3	34.56	June 2	38.56	Sept. 2	44.13	Dec. 1	39.27

a Pumping recently.

4N/6-34R1 (*619, p. 344; *777, p. 31; *817, p. 20; *840, p. 47; 845, p. 46; 886, p. 55; 911, p. 134; *941, p. 139; *949, p. 173; 991, p. 141; 1021, p. 127; 1028, p. 144; 1076, p. 160). E. M. Smith.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	14.83	Apr. 2	15.27	July 1	a 15.79	Oct. 1	16.32
Feb. 3	14.96	May 1	15.47	Aug. 1	a 16.15	Nov. 3	15.61
Mar. 3	15.08	June 2	a 15.55	Sept. 2	16.32	Dec. 1	15.52

a Nearby well pumping.

4N/6-36D1 (*619, p. 345; *777, p. 31; *817, p. 20; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 139; *949, p. 173; 991, p. 141; 1021, p. 127; 1028, p. 144; 1076, p. 161). D. D. Smith and S. H. and I. Zimmerman.

Water level, in feet below land-surface datum, 1947

Jan. 3	22.53	May 1	(a)	July 1	28.55	Oct. 1	23.87
Feb. 3	23.58	9 bc	31.53	Aug. 1	27.04	Nov. 3	23.69
Mar. 3	24.92	June 2	27.39	Sept. 2	24.67	Dec. 1	24.73
Apr. 2	25.71						

a Dry 28.9 feet below land-surface datum.

b Nearby well pumping.

c Cleaned out prior to measurement.

4N/7-15B3 (*777, p. 32; *817, p. 21; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 139; *949, p. 174; 991, p. 141; 1021, p. 127; 1028, p. 145; 1076, p. 161). Robert L. Carter.

Water level, in feet below land-surface datum, 1947

Jan. 8	53.29	Apr. 3	51.79	July 1	(bc)	Oct. 7	(b)
Feb. 3	52.63	30	a 52.58	Aug. 1	(b)	Nov. 3	(b)
Mar. 3	52.09	May 1	52.92	Sept. 2	(b)	Dec. 1	(b)
27	51.62	June 2	56.34				

a Cleaned out Apr. 29.

b Dry 56.7 feet below land-surface datum.

c Well 300 feet away pumping.

4N/7-18N3 (*777, p. 32; *817, p. 21; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 139; *949, p. 174; 991, p. 142; 1021, p. 127; 1028, p. 145; 1076, p. 161). Martha Eddlemon.

Water level, in feet below land-surface datum, 1947

Jan. 3	37.28	Apr. 10	37.50	July 1	(b)	Oct. 3	43.77
Feb. 3	58.61	May 1	40.22	Aug. 1	(b)	Nov. 3	42.86
Mar. 3	37.16	2	a 40.24	Sept. 2	(b)	Dec. 1	41.59
27	56.89	June 2	42.57				

a Cleaned out prior to measurement.

b Dry 44.7 feet below land-surface datum.

4N/7-22Q4 (*777, p. 32; *817, p. 21; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 139; *949, p. 174; 991, p. 142; 1021, p. 128; 1028, p. 145; 1076, p. 161). Adolphus Eddlemon.

Water level, in feet below land-surface datum, 1947

Jan. 7	42.80	Apr. 3	42.55	July 1	48.13	Oct. 7	48.08
Feb. 3	42.56	May 1	44.98	Aug. 1	(a)	Nov. 3	47.22
Mar. 3	42.39	June 2	a 46.53	Sept. 2	49.46	Dec. 1	46.50

a Dry 49.5 feet below land-surface datum.

4N/7-22Q5 (*777, p. 32; *817, p. 21; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 139; *949, p. 174; 991, p. 142; 1021, p. 128; 1028, p. 145; 1076, p. 161). Adolphus Eddlemon.

Water level, in feet below land-surface datum, 1947

Jan. 7	42.96	Apr. 3	45.59	July 1	58.37	Oct. 7	49.20
Feb. 3	44.26	May 1	54.44	Aug. 1	53.97	Nov. 3	47.31
Mar. 3	43.06	June 2	52.97	Sept. 2	51.32	Dec. 1	46.45

4N/7-27P1 (*777, p. 33; *817, p. 21; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 140; *949, p. 174; 991, p. 142; 1021, p. 128; 1028, p. 145; 1076, p. 161). Frank H. and Leonard W. Buck.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	34.29	Apr. 3	35.36	July 1	36.33	Oct. 7	36.17
Feb. 3	34.33	May 1	35.31	Aug. 1	36.17	Nov. 3	36.15
Mar. 3	34.47	June 2	35.67	Sept. 2	36.26	Dec. 1	36.26

4N/7-30E4. Charles Weber. About 2.5 miles northeast of Lodi, 150 feet east and 2,200 feet south of northwest corner of sec. 30, and about 1,800 feet north of well 4N/7-30M2 which it replaces. Unused drilled well, diameter 6 inches, depth 75.5 feet. Measuring point, top of casing, 0.5 foot above land-surface datum which is 57.18 feet above mean sea level. (Altitude by East Bay Municipal Utility District.)

Water level, in feet below land-surface datum, 1941-47

Date	Water level	Date	Water level	Date	Water level
Oct. 7, 1941	30.62	Oct. 5, 1944	32.29	Aug. 1, 1947	42.64
Jan. 6, 1942	27.69	Jan. 3, 1945	29.95	Sept. 2	43.30
Oct. 8	29.59	Oct. 4	34.12	Oct. 3	38.52
Jan. 7, 1943	27.21	Jan. 3, 1946	31.33	Nov. 3	36.81
Oct. 6	27.94	July 2, 1947	41.39	Dec. 1	36.02
Jan. 4, 1944	26.35				

4N/7-30M2 (*777, p. 33; *817, p. 22; 840, p. 48; 845, p. 46; 886, p. 55; 911, p. 134; 941, p. 140; *949, p. 174; 991, p. 142; 1021, p. 138; 1028, p. 145; 1076, p. 161). Clara A. Barton. Measurements discontinued. Replaced by well 4 N/7-30E4.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 3	31.27	Apr. 10	38.43	May 12	c 39.76	Aug. 1	(d)
Feb. 3	31.54	May 1	a 40.90	June 2	(d)	Sept. 2	(d)
Mar. 3	32.21	12	b 39.76	July 1	(d)		

a Nearby well pumping.

b Before cleaning out well.

c After cleaning out well.

d Dry 40.9 feet below land-surface datum.

4N/7-31M3 (*777, p. 33; *817, p. 22; *840, p. 49; *845, p. 47; 886, p. 55; 911, p. 135; 941, p. 140; *949, p. 174; 991, p. 142; 1021, p. 128; 1028, p. 145; 1076, p. 162). Charles H. Woest.

Water level, in feet below land-surface datum, 1947

Jan. 3	25.73	Apr. 17	a 23.53	July 1	a 30.43	Oct. 3	26.92
Feb. 3	25.71	May 1	a 31.02	Aug. 1	28.84	Nov. 3	a 27.08
Mar. 3	a 26.29	June 2	a 29.19	Sept. 2	27.52	Dec. 1	a 27.98
Apr. 10	a 24.93						

a Water leaking into well.

4N/7-31N5 (*777, p. 33; *817, p. 22; 840, p. 49; 845, p. 47; 886, p. 55; 911, p. 135; 941, p. 140; *949, p. 175; 991, p. 142; 1021, p. 128; 1028, p. 145; 1076, p. 162). Jacob Goehring.

Water level, in feet below land-surface datum, 1947

Jan. 3	11.15	Apr. 10	10.22	July 1	9.41	Oct. 3	10.69
Feb. 3	11.33	May 1	9.38	Aug. 1	10.49	Nov. 3	11.62
Mar. 3	11.74	June 2	9.66	Sept. 2	10.34	Dec. 1	13.33

4N/7-34G1 (*777, p. 34; 817, p. 22; 840, p. 49; 886, p. 55; 911, p. 135; 941, p. 140; *949, p. 175; 991, p. 143; 1021, p. 128; 1028, p. 145; 1076, p. 162). John J. Schmiedt.

Water level, in feet below land-surface datum, 1947

Jan. 3	8.97	May 1	10.78	Aug. 1	10.72	Nov. 33	10.83
Mar. 3	9.86	June 2	10.53	Sept. 2	10.69	Dec. 1	11.11
Apr. 2	10.81	July 1	11.02	Oct. 6	10.83		

Santa Barbara County

Carpinteria Basin

4/25-19F4 (*949, p. 189; 991, p. 143; 1021, p. 129; 1028, p. 146; 1076, p. 162). M. F. Lewis.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	97.48	June 5	98.44	Oct. 27	all0.14	Dec. 26	all0.98
May 1	94.57	Sept. 26	all08.73	Dec. 2	all1.98		

a Below mean sea level.

4/25-19J5 (*949, p. 190; 991, p. 143; 1021, p. 129; 1028, p. 146; 1076, p. 162). Lyman & Young.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 61.12	Apr. 4	a 58.80	June 5	a 68.74	Dec. 2	a 81.38
Mar. 7	a 58.36	May 1	a 61.28	Sept. 26	a 80.41	26	a 80.04

a Below mean sea level.

4/25-20Q2 (*949, p. 190; 991, p. 143; 1021, p. 129; 1028, p. 146; 1076, p. 162). J. B. Romero.

Water level, in feet below land-surface datum, 1947

Feb. 4	40.82	May 1	ab 46.35	Sept. 26	b 64.43	Dec. 2	ab 70.39
Mar. 7	39.29	June 5	ab 50.08	Oct. 27	b 60.20	26	b 62.14
Apr. 4	38.57	Aug. 1	ab 59.68				

a Nearby well pumping.

b Below mean sea level.

4/25-21N2 (*941, p. 162; *949, p. 190; 991, p. 143; 1021, p. 129; 1028, p. 146; 1076, p. 162). E. S. Pillsbury.

Water level, in feet below land-surface datum, 1947

Feb. 4	45.96	Apr. 4	42.87	Sept. 26	ab 93.93	Dec. 2	a 76.68
Mar. 7	42.46	June 5	a 59.55	Oct. 27	a 74.02	26	a 71.49

a Below mean sea level.

b Nearby well pumping.

4/25-21R1 (*949, p. 190; 991, p. 144; 1021, p. 129; 1028, p. 146; 1076, p. 162). B. Moore.

Water level, in feet below land-surface datum, 1947

Feb. 4	80.56	May 1	78.71	Sept. 26	89.80	Dec. 2	93.73
Mar. 7	79.27	June 5	81.94	Oct. 27	91.49	26	95.07
Apr. 4	78.09	Aug. 1	85.78				

4/25-26A1 (*1076, p. 163). Moses Mesa Associates Co. Water levels, in feet below land-surface datum, 1947: Feb. 4, 235.50; Mar. 7, 231.00; Apr. 4, 232.97; Dec. 26, 281.77, pumping recently.

4/25-26C2 (*1076, p. 163). Shepherd Mesa Mutual Water Co.

Water level, in feet below land-surface datum, 1947

Feb. 4	235.33	Apr. 4	230.47	June 5	a242.53	Dec. 2	281.73
Mar. 7	229.94	May 1	a236.50	Sept. 26	271.90	26	282.21

a Nearby well pumping.

4/25-27G3. H. S. Russell. About 2 miles east-northeast of Carpinteria, at mouth of Carpinteria Creek canyon, 250 feet easterly from junction of State Highway 150 and canyon road, about 60 feet east of bridge over Carpinteria Creek, and 40 feet west of canyon road, in large wooden pump house painted green. Drilled irrigation well, diameter 12 inches, depth 172 feet. Derives water from sand and gravel in Casitas formation. Measuring point, top of casing west side, 0.10 foot above land-surface datum, and about 136 feet above mean sea level.

4/25-27G3--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 4	115.23	Apr. 4	112.62	June 5	123.40
Mar. 7	113.66	May 1	118.50	Aug. 1	133.16

a Nearby well pumping.

4/25-27Q2 (*949, p. 162; *949, p. 192; 991, p. 144; 1021, p. 130; 1028, p. 146; 1076, p. 163). A. F. Heimlich.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	112.78	May 1	113.42	Sept. 26	ab133.00	Dec. 2	ab136.36
Mar. 7	111.48	June 5	117.44	Oct. 27	ab134.41	26	ab136.22
Apr. 4	109.10	Aug. 1	125.84				

a Below mean sea level.

b Nearby well pumping.

4/25-27R2 (*949, p. 193; 991, p. 145; 1021, p. 130; 1028, p. 147; 1076, p. 163). W. H. Yule.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 4	115.74	Apr. 4	108.54	Dec. 26	ab139.36
Mar. 7	110.28	Oct. 27	ab132.23		

a Nearby well pumping.

b Below mean sea level.

4/25-28J1 (*949, p. 193; 991, p. 145; 1021, p. 130; 1028, p. 147; 1076, p. 163). W. C. and C. A. Catlin. Water levels, in feet below land-surface datum, 1947: Feb. 4, 72.92; Mar. 7, 68.72; Apr. 4, 66.14.

4/25-28M1 (*941, p. 163; *949, p. 193; 991, p. 145; 1021, p. 130; 1028, p. 147; 1076, p. 163). Mrs. A. Baylor.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	37.49	May 1	a 45.46	Sept. 26	ab 69.21	Dec. 2	b 62.00
Mar. 7	33.82	June 5	ab 65.85	Oct. 27	b 66.23	26	b 66.53
Apr. 4	31.19	Aug. 1	ab 66.44				

a Nearby well pumping.

b Below mean sea level.

4/25-29D1 (*949, p. 194; 991, p. 145; 1021, p. 130; 1028, p. 147; 1076, p. 164). H. Sturmer.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 24.26	May 1	ab 26.90	Aug. 1	ab 44.78	Dec. 2	a 45.86
Mar. 7	a 21.98	June 5	ab 36.79	Oct. 27	ab 46.63	26	a 44.27
Apr. 4	a 23.60						

a Below mean sea level.

b Nearby well pumping.

4/25-29R1 (*949, p. 194; *991, p. 145; 1021, p. 130; 1028, p. 147; 1076, p. 164). Carpinteria Union High School.

Water level, in feet below land-surface datum, 1947

Feb. 4	17.31	May 1	a 25.78	Sept. 26	ab 45.05	Dec. 2	b 32.24
Mar. 7	15.59	June 5	a 30.12	Oct. 27	ab 45.23	26	b 32.33
Apr. 4	15.28	Aug. 1	ab 37.74				

a Nearby well pumping.

b Below mean sea level.

4/25-30D1. Sandyland Beach Club. About 2 miles west-northwest of Carpinteria, south of U. S. Highway 101, about 400 feet east of entrance road to beach club, and about 40 feet south of Southern Pacific Railroad tracks, in wooden pump house painted green. Drilled public-supply well, diameter 10 inches, reported depth 209 feet. Measuring point, top of hole in pump base at west side, 1.00 foot above land-surface datum and 7.50 feet above preliminary sea-level datum of 1934.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Mar. 7	a 12.45	June 5	a 18.08	Dec. 2	a 32.65
Mar. 1	ab 19.50	Sept. 26	ac 27.32	26	a 30.42

a Below mean sea level.
 b Pumped recently.
 c Nearby well pumping.

4/25-35B1 (*949, p. 195; 991, p. 146; 1021, p. 131; 1028, p. 147; 1076, p. 164). R. Nichols.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	33.57	May 1	a 33.39	Sept. 26	a 80.02	Dec. 2	a 88.49
Mar. 7	34.04	June 5	a 45.01	Oct. 27	a 78.99	26	a 84.66
Apr. 4	26.18	Aug. 1	a 66.08				

a Nearby well pumping.

4/26-23A2. Frank Wymond. About 4 miles west-northwest of Carpinteria, 0.25 mile north of U. S. Highway 101, 200 yards west of polo field, at north edge of walnut orchard, in wooden pump house. Drilled irrigation well, diameter 10 inches, reported depth 330 feet. Measuring point, top of hole in pump base on south side, 0.50 foot above land-surface datum and about 64 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Feb. 4	49.63	Apr. 4	49.21	June 5	58.55	Dec. 2	56.92
Mar. 7	49.61	May 1	55.95	Sept. 26	60.03	26	53.87

4/26-24F2 (*949, p. 196; 991, p. 147; 1021, p. 131; 1028, p. 148; 1076, p. 164). A. F. Thurmond.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 4	9.93	Apr. 4	8.89	Oct. 27	ab 38.64
Mar. 7	9.78	Aug. 1	ab 27.41	Dec. 26	ab 33.15

a Below mean sea level.
 b Nearby well pumping.

Goleta Basin

4/27-6N1 (*949, p. 197; 991, p. 147; 1021, p. 131; 1028, p. 148; 1076, p. 164). John McCaughy.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	91.07	June 5	91.92	Sept. 26	92.67	Dec. 1	92.95
Mar. 7	91.05	Aug. 1	93.27	Oct. 27	92.92	26	93.27
Apr. 4	91.15						

4/28-2N2 (*991, p. 147; 1021, p. 131; 1028, p. 148; 1076, p. 164). County of Santa Barbara, Tucker's Grove.

Water level, in feet below land-surface datum, 1947

Feb. 4	18.70	May 1	24.71	Sept. 26	32.73	Dec. 1	35.64
Mar. 7	19.43	June 5	26.72	Oct. 27	34.52	26	36.55
Apr. 4	22.23	Aug. 1	30.10				

4/28-3E2 (*949, p. 197; 991, p. 147; 1021, p. 131; 1028, p. 148; 1076, p. 165). Peter Cavallotto.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	13.68	Apr. 4	21.42	June 5	a 28.32	Sept. 26	a 41.44
Mar. 7	13.08	May 1	14.64	Aug. 1	a 37.02		

a Nearby well pumping.

4/28-3M2 (*949, p. 197; 991, p. 147; 1021, p. 132; 1028, p. 148; 1076, p. 165). L. W. Fowler. Water levels, in feet below land-surface datum, 1947: Feb. 4, 102.53; Mar. 7, 99.88. Measurements discontinued Mar. 7; replaced by well 4/28-3M3.

4/28-3M3. L. W. Fowler. About 1.8 miles northeast of Goleta, 150 feet north of Cathedral Oaks Road, 80 feet east of Patterson Avenue, 30 feet north and 3 feet west of well 4/28-3M2, at north side of dirt road. Abandoned drilled irrigation well, diameter 8 inches. Measuring point, top south side of outer casing, 0.30 foot above land-surface datum and 118.70 feet above preliminary sea-level datum of 1934. Water level, in feet below land-surface datum, 1947: Dec. 26, 113.01.

4/28-3P1 (*949, p. 197; 991, p. 148; 1021, p. 132; 1028, p. 149; 1076, p. 165). Joseph Sexton. Water levels, in feet below land-surface datum, 1947: Feb. 4, 139.55; Mar. 7, 139.00; Apr. 4, 139.92; May 1, 140.92. Measurements discontinued.

4/28-3Q2 (*991, p. 148; 1021, p. 132; 1028, p. 149; 1076, p. 165). A. J. Haverland.

Water level, in feet below land-surface datum, 1947

Feb. 4	101.08	May 1	all1.19	Aug. 1	all15.88	Oct. 27	all17.03
Apr. 4	102.48	June 5	a109.38	Sept. 26	112.82		

a Nearby well pumping.

4/28-4K4 (*949, p. 198; 991, p. 148; 1021, p. 132; 1028, p. 149; 1076, p. 165). R. S. Rowe. Well destroyed, measurements discontinued Dec. 1.

Water level, in feet below land-surface datum, 1947

Feb. 4	17.51	May 1	18.07	Aug. 1	25.12	Oct. 27	26.69
Mar. 7	18.71	June 5	a 27.15	Sept. 26	36.67	Dec. 1	26.11
Apr. 4	18.13						

a Nearby well pumping.

4/28-4Q2 (*949, p. 198; 991, p. 148; 1021, p. 132; 1028, p. 149; 1076, p. 165). R. S. Rowe.

Water level, in feet below land-surface datum, 1947

Feb. 4	68.52	May 1	a 70.38	Sept. 26	ab 96.62	Dec. 1	ab100.90
Mar. 7	67.31	June 5	71.35	Oct. 27	83.35	26	84.43
Apr. 4	67.65	Aug. 1	76.26				

a Nearby well pumping.

b Below preliminary sea-level datum of 1934.

4/28-5R4 (*991, p. 149; 1021, p. 133; 1028, p. 150; 1076, p. 166). E. J. Ewing.

Water level, in feet below land-surface datum, 1947

Feb. 4	50.05	May 1	52.28	Aug. 1	a 55.16	Dec. 1	a 55.34
Mar. 7	49.26	June 5	53.31	Oct. 27	a 55.68	26	a 55.70

a Below preliminary sea-level datum of 1934.

4/28-8C2 (*1028, p. 150; 1076, p. 166). G. S. Cavalletto. All water levels are below preliminary sea-level datum. Water-stage recorder removed on Dec. 21.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 3	60.18	Apr. 5	59.55	July 5	62.24	Sept. 30	66.42
10	59.63	10	a 59.95	10	62.43	Oct. 5	66.09
15	59.78	15	59.58	15	a 62.54	10	66.05
20	59.47	20	59.48	20	a 63.52	15	65.91
25	59.34	25	59.65	25	63.98	20	65.91
29	59.34	30	59.47	31	63.84	25	a 66.71
Feb. 5	58.99	May 5	59.70	Aug. 5	64.02	31	66.32
10	59.12	10	59.51	10	64.15	Nov. 5	a 66.65
15	58.86	15	a 59.97	15	a 64.10	10	a 67.08
20	58.91	20	a 60.67	20	a 64.79	15	67.26
25	58.65	25	a 61.53	25	65.06	20	67.32
28	58.78	31	61.94	31	65.25	25	67.23
Mar. 5	58.51	June 5	61.85	Sept. 5	65.70	30	66.91
10	59.37	10	61.89	10	65.67	Dec. 5	67.20
15	58.23	15	62.15	15	65.74	10	67.39
20	58.22	20	61.81	20	66.16	15	67.19
25	58.23	25	61.89	25	66.37	21	67.48
31	58.32	30	62.24				

a Nearby well pumping.

4/28-9A3 (*941, p. 166; *949, p. 200; 991, p. 150; 1021, p. 134; 1028, p. 151; 1076, p. 166). L. M. Cavalletto.

Water level, in feet below land-surface datum, 1947^a/
(From float gage)

50.53		51.35	June 5	52.18		58.62
52.08	Apr. 4	49.96		52.18		61.20
Feb. 4	50.53	49.72	Aug. 1	55.16	Dec. 1	60.28
	50.22	52.24	Sept. 26	57.85		59.97
	50.59	51.95		57.85		60.52
Mar. 7	50.48	50.50		60.58	26	59.98
	49.93	52.67	Oct. 27	58.71		

a Undated entries are highest and lowest levels between dates of observation.

4/28-9E1 (*991, p. 150; 1021, p. 134; 1028, p. 151; 1076, p. 167). A. T. Spaulding.

Water level, in feet below land-surface datum, 1947

Feb. 4	43.02	Apr. 4	a 44.22	June 5	a 48.53	Dec. 1	a 50.34
Mar. 7	42.47	May 1	ab 48.08	Sept. 26	ab 50.41	26	a 50.61

a Below preliminary sea-level datum of 1934.

b Nearby well pumping.

4/28-10A1 (*949, p. 201; 991, p. 150; 1021, p. 134; 1028, p. 151; 1076, p. 167). C. C. Lee.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 4	105.88	Apr. 4	106.37	Dec. 1	8117.73
Mar. 7	108.67	May 1	all 14.30	26	120.30

a Nearby well pumping.

4/28-10F1 (*949, p. 201; 991, p. 150; 1021, p. 134; 1028, p. 151; 1076, p. 167). J. S. Edwards.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Feb. 4	71.77	Apr. 4	71.57	Aug. 1	75.95
Mar. 7	71.69	June 5	74.39	Oct. 27	78.35

4/28-10K2 (*949, p. 201; 991, p. 151; 1021, p. 134; 1028, p. 151; 1076, p. 167). Norman Troup.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	a 94.25	Apr. 4	a 96.16	Aug. 1	ab14.74	Dec. 1	a108.25
Mar. 7	a 93.72	May 1	ab100.61	Oct. 27	a107.51	26	a107.67

a Below preliminary sea-level datum of 1934.
b Nearby well pumping.

4/28-11K4. Giovanni Cavalli. About 2.7 miles nearly east of Goleta, 0.1 mile west of entrance road to county hospital, and 150 feet north of U. S. Highway 101 along railroad tracks, open pump near southwest corner of walnut orchard. Drilled irrigation well, reported depth 297 feet, diameter 12 inches. Measuring point, hole in west side top of pump base, 2.00 feet above land-surface datum, and about 69 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Feb. 4	68.06	May 1	a 70.07	Sept. 26	a 76.64	Dec. 1	a 81.58
Mar. 7	67.72	June 5	a 71.38	Oct. 27	a 76.52	26	a 79.78
Apr. 4	68.06						

a Below mean sea level.

4/28-12L4 (*941, p. 167; *949, p. 202; 991, p. 151; 1021, p. 135; 1028, p. 152; 1076, p. 167). L. More.

Water level, in feet below land-surface datum, 1947

Jan. 31	47.26	Apr. 4	56.81	Aug. 1	a 88.88	Dec. 1	72.73
Feb. 7	47.09	May 1	a 91.98	Sept. 26	a 87.21	26	68.86
Mar. 7	52.23	June 5	a 74.57	Oct. 27	a 91.19		

a Nearby well pumping.

4/28-15E1 (*949, p. 202; 991, p. 152; 1021, p. 135; 1028, p. 152; 1076, p. 167). A. J. Holloway.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 50.60	Apr. 4	a 49.82	June 5	ab 60.68	Sept. 26	ab 61.64
Mar. 7	a 50.36	May 1	ab 57.06	Aug. 1	ab 64.38	Dec. 26	a 61.45

a Below mean sea level.

b Nearby well pumping.

4/28-16F2 (*991, p. 152; 1021, p. 135; 1028, p. 153; 1076, p. 168). John Begg.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 34.71	May 1	ab 51.54	Sept. 26	ab 50.31	Dec. 1	a 49.86
Mar. 7	a 34.96	June 5	ab 49.89	Oct. 27	ab 48.30	26	a 40.66
Apr. 4	a 34.33	Aug. 1	ab 76.70				

a Below mean sea level.

b Nearby well pumping.

4/28-16F3 (*991, p. 152; 1021, p. 135; 1028, p. 153; 1076, p. 168). John Begg.

Water level, in feet below land-surface datum, 1947

Feb. 4	13.33	May 1	13.85	Sept. 26	14.52	Dec. 1	15.25
Mar. 7	13.25	June 5	14.05	Oct. 27	14.72	26	15.55
Apr. 4	13.48	Aug. 1	14.31				

4/28-16R1 (*1028, p. 153; 1076, p. 168). Pacific Lighting Corporation.

Water level, in feet below land-surface datum, 1947

Feb. 4	13.47	May 1	14.21	Sept. 26	ab 32.40	Dec. 1	23.84
Mar. 7	12.60	June 5	a 28.40	Oct. 27	26.64	26	25.75
Apr. 4	11.96	Aug. 1	ab 33.97				

a Nearby well pumping.

b Below mean sea level.

4/28-17H3 (*941, p. 167; *949, p. 203; 991, p. 152; 1021, p. 135; 1028, p. 153; 1076, p. 168). J. J. Mathews.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	5.27	May 1	6.51	Sept. 26	8.19	Dec. 1	8.48
Mar. 7	5.72	June 5	7.05	Oct. 27	8.38	26	8.64
Apr. 4	5.82	Aug. 1	7.75				

4/28-17H11 (*941, p. 168; *949, p. 203; 991, p. 153; 1021, p. 135; 1028, p. 153; 1076, p. 168). Mrs. L. Oakley and Mrs. M. Bonetti.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 16.53	May 1	ab 24.21	Sept. 26	ab 27.58	Dec. 1	a 25.77
Mar. 7	a 15.93	June 5	a 25.58	Oct. 27	a 25.98	26	a 23.75
Apr. 4	a 16.62						

a Below mean sea level.

b Nearby well pumping.

4/28-18G2 (*949, p. 203; 991, p. 153; 1021, p. 136; 1028, p. 153; 1076, p. 168). T. B. Bishop Co.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 23.52	Apr. 4	a 23.47	Sept. 26	a 25.46	Dec. 1	a 24.81
Mar. 7	a 23.02	May 1	ab 37.99	Oct. 27	a 25.14	26	a 24.60

a Below mean sea level.

b Nearby well pumping.

4/28-18N3 (*949, p. 204; 991, p. 153; 1021, p. 136; 1028, p. 153; 1076, p. 168). T. M. Storke.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 17.57	May 1	a 13.86	Sept. 26	a 15.19	Dec. 1	a 17.08
Mar. 7	a 14.89	June 5	a 13.70	Oct. 27	a 16.46	26	a 16.89
Apr. 4	a 13.08	Aug. 1	ab 16.24				

a Below mean sea level.

b Nearby well pumping.

4/29-13K2 (*949, p. 204; 991, p. 153; 1021, p. 136; 1028, p. 154; 1076, p. 169). T. B. Bishop Co.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 43.67	May 1	ab 46.75	Sept. 26	ab 48.60	Dec. 1	a 48.73
Mar. 7	a 43.28	June 5	ab 46.87	Oct. 27	ab 49.06	26	a 48.36
Apr. 4	ab 45.02	Aug. 1	ab 48.50				

a Below mean sea level.

b Nearby well pumping.

4/29-14A3 (*949, p. 205; 991, p. 153; 1021, p. 136; 1028, p. 154; 1076, p. 169). Frank Baker.

Water level, in feet below land-surface datum, 1947

Feb. 4	a 73.43	May 1	a 74.08	Aug. 1	a 75.74	Dec. 1	a 76.90
Mar. 7	a 73.15	June 5	a 76.03	Sept. 26	a 76.48	26	a 76.56
Apr. 4	a 73.35						

a Below mean sea level.

Santa Ynez, San Antonio, Santa Maria, and Cuyama Valleys

6/30-6A1 (*949, p. 205; 991, p. 154; 1021, p. 136; 1028, p. 154; 1076, p. 169). Sam Torrence. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 31	55.25	Apr. 2	59.22	Dec. 30	66.56
Mar. 10	55.22	Nov. 26	65.50		

6/30-7K1 (*949, p. 205; 991, p. 154; 1021, p. 136; 1028, p. 154; 1076, p. 169). Mrs. W. Anderson. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level						
Jan. 31	40.14	June 4	a 41.44	Oct. 29	42.44	Dec. 30	39.63
Apr. 3	40.39	July 30	a 42.33	Nov. 26	42.65		

a Pumping.

6/30-9N1 (*949, p. 205; 991, p. 154; 1021, p. 136; 1028, p. 154; 1076, p. 169). San Lucas Ranch. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 31	31.97	June 4	32.25	Nov. 26	31.38
Apr. 30	32.12	Oct. 29	33.14		

6/30-29E1 (*949, p. 206; 991, p. 154; 1021, p. 137; 1028, p. 155; 1076, p. 169). Rancho Juan y Lolita. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 31	13.68	Apr. 30	13.84	July 30	20.12
Mar. 10	13.10	June 4	16.69	Oct. 29	22.59

6/31-2K1. Sam de la Cuesta (Rancho Alamo Pintado). In Middle Santa Ynez Valley, about 0.5 mile south of Fallard, in valley of Alamo Pintado Creek, 230 yards east of paved road, 70 feet southwest of white stucco house, 10 feet west of motor house, in corral. Drilled domestic and irrigation well, diameter 10 inches, reported depth 75 feet. Measuring point, lower edge of notch in top south side of casing, 1.00 foot above land-surface datum and about 628 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 31	24.76	Apr. 30	24.42	Dec. 30	28.55
Mar. 10	24.14	June 4	a 26.84		

a Pumped recently.

6/31-13D1 (*949, p. 207; 991, p. 155; 1021, p. 137; 1028, p. 155; 1076, p. 169). Mrs. W. E. Parker. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 31	107.49	Sept. 25	109.30	Nov. 26	109.50
Apr. 3	107.73	Oct. 29	109.43	Dec. 30	109.51

6/31-17F1 (*949, p. 208; 991, p. 155; 1021, p. 137; 1028, p. 155; 1076, p. 169). J. R. Orton. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	17.31	Apr. 3	17.64	July 30	b 20.33	Nov. 26	20.30
Mar. 10	17.36	June 4	a 18.57	Oct. 29	20.92	Dec. 30	19.02

a Pumped recently.

b Pumping.

6/31-21H2 (*991, p. 155; 1021, p. 137; 1028, p. 155; 1076, p. 170). Alisal Corporation. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 31	8.38	Apr. 30	8.45	Sept. 25	9.20	Nov. 26	9.24
Mar. 10	8.30	June 4	8.37	Oct. 29	9.44	Dec. 30	9.51
Apr. 3	8.37	July 30	8.75				

6/32-6KL (*949, p. 209; 991, p. 156; 1021, p. 137; 1028, p. 155; 1076, p. 170). Mrs. M. Barker. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	16.56	Apr. 30	a 20.60	Sept. 25	19.60	Dec. 31	17.16
Mar. 6	16.54	July 31	17.02	Nov. 28	17.17		

a Pumping.

6/32-9A1 (*949, p. 209; 991, p. 156; 1021, p. 137; 1028, p. 155; 1076, p. 170). Owen Hollister. In Middle Santa Ynez Valley. Water levels, in feet below land-surface datum, 1947: Jan. 31, 30.42; Sept. 25, 32.30; Nov. 28, 31.88; Dec. 30, 32.45.

6/32-12J2 (*941, p. 153; 949, p. 210; 991, p. 156; 1021, p. 138; 1028, p. 155; 1076, p. 170). A. Bodine. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 31	31.48	Apr. 30	33.52	Sept. 24	32.08	Nov. 28	29.88
Mar. 10	32.03	June 4	30.95	Oct. 29	31.48	Dec. 30	34.30
Apr. 3	32.19	July 30	34.16				

6/32-16P3 (*949, p. 210; 991, p. 157; 1021, p. 138; 1028, p. 155; 1076, p. 170). Channing Peake. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	45.29	Apr. 3	45.59	July 31	47.14	Oct. 29	a 47.76
Mar. 10	45.37	Apr. 30	45.40	Sept. 25	47.61	Dec. 30	46.89

a Pumped recently.

6/33-9P1 (*941, p. 154; *949, p. 211; 991, p. 157; 1021, p. 138; 1028, p. 156; 1076, p. 170). Hollister Estate. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947^a /
(From float gage)

Jan. 30	38.26	38.37	June 3	39.33		41.21
	38.54	Apr. 3	38.34	39.33		41.61
	38.28		38.34	40.33	Oct. 29	41.25
	38.11		38.87	40.33		41.17
	38.28	Apr. 30	38.87	40.33	Nov. 28	b 42.69
	38.13		38.87	41.76	Dec. 30	42.44
	38.13		39.33	41.55		

a Undated entries are highest and lowest levels between dates of observation.

b Float gage removed.

6/34-2A1 (*941, p. 154; *949, p. 212; 991, p. 158; 1021, p. 138; 1028, p. 156; 1076, p. 170). C. Madsen. In Lower Santa Ynez Valley. No measurements made in 1947.

6/34-4D1 (*949, p. 212; 991, p. 158; 1021, p. 138; 1028, p. 156; 1076, p. 171). Peter Tognatti. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	30.77	Apr. 3	a 38.16	Sept. 25	34.57	Nov. 28	37.04
Mar. 6	31.07	June 3	36.97	Oct. 23	34.45	Dec. 31	38.00

a Nearby well pumping.

6/34-602 (*991, p. 158; 1021, p. 139; 1028, p. 156; 1076, p. 171). Bank of America. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Mar. 6	a 58.26	June 3	a 65.36	Sept. 25	62.37	Nov. 28	60.72
Apr. 3	b 59.78	July 31	a 64.75	Oct. 23	60.30	Dec. 31	61.32
30	b 65.60						

a Pumped recently.

b Nearby well pumping.

7/24-13C1 (*949, p. 237; 991, p. 158; 1021, p. 139; 1028, p. 156; 1076, p. 171). Ventura County, Apache School District. In Cuyama Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 29	8.68	June 2	8.47	Sept. 23	15.35	Nov. 25	17.21
Mar. 18	8.16	July 29	12.05	Oct. 30	16.56	Dec. 29	16.69
Apr. 23	8.17						

7/31-23P1 (*949, p. 213; 991, p. 159; 1021, p. 139; 1028, p. 156; 1076, p. 171). F. L. Mattei. In Middle Santa Ynez Valley. Water levels, in feet below land-surface datum, 1947: Jan. 31, 23.22; Mar. 10, 23.70; Oct. 29, 31.89; Nov. 26, 30.37.

7/31-25L1 (*949, p. 213; 991, p. 159; 1021, p. 139; 1028, p. 157; 1076, p. 171). Russell Smith. In Middle Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 31	65.52	Apr. 2	a 67.34	Oct. 29	70.15	Dec. 30	72.37
Mar. 10	66.01	June 4	a 69.11	Nov. 26	70.36		

a Pumped recently.

7/31-36G2. Laura Grossi. In Middle Santa Ynez Valley, about 1 mile northeast of Ballard, 0.5 mile south of Roblar Avenue, 50 feet east of Refugio Avenue, in field. Abandoned well, diameter 8 inches, reported depth 127 feet. Measuring point, top west side of 1½-inch threaded collar, 2.40 feet above land-surface datum and about 733 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Jan. 31	30.65	Apr. 29	31.45	Sept. 24	33.24	Nov. 26	33.63
Mar. 10	30.80	June 4	31.75	Oct. 29	33.52	Dec. 30	33.48
Apr. 2	30.83	July 30	32.63				

7/31-36L2 (*949, p. 213; 991, p. 159; 1021, p. 139; 1028, p. 157; 1076, p. 171). D. B. Kilborune. Formerly owned by Dr. W. B. Swackhamer. In Middle Santa Ynez Valley. Measurements resumed December 1947. Measuring point No. 2, bottom of hole in northwest side of casing, 0.18 foot below measuring point No. 1, 0.82 foot above land-surface datum and about 716 feet above mean sea level. Water level, in feet below land-surface datum, 1947: Dec. 30, 25.94.

7/33-30C1 (*949, p. 214; 991, p. 159; 1021, p. 140; 1028, p. 157; 1076, p. 171). John Valla. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	150.91	Apr. 30	150.94	Sept. 25	151.37	Nov. 28	151.45
Mar. 6	150.85	July 31	151.17	Oct. 23	151.37	Dec. 30	151.48

7/34-14P1. Walter F. Ziesche. In Lower Santa Ynez Valley, about 3.0 miles west-northwest of Lompoc, 2 miles northerly from "four-corners" intersection of State Highway 150 and paved road, up Purisima Canyon, 150 yards north of the road and 75 yards east of valley side; open casing in field. Abandoned drilled well, diameter 12 inches, reported depth 250 feet. Measuring point, top south side of casing, 1.50 feet above land-surface datum and 269.82 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 194.94; Nov. 28, 195.00; Dec. 30, 195.00.

7/34-22H1 (*949, p. 215; 991, p. 160; 1076, p. 171). H. E. Harris. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	23.88	Apr. 30	24.98	Sept. 25	24.58	Nov. 28	24.19
Mar. 6	25.34	June 3	25.69	Oct. 23	24.28	Dec. 30	24.02
Apr. 3	a 24.23	July 31	24.74				

a Pumped recently.

7/34-22Q4. Geol. Survey, U. S. Dept. of Interior. A. Scolari property. In Lower Santa Ynez Valley, about 2.2 miles north-northeast of Lompoc, 0.3 mile north of Rucker Crossing Road, at east side of North A Street (extended), 20 feet northeast of site of well 7/34-22Q3, near edge of lower terrace by river channel at north edge of cultivated field. Bored observation well, diameter 2 inches, depth 24 feet. Unconfined water in Recent alluvial sand. Measuring point, top of coupling south side, 0.8 foot above land-surface datum and 83.52 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Sept. 25, 17.52; Oct. 23, 17.89; Nov. 28, 17.94; Dec. 31, 17.96.

7/34-26A2 (*941, p. 155; *949, p. 216; 991, p. 161; 1021, p. 140; 1028, p. 158; 1076, p. 172). K. McConnell. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	38.06	Apr. 30	38.90	Sept. 25	39.66	Nov. 28	39.38
Mar. 6	37.74	June 3	39.00	Oct. 23	39.65	Dec. 31	39.43
Apr. 3	38.59	July 31	39.37				

7/34-27A4. Geol. Survey, U. S. Dept. of Interior. L. H. Schuyler property. In Lower Santa Ynez Valley, about 2.1 miles north-northeast of Lompoc, 0.27 mile east of North A Street (extended), 170 yards west of Santa Ynez River, 20 feet south of center line of road, 19 feet east and 4 feet south of fence corner post. Bored observation well, diameter 2 inches, depth 30 feet. Unconfined water in Recent alluvial sand and gravel. Measuring point, top north side of coupling, 0.80 foot above land-surface datum and 79.99 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Sept. 25, 11.47; Oct. 23, 11.73; Nov. 28, 11.96; Dec. 31, 12.10.

7/34-27J3 (*991, p. 164; 1021, p. 144). Geol. Survey, U. S. Dept. of Interior. L. H. Schuyler property. In Lower Santa Ynez Valley. Deepened to 29 feet, and measurements resumed. Measuring point, top south side of casing, 1.96 feet above land-surface datum and 88.14 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Sept. 25, 20.61; Oct. 23, 20.32; Nov. 28, 20.57; Dec. 31, 20.68.

7/34-27L1 (*949, p. 217; 991, p. 164; 1021, p. 145; 1028, p. 160; 1076, p. 172). Mrs. Susan Van Clief. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	31.72	Apr. 3	33.70	June 3	34.59	Oct. 23	35.85
Mar. 10	31.79	Apr. 30	36.41	Sept. 25	35.54	Nov. 28	35.56

7/34-27P2 (*1021, p. 145; 1028, p. 160; 1076, p. 172). Geol. Survey, U. S. Dept. of Interior. Mary Skaarup property. In Lower Santa Ynez Valley. Casing pulled, measurements discontinued.

7/34-28A2. Geol. Survey, U. S. Dept. of Interior. S. B. Westrope property. In Lower Santa Ynez Valley, nearly due north of Lompoc, about 0.5 mile north of Central Avenue, 0.2 mile west of North H Street, near northeast corner of field, about 0.1 mile south of edge of alluvial plain, 75 feet west of farm road along west side of eucalyptus row, 21 feet west and 5 feet north of irrigation well 7/34-28A1. Bored observation well, diameter 2 inches, depth 35.4 feet. Unconfined water in Recent alluvial sand and silt. Measuring point, top west side of casing, 3.50 feet above land-surface datum and 93.26 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 28.60; Nov. 28, 28.56; Dec. 31, 28.78.

7/34-28H2 (*949, p. 217; 991, p. 165; 1021, p. 145; 1028, p. 160; 1076, p. 172). T. M. Parks. In Lower Santa Ynez Valley. Automatic water-stage recorder removed Feb. 28.

Water level, in feet below land-surface datum, 1947
(From recorder charts until Feb. 28)

Jan. 1	26.17	Feb. 28	27.89	June 3	29.63	Oct. 23	29.57
30	26.76	Apr. 3	a 30.91	July 31	a 32.37	Nov. 28	29.46
Feb. 6	26.97	30	a 35.96	Sept. 25	30.03	Dec. 31	a 31.59

a Nearby well pumping.

7/34-28R1 (*991, p. 165; 1021, p. 145; 1028, p. 160; 1076, p. 172).
A. C. Zvolanek. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	8.98	July 30	14.64	Oct. 23	12.01	Dec. 31	a 14.22
Mar. 10	9.41	Sept. 25	12.76	Nov. 28	11.67		

a Nearby well pumping.

7/34-28R2. Geol. Survey, U. S. Dept. of Interior. A. C. Zvolanek property. In Lower Santa Ynez Valley. Deepened to 20 feet in September 1947. Measuring point after September, top west side of 2-inch coupling, 1.03 feet above land-surface datum and 70.53 feet above sea-level datum of 1929.

Water level, in feet below land-surface datum, 1947

Jan. 30	7.40	Apr. 3	a 6.65	Oct. 23	9.08	Dec. 31	9.72
Mar. 10	7.31	Sept. 25	9.95	Nov. 28	9.87		

a Nearby well pumping.

7/34-29A3. Geol. Survey, U. S. Dept. of Interior. Charles Everett property. In Lower Santa Ynez Valley, about 1.2 miles northwest of Lompoc, 0.3 mile north of Central Avenue, 160 feet north of irrigation well 7/34-29A1, and 18 feet west of center line of 13th Street, about at foot of terrace front at edge of Lompoc Plain. Bored observation well, diameter 2 inches, depth 24 feet. Unconfined water in Recent alluvial sand. Measuring point, top of 2-inch coupling west side, 0.70 foot above land-surface datum and about 71 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 15.41; Nov. 28, 15.97; Dec. 31, 16.04.

7/34-29F4 (*1028, p. 160; 1076, p. 172). G. F. Sanor. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	24.37	Apr. 30	a 32.34	Sept. 25	26.37	Nov. 28	24.28
Mar. 10	23.15	July 31	27.75	Oct. 23	23.73	Dec. 31	25.26
Apr. 3	a 27.95						

a Nearby well pumping.

7/34-29E5 (*1028, p. 161; 1076, p. 172). Geol. Survey, U. S. Dept. of Interior. G. F. Sanor property. In Lower Santa Ynez Valley. Deepened to 27 feet in September 1947. Measuring point after September, top of casing south side, 2.02 feet above land-surface datum and 69.76 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 21.26; Nov. 28, 21.58; Dec. 31, 21.80.

7/34-30L2 (*1028, p. 161; 1076, p. 173). Union Sugar Co. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Mar. 10	22.60	June 3	27.71	Sept. 25	26.15	Dec. 31	23.25
Apr. 3	a 29.64	July 31	26.72	Oct. 23	23.31		

a Nearby well pumping.

7/34-30L3 (*1028, p. 161; 1076, p. 173). Geol. Survey, U. S. Dept. of Interior. Union Sugar Co. property. In Lower Santa Ynez Valley. Deepened October 1947. Measuring point after October, top west side of 2-inch coupling, 4.57 feet above land-surface datum and 63.36 feet above sea-level datum of 1929.

Water level, in feet below land-surface datum, 1947

Jan. 30	17.00	Apr. 3	19.78	June 3	22.80	Nov. 28	a 21.09
Mar. 10	17.47	A 30	22.70	Oct. 23	19.85	Dec. 31	21.03

a Pumping.

7/34-30R1 (*949, p. 218; 991, p. 166; 1021, p. 146; 1028, p. 161; 1076, p. 173). Mrs. E. Manfrina. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	18.71	July 31	21.40	Oct. 23	21.45	Dec. 31	b 22.08
Apr. 3	a 24.07	Sept. 25	21.42	Nov. 28	21.59		

a Pumping.

b Nearby well pumping.

7/34-31C2. Union Sugar Co. In Lower Santa Ynez Valley, about 2.6 miles west-northwest of Lompoc, 0.5 mile north of Ocean Avenue, 50 feet west of center line of Legee Avenue, on west side of ditch, in corrugated-iron pump house. Drilled irrigation well, diameter and depth unknown. Measuring point, lower edge of pump base north side over hole, 1.00 foot above land-surface datum and 65.72 feet above sea-level datum of 1929. Water level, in feet below land-surface datum, 1947: Nov. 28, 25.84.

7/34-31C3. Geol. Survey, U. S. Dept. of Interior. Union Sugar Co. property. In Lower Santa Ynez Valley, about 2.6 miles west-northwest of Lompoc, 30 feet south of irrigation well 7/34-31C2 and 24 feet east-south-east of large concrete-tile standpipe. Bored observation well, diameter 2 inches, depth 28 feet. Unconfined water in Recent alluvial clay and silt. Measuring point, top of 2-inch coupling, 0.70 foot above land-surface datum and 65.38 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 16.06; Nov. 28, 16.18; Dec. 31, 16.77, nearby well pumping.

7/34-32A1. O. F. Benn. In Lower Santa Ynez Valley, about 1.5 miles northwest of Lompoc, 250 feet north of Pine Avenue and 45 feet west of 13th Road, in corrugated-iron pump house. Drilled irrigation well, diameter 12 inches, depth 180 feet. Confined water in Recent alluvial gravel from 147 to 174 feet. Measuring point, lower edge of hand hole in east side of pump base over hole, 1.00 foot above land-surface datum and about 80 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 30.10; Nov. 28, 30.26; Dec. 31, 32.30, pumped recently.

7/34-32A4. Geol. Survey, U. S. Dept. of Interior. O. F. Benn. In Lower Santa Ynez Valley, about 1.5 miles northwest of Lompoc, 21.5 feet south of well 7/34-32A1, and 2 feet southwest of northwest corner of corral fence. Bored observation well, diameter 2 inches, depth 31 feet. Unconfined water in Recent alluvial clay, silt, and sand. Measuring point, top west side of 2-inch coupling, 0.90 foot above land-surface datum and about 80.18 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 25.64; Nov. 28, 26.50; Dec. 31, 24.21.

7/34-32P5. Geol. Survey, U. S. Dept. of Interior. J. Bodger & Sons property. In Lower Santa Ynez Valley, about 1.5 miles west of Lompoc, 37 feet north of State Highway 150 (Ocean Avenue), 22 feet west of Bailey Avenue, 5.5 feet north of Associated Telephone Co. pole, in corner of field. Bored observation well, diameter 2 inches, depth 37 feet. Unconfined water in Recent alluvial clay, silt, and sand. Measuring point, top east side of 2-inch coupling, 4.00 feet above land-surface datum and 81.60 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 27.58; Nov. 28, 27.86; Dec. 31, 28.29.

7/34-34H1 (*949, p. 220; 991, p. 167; 1021, p. 147; 1028, p. 162; 1076, p. 173). Mrs. M. Balaam. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Mar. 10	39.30	June 3	a 43.88	Sept. 25	44.48	Nov. 28	a 46.95
Apr. 3	41.26	July 30	43.52	Oct. 23	46.81	Dec. 31	44.65

a Nearby well pumping.

7/34-34H2 (*991, p. 167; 1021, p. 147; 1028, p. 162; 1076, p. 173). Geol. Survey, U. S. Dept. of Interior. Mary Skaarup property. In Lower Santa Ynez Valley. Deepened to 50 feet in September 1947. Measuring point, top east side of 2-inch coupling, 0.59 foot above land-surface datum and 112.54 feet above sea-level datum of 1929. Water level, in feet below land-surface datum, 1947: Sept. 25, 43.60; Oct. 23, 44.32; Nov. 28, 44.61; nearby well pumping; Dec. 31, 44.14.

7/34-35F2 (*991, p. 169; 1021, p. 149; 1028, p. 163; 1076, p. 174). Valla Bros. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 30	17.57	Apr. 3	18.21	Nov. 28	a 27.84
Mar. 6	17.75	Sept. 25	26.84	Dec. 31	26.66

a Nearby well pumping.

7/34-35F6 (*991, p. 170; 1021, p. 150; 1028, p. 163; 1076, p. 174). Geol. Survey, U. S. Dept. of Interior. M. Schuyler property. In Lower Santa Ynez Valley. Deepened to 55 feet in September 1947. Measuring point, top south side of 2-inch coupling, 1.93 feet above land-surface datum and 121.39 feet above sea-level datum of 1929.

Water level, in feet below land-surface datum, 1947

Jan. 30	39.13	Sept. 25	a 47.02	Nov. 28	a 48.41
Apr. 3	39.78	Oct. 23	48.00	Dec. 31	47.22

a Nearby well pumping.

7/34-35F16. M. Schuyler. In Lower Santa Ynez Valley, about 1.4 miles east-northeast of Lompoc, 0.27 mile east of north First Street, 150 feet south of College Avenue extended, in unpainted frame pump house, 55 feet west of edge of Lompoc Plain, and 30 feet west of site of destroyed well 7/34-35F5. Drilled irrigation well, diameter 16 inches, depth 173 feet. Unconfined water in Recent alluvial sand and gravel. Measuring point, bottom of notch in casing south side, at land-surface datum and about 119.5 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: July 30, 47.56; Oct. 23, 49.02; Nov. 28, 49.85; nearby well pumping; Dec. 31, 47.84.

7/34-35K2 (*949, p. 221; 991, p. 171; 1021, p. 150; 1028, p. 163; 1076, p. 174). Mrs. M. McDonald. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	10.80	Apr. 30	a 12.20	Sept. 25	14.48	Nov. 28	13.69
Mar. 6	10.72	June 3	a 13.83	Oct. 23	14.30	Dec. 31	13.64
Apr. 3	10.92	July 31	a 14.04				

a Nearby well pumping.

7/34-35P1 (*949, p. 221; 991, p. 172; 1021, p. 152; 1028, p. 164; 1076, p. 174). W. P. and N. L. Robinson. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947a/
(From float gage until Apr. 3)

Jan. 30	37.27	37.97	Apr. 3	38.37	Sept. 25	45.18	
	37.98	Mar. 6	37.90	30	39.32	Oct. 23	45.35
	37.97		37.90	June 3	41.92	Nov. 28	47.56
	37.87		38.37	July 31	45.42	Dec. 31	45.39

a Undated entries are highest and lowest levels between dates of observation.

7/35-18J1 (*941, p. 158; *949, p. 222; 991, p. 173; 1021, p. 153; 1028, p. 164; 1076, p. 174). War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	1.79	Apr. 30	1.61	Sept. 25	2.04	Dec. 31	+.36
Mar. 6	1.04	July 31	1.95	Oct. 23	1.52		

7/35-20J1 (*949, p. 223; 991, p. 173; 1021, p. 153; 1028, p. 165; 1076, p. 174). War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	8.69	Apr. 30	9.83	Sept. 25	10.38	Nov. 29	10.00
Mar. 6	8.61	June 3	10.21	Oct. 23	10.29	Dec. 31	9.65
Apr. 3	8.87	July 31	10.65				

7/35-22F2. War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley, about 6 miles northwest of Lompoc, about 0.5 mile northeast of State Highway 150 (Ocean Avenue), opposite mouth of Lompoc Canyon, 240 feet north of east-west row of gum trees, 130 feet south of Santa Ynez River, at east side of gravel-surfaced road. Bored observation well, diameter 2 inches, depth 11 feet. Unconfined water in Recent alluvium. Measuring point, top west side of 2-inch coupling, 0.50 foot above land-surface datum and 19.62 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 5.37; Nov. 28, 5.13; Dec. 31, 5.26.

7/35-22J1 (*1028, p. 165; 1076, p. 175). Union Sugar Co. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	11.98	Apr. 3	17.27	Oct. 23	14.17	Dec. 31	13.92
Mar. 6	12.09	Sept. 25	14.84	Nov. 28	16.35		

7/35-22M1. War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley, about 6.4 miles northwest of Lompoc, about 230 yards northeast of railroad tracks, 300 yards northwest of gravel-surfaced road, in open brushy field, in small corrugated-iron pump house. Drilled irrigation well, abandoned, reported depth 180 feet. Measuring point, top west side of pump flange at air-line hole, 1.00 foot above land-surface datum and 29.84 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 11.36; Nov. 28, 11.96; Dec. 31, 11.26.

7/35-22M2. War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley, about 6.4 miles northwest of Lompoc, 27 feet east of well 7/35-22M1, and 2 feet east of 6-foot wooden post. Bored observation well, diameter 2 inches, depth 22.5 feet. Unconfined water in Recent alluvial sand and silt. Measuring point, top east side of 2-inch coupling, 0.80 foot above land-surface datum and 29.00 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 14.09; Nov. 28, 14.19; Dec. 31, 14.95.

7/35-23E2 (*949, p. 224; 991, p. 174; 1028, p. 165; 1076, p. 175). Union Sugar Co. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	16.40	Apr. 3	19.06	Sept. 25	19.17	Nov. 28	19.49
Mar. 6	16.50	June 3	20.93	Oct. 23	18.75	Dec. 31	18.57

7/35-23E3 (*1028, p. 165; 1076, p. 175). Union Sugar Co. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	17.21	Apr. 3	(a)	June 3	(a)	Sept. 25	(a)
Mar. 6	16.96	30	(a)	July 31	(a)		

a Dry. Destroyed Oct. 1947; replaced by 7/35-23E4, 2 feet northwest.

7/35-23E4. Geol. Survey, U. S. Dept. of Interior. Union Sugar Co. property. In Lower Santa Ynez Valley, about 5.5 miles west-northwest of Lompoc, 28 feet east-southeast of well 7/35-23E2, 12 feet southeast of abandoned irrigation well 7/35-23E1, 3 feet west-southwest of large silver-painted standpipe, and 2 feet northwest of site of destroyed well 7/35-23E3. Bored observation well, diameter 2 inches, depth 28.5 feet. Unconfined water in Recent alluvial sand. Measuring point, top north side of 2-inch casing, 1.86 feet above land-surface datum and 38.76 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 19.57; Nov. 28, 19.79; Dec. 31, 19.32.

7/35-23J2. Union Sugar Co. In Lower Santa Ynez Valley, about 4.6 miles northwest of Lompoc, 0.8 mile north of Central Avenue, 18 feet west of center line of Artesia Avenue, 25 feet north of long pump house painted red, 50 feet northeast of tank tower, in small corrugated-iron pump house. Drilled irrigation well. Measuring point, top of hole in pump base flange, south side, 1.00 foot above land-surface datum and 44.93 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 18.05; Nov. 28, 26.34; Dec. 31, 17.14.

7/35-23J3. Geol. Survey, U. S. Dept. of Interior. Union Sugar Co. property. In Lower Santa Ynez Valley, about 4.6 miles northwest of Lompoc, 63 feet west of center line of Artesia Avenue, 45 feet west and 15 feet south of irrigation well 7/35-23J2, at east side of wooden barn. Bored observation well, diameter 2 inches, depth 32 feet. Uncoiifined water in Recent alluvial sand. Measuring point, top east side of 2-inch casing, 1.00 foot above land-surface datum and 44.43 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 19.87; Nov. 28, 19.24; Dec. 31, 19.00.

7/35-23N2 (*1028, p. 165; 1076, p. 175). Union Sugar Co. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	12.29	Apr. 30	a 13.06	Sept. 25	13.64	Nov. 28	13.47
Mar. 6	12.33	June 3	a 13.02	Oct. 23	13.49	Dec. 31	13.47
Apr. 3	10.80	July 31	a 14.22				

a Nearby well pumping.

7/35-24J1 (*941, p. 159; *949, p. 224; 991, p. 174). T. M. Parks. In Lower Santa Ynez Valley. Measurements resumed Oct. 1947. Measuring point, top of hole in southeast side of pump base, 1.65 feet above land-surface datum and 61.05 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 28.80; Dec. 31, 28.41.

7/35-24J2. Geol. Survey, U. S. Dept. of Interior. T. M. Parks property. In Lower Santa Ynez Valley, about 3.9 miles northwest of Lompoc in fence line along west side of Douglass Avenue extended, 33 feet north and 16 feet east of irrigation well 7/35-24J1, 2 feet north of gatepost in fence. Bored observation well, diameter 2 inches, depth 33 feet. Uncoiifined water in Recent alluvial fine sand and clay. Measuring point, top east side of 2-inch casing, 0.80 foot above land-surface datum and 59.78 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 26.13; Nov. 28, 24.93, nearby well pumping; Dec. 31, 25.74.

7/35-24K2 (*949, p. 225; 991, p. 175; 1021, p. 153; 1028, p. 166; 1076, p. 175). A. B. Henning. In Lower Santa Ynez Valley. Well collapsed, measurements discontinued Sept. 25.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 30	19.60	Apr. 3	a 27.67	Sept. 25	23.36
Mar. 10	a 21.85	June 3	27.22		

a Nearby well pumping.

7/35-24K3 (*1028, p. 166; 1076, p. 175). A. B. Henning. In Lower Santa Ynez Valley. Well destroyed Sept. 1947; measurements discontinued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	20.66	Apr. 3	(a)	June 3	(a)	Sept. 25	(a)
Mar. 10	21.83	30	(a)	July 31	(a)		

a Dry.

7/35-25F5 (*1028, p. 166; 1076, p. 175). Union Sugar Co. In Lower Santa Ynez Valley. Water levels, in feet below land-surface datum, 1947: Mar. 10, 16.65, nearby well pumping; Apr. 30, 29.16, nearby well pumping; Nov. 28, 22.56; Dec. 31, 16.51.

7/35-25F6 (*1028, p. 166; 1076, p. 176). Union Sugar Co. In Lower Santa Ynez Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	10.55	Apr. 30	8.07	Sept. 25	12.16	Nov. 28	12.73
Mar. 10	7.89	June 3	9.30	Oct. 23	12.61	Dec. 31	15.07
Apr. 3	a 8.44	July 31	10.13				

a Irrigating in field near well.

7/35-26F1. Union Sugar Co. In Lower Santa Ynez Valley, about 4.8 miles west-northwest of Lompoc, 430 feet north of Central Avenue, 125 feet west of Union Sugar Avenue, in silver-painted iron pump house, west of residence. Drilled irrigation well, diameter 16 inches, depth 186 feet. Confined water in Recent alluvial sand and gravel. Measuring point, top edge of hole in east side pump base flange, 0.80 foot above land-surface datum and 37.64 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 12.17; Dec. 31, 10.38.

7/35-26F3. Geol. Survey, U. S. Dept. of Interior. Union Sugar Co. property. In Lower Santa Ynez Valley. About 4.8 miles west-northwest of Lompoc, on side of shallow swale in Lompoc Plain, 33 feet north of irrigation well 7/35-26F2, 3 feet west of southwest corner of wooden shed. Bored observation well, diameter 2 inches, depth 18.5 feet. Confined water in Recent alluvial fine sand and clay. Measuring point, top north side of coupling, 2.00 feet above land-surface datum and 36.70 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 10.44; Nov. 28, 11.01, nearby well pumping; Dec. 31, 10.23.

7/35-26J3 (*949, p. 226; 991, p. 175; 1021, p. 153; 1028, p. 166; 1076, p. 176). Santa Barbara County. Artesia School District. In Lower Santa Ynez Valley. Automatic water-stage recorder removed Mar. 6. Destroyed; replaced by well 7/35-26J4.

Water level at noon, in feet below land-surface datum, 1947
(From recorder charts until Mar. 6)

Jan. 1	7.95	Jan. 25	10.24	Mar. 6	10.15	July 31	19.54
5	7.85	30	9.20	Apr. 3	a 28.66	Sept. 4	15.23
7	7.80	Feb. 4	14.39	30	a 24.57	25	13.35
15	7.84	11	10.70	June 3	19.61	Oct. 23	a 16.76
20	8.76	28	12.03	26	22.25		

a Nearby well pumping.

7/35-26J4. Santa Barbara County. Artesia School District. In Lower Santa Ynez Valley, about 4.3 miles west-northwest of Lompoc, 27 feet east of destroyed well 7/35-26J3. Drilled public-supply well, diameter 6 inches, depth 141 feet. Measuring point, top edge of hole in east side of pump base, 1.64 feet above land-surface datum (same as for well 7/35-26J3) and 42.50 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Nov. 28, 22.49; Dec. 31, 12.65.

7/35-27C2 (*941, p. 160; *949, p. 226; 991, p. 176; 1021, p. 154; 1028, p. 167; 1076, p. 176). Southern Pacific Railroad. In Lower Santa Ynez Valley. Water levels, in feet below land-surface datum, 1947: Jan. 30, 13.45; Apr. 30, 16.15.

7/35-35A3. Gus Aquistapace. In Lower Santa Ynez Valley, about 4.2 miles west-northwest of Lompoc; 185 feet north and 138 feet northwest of intersection of State Highway 150 (Ocean Avenue) and Artesia Avenue, 95 feet north of railroad tracks, in corrugated-iron pump house. Drilled irrigation well, diameter 14 inches, depth 100 feet. Confined water in Recent alluvial sand and gravel. Measuring point, lower edge of pump base flange southwest side over hole in concrete foundation, at land-surface datum and 45.58 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 13.98; Nov. 28, 12.88; Dec. 31, 12.69.

7/35-35A4. Geol. Survey, U. S. Dept. of Interior. Gus Aquistapace property. In Lower Santa Ynez Valley, about 4.2 miles west-northwest of Lompoc, 30 feet southeast of well 7/35-35A3, and 6 feet southeast of power pole in field. Bored observation well, diameter 2 inches, depth 23.5 feet. Unconfined water in Recent alluvial clay, silt, and sand. Measuring point, top north side of 2-inch casing, 2.00 feet above land-surface datum and 47.88 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 14.11; Nov. 28, 13.50; Dec. 31, 12.99.

7/35-35C2. War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley, about 4.8 miles nearly west of Lompoc, 330 yards southwest of State Highway 150 (Ocean Avenue), between two farm roads on west side of drainage ditch, in corrugated-iron pump house. Drilled irrigation well, diameter 16 inches, depth 122 feet. Confined water in gravel and sand of the Orcutt (?) formation. Measuring point, top of hole in pump base flange, south side, 0.50 foot above land-surface datum and 36.87 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Nov. 28, 2.45; Dec. 31, 2.12.

7/35-35C4. War Department, Camp Cooke Military Reservation. In Lower Santa Ynez Valley, about 4.8 miles nearly west of Lompoc, 33 feet south of irrigation well 7/35-35C3, at west edge of ditch, and 1 foot west of fence. Bored observation well, diameter 2 inches, depth 9 feet. Unconfined water in Recent alluvial clay. Measuring point, top south side of 2-inch coupling, 1.00 foot above land-surface datum, and 37.68 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 3.73; Nov. 28, 4.60; Dec. 31, 4.49.

7/35-36E3 (*901, p. 176; 1021, p. 154; 1028, p. 167; 1076, p. 176). Southern Pacific Milling Co. In Lower Santa Ynez Valley. Measurements discontinued Sept. 25.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	17.93	Apr. 3	a 23.81	June 3	24.12	Sept. 25	24.46
Mar. 6	17.69	30	a 25.16	July 31	25.84		

a Nearby well pumping.

7/35-36J6. Denholm Seed Co. In Lower Santa Ynez Valley, about 3 miles nearly west of Lompoc, 48 feet north and 28 feet west of centerline intersection of State Highway 150 (Ocean Avenue) and Douglass Avenue, in unpainted wooden pump house. Drilled irrigation well, diameter 16 inches, reported depth 102 feet. Measuring point, lower edge of cut-out over hole in pump base, 0.50 foot above land-surface datum and about 59 feet above sea level of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 24.37; Nov. 28, 24.04; Dec. 31, 26.30.

7/35-36J7. Geol. Survey, U. S. Dept. of Interior. Denholm Seed Co. property. In Lower Santa Ynez Valley, about 3 miles nearly west of Lompoc, 35 feet north and 15 feet east of irrigation well 7/35-36J6, at edge of Douglass Avenue. Bored observation well, diameter 2 inches, depth 32.5 feet. Unconfined water in Recent alluvial clay, silt, and sand. Measuring point, top east side of 2-inch coupling, 1.03 feet above land-surface datum and about 59.53 feet above sea-level datum of 1929. Water levels, in feet below land-surface datum, 1947: Oct. 23, 23.5; Nov. 28, 23.33; Dec. 31, 24.86.

8/32-30K2 (*1021, p. 155; 1028, p. 167; 1076, p. 176). John Parma. In San Antonio Valley.

Water level, in feet with reference to land-surface datum, 1947

Jan. 30	+0.65	Apr. 29	+0.78	Sept. 24	-2.72	Nov. 26	-1.41
Mar. 5	+.97	June 3	.02	Oct. 28	-1.85	Dec. 30	-.98
Apr. 2	+.92	July 30	-1.62				

8/33-20K1 (*1021, p. 155; 1028, p. 167; 1076, p. 176). Virginia Barca. In San Antonio Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	14.90	Apr. 29	38.15	Sept. 24	21.59	Nov. 26	a 35.56
Mar. 5	14.83	June 3	a 40.08	Oct. 28	a 23.15	Dec. 30	20.56
Apr. 2	a 33.96	July 30	a 38.09				

a Nearby well pumping.

8/33-20R1 (*1021, p. 155; 1028, p. 167; 1076, p. 176). Virginia Barca. In San Antonio Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	21.20	Apr. 2	ab 36.24	Oct. 28	26.86	Dec. 30	23.18
Mar. 5	a 21.28	June 3	c 43.88	Nov. 26	33.48		

a Pumped recently.

b Nearby well pumping.

c Pumping.

8/34-23B1 (*1021, p. 156; 1028, p. 168; 1076, p. 177). Josephine Harris Estate. In San Antonio Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	13.68	Apr. 29	14.27	Sept. 24	15.25	Nov. 26	a 15.54
Feb. 28	13.60	June 3	15.57	Oct. 28	15.28	Dec. 30	15.41
Apr. 2	14.51	July 30	16.20				

a Nearby well pumping.

9/24-19Q1 (*941, p. 146; *949, p. 237; 991, p. 177; 1021, p. 156; 1028, p. 168; 1076, p. 176). W. C. Ramelli. In Cuyama Valley.

Water level, in feet below land-surface datum, 1947

Jan. 29	36.92	Apr. 21	38.86	Sept. 23	42.03	Nov. 25	43.45
Feb. 26	37.32	June 2	a 39.59	Oct. 30	42.78	Dec. 29	44.08
Mar. 31	37.86	July 29	a 40.82				

a Pumped recently.

9/32-7N1 (*941, p. 147; *949, p. 228; 991, p. 177; 1021, p. 156; 1028, p. 168; 1076, p. 177). Valerio Tognazzini. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 53.50	Apr. 1	a 55.40	July 1	a 60.43	Nov. 26	65.30
29	53.88	2	55.47	Oct. 1	a 64.45	Dec. 29	66.19
Mar. 5	54.72	29	b 59.78	29	64.80		

a By Santa Maria Valley Water Conservation District.

b Nearby well pumping.

9/32-17G1 (*949, p. 228; 991, p. 177; 1021, p. 156; 1028, p. 168; 1076, p. 177). E. C. Lyman. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 29	33.23	Apr. 29	36.40	Sept. 24	42.75	Nov. 29	43.14
Mar. 5	34.12	June 3	38.08	Oct. 29	42.70	Dec. 29	43.70
Apr. 2	a 36.84	July 30	a 41.57				

a Pumped recently.

9/33-2A1 (*941, p. 147; *949, p. 229; 991, p. 178; 1021, p. 156; 1028, p. 168; 1076, p. 177). Santa Maria Realty Co. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 39.75	Apr. 1	a 39.75	Sept. 24	46.18	Nov. 26	47.76
29	39.04	2	39.89	Oct. 1	a 46.10	Dec. 29	48.62
Mar. 5	39.60	July 1	ab 45.00	29	47.00		

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

10/33-27G1 (*#949, p. 230; 991, p. 179; 1021, p. 158; 1028, p. 169; 1076, p. 179). W. C. Adam. In Santa Maria Valley. Measurements by Santa Maria Valley Water Conservation District. Water levels, in feet below land-surface datum, 1947: Jan. 1, 59.61; Apr. 1, 93.45, pumped recently; July 1, 78.45, pumped recently; Oct. 1, 76.70, pumped recently.

10/33-27K1 (*#941, p. 149; *#949, p. 230; 991, p. 179; 1021, p. 158; 1028, p. 169; 1076, p. 179). Newhall Land & Farming Co. In Santa Maria Valley. Float gage removed July 30.

Water level, in feet below land-surface datum, 1947^a/
(From float gage until July 30)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 29	57.33	Apr. 2	57.25	June 3	60.30	July 30	67.20
	57.65		58.55		62.63	Sept. 24	68.50
	57.44		58.50		62.56	Oct. 29	69.16
	57.22		58.28		62.56	Nov. 26	69.82
	57.83		60.30		67.20	Dec. 29	70.07
Mar. 5	57.33	29	60.30				

a Undated entries are highest and lowest levels between dates of observation.

10/33-28A1 (*#949, p. 230; 991, p. 179; 1021, p. 158; 1028, p. 170; 1076, p. 179). Joe Soares. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 65.72	Apr. 1	ab 68.55	Oct. 1	ab 82.47	Dec. 29	82.78
29	65.89	July 1	ab 69.80	Nov. 26	82.80		

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

10/33-33H1. E. L. Sargent. In Santa Maria Valley, about 5.0 miles southeast of Santa Maria, 0.5 mile south of Sisquoc Road, 175 feet west of Bradley Canyon Road, 75 feet south of red-painted tank and tower, beneath metal windmill tower at east edge of canyon. Drilled domestic and stock well, diameter 16 inches, depth 290 feet. Unconfined water in clay, sand, and gravel of the Paso Robles formation. Measuring point, top south side of casing, 1.00 foot above land-surface datum and about 403 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Jan. 29	179.50	Apr. 29	a180.97	July 30	182.45	Nov. 26	184.62
Mar. 5	179.92	June 3	181.36	Sept. 24	183.39	Dec. 29	185.05
Apr. 2	180.22						

a Pumped recently.

10/33-35B1 (*#1021, p. 159; 1028, p. 170; 1076, p. 179). Newhall Land & Farming Co. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level
Jan. 29	39.94	Sept. 24	45.93	Nov. 26	47.53
Mar. 5	38.90	Oct. 29	46.83	Dec. 29	48.27

10/34-2R1 (*#949, p. 231; 991, p. 179; 1021, p. 159; 1028, p. 171; 1076, p. 180). Gracio Apalatequi. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	a100.52	Apr. 1	a103.10	July 1	a105.02	Nov. 25	108.22
	101.10		104.62		ab112.93		
	101.31		104.31		109.00		

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

10/34-4R1 (*1028, p. 171; 1076, p. 180). Gerald Donovan. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	84.82	Apr. 2	85.77	Sept. 24	93.51	Dec. 30	93.12
Mar. 5	84.92	July 29	92.27	Oct. 29	93.55		

10/34-6N1 (*949, p. 231; 991, p. 180; 1021, p. 159; 1026, p. 171; 1076, p. 180). Grisingher & Signorelli. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 56.90	Apr. 1	a 60.05	July 1	ab 65.90	Oct. 28	65.56
30	57.10	2	59.55	Sept. 24	66.46	Nov. 26	c 66.30
Mar. 5	57.30	29	61.62	Oct. 1	a 66.60	Dec. 30	64.41

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

c Nearby well pumping.

10/34-9F1 (*991, p. 180; 1021, p. 160; 1028, p. 171; 1076, p. 180). Mrs. A. E. Preisker. In Santa Maria Valley. Measurements by Santa Maria Valley Water Conservation District. Water levels, in feet below land-surface datum, 1947: Jan. 1, 82.35; Apr. 1, 84.37, pumped recently; July 1, 90.20, pumped recently; Oct. 1, 92.60, pumped recently.

10/34-14E3 (*941, p. 151; *949, p. 231; 991, p. 180; 1021, p. 160; 1028, p. 171; 1076, p. 180). City of Santa Maria. In Santa Maria Valley. Measurements by city of Santa Maria, except as indicated.

Water level, in feet below land-surface datum, 1947

Jan. 5	108.54	Apr. 6	109.38	July 6	114.00	Oct. 5	117.21
12	108.58	13	109.75	13	114.38	12	117.25
19	108.61	20	110.15	20	114.54	19	117.56
26	108.65	27	110.42	27	115.23	26	117.35
30	a108.76	29	a110.50	30	a115.30	28	a117.26
Feb. 2	108.56	May 4	110.81	Aug. 3	115.58	Nov. 9	117.42
9	108.50	11	110.92	10	115.96	16	117.40
16	108.58	18	110.96	17	116.21	23	117.46
23	108.69	25	110.88	25	116.40	25	a117.46
28	a108.73	June 2	a112.19	Sept. 3	a116.55	30	117.46
Mar. 2	107.21	8	112.54	7	116.67	Dec. 7	117.44
9	108.98	15	112.67	14	116.88	14	117.46
16	108.92	22	113.21	21	116.98	21	117.43
23	109.21	26	a113.36	24	a116.93	28	117.38
30	109.29	29	113.56	28	117.08	30	a117.29
Apr. 2	a109.44						

a By Geological Survey.

10/34-20H1 (*1021, p. 160; 1028, p. 172; 1076, p. 181). Ulisse Tognazzini. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	74.10	Apr. 29	77.52	Sept. 24	82.12	Nov. 26	81.61
Mar. 5	74.43	June 3	79.02	Oct. 28	82.04	Dec. 30	81.04

10/34-22R1 (*949, p. 232; 991, p. 180; 1021, p. 160; 1028, p. 172; 1076, p. 181). George J. Wheat. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a102.00	Apr. 2	103.04	July 29	b108.60	Oct. 29	109.22
30	102.00	29	104.28	Sept. 24	109.02	Nov. 26	111.42
Mar. 5	102.15	June 2	105.80	Oct. 1	a109.00	Dec. 30	109.17
Apr. 1	a102.90	July 1	a108.10				

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

10/34-23H1 (*949, p. 232; 991, p. 181; 1021, p. 161; 1028, p. 172; 1076, p. 181). Marion B. Rice. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	a 117.00	Apr. 1	a 118.50	Sept. 24	123.59	Oct. 29	123.43
30	117.94	2	118.48	Oct. 1	a 123.25	Dec. 29	125.67
Mar. 5	117.58	July 1	a 124.00				

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

10/34-31F1 (*1021, p. 161; 1028, p. 172; 1076, p. 181). Union Sugar Co. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	80.45	Apr. 29	81.67	July 30	85.15	Nov. 26	86.37
Mar. 5	80.2 ^a	June 3	83.75	Sept. 24	86.00	Dec. 30	86.08
Apr. 2	80.68						

10/35-7F1 (*941, p. 152; *949, p. 232; 991, p. 181; 1021, p. 161; 1028, p. 172; 1076, p. 181). M. J. Ellis. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	(ab)	Apr. 1	ad 13.95	July 1	a 12.10	Oct. 1	a 11.60
30	2.30	29	c 9.00	30	12.70	Dec. 30	6.89
Mar. 5	c 6.15	June 3	9.09				

a By Santa Maria Valley Water Conservation District.

b Well flowing.

c Nearby well pumping.

d Pumped recently.

10/35-7G3 (*949, p. 233; 991, p. 181; 1021, p. 161; 1028, p. 172; 1076, p. 181). John Jenkins. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947^a/ (From float gage)

6.92	Apr. 2	13.73	b 24.03	Oct. 28	16.26
b 16.56		11.34	July 30 b 22.80		14.23
Jan. 30	11.31	b 23.54	16.60		b 19.67
	7.67	29	b 24.02	Nov. 26	15.53
	b 18.43	17.65	Sept. 24	19.28	11.25
Mar. 5	12.63	16.13		14.11	b 17.62
	11.01	b 23.06		b 20.54	Dec. 30
	b 19.15	18.02			13.49
		18.02			

a Undated entries are highest and lowest levels between dates of observation.

b Nearby well pumping.

10/35-9F1 (*941, p. 152; *949, p. 233; 991, p. 181; 1021, p. 161; 1028, p. 172; 1076, p. 182). Waller-Franklin Seed Co. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 18.17	Apr. 2	b 24.07	July 1	ac 37.35	Oct. 1	a 31.33
Mar. 5	b 24.90	June 3	b 30.45	Sept. 24	29.89	28	b 31.49
Apr. 1	a 26.60						

a By Santa Maria Valley Water Conservation District.

b Nearby well pumping.

c Pumped recently.

10/35-9N1 (*949, p. 234; 991, p. 181; 1021, p. 162; 1028, p. 173; 1076, p. 182). Agnes King. In Santa Maria Valley. Measurements by Santa Maria Valley Water Conservation District. Water levels, in feet below land-surface datum, 1947: Jan. 1, 17.72; Apr. 1, 32.70; July 1, 34.63; Oct. 1, 30.97.

10/35-12M1 (*949, p. 234; 991, p. 181; 1021, p. 162; 1028, p. 173; 1076, p. 182). E. and G. Lehoy. In Santa Maria Valley.

10/35-12M1--Continued.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	a 54.85	Apr. 1	ac 54.10	Oct. 1	a 57.40	Nov. 26	b 55.66
30	b 46.49	June 3	c 56.13	28	56.64	Dec. 30	52.03
Mar. 5	46.37	July 1	ac 60.90				

a By Santa Maria Valley Water Conservation District.

b Nearby well pumping.

c Pumped recently.

10/35-21B1 (*949, p. 234; 991, p. 182; 1021, p. 162; 1028, p. 173; 1076, p. 182). C. P. Mathison. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 11.80	Apr. 2	b 22.31	July 30	31.03	Dec. 30	21.66
Apr. 1	a 24.47	July 1	ab 33.90	Oct. 1	a 29.80		

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

10/35-24B1 (*941, p. 152; *949, p. 234; 991, p. 182; 1021, p. 162; 1028, p. 173; 1076, p. 182). Union Sugar Co. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 48.40	Apr. 1	a 54.75	July 30	b 59.73	Oct. 28	b 59.77
30	49.63		2 ab 53.45	Sept. 24	58.50	Nov. 26	b 59.65
Mar. 5	50.07	July 1	ac 61.70	Oct. 1	a 58.25	Dec. 30	55.26

a By Santa Maria Valley Water Conservation District.

b Nearby well pumping.

c Pumped recently.

11/34-19Q1. Frank Silva. In Santa Maria Valley, about 5.3 miles north-northwest of Santa Maria, on upland 0.30 mile north of Santa Maria Plain, 115 feet west of Guadalupe-Nipomo road, 50 feet west-southwest of house, and 10 feet south of two water tanks, beneath steel windmill tower. Drilled domestic well, diameter 6 inches, depth unknown. Measuring point, top east side of casing, 1.30 feet above land-surface datum and about 306 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Jan. 30	223.77	Apr. 2	225.80	Oct. 28	235.75	Dec. 30	228.63
Mar. 5	224.21	June 3	a 232.95	Nov. 26	230.87		

a Pumped recently.

11/34-30Q1 (*949, p. 235; 991, p. 182; 1021, p. 162; 1028, p. 174; 1076, p. 183). Mary Bolton. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1	a 54.60	Mar. 5	55.07	Apr. 2	55.55	Oct. 1	b 62.17
30	55.08	Apr. 1	a 57.40	July 1	ab 60.67	Dec. 30	61.99

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

11/34-34J1. L. O. Fox. In Santa Maria Valley, about 2.25 miles north of Santa Maria, 1.3 miles north of north city limit, 0.25 mile north of abandoned steel road trestle, 175 feet west of U. S. Highway 101, 40 feet northwest of house, beneath metal windmill tower. Drilled domestic and stock well, diameter 8 inches, depth unknown. Measuring point, top north side of casing, 2.00 feet above land-surface datum and about 211 feet above mean sea level.

Water level, in feet below land-surface datum, 1947

Jan. 30	86.58	June 2	88.63	Sept. 24	92.07	Nov. 25	96.40
Apr. 2	87.60	July 29	90.28	Oct. 29	93.03	Dec. 29	95.47
29	88.08						

11/35-20E1 (*941, p. 153; *949, p. 235; 991, p. 182; 1021, p. 163; 1028, p. 174; 1076, p. 183). Union Sugar Co. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1 a	2.00	June 3 b	15.20	Oct. 1 ab	41.00	Nov. 26	8.51
Apr. 1 ab	30.50	July 1 ab	49.50	28	6.77		

a By Santa Maria Valley Water Conservation District.

b Pumped recently.

11/35-25H1 (*1021, p. 163; 1028, p. 174; 1076, p. 183). M. J. Mendoza. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30	41.98	Apr. 29	42.62	Sept. 24	45.60	Nov. 26	a 46.29
Mar. 5	41.98	June 3	43.05	Oct. 28	45.98	Dec. 30	46.26
Apr. 2	42.38	July 30	44.54				

a Nearby well pumping.

11/35-26M2 (*1021, p. 163; 1028, p. 174; 1076, p. 183). Sam Tognazzini. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 30 a	33.64	Apr. 29 a	49.33	Sept. 24 a	49.30	Nov. 26 a	40.53
Mar. 5 a	35.48	June 3 a	49.90	Oct. 28	42.88	Dec. 30	38.57
Apr. 2 a	45.10	July 30 a	53.16				

a Nearby well pumping.

11/35-28M1 (*949, p. 236; 991, p. 182; 1021, p. 163; 1028, p. 174; 1076, p. 183). Union Sugar Co. In Santa Maria Valley. Measurements by Santa Maria Valley Water Conservation District. Water levels, in feet below land-surface datum, 1947: Jan. 1, 14.40; Apr. 1, 26.00; July 1, 32.83; Oct. 1, 25.33.

11/35-33G1 (*949, p. 236; 991, p. 183; 1021, p. 163; 1028, p. 174; 1076, p. 183). H. E. Pezzoni. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1 a	21.00	Apr. 1 ab	30.10	July 30 b	36.45	Oct. 28	31.54
30	23.56	2	26.89	Sept. 24	33.02	Nov. 26	30.23
Mar. 5	25.74	July 1 ac	37.43	Oct. 1 a	31.50	Dec. 30	27.88

a By Santa Maria Valley Water Conservation District.

b Nearby well pumping.

c Pumped recently.

11/35-35A1 (*949, p. 236; 991, p. 183; 1021, p. 163; 1028, p. 174; 1076, p. 183). Bello Estate. In Santa Maria Valley.

Water level, in feet below land-surface datum, 1947

Jan. 1 a	40.65	Apr. 2 b	43.06	July 1 ac	49.00	Nov. 26	48.00
Mar. 5	41.73	June 3 b	53.07	Oct. 1 a	49.25	Dec. 30	47.21
Apr. 1 a	43.40						

a By Santa Maria Valley Water Conservation District.

b Nearby well pumping.

c Pumped recently.

HAWAII

By D. A. Davis

PROGRAM OF WORK

Investigation of the geology and ground-water resources of the Hawaiian Islands was continued in 1947 in cooperation with the Hawaii Division of Hydrography. Systematic studies were continued on the island of Hawaii. Reports on the geology and ground-water resources of Molokai and Niihau and a bibliography of the geology and water resources of the island of Hawaii were published.

The total ground-water draft for the Territory of Hawaii during 1947 was 189,876 million gallons. This amount is 19,894 million gallons greater than the draft for 1946. The increase is due, in part, to the fact that the draft reported for 1947 includes water from tunnels not previously reported in the total draft figures.

The well records in the accompanying tables show the measurements of artesian heads or water levels, in feet, with reference to both sea level and to land-surface datum. They are listed in two columns, designated A and B; those in column A are referred to mean sea level and those in column B to land-surface datum. The plus symbol in column B indicates that the artesian head or water level is above land-surface datum; no symbol indicates the water level is below land-surface datum. For some of the wells the figure given is the measured water level in the well; for others it is the height to which the water would rise in a casing as indicated by the shut-in pressure.

ISLAND OF OAHU

During 1947 the Geological Survey made 314 water-level measurements and 387 chloride determinations on 166 wells on the island of Oahu. Twenty-two of the wells were measured monthly. The Board of Water Supply, City and County of Honolulu made 52 measurements in 51 wells, 1 of which was measured more than once. The Geological Survey maintained 1 automatic water-stage recorder and the Board of Water Supply maintained 15.

Although the rainfall during some months exceeded the normal, drought conditions of the last several years continued into 1947. The following table indicates the rainfall during each month of 1947 at 10 index stations in the Honolulu watershed area, expressed in percentage of the normal rainfall at the stations during the last 58 years. The data are from a table prepared by C. K. Wentworth, ^{1/} geologist for the Honolulu Board of Water Supply, who has listed the monthly and annual indices from 1890 through 1947.

Rainfall in the Honolulu area in percentage of normal, 1946					
Month	Rain-fall	Month	Rain-fall	Month	Rain-fall
January	46	May	148	September	141
February	10	June	86	October	61
March	147	July	73	November	135
April	59	August	107	December	106
Average for the year					93

The following table shows a comparison of the lowest heads in observation wells in 1926, 1946, and 1947. In artesian areas 2, 3, 4, 6, 7, and 8 wells indicative of artesian conditions showed some gain during 1947 in the lowest observed head, but the lowest heads in these areas still continued to be below those of 1926. In areas 1 and 12 water levels continued to be above the lowest values for 1926. During the period December 1946 to December 1947 all artesian areas showed a net rise in water level except areas 4, 6, 8, and 11, which showed in most wells, a net loss during the year.

In most of the artesian areas the chloride content of the water was somewhat higher than during 1946.

Lowest head and net change in head, in feet above sea level, in observation wells on Oahu in 1926 and 1947

Well No.	Artesian area		Head			Net change 1926-47
	No.	Name	1926	1946	1947	
2	1	St. Louis Heights	20.88	22.14	21.44	+0.56
83	2	Makiki-Pacific Heights	23.52	22.14	23.19	-.33
132	3	Kapalama	24.84	21.63	22.55	-2.29
T24	4	Moanalua	24.00	19.60	20.24	-3.76
201	6	Pearl Harbor	17.09	14.18	15.02	-2.07
244			17.27	14.92	16.07	-1.20
266			15.75	12.84	14.09	-1.66
326	7	Waialua	10.34	9.19	9.69	-.65
356	8	Kahuiku	13.05	9.43	9.28	-3.77
396			18.78	16.88	17.30	-1.48
308	12	Mokuleia	17.55	17.89	17.75	+.20

a Estimated from head in well 144.

^{1/} Wentworth, C. K., Board of Water Supply, City and County of Honolulu, 11th Biennial Rept., 1945-46, p. 180, 1947.

Time of high and low heads in artesian areas and net gain or loss in static head, in feet, as shown by typical wells on the island of Oahu, 1947

Area	Name	Well	High	Low	Net gain or loss
1	St. Louis Heights	2	December	April	+1.62
2	Makiki-Pacific Heights	83	December	August	+.51
3	Kapalama	132	January and February	August	+.31
4	Moanalua	T-24	January	August	-.32
5	Wilhelmina Rise	a Shaft 7	November	June	+.13
6	Pearl Harbor	201	January	July	.00
		244	January	July	-.62
		266	January	August	-1.32
7	Waialua	326	December	June	+.15
8	Kahuku	356	December	July	-.87
		396	December	October	-.24
9	Kahana	405	May and November	February and September	+.68
10	Kaaawa	406	December	February	+1.00
11	Gilbert	T5	October	August	-.25
12	Mokuleia	286	December	February	+.24
		308	December	April	+.97

a Nonartesian, but indicative of artesian conditions.

Schofield Barracks shaft 4 (*840, p. 59; 845, p. 56; 886, p. 82; 911, p. 138; 941, p. 171; 949, p. 241; 991, p. 186; 1021, p. 166; 1028, p. 178; 1076, p. 190). Static level determined when pumps were shut down. On all other days pumps operated continuously.

Water level, in feet, 1947
(From recorder charts)

Date	Water level		Date	Water level	
	A	B		A	B
Jan. 1	274.57	575.43	Aug. 1	274.18	575.82
Feb. 1	274.72	575.28	Sept. 1	274.36	575.64
Mar. 2	274.65	575.35	Oct. 3	274.59	575.41
Apr. 1	274.34	575.66	Nov. 1	274.65	575.35
May 1	274.23	575.77	Dec. 2	274.84	575.16
June 1	274.01	575.99	14	274.99	575.01
July 1	274.04	575.96			

Water levels in feet in four test borings in the Pearl Harbor and Waialua areas, 1947

(Mean daily measurements furnished by Board of Water Supply, City and County of Honolulu, from recorder charts)

Area	6		6		6		7	
	Well No.	T25	T26		T27a/		T28b/	
		A	B	A	B	A	B	
Jan.	1	17.24	7.16	20.30	61.90	18.23	28.77	.....
	8	17.27	7.13	19.90	62.30	18.08	28.92	.....
	15	17.15	7.25	19.40	62.80	18.10	28.90	.....
	22	17.28	7.12	20.00	62.20	18.26	28.74	.....
	29	17.28	7.12	19.10	63.10	18.10	28.90	.....
Feb.	5	17.16	7.24	18.45	63.75	17.88	29.12	.....
	12	16.92	7.48	18.40	63.80	17.74	29.26	.....
	19	16.65	7.75	17.85	64.35	17.38	29.62	.....
	26	16.46	7.94	17.95	64.25	17.08	29.92	.....
Mar.	5	16.72	7.58	17.55	64.65	17.20	29.80	.....
	12	16.35	8.05	17.55	64.65	17.08	29.92	.....
	19	16.32	8.08	.....	.....	16.92	30.08	.....
	26	16.10	8.30	17.25	64.95	16.75	30.25	.....

* See footnotes at end of table.

Water levels in feet in four test borings in the Pearl Harbor and Waialua areas, 1947--Continued

(Mean daily measurements furnished by Board of Water Supply, City and County of Honolulu, from recorder charts)

Area	6		6		6		7	
	T25		T26		T27a/		T28b/	
	A	B	A	B	A	B	A	B
Apr.	2	16.58	7.82	17.40	64.80	16.96	30.04	.....
	9	16.42	7.98	17.50	64.70	17.04	29.96	.....
	16	16.25	8.15	16.95	65.25	16.82	30.18	.....
	23	16.06	8.34	.....	.....	16.70	30.30	.....
	30	15.98	8.42	16.65	65.55	16.62	30.38	.....
	May	16.55	7.85	16.65	65.55	16.84	30.16	.....
June	14	16.45	7.95	16.85	65.35	16.90	30.10	.....
	21	16.54	7.86	16.65	65.55	16.87	30.13	.....
	28	16.22	8.18	16.55	65.65	16.66	30.34	.....
	4	16.15	8.25	16.80	65.40	16.67	30.33	9.77 25.23
	11	15.80	8.60	15.90	66.30	16.34	30.66	9.64 25.36
	18	15.60	8.80	15.40	66.80	16.09	30.91	9.59 25.41
July	25	15.59	8.81	15.35	66.85	15.99	31.06	9.72 25.28
	2	15.70	8.70	.....	.....	16.02	30.80	.....
	9	16.00	8.40	.....	.....	16.30	30.70	10.18 24.82
	16	15.66	8.74	.....	.....	16.06	30.94	10.09 24.91
	23	15.51	8.89	15.40	66.80	15.13	31.07	10.06 24.94
	30	15.40	9.00	15.25	66.95	15.83	31.17	10.00 25.00
Aug.	6	15.40	9.00	15.15	67.05	15.78	31.22	.....
	13	15.32	9.08	15.15	67.05	15.71	31.29	.....
	20	15.28	9.12	15.20	67.00	15.71	31.23	.....
	27	15.70	8.70	15.20	67.00	15.94	31.06	.....
	Sept.	15.72	8.68	15.65	66.55	16.06	30.94	.....
	3	16.01	8.39	15.80	66.40	16.41	30.59	10.39 24.61
Oct.	17	16.45	7.95	18.50	63.70	17.05	29.95	10.54 24.46
	24	16.37	8.03	17.60	64.60	17.03	29.97	10.49 24.51
	1	16.13	8.27	17.05	65.15	16.80	30.20	10.55 24.45
	8	16.05	8.35	16.35	65.85	16.59	30.41	10.47 24.53
	15	16.03	8.37	.....	.....	16.40	30.60	10.42 24.58
	22	15.82	8.58	15.60	66.60	16.23	30.77	10.37 24.63
Nov.	29	16.30	8.10	17.10	65.10	16.70	30.30	10.33 24.67
	5	16.14	8.26	16.20	66.00	16.59	30.41	10.41 24.59
	12	16.48	7.92	16.65	65.55	16.87	30.13	10.33 24.67
	19	.....	....	18.35	63.85	17.44	29.56	10.77 24.23
	26	16.98	7.42	18.80	63.40	17.70	29.30	.....
	Dec.	17.14	7.26	17.45	64.75	17.80	29.20	10.63 24.37
	10	17.18	7.22	18.10	64.10	17.80	29.20	10.68 24.32
	17	17.29	7.11	18.45	63.75	17.92	29.06	11.04 23.96
	24	17.38	7.02	18.95	63.25	18.12	28.88	10.97 24.03
	31	17.52	6.88	19.20	63.00	18.34	28.66	10.87 24.13

a Test boring T-27. Board of Water Supply, Honolulu. At Pearl City on north side Kamehameha Highway and about 800 feet west of Waimano Home Road, latitude 21°23'55" N, longitude 157°58'55" W. Drilled December 1946, diameter 12 inches, depth 71 feet, upper 60 feet cased. Use, observation well.

b Test boring Oahu T-28. Waialua Agricultural Co. In Halemano gulch, 125 yards north of Kamehameha Highway, 1 mile south of Haleiwa, latitude 21°34'40" N, longitude 158°06'07" W. Drilled May 1947. Diameter 12 inches depth 60 feet, upper 39 feet cased. Use, observation well.

Artesian head, in feet in five wells and one test boring in the Honolulu area, 1947

(Mean daily measurements furnished by Board of Water Supply, City and County of Honolulu, from recorder charts)

Area	Well No.	1		2		3		4		5		6		7		
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Jan.	1	23.72	13.28	25.01	17.96	22.51	35.89	7.89	10.11	9.07	150.93					
	8	23.79	13.21	25.70	1.30	22.56	35.83	7.90	10.10	9.02	150.93					
	15	23.77	13.23	25.83	1.17	22.42	35.84	7.90	10.10	9.09	150.91					
	22	23.40	13.60	25.27	17.73	22.52	35.98	7.88	10.11	9.09	150.91					
Feb.	5	23.15	13.87	25.84	1.16	25.27	17.73	22.41	35.99	7.80	10.20	9.00	151.01			
	12	22.42	14.58	25.73	1.27	25.09	17.91	22.26	36.14	7.80	10.20	8.96	151.04			
	19	22.17	14.83	25.59	1.41	24.94	18.06	21.88	36.40	7.80	10.25	8.88	151.05			
	26	22.06	14.83	25.53	1.47	24.90	18.10	21.73	36.52	7.75	10.25	8.92	151.03			
Mar.	5	22.00	14.83	25.46	1.54	24.80	18.20	21.77	36.67	7.70	10.25	8.87	151.13			
	12	21.77	15.23	25.25	1.75	24.70	18.30	21.72	36.63	7.65	10.25	8.89	151.11			
	19	21.98	15.02	25.10	1.85	24.60	18.40	21.56	36.84	7.60	10.25	8.84	151.16			
	26	22.25	14.77	24.62	1.90	24.54	18.46	21.56	36.94	7.60	10.25	8.87	151.13			
Apr.	9	22.06	14.74	24.98	2.02	24.48	18.38	21.61	36.78	7.62	10.38	8.87	151.13			
	16	21.50	15.50	24.91	2.09	24.57	18.43	21.46	36.84	7.58	10.42	8.83	151.11			
	23	21.44	15.95	24.51	2.09	24.43	19.57	21.26	37.01	7.60	10.42	8.83	151.17			
	30	21.44	15.95	24.58	2.12	24.44	18.56	21.38	37.14	7.53	10.47	8.83	151.15			
May	7	21.98	14.77	24.62	2.12	24.46	16.74	21.47	36.93	7.55	10.45	8.87	151.13			
	14	21.77	14.77	24.84	2.16	24.16	18.84	21.45	36.95	7.59	10.41	8.85	151.15			
	21	21.44	14.77	24.68	2.32	24.04	18.96	21.38	37.02	7.52	10.48	8.86	151.14			
	28	21.44	14.77	24.58	2.42	24.01	18.99	21.28	37.12	7.57	10.43	8.84	151.16			
June	4	23.00	14.00	24.46	2.54	23.83	19.17	21.08	37.32	7.58	10.42	8.80	151.20			
	11	23.00	14.00	24.29	2.71	23.63	19.37	20.92	37.48	7.58	10.42	8.84	151.16			
	18	23.07	13.95	24.16	2.84	23.51	18.49	20.81	37.55	7.56	10.42	8.84	151.16			
	25	23.42	13.58	24.08	2.92	23.41	19.59	20.83	37.57	7.67	10.33	8.88	151.12			
July	2	23.42	13.58	23.97	3.03	23.27	19.73	20.86	37.54	7.69	10.31	8.93	151.07			
	9	23.31	13.66	23.84	3.16	23.23	19.77	20.76	37.64	7.71	10.29	8.94	151.06			
	16	22.76	14.24	23.65	3.35	22.99	20.01	20.62	37.78	7.73	10.27	9.02	150.98			
	23	22.64	14.36	23.53	3.47	22.66	20.34	20.51	37.89	7.72	10.28	9.01	150.99			
Aug.	6	22.17	14.83	23.36	3.64	22.59	20.41	20.40	38.00	7.74	10.26	9.03	150.97			
	13	22.22	14.76	23.28	3.72	22.59	20.41	20.32	38.08	7.77	10.23	9.09	151.01			
	20	22.22	14.76	23.20	3.80	22.55	20.45	20.24	38.16	7.82	10.18	9.00	151.00			
	27	22.73	14.27	23.19	3.81	22.58	20.42	20.24	38.16	7.82	10.18	9.00	151.00			

Artesian head, in feet in five wells and one test boring in the Honolulu area, 1947--Continued

(Mean daily measurements furnished by Board of Water Supply, City and County of Honolulu, from recorder charts)

Area	1	2	3	4	5	6	7
Well No.	A	B	A	B	A	B	A
Sept. 3	25.35	3.65	23.05	19.91	20.37	39.03	7.77
10	23.59	3.41	23.06	20.54	37.86	7.75	10.25
17	25.44	19.56	23.44	20.80	37.60	7.85	10.15
24	23.66	16.44	23.66	20.92	37.48	7.88	10.12
Oct. 1	24.16	2.84	23.69	16.31	20.92	37.48	7.88
8	24.24	2.76	23.66	19.34	20.84	37.56	7.85
15	24.25	2.75	23.68	19.32	20.82	37.58	7.85
22	24.31	2.69	23.68	19.32	20.69	37.71	7.90
29	23.68	13.32	2.61	23.86	19.14	20.84	37.56
Nov. 5	24.54	2.46	24.02	18.98	20.96	37.44	7.85
12	24.69	2.31	24.16	18.84	21.07	37.33	7.85
19	24.89	2.11	24.32	18.68	21.36	37.04	7.85
26	25.01	1.99	24.48	18.52	21.59	36.81	7.85
Dec. 3	24.81	12.19	25.21	1.79	24.62	18.38	21.74
10	24.91	12.09	25.42	1.58	24.83	18.17	21.87
17	25.10	11.90	25.61	1.39	24.93	18.07	21.96
24	25.22	11.78	25.72	1.28	25.07	17.43	22.08
31	25.12	11.88	25.91	1.09	25.21	17.79	22.21

Artesian head, in feet, and chloride, in parts per million, in typical wells in Oahu, 1947

Well 1B(area 5) (*777, p. 50; 817, p. 37; 840, p. 56, 61; 845, p. 57; 886, p. 83; 911, p. 139; 941, p. 172; 949, p. 243; 991, p. 188; 1021, p. 167; 1028, p. 181; 1076, p. 191). Bishop Estate. On north side of Waialae Golf Links, Kaimuki.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 27	7.72	10.50	224	July 24	7.66	10.56	243
Feb. 24	7.66	10.56	213	Aug. 28	7.47	10.75	249
Mar. 26	7.58	10.64	242	Sept. 24	7.79	10.43	228
Apr. 25	7.56	10.66	254	Oct. 28	7.94	10.28	220
May 28	7.54	10.68	220	Nov. 28	7.98	10.24	209
June 26	7.57	10.65	238	Dec. 19	7.97	10.25	195

Well 9(area 1) (*777, p. 49; 817, p. 37; 840, p. 56, 62; 845, p. 57; 886, p. 83; 911, p. 139; 941, p. 172; 949, p. 243; 991, p. 188; 1021, p. 168; 1028, p. 181; 1076, p. 191). J. J. Gouveia. Kapahulu Road, Honolulu.

Jan. 24	23.37	+7.29	58	July 22	23.09	+7.01	56
Feb. 24	22.27	+6.19	56	Aug. 27	22.87	+6.79	58
Mar. 26	21.68	+5.60	56	Sept. 23	22.87	+6.79	57
Apr. 23	21.48	+5.40	58	Oct. 27	23.47	+7.39	56
May 26	23.29	+7.21	55	Nov. 25	24.57	+8.49	56
June 25	22.68	+6.60	58	Dec. 19	25.18	+9.10	59

Well 81 (area 2) (*777, p. 49; 817, p. 37; 840, p. 56, 62; 845, p. 57; 886, p. 83; 911, p. 139; 941, p. 172; 949, p. 243; 991, p. 188; 1021, p. 168; 1028, p. 182; 1076, p. 191). A Young. Young Street, Honolulu.

Jan. 24	25.63	+7.59	35	July 22	23.70	+5.66	37
Feb. 24	25.63	+7.59	37	Aug. 27	22.93	+4.89	36
Mar. 25	24.94	+6.90	38	Sept. 23	24.23	+6.19	35
Apr. 23	24.74	+6.70	37	Oct. 27	24.33	+6.29	37
May 26	24.55	+6.51	40	Nov. 25	24.83	+6.79	44
June 25	23.98	+5.94	37	Dec. 19	25.59	+7.55	53

Well 119 (area 3) (*777, p. 49; 817, p. 37; 840, p. 56, 62; 845, p. 57; 886, p. 83; 911, p. 139; 941, p. 172; 949, p. 243; 991, p. 188; 1021, p. 168; 1028, p. 182; 1076, p. 191). Honolulu Gas Co. Honolulu.

Jan. 24	.....	.....	434	July 29	22.56	+18.34	418
Feb. 27	23.77	+19.55	615	Aug. 29	.....	.....	411
Mar. 27	23.86	+19.64	449	Sept. 23	22.14	+17.92	429
Apr. 28	22.86	+18.64	569	Oct. 28	22.94	+18.72	414
May 26	.....	.....	530	Nov. 25	24.24	+20.02	390
July 1	23.08	+18.86	430	Dec. 23	24.25	+20.03	407

Well 153 (area 4) (*777, p. 50; 817, p. 37; 840, p. 56, 62; 845, p. 58; 886, p. 83; 911, p. 140; 941, p. 173; 949, p. 243; 991, p. 188; 1021, p. 168; 1028, p. 182; 1076, p. 191). S. Damon Estate. Moanalua Gardens, Honolulu.

Jan. 24	22.50	+2.12	53	July 24	20.66	+0.28	53
Feb. 25	21.99	+1.61	55	Sept. 4	20.47	+.09	54
Mar. 27	21.27	+.89	52	Sept. 29	20.95	+.57	55
Apr. 28	21.41	+1.03	56	Oct. 29	20.87	+.49	53
May 26	21.49	+1.11	54	Nov. 25	21.54	+1.16	51
June 25	20.89	+.51	54	Dec. 19	22.11	+.1.73	54

Well 187B (area 6) (*817, p. 37; 840, p. 56, 62; 845, p. 58; 886, p. 83; 911, p. 140; 941, p. 173; 949, p. 243; 991, p. 189; 1021, p. 169; 1028, p. 182; 1076, p. 191). U. S. Navy. Near Aiea railroad station.

Date	Head	Chloride	Date	Head	Chloride		
	A	B		A	B		
Jan. 24	19.28	+9.35	170	July 28	17.20	+7.27	140
Feb. 24	18.50	+8.57	140	Aug. 27	15.89	+5.96	194
Mar. 21	17.80	+7.87	151	Sept. 23	16.52	+6.59	217
Apr. 23	17.74	+7.81	152	Oct. 27	17.85	+7.92	250
May 26	18.74	+8.81	130	Nov. 25	18.79	+8.86	175
June 23	17.35	+7.42	145	Dec. 19	19.20	+9.27	146
July 22	17.10	+7.17	148				

Well 190 (area 6) (*777, p. 51; 817, p. 37; 840, p. 57, 62; 845, p. 58; 886, p. 83; 911, p. 140; 941, p. 173; 949, p. 243; 991, p. 189; 1021, p. 169; 1028, p. 182; 1076, p. 192). C. B. Cooper. Half a mile west of Aiea.

	A	B		A	B		
	A	B		A	B		
Jan. 24	19.20	3.53	165	July 22	16.73	6.00	151
Feb. 24	18.48	4.25	159	Aug. 27	17.38	5.35	150
Mar. 21	17.83	4.90	164	Sept. 23	17.88	4.85	158
Apr. 23	17.43	5.30	166	Oct. 27	17.18	5.55	132
May 26	18.26	4.47	152	Nov. 25	18.82	3.91	...
June 23	17.11	5.62	148	Dec. 19	19.21	3.52	...

Well 193 (area 6) (*777, p. 51; 817, p. 38; 840, p. 57, 62; 845, p. 58; 886, p. 83; 911, p. 140; 941, p. 173; 949, p. 244; 991, p. 189; 1021, p. 169; 1028, p. 183; 1076, p. 192). L. L. McCandless Estate. In Waimalu Valley, 1 mile northwest of Aiea.

	A	B		A	B		
	A	B		A	B		
Jan. 24	a18.60	a+5.55	165	Aug. 27	16.75	+3.70	186
Feb. 24	a17.65	a+4.60	163	Sept. 23	17.21	+4.16	186
Mar. 25	17.12	+4.07	180	Oct. 27	17.15	+4.10	193
Apr. 23	16.88	+3.83	183	Nov. 25	.....	.....	168
May 26	a17.53	a+4.48	177	Dec. 3	b18.70	b+5.65	...
June 23	16.45	+3.40	187	19	b18.60	b+5.55	153
July 22	16.35	+3.30	177				

a Estimated by comparison with well 194.

b Estimated by comparison with well 195.

Well 201 (area 6) (*777, p. 52; 817, p. 38; 840, p. 57, 62; 845, p. 58; 886, p. 83; 911, p. 140; 941, p. 173; 949, p. 244; 991, p. 189; 1021, p. 169; 1028, p. 183; 1076, p. 192). Bishop Estate. In Pearl City.

	A	B		A	B		
	A	B		A	B		
Jan. 24	17.17	+8.00	724	July 22	15.02	+5.85	585
Feb. 24	16.49	+7.32	730	Aug. 27	15.11	+5.94	526
Mar. 25	15.83	+6.66	651	Sept. 23	15.93	+6.76	621
Apr. 23	15.74	+6.57	712	Oct. 27	15.73	+6.56	559
May 26	15.87	+6.70	640	Nov. 25	16.70	+7.53	662
June 23	15.16	+5.99	635	Dec. 19	16.97	+7.80	721

Well 244 (area 6) (*777, p. 52; 817, p. 38; 840, p. 57, 62; 845, p. 58; 886, p. 84; 911, p. 140; 941, p. 173; 949, p. 244; 991, p. 189; 1021, p. 169; 1028, p. 183; 1076, p. 192). Bishop Estate. In Waipahu.

	A	B		A	B		
	A	B		A	B		
Jan. 24	19.48	+9.01	118	July 22	16.07	+5.60	110
Feb. 24	18.52	+7.85	117	Aug. 27	16.18	+5.71	112
Mar. 25	17.37	+6.90	115	Sept. 23	17.77	+7.30	114
Apr. 23	17.22	+6.75	117	Oct. 27	16.97	+6.50	112
May 26	17.17	+6.70	118	Nov. 25	18.68	+8.21	112
June 23	16.14	+5.67	114	Dec. 19	18.48	+8.01	115

Well 266 (area 6) (*777, p. 52; 817, p. 38; 840, p. 57, 62; 845, p. 58; 886, p. 84; 911, p. 140; 941, p. 173; 949, p. 244; 991, p. 190; 1021, p. 170; 1028, p. 183; 1076, p. 192). Honouliuli Ranch. 1.75 miles northeast of Ewa.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 24	18.77	+6.11	212	July 22	14.11	+1.45	260
Feb. 24	16.85	+4.19	205	Aug. 27	14.09	+1.43	258
Mar. 25	15.62	+2.96	222	Sept. 23	16.21	+3.55	231
Apr. 23	15.31	+2.65	218	Oct. 27	15.26	+2.60	227
May 26	15.42	+2.76	220	Nov. 25	17.51	+4.85	231
June 23	14.12	+1.46	245	Dec. 19	17.06	+4.40	219

Well 276 (area 11) (*817, p. 38; 840, p. 57, 63; 845, p. 58; 886, p. 84; 911, p. 140; 941, p. 174; 949, p. 244; 1021, p. 170; 1028, p. 183; 1076, p. 193). Ewa Plantation Co. 4.5 miles west of Ewa. Records furnished by owner; figures are monthly averages.

Jan.	Head		Chloride	July	Head		Chloride
	A	B			A	B	
Jan.	12.91	27.67	550	July	11.73	27.85	561
Feb.	12.53	28.05	562	Aug.	11.65	29.93	567
Mar.	12.36	28.22	561	Sept.	12.24	29.34	551
Apr.	12.44	28.14	559	Oct.	12.39	29.19	570
May	12.13	28.45	560	Nov.	12.28	29.30	564
June	12.02	28.56	563	Dec.	12.23	29.35	565

Well 286 (area 12) (*777, p. 53; 817, p. 38; 840, p. 57, 63; 845, p. 59; 886, p. 84; 911, p. 141; 941, p. 174; 949, p. 244; 991, p. 190; 1021, p. 170; 1028, p. 184; 1076, p. 193). Waialua Agricultural Co. In Mokuleia.

Jan. 27	Head		Chloride	July 23	Head		Chloride
	A	B			A	B	
Jan. 27	16.92	+5.38	193	July 23	16.84	+5.30	200
Feb. 25	16.65	+5.11	163	Aug. 20	16.94	+5.40	200
Mar. 26	16.73	+5.19	180	Sept. 26	17.06	+5.52	214
Apr. 22	16.96	+5.42	186	Oct. 28	17.22	+5.68	203
May 27	16.86	+5.32	187	Nov. 26	17.32	+5.78	218
June 27	16.87	+5.33	193	Dec. 22	17.55	+6.01	219

Well 308 (area 12) (*777, p. 54; 817, p. 38; 840, p. 57, 63; 845, p. 59; 886, p. 84; 911, p. 141; 941, p. 174; 949, p. 244; 991, p. 190; 1021, p. 170; 1028, p. 184; 1076, p. 193). J. F. Mendonca. 1.5 miles west of Waialua Mill.

Jan. 27	Head		Chloride	July 23	Head		Chloride
	A	B			A	B	
Jan. 27	17.95	+9.49	145	July 23	17.86	+9.40	121
Feb. 25	17.84	+9.38	146	Aug. 20	18.15	+9.69	100
Mar. 26	17.85	+9.39	150	Sept. 26	18.29	+9.83	107
Apr. 22	17.75	+9.29	151	Oct. 28	18.84	+10.38	112
May 27	17.77	+9.31	152	Nov. 26	18.80	+10.34	106
June 27	17.87	+9.41	150	Dec. 22	19.20	+10.74	115

Well 326 (area 7) (*777, p. 52; 817, p. 39; 840, p. 58, 63; 845, p. 59; 886, p. 84; 911, p. 141; 941, p. 174; 949, p. 244, 245; 991, p. 190; 1021, p. 171; 1028, p. 184; 1076, p. 193). Waialua Agricultural Co. About 0.5 mile south of Waialua.

Jan. 27	Head		Chloride	July 23	Head		Chloride
	A	B			A	B	
Jan. 27	10.59	+4.40	82	July 23	9.94	+3.75	87
Feb. 25	10.12	+3.93	80	Aug. 20	9.91	+3.72	86
Mar. 26	9.74	+3.55	96	Sept. 26	10.53	+4.34	88
Apr. 22	9.85	+3.66	97	Oct. 28	10.44	+4.25	91
May 27	9.78	+3.59	82	Nov. 20	10.91	+4.72	94
June 27	9.69	+3.50	88	Dec. 22	10.99	+4.80	93

Well 337 (area 8) (*777, p. 53; 817, p. 39; 840, p. 58, 63; 845, p. 59; 886, p. 84; 911, p. 141; 941, p. 174; 949, p. 245; 991, p. 190; 1021, p. 171; 1028, p. 184; 1076, p. 193). Waialee Training School for Boys.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 27	12.00	9.45	90	July 23	12.27	9.18	71
Feb. 18	11.93	9.52	93	Aug. 28	12.42	9.03	60
Mar. 26	11.75	9.70	87	Sept. 26	12.25	9.20	91
Apr. 22	11.91	9.54	76	Oct. 28	12.15	9.30	90
May 27	11.70	9.75	67	Nov. 26	12.74	8.71	96
June 27	12.30	9.15	73	Dec. 22	12.35	9.10	104

Well 356 (area 8) (*777, p. 53; 817, p. 39; 840, p. 58, 63; 845, p. 59; 886, p. 85; 911, p. 141; 941, p. 174; 949, p. 245; 991, p. 191; 1021, p. 171; 1028, p. 184; 1076, p. 194). Kahuku Plantation Co. At sugar mill in Kahuku.

Jan. 27	10.58	+1.75	202	July 23	9.28	+0.45	492
Feb. 25	9.92	+1.09	260	Aug. 28	10.35	+1.52	347
Mar. 26	9.67	+.84	308	Sept. 26	11.21	+2.38	295
Apr. 22	9.77	+.94	330	Oct. 28	10.43	+1.60	290
May 27	9.66	+.83	352	Nov. 26	11.59	+2.76	308
June 27	9.43	+.60	425	Dec. 22	11.61	+2.78	324

Well 396 (area 8) (*777, p. 53; 817, p. 39; 840, p. 58, 63; 845, p. 59; 886, p. 85; 911, p. 141; 941, p. 174; 949, p. 245; 991, p. 191; 1021, p. 171; 1028, p. 185; 1076, p. 194). Kahuku Plantation Co. In Hauula.

Jan. 27	18.65	+8.29	67	July 23	17.37	+7.01	68
Feb. 25	17.66	+7.30	66	Aug. 28	18.01	+7.65	69
Mar. 26	17.79	+7.43	65	Sept. 26	17.34	+6.98	69
Apr. 22	18.28	+7.92	66	Oct. 28	17.30	+6.94	68
May 27	17.51	+7.15	64	Nov. 26	17.97	+7.61	69
June 27	17.32	+6.96	67	Dec. 22	18.80	+8.44	70

Well 405 (area 9) (817, p. 39; 840, p. 58, 63; 845, p. 59; 886, p. 85; 911, p. 141; *941, p. 174; 949, p. 245; 991, p. 191; 1021, p. 171; 1028, p. 185; 1076, p. 194). M. E. Foster Estate. In Kahana.

Jan. 27	15.37	+9.61	41	July 23	16.38	+10.62	38
Feb. 25	15.18	+9.42	41	Aug. 28	16.16	+10.40	39
Mar. 26	15.47	+9.71	38	Sept. 26	15.26	+9.50	39
Apr. 22	16.07	+10.31	41	Oct. 28	16.06	+10.30	38
May 27	16.44	+10.68	41	Nov. 26	16.43	+10.67	38
June 27	16.29	+10.53	39	Dec. 22	16.37	+10.61	39

Well 406 (area 10) (*777, p. 53; 817, p. 39; 840, p. 58, 63; 845, p. 59; 886, p. 85; 911, p. 141; 941, p. 175; 949, p. 245; 991, p. 191; 1021, p. 171; 1028, p. 185; 1076, p. 194). F. M. Swanzy. In Kaawa Valley.

Jan. 27	13.07	+2.80	253	July 23	13.63	+3.36	229
Feb. 25	13.01	+2.74	245	Aug. 28	13.66	+3.39	231
Mar. 26	13.31	+3.04	237	Sept. 26	13.67	+3.40	242
Apr. 22	13.33	+3.06	244	Oct. 28	13.70	+3.43	222
May 27	13.60	+3.33	223	Nov. 26	13.87	+3.60	231
June 27	13.67	+3.40	240	Dec. 22	13.95	+3.68	235

Water levels, in feet, and chloride, in parts per million, in test borings in Oahu, 1947

Test boring Oahu T1 (tributary to area 12) (*845, p. 6C; 886, p. 85; 911, p. 141; 941, p. 175; 949, p. 245; 991, p. 191, 192; 1021, p. 172; 1028, p. 185; 1076, p. 194). Waialua Agricultural Co. In Kaukonahua Gulch, 4 miles south of Waialua.

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Mar. 14	14.83	258.78	21	July 30	15.08	258.53	52
Apr. 1	14.73	258.88	42	Aug. 28	14.98	258.63	31
30	15.83	257.78	31	Oct. 4	15.48	258.13	31
May 30	16.16	257.45	10	Nov. 3	15.78	257.83	31
July 2	15.38	258.23	31	Dec. 2	16.48	257.13	21

Test boring Oahu T2 (tributary to area 7) (*845, p. 60; 886, p. 85; 911, p. 142; 941, p. 175; 949, p. 245; 991, p. 192; 1021, p. 172; 1028, p. 186; 1076, p. 195). Waialua Agricultural Co. Near Anahulu Canyon, 3.5 miles east of Haleiwa.

Mar. 14	5.81	336.07	42	July 30	4.51	337.37	125
Apr. 1	4.61	337.27	31	Aug. 28	6.01	335.87	62
30	5.83	336.05	42	Oct. 4	4.76	337.12	104
May 30	4.78	337.10	52	Nov. 3	4.86	337.02	125
July 2	7.18	334.70	125	Dec. 2	5.16	336.72	31

Test boring Oahu T5 (tributary to area 11) (*886, p. 84; 911, p. 142; 941, p. 175; 949, p. 246; 991, p. 192; 1021, p. 172; 1028, p. 186; 1076, p. 195). Suburban Water Works, Honolulu. 5 miles west of Ewa on main highway.

Jan. 28	4.47	74.66	72	July 24	4.11	75.02	300
Feb. 26	4.16	74.97	87	Aug. 29	3.84	75.29	320
Mar. 27	4.02	75.11	128	Sept. 29	4.26	74.87	63
Apr. 24	3.92	75.21	159	Oct. 29	4.49	74.64	109
May 28	3.95	75.18	200	Dec. 3	4.27	74.86	182
June 24	4.05	75.08	265	19	4.20	74.93	240

Test boring Oahu T15 (*911, p. 142; 941, p. 175; 949, p. 246; 991, p. 192; 1021, p. 172; 1028, p. 186; 1076, p. 195). Suburban Water Works, Honolulu. 1.8 miles above mouth of Nanakuli Gulch.

Jan. 28	1.86	476.78	91	July 24	1.57	477.07	91
Feb. 26	1.93	476.71	90	Aug. 29	1.65	476.99	90
Mar. 27	1.72	476.92	92	Sept. 29	1.95	476.69	92
Apr. 24	1.86	476.78	93	Oct. 29	1.75	476.89	88
May 28	2.00	476.64	92	Dec. 23	1.86	476.78	92
June 30	1.74	476.90	92				

Test boring Oahu T20 (a tributary to area 6) (*949, p. 246; 991, p. 192; 1021, p. 172; 1028, p. 186; 1076, p. 195). U. S. Navy. 2 miles northwest of Ewa, on main highway to Waianae.

Jan. 28	17.36	122.14	222	July 24	16.03	123.47	216
Feb. 26	17.04	122.46	220	Aug. 29	15.98	123.52	210
Mar. 27	16.73	122.77	227	Sept. 29	16.67	122.83	205
Apr. 24	16.86	122.64	218	Oct. 29	16.68	122.82	202
May 28	16.74	122.76	210	Dec. 3	17.03	122.47	200
June 30	16.44	123.06	215	19	17.09	122.41	209

ISLAND OF MAUI

In three of the wells of the Hawaiian Commercial and Sugar Company the water levels showed a net rise in 1947, ranging from 0.04 to 0.25 foot. In the other five wells measured a decline occurred during the year, the maximum of which was 0.30 foot. The net changes in the Maui Agricultural Company wells are not known owing to uncertainty of measurements during 1946. In wells of the Pioneer Mill Company no measurements for December 1946 are available for comparison.

During 1947, 74,117.00 million gallons of water was delivered to the Maui isthmus in East Maui Irrigation Company ditches. The quantity is 5,839 million gallons more than was delivered in 1946. Pumpage for the year on Maui was 52,278 million gallons or 1,903 million gallons more than in 1946. Pumping at all wells of the Hawaiian Commercial and Sugar Company began in January and continued through December. All Maui Agricultural Company pumps were started in January except pump 5 (U. S.G.S. well 30) which began in June, and all pumped throughout the year. All Pioneer Mill Company pumps were started in January except pumps A and P (U.S.G.S. wells 9 and 12) which began in February, and all pumped until December, except pump A which was stopped in October.

Data in the following tables were furnished by R. E. Hughes, Ralph Bradley, and John T. Moir, Jr.

Chloride, in parts per million, and water levels and net gain or loss in static level, in feet above sea level on Maui, 1947

(*931, p. 143; 941, p. 176; 949, p. 247; 991, p. 193;
1021, p. 174; 1028, p. 187; 1076, p. 196).

Location	Geol. Survey well No.	Chloride	Date	Water level	
				Height	Gain or loss
Hawaiian Commercial and Sugar Co.					
1 (Kihei)	14	.....	.....	....	....
2	25	a 355	Dec. 31	5.04	-.04
3	22	a 353	Dec. 31	3.73	+.08
4	24	a 536	Dec. 31	3.06	-.08
5	19	a 448	Dec. 31	3.96	-.06
6	18	a 400	Dec. 31	4.70	-.30
7	16	a 288	Dec. 31	5.14	-.04
8(Mill)	17	a 447	Dec. 31	4.75	+.25
3(Kihei)	15	a 415	Dec. 31	6.23	+.04

a Average for year.

Chloride, in parts per million, and water levels and net gain or loss in static level, in feet above sea level on Maui, 1947--Continued

Location	Geol. Survey well No.	Chloride	Date	Water level	
				Height	Gain or loss
Maui Agricultural Co.					
Lower Paia (pumps 1, 5, and 6)	30	a 615	Jan. 9, 1948	3.45	....
Kaheka (pumps 3 and 4)	27	a 281	Jan. 10, 1948	6.31	....
Paia School (pump 7)	28	a 312	Jan. 9, 1948	3.95	....
Mill (pumps 8 and 13)	29	a 415	Jan. 10, 1948	3.92	....
Kuau (pump 12)	31	a 288	Jan. 9, 1948	3.74	....
Maliko (pumps 10 and 11)	32	a 585	Jan. 9, 1948	3.69	....
Pioneer Mill Co.					
Kaanapali	3	b 766	Dec. 31	1.75	....
Wahoma	5	b 256	Dec. 31	2.50	....
Tahaina	9	b 434	Dec. 31	2.75	....
Mill	7	b 791	Dec. 31	3.50	....
Olowalu	10	b 375	Dec. 31	3.35	....
Ukumehame	12	b 447	Dec. 31	5.48	....

a Average for year.

b Average for 9-month period, April to December.

Water levels, in feet, and chloride, in parts per million, in test borings in Maui, 1947
(Measurements furnished by Wailuku Sugar Co.)

Test boring Maui T102 (Iao Valley) (*911, p. 144; 941, p. 176; 949,
p. 247; 991, p. 194; 1021, p. 174; 1028, p. 188; 1076, p. 197). Geological
Survey, Dept. of Interior. In Iao Valley, 1 mile west of Wailuku.

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Jan. 17	28.43	425.47	18	July 15	29.45	424.45	17
Feb. 14	29.28	424.62	17	Aug. 13	29.89	424.01	18
Mar. 14	29.21	424.69	18	Sept. 12	30.18	423.72	19
Apr. 18	28.46	425.44	18	Oct. 16	30.98	422.92	18
May 16	28.52	425.38	18	Nov. 14	30.64	423.26	20
June 17	28.84	425.06	18	Dec. 16	28.40	425.50	18

Test boring Maui T110 (Puu Hele) (*911, p. 143; 941, p. 177; 949,
p. 247; 991, p. 194; 1021, p. 174, 175; 1028, p. 188; 1076, p. 197).
Wailuku Sugar Co. 2 miles north of Maalaea.

Jan. 17	6.70	305.97	266	July 15	7.38	305.29	278
Feb. 14	6.62	306.05	247	Aug. 13	7.74	304.93	...
Mar. 14	6.59	306.08	249	Sept. 12	7.91	304.76	...
Apr. 18	5.99	306.68	256	Oct. 16	8.55	304.12	257
May 16	6.82	305.85	266	Nov. 14	8.72	303.95	255
June 17	7.00	305.67	291	Dec. 16	6.40	306.27	246

Test boring Maui T112 (*1076, p. 197). Wailuku Sugar Co. 0.5 mile of southwest of Wailuku.

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Jan. 17	29.07	428.00	15	July 15	30.45	426.62	18
Feb. 14	29.09	427.98	15	Aug. 13	30.15	426.92	19
Mar. 14	28.84	428.23	15	Sept. 12	30.76	426.31	19
Apr. 18	29.06	428.01	16	Oct. 16	31.55	425.52	25
May 16	29.15	427.92	15	Nov. 14	31.21	425.86	18
June 17	29.56	427.51	11	Dec. 16	29.43	427.64	12

Test boring Maui T113 (*1076, p. 197). Wailuku Sugar Co. At Wailuku Mill.

Jan. 17	18.35	162.74	105	July 15	18.21	162.88	111
Feb. 14	18.02	163.07	113	Aug. 13	18.31	162.78	...
Mar. 14	18.01	163.08	110	Sept. 12	18.45	162.64	...
Apr. 18	18.48	162.61	108	Oct. 16	18.56	162.53	114
May 16	18.17	162.92	112	Nov. 14	18.64	162.45	105
June 17	18.03	163.06	112	Dec. 16	18.15	162.94	102

Shaft 33 (*1076, p. 198). Wailuku Sugar Co. 0.5 mile southwest of Wailuku.

Date	Water level		Date	Water level	
	A	B		A	B
Jan. 17	26.45	373.55	July 15	26.20	373.80
Feb. 14	26.45	373.55	Aug. 13	27.24	372.76
Mar. 14	26.18	373.82	Sept. 12	27.62	372.38
Apr. 18	26.10	373.90	Oct. 16	27.99	372.01
May 16	26.05	373.95	Nov. 14	27.80	372.20
June 17	26.26	373.74	Dec. 16	26.89	373.11

ISLAND OF MOLOKAI

Water-level measurements for test boring T-1 are not included in the records for Molokai for 1947 owing to uncertainty of measurements. Accurate determinations of the altitudes of measuring points and refinement in method of measuring water levels in the Ualapue and Kamalo wells during 1947 have resulted in data which are not comparable with measurements of previous years.

Total pumpage for 1947 on Molokai was 17 million gallons. 11 million gallons more than was reported in 1946. The increase is due principally to pumpage by pineapple companies from new wells at Kualapuu and on West Molokai.

Water levels, in feet, in observation wells in Molokai, 1947

Kamalo well (*845, p. 63; 886, p. 87; 911, p. 144; 941, p. 177; 949, p. 248; 991, p. 195; 1021, p. 176; 1028, p. 189; 1076, p. 198). Half a mile northeast of Kamalo wharf.

Date	Water level		Date	Water level	
	A	B		A	B
June 9	a3.43	39.80	Sept. 21	a4.02	39.21
Aug. 3	4.32	38.91	Nov. 7	4.44	38.79

a Pumping.

Ualapue well (*845, p. 63; 886, p. 87; 911, p. 144; 941, p. 177; 949, p. 248; 991, p. 195; 1021, p. 176; 1028, p. 189; 1076, p. 198). 2.75 miles east of Kamalo well.

June 9	4.78	38.93	Nov. 7	5.04	38.67
Aug. 3	4.93	38.78	Dec. 19	5.06	38.65
Sept. 21	5.18	38.53			

Conant-Kawela well. Molokai Ranch Co. 5 miles east of Kaunakakai, on west bank of Kawela gulch. Latitude 21° 04' 20" N, longitude 157° 57' 00" W. Maui-type well, dug in 1921, depth 38 feet, altitude of well curb, 38.24 feet. Aquifer, east Molokai basalt. Unused. Measuring point is 1.00 foot above land-surface datum.

June 8	3.24	34.40	Oct. 26	3.61	34.03
Aug. 3	3.46	34.18	Dec. 19	3.97	33.67
Sept. 21	3.76	33.88			

Test boring Molokai T4. County of Maui. In Kaunakakai, 0.25 mile north of post office. Latitude, 21° 05' 42" N., longitude, 157° 05' 20" W. Drilled in 1945, diameter 6 inches, depth 21 feet, cased to 5 feet, altitude 15 feet. Aquifer, east Molokai basalt. Measuring point is 1.00 foot above land-surface datum.

June 2	2.28	13.10	Sept. 21	2.50	12.88
8	2.07	13.31	Oct. 26	2.58	12.80
Aug. 3	2.03	13.35	Dec. 19	2.48	12.90

ISLAND OF LANAI

In Maunalei shaft 1 the water level ranged from a low of 2.46 feet above sea level to a high of 2.62 feet above sea level in October. During the year the net decline in water level was 0.04 foot. Construction of drilled well 1 was completed and pumping of the well for domestic use was begun.

Maunalei shaft 1 (*817, p. 41; 840, p. 65; 845, p. 63; 886, p. 87; 911, p. 144; 941, p. 178; 949, p. 249; 991, p. 195; 1021, p. 176; 1028, p. 190; 1076, p. 199). 4 miles north-northeast of Lanai City. Records furnished by the Hawaiian Pineapple Co.

Jan. 1	2.53	291.47	July 1	2.48	291.52
Feb. 1	2.52	291.48	Aug. 1	2.57	291.43
Mar. 1	2.46	291.54	Sept. 1	2.61	291.39
Apr. 1	2.60	291.40	Oct. 1	2.62	291.58
May 1	2.49	291.51	Nov. 1	2.56	291.42
June 1	2.40	291.60	Dec. 1	2.58	291.42

ISLAND OF HAWAII

Water levels in the Olaa shaft varied from a high of 17.09 feet above sea level on January 5 to a low of 13.59 feet on August 3. From December 1946 to December 1947 the water level showed a net decline of 1.40 feet. In the Ookala shaft the water levels were generally higher throughout the year than in 1946 and showed a net rise of 2.08 feet. Accompanying the higher water levels was a slight drop in chloride content of the water.

In the Paauilo shaft of Hamakua Mill Company the water level was 2.5 feet above sea level on December 31, 1.0 foot below the level of December 31, 1946. The average chloride content of the water during the year was 192 parts per million.

Total ground-water draft on the island of Hawaii during 1947 was 8,854 million gallons, 5,560 million gallons more than was reported in 1946. This increase is due, in part, to increased pumpage on all plantations and, in part, to the draft from wells at Pahala and Honuapo and the Honokane tunnel which has not been included in previous reports.

Olaa shaft (*817, p. 42; 840, p. 66; 845, p. 64; 886, p. 88; 911, p. 145; 941, p. 178; 949, p. 249; 991, p. 196; 1021, p. 177; 1028, p. 191; 1076, p. 200).

Water level, in feet, 1947
(Records furnished by George Duncan, Olaa Sugar Co., Ltd.)

Date	Water level		Date	Water level	
	A	B		A	B
Jan. 5	17.09	202.91	July 6	13.87	206.13
12	16.78	203.22	13	13.78	206.22
19	16.36	203.64	20	13.75	206.25
26	15.88	204.12	27	13.61	206.39
Feb. 2	15.81	204.19	Aug. 3	13.59	206.41
9	15.53	204.47	10	13.96	206.04
16	14.94	205.06	17	13.78	206.22
23	14.57	205.43	24	13.64	206.36
Mar. 2	14.59	205.41	31	13.40	206.60
9	14.71	205.29	Sept. 7	14.36	205.64
16	14.88	205.12	14	14.29	205.71
23	14.53	205.47	21	14.03	205.97
30	14.51	205.49	28	14.36	205.64
Apr. 6	14.53	205.47	Oct. 5	14.43	205.57
13	14.44	205.56	12	14.43	205.57
20	14.36	205.64	19	14.27	205.73
27	14.36	205.64	26	14.33	205.67
May 4	14.46	205.54	Nov. 2	14.11	205.89
11	14.26	205.74	9	14.30	205.70
18	14.34	205.66	16	19.23	200.77
25	14.27	205.73	23	16.11	203.89
June 1	14.14	205.86	30	15.48	204.52
8	14.09	205.91	Dec. 7	15.49	204.51
15	14.05	205.95	14	15.43	204.57
22	13.89	206.11	21	16.72	203.28
29	13.96	206.04	28	16.33	203.67

Ookala shaft (#840, p. 66; 845, p. 64; 886, p. 88; 911, p. 145; 941, p. 178; 949, p. 250; 991, p. 196; 1021, p. 177; 1028, p. 191; 1076, p. 200). All measurements in old (domestic supply) tunnel.

Water level, in feet, and chloride, in parts per million, 1947
(Records furnished by David E. Larsen, manager, Kaiwi Sugar Co.)

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Feb. 10	5.17	294.83	29	July 14	5.17	294.83	25
17	4.33	295.67	28	21	4.92	295.08	29
Mar. 4	4.83	295.17	43	Aug. 1	4.67	295.33	27
11	....	62		9	4.83	295.17	28
17	4.58	295.42	45	13	4.92	295.08	42
24	....	26		25	4.83	295.17	11
Apr. 19	4.67	295.33	42	Sept. 9	4.83	295.17	24
22	5.00	295.00	21	15	4.83	295.17	26
May 2	5.50	294.50	27	22	4.67	295.33	22
9	....	45		29	4.83	295.17	21
26	4.67	295.33	31	Oct. 21	4.75	295.25	26
June 10	....	35		Nov. 14	5.33	294.67	10
16	4.67	295.33	29	Dec. 27	5.25	294.75	..
23	4.87	295.13	20				

ISLAND OF KAUAI

In well 8 the artesian head showed a net rise of 1.00 foot for the year; in wells 2F and 14N the water levels dropped 0.29 foot and 0.55 foot, respectively. There was no appreciable change in chloride content of the water from the wells during the year.

Construction of a new shaft, approximately $2\frac{1}{2}$ miles northeast of Makaweli and at an altitude of 372 feet, for domestic water supply was completed by the Olokele Sugar Company. The shaft is inclined with a vertical depth of 355 feet. The water level in the well is 17 feet above sea level.

Ground-water draft on the island of Kauai was 4,276 million gallons during 1947, 247 million gallons more than in 1946.

Artesian head, in feet, and chloride, in parts per million, in typical artesian wells in Kauai, 1947

Well 2F (#840, p. 67; 845, p. 65; 886, p. 89; 911, p. 146; 941, p. 179; 949, p. 250; 991, p. 197; 1021, p. 178; 1028, p. 192; 1076, p. 201). In Kealia. Records furnished by East Kauai Water Co.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 20	9.63	+1.58	42	July 24	9.34	+1.29	43
Feb. 27	9.44	+1.39	44	Aug. 26	9.70	+1.65	40
Mar. 25	9.38	+1.33	46	Sept. 24	9.74	+1.69	44
Apr. 29	9.37	+1.32	45	Oct. 23	9.92	+1.87	40
May 28	9.49	+1.44	44	Nov. 26	9.83	+1.78	39
June 30	9.32	+1.27	42	Dec. 22	9.78	+1.73	43

Well 7 (*840, p. 68; 845, p. 65; 886, p. 89; 911, p. 146; 941, p. 179; 949, p. 250; 991, p. 197; 1021, p. 179; 1028, p. 192; 1076, p. 201). In Wailua.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 20	158	July 16	....	....	154
Mar. 29	155	Nov. 19	....	....	157
June 4	156				

Well 8 (*840, p. 68; 845, p. 65; 886, p. 89; 911, p. 146; 941, p. 179; 949, p. 250; 991, p. 197; 1021, p. 179; 1028, p. 192; 1076, p. 201). In Wailua.

Jan. 20	10.07	1.88	117	July 16	10.35	1.60	110
Mar. 29	9.96	1.99	102	Nov. 19	10.52	1.43	111
June 4	10.23	1.72	105				

Well 14N (*840, p. 68; 886, p. 89; 911, p. 146; 941, p. 179; 949, p. 250; 991, p. 197; 1021, p. 179; 1028, p. 192; 1076, p. 201). In Koloa Records furnished by Koloa Sugar Co.

Jan. 28	30.77	55.25	41	Aug. 5	a8.02	a78.00	42
Feb. 28	30.77	55.25	41	Sept. 3	28.22	57.80	42
Apr. 19	a10.35	a75.67	42	Oct. 28	30.02	56.00	41
May 6	a10.77	a75.25	41	Dec. 3	29.32	56.70	41
June 10	29.02	a77.00	43	31	30.22	55.80	...
July 2	a 8.22	a77.80	42				

a Pumping.

Artesian head, in feet, and chloride, in parts per million, in the Kekaha Sugar Co's artesian wells, on Kauai, 1947
(Records furnished by Kekaha Sugar Co.)

Well 35 (*840, p. 68; 845, p. 65; 886, p. 89; 911, p. 146; 941, p. 179; 949, p. 251; 991, p. 198; 1021, p. 179; 1028, p. 193; 1076, p. 202). Near Kekaha.

Jan. 15	8.38	+0.56	346	July 15	7.95	+0.13	509
Feb. 14	8.54	+.72	261	Aug. 15	7.77	.05	491
Mar. 15	8.24	+.42	478	Sept. 16	7.82	.00	522
Apr. 16	8.18	+.36	467	Oct.	(a)	(a)	(a)
May 19	7.81	.01	455	Nov.	(a)	(a)	(a)
June 14	7.82	.00	522	Dec. 15	9.50	+1.68	370

a No record for October and November because of broken pipe.

Well 37 (*840, p. 68; 845, p. 65; 886, p. 89; 911, p. 146; 941, p. 179; 949, p. 251; 991, p. 198; 1021, p. 179; 1028, p. 193; 1076, p. 202). 4 miles northwest of Kekaha.

Jan. 15	9.12	0.86	316	July 15	8.23	1.75	400
Feb. 14	8.99	.99	334	Aug. 15	8.96	1.02	291
Mar. 15	9.10	.88	412	Sept. 16	8.60	1.38	273
Apr. 16	8.68	1.30	303	Oct.	8.10	1.88	406
May 19	8.78	1.20	443	Nov.	8.81	1.17	316
June 14	7.93	2.05	430	Dec. 15	9.93	.05	218

No measurements were made in wells 43 and 56 in 1947 because of leaky casing.

PUMPAGE

The following table gives the draft from all large ground-water pumping plants and many individual wells in the Territory of Hawaii. The draft from all other drilled wells entering the main basalt aquifer of Oahu, which are not included, is estimated to be about 30 million gallons a day. The wells represented include irrigation, domestic, and industrial wells. The numbers in parentheses in the records for Oahu and Maui are those used by the Federal Geological Survey.

Total draft during 1947 was 189,876 million gallons. This was 19,890 million gallons more than was reported in 1946. An increase in draft is shown on all the islands. The increase is due to increased pumping by plantations, the construction of new wells for domestic and irrigation use, and the addition to the total for 1947 of draft from high-level water development tunnels. The Honolulu Suburban Water System received 213 million gallons of spring and tunnel water by gravity flow from the Waianae powerhouse in Waianae Valley during the year. This quantity is not included in the table.

Ground-water draft, in millions of gallons, from wells and tunnels in the Territory of Hawaii, 1947
(Data furnished by owners)

Island of Hawaii			Island of Kauai	b/
Hamakua Mill Co.	a 646		County of Kauai	
			Waimea water	93
Hawaiian Agricultural Co.	93		works	
			Hanapepe water	173
Hutchinson Sugar Plantation Co.			works	266
Honuapo well	a 828			
Kaiwaki Sugar Co.			Kekaha Sugar Co.	
Domestic tunnel	54		Well 9	525
Cane cleaning			Wells K-1 to	
plant tunnel	434	488	K-5	350
			Wells M-1 to	
			M-12	1,267
Kohala Sugar Co.			Kekaha pump	366
Hoea pump	1,483		Mana pump	92
Kohala pump	2,244		Walawa pump	471
Waikane pump	559		Well 16	3
Honokane tunnel	1,666	5,952		3,073
Olaa Sugar Co.			Lihue Plantation Co.	
			Domestic shaft	499
U. S. Navy			Kealia wells	a 200
Hilo air station	25		Hanamaulu	a 10
				709
Total	8,854		Olokele Sugar Co.	
			Domestic shaft	228
			Total	4,276

*See footnotes at end of table.

Ground-water draft, in millions of gallons, from wells and tunnels in the Territory of Hawaii, 1947--Continued
(Data furnished by owners)

Island of Lanai		Island of Molokai	
Hawaiian Pineapple Co.		County of Maui	
Tunnels 1 and 2	77	Kamakana well	a 5
Shaft 2	125	California Packing Corp.	
Well 2	86	Kualapuu	8
Total	288	Libby, McNeill, & Libby	
		West Molokai	3
Island of Maui		Other wells	
Hawaiian Commercial and Sugar Co.		Total	
Pump 1 (14) (Kihei)	0	Island of Oahu	
Pump 2 (25)	2,653	Ewa Plantation Co.	
Pump 3 (22)	3,432	Pump 1 (268)	1,131
Pump 4 (24)	1,943	Pump 2 (257)	758
Pump 5 (19)	1,944	Pump 3 (264)	3,824
Pump 6 (18)	4,163	Pump 4 (264)	3,082
Pump 7 (16)	5,031	Pump 5 (259)	2,249
Pump 8 (17)	4,217	Pump 6 (259)	2,885
Pump 3 (15) (Kihei)	5,682	Pump 7 (263)	2,276
Central power plant (20)	2,383	Pump 8 (270)	733
	31,448	Pump 10 (276)	2,550
		Pump 11 (276)	1,576
Maui Agricultural Co.		Pump 12 (276)	1,312
Lower Paia (30)		Pump 13 (276)	33
(pumps 1, 5 and 6)	955	Pump 15 (shaft 3)	3,187
Kaheka (27)		Pump 16 (shaft 3)	3,461
(pumps 3 and 4)	1,971	Pump 20	
Pump 7 (28)	1,588	(dug well 20)	618
Maliko (32)		Pump 21	
(pumps 10 and 11)	486	(dug well 21)	382
Pump 12 (31)	438	Pump 22	
Mill (29)		(dug well 22)	257
(pumps 8 and 13)	3,394	Pump 23	
	8,832	(dug well 23)	2,624
Pioneer Mill Co.		Pump 24 (254)	659
Pump A (9) Lahaina	1,816	Pump 25	349
Pump B (8) Lahaina	385		33,946
Pump C (7) Mill	2,194		
Pump D (3)		Hawaiian Avocado Co.	
Kaanapali	1,728	Pupukea (335-4)	27
Pump F (2)			
Honokowai	1,001	Hawaiian Electric Co.	
Pump G (4) Hahakea	748	Wells and tunnel	
Pump H (3)		(199-1 and shaft 8)	3,854
Kaanapali	2,257	Kaiuaoopu Spring	2,920 e6,774
Pump L (6) Wahikuli	....	
Pump M (5) Kahoma	1,178	Honolulu Board of Water Supply	
Pump N (10) Olowalu	439	Kalihhi station	
Pump O (11) Olowalu	106	(shaft 6)	3,219
Pump P (12)		Waialae station	
Ukumehame	53	(shaft 7)	153
	all, 903	Halawa station	
Maui Pineapple Co.		(shaft 12)	2,619
Kahului cannery (13)	a 95	Kaimuki station (7)	1,654
U. S. Navy		Beretania station	
Puunene air base		(88)	3,137
(shaft 33)		Kalihhi station	
		(128)	1,828 12,610
Total	52,278		

* See footnotes at end of table.

Ground-water draft, in millions of gallons, from wells and tunnels in the Territory of Hawaii, 1947--Continued
(Data furnished by owners)

Island of Oahu--Continued		Island of Oahu--Continued	
Honolulu Suburban Water System		Private wells in Honolulu	h ⁷ ,528
Aiea (190-1-B)	10	U. S. Army	
Pearl City (shaft 9)	118	Schofield	
Pearl City (202)	32	(shaft 4)	1,577
Waipahu (241)	148	Kahuku air base	<u>8</u> 11 1,588
Nanakuli (dug well 16)	14		
Lualualei (shaft 2)	0		
Waialua (well 333)	127	U. S. Navy	
Hauula (394)	19	Aiea (shaft 5)	1,884
Kaaawa (shaft 10)	38	Red Hill (shaft 11)	3,096
Haiku tunnel	707	Barbers Point	
Luluku tunnel	141	(shaft 14)	937
Kahaluu tunnel	312	Aiea wells (187)	0
Waimanalo tunnel	<u>87</u> 1,753	Wahiawa radio	
Kaneohe Hospital	.03	station (330-2)	87
Kahuku Plantation Co.		Moanalua (156)	0
Pump 1 (353)	1,569	Pearl City wells	930
Pump 2 (341)	3,576	Ewa Junction	<u>a</u> 4
Pump 3 (362)	2,397	Lualualei tunnel	143
Pump 5 (352)	2,874	Waiawa pump	<u>246</u> 7,326
Pump 6 (362-1)	817		
Pump 7 (363)	422	Wahiawa Water Co.	
Pump 8 (357)	418	Deep well (330-3)	17
Pump 12 (361)	309		
Pump 14 (338)	<u>a</u> 470	Waialee Training School	
Pump 15 (348)	205	Sunset Beach	<u>a</u> 9
Pump 17 (362)	220	(337-1 & 2)	
Pump 20 (377)	1,171	School pump	<u>a</u> 30
Pump 23 (387)	191	(337-4 & 2)	
Pump 25 (373)	193		39
Pump 26 (392)	253		
Pump 27 (396)	667	Waialua Agricultural Co.	
Mill pump (355)	<u>a</u> 714 16,464	Pump 1 (321)	239
Waialua Section		Pump 2 (322)	4,717
Pump 1 (247)	1,621	Pump 3 (331)	2,286
Pump 2 (249)	1,459	Pump 4 (334)	1,563
Pump 3 (249)	629	Pump 5 (285)	878
Pump 4 (248)	915	Pump 6 (298,	
Pump 4B (tunnel)	354	299, & 301)	187
Pump 5 (274)	1,596	Pump 7 (324)	486
Pump 6 (239)	1,617	Pump 8 (329)	399
Pump 6B (239)	592	Pump 9 (327)	220
Pump 7 (246)	3,075	Pump 10 (323)	1,333
Pump 8 (Waikale Spring)	1,583	Pump 11 (296)	59
Pump 9 (Waiawa Spring)	253	Pump 12 (332)	262
Aiea Section f/		Pump 13 (328)	219
Pump 1 (165)	(d)	Pump 15 (317)	70
Pump 2 (196)	945	Pump 16 (316)	148
Pump 3 (186)	1,327	Mill (319)	<u>3,020</u> 16,086
Pump 4 (197)	1,302		
Pump 5 & 5B (189)	1,212		
Pump 6 (Kalawao Spring)	709	Waianae Co.	(j)
Pump 16 (199-1)	(g)	Waimano home (196-1)	77
Pump 21 & 21B (shaft 13)	741 19,928	California Packing Corp.	
		Kunia well (330-5)	<u>a</u> 2
		Total	124,163
		Grand total	189,876

* See footnotes at end of table.

a Estimated.

b McBryde Sugar Co. not included. Three pumps in Hanapepe Valley and one pump at Lawai Valley pump ground water and surface water. It is not possible to separate the ground-water draft from the surface water.

c Of this, 3,286 million gallons was wasted.

d Out of service.

e Of this, 2,498 million gallons was delivered to Oahu Sugar Co.

f Pumpage under Aiea section of Oahu Sugar Co. was previously reported under Honolulu Plantation Co., which was merged with Oahu Sugar Co. on Jan. 1, 1947.

g Pumpage from Pump 16 (199-1) included with that of Hawaiian Electric Co.

h Includes pumpage from wells belonging to military establishments in Honolulu.

j No pumping during 1947 owing to cessation of sugar planting operations by the Waianae Co.

NEW MEXICO

By C. S. Conover

INTRODUCTION

PROGRAM OF WORK

Investigation of ground-water resources in various areas in New Mexico was continued in 1947 in cooperation with the State engineer of New Mexico. Studies of ground water in New Mexico have been largely confined to areas where it is used for irrigation and have been in progress in certain areas for many years. Reports on these investigations are listed in Part 1, general discussion, for each county.

Measurement of water levels or artesian head in observation wells constitutes an important part of the ground-water program. Water levels in a large number of observation wells are measured in January or February each year when recovery from pumping effects of the previous pumping season has taken place and comparison with water levels in former years can best be made. Measurements are also made in selected groups of observation wells at approximately 2-month intervals in order to note seasonal changes in water levels caused by precipitation and changes in pumping schedules. Estimates of the amount of ground water pumped during the year in each area are made to determine the magnitude of the effect of artificial withdrawal on the yearly changes in water level.

In all, about 2,700 measurements of water level were made during the year in about 1,020 observation wells, exclusive of Hidalgo County, and including about 230 measurements of water level made in 29 of the observation wells that were equipped with water-stage recorders for which daily records are presented.

FLUCTUATIONS OF WATER LEVEL

By the end of 1947 water levels in areas in New Mexico where ground water is used for irrigation reached their lowest levels on record and the largest net annual declines in water level on record occurred in most of the areas of pumping. These record declines in water level exceeded those of previous years because of the increased pumping which resulted from the deficient precipitation, high crop prices, and, in most areas, increased irrigated acreage.

In the 6-year period from January 1942 to January 1948 the water levels in the wells in the Roswell basin pumping from alluvium declined more than 10 feet over the major part of the irrigated area and more than 30 feet in the heavily pumped areas northwest and southwest of Hagerman and Artesia. Net declines in water level in the Roswell basin in 1947 amounted to more than 12 feet over an area of about 3 square miles and more than 4 feet over about 125 square miles whereas a decline of more than 4 feet occurred over only 18 square miles in the preceding year.

Mean annual artesian pressures for 1947 in the deep aquifer in the Roswell basin exceeded previous mean annual lows in five of the six observation wells. In the Artesia well the mean annual pressure for 1947 was 9 feet lower than the previous lowest level which was in 1946.

In the Portales Valley, water levels have declined from January 1942 to January 1947 more than 16 feet over an area of about 3 square miles and more than 6 feet over nearly 80 square miles. Additional net declines in water level occurred in the Portales Valley in 1947 and amounted to more than 2 feet over about 66 square miles and more than 3 feet over about 36 square miles.

In the House area water levels have declined an average of more than 1 foot a year from January 1942 to January 1948 over an area of more than 2 square miles while in 1947 the net decline of 1 foot occurred over an area of about 18 square miles.

Water levels in the Mimbres Valley near Deming have declined an average of more than 1 foot a year from January 1942 to January 1948 over an area of about 95 square miles while in 1947 the net decline of 1 foot occurred over an area of 157 square miles.

In the Grants-Bluewater area declines of water level during the 3 years of pumping of ground water have been quite large. The average net decline of water level in 14 wells was 5.88 feet in 1946 and 3.91 feet in 1947.

WELL-NUMBERING SYSTEM

The system of numbering wells in New Mexico, used in all counties except Hidalgo and Sierra, is based on the common subdivisions in sectionized land, and, by means of it, the well number, in addition to designating the well, locates its position to the nearest 10-acre tract in the land net. The number is divided into four segments by periods. The first segment denotes the township north or south of the New Mexico base line; the second denotes the range east or west of the New Mexico principal meridian; and the third denotes the section. In a county such as Roosevelt, where wells are situated both north and south of the base line, an N is added to the first segment of the well number if the well is north of the base line, but no letter is added if the well is south of the base line. Similarly, in a county where wells are located both east and west of the meridian, an E is added to the second segment of the well number of those wells east of the meridian. In counties in which no confusion can arise, the direction north or south of the base line or east or west of the meridian is not given.

The fourth segment of the number, which consists of three digits, denotes the particular 10-acre tract in which the well is situated. For this purpose, the section is divided into four quarters, numbered 1, 2, 3, and 4, in the normal reading order, for the northwest, northeast, southwest, and southeast quarters, respectively. The first digit of the fourth segment gives the quarter section, which is a tract of 160 acres. Similarly, the quarter section is divided into four 40-acre tracts numbered in the same manner, and the second digit denotes the 40-acre tract. Finally, the 40-acre tract is divided into four 10-acre tracts, and the third digit denotes the 10-acre tract. Thus, well 12.36.24.123 in Lea County is in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 24, T. 12 S., R. 36 E. If a well cannot be located accurately to a 10-acre tract, a zero is used as the third digit, and if it cannot be located accurately within a 40-acre tract, zeros are used for both the second and third digits. If the well cannot be located more

closely than the section, the fourth segment of the well number is omitted. When it becomes possible to more accurately locate a well in whose number zeros have been used, the proper digit or digits are substituted for the zeros. In Water-Supply Paper 911 and earlier reports the digits corresponding to unknown 10-acre and 40-acre tracts were simply omitted, but this practice caused some confusion in cataloging the wells. In Water-Supply Paper 941 and subsequent reports, wells the last segment of whose numbers end in one or two zeros correspond to wells whose numbers in earlier reports are the same except for the omission of the last one or two zeros. Letters a, b, c, . . . are added to the last segment to designate the second, third, fourth and succeeding wells in the same 10-acre tract.

The following diagram shows the method of numbering the tracts within a section.

111 | 112	121 | 122	211 | 212	221 | 222
--(1)--	--(2)--	--(1)--	--(2)--
113 | 114	123 | 124	213 | 214	223 | 224
	[1]		[2]
131 | 132	141 | 142	231 | 232	241 | 242
--(3)--	--(4)--	--(3)--	--(4)--
133 | 134	143 | 144	233 | 234	243 | 244
311 | 312	321 | 322	411 | 412	421 | 422
--(1)--	--(2)--	--(1)--	--(2)--
313 | 314	323 | 324	413 | 414	423 | 424
	[3]		[4]
331 | 332	341 | 342	431 | 432	441 | 442
--(3)--	--(4)--	--(3)--	--(4)--
333 | 334	343 | 344	433 | 434	443 | 444

WELL DESCRIPTIONS, RECORDS OF ARTESIAN HEAD, AND WATER-LEVEL MEASUREMENTS

General discussion

Measurements for most of the observation wells in New Mexico are listed under the counties in which the wells are situated. Two groups of measurements--those of artesian head in the Roswell artesian basin and those of water level in the artesian-intake area of that basin--are listed under the common heading "Chaves and Eddy Counties (Roswell Basin)."

The data for Chaves, Eddy, Lea, Luna, Quay, Roosevelt, Sierra, and Torrance Counties are presented in five parts as outlined below. Part 1 for Eddy County covers only areas in Eddy County other than the Roswell basin which is included in Part 1 for Chaves County. The five parts are as follows:

Part 1. General discussion.

Part 2. Water levels in January or February 1947, and highest and lowest recorded water levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders.

Part 5. Miscellaneous data concerning observation wells.

Part 1 for each county gives the number of observation wells, the number of measurements made on the wells during the year, the program of work, the amount of precipitation, the amount of pumpage, and a general discussion of the fluctuations of water level during the year. Also given is a list of water-supply papers in which records of water levels in observation wells in the particular county have been previously published. The descriptions of wells are, in general, given in the water-supply paper covering the year in which the record begins (next to last column in Part 2). In the case of a few wells whose records began in the latter part of a year, the descriptions have been published in the water-supply paper for the year previous to that given in Part 2 as the year when record began. Also, in a very few cases, the description of a well was published in the

water-supply paper for the year succeeding that given in Part 2 for the year when record began.

Part 2 lists the water levels in January or February 1947 for all observation wells, the change since the measurements of the preceding January, and lists for comparison the highest and lowest recorded levels during January in past years, along with the length of record. For years in which January readings were not made, February readings were used if available. If any reading is used other than January or February, a footnote is added stating the month.

The lowest recorded level as published for a well is a nonpumping level, that is, a static level, as far as could be determined, except in a few instances where windmills were pumping and the water level was not lowered appreciably by the pumping. The year of beginning of record is considered as the first year in which a January or February measurement was made. The years of missing record are succeeding years in which a January or February measurement was not made or when the measurement made was affected by pumping to the extent that it would be the lowest recorded level. If a pumping measurement is recorded for the present year lower than a previous low, then the present year will not be reported as missing until the following year. In some cases a previous year will be reported as missing due to a low reading as a result of the effects of pumping, yet a yearly change will be shown. For wells having water-stage recorders, the highest and lowest reported levels are taken from the recorder record for the month of January when available, except in Torrance and Valencia Counties where the levels for February are used. However, for the wells equipped with water-stage recorders, the measurement reported for the present year and the yearly change are taken from the tape measurements in order to keep the records of these wells comparable with those of the other observation wells. The lowest reported level when taken from recorder records is the lowest of the highest daily water levels.

In Part 2 the years are all in the present century and the "19" of the year and also the apostrophe commonly used to indicate omission of the "19" are omitted for the sake of brevity. The year 1942, for instance, is shown simply as 42.

This part of the report shows in clear form the current and past changes in the amount of water stored underground in the vicinity of the well. It presents the most critical data concerning the pumping district, that is, the current status of the ground-water reserve.

Part 3 gives the data for wells measured at fixed periods, generally bimonthly, throughout the year. The readings for January are also given in Part 2. Only the last name of the owner is given in Part 3, but the full name may be found in Part 2. These records show the seasonal trend of water levels in the area.

Part 4 presents the data for the wells on which automatic water-stage recorders are maintained. These show the day-to-day fluctuation of typical wells. In some wells they serve to show the effects of precipitation in recharging the ground-water reservoir, in others the effects of transpiration, and in others the effects of nearby pumping.

Part 5 lists miscellaneous data concerning the observation wells, such as changes in ownership, descriptions of new wells and measuring points, and a few miscellaneous water-level records that do not conform to the other tables. Reference to Part 5 and to other parts is given in column 3 in Part 2.

In the following data on New Mexico, except for Hidalgo County, eight standard footnotes have been employed as follows:

- a Pumping.
- b Pumping recently.
- c Nearby well pumping.
- d Nearby well pumping recently.
- e Dry at depth given.
- f From recorder chart.
- g Estimated.
- h Tape measurement.

Records of mean monthly and mean annual artesian head in the Roswell basin are expressed as water level in feet above mean sea level. All other measurements are given in feet below a precisely established land-surface datum which approximates closely the land surface at the well. Where measurements are made from a measuring point from which the tape cannot hang vertically, the correction to apply to the tape reading to reduce it to the land-surface datum is stated in the description of the measuring point; whereas, if the tape hangs vertically throughout the whole length, the distance of the measuring point above the land-surface datum is stated in its description.

CHAVES AND EDDY COUNTIES (ROSWELL BASIN)

Part 1. General discussion

The program of maintaining records of water level and artesian head in the Roswell basin was continued in 1947 in cooperation with the State engineer of New Mexico. Most of the Roswell basin is in Chaves County, but a considerable part lies in northern Eddy County.

The first intensive investigation by the Federal Geological Survey of the artesian-water resources of the Roswell artesian basin was begun by A. G. Fiedler and S. S. Nye in 1925, and an intensive investigation of the shallow-water resources was begun by A. M. Morgan in 1937. The findings of these investigations have been published in Geological Survey Water-Supply Paper 639 and in the 7th to 13th biennial reports of the State engineer of New Mexico. A comprehensive report of the hydrology and agricultural development of the Pecos Valley has been published by the National Resources Planning Board as part 10 of the Regional Planning series, "The Pecos River Joint Investigation in the Pecos River Basin in New Mexico and Texas," 1942. Data on artesian head and shallow-water levels have been published in past years in Geological Survey water-supply papers as follows:

Year of record	Water-Supply Paper	Page numbers Artesian head	Page numbers Shallow-water levels
1925-1935	777	109-114	.....
1936	817	195-197	.....
1937	840	252-254	.....
1938	845	279-282	.....
1926-1938	845	.....	282-300
1939	886	376-378	378-422
1940	911	152-154	154-174
1941	941	186-188	190-212
1942	949	259-262	264-293
1943	991	206-209	210-244
1944	1021	188-195	199-232
1945	1028	207-216	216-240
1946	1076	217-225	225-235

Shallow water-level measurements from 1926 to 1938, Water-Supply Paper 845, for Chaves and Eddy Counties are given in feet below land-surface datum and not below measuring point as captioned.

Artesian wells

The continuous water-stage recorders on the six artesian observation wells reported in previous years were kept in operation in 1947 and the records obtained were used to compute the mean monthly and mean annual artesian heads, as has been done in previous years. The mean monthly head was computed by averaging the daily maximum and minimum heads throughout

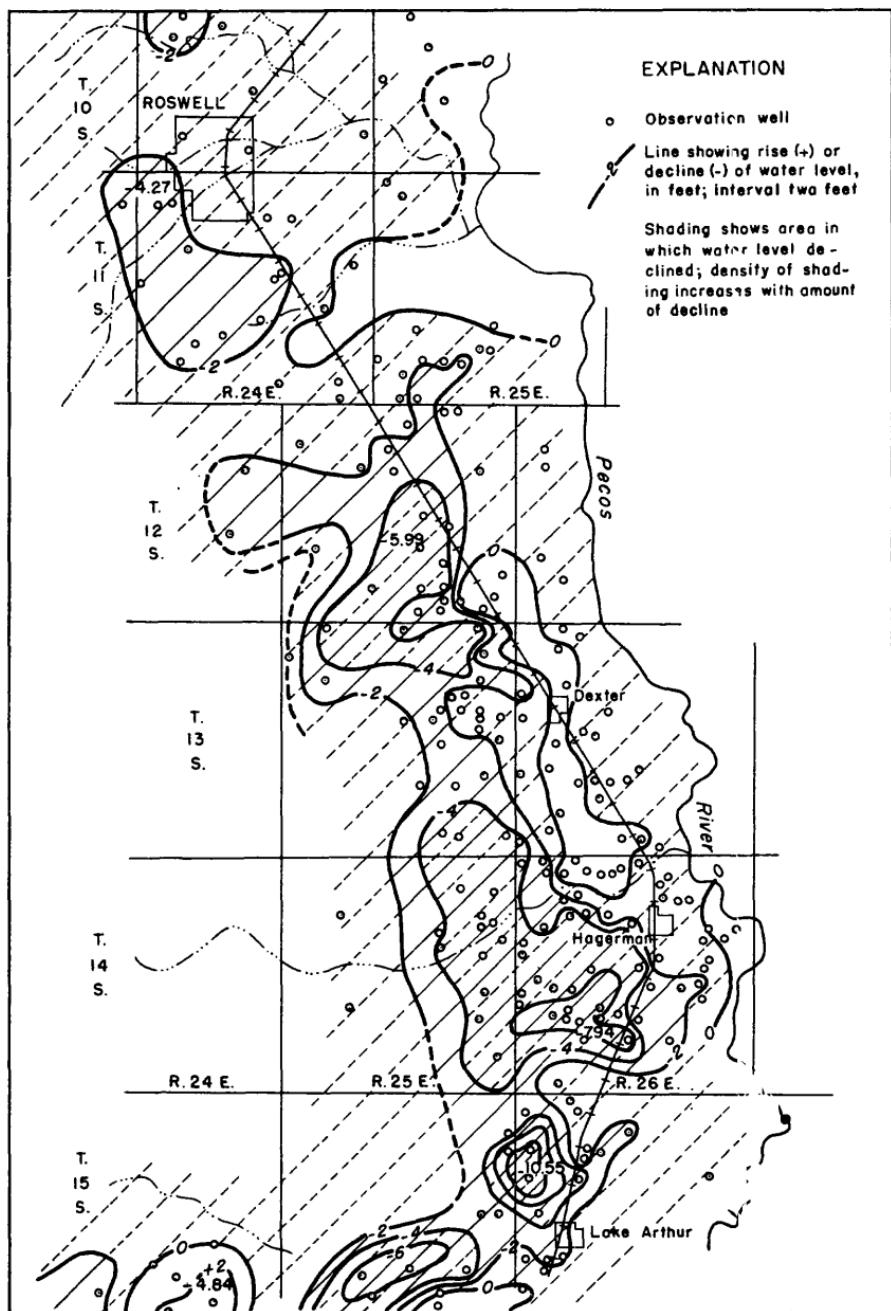


Figure 12.--Map showing change in ground-water level in northern part of Roswell Basin, Chaves County, N. Mex., from January or February 1947 to January or February 1948.

the month. The mean annual head is the average of the mean monthly heads. Values for missing days were estimated by inspection of the recorder charts where feasible, otherwise they were obtained by simple interpolation. A day of record is considered as one in which both a maximum and a minimum water-level reading were recorded or estimated. In the accompanying full-page table the mean monthly and mean annual water levels are given in feet above mean sea level in conformity with previously published reports but the daily maximum water levels are given in feet below land-surface datum.

Artesian-intake area wells

Measurements of water levels in the intake area of the Roswell artesian basin were continued in 1947 to show the change in ground-water storage and the change in recharge to the artesian aquifer. A total of 35 measurements was made during the year on the artesian-intake wells, all of which, except those in September, were made by U. N. Benge. Water levels in the intake area respond to changes in the rate of draft on the aquifer by the artesian wells many miles to the east as well as to changes in storage and rate of recharge.

Shallow wells

In order to show the yearly change in the shallow-water level caused by withdrawals for irrigation and additions by recharge, water levels are measured in a large number of wells once a year usually in January. Water levels were measured in 395 wells in January or February 1947, most of which had been measured in January 1946. In order to show the trend of the water table throughout the year, water levels were measured in about 47 of the wells at bimonthly intervals and water-stage recorders were maintained intermittently on 6 of the wells. A total of 681 measurements was made during the year on the shallow wells including 216 measurements made on the bimonthly observation wells and about 70 made on the recorder wells. Of the observation wells 271 are in Chaves County and 124 in Eddy County. All measurements were made by U. N. Benge, except those in September which were made by C. S. Conover, R. L. Griggs, and R. S. Jones.

Precipitation and pumpage

Variation in the amount of precipitation in the Roswell basin affects the water levels by changing the amount of pumping necessary for irrigation of growing crops and the amount of water that recharges the ground-water body, particularly that in the intake area of the artesian aquifer to the west. Years of deficient precipitation, such as 1947, are characterized by large declines in water levels, both during the pumping season and annually, while years of excessive precipitation, such as 1941, are characterized by net annual rises in water level.

The precipitation for 1947, as reported by the U. S. Weather Bureau, was below normal at all stations in the Roswell basin and less than in the preceding year. The precipitation at Roswell was 55 percent of normal, at Artesia, 40 percent of normal, and at Carlsbad, 45 percent of normal. Precipitation during the main part of the growing season, April through September, was particularly deficient and amounted to 43 percent of normal at Roswell, 34 percent of normal at Artesia, and only 26 percent of normal at Carlsbad. The deficiency of precipitation in 1947 was about 38 percent greater than during 1946. Only in January was there above-normal precipitation at all stations in 1947.

Precipitation and departures from normal, in inches, at stations in Roswell basin and vicinity, 1947

Month	Roswell		Hagerman		Artesia		Carlsbad	
	Precip- itation	Depart- ture	Precip- itation	Depart- ture	Precip- itation	Depart- ture	Precip- itation	Depart- ture
Jan.	0.81	0.28	....	....	0.68	+0.32	0.77	+0.43
Feb.	T	-.59	....	....	.00	-.51	T	-.39
Mar.	.35	-.39	....	....	.32	-.32	.63	+.08
Apr.	.48	-.41	.45	-.40	.25	-.73	.24	-.56
May	1.71	+.62	1.89	-.20	1.10	-.37	.66	-.53
June	.56	-1.11	.46	-1.51	.10	-1.18	.04	-1.59
July	.13	-2.13	.51	-1.08	.15	-1.82	.13	-2.02
Aug.	1.55	-.60	2.02	+.24	1.09	-.44	1.13	-.67
Sept.	.39	-1.72	....	....	.35	-1.36	.22	-1.69
Oct.	.52	-.90	....	....	.32	-.92	.97	-.44
Nov.	.93	+.08	....	....	.50	-.07	.61	+.08
Dec.	.83	+.17	....	....	.20	-.38	.56	-.02
Total	8.26	-6.70	....	....	5.06	-7.78	5.96	-7.32
Apr.- Sept.	4.82	-5.35	....	....	3.04	-5.90	2.42	-7.06

T - Trace.

The deficient precipitation during 1947 caused a large increase in unit use of ground water for irrigation in the Roswell basin. A preliminary study of the records of power and fuel used in 1947 for 672 wells,

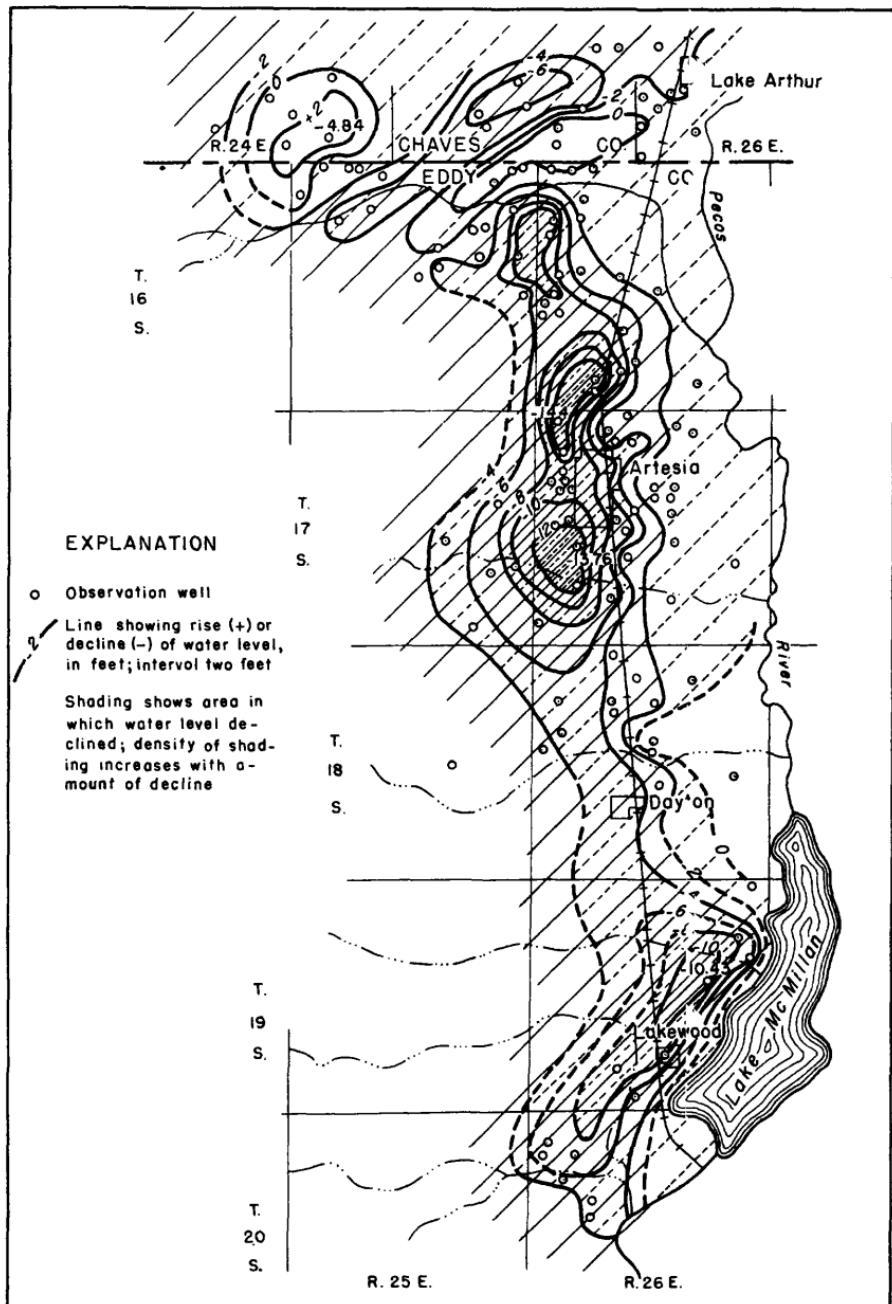


Figure 13.--Map showing change in ground-water level in southern part of Roswell Basin, Chaves and Eddy Counties, N. Mex., from January 1947 to January 1948.

for which comparable records were also available in 1946, indicates that, on the average, probably 12 percent more water was pumped in 1947 than in 1946. It is probable, therefore, that about 224,000 acre-feet of artesian water and about 129,000 acre-feet of shallow water was used for irrigation in 1947. The large increase in pumpage for irrigation is apparently, in part, the result of the deficient precipitation. Also, a part of the increase may be due to a slight increase in actual irrigated acreage resulting from irrigation of nearly all of the land having a water permit because of high crop prices. In other words, very little permit land was fallow.

In the southern part of the Roswell basin the pumpage of ground water, on the basis of power records, was seemingly from 20 to 30 percent greater for comparable wells in 1947 than in 1946. This large increase of pumpage in the southern part of the basin apparently resulted from an increase of irrigated acreage and an increase in the percentage of crop land devoted to alfalfa as well as from the deficient precipitation. Mr. E. G. Minton, Jr., artesian well supervisor, estimates about 10 percent of the irrigated land in the southern part of the basin has no water right.

Changes in artesian head and water level

Artesian wells

The mean monthly water levels in the six artesian wells equipped with water-stage recorders were higher in January 1947 than in January 1946 and also somewhat higher than the average for the period of record for that month. This was mainly the result of the early ending of the pumping season in 1946 which gave a comparatively long time for recovery from the pumping effects of that pumping season.

However, water levels in the six artesian wells began declining in February as a result of pumping for irrigation. The decline continued, with the exception of May, until the low levels for the year were reached in August. In spite of the comparatively high artesian head in January, the amount of pumping was so large in the southern part of the basin that new mean monthly lows were recorded in the three southern artesian recorder wells, Orchard Park, Greenfield, and Artesia. The mean monthly level for August 1947 in the Artesia well was 13 feet lower than the previous monthly low of August 1946 and nearly 29 feet lower than the average August level for that well.

Recovery of water levels after the end of the pumping season was less than the decline during the pumping season with the result that the mean annual levels for 1947 were below average for all of the wells and lower than the mean annual levels of 1946. Mean annual water levels for 1947 were less than previous mean annual lows in five of the six artesian observation wells. In the Artesia well the mean annual level for 1947 was 9 feet lower than the previous mean annual low of 1946 and 19 feet below average for the period of record. In the comparison of mean annual levels, it is apparent that a greater decline of head occurred in 1947 in the three southern wells than in 1946.

The difference in head between the seasonal high and low levels for the artesian wells for the last few years has steadily increased; in other words, the drawdown during the pumping season is getting progressively greater year by year. The use of artesian water has likewise increased annually during the last few years and such an increase is probably responsible in large part for the lowering summer levels, which may also, in part, be due to installation of pumps on wells that previously had been allowed to flow naturally. Installation of a pump on a flowing well lowers the head not only in that well but in nearby wells so that, in consequence, nearby wells decrease in flow. It is then necessary to install pumps on the nearby wells which in turn lowers the head in additional nearby wells and so on ad infinitum until most of the wells will necessarily be equipped with pumps.

Departure from average since beginning of record and change since 1946 of mean monthly and mean annual water levels in artesian wells in 1947, in feet

Name	Berrendo	Berrendo	Smith	Mountain View	Orchard Park	Greenfield	Artesia
	10.24.	10.24.	21.212	11.24. 29.242	12.25. 25.110	13.25. 27.211	18.26. 5.350
Ave.	Ave.	Ave.	Ave.	Ave.	Ave.	Ave.	Ave.
1947	1946-47	1947	1946-47	1947	1946-47	1947	1946-47
Jan.	+0.4	+0.12	-0.6	-0.02	-0.9	+0.43	+10.0
Feb.	+.6	+.05	-.7	-.58	-.1.2	-.47	+5.78
Mar.	-.4	-.31	-1.4	-.35	-.2.0	-.47	-4.34
Apr.	-1.2	-.57	-2.2	-.36	-.3.0	-.19	-19.1
May	-.2	+.74	-.1.1	+.1.23	-.9	+.2.03	-.4.7
June	-2.0	-.52	-1.8	-.41	-.2.9	+.62	-.6.24
July	-3.0	-1.51	-3.5	-1.78	-.4.3	-.1.25	-.19.3
Aug.	-3.3	-.05	-2.2	+.48	-.4.2	-.08	-.13.84
Sept.	-3.5	-1.60	-3.4	-2.27	-.5.1	-.2.90	-.27.6
Oct.	-3.6	-3.51	-4.2	-3.66	-.5.7	-.4.74	-.19.5
Nov.	-2.2	-1.89	-3.2	-2.45	-.4.2	-.3.15	-.12.68
Dec.	-1.9	-1.84	-2.6	-1.83	-.3.3	-2.18	-.4.0
Year	-1.7	-.92	-2.8	-1.00	-.3.1	-1.03	-11.3
Beginning of record	June 1926	June 1940	July 1940	August 1925	May 1940	April 1931	April 1931

Mean monthly and annual water levels in artesian wells in 1947 and highest and lowest mean sea level monthly water levels, in feet above mean sea level

Name	Berrendo	Berrendo-Smith	Mountain View	Orchard Park	Greenfield	Artesia
Location number	10.24.9.330	10.24.21.212	11.24.29.242	12.25.23.110	13.25.27.211	18.26.5.330
Days of record	Days of record	Days of record	Days of record	Days of record	Days of record	Days of record
1947	1947	1947	1947	1947	1947	1947
Jan.	24	3570.91	31	3570.96	31	3569.30
Feb.	28	3570.59	28	3570.36	28	3568.57
Mar.	31	3568.89	31	3567.95	31	3565.61
Apr.	30	3566.31	30	3564.02	30	3560.73
May	31	3567.28	31	3566.23	31	3563.12
June	30	3565.24	30	3563.19	30	3560.14
July	31	3563.13	31	3560.84	31	3557.14
Aug.	31	3562.7	31	3560.36	31	3554.6
Sept.	25	3563.47	30	3561.86	30	3556.26
Oct.	31	3565.12	31	3564.60	31	3560.26
Nov.	30	3567.38	30	3567.03	30	3563.95
Dec.	31	3568.42	31	3568.37	31	3566.05
Mean annual:	3566.58	365	3565.48	365	3562.17	326
Mean annual:	3566.58	Water level	Water level	Water level	Water level	Water level
Highest	3571.8	1942	3571.0	1942	3569.6	1942
Lowest	3563.0	1947	3565.48	1947	3562.18	1947
Mean monthly:	Water level	Date	Water level	Date	Water level	Water level
Highest	Dec. '42 3571.3	Jan. '43 3571.4	Jan. '43 3573.7	Jan. '42 3564.0	Jan. '42 3517.5	1942 3593.9
Lowest	Aug. '40 3560.0	Aug. '40 3557.9	Aug. '40 3553.4	July '47 3482.99	Aug. '47 3462.69	Aug. '47 3542.28
Beginning of record	June 1926	June 1940	July 1940	August 1925	May 1940	April 1931

g A few days estimated.

Records of artesian head

10.24.9.330. Berrendo well. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Jan. 29, 14.85; Aug. 16, 25.27. Maximum recorded daily fluctuation, 1947: Aug. 4, 3.13 feet.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	15.43	15.05	15.36	19.02	18.83	19.13	20.50	23.37	21.33	21.80	19.36	18.05
2	15.43	14.95	15.34	19.24	18.95	19.04	20.65	22.93	22.45	22.73	19.25	18.03
3	15.47	14.92	15.33	19.32	19.12	19.47	20.68	22.40	22.09	22.38	19.22	18.01
4	15.43	15.00	15.34	19.64	18.92	19.63	20.84	22.22	22.49	23.04	19.20	17.99
5	15.39	14.92	15.40	18.74	18.76	18.90	20.67	22.74	22.65	22.02	19.12	17.95
6	15.31	14.90	15.44	18.85	18.79	19.11	20.91	22.82	22.33	21.91	19.09	17.90
7	15.35	14.94	15.39	18.60	19.00	19.48	20.93	23.85	21.75	22.48	19.06	17.88
8	15.34	14.99	15.40	19.10	19.04	19.44	21.30	23.93	21.65	21.40	18.97	17.84
9	15.30	15.00	15.50	18.95	18.81	19.70	21.64	23.80	21.68	21.00	18.92	17.82
10	15.24	14.97	15.53	18.92	18.69	19.65	22.53	23.85	21.56	20.82	18.90	17.79
11	15.20	14.97	15.77	19.10	19.29	19.75	22.57	23.63	22.09	20.68	18.92	17.75
12	15.16	15.07	15.93	18.97	19.22	19.92	22.67	23.87	21.62	20.61	18.88	17.74
13	15.09	15.09	15.87	18.79	19.10	20.00	22.40	24.05	21.50	20.35	18.77	17.67
14	15.11	15.10	16.04	18.57	18.23	20.00	22.20	24.04	21.37	20.28	18.72	17.60
15	15.13	15.09	16.63	18.42	18.07	20.12	22.62	24.39	21.29	20.24	18.68	17.63
16	.....	15.05	16.25	18.79	17.89	19.91	22.68	25.27	21.71	20.17	18.64	17.60
17	.....	15.02	16.17	18.95	17.76	20.16	22.80	23.12	21.84	20.04	18.60	17.52
18	.....	15.15	16.85	18.96	17.64	20.02	22.90	22.83	21.75	20.00	18.53	17.55
19	.....	15.18	17.01	18.85	17.55	20.15	23.02	22.87	21.87	19.90	18.49	17.55
20	.....	15.28	16.57	18.73	17.50	20.19	22.82	23.46	22.72	19.86	18.44	17.55
21	.....	15.31	16.43	18.57	17.45	20.12	22.77	23.31	22.65	19.82	18.42	17.45
22	15.05	15.32	16.52	18.63	17.40	20.07	22.32	23.50	22.82	19.83	18.39	17.45
23	15.00	15.30	16.55	18.74	17.41	19.90	22.03	23.74	22.93	19.82	18.33	17.47
24	14.99	15.27	16.61	18.81	17.39	20.04	22.05	23.18	23.03	19.73	18.29	17.45
25	14.99	15.32	17.00	18.85	17.40	20.20	22.17	23.03	.....	19.79	18.27	17.42
26	14.94	15.30	17.12	18.71	17.34	20.20	22.09	22.05	.....	19.72	18.23	17.40
27	14.93	15.25	17.32	18.60	17.40	20.26	22.07	21.92	.....	19.63	18.20	17.37
28	14.87	15.23	17.58	18.48	17.50	20.28	22.38	22.12	22.75	19.58	18.18	17.30
29	14.85	17.75	18.59	18.80	20.39	22.95	22.03	22.65	19.49	18.16	17.27	.....
30	14.92	.....	17.90	16.69	19.02	20.28	23.07	21.88	21.98	19.45	18.10	17.25
31	14.95	.....	17.83	.....	19.10	.....	23.33	21.43	.....	19.44	.....	17.24

g Estimated.

10.24.21.212. Berrendo-Smith well. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Jan. 29, 9.33; Aug. 16, 21.17. Maximum recorded daily fluctuation, 1947: July 28, 4.79 feet.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.93	9.71	10.40	14.50	15.12	14.24	16.77	19.80	16.80	17.82	14.32	12.68
2	9.92	9.60	10.25	14.81	15.25	14.05	17.41	19.86	17.26	17.82	14.17	12.66
3	9.97	9.53	10.20	15.20	15.53	15.16	17.46	18.78	17.25	17.27	14.11	12.65
4	9.91	9.68	10.36	15.38	15.00	15.04	17.36	18.55	17.69	17.82	14.13	12.63
5	9.92	9.62	10.46	15.30	14.75	15.13	17.18	20.11	17.72	17.06	14.12	12.56
6	9.83	9.64	10.45	15.15	14.98	15.73	17.25	19.72	18.01	16.95	14.02	12.49
7	9.87	9.67	10.35	14.70	15.30	16.06	17.30	20.35	17.87	16.97	13.94	12.46
8	9.82	9.75	10.40	15.86	15.03	15.77	18.37	20.20	17.68	16.92	13.82	12.38
9	9.75	9.77	10.52	15.53	14.42	15.40	18.95	20.00	17.82	16.49	13.74	12.35
10	9.65	9.72	10.49	15.42	14.30	16.51	18.72	19.52	17.73	16.75	13.70	12.35
11	9.61	9.82	11.10	15.80	13.63	16.62	19.07	19.08	17.93	16.12	13.84	12.26
12	9.54	9.97	11.40	15.22	13.54	16.87	18.98	20.20	18.26	15.98	13.78	12.24
13	9.50	10.06	11.25	14.90	13.55	16.81	18.73	20.62	18.07	15.59	13.58	12.18
14	9.56	10.14	11.59	14.84	13.42	16.63	18.40	20.05	17.71	15.47	13.48	12.08
15	9.57	10.13	11.45	14.29	13.34	16.47	18.70	20.53	17.48	15.41	13.47	12.15
16	9.73	10.10	11.75	15.28	13.16	16.19	18.38	21.17	18.60	15.24	13.40	12.13
17	9.68	9.99	11.66	15.55	12.94	16.65	18.92	19.15	18.73	15.15	13.35	12.11
18	9.54	10.27	11.56	15.60	12.84	16.33	18.99	18.73	18.17	15.14	13.25	12.08
19	9.45	10.20	11.85	15.13	12.72	16.55	19.08	18.94	18.72	15.07	13.20	12.15
20	9.45	10.38	12.02	14.86	12.68	16.32	18.53	18.82	18.44	15.00	13.15	12.18

10.24.21.212--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
21	9.57	10.40	12.60	14.59	12.69	16.39	18.68	18.84	17.89	14.99	13.14	11.99
22	9.50	10.33	12.83	14.93	12.65	15.99	19.07	19.05	18.34	15.06	13.10	11.93
23	9.47	10.37	12.52	15.29	12.74	15.80	18.78	19.02	18.82	15.00	13.01	12.10
24	9.45	10.28	12.37	15.47	12.71	16.20	18.69	18.39	18.36	14.94	12.94	12.07
25	9.45	10.41	13.40	15.05	12.64	16.42	18.92	18.16	18.65	15.02	12.90	12.00
26	9.42	10.34	13.46	15.03	12.57	16.38	18.53	17.57	18.60	14.79	12.88	11.93
27	9.45	10.30	13.75	14.93	12.92	16.26	18.15	17.43	18.59	14.72	12.82	11.93
28	9.38	10.28	14.07	14.45	13.31	16.50	17.83	17.64	17.89	14.70	12.84	11.88
29	9.33		14.30	14.85	14.09	16.53	18.80	17.56	17.72	14.51	12.83	11.81
30	9.58		14.45	14.86	14.43	16.25	19.03	17.53	17.98	14.38	12.74	11.80
31	9.58		14.06		14.52		19.50	16.98		14.40		11.76

11.24.29.242. Mountain View well. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Jan. 29, 57.33; Aug. 9, 73.15. Maximum recorded daily fluctuation, 1947: July 28, 1.61 feet.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	58.20	57.78	59.24	64.82	66.11	63.97	67.73	72.02	70.13	69.32	64.67	61.79
2	58.23	57.60	58.81	65.20	66.30	63.88	68.83	72.20	70.50	68.32	64.44	61.79
3	58.31	57.53	58.76	65.52	66.34	64.78	68.65	71.79	70.63	68.23	64.39	61.74
4	58.21	57.86	59.09	65.88	65.60	65.27	68.54	71.50	70.98	68.97	64.29	61.70
5	58.14	57.79	59.35	65.89	65.40	65.85	68.23	72.13	71.35	68.46	64.08	61.69
6	57.98	57.80	59.40	65.87	65.74	66.18	68.23	72.52	71.56	68.31	63.99	61.53
7	58.04	57.94	59.28	65.51	65.65	66.50	68.03	72.75	70.98	68.42	63.90	61.47
8	58.05	58.10	59.36	66.40	65.65	66.27	68.80	72.96	70.62	68.33	63.67	61.40
9	58.00	58.05	59.44	66.55	64.68	66.06	69.27	73.15	70.53	68.15	63.52	61.38
10	57.85	57.99	59.49	66.31	64.17	66.64	69.23	72.35	70.99	67.87	63.48	61.39
11	57.78	58.25	59.53	66.68	63.66	67.04	69.57	72.07	71.24	67.57	63.50	61.27
12	57.69	58.54	59.86	66.35	63.59	67.32	69.62	72.71	71.20	67.13	63.40	61.28
13	57.62	58.51	60.00	65.94	63.53	67.42	69.05	73.04	70.96	68.88	63.23	61.17
14	57.77	58.60	60.15	65.47	63.40	67.38	68.82	72.89	70.47	68.62	63.12	61.00
15	57.80	58.61	60.39	65.16	63.37	66.80	69.47	72.89	70.22	68.40	63.13	61.06
16	57.97	58.49	60.36	65.95	63.10	66.62	69.98	72.95	70.47	68.26	63.02	61.03
17	57.89	58.47	60.35	66.15	62.83	67.17	69.81	72.13	70.82	68.12	62.95	61.00
18	57.69	58.69	60.79	66.13	62.56	67.31	70.00	71.65	70.78	68.96	62.85	60.91
19	57.55	58.75	60.98	66.19	62.40	67.25	69.97	71.78	70.69	68.64	62.75	60.88
20	57.60	58.83	61.73	65.71	62.33	67.50	69.18	71.77	70.62	68.60	62.70	60.85
21	57.79	58.95	62.18	65.52	62.33	67.53	68.98	71.75	70.26	68.63	62.69	60.71
22	57.70	59.00	62.64	66.12	62.22	66.70	69.85	71.65	70.15	68.59	62.50	60.71
23	57.60	59.03	62.52	66.34	62.17	66.52	70.00	71.90	70.43	68.55	62.39	60.73
24	57.56	59.00	62.49	66.48	62.21	66.97	70.25	71.05	70.53	68.54	62.37	60.67
25	57.55	59.20	63.35	66.39	62.11	67.19	70.62	70.80	70.47	68.51	62.29	60.66
26	57.48	59.17	63.71	66.22	62.07	67.17	70.89	70.80	70.44	68.24	62.21	60.59
27	57.50	58.98	64.13	65.62	62.46	67.35	70.25	70.62	70.33	68.17	62.15	60.57
28	57.41	58.93	64.30	65.48	62.68	67.37	69.94	70.50	69.56	68.13	62.11	60.42
29	57.33			64.66	65.86	63.41	67.13	70.69	70.63	69.29	64.91	62.04
30	57.62			64.38	65.94	63.68	67.02	71.23	70.68	69.64	64.80	61.87
31	57.60			64.15		64.05		71.74	70.35		64.85	

12.25.23.110. Orchard Park well. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Jan. 20, 1.38; Aug. 8, 69.26. Maximum recorded daily fluctuation, 1947: May 9, 14.02 feet.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.47	8.59	27.37	52.23	49.78	31.43	55.85	67.00	50.50	47.18	20.26	9.91
2	3.04	8.93	26.30	55.56	48.15	31.16	57.08	67.03	53.50	42.15	19.10	10.03
3	2.68	8.90	25.40	55.98	45.66	.....	58.29	66.37	55.25	41.72	18.37	10.38
4	2.46	11.41	27.77	55.12	45.85	.....	57.17	65.46	55.03	40.79	17.90	10.08
5	2.17	12.05	27.95	54.49	50.42	.....	57.74	66.65	.....	39.70	16.95	10.20
6	1.98	12.22	25.62	52.36	49.90	.....	58.75	67.75	.....	39.95	16.49	9.66

g Estimated.

12.25.23.110--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
7	2.46	13.72	24.44	50.21	49.50	49.44	58.22	67.75	....	38.73	15.57	9.50
8	2.88	14.60	27.67	50.83	48.91	49.67	60.06	69.26	51.95	38.30	14.75	9.18
9	2.40	14.56	29.30	49.95	36.35	46.31	60.78	68.93	48.12	37.28	14.20	8.92
10	2.35	14.24	28.81	49.35	32.63	50.75	60.98	66.97	48.34	34.62	14.08	9.00
11	2.60	16.00	30.49	52.17	30.46	52.03	61.31	65.93	47.98	31.68	14.22	8.91
12	2.36	18.23	31.73	47.63	29.85	50.69	61.98	....	47.50	28.72	14.19	8.29
13	2.01	19.39	33.12	44.88	31.28	51.95	61.65	....	47.01	27.43	13.77	7.74
14	2.24	20.15	33.03	43.27	29.45	52.22	61.07	65.31	44.75	26.82	13.41	7.23
15	1.93	19.64	32.73	41.85	28.59	49.81	61.24	65.67	43.52	26.31	13.28	7.91
16	1.83	18.55	32.58	46.35	26.37	48.42	62.70	65.55	45.00	24.86	13.13	7.65
17	1.61	18.81	33.82	48.98	25.17	50.93	64.03	59.90	43.28	23.80	12.76	6.97
18	2.05	19.98	37.91	49.66	24.55	49.10	....	57.92	42.23	23.70	12.40	6.78
19	1.50	20.95	40.28	48.77	24.69	51.45	....	....	41.59	22.88	11.91	....
20	1.38	21.97	42.74	45.12	24.91	52.52	63.35	....	43.13	22.17	11.50	....
21	2.04	22.77	45.42	44.43	25.49	54.14	61.95	....	42.53	22.56	11.48	5.90
22	3.32	23.30	45.58	47.45	27.55	52.47	63.42	....	42.57	22.93	11.43	5.82
23	2.80	21.25	43.32	50.65	29.99	51.50	64.25	....	....	22.58	10.93	5.60
24	3.90	21.10	43.63	50.78	28.85	54.57	65.88	....	....	21.77	10.50	5.44
25	3.71	22.93	47.06	50.84	28.69	....	66.54	57.90	....	21.07	10.24	5.14
26	3.17	23.92	51.30	50.92	27.80	....	66.92	....	....	20.53	10.05	5.05
27	3.36	24.50	52.57	51.95	27.20	55.72	66.53	57.62	....	20.43	10.08	....
28	4.14	25.63	53.35	53.71	27.69	55.98	65.65	56.17	45.23	....	10.26	5.37
29	5.63					51.25	52.06	29.29	52.47	68.13	56.47	44.47
30	5.56					51.57	49.78	29.59	52.43	67.75	54.25	44.27
31	6.99					50.06	31.63	66.93	52.30	....	....	4.80

g Estimated.

13.25.27.211. Greenfield well. Highest and lowest recorded water levels, in feet with reference to land-surface datum, 1947: Jan. 20, +13.83; Aug 12, -65.15. Maximum recorded daily fluctuation, 1947: May 9, 13.55 feet.

Highest daily water level, in feet with reference to land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	+7.18	-19.87	-47.35	-46.52	-25.19	....	-63.22	-45.17	-41.01	-9.92	+2.92
2	....	+6.99	-16.94	-48.72	-45.15	-26.94	....	-64.10	-49.27	-40.10	-8.32	+3.40
3	....	+7.38	-17.01	-49.25	-42.98	-33.04	....	-61.33	-49.92	-40.38	-8.07	+3.57
4	....	+5.37	-19.27	-50.23	-39.45	-36.75	....	-59.72	-50.28	-40.03	-5.67	+3.51
5	....	+2.84	-19.63	-48.08	-39.07	-38.60	-54.92	-62.13	-53.15	-38.61	-4.93	+3.37
6	....	+1.28	-15.88	-48.05	-39.64	-43.70	-52.67	-63.28	-54.64	-37.46	-4.90	+4.02
7	+10.17	+1.43	-14.87	-45.92	-39.84	-44.06	-53.18	-62.55	-46.57	-35.72	-3.87	+3.87
8	+11.59	+1.57	-21.94	-49.99	-35.13	-44.95	-55.66	-60.96	-41.58	-34.02	-2.11	+4.03
9	+12.01	+2.52	-20.33	-44.43	-28.18	-43.27	-55.75	-62.28	-40.17	-33.35	-2.08	+3.94
10	+12.23	+8.85	-20.31	-46.30	-23.91	-49.22	-58.55	-60.64	-38.28	-30.00	-2.50	+4.76
11	+12.07	-2.16	-21.61	-50.32	-21.88	-49.81	-57.87	-61.07	-39.29	-27.07	-2.19	+5.47
12	+12.47	-5.09	-21.33	-41.30	-21.23	-48.40	-60.03	-65.15	-40.15	-23.08	-2.63	+6.05
13	+13.08	-7.70	-20.25	-39.19	-21.75	-53.93	-54.54	-60.59	-58.68	-36.18	-2.19	-1.58
14	+13.22	-10.32	-27.61	-38.43	-20.73	-54.70	-53.77	-56.35	-33.82	-21.48	-1.47	+6.39
15	+12.80	-9.64	-26.66	-36.23	-20.07	-51.12	-55.06	-61.44	-35.35	-19.72	-1.50	+6.16
16	+12.95	-5.19	-26.55	-43.55	-17.72	-49.56	-53.56	-63.03	-36.02	-15.93	-1.14	+6.78
17	+13.23	-5.28	-26.27	-12.44	-03.16	-84.51	-24.59	-21.57	-43.36	-94.14	-5.68	+7.21
18	+12.88	-8.65	-30.33	-45.51	-16.20	-40.17	-60.18	-55.97	-36.35	-14.15	+2.28	+6.90
19	+13.81	-11.70	-30.32	-45.48	-16.97	-53.16	-59.69	-61.79	-35.76	-13.64	+8.80	+7.59
20	+13.83	-14.77	-31.41	-40.45	-17.31	-53.44	-60.59	-61.82	-41.08	-13.03	+1.05	+6.44
21	+11.39	-16.62	-37.32	-39.38	-18.88	-54.35	-58.94	-62.75	-39.23	-12.03	+1.10	+8.17
22	+12.09	-16.35	-39.63	-45.63	-19.17	-55.80	-61.04	-62.60	-38.04	-11.82	+1.15	+8.18
23	+12.63	-10.85	-33.74	-45.78	-19.89	-56.27	-60.35	-62.15	-42.88	-11.40	+1.63	+8.58
24	+11.12	-12.59	-35.15	-44.79	-19.57	-52.93	-63.37	-54.23	-43.56	-10.76	+2.27	+9.72
25	+11.92	-17.82	-36.93	-43.98	-18.35	-54.26	-62.84	-54.90	-43.34	-11.08	+2.57	+10.07
26	+12.48	-19.64	-42.13	-46.48	-18.77	-54.20	-62.64	-57.98	-42.47	-10.39	+2.74	+8.83
27	+11.28	-19.43	-44.46	-36.15	-18.88	-37.15	-61.20	-55.27	-43.94	-10.65	+2.97	+7.75
28	+11.62	-20.74	-46.00	-31.74	-22.28	-39.75	-60.48	-53.27	-40.68	-11.94	+3.02	+8.73

13.25.27.211--Continued.

Highest daily water level, in feet with reference to land-surface datum,
1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
29	+8.80		-43.26	-43.93	-23.34			-63.38	-51.67	-40.67	-11.51	+3.30 +9.53
30	+9.37		-42.64	-45.17	-26.18			-63.66	-49.36	-41.93	-11.72	+2.53 +9.79
31	+8.02		-43.97		-27.85			-63.18	-45.63		-10.77	+10.42

18.26.5.330. Artesia well. Highest and lowest recorded water levels,
in feet below land-surface datum, 1947: Jan. 6, 5.00; Aug. 9, 55.54.
Maximum recorded daily fluctuation, 1947: May 26, 3.59.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.49	9.92	15.43	32.42	33.83	35.05	46.30	53.75	49.32	40.61	26.10	19.07
2	5.43	9.35	14.17	33.04	33.97	34.87	46.80	53.82	49.98	40.23	25.00	19.09
3	5.57	9.05	13.80	33.78	33.86	36.04	46.87	53.15	50.05	39.30	24.71	18.80
4	5.37	9.72	.....	33.98	31.75	37.28	47.50	52.59	51.17	38.55	24.50	18.62
5	5.23	9.83	.....	33.87	30.59	38.35	47.28	51.63	51.73	37.65	24.18	18.49
6	5.00	10.65	.....	33.81	30.64	39.43	46.45	53.80	52.75	37.21	24.13	18.29
7	5.31	11.47	.....	32.02	31.01	39.81	45.50	54.76	52.20	36.78	24.11	18.16
8	....	12.04	.....	.....	29.90	39.40	46.53	55.12	50.84	36.53	24.03	17.92
9	....	11.55	.....	.....	29.03	38.68	46.73	55.54	51.78	36.53	23.74	17.75
10	....	11.14	.....	35.96	28.11	39.75	46.84	54.88	51.88	36.07	23.54	17.64
11	h6.03	11.65	h19.76	.....	26.59	40.65	47.27	54.62	52.07	35.38	23.39	17.40
12	6.03	12.70	18.73	32.01	26.08	.....	47.68	55.22	52.40	34.88	23.30	17.32
13	6.00	13.05	20.71	30.80	26.40	.....	46.97	55.00	51.58	34.39	23.00	17.18
14	6.34	13.85	22.52	30.66	27.33	.....	46.20	52.27	49.91	33.56	22.78	16.74
15	6.68	14.04	22.35	29.86	26.94	.....	47.14	50.90	48.97	33.06	22.93	16.71
16	7.27	13.20	22.55	31.53	27.34	.....	48.72	49.55	49.72	32.72	22.48	16.66
17	6.74	12.90	23.00	31.88	27.60	.....	49.57	47.55	49.94	32.25	22.12	16.71
18	6.19	13.52	23.11	32.65	28.29	.....	49.83	46.76	49.86	32.21	21.72	16.50
19	6.02	14.35	22.44	33.53	27.40	.....	50.48	48.02	49.58	31.70	21.43	16.42
20	6.49	....	23.85	32.77	27.95	.....	50.17	49.12	49.01	31.26	21.19	16.29
21	7.07	14.49	24.76	32.76	28.27	.....	49.52	49.47	46.96	30.54	21.04	16.02
22	7.24	14.04	....	33.31	29.15	.....	50.15	48.83	46.33	30.22	20.97	16.00
23	8.05	13.07	....	34.53	29.29	.....	50.14	49.57	46.62	30.40	20.55	16.05
24	9.09	12.82	....	34.87	28.67	.....	50.37	47.93	45.89	29.80	20.54	16.05
25	9.92	13.03	....	35.28	28.60	.....	50.71	47.17	45.29	28.79	20.26	16.15
26	10.25	13.85	g31.25	35.28	28.84	44.29	51.16	48.82	44.43	28.35	20.26	16.00
27	10.35	14.55	g31.45	33.76	31.41	44.76	50.88	49.13	44.32	28.09	20.10	15.94
28	10.57	14.69	32.25	32.00	32.66	45.37	50.56	49.55	42.49	27.56	20.04	15.86
29	10.24			32.50	33.07	34.64	45.12	51.83	50.12	41.78	27.10	19.67
30	10.11			31.78	33.66	35.65	44.80	53.02	50.75	41.30	26.82	19.36
31	9.84			30.96	35.88		53.35	49.94		26.58		16.07

h Tape measurement.

g Estimated.

Artesian-intake wells

The water levels in the wells in the intake area of the artesian basin, as based upon bimonthly measurements, reached their highest levels in March and their lowest levels generally in September in response to the draft on the artesian aquifer by the artesian wells to the east. The decline from March to September in general was slightly greater than during the corresponding period in 1946 as a result of the greater pumpage in 1947 than in 1946. Because of the small amount of precipitation in the fall of 1947 as compared with the fall of 1946, recharge to the aquifer was less

in late 1947 as compared with late 1946. This, coupled with the larger pumpage and later ending of pumping season, resulted in the water levels rising less in 1947 following the pumping season than they did in 1946. The net declines in water levels in the intake area for 1947 were therefore greater than for 1946. The average net yearly declines for the four northern wells was about 2.8 feet in 1947 as compared with about 1.0 foot in 1946. Comparable readings are not available for the two southern wells, Clements and Coffin. The net yearly decline for the Diamond A Cattle Company well was 3.25 feet in 1947 as compared with 1.56 feet in 1946. Water levels in the wells in the intake area at the end of 1947 were still above the previous low levels observed in 1941 prior to the above-normal precipitation in late 1941 and early 1942.

Water levels in wells in artesian-intake area, in feet below land-surface datum, showing seasonal changes during 1947

Location	11.22.	12.23.	14.23.	16.23.	18.23.	19.23.
No.	1.312	5.320	8.340	15.323	5.333	27.111
Owner	H. L. Wood	J. Herbst	Diamond A. Cattle Co.	D. W. Runyan	Joe Clements	C. R. Coffin
Jan. 15, 22, 23	256.41	a236.47	261.29	215.51	387.46	b372.33
Mar. 14, 19	256.18	235.63	261.27	216.07	388.82	b371.52
May 14, 15	b257.49	a237.99	262.56	216.85	b390.81	b373.03
July 14, 17	259.42	b238.62	263.65	218.24	394.17	(a)
Sept. 9, 12	260.82	240.09	265.04	219.43	396.93	1381.35
Nov. 5, 10	260.53	240.17	a1265.44	219.02	397.73	372.40
Change:						
Jan. 46-47	-0.50	-1.07	-1.04	-1.56	.....	-3.50
Jan. 47-48	-2.49	j-2.35	-3.25	-3.26	j-11.58	j-1.77

Highest and lowest January water levels, in feet below land-surface datum

Well No.	Highest	Year	Lowest	Year	Record began	Year missing
11.22.1.312	253.75	1945	256.41	1947	1945	....
12.23.5.320	228.74	1943	243.33	1941	1941	....
14.23.8.340	258.00	1945	270.01	1941	1941	....
16.23.15.323	211.92	1945	225.70	1941	1941	....
18.23.5.333	.....	....	.....	....	1947	....
19.23.27.111	368.83	1946	379.30	1941	1941	1945

a Pumping.

b Pumping recently.

i Measurement uncertain.

j Influenced by pumping.

18.23.5.333. Joe Clements. Used drilled stock well, diameter 6 inches, depth 420 feet. Measuring point, top edge of casing, west side of well, 0.40 foot above land-surface datum. Equipped with windmill beginning with measurement in March 1946.

Water level, in feet below land-surface datum, 1945-46

Date	Water level	Date	Water level	Date	Water level
July 21, 1945	385.50	May 18, 1946	391.55	Sept. 9, 1946	394.14
Sept. 17	388.03	July 15	392.84	Nov. 18	386.39
Mar. 16, 1946	392.23				

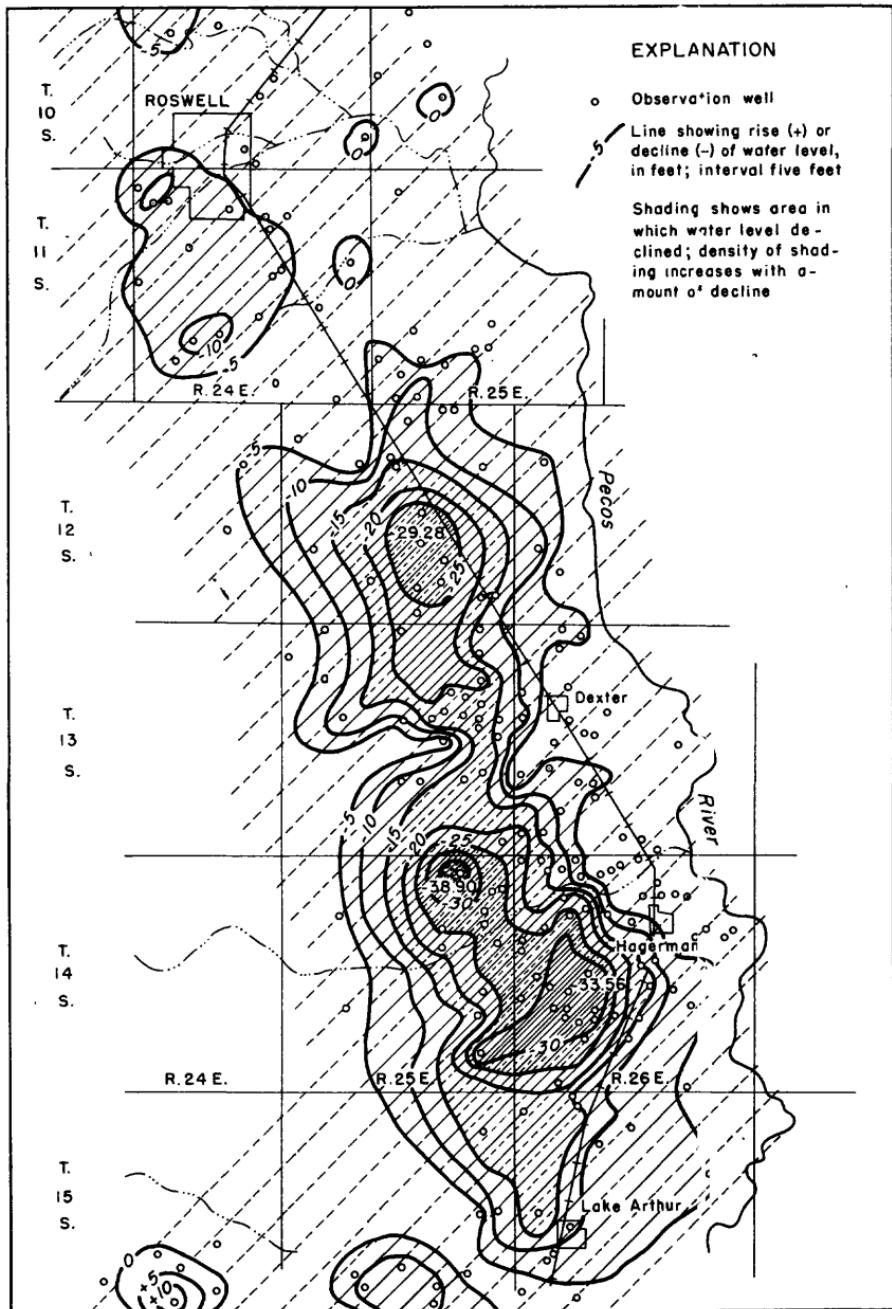


Figure 14.--Map showing change in ground-water level in northern part of Roswell Basin, Chaves County, N. Mex., from January or February 1942 to January or February 1948.

Shallow wells

In the 6-year period from January 1942, when water levels were generally at the highest levels on record, to January 1948, the water levels in the Roswell basin declined to the lowest levels on record over a major part of the area where shallow water is pumped for irrigation. In this period net declines of more than 10 feet have taken place over the major part of the irrigated area of the Roswell basin and declines of more than 30 feet have occurred in the heavily pumped areas northwest and southwest of Hagerman and Artesia. Declines of water level of more than 10 feet occurred over about 200 square miles and more than 20 feet over about 65 square miles. (See accompanying figures.)

In the northern end of the Roswell basin, near Roswell, the water levels have shown relatively small declines of 1 foot a year or less since 1942. This is the area of natural ground-water discharge and the effects of pumping are balanced somewhat by a decrease in natural discharge with, as a consequence, only small declines of water level.

The water table in the Roswell basin lowered from January 1947 to January 1948 over most of the area where appreciable amounts of shallow water were used for irrigation. The water table showed a net lowering of more than 2 feet over an area of about 263 square miles, more than 4 feet over about 126 square miles, and more than 6 feet over about 49 square miles. These areas are considerably greater than those in 1946 when the water table lowered more than 2 feet over an area of about 117 square miles, more than 4 feet over about 18 square miles, and more than 6 feet over about 3 square miles. The greatest declines occurred in the southern part of the basin, in Eddy County, where the greatest increase of pumpage occurred. A net lowering of water level of more than 10 feet occurred over an area of about 9 square miles during 1947. This excessive lowering took place mainly north and south of Artesia where net lowerings of only 2 to 5 feet had taken place in the preceding year. The maximum observed decline from January 1947 to January 1948 was more than 14 feet and took place in a well at the northwest corner of Artesia.

From January 1947 to January 1948 the water table in Chaves County declined more than 2 feet over an area of about 110 square miles, more than 4 feet over an area of about 45 square miles, and more than 6 feet over about 7 square miles. The declines were the greatest in the heavily pumped area southwest of Hagerman and north of Lake Arthur.

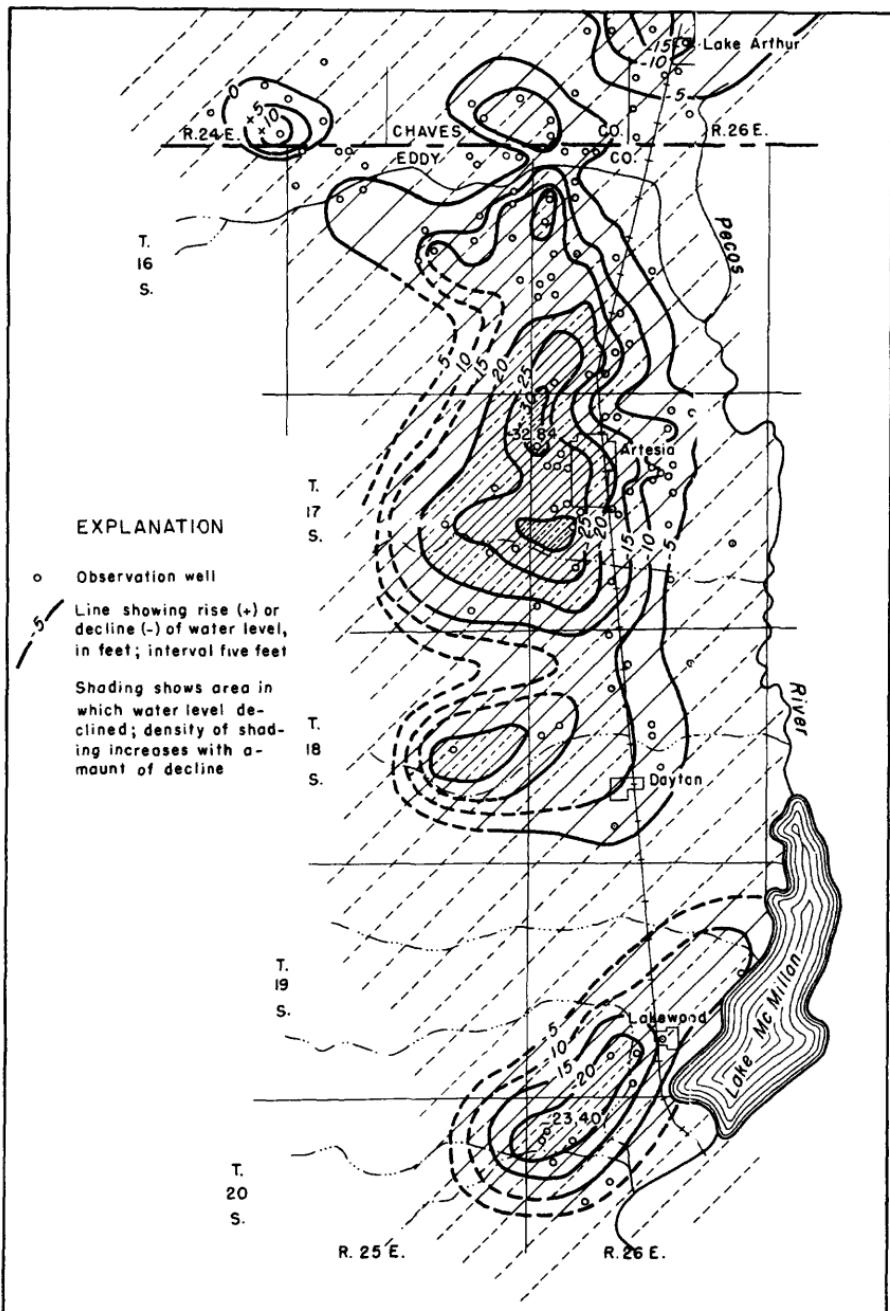


Figure 15.--Map showing change in ground-water level in southern part of Roswell Basin, Chaves and Eddy Counties, N. Mex., from January 1942 to January 1948.

In the Eddy County part of the Roswell basin the water table declined more than 2 feet over an area of about 150 square miles, more than 4 feet over about 80 square miles, and more than 6 feet over about 42 square miles. In three areas totaling nearly 9 square miles, the water table declined more than 10 feet. The maximum declines of water level occurred in the heavily pumped areas northwest and southwest of Artesia and north of Lakewood.

The continued yearly declines in water level over the past years have resulted in large pumping lifts in certain areas and may cause abandonment of some wells when farm profits decline.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet

Location number	Owner	Water levels										Record
		See also	Jan. 1947	Change	Highest	Lowest	Year	Level	Year	Level	Year	
Part	Level	Day	1946-47	Level	Year	Level	Year	Level	Year	Level	Year	
10.24.8.111	C. S. Stockton	5	42.44	1	5	-1.42	40.16	39	45.79	45	38	42,44
8.353	Ira Lee	3,5	40.67	1	5	.....	.....	8.82	38	12.99	41	47
15.342	W. C. Crawford	.	.....	.	.....	.....	.....	.....	.....	.....	38	39,42, 44,47
16.133	G. D. Perrine	24.39	1	5	+.07	22.85	43	28.70	41	38	38	
17.111	C. C. Henry and G. P. Nabry	3	39.25	1	5	-.31	38.92	46	39.23	47	46	
17.122	Mr. Howard	27.56	1	5	-.21	24.58	42	33.67	41	38		
18.424	L. T. Lewis	38.15	1	5	-.25	34.32	42	44.50	41	38		
20.344	Clyde Blackwell	.....	.	.....	.....	36.54	42	46.65	41	38	39,45,	47
22.322	A. B. Carpenter	13.80	1	5	+.41	11.19	42	19.70	41	38		
27.111	Jack Taylor	18.13	1	5	+.19	15.20	42	25.17	38	38		
32.111	F. W. Lewis	28.45	1	5	-.97	27.48	46	28.45	47	46		
33.244	J. Westover	e 6.0	1	5	.....	5.35	43	e 6.0	47	41	47	
34.333	Elmer Butler	4.48	1	5	-.03	2.67	42	4.94	45	41		
36.222	State of New Mexico	2.13	1	5	+.05	2.13	47	4.15	41	41		
10.25.17.344	P. E. Cannon	6.62	1	5	+.35	4.16	42	7.65	41	41		
18.222	J. R. Pendergrass	7.83	1	5	+.56	3.28	42	8.96	41	41		
19.331	F. C. Smith, Jr.	34.06	1	5	+.34	30.76	42	34.06	47	41	46	
29.222	U. S. Government	1.21	1	5	-.24	.97	46	3.15	41	41		
11.23.1.33	S. M. Wiggins	57.67	1	4	.....	.....	.....	.....	.....	47		
12.221	S. P. Hannifin	.....	.	.....	.....	51.57	43	61.14	40	38	41,42,	47
11.24.6.243	J. A. Moore	(Measurements discontinued, well plugged)										46
6.311	R. B. Wirtz	(a)	1	4	.....	37.61	39	51.87	41	39	40,47	
6.333	Mr. Watkins	35.38	1	4	-.26	28.98	42	41.29	41	38		
6.444	Morrile Huff	35.53	1	4	-.33	31.20	43	42.00	41	39		
9.122	Raymond McCutchen	32.93	1	3	-.04	27.25	42	34.83	41	38		
10.114	Claude Hobbs	20.54	1	3	+.11	16.85	42	26.60	41	40		
10.224	C. E. Smith	13.64	1	3	+.19	11.69	42	b 19.61	39	38		
10.321	G. A. Oney	25.68	1	3	-.48	21.13	42	28.64	40	38	39	
13.144	Frank Peters	13.82	1	3	.....	12.05	42	16.08	43	38	46	
14.313b	J. F. Martin Filling Station	(Measurements discontinued, well dry)										
15.421	M. L. Barnett	5	b 33.81	1	4	+.52	30.09	42	38.45	41	38	47

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also	Water levels						Record
			Part	Jan. 1947 Level	Jan. 1947 Day	Change 1946-47	Highest Level	Lowest Level	
11.24.15.431	M. L. and S. Barnett	5	34.69	1 4	+0.55	31.30	k 42	41	38
17.122a	D. H. Johnson	5	53.23	1 4	....	48.96	43	53.23	47
18.333	G. V. Coker	5	84.10	1 4	-43	79.36	43	90.84	41
22.333	John Tweedy	•	44.22	1 4	-09	40.03	42	52.26	41
23.411a	H. E. Babcock, Jr.	•	c 11.80	1 4	+.21	10.35	42	17.34	41
23.133	Tweedy Gin	(Measurements discontinued, well filled)	20.40	1 4	-3.97	7.60	42	19.80	40
23.433a	do	•	61.79	1 4	+.31	53.52	42	20.40	47
28.113	Rocky Arroyo School	3	80.23	1 4	-.66	69.82	42	85.65	41
29.144	Belle Hurst	•	85.94	1 4	....	78.91	42	85.84	47
29.333	F. W. GLOW	•	44.61	1 4	-.46	40.28	43	51.63	41
34.411b	Belle Hurst	•	28.25	1 4	-1.19	25.48	43	36.02	40
36.133	Wiley Grizzile	•	19.02	1 4	-.33	15.44	42	24.88	40
36.211	Russell Smith	•	30.68	1 4	-.46	28.45	42	35.55	39
36.333	Wiley Grizzile	•	c 24.93	1 3	-9.96	13.26	43	14.97	43
11.25.6.122a.	J. P. White & Co.	3	6.59	1 3	-.56	4.44	42	7.13	41
6.421a	do	•	7.85	1 3	-.06	5.36	42	7.85	47
22.333	Mrs. T. E. Whitney	•	8.70	1 3	-2.08	5.35	42	8.70	47
28.234	E. Whitney	•	8.15	1 3	-1.50	4.07	42	8.15	47
28.244	R. O. Whitney	•	9.77	1 3	-.79	5.34	44	9.77	47
28.333	Unknown	•	8.30	1 3	-.55	5.47	39	8.74	43
29.111	Farmers Incorporated	•	7.55	1 3	-.11	4.38	40	8.35	41
29.343	Albert Hobson	•	8.96	6	+.29	f 4.58	42	11.02	46
29.444	Glenn Wheeler	4	13.23	1 3	-.05	9.24	42	17.07	40
30.333	J. P. White & Co.	•	13.13	1 3	-.60	8.60	42	14.58	41
31.223	Ruby Brown	5	28.24	1 3	-.57	23.60	43	30.68	40
31.433a	Albert Watson	•	c 24.29	1 3	+.03	16.89	42	30.68	40
31.433b	do	5	65.85	1 3	-.02	62.36	43	65.85	47
31.433c	George Bogart	3	73.52	1 3	+.12	75.53	43	83.95	40
32.333	Leora Newman	•	16.29	31	+.20	9.80	42	16.49	46
23.411a	Monte Goodin	•	13.84	31	+.50	7.27	42	14.34	46
12.25.2.Lot 3	B. F. Heire	•	30.48	31	-.98	21.21	42	30.47	47
2.Lot 4	V. H. Hodges	•	40.48	31	-.33	37.08	43	45.00	38
3.334	J. W. Young	•							
7.144a	Olivia Ett	•							

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also Part	Water levels				Lowest Year	Be- gan	Record Years missing
			Jan. 1947 Level	Jan. 1947 Change	1946-47 Level	Highest Year			
12.25.9.422	Cumberland townsite	3	46.35	31	-1.67	39.60	42	49.35	47
13.111	W. E. Colclazier	•	15.86	31	+2.29	11.23	43	18.15	46
16.111	Ernest Nelson	•	33.18	31	+.30	29.50	43	35.98	41
16.222	State of New Mexico	•	57.04	31	-1.84	42.25	38	57.04	47
22.231	W. T. Clancy	5	80.89	31	-3.18	51.84	39	80.89	47
25.413	Ann E. Freeman	•	36.25	31	-3.29	17.90	42	36.25	47
26.311	J. K. Murphrey	•	66.95	31	-3.66	40.62	38	66.95	47
27.211	W. T. Clancy	•	76.21	31	-3.23	48.70	39	76.21	47
30.222	Ivy Woodman	•	80.19	31	-.14	78.24	43	81.50	41
33.112	H. D. Wager	•	88.10	31	-3.95	67.07	39	88.10	47
34.211	Donald Corn	6	65.43	31	-3.93	39.09	38	65.43	47
34.431	Jack Mask	•	62.97	31	-3.66	43.14	42	62.97	47
35.111	C. E. Smith	5	57.30	31	-3.60	34.00	42	57.30	47
35.131	do	•	58.95	31	-3.19	47.14	44	58.95	47
35.311a	H. G. Koberly	(Measurements discontinued, well dry)	•	•	•	35.81	42	•	46, 47
35.311b	do	•	•	•	•	36.42	42	55.79	46
35.311c	Jack Mask	5	56.90	31	•	•	•	•	47
36.411a	A. C. Stone	3, 5	57.35	31	-9.13	40.23	45	•	•
36.133	H. Kuykendall	•	80.93	31	-40.98	23.91	42	39.95	46
36.142	O. B. Berry	•	32.72	31	•	13.85	42	32.72	47
36.211	Unknown	•	47.67	31	•	24.55	44	27.01	44
36.313	W. L. Kuykendall	•	44.06	31	-7.36	22.84	38	44.06	47
12.26.7.421	Cecil Johnson	5	1.43	1.3	+1.14	(m.)	5.60	38	42
18.221	do	b	24.25	1.3	•	10.87	42	14.19	45
18.222a	do	3	15.09	1.3	-.14	14.57	45	15.09	47
29.333	T. S. Lawing	3	16.19	1.3	+1.79	14.20	40	17.98	46
30.213	Louman Wiley	•	23.83	31	-.74	13.32	42	23.83	47
13.25.1.111	W. L. Kuykendall	•	22.24	20	+2.85	12.78	42	25.09	46
1.331	Will Schapkok	•	24.17	29	-2.99	9.77	42	24.17	47
3.111	Grace Stanley	•	68.98	30	-3.56	45.40	38	68.98	47
5.111	W. H. Belcher	•	62.21	30	+.75	60.70	42	65.30	41
6.333	R. L. Lowe	•	80.87	30	+.14	78.22	38	82.16	44
8.133	W. H. Jeffries	3	62.74	30	+2.99	59.61	42	70.35	41
10.344	H. W. Reincke	•	•	•	•	57.30	38	66.98	45
11.111	Kermit Southard	•	(a)	30	•	36.01	42	51.21	46
									39

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also Part	Water levels						Record
			Jan. 1947 Level	Jan. 1947 Lb	Change 1946-47	Highest Level	Lowest Level	Year	
13.25.11.343	J. E. Brockman	*	59.95	30	-0.65	42.21	42	59.95	47
11.433	do	5	50.94	30	-.23	32.75	42	50.94	47
12.133	M. E. Colclazier	5	37.00	30	.....	17.93	42	37.00	47
12.311	do	*	34.98	30	+2.69	16.23	42	34.88	47
13.113	W. F. Kerr	3	46.73	30	-1.03	29.95	42	46.73	47
13.131	Fletcher Bros.	*	45.29	30	+.64	29.05	42	45.93	46
13.133	do	*	66.94	30	-17.25	32.76	42	49.66	46
13.233a	W. F. Kerr	*	34.55	30	+.78	21.05	42	35.33	46
13.233b	do	*	35.25	30	+.98	22.96	42	36.23	46
13.311	Fletcher Bros.	*	73.42	30	-20.83	32.13	42	52.59	46
13.433	Mrs. J. W. Weir	*	37.69	30	+1.56	25.54	42	39.26	46
14.131	M. C. Conn	*	64.48	30	+.95	48.65	42	65.43	46
14.231	William Zappe	*	57.80	30	+.05	40.12	42	57.85	46
15.311	Rex Richmond	*	81.94	30	-1.88	68.88	38	81.94	47
15.432	do	*	64.90	30	+1.30	46.63	42	66.20	46
17.411	R. Thaman	*	73.26	30	-10.11	55.08	42	73.26	47
23.111	I. F. Worthman	5	49.76	30	+10.23	51.21	42	55.17	41
24.333	Hal Bogle	5	53.48	29	+2.92	41.34	42	56.40	46
26.211	Belle Hurst	*	60.85	29	+4.87	47.33	42	63.93	46
26.222	do	*	53.80	29	+2.83	41.42	42	56.63	46
27.111	Hal Bogle	*	.....	30	.....	69.30	38	78.77	45
27.211b	do	*	74.93	30	-2.23	61.95	42	74.93	47
32.411	William Brashler	*	80.2	29	.....	.....	38	85.49	44
34.433a	W. F. Kerr	(Measurements discontinued)	.....	.....	.....	61.30	42	78.78	46
35.311a	W. F. and L. D. Kerr	*	74.63	29	+.07	74.63	47	74.70	46
35.322	W. F. Kerr	*	71.78	29	+.68	58.73	43	72.46	46
36.421a	R. M. Ware	*	54.30	29	+1.14	39.00	38	55.44	46
36.421c	do	*	55.24	29	+2.22	39.79	42	57.46	46
13.26.5.111	R. H. Aston	*	15.64	29	-.31	7.40	42	15.64	47
5.231a	C. P. Sterrett	(Measurements discontinued, well dry)	.....	.....	.....	11.85	42	17.79	41
5.231b	do	*	14.01	25	-.40	7.43	42	14.01	47
5.231c	do	*	18.39	29	.....	.....	47	.....	..

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also	Water levels						Recorded	
			Jan. 1947	Change	Highest	Lowest	Level	Year		
Part	Level	Day	1946-47	Level	Year	Level	Year	Year		
13.265.331	W. W. Harris	5	18.27	29	-3.74	13.27	4.2	18.27	47	
7.333	Howard Amason	4	14.00	6	+1.69	6.28	4.2	15.83	46	
7.433	J. E. Sims (Measurements discontinued, well filled)					8.18	4.2	12.89	46	
8.332	G. M. Sterrett	8.33	29	-2.56	5.77	4.6	10.29	38	40	
14.331	G. C. and H. E. Saunders	3	c 9.98	28	-6.65	.26	4.2	3.33	41	
16.114a	U. S. Government (fish hatchery)									
16.114b	do	11.72	29	-3.02	8.01	4.3	11.72	47	38	
16.114c	do	8.33	29	-2.91	4.81	4.3	8.33	47	39	
17.321	Leo Nowak	3 b	19.33	30	-2.89	5.19	4.3	8.75	47	
17.443	H. Vandembout	13.96	28	-.94	11.28	4.2	13.96	47	38	
17.444	do	13.87	28	-1.27	11.56	4.2	14.25	44	38	
18.311	W. F. Kerr	a	22.01	29	-1.16	11.50	4.2	22.81	47	38
19.222	A. T. Stone	21.38	28	+1.45	18.22	3.9	22.83	46	38	
19.333	Hal Bogle	p	18.20	28	+15.12	20.00	4.2	33.32	46	38
19.343	do	26.40	28	+1.28	16.15	4.2	27.68	46	38	
19.432	Tom Bogle	5	13.85	28	+1.09	6.19	4.2	14.94	46	38
20.113	A. T. Stone					17.25	4.2	23.20	46	38
20.333	Mrs. O. W. Lockhead					10.89	4.2	17.85	47	38
22.331	G. C. Saunders	5	5.90	28	***	***	***	***	46	
23.111	G. C. and H. E. Saunders	a	33.93	28	-27.16	3.55	4.2	6.77	47	38
28.111	Joe Nowack	19.98	28	-6.00	9.66	4.2	26.02	38	38	
28.121	Geo. Grassie	3	19.87	28	-3.54	14.82	3.9	20.79	41	38
28.221	Hal Bogle					6.90	4.6	10.84	41	38
28.221b	do	5	9.76	28	***	***	***	***	47	38
28.311	Joe Giles and Anna Heinzel		13.44	28	-2.60	10.42	3.9	15.19	44	38
29.111	J. H. Reid		.....	.....	9.67	3.9	15.72	40	39	42,47
29.113	Kermit O. Southard	5	14.18	28	-2.88	13.39	4.2	17.60	44	38
29.211	J. H. Reid		18.48	28	-1.26	7.22	3.9	14.55	43	38
29.333	M. Y. Monical					11.04	4.2	18.48	47	38
31.241	Hal Bogle		18.25	28	-3.39	6.03	4.2	18.25	47	38
31.311	E. C. Moore		52.12	28	+9.96	35.30	3.8	52.98	46	38
33.421	E. P. Malone		19.92	28	-3.75	15.62	4.2	19.92	47	38
34.313	Hilton Lanford		12.27	28	-2.91	8.28	3.9	12.27	47	38
34.431	Mrs. Elizabeth Cole		20.55	28	.....	20.55	4.7	32.79	44	46

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, 1946 to January or February 1947, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also	Water levels			Record			
			Jan. 1947 Level	Jan. 1946-47 Change	Highest Year	Lowest Year	Be- gan	Years missing	
14.25.1.112	P. R. Fuller	(Measurements discontinued, well dry)	25.87	36	42.15	45	36	46,47	
1.343	A. W. Langegger	•	43.20	38	65.90	46	38	40,47	
1.344	V. F. Flores	3,5	44.42	36.04	65.58	47	36		
2.233a	L. T. Lewis	3	52.65	-91	52.13	42	27.65	40	
2.431	J. V. Thomas	•	87.42	-2.82	67.69	43	87.42	43	
2.444	do	•	••••	••••	48.50	38	71.17	38	
8.411	Ray Mathes	•	95.68	-10	93.24	42	95.68	47	
11.333	do	•	102.33	25	78.83	42	102.33	47	
12.133a	C. H. Whitman	•	83.84	-3.34	60.82	42	83.84	47	
12.133b	do	•	83.0	25	58.17	38	83.0	47	
12.313	L. T. Lewis	•	87.57	25	60.75	38	87.57	41	
12.314	do	•	85.19	-3.47	71.35	44	85.19	47	
13.213	Calvin Graham	•	82.40	25	53.57	42	82.40	47	
13.311a	E. O. Moore	•	89.13	-3.59	80.38	45	89.13	45	
14.131	Ray Mathes	•	104.06	25	84.52	39	104.06	47	
20.443	Brebb Hurst	3	75.17	25	71.46	42	75.17	47	
24.133	E. O. Moore	5	80.00	24	56.73	38	80.00	47	
25.111	J. N. Morris	•	77.95	-3.97	56.05	38	77.95	47	
25.111a	do	•	74.92	24	-3.00	59.92	43	74.92	47
25.221	do	•	59.93	24	-4.49	24.50	26	n	
36.111	C. H. Foster	•	68.31	24	-3.27	55.69	43	68.31	47
36.211	do	•	71.80	24	-3.77	60.83	44	71.80	47
14.26.3.111	Flora West	•	15.83	-3.43	12.03	39	15.83	47	
3.243	Mary Brown	•	16.80	26	-4.15	12.45	45	16.80	47
3.413	Howard Kenefick	•	11.81	26	-2.76	8.35	39	11.81	47
3.442	John Langegger	•	19.38	26	-2.72	16.10	38	19.38	47
4.133a	W. E. Jacobson	•	23.95	26	-4.43	18.43	39	23.95	47
4.141	Roy Lockheed	•	24.66	26	-5.61	18.47	39	24.66	47
4.231	G. E. Wade	5	21.66	26	-5.13	15.82	39	21.66	47
5.131	L. M. Harter	5	33.01	25	-4.34	21.70	42	33.01	47
5.211	M. D. Menard	•	29.65	26	-4.97	22.20	42	29.65	47
5.243	J. D. S. McKinstry	•	25.76	26	-4.51	20.00	39	25.76	38
5.433	D. L. Newsom	•	34.79	27	-6.11	25.62	38	34.79	47
5.433a	J. D. Jones	5	34.62	27	••••	••••	••	••	47
6.111	Wiley Grizzle	•	33.18	26	+4.43	16.30	38	33.61	38

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet--Continued

Location number	Owner	See also	Water levels						Record
			Part	Jan. 1947 Level	Change Day	1946-47	Highest Level	Lowest Year	
114-26-6-142	W. L. Heitmann	•	34.02	.26	-1.01	19.77	42	28.11	45
6-211	Wiley Grizzle	•	39.72	.26	-1.77	26.82	42	34.02	47
6-232	Tom Andrews	•	53.26	.27	+2.49	30.25	38	35.72	47
6-241	W. W. Adams	•	38.68	.27	-3.25	21.80	38	32.43	46
7-443	G. L. Truitt	•	38.68	.27	-3.44	19.83	38	35.75	46
8-112	P. Flores, Jr.	•	38.00	.27	-3.61	41.54	42	38.68	47
8-243	N. C. Newcom	•	64.54	.27	-4.12	35.32	36	64.54	42
8-312	Tom Ferguson	•	67.15	.27	-1.67	26.06	39	67.15	44
8-433a	V. R. Barnett	•	31.22	.27	-4.05	8.35	38	31.22	44
9-143	Cave Bros.	•	21.23	.27	-3.59	12.25	42	21.23	45
9-434	Oscar Cave	•	18.67	.27	-3.59	12.25	42	18.67	41
10-121	S. J. Smith	5	••••	••••	••••	12.22	39	14.91	47
10-221	John Langmeier	•	13.25	.26	-1.93	10.88	42	13.35	42
10-244	do	•	14.65	.26	-3.14	10.69	45	14.65	47
11-111	do	•	17.82	.26	-3.50	14.52	46	17.82	47
11-121	H. A. Kiper	•	17.57	.26	-2.25	15.13	39	17.57	47
11-322	Marie Stewart (Measurements discontinued, well filled)	•	11.61	.26	-6.69	8.76	46	13.59	43
11-444	W. E. Utterback	•	22.00	.26	+.02	9.43	42	11.61	47
12-131	do	•	16.50	.26	-.67	12.50	42	22.02	46
12-433b	W. N. Olive	•	17.38	.26	-.73	14.30	42	16.88	40
13-121	L. M. Lang	•	13.23	.26	+12.01	11.36	42	17.50	41
14-212	B. L. Barnett	•	13.01	.26	+.27	10.49	43	13.40	41
14-421	Jim Michelet	•	15.14	.26	+.34	10.04	42	13.28	43
14-441	do	5	13.93	.26	-1.11	11.22	44	13.93	46
14-443	Unknown	5	21.06	.26	-5.38	13.40	42	21.06	47
15-113	State of New Mexico	•	12.13	.26	-2.52	5.55	42	12.13	42
15-322	F. H. Evans	3	30.97	.26	-6.53	16.42	38	30.97	47
15-333	E. D. Menoud	(Measurements discontinued)	30.97	.26	-6.53	40.46	42	56.04	45
17-122	R. A. and T. A. Bledsoe	•	66.32	.27	-3.98	55.10	45	66.32	47
17-211a	William Salomon	•	64.45	.27	-5.47	38.42	38	64.45	47
17-444	Pearson Bros.	5	74.36	.25	-3.71	50.57	39	74.36	47
18-113	N. G. Campbell	•	••••	••••	••••	50.83	42	70.54	46
18-131a	William Cooke	5	74.92	.25	••••	••••	47	74.92	47
18-131a	do	5	67.27	.25	-3.97	39.68	38	67.27	45
19-211	Pearson Bros.	•	67.27	.25	-3.97	39.68	38	67.27	45

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also	Water levels						Record	
			Jan. 1947 Level	Jan. 1947 Day	Change 1946-47	Highest Level	Lowest Level	Year		
14.26.19.242	Oscar H. Pearson	4	79.31	7	-5.76	48.05	38	f 79.79	47	
19.311	W. C. West	n	66.05	25	-7.55	36.12	38	n 66.03	47	
19.444	E. E. Lane		76.59	24	-4.06	49.10	38	76.59	47	
20.143	Pearson Bros.		80.99	25	-7.78	48.15	38	80.99	47	
20.334	E. Langnegger					64.36	42	73.34	44	
20.343	do		85.99	24	-4.84	56.26	38	85.99	47	
21.335	G. E. Wade		57.69	24	-6.49	33.38	42	57.69	47	
22.141	Wayne Adams	5	33.82	26	-3.54	21.66	42	33.82	47	
23.131	E. A. White		14.13	26	-7.78	6.89	42	14.13	47	
23.214a	F. E. Filley		14.38	26	+.38	13.96	45	14.76	46	
23.413	E. A. White		14.60	26	+.35	8.69	42	14.95	46	
27.111	J. L. Ogle		17.61	25	-1.96	8.43	42	17.61	47	
27.424a	M. D. Brown		25.40	25	+.17	25.40	47	25.57	46	
28.111	William Langnegger	5	57.98	24	-8.57	32.32	42	57.98	47	
28.114	do	(Measurements discontinued, well filled)				29.85	42	44.80	46	
28.211	L. T. Lewis	5	40.22	24	-4.34	24.18	42	40.22	47	
28.423	do		22.78	25	-1.55	24.18	42	22.39	43	
29.112	P. E. Stoes	5	89.09	24	-4.86	58.80	38	89.09	47	
29.223	do		5	79.52	24	-4.94	49.52	38	79.52	47
29.441a	J. W. Wiggins		56.68	24	-5.18	32.25	38	56.68	47	
29.441b	do	b	56.25	24	-5.09	31.20	38	b 56.25	47	
32.331a	B. F. Knoll	5	72.50	24	-2.17	53.09	43	72.50	47	
32.331	B. E. Spencer	3	57.03	24	-12.30	32.85	38	57.03	47	
35.344	J. W. Mitchell	3.5	69.64	25	-.55	65.68	43	a 69.64	47	
15.24.23.344	Carroll Jackson	a	66.75	16	+.60	65.87	44	a 67.35	46	
27.344	S. A. Laning	5	58.80	16	-.31	58.49	46	61.75	38	
28.244	State of New Mexico		88.40	16	+8.79	88.40	47	92.30	41	
32.211	Carl Kangan	3	41.40	16	-1.79	37.63	45	50.72	41	
34.341	S. A. Laning		33.23	16	+1.72	30.58	38	39.82	42	
35.143	E. P. Malone		22.66	16	-.68	16.81	44	27.70	38	
36.243	State of New Mexico		...		...	37.67	42	41.88	45
15.25.12.111a	Jack Palmer	(a)				35.64	42	45.20	46	
12.212b	Unknown		50.49	23	-.89	41.92	44	50.49	47	
12.421	C. H. Foster	5	53.89	23	-2.55	41.66	44	53.89	47	
24.111	Hal Bogle	5	13.01	23	+.19	12.06	42	14.30	44	
	do					7.65	42	16.52	46	
	24.211					+.22			38	

* See footnotes at end of table.

Part 2. Water levels in January or February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January or February 1947, in feet--Continued

Location number	Owner	See also Part	Water levels						Record
			Jan. 1947 Day	1946-47 Change	Highest Level	Lowest Level	Year	Year	
15.2526.423	R. T. Spence	•	3.65	17	+1.29	3.59	42	5.96	42
27.321	Pearson Bros.	•	30.20	17	-4.86	17.50	42	35.93	44
28.331	T. C. Sexton	•	32.34	16	+1.89	27.64	45	34.23	46
28.331a	do	•	39.71	16	-7.00	26.48	45	39.71	47
33.112	Carroll Jackson	•	21.28	16	+2.90	11.18	42	24.18	46
35.111	M. M. Spence	•	29.23	17	+3.33	15.51	42	29.56	46
35.311	Z. C. Robinson	•	40.74	17	••••	28.85	42	40.74	47
35.311a	do	•	31.61	17	-2.56	26.05	46	31.61	47
36.333	J. M. Norris	5	28.62	17	+.90	24.20	42	29.52	46
15.264.444	Harry Cowan	3	40.19	24	-.76	33.14	42	40.19	47
5.121	B. E. Spencer	3	51.82	24	-1.16	34.80	38	51.82	47
5.142	A. Russell Estate	•	45.13	24	-2.09	26.55	43	45.13	47
6.311	Calvin Graham	5	48.20	23	-5.41	28.66	38	48.20	47
7.312	C. H. Foster	5	49.02	23	-2.92	36.25	44	49.02	47
8.411	E. M. George	•	29.59	24	-6.86	16.08	44	29.59	47
8.413	do	•	29.13	24	-6.65	15.53	44	29.13	47
9.133	do	5	22.10	24	-.01	16.68	42	22.42	41
14.222	Breeb Hurst	•	6.85	24	+.12	2.38	42	6.95	46
17.211	E. M. George	•	25.44	24	-4.68	12.06	44	25.44	47
18.112	R. T. Spence	•	42.01	23	-2.09	31.29	44	42.01	47
19.211	Lake Arthur Cemetery	3	35.65	23	-.30	23.87	42	35.65	47
19.442	Paul Robinson	5	••••	17	••••	5.47	42	12.44	46
20.144	J. W. Webb	•	28.73	17	-1.20	18.30	42	28.73	47
20.431a	Unknown	•	15.48	17	-.79	16.94	45	19.48	47
20.111	E. C. Jackson	•	8.37	23	-1.23	3.68	42	8.37	47
30.131	Paul Robinson	•	7.46	17	+.21	2.10	40	7.72	43
30.224	1st Nat'l Bank, Artesia	•	11.51	17	-.06	6.27	41	11.51	47
30.411	J. B. Crook	•	14.87	17	+.20	13.35	43	15.07	46
31.111	E. J. Gromo	•	12.53	17	+.94	9.35	42	13.73	41
31.333	B. E. Spencer	•	17.65	17	+.50	15.12	42	18.15	46
32.231	Mrs. H. C. Evans	•	9.26	17	+.18	7.70	42	9.64	40

a Pumping. e Dry at depth given. j Also 1940.

b Pumping recently. f From recorder chart. k Also 1943.

c Nearby well pumping. l February. m Flowing in 1939, 1940, 1941.

n Measurement uncertain.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Location number	10.24.	10.24.	10.24.	10.25.	11.24.	11.24.	11.25.	12.24.
Owner	Lee	Henry	Lewis	Smith	Smith	School	White	Newman
			and Mabry					
Feb. 3-5	40.67	39.23	28.45	34.06	13.64	61.79	6.59	65.85
Mar. 12, 15	41.52	40.10	28.07	34.34	b18.92	60.79	9.36	66.45
May 12-14	43.59	42.14	29.45	33.73	19.44	66.74	7.26	a75.13
July 11, 14	a65.09	.....	30.28	a35.18	28.23	.....	11.03	a74.30
Sept. 9, 10	46.92	.....	32.10	34.76	27.35	b72.69	10.70	76.08
Nov. 4, 5	45.16	43.75	32.16	b34.96	b16.51	b70.78	8.70	72.83
Location number	12.25.	12.25.	12.26.	12.26.	13.25.	13.25.	13.26.	13.26.
Owner	Town- site	Stone	John- son	Law- ing	Jeff- ries	Kerr	Saun- ders	Nowak
Jan. 28, 30, 31	49.35	57.33	.....	16.35	62.74	46.73	c9.98	b19.33
Feb. 3	.....	.....	15.09	16.19	.....	.....	.....	.....
Mar. 15	48.94	63.10	c14.75	16.57	65.93	53.94	c11.95	b17.93
May 13	51.85	61.13	14.62	16.08	75.68	c64.27	6.19	b20.97
July 12, 15	53.21	c72.80	15.33	17.43	77.80	c72.95	11.20	b24.78
Sept. 8, 9	55.54	67.62	15.73	17.09	79.85	c75.93	.....	b24.31
Nov. 4, 6, 7	54.40	60.64	c16.02	17.25	78.06	58.03	.....	13.60
Location number	13.26.	14.25.	14.25.	14.25.	14.26.	14.26.	14.26.	14.26.
Owner	Grassie	Flores	Lewis	Hurst	Adams	Utter- back	Evans	Menoud
Jan. 25-28	19.87	65.98	72.65	75.17	53.26	22.00	12.13	30.97
Mar. 15, 17	23.24	66.05	.....	75.36	b55.78	21.87	10.37	31.23
May 13, 14	17.94	155.61	76.22	75.55	a53.60	21.34	a15.81	33.29
July 15, 16	24.35	71.54	b83.63	75.65	b41.40	21.18	b14.77	36.26
Sept. 9, 11, 12	26.47	75.93	b83.35	75.79	.....	.....	15.35	b45.85
Nov. 6, 7	b22.06	75.03	82.33	75.90	b48.59	.....	13.38	34.73
Location number	14.26.	14.26.	15.24.	15.25.	15.26.	15.26.	15.26.	15.26.
Owner	Spencer	King	Mangum	Spence	Cowan	Spencer	Cemetery	
Jan. 16, 17, 23-25	57.03	69.64	a41.40	29.23	40.19	51.82	75.65	
Mar. 17	59.11	a70.38	a42.59	27.34	41.45	51.91	35.26	
May 16	51.83	69.63	a43.60	b28.14	41.33	52.04	37.23	
July 16	52.23	70.16	a45.72	b29.43	42.74	52.17	38.63	
Sept. 11	50.10	70.23	a46.81	b32.36	42.52	52.70	39.85	
Nov. 7	53.45	70.52	45.52	30.45	a2.38	52.41	40.18	

a Pumping.

b Pumping recently.

c Nearby well pumping.

i Rainwater ran into well.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

11.25.29.444. Glenn Wheeler. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Apr. 15, 7.67; Oct. 7, 13.65.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.43	10.98	8.92	8.88	9.74	12.46	12.24	11.75	12.48	10.51	10.56
2	9.38	10.59	9.21	8.92	9.60	12.48	12.22	12.09	12.89	10.45	10.57
3	9.38	10.52	9.37	9.45	9.78	12.80	12.28	12.48	13.17	10.43	10.58
4	9.45	11.01	9.15	9.83	9.59	12.96	12.04	12.53	13.32	10.47	10.59

11.25.29.444--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5	....	9.37	11.40	8.70	10.13	9.48	13.10	11.97	12.55	13.44	10.44	10.58
6	h 8.96	9.38	11.16	8.41	9.96	9.97	13.10	12.05	12.75	13.60	10.44	10.56
7	9.01	9.43	10.67	8.19	10.15	10.48	13.09	12.30	12.50	13.65	10.50	10.57
8	9.08	9.45	10.58	8.01	10.36	10.92	13.13	12.47	11.98	13.13	10.48	10.57
9	9.08	9.48	10.95	7.89	9.48	11.25	13.22	12.64	11.83	....	10.48	10.57
10	....	9.45	10.68	7.88	8.77	11.55	13.28	12.75	11.65	....	10.50	10.61
11	....	9.47	10.84	7.80	8.51	11.66	13.36	12.80	11.56	....	10.51	10.61
12	....	9.52	11.40	7.80	8.32	11.78	13.47	12.83	11.67	12.52	10.52	10.62
13	....	9.52	11.35	7.73	8.25	11.77	13.46	12.93	11.42	12.37	10.54	10.62
14	....	9.52	11.59	7.69	8.21	11.81	13.54	12.66	11.32	12.64	10.54	10.57
15	....	9.52	11.62	7.67	8.17	11.90	13.59	12.82	11.25	12.99	10.58	10.59
16	....	9.52	11.84	7.73	8.19	11.98	13.25	12.75	11.54	....	10.59	10.65
17	....	9.51	12.04	7.68	8.17	11.98	12.69	12.26	12.15	12.90	10.61	10.65
18	....	9.54	12.17	7.63	8.15	11.89	12.49	12.26	11.87	12.57	10.62	10.64
19	....	9.54	12.24	8.41	8.14	12.08	12.26	12.40	11.39	12.13	10.62	10.64
20	....	9.57	12.32	8.79	8.50	12.32	12.05	12.66	11.00	11.67	10.62	10.69
21	....	9.59	12.34	9.05	8.46	12.50	12.26	12.86	10.89	11.25	10.64	10.62
22	....	9.59	12.43	9.30	8.69	12.65	12.39	12.82	11.34	11.03	10.64	10.63
23	9.27	9.59	12.04	9.13	9.17	12.70	12.54	12.82	11.80	10.66	10.62	10.69
24	9.30	9.59	11.73	9.15	9.53	12.74	12.79	12.91	12.10	10.60	10.62	10.69
25	9.33	9.61	11.14	8.76	9.80	12.69	12.99	13.05	12.32	10.59	10.62	10.70
26	9.30	9.97	10.62	8.57	9.80	12.67	13.14	13.04	11.82	10.57	10.61	10.68
27	9.32	10.45	10.10	8.74	10.04	12.73	13.18	12.56	11.64	10.60	10.61	10.69
28	9.30	10.74	9.38	8.85	9.92	12.69	13.14	12.19	11.98	10.60	10.61	10.85
29	9.28	8.39	9.34	10.22	12.59	13.11	11.98	12.40	10.57	10.61	11.06	
30	9.37	8.26	9.04	9.97	12.60	12.72	11.71	12.20	10.58	10.60	11.65	
31	9.38	8.56	9.71		12.26	11.58			10.57		11.81	

h Tape measurement.

13.26.7.333. Howard Amason.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 6	h 14.00	Feb. 9	14.40	Mar. 29	14.56	July 19	15.60
7	14.00	10	14.44	30	14.65	20	15.69
8	14.01	11	14.46	31	14.76	21	15.75
9	14.02	12	14.46	Apr. 1	14.81	22	15.84
10	14.03	13	14.47	2	14.90	23	15.94
11	14.02	18	14.43	3	14.99	24	16.04
12	14.00	19	14.42	4	15.05	25	16.16
14	13.97	20	14.40	5	15.11	26	16.27
15	13.97	21	14.38	6	15.18	27	16.35
16	13.97	22	14.34	22	h 14.82	28	16.38
17	13.97	Mar. 11	h 13.77	23	14.84	29	16.38
18	13.98	12	13.76	24	14.90	Sept. 5	16.98
19	13.99	13	13.76	25	14.96	6	17.06
20	13.98	14	13.76	26	14.97	7	17.14
21	13.99	15	13.76	27	14.98	8	17.21
23	13.98	16	13.77	28	14.93	9	17.25
24	13.98	17	13.77	29	14.90	10	17.18
25	13.98	18	13.76	May 13	14.47	11	17.11
26	13.99	19	13.74	14	14.37	12	17.05
27	14.00	20	13.74	15	14.30	13	16.99
28	14.01	21	13.74	16	14.23	14	16.93
29	14.02	22	13.77	July 12	h 15.46	15	16.87
30	14.03	23	13.92	13	15.44	16	16.82
31	14.06	24	14.00	14	15.41	17	16.80
Feb. 1	14.10	25	14.09	15	15.39	18	16.79
6	h 14.31	26	14.18	16	15.39	19	16.78
7	14.32	27	14.30	17	15.43	Nov. 5	h 16.15
8	14.35	28	14.43	18	15.50	6	16.17

h Tape measurement.

13.26.7.333--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Nov. 7	16.19	Dec. 8	16.56	Dec. 16	16.58	Dec. 24	16.56
8	16.25	9	16.56	17	16.58	25	16.55
9	16.29	10	16.56	18	16.58	26	16.54
10	16.31	11	16.57	19	16.58	27	16.51
11	16.33	12	16.57	20	16.59	28	16.48
12	16.35	13	16.58	21	16.59	29	16.44
Dec. 5	16.57	14	16.58	22	16.58	30	16.40
6	16.57	15	16.58	23	16.57	31	16.37
7	16.56						

14.26.19.242. Oscar H. Pearson. Recorder removed.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Jan. 1	79.79	Feb. 10	80.44	Mar. 17	81.45	Apr. 7	84.26
2	79.79	11	80.50	18	81.53	8	84.33
7	79.28	12	80.54	19	81.64	23	h 86.93
8	79.26	13	80.51	20	81.80	24	86.97
9	79.16	14	80.53	21	81.90	25	87.07
10	79.09	15	80.62	22	82.05	26	87.15
11	79.06	16	80.65	23	82.20	27	87.23
12	79.05	18	h 80.83	24	82.39	28	87.33
13	79.00	19	80.85	25	82.52	29	87.43
14	78.98	20	80.86	26	82.59	30	87.54
23	h 78.62	21	80.89	27	82.73	May 14	h 87.27
24	78.68	22	80.90	28	82.93	15	87.29
25	78.80	23	80.93	29	83.06	16	87.34
26	78.93	24	80.98	30	83.31	17	87.41
27	79.00	25	80.98	31	83.43	18	87.30
28	79.12	Mar. 11	h 81.02	Apr. 1	83.68	19	87.16
29	79.11	12	81.05	2	83.81	20	87.10
30	79.27	13	81.20	3	83.91	21	87.06
Feb. 6	80.08	14	81.22	4	84.01	July 15	h 90.32
7	80.09	15	81.37	5	84.09	Sept. 11	h 93.15
8	80.26	16	81.43	6	84.16	Nov. 7	h 89.61
9	80.36						

h Tape measurement.

Part 5. Miscellaneous data concerning observation wells

10.24.8.111. Stockton. Reference point established Feb. 5, 1947, top of concrete well curb, 0.60 foot below land-surface datum.

10.24.8.333. Lee. Drilled irrigation well, diameter 13 inches, depth 181 feet. Measuring point, top of casing west side of well, 0.50 foot above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: Sept. 4, 46.99; Nov. 13, 42.32.

11.23.1.433. Wiggins. Drilled irrigation well, diameter 14 inches. Measuring point, lower inside edge of rectangular opening in north side of pump case, 0.80 foot above concrete pump base, 1.60 feet above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1947: Sept. 11, 65.03; Nov. 4, 61.63.

11.24.13.144. Peters. Old measuring point destroyed, pump changed. Reference point established Feb. 3, 1947, top of casing, 0.50 foot below land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

11.24.15.421. Barnett. Measuring point beginning Feb. 4, 1947, lower edge of 4- by 4-inch timber across concrete well curb, 0.36 foot above land-surface datum. Equipped with small pressure pump.

11.24.15.431. Barnett. Measuring point beginning Feb. 4, 1947, lower inside edge of rectangular opening in north side of pump case, 0.80 foot above concrete pump base, 1.16 feet above land-surface datum. Equipped with turbine pump.

11.24.17.121a. Johnson. Casing extended 2 feet. Measuring point beginning Feb. 4, 1947, top of casing, 1.80 feet above land-surface datum. Equipped with turbine pump.

11.24.18.333. Coker. Measuring point beginning Feb. 4, 1947, lower inside edge of rectangular opening in west side of pump base, 0.78 foot above concrete base, 1.10 feet above land-surface datum.

11.25.31.223. Brown. Reference point established Feb. 3, 1947, top of casing at north side, 0.37 foot below land-surface datum.

11.25.31.433c. Watson. 90 feet north of well 11.25.31.433a. Drilled irrigation well, diameter 12 inches. Reference point, top steel channel over well, at land-surface datum. Measuring point, top of 12½-inch collar on 12-inch casing, 0.85 foot above land-surface datum. Equipped with turbine pump.

12.25.22.231. Clardy. Water level, in feet below land-surface datum, 1947: Nov. 4, 93.98.

12.25.34.211. Corn. Formerly owned by Mack Sharp.

12.25.35.111. Smith. Reference point established Jan. 31, 1947, top surface at northwest corner of concrete discharge box, 4.75 feet above land-surface datum.

12.25.35.311c. Mask. At southwest corner of earthen reservoir. Drilled irrigation well, diameter 18 inches, depth 195 feet, drilled July 1945. Measuring point, top of casing east side of well, 0.50 foot below land-surface datum. Equipped with turbine pump.

12.25.35.411a. Stone. Artesian well, 75 feet west of observation well, was plugged because of leakage September 1946.

12.26.7.421. Johnson. Measuring point beginning Feb. 3, 1947, top of casing, east side of well, 0.50 foot above land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum.

13.25.11.433. Brockman. Water level, in feet below land-surface datum, 1947: Mar. 15, 56.60, dry at depth given.

13.25.12.133. Colclazier. Measuring point beginning Jan. 30, 1947, outer edge of ½-inch hole in base of pump. Subtract 0.40 foot from tape measurements to reduce to top of concrete pump base, 1.10 feet to reduce to land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum. New turbine pump installed.

13.25.23.111. Wortman. Water from nearby artesian well flowing around observation well Jan. 30, 1947.

13.25.24.333. Bogle. Measuring point beginning Jan. 29, 1947, lower inside edge of rectangular opening in south side of pump case, 0.70 foot above top of casing, 0.50 foot above land-surface datum. Equipped with turbine pump.

13.26.5.231c. Sterrett. 30 feet west and 75 feet north of house. Drilled domestic well. Measuring point, top inside edge of pipe clamps, 0.75 foot above top of casing, 0.50 foot above land-surface datum. Equipped with pump and windmill.

13.26.5.331. Harris. Well abandoned, pump removed. Measuring point beginning Jan. 29, 1947, top of concrete pump base, 0.30 foot above land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

13.26.19.432. Bogle. New turbine pump installed, 14-inch steel casing set inside of old galvanized casing. Reference point established Jan. 28, 1947, top edge of steel casing, 0.63 foot above land-surface datum.

13.26.22.331. Saunders. Drilled irrigation well, diameter 14 inches, depth 226 feet. Measuring point, top inside edge of casing, at north side, 0.45 foot above land-surface datum. Equipped with turbine pump.

13.26.28.221b. Bogle. Middle well of 3 in north-south line, 150 feet apart. Drilled irrigation well. Reference point, top of concrete pump base, 0.30 foot above land-surface datum. Equipped with turbine pump.

13.26.29.113. Southard. Formerly owned by J. H. Reid.

14.25.1.344. Flores. Formerly owned by A. W. Langnegger. Windmill and pump removed. Measuring point beginning Sept. 11, 1947, top of casing, east side of well, 0.19 foot above land-surface datum.

14.25.24.133. Moore. Measuring point beginning Jan. 24, 1947, lower inside edge of rectangular opening in west side of pump case. Subtract 1.35 feet from tape measurements to reduce to land-surface datum.

14.26.4.231. Wade. Measuring point beginning Jan. 26, 1947, top edge of opening in basal plate, inside of pump case, level with concrete pump base, 0.32 foot above land-surface datum.

14.26.5.131. Harter. Reference point established Jan. 26, 1947, top of concrete pump base, 0.09 foot above land-surface datum.

14.26.5.433a. Jones. 185 feet north of well 14.26.5.433. Drilled irrigation well. Reference point, top of upper surface of concrete base, at land-surface datum. Equipped with turbine pump with base of pump counter-sunk into concrete base.

14.26.10.121. Smith. Formerly owned by Levi Barnett.

14.26.14.443. Unknown. Pump lowered into dug pit. Reference point established Jan. 26, 1947, top of casing, 0.57 foot below land-surface datum. Measuring point beginning Jan. 26, 1947, top of opening in basal plate of pump, inside of pump case, 0.50 foot below land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum.

14.26.17.444. Pearson. Measuring point beginning Jan. 23, 1946, top edge of 3/4-inch hole in base plate of pump inside of pump case, 0.13 foot above top of casing, 0.45 foot above land-surface datum.

14.26.18.131a. Cooke. 90 feet west of well 14.26.18.131. Drilled abandoned well, diameter 14 inches. Measuring point, top of casing north side of well, at land-surface datum. Equipped with pressure pump.

14.26.22.141. Adams. Formerly owned by J. E. Lusk.

14.26.28.111. Langnegger. Middle well of 3 wells in east-west line. Measuring point beginning Jan. 24, 1947, top edge of opening in basal plate, inside of pump case, 0.16 foot above concrete pump base and land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

14.26.28.211. Lewis. Measuring point beginning Jan. 24, 1947, top edge of opening inside of pump case, 0.16 foot above concrete base, 1.44 feet above land-surface datum. New turbine pump installed.

14.26.29.112. Stoes. Previously reported as P. E. Stokes.

14.26.29.213. Stoes. Previously reported as P. E. Stokes. Measuring point beginning Jan. 24, 1947, top edge of opening inside of pump case, 0.06 foot above top of casing, 0.26 foot above land-surface datum. New turbine pump installed.

14.26.32.131a. Knoll. Reference point established Jan. 24, 1947, top of concrete pump base, 0.35 foot above land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum.

14.26.35.344. Mitchell. Measuring point beginning Nov. 7, 1947, top inside edge of 6-inch steel casing, east side of well, 2.30 feet above land-surface datum.

15.24.27.344. Lanning. Well not in use, measuring point destroyed, casing extended. Measuring point beginning Jan. 16, 1947, top of casing, 1.00 foot above land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

15.25.12.421. Foster. Reference point established Jan. 23, 1947, top of casing, 0.45 foot above land-surface datum.

15.25.24.111. Bogle. Measuring point beginning Jan. 23, 1947, top of casing, 0.67 foot above land-surface datum.

15.25.35.311. Robinson. Formerly owned by Paul Robinson. Measuring point beginning Jan. 17, 1947, top edge of opening in basal plate, inside of pump case, 0.06 foot above concrete base, 0.76 foot above land-surface datum. New turbine pump installed.

15.25.36.333. Norris. Pump removed, well abandoned. Measuring point beginning Jan. 17, 1947, top of concrete pump base, 0.50 foot above land-surface datum.

15.26.6.311. Graham. Reference point established Jan. 23, 1947, top of casing, 0.73 foot below land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

15.26.7.312. Foster. Measuring point beginning Jan. 23, 1947, top edge of opening in basal plate, inside of pump case, 0.25 foot above land-surface datum. New turbine pump installed.

15.26.9.133. George. New concrete pump base. Reference point established Jan. 24, 1947, top of concrete base, 0.30 foot above land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

15.26.19.442. Robinson. Formerly owned by J. F. Frazier.

EDDY COUNTY

Part 1. General discussion

Roswell basin

The general discussion of water-level changes in the Eddy County portion of the Roswell basin has been included with Part 1 for Chaves County as the areas are part of one continuous hydrologic area and cannot coherently be discussed separately.

Carlsbad area

During construction of the Carlsbad Army Air Base in early 1942 at the site of the City Airport, about $4\frac{1}{2}$ miles southwest of Carlsbad, three wells were drilled at the airport to furnish water for the base. A type-written report on the possibilities of obtaining water at this site was prepared by W. E. Hale and C. V. Theis of the Geological Survey "Memorandum on ground-water conditions in the vicinity of the City Airport southwest of Carlsbad, New Mexico." A report "Ground-water conditions in the vicinity of Carlsbad, New Mexico" was prepared in 1945 by W. E. Hale of the Geological Survey in cooperation with the State engineer of New Mexico. This report will be published in a forthcoming biennial report of the State engineer of New Mexico.

A program of measuring water levels at regular intervals in the three airfield wells has been maintained in cooperation with the State engineer of New Mexico since their completion. Beginning in June 1944, water levels in two additional wells northeast of the airfield wells have been measured at bimonthly intervals. (See part 3.) Descriptions of the wells are given in part 5.

The airfield wells are in the alluvial fill and on the east side of Dark Canyon, which has water only during floods. It is believed that the comparatively good quality of water obtained in the airfield wells is derived from recharge to the aquifer from the infrequent flood flows in Dark Canyon. Water of poorer quality occurs in the aquifer a short distance eastward toward the Pecos River. This poorer water is believed to be derived in part from leakage from the Southern Canal that carries surface water for irrigation of the lands of the Carlsbad Irrigation Project of the Bureau of Reclamation.

Because of the poorer quality of water east of the airfield wells and the small easterly gradient of the water table of about 3 feet to the mile, excessive pumping of the airfield wells could draw in this poorer water if a decided relative lowering of water level occurred between the airfield wells and the water table to the east. The continued measurement of water levels in these wells is useful because of this condition and in determining the adequacy of the wells.

During the war the airfield wells were pumped at a rate varying from about 4 million gallons a month during the winter to more than 16 million gallons a month during the summer. Since deactivation of the air base the wells have furnished water to a government-housing project at the field. The reported rate of pumping during 1947 varied from about 2 million gallons a month during the winter to about $5\frac{1}{2}$ million gallons a month during the summer.

The water levels in these wells have shown a seasonal fluctuation. During operation of the air base the highest levels usually occurred during November and the lowest levels during June or July. During 1947, since cessation of air-force operations at the air base, the highest level occurred in March and the lowest level in early September. This change in the time of the seasonal high and low levels has apparently been brought

about mainly by the response of the water levels to the effects of pumping of ground water for irrigation on the farmlands to the east. Prior to 1947, there were only a few irrigation wells in operation. During 1947, because of the shortage of surface water, a large number of irrigation wells were put in operation.

There has been an annual net decline of water levels since observations began in 1942. This annual decline in airfield well 3, based upon readings from November to November, was 2.0 feet in 1943, 2.3 feet in 1944, 0.6 foot in 1945, 1.8 foot in 1946, and 15.54 feet in 1947. During 1943 and 1944 there were full-scale activities at the air base which were curtailed somewhat late in 1945 and in late 1946 water began to be furnished to the housing project. Large-scale pumping for irrigation was begun on the farms to the east in 1947. The greatest decline of water levels has occurred at the time of the large increase of pumpage for irrigation, that is, during 1947.

The decline of water levels during 1947 resulted in such a lowering of water levels that airfield well 1 had to be deepened and well 3 re-drilled. Continued declines at the same rate as occurred in 1947 will endanger the water supply for the airfield and the housing project.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet

Location number	Owner	See also	Water levels						Record
			Jan. 1947 Level	Jan. 1947 Day	Change 1946-47	Highest Level	Lowest Level	Year began	
Roswell basin									
16.25.1.Lot 3	Pearson Bros.	5	14.82	16	-0.86	10.61	44	19.40	38
1.Lot 13a	Charles Buck	5	18.58	16	-.30	14.66	44	18.89	45
1.344	Buck Bros.	3	13.12	15	+.53	9.50	42	b 13.65	38
2.Lot 9	Ralph Pearson	3	18.27	16	+1.22	14.07	44	a 20.90	45
2.Lot 15	do	5	19.79	16	+.53	17.35	44	20.32	40
4.Lot 12	J. E. Taylor	5	12.58	16	+.51	10.58	42	13.74	38
5.Lot 4	E. P. Malone, Jr.	5	10.06	16	+.09	9.22	42	13.35	45
5.Lot 5	do	10	10.63	16	-.41	9.48	42	14.17	42
5.Lot 13	Fred Croom	5	3.12	16	+.33	5.12	47	15.72	38
5.443	W. L. Ault	5	12.43	16	+6.25	8.27	42	18.66	46
6.Lot 4	F. M. Nelson	5	12.78	16	+1.78	11.42	42	a 15.40	38
6.313	Frank Childress	4	28.74	16	+1.08	f 27.27	42	f 30.30	41
6.111	Pearson Bros.	5	26.14	16	-.81	24.27	45	a 31.39	40
10.333	Orval Gray	5	69.37	16	-8.89	56.55	44	60.48	44
10.334	do	51.96	16	+1.29	48.60	42	53.64	39	40, 41
11.133	J. J. Terry	5	37.28	15	-1.04	34.46	44	37.28	47
11.253	Noah Buck	5	34.68	16	-1.06	34.68	47	34.68	47
12.124	Buck Bros.	5	19.86	15	-.26	15.45	42	19.86	47
12.412	T. J. Terry	5	15.46	14	****	10.85	42	14.17	41
13.211	do	27.47	14	+.65	16.64	42	28.12	46	39
14.211	L. T. Lewis	5	38.92	16	-1.27	30.70	42	38.92	47
15.233	J. H. Everest	5	78.30	16	-2.23	64.20	39	78.30	47
15.331	do	94.11	16	-1.69	82.78	38	94.11	47	38
24.212	Monroe Howard	5	41.27	14	+.68	30.42	42	41.95	46
16.26.5.Lot 3	Ed Taylor	5	29.12	17	-.21	22.73	42	29.12	47
5.Lot 4	H. V. Parker	5	33.00	17	-.16	27.35	42	33.00	47
5.331	Nancy Eipper	5	19.38	15	-.65	16.21	38	20.20	45
6.Lot 2	H. V. Parker	5	32.11	17	-.05	24.07	42	32.11	47
6.Lot 4	do	34.58	16	-.15	27.15	42	34.58	47	38
6.Lot 4a	do	40.22	16	-.23	19.99	46	29.06	45	44
6.333	Scott Meyer (Measurements discontinued, well filled)	14.38	15	-.80	10.80	42	13.70	45	38
7.121	L. T. Lewis	10.44	14	-.03	7.20	42	15.65	40	38
7.321	T. J. Frink	17.68	15	-1.21	12.45	42	10.44	47	38
8.111	Ira S. Reeser	12.04	14	+.16	9.66	42	17.68	47	38
15.333	Carl Manda	do	do	do	do	do	do	do	do

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	See also Part	Water levels				Roswell basin--Continued	Record	
			Jan. 1947 Level	Jan. 1947 Day	Change 1946-47	Highest Level	Lowest Level	Year began	Years missing
Water levels									
16.2616.313	V. L. Jeter	*	8.00	14	-1.57	3.80	42	8.60	40
17.311	W. R. Roberts	5	28.04	14	-1.60	16.68	42	28.04	47
17.331	Elzie Swift	*	15.99	14	-1.25	6.12	43	15.99	47
18.331	Monroe Howard	*	24.70	14	***	14.32	42	24.70	47
18.411	Ira S. Reser	*	25.52	14	-1.25	13.29	42	25.52	47
19.113	H. E. Hall	*	27.02	14	+4.96	16.19	42	31.98	46
19.133	E. Jeffers	*	27.98	14	+.30	16.54	42	28.28	46
19.211	H. V. Parker	*	19.71	14	+.74	9.34	42	20.45	46
19.411	E. Jeffers	3,5	34.16	14	+3.02	27.84	42	37.18	46
21.333	J. H. Everest	*	8.93	15	-.20	2.09	42	8.93	47
28.333	Irvin Lixon	3	18.50	14	-2.60	9.57	42	18.50	47
28.431	R. E. Coleman	*	16.70	14	-1.97	8.72	42	16.70	47
31.413	T. F. Wilson	*	49.11	14	-1.77	35.33	38	49.11	47
32.231	B. E. Green	*	29.63	14	-2.43	20.41	43	26.63	47
32.411	do	*	25.60	14	-2.25	15.20	42	25.60	47
32.421	W. W. Parker	5	32.30	14	-12.03	13.78	42	20.27	46
35.113	J. T. Fulton	5	12.12	14	-2.58	7.86	43	12.12	47
17.2513.131	L. G. Monschke	*	103.22	11	-4.87	85.20	42	103.22	47
22.223	(Incorrect designation used previously for well 11.17.25.22-224, which see)	*	155.68	11	-3.20	135.66	42 b	155.68	47
22.224	J. M. Jackson	5	99.12	11	+7.47	82.40	42	91.82	41
24.433	do	*	109.44	11	***	91.56	42	101.77	41
26.222	Mildred and M. L. Doss	5	122.49	11	-3.69	107.95	43	122.49	47
35.411	Ed Kissinger Estate	3	9.65	14	-.46	5.62	42	9.68	41
17.26.2.133	Fred Savole	5	10.49	14	-.88	4.61	42	10.49	47
3.231	H. R. Rogers	*	10.38	14	***	9.96	43	12.63	46
3.333	A. T. Woelk	*	10.38	14	-.30	5.23	42	10.38	47
3.433	Mrs. R. W. Box	*	10.38	14	***	9.25	42	17.39	38
4.121	State of New Mexico (measurements discontinued, well filled)	5	16.60	14	***	10	38	3.9	47
4.121a	do	*	13.4†	13	-3.0†	.55	42	8.92	41
4.331a	Howard Stroup	*	17.48	13	-.34	9.48	41	13.4†	47
4.331b	do	*	15.47	13	-1.79	9.83	42	16.30	45
4.413	Fred Crawford	*	15.47	13	-1.79	9.83	42	40.42,	44,45,
5.422	Joe Luce	*							

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	Water levels						Record
		also	Jan. 1947	Change	Highest	Lowest	Began	
Part	Level	Day	1946-47	Level	Year	Year	Year	Years missing
Roswell basin--Cont'd								
17.26.6-213	Martin Yates, Jr.	46.37	13	-3.64	42.73	46	46.37	47
6.413	Fred and B. A. Savoie	•	•	•	34.75	42	42.24	45
7.131	J. W. Collins	c 60.54	13	-3.85	42.87	42	c 60.54	47
7.221	Buck Jernigan	42.96	13	-3.23	32.74	44	42.96	44
7.344	E. E. Scooggins	50.43	13	-5.34	31.53	42	50.43	40
7.421	Ivan Rogers	35.90	13	-3.16	19.24	42	35.90	47
7.423	C. A. Houghton	34.58	13	-3.87	15.87	42	34.58	40
7.433	Ed Stone	44.46	13	-3.28	26.90	42	44.46	47
7.444	Albert Blake	36.97	13	-3.48	20.98	42	36.97	38
10.333	V. L. Gates	5.89	13	-4.44	4.60	42	10.61	41
10.433	D. D. Sullivan	19.72	13	+7.75	14.41	42	19.72	47
15.113	R. L. Vogel	6.91	13	-7.36	1.48	42	9.91	47
15.121	do	a 16.84	13	-2.79	5.00	42	a 16.84	47
15.211	J. L. Vogel	5 16.97	13	+6.67	11.57	42	17.64	46
15.411	W. K. Jackson	17.18	13	+5.72	11.25	42	22.90	46
16.333	Artesia Cemetery	3 19.27	11	-2.27	6.14	42	19.27	47
16.411	G. G. Armstrong & Son	20.83	13	-1.43	11.34	42	20.83	47
17.423	H. A. Denton	21.58	11	-5.55	17.93	45	21.58	47
18.433	A. C. Baca	56.19	11	-3.87	38.61	42	56.19	47
18.442	Mrs. Murphy	a 43.79	11	-3.60	26.30	42	a 43.79	47
20.133	J. W. Sharp & G. V. McCrary	41.76	11	-3.39	26.48	42	41.76	47
21.112	Roger Durand	20.17	13	••••	8.63	42	20.17	47
21.341	W. S. Hogsett	10.48	13	-2.26	••••	42	10.48	47
22.233	R. L. Paris	23.49	13	-4.46	18.34	42	23.49	47
24.333	Mary E. Yates	3.15	13	+4.42	2.13	42	3.57	41
27.413	W. L. Martin	14.50	13	-1.42	11.16	42	14.87	38
27.423	do	14.85	13	-1.85	10.38	42	15.90	41
29.331	C. E. Martin	20.94	10	-2.11	8.78	42	20.94	47
29.131a	do	40.80	11	-2.65	26.04	42	40.80	47
18.25.35.111	G. R. Brainard	71.65	11	-3.70	56.57	43	71.65	47
18.26.2.333	Mrs. G. M. Phelps	3 103.37	11	+3.53	90.67	42	106.90	46
4.111b	S. O. Higgins	13.44	10	-2.69	10.75	46	14.35	40
4.433	Frank Watkins	28.42	10	-1.69	18.19	43	28.42	47
	W. M. Schneider	24.21	10	••••	16.82	43	24.21	47

* See footnotes at end of table.

Part 2. Water levels in January 1947 and lowest and recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	See also	Water levels						Record
			Jan. 1947 Part Level	Jan. 1947 Day	Change 1946-47	Highest Level	Lowest Level	Year began	
Roswell basin--Continued									
18.26.7.234a	C. H. Hutsonpillar	4	56.47	7	-2.90	f 43.62	43	f 56.63	47
7.234c	do	•	56.58	11	-1.70	f 53.73	44	56.83	39
9.133	Martin Yates, Jr.	•	37.03	10	-2.62	26.01	43	37.03	47
9.311	C. T. McCaulley	•	36.76	10	-2.41	26.62	43	36.76	47
10.235	Charles Rogers	•	15.92	10	-3.31	9.80	42	15.92	47
15.133	J. D. Terry Estate	•	24.33	10	-2.76	15.78	42	24.33	47
15.311	Charles Martin	•	21.68	10	-1.37	14.16	42	21.02	40
18.241	W. B. McRary	•	51.32	11	-2.38	37.50	43	53.35	41
18.323	do	•	56.68	11	-2.14	38.49	43	56.68	47
21.344	Town of Dayton	4	45.37	9	-2.39	f 32.97	43	f 45.44	47
22.314	Mrs. W. D. Eads	•	14.85	10	-1.25	8.16	43	14.85	47
23.213	A. W. Boyce	•	••••	••••	••••	17.55	42	27.80	41
24.131	F. G. Goodwin	•	22.77	10	-5.36	14.16	43	22.77	47
24.223	P. R. Ramuz	5	5.25	10	+1.22	1.26	42	6.47	46
28.132	Dayton School (Measurements discontinued)	•	••••	••••	••••	49.83	43	59.30	41
28.143	Town of Dayton	5	52.87	9	••••	••••	47	••••	47
33.111	Thelma Yates	•	27.33	9	+.24	64.22	45	67.97	40
19.26.12.323	Forrest Lee	•	••••	••••	••••	1b.74	42	27.57	46
12.323a	do (Measurements discontinued, well filled)	•	32.76	9	-1.11	17.06	43	27.45	46
12.333	Ollie Banks	3	19.51	9	-1.11	22.21	43	32.76	47
13.211a	R. L. House	5	19.10	9	••••	••••	41	••••	47
13.344	R. W. Rankin	3	11.36	9	+.63	2.70	42	11.99	46
14.431a	Albert Lee	•	••••	••••	••••	11.75	45	15.88	46
14.431b	do	3.5	16.43	9	••••	••••	47	43	47
27.233	Lakewood School	3	49.51	9	+4.94	40.73	43	54.45	46
28.334	Frank Howard	•	57.57	9	+5.97	46.20	42	61.54	46
28.441	D. D. Sullivan	•	50.55	9	-2.26	53.11	42	68.39	46
33.412	J. H. Everest	•	52.15	9	-3.17	39.63	42	51.90	41
20.26.6.431	J. G. Moutny & Sons	3	51.62	9	-2.30	36.57	42	52.15	47
7.122	P. S. Campbell	•	••••	••••	••••	30.99	42	51.62	47
7.421	E. Mantisai	•	••••	••••	••••	39.47	41	38	39.46,
8.112	J. G. Moutny & Sons	•	37.84	9	-63	24.15	42	37.84	47
17.231	J. E. Howell	5	55.50	10	••••	••••	42	••••	47
17.411	J. H. Angell	5	44.98	10	••••	43.00	42	46.42	38

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	See also	Water Levels						Record	
			Jan. 1947	Change	Highest	Lowest	Year	Year	Be- gan	Years missing
			Part Level	Day	1946-47	Level				
Roswell basin--Continued										
20.26.21.112	Manuel Hernandez		17.31	10	+3.66	17.31	47	20.97	46	46
		Carlsbad area								
22.26.25.432	V. V. Barfield	3,5	111.84	1	6	111.41	45	111.84	47	45
35.222	Carlsbad Airfield	3,5	136.34	1	7	135.70	43	139.34	47	43
36.111	do	3,5	139.24	1	7	135.09	43	139.24	47	43
36.111a	do	3,5	138.91	1	7	135.70	43	138.91	47	43
22.27.30.133	W. H. Merchant	3,5	99.06	1	6	+.21	98.94	45	99.27	46

a Pumping.
b Pumping recently.

c Nearby well pumping.
f From recorder chart.

1 February.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Roswell basin										
Location number	16.25.	16.25.	16.26.	16.26.	17.25.	17.26.	17.26.	17.26.	17.26.	17.26.
Owner	1.344	6.Lot 4	19.411	28.353	35.411	7.344	10.353	16.353		
	Buck Nelson	Jef- fers	Dixon		Kiss- inger	Sccg-	Gates	Ceme- tary		
Jan. 11,13-16	b13.12	12.78	34.16	18.50	122.49	50.43	9.89	19.27		
Mar. 17,18	b20.19	11.68	34.48	26.03	122.92	55.16	18.97	31.51		
May 16,17	b30.50	10.88	32.57	28.88	126.70	60.97	(a)	32.29		
July 16-18	b33.56	11.39	31.66	32.34	128.82	65.73	(a)	47.15		
Sept.11,12	b32.76	11.47	28.28	34.17	130.86	69.12	(a)	51.25		
Nov. 7,8,10,11	a18.44	13.48	30.79	31.90	130.61	62.93	12.07	26.49		
Location number	17.26.	18.25.	18.26.	19.26.	19.26.	19.26.	19.26.	19.26.	20.26.	
Owner	24.353	23.111	4.111b	12.353	13.344	14.		27.233	7.122	
	Yates	Phelps	Watkins	Banks	Rankin	431b	School	Camp- Lee		
Jan. 9-11, 13	3.15	103.37	28.42	32.76	11.36	16.43	49.51	51.62		
Mar. 18,19	2.50	116.61	29.98	32.32	10.27ac	31.07	55.40	45.35		
May 17	3.03	121.73	32.49	34.28	10.57	20.26	53.53	54.48		
July 18	5.26	136.42	37.68	e38.62	15.18ac	34.95	b62.91	60.25		
Sept.12	5.28	137.41	b46.05	.....	e16.03	c32.65	a65.07	62.96		
Nov. 8,10,11	5.09	120.35	34.52	e38.62	.....	26.04	60.47	61.91		
Carlsbad area										
Location number	22.26.				22.26.				22.26.	
Owner	35.222				36.111				36.111a	
	Air- field				Air- field				Air- field	
July 22, 1942	134.56				133.95				134.10	
Aug. 19	134.13				135.13				135.22	
Sept.17	132.84				132.09				131.91	
Oct. 14	132.53				131.81				131.50	
Nov. 11	132.95				b132.30				131.96	
Dec. 18	134.23				133.09				132.78	
Feb. 13, 1943	135.70				135.09				134.75	
Mar. 18	136.41				135.83				135.48	
Apr. 15	137.27				136.68				136.35	
May 15	b137.87				b137.28				d136.97	
June 22	b138.40				b137.83				d137.55	
July 22	136.79				136.18				135.89	
Aug. 14	137.64				137.14				136.81	
Sept.15	137.59				137.09				136.76	
Oct. 27	b135.72				b135.26				d134.94	
Nov. 18	134.99				134.54				134.22	
Dec. 30	135.26				134.89				134.48	
Feb. 25, 1944	137.19				136.86				136.49	
Mar. 29	138.75				138.48				138.07	
Apr. 22	139.69				139.47				139.09	
May 24	140.10				139.87				139.51	
June 22	b141.85				b141.60				c141.29	
July 25	141.11				141.02				140.64	
Aug. 31	b140.78				c140.54				c140.28	
Sept.19	138.88				138.84				138.47	
Nov. 24	137.33				137.39				137.55	
Jan. 22, 1945	a1143.5				.....				c139.19	
Mar. 30	141.73				141.85				141.57	
May 24,25	142.82				142.91				142.68	
July 25	143.65				143.56				143.39	
Sept.21	142.05				141.81				141.63	
Nov. 20	137.93				137.88				137.54	
Feb. 4, 1946	139.03				138.98				138.65	
Mar. 20	139.77				139.72				139.37	
May 22	140.75				140.68				140.35	
July 16,17	141.46				141.41				141.08	
Sept.12,13	142.85				143.35				143.03	
Nov. 20,21	139.73				139.62				139.30	

* See footnotes at end of table.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947--Continued

Carlsbad area--Continued			
Location	22.26.	22.26.	22.26.
number	35.222	36.111	36.111a
Owner	Air-field	Air-field	Air-field
Feb. 6, 7, 1947	139.34	139.24	138.91
Mar. 20, 21	139.34	139.25	138.94
May 20	142.85	142.77	142.44
July 24	150.32	150.18	149.90
Sept. 6	156.10	154.95	155.13
Nov. 14	155.27	154.70	154.31
Location	22.26.	22.27.	
number	25.432	30.133	
Owner	Bar-field	Merchant	
June 22, 1944	112.13	99.02	
July 25	112.17	98.86	
Aug. 31	111.82	98.57	
Sept. 19	110.58	97.60	
Nov. 24	109.45	96.80	
Jan. 22, 1945	111.41	98.94	
Mar. 30	113.92	101.42	
May 24, 25	114.68	101.68	
July 25	115.43	102.04	
Sept. 21	114.28	101.03	
Nov. 20	110.73	98.15	
Feb. 4, 1946	111.83	99.27	
Mar. 20	112.57	100.05	
May 22	113.30	100.50	
July 16, 17	114.16	101.80	
Sept. 12, 13	115.39	103.07	
Nov. 20, 21	112.14	99.53	
Feb. 6, 7, 1947	111.84	99.06	
Mar. 20, 21	111.83	98.95	
May 20	115.32	102.24	
July 24	123.76	111.97	
Sept. 6	127.78	115.15	
Nov. 14	127.03	115.95	

a Pumping.

d Nearby well pumping recently.

b Pumping recently.

e Dry at depth given.

c Nearby well pumping.

f Air-gage reading.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

16.25.6.313. Frank Childress.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	28.55	Jan. 19	28.26	Mar. 13	28.24	Mar. 26	27.94
2	28.55	20	28.26	14	28.28	27	27.95
7 h	28.54	21	28.52	15	28.28	28	27.96
8	28.56	22	28.44	16	28.07	29	27.97
9	28.60	Feb. 18	28.22	17	28.06	30	27.93
10	28.39	19	28.16	18	28.03	31	27.91
11	28.31	20	28.18	19	28.04	Apr. 1	27.95
12	28.28	21	28.03	20	28.09	2	27.92
13	28.22	22	28.26	21	28.08	3	27.92
14	28.27	23	28.25	22	27.93	4	27.85
16	28.71	24	28.23	23	27.97	5	27.94
17	28.61	Mar. 11	28.00	24	28.07	6	28.10
18	28.46	12	28.00	25	28.14	7	28.07

h Tape measurement.

16.25.6.313--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Apr. 8	28.00	July 17	28.46	Oct. 30	28.57	Dec. 12	28.37
9	27.77	18	28.55	31	28.67	13	28.36
23	27.94	19	28.55	Nov. 1	28.72	14	28.12
24	27.94	20	28.46	2	28.47	15	28.13
25	28.11	21	28.48	3	28.42	16	28.28
26	28.13	22	28.41	7	h 28.68	17	28.34
27	27.93	23	28.43	8	28.55	18	28.25
28	27.87	Sept. 8	28.68	9	28.42	19	28.25
29	27.88	9	28.62	10	28.45	20	28.40
30	27.92	10	28.63	11	28.52	21	28.22
31	27.94	11	28.67	12	28.51	22	28.22
May 16	27.92	12	28.84	13	28.48	23	28.30
17	27.93	13	28.67	14	28.44	24	28.35
18	27.87	14	28.66	Dec. 5	h 28.40	25	28.44
19	27.82	15	28.80	6	28.27	26	28.34
20	27.81	16	28.71	7	28.27	27	28.24
21	27.84	17	28.72	8	28.31	28	28.10
22	27.85	18	28.75	9	28.30	29	28.05
23	27.90	Oct. 28	28.64	10	28.40	30	28.03
July 16	28.44	29	28.56	11	28.37	31	28.03

h Tape measurement.

18.26.7.234a. C. H. Hutsonpillar.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Jan. 1	56.63	Mar. 15	56.91	May 15	h 60.89	Nov. 9	64.15
2	56.63	16	56.95	16	60.90	10	64.10
7	56.47	17	56.95	17	60.92	11	64.03
8	56.46	18	57.00	18	60.91	12	63.97
9	56.43	19	57.02	19	60.91	13	63.90
10	56.37	20	57.10	20	60.91	14	63.85
11	56.32	21	57.15	21	60.91	15	63.79
12	56.28	22	57.23	22	60.94	I ^{ac.} 5	62.61
13	56.24	23	57.32	July 16	h 63.36	6	62.55
14	56.24	24	57.43	17	63.38	7	62.49
15	56.24	25	57.54	18	63.43	8	62.43
16	56.26	26	57.61	19	63.48	9	62.39
17	56.23	27	57.70	20	63.53	10	62.34
18	56.20	28	57.83	21	63.58	11	62.28
31	56.02	29	57.88	22	63.63	12	62.26
Feb. 1	56.06	30	58.01	23	63.68	13	62.17
2	56.01	31	58.07	24	63.73	14	62.10
3	56.01	Apr. 1	58.18	25	63.78	15	62.06
4	56.00	2	h 58.37	26	63.83	16	62.03
5	55.98	3	58.42	27	63.88	17	61.96
6	55.98	4	58.52	28	63.93	18	61.91
7	55.98	5	58.62	29	63.98	19	61.85
18	56.21	6	58.73	Sept. 8	h 65.83	20	61.81
19	56.21	7	58.83	9	65.84	21	61.72
20	56.21	8	58.92	10	65.87	22	61.69
21	56.25	9	59.00	11	65.89	23	61.66
22	56.26	23	h 60.34	13	65.96	24	61.61
23	56.28	24	60.37	14	65.98	25	61.57
24	56.29	25	60.46	15	65.99	26	61.51
25	56.32	26	60.53	16	65.99	27	61.45
Mar. 11	h 56.74	27	60.59	17	65.98	29	61.31
12	56.75	28	60.62	18	65.98	30	61.26
13	56.83	29	60.63	19	65.98	31	61.24
14	56.85	30	60.65	Nov. 8	64.20		

h Tape measurement.

18.26.21.344. Town of Dayton. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Jan. 13, 14, 45.27; Sept. 12, 13, 50.97.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	45.42	45.35	45.58	46.47	47.37	47.84	48.55	49.53	50.64	50.69	50.85	50.59
2	45.44	45.32	45.56	46.50	47.37	47.85	48.58	49.58	50.67	50.68	50.88	50.55
3	45.43	45.33	45.60	46.54	47.38	47.87	48.61	49.64	50.70	50.67	50.91	50.52
4	45.40	45.35	45.58	46.57	47.40	47.91	48.65	49.67	50.73	50.66	50.91	50.52
5	45.40	45.33	45.60	46.62	47.41	47.93	48.69	49.71	50.77	50.66	50.92	50.50
6	45.36	45.34	45.65	46.65	47.47	47.96	48.72	49.75	50.79	50.65	50.93	50.49
7	45.38	45.34	45.65	46.67	47.47	47.98	48.75	49.80	50.82	50.64	50.94	50.47
8	45.37	45.33	45.66	46.71	47.47	47.99	48.77	49.83	50.85	50.62	50.94	50.46
9	45.34	45.33	45.67	46.72	47.47	48.00	48.79	49.84	50.87	50.62	50.92	50.46
10	45.33	45.28	45.69	46.78	47.47	48.01	49.82	50.81	50.91	50.63	50.91	50.43
11	45.31	45.30	45.70	46.80	47.47	48.01	49.87	50.95	50.62	50.88	50.40	
12	45.29	45.28	45.72	46.87	47.47	48.01	49.91	50.00	50.97	50.58	50.88	50.41
13	45.27	45.28	45.75	46.86	47.47	48.01	49.93	50.00	50.97	50.59	50.86	50.38
14	45.27	45.30	45.73	46.89	47.45	48.01	49.99	50.05	50.93	50.61	50.85	50.34
15	45.28	45.29	45.80	46.90	47.47	48.01	50.01	50.10	50.93	50.63	50.85	50.35
16	45.32	45.30	45.78	46.97	47.49	48.04	50.04	50.13	50.92	50.63	50.84	50.34
17	45.32	45.31	45.80	46.98	47.49	48.08	50.08	50.15	50.90	50.64	50.83	50.31
18	45.31	45.34	45.83	47.00	47.49	48.13	50.13	50.18	50.89	50.63	50.82	50.27
19	45.28	45.36	47.04	47.51	48.01	49.16	50.16	50.21	50.87	50.64	50.81	50.27
20	45.33	45.39	47.07	47.53	48.01	49.19	50.19	50.23	50.83	50.66	50.79	50.25
21	45.35	45.44	47.09	47.55	48.01	49.20	50.20	50.28	50.81	50.69	50.77	50.20
22	45.33	45.46	47.11	47.56	48.01	49.21	50.21	50.28	50.81	50.70	50.76	50.21
23	45.33	45.50	47.15	47.59	48.01	49.26	50.26	50.30	50.80	50.71	50.73	50.19
24	45.35	45.51	47.18	47.62	48.30	49.28	50.28	50.37	50.77	50.74	50.71	50.17
25	45.33	45.55	46.02	47.23	47.63	48.37	49.33	50.37	50.76	50.75	50.71	50.15
26	45.31	45.55	46.16	47.25	47.66	48.40	49.34	50.44	50.75	50.76	50.67	50.13
27	45.32	45.55	46.20	47.26	47.67	48.44	49.37	50.49	50.73	50.77	50.68	50.10
28	45.31	45.55	46.26	47.28	47.69	48.46	49.40	50.53	50.71	50.79	50.63	50.06
29	45.29	46.31	47.32	47.74	48.49	49.43	50.57	50.70	50.81	50.64	50.05	
30	45.33	46.35	47.34	47.77	48.51	49.46	50.59	50.70	50.83	50.59	50.02	
31	45.33	46.39	47.80	48.50	49.50	50.61	50.82	50.03				

Part 5. Miscellaneous data concerning observation wells

Roswell basin

16.25.1.Lot 3. Pearson. Well casing apparently cut off. Measuring point beginning Jan. 16, 1947, top of casing, 1.10 feet above land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

16.25.2.Lot 15. Pearson. Pump removed, well abandoned. Measuring point beginning Jan. 16, 1947, top of casing, 0.05 foot below land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum.

16.25.12.412. Terry. Measuring point beginning Jan. 14, 1947, top of casing, at land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum. New turbine pump installed.

16.26.5.Lot 3. Taylor. Measuring point beginning Jan. 17, 1947, top inside edge of rectangular opening in pump case, 0.64 foot above land-surface datum.

16.26.17.311. Roberts. Reference point established Jan. 14, 1947, top of concrete pump base, 0.04 foot above land-surface datum.

16.26.19.133. Jeffers. Formerly owned by F. M. Privett.

16.26.19.411. Jeffers. Formerly owned by F. M. Privett.

16.26.32.421. Parker. Pump removed, well abandoned. Measuring point beginning Jan. 14, 1947, top of casing, 1.00 foot below land-surface datum.

16.26.35.113. Fulton. Pump removed, well abandoned. New irrigation well with pump drilled 28 feet south of observation well.

17.25.22.224. Jackson. Previously designated incorrectly as 17.25.22.223.

17.25.26.222. Doss. Windmill, tower removed from well. Measuring point beginning Jan. 11, 1947, top inside edge of tee collar on casing 1.60 feet above land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum.

17.26.2.133. Savoie. Reference point established Jan. 14, 1947, top east edge of east 6- by 6-inch north-south timber pump support, 2.69 feet below land-surface datum.

17.26.4.121a. State of New Mexico. About 150 feet south of well 17.26.4.121. Dug domestic well. Measuring point, top edge of Geological Survey washer in 2- by 6-inch board across top of well cover, at center of well, 1.00 foot above land-surface datum. Equipped with hand pump.

17.26.10.433. Sullivan. Reference point established Jan. 13, 1947, top of concrete pump base, 0.33 foot above concrete slab, 0.30 foot above land-surface datum.

17.26.15.211. Vogel. Reference point established Jan. 13, 1947, top of concrete pump base, 0.32 foot above land-surface datum.

17.26.17.423. Denton. Measuring point beginning Jan. 11, 1947, top inside edge of 8-inch steel casing, at north side, 1.20 feet above land-surface datum. Pressure pump and storage tank installed.

17.26.18.433. Baca. Reference point established Jan. 11, 1947, top of concrete pump base, 0.70 foot above land-surface datum. New turbine pump installed.

18.26.24.223. Ramuz. Formerly owned by Angeline Mackey.

18.26.28.143. Town of Dayton. Southeast of Dayton school. Drilled well, diameter 8 inches. Measuring point, top of steel collar on casing, at land-surface datum.

19.26.13.211a. House. 156 feet east of well 19.26.13.211. Drilled irrigation well, diameter 14 inches. Measuring point, base of pump, west side of well, level with top of casing, 0.60 foot above land-surface datum. Equipped with turbine pump.

19.26.14.431b. Lee. 10 feet northwest of irrigation well 19.26.14.431. Drilled irrigation well, diameter 16 inches, depth 132 feet. Reference point, top of steel collar on casing, 0.30 foot above top of casing, 0.60 foot above land-surface datum. Equipped with turbine pump in 1947. Water levels, in feet below land-surface datum, 1946: July 16, 29.67, nearby well pumping; Sept. 10, 23.13; Nov. 18, 17.90.

20.26.17.231. Howell. Drilled irrigation well, diameter 14 inches. Measuring point, top of casing, 1.30 feet above land-surface datum.

20.26.17.411. Angell. Measuring point beginning Jan. 10, 1947, lower inside edge of rectangular opening in east side of pump case, 0.82 foot above base of pump and land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

Carlsbad area

22.26.25.432. Barfield. Unused drilled well, depth 140 feet. About 15 feet west of east entrance road to airfield. Measuring point beginning Sept. 21, 1945, top edge of concrete well curb, 1.34 feet above top of casing, at land-surface datum. Equipped with hand pump prior to July 1945.

22.26.35.222. Carlsbad airfield well 3. In shed No. T-405, 612 feet west and 32 feet north of well 1. Used drilled domestic well, diameter 12 inches, original depth 256 feet, cleaned to 200 feet August 1947. Equipped with turbine pump. Reference point, top of concrete pump base, 0.50 foot above concrete floor of pumphouse, 0.70 foot above land-surface datum.

22.26.36.111. Carlsbad airfield well 1. In shed No. T-403. Used drilled domestic well, diameter 12 (?) inches, deepened from 164 feet to 194 feet in July 1947. Reference point, top of concrete pump base, 0.35 foot above concrete floor of pumphouse, 0.55 foot above land-surface datum. Equipped with turbine pump.

22.26.36.111a. Carlsbad airfield well 2. In shed No. T-404, 421 feet west and 108 feet north of well 1. Used drilled domestic well, diameter 12 inches, original depth 260 feet. Reference point, top of casing, level with concrete floor of pumphouse, 0.30 foot above land-surface datum. Equipped with turbine pump.

22.27.30.133. Merchant. 50 feet east of U. S. Highway 62, 50 feet north of east-west road, about 15 feet south of steel storage tank. Unused drilled well, diameter 6 inches, depth 207 feet. Measuring point beginning Nov. 20, 1946, top of concrete well curb, west side of well, 0.35 foot above land-surface datum. Equipped with windmill prior to November 1946. Water levels, in feet below land-surface datum, 1942: Feb. 17, 91.03; Mar. 9, 91.97.

HIDALGO COUNTY (VIRDEN VALLEY)

The Virden Valley is the New Mexico portion of the Duncan-Virden Valley, which lies along the Gila River in Greenlee County, Arizona, and Hidalgo County, New Mexico. Water-level fluctuations in typical wells in the Duncan-Virden Valley are compared with precipitation and pumppage in the Greenlee County, Arizona, section of this paper.

During 1947, 10 water-level measurements were made in 6 wells in the Virden Valley.

Well descriptions and water-level measurements

181 (*911, p. 75; 941, p. 213; 949, p. 294; *991, p. 246; 1021, p. 236; 1028, p. 243; 1076, p. 252). P. Lunt. SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 32, T. 18 S., R. 21 W. Water levels, in feet below land-surface datum, 1947: Mar. 12, 41.03; July 23, 44.56.

185 (*911, p. 175; 941, p. 213; 949, p. 294; *991, p. 246; 1021, p. 236; 1028, p. 243; 1076, p. 252). J. Pierce. SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 32, T. 18 S., R. 21 W. Water levels, in feet below land-surface datum, 1947: Mar. 12, 31.42; July 23, 34.26.

201 (*911, p. 175; 941, p. 213; 949, p. 294; *991, p. 246; 1021, p. 236; 1028, p. 243; 1076, p. 252). J. E. Payne. NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 2, T. 19 S., R. 21 W. Water levels, in feet below land-surface datum, 1947: Mar. 12, 45.26; July 23, 48.16.

202 (*991, p. 246; 1021, p. 236; 1028, p. 243; 1076, p. 252). Byron Echols. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 2, T. 19 S., R. 21 W. Water levels, in feet below land-surface datum, 1947: Mar. 12, 15.14; July 23, pumping.

217 (*911, p. 176; 941, p. 213; *949, p. 294; *991, p. 246; 1021, p. 236; 1028, p. 243; 1076, p. 252). Nancy O. Pace. NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 12, T. 19 S., R. 21 W. Water levels, in feet below land-surface datum, 1947: Mar. 12, 17.02; July 23, 22.65.

232 (*911, p. 177; 941, p. 214; 949, p. 294; *991, p. 246; 1021, p. 236; 1028, p. 244; 1076, p. 252). Floyd Johns. NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 18, T. 19 S., R. 20 W. Water levels, in feet below land-surface datum, 1947: Mar. 12, pumping; July 23, 55.00, nearby well pumping.

LEA COUNTY (TATUM-LOVINGTON-HOBBS AREA)

Part 1. General discussion

Investigation of the ground-water resources of the part of Lea County in which ground water is used for irrigation was continued in 1947 in cooperation with the State engineer of New Mexico, primarily by measuring water levels in the system of observation wells. Results of this investigation, which began in 1929, have been published in the 9th to 13th biennial reports of the State engineer and results for the years 1938 to 1941 are to be published in a forthcoming report of the State engineer. Records of water levels in past years in Lea County have been published in the following Geological Survey water-supply papers:

<u>Year of record</u>	<u>Water-Supply Paper</u>	<u>Page Nos.</u>
1929-40	911	177-200
1941	941	214-227
1942	949	294-302
1943	991	247-255
1944	1021	236-245
1945	1028	244-252
1946	1076	253-261

Water levels are measured in a large number of wells each January, when the residual drawdown of the water levels, due to the effects of the previous year's pumping, is slight, in order that the net yearly change in water levels can be determined. (See part 2.)

Water levels are also measured at 2-month intervals in a selected group of wells to determine the seasonal fluctuations caused by the combined effects of pumping and precipitation. (See part 3.)

Water levels were measured in 94 wells in January 1947 and in about 26 in March, May, July, September, and November. Two water-stage recorders were in operation during the year. (See part 4.) A total of 228 measurements of water level was made during the year including 12 tape measurements made upon the recorder wells. All water-level measurements were made by U. N. Benge, except those in January which were made by C. S. Conover and those in September which were made by R. S. Jones.

Precipitation and pumpage

Precipitation causes changes in the water levels by changing the amount of recharge to the ground-water body and by changing the amount of discharge from the ground-water body by pumping for irrigation. At times of near-normal or above-normal precipitation, the amount of pumping of

ground water for irrigation is reduced and the amount of recharge directly from precipitation to the ground-water body is increased. The net effect at such times is a rise in water levels.

The precipitation for 1947, as reported by the U. S. Weather Bureau, was 8.33 inches at Lovington, 6.60 inches below normal, 8.82 inches at Pearl, 4.86 inches below normal, and about 11 inches at Hobbs, July records for Hobbs not being available. The precipitation in 1947 was considerably less than in 1946 when above-normal amounts were recorded at these stations. Precipitation during the growing season of 1947 was also below normal with the exception of May when 7 inches of rain fell at Hobbs, 5.6 inches above normal for May. The heavy precipitation in May coupled with good rains in March provided ample soil moisture and delayed the beginning of the pumping season to near the latter part of May, about 2 months later than usual.

The acreage of land served by pumps in Lea County increased greatly during 1947. The acreage of land irrigated in 1947 is roughly estimated by W. E. Flint, county agricultural extension agent, at 9,300 acres, an increase of 4,300 acres over 1946. The greater part of the increased acreage has been planted to cotton of which about 5,300 acres was irrigated in 1947. Acreages of grasses for permanent pasture and alfalfa increased to about 2,000 acres in 1947. The greater part of the remaining acreage was planted to row feed crops. The exact number of pumps used for irrigation in 1947 is not known but was probably at least 150.

It is estimated that about 19,000 acre-feet of water was pumped for irrigation in 1947 in addition to about 8,000 acre-feet pumped for stock, municipal, and industrial use.

Fluctuations of water level

The distances between observation wells in Lea County are so great that the relationship of the fluctuations of water level in different observation wells is not always readily apparent. The water levels in observation wells which are at some distance from pumping wells show the effects of precipitation. Those in observation wells in lightly and sporadically pumped areas show varying fluctuations. Other observation wells, in the more heavily pumped areas, show mainly the effects of pumping.

Water levels in January 1947 were at relatively high levels as a result of the above-normal precipitation in 1946. Because of the below-normal precipitation and the increase in pumping in 1947 water levels showed a decline from January 1947 to January 1948 in most of the observation wells. The declines were greater in the pumped areas than in outlying nonpumped areas. Also in the pumped areas, the net yearly declines were generally greater than for any previous year because of the increased pumping of ground water for irrigation.

In the pumped area surrounding Lovington the water levels declined generally more than 2 feet from January 1947 to January 1948 with a maximum observed net decline of 6.64 feet in an irrigation well about 2 miles northeast of Lovington. In the pumped area near McDonald and Prairieview the water levels declined generally from 1 foot to 2 feet from January 1947 to January 1948, whereas, in the preceding year the water levels showed small rises in some wells and declines in others. In the lightly pumped area near and east of Humble City water levels declined in all wells and in a well a mile east and north of Humble City, declined 2.2 feet.

The water level in the artesian well of W. O. Dunlap, 12.37.20.331, east of Tatum, declined 7.3 feet from January 1947 to January 1948 and 6.4 feet in the preceding year. This large decline seems to have occurred because a large number of holes drilled into the confining bed around Tatum for geophysical prospecting allowed the artesian water to escape into the shallow-water body.

Water levels at the end of 1947 were generally above the previous low levels reached in early 1941 but in the pumped area around Lovington they were at their lowest recorded level. With the increase in the number of pumps, the general tendency in succeeding years in the pumped areas will be a gradual net annual lowering of water levels except in years of abnormal precipitation. The magnitude of the annual declines in water level in particular areas will depend mainly upon the spacing of the wells and the amount of water pumped. Close spacing and large pumpage will result in large declines of water levels in some areas.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January 1947, in feet

Location number	Owner	Water levels		Water levels		Water levels		Water levels		Water levels		Years missing	
		Jan. 1947 also Part	1946-47 Level Day	Jan. 1947 also Part	1946-47 Level Day	Jan. 1947 also Part	1946-47 Level Day	Jan. 1947 also Part	1946-47 Level Day	Jan. 1947 also Part	1946-47 Level Day		
12.36.19.223	O. V. Fisher	*	26.67	15	-0.27	22.13	43	*	32.05	41	39		
24.434	Jerry Clay	b	5.74	15	+5.31	1.32	42	a	11.05	46	41		
25.222	State of New Mexico	3	20.18	15	+7.75	20.18	47		24.60	41	36		
27.212	do	3	33.14	15	+2.46	32.04	42		37.21	41	36		
29.110	E. D. Holt	5	29.63	15	-2.25	f	27.69	44	f	34.25	41	30	
29.111	do	3.5	30.72	15	47		
29.122	do	4.5	27.88	15	47		
12.37.20.331	W. O. Dunlap	*	7.36	15	-6.35	+15.24	43	*	+7.36	47	41		
12.38.4.312	G. C. Copeland	40.30	16	-7.49	36.15	43		43.35	41	41			
13.35.11.222	Ashley Green	5	25.63	15	+1.79	29.14	43		35.22	39	30	32-38	
19.211	Clara Elkins	44.82	15	-0.07	44.75	46		46.07	41	41			
13.36.6.221	R. W. Duncan	33.45	15	+.23	33.45	47		36.27	41	39			
9.111	Bob Baum	5	38.18	15			
33.321	Lewis Beaman	40.16	19	+1.15	40.16	47		43.28	41	39			
36.323	M. J. McGilish	36.77	16	-.10	36.07	45		38.85	41	39			
13.37.3.131	J. H. Simpson	37.74	16	+1.12	37.74	47		39.86	41	39			
3.133	do	34.13	16	+.64	33.83	43		35.67	41	40	42		
7.121	W. O. Barrow (Measurements discontinued)	3.5	29.61	15	31.49	45		34.28	36	30	46,47	
7.234	W. D. Patton	28.53	16	-.21	26.46	42		30.19	41	30			
13.132	A. M. Brownfield	3	45.94	16	-.58	33.76	46		33.76	46	47		
28.230	A. F. Hight	32.90	16	-.38	31.70	45		32.10	47	45			
28.413	Mr. Dorn	45.97	16	-.63	43.02	45		45.62	41	40			
13.38.6.341	Opal Fulton	46.57	15	45.46	45	48.93							
14.35.30.141	W. A. Anderson	3	40.06	15	+.02	40.06	47		42.37	30	30		
33.433	do	39.71	16	-.41	36.02	45		40.88	41	39			
14.36.2.410	C. M. King	39.27	15	-.03	39.03	44		40.16	41	45			
6.420	S. A. and W. B. Richardson	39.36	15	-.93	38.36	44		40.77	41	39			
9.111	A. C. Drake	40.76	15	.00	40.46	43		42.45	41	39			
9.210	Buford Rankins	35.77	16	-.03	35.74	46		37.18	41	39			
13.211	Mattie Chambers	40.79	16	-.04	40.75	46		42.09	41	39			
14.121	V. M. Chambers	31.98	16	+.60	31.40	45		34.72	40	39	42		
14.37.3.113	Lois C. Hobbs	34.56	16	+.06	34.53	45		36.69	41	39			
14.112	R. W. Smith	29.45	16	-.31	28.86	43		31.42	39	39			
16.421	School 1 land	(Incorrect designation used previously for well 14.37.20.412, which see)											
20.410	Doyle Hudgens	33.93	16	-.40	33.30	45		35.26	41	40			

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January 1947, in feet--Cont.

Location number	Owner	See also Part			Jan. 1947	Change 1946-47	Highest Level Year	Lowest Level Year	E- gan	Years missing
		Part	Level	Day						
14.37.123.213	Lee Whitman (Incorrect designation used previously for well 11)	3	33.90	16	+0.05	33.90	47	33.95	46	46
23.232	J. R. Fort	3	36.14	16	+0.02	36.14	33.213, which see)	37.89	41	30
27.130	J. W. Gaines	3	36.17	16	-.77	34.57	45	36.17	47	43
14.38.27.233	do	3	38.05	16	-1.25	36.80	46	40.14	41	39
27.240	Illa Cox	3	25.50	16	-.24	24.28	42	26.94	41	30
28.120	Will Gorrell	3	39.98	15	+.16	39.60	43	41.51	41	40
15.35.35.112	Orren Beatty	3	39.93	15	+.16	39.93	47	41.65	41	30
15.36.8.131	Ben Graham	5	44.53	19	.....	42.38	45	43.52	41	41
14.131	J. R. Hale	5	44.38	19	.....	41.89	42	44.38	47	47
28.135	D. A. Huddens	5	49.14	16	.....	41.55	42	43.95	41	41
29.410	H. R. Fleming	5	49.14	16	.....	41.55	42	43.95	41	45-47
29.441	Spencer Nymeyer	5	34.81	16	-.22	34.66	45	36.63	39	38
33.211	W. A. Simpson	5	31.23	16	.....	29.20	45	a 39.46	41	44
15.37.10.113	R. W. Dean (Incorrect designation used previously for well 11)	3	30.17	16	-.81	27.111	45	a 39.46	41	31
21.330	C. L. Neul	5	31.67	19	-1.10	29.38	43	31.23	47	42
27.110	J. W. Kotsenbocker	5	41.93	18	+.81	39.65	45	32.50	41	40
15.38.22.441	Lorene Easley	5	46.59	15	.....	43.50	43	43.84	41	39
16.36.1.400	W. L. Barber	5	45.74	15	-.94	f 43.50	43	44.20	47	47
4. Lot 12	E. H. Byers	4	46.02	15	-.42	44.53	42	46.82	47	35
5. Lot 10	Mrs. Mary Coxey	5	49.64	15	-.98	45.23	42	49.64	47	39
5. Lot 14	J. B. Phillips	5	48.36	15	-.28	44.81	42	48.36	47	39
5.321	J. T. Gwynn	5	50.18	15	-.31	45.72	42	50.18	47	39
5.411	Mrs. E. J. Robinson	5	51.79	17	-.58	50.76	44	52.48	41	38
8.424	E. B. Yarbo	5	51.99	18	+.30	50.22	42	52.61	41	40
10.233	J. E. Simmons	5	48.52	18	-.18	46.72	43	48.70	41	36
15.240	J. C. Griffin	5	49.35	18	+.05	49.33	47	50.85	41	39
27.133	State of New Mexico	5	30.32	18	-.52	28.60	42	30.90	41	38
16.37.19.200	H. T. Montielth	5	32.65	19	.....	27.48	42	33.61	41	39
33.110	Elbert Shipp	5	35.39	18	.....	30.78	46	33.63	35	31
16.38.25.144	J. S. and Rose Eaves (Measurements discontinued)	5	35.17	19	+.18	34.02	44	36.57	41	40
28.444	J. L. Williams	5	35.17	19	.....	34.02	44	36.57	41	32,47
34.131	Ralph Moe	5	35.39	18	.....	34.02	44	36.57	41	47
35.110	Mrs. P. S. Bennett	5	35.17	19	.....	34.02	44	36.57	41	40

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January 1947, in feet--Cont.

Location number	Owner	See also	Water Levels						Record
			Jan. 1947 Level	1946-47 Change	Highest Level	Lowest Level	Year	Be- gan	
17.34.35.130	Phillips Petroleum Co.	3	20.08	17 +0.60	20.08	4.7	91.98	41	41
17.35.35.120	(Incorrect designation used previously for well 17.35.35.213, which see)								
17.35.35.13	Phillips Petroleum Co.	3	35.64	17 +.48	38.64	47	41.45	41	41
17.36.3.333	State of New Mexico	3	42.11	18 +.27	42.11	42.02	44	44.29	39
17.37.3.310	John Catchings		26.54	18 +.15	26.54	26.05	44	28.84	41
26.333	Mrs. L. E. Wilhoit		27.15	18 +3.47	27.15	26.21	43	30.62	38
34.441	B. J. Caudill		25.17	18 +.73	24.60	43	27.22	41	41
36.141	State of New Mexico		••••	••••	23.78	42	26.15	40	39
17.38.27.135	W. E. Manning		25.55	18 +.52	25.55	4.7	26.07	46	46
30.113	W. H. Martin		25.62	18 +.26	25.97	42	27.95	41	38
30.312	C. V. Hawkins		28.08	18 +.31	26.47	42	30.44	41	30
34.113	H. E. Eusby		25.34	17 +.47	24.78	44	25.81	46	44
18.36.27.111	State of New Mexico	3	39.49	17 +.13	38.13	43	41.66	41	39
18.38.2.131	Sam Lalmont		28.32	17 +.30	28.20	43	30.64	40	39
4.252	J. R. Isaacs		23.07	17 +.48	22.17	43	25.59	40	30
15.241	V. L. Greenon		27.60	17 +.37	26.77	43	29.16	41	40
22.411	O. L. Key		34.63	17 +.71	34.43	43	35.67	41	40
22.412	M. C. Younger		••••	••••	37.09	43	38.69	41	40
23.131	Charles Mills		••••	••••	40.59	45	40.62	44	44
28.343	J. F. Mattox		42.10	17 +.36	40.30	43	b 44.23	45	40
30.200	Mrs. Sadie Davis		23.31	17 +.64	23.31	47	27.56	31	31
19.35.13.211	Clara Fowler	3	19.07	17 +3.16	18.38	42	a 26.67	30	30
24.222	F. K. Turner		17.78	17 +1.74	17.78	47	20.38	41	39
19.36.19.113	L. S. Evans		15.06	17 +1.47	15.06	47	17.93	41	39
19.411	C. R. Jordan		16.35	17 +.22	16.35	47	k 16.57	44	42
32.111	S. P. Jordan		15.29	17 +1.51	15.15	42	18.60	40	39
16.36.39.321	L. T. Chinders		24.29	17 +2.48	23.80	42	26.77	46	42
32.323	do		23.91	17 +2.27	23.17	42	26.18	46	42
19.37.1.231	Hobbs Country Club		24.75	17 +.58	24.75	47	25.33	46	45
32.241	Mrs. L. A. Anderson	3	12.07	17 +.22	11.50	33	12.31	37	30
16.38.2.122	A. C. Chesser		47.09	17 +.92	43.59	42	48.01	46	40
2.242	J. E. Nixon	5	44.76	17 +1.92	44.38	42	46.97	41	41
2.424	A. C. Chesser		43.09	17 +1.79	43.09	47	46.54	41	41
20.35.1.222	J. L. Wood	3	c 21.05	17 -.38	19.70	44	25.63	41	42

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January or February 1946 to January 1947, in feet--Cont.

Location number	Owner	See also	Water levels			Record	
			Jan, 1947 Part Level	Change 1946-47 Day	Highest Level Year		
20.37.9.110 9.110a	W. H. Laughlin do	3 3	29.74 28.65	17 17	-0.44 +.05	27.18 26.36 43 43 37.12 41 41	42.40 38 30 36,37

a Pumping.

b Pumping recently.

c Nearby well pumping.

f From recorder charts.

i Also 1937

j Mar. 30.

k Also 1946.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Location number	12.36.	12.36.	12.36.	13.37.	13.37.	14.35.	14.36.	14.37.
Owner	State of N.M. of N.M.	Holt	Patton	Brownfield	Ander-	Cham-	Smith	lers
Jan. 15, 16	20.18	33.14	30.72	29.61	28.53	40.06	35.77	34.56
Mar. 25, 27	20.23	33.31	30.69	29.56	28.57	40.03	35.77	34.55
May 22, 23	20.13	33.54	31.10	29.57	28.56	40.00	35.76	34.67
July 26	20.19	33.91	(a)	29.57	28.61	39.99	35.75	34.87
Sept. 10, 11	20.45	34.22	31.21	29.57	28.62	39.96	35.76	....
Nov. 15	.....	34.34	c31.25	29.56	28.59	39.93	35.75	35.37
Location number	14.37.	14.38.	15.36.	15.37.	16.38.	17.34.	17.35.	17.36.
Owner	Fort	Cox	Beatty	Dean	Moe	Petro-	Petro-	State
						leum	leum	of N.M.
Jan. 16-19	36.14	25.50	39.93	b30.17	35.39	90.08	38.64	42.11
Mar. 25-27	36.14	25.38	39.96	a30.66	35.09	89.97	38.65	42.07
May 22, 23	36.10	25.68	39.95	a31.63	35.06	89.98	38.70	42.12
July 25-27	36.33	(a)	39.97	a31.95	b46.15	89.97	38.70	42.27
Sept. 11, 12	36.59	27.92	40.00	b30.03	b47.09	89.93	38.70	42.30
Nov. 14, 15, 17	36.76	26.94	40.17	b30.03	37.73	90.00	38.72	42.26
Location number	17.38.	18.36.	18.38.	18.38.	18.38.	19.35.	19.37.	20.35.
Owner	Hawkins	State of N.M.	Isaacs	Greebon	Davis	Fowler	Anderson	Wood
Jan. 17, 18	28.08	39.49	23.07	27.60	23.31	19.07	12.07	c21.05
Mar. 26	28.29	39.48	23.12	28.85	23.22	19.38	12.18	20.93
May 21	28.39	39.57	23.25	27.80	23.37	19.65	12.11	20.77
July 25	28.72	39.70	23.89	a43.41	23.12	20.01	12.25	20.55
Sept. 12	129.48	39.92	....	....	....	....	12.04	20.48
Nov. 14, 17	28.93	39.78	23.56	28.45	23.01	20.55	12.18	20.52
Location number	20.37.	20.37.						
Owner	Laughlin	Laughlin						
Jan. 17	29.44	28.65						
Mar. 26	29.08	28.30						
May 21	28.90	28.19						
July 25	29.71	28.91						
Sept. 12	30.19	29.39						
Nov. 17	30.44	29.58						

a Pumping.

b Pumping recently.

c Nearby well pumping.

i Measurement uncertain.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

12.36.29.122. E. D. Holt. Highest and lowest recorded water levels in feet below land-surface datum: Mar. 25, 1946, 27.84; Sept. 19, 1946, 28.64; Mar. 26, 28, 1947, 27.77; Oct. 5-7, 1947, 28.68

Highest daily water level, in feet below land-surface datum, 1946
(From recorder charts)

Day	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	27.89	28.00	28.21	28.36	28.44	28.57	28.58	28.28	28.08
2	27.88	28.02	28.22	28.37	28.45	28.57	28.57	28.27	28.07
3	27.88	28.03	28.23	28.36	28.45	28.57	28.56	28.28	28.07
4	27.90	28.04	28.24	28.36	28.46	28.56	28.55	28.30	28.06
5	27.89	28.05	28.24	28.36	28.46	28.56	28.54	28.28	28.05

12.36.29.122--Continued.

Highest daily water level, in feet below land-surface datum, 1946
(From recorder charts)

Day	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
6	.....	27.90	28.06	28.24	28.35	28.47	28.56	28.54	28.26	28.04
7	.....	27.90	28.07	28.24	28.35	28.47	28.57	28.48	28.25	28.04
8	.....	27.90	28.08	28.24	28.35	28.47	28.59	28.43	28.23	28.04
9	.....	27.90	28.08	28.24	28.34	28.48	28.59	28.41	28.22	28.04
10	.....	27.91	28.09	28.24	28.34	28.49	28.60	28.41	28.22	28.01
11	.....	27.92	28.10	28.24	28.35	28.49	28.62	28.42	28.22	28.01
12	.....	27.93	28.11	28.25	28.35	28.50	28.62	28.40	28.22	28.01
13	.....	27.93	28.10	28.26	28.34	28.50	28.60	28.40	28.21	28.00
14	.....	27.93	28.10	28.27	28.34	28.50	28.62	28.39	28.18	28.00
15	.....	27.93	28.10	28.28	28.34	28.52	28.63	28.38	28.18	28.00
16	.....	27.94	28.11	28.28	28.34	28.53	28.63	28.36	28.18	28.01
17	.....	27.94	28.11	28.29	28.34	28.54	28.63	28.35	28.19	28.00
18	.....	27.95	28.10	28.30	28.35	28.55	28.63	28.34	28.17	27.98
19	.....	27.95	28.12	28.30	28.36	28.56	28.64	28.34	28.16	27.97
20	.....	27.95	28.12	28.32	28.39	28.55	28.62	28.33	28.14	27.97
21	.....	27.95	28.13	28.33	28.39	28.55	28.61	28.32	28.14	27.97
22	27.85	27.95	28.12	28.34	28.40	28.55	28.61	28.31	28.14	27.97
23	27.86	27.97	28.13	28.35	28.40	28.56	28.62	28.29	28.11	27.97
24	27.85	27.97	28.15	28.35	28.41	28.57	28.62	28.28	28.10	27.96
25	27.84	27.97	28.17	28.36	28.41	28.58	28.61	28.27	28.10	27.96
26	27.87	27.98	28.17	28.35	28.42	28.58	28.59	28.26	28.11	27.94
27	27.88	27.98	28.17	28.36	28.42	28.55	28.59	28.26	28.11	27.93
28	27.86	27.98	28.17	28.36	28.43	28.57	28.59	28.25	28.09	27.92
29	27.87	27.99	28.18	28.36	28.43	28.59	28.61	28.24	28.08	27.95
30	27.88	28.00	28.19	28.36	28.43	28.58	28.59	28.25	28.08	27.94
31	27.89		28.20		28.43	28.57		28.27		27.93

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	27.92	27.87	.....	27.79	27.95	27.92	28.19	28.31	28.40	28.66	28.67	28.51
2	27.92	27.85	.....	27.80	27.94	27.92	28.21	28.31	28.40	28.64	28.64	28.51
3	.....	27.83	27.85	27.81	27.93	27.92	28.22	28.32	28.41	28.64	28.63	28.50
4	.....	27.85	27.84	27.81	27.91	27.94	28.21	28.34	28.43	28.66	28.63	28.50
5	.....	27.82	27.84	27.84	27.91	27.94	28.22	28.34	28.46	28.68	28.62	28.49
6	.....	27.82	27.86	27.89	27.92	27.96	28.22	28.35	28.46	28.68	28.60	28.48
7	.....	27.82	27.85	27.89	27.94	27.97	28.21	28.37	28.48	28.68	28.62	28.47
8	.....	27.83	27.84	27.89	27.95	27.98	28.22	28.39	28.49	28.67	28.60	28.47
9	.....	27.83	27.84	27.85	27.96	27.98	28.22	28.39	28.49	28.66	28.59	28.47
10	.....	27.81	27.83	27.87	27.96	27.99	28.23	28.39	28.49	28.65	28.60	28.48
11	.....	27.81	27.81	27.87	27.95	28.00	28.24	28.39	28.50	28.65	28.60	28.47
12	.....	27.83	27.81	27.89	27.96	28.02	28.24	28.41	28.51	28.65	28.60	28.47
13	.....	27.82	27.82	27.90	27.94	28.06	28.26	28.42	28.52	28.67	28.60	28.47
14	.....	27.82	27.81	27.88	27.92	28.08	28.27	28.42	28.52	28.64	28.58	28.47
15	27.88	27.84	27.83	27.87	27.93	28.09	28.28	28.41	28.54	28.63	28.59	.....
16	27.90	27.85	27.81	27.88	27.93	28.11	28.29	28.41	28.54	28.61	28.59	.....
17	27.90	27.83	27.80	27.86	27.93	28.11	28.29	28.40	28.55	28.61	28.59	.....
18	27.88	27.86	27.80	27.83	27.92	28.12	28.30	28.40	28.57	28.61	28.57	.....
19	27.85	27.88	27.80	27.84	27.90	28.14	28.28	28.40	28.59	28.60	28.57	.....
20	27.86	27.89	27.80	27.84	27.90	28.13	28.26	28.41	28.60	28.59	28.56	.....
21	27.89	27.92	27.80	27.83	27.94	28.12	28.25	28.43	28.61	28.57	28.55	.....
22	27.88	27.91	27.78	27.82	27.94	.....	28.23	28.44	28.62	28.57	28.55	.....
23	27.86	27.91	27.78	27.84	27.95	.....	28.22	28.44	28.62	28.59	28.53	.....
24	27.86	27.91	27.80	27.87	27.96	.....	28.23	28.45	28.62	28.61	28.53	.....
25	27.86	.....	27.80	27.91	27.95	28.12	28.22	28.45	28.64	28.63	28.52	.....
26	27.84	.....	27.77	27.94	27.94	28.13	28.22	28.46	28.65	28.65	28.53	.....
27	27.84	.....	27.78	27.94	27.92	28.13	28.22	28.46	28.66	28.65	28.53	.....
28	27.82	.....	27.77	27.93	27.91	28.13	28.24	28.46	28.66	28.64	28.54	28.42
29	27.81	.....	27.78	27.93	27.94	28.15	28.25	28.46	28.67	28.64	28.53	28.41
30	27.85	.....	27.78	27.94	27.92	28.17	28.27	28.42	28.67	28.65	28.53	28.40
31	27.85	.....	27.78	.....	27.91	28.29	28.39		28.67		28.40	

16.36.4.Lot 12. E. H. Byers. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Apr. 24, 28-30, 44.90; Sept. 12, 14, 48.10.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	46.20	45.41	.....	44.95	44.91	45.91	.....	47.47	47.73	47.73	47.16	.....
2	46.16	45.40	.....	44.94	44.91	45.96	.....	47.50	47.81	47.91	47.09	.....
3	46.11	45.39	.....	44.94	44.91	46.06	.....	47.47	47.85	47.82	47.04	.....
4	46.06	45.38	.....	44.93	44.91	46.10	.....	47.40	47.85	47.73	47.00	.....
5	46.02	45.36	.....	44.93	44.91	46.08	.....	47.31	47.88	47.80	46.95	.....
6	45.99	45.35	.....	44.94	44.91	46.12	.....	47.29	47.91	47.77	46.92	.....
7	45.96	45.35	.....	44.93	44.91	46.20	.....	47.39	47.96	47.83	46.88	.....
8	45.93	45.34	.....	44.93	44.91	46.27	.....	47.50	48.00	47.90	46.84	.....
9	45.88	45.33	.....	44.91	44.91	46.31	.....	47.55	48.03	47.93	46.81	.....
10	45.84	45.32	.....	44.92	44.91	46.39	.....	47.58	48.06	47.89	46.77	.....
11	45.81	45.31	.....	44.92	44.92	46.48	.....	47.56	48.09	47.83	46.74	.....
12	45.79	45.30	.....	44.92	44.92	46.59	.....	47.61	48.10	47.74	46.70	.....
13	45.77	45.29	.....	44.92	44.92	46.67	.....	47.64	48.09	47.65	46.67	46.20
14	45.75	45.29	.....	44.92	44.91	46.77	.....	47.67	48.10	47.57	46.66	.....
15	45.72	45.27	.....	44.92	44.91	46.86	.....	47.68	48.00	47.50	46.63	.....
16	45.69	.....	.....	44.92	44.91	46.90	47.12	47.71	47.89	47.48	46.61	.....
17	45.67	.....	.....	44.92	44.91	46.97	47.06	47.71	47.80	47.43	46.58	46.17
18	45.64	.....	.....	44.91	45.04	47.03	47.02	47.68	47.70	47.41	46.56	.....
19	45.63	.....	.....	44.91	45.11	47.07	46.98	47.75	47.62	47.46	46.56	.....
20	45.61	.....	.....	44.91	45.14	47.11	46.93	47.78	47.51	47.41	46.55	.....
21	45.59	.....	.....	44.91	45.16	.....	46.90	47.61	47.45	47.34	46.50	46.13
22	45.57	.....	.....	44.91	45.15	47.11	46.96	47.76	47.59	47.23	46.47	.....
23	45.56	.....	.....	44.91	45.14	47.05	47.08	47.81	47.31	47.23	46.45	.....
24	45.54	.....	.....	44.90	45.13	46.98	.....	47.80	47.25	47.35	46.43	.....
25	45.52	.....	45.01	44.91	45.12	46.97	.....	47.67	47.24	47.43	46.43	.....
26	45.51	.....	45.00	44.91	45.12	47.02	47.36	47.56	47.31	47.54	.....	.....
27	45.48	.....	44.99	44.91	45.21	.....	47.38	47.53	47.43	47.50	.....	.....
28	45.46	.....	44.97	44.90	45.36	.....	47.34	47.57	47.53	47.45	.....	.....
29	45.44	.....	44.97	44.90	45.54	.....	47.33	47.64	47.54	47.36	.....	.....
30	45.44	.....	44.96	44.90	45.68	.....	47.40	47.72	47.65	47.23	46.33	.....
31	45.42	.....	44.95	.....	45.79	.....	47.43	47.77	.....	47.22	.....	.....

Part 5. Miscellaneous data concerning observation wells

12.36.29.110. Holt. Equipped with turbine pump in fall of 1946.

12.36.29.111. Holt. Drilled irrigation well, diameter 12 inches.

Measuring point beginning Nov. 15, 1947, top west edge of east 6- by 5-inch timber pump support, 0.50 foot above land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: Sept. 25, 31.59; Nov. 26, 30.98.

12.36.29.122. Holt. Abandoned drilled irrigation well, diameter 12 inches, depth 75 feet. Measuring point, top of casing level with concrete pump base, 0.25 foot above land-surface datum. Equipped with an automatic water-stage recorder Mar. 22, 1946. Water level, in feet below land-surface datum, 1945: Sept. 24, 27.43.

13.35.11.222. Green. Measuring point beginning Jan. 15, 1947, top of wooden well flooring, 1.10 feet above land-surface datum.

13.36.9.111. Baum. Drilled irrigation well. Measuring point, top of concrete pump base, 0.30 foot above land-surface datum. Equipped with turbine pump.

13.37.7.234. Patton. Drilled stock and domestic well. Measuring point, top edge of 3-inch windmill pipe, 2.68 feet above 4-inch pipe clamps, 3.03 feet above land-surface datum.

13.37.7.234--Continued.

Water level, in feet below land-surface datum, 1945-46

Date	Water level	Date	Water level	Date	Water level
May 27, 1945	30.03	Nov. 22, 1945	30.08	July 23, 1946	30.14
July 28	30.07	Mar. 22, 1946	30.08	Sept. 25	30.10
Sept. 24	30.09	May 24	30.11	Nov. 26	29.70

14.37.20.412. Hudgens. Previously designated incorrectly as 14.37.20.410.

14.37.23.213. Whitman. Previously designated incorrectly as 14.37.23.232.

15.36.28.133. Hale. Drilled irrigation well, diameter 13 $\frac{1}{2}$ inches. Reference point, top of casing level with concrete pump base, 0.50 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1946: July 22, 44.23.

15.36.33.211. Nymeyer. Drilled irrigation well, diameter 16 inches, depth 110 feet. Reference point, top of concrete pump base, 0.56 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1947: May 23, 79.92, pumping.

15.37.27.111. Naul. Previously designated incorrectly as 15.37.27.110.

16.36.4.Lot 2. Barbee. Drilled irrigation well. Measuring point, top of concrete pump base, 0.70 foot above land-surface datum. Equipped with turbine pump.

16.36.5.Lot 14. Phillips. Old measuring point and reference point destroyed. New concrete pump base 2 $\frac{1}{2}$ by 2 $\frac{1}{2}$ feet. Reference point beginning Jan. 15, 1947, top of concrete pump base, 0.40 foot above land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.

16.38.34.131. Moe. Drilled irrigation well, diameter 16 inches, depth 140 feet. Measuring point, top edge of concrete pump base, west side of well, 0.65 foot above land-surface datum. Equipped with turbine pump.

17.35.35.213. Phillips Petroleum Co. Previously designated incorrectly as 17.35.35.120.

19.38.2.242. Nixon. Formerly given as Nickson. Reference point beginning Jan. 17, 1947, top edge of concrete weir box, 10 feet south of well, about 200 feet west of road, 2.48 feet above land-surface datum.

LUNA COUNTY (MIMBRES VALLEY)

Part 1. General discussion

The Mimbres Valley, in which ground water is used extensively for irrigation, is in the southwestern part of New Mexico near Deming. Investigation of the ground-water resources of this area was continued in 1947 in cooperation with the State engineer of New Mexico. Data on early development of the area are contained in Geological Survey Bulletin 618 and Water-Supply Paper 345c. Results of continuation studies have been published in the 8th to 13th biennial reports of the State engineer of New Mexico. Results for the years 1938 to 1941 are to be published in a forthcoming report of the State engineer. Records of water levels in past years

In Luna County have been published in the following Geological Survey water-supply papers:

<u>Year of record</u>	<u>Water-Supply Paper</u>	<u>Page Nos.</u>
1927-39	886	423-449
1940	911	200-217
1941	941	228-243
1942	949	302-313
1943	991	256-268
1944	1021	245-262
1945	1028	252-267
1946	1076	261-275

The water levels in the Mimbres Valley generally continue to decline every year as a result of the continued pumping of ground water from storage. Careful study of the changes in the water level is essential as the major decline which has occurred over a period of years makes the recovery of water for irrigation costly.

Most of the development at the present time consists of deepening present wells in order to tap additional aquifers. As the water in the deeper aquifers is under pressure, deepening of wells tends to temporarily reduce the pumping lift to a small extent. However, as all of the water appears to be part of the same hydrologic system, tapping of the deeper aquifers does not tap a new source of supply but does partially relieve the draft upon the shallow aquifers in the vicinity of the deeper well. Some new development has been allowed in the area south of Deming. A large part of this new development has been by transfer of water rights from areas of concentrated development, such as from east of the Florida Mountains.

Water levels were measured in 135 wells distributed throughout the area in January 1947 by which time the major part of the recovery from the preceding summer's pumping had occurred. Comparing January readings from year to year gives the net annual change in water level. (See part 2 and the accompanying map.) Water levels were also measured in about 63 of these wells in March, May, July, September, and November in order to observe the varying seasonal fluctuations caused by pumping and the sporadic recharge from the Mimbres River. (See part 3.) Water-stage recorders were operated throughout the year on the same four wells as in preceding years and part of the year on another well. The daily readings obtained (see part 4) are helpful in completing the picture of the changing water levels. A total of 451 water-level measurements was made during the year

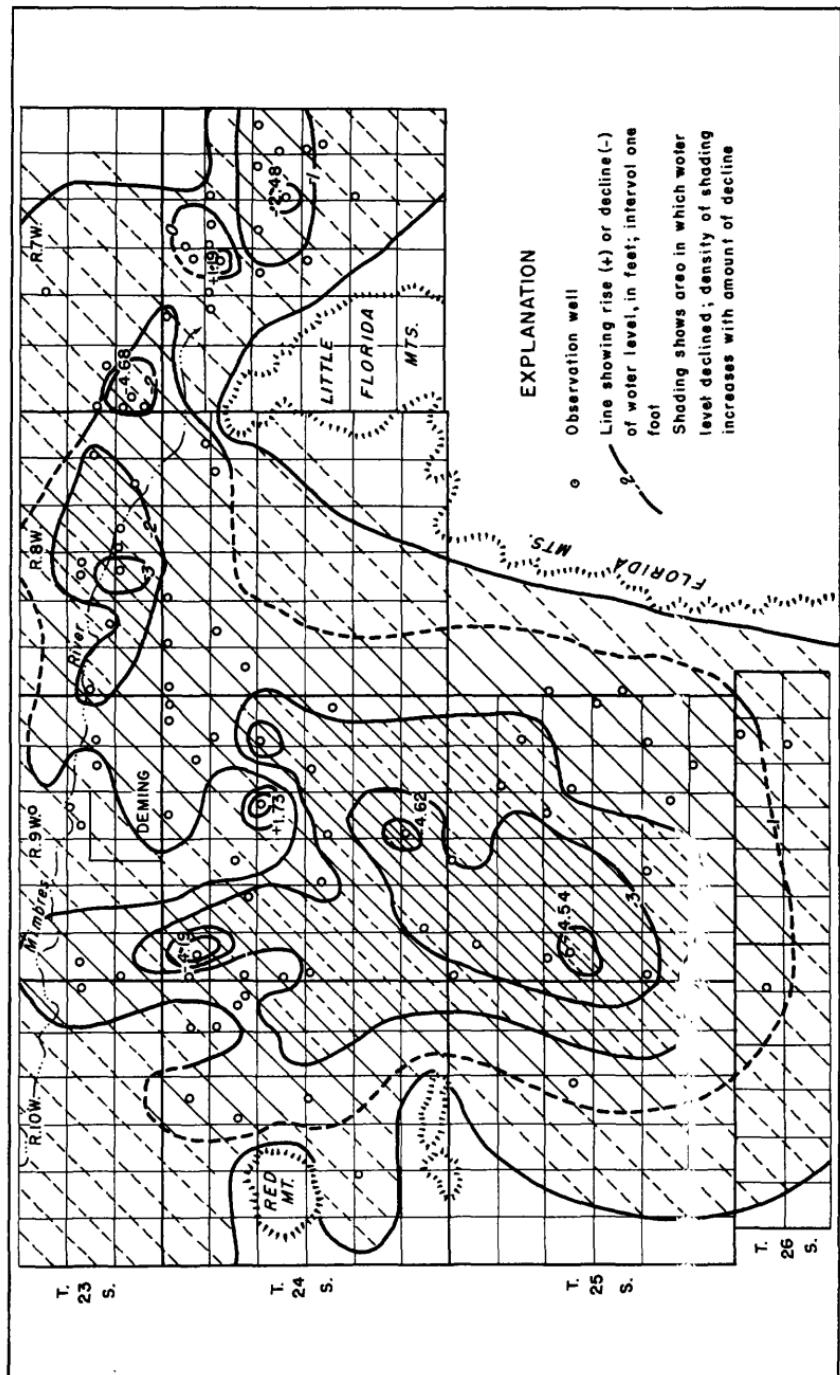


Figure 16.--Map of Limbres Valley, Luna County, N. Mex., showing decline of ground-water level from January 1947 to January 1948.

on the observation wells, including 30 tape measurements made on the recorder wells. All measurements of water level were made by G. R. Chenot except part of those in January which were made by C. S. Conover and those in November which were made by C. R. Murray.

Precipitation and pumpage

Precipitation falling on the Mimbres Valley, particularly on the headwaters of the Mimbres River, is the ultimate source of the water stored in the aquifer and also furnishes part of the water requirement of the crops and consequently at such times reduces the amount of pumping necessary. In 1947 the precipitation at Deming, as reported by the U. S. Weather Bureau, was 5.46 inches, 4.25 inches below normal and 2.33 inches less than in 1946. The precipitation at Columbus, near the Mexican border, was 5.64 inches, 4.05 inches below normal, while that at Mimbres ranger station in the area of the headwaters of the Mimbres River, was 10.59 inches, 5.46 inches below normal. The precipitation at both Gage and Florida was less than 6 inches, about 4 inches below normal. As precipitation during the main part of the growing season, April to September, amounted to only 3.19 inches, 3.20 inches below normal, practically all the water requirements of the crops was furnished by irrigation.

The acreage irrigated in the Mimbres Valley has continued to increase year by year, with an estimated 19,000 acres being irrigated in 1947, an increase of about 1,000 acres over 1946. The increased acreage and the high price obtained for crops, as well as the deficient rainfall, caused an increase in the amount of water pumped. On the basis of the power records for 174 comparable pumps, it is estimated that about 10 percent more water was required for crops in 1947 than in 1946 and that about 47,000 acre-feet of water was pumped for irrigation in 1947. An additional 2,300 acre-feet is estimated to have been used for domestic and industrial purposes, a slight increase from 1946 as a result, mainly, of increased use for the Deming swimming pool.

Fluctuations of water level

The ground-water levels in the Mimbres Valley, from January 1947 to January 1948, showed the largest net annual decline on record. The areas of decline are shown on the accompanying map. The ground-water levels declined more than 1 foot over all of the irrigated area except a small area

Water levels in observation wells near the Mimbres R'ver about 13 miles northwest of Deming showed declines of from 0.8 to more than 1 foot from January 1947 to January 1948. One well near the Mimbres River where the river leaves the hills and enters upon the alluvial plain showed a decline in water level of more than 5 feet. These declines indicate deficient recharge from the Mimbres River during 1947.

The increased area of decline of water levels in 1947 which resulted from the increased pumpage and deficient recharge is shown by the following table which gives the comparative areas for preceding years:

Area, in square miles, in which water levels showed a net decline of more than:

<u>Year</u>	<u>1 foot</u>	<u>2 feet</u>	<u>3 feet</u>
1941	36	5	1
1942	41	4	0
1943	100	10	1
1944	23	4	1
1945	133	9	1
1946	147	29	1
1947	157	63	19

In the 6-year period from January 1942 to January 1948 the water levels in the Mimbres Valley declined an average of more than 1 foot a year over an area of about 95 square miles. (See accompanying map.) This decline was confined to three areas wherein the greatest pumping has occurred. The largest area of decline of more than 6 feet over about 79 square miles covered mainly Tps. 24 and 25 S., R. 9 W., south of Deming. The other areas of decline of more than 6 feet occurred over about 10 square miles in the irrigated area northwest of the Little Florida Mountains and over about 6 square miles in the irrigated area northeast of the Little Florida Mountains.

The maximum observed declines from January 1942 to January 1948 were: 11.2 feet in a well in the irrigated area 6 miles south of Deming; 10.40, 13.5, and 17.0 feet in three wells from 3 to 5 miles west of Deming; 9.8 feet in a well 5 miles east of Deming; 17.7 feet in a well on the east side of the underground dam that extends northward from the Little Florida Mountains; and 7.1 feet in a well 5 miles east of the Little Florida Mountains.

The large observed decline of 17.0 feet west of Deming occurred in the State engineer test well that was drilled in 1941 to a depth of 1,000 feet in order to test an available water supply in the deeper aquifers.

The original water level in this well in January 1942 was 57.9 feet below the land surface, about 15 feet above the general water level in nearby shallow wells. The water level in this well, which has been pumped since 1944, has declined at a rate in excess of that in the nearby shallow wells so that by the end of 1947 the water level in this well was only about 7 feet above that in nearby shallow wells.

Other deep wells drilled in the Mimbres Valley have also exhibited a greater rate of decline of water level than in nearby shallow wells. Drilling of the deeper wells results in a temporary rise of water level in the particular well because of the greater hydrostatic pressure in the deeper aquifer and results in an increase in discharge of the well. The shallower aquifers surrounding the deepened wells also are generally replenished somewhat by the flow of water from the deeper aquifers. However, the ultimate effect of deepening wells will be to bring the water in the lower aquifers to the same hydrostatic head as that in the upper aquifers. Until such time as this occurs the water levels in the deeper wells will decline at a greater rate than in the shallower wells.

The effect of recharging the shallower aquifers by leakage from the deeper aquifers through the medium of deep wells and the larger decline of the water level in the deep wells from January 1942 to January 1948 is shown on the accompanying map. A number of wells have been deepened during this time in the irrigated area west of Deming. The over-all decline of shallow-water level of about 6 feet in this area during this time is apparently less than would otherwise have occurred with the amount of water that has been pumped. Declines in water level of as much as 10 feet occurred 2 miles farther west where the amount of pumping has been less. Observed declines of water levels in two deep wells in this area, secs. 6 and 7, T. 24 S., R. 9 W., during this period, however, are quite large, 13 and 17 feet.

As the water pumped in the Mimbres Valley is being taken from ground-water storage the water levels will continue to decline from year to year and result in increased pumping lifts. If the amount of pumping is not increased, the rate of decline will gradually decrease as the effects of pumping reach greater and greater areas.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet

Location number	Owner	Water levels						Record
		See also	Jan. 1947 Part Level	1946-47 Change Day	Highest Level	Lowest Level	Year Begun	
21.10.6.112	Tom Tigner	3	9.76	7	-1.03	6.57	33	9.76 47 29
21.11.13.411c	Claude Irwin	3	44.68	7	-5.91	38.77	46	44.68 47 45
35.310	State of New Mexico	3	33.67	7	-2.79	18.76	32	33.67 47 30
22.10.18.121	do	3	76.20	9	-1.05	68.51	30	76.20 47 29
20.210	do	3	92.29	7	-5.57	88.72	40	93.18 41 40
22.11.2.210	do	3	34.07	7	-2.19	21.11	30	34.07 47 30
13.122	do	3	68.09	9	-1.16	59.07	30	68.09 47 29
13.221	do	3	74.70	6	-1.00	66.06	30	74.70 47 29
13.411	do	5	76.30	9	.....	.....	.....	47 29
14.222	do	3	.....	•	.....	50.23	32	59.46 46 29
23.222	do	3	54.89	6	-1.19	47.43	42	60.30 37 29
24.211	do	5	77.05	6	.....	92.90	42	94.29 46 42
23.7.17.242	Jack Smyer	3	97.27	12	-2.98	95.45	45	97.96 47 45
21.311	Unknown	3	70.96	12	-5.58	69.56	40	70.96 47 40
30.433	John Kelly	3	65.24	12	-9.4	58.42	40	65.24 47 40
30.Lot 16	H. T. Foster	3	28.70	12	-6.6	22.62	32	28.70 47 32
31.111	William Hass	3	56.54	12	+2.97	39.49	40	56.54 47 40
31.111a	do	5	55.95	12	.....	.....	.....	47 40
31.132	do	5	58.80	12	+8.23	40.60	40	58.80 47 40
31.133	do	3,5	48.86	12	-3.42	59.99	40	65.20 46 40
33.211	Lewis and R. S. Smyer	3	68.62	12	-3.42	131.14	42	132.70 47 42
23.8.3.322	U. S. Government	3	132.70	8	-4.42	34.67	30	38.65 46 30
13.411	E. P. Peoples	•	.....	•	.....	.....	.....	31-36, 44,47
25.311	Ed Remondini	23.81	12	-1.07	20.75	40	23.81 47 40	
26.131	Geo. Snyder	3 (c)	12	.....	28.26	28	37.10 46 28	
28.231	C. R. Lewis, Jr.	•	50.52	12	-1.85	43.50	42	50.52 47 42
28.241	do	•	49.93	12	-1.89	40.23	40	49.93 47 40
29.433	E. Krenek	•	51.67	12	-1.23	42.56	39	51.67 47 39
30.133	Lee Wilkerson	•	49.56	13	-1.11	44.96	39	49.56 47 39
32.323	H. H. Holliday	•	45.8	11	-1.0+	33.92	29	45.8 47 29
33.221	Geo. Dowdle	3	42.98	12	-1.71	35.66	40	42.98 47 40
34.111	do	3,5	40.62	12	-1.55	33.52	40	40.62 47 40

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Cont'd nued

Location number	Owner	Water levels						Record
		See also Part	Jan. 1947 Level	Change 1946-47	Highest Level	Lowest Level	Be-gan	
Day	Day	Day	Year	Year	Year	Year	Year	Years missing
23.8.34.211	E. B. Law	3	39.07	1.2	-1.46	27.50	29	39.07
35.233	Joe Remondini	•	29.47	.12	+.11	29.14	44	30.44
23.9.7.240	R. W. Wilson	•	100.10	9	-.88	97.06	40	100.10
22.113	Roy Perkins	3	64.53	9	-.49	58.77	32	64.53
25.311	Albert Ernst	3	58.55	12	-.65	50.40	28	58.55
26.410	H. H. Ruebush	•	58.38	9	-.77	53.64	39	58.38
27.142	H. J. Thomas	3	63.58	9	-.71	54.75	32	63.58
27.221	J. D. McDaniels	3	60.56	8	-1.07	52.18	30	60.56
30.142	J. W. Mazac	5	83.39	9	••••	••••	••••	••••
31.110	Glen Neighbors	5	75.12	9	-2.18	75.38	40	79.76
23.10.25.342	J. W. Mazac	5	82.84	9	••••	••••	••••	••••
24.6.29.300	Bill Birchfield	•	68.02	11	-.37	66.89	1	68.26
30.111	do	a	69.10	11	-.50	66.16	1	69.10
24.7.3.311	G. D. Hatfield	5	10.74	11	-3.38	7.36	46	10.74
4.424	do	3	86.87	11	-.50	65.36	29	86.87
5.211	R. W. Williamson	3	b	86.74	12	-1.37	66.90	32
8.212	J. W. McDougall	•	84.97	11	-1.80	78.47	40	84.97
9.111	Smyer Bros.	3	86.27	11	-1.61	77.25	39	86.27
9.111a	do	3.5	38.22	11	••••	••••	••••	••••
9.241	G. L. Hatfield	3.4	91.53	11	-.04	84.60	40	91.80
9.241a	do	3.5	28.5	12	-6.2	21.49	45	28.5
10.111	Fred Hassman	3.5	20.73	11	••••	20.73	47	91.67
10.211	Edith E. Pollard	3	92.35	11	-1.17	82.47	40	92.35
11.111	Myrtle Franklin	•	89.18	11	+1.31	74.69	39	90.49
13.212	Robert Eggleston	•	72.18	11	-.26	66.53	40	72.18
13.311	J. H. Winslow	•	79.34	11	-.47	69.97	39	79.34
14.221	Catherine Nordhaus	4	83.62	11	-1.05	f	72.11	39
14.331	Fred Abraham	•	82.23	11	+.47	76.38	40	82.70
15.122	Geo. Snyder	3	87.69	11	+.25	79.36	39	90.71
16.211b	C. W. Gevrin	•	78.41	11	-.83	81.08	42	87.69
21.222	Jasper Wilson	3	77.15	11	-.66	70.16	40	78.41
24.111	Bill Birchfield	3	73.39	11	-.60	68.60	41	77.15
24.312	do	3	72.22	11	-.59	69.59	43	72.22
26.113								43

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Cont'd

Location number	Owner	See also	Water levels						Record	
			Jan. 1947 Level	1947 Day	Change 1946-47	Highest Level	Lowest Level	Years began		
24.8.1.333b	F. K. Kretetk	3	19.55	11	-2.01	15.86	45	19.55	40	
4.111	Foy Riley	4	40.43	11	-1.04	35.59	41	40.47	41	
5.111	R. A. Hackebell	*	46.81	11	-0.67	34.52	29	46.81	29	
6.1112	Deming Air Base	3	53.24	13	-1.13	46.22	43	53.24	43	
7.431	Paul Hrina	*	43.84	13	+ .55	39.06	42	44.39	42	
8.121	Mrs. J. F. Holiday	3	45.99	13	-1.41	40.21	39	45.99	43	
11.221	F. K. Kretetk	*	18.96	11	-1.59	12.60	34	18.96	47	
24.9.1.211	Deming Air Base	3	58.83	13	-0.07	55.64	43	58.83	43	
1.222	do	3	55.88	13	-0.07	54.69	44	55.88	47	
2.421	Rosendo Trujillo	3	58.48	12	-0.77	48.10	33	58.48	44	
3.121	Jim Swartz	*	5	62.42	9	59.09	42	62.34	46
3.122	Unknown	*	80.10	9	+ .26	61.35	28	80.36	46	
6.311	J. B. Wells	3	70.10	7	-3.84	57.50	42	70.10	47	
6.431	State of New Mexico	*	m 71.30	7	+3.89	67.49	42	78.76	41	
7.211	Emanuel Vocale	*	80.43	8	-2.28	66.10	30	80.43	47	
7.351	S. R. Moir	3	75.52	9	-1.76	61.90	31	76.85	46	
8.112	B. F. Jones (Measurements discontinued, well dry)	*	71.03	9	-1.53	68.60	40	75.52	47	
8.441	F. A. Bredecko	*	58.88	12	-1.13	65.16	39	71.03	47	
9.411	Joe Clary	3	52.98	12	-20.64	47.68	28	58.88	47	
12.111	E. H. Hatcher	*	67.40	10	-1.23	61.60	40	67.40	47	
13.111	Mary E. Barrett	3,5	78.40	8	-1.72	72.38	40	78.40	40	
15.221	Joe Lutonsky	*	79.39	9	-1.55	72.82	40	79.39	47	
18.311	Chas. Peter	*	77.26	13	-2.19	59.33	29	77.26	47	
19.111	Francis Lipocky	3	73.35	10	-2.22	69.50	45	73.35	47	
21.131	L. L. Gaskill	*	73.33	10	-1.10	58.12	30	73.33	47	
22.311	Joe Hrina	*	63.18	12	-1.28	57.99	41	63.18	47	
23.211	Emanuel Vocale	3,5	69.45	12	-2.25	62.88	41	74.65	47	
24.421	W. F. Roberts	*	74.65	10	-2.16	65.00	40	77.66	47	
26.211	Unknown	*	77.86	10	-2.29	65.94	46	68.23	47	
28.221	John Hrina	*	68.23	10	-2.43	78.45	42	83.91	47	
32.311	D. D. Roderick	*	83.91	9	-2.68	75.17	30	91.65	47	
34.111a	V. V. Norwood	*	91.65	8	-2.68	78.45	42	31, 33,	34	
24.10.1.311	R. V. Griggs	*	do	do	do	do	do	do	do	
3.411	Josh Bryan	*	do	do	do	do	do	do	do	

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	See also	Water Levels						Record
			Part	Jan. 1947 Level	Change 1946-47	Highest Year	Lowest Year	Be- gan	
24.10.3.411b 10.311	Josh Bryan John Tilich	3	83.34 85.36	8 9	-1.94 -1.44	75.34 76.53	42 30	83.34 85.36	47 47
12.111	Morgan Garrett	4	85.42	9	•••	79.69	39	85.42	47
12.431	Steve Hrina	•	82.76	9	-1.15	f 78.08	40	f 82.95	47
12.432a	do	•	82.97	8	-2.04	77.29	40	82.97	47
12.432b	do	•	83.29	8	-1.95	78.05	40	83.29	47
22.211	E. F. Hurt	3	72.99	9	-1.13	69.61	42	72.99	47
29.222	State of New Mexico	3	65.81	9	-6.60	63.87	41	65.81	47
24.11.1.333	J. D. Smith	•	100.35	9	-24	99.78	44	100.35	47
25.8.1.111	Spencer McCann	3	55.92	11	-1.13	50.00	40	55.92	47
19.331	Unknown	3	63.05	11	-1.25	59.01	42	63.05	47
25.9.4.211	Val Miller	4	73.30	13	-2.52	63.70	41	73.30	47
6.111	P. M. Yates	3	70.69	10	-1.37	65.14	41	70.69	47
6.421	Roderick & Wheeler	3	75.17	10	-2.34	66.41	39	75.17	47
11.111	J. B. Anderson	3	69.11	11	-1.66	60.01	39	69.11	47
12.311	Jo Villa Cheek	•	62.92	11	-1.32	56.69	40	62.92	47
14.311	C. W. Gaines	•	63.47	13	-1.42	57.10	40	63.47	47
15.211	C. H. Paulk	•	67.57	11	-1.65	59.78	39	67.57	47
18.211	S. P. Walker	5	74.30	10	••••	••••	••••	••••	47
18.412	Tom Marcak	5	73.37	10	••••	••••	••••	••••	47
19.111	do	•	69.81	10	-1.96	62.41	40	68.81	47
21.311	A. W. Speir	3	••••	••	••••	63.48	39	67.97	45
24.222	D. J. Schmelzla	•	53.74	11	-1.57	42.26	28	53.74	47
24.222a	do	•	53.43	11	-1.28	52.14	46	53.43	47
25.111	Alan Crotchett	•	51.81	11	-1.20	47.54	40	51.81	47
27.422	H. A. Gray	•	59.06	11	-1.20	53.42	40	59.06	47
28.121	Leonard Zumwalt	3	72.37	11	-2.12	66.03	42	72.37	42
30.111	M. M. Robertson	65.60	10	-3.15	55.78	40	65.60	47	40
30.222	Ernest Welch	5	67.67	11	••••	••••	••••	••••	47
35.211	Joe Marcak	3	53.10	11	-1.15	47.21	39	53.10	47
25.10.15.422	U. H. Graves	•	60.15	10	-3.35	57.18	40	60.15	47
36.111	State of New Mexico	3	65.53	10	-1.43	56.84	40	65.53	47
36.222	do	•	67.12	10	-2.22	56.94	39	67.12	47
26.9.2.221	T. R. Taylor	43.09	11	-7.77	39.69	41	43.09	47	42
4.331	R. E. Smyer	(a)	11	••••	••••	52.28	41	55.62	47

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number ^a	Owner ^b	Water levels						Record
		See also ^c	Jan. 1947 Part	Jan. 1947 Level	Change 1946-47	Highest level	Lowest level	
26.9.11.211	State of New Mexico	3	40.48	11	-0.58	37.30	40	40
26.10.1.310	Theo. Eissen	•	63.13	10	-1.49	55.42	28	33,36-39
27.8.8.411	Bill Birchfield	3	23.96	13	-.17	23.45	42	40
27.9.12.111	Waterloo School	3	27.43	13	-.31	27.12	46	45
28.7.18.211	R. W. Marshall	2.85	13	+3.50	•50	41	14.53	40
29.8.12.244	A. G. Anderson	•	7.48	13	+.07	7.07	1	40
13.111	L. L. Burkhead	•	6.68	13	+.04	6.44	1	40

^a Pumping.^b Pumping recently.^c Nearby well pumping.^d Dry at depth given.^e From recorder charts.^f March.^g Measured by air gage.^h Measurement uncertain.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Location number	21.10.	21.11.	21.11.	22.10.	22.11.	22.11.	22.11.	22.11.
Owner	6.112	13.411c	35.310	18.121	2.210	13.122	13.221	14.222
Jan. 6,7,9	9.76	44.68	33.67	76.20	34.07	68.09	74.70	.....
Mar. 20	9.40	45.25	34.07	76.44	34.47	68.35	75.00	59.68
May 20	9.97	46.10	34.42	76.58	34.72	68.46	75.16	59.80
July 28	10.40	a86.36	34.72	76.79	35.07	68.70	75.34	.....
Sept. 9	8.70	a85.65	29.18	76.82	33.09	68.63	75.35	.....
Nov. 8	9.80	(a)	33.56	71.95	34.55	68.74	75.42	.....
Location number	22.11.	23.7.	23.7.	23.7.	23.8.	23.8.	23.8.	23.8.
Owner	23.222	21.311	30.Lot16	31.133	3.322	26.131	34.111	34.211
	State of N.M.	Un- known	Foster	Hass	U. S. Gov't	Snyder	Dowdle	Law
Jan. 6,8,12	54.89	70.96	28.70	48.86	132.70	(c)	40.62	39.07
Mar. 19-22	55.16	71.08	28.62	49.06	132.72	42.80	(a)	.....
May 19,20	55.35	70.75	29.75	50.00	132.82	c93.28	b49.65	45.36
July 28-30	55.53	71.22	30.06	50.84	132.82	(c)	a94.10	a66.54
Sept. 8,9	55.50	71.30	29.70	51.14	132.94	(c)	(a)	a66.44
Nov. 5,7,8	55.50	71.40	29.69	50.82	132.98	45.25	(a)	b57.07
Location number	23.9.	23.9.	23.9.	23.9.	24.7.	24.7.	24.7.	24.7.
Owner	22.213	25.311	27.142	27.221	3.311	4.424	5.211	9.111
	Per- kins	Ernst	Thomas	Mc- Daniels	Hat- field	Hat- field	Will- iamson	Smyer Bros.
Jan. 8,9, 11,12	64.53	58.55	63.58	a60.56	10.74	89.87	196.74	86.27
Mar. 19,22	64.52	59.84	.....	60.20	(a)	a89.61	a87.55	87.83
May 19-21	65.12	60.18	64.24	60.28	22.11	a92.84	a88.22	(a)
July 29,30	66.08	61.82	a64.67	a61.48	c30.21	94.98	87.58	a99.91
Sept. 8-10	66.91	60.92	64.60	59.87	29.46	a97.24	a88.60	a97.61
Nov. 6-8	65.64	59.90	64.23	60.68	.....	92.03	a97.86	a89.72
Location number	24.7.	24.7.	24.7.	24.7.	24.7.	24.7.	24.7.	24.7.
Owner	9.111a	9.241	10.111	10.211	16.211b	24.111	24.312	26.113
	Smyer Bros.	Hat- field	Hat- field	Hass- man	Snyder	Wilson	Birch- field	Birch- field
Jan. 11	38.22	91.53	20.73	92.35	87.69	77.15	73.39	72.22
Mar. 19	37.46	90.93	23.11	91.19	87.85	77.04	73.50	a78.58
May 19	(a)	88.56	73.38	.....	88.02	77.25	73.55	73.10
July 30	(a)	90.83	(a)	c101.50	a88.45	77.65	73.65	a74.38
Sept. 8	(c)	b91.48	a199.31	c99.65	88.32	78.45	73.78	a72.82
Nov. 7	(a)	90.22	69.01	94.49	88.48	78.42	73.90	72.80
Location number	24.8.	24.8.	24.8.	24.9.	24.9.	24.9.	24.9.	24.9.
Owner	1.333b	6.112	11.221	1.211	1.222	2.421	6.431	7.331
	Kretek	Air	Kretek	Air	Air	Tru- Base	State Base	Moir of N.M.
Jan. 7,8, 11-13	19.55	53.24	18.96	58.83	55.88	a58.48	70.10	80.43
Mar. 20,21	19.45	53.17	18.76	58.81	55.86	58.27	72.56	80.90
May 20,21	a28.10	53.42	19.47	58.99	56.07	c64.42	a19.90	d85.18
July 28-30	a30.02	53.77	20.31	59.39	56.46	65.86	a19.45	c91.50
Sept. 8-10	a30.82	54.00	20.78	59.60	56.65	c65.50	a10.47	d92.50
Nov. 6-8	22.21	54.35	20.88	59.88	56.98	59.61	76.53	83.87

* See footnotes at end of table.

Part 3.--Water levels, in feet below land-surface datum, showing seasonal changes during 1947--Continued

Location number Owner	24.9. 9.411 Clary	24.9. 13.111 Bar- rett	24.9. 19.111 Lig- ocky	24.9. 21.131 Gas- kill	24.9. 23.211 Vocale	24.10. 1.311 Griggs	24.10. 3.411 Bryan	24.10. 3.411b Bryan
Jan. 8-10, 12,13	71.03	52.98	79.39	77.26	73.33	83.91	91.65	83.34
Mar. 20,21	71.14	52.64	79.13	77.23	b75.07	c94.85	90.97	83.70
May 20,21	c76.66	a81.44	81.58	d82.41	b79.70	c99.75	c95.69	a107.95
July 28,29	c84.62	a84.72	84.14	c87.98	(a)	c103.50	c121.74	a111.80
Sept. 8-10	83.11	a92.64	85.19	d88.21	(a)	c103.77	92.61	86.92
Nov. 5,6,8	74.05	58.56	83.24	80.80	77.19	86.76	92.48	84.90
Location number Owner	24.10. 10.311 Tilch	24.10. 22.211 Hurt	24.10. 29.222 State	25.8. 18.111 McCann	25.8. 19.331 Un- known	25.9. 6.421 Wheeler	25.9. 11.111 Ander- son	25.9. 21.311 Speir
Jan. 9-11	85.36	72.99	65.81	55.92	63.05	75.17	69.11	.....
Mar. 20,21	85.60	73.13	65.84	55.76	63.02	(a)	69.38	.....
May 20,21	86.02	74.58	65.94	c67.89	a64.50	a92.66	a94.45	78.58
July 28,29	c93.06	74.29	66.10	.....	a65.50	93.85	a89.23	89.96
Sept. 8,9	c92.20	74.46	.....	.....	65.92	a95.14	(a)	a88.61
Nov. 5,6	86.63	74.40	66.36	58.31	a65.36	80.30	72.94	75.50
Location number Owner	25.9. 28.121 Zum- walt	25.9. 35.211 Marcak	25.10. 36.111 State	26.9. 2.221 Taylor	26.9. 11.211 State	27.8. 8.411 Birch- field	27.9. 12.111 Waterloo School	27.9.
Jan. 10,11,13	72.37	53.10	65.53	43.09	40.48	23.96	27.43	
Mar. 21	72.59	53.71	.....	43.15	40.54	23.95	27.30	
May 21	a85.60	b54.68	a87.35	b44.03	40.60	23.94	27.55	
July 29	a85.18	66.02	89.90	44.02	40.78	24.10	27.87	
Sept. 9	(a)	55.12	a89.70	a51.10	40.92	22.50	27.97	
Nov. 6	79.00	55.02	68.93	44.57	41.08	23.69	27.85	

a Pumping.

b Pumping recently.

c Nearby well pumping.

d Nearby well pumping recently.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

24.7.9.241. G. D. Hatfield.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 11	h91.53	Jan. 28	91.35	Feb. 13	91.24	May 26	89.23
12	91.50	29	91.32	14	91.24	27	89.27
13	91.50	30	91.39	15	91.19	28	89.37
14	91.55	31	91.39	16	91.15	29	89.49
15	91.56	Feb. 1	91.43	17	91.14	30	89.53
16	91.58	2	91.32	18	91.14	31	89.59
17	91.53	3	91.35	19	91.16	June 1	89.66
18	91.50	4	91.35	20	91.14	2	89.68
19	91.44	5	91.27	Mar. 19	h90.93	3	89.69
20	91.52	6	91.31	May 19	88.51	4	89.79
21	91.55	7	91.26	20	88.62	5	89.87
22	91.46	8	91.27	21	88.73	6	89.88
23	91.42	9	91.29	22	88.87	7	89.89
24	91.44	10	91.23	23	88.98	July 30	h90.83
25	91.45	11	91.29	24	89.09	Sept. 8	h91.48
26	91.37	12	91.29	25	89.05	Nov. 7	h90.22
27	91.38						

h Tape measurement.

24.7.14.221. J. H. Winslow. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Apr. 18, 21, 22, 82.69; Nov. 17, 86.16.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	83.67	83.38	83.04	82.76	82.95	83.63	83.90	84.63	85.12	85.58	86.00	85.91
2	83.68	83.35	83.02	82.75	82.99	83.62	83.83	84.66	85.13	85.60	86.00	85.90
3	83.67	83.35	83.01	82.75	83.02	83.61	83.85	84.68	85.15	85.61	86.01	85.88
4	83.65	83.34	83.00	82.74	83.07	83.61	83.89	84.70	85.16	85.63	86.04	85.86
5	83.64	83.32	82.99	82.75	83.10	83.61	83.92	84.71	85.18	85.63	86.04	85.83
6	83.63	83.32	82.98	82.75	83.14	83.60	83.97	84.73	85.19	85.64	86.05	85.81
7	83.63	83.29	82.97	82.74	83.19	83.59	84.00	84.75	85.21	85.65	86.07	85.79
8	83.62	83.29	82.97	82.73	83.23	83.57	84.03	84.77	85.23	85.67	86.07	85.75
9	83.62	83.28	82.95	82.71	83.28	83.56	84.05	84.79	85.25	85.69	86.07	85.74
10	83.61	83.26	82.93	82.74	83.32	83.54	84.08	84.80	85.26	85.70	86.09	85.71
11	83.60	83.26	82.92	82.72	83.37	83.54	84.11	84.82	85.28	85.72	86.09	85.69
12	83.61	83.25	82.93	82.73	83.42	83.53	84.14	84.84	85.30	85.73	86.11	85.68
13	83.60	83.24	82.91	82.72	83.46	83.50	84.18	84.85	85.31	85.76	86.12	85.65
14	83.59	83.23	82.89	82.72	83.50	83.49	84.21	84.87	85.33	85.76	86.14	85.62
15	83.59	83.21	82.89	82.71	83.55	83.48	84.24	84.89	85.35	85.78	86.14	85.61
16	83.58	83.19	82.87	82.71	83.60	83.46	84.27	84.90	85.36	85.79	86.15	85.59
17	83.57	83.17	82.86	82.70	83.63	83.44	84.30	84.92	85.38	85.81	86.16	85.56
18	83.55	83.16	82.86	82.69	83.66	83.46	84.33	84.93	85.40	85.83	86.15	85.53
19	83.54	83.16	82.85	82.70	83.69	83.46	84.36	84.94	85.42	85.85	86.14	85.52
20	83.54	83.14	82.84	82.70	83.71	83.46	84.38	84.95	85.42	85.85	86.07	85.50
21	83.53	83.14	82.84	82.69	83.72	83.47	84.40	84.96	85.44	85.86	86.07	85.47
22	83.50	83.13	82.83	82.69	83.73	83.50	84.42	84.98	85.46	85.87	86.07	85.46
23	83.48	83.11	82.82	82.70	83.74	83.53	84.44	85.00	85.46	85.83	86.09	85.44
24	83.47	83.09	82.82	82.71	83.74	83.55	84.46	85.01	85.48	85.91	86.07	85.42
25	83.47	83.08	82.81	82.73	83.73	83.57	84.49	85.02	85.50	85.92	86.06	85.40
26	83.44	83.08	82.79	82.77	83.71	83.61	84.51	85.03	85.51	85.93	86.03	85.38
27	83.42	83.05	82.80	82.79	83.69	83.64	84.53	85.04	85.52	85.95	86.02	85.35
28	83.41	83.06	82.79	82.82	83.69	83.69	84.55	85.06	85.54	85.95	85.99	85.33
29	83.40		82.78	82.85	83.67	83.72	84.58	85.07	85.55	85.93	85.97	85.30
30	83.39		82.77	82.90	83.65	83.77	84.60	85.09	85.57	85.97	85.94	85.28
31	83.39		82.77		83.64		84.62	85.10		85.99		85.28

24.8.4.111. Foy Riley. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Mar. 4-9, 40.21; Nov. 9, 42.74.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	July	Aug.	Sept.	Nov.
1	40.47	40.32	40.24	40.49	40.79	.....	41.81	.....	.....
2	40.47	40.31	40.22	40.50	40.81	.....	41.85	.....	.....
3	40.47	40.30	40.22	40.51	40.81	.....	41.86	.....	.....
4	40.47	40.29	40.21	40.51	40.83	.....	41.89	.....	.....
5	40.45	40.28	40.21	40.53	40.83	.....	41.91	.....	.....
6	40.45	40.28	40.21	40.54	40.85	.....	41.93	.....	.....
7	40.45	40.27	40.21	40.55	40.85	.....	41.95	.....	.....
8	40.45	40.27	40.21	40.54	40.86	.....	41.96	.....	42.73
9	40.45	40.26	40.21	40.52	40.87	.....	41.97	.....	42.74
10	40.43	40.25	40.24	40.53	40.88	.....	41.97	42.34	.....
11	40.44	40.25	40.25	40.54	40.89	.....	42.34	.....	.....
12	40.43	40.25	40.27	40.54	40.90	.....	42.34	.....	.....
13	40.42	40.25	40.31	40.55	40.91	.....	42.34	.....	.....
14	40.42	40.25	40.32	40.55	40.91	.....	42.34	.....	.....
15	40.42	40.24	40.33	40.56	40.93	.....	42.34	.....	.....
16	40.42	40.23	40.34	40.57	40.94	.....	42.34	.....	.....
17	40.41	40.22	40.35	40.58	40.94	.....	42.34	.....	.....
18	40.41	40.22	40.35	40.60	40.95	.....	42.34	.....	.....
19	40.39	40.22	40.37	40.61	40.95	41.66	.....	.....	.....
20	40.39	40.22	40.37	40.63	40.96	41.67	.....	.....	.....
21	40.39	40.22	40.38	40.64	40.96	41.68	.....	.....	.....
22	40.38	40.23	40.39	40.65	.....	41.69	.....	.....	.....
23	40.38	40.24	40.40	40.66	.....	41.69	.....	.....	.....
24	40.37	40.28	40.41	40.68	.....	41.70	.....	.....	.....

h Tape measurement.

24.8.4.111--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	July	Aug.	Sept.	Nov.
25	40.36	40.27	40.43	40.70	.....	41.72	.....	.....	.....
26	40.34	40.26	40.43	40.72	.....	41.73	.....	.....	.....
27	40.34	40.24	40.44	40.73	.....	41.74	.....	.....	.....
28	40.32	40.24	40.45	40.75	.....	41.76	.....	.....	.....
29	40.31		40.46	40.76	.....	41.77	.....	.....	.....
30	40.32		40.47	40.76	.....	41.78	.....	.....	.....
31	40.32		40.47		.....	41.80	.....	.....	.....

24.10.12.431. Steve Hrna. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Mar. 22, 81.96; Sept. 6, 87.57.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.		
1	82.95	82.18	82.48	82.16	83.72	84.17	85.81	86.75	87.48	.....	.....	85.29
2	.....	82.13	82.41	82.22	83.69	84.18	85.85	86.76	87.50	.....	.....	85.26
3	82.93	82.11	82.39	82.31	83.67	84.20	85.90	86.81	87.50	.....	.....	85.24
4	82.89	82.11	82.34	82.39	83.68	84.24	85.94	86.83	87.53	.....	.....	85.20
5	82.85	82.08	82.32	82.52	83.68	84.27	85.97	86.86	87.56	.....	86.15	85.15	
6	82.80	82.08	82.31	82.60	83.68	84.31	86.00	86.88	87.57	.....	86.13	85.13	
7	82.79	82.07	82.28	82.65	83.70	84.36	86.02	86.91	.....	.....	86.10	85.10
8	82.75	82.08	82.21	82.71	83.70	84.41	86.04	86.93	.....	.....	86.06	85.06
9	82.74	82.11	82.22	82.78	83.71	84.46	86.07	86.96	.....	87.07	86.02	85.04	
10	82.70	82.12	82.17	82.98	83.71	84.53	86.10	86.98	.....	87.04	85.99	84.99	
11	82.65	82.18	82.14	83.09	83.73	84.60	86.15	87.01	.....	87.00	85.96	84.96	
12	82.61	82.16	82.18	83.18	83.73	84.67	86.18	87.03	.....	86.97	85.93	84.94	
13	82.57	82.29	82.12	83.25	83.74	84.75	86.22	87.07	.....	86.94	85.89	84.88	
14	82.56	82.35	82.07	83.29	83.77	84.83	86.27	87.10	.....	86.90	85.87	84.86	
15	82.56	82.40	82.07	83.34	83.81	84.90	86.31	87.13	.....	86.87	85.84	84.83	
16	82.55	82.40	82.05	83.39	83.83	84.96	86.36	87.14	.....	86.83	85.81	84.82	
17	82.57	82.41	82.01	83.42	83.85	85.03	86.40	87.17	.....	86.80	85.78	84.79	
18	82.49	82.44	82.01	83.40	83.88	85.09	86.44	87.19	.....	86.76	85.75	84.76	
19	82.44	82.46	82.00	83.45	83.92	85.16	86.48	87.20	.....	86.74	85.71	84.74	
20	82.44	82.48	81.99	83.50	83.95	85.22	86.50	87.22	.....	86.70	85.67	84.70	
21	82.43	82.49	81.98	83.52	83.97	85.29	86.51	87.26	.....	86.66	85.65	84.67	
22	82.38	82.48	81.96	83.57	83.98	85.37	86.52	87.27	.....	86.63	85.60	84.65	
23	82.34	82.47	81.99	83.64	83.99	85.41	86.53	87.29	.....	86.61	85.59	84.63	
24	82.33	82.46	82.00	83.69	84.02	85.47	86.52	87.31	.....	86.58	85.54	84.60	
25	82.32	82.48	81.99	83.76	84.03	85.52	86.51	87.32	.....	86.54	85.52	84.58	
26	82.26	82.52	81.97	83.76	84.03	85.58	86.52	87.34	.....	86.51	85.48	84.55	
27	82.23	82.47	82.03	83.75	84.02	85.63	86.54	87.36	.....	86.48	85.46	84.52	
28	82.19	82.48	82.04	83.74	84.04	85.69	86.60	87.38	.....	86.45	85.41	84.47	
29	82.20				82.06	83.73	84.07	85.74	86.65	87.41	86.41	85.39	84.43
30	82.18				82.07	83.72	84.10	85.78	86.68	87.43	85.34	84.39	
31	82.17				82.11		84.13		86.72	87.46		84.38	

25.9.4.211. Val Miller. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Jan. 18, 19, 23, 27-31, 73.28; Dec. 31, 76.19.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	73.29	73.33	73.42	73.71	74.00	74.43	74.90	75.34	75.71	.....	76.08
2	73.29	73.32	73.42	73.71	74.01	74.44	74.91	75.35	75.71	.....	76.09
3	73.29	73.33	73.43	73.72	74.02	74.46	74.93	75.37	75.73	.....	76.09
4	73.29	73.33	73.43	73.73	74.03	74.48	74.95	75.38	75.73	.....	76.09
5	73.29	73.33	73.44	73.74	74.05	74.48	74.96	75.39	75.74	.....	76.10
6	73.29	73.33	73.44	73.74	74.07	74.51	74.98	75.41	75.71	.....	76.00
7	73.29	73.34	73.45	73.74	74.09	74.53	75.00	75.42	75.74	.....	75.98
8	73.29	73.34	73.45	73.74	74.10	74.55	75.00	75.44	75.74	.....	75.98
9	73.29	73.34	73.46	73.75	74.12	74.56	75.02	75.46	75.74	.....	75.99
10	73.30	73.34	73.47	73.76	74.13	74.57	75.03	75.47	75.74	.....	76.00

25.9.4.211--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
11	....	73.30	73.34	73.47	73.76	74.15	74.58	75.05	75.49	....	76.00	76.12
12	....	73.30	73.34	73.50	73.76	74.17	74.60	75.07	75.50	....	76.00	76.12
13	73.30	73.30	73.34	73.50	73.76	74.18	74.61	75.09	75.51	....	76.00	76.13
14	73.30	73.30	73.34	73.50	73.76	74.21	74.63	75.10	75.53	....	76.01	76.13
15	73.29	73.30	73.36	73.50	73.78	74.22	74.65	75.12	75.55	....	76.02	76.13
16	73.30	73.30	73.36	73.50	73.79	74.22	74.67	75.13	75.56	....	76.03	76.14
17	73.30	73.30	73.36	73.54	73.80	74.23	74.68	75.14	75.58	....	76.03	76.14
18	73.26	73.31	73.36	73.54	73.81	74.25	74.71	75.16	75.60	....	76.04	76.14
19	73.28	73.31	73.37	73.56	73.82	74.27	74.72	75.17	75.61	....	76.04	76.15
20	73.30	73.31	73.37	73.57	73.83	74.28	74.72	75.18	75.62	....	76.04	76.15
21	73.29	73.31	73.37	73.59	73.84	74.29	74.74	75.20	75.63	....	76.05	76.16
22	73.29	73.31	73.37	73.60	73.85	74.31	74.76	75.21	75.64	....	76.06	76.16
23	73.28	73.31	73.38	73.62	73.86	74.31	74.78	75.23	75.64	....	76.06	76.15
24	73.29	73.31	73.38	73.63	73.87	74.32	74.79	75.24	75.65	....	76.06	76.16
25	73.29	73.31	73.38	73.65	73.88	74.34	74.82	75.25	75.66	....	76.07	76.16
26	73.29	73.32	73.38	73.66	73.90	74.36	74.83	75.26	75.67	....	76.07	76.17
27	73.28	73.32	73.39	73.67	73.92	74.37	74.84	75.26	75.67	....	76.07	76.17
28	73.28	73.32	73.39	73.68	73.93	74.39	74.85	75.27	75.69	....	76.07	76.18
29	73.28			73.39	73.69	73.94	74.40	74.86	75.31	75.70	76.08	76.18
30	73.28			73.40	73.70	73.96	74.41	74.87	75.31	75.71	76.08	76.18
31	73.28			73.41	73.97		74.88	75.32				76.19	

Part 5. Miscellaneous data concerning observation wells

22.11.13.411. State of New Mexico. Drilled well, no equipment. Measuring point, surface of concrete well curb west side of well, at land-surface datum. Water levels, in feet below land-surface datum: May 22, 1946, 75.64; Nov. 8, 1947, 76.65.

22.11.24.211. State of New Mexico. Drilled well, no equipment. Measuring point, surface of concrete well curb, north side of well, at land-surface datum. Water levels, in feet below land-surface datum: May 22, 1946, 76.39; Nov. 8, 1947, 77.66.

23.7. 31.111a. Haas. About 50 feet east of well 23.7.31.111. Drilled well, no equipment, diameter 14 inches, depth 250 feet. Measuring point, top of casing, south side, 1.25 feet above land-surface datum.

23.7.31.133. Haas. Drilled well, no equipment, diameter 14 inches, depth 450 feet. Measuring point, top edge of 14-inch casing, 1.50 feet above land-surface datum. Water levels, in feet below land-surface datum, 1946: Aug. 9, 49.20; Sept. 25, 50.08, nearby well pumping; Nov. 7, 49.29.

23.8.34.111. Dowdle. Measuring point beginning May 19, 1947, top edge of rectangular hole in northwest side of basal flange of pump, 1.93 feet above land-surface datum. Pump reinstalled prior to Mar. 21, 1947.

23.9.30.142. Mazac. Drilled irrigation well. Measuring point, top edge of $\frac{1}{2}$ -inch hole in air-line flange support, 0.45 foot above north-south pump support, 1.00 foot above land-surface datum. Equipped with turbine pump.

23.10.25.242. Mazac. Drilled irrigation well. Measuring point, top edge of $\frac{1}{2}$ -inch hole in north side of base of pump, 0.07 foot above east-west 4- by 4-inch pump supports and concrete base. Subtract 0.37 foot from tape measurements to reduce to concrete base, 1.00 foot to reduce to land-surface datum. Equipped with turbine pump.

24.7.9.111a. Smyer. About 15 feet north of well 24.7.9.111. Drilled irrigation well, diameter 14 inches, depth 285 feet. Reference point, same as for well 24.7.9.111. Measuring point, top of casing, 0.63 foot above steel rim around well, 0.68 foot above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: Mar. 27, 36.41; Nov. 6, 39.64.

24.7.10.111. Hatfield. Measuring point beginning May 19, 1947, top edge of 3/4-inch hole in north side of basal flange of newly installed turbine pump, 0.54 foot above top edge of casing, 0.89 foot above land-surface datum.

24.9.3.122. Unknown. About 10 feet east of elevated water tank, about 50 feet south of road. Drilled domestic well, diameter 6 inches. Measuring point, top edge of casing, east side of well 0.05 foot above motor supports, 0.75 foot above land-surface datum. Equipped with pump jack.

24.9.13.111. Barrett. Large yearly change in water level due to perforated casing opposite upper stratas in 1946 thus allowing water under pressure from lower strata to drain into upper strata.

24.9.23.211. Vocale. Formerly owned by C. R. Isbell.

24.9.26.211. Unknown. At northeast corner of earthen tank. Dug and drilled irrigation well. Measuring point, top of concrete well curbing, east side of well at chisel mark, 1.00 foot above land-surface datum. Equipped with turbine pump.

25.9.18.211. Walker. At northeast corner of earthen tank. Drilled irrigation well. Measuring point, top of casing, east side of well, 3.50 feet above land-surface datum. Equipped with turbine pump.

25.9.18.412. Marcak. At northeast corner of earthen tank. Drilled irrigation well, depth about 300 feet. Measuring point, top edge of casing, north side of well, 1.75 feet above land-surface datum. Equipped with turbine pump.

25.9.30.222. Welch. Dug and drilled irrigation well. Measuring point, top of concrete well curb, at land-surface datum. Equipped with turbine pump.

QUAY COUNTY (HOUSE AREA)

Part 1. General discussion

The investigation of the ground-water resources of the House area, in Quay County, was continued in 1947 in cooperation with the State engineer of New Mexico. Records of water levels in observation wells in the House area have been published in the following Geological Survey water-supply papers:

<u>Year of record</u>	<u>Water-Supply Paper</u>	<u>Page Nos.</u>
1940-41	941	243-250
1942	949	314-318
1943	991	269-276
1944	1021	262-272
1945	1028	267-275
1946	1076	276-284

The letter N was added to the first segment of the well numbers in reports prior to 1945 but the distinguishing letter has been omitted in subsequent reports as all wells are north of the New Mexico base line.

Water levels are measured once a year, in January or February, in a large number of wells in the House area many of which are also measured at bimonthly intervals. The water levels obtained at the first of the year, after recovery from the effects of pumping of the previous year has taken place, show the net yearly change in water levels. (See Part 2 and

accompanying map.) The measurements of water level observed bimonthly show the varying fluctuations during the year resulting from changes in the rate and amount of pumping and precipitation. (See Part 3.) Water levels were measured in 70 wells in January 1947 of which about 22 were measured at bimonthly intervals. Water-stage recorders were operated on two of the above wells in order to obtain a continuous record of the water level. A total of 187 measurements of water level was made during the year including 12 tape measurements made on the recorder wells. Measurements of water level in January were made by C. S. Conover and G. R. Chenot, in September by R. L. Griggs, and in the remaining months by U. N. Benge.

Precipitation and pumpage

Fluctuations of the water level in the House area are the result mainly of pumping of ground water for irrigation. As precipitation reduces the amount of pumping of ground water for irrigation and, in periods of excessive rainfall, recharges the water table, the net effect is a rise in water levels. On the basis of an incomplete report at Hassell, about 8 miles northwest of House, the precipitation during 1947 was less than 9 inches, more than 7 inches below normal, and during the growing season, April to September, was only 5.77 inches, 6.56 inches below normal. Only in May was the precipitation above normal when it amounted to 2.85 inches at Hassell.

The pumping of ground water for irrigation in 1947 began about mid-March, about 3 weeks later than in 1946. Because of the rains in May some decrease in pumping occurred after which intensive pumping was resumed. Deficient precipitation the rest of the year lengthened the pumping season to the end of October, about 6 to 8 weeks later than in 1946. It is estimated that about 3,100 acres were irrigated in 1947. The pumpage per acre in 1947 probably exceeded that in 1946 because of less precipitation. It is probable that about 7,750 acre-feet of water was pumped for irrigation in 1946, the largest since development of ground water began. The amount of land irrigated has increased gradually since 1939 and, in general, each year there has been an increase in the amount of water used. However, the amount used per acre varies from year to year dependent upon the amount of precipitation in a particular year and the type of crops grown.

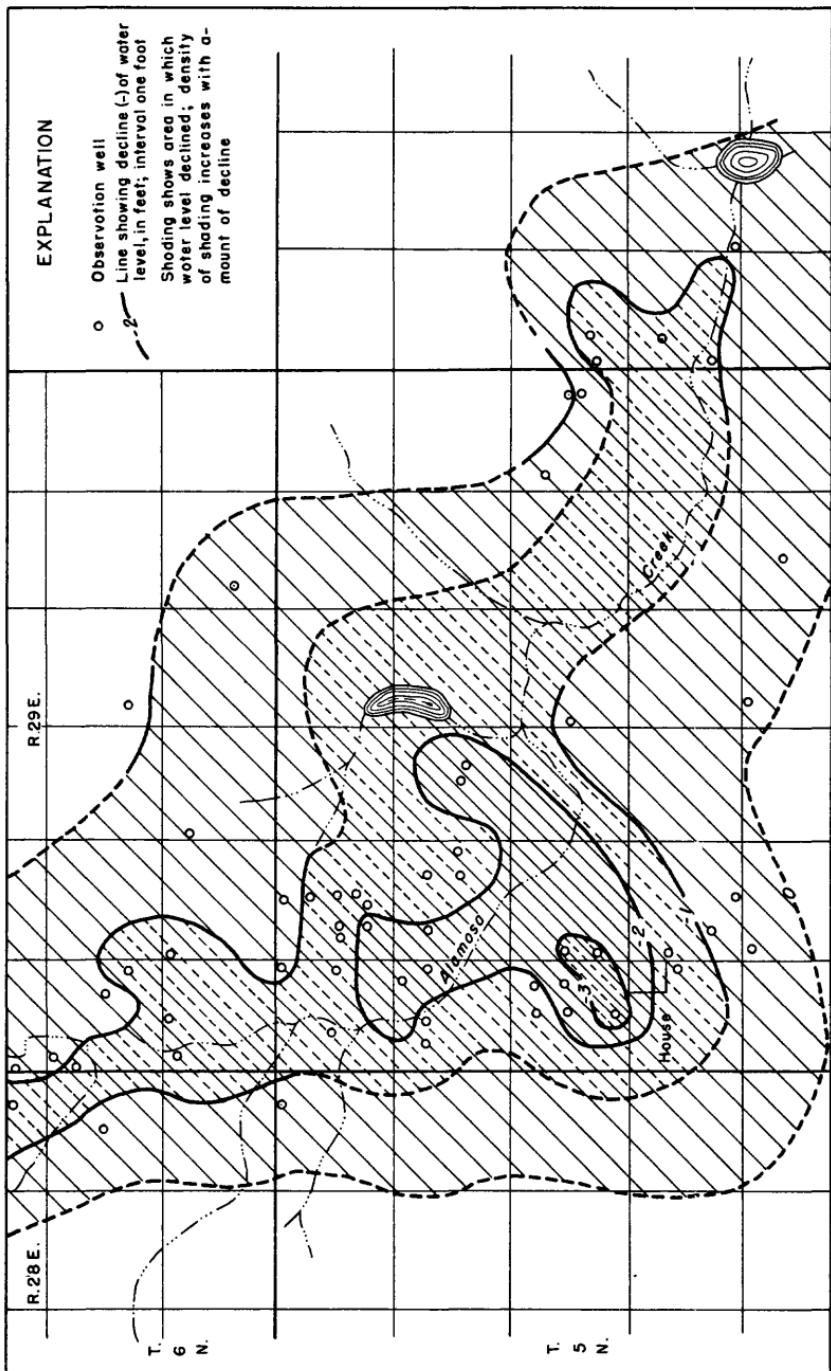


Figure 18.—Map of House area, Quay County, N. Mex., showing change of ground-water level from January 1947 to January 1948.

Fluctuations of water level

Fluctuations of water level in the House area in 1947 followed the general pattern of former years with declines occurring throughout the summer pumping season and rises occurring during the winter nonpumping season. Because of pumping, water levels began declining about mid-March, about 3 weeks later than in 1946 and about 1 month earlier than average. With the exception of slight general rises in May, as a result mainly of a decrease in pumping, the water levels continued to decline until the end of the pumping season, the last of October, about 2 months later than average.

Because of the deficient rainfall, the longer pumping season, and the gradual increase in irrigated acreage, the water levels showed record net annual declines. The water levels declined more than 1 foot from January 1947 to January 1948 over an area of about 18 square miles and more than 2 feet over an area of about 3.4 square miles as compared with like declines in 1946 of 6 square miles and less than 1 square mile, respectively. The area of decline of more than 1 foot encompassed all of the area in which ground water was pumped for irrigation and extended along the valley from about 7 miles north and west of House to about 6 miles east of House and had a maximum width of about 4 miles near House. The area of maximum observed decline, more than 3 feet over an area of about a quarter of a mile, occurred north of House in sections 17 and 18. (See accompanying map.)

In the 6-year period from January 1942, when the water levels in most of the wells were at their highest, to January 1948 the water levels declined more than 6 feet, an average of more than 1 foot a year, over an area of 2.4 square miles. This area coincides closely with the area of heavy pumping and extends in an elliptical pattern from about half a mile south of House to $2\frac{1}{2}$ miles north of House and has a maximum width of about 1 mile. (See accompanying map.) The maximum observed decline, 8.76 feet, occurred in one of the oldest irrigation wells in the area, a quarter of a mile north of House.

In this 6-year period the water levels declined more than 2 feet over about 23 square miles, comprising mainly the western half of T. 5 N., R. 29 E., and the southwestern corner of T. 6 N., R. 29 E., and encompassed nearly all of the irrigation wells. A decline also occurred in the lightly

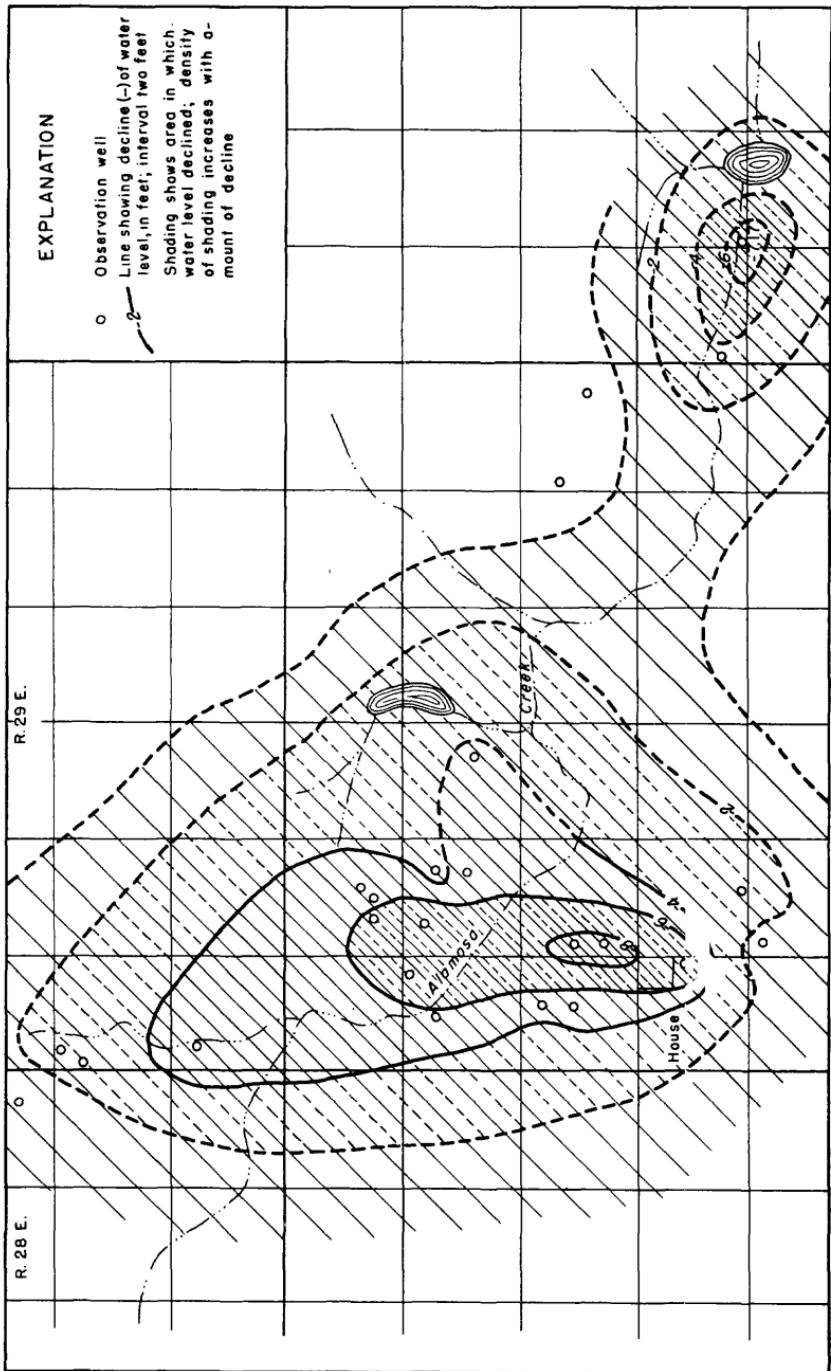


FIGURE 19.—Map of House area, Gray County, K. S., showing change of ground-water level from January 1947 to January 1948.

pumped area 6 miles east of House. The maximum decline in this area was 7.17 feet in a windmill well and was mainly the result of a natural decline from the excessively high water level in 1942 along the lower part of Alamosa Creek.

In a few outlying wells, removed from the effects of pumping, the water levels at the end of 1947 were still higher than in 1942 although a progressive small decline has taken place in these wells since the high levels reached between 1943 and 1945.

The water levels at the end of 1947 were below the previous low levels observed in early 1941 prior to the heavy rains in late 1941 and early 1942 except in a very few outlying wells. Water levels will continue to fall year by year as long as the present amount of water is pumped except in years of heavy precipitation. Additional pumps will accelerate the rate of decline somewhat. Slight rises may occur in a particular year due to a decrease in pumping as a result of either unfavorable economic conditions or near or above-normal precipitation. However, as most of the water is being taken from ground-water storage, the long-term trend will be a decline of water levels as long as ground water is pumped.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from February 1946 to January 1947, in feet

Location number	Owner	See also	Water levels				Record
			Jan. 1947 Part	Change Level Day	1946-47	Jan. 1947 Part	
5.28.1.212	D. C. Wyatt		(Measurements discontinued)	48.95	.44	50.08	46 44 47
1.221	do	3,5	46.33	.24			
5.28.5.211	R. H. Occurrence		51.57	-.144	48.68	.44	51.57 47
5.231	do		45.57	.25	-1.53	42.35	45.37 44
5.312	Troy Powdergrass		42.76	.25			
5.321	J. F. Wallace		42.49	.25	-1.79	40.70	42.49 47
5.341	William Martin		34.62	.25	-1.41	29.73	34.62 47
5.342	do	4	34.89	.25	-1.54	30.15	35.07 41
5.411	A. R. Wallace		42.07	.25	-1.63	37.94	42.07 43
5.413	do		35.60	.25	-1.73	f	
6.144	F. I. Austin		25.79	.24	-.34	23.45	35.60 42
6.222	L. L. Poe		52.37	.25	+.31	52.37	25.79 44
6.422	do		38.85	.25	+.14	36.24	52.68 46
7.141	D. L. Birch		33.19	.25	-.51	29.26	38.99 45
7.142	do		18.67	.25	+.16	14.31	33.19 43
7.143	C. P. McBride		29.73	.25	-.16	22.46	21.00 41
7.221	do		20.38	.25	+.01	18.44	24.38 41
7.242	J. C. Davenport		27.44	.25	-.94	22.75	29.73 42
8.114	G. W. Turner		38.76	.25	-.151	34.19	27.88 41
8.232	W. W. Kuykendall		32.49	.25	-.119	27.94	38.76 47
8.412	Bill Dwright		33.85	.25	-.117	32.03	32.49 42
8.422a	W. Y. Head		23.50	.25	+.47	21.33	33.85 45
9.400	W. F. and Wyllie Hudman		77.15	.24	-.21	76.94	23.97 42
13.121	do		57.34	.24	+.05	56.80	79.13 41
13.131	H. S. Crosby		50.31	.24	.00	50.25	59.19 41
13.243	W. F. and Wyllie Hudman		47.59	.24	-.03	46.61	50.31 45
14.300	(Incorrect designation used previously for well 11.5-02.14.321, which see)						47.97 41
14.321	R. A. Tullis	5	37.38	.24	-.69	35.55	37.38 47
15.311b	do	3	20.33	.24	+.02	17.91	20.45 43
15.331	do	a	36.12	.24	-.34	34.48	34.78 46
17.133	W. W. Kuykendall	4	35.30	.25	-.142	f	34.97 43
17.331	M. M. McEndree		38.63	.24	-.69	32.92	38.63 41
18.213	Dayton Harris		36.12	.24	-.150	35.07	36.90 41
18.223	Carl Johnson		33.92	.24	-.130	31.89	33.92 45
18.233	M. R. Wallace		48.85	.24	-.95	45.74	48.89 41

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from February 1946 to January 1947, in feet--Continued

Location number	Owner	Water levels						Record
		also Part	Jan. 1947 Level	Change 1946-47	Highest Level	Lowest Level	Year began	
5.29.18.243	L. M. Bright	*	37.20	24	-1.76	34.83	4.5	37.20 47 45
18.433	Frank Davis	54.02	24	-1.75	51.42	4.4	54.02 47 44	
18.444	L. V. Vaughn	42.30	24	-1.59	36.70	4.2	42.30 47 41	
19.244	Lester McCasland	51.14	24	-0.98	46.66	4.2	51.14 47 41	
20.131a	J. M. Thompson	52.62	24	-1.02	48.49	4.3	52.62 47 43	
20.131b	do	52.83	24	-1.18	48.79	4.3	52.83 47 43	
20.133	Welton Henry	50.54	24	-0.99	48.32	4.4	50.54 47 44	
20.314	Stanley Elliott	53.08	24	-0.40	52.20	4.5	53.08 47 45	
20.433b	D. J. Speed	49.96	24	-0.29	f 46.99	4.3	49.96 47 41	
27.112	E. D. Gallehon	3,5	70.88	24	***	65.91	4.3	*** 47 41
29.111	C. A. Morrow	67.44	24	-0.51	54.98	4.7	67.44 47 42	
36.242	State of New Mexico	94.98	24	***	94.98	4.7	96.28 42 42	
5.30.18.323	Jerry Thompson	39.84	24	-1.11	39.73	4.6	39.84 47 46	
18.331	do	34.96	24	-0.16	34.80	4.6	35.63 45 45	
19.132a	Ralph Hendrix	27.53	24	-0.42	26.17	4.4	27.53 47 44	
19.313	do	18.78	24	-0.05	15.94	4.2	18.78 47 42	
20.333	Arthur Shaddon	23.06	24	-0.83	16.82	4.2	23.06 47 42	
31.442	T. W. Coleman	98.95	24	+0.20	98.95	4.7	99.77 44 44	
6.28.13.232	Irwin Estate	60.90	24	+0.80	60.90	4.7	61.84 45 45	
23.112	William Upton	74.55	24	***	78.12	4.5	78.56 47 45	
24.233	Byers Irwin	78.95	24	-0.65	62.83	4.5	64.00 47 42	
24.423	R. J. Ferry	64.00	24	-0.43	52.20	4.5	53.38 47 44	
25.411	R. A. Davenport	53.38	24	-0.50	53.50	4.7	53.80 47 46	
6.29.19.313	R. W. Dean	53.80	24	-0.30	43.84	4.7	44.20 45 45	
27.332	J. D. Green	43.84	25	+0.09	43.84	4.7	44.20 45 45	
30.112	L. M. McDaniels	49.92	24	-0.15	48.08	4.3	51.12 41 41	
30.113	do	53.13	24	-0.13	51.29	4.3	54.34 41 41	
30.412	R. W. Dean	73.83	24	***	78.23	4.6	*** 47 46	
30.424	do	80.42	24	-2.18	36.40	4.2	80.42 47 46	
31.114	Clyde Kuykendall	36.90	24	-0.47	53.57	4.4	56.23 47 44	
31.122	G. H. Briggs	56.23	24	-1.53	53.57	4.4	56.23 47 44	
32.111	Sam Morrow	73.75	25	-2.16	70.99	4.6	73.75 47 43	
33.131	Frank Morrow	54.65	25	-0.25	54.26	4.4	54.65 47 43	
35.314	P. R. Gates	38.46	25	-0.10	38.36	4.6	38.46 47 46	
7.28.9.342	W. B. Giles	27.17	25	***	25.69	4.5	27.8 46 45	
35.333	Dayton Harris	129.38	25	-0.06	129.32	4.6	129.62 45 45	

a Pumping. c Nearby well pumping. e Dry at depth given.

f From recorder chart. i Also 1947.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Location number Owner	5.28. Wyatt	5.29. Poe	5.29. Birch	5.29. Turner	5.29. Head	5.29. Hudman	5.29. Tullis	5.29. Vaughn
Jan. 24, 25	46.93	52.37	33.19	38.76	23.50	77.15	20.43	42.30
Apr. 1	47.04	53.28	33.44	39.71	23.59	77.43	20.53	44.06
May 30	47.15	52.56	33.00	a65.15	23.57	77.74	20.46	45.40
Aug. 1, 2	47.23	54.99	34.02	a65.43	24.23	77.38	20.67	49.58
Sept. 18	47.40	55.09	34.60	43.97	a52.80	....	20.82	....
Nov. 24, 25	47.48	53.71	35.05	40.88	a25.45	77.81	20.93	....
Location number Owner	5.29. 27.112	5.29. Morrow	5.30. Thompson	5.30. Shaddon	6.28. Cole- man	6.28. Upton	6.28. Irwin	6.28. Daven- port
Jan. 24	70.88	67.44	34.96	23.06	98.95	74.35	78.95	53.38
Apr. 1	71.48	67.77	34.92	a23.71	99.04	75.25	80.22	58.19
May 30	71.15	67.54	35.03	a23.03	99.03	79.34	80.56	54.03
Aug. 1	71.57	67.73	35.00	23.30	99.25	74.40	81.53	54.17
Sept. 17, 18	71.44	72.72	37.47	a24.77	99.17	74.29	84.29	53.85
Nov. 24, 25	71.19	67.62	38.89	23.86	99.09	74.25	82.01	53.71
Location number Owner	6.29. 27.332	6.29. 30.112	6.29. 30.412	6.29. 35.131	6.29. 35.314	7.28. 35.333	7.28. 35.333	7.28. 35.333
Jan. 24, 25	43.84	49.92	73.83	54.65	38.46	129.38		
Apr. 1	43.79	....	73.63	54.77	38.24	129.34		
May 30	43.81	50.98	73.98	54.55	38.38	129.36		
Aug. 1, 2	43.80	50.90	73.95	54.52	a49.22	129.37		
Sept. 17	43.75	51.55	74.87	55.24	(a)	129.40		
Nov. 24, 25	43.79	51.09	74.89	55.45	40.54	129.48		

a Pumping.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

5.29.5.342. William Martin. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Mar. 16, 34.55; Nov. 6, 38.07.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	35.02	34.85	34.69	35.09	35.14	35.25	36.19	36.83	37.40	37.97	38.01	37.45
2	35.07	34.83	34.64	35.12	35.10	35.31	36.22	36.87	37.40	37.98	37.99	37.45
3	35.05	34.83	34.64	35.12	35.09	35.34	36.25	36.88	37.40	38.00	38.00	37.41
4	35.03	34.83	34.64	35.12	35.10	35.35	36.27	36.93	37.40	38.01	38.05	37.42
5	35.02	34.77	34.65	35.12	35.10	35.42	36.32	36.94	37.45	38.04	38.05	37.38
6	34.95	34.77	34.66	35.19	35.14	35.46	36.37	36.96	37.46	38.04	38.07	37.33
7	35.04	34.78	34.65	35.09	35.17	35.49	36.40	36.98	37.49	38.03	38.03	37.33
8	35.02	34.79	34.61	35.07	35.19	35.53	36.40	36.98	37.53	38.02	37.97	37.32
9	34.97	34.83	34.61	34.94	35.16	35.55	36.41	36.99	37.55	38.02	37.94	37.30
10	34.93	34.78	34.61	35.04	35.17	35.56	36.47	36.99	37.56	37.99	37.94	37.30
11	34.93	34.78	34.60	....	35.19	35.58	36.47	36.99	37.57	37.96	37.90	37.28
12	34.92	34.84	34.61	....	35.21	35.59	36.49	37.00	37.65	37.97	37.90	37.28
13	34.89	34.77	34.62	35.02	35.17	35.70	36.52	37.00	37.65	37.94	37.83	37.20
14	34.95	34.79	34.62	34.98	35.11	35.68	36.53	37.05	37.69	37.89	37.82	37.16
15	34.95	34.74	34.63	34.97	35.14	35.74	36.54	37.05	37.74	37.88	37.79	37.19
16	34.98	34.74	34.55	35.04	35.18	35.74	36.58	37.14	37.76	37.87	37.78	37.17
17	34.94	34.75	34.57	34.94	35.17	35.71	36.61	37.15	37.79	37.87	37.76	37.14
18	34.87	34.76	34.57	34.94	35.15	35.76	36.65	37.19	37.80	37.84	37.73	37.13
19	34.83	34.74	34.58	34.97	35.08	35.78	36.64	37.19	37.79	37.83	37.71	37.12
20	34.91	34.74	34.58	34.97	35.10	35.80	36.64	37.20	37.80	37.79	37.71	37.10
21	34.92	34.74	34.61	34.97	35.08	35.81	36.65	37.20	37.82	37.78	37.70	37.05
22	34.86	34.74	34.61	34.97	35.09	35.89	36.64	37.20	37.80	37.78	37.63	37.06

5.29.5.342--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
23	34.84	34.74	34.69	34.97	35.12	35.91	36.65	37.20	37.60	37.79	37.60	37.06
24	34.85	34.74	34.85	34.97	35.11	35.91	36.65	37.22	37.82	37.80	37.59	37.04
25	34.88	34.71	34.91	35.02	35.05	35.93	36.65	37.27	37.84	37.84	37.59	37.02
26	34.85	34.71	34.91	35.00	35.04	35.96	36.69	37.28	37.86	37.86	37.57	37.01
27	34.85	34.64	34.91	34.98	34.99	35.98	36.71	37.32	37.87	37.93	37.56	36.98
28	34.79	34.64	34.91	34.98	34.99	36.00	36.71	37.32	37.92	37.98	37.53	36.95
29	34.79		34.96	34.98	35.11	36.07	36.74	37.32	37.92	38.01	37.52	36.94
30	34.85			35.02	35.00	35.14	36.11	36.76	37.33	37.93	38.03	37.47
31	34.85				35.03	35.20		36.80	37.39		38.05	36.93

5.29.17.133. W. W. Kuykendall. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Mar. 16, 35.58; Oct. 30, 31, Nov. 1, 39.34.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	35.96	35.75	35.62	35.69	.....	36.72	37.61	38.22	38.73	39.10	39.34	39.00
2	35.97	35.73	35.61	35.69	.....	36.73	37.63	38.23	38.73	39.10	39.33	38.99
3	.....	35.72	35.61	35.69	.....	36.74	37.65	38.25	38.74	39.11	39.33	38.98
4	.....	35.73	35.59	35.70	.....	36.74	37.67	38.27	38.75	39.12	39.33	38.97
5	35.95	35.70	35.60	35.70	.....	36.75	37.67	38.29	38.75	39.12	39.32	38.95
6	35.93	35.70	35.61	35.75	.....	36.76	37.68	38.31	38.76	39.13	39.31	38.93
7	35.93	35.70	.....	35.75	.....	36.77	37.69	38.34	38.77	39.14	39.31	38.93
8	35.93	35.69	.....	35.75	.....	36.79	37.70	38.37	38.79	39.12	39.29	38.91
9	35.91	35.69	35.58	35.77	30.35	36.81	37.72	38.39	38.81	39.03	39.28	38.90
10	35.89	35.68	35.58	35.79	36.39	36.83	37.73	38.41	38.82	39.03	39.28	38.89
11	35.89	35.68	35.57	35.82	36.42	36.86	37.75	38.44	38.84	39.05	39.26	38.87
12	35.87	35.68	35.57	35.84	36.45	36.88	37.78	38.46	38.86	39.08	39.25	38.86
13	35.86	35.67	35.58	35.88	36.47	36.93	37.80	38.49	38.87	39.12	39.29	38.74
14	35.86	35.67	35.57	35.90	36.49	36.96	37.82	38.51	38.91	39.14	39.23	38.74
15	35.86	35.65	35.58	35.90	36.51	.....	37.84	38.54	38.92	39.16	39.22	38.74
16	35.87	35.65	35.58	35.94	36.53	.....	37.86	38.55	38.93	39.18	39.21	38.74
17	35.85	35.64	35.57	35.97	36.55	.....	37.89	38.56	38.95	39.19	39.21	38.74
18	35.84	35.65	35.57	35.98	36.56	.....	37.93	38.56	38.96	39.21	39.18	38.74
19	35.82	35.63	35.57	36.02	36.57	.....	37.95	38.56	39.00	39.21	39.17	38.74
20	35.82	35.64	35.58	36.04	36.58	.....	37.97	38.56	39.02	39.23	39.16	38.74
21	35.82	35.64	35.58	36.04	36.58	.....	38.00	38.57	39.03	39.24	39.14	38.72
22	35.82	35.63	35.57	36.06	36.59	37.32	38.01	38.59	39.04	39.26	39.15	38.71
23	35.80	35.63	35.58	36.07	36.60	37.36	38.03	38.60	39.04	39.27	39.12	38.70
24	35.80	35.63	35.60	36.09	36.61	37.40	38.07	38.62	39.05	39.29	39.10	38.69
25	35.79	35.62	35.62	36.10	36.62	37.44	.....	38.64	39.06	39.30	39.09	38.67
26	35.77	35.62	35.60	36.12	36.63	37.47	38.11	38.65	39.06	39.31	39.08	38.66
27	35.77	.....	35.61	.....	36.64	37.49	38.13	38.67	39.06	39.32	39.07	38.64
28	35.75	.....	35.63	.....	36.64	37.51	38.15	38.68	39.07	39.33	39.06	38.62
29	35.73	.....	35.65	.....	36.67	37.55	38.17	38.69	39.08	39.33	39.04	38.61
30	35.75	.....	35.66	.....	36.68	37.58	38.19	38.71	39.09	39.34	39.02	38.59
31	35.74	.....	35.67	.....	36.70	.....	38.21	38.72	39.34	.....	.....	.....

Part 5. Miscellaneous data concerning observation wells

5.28.1.221. Wyatt. Drilled irrigation well, diameter 16 inches, depth 133 feet. Reference point, top of casing, level with top of concrete pump base, 1.00 foot above land-surface datum. Equipped with turbine pump.

Water level, in feet below land-surface datum, 1946

Date	Water level	Date	Water level	Date	Water level
Mar. 29	46.63	July 31	47.68	Dec. 3	46.99
May 31	46.73	Oct. 2	47.39		

5.29.5.312. Pendergrass. Drilled irrigation well. Measuring point, top edge of 3/4-inch hole in south side of base flange of pump, 0.12 foot above concrete pump base, 0.37 foot above land-surface datum. Water level, in feet below land-surface datum, 1941: Apr. 30, 41.24.

5.29.14.321. Tullis. Previously designated incorrectly as 5.29.14.300.

5.29.27.112. Gallehon. Drilled irrigation well, diameter 16 inches, depth 152 feet. Measuring point, lower inside edge of rectangular opening in west side of pump case, 0.80 foot above circular concrete pump base, 1.80 feet above land-surface datum. Equipped with turbine pump.

5.29.36.242. State of New Mexico. Measurements resumed Jan. 24, 1947. Measuring point beginning Jan. 24, 1947, top edge of hole in east wooden pipe clamp, 0.35 foot above top of 6-inch galvanized casing, 1.00 foot above land-surface datum.

6.28.23.112. Upton. Drilled irrigation well, diameter 18 inches, depth 122 feet. Measuring point beginning Jan. 24, 1947, top edge of 1-inch hole in north side of pump base flange, 0.12 foot above concrete pump base, 0.62 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1946: Dec. 3, 74.48.

6.28.24.233. Irwin. Measuring point beginning Aug. 1, 1947, same description as before but raised to 1.21 feet above land-surface datum. Concrete slab placed on top of old pump base.

6.29.30.412. Dean. Drilled irrigation well, diameter 18 inches, depth 122 feet. Measuring point, top of casing east side of well, 0.12 foot above circular concrete pump base, 0.87 foot above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: July 30, 74.54; Oct. 3, 74.15; Dec. 3, 74.01.

ROOSEVELT COUNTY (PORTALES VALLEY)

Part 1. General discussion

The investigation of the ground-water resources of Portales Valley, which began in 1931, was continued during 1947 in cooperation with the State engineer of New Mexico. Results of the investigation for the years 1931 to 1938 have been published in the 10th to 13th biennial reports of the State engineer, while results for the years 1938 to 1941 are to be published in a forthcoming report of the State engineer. Records of water levels in observation wells in Roosevelt County have been published in Geological Survey water-supply papers as follows:

Year of record	Water-Supply Paper	Page Nos.
1931-38	845	245-278
1939	886	449-467
1940	911	217-235
1941	941	251-270
1942	949	319-336
1943	991	276-295
1944	1021	272-290
1945	1028	276-289
1946	1076	285-300

Water levels are measured in a large number of observation wells in Portales Valley once a year, usually in January, when most of the recovery from the effects of pumping of irrigation wells in the preceding year has taken place. These measurements are given in Part 2 and show the net

yearly changes in water level. (See accompanying map.) Water levels are also measured in a number of wells at bimonthly intervals in order to determine the varying seasonal trends caused by pumping and precipitation. (See Part 3.) In January 1947, 183 wells were measured. Of these, about 52 were also measured in March, May, July, September, and November. Water-stage recorders were operated on four wells during 1947 in order to obtain a continuous record of water levels. (See Part 4.) A total of 443 measurements of water level was made during the year, including 25 tape measurements made on recorder wells. All measurements were made by U. N. Benge except those in January which were made by C. S. Conover and G. R. Chenot and those in September which were made by R. L. Griggs.

Precipitation and pumpage

The fluctuations in water level in Portales Valley are the result primarily of variation in the amount and time of pumping which in turn is affected by the amount and time of precipitation occurring throughout the year. Fluctuations in water level also result from recharge to the water table in periods of excessive precipitation such as occurred in late 1941. The precipitation in the Portales Valley for 1947 was considerably less than in 1946 and averaged approximately 60 percent of normal. The precipitation at Floyd was 9.84 inches, 6.29 inches below normal; at Portales Evaporation Station, 9.69 inches, not including missing record for July; at Portales, 10.27 inches, not including missing record for July; and at Arch, 6.93 inches, 9.57 inches below normal. The deficiency of precipitation during the growing season, April through September, was nearly as great as for the year as a whole. Precipitation was particularly deficient in June, August, and September.

The amount of ground water pumped for irrigation in Portales Valley in 1947 was somewhat greater than in the preceding year. The increase in pumping was caused by the deficient rainfall and an increase in irrigated acreage. On the basis of electric power records for 137 comparable wells, it is estimated that about 5 to 10 percent more water was required per acre in 1947 than in 1946. The acreage irrigated in 1947 is estimated as about 27,500 acres, an increase of 3,000 acres over 1946. The pumpage in 1947 is estimated as 44,500 acre-feet, an increase of 7,500 acre-feet over 1946.

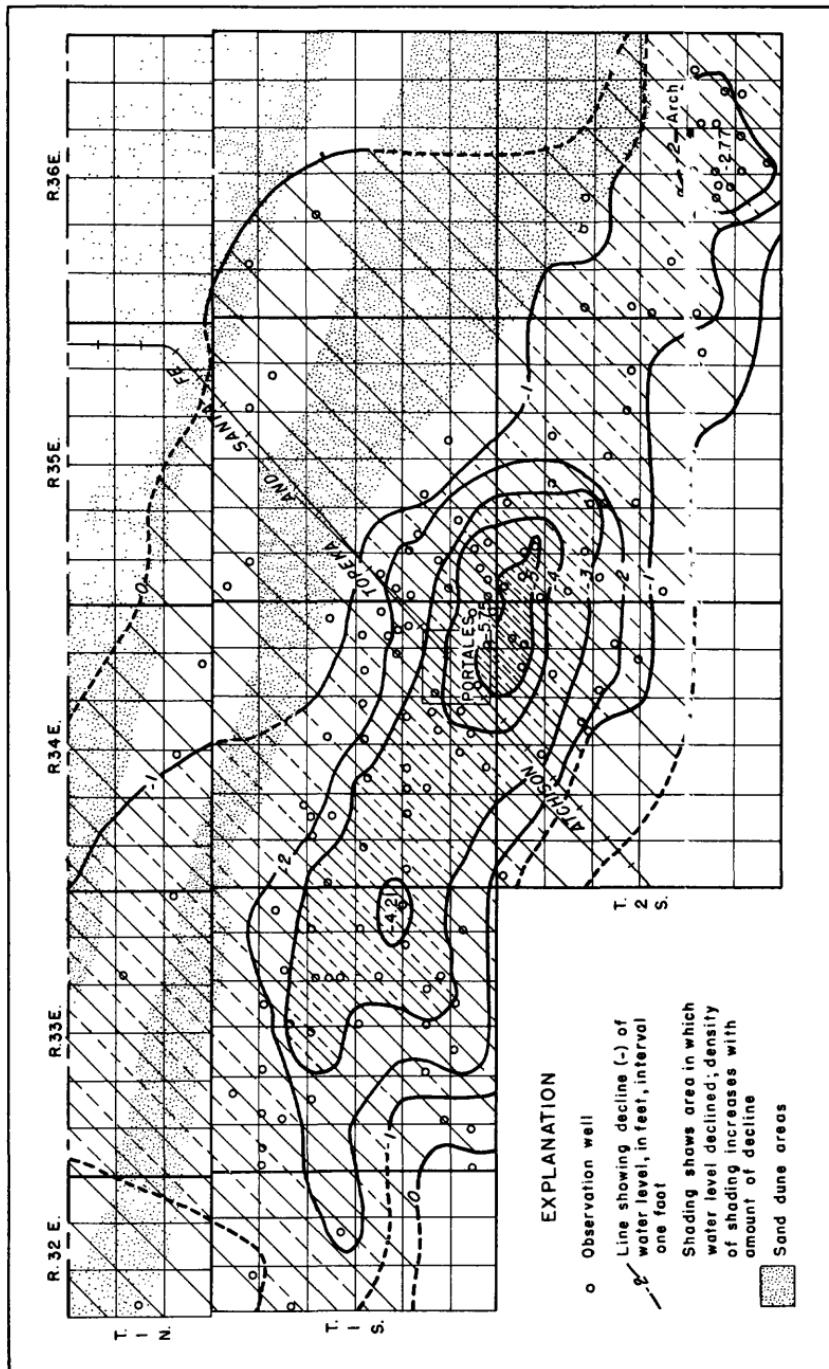


Figure 20.--Map of Portales Valley, Roosevelt County, N. Mex., showing decline of ground-water level from January 1947 to January 1948.

A large part of the increase in irrigated acreage in the later years has been planted to row crops that require less water than truck crops. The over-all average water pumped per acre irrigated has therefore shown a tendency to decrease in the later years. As row crops are grown successfully in years of normally distributed precipitation without the aid of irrigation, the actual acreage irrigated and amount of water pumped vary widely from a dry year to a normal year.

Fluctuations of water level

The ground-water levels in Portales Valley declined from January 1947 to January 1948 in an elliptical area extending along the axis of the valley as shown by the accompanying map. The areal distribution of the decline was similar to that of preceding years, the areas of largest decline generally coinciding with the areas of greatest pumping. The magnitude of the net declines from January 1947 to January 1948 was greater than for the preceding year as a result of the increase in pumping in 1947 and the deficient recharge from precipitation. The ground-water level in Portales Valley showed a net decline from January 1947 to January 1948 of more than 1 foot over an area of about 160 square miles, more than 2 feet over an area of about 66 square miles, more than 3 feet over an area of about 36 square miles, and more than 4 feet over an area of nearly 10 square miles. The area of greatest decline, more than 5 feet over an area of 2.3 square miles, was centered near the southeast corner of Portales.

In the 5-year period from January 1942, when the water levels were at or near their highest recorded levels, to January 1947 the water levels in the Portales Valley lowered more than 6 feet in an elliptical area of about 68 square miles that extends along the axis of the valley from about 14 miles northwest of Portales to about 6 miles southeast of Portales and has a maximum width of 4.5 miles near Portales. The water level also declined more than 6 feet in a nearly circular area of about 10 square miles that has its center about 1 mile west of Arch. In this 5-year period the water levels declined more than 16 feet in two areas, one of about 2 square miles centered about 1 mile northwest of Portales and one of more than 1 square mile centered about 1 mile southeast of Portales. It is in these areas of large decline where the greatest concentration of pumps occurs and also where pumping has been practiced the longest.

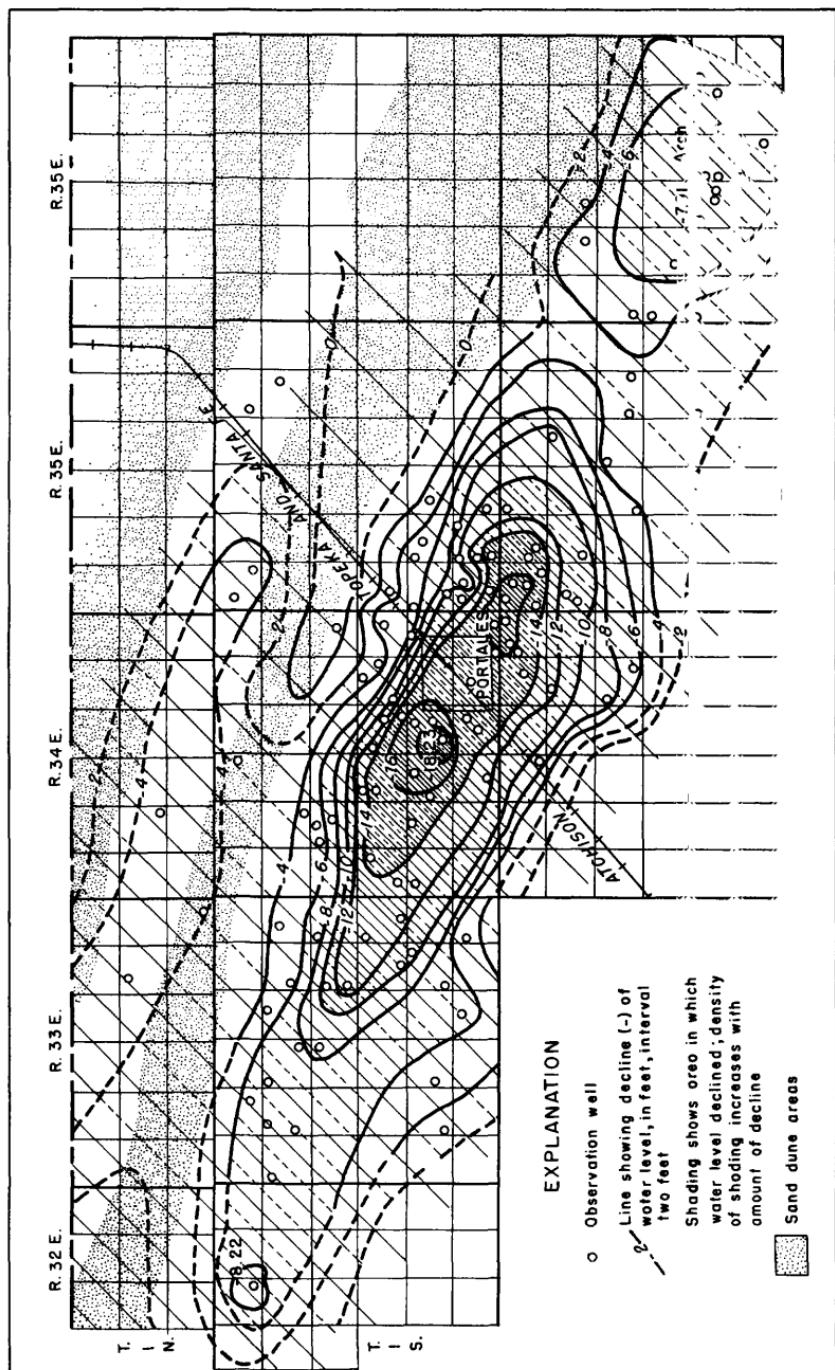


FIGURE 21.—Map of Portales Valley, Roosevelt County, N. Mex., showing decline of ground-water level from January 1942 to January 1948.

The water levels at the end of 1947 reached their lowest levels on record in the major part of the irrigated area around Portales and exceeded the previous low level in 1941 by more than 6 feet in many wells near Portales. However, the water levels in wells outside the heavily pumped areas have not yet fallen very far below the previous low levels of 1941. The slope of the cone of depression in the water table developed since 1941 is thus steeper than the cone of depression developed prior to 1941.

It is expected that water levels will usually continue to decline from year to year in Portales Valley as long as the present amount of pumping continues. A slight rise of water level may occur in a particular year due to a reduction in the amount of pumping that would result from either unfavorable economic conditions or a year of heavy precipitation. However, as the pumpage of ground water is mainly from ground-water storage, the long-term trend will be a decline in water level.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet

Location number*	Owner	See also Part	Water Levels				Record			
			Jan. 1947 Level	1946-47 Change Level	Highest Level	Lowest Level	Be- gan	Years missing		
1N.32.7.300	W. J. Cronshaw	3	16.10	15	+0.20	14.93	43	18.78	41	32
30.421	A. R. Dillard	5	57.95	15	.....	.....	.....	.....	47	47
32.133	Virgie Hawkins	5	65.41	15	.....	19.24	42	26.14	41	41
1N.33.16.100a	Mr. Hardwick	•	24.68	19	-2.15	20.00	42	24.68	47	47
16.100c	do	•	7.68	19	-1.74	3.54	42	12.06	39	43
26.120	Mary E. Miller	4	2.98	23	-1.13	f +1.57	42	f 8.23	41	32
36.4000b	A. C. Woodburn	do	6.47	23	-2.20	1.98	42	13.97	41	32
1N.34.29.444	J. N. Tefer tiller	•	15.93	22	-3.34	10.78	42	20.62	41	39
35.224	Mrs. Lee Garrett	•	17.60	22	+ .44	10.96	42	23.10	41	39
35.432	Earl McCallum	•	18.97	22	.....	18.97	47	22.88	44	39
1.31.1.222	L. H. Lee	3,5	74.98	24	+ .22	76.20	46	75.60	45	45
1.32.3.440	M. Nall	3	32.57	15	- .84	24.35	42	39.68	32	32
10.331	J. R. Meadows	3,5	45.23	15	.....	.....	.....	.....	47	47
14.432	Robert Morrison	3,5	44.94	15	- .80	43.63	45	44.94	47	45
15.111	Mrs. J. P. Nash	(Measurements discontinued, well dry)	19.93	15	-2.53	13.10	44	48.42	41	40
1.33.5.432	Cley Jones	5	18.79	15	-1.49	12.17	42	23.51	37	35
7.111	E. L. Sisk	5	18.85	23	-1.71	15.29	45	22.02	41	40
7.211	A. J. Smith	do	19.04	15	-2.96	11.69	43	18.85	47	45
8.112	do	•	20.19	15	-3.51	12.28	43	22.30	37	35
8.311	E. E. Marcus	•	20.40	15	-2.68	13.36	43	23.00	41	39
9.111	Earl Plank	•	20.98	15	-1.70	12.58	43	22.86	41	39
9.442	John Adams	•	24.32	17	-1.73	17.63	43	25.74	39	36
10.211	O. B. Sherman	(Measurements discontinued, well filled)	14.75	43	.....	.....	37	24.53	37	47
10.313	Jim Allen	do	22.49	15	.....	18.17	43	25.87	41	35
10.313a	do	3,5	24.34	17	-1.59	28.61	32	34.42	41	32
11.312	C. F. Williams	3	33.70	17	-1.56	17.83	41	25.70	41	35
12.144	A. C. Woodburn	3	25.53	17	-1.32	19.23	42	29.88	41	35
13.111	E. Elkins	(Measurements discontinued)	26.38	17	-1.65	24.53	47	34.37	46	46
13.431	Buddie Black	•	26.02	17	-1.49	13.89	42	25.02	47	35
14.131	J. V. Miller	•	23.90	17	-1.43	11.81	42	23.90	47	36
14.331	Claude Elder	do	24.56	17	-1.45	12.06	42	23.87	41	41
14.331c	(Measurements discontinued, well dry)	3	24.56	17	-1.45	19.37	45	24.56	47	45
14.421a	J. E. Stacey	do	26.38	17	-1.65	24.53	47	26.38	47	46
	Adolph Pinkart	•								

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	Water levels						Record
		Jan. 1947 also Part	1946-47 Level Day	Change 1946-47	Highest Level	Lowest Level	Year Begun	
1.33.15.212	O. D. Minick	3	20.04	•••	13.44	4.2	23.20	41
16.222	Bethel Church	3.5	20.66	15 -2.16	11.13	4.3	20.04	47
17.211	R. F. Campbell	(Measurements discontinued, well filled)						47
22.311a	Mrs. E. J. Smith	5	22.49	17	•••	4.3	21.57	37
23.311a	D. H. Smith	•	25.36	16	1.75	•••	•••	47
23.433	H. A. Miller	•	25.90	16	-1.24	15.73	4.2	27.36
24.111	J. E. Dictson	•	31.43	17	-1.82	18.40	4.2	32.28
24.433	J. E. Jones	•	27.98	16	-1.46	15.82	4.2	28.82
26.221	D. E. Thomas	•	25.72	16	-1.05	15.54	4.2	27.14
26.331	C. G. Norton	•	30.33	16	-1.36	22.56	4.3	32.27
27.311	J. A. Henley	•	43.06	16	•••	36.55	4.3	45.18
27.411	W. W. McClary	•	34.49	16	-1.66	27.20	4.3	36.44
27.421	Luther Cooper	•	30.98	16	-1.68	23.31	4.3	30.98
28.311	J. J. Spires	3	44.57	16	-1.19	39.39	4.3	47.30
29.333	M. H. Rea	3 a	35.59	15	-•••	29.73	4.3	37.03
30.	J. S. Lewis	(Measurements discontinued, well filled)						42-47
31.244	Luther Cox	5	44.61	16	•••	(1)	1.98	35
31.313	Webbie Starr	5	58.07	16	•••	•••	•••	47
33.211	W. R. McAffee	5	39.11	16	•••	•••	•••	47
34.211	R. T. Billberry	3	26.84	16	-1.45	19.72	4.3	28.94
36.131	Edwin Johnson	5	38.52	16	-1.56	31.89	4.2	41.16
1.34.8434	Bob Ledbetter	•	33.04	17	-•••	28.33	4.3	36.64
13.412	Ben Donathan	3	52.73	20	-•••	51.50	4.4	56.44
15.131	E. R. Kemp	3	50.56	19	-1.31	49.25	4.6	50.66
17.111	W. D. Ware	•	34.50	17	-1.34	28.16	4.3	36.27
17.122	Bob Ledbetter	•	33.38	17	-•••	27.59	4.3	36.34
17.233	L. E. Allison	•	33.52	17	-1.23	25.10	4.3	35.20
17.241	B. F. Ray	•	•••	•••	•••	22.52	4.3	31.81
18.135	J. E. Tucker	•	35.63	17	-•••	25.64	4.2	33.63
18.343	J. W. Terry	(Measurements discontinued, well filled)						47
19.223	A. H. Yesswater	•	33.21	17	-2.50	19.03	4.2	33.21
19.341	Floyd Horne	•	30.61	16	-2.10	16.62	4.2	30.61
21.121	J. H. Lee	•	39.99	17	-2.72	26.36	4.2	39.99
21.141	R. L. Ledbetter	5	40.84	17	-3.52	25.82	4.2	40.84
22.131	Mrs. W. E. Jergins	•	40.13	17	-2.28	27.47	4.2	40.13
22.222	Mrs. A. J. Goodwin	3	41.55	18	-•••	38.17	4.3	43.62

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	Water levels						Record
		See also Part	Jan. 1947 Level	Change 1 st 46-47	Highest Level	Lowest Level	Years gain	
1.34.22.421	R. C. Grunig	40.28	18	-1.60	25.89	42	4C.28	47
22.443	Mable Jernigan	38.98	20	-2.16	23.65	42	3C.98	47
25.211	Pope Long	40.15	19	... Measurements discontinued, well filled	28.85	43	41.55	41
23.311	J. R. Maffaffey	37.75	18	-1.78	27.47	43	37.04	41
23.312a	R. E. McDonald	32.96	19	-4.47	27.73	43	37.75	47
23.422a	E. L. Yandell	35.0	20	-1.63	28.34	43	34.05	41
23.442a	S. E. Fletcher	37.41	16	... Measurements discontinued, well dry	42.45	43	35.50	47
24.112a	J. A. Panson	47.27	20	-1.50	48.14	41	47	41
24.243	J. T. Correll	34.47	20	-1.53	29.40	43	34.47	42
24.312a	J. A. Cummings	38.48	23	-2.24	25.20	42	38.48	47
25.200	J. B. H. Young and Smith	40.24	20	-2.20	32.54	32	4C.24	47
25.211	J. B. H. Young	35	20	... Measurements discontinued, well dry	26.52	35	36.52	47
26.313	Unknown	37.39	20	... Measurements discontinued, well dry	26.63	42	37.39	47
27.211	J. F. Bowman	35.47	20	-3.05	18.90	42	31.72	41
27.331	Lewis Kirby (Measurements discontinued, well dry)	36.1	20	-2.80	20.17	42	35.47	47
27.341	B. F. Smith	31.54	21	-2.70	28.94	46	31.54	47
27.412	J. E. Flumurer	19.34	21	-2.34	7.24	42	31.44	41
27.444	Mr. Huffman (Measurements discontinued, well dry)	36.37	19	-2.77	18.84	42	34.57	47
28.111	G. C. Morris	36.37	19	-2.68	20.42	42	36.37	47
28.133a	Lee Daniels	36.36	19	-2.84	19.74	42	36.36	47
28.211	G. B. Thompson	33.85	16	-2.25	17.96	42	33.85	47
29.211	J. W. King	26.34	16	-1.91	16.55	42	29.34	47
30.121	H. A. Fember	31.54	21	-2.70	23.06	42	31.54	47
33.223a	W. W. Blakeley	36.79	21	-3.03	23.05	42	34.38	46
33.431	W. A. Moore	36.12	21	-2.96	19.90	42	36.79	47
34.143	J. A. Sanders	36.25	21	-3.10	20.06	42	35.15	47
34.232	J. W. Owens	34.86	22	... Measurements discontinued, well dry	22.81	44	34.86	47
34.322	T. E. Kears	35.11	22	-3.23	23.05	42	35.35	47
35.312	Eastern N. Mex. College	34.25	22	... Measurements discontinued, well dry	22	42	35.11	47
36.324	Mr. Disney (Measurements discontinued, well dry)	34.86	22	... Measurements discontinued, well dry	22	42	34.25	47
36.333	Jim Landiss	35.76	22	-2.56	19.37	42	35.76	47
36.421	Earl McCollum	34.86	22	... Measurements discontinued, well dry	26.64	44	34.86	47
36.443	Foy Williams	35.76	22	-2.56	19.37	42	35.76	47

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	Eastern N. Mex. State Park	Water levels						Record
			See also	Jan. 1947 Level	1946-47 Change	Highest Level	Lowest Level	Year	
Part	Part	Level	Year	Year	Year	Year	Year	Year	Year
1.35.2.300									
6.141	Aubrey Ellis	3	44.47	22	-0.52	43.52	44	48.07	40
6.400	J. C. Brown	3	6.08	22	-1.19	5.54	42	10.70	41
11.241	Eunice McPherson	3	10.74	22	-0.53	5.24	42	15.46	41
19.332	S. L. Foreman	3	15.48	22	-0.34	14.03	43	19.02	41
19.441	E. T. Hensley	4 ^a , 5	43.40	20	-2.50	37.80	43	44.41	41
27.344a	H. J. McCroary	3, 5	47.30	23	.....	.....	.....	.....	47
28.143	Mrs. Albinia Krivarick	3	30.42	20	.....	.....	.....	.....	47
29.111	Clara Nullmeyer	3	46.72	20	-1.27	44.24	43	51.49	41
29.142	R. E. Lee	5	40.38	20	-1.58	35.26	43	41.69	41
30.111	E. F. Foreman	5	38.97	23	-1.56	35.15	43	40.78	41
30.343	T. B. Livingston	5	40.48	20	-2.42	33.65	43	40.48	47
30.441	J. J. Ereshaars	5	33.73	20	-2.26	22.67	43	33.73	47
31.122	Mary M. Kenyon	5	35.21	23	.....	26.85	43	35.21	47
31.231	W. R. McCallum	5	33.79 ^a	21	-2.15	22.00	43	33.79	47
31.331	R. A. Young (Measurements discontinued, well filled)	5	30.81	22	-1.18	19.23	43	31.60	41
31.331a	do	5	34.31	22	.....	16.31	42	31.79	46
31.342	E. F. Moore	5	34.36	21	.....	16.37	43	34.36	47
31.412	Henry Beebe	5	32.86	21	-2.46	30.40	46	32.86	47
32.111	Alvin George	5	30.50	23	-3.19	19.65	43	30.52	41
32.212	R. H. Green	5	27.15	21	-1.86	18.45	43	27.67	41
32.311	O. W. Doak	5	30.47	21	-2.66	17.41	42	30.47	47
32.332	C. E. Lane	5	31.26	21	-2.66	17.12	42	31.26	47
32.413	W. L. Daniels	5	23.95	21	-1.16	14.77	42	25.55	41
33.331	L. C. Green	5	33.97	22	-0.63	32.94	43	24.03	41
1.36.5.300	W. H. McDaniel	3	a	(a)	.....	37.08	42	36.01	41
6.100	O. W. Bivine	3	b	19.10	22	.....	b	40.73	41
16.100	State of New Mexico	3	26.93	21	-0.35	26.58	46	30.20	40
2.33.1.422	W. B. and H. R. Skeen	5	53.04	16	.....	46	26.93	47	46
5.113	Kenneth Nunn	5	49.56	16	.....	46	45.94	46	46
7.232	John Morgan	5	34.55	22	-2.64	18.24	42	34.55	47
2.34.1.114	E. C. Murrill	5	32.15	21	-2.59	18.18	42	33.15	47
1.133	H. R. Knox	5	35.46	22	-2.61	18.98	42	35.46	47
1.221	Foy Williams	4	48.50	23	-2.50	33.94	42	48.55	47
2.233	Louisa Trout	4	.....	.....	.....	.....	.....	32	32

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Cont'd next

Location number*	Owner	Water levels						Record
		See also	Jan. 1947	Change	Highest	Lowest	Year	
Location number*	Owner	Part	Level	1946-47	Level	Year	Level	Year
2.34.4.441	Maud Wallace	2	5.24	22	-1.38	+4.17	42	6.00 41 39
6.112	Clyde Collis	5	28.56	21	••••	•••	46	•••• 47
10.324	Jim Cooper	3	34.78	22	-1.33	25.45	46	24.78 47 46
10.343	J. E. Eccellen	•	33.95	22	-1.36	32.25	43	36.03 41 25
11.122	D. W. Bedinger	•	31.85	23	-1.97	19.20	42	31.95 47 41
13.133	E. W. McFarland	3	22.82	22	-1.94	19.09	45	22.82 47 45
14.113	J. F. Terrell	•	28.44	22	-1.18	20.56	42	30.34 41 35
14.443	J. M. Shim	•	35.81	23	-1.02	29.22	42	36.87 37 35
2.35.4.111	G. E. Lunsey	3	24.25	21	-1.30	12.54	42	24.25 47 35
5.311	H. C. Dale	5	28.46	23	-2.86	12.87	42	28.46 47 35
5.341	H. R. Sedler	•	27.94	23	-2.30	13.45	42	27.54 47 35
6.121	Dollie Clark	3	33.88	23	-2.62	16.73	42	33.28 47 32
6.213	Beulah County	•	33.23	23	••••	16.87	42	33.23 47 35
6.312a	C. H. Lawdy	5	31.49	23	••••	24.37	45	31.49 47 46
6.331	J. A. Atkins	5	26.98	23	-1.18	12.96	42	26.94 47 35
6.411	F. A. Jewell	•	30.66	23	-2.94	14.25	42	30.66 47 39
6.443	Cra Johnson	•	27.92	23	-2.51	13.07	42	27.92 47 35
7.134	A. L. Reilly	•	35.53	22	-1.80	24.01	42	35.53 47 37
7.311	(Incorrect designation used previously for well 12-35.7-31z, which see)	22	••••	••••	••••	18.18	47	32
7.312	J. E. Elliott	3.5	18.18	21	-1.71	7.04	42	28.90 47 47
8.331	D. L. Hay	28.50	22	-1.58	18.28	42	18.18 47 37	
8.122	L. L. Griffith	3.5	20.57	23	••••	••••	42	18.18 47 37
9.211	Joe Maxwell (Measurements discontinued, well dry)	27.76	23	-1.68	10.26	42	16.75 41 39	
9.333	C. E. Clark	•	18.40	23	-1.15	10.30	42	27.76 47 45
10.211	S. H. Hare	•	10.72	21	-1.37	6.79	42	19.52 41 40
14.313	1st Mtnl Fank, Portales	3	2.55	21	-1.59	+0.07	43	3.44 41 40
14.414	do	3	2.64	21	-1.65	+0.02	42	2.76 41 39
15.131	Robert Stokes	5	24.52	21	••••	••••	42	•••• 47
16.111	A. J. Cline	3	19.30	21	-1.32	4.12	42	8.51 41 39
16.333	State of New Mexico	5	5.66	21	-1.91	(1)	42	5.86 47 39
18.211	Hoy Haircloth	3.5	27.55	21	••••	••••	42	•••• 47
18.134	E. C. Atkins	3.5	24.53	21	••••	••••	42	•••• 47
25.114	L. C. Buchanan (Measurements discontinued, well dry)	31.39	21	-1.42	28.07	42	24.73 37 36	
25.123	L. C. McCrary	3	18.92	21	-1.81	16.60	45	32.98 41 41
26.111	Loren Johnson	3	18.92	21	-1.81	18.92	45	41 45
2.36.7.332	See footnotes at end of table.							

* See footnotes at end of table.

Part 2. Water levels in January 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from January 1946 to January 1947, in feet--Continued

Location number	Owner	also pert	Water Levels			Record		
			Jan. 1947 Level	Jan. 1947 Day	Change 1946-47	Highest Level	Lowest Level	Be- gan
2.36.8.432	S. W. Davis	3	18.65	21	-0.87	13.26	42	20.04
9.431	T. E. Polly	*	19.62	21	-.73	15.67	43	21.63
18.541	Bob Stokes	3	14.98	21	-.94	9.42	42	18.26
19.113	E. O. Hobbs	*	21.81	21	-.94	16.93	42	22.96
20.321	W. O. Davis	3	14.53	21	-1.26	8.12	42	16.96
21.432	C. O. Statts	*	15.80	21	-.95	10.39	43	32
25.112	W. D. Pete	*	13.47	21	+.49	8.13	42	16.50
26.131	L. L. Bugg	3	12.39	21	-.31	5.29	42	14.21
26.311	J. S. Riley	*	11.96	21	-.34	5.09	42	13.56
26.423	W. B. Cox	*	13.97	21	+.28	8.15	42	16.09
27.111	B. L. Kennedy	*	14.13	21	-.85	6.27	42	15.47
27.131	do	*	14.32	21	-.99	6.54	42	15.26
27.211	M. C. Pete	*	13.15	21	-.45	5.58	42	14.79
27.311	J. K. Riley	3	14.71	21	-.90	7.04	42	14.79
28.114b	Morgan Trammell	4	15.28	21	-1.09	f	7.37	42
28.411	C. A. Tevis	*	14.94	21	-1.03	7.06	42	15.96
28.421	do	*	15.92	21	-.75	8.26	42	17.05
28.441	E. C. Sanders	*	16.64	21	-.91	11.60	43	17.74
30.111	L. B. Thornton	3	4.00	21	-.86	*.70	42	4.00
34.111	D. J. Petton	5	15.48	21	-.81	8.18	42	16.59
34.222	W. H. Davenport	*	9.90	21	-.51	4.01	42	11.01
34.341	W. J. Murrill	3	18.88	21	-.73	12.39	42	20.05
34.421	F. F. Dacus	*	9.77	21	-.45	4.24	42	10.64
35.212	A. E. Whitehead	3	9.03	21	-.01	3.81	42	12.96
2.37.19.331	W. H. McDougal	3	16.62	21	+.47	12.74	42	20.19
19.341	C. R. Anderson	*	16.67	21	+.47	12.97	42	19.84
21.312	C. E. Pattison	*	13.42	21	-.56	12.86	46	13.42

a. Pumping.

b. Pumping recently.

f. From recorder charts.

1. Above land-surface datum, well inaccessible.

J. Also 1941.

1.35-19.411. E. T. Hensley. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Apr. 9, 47.08; Sept. 10, 51.39.

Highest daily water level, in feet below land-surface datum, 1946
(From recorder charts)

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Dec. 1	47.62	Dec. 9	47.54	Dec. 17	47.53	Dec. 25	47.47
2	47.60	10	47.52	18	47.50	26	47.43
3	47.60	11	47.51	19	47.49	27	47.46
4	47.58	12	47.52	20	47.50	28	47.44
5	47.57	13	47.52	21	47.49	29	47.45
6	47.56	14	47.51	22	47.48	30	47.45
7	47.54	15	47.51	23	47.49	31	47.44
8	47.55	16	47.51	24	47.49		

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Nov.	Dec.
1	47.43	47.32	47.22	47.11	47.28	47.46	49.28	50.36	.....	49.28	
2	47.45	47.29	47.18	47.11	47.18	47.27	47.46	50.10	50.19	.....	49.24
3	47.43	47.28	47.20	47.10	47.17	47.26	47.46	50.14	50.13	.....	49.20
4	47.43	47.29	47.18	47.09	47.18	47.28	47.47	50.60	50.60	.....	49.20
5	47.41	47.27	47.19	47.11	47.18	47.28	47.48	50.58	50.09	.....	49.18
6	47.40	47.28	47.20	47.14	47.15	47.30	47.49	50.80	50.79	.....	49.16
7	47.42	47.27	47.19	47.12	47.20	47.30	47.50	50.48	50.88	.....	49.17
8	47.41	47.28	47.18	47.12	47.20	47.30	47.49	50.25	50.82	.....	49.26
9	47.41	47.27	47.18	47.08	47.21	47.28	47.48	50.09	51.27	.....	49.23
10	47.39	47.25	47.18	47.12	47.21	47.30	47.49	49.94	51.39	.....	49.20
11	47.38	47.26	47.17	47.11	47.21	47.30	47.51	49.82	51.04	.....	49.16
12	47.37	47.27	47.16	47.14	47.24	47.33	47.53	49.72	50.82	.....	49.16
13	47.35	47.26	47.18	47.14	47.24	47.34	47.88	49.64	50.64	.....	49.12
14	47.37	47.27	47.17	47.12	47.20	47.33	48.18	49.56	50.52	.....	49.11
15	47.37	47.25	47.19	47.12	47.23	47.34	48.69	49.50	50.37	.....	49.17
16	47.39	47.24	47.16	47.15	47.25	47.35	48.86	49.43	50.26	.....	49.14
17	47.38	47.23	47.16	47.12	47.26	47.33	49.29	49.37	50.18	.....	49.10
18	47.35	47.24	47.16	47.10	47.24	47.33	49.49	49.37	50.11h49.31	49.08	
19	47.34	47.22	47.16	47.13	47.24	47.36	49.91	49.88	50.01	49.28	49.07
20	47.37	47.24	47.15	47.13	47.25	47.34	49.75	49.72	49.96	49.26	49.05
21	47.37	47.24	47.16	47.12	47.25	47.36	49.68	49.62	49.92	49.25	49.00
22	47.34	47.24	47.13	47.11	47.26	47.40	50.28	49.54	.....	49.27	49.00
23	47.30	47.23	47.13	47.12	47.25	47.40	50.83	49.46	.....	49.35	49.14
24	47.30	47.22	47.16	47.12	47.27	47.39	50.34	49.40	.....	49.30	49.10
25	47.30	47.21	47.16	47.17	47.26	47.40	50.07	49.36	.....	49.29	49.06
26	47.28	47.21	47.13	47.16	47.25	47.41	49.88	49.32	.....	49.26	49.04
27	47.30	47.19	47.15	47.14	47.23	47.40	49.72	49.36	.....	49.25	49.02
28	47.28	47.20	47.10	47.14	47.23	47.42	49.58	49.71	.....	49.23	49.00
29	47.26	47.12	47.15	47.26	47.44	49.47	50.35	.....	49.23	49.03	
30	47.31	47.09	47.15	47.26	47.45	49.37	50.85	.....	49.32	49.01	
31	47.30	47.10		47.25		49.29	50.58			49.00	

h Tape measurement.

2.34.2.233. Louisa Trout. Highest recorded water level, in feet below land-surface datum, 1947: Feb. 16, 48.40.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Nov.	Dec.
1	48.52	48.64	.....	.....	50.65	.....	54.29	53.75	.....	54.57
2	48.48	48.55	.....	.....	50.94	53.08	54.33	56.54	.....	54.55
3	48.48	48.66	.....	.....	51.08	53.18	54.32	56.44	.....	54.52
4	48.52	48.66	.....	50.43	51.08	53.27	54.67	56.35	.....	54.51
5	48.48	48.68	.....	50.43	51.50	53.26	54.65	56.25	.....	54.46
6	48.45	48.63	49.57	50.46	51.78	53.19	54.73	56.17	.....	54.40
7	48.46	48.63	49.55	50.59	51.79	53.18	54.80	56.17	.....	54.37
8	48.50	48.58	49.53	50.67	51.67	.....	54.76	56.17	.....	54.35
9	48.43	48.54	49.56	50.77	51.65	.....	55.00	.....	.....	54.33
10	48.42	48.53	49.60	50.64	51.92	.....	55.00	56.16	.....	54.29
11	48.49	48.53	49.72	50.57	51.91	.....	55.05	56.15	.....	54.25

2.34.2.233--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Nov.	Dec.
12	.....	48.46	48.57	49.66	50.55	51.03	.....	55.14	56.77	.....	54.25
13	.....	48.46	48.53	48.63	50.52	52.00	.....	55.13	50.91	.....	54.20
14	.....	48.44	48.52	49.55	50.48	52.22	.....	55.05	.....	.....	54.15
15	.....	48.42	48.55	49.62	50.48	52.18	.....	55.06	.....	.....	54.16
16	.....	48.40	48.51	49.57	50.47	.....	.....	55.10	.....	.....	54.14
17	.....	48.48	48.48	.....	50.45	52.38	.....	55.30	.....	.....	54.10
18	.....	48.42	48.46	.....	50.45	52.50	.....	55.30	.....	55.18	54.08
19	.....	48.42	48.51	.....	50.33	52.40	.....	55.53	.....	55.12	54.06
20	.....	48.48	48.52	.....	50.32	52.37	.....	55.34	.....	55.00	54.03
21	.....	48.47	48.54	50.00	50.64	52.53	.....	55.35	.....	55.02	53.95
22	.....	48.48	48.57	50.42	50.02	52.47	.....	55.37	.....	54.95	53.97
23	48.55	48.48	48.60	50.42	50.70	52.48	.....	55.39	.....	54.91	53.95
24	48.55	48.54	48.64	50.42	50.65	52.73	.....	55.55	.....	54.85	53.92
25	48.55	48.66	48.72	50.42	50.60	52.85	.....	55.94	.....	54.83	53.91
26	48.50	48.68	48.79	50.42	50.49	52.85	.....	.....	.....	54.78	53.89
27	48.52	48.63	48.80	50.42	50.47	52.75	.....	.....	.....	54.76	54.11
28	48.49	48.69	48.90	50.42	50.47	52.75	54.02	.....	.....	54.71	54.35
29	48.47	.....	48.93	.....	50.52	52.85	53.89	.....	.....	54.70	54.27
30	48.50	.....	49.03	.....	50.53	.....	54.25	.....	.....	54.62	54.15
31	48.52	.....	.....	.....	50.51	.....	54.17	.....	.....	.....	54.06

h Tape measurement.

2.36.28.114b. Morgan Trammell. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Mar. 16-19, 15.07; Oct. 12, 18.31.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	15.37	15.24	15.12	15.26	15.19	15.29	16.20	16.93	17.56	15.14	17.93	17.56
2	15.36	15.22	15.10	15.30	15.19	15.33	16.24	16.94	17.58	18.14	17.91	17.55
3	15.37	15.21	15.11	15.32	15.17	15.34	16.28	16.95	17.60	18.14	17.90	17.54
4	15.35	15.22	15.10	15.34	15.17	15.34	16.31	16.95	17.62	18.18	17.89	17.53
5	15.34	15.21	15.10	15.36	15.17	15.35	16.34	16.97	17.65	18.25	17.87	17.52
6	15.33	15.21	15.11	15.40	15.18	15.36	16.36	16.98	17.68	18.26	17.86	17.50
7	15.33	15.21	15.10	15.42	15.22	15.37	16.41	16.99	17.71	18.26	17.85	17.49
8	15.34	15.20	15.10	15.42	15.23	15.38	16.44	17.00	17.74	18.26	17.84	17.48
9	15.33	15.20	15.08	15.39	15.25	15.40	16.46	17.01	17.77	18.27	17.81	17.48
10	15.31	15.19	15.08	15.40	15.24	15.44	16.48	17.02	17.80	18.28	17.80	17.47
11	15.30	15.19	15.08	15.38	15.24	15.47	16.50	17.04	17.83	18.28	17.78	17.46
12	15.29	15.19	15.08	15.39	15.24	15.49	16.52	17.06	17.87	18.31	17.77	17.46
13	15.28	15.18	15.08	15.37	15.23	15.53	16.55	17.07	17.89	18.30	17.75	17.45
14	15.29	15.19	15.07	15.34	15.21	15.55	16.57	17.08	17.92	18.29	17.74	17.43
15	15.29	15.17	15.09	15.33	15.21	15.59	16.60	17.10	17.94	18.28	17.73	17.43
16	15.30	15.16	15.07	15.32	15.22	15.62	16.62	17.11	17.95	18.27	17.72	17.42
17	15.29	15.15	15.07	15.29	15.21	15.66	16.66	17.13	17.97	18.26	17.71	17.42
18	15.29	15.15	15.07	15.27	15.20	15.71	16.69	17.16	17.99	18.24	17.70	17.41
19	15.27	15.14	15.07	15.27	15.20	15.76	16.72	17.19	18.01	18.21	17.69	17.40
20	15.27	15.15	15.08	15.25	15.20	15.80	16.74	17.22	18.04	18.21	17.68	17.40
21	15.28	15.14	15.09	15.24	15.21	15.85	16.77	17.25	18.06	18.19	17.67	17.38
22	15.27	15.14	15.08	15.23	15.20	15.90	16.75	17.28	18.07	18.18	17.65	17.38
23	15.26	15.14	15.08	15.22	15.22	15.93	16.79	17.32	18.09	18.17	17.64	17.38
24	15.26	15.14	15.10	15.23	15.23	15.94	16.81	17.35	18.10	18.17	17.63	17.37
25	15.26	15.14	15.10	15.23	15.22	15.95	16.82	17.38	18.10	18.05	17.62	.....
26	15.23	15.13	15.08	15.22	15.23	15.97	16.83	17.41	18.11	18.04	17.61	.....
27	15.24	15.12	15.09	15.20	15.23	16.02	16.85	17.44	18.11	18.02	17.61	.....
28	15.23	15.11	.....	15.19	15.24	16.06	16.88	17.47	18.12	18.01	17.59	.....
29	15.22	.....	15.19	15.25	16.10	16.88	17.50	18.13	17.98	17.58	.....	.....
30	15.23	.....	15.19	15.25	16.15	16.90	17.52	18.13	17.96	17.57	.....	.....
31	15.23	.....	15.21	.....	15.26	.....	16.92	17.54	.....	17.94	.....	.....

Part 5. Miscellaneous data concerning observation wells

1N.32.30.421. Dillard. Drilled irrigation well, diameter 12 inches, depth 148 feet. Reference point, top of concrete pump base, 0.30 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1947: May 27, 60.11.

1N.32.32.133. Hawkins. Drilled irrigation well, diameter 12 inches, depth 148 feet. Measuring point beginning Jan. 15, 1947, top edge of south $\frac{1}{2}$ -inch hole in east side of base of pump. Subtract 0.43 foot from tape measurements to reduce to top of concrete base and 1.18 feet to reduce to land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1946: June 13, 65.46.

1.31.1.222. Lee. Measuring point beginning July 31, 1947, top of concrete pump base, 0.76 foot above land-surface datum. Pump removed.

1.32.10.331. Meadows. Drilled irrigation well, diameter 12 inches, depth 122 feet. Measuring point, top of casing level with top of concrete well curb, 0.50 foot above land-surface datum. Water levels, in feet below land-surface datum, 1946: July 29, 45.35; Sept. 30, 45.80; Nov. 29, 45.33.

1.32.14.432. Morrison. Well abandoned prior to measurement on May 29, 1947. Pump removed to new drilled irrigation well about 150 feet east.

1.33.7.111. Sisk. Correction made in reference point, May 29, 1947; concrete pump base is 0.09 foot above land-surface datum, rather than 0.50 foot as stated in Water-Supply Paper 911, p. 223. Measuring point beginning May 29, 1947, lower outer edge of mouth of discharge pipe. Subtract 3.45 feet from tape measurements to reduce to top of concrete pump base, 3.54 feet to reduce to land-surface datum.

1.33.10.313a. Allen. 25 feet northeast of observation well 1.33.10.313, which has been filled. Drilled irrigation well. Measuring point, lower outer edge of base of pump, at southwest side of well. Subtract 0.39 foot from tape measurements to reduce to top of casing, 0.89 foot to reduce to land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: July 29, 44.26, pumping; Sept. 30, 25.22; Nov. 29, 23.06.

1.33.17.211. Campbell. Drilled irrigation well, diameter 14 inches, depth 102 feet. Measuring point, top of casing west side of well, level with concrete pump base, 0.50 foot above land-surface datum. Equipped with turbine pump.

Water level, in feet below land-surface datum, 1945-46

Date	Water level	Date	Water level	Date	Water level
Aug. 1, 1945	17.29	May 29, 1946	a39.96	Sept. 30	23.26
Mar. 26, 1946	18.33	July 29	a39.45	Nov. 29	20.89

a Pumping.

1.33.22.111. Smith. Drilled irrigation well. Reference point, top of concrete pump base, 0.45 foot above land-surface datum. Equipped with turbine pump.

1.33.31.244. Cox. Drilled irrigation well, diameter 12 inches, depth 103 feet. Reference point, top of concrete pump base, 0.50 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1945: Nov. 26, 43.90.

1.33.31.313. Starr. Drilled domestic well, diameter 14 inches. Measuring point, top edge of casing south side of well, 1.30 feet above land-surface datum.

1.33.33.211. W. R. McAfee. Drilled irrigation well, diameter 14 inches, depth 136 feet. Reference point, top of concrete pump base, 0.70 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1947: May 29, 44.88.

1.33.36.131. Johnson. Measuring point beginning Jan. 16, 1947, top edge of Geological Survey washer in top west inside edge of 5 $\frac{1}{2}$ - by 5 $\frac{1}{2}$ -inch timber across east side of well, 0.11 foot below land-surface datum. Pump removed.

1.34.21.141. Ledbetter. Formerly owned by Douglas Owen.

1.34.23.422. Yandell. Measuring point beginning Jan. 19, 1947, top edge of north $\frac{1}{2}$ -inch hole in east side of pump base. Subtract 0.19 foot from tape measurements to reduce to top of concrete pump base and land-surface datum. Possible discrepancy of a few tenths of a foot between present and previous land-surface datum. New pump and pump base. Reference point destroyed.

1.34.24.112a. Pinson. Drilled irrigation well. Measuring point beginning Jan. 19, 1947, top of concrete pump base level with top of casing, at land-surface datum. Equipped with turbine pump.

1.34.25.211. Young. Turbine pump on well March and May 1947.

1.34.26.313. Unknown. Measurements resumed Jan. 20, 1947. Irrigation well. Measuring point beginning Jan. 20, 1947, top edge of $\frac{1}{2}$ -inch hole in north side of base of pump, 0.77 foot above old automobile frame pump support and 1.61 feet above land-surface datum. Reference point, established Jan. 16, 1940, top edge of Geological Survey washer in south side of power-line pole about 15 feet west of well, 1.96 feet above land-surface datum. Equipped with turbine pump.

1.35.19.411. Hensley. Drilled well, about 400 feet west of irrigation well, diameter 18 inches. Measuring point, top edge of casing at lowest point, 0.02 foot above concrete pump base, 1.52 feet above land-surface datum. Equipped with water-stage recorder Nov. 28, 1946. Water levels, in feet below land-surface datum, 1946: June 7, 51.71, nearby well pumping; Nov. 29, 47.62.

1.35.27.344a. McCroary. Drilled domestic well, diameter 4 inches. Reference point, same as that for well 1.35.27.344, top of 2- by 2-inch stake, 1 foot west of center of tree, which is 40 feet southeast of well 1.35.27.344, and 20 feet north of house, 0.35 foot above land-surface datum. Measuring point, top of 4-inch casing level with concrete base around casing, 3.23 feet above land-surface datum of well 1.35.27.344. Equipped with pump and windmill.

Water level, in feet below land-surface datum, 1945-46

Date	Water level	Date	Water level	Date	Water level
Sept. 26, 1945	29.81	May 27	30.30	Sept. 27, 1946	30.49
Nov. 24	29.90	July 26	a37.50	Nov. 27	30.46
Mar. 27, 1946	a43.14				

a Pumping.

1.35.29.142. Lee. Measuring point beginning Jan. 23, 1947, top of concrete pump base, at land-surface datum. Pump removed.

1.35.30.441. Breshears. Abandoned drilled irrigation well, no equipment, diameter 12 inches. Measurements resumed July 26, 1946. Measuring point, top north edge of Geological Survey washer, nailed in south 6- by 6-inch timber for pump support, 1.25 feet above top of casing, at land-surface datum. Possible discrepancy of a few hundredths of a foot between present and previous land-surface datum. Water level, in feet below land-surface datum, 1946: July 26, 35.75.

1.35.31.331a. Young. About 15 feet south of previous observation well 1.35.31.331 which has been filled. Drilled irrigation well. Reference point, top of concrete pump base, 0.83 foot above land-surface datum. Equipped with turbine pump.

1.35.31.412. Beebe. Measuring point given in Water-Supply Paper 1076 is at land-surface datum.

2.33.5.113. Nunn. Drilled irrigation well, diameter 16 inches, depth 103 feet. Measuring point beginning Jan. 16, 1947, lower edge of discharge pipe. Subtract 4.30 feet from tape measurements to reduce to land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum: Nov. 25, 1945, 49.87; May 29, 1947, 52.97.

2.34.6.112. Collis. Drilled irrigation well. Measuring point inside edge of oval hole in south side of pump case, 1.10 feet below top of southwest corner of concrete weir box to north of pump, 0.25 foot above land-surface datum. Equipped with turbine pump.

2.35.5.311. Dale. Formerly owned by H. G. Black.

2.35.6.312a. Dawdy. Formerly owned by Hugh Brassell.

2.35.6.331. Akens. New concrete base poured upon old base. Reference point beginning Jan. 24, 1947, top of new concrete pump base, 0.92 foot above land-surface datum.

2.35.7.312. Elliott. Previously designated incorrectly as 2.35.7.311.

2.35.9.122. Griffith. 140 feet southwest of house. Drilled irrigation well. Reference point, top of concrete base and top of casing, 0.25 foot above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: May 27, 20.45; July 26, 21.20, nearby well pumping; Sept. 28, 21.08; Nov. 27, 20.64.

2.35.16.111. Stokes. Drilled irrigation well, diameter 16 inches, depth 120 feet. Measuring point, top of casing at south side of well, 1.00 foot above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1945: Apr. 5, 21.21; June 9, 21.11.

2.35.19.134. Faircloth. Drilled irrigation well, no equipment, diameter 10 inches. Measuring point, top of concrete pump base, south side, level with top of casing, 0.50 foot above land-surface datum. Reference point, top surface at southwest corner of concrete weir box, just north of well, 1.27 feet above land-surface datum. Water levels, in feet below land-surface datum, 1946: June 12, 27.13; July 25, 27.22; Sept. 28, 27.40; Nov. 27, 27.47.

2.35.25.114. Watkins. Dug and drilled irrigation well. Measuring point, top edge of Geological Survey washer nailed in southwest edge of northeast horizontal timber support for vertical pump shaft, 0.40 foot north of northeast vertical upright, 0.50 foot above land-surface datum. Equipped with centrifugal pump. Water levels, in feet below land-surface datum, 1946: July 25, 24.32; Sept. 28, 24.53; Nov. 30, 24.45.

2.36.34.111. Patton. Formerly owned by M. F. Riley.

SIERRA COUNTY (HOT SPRINGS AREA)

Part 1. General discussion

Water levels were measured in the observation wells at Hot Springs during 1947 in cooperation with the State engineer of New Mexico. These measurements continue the record begun in 1939 when the investigation of the thermal wells and springs was started under the cooperative program. A report covering the general phases of the investigation was prepared in 1941 and is to be published in a forthcoming biennial report of the State engineer. Water-level measurements made in past years have been published in the following Geological Survey water-supply papers:

Year of record	Water-Supply Paper	Page Nos.
1939-1940	911	235-240
1941	941	270-274
1942	949	336-340
1943	991	297-299
1944	1021	290-294
1945	1028	290-295
1946	1076	300-304

Water levels are measured periodically so as to detect any changes that may occur which might indicate a change in the amount of thermal water available. A few measurements of the temperature and dissolved mineral content of the thermal water are also made during the year to detect any changes which might occur in the characteristics of the water. Water levels were measured in 13 wells in January and every 2 months thereafter. Water-stage recorders were operated on three of the wells throughout the year; of these, one was on an artesian well, No. 6, one on a shallow well dug into the alluvium, No. 6a, and one on a well dug into the Magdalena limestone near the upper edge of the spring area, No. 25. (See part 4.) A total of 78 measurements of water level was made during the year including about 18 made upon the recorder wells.

Fluctuations of water level and artesian head

Since the thermal water of the Hot Springs area discharges into the Rio Grande either directly or indirectly, the stage of the river is the major factor at present in controlling the pressure in the artesian wells and the water levels in the shallow-water wells. As power is developed at Elephant Butte Dam above Hot Springs, the stage of the river is maintained at a fairly constant elevation and water levels and artesian pressures at Hot Springs have been fairly stable since operation of the power plant began. The release of water from Elephant Butte Reservoir in 1946 and 1947 was somewhat less than in previous years because of the limited water supply. Artesian pressures at Hot Springs declined an average of 0.09 foot from January 1947 to January 1948 as compared with a slight rise of 0.02 foot in the preceding year. Ten of the 13 wells reached their lowest levels on record at the end of 1947 while the other 3 were from 0.01 foot to 0.17 foot above their previous low levels.

The highest observed level for the year was reached in March and the lowest in September with an average range of about 0.4 foot which is apparently about 0.1 foot greater range than occurred in the same period of the previous year. Part of this greater summer lowering may have been the result of increased use of the thermal waters.

As measurements of water levels have not shown any serious depletion of the thermal water, the State engineer in August 1947 reopened the area to drilling of wells for thermal water. The increased pumpage of the

thermal water, which will result from drilling of new wells, will salvage some water for beneficial use that at present escapes through the overlying alluvium to the river. Some lowering of the artesian pressures is to be expected from this additional pumping and change in point of discharge of the thermal water.

Part 2. Water levels in January 1947 and highest and lowest recorded levels, ^{1/} in feet with reference to land-surface datum, and change from January 1946 to January 1947, in feet

Field No.	Location	Owner	Part Elevation	See also Juri. 1947 Water Levels			Record
				Part Level	1946-47 Change	Highest Year Level	
2	17	1 H. L. Lockhart	3	+0.36	21	••••	+1.20 42 +0.30 44 41 46
3	17	1 do	3	+.41	21	••••	+1.23 42 +.35 44 41 46
4	21	2 C. E. James	3	+.42	21	+.02	+1.28 42 +.40 41 36 39
5	12	9 C. J. Malone	3	-.69	21	+.11	+1.13 42 -.80 46 39
6	4	8 C. E. James	4	+.59	21	-.02	+1.57 42 f+.52 41 41
6a	4	8 do	4	-1.66	21	-.04	f-1.24 42 f-1.66 47 42
12	8	40 Mr. Mathis	3	+.72	21	+.02	+4.53 42 +3.69 44 39
18	7	106 W. R. Whitehead	3	-1.76	21	+.C1	-1.19 42 -1.92 39 39
19	12	105 Bill Green	3	-.93	21	-.02	-.20 42 -.98 39 39
25	4	93 Jim Knox	4	-7.79	21	+.06	f-6.95 42 f-7.99 44 39
27	4	42 Ben Graham	3	+2.15	21	+.01	+2.97 42 +2.13 40 39
30	1	102 G. L. Lill	3	-1.42	21	+.05	-.63 42 -1.48 40 39
33	2	106 C. E. James	3	-.44	21	+.04	+.29 42 -.48 44 41

¹ From recorder charts.
 1 Mar. 1939, Feb. 1940, Feb. 1941, Mar. 1942, Apr. 1943, Jan. 1944-46.
 1 Also 1946.

Part 3. Water levels, in feet with reference to land-surface datum,
showing seasonal changes during 1947

Field No.	2 Owner Lock- hart	3 Lock- hart	4 James	5 Malone	12 Mathis	18 White- head	19 Green	27 Gra- ham
Jan. 21	+0.36	+0.41	+0.42	-0.69	+3.72	-1.76	-0.93	+2.15
Mar. 26	+.39	+.43	+.48	-.64	+3.80	-1.70	-.88	+2.24
May 29	.....	.....	+.33	.....	+3.67	-1.82	-.96	+2.12
July 30	+.08	+.11	1 +.23	-.90	+3.48	-1.95	-1.15 1	+1.93
Sept. 30	.00	+.04	1 +.23	-1.04	+3.37	-2.10	-1.26 1	+1.93
Nov. 4, 5	c -.10	c -.04	1 +.23	a -4.31	+3.41	-2.08	-1.24 1	+1.93

Field No.	30 Owner Mills	33 James
Jan. 21	-1.42	-0.44
Mar. 26	-1.33	-.37
May 29	-1.46	-.48
July 30	-1.65	-.64
Sept. 30	-1.81	-.74
Nov. 4	-1.76	-.70

a Pumping.

c Nearby well pumping.

1 Below level given.

Part 4. Highest daily water levels in wells equipped with automatic
water-stage recorders

6 Lot 4, block 6. C. E. James. Highest and lowest recorded water
levels, in feet above land-surface datum, 1947: Mar. 27, 0.81; Sept. 30,
Oct. 4, 0.35.

Highest daily water level, in feet above land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.72	0.65	0.73	0.67	0.71	0.60	0.59	0.47	....	0.38	0.41	0.46
2	.72	.67	.74	.73	.71	.61	.59	.46	....	.39	.46	.45
3	.68	.68	.73	.73	.71	.62	....	.43	....	.38	.44	.43
4	....	.67	.75	.73	.69	.62	....	.43	....	.35	.41	.41
5	.70	.70	.72	.73	.70	.61	....	.43	....	.36	.44	.41
6	.73	.70	.74	....	.71	.60	....	.41	....	.38	.45	.43
7	.68	.69	.74	....	.70	.60	....	.41	....	.36	.42	.43
8	.69	.69	.74	....	.70	.60	....	.41	....	.36	.44	.44
9	.67	.72	.72	....	.71	.60	....	.41	....	.38	.45	.43
10	.70	.72	.73	.73	.72	.60	....	.41	....	.41	.45	.41
11	.70	.69	.74	.74	.67	.60	....	....	....	.42	.45	.40
12	.73	.39	.73	.72	.67	.58	....	....	....	.41	.46	.41
13	.74	.70	.72	.73	.68	.59	....	....	....	.38	.44	.40
14	.69	.71	.73	.74	.69	.57	....	....	....	.42	.45	.44
15	.70	.71	.69	.73	.68	.57	....	....	....	.42	.41	.44
16	.68	.73	.70	.74	.67	.58	....	....	....	.42	.43	.43
17	.69	.71	.71	.73	.66	.59	....	....	....	.41	.43	.43
18	.70	.71	.71	.75	.67	.62	....	....	....	.40	.46	.44
19	.70	.73	.71	.73	.68	.63	....	....	....	.40	.48	.44
20	.69	.71	.70	.72	.67	.67	....	....	....	.41	.49	.43
21	.66	.70	.72	.73	.65	.65	....	....	....	.43	.47	.46
22	.67	.69	.73	.74	.66	.59	....	....	....	.43	.45	.46
23	.69	.70	.73	.72	.65	.60	....	....	....	.41	.47	.45
24	.67	.72	.76	.72	.65	.61	....	....	....	.41	.43	.46
25	.66	.74	.77	.70	.64	.60	....	....	....	.45	.46	.42
26	.69	.73	.79	.70	.64	.58	....	....	....	.47	.43	....
27	.72	.75	.81	.71	.67	.59	....	....	....	.46	.45	.41
28	.74	.75	.75	.71	.68	.58	....	....	....	.44	.43	.45
29	.75	.73	.73	.64	.54	....	....	....	....	.45	.43	.46
30	.69	.73	.72	.64	.56	.46	....	.35	.44	.42	.47	....
31	.69	.73	....	....	....	....	....	....	.41	....	.48	....

6a Lot 4, block 8. C. E. James. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Aug. 19, 1.20; Sept. 28, 2.03.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.
1	1.65	1.65	1.61	1.63	1.65	1.78	1.63	1.89	1.88	....	2.00	1.95
2	1.64	1.66	1.62	1.62	1.66	1.78	1.62	1.89	1.86	....	2.00	1.94
3	1.65	1.65	1.62	1.61	1.66	1.79	1.65	1.90	1.87	....	1.99	1.94
4	1.65	1.66	1.62	1.60	1.67	1.79	....	1.89	1.87	....	2.00	1.95
5	1.64	1.66	1.62	1.60	1.67	1.79	....	1.89	1.89	2.02	2.00	1.96
6	1.64	1.65	1.36	....	1.68	1.80	....	1.91	1.89	2.01	1.99	1.95
7	1.64	1.65	1.35	....	1.68	1.80	....	1.91	1.89	2.01	2.00	1.95
8	1.64	1.64	1.42	....	1.67	1.81	....	1.91	1.88	2.01	2.00	1.95
9	1.65	1.64	1.52	....	1.67	1.81	....	1.92	1.89	2.01	2.00	1.95
10	1.65	1.63	1.57	1.62	1.67	1.81	....	....	1.90	2.01	1.99	1.96
11	1.64	1.64	1.60	1.62	1.68	1.81	....	1.92	1.92	2.00	1.99	1.96
12	1.64	1.64	1.61	1.63	1.70	1.82	....	1.92	1.95	2.00	1.99	1.96
13	1.64	1.64	1.63	1.64	1.72	1.81	....	1.91	1.97	2.01	1.98	1.96
14	1.65	1.64	1.63	1.64	1.71	1.81	....	1.86	1.97	2.00	1.98	1.96
15	1.65	1.64	1.63	1.64	1.71	1.81	....	1.84	1.98	2.00	1.98	1.96
16	1.66	1.64	1.65	1.63	1.71	1.81	....	1.86	1.99	2.00	1.99	1.96
17	1.65	1.64	1.64	1.63	1.72	1.81	....	1.71	1.99	1.99	1.98	1.96
18	1.65	1.64	1.64	1.63	1.72	1.67	....	11.46	1.99	2.00	1.96	1.96
19	1.63	1.64	1.64	1.63	1.71	1.66	....	11.20	1.98	2.00	1.94	1.96
20	1.63	1.64	1.64	1.65	1.72	1.38	....	11.33	1.97	....	1.92	1.95
21	1.65	1.64	1.63	1.64	1.73	1.43	....	11.49	1.99	....	1.92	1.95
22	1.65	1.64	1.62	1.64	1.74	1.60	....	11.58	2.00	....	1.93	1.95
23	1.65	1.64	1.64	1.64	1.74	1.68	....	1.61	2.01	2.01	1.95	1.95
24	1.65	1.64	1.64	1.65	1.74	1.74	....	1.65	2.01	2.00	1.95	1.93
25	1.65	1.64	1.65	1.65	1.74	1.75	....	1.69	2.01	2.00	1.95	....
26	1.66	1.63	1.64	1.65	1.74	1.76	....	1.73	2.01	1.96	1.96	....
27	1.66	1.62	1.64	1.66	1.75	1.76	....	1.75	2.02	1.96	1.95	1.94
28	1.65	1.61	1.63	1.66	1.74	1.77	....	1.79	2.03	1.97	1.95	1.94
29	1.64	1.63	1.66	1.75	1.79	....	1.83	2.02	1.97	1.95	1.94	....
30	1.65	1.64	1.66	1.76	1.80	1.90	1.86	2.02	1.98	1.96	1.93	....
31	1.65	1.63	1.76	....	1.89	1.88	....	1.99	1.99	....	1.93	....

1 High level due to leakage from nearby water main.

25 Lot 4, block 93. Jim Knox. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Mar. 4, 7.54; Sept. 21, 22, 8.03.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.62	7.67	7.57	7.58	7.63	7.74	7.77	7.89	7.97	7.98	7.93	7.90
2	7.61	7.64	7.57	7.55	7.63	7.73	7.77	7.90	7.96	7.97	7.91	7.89
3	7.66	7.63	7.56	....	7.62	7.72	....	7.93	7.96	7.97	7.91	7.92
4	7.65	7.63	7.54	....	7.64	7.73	....	7.92	7.96	7.99	7.94	7.94
5	7.64	7.60	7.56	....	7.63	7.75	....	7.93	7.96	7.98	7.92	7.95
6	7.60	7.60	7.55	....	7.62	7.76	....	7.95	7.96	7.97	7.91	7.91
7	7.66	7.61	7.55	....	7.64	7.77	....	7.95	7.95	7.98	7.94	7.93
8	7.65	7.61	7.55	....	7.63	7.77	....	7.95	7.94	7.97	7.93	7.91
9	7.67	7.58	7.57	....	7.63	7.76	....	....	7.95	7.97	7.91	7.91
10	7.64	7.58	7.57	7.61	7.62	7.77	....	....	7.97	7.94	7.92	7.92
11	7.64	7.61	7.56	7.60	7.67	7.77	....	7.96	8.00	7.93	7.93	7.93
12	7.62	7.62	7.57	7.62	7.68	....	....	7.95	8.02	7.94	7.91	7.93
13	7.61	7.60	7.59	7.61	7.69	....	....	7.94	8.00	7.95	7.92	7.94
14	7.65	7.59	7.57	7.60	7.66	....	....	7.93	8.00	7.93	7.91	7.92
15	7.64	7.59	7.61	7.60	7.67	....	....	7.93	8.02	7.94	7.94	7.92
16	7.65	7.58	7.60	7.60	7.68	7.78	....	7.94	8.01	7.94	7.93	7.93
17	7.64	7.58	7.58	7.62	7.69	7.77	....	7.88	8.01	7.93	7.92	7.94
18	7.63	7.58	7.58	....	7.68	7.76	....	7.79	8.01	7.94	7.90	7.92
19	7.63	7.56	7.58	....	7.66	7.75	....	7.81	7.99	7.94	7.89	7.92
20	7.64	....	7.59	7.63	7.68	7.71	....	7.84	7.98	7.93	7.88	7.93
21	7.67	....	7.57	7.61	7.69	7.73	....	7.83	8.03	7.92	7.89	7.91
22	7.66	....	....	7.60	7.69	7.78	....	7.84	8.03	7.92	7.91	7.90

25 Lot 4, block 93--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
23	7.64	7.60	7.63	7.62	7.70	7.78	....	7.85	8.02	7.94	7.90	7.90
24	7.66	7.57	7.63	7.62	7.70	7.76	....	7.89	8.00	7.93	7.93	....
25	7.67	7.56	....	7.64	7.71	7.76	....	7.89	8.02	7.91	7.91	....
26	7.64	7.56	7.61	7.64	7.70	7.78	....	....	8.01	7.90	7.93	....
27	7.62	7.55	7.60	7.64	7.69	7.78	....	7.96	8.01	7.90	7.91	....
28	7.58	7.55	7.59	7.63	7.68	7.78	....	7.94	8.02	7.91	7.93	7.90
29	7.57	7.58	7.61	7.71	7.82	....	....	7.97	8.00	7.91	7.92	7.89
30	7.63	7.60	7.62	7.70	7.81	7.90	7.98	7.99	7.91	7.93	7.88	....
31	7.63	7.59	7.71			7.90	7.99		7.93			7.88

TORRANCE COUNTY (ESTANCIA VALLEY)

Part 1. General discussion

The water-level measurement program started in Estancia Valley in 1941 in cooperation with the State engineer of New Mexico was continued in 1947. The area was first studied in detail by O. E. Meinzer in 1909, and the results of the investigation were published in Water-Supply Paper 275. Records of water levels measured since the inception of the current program have been published in Geological Survey water-supply papers as follows:

Year of record	Water-Supply Paper	Page Nos.
1941	941	275-282
1942	949	340-344
1943	991	299-305
1944	1021	294-302
1945	1028	295-301
1946	1076	305-311

Water levels were measured in 78 wells in February, 57 wells in May, and 64 wells in September making a total of 199 measurements during the year, including 3 measurements made on the recorder well. (See parts 2 and 3.) A water-stage recorder was operated throughout the year on well 7.8.27.221. (See part 4.)

Precipitation and pumpage

Precipitation within the area of the closed basin of Estancia Valley is the ultimate source of the ground water, whether by direct penetration to the water-bearing formation or from runoff from the surrounding higher lands. The discharge of ground water, both natural and artificial, is dependent, in part, upon the amount of precipitation. Excess precipitation reduces the amount of pumping required for irrigation of crops and also reduces the transpiration of ground water by plants in areas of shallow ground water by directly supplying part of the water requirements of the plants.

Recharge to the ground-water body in 1947 was less than normal as indicated by the deficient precipitation. The precipitation at Otto was 7.71 inches, 4.77 inches below normal; at McIntosh, 9.73 inches, 4.30 inches below normal; at Mountainair, 10.47 inches, 5.85 inches below normal; at Tajique, 12.26 inches, 8.02 inches below normal; and at Estancia, for which records for August and September were missing, estimated about 7 inches. Precipitation was less than in 1946 and generally below normal for the first 9 months and slightly above normal for the last 3 months of 1947.

There was a large increase in ground-water development in Estancia Valley in 1947. It is estimated that about 5,000 acres were watered from wells in 1947 and that about 5,000 acre-feet of water was pumped. The irrigated acreage in 1945 and 1946 has been estimated as 250 and 725 acres, respectively. Most of the new development has been concentrated in a relatively small area about 7 miles southwest of Estancia. Development has also taken place between Estancia and McIntosh and extending from the railroad west about 3 miles. Additional development is expected in the coming year.

Fluctuations of water level

Water levels from February 1947 to March 1948 rose in 14 observation wells and fell in 53 observation wells for which records are comparable. The average change for these wells was a decline of 0.20 foot as compared with an average rise in 53 wells of 0.08 foot in 1946. As the water levels in 1948 were measured in March, 1 month later than in 1947, the observed net declines may be somewhat smaller than if the water levels in 1948 had been measured in February.

The observed rises in water level, less than 1 foot, occurred mainly in wells to the east of the railroad, in general removed from the effects of pumping and to some extent in areas where the water level is comparatively shallow. These small rises may be due, in part, to recharge as a result of above-normal precipitation in the last 3 months of 1947.

The largest declines in water level from February 1947 to March 1948 occurred in the area of largest pumpage of ground water, about 7 miles southwest of Estancia. The maximum observed decline of 1.81 feet, well 5.8.18.421, was in this area. The ground-water levels showed a net decline

of more than 1 foot over a circular area of about 17 square miles centered around the northeast corner of section 18, T. 5.N., R. 8 E. Only minor net rises and declines of water level were observed in this area in the preceding year.

Of the observation wells, only two not in this area of heavy pumpage showed net declines of water level in excess of 1 foot from February 1947 to March 1948. These two wells, 7.7.12.444 and 7.8.26.141, both exhibit artesian pressure and the decline which was fairly continuous during the year, may result from the drilling of additional wells through the confining bed.

The net decline of water levels from February 1947 to March 1948 in observation wells in the remainder of Estancia Valley was less than 1 foot but was greater than the minor net rises and declines of the preceding year. The effect of pumping from the new irrigation wells is apparent but the decline in water level is not yet excessive.

As 1947 was the first year of rather intensive irrigation, it is the first year that definite observed net declines in water level have taken place since measurements of water level began in 1941. With the increased use of ground water for irrigation it is expected that the downward trend in water levels exhibited in pumped areas in 1947 will continue and that within the next few years distinct depressions in the water table will form around the areas of concentrated pumping.

930250 O-51-20

Part 2. Water levels in February 1947 and highest and lowest recorded levels in January or February, 1947, in feet below land-surface datum, and change from February 1946 to February 1947, in feet

Location number	Owner	See also Part	Water levels				Record
			Feb. 1947 Level	Feb. 1947 Day	Change 1946-47 Level	Highest Year	
4.8.1.144	J. M. Harper	•	53.79	19	-0.68	52.31	46 44
4.9.2.222	M. E. Ottoson	•	55.90	19	+.06	55.90	47 41
4.9.5.344	Morris Ottoson	3,5	30.14	19	•••	35.54	••• 47
6.444	Red Ball Camp	(Measurements discontinued)	52.95	19	+.08	52.68	1 43 41
7.441	Unknown	3	17.15	19	+.20	17.15	47 42
10.133	Homer Arnn	3	115.57	18	-.24	115.33	46 41
5.7.16.212	Bwing School	3	32.55	18	-.97	30.24	42 a 32.71
5.8.4.343	Unknown	3,5	51.14	18	•••	•••	••• 47
5.344	O. R. Ethridge	3,5	70.21	18	•••	•••	••• 47
7.431	John Ingle	3,5	55.81	18	•••	•••	••• 47
8.231	E. F. Richards	3,5	54.24	18	•••	•••	••• 47
8.351	Madison Davis	3,5	52.52	19	•••	•••	••• 47
9.423	Carter Eowden	3,5	18.25	18	•••	•••	••• 47
10.351	Charles Rattan	3,5	17.32	18	•••	•••	••• 47
10.333	do	3,5	10.97	19	-.35	9.78	45 10.97
11.221a	J. V. Chamberlin	3	14.89	18	-.60	12.04	43 17.10
12.111	do	3	17.61	18	•••	•••	••• 47
15.113	D. S. Bailey	3,5	14.45	18	+.29	14.45	47 14.74
15.131	Joe Begley	3,5	16.29	18	•••	•••	••• 47
15.131a	do	3,5	19.44	18	•••	•••	••• 47
15.311	Charles Rattan	3,5	20.33	18	+.24	20.33	47 20.57
15.313	do	3	45.12	18	-.11	45.01	46 45.12
17.113	Madison Davis	3	41.81	18	+.01	40.78	43 41.82
17.241	Ray Brown	•	28.20	18	-.38	26.92	42 30.43
17.311	do	3	27.63	18	-.05	26.05	42 29.66
17.323	do	3	11.48	18	+.08	9.80	42 13.61
17.334	do	3	38.69	18	•••	•••	••• 47
18.233	S. W. Hodgson	3,5	38.57	18	•••	•••	••• 47
18.312	Willard Hodgson	3,5	32.23	18	•••	•••	••• 47
18.313	do	3,5	26.89	18	•••	•••	••• 47
18.421	F. H. Ayres	3,5	27.23	18	+.41	27.23	47 27.64
21.111	R. B. Ford	3	22.88	18	-.95	21.93	46 22.88
24.311	E. B. Wallace	•	24.84	18	-.32	22.45	42 24.84
25.212	Homer Arnn	3	(Measurements discontinued)	•••	•••	•••	••• 47
25.222b	do	3	26.25	18	-.16	23.35	42 27.92
30.121	Unknown	3	26.25	18	-.16	22.68	42 29.66

* See footnotes at end of table.

Part 2. Water levels in February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from February 1846 to February 1947, in feet--continued

Location number	Owner	See also Part	Water levels						Record
			Feb. 1947 Level	Feb. 1947 Lay	Change 1846-47	Highest Level	Lowest Level	Year	
5.8.36.341	Mrs. Iva Moe	3	45.11	19	+0.07	45.11	47	46.69	41
5.9.31.351	Homer Arm	3	32.56	18	+0.08	32.56	47	34.10	41
5.10.27.444	Unknown	3	40.37	19	+0.10	40.37	47	40.78	41
6.8.1.244	J. H. Wiggins	3	20.78	20	+0.43	20.78	47	21.62	42
3.221	Ellison Timmins	3,5	26.67	19	+0.19	26.67	42	28.86	41
11.435	Pablo Lucero	(Measurements discontinued)	5.55	43	5.55	43	6.26	42	47
12.133	Aurileo Brito	(Measurements discontinued, well filled)	16.90	43	16.90	43	18.66	46	41
15.444	Estancia Cemetery	3	30.38	18	+0.02	29.99	43	31.04	41
16.4222	McGee Estate	3	58.80	18	-0.09	58.66	44	59.47	41
24.111	Aurileo Brito	3	9.95	18	+0.83	6.22	42	10.78	41
27.134	R. W. Spruill	3	20.53	18	-0.05	19.59	43	21.49	42
30.434	J. W. Langley	3	38.13	19	-0.56	25.63	42	40.69	41
32.212	C. R. Ethridge	3,5	23.22	18	.....	.....	.....	.....	47
34.311	John Chamberlin	3,5	16.11	18	.....	.....	.....	.....	47
6.9.9.22	Unknown	3	27.50	20	-16.98	4.84	45	11.93	43
6.10.26.344	C. A. Blackwell	3	42.81	19	-1.00	41.81	46	42.38	42
27.444	Major Dean	3	20.21	19	+0.13	20.21	47	20.77	41
7.7.12.444	C. E. Koland	3	41.37	19	+0.65	41.37	47	46.45	41
7.8.1.231	Myrtle Homan Estate	3	25.10	20	+0.43	25.10	47	26.27	42
1.423	Floyd Stump	3	23.93	20	+0.23	23.93	47	24.79	42
9.444	Clayton Norman	3	57.72	19	+0.09	57.72	47	62.45	41
10.221	H. W. Rice	3	16.18	20	+0.17	16.18	47	17.52	42
10.244	Ted Maxfield	3	17.13	20	+0.98	17.13	47	22.37	42
12.433	G. M. Elknap	3	21.65	19	+0.08	21.65	47	23.53	41
16.142	J. J. Thomas	3,5	63.53	19	.....	.....	.....	.....	47
16.422	Jim Erwood	3	43.94	20	-0.06	43.88	46	45.01	41
23.311	O. L. Austin	3	17.80	19	+0.07	17.80	47	18.33	41
23.324	do	3	15.50	19	+0.30	1.90	47	2.45	41
24.433	R. T. Floyd	3	24.34	19	+0.86	23.68	42	25.20	41
25.411	H. F. Brunell	3	21.48	20	-0.02	21.26	42	22.13	41
26.141	Mr. Richter	3	4.10	19	+1.20	4.10	47	5.30	46
27.221	Wagner Estate	3,4	19.24	19	+0.08	f 19.21	47	19.83	41
27.434	Lilburn Homan	3,5	25.88	19	.....	.....	.....	.....	47
33.123	B. A. Kincheloe	3,5	26.99	19	+0.56	26.24	42	32.35	41
33.424	E. C. Hayes Estate	3	52.45	19	+0.26	52.45	47	53.34	42
35.111	W. Dunn	3,5	18.50	19	+0.28	17.95	42	19.22	41

* See footnotes at end of table.

Part 2. Water levels in February 1947 and highest and lowest recorded levels in January or February, in feet below land-surface datum, and change from February 1946 to February 1947, in feet--Continued

Location number	Owner	See also Part	Water levels						Record
			Feb. 1947 Level	Feb. 1947 Day	Change 1946-47	Highest Year	Lowest Year	Year	
7.9.5.211	Unknown	3	18.86	20	+0.10	18.86	47	19.22	42
10.333	Mr. Price	3	14.81	20	+.14	14.91	47	15.40	45
8.8.10.244	Dennis Willie	(s)	20	..	..	65.21	43	66.43	45, 47
8.26.222	Unknown	3	6.64	20	+.04	6.64	47	7.52	42
8.9.8.111	do	3	24.45	20	+.89	23.77	42	25.34	42
29.111	Mrs. Harry Bigger	3	22.06	19	-.16	20.89	42	b 22.06	47
29.111a	do	3	21.65	19	-.70	20.93	46	21.70	44
9.8.26.121	Unknown	3	20.86	20	+.14	19.60	43	21.00	46
9.9.32.131	G. L. Dean	3	5.64	20	+.54	5.64	47	6.88	41
32.131a	do	3	5.70	20	+.50	5.70	47	6.68	44
10.9.21.451	Everett Shockley	3,5	24.63	20	.....	.....	.....	.....	47

a Pumping.

b Pumping recently.

c Nearby well pumping.

f From recorder charts.

1 Also 1942.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Location number Owner	4.9. 5.344 Otto- son	4.9. 7.441 Un- known	4.9. 10.133 Arnn	5.7. 15.212 Ewing	5.8. 4.343 Un- known	5.8. 5.344 Eth- ridge	5.8. 7.431 Ingle	5.8. 8.231 Rich- ards
Feb. 18,19	30.14	52.95	17.15	115.57	32.55	51.14	70.21	55.81
May 27,29	30.15	52.87	17.26	115.60	32.35	52.30	72.13	57.45
Sept.13,14	30.42	52.95	17.57	(a)	34.27	55.84	74.08	60.35
Location number Owner	5.8. 8.331 Davis	5.8. 9.423 Bowden	5.8. 10.331 Rattan	5.8. 10.333 Rattan	5.8. 11.221a Cham- berlin	5.8. 12.111 Cham- berlin	5.8. 15.113 Bailey	5.8. 15.131 Begley
Feb. 18,19	54.24	52.52	18.25	17.32	10.97	14.89	17.91	14.45
May 27,29	56.53	(a)	(a)	(a)	10.17	14.90	28.13	22.38
Sept.13,14	56.98	56.46	22.06	21.69	(a)	14.48	22.54	18.87
Location number Owner	5.8. 15.131a Begley	5.8. 15.311 Rattan	5.8. 15.313 Rattan	5.8. 17.113 Davis	5.8. 17.311 Brown	5.8. 17.323 Brown	5.8. 17.334 Brown	5.8. 18.233 Hodg- son
Feb. 18	16.29	19.44	20.33	45.12	28.20	27.63	11.48	38.69
May 27	23.65	(a)	c22.10	47.56	30.30	29.36	12.35	c40.99
Sept.14	20.92	23.15	23.30	49.93	.....	31.58	14.83	42.59
Location number Owner	5.8. 18.312 Hodg- son	5.8. 18.313 Hodg- son	5.8. 18.421 Ayres	5.8. 21.111 Ford	5.8. 25.212 Arnn	5.8. 30.121 Un- known	5.8. 36.341 Moe	5.9. 31.331 Arnn
Feb. 18,19	38.57	32.23	26.89	27.23	24.84	26.25	45.11	32.56
May 27	(a)	c34.11	29.42	27.69	24.95	c26.35	(a)	32.54
Sept.13,14	42.20	.....	31.24	.....	25.20	c27.21	b45.10	32.63
Location number Owner	5.10. 27.444 Un- known	6.8. 1.244 Wiggins	6.8. 3.221 Timmins	6.8. Estan- cia Cemetery	6.8. 16.222 McGee	6.8. 24.111 Brito	6.8. 27.134 Spru- ll	6.8. 32.212 Eth- ridge
Feb. 18-20	40.37	20.78	26.67	30.38	58.80	9.95	20.53	23.22
May 27,29	40.37	20.86	26.82	30.16	(a)	8.80	20.41	(a)
Sept.13-15	40.35	20.97	26.82	30.81	58.85	12.51	21.03	24.26
Location number Owner	6.8. 34.311 Cham- berlin	6.10. 25.344 Black- well	6.10. 27.444 Dean	7.7. 12.444 Roland	7.8. 1.231 Homan	7.8. 1.423 Stump	7.8. 9.444 Norman	7.8. 10.221 Rice
Feb. 18-20	16.11	a42.81	20.21	41.37	c25.10	23.93	57.72	16.18
May 27-29	(a)	41.75	20.25	41.97	c25.48	24.59	57.94	16.38
Sept.13,14, 16	17.12	41.75	20.18	42.15	c25.91	24.68	58.38	16.99
Location number Owner	7.8. 10.244 Max- field	7.8. 12.433 Belk- nap	7.8. 16.142 Thomas	7.8. 23.311 Austin	7.8. 23.324 Austin	7.8. 24.433 Floyd	7.8. 25.411 Brun- nells	7.8. 26.141 Rich- ter
Feb. 19,20	17.13	21.65	63.53	17.80	1.90	24.34	21.48	4.10
May 27-29	17.47	c23.55	63.68	18.10	2.38	(a)	21.46	3.82
Sept.15,16	(a)	22.86	64.08	20.19	3.13	25.27	21.74	4.18
Location number Owner	7.8. 27.221 Wagner	7.8. 27.434 Homan	7.8. 33.123 Kinche- loe	7.8. 33.424 Hayes Estate	7.8. 35.111 Dunn	7.9. 5.211 Un- known	7.9. 10.333 Price	8.8. 26.222 Un- known
Feb. 19,20	19.24	25.88	29.99	52.45	18.50	18.86	14.81	6.64
May 28,29	19.40	27.61	30.27	52.45	18.70	18.85	14.82	(a)
Sept.15,16	20.72	25.94	30.54	52.46	18.71	18.95	14.89	6.86

* See footnotes at end of table.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947--Continued

Location	8.9.	8.9.	8.9.	9.9.	9.9.	10.9.
number	8.111	29.111	29.111a	32.131	32.131a	21.431
Owner	Un- known	Bigger	Bigger	Dean	Dean	Shockley
Feb. 19,20	24.45	b22.06	21.63	5.64	5.70	24.63
May 28	24.63	21.48	21.63	5.72	5.75	24.73
Sept.13,15, 16	24.65	21.87	22.00	b7.11	b7.27	24.9 ^a

^a Pumping.^b Pumping recently.^c Nearby well pumping.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

7.8.27.221. Wagner Estate. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: May 7-10, 19.06; Sept. 17-19, 20.72.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	19.36	19.32	19.23	19.14	19.10	19.37	20.30	20.21	20.47	20.48	20.16	19.97
2	19.38	19.30	19.21	19.13	19.09	19.37	20.28	20.20	20.45	20.47	20.15	19.95
3	19.39	19.29	19.21	19.12	19.08	19.36	20.26	20.18	20.43	20.45	20.16	19.95
4	19.37	19.30	19.19	19.12	19.07	19.34	20.25	20.16	20.42	20.43	20.19	19.95
5	19.37	19.27	19.21	19.14	19.07	19.36	20.23	20.16	20.40	20.41	20.16	19.95
6	19.35	19.27	19.22	19.15	19.07	19.40	20.22	20.14	20.35	20.39	20.10	19.93
7	19.36	19.27	19.22	19.15	19.06	19.47	20.21	20.13	20.36	20.38	20.10	19.93
8	19.38	19.27	19.20	19.12	19.06	19.50	20.22	20.13	20.36	20.36	20.09	19.93
9	19.37	19.27	19.19	19.09	19.06	19.55	20.28	20.11	20.37	20.35	20.08	19.93
10	19.36	19.26	19.20	19.12	19.06	19.60	20.38	20.10	20.44	20.32	20.08	19.92
11	19.35	19.26	19.18	19.12	19.07	19.67	20.46	20.09	20.51	20.31	20.08	19.90
12	19.35	19.27	19.19	19.15	19.07	19.74	20.49	20.09	20.56	....	20.06	19.91
13	19.32	19.27	19.20	19.13	19.07	19.80	20.52	20.11	20.60	20.27	20.06	19.91
14	19.33	19.27	19.19	19.13	19.08	19.86	20.52	20.20	20.57	20.30	20.05	19.89
15	19.34	19.25	19.20	19.12	19.11	19.90	20.50	20.32	20.70	20.29	20.05	19.89
16	19.36	19.25	19.18	19.14	19.17	19.96	20.48	20.40	20.71	20.27	20.05	19.89
17	19.35	19.24	19.18	19.11	19.24	20.02	20.48	20.47	20.72	20.26	20.05	19.89
18	19.35	19.25	19.17	19.09	19.31	20.09	20.43	20.50	20.72	20.26	20.03	19.89
19	19.32	19.24	19.18	19.11	19.35	20.17	20.41	20.55	20.72	20.25	20.01	19.88
20	19.31	19.24	19.17	19.10	19.38	20.24	20.39	20.59	20.70	20.23	20.01	19.88
21	19.34	19.23	19.17	19.09	19.39	20.32	20.37	20.63	20.68	20.22	20.01	19.87
22	19.32	19.24	19.16	19.08	19.40	20.37	20.35	20.64	20.67	20.20	20.01	19.87
23	19.30	19.23	19.16	19.09	19.41	20.38	20.33	20.65	20.65	20.20	20.01	19.87
24	19.31	19.23	19.18	19.10	19.42	20.41	20.31	20.65	20.61	20.19	19.99	19.87
25	19.31	19.22	19.17	19.14	19.41	20.40	20.30	20.63	20.58	20.18	19.98	19.87
26	19.30	19.22	19.15	19.11	19.40	20.39	20.29	20.60	20.56	20.17	19.99	19.87
27	19.29	19.21	19.16	19.09	19.37	20.37	20.27	20.59	....	20.18	19.98	19.85
28	19.26	19.22	19.15	19.09	19.38	20.36	20.26	20.56	20.53	20.20	19.98	19.84
29	19.26	19.15	19.09	19.38	20.34	20.25	20.54	20.52	20.18	19.98	19.83	
30	19.30	19.14	19.09	19.37	20.33	20.23	20.50	20.50	20.17	19.97	19.82	
31	19.30	19.14	19.36		20.22	20.49			20.17		19.83	

Part 5. Miscellaneous data concerning observation wells

4.9.5.344. Ottoson. Abandoned drilled stock well, diameter 6 inches. Measuring point, top edge of casing, west side, 0.33 foot above concrete platform, 1.00 foot above land-surface datum. Water level, in feet below land-surface datum, 1946: Sept. 4, 30.33.

5.8.5.344. Ethridge. Drilled irrigation well, diameter 18 inches, depth 200 feet. Measuring point, top edge of 3/4-inch hole in south side of base of pump, 0.64 foot above top of casing, 1.15 feet above land-surface datum. Top of casing is 0.25 foot below top edge of southwest corner of weir box. Equipped with turbine pump.

5.8.7.431. Ingle. Drilled irrigation well, diameter 16 inches, depth 201 feet. Measuring point, top edge of casing, 0.50 foot above land-surface datum. Equipped with turbine pump in 1947. Water levels, in feet below land-surface datum, 1946: May 14, 70.64; Sept. 5, 70.20.

5.8.8.231. Richards. Drilled irrigation well, diameter 16 inches, depth 195 feet. Measuring point, top of casing, southwest side of well, 0.50 foot above land-surface datum. Equipped with turbine pump in 1947. Water levels, in feet below land-surface datum, 1946: May 14, 56.13; Sept. 5, 55.56.

5.8.8.331. Davis. Drilled irrigation well, diameter 18 inches, depth 200 feet. Measuring point, top edge of 3/4-inch hole in south side of base of pump, 0.06 foot above top of casing and concrete pump base, 0.81 foot above land-surface datum. Equipped with turbine pump.

5.8.9.423. Bowden. Drilled domestic and stock well, diameter 8 inches, depth 150 feet. Measuring point, top edge of casing, 0.75 foot above land-surface datum. Equipped with windmill. Water level, in feet below land-surface datum, 1946: Sept. 5, 53.09, pumping recently.

5.8.10.331. Rattan. Drilled irrigation well, diameter 16 inches, depth 176 feet. Measuring point, top edge of 3/4-inch hole in air-line gage flange support, 0.65 foot above pump base, -0.90 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1946: Sept. 5, 18.91.

5.8.10.333. Rattan. Drilled irrigation well, diameter 16 inches, depth 132 feet. Measuring point, top edge of 3/4-inch hole in air-line gage flange support, 0.65 foot above pump base, 1.15 feet above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: May 14, 18.44; Sept. 5, 18.02.

5.8.15.113. Bailey. Drilled irrigation well, diameter 18 inches, depth 153 feet. Measuring point beginning May 27, 1947, lower edge of mouth of discharge pipe; subtract 4.22 feet from tape measurements to reduce to land-surface datum. Reference point, top of casing, 0.50 foot above land-surface datum. Equipped with turbine pump.

5.8.15.131a. Begley. Drilled domestic well, diameter 8 inches, depth 70 feet. Measuring point, top of tile casing, 8.00 feet above top of 8-inch casing, 3.00 feet above land-surface datum. Equipped with pressure pump. Water levels, in feet below land-surface datum, 1946: May 14, 18.35; Sept. 5, 17.24.

5.8.15.311. Rattan. Drilled irrigation well, diameter 16 inches, depth 151 feet. Measuring point, top edge of 3/4-inch hole in air-line gage flange support, 0.65 foot above pump base, 1.15 feet above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: May 14, 20.98; Sept. 5, 20.35.

5.8.18.233. Hodgson. Drilled irrigation well, no equipment, diameter 16 inches, depth 153 feet. Measuring point, top of casing, 0.50 foot above land-surface datum. Water levels, in feet below land-surface datum, 1946: May 14, 39.18; Sept. 5, 38.88.

5.8.18.312. Hodgson. Drilled irrigation well, diameter 18 inches, depth 159 feet. Measuring point, top edge of 1½-inch hole in west side of base of pump, 0.05 foot above top of casing, 1.05 foot above land-surface datum. Equipped with turbine pump.

5.8.18.313. Hodgson. Drilled domestic well, diameter 6 inches, depth 64 feet. Measuring point, top edge of casing level with concrete pump base, 0.50 foot above land-surface datum. Equipped with pitcher pump.

5.8.18.421. Ayres. Drilled irrigation well, diameter 16 inches, depth 146 feet. Measuring point, top edge of 1½-inch hole in south side of base of pump, 0.06 foot above top of casing, 0.56 foot above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: May 14, 27.63; Sept. 5, 27.24.

6.8.3.221. Timmins. Turbine pump installed in well in May 1947.

6.8.32.212. Ethridge. Drilled irrigation well, diameter 18 inches, depth 160 (?) feet. Measuring point, top edge of 1½-inch hole in east side of base of pump, 0.04 foot above top of casing and land-surface datum. Equipped with turbine pump.

6.8.34.311. Chamberlin. Drilled irrigation well, diameter 14 inches, depth 150 feet. Measuring point, top edge of ½-inch hole in air-line gage flange support, 0.47 foot above concrete pump base, 1.47 foot above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1946: Sept. 5, 16.46.

7.8.16.142. Thomas. Drilled irrigation well, diameter 16 inches, depth 200 feet. Measuring point, top edge of casing, level with top of concrete pump base, 1.00 foot above land-surface datum. Water level, in feet below land-surface datum, 1946: Sept. 6, 63.67.

7.8.27.434. Homan. Drilled irrigation well, diameter 18 inches, depth 240 feet. Measuring point, top of casing, south side, at lap joint, 0.75 foot above land-surface datum. Water level, in feet below land-surface datum, 1946: Sept. 6, 26.09, nearby well pumping.

7.8.33.123. Kincheloe. Measured depth 105 feet, Sept. 15, 1947.

7.8.35.111. Dunn. Measuring point beginning Sept. 16, 1947, top edge of casing, north side, 0.35 foot above land-surface datum.

10.9.21.431. Shockey. Drilled domestic well, diameter 6-5/8 inches, depth 101 feet. Measuring point, top of casing, 0.50 foot above land-surface datum. Equipped with pump jack. Water levels, in feet below land-surface datum, 1946: May 15, 27.09, pumping recently; Sept. 6, 25.00.

VALENCIA COUNTY (GRANTS-BLUEWATER AREA)

Part 1. General discussion

The Grants-Bluewater area, in Valencia County, is near the towns of Grants and Bluewater on U. S. Highway 66, about 80 miles west of Albuquerque. The area of irrigated lands is under the Bluewater-Toltec Irrigation District for distribution of surface-water supplies from Bluewater Lake, on Bluewater Creek. A succession of dry years, in which only a partial surface-water supply was available, aroused interest in obtaining a supply of ground water from wells. The first successful irrigation well was drilled in August 1944.

The program of measuring water levels in observation wells and gathering other data pertaining to ground water in the area began in February 1946 and was continued in 1947 in cooperation with the State engineer of New Mexico. Records of water level in 1946 have been published in Geological Survey Water-Supply Paper 1076.

Water levels were measured in 35 wells in February 1947, after the water levels had recovered in large part from the effects of pumping for irrigation during the summer of 1946. These winter measurements are used to determine the net change in water levels for the year and give a measure of the status of the ground-water reservoir. (See part 2.) In order

to more closely determine the effects of recharge and discharge upon the ground-water body, water levels were measured in 31 wells at monthly intervals during the year. (See part 3.) A more detailed record of the fluctuations was obtained by a water-stage recorder that was installed in 1946 on well 12.11.9.222. (See part 4.) A total of 321 measurements of water level was made during the year including 11 made in the recorder well.

Precipitation and pumpage

Precipitation is the ultimate source of the ground water in the aquifer, whether it seeps directly to the aquifer through the extensive lava beds exposed in the valley, by penetration through the alluvium in the valley, by being absorbed on the outcrop of the aquifer in the Zuni Mountains to the south, or by leakage from Bluewater Reservoir and Bluewater Canyon. Recharge to the aquifer also occurs from the various canals and from return of irrigation water applied upon the lands.

Precipitation also causes changes in the water levels by reducing the amount of pumpage of ground water necessary for crops. However, as most of the irrigated land is given to raising truck crops, precipitation generally causes only a minor change in the amount of pumping necessary.

The precipitation at Bluewater in 1947, on the basis of an estimated record for May, was about 9 inches, about 2 inches below normal and less than in 1946. However, 4.71 inches of the total fell in August which greatly reduced the pumping in August from what it was in July and ended the pumping season earlier than in 1946.

On the basis of measured power input and water output ratios and electric power records on 12 of the 15 used irrigation wells in 1947, fairly reliable estimates of pumpage for 2 of the wells, and a rough estimate of the pumpage from 1 well, the pumpage of ground water for irrigation in 1947 is believed to have been 10,300 acre-feet, a slight increase from the 9,000 acre-feet estimated as having been pumped in 1946. One other well, 11.10.4.211, was not pumped in 1946 because of a broken pump. The acreage irrigated in 1947 is believed to have been about equal to that irrigated in 1946, about 4,500 acres, and was planted largely to carrots and beans. No surface water was available for irrigation from Bluewater Reservoir during 1947.

Fluctuations of water level

Water levels reached their highest stages in the early part of March before the beginning of the pumping season. During the pumping season the water levels declined steadily, with only minor rises during cessations of pumping, and reached their lowest stages generally in early August, the end of the pumping season. The pumping season in 1947 ended about 4 to 6 weeks earlier than in 1946 because of the heavy rains in August. Only a minor amount of water was pumped the remainder of the year during which time the water levels steadily rose.

The rate of recovery of water levels after cessation of the pumping season was considerably less than the rate of drawdown during the pumping season, and consequently a net deficit in the stage of the water levels was exhibited at the end of the year.

The average net decline in water levels from February 1947 to February 1948 in 14 wells that were also measured in February 1946 was 3.91 feet as compared with 5.88 feet in the same wells in the preceding year. The smaller decline in 1947 was apparently the result mainly of the longer period of recovery after the end of the pumping season as compared with 1946. Some recharge may have reached the water table as a result of the heavy rains in August 1947, especially in areas covered with lava where there is no surface runoff. Well 11.10.27.410, south of Grants on the edge of a lava covered area and about $2\frac{1}{2}$ miles from the nearest pumped irrigation well, showed a rise in water level of almost 2 feet from August 6 to September 2. From September to October the water level in this well fell about half a foot while the water levels in wells nearer the pumped area continued the rise that began in August. It appears that local recharge occurred in the lava-covered area in August and that this caused a ground-water mound which flattened during September with a consequent decline in water level.

The maximum recorded decline from February 1947 to February 1948 was 8.3 feet and occurred in an unused well, 12.11.9.222, which was the same well in which the maximum decline of 11.9 feet occurred in 1946. This well is about a quarter of a mile from Bluewater Creek and the irrigation district canal that parallels the creek. It is believed that recharge occurs to the ground water from leakage of the surface water in the canal

and creek in this area. However, in the last 2 years surface water has not been released from the reservoir and thus recharge in this area has been very small. The large decline in ground-water level in this area is probably in large part the result of the deficient recharge.

As pumping of ground water is a new discharge imposed upon a previously more or less stable ground-water system, the annual declines in water level in this area are expected to continue, as long as pumping continues, until the effect of the pumping reaches the area of ground-water discharge in the swamp area from Grants southward to San Rafael. It is probable that in scattered years enough water will be available in Bluewater Reservoir to furnish an adequate supply of surface water to the area in which case the ground water will be replenished to some extent. Also, with an adequate supply of surface water the amount of pumping will be reduced if additional lands now not receiving water are not farmed. In view of these factors and as the decline of water level is greater in the initial period of pumping than later, it seems probable that the net decline of water levels in succeeding years may be less than during 1946 and 1947 unless an increase in irrigated acreage occurs.

Part 2. Water levels in February 1947 and highest and lowest recorded levels from February 1946 to February 1947, in feet below land-surface datum, and change from February 1946 to February 1947

Location number	Owner	See also	Water levels			Change 1946-47	Highest Level	Lowest Level	Be- gan	Be- ginn- ing years missing	Record
			Feb. 1947 Level	Feb. 1947 Lay	Feb. 1947 Lay						
10.9.224	Robert Gottlieb	3,5 6,5	b 8.75 69.25	3 3	3 3						47
10.10.10.200	Joe Padilla	3,5	6,83	3	3						47
11.10.4.111	M. C. Read	3,5	69.25	3	3						47
4.211	J. C. Church and E. E. Harden	3	62.73	3	-4.76	57.97	46	62.73	47	46	
4.222	E. E. Harden	3,5	60.85	3							47
5.214	V. M. Vidal	3,5	68.99	3							47
8.111	Salvador Milan	3,5	73.75	3							47
8.222	do	3	63.04	3	-5.19	57.85	46	63.04	47	46	
8.344	do	3,5	53.02	4							47
9.222	Dean Stanley and A. R. Card	3	59.45	3	-4.96	54.49	46	59.45	47	46	
9.242	A. R. Card	3	57.35	3	-5.09	52.24	46	57.35	47	46	
10.111	Milton Harding	3	55.26	3	-3.34	51.92	46	55.26	47	46	
16.121	Frank Wilson	3	51.42	3	-4.95	46.47	46	51.42	47	46	
16.142	do	3	49.85	3	-4.35	45.50	46	49.85	47	46	
17.222	Salvador Milan	3,5	47.84	4							47
26.411	City of Grants well 3	3,5	7.65	4							47
27.110	Cecil Moore	3,5	35.59	3							47
12.10.23.233	John Jacobs	3	120.14	3	-4.55	115.59	46	120.14	47	46	
29.434	Dean Stanley and A. R. Card	3	73.76	3	-4.53	69.23	46	73.76	47	46	
30.111	E. E. Harden	5	107.98	3							47
30.242	do	3,5	b90.93	3							47
30.332	J. C. Church	5	106.54	4							47
30.412	Fred Fress	3	95.53	3	-5.49	90.04	46	95.53	47	46	
30.421	Milton Harding	3	93.75	3	-5.37	88.38	46	93.75	47	46	
32.111	J. C. Church and E. E. Harden	3	87.12	3	-5.03	82.09	46	87.12	47	46	
12.11.9.222	George Rowley	4	127.63	3	-11.93	115.70	46	f127.72	47	46	
9.424	Burton John (Measurements discontinued)	3,5	99.23	3							47
10.431	Edward Fress	3,5	108.07	4							46
15.341	E. E. Harden	3,5	123.68	3							47
16.223	J. F. Nelson	3,5	243.85	4							47
20.424	Hassell	3,5	121.06	4	-10.47	110.59	46	121.06	47	46	

* See footnotes at end of table.

Part 2. Water levels in February 1947 and highest and lowest recorded levels in February, in feet below land-surface datum, and change from February 1946 to February 1947.--Continued

Location number	Owner	See also	Water levels						Record
			Feb. 1947 Level	1947 Day	Change 1946-47	Highest Level	Lowest Year	Level	
12.11.23.233	Harmon and Read	3,5	69.68	3	.....	.....	.....	.....	47
25.223	J. C. Church and E. E.								
25.223a	Harden	3	105.76	3	-5.58	100.18	46	105.76	47
	do	3,5	106.82	3	.....	.....	..	.....	47
25.311	Harmon and Read	5	124.50	3	.....	.....	..	.....	47

b Pumping recently.
f From recorder charts.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947

Location number	10.9. 26.224	10.10. 10.200	11.10. 4.111	11.10. 4.211	11.10. 4.222	11.10. 5.214	11.10. 8.111
Owner	Gott- lieb	Padilla	Read	Church	Harden	Vidal	Milan
Jan. 3	8.90	10.37	69.50	62.89	60.86	69.34	74.11
Feb. 3	b8.75	9.83	69.25	62.73	60.85	68.99	73.75
Mar. 11	8.78	9.87	69.05	.....	60.83	68.78	73.45
Apr. 7	8.72	b10.60	69.92	.....	60.98	70.60	75.10
May 5	8.67	9.97	73.03	64.93	61.29	76.59	a94.36
June 4	8.56	10.66	73.39	65.96	61.65	78.70	a94.42
July 7	8.36	11.19	74.50	66.98	61.98	80.28	84.43
Aug. 6	8.35	11.70	75.80	67.76	62.16	83.38	86.12
Sept. 2	8.14	11.04	75.02	67.37	.....	77.60	81.37
Oct. 2	8.67	11.66	74.32	66.94	62.68	75.91	80.37
Dec. 10	8.76	.....	72.83	66.07	62.91	73.23	77.90
Location number	11.10. 8.222	11.10. 8.344	11.10. 9.222	11.10. 9.242	11.10. 10.111	11.10. 16.121	11.10. 16.142
Owner	Milan	Milan	Stanley & Card	Card	Harding	Wilson	Wilson
Jan. 3,4	63.37	53.42	b60.04	d58.06	55.12	51.75	50.15
Feb. 3,4	63.04	53.02	59.45	57.33	55.26	51.42	49.85
Mar. 11	62.79	52.76	60.12	57.71	55.39	b52.58	49.56
Apr. 7,8	64.52	54.41	a91.89	c62.96	c55.50	a71.65	50.89
May 5,6	a72.18	59.11	a93.12	c65.39	c55.62	56.12	52.04
June 4,5	a73.99	60.99	a94.46	c67.31	c55.84	a75.34	52.53
July 7,8	a75.49	62.50	a95.51	c68.97	c56.16	a77.25	53.96
Aug. 6	a76.95	64.06	68.96	66.80	.....	60.18	54.79
Sept. 2,3	70.15	60.03	65.46	63.48	.....	57.32	54.69
Oct. 2,3	b69.22	59.05	66.04	62.75	.....	56.62	54.38
Dec. 10	67.02	.....	63.06	61.13	.....	55.12	53.33
Location number	11.10. 17.222	11.10. 26.411	11.10. 27.410	12.10. 23.233	12.10. 29.434	12.10. 30.242	12.10. 30.412
Owner	Milan	City of Grants	Moore	Jacobs	Stanley & Card	Harden	Freas
Jan. 3,4	48.44	.....	35.77	120.45	73.87	90.78	95.86
Feb. 3,4	47.84	7.95	35.59	120.14	73.76	b90.93	95.53
Mar. 11	47.64	7.40	35.54	a139.91	73.65	a91.74	d95.51
Apr. 7,8	149.5	10.86	36.22	a140.02	73.97	91.86	97.91
May 5	.....	8.92	36.81	a126.71	a102†	94.41	a107.06
June 4	.....	9.44	37.22	a142.93	a103†	95.87	(a)
July 7	.....	12.60	38.12	a129.78	a118†	b97.15	a110.25
Aug. 6,7	.....	12.75	38.73	b130.16	a122†	98.22	(a)
Sept. 2	.....	10.71	36.77	126.13	78.04	b96.43	103.51
Oct. 2	.....	10.59	37.24	125.45	77.39	b96.22	a105.16
Dec. 10	.....	9.70	37.04	123.69	76.73	94.82	99.85
Location number	12.10. 30.421	12.10. 32.111	12.11. 9.424	12.11. Rowley	12.11. Frreas	12.11. Harden	12.11. Harden
Owner	Harding	Church & Harden					
Jan. 3,4	94.10	87.47	99.21	103.22	.....	.....	.....
Feb. 3,4	93.75	87.12	99.23	103.07	123.68	.....	.....
Mar. 11	b93.75	87.15	99.66	103.86	123.60	.....	.....
Apr. 7,8	96.15	a92.84	100.09	103.09	123.82	.....	.....
May 5,6	c103.37	(a)	100.59	a133.45	125.77	.....	.....
June 4,5	a113.67	(a)	101.74	a114.3	131.95	.....	.....
July 7,8	a105.56	(a)	103.96	(a)	137.40	.....	.....
Aug. 6,7	a110.37	101.53	105.57	(a)	139.95	.....	.....
Sept. 2,3	101.84	95.14	105.14	117.71	135.24	.....	.....
Oct. 2,3	c101.32	94.45	105.29	117.92	135.44	.....	.....
Dec. 10,11	98.18	91.49	104.97	.....	.....	.....	k139.38

* See footnotes at end of table.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during 1947--Continued

Location number Owner	12.11. 20.424 Nielson	12.11. 22.414 Hassell	12.11. 23.233 Harmon & Read	12.11. 25.223 Church & Harde	12.11. 25.223a Church & Harden
Jan. 3,4	244.01	121.19	69.54	106.10	107.16
Feb. 3,4	243.85	121.06	69.68	105.76	106.82
Mar. 11	243.87	120.82	69.75	(a)	c106.98
Apr. 7,8	243.98	121.22	68.82	(a)	(a)
May 5,6	245.41	123.52	69.20	(a)	(a)
June 4,5	248.33	130.14	b72.08	(a)	(a)
July 7,8	252.56	134.60	70.72	(a)	(a)
Aug. 7	255.56	136.48	b71.74	120.41	121.26
Sept. 2,3	254.13	133.28	a71.82	114.20	115.22
Oct. 2,3	253.82	135.16	70.74	115.42	114.43
Dec. 10,11	251.50	130.75	70.72	110.30	111.36

a Pumping

i Below level given.

b Pumping recently.

j Air-gage reading.

c Nearby well pumping.

k Measurement uncertain.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

12.11.9.222. J. C. Church and E. E. Hardin. Highest and lowest recorded water levels, in feet below land-surface datum, 1947: Feb. 17, 127.48; Aug. 4, 144.43.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	Jan.	Feb.	Mar.	Apr.	May	June
1	127.60	127.68	127.61	.....	129.18	133.45
2	127.63	.....	127.57	.....	129.30	133.75
3	127.85	h127.63	127.59	.....	129.20	133.95
4	127.79	127.68	127.62	.....	129.33	134.18
5	127.78	127.54	127.66	.....	129.39	134.46
6	127.62	127.54	127.67	.....	129.46	134.68
7	127.71	127.52	127.69	.....	129.50	134.89
8	127.77	127.51	127.62	127.71	129.51	134.80
9	127.85	127.55	127.64	127.62	129.54	135.01
10	127.74	127.53	127.69	127.68	129.49	135.30
11	127.62	127.56	127.61	127.79	129.54	135.50
12	127.52	127.69	127.64	127.91	129.62	135.77
13	127.54	127.71	127.74	128.04	129.61	136.04
14	127.52	127.72	127.64	128.07	129.52	136.27
15	127.57	127.68	127.68	128.09	129.57	136.22
16	127.76	127.56	127.70	128.14	129.66	136.33
17	127.70	127.48	127.68	128.27	129.75	136.50
18	127.68	127.52	127.65	128.18	129.72	136.40
19	127.58	127.52	127.68	128.32	129.67	136.72
20	127.63	127.54	127.71	128.41	129.70	136.94
21	127.76	127.61	127.69	128.42	130.07	137.01
22	127.73	127.68	.....	128.44	130.60	137.32
23	127.68	127.67	.....	128.52	131.10	137.57
24	127.69	127.61	.....	128.56	131.07	137.67
25	127.70	127.56	.....	128.72	131.45	137.88
26	127.59	127.58	.....	128.86	131.70	138.12
27	127.52	127.51	.....	128.86	132.07	138.31
28	127.53	127.52	.....	128.92	132.33	138.50
29	127.52	.....	.....	128.95	132.71	138.69
30	127.53	.....	.....	129.06	132.97	138.93
31	127.54	.....	.....	.....	133.07	

h Tape measurement.

12.11.9.222--Continued.

Highest daily water level, in feet below land-surface datum, 1947
(From recorder charts)

Day	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	139.16	143.89	139.54	140.00	138.11	137.07
2	139.36	144.08	139.72	139.75	137.94	137.03
3	139.58	144.29	139.67	139.60	137.90	137.03
4	139.73	144.43	139.56	139.52	137.95	137.05
5	139.93	143.93	139.47	139.40	137.83	137.00
6	140.13	143.69	139.35	139.30	137.82	136.85
7	140.32	143.60	139.28	139.24	137.89	136.88
8	140.44	143.43	139.21	139.14	137.79	136.82
9	140.54	143.17	139.07	139.05	137.67	136.81
10	140.71	142.95	139.01	138.95	137.67	136.86
11	140.81	142.78	139.01	138.82	137.64	136.86
12	140.96	142.64	139.02	138.85	137.58	136.85
13	141.16	142.40	139.08	138.83	137.54	136.87
14	141.37	142.20	139.24	138.80	137.50	136.71
15	141.54	142.00	139.46	138.71	137.52	136.73
16	141.63	141.83	139.65	138.65	137.50	136.76
17	141.13	141.68	139.77	138.66	137.51	136.78
18	140.97	141.54	139.66	138.66	137.44	136.68
19	141.21	141.36	139.67	138.62	137.34	136.71
20	141.60	141.23	139.52	138.61	137.35	136.75
21	141.91	141.07	139.52	138.49	137.35	136.65
22	142.15	140.99	139.53	138.51	137.34	136.65
23	142.35	140.85	139.81	138.55	137.33	136.70
24	142.56	140.74	140.01	138.52	137.35	136.70
25	142.78	140.61	140.00	138.41	137.34	136.76
26	142.97	140.45	139.98	138.34	137.34	136.68
27	143.14	140.34	140.00	138.29	137.31	136.62
28	143.32	140.23	140.06	138.25	137.28	136.50
29	143.50	140.15	140.08	138.19	137.28	136.56
30	143.54	140.06	140.14	138.20	137.21	136.32
31	143.66	139.92		138.24		136.32

Part 5. Miscellaneous data concerning observation wells

10.9.26.224. Gottlieb. On south side of U. S. Highway 66, 8.3 miles east of Grants, opposite road to Horace. Drilled stock well, diameter 6 inches, depth 100 feet. Measuring point, top edge of casing, 0.30 foot above land-surface datum. Equipped with windmill. Water levels, in feet below land-surface datum, 1946: Oct. 3, 8.78; Nov. 6, 8.84; Dec. 3, 8.91.

10.10.10.200. Padilla. In adobe shed west of two-story house painted pink with white trimmings, 0.10 mile south of road junction at north edge of San Rafael. Dug domestic well, size 4 by 6 feet, depth 15 feet. Reference point, top of concrete well curbing, south side of well, 0.50 foot above land-surface datum. Equipped with pressure pump. Water levels, in feet below land-surface datum, 1946: Oct. 3, 10.82; Nov. 6, 10.20; Dec. 3, 10.34.

11.10.4.111. Read. Drilled domestic well, diameter 12 inches, depth 118 feet. Measuring point, top of disc well covering, 0.05 foot above top of casing, 0.55 foot above concrete base around casing and land-surface datum. Equipped with windmill.

Water level, in feet below land-surface datum, 1946

Date	Water level	Date	Water level	Date	Water level
May 10	67.68	Sept. 4	71.43	Nov. 6	70.10
July 11	72.29	Oct. 1	71.02	Dec. 3	69.85

11.10.4.222. Harden. Drilled domestic well, diameter 6 inches. Measuring point, top edge of casing, 1.00 foot above land-surface datum. Equipped with windmill.

11.10.4.222--Continued.

Water level, in feet below land-surface datum, 1946

Date	Water level	Date	Water level	Date	Water level
May 10	58.70	Sept. 4	60.37	Nov. 6	60.72
July 11	60.35	Oct. 1	60.84	Dec. 3	60.73

11.10.5.214. Vidal. Drilled domestic and filling station well, diameter 4 inches, depth 96 feet. Measuring point beginning Mar. 11, 1947, top edge of 15-inch surface casing, east side of well, 0.32 foot above land-surface datum. Equipped with pressure pump since March 1947.

Water level, in feet below land-surface datum, 1946

May 10	68.79	Sept. 3	71.86	Nov. 7	70.46
July 12	75.32	Oct. 1	72.06	Dec. 3	69.80

11.10.8.111. Milan. Drilled irrigation well, diameter 12 inches, depth 150 feet. Reference point, top of concrete pump base, 2.50 feet above land-surface datum. Equipped with turbine pump.

Water level, in feet below land-surface datum, 1946

Feb. 26	a 95.60	Sept. 3	76.39	Nov. 7	75.21
May 9	72.95	Oct. 1	76.55	Dec. 3	74.58

a Pumping.

11.10.8.344. Milan. Drilled domestic well, diameter 6 inches, depth 100 feet. Measuring point beginning Aug. 6, 1947, surface of concrete base, 0.87 foot above land-surface datum. Equipped with pressure pump since August 1947. Water levels, in feet below land-surface datum, 1946: Oct. 2, 55.30; Nov. 7, 54.41; Dec. 3, 53.91.

11.10.17.222. Milan. Drilled irrigation well, diameter 12 inches, depth 125 feet. Reference point, surface of concrete pump base, 2.50 feet above concrete platform and land-surface datum. Equipped with turbine pump.

Water level, in feet below land-surface datum, 1946

May 9	46.87	Sept. 3	49.72	Nov. 7	49.00
July 11	52.00	Oct. 1	49.74	Dec. 3	48.61

11.10.26.411. City of Grants well 3. Drilled municipal well, diameter 16 inches, depth 110 feet. Measuring point, top edge of casing, 1.50 feet above land-surface datum. Equipped with turbine pump since July 1947. Water level, in feet below land-surface datum, 1946: Oct. 2, 9.36.

11.10.27.410. Moore. On south side of road to Bonita Mine, 0.10 mile from junction with El Morro road. Drilled well, no equipment, diameter 9 inches. Measuring point, top edge of casing, 1.20 feet above land-surface datum. Water levels, in feet below land-surface datum, 1946: Oct. 2, 35.84; Nov. 6, 35.81; Dec. 3, 35.86.

12.10.30.111. Harden. Drilled domestic and stock well, diameter 6 inches, depth 280 feet. Measuring point, top edge of casing, 1.00 foot above land-surface datum. Equipped with windmill. Water levels, in feet below land-surface datum: May 10, 1946, 108.84; July 11, 1946, 117.07; May 5, 1947, 118.95.

12.10.30.242. Harden. Drilled domestic and stock well, diameter 4 inches. Measuring point, top edge of casing, 1.25 feet above land-surface datum. Equipped with windmill.

Water level, in feet below land-surface datum, 1946

May 10	88.45	Sept. 3	91.66	Nov. 7	91.51
July 11	92.37	Oct. 1	92.15	Dec. 3	91.26

12.10.30.332. Church. Drilled domestic well. Measuring point, south upper edge of north 8- by 8-inch pump support, east of pump, 0.80 foot above land-surface datum. Equipped with pump jack.

12.11.9.424. Rowley. Drilled irrigation well, no equipment, diameter 16 inches, depth 505 feet. Measuring point, top edge of casing, 0.05 foot above concrete base, 3.05 feet above land-surface datum. Water of very poor quality.

Water level, in feet below land-surface datum, 1946

Date	Water level	Date	Water level	Date	Water level
May 10	93.75	Oct. 2	99.09	Dec. 4	99.15
Sept. 4	98.76	Nov. 7	99.05		

12.11.15.341. Freas. On east side of bluff. Drilled irrigation well, diameter 14 inches, depth 300 feet. Measuring point beginning Oct. 2, 1946, top edge of casing, level with top of concrete pump base, 3.30 feet above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: Sept. 4, 107.72; Oct. 2, 109.12; Nov. 8, 106.76; Dec. 4, 106.55.

12.11.16.223. Harden. Drilled well, diameter 6 inches, depth 160 feet. Measuring point, top edge of collar on casing, 1.00 foot above land-surface datum.

12.11.20.424. Nielson. Drilled well, no equipment, diameter 18 inches, depth 310 feet. Measuring point, top edge of casing, west side of well, 4.50 feet above land-surface datum. Water level, in feet below land-surface datum, 1946: Dec. 4, 244.56.

12.11.22.414. Hassell. Well deepened in April 1947 to 495 feet.

12.11.23.233. Harmon and Read. Drilled stock well, diameter 8 inches, depth 300 (?) feet. Measuring point, top edge of casing, 1.00 foot above land-surface datum. Equipped with windmill. Water levels, in feet below land-surface datum, 1946: Oct. 2, 69.07; Nov. 8, 68.55; Dec. 4, 69.35.

12.11.25.223a. Church and Harden. About 500 feet northwest of well 12.11.25.223. Drilled irrigation well, diameter 18 inches, depth 236 feet. Reference point, top edge of casing, level with concrete pump base, 2.75 feet above land-surface datum. Equipped with turbine pump. Water levels, in feet below land-surface datum, 1946: May 10, 107.81, nearby well pumping; Oct. 2, 111.10, nearby well pumping; Dec. 4, 107.69.

12.11.25.311. Harmon and Read. Drilled irrigation well, depth 365 feet. Measuring point, top edge of 3/4-inch hole in air-line flange support, 0.80 foot above top of casing, 5.80 feet above land-surface datum. Equipped with turbine pump. Water level, in feet below land-surface datum, 1946: July 11, 132.70.