Water Levels and Artesian Pressure in Observation Wells in the United States in 1948

Part 6. Southwestern States and Territory of Hawaii

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

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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:

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INTRODUCTION

By A. N. Sayre and others

The ground-water investigations of the United States Geological Survey are primarily concerned with the location and appraisal of the ground-water resources of the Nation. They are carried on principally in financial cooperation with States and municipalities, or at the request of other Federal agencies. Most of the investigations have to do with the availability of usable water supplies, but a few deal with drainage, flood control, construction of waterways and dams, mine drainage, and other problems to which the principles of ground-water hydrology are pertinent. Water-Supply Paper 992 lists about 1,800 papers and reports describing ground-water investigations made by the Survey in cooperation with States and municipalities through 1945.

Significance of records of water level and artesian pressure

An essential part of the ground-water investigations is the measurement of fluctuations of water level and artesian pressure in wells. 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 indicate 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. Changes of pressure in artesian wells also indicate the rate of depletion or replenishment of artesian supplies.

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. This series of water-supply papers is in a sense an inventory of ground-water supplies. Prior to 1940 the records were published in a single volume. 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 introduction to the chapter on each State contains an outline of the general program of work and special features of the program in the current year, such as preliminary reports issued or put on file during the year or of work done in preparation for such a report. A general discussion of the fluctuations of water level and statements in regard to precipitation, pumpage, and other factors affecting water level are included. The following table gives the numbers of water-level reports from 1935 through 1948.

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
1948	1126	1127	1128	1129	1130	1131

Scope of present volume

The present volume covers the southwestern States and gives records of water level and artesian pressure in about 2,230 observation wells of the Geological Survey and cooperating agencies in Arizona, California, Hawaii, and New Mexico. Of these wells, 60 are equipped with automatic water-stage recorders. For some wells not previously reported complete records of water level are given. 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 description are given in this report. This report includes about 8,630 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. In 1943, it was decided that uniform

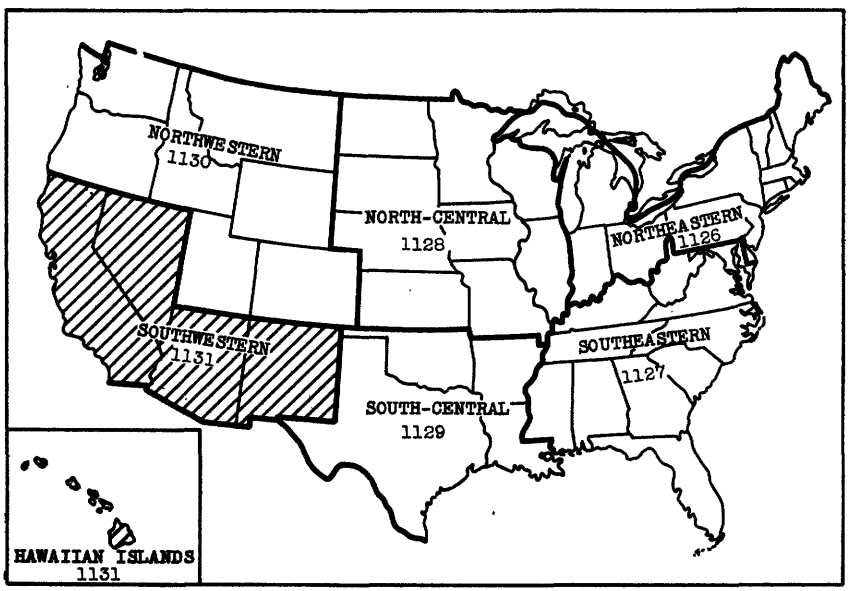

Figure 1.--Outline map of the United States, showing sections of the country covered by the six water-supply papers on water levels and artesian pressure in observation wells in 1948. The shaded section represents the part of the country covered by this volume.

practice should be adopted. Accordingly, a precise datum plane was established approximating the land surface at each well. The water levels and artesian heads for all wells listed in this report are given in feet below land-surface datum unless preceded by a plus (+) sign, or otherwise indicated in the descriptive text for each State. When 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.

Network of Federal observation wells

In 1942 and 1943 the Geological Survey established a network of 60 Federal observation wells. These wells were selected because the water

level was indicative of the general water-table conditions in areas remote from heavy pumping. At the end of 1948 the network comprised 360 wells in 45 States, including 300 water-table wells and artesian wells, some of which are in areas of heavy pumping. They are being observed in connection with cooperative ground-water investigations.

Changes in ground-water level in 1948 in the southwestern part of the United States

The year 1948 was one of continued drought in Arizona. In February precipitation was above normal for the first time since October 1947 with the average for the State 1.56 inches. In November 1948 the monthly average was .02 inch, which is .95 inch below normal. California was faced with a serious water shortage at the beginning of 1948. Above-normal amounts of precipitation occurred in all months from March through June. From July to December precipitation was slightly below normal. In New Mexico, annual precipitation was 1.69 inches below normal. The fluctuations of both water level and artesian pressure in wells, however, depend 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

The observation-well program was supervised by Penn Livingston. The reports were edited by Miss Verda M. Dougherty and the illustrations by Rodney Hart.

ARIZONA

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

PROGRAM OF WORK

Studies of the ground-water resources of Arizona were continued in 1948 in cooperation with the State Land Department. The 1948 program consisted of measuring water levels in selected wells and making an inventory of the quantities of water pumped from wells in the principal ground-water basins in the State. In addition, detailed studies were made of the geology and ground-water resources of the Eloy area in Pinal County. Data from the Eloy area studies were made available to the State Land Commissioner to assist him in evaluating the area as a critical or noncritical ground-water area. Similar studies are under way in the Casa Grande-Florence area of Pinal County, and in the Deer Valley area of Maricopa County.

List of reports issued in 1948: Memorandum on ground-water supply of the Joseph City Irrigation District, by H. M. Babcock. Wellton-Mohawk area, Yuma County, Records of wells, well logs, water analyses, and maps showing ocation of wells, by H. M. Babcock and A. M. Sourdry.

PUMPAGE

Ground water has been the major source of water for irrigation since the beginning of the 1945 irrigation season. Each succeeding year, pumpage from wells has supplied a larger percentage of the total water supply for irrigation. In 1948, approximately 71 percent of the total water supply for irrigation was pumped from wells, an increase of 3 percent over 1947. The following table contains a summary of the quantities of water pumped in the principal ground-water areas in the State. The lack of surface-water supplies and the cultivation of newly cleared lands resulted in an increase in pumpage of water from wells, from about 2½ million acre-feet in 1947 to 3 million in 1948.

Table 1. Pumpage, in acre-feet, in principal ground-water areas

	1941	1942	1943	1944
Cochise County:				
San Simon basin	(a)	(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	8,685	18,900	35,000	52,000
Greenlee County:				
Duncan-Virden valley[b]	1,348	1,900	7,100	9,500
Maricopa County:				
Salt River valley area[c]	444,000	1,004,000	1,104,000	1,017,000
Gila Bend area	(a)	(a)	(a)	(a)
Dendora Ranch area	(a)	(a)	(a)	(a)
Pima County:				
Part of Santa Cruz River basin	68,500	85,500	100,000	106,000
Pinal County:				
Part of Santa Cruz and Gila River basins	351,000	500,000	515,000	530,000
Santa Cruz County:				
Part of Santa Cruz River basin	11,500	14,500	15,000	12,500
Yuma County:				
Dateland area	(a)	(a)	(a)	4,000
Wellton-Mohawk area	(a)	(a)	(a)	37,000
South Gila valley	(a)	(a)	(a)	20,000

	1945	1946	1947	1948
Cochise County:				
San Simon basin	(a)	5,800	(a)	(a)
Willcox basin	9,000	15,500	20,000	23,000
Douglas basin	8,000	12,500	17,000	22,000
Graham County:				
Cactus Flat-Artesia area	(a)	5,600	(a)	(a)
Safford valley	35,200	115,000	100,000	110,000
Greenlee County:				
Duncan-Virden valley[b]	8,300	21,000	26,000	27,000
Maricopa County:				
Salt River valley area[c]	1,143,000	1,360,000	1,406,000	1,670,000
Gila Bend area	(a)	33,300	40,500	60,800
Dendora Ranch area	(a)	6,700	6,700	1,900
Pima County:				
Part of Santa Cruz River basin	111,000	108,000	145,000	145,000
Pinal County:				
Part of Santa Cruz and Gila River basins	610,000	660,000	700,000	950,000
Santa Cruz County:				
Part of Santa Cruz River basin	18,500	24,000	25,000	28,000
Yuma County:				
Dateland area	4,000	4,000	4,000	5,300
Wellton-Mohawk area	35,000	38,000	43,000	49,900
South Gila valley	22,000	32,000	35,000	53,800
Total		2,441,400	2,568,200	3,146,700

a Not determined.
b Partly in Hidalgo County, N. Mex.
c Includes Queen Creek area of Maricopa and Pinal Counties.

FLUCTUATIONS OF WATER LEVEL

Ground-water levels in most areas were lower in 1948 than at any time on record since the beginning of the program of water-level measurements in the State in 1939. The water table lowered at a more rapid rate in the last 3 years than in the preceding years. It was depressed as a result of heavy pumping from wells to supplement dwindling surface-water supplies, and because of drought conditions. The greatest declines of the water table occurred in Maricopa and Pinal Counties, the areas of heaviest withdrawals.

Records of water levels for the years 1940-47, inclusive, are given in U. S. Geological Survey Water-Supply Papers 911, 941, 949, 991, 1021, 1028, 1076, and 1101.

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, Office of Indian Affairs, and Bureau of Reclamation, U. S. Department of Interior.

APACHE COUNTY

By G. E. Hazen

A total of 20 water-level measurements was made in 7 wells in Apache County during 1948. Little ground water is pumped for irrigation in the county, and the water levels in wells fluctuate directly with the changes in rainfall and with the runoff in the streams in the area.

Well descriptions and water-level measurements

3152. Petrified Forest National Monument. SE¼NW¼ sec. 5, T. 19 N., R. 24 E. Records available: 1945-48. Jan. 19, 8.04; Feb. 18, 8.90.

6601. L. M. Farr. NE¼NE¼ sec. 26, T. 13 N., R. 27 E. Records available: 1939-48. June 3, 26.38; Oct. 13, 26.77.

6709. Jacob Barth. SE¼NW¼ sec. 27, T. 13 N., R. 28 E. Records available: 1944-48. June 3, flowing; Oct. 13, flowing.

6716. E. L. Johns. SW¼ sec. 30, T. 13 N., R. 28 E. Records available: 1944-48. June 3, 20.14; Oct. 13, 13.03.

7415. Max Romel. SE¼ sec. 18, T. 12 N., R. 28 E. Records available: 1944-48. June 3, 16.44; Oct. 13, 15.23.

7416. J. B. Lampson. NE¼ sec. 18, T. 12 N., R. 28 E., 0.5 mile west of U. S. Highway 666, 4.5 miles south of St. Johns. Drilled domestic well, diameter 6 inches, depth 115 feet. Measuring point, top of casing, 1.5 feet above land-surface datum. Equipped with windmill and cylinder pump. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level
June 8, 1944	2.45	Sept.25, 1945	1.96	June 11, 1947	4.13
Aug. 9	2.30	June 5, 1946	3.09	Oct. 13, 1948	2.66
May 30, 1945	4.50	Aug. 28	2.96		

9007. E. C. Becker. SW¼NW¼ sec. 33, T. 9 N., R. 29 E. Records available: 1944-48. June 2, 9.65; Oct. 13, 11.41.

10,001. C. Traweek. NW¼ sec. 33, T. 9 N., R. 29 E. Records available: 1944-48. June 2, 31.59; Oct. 13, 31.73.

COCHISE COUNTY

By R. L. Cushman and M. B. Booher

Water-level measurements were made during 1948 in selected wells in Cochise County in the principal cultivated areas where water from wells is used for irrigation.

St. David-Benson-Pomerene area

Most of the water developed from wells in the St. David-Benson-Pomerene area comes from artesian aquifers. The available records of water-level measurements in artesian wells were begun in 1944. The annual net changes in water level as measured in four artesian wells were somewhat inconsistent, and do not indicate a general change in pressure within the artesian system. Pressure changes observed were the result of interference caused by pumping from nearby wells.

Water levels in shallow nonartesian wells changed slightly but with no definite trend.

Fort Huachuca-Charleston area

Water-level records dating back to 1941 show a slight downward trend of the water level in most of the wells in this area. The annual decline in water level in five of six wells averaged about 0.6 foot during the period 1941-48. The sixth well is near the river, and the water level has risen about 0.5 foot a year.

Sulphur Springs Valley

The water-level measurements reported for this area are divided into two parts: (1) water levels in wells in the Willcox Basin, and (2) water levels in wells in the Douglas Basin. A partially buried rock barrier near the town of Pearce divides the Sulphur Springs Valley into these two ground-water basins.

There has been a general downward trend of the water levels in wells in the Willcox Basin during the period of record, 1942-48. The average total decline of the water table in the 7-year period was about 5½ feet in the pumped area northwest of Willcox. Water levels in wells outside the pumped areas declined about 2 feet in the same period of time. Drought conditions and heavy pumping from wells for irrigation were the principal causes of the general water-level decline.

Water-level fluctuations in wells 1527 and 1700, precipitation at Willcox, and pumpage from wells in the Willcox Basin are shown by graphs in figure 2 .

The water-level fluctuations in well 1527 are typical for wells in the pumped area northwest of Willcox. The rate of water-level decline was accelerated during the last 3 years. Only one water-level measurement was made in well 1527 during 1948, because the well was being pumped at the time of other visits. The rate of decline of the water table in this vicinity in 1948 cannot be judged from this single measurement; however, measurements made in neighboring wells indicate that the decline was greater in 1948 than in either 1946 or 1947.

The water-level fluctuations in well 1700 are typical for wells outside the pumped areas but near the Willcox Playa. All the surface water and most of the ground water in the Willcox Basin moves toward the playa area. Water reaching that area is discharged from the basin by evaporation from the surface of the playa. The general downward trend of the water level in well 1700 indicates that less ground water is moving to the playa area, probably as a result of the drought and heavy pumping from wells for irrigation.

Figure 2 shows graphs of water-level fluctuations in wells 2701 and 3350, and pumpage from wells in the Douglas Basin.

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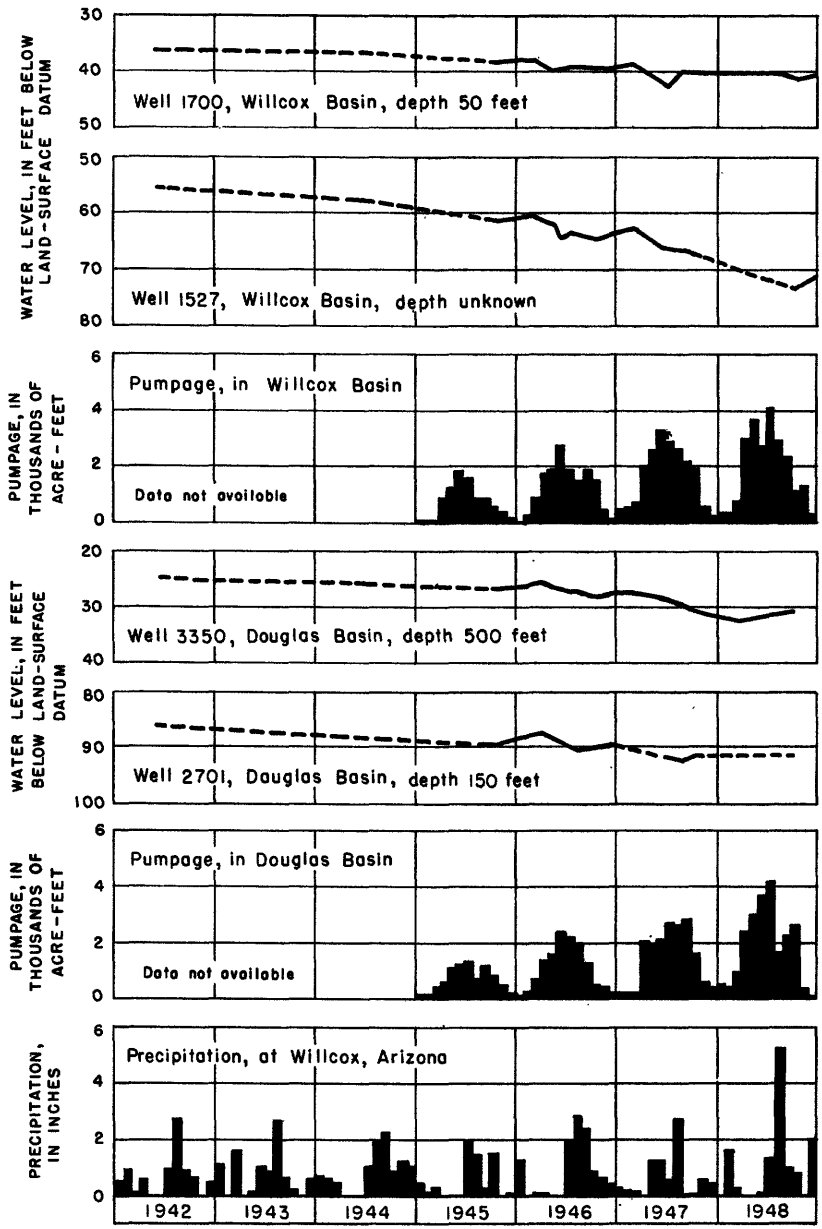

Figure 2.--Graphs showing fluctuations of water level in observation wells in Willcox and Douglas Basins, Cochise County.

The water-level fluctuations in well 2701 reflect the ground-water conditions in the irrigated area near Elfrida. The water level in this well declined about 5 feet during the period of record, from 1942 to 1948. The rate of decline was higher in the last 3 years than in the first 2 years. Water-level measurements made in other wells in the Elfrida area indicate that declines near the center of heavy pumping were greater than 5 feet for the period 1942 to 1948.

The water-level fluctuations in well 3350 indicate the ground-water conditions in the irrigated area near McNeal and Double Adobe. The 6-foot decline of the water level in well 3350 from 1942 to 1948 was about the average decline for wells in this area. It is apparent from the hydrograph for well 3350 that the annual rate of decline in water level has increased in the period 1946 to 1948.

About 23,000 acre-feet of water was pumped for irrigation from wells in the Willcox Basin in 1948, or about 3,000 acre-feet more water than was pumped in 1947. In the Douglas Basin, pumpage of ground water for irrigation increased from 17,500 acre-feet in 1947 to about 22,000 in 1948. The additional water pumped in both basins in 1948 was used to irrigate newly cultivated lands.

Precipitation totaled 12.19 inches at Willcox in 1948, or 0.78 inch above normal. This is the only above-normal precipitation shown in figure 2.

San Simon Valley

Most of the water developed from wells in the San Simon Valley comes from artesian aquifers. Water levels in wells in the pumped area near San Simon declined about 3 feet during the period of record, 1942 to 1948. Water levels in these wells indicate that the rate of decline was accelerated during the last 3 years of this period. Pumping from artesian wells for irrigation caused seasonal declines of as much as 7 feet in neighboring wells.

Water levels declined about 2 feet in the period 1942 to 1948 in two wells in the Bowie area, where artesian wells are pumped only for domestic and stock use. Apparently the artesian system received less water from recharge because of the prolonged period of below-normal precipitation.

Well descriptions and water-level measurements

St. David-Benson-Pomerene area

302-A. (Replaces well 302.) W. N. East. SW¼SE¼ sec. 27, T. 16 S., R. 20 E., 100 feet east of county road, 0.75 mile west and north of Pomerene Post Office. Drilled well, diameter 12 inches, depth 110 feet. Measuring point, bottom of hole in south side of casing, 3.5 feet above land-surface datum. Equipped with turbine and gasoline engine. Records available: 1945, 1947-48. Sept. 25, 1945, 44.40; Sept. 22, 1947, 46.82; May 18, 1948, 47.61.

305. L. A. Scott. SW¼NE¼ sec. 34, T. 16 S., R. 20 E. Records available: 1940-42, 1944-48. May 18, 77.84.

475. Earl M. Brown. NW¼NW¼ sec. 12, T. 17 S., R. 20 E. Records available: 1944-48. May 18, 56.94.

477. City of Benson. SW¼SW¼ sec. 10, T. 17 S., R. 20 E. Records available: 1944-48. May 19, 14.00.

583. Will Campbell. SW¼SW¼ sec. 31, T. 17 S., R. 21 E. Records available: 1941-42, 1944-48. May 18, 22.80.

599. Boquillas Cattle Co. NW¼NW¼ sec. 32, T. 17 S., R. 21 E. Records available: 1944-48. May 18, 17.61.

600. Mrs. E. M. Miller. SE¼SE¼ sec. 32, T. 17 S., R. 21 E. Records available: 1944-47. Measurements discontinued, Sept. 22, 1947.

601. Mrs. Parley McRae. SE¼SE¼ sec. 32, T. 17 S., R. 21 E. Records available: 1944-48. May 18, 1.92.

701. Leo Westfield. SE¼SE¼ sec. 1, T. 18 S., R. 20 E. Records available: 1944-48. May 18, 9.64.

745. Walter Haymore. NW¼NE¼ sec. 6, T. 18 S., R. 21 E. Records available: 1944-48. May 18, 29.83.

749. A. L. Owens. SW¼NE¼ sec. 5, T. 18 S., R. 21 E. Records available: 1944-48. May 18, 56.43.

753. Milton Curtis. SE¼ sec. 34, T. 18 S., R. 21 E. Records available: 1944-48. May 18, 24.60.

Charleston area

950. Lon Hunt. SE¼SW¼ sec. 32, T. 20 S., R. 20 E. Records available: 1941-43, 1945-48. May 19, 89.68.

951. Lon Hunt. SW¼SE¼ sec. 32, T. 20 S., R. 20 E. Records available: 1941-47. No measurements made in 1948.

1070. Cochise County. SW¼SW¼ sec. 31, T. 21 S., R. 21 E. Records available: 1942-43, 1945-48. May 19, 297.50.

1071. E. Fry. SW¼SW¼ sec. 29, T. 21 S., R. 21 E. Records available: 1942-47. No measurements made in 1948.

1072. E. Fry. SE¼SE¼ sec. 22, T. 21 S., R. 21 E. Records available: 1941, 1944, 1946-48. May 19, 60.65.

1074. J. L. Parker. NE¼NE¼ sec. 11, T. 21 N., R. 21 E. Records available: 1941, 1944-48. May 19, 27.27.

1126. Dept. of the Army. NW¼NW¼ sec. 3, T. 22 S., R. 20 E. Records available: 1942-48. May 19, 495.80.

1226. H. F. Fletcher. NW¼NE¼ sec. 8, T. 23 S., R. 21 E. Records available: 1941, 1944-48. May 19, 61.72.

Willcox Basin of Sulphur Springs Valley

1500. Frank R. Harris. NE¼NE¼ sec. 13, T. 12 S., R. 23 E. Records available: 1942, 1945-48. June 16, 71.25; Aug. 12, 72.55; Oct. 13, 73.82.

1527. Owner unknown. NW¼NW¼ sec. 28, T. 12 S., R. 24 E. Records available: 1942, 1944-48. Oct. 13, 73.37.

1576. J. D. Rutledge. NW¼NE¼ sec. 2, T. 13 S., R. 24 E. Records available: 1942, 1944-48. June 16, 68.20; Oct. 13, 66.64.

1581. Paul Lely. SE¼SE¼ sec. 13, T. 13 S., R. 24 E. Records available: 1942, 1946-47. Sealed, measurements discontinued, Sept. 24, 1947.

1582. State of Arizona. NW¼NW¼ sec. 16, T. 13 S., R. 24 E. Records available: 1942, 1944-48. June 16, 37.10; Aug. 12, 37.86; Oct. 13, 38.90.

1584. J. J. Meyer. NW¼NW¼ sec. 23, T. 13 S., R. 24 E. Records available: 1942, 1944-48. June 16, well dry at 45.0 feet; irrigation well, 600 feet west, pumping; Oct. 13, 41.82.

1585. W. A. Hines. SW¼SW¼ sec. 25, T. 13 S., R. 24 E. Records available: 1942, 1944-48. June 16, 26.48; Aug. 12, 26.94; Oct. 13, 31.10.

1588. P. H. Pregenzer. NE¼SW¼ sec. 35, T. 13 S., R. 24 E. Records available: 1942, 1944-48. June 16, 26.55; Oct. 13, 26.17.

1700. Fay Proctor. NE¼NW¼ sec. 36, T. 14 S., R. 23 E. Records available: 1942, 1944-48. June 18, 40.40; Aug. 30, 40.74; Oct. 13, 41.50.

1725. C. A. Williamson. NW¼SW¼ sec. 13, T. 14 S., R. 24 E. Records available: 1942, 1944-48. Oct. 13, 13.94.

1726. W. L. Woodrow. NW¼NW¼ sec. 14, T. 14 S., R. 24 E. Records available: 1942, 1944-48. June 18, 20.65; Aug. 30, 19.55; Oct. 13, 17.70.

1728. Fay Proctor. NW¼SE¼ sec. 30, T. 14 S., R. 24 E. Records available: 1942, 1944-48. June 18, 23.44; Aug. 30, 25.70; Oct. 13, 24.83.

1776. Dunlap Auto Court. NE¼SW¼ sec. 6, T. 14 S., R. 25 E. Records available: 1942, 1944-48. June 17, pumping; Aug. 30, 14.89; Oct. 13, 15.02.

1953. B. B. Gibbons. NE¼NE¼ sec. 11, T. 16 S., R. 25 E. Records available: 1942, 1944-48. June 17, 47.10; Aug. 30, 48.45; Oct. 14, 55.40, irrigation well, 500 yards east, pumping.

1954. Henry Gibbons. NW¼NW¼ sec. 13, T. 16 S., R. 25 E. Records available: 1942, 1944-48. June 17, 47.66; Aug. 30, 47.93; Oct. 13, 47.78.

1956. State of Arizona. SE¼NE¼ sec. 16, T. 16 S., R. 25 E. Records available: 1942, 1944-48. June 17, 35.43; Aug. 30, 38.30; Oct. 14, 37.40.

Douglas Basin of Sulphur Springs Valley

2700. M. L. Vineyard. NE¼NE¼ sec. 3, T. 20 S., R. 26 E. Records available: 1942, 1946-48. Mar. 27, 76.05; June 16, pumping; Oct. 12, 78.21.

2701. W. H. Seaver. NE¼NW¼ sec. 12, T. 20 S., R. 26 E. Records available: 1942, 1945-48. Oct. 11, 91.63.

2702. W. P. Cheek. Formerly owned by Gilbert Thompson. SE¼SE¼ sec. 11, T. 20 S., R. 26 E. Records available: 1942, 1944-48. June 16, 80.15, irrigation well, 100 feet south, pumping; Oct. 11, 79.73.

2709. F. O. Mackey. SE¼NE¼ sec. 33, T. 20 S., R. 26 E. Records available: 1942, 1944-48. Mar. 27, pumping; June 16, pumping; Oct. 12, 33.18.

3001. Owner unknown. NE¼NW¼ sec. 24, T. 21 S., R. 26 E. Records available: 1946-48. Mar. 27, 114.00; June 16, 114.84; Oct. 12, 115.57.

3350. J. E. Brophy. NE¼NW¼ sec. 28, T. 22 S., R. 26 E. Records available: 1942, 1944-48. Mar. 27, 32.30; June 16, pumping; Oct. 11, 30.75.

3651. McGintry. SE¼SW¼ sec. 27, T. 23 S., R. 27 E. Records available: 1943-44, 1946-48. Mar. 27, 53.50; June 15, 53.60; Oct. 11, 53.87.

3654. W. E. Mason. NE¼SE¼ sec. 19, T. 23 S., R. 27 E. Records available: 1946-48. June 15, 32.02; Oct. 11, 31.84.

3800. Walter Holland. NW¼SW¼ sec. 1, T. 24 S., R. 26 E. Records available: 1942, 1944-48. June 15, 111.05.

3803. Cochise County Hospital. SW¼SW¼ sec. 3, T. 24 S., R. 27 E. Records available: 1942, 1944-48. Mar. 26, 70.60; June 15, 74.45; Oct. 11, 72.65.

3804. L. L. Keith. SE¼NW¼ sec. 5, T. 24 S., R. 27 E. Records available: 1942, 1944-48. June 15, 57.31; Oct. 11, 57.70.

3810. Victor Nelson. NE¼NE¼ sec. 17, T. 24 S., R. 27 E. Records available: 1942, 1944-48. June 15, 52.94; Oct. 11, 51.78.

San Simon Valley

4200. A. R. Spikes. SW¼SW¼ sec. 6, T. 13 S., R. 29 E. Records available: 1941-42, 1944-47. No measurements made in 1948.

4201. U. S. Dept. of Agriculture. NW¼SW¼ sec. 8, T. 13 S., R. 29 E. Records available: 1942, 1944, 1946-48. Feb. 20, 2.40.

4250. U. S. Dept. of Agriculture. SE¼NW¼ sec. 3, T. 13 S., R. 30 E. Records available: 1940, 1942, 1944, 1946. No measurements made in 1948.

4252. T. P. Garrett. SW¼NE¼ sec. 9, T. 13 S., R. 30 E. Records available: 1940-42, 1946-48. Feb. 20, 28.51.

4261. Woolston. SE¼SE¼ sec. 25, T. 13 S., R. 30 E. Records available: 1940-42, 1944, 1946-48. Feb. 20, 60.40; June 11, 59.75.

4262. W. F. Lewis. NW¼SW¼ sec. 30, T. 13 S., R. 31 E. Records available: 1940-42, 1946-48. Feb. 20, 60.29.

4366. Elmer Franklin. SE¼SW¼ sec. 30, T. 13 S., R. 31 E. Records available: 1940-42, 1944, 1946-48. Feb. 20, 60.85.

4500. U. S. Dept. of Agriculture. NE¼SE¼ sec. 1, T. 14 S., R. 30 E. Records available: 1940-42, 1944, 1946-48. Feb. 20, 69.95; June 17, 70.34.

4600. Otto Malone. NW¼NW¼ sec. 3, T. 14 S., R. 31 E. Records available: 1941-42, 1946-48. Feb. 20, 3.12.

4606. Owner unknown. SE¼SE¼ sec. 3, T. 14 S., R. 31 E. Records available: 1941-42, 1946-48. Feb. 20, 21.40.

4633. Marshall Barnes. NE¼SW¼ sec. 14, T. 14 S., R. 31 E. Records available: 1940, 1942, 1944, 1946. Measurements discontinued, Oct. 31, 1946.

4661. M. Calloway. SE¼NE¼ sec. 25, T. 14 S., R. 31 E. Records available: 1940-42, 1944, 1946-48. Feb. 20, 2.53.

GRAHAM COUNTY

By R. L. Cushman and M. B. Booher

Water pumped from wells was the major source of water for irrigation in the Safford Valley portion of Graham County from 1946 to 1948. During this period the water level in 19 selected wells in the valley declined an average of 8½ feet, about 4 feet of the decline occurring in 1948. The large decline in 1948 was caused by the cumulative effects of drought and heavy pumping from wells during the period 1947-48 rather than from conditions originating entirely within the last year. The average water level in the 19 wells in 1948 was lower than for any year in the period 1940-48.

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

Well 662 is an unused dug well in the eastern part of the Safford Valley, about 1,250 feet south of the Gila River. An automatic water-stage recorder is operated on this well. The water level fluctuates with the change in amount of ground water in storage in the vicinity. The amount of ground water in storage during the first part of the period of record was regulated almost entirely by the stage of the river, but in the last 2 years pumping from nearby irrigation wells has had a prominent effect. A prolonged period of low flow in the Gila River and heavy pumping from nearby wells to make up for the scarcity of surface water for irrigation resulted in the loss of ground water in storage to the extent that the water level in well 662 declined below the bottom of the well. The well was dry from July 24, 1947, until March 24, 1948. A sand point was driven about 4 feet into the bottom of the well on February 2, 1948, and water levels were measured at weekly intervals in the sand point with a steel tape. The water table was within the dug portion of the well from March 24 to August 17 and the automatic water-stage recorder registered water-level fluctuations during that period. Tape measurements of the water level were made in the sand point for the remainder of the year.

Well 597 is an unused well near Solomonsville, about 100 feet from a major canal. This well went dry for the first time since water-level records were begun in 1939, and remained dry throughout 1948. This well, like well 282, near Pima, and well 76, near Geronimo, went dry as the

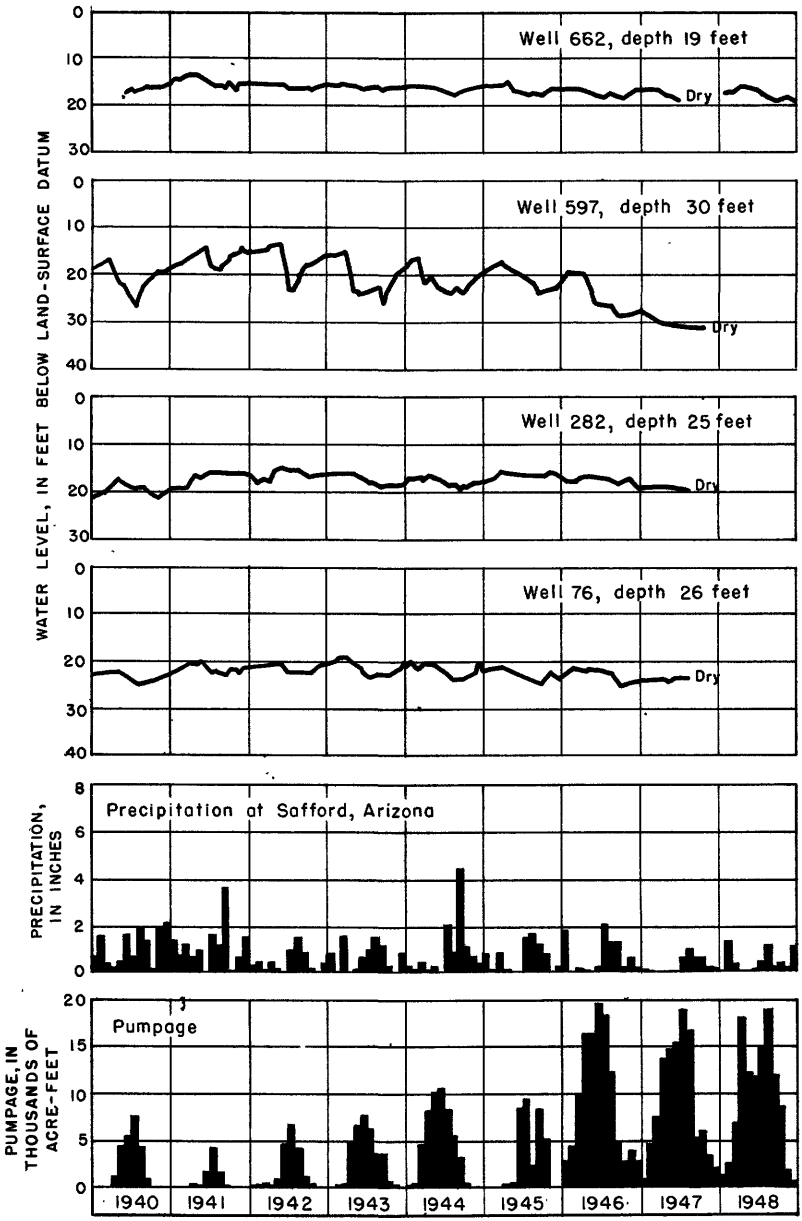

Figure 3.--Graphs showing fluctuations of water level in observation wells in the Safford Valley, Graham County, Arizona.

result of heavy pumping from wells in the Safford Valley to make up for the scarcity of surface water for irrigation.

Approximately 67 percent of the total supply of water used for irrigation in the Safford Valley from 1946 through 1948 was pumped from wells. Additional wells placed in operation during 1948 made it possible for farmers to pump about 10,000 acre-feet more water in 1948 than was pumped in 1947. 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 1940-48. The information on surface water was obtained from annual reports of the Gila Water Commissioner.

Year	Surface water (acre-feet)	Ground 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	35,000	183,875
1946	69,909	115,000	184,909
1947	51,978	100,000	151,978
1948	39,848	110,000	149,848

Precipitation amounting to 5.57 inches was recorded at Safford in 1948. This is an increase of 1.75 inches over the total recorded in 1947, but is 3.91 inches below normal.

Well descriptions and water-level measurements

8. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Calva. Records available: 1940-48. Apr. 29, 7.70.

9. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Calva. Records available: 1940-48. Apr. 29, 6.49.

11. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Calva. Records available: 1940-48. Apr. 29, 4.97.

12. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Calva. Records available: 1940-48. Apr. 29, 5.11.

13. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Calva. Records available: 1940-48. Apr. 29, 9.86.

14. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Calva. Records available: 1940-48. Apr. 29, 10.59.

17. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Bylas. Records available: 1940-48. Apr. 29, 7.32.

18. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Bylas. Records available: 1940-48. Apr. 29, 7.48.

20. Office of Indian Affairs, U. S. Dept. of Interior. On San Carlos Indian Reservation, at Bylas. Records available: 1940-48, Apr. 29, 8.15.

51. Bert Hinton. SW¼NE¼ sec. 13, T. 4 S., R. 22 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 15	21.18	Apr. 29	(a)	July 26	22.21	Oct. 25	22.98
Mar. 14	20.88	May 29	20.82	Aug. 30	(a)	Nov. 29	22.65
Apr. 9	21.30	June 26	21.20	Sept.27	22.90	Dec. 24	22.40

a Pumping.

52. Bert Hinton. SW¼NE¼ sec. 13, T. 4 S., R. 22 E. Records available: 1940-47. Measurements discontinued, July 24, 1947.

55A. J. G. Willis. SW¼NW¼ sec. 19, T. 4 S., R. 23 E. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 15	32.01	Aug. 30	38.25	Dec. 24	33.14
May 29	35.00	Oct. 25	35.01		

56. Eliza Allen. SW¼NE¼ sec. 24, T. 4 S., R. 22 E. Records available: 1940-48. Feb. 15, 36.75; Apr. 29, 17.96, irrigation water in nearby field.

60. Pat Hinton. SE¼SE¼ sec. 35, T. 4 S., R. 22 E. Records available: 1941-48. Feb. 15, 25.80; Apr. 29, 26.24.

71. Ed McEuen. SE¼SW¼ sec. 7, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 20.00; Apr. 29, 18.90.

72. Ed McEuen. SE¼SW¼ sec. 7, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 5.50; Apr. 29, 3.98.

76. E. W. Black. SW¼NW¼ sec. 18, T. 4 S., R. 23 E. Well was deepened to 50 feet and equipped with a turbine pump. Records available: 1940-48. Apr. 29, 22.60.

77. E. M. Claridge. NW¼SW¼ sec. 18, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 38.46.

80. Fay Rabb. NW¼SW¼ sec. 17, T. 4 S., R. 23 E. Records available: 1940-47. Measurements discontinued, Mar. 15, 1947.

81. Mrs. J. B. Blessing. NW¼NE¼ sec. 19, T. 4 S., R. 23 E. Records available: 1940-48. Apr. 29, 34.53.

82-A. Fay Rabb. NE¼SW¼ sec. 35, T. 4 S., R. 23 E. Records available: 1944-48. Feb. 15, 21.40; Apr. 30, 21.45.

91. Ben Montierth. SE¼NE¼ sec. 29, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 63.23; Apr. 29, 57.39.

92. Wendell Montierth. SE¼SW¼ sec. 28, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 68.18; Apr. 29, 64.76.

93. Graham County. NE¼SE¼ sec. 27, T. 4 S., R. 23 E. Records available: 1940-48. Apr. 30, 12.64, river water in nearby canal.

94. Graham County. NE¼SE¼ sec. 27, T. 4 S., R. 23 E. Records available: 1940-48. Apr. 30, 9.05.

95. Graham County. SE¼SE¼ sec. 27, T. 4 S., R. 23 E. Records available: 1940-48. Apr. 30, 10.45.

98. Graham County. NW¼NW¼ sec. 35, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 6.20; Apr. 30, 5.16.

100. C. N. Higgins. SE¼NE¼ sec. 34, T. 4 S., R. 23 E. Records available: 1940-48. Feb. 15, 13.45; Apr. 30, 12.45.

107. Port McEuen. SW¼SW¼ sec. 35, T. 4 S., R. 23 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	47.40	Apr. 29	44.82	July 26	47.17	Oct. 25	(a)
Mar. 14	45.36	May 29	44.78	Aug. 30	46.65	Nov. 29	(a)
Apr. 9	45.90	June 26	45.62	Sept.29	a 47.4	Dec. 27	(a)

a Dry.

108. W. O. Tyler. NW¼NE¼ sec. 2, T. 5 S., R. 23 E. Records available: 1940-48. Feb. 15, 17.85; Apr. 30, 17.12.

122A. Elliott Montierth. NW¼NW¼ sec. 28, T. 4 S., R. 23 E. Records available: 1944-48.

Mar. 14	36.16	May 29	38.62	Aug. 30	41.55	Nov. 29	39.36
Apr. 9	36.64	June 26	39.80	Sept.27	41.77	Dec. 24	38.60
29	38.02	July 26	41.21	Oct. 25	40.35		

124A. Nash C. Willis. SW¼SW¼ sec. 27, T. 4 S., R. 23 E. Records available: 1943-48.

Feb. 15	37.84	July 26	39.44	Sept.27	40.10	Nov. 29	39.63
May 29	37.96	Aug. 30	39.93	Oct. 25	39.90	Dec. 24	39.33

126. YL Ranch. SE¼NE¼ sec. 24, T. 5 S., R. 21 E. Records available: 1940-48. Feb. 15, dry at 73.1 feet; Apr. 29, 70.30.

143. R. S. Snedigar. NW¼SW¼ sec. 25, T. 5 S., R. 22 E. Records available: 1940-48. Feb. 15, 51.85; Apr. 29, 50.65.

156. Roy Layton. SW¼SE¼ sec. 1, T. 5 S., R. 23 E. Records available: 1940-48. Apr. 30, 12.19, irrigation water in nearby ditch.

157. M. J. Ferguson. SE¼SE¼ sec. 2, T. 5 S., R. 23 E. Records available: 1943-48.

Feb. 14	17.12	Apr. 30	17.37	July 26	18.06	Oct. 25	18.60
Mar. 14	17.00	May 29	16.50	Aug. 30	18.37	Nov. 29	18.30
Apr. 9	16.83	June 26	17.24	Sept.27	18.50	Dec. 27	17.90

158. W. C. Rhodes. NE¼SW¼ sec. 2, T. 5 S., R. 23 E. Records available: 1940-48. Feb. 15, 51.10; Apr. 30, 52.55; irrigation well, 300 feet north, pumping 2 days.

160. W. O. Tyler. NW¼NE¼ sec. 2, T. 5 S., R. 23 E. Records available: 1940-48. Feb. 15, 31.90; Apr. 30, 31.40.

194A. Ed and Port McEuen. NE¼SE¼ sec. 18, T. 5 S., R. 24 E. Records available: 1945-48.

Feb. 15	19.82	Apr. 28	18.73	July 26	20.60	Oct. 25	21.71
Mar. 14	19.41	May 29	19.18	Aug. 30	20.96	Nov. 29	21.65
Apr. 9	18.93	June 26	19.67	Sept.27	21.43	Dec. 27	21.53

198A. C. J. Farrington. SE¼SW¼ sec. 19, T. 5 S., R. 24 E. Records available: 1943-48.

Feb. 14	25.25	Apr. 30	24.30	July 26	27.72	Oct. 25	28.50
Mar. 14	24.60	May 29	25.72	Aug. 30	28.42	Nov. 29	27.76
Apr. 9	24.16	June 26	26.34	Sept.27	28.83	Dec. 27	26.92

206. J. D. Colvin. SE¼NE¼ sec. 29, T. 5 S., R. 24 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level
May 29	28.82	Sept.27	28.67	Nov. 29	27.40
Aug. 30	28.20	Oct. 25	27.80	Dec. 27	27.40

208. L. W. Farrington. SW¼SE¼ sec. 30, T. 5 S., R. 24 E. Records available: 1940-48. Feb. 15, 27.90; Apr. 30, 27.59.

210. Boyd Hawkins. SW¼NE¼ sec. 31, T. 5 S., R. 24 E. Records available: 1940-48. Feb. 15, 39.95; Apr. 30, 35.70. Destroyed, measurements discontinued.

211. Producers Ginning Co. NW¼NE¼ sec. 31, T. 5 S., R. 24 E. Records available: 1940-47. Measurements discontinued, Dec. 28, 1947.

214. Graham County. NE¼NE¼ sec. 31, T. 5 S., R. 24 E. Records available: 1940-48. Feb. 15, 15.22; Apr. 30, 15.91, Gila River, 200 feet east, flowing about 100 second-feet, and an irrigation well 200 feet southwest pumping.

220. Lionel Hancock. NW¼NW¼ sec. 33, T. 5 S., R. 24 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 15	16.51	Apr. 30	13.35	July 26	16.59	Oct. 26	15.73
Mar. 14	16.30	May 29	14.50	Aug. 30	15.29	Nov. 29	16.18
Apr. 9	14.42	June 26	15.84	Sept.27	16.30	Dec. 27	16.41

223A. Ira Hancock. NE¼SW¼ sec. 33, T. 5 S., R. 24 E. Records available: 1944-48. Feb. 15, 34.60.

259. Jess Udall. SW¼NE¼ sec. 1, T. 6 S., R. 24 E. Records available: 1944-48.

Feb. 15	30.82	Apr. 30	30.40	July 26	35.45	Oct. 25	34.30
Mar. 14	29.45	May 29	(a)	Aug. 30	(a)	Nov. 29	33.28
Apr. 9	31.04	June 26	37.52	Sept.27	35.85	Dec. 27	32.60

a Pumping.

264. J. Hancock. NE¼NE¼ sec. 3, T. 6 S., R. 24 E. Records available: 1940-48. Feb. 15, 14.64; Apr. 28, 13.75. Destroyed, measurements discontinued.

267. Wm. Carpenter. NE¼NE¼ sec. 4, T. 6 S., R. 24 E. Records available: 1940-48.

Feb. 15	24.62	Apr. 30	26.45	July 26	29.03	Oct. 25	27.35
Mar. 14	24.36	May 29	27.42	Aug. 30	(a)	Nov. 29	26.18
Apr. 9	26.11	June 26	27.44	Sept.27	28.05	Dec. 27	25.74

a Dry at 31.8 feet.

269A. Silas Jarvis. NW¼NW¼ sec. 10, T. 6 S., R. 24 E. Records available: 1943-48.

Feb. 14	26.80	Apr. 30	25.91	July 26	28.21	Oct. 25	(a)
Mar. 14	26.77	May 29	26.15	Aug. 30	29.09	Nov. 29	29.15
Apr. 9	26.52	June 26	27.00	Sept.27	a 29.3	Dec. 27	28.57

a Dry.

270A. M. J. Ferguson. NW¼NW¼ sec. 9, T. 6 S., R. 24 E. Records available: 1943-48. Feb. 15, 54.22; Apr. 30, 53.13.

273. Eldon Palmer. SW¼NE¼ sec. 5, T. 6 S., R. 24 E. Records available: 1940-48.

273--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Apr. 30	43.18	July 26	(a)	Sept.27	48.87	Nov. 29	47.60
May 29	45.57	Aug. 30	(a)	Oct. 25	(a)	Dec. 27	47.04
June 26	(a)						

a Pumping.

275. Lamar Bellman. SE¼NE¼ sec. 10, T. 6 S., R. 24 E. Records available: 1940-48. Feb. 15, 26.45; May 6, 25.90.

276A. M. J. Ferguson. SW¼SW¼ sec. 11, T. 6 S., R. 24 E. Records available: 1943-48.

Feb. 14	47.37	Apr. 30	39.80	July 26	41.18	Oct. 25	41.94
Mar. 14	40.38	May 29	40.22	Aug. 30	41.42	Nov. 29	42.03
Apr. 9	40.37	June 26	40.66	Sept.27	41.68	Dec. 27	42.10

279. Howard McBride. SW¼SW¼ sec. 12, T. 6 S., R. 24 E. Records available: 1943-47. Destroyed, measurements discontinued, Mar. 13, 1947.

282. Guy Anderson. SW¼NE¼ sec. 13, T. 6 S., R. 24 E. Records available: 1940-48. Mar. 14, 24.54; Apr. 9, 24.55; Apr. 30, measurements discontinued.

285. Guy Anderson. SE¼SE¼ sec. 13, T. 6 S., R. 24 E. Records available: 1940-48. Feb. 15, 45.00; Apr. 30, 41.20, pump removed and a new irrigation well drilled 8 feet east.

289. W. J. Preston. NW¼SW¼ sec. 13, T. 6 S., R. 24 E. Records available: 1942-48. Feb. 15, 44.20; Apr. 30, 44.43.

298. Joe Rogers. NE¼NW¼ sec. 25, T. 6 S., R. 24 E. Records available: 1940-48. Feb. 15, 16.95; Apr. 30, 16.06.

302A. Mattice Bros. SE¼NE¼ sec. 23, T. 6 S., R. 24 E. Records available: 1943-48.

Mar. 14	50.54	May 28	50.94	Sept.27	50.96	Nov. 29	50.75
Apr. 9	53.38	Aug. 30	50.90	Oct. 25	50.74	Dec. 27	50.95
30	50.77						

313. Jack Bryce. NW¼NE¼ sec. 7, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 63.89. Measurements discontinued.

318. Vance Marshall. NE¼NE¼ sec. 17, T. 6 S., R. 25 E. Records available: 1941-48. Feb. 15, 27.90; Apr. 28, pumping.

320. Vance Marshall. SE¼SE¼ sec. 17, T. 6 S., R. 25 E. Records available: 1940-46, 1948. Feb. 15, 17.75; May 5, 16.15.

321. Graham County. SW¼SE¼ sec. 7, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 9.88; Apr. 28, 8.70.

322. Bryce Bros. NE¼NW¼ sec. 18, T. 6 S., R. 25 E. Records available: 1940-47. Destroyed, measurements discontinued, July 22, 1947.

324. Graham County. SW¼NE¼ sec. 18, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 5.94; Apr. 28, 5.44.

325. Graham County. SW¼NE¼ sec. 18, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 7.43; Apr. 28, 7.22.

326. Graham County. SW¼NE¼ sec. 18, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 8.57; Apr. 28, 7.23.

342. Ed Howard. SE¼SW¼ sec. 23, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 28.44; Apr. 28, 29.43.

346. Graham County. SE¼NE¼ sec. 27, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 12.06; Destroyed, measurements discontinued Apr. 28.

347. Graham County. SE¼NE¼ sec. 27, T. 6 S., R. 25 E. Records available: 1940-48. Feb. 15, 9.31; Apr. 28, 7.63.

354. Ned Daley. SE¼SE¼ sec. 27, T. 6 S., R. 25 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	15.12	Apr. 30	18.10	July 26	24.51	Oct. 25	25.23
Mar. 14	(a)	May 29	(a)	Aug. 30	25.54	Nov. 29	23.18
Apr. 9	(a)	June 26	(a)	Sept.27	25.99	Dec. 27	21.70

a Pumping.

366. Charles M. Beals. NE¼SE¼ sec. 30, T. 6 S., R. 25 E. Records available: 1940-48. Apr. 28, 20.18.

408. Roy Saline. SW¼NW¼ sec. 30, T. 6 S., R. 25 E. Records available: 1943-48.

Mar. 14	54.96	May 28	55.10	Aug. 30	55.68	Nov. 29	56.66
Apr. 9	54.94	June 26	55.43	Sept.27	55.86	Dec. 27	56.00
30	54.88	July 26	55.56	Oct. 25	56.05		

409. Joe Alder. NE¼SW¼ sec. 29, T. 6 S., R. 25 E. Records available: 1943-48.

Feb. 14	7.39	Apr. 30	5.31	July 26	7.43	Oct. 25	9.49
Mar. 14	6.62	May 28	6.63	Aug. 30	7.58	Nov. 29	8.77
Apr. 9	6.82	June 26	6.30	Sept.27	8.85	Dec. 27	8.27

434. Abel Sanchez. SW¼NW¼ sec. 36, T. 6 S., R. 27 E. Records available: 1940-48. Feb. 12, 21.15; Apr. 28, 20.45.

452. S. A. Clontz. SW¼SW¼ sec. 31, T. 6 S., R. 28 E. Records available: 1940-48. Feb. 12, 24.30.

454. Brown Canal Co. NE¼NE¼ sec. 31, T. 6 S., R. 28 E. Records available: 1940-48. Feb. 12, 23.36; Apr. 28, 22.57.

506. Roy Layton. SW¼NW¼ sec. 2, T. 7 S., R. 25 E. Records available: 1943-48.

Feb. 14	a 37.7	Apr. 30	36.82	July 26	34.89	Oct. 25	32.84
Mar. 14	(a)	May 28	(a)	Aug. 30	(a)	Nov. 29	(a)
Apr. 9	(a)	June 26	34.70	Sept.27	(a)	Dec. 27	(a)

a Dry.

509. Ellis Welker and Eldon Palmer. SE¼SW¼ sec. 3, T. 7 S., R. 25 E. Records available: 1940-48. Feb. 16, 50.03; Apr. 28, 49.90.

565A. Z. C. Prina. SW¼NW¼ sec. 8, T. 7 S., R. 26 E. Records available: 1941-46, 1948.

Feb. 14	a 12.4	Apr. 30	(a)	July 26	(a)	Oct. 25	(a)
Mar. 14	(a)	May 29	(a)	Aug. 30	(a)	Nov. 29	(a)
Apr. 9	(a)	June 26	(a)	Sept.27	(a)	Dec. 30	(a)

a Dry.

566A. Z. C. Prina. SW¼NW¼ sec. 8, T. 7 S., R. 26 E. Records available: 1941-48. Feb. 15, dry at 11.6 feet; Apr. 28, dry.

567A. Z. C. Prina. NW¼NW¼ sec. 8, T. 7 S., R. 26 E. Records available: 1941-48. Feb. 15, dry at 12.8 feet; Apr. 28, dry.

568A. Z. C. Prina. NW¼NW¼ sec. 8, T. 7 S., R. 26 E. Records available: 1941-48. Feb. 15, dry at 12.8 feet; Apr. 28, dry.

569A. Graham County. NW¼SW¼ sec. 8, T. 7 S., R. 26 E. Records available: 1941-48. Feb. 15, dry; Apr. 28, destroyed, measurements discontinued.

574. Z. C. Prina. SW¼SW¼ sec. 5, T. 7 S., R. 26 E. Records available: 1940-47. Destroyed, measurements discontinued, Mar. 11, 1947.

575. Z. C. Prina. SW¼SW¼ sec. 5, T. 7 S., R. 26 E. Records available: 1940-47. Destroyed, measurements discontinued, Mar. 11, 1947.

580. City of Safford. NE¼SW¼ sec. 8, T. 7 S., R. 26 E. Records available: 1940-48. Feb. 16, 24.85; Apr. 28, 26.42.

586. Ted Tidwell. SE¼SE¼ sec. 12, T. 7 S., R. 26 E. Records available: 1940-48. Apr. 28, 27.82, irrigation water in nearby field.

592. E. M. Claridge. SW¼SE¼ sec. 13, T. 7 S., R. 26 E. Records available: 1940-48. Feb. 17, resetting pump sealed entrance to casing; Apr. 28, 51.02.

593. E. M. Claridge. SE¼SW¼ sec. 13, T. 7 S., R. 26 E. Records available: 1940-46, 1948. Feb. 17, 37.90; Apr. 28, 49.78; irrigation well, 600 feet south, pumping.

594. E. M. Claridge. NE¼SE¼ sec. 14, T. 7 S., R. 26 E. Records available: 1940-48. Feb. 17, 21.50; Apr. 28, pumping.

597. C. M. Pursley. NE¼SE¼ sec. 15, T. 7 S., R. 26 E. Records available: 1940-48. Dry at 31.1 feet on Apr. 30, 1948.

598. Union Canal Co. NE¼SE¼ sec. 15, T. 7 S., R. 26 E. Records available: 1940-48. Feb. 14, 30.62; Feb. 17, 30.79; Mar. 10, 30.40; Apr. 28, dry at 31.1 feet.

603. L. A. Nelson. SE¼SW¼ sec. 16, T. 7 S., R. 26 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	62.02	Apr. 14	67.66	June 20	72.80	Nov. 29	65.98
Mar. 10	52.55	30	64.27	July 26	(a)	Dec. 28	63.65
17	53.09	May 26	71.50	Oct. 25	69.66		

a Pumping.

610. Bert Hatch. SW¼SW¼ sec. 17, T. 7 S., R. 26 E. Records available: 1940-48. Feb. 16, dry at 65.0 feet; Apr. 28, destroyed, measurements discontinued.

616. Kimball & Greenhalgh. NW¼SE¼ sec. 20, T. 7 S., R. 26 E. Records available: 1940-47. Dry, measurements discontinued, Nov. 29, 1947.

623. Lee Johns. NE¼NW¼ sec. 22, T. 7 S., R. 26 E. Records available: 1940-48. Feb. 17, pumping; Apr. 28, 58.23.

625. Willard Welker. NE¼SE¼ sec. 22, T. 7 S., R. 26 E. Records available: 1940-48.

Feb. 14	52.58	Apr. 30	55.77	July 26	60.58	Oct. 25	64.41
Mar. 10	53.04	May 26	57.56	Aug. 30	62.39	Nov. 29	64.14
Apr. 14	54.36	June 30	59.36	Sept.26	63.58	Dec. 28	63.50

630. E. L. Claridge. NE¼NE¼ sec. 24, T. 7 S., R. 26 E. Records available: 1940-48.

Feb. 14	40.10	Apr. 30	a 50.96	July 26	57.60	Oct. 25	54.52
Mar. 10	42.41	May 26	52.48	Aug. 30	57.94	Nov. 29	52.23
17	46.52	June 30	56.58	Sept.26	57.88	Dec. 28	50.32
Apr. 14	52.66						

a Water in canal, 15 feet south.

639. Amos Cook. NW¼SE¼ sec. 31, T. 7 S., R. 26 E. Records available: 1940-46, 1948. May 14, 21.15.

662. Mrs. Jose Somora. NE¼NE¼ sec. 2, T. 7 S., R. 27 E. Records available: 1940-48.

Daily noon water level, from recorder charts

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	16.31	15.90	16.11	16.57	17.18	(b)	(b)	c18.31	(b)
2	.....	.....	16.29	15.92	16.26	16.59	17.20	(b)	(b)	(b)	(b)
3	.....	a16.57	16.28	15.92	16.33	16.60	17.22	(b)	(b)	(b)	(b)
4	.....	.....	16.27	15.90	16.40	16.60	17.25	(b)	c18.50	(b)	(b)
5	.....	.....	16.26	15.90	16.44	16.61	17.29	(b)	(b)	(b)	(b)
6	.....	.....	16.24	15.90	16.48	16.63	17.33	c18.30	(b)	(b)	c17.94
7	.....	a16.53	16.23	15.90	16.50	16.63	17.39	(b)	(b)	(b)	(b)
8	.....	.....	16.21	15.90	16.53	16.62	17.26	(b)	(b)	c18.23	(b)
9	.....	.....	16.19	15.91	16.57	16.63	17.16	(b)	(b)	(b)	(b)
10	.....	a16.51	16.18	15.93	16.62	16.62	17.09	(b)	(b)	(b)	(b)
11	.....	.....	16.16	15.92	16.66	16.61	17.03	(b)	c18.73	(b)	(b)
12	a16.72	.....	16.14	15.96	16.70	16.60	17.15	(b)	(b)	(b)	(b)
13	.....	.....	16.12	15.98	16.74	16.61	17.31	18.34	(b)	(b)	c18.02
14	a16.70	.....	16.11	16.01	16.74	16.66	17.42	(b)	(b)	(b)	(b)
15	.....	.....	16.10	16.03	16.81	16.71	17.47	(b)	(b)	c18.15	(b)
16	.....	.....	16.07	16.05	16.86	16.77	17.63	(b)	(b)	(b)	(b)
17	.....	a16.45	16.04	16.07	16.85	16.82	(b)	(b)	(b)	(b)	(b)
18	a16.68	.....	16.01	16.09	16.78	16.86	(b)	(b)	c18.36	(b)	(b)
19	.....	.....	15.99	16.10	16.71	16.90	(b)	(b)	(b)	(b)	(b)
20	.....	.....	15.97	16.13	16.64	16.90	(b)	18.40	(b)	(b)	c18.70
21	.....	.....	15.95	16.14	16.59	16.92	(b)	(b)	(b)	(b)	(b)
22	.....	.....	15.93	16.14	16.56	16.94	(b)	(b)	(b)	c18.16	(b)
23	.....	.....	15.90	16.20	16.53	16.96	c17.97	(b)	(b)	(b)	(b)
24	.....	a16.39	16.00	16.24	16.50	16.99	(b)	(b)	(b)	(b)	(b)
25	a16.62	16.39	15.96	16.15	16.49	17.02	(b)	(b)	c18.55	(b)	(b)
26	.....	16.38	15.87	16.07	16.50	17.04	(b)	(b)	(b)	(b)	(b)
27	.....	16.37	15.83	16.05	16.49	17.07	(b)	18.56	(b)	(b)	c18.62
28	.....	16.36	15.80	16.06	16.50	17.10	(b)	(b)	(b)	(b)	(b)
29		16.35	15.79	16.09	16.53	17.12	(b)	(b)	(b)	c18.00	(b)
30		16.34	15.78	16.09	16.56	17.14	c18.19	(b)	(b)	(b)	(b)
31		16.33		16.09		17.16	(b)		(b)		(b)

a Tape measurement at odd hours.
b Float on bottom of well.
c Tape measurement made in sand point driven in bottom of well.

664. San Jose Canal Co. SW¼NE¼ sec. 2, T. 7 S., R. 27 E. Records available: 1940-48. Feb. 17, 20.57; Apr. 28, 20.07.

674. Louis Michelena. NE¼SW¼ sec. 4, T. 7 S., R. 27 E. Records available: 1940-48. Feb. 12, 19.67; Apr. 28, 20.54.

675. Louis Michelena. SE¼SE¼ sec. 4, T. 7 S., R. 27 E. Records available: 1941-48. Apr. 28, 17.93.

676. Louis Michelena. SW¼SE¼ sec. 4, T. 7 S., R. 27 E. Records available: 1940-48. Feb. 12, 1940; Apr. 28, 20.02.

683. Tom Gardner. NE¼NW¼ sec. 10, T. 7 S., R. 27 E. Records available: 1940-46, 1948. Dry at 24 feet, Apr. 28, 19.40. Measurements discontinued.

708. Pete Bertaldo. SE¼NE¼ sec. 20, T. 7 S., R. 27 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 14	40.78	Apr. 30	39.42	July 26	39.58	Oct. 25	39.65
Mar. 10	40.18	May 26	39.42	Aug. 30	39.59	Nov. 29	39.69
Apr. 14	39.41	June 30	39.52	Sept.26	39.64	Dec. 27	39.65

709. E. E. Taylor. NW¼NW¼ sec. 30, T. 7 S., R. 27 E. Records available: 1940-48. Feb. 17, 24.22; Apr. 28, casing sealed; measurements discontinued.

791. Howard Olsen. SW¼SE¼ sec. 16, T. 8 S., R. 27 E. Records available: 1940-46. Measurements discontinued, Dec. 28, 1946.

792. Howard Olsen. NW¼SW¼ sec. 15, T. 8 S., R. 27 E. Records available: 1940-46. Measurements discontinued, Dec. 28, 1946.

793. Howard Olsen. SW¼NE¼ sec. 16, T. 8 S., R. 27 E. Records available: 1940-46. Measurements discontinued, Dec. 28, 1946.

GREENLEE COUNTY (DUNCAN VALLEY)

By R. L. Cushman and M. B. Booher

The Duncan Valley is the Arizona portion of a northwest-southeast-trending valley in which the Gila River flows through Hidalgo County, New Mexico, and Greenlee County, Arizona. The New Mexico portion of the valley is known as the Virden Valley and the whole valley is known as the Duncan-Virden Valley. Hydrologically there is no division between the Duncan Valley in Arizona and the Virden Valley in New Mexico.

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

The broken lines in the graphs of water-level fluctuations connect measurements that are separated by a period of time in excess of 6 months. The graphs of water-level fluctuations in these wells were extended through the last 7 months of 1948 by a straight-line interpolation between measurements made in May 1948 and measurements made in March 1949. The rise in water level shown by the graphs for the last half of 1948 is, therefore, not a true representation of the actual trend of the water level during the period. Instead, the scarcity of surface water for irrigation necessitated heavy pumping from wells, and the water levels probably declined until December. Starting in December 1948, rains and melting snow in the headwaters of the Gila River resulted in above-normal runoff in the river. The ground-water reservoir in the Duncan Valley gained in water storage from the flows in the river, and water levels in wells in the Duncan Valley rose.

Well 171 went dry after May 1948 and the top of the well was sealed by the owner. Water level measurements in this well were discontinued.

1 Measurements of water level made in wells in Virden Valley are listed in the New Mexico section under Hidalgo County.

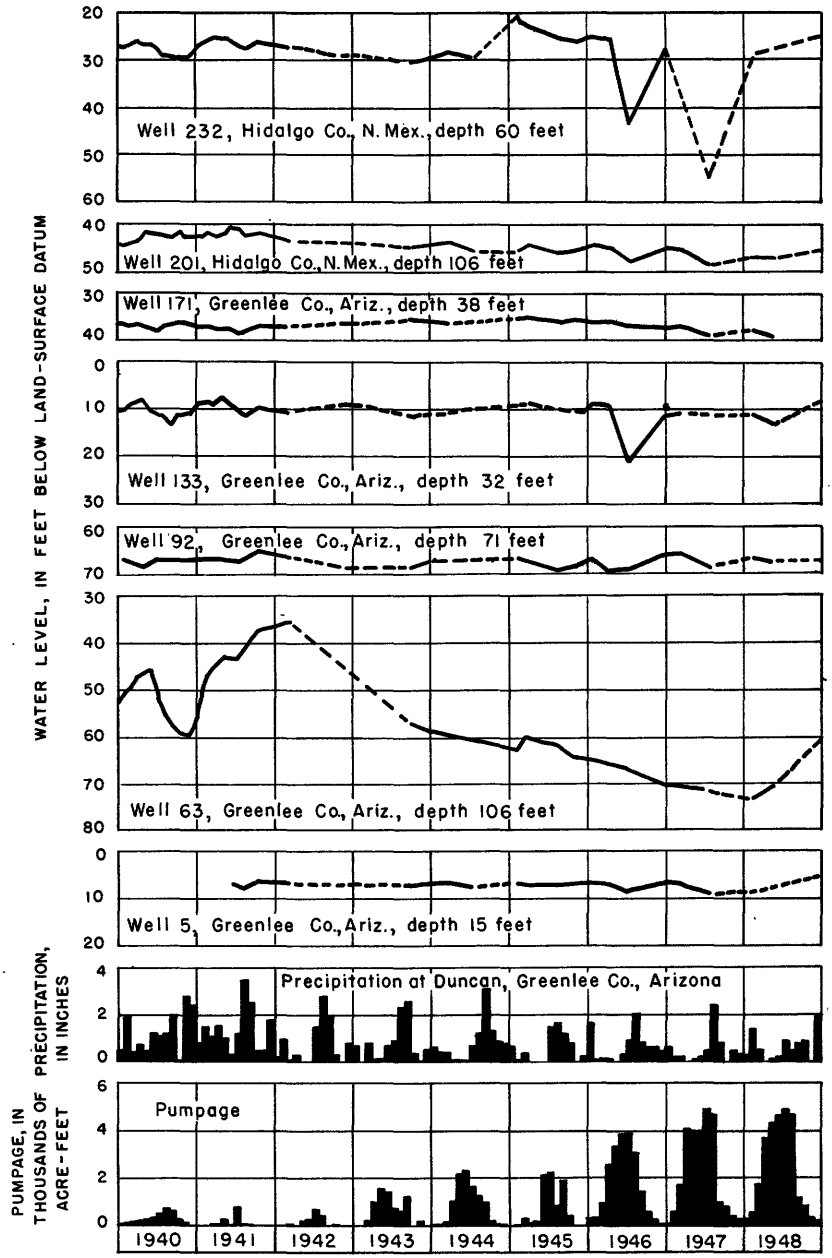

Figure 4.--Graphs showing fluctuations of water level in observation wells in Duncan-Virden Valley, Greenlee County, Arizona, and Hidalgo County, New Mexico.

Precipitation totaling 7.28 inches, 2.58 inches below normal, was recorded at Duncan, Arizona, in 1948. Below-normal precipitation apparently was common in the Gila River watershed, as surface-water supplies for irrigation were deficient. To supplement dwindling surface-water supplies approximately 27,000 acre-feet of water was pumped from wells in the Duncan-Virden Valley in 1948. This amounted to an increase of 1,000 acre-feet over the total pumpage in 1947. 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)	Ground 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
1948	9,080	27,000	36,080

Well descriptions and water-level measurements

5. Warner Foote. SE¼NW¼ sec. 7, T. 6 S., R. 31 E. Records available: 1941-48. Feb. 13, 8.66.

14. Victor Rowden. SE¼SE¼ sec. 19, T. 6 S., R. 31 E. Records available: 1940-48. Feb. 13, 31.00; May 19, 39.00.

31. J. C. Merritt. SW¼NW¼ sec. 4, T. 7 S., R. 31 E. Records available: 1940-48. May 19, 32.77.

36. M. M. Cosper. NE¼NW¼ sec. 16, T. 7 S., R. 31 E. Records available: 1940-48. Feb. 13, 24.25; May 19, 20.90.

49. W. M. Zumwalt. NE¼NW¼ sec. 34, T. 7 S., R. 31 E. Records available: 1940-48. Feb. 13, 61.50; May 18, 53.08.

63. M. W. McKelvey. NE¼SE¼ sec. 3, T. 8 S., R. 31 E. Records available: 1940-48. Feb. 13, 73.68; May 18, 70.81.

72. Hugh Howell. Formerly owned by J. C. Campbell. SE¼SE¼ sec. 12, T. 8 S., R. 31 E. Records available: 1940-48. Feb. 13, 50.38; May 18, 58.85, pumping recently; May 19, 55.60.

92. Raymond Davis. SW¼SE¼ sec. 17, T. 8 S., R. 32 E. Records available: 1940-48. Feb. 13, 66.50; May 18, 67.60, pumping recently.

96. L. Deane. NW¼NW¼ sec. 19, T. 8 S., R. 32 E. Records available: 1940-48. Feb. 13, 28.70. Destroyed, measurements discontinued.

120. D. E. Wilkins. NE¼NW¼ sec. 32, T. 8 S., R. 32 E. Records available: 1940-48. Feb. 13, 9.38; May 18, 7.79. Destroyed, measurements discontinued.

122. O. Christensen. Formerly owned by Delbert Moyer. SE¼SW¼ sec. 32, T. 8 S., R. 32 E. Records available: 1940-48. Feb. 13, 27.50; May 18, 28.05.

133. Floyd McDaniels. SE¼SW¼ sec. 34, T. 8 S., R. 32 E. Records available: 1940-43, 1945-48. Feb. 13, 11.25; May 18, 13.24.

136. Franklin Irrigation District well 1. SE¼NE¼ sec. 34, T. 8 S., R. 32 E. Records available: 1940-43, 1945-48. Feb. 13, 52.90; May 19, 47.60.

160. Franklin Irrigation District well 7. NE¼NE¼ sec. 3, T. 9 S., R. 32 E. Records available: 1940-48. Feb. 13, 10.09; May 18, pumping.

161. Franklin Irrigation District well 6. NE¼NE¼ sec. 3, T. 9 S., R. 32 E. Records available: 1940-48. Feb. 13, 9.89; May 18, 15.09, irrigation well, 400 feet east, pumping.

162. Franklin Irrigation District well 5. NE¼NE¼ sec. 3, T. 9 S., R. 32 E. Records available: 1940-48. Feb. 13, 22.70.

171. John Chapman. NE¼NW¼ sec. 9, T. 9 S., R. 32 E. Records available: 1940-48. Feb. 13, 37.85; May 18, 38.96. Sealed, measurements discontinued.

MARICOPA COUNTY

By F. I. Bluhm and H. E. Skibitzke

During 1948, water-level measurements were made in selected observation wells, and an inventory was made of the water pumped for irrigation. A total of 242 water-level measurements in 124 wells in the county is listed.

In 1948, 1,732,700 acre-feet of water was pumped for irrigation in the county. The records of the quantity of water pumped have been supplied by the irrigation districts. The amount of water pumped from the privately owned wells was determined as follows: The discharge of each well was measured; 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; where other types of power were used the amount of water pumped was computed on the basis of average crop usage for the crop concerned. The following tables show the amount of water pumped, in acre-feet, in Maricopa County.

Area	1946	1947	1948
Salt River Valley	1,360,000	1,406,000	1,670,000
Gila Bend	33,300	40,500	60,800
Dendora Ranch	6,700	6,700	1,900
Total	1,400,000	1,453,200	1,732,700

Quantity of water pumped from wells and quantity of surface water diverted at Granite Reef Dam, Salt River Valley area, 1933-48

	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	738,000	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	1948
Water pumped from wells	1,143,000	1,360,000	1,406,000	1,670,000
Water diverted at Granite Reef Dam	997,900	875,500	663,600	632,200
Ratio of water pumped from wells to total water used (percent)	53	61	68	73

For the 16-year period 1933-48, the total amount of water pumped for irrigation in the Salt River Valley area was 14,920,000 acre-feet, and the total amount of water diverted at Granite Reef Dam was 15,117,200 acre-feet. The ratio of water pumped from wells to the total water used in the 16-year period thus was about 50 percent.

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 a general decline in the water levels, during the past years, in all but the Liberty-Buckeye-Hassayampa area. The decline has been the result of the generally increasing rate of pumping.

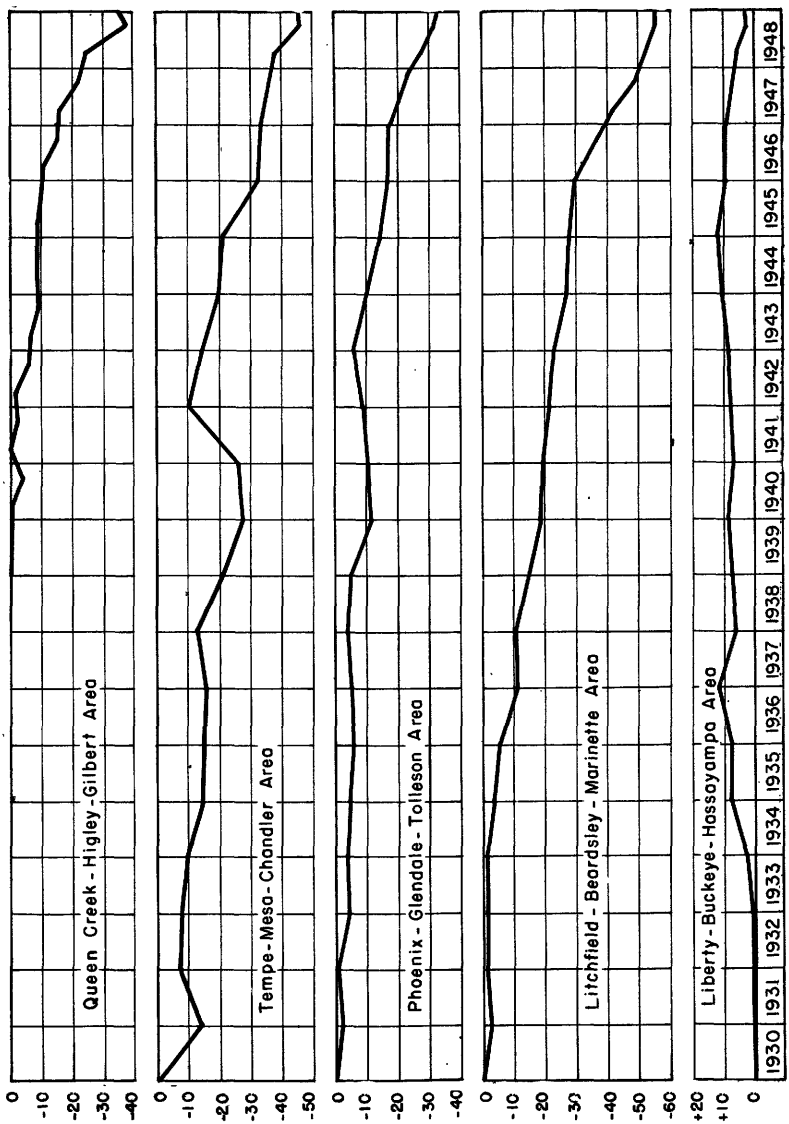

Figure 5.--Graphs showing cumulative net change in water levels in various parts of the Salt River Valley area, Maricopa County.

Most of the irrigation water used in the Queen Creek-Higley-Gilbert area is derived from the ground-water reservoir. The increase in pumping in the area has resulted in a continued decline of the water levels during 1948. The water levels declined during the late spring, summer, and fall, but recovered a part of the decline during the winter months. This recovery was the result of the decreased demand for pumped water during the winter. From the beginning of 1939 to the end of 1948 the water levels in the area declined an average of 34.5 feet. More than 24 feet of this decline occurred in the last 3 years.

The fluctuations of the water levels in the Tempe-Mesa-Chandler area are caused mainly by pumping water for irrigation and by recharge from irrigation water. During 1948 there was a shortage of surface water, and large quantities of ground water were pumped, which caused a lowering of the water table. The general trend of the water table in this area has been downward, the total decline having been about 45 feet between 1930 and 1948.

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 quite so great. The trend of the water levels has been generally downward, the total decline having been about 33 feet between 1930 and 1948.

In the Litchfield-Beardsley-Marinette area the trend of the water table has been downward. The average decline in the water levels was about 56 feet between 1930 and 1948, and it is evident that the rate of pumping is greatly in excess of the safe yield. In this area, as in the Queen Creek-Higley-Gilbert area, little surface water is available for irrigation in comparison to the amount of water pumped.

In the Liberty-Buckeye-Hassayampa area there was a rise of the water levels prior to 1945, as most of the pumped water used was derived from outside the area. Since 1945 there has been a general decline of the water levels as the amount of water pumped within the area increased. The water levels lowered an average of 3.5 feet during 1948. However, the average water levels at the end of 1948 were 3 feet higher than in 1930.

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 in the area since 1933. The water levels fluctuate with

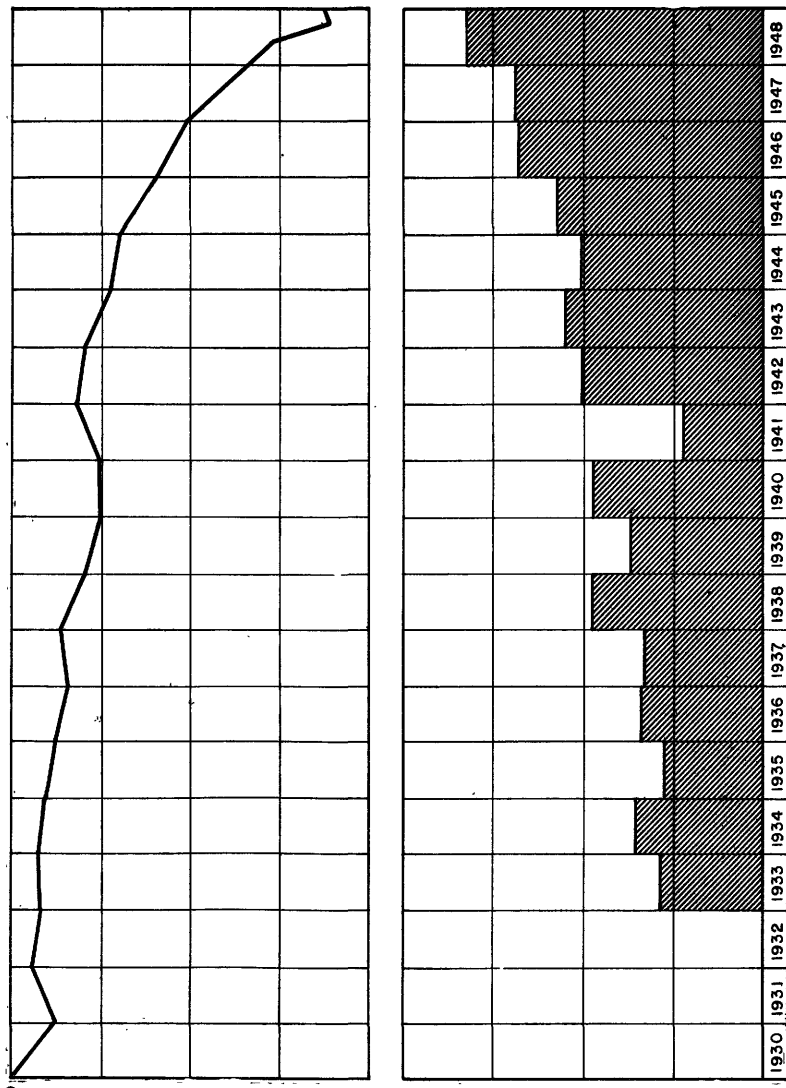

Figure 6.--Graph showing cumulative net change in water level and water pumped for irrigation in the Salt River Valley area, Maricopa County.

the rate of pumping. The average decline of the water table in the Salt River Valley area was 34.5 feet between 1930 and 1948, and 7 feet of this decline occurred during 1948.

Well descriptions and water-level measurements

19. E. D. Edwards. NE¼NE¼ sec. 28, T. 1 N., R. 6 E. Records available: 1939-48. Apr. 19, 164.50; Sept. 16, 174.44.

68. Osborn and Gass. Formerly owned by Mr. Schmitt. NW¼SE¼ sec. 23, T. 1 N., R. 7 E. Records available: 1939-48. Apr. 19, pumping; Sept. 16, pumping; Dec. 20, 308.01.

84. W. A. Anderson. SW¼SE¼ sec. 11, T. 1 S., R. 7 E. Records available: 1939-48. Apr. 20, 179.00; Sept. 20, 187.45.

89. D. Cole. NE¼SE¼ sec. 18, T. 1 S., R. 7 E. Records available: 1939-48. Apr. 20, 123.70; Sept. 20, 129.15.

94. Old Clifford Place. NE¼NE¼ sec. 21, T. 1 S., R. 7 E. Records available: 1939-48. Apr. 20, 140.33; Sept. 20, 145.60.

101. Mr. Gardiner. NE¼SE¼ sec. 25, T. 1 S., R. 7 E. Records available: 1939-48. Apr. 20, 169.71; Sept. 20, 174.66.

125. G. H. Dunn. NW¼NW¼ sec. 12, T. 1 S., R. 6 E. Records available: 1940-48. Sept. 16, 197.80. Measurements discontinued.

136. Roosevelt Water Conservation District. NE¼NE¼ sec. 25, T. 1 S., R. 6 E. Records available: 1939-48. Apr. 19, 110.01; Sept. 17, 119.37.

151. Roosevelt Water Conservation District. SW¼SE¼ sec. 13, T. 2 S., R. 5 E. Records available: 1939-48. Apr. 19, 86.75:

177. J. O. Power. SE¼NW¼ sec. 12, T. 2 S., R. 6 E. Records available: 1940-48. Apr. 19, pumping; Sept. 20, 181.71.

205. Joy Compton. SE¼SW¼ sec. 24, T. 2 S., R. 6 E. Records available: 1940-48. Apr. 19, pumping; Sept. 20, 164.90.

218. Clyde Fitzgerald. SE¼NW¼ sec. 34, T. 2 S., R. 6 E. Records available: 1940-46, 1947. No measurements made in 1948.

221. Roosevelt Water Conservation District. NE¼NE¼ sec. 31, T. 2 S., R. 6 E. Records available: 1940-48. Apr. 19, 55.10.

254. W. J. Germann. SE¼NE¼ sec. 7, T. 2 S., R. 7 E. Records available: 1940-48. Sept. 20, 180.20.

261. Higley Ward School. NW¼NW¼ sec. 15, T. 2 S., R. 7 E. Records available: 1940-47. No measurements made in 1948.

273. Leo Ellsworth. SE¼NE¼ sec. 28, T. 2 S., R. 7 E. Records available: 1940-47. No measurements made in 1948.

926. O. H. Semon. NW¼NW¼ sec. 31, T. 2 N., R. 6 E. Records available: 1946-48. Mar. 5, 101.24; Oct. 7, 103.61.

1061. W. L. Brooks. NW¼NW¼ sec. 29, T. 3 N., R. 5 E. Records available: 1946-48. Mar. 4, 185.13; Sept. 28, 187.71.

1086. Salt River Valley Water Users' Association. SE¼SW¼ sec. 8, T. 2 N., R. 5 E. Records available: 1946-48. Mar. 5, 104.60; Oct. 7, 105.17.

1087. Salt River Valley Water Users' Association. NW¼SE¼ sec. 23, T. 2 N., R. 5 E. Records available: 1945-48. Mar. 5, 114.18; Oct. 7, 118.30.

1106. Charley Weaks. NE¼SE¼ sec. 25, T. 1 N., R. 5 E. Records available: 1935-48. Mar. 5, 94.06; Oct. 7, 107.72.

1107. Frank E. Shill. SW¼NW¼ sec. 2, T. 1 N., R. 5 E. Records available: 1946-48. Mar. 5, 83.40; Oct. 7, 88.61.

1208. Salt River Valley Water Users' Association. NW¼NW¼ sec. 1, T. 1 S., R. 5 E. Records available: 1945-48. Mar. 5, 91.49; Oct. 7, 98.12.

1210. Mrs. J. L. Cobb. SE¼SE¼ sec. 32, T. 1 S., R. 5 E. Records available: 1946-48. Oct. 8, 83.74.

1211. K. K. Skousen. NE¼SE¼ sec. 35, T. 1 S., R. 5 E. Records available: 1946-48. Mar. 5, 95.40; Oct. 8, 108.30.

1307. Bob Milan. SE¼SE¼ sec. 22, T. 2 S., R. 5 E. Records available: 1946-48. Mar. 5, 41.79; Oct. 8, dry at 44 feet; measurements discontinued.

1308. R. W. Hanna. SE¼SE¼ sec. 30, T. 2 S., R. 5 E. Records available: 1946-48. Mar. 5, 41.16; Oct. 8, 44.90.

1309. Travis Moseley. NW¼NE¼ sec. 34, T. 2 S., R. 5 E. Records available: 1946-48. Mar. 5, 55.21; Oct. 8, 60.85.

1456. G. R. Finch. SW¼SW¼ sec. 15, T. 1 S., R. 4 E. Records available: 1935-48. Mar. 8, 49.10; Oct. 8, 65.80.

1457. Ben Taylor. SW¼SW¼ sec. 29, T. 1 S., R. 4 E. Records available: 1946-48. Mar. 8, 76.66; Oct. 8, 84.70.

1458. C. W. Brooks. SE¼SE¼ sec. 27, T. 1 S., R. 4 E. Records available: 1946-48. Mar. 8, 38.50; Oct. 8, 35.32.

1459. F. H. Hall. SE¼SW¼ sec. 29, T. 1 S., R. 4 E. Records available: 1946-48. Mar. 8, 76.27; Oct. 8, 81.26.

1501. Elkins. NW¼NE¼ sec. 24, T. 1 N., R. 4 E. Records available: 1935-48. Mar. 8, 36.34; Oct. 11, dry at 40.0 feet; measurements discontinued.

1502. J. B. House. SW¼NW¼ sec. 11, T. 1 N., R. 4 E. Records available: 1946-48. Mar. 8, 43.91; Oct. 11, 50.39, nearby well pumping.

1503. M. P. Bearden. SW¼NW¼ sec. 23, T. 1 N., R. 4 E. Records available: 1946-48. Mar. 8, dry at 32.5 feet; Oct. 11, dry at 32.5 feet.

1504. Nelson Pritchard. NE¼SE¼ sec. 35, T. 1 N., R. 4 E. Records available: 1946-47. Dry, measurements discontinued, Aug. 27, 1947.

1601A. Stannards. SW¼NE¼ sec. 19, T. 2 N., R. 4 E. Records available: 1935-48. Mar. 22, 17.26; Sept. 30, 11.88.

1603A. Owner unknown. NW¼NW¼ sec. 26, T. 2 N., R. 4 E. Records available: 1935-47. Dry, measurements discontinued, Mar. 5, 1948.

1619. Wm. Schrader. NE¼NE¼ sec. 26, T. 2 N., R. 4 E. Records available: 1946-48. Mar. 6, 73.86; Oct. 7, 82.62, nearby irrigation well pumping.

1620. C. T. Sharp. NE¼NW¼ sec. 29, T. 2 N., R. 4 E. Records available: 1946-48. Mar. 22, 13.18; Sept. 30, 9.48.

1701. K. C. Caswell. NW¼SW¼ sec. 15, T. 3 N., R. 4 E. Records available: 1945-48. Mar. 4, 170.66; Sept. 28, 170.27.

1711. Owner unknown. SE¼SE¼ sec. 15, T. 3 N., R. 4 E. Records available: 1946-48. Mar. 4, 166.15; Sept. 28, 166.22.

1712. Owner unknown. SE¼SE¼ sec. 17, T. 3 N., R. 4 E. Records available: 1946-48. Mar. 4, 161.91; Sept. 28, 161.95.

1887. Owner unknown. NE¼SW¼ sec. 3, T. 4 N., R. 3 E. Records available: 1946-48. Sept. 28, 36.71.

1891. Owner unknown. SE¼SE¼ sec. 27, T. 4 N., R. 3 E. Records available: 1946-48. Mar. 4, 216.41; Sept. 28, 216.71.

1906. Maxwell. SW¼SW¼ sec. 1, T. 3 N., R. 3 E. Records available: 1946-48. Mar. 4, 183.79; Sept. 28, 183.85.

1906A. Geo. R. Putnam. NW¼NW¼ sec. 32, T. 3 N., R. 3 E. Records available: 1943-48. Mar. 22, 86.23; Sept. 30, 93.97.

1907. H. J. Love. SW¼NW¼ sec. 2, T. 3 N., R. 3 E. Records available: 1947-48. Mar. 4, 176.23; Sept. 28, 176.96.

1920. Arizona Aeronautics Corporation. SW¼ sec. 14, T. 3 N., R. 3 E. Records available: 1946-47. No measurements made in 1948.

1924. Owner unknown. NE¼NW¼ sec. 5, T. 3 N., R. 3 E. Records available: 1946-48. Mar. 22, 207.60; Sept. 30, 210.88; Dec. 20, 211.70.

1925. E. S. Stewart. NW¼NE¼ sec. 32, T. 3 N., R. 3 E. Records available: 1946-47. Measurements discontinued.

1957. A. Fieks. NW¼NW¼ sec. 24, T. 2 N., R. 3 E. Records available: 1946-48. Sept. 30, 22.40.

1958. J. H. Forsyth. SE¼NE¼ sec. 33, T. 2 N., R. 3 E. Records available: 1946-48. Mar. 22, dry at 42 feet, measurements discontinued.

2056. Godfrey. NE¼NW¼ sec. 36, T. 1 N., R. 3 E. Records available: 1935-48. Oct. 7, 43.89.

2058. W. A. Campbell. SE¼SW¼ sec. 33, T. 1 N., R. 3 E. Records available: 1946-48. Oct. 7, 110.54.

2157. Bill Damon. NE¼NE¼ sec. 9, T. 2 S., R. 3 E. Records available: 1946-48. Mar. 8, 53.01; Oct. 8, 55.49.

2256. W. R. Collier. NE¼NW¼ sec. 36, T. 1 S., R. 3 E. Records available: 1946-48. Mar. 8, 87.92; Oct. 8, 98.12.

2301. A. Cheatum. SE¼SE¼ sec. 8, T. 1 S., R. 2 E. Records available: 1935-48. Mar. 24, 11.73.

2351. W. E. Sorenson. SW¼SW¼ sec. 3, T. 1 N., R. 2 E. Records available: 1935-48. Mar. 24, 71.71; Oct. 1, 89.00.

2352. C. V. Hilburs. NW¼SW¼ sec. 7, T. 1 N., R. 2 E. Records available: 1946-48. Mar. 24, 61.46; Oct. 1, dry at 64.5 feet, measurements discontinued.

2353. C. Hobson. NW¼SW¼ sec. 28, T. 1 N., R. 2 E. Records available: 1946-48. Mar. 24, 21.26; Oct. 7, 35.14.

2451. V. E. Messinger. NW¼SW¼ sec. 8, T. 2 N., R. 2 E. Records available: 1935-48. Mar. 24, 75.39; Oct. 1, 84.10.

2452. Leonard. SW¼SW¼ sec. 13, T. 2 N., R. 2 E. Records available: 1935-48. Mar. 24, 39.11; Oct. 1, 42.94.

2453. B. F. Reichenberger. SW¼SW¼ sec. 20, T. 2 N., R. 2 E. Records available: 1946-48. Mar. 24, pumping; Oct. 1, 76.57.

2551. Charles Christopher. SE¼SE¼ sec. 24, T. 3 N., R. 2 E. Records available: 1940-48. Mar. 22, 153.63; Sept. 30, 153.67; Nov. 5, 154.96.

2552. Lee Hopper. NW¼SW¼ sec. 7, T. 3 N., R. 2 E. Records available: 1946-48. Mar. 23, 123.78; Oct. 1, 138.00.

2553. American Institute for Foreign Trade. NW¼NW¼ sec. 8, T. 3 N., R. 2 E. Records available: 1946-48. Mar. 23, 150.68; Sept. 30, 169.82.

2555. Salt River Valley Water Users' Association. SW¼SW¼ sec. 26, T. 3 N., R. 2 E. Records available: 1944-48. Mar. 22, 125.51; Sept. 30, 142.18.

2556A. H. D. Connor. NE¼NE¼ sec. 1, T. 3 N., R. 2 E., at concrete block, 75 feet southwest of intersection of 19th Ave. and Bell Road. Unused drilled well, diameter 6 inches, depth 282 feet. Measuring point, top of casing, 1.7 feet above land-surface datum and 1,344.3 feet above mean sea level. Records available: 1948. Mar. 17, 266.08.

2651. Frank Echenique. SE¼NE¼ sec. 27, T. 4 N., R. 2 E. Records available: 1946-48. Mar. 22, 221.36; Sept. 30, 245.00; Nov. 5, 248.58; Dec. 21, 250.10.

2781. C. F. Edwards. SW¼ sec. 20, T. 5 N., R. 1 E. Records available: 1946-48. Mar. 4, 51.85; Oct. 1, 53.55.

2801. Owner unknown. NE¼NE¼ sec. 30, T. 4 N., R. 1 E. Records available: 1946-48. Mar. 4, 149.01.

2802. J. G. Boswell. NW¼NW¼ sec. 5, T. 4 N., R. 1 E. Records available: 1946-48. Mar. 4, 78.39.

2804. R. E. Grace. NW¼NW¼ sec. 34, T. 4 N., R. 1 E. Records available: 1946-47. No measurements made in 1948.

2852. J. G. Boswell. NW¼SE¼ sec. 9, T. 3 N., R. 1 E. Records available: 1946-47. No measurements made in 1948.

2854. J. G. Boswell. SE¼SE¼ sec. 7, T. 3 N., R. 1 E. Records available: 1942-48. Mar. 4, 130.55; Oct. 1, 139.75.

2856. Otis Cook. NE¼NW¼ sec. 35, T. 3 N., R. 1 E. Records available: 1946-48. Mar. 23, 67.63; Oct. 1, 75.94.

3051. Roosevelt Irrigation District. NE¼SE¼ sec. 12, T. 1 N., R. 1 E. Records available: 1930-46. No measurements made in 1948.

3053. Isabell-Hartner Co. NE¼NE¼ sec. 4, T. 1 N., R. 1 E. Records available: 1946-48. Mar. 24, 69.73; Oct. 1, 88.20.

3054. Owner unknown. NE¼NE¼ sec. 6, T. 1 N., R. 1 E. Records available: 1935-48. Mar. 24, 66.21.

3366. D. E. Accomazzo. SE¼NW¼ sec. 2, T. 1 S., R. 1 W. Records available: 1946-48. Oct. 1, 44.16.

3386. Goodyear Farms well 9 B. NE¼SE¼ sec. 9, T. 1 N., R. 1 W. Records available: 1940-48. Sept. 27, 60.15.

3387. Roosevelt Irrigation District. NE¼NE¼NE¼ sec. 10, T. 1 N., R. 1 W., 150 feet west of Richfield service station on the southwest corner of intersection, 4.6 miles east of Tolleson High School. Used drilled irrigation well, diameter 20 inches, depth unknown. Measuring point, bottom of notch on east side of pump base, at land-surface datum. Equipped with turbine pump and 100 horsepower electric motor. Records available: 1929-45, 1947-48.

3387--Continued.

Date	Water level	Date	Water level	Date	Water level
Jan. 1929	24.7	Jan. 1935	31.0	Jan. 1941	39.9
May 1	25.1	May 1	31.3	May 1	38.9
Jan. 1930	25.8	Jan. 1936	32.0	Jan. 1942	38.4
May 1	26.2	May 1	32.1	May 1	39.8
Jan. 1931	26.9	Jan. 1937	33.0	Jan. 1943	42.2
May 1	27.1	May 1	32.4	May 1	43.3
Jan. 1932	27.9	Jan. 1938	33.2	Jan. 1944	45.7
May 1	28.1	May 1	32.6	May 1	44.6
Jan. 1933	28.9	Jan. 1939	35.0	Jan. 1945	40.2
May 1	29.2	May 1	34.7	Nov. 4, 1947	51.96
Jan. 1934	30.0	Jan. 1940	36.7	Mar. 5, 1948	51.98
May	30.2	May 1	37.7		

3388. T. C. Rhodes. NW¼NE¼ sec. 6, T. 1 N., R. 1 W. Records available: 1946-48. Mar. 5, 80.04; Sept. 27, 91.52.

3389. A. R. Petri. NE¼NW¼ sec. 28, T. 1 N., R. 1 W. Records available: 1946-48. Apr. 2, 15.08; Oct. 6, 19.78.

3486. Goodyear Farms. SE¼NW¼ sec. 2, T. 2 N., R. 1 W. Records available: 1946-48. Mar. 5, 95.93; Oct. 6, 126.40.

3487. Goodyear Farms well 19-D. NE¼NE¼ sec. 19, T. 2 N., R. 1 W. Records available: 1927-48. Mar. 5, pumping; Sept. 27, 136.40.

3489. R. E. McMurchy. NW¼SW¼ sec. 13, T. 2 N., R. 1 W. Records available: 1946-48. Mar. 5, 68.58; Oct. 11, 82.47.

3490. Goodyear Farms. NE¼NW¼ sec. 26, T. 2 N., R. 1 W. Records available: 1946-48. Mar. 5, 87.66; Sept. 27, 107.50, irrigation well nearby pumping.

3586. A. J. Reems. SW¼SW¼ sec. 5, T. 3 N., R. 1 W. Records available: 1946-48. Mar. 4, 209.90; Oct. 1, 224.14.

3587. Rancho Santa Maria. NW¼NW¼ sec. 22, T. 3 N., R. 1 W. Records available: 1932-48. Mar. 5, 175.80. Measurements discontinued.

3587A. Rancho Santa Maria. NW¼NW¼ sec. 22, T. 3 N., R. 1 W., 100 feet southeast of intersection, 4 miles west and 0.5 mile south of Marinette. Used drilled irrigation well, diameter 20 inches, depth 408 feet. Measuring point, top of pump base, at land-surface datum. Equipped with turbine pump and electric motor. Records available: 1948. Oct. 1, 185.45.

3588. Maricopa County Municipal Water Conservation District No. 1. NW¼NW¼ sec. 31, T. 3 N., R. 1 W. Records available: 1946-48. Measurements discontinued, Dec. 31, 1946.

3686. Maricopa County Municipal Water Conservation District No. 1. NE¼SE¼ sec. 8, T. 4 N., R. 1 W. Records available: 1946-48. Mar. 4, 205.10; Oct. 1, 211.16.

3786. Bard Ranch. Approximate location, SW¼ sec. 36, T. 5 N., R. 1 W. Records available: 1946-48. Mar. 4, 169.71; Measurements discontinued.

3956. Maricopa County Municipal Water Conservation District No. 1. NW¼NE¼ sec. 4, T. 3 N., R. 2 W. Records available: 1946-48. Mar. 4, 267.99; Oct. 1, dry at 286 feet.

4002. Maricopa County Municipal Water Conservation District No. 1. SW¼SE¼ sec. 4, T. 2 N., R. 2 W. Records available: 1946-48. Mar. 5, 213.01; Oct. 6, 220.46.

4051. Roosevelt Irrigation District. SW¼SW¼ sec. 16, T. 1 N., R. 2 W. Records available: 1946-47. No measurement made in 1948.

4052. H. F. Hollingshead. NW¼NW¼ sec. 3, T. 1 N., R. 2 W. Records available: 1946-48. Apr. 2, pumping; Oct. 7, 158.5.

4053. Owner unknown. NW¼SW¼ sec. 5, T. 1 N., R. 2 W. Records available: 1947-48. Apr. 2, 170.00; Oct. 7, 172.79.

4054. Jettie Robinson. NE¼SE¼ sec. 12, T. 1 N., R. 2 W. Records available: 1946-48. Apr. 2, 89.85.

4055. H. T. Kiefer. NE¼SW¼ sec. 23, T. 1 N., R. 2 W. Records available: 1946-48. Apr. 2, 31.36; Oct. 6, 38.55.

4100. Roosevelt Irrigation District. SW¼NE¼ sec. 13, T. 1 N., R. 2 W. Records available: 1947-48. Apr. 2, 56.10; Oct. 6, 65.16.

4151. Lee Hunter. NE¼NW¼ sec. 4, T. 1 S., R. 2 W. Records available: 1946-48. Apr. 2, 16.83; Oct. 8, 20.83.

4352. Mrs. John Hughes. NE¼SE¼ sec. 5, T. 1 S., R. 3 W. Records available: 1946-48. Apr. 2, 5.71; Oct. 8, 7.85.

4401. Roosevelt Irrigation District. NW¼NW¼ sec. 34, T. 1 N., R. 3 W. Records available: 1928-48. Apr. 2, 56.99; Oct. 7, 57.74.

4402. Roosevelt Irrigation District. NE¼NW¼ sec. 32, T. 1 N., R. 3 W. Records available: 1937-48. Apr. 2, 63.84.

4616. Palmer. NE¼ sec. 15, T. 6 N., R. 4 W. Records available: 1946-48. Sept. 29, dry at 57 feet. Measurements discontinued.

4665. Lawrence Narramore. NW¼SW¼ sec. 13, T. 4 N., R. 4 W. Records available: 1946, 1948. Sept. 29, 314.65.

4711. Roosevelt Irrigation District. SW¼SW¼ sec. 31, T. 1 N., R. 4 W. Records available: 1937-48. Apr. 2, 65.33; Oct. 8, 64.87.

4712. Roosevelt Irrigation District. SW¼SE¼ sec. 34, T. 1 N., R. 4 W. Records available: 1928-48. Apr. 2, 45.28; Oct. 7, 55.53, nearby irrigation well pumping.

4713. D. E. Accomazzo. NE¼NE¼ sec. 16, T. 1 N., R. 4 W. Records available: 1946-48. Apr. 2, 167.41. Measurements discontinued.

4714. Ben Youngker. NE¼NE¼ sec. 19, T. 1 N., R. 4 W. Records available: 1946-48. Apr. 2, 55.81. Destroyed, measurements discontinued.

4714A. Ben Youngker. NW¼NE¼ sec. 19, T. 1 N., R. 4 W., 0.3 mile west of road along east side of section, on north line of section, 6.3 miles west and 3.5 miles north of Buckeye. Used drilled irrigation well, diameter 16 inches, depth 370 feet. Measuring point, top of casing, 1.0 foot above land-surface datum. Equipped with turbine pump and electric motor. Records available: 1948. Oct. 7, 55.94.

4715. Owner unknown. NE¼SW¼ sec. 25, T. 1 N., R. 4 W. Records available: 1946-48. Apr. 2, 67.30; Oct. 7, 69.86.

4761. Blake. NW¼SW¼ sec. 17, T. 1 S., R. 4 W. Records available: 1946-48. Apr. 2, 13.21.

4762. George G. Sevey. NE¼SE¼ sec. 11, T. 1 S., R. 4 W. Records available: 1946-48. Apr. 2, 4.65.

5350. Owner unknown. SW¼SE¼ sec. 13, T. 5 S., R. 5 W. Records available: 1945-48. Mar. 1, 33.28; Sept. 7, 36.75.

5456. H. A. Kreager. SW¼NW¼ sec. 8, T. 2 S., R. 5 W. Records available: 1946-48. Apr. 2, 18.40; Oct. 8, 23.54.

5457. Bill Jagow. NE¼ sec. 20, T. 2 S., R. 5 W. Records available: 1946-48. Oct. 8, 26.89.

5502. Gillespie Land & Irrigation Co. SE¼SW¼ sec. 36, T. 2 S., R. 5 W. Records available: 1945-48. Mar. 1, 60.48; Sept. 7, 67.07.

5506. Charles Yokum. NE¼NE¼ sec. 1, T. 1 S., R. 5 W. (erroneously published in Water-Supply Paper 1076 as NW¼NE¼ sec. 1, T. 1 S., R. 5 W.). Records available: 1946-48. Apr. 2, 64.00; Oct. 8, 68.11.

5507. Owner unknown. NE¼ sec. 11, T. 1 S., R. 5 W. Records available: 1946-48. Apr. 2, 27.94; Oct. 8, 34.43.

5606. Wheeler. SE¼ sec. 4, T. 1 N., R. 5 W. Records available: 1946-48. Oct. 11, 62.13.

5607. Spencer Wilson. NW¼NW¼ sec. 22, T. 1 N., R. 5 W. Records available: 1946-48. Apr. 2, 6.50; Oct. 11, 7.58.

5921. Owner unknown. SE¼SW¼ sec. 20, T. 2 N., R. 6 W. Records available: 1946-48. May 13, 120.77; Oct. 13, 120.78.

5971. Mitchell. SE¼SE¼ sec. 16, T. 1 N., R. 6 W. Records available: 1946-48. May 13, 85.74.

5972. Owner unknown. SE¼NE¼ sec. 22, T. 1 N., R. 6 W. Records available: 1946. Measurements discontinued, May 2, 1946.

6260. Gillespie Land & Irrigation Co. NE¼NE¼ sec. 4, T. 6 S., R. 6 W. Records available: 1945-48. Mar. 1, 127.35; Sept. 7, 132.31.

6562. R. L. Ward. NW¼NW¼ sec. 19, T. 1 S., R. 7 W., near rock tank, 200 feet east of road, 16 miles west of Hassayampa. Used dug well, diameter 48 inches, depth unknown. Measuring point, top of plank cover, 0.3 foot above land-surface datum. Records available: 1946-48. Mar. 21, 1946, 16.90; Oct. 13, 1948, 19.55.

6563. Dr. Ward. SE¼ sec. 32, T. 1 S., R. 7 W. Records available: 1946. Measurements discontinued, Apr. 12, 1946.

6581. Owner unknown. NE¼NE¼ sec. 26, T. 2 N., R. 7 W. Records available: 1946-48. May 13, 140.50; Oct. 13, 139.50.

6731. Owner unknown. SW¼SE¼ sec. 13, T. 1 S., R. 8 W., 100 feet north of road, 0.3 mile west of southeast corner of section 13, 16 miles west of Hassayampa. Unused drilled well, diameter 20 inches, depth 82 feet. Measuring point, top of casing, 2.0 feet above land-surface datum. Records available: 1946-48. Mar. 21, 1946, 17.10; Oct. 22, 1947, 17.80; Oct. 13, 1948, 21.09.

6732. Roy Davis. NW¼NW¼ sec. 22, T. 1 S., R. 8 W., on east side of road, near old Volcanic School, 0.25 mile south of graded road, 19 miles west of Hassayampa. Unused drilled well, diameter 16 inches, depth 500 feet. Measuring point, top of casing at land-surface datum. Records available: 1946-48. Mar. 21, 1946, 55.90; Oct. 23, 1947, 56.30; Oct. 13, 1948, 56.30.

6733. Roy Davis. NE¼ sec. 32, T. 1 S., R. 8 W. Records available: 1946. Measurements discontinued, Apr. 12, 1946.

6751. Owner unknown. NE¼ sec. 1, T. 2 S., R. 8 W. Records available: 1946. Measurements discontinued, Apr. 12, 1946.

7201. Moser. NE¼NE¼ sec. 31, T. 3 N., R. 9 W. Records available: 1946. Measurements discontinued, Mar. 27, 1946.

7241. R. E. Miller and Hodgeman. SE¼NW¼ sec. 34, T. 7 N., R. 9 W. Records available: 1946. Measurements discontinued, Mar. 27, 1946.

NAVAJO COUNTY

By G. E. Hazen

A total of 29 water-level measurements was made in 15 wells in Navajo County during 1948. Water-level measurements have been made in selected observation wells in the county since 1944. A report on the ground-water resources of the Joseph City area, entitled "Memorandum on ground-water supply of the Joseph City Irrigation District," was released in August 1948.

The main source of ground water in the county is the Coconino sandstone. Discharge of ground water from the sandstone takes place through springs and from flowing and nonflowing wells. There has been little change in the rate of discharge of ground water for several years, and consequently little change in the water levels. Water levels in wells that penetrate the alluvial fill of the river fluctuate with the rise and fall of the river surface.

Well descriptions and water-level measurements

2853. Simon Ranch. SW¼NE¼ sec. 27, T. 19 N., R. 15 E. Records available: 1944-48. June 4, 163.98; Oct. 14, 163.91.

5452. A. Smith. In Joseph City, on small knoll, one block north of store. Records available: 1944-47. No measurements made in 1948.

5652. Ben Hunt. SW¼SW¼ sec. 30, T. 18 N., R. 20 E. Records available: 1944-48. June 3, 38.57; Oct. 14, 39.27.

5653. Ben Hunt. SW¼SW¼ sec. 30, T. 18 N., R. 20 E. Records available: 1944-48. June 3, 21.84; Oct. 14, 22.62.

5654. Ben Hunt. SE¼ sec. 32, T. 18 N., R. 20 E. Records available: 1944-48. June 3, 37.04; Oct. 14, 37.42.

7451. E. B. Neuman. SW¼NW¼ sec. 1, T. 17 N., R. 20 E. Records available: 1944-48. June 3, 1.48; Oct. 14, 1.98.

7470. R. E. Whiting. NE¼SW¼ sec. 10. T. 17 N.. R. 20 E. Records available: 1944-48. June 3, 29.39; Oct. 14, 30.60.

7471. R. E. Whiting. NE¼SW¼ sec. 10, T. 17 N., R. 20 E. Records available: 1944-47. No measurements made in 1948.

7478. Geo. McLaws. SE¼SW¼ sec. 10, T. 17 N., R. 20 E. Records available: 1944-48. June 3, 50.74; Oct. 14, 50.81.

7489. R. Henderson. NW¼SW¼ sec. 11, T. 17 N., R. 20 E. Records available: 1944-48. June 3, 13.32; Oct. 14, 13.37.

7493. F. J. McLaws. SE¼NW¼ sec. 12, T. 17 N., R. 20 E. Records available: 1944-48. June 3, 54.69; Oct. 14, 54.38.

7651. Ambrosia Armijo. SW¼SW¼ sec. 6, T. 17 N., R. 21 E. Records available: 1944-48. June 3, 12.98; Oct. 14, 13.55.

7652. Ambrosia Armijo. SW¼SW¼ sec. 6, T. 17 N., R. 21 E. Records available: 1944-48. June 3, 7.61; Oct. 14, 8.28.

7653. State of Arizona. NW¼NW¼ sec. 7, T. 17 N., R. 21 E. Records available: 1944-48. June 3, 39.51; Oct. 14, 40.05.

7654. Roy Richards. SE¼NW¼ sec. 7, T. 17 N., R. 21 E. Records available: 1944-46. Measurements discontinued, June 12, 1947.

7655. John Mooko. SW¼NW¼ sec. 10, T. 17 N., R. 21 E. Records available: 1944-48. June 3, 51.75; Oct. 14, 51.92.

10,500. McNeil. In small valley, 0.4 mile north of U. S. Highway 60, 1.9 miles west of Showlow. Records available: 1944-48. June 2, 52.84; Oct. 12, dry.

11,000. Office of Indian Affairs, U. S. Dept. of Interior. Unsurveyed land. In shed, behind house, at Forestdale Trading Post, 9 miles south of Showlow. Records available: 1944-48. June 2, 7.55; Oct. 12, 15.28.

PIMA COUNTY

By R. L. Cushman and M. B. Booher

Water levels were measured in the Santa Cruz River Valley and Avra Valley of Pima County in 1948. Most of the cultivated area of Pima County is in the Santa Cruz River Valley.

Figure 7 shows graphs of water-level fluctuations in wells 1337, 4156, and 8686; precipitation at Tucson; and quantities of water pumped from wells in Pima County.

Well 1337 is about 16 miles northwest of Tucson in a heavily pumped area of the Santa Cruz River Valley. Water levels in this area are regulated by gains in ground-water storage as a result of flows in the river, and by losses in ground-water storage as a result of pumping from wells. In the period of record, 1940-48, losses in storage exceeded the gains, and in 1948 the water levels in wells in this area reached their lowest stage in the period. The water level in well 1337 was about 2 feet lower at the end of 1948 than at the beginning of the year. Increased pumpage from wells in this vicinity in 1947 and 1948 was indicated by the magnitude of the seasonal drawdowns in well 1337 illustrated in figure 7 .

Well 4156 is 6 miles east of Tucson and several miles away from areas of recharge or heavy pumping from wells. The water level in this well reflects the combined effects of heavy pumping in the Santa Cruz River Valley to the west and gains in ground-water storage in the recharge areas to the east. The increased rates of pumping from wells to the west since 1943 accelerated the rate of water-level decline in well 4156. The water level was about 1.3 feet lower at the end of 1948 than at the beginning of the year.

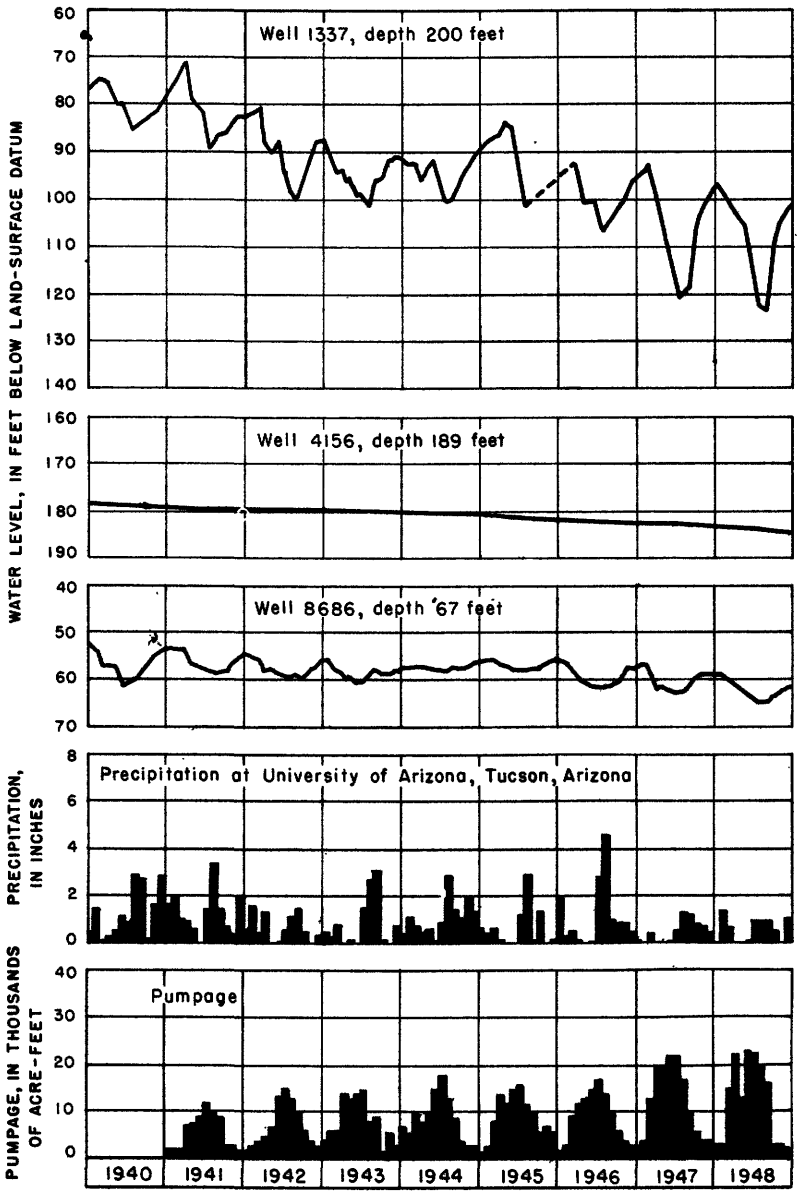

Figure 7.--Graphs showing fluctuations of water level in observation wells in the Santa Cruz Valley, Pima County, Arizona.

Well 8686 is 20 miles south of Tucson in an area where water is pumped from wells for irrigation. Water-level fluctuations in this well represent the trend of the regional water-level fluctuations, as no irrigation wells are close enough to well 8686 to cause local water-level fluctuations that result from intermittent pumping. The general trend of the water level has been downward in this well in the period 1940-48. The water level was about 2 feet lower at the end of 1948 than at the beginning of the same year.

There were no significant changes in water levels in most wells in Avra Valley during the period 1940-48. In the northern part of Avra Valley, near its junction with the Santa Cruz River Valley, water levels in wells declined about 7½ feet in the period 1940-48 as the result of pumping from nearby wells in the Santa Cruz Valley.

Precipitation totaling 6.81 inches was recorded at the University of Arizona weather station in 1948, an increase of 1.09 inches above the 1947 total but 4.30 inches below normal. Pumpage from wells in Pima County in 1948 equaled the 1947 pumpage of 145,000 acre-feet.

Well descriptions and water-level measurements

454. Cortaro Farms. SE¼NE¼ sec. 11, T. 11 S., R. 10 E. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	158.80	July 31	156.92	Oct. 1	160.21	Nov. 26	160.20
May 21	164.82	Aug. 26	157.68	25	160.00		

457. T. J. Smith. SE¼NE¼ sec. 22, T. 11 S., R. 10 E. Records available: 1940-42, 1944-48. June 24, 152.96; Oct. 8, 152.70.

460. W. E. Anway. NW¼ sec. 27, T. 11 S., R. 10 E. Records available: 1940-42, 1944-48. June 24, well being deepened; Oct. 8, 142.69.

463. Bud Parker. SE¼SE¼ sec. 36, T. 11 S., R. 10 E. Records available: 1940-42, 1944-48. June 24, 172.28; Oct. 8, 173.83.

466. T. V. Valenzuela. NE¼SE¼ sec. 32, T. 11 S., R. 10 E. Records available: 1946-48. June 24, 161.10.

535. Cortaro Farms. NE¼NE¼ sec. 30, T. 11 S., R. 11 E. Records available: 1939-48.

Jan. 7	177.35	July 31	(a)	Oct. 1	180.91	Nov. 26	179.95
May 21	181.07	Aug. 26	(a)	25	(a)		

a Pumping.

1254. Cortaro Farms. SE¼SW¼ sec. 31, T. 12 S., R. 13 E. Records available: 1939-46. Measurements discontinued, Aug. 28, 1946.

1337. Cortaro Farms. NE¼NW¼ sec. 16, T. 12 S., R. 12 E. Records available: 1939-48.

1337--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	96.25	July 31	a122.88	Oct. 1	108.92	Nov. 26	102.92
May 21	105.90	Aug. 25	123.33	25	105.62		

a Nearby irrigation well pumping.

1367. Grady Wilson (formerly published as owned by Grady Adams.). SE¼SE¼ sec. 28, T. 12 S., R. 12 E. Records available: 1939-48.

Jan. 7	138.39	July 31	144.85	Oct. 1	146.55	Nov. 26	143.40
May 21	139.33	Aug. 26	146.12	26	145.37		

1428. J. E. Glover. NE¼SW¼ sec. 8, T. 12 S., R. 11 E. Records available: 1940, 1942, 1944-48. June 24, 190.40; Oct. 8, 190.88.

1430. J. E. Glover. SE¼SE¼ sec. 18, T. 12 S., R. 11 E. Records available: 1940-42, 1944-47. No measurements made in 1948; well in use.

1432. P. Johansen. NE¼NE¼ sec. 29, T. 12 S., R. 11 E. Records available: 1940-42, 1944-46. No measurement made in 1946.

1435. S. B. Niles. SW¼SW¼ sec. 34, T. 12 S., R. 11 E. Records available: 1940-42, 1944-46, 1948. Oct. 21, 305.28.

1503. V. Valenzuela. NW¼NW¼ sec. 9, T. 12 S., R. 10 E. Records available: 1940-42, 1944-48. June 24, 167.55; Oct. 8, 165.86.

1505. Alonzo Stephens. Formerly owned by Wirt Bowman. SE¼SE¼ sec. 20, T. 12 S., R. 10 E. Records available: 1940-42, 1944-48. June 24, 189.44; Oct. 8, 187.10.

1506. Harry Alexander. NE¼NE¼ sec. 26, T. 12 S., R. 10 E. Records available: 1940-42, 1944, 1946-48. June 24, 200.30.

2651. Pima County. SW¼NE¼ sec. 7, T. 13 S., R. 12 E. Records available: 1940-42, 1944-48. May 25, 35.30; Oct. 21, 32.25.

2738. Bruce Knapp. SE¼NE¼ sec. 28, T. 13 S., R. 13 E. Records available: 1939-48.

Jan. 7	47.70	July 31	51.65	Oct. 1	50.92	Nov. 26	51.51
May 21	48.30	Aug. 26	(a)	26	(a)		

a Pumping.

2808. Courtright Stables. SE¼SE¼ sec. 25, T. 13 S., R. 14 E. Records available: 1939-48. Jan. 1, 11.74; May 21, 12.44; Nov. 26, 12.18.

2910. V. C. Crouch. SW¼SE¼ sec. 36, T. 13 S., R. 15 E. Records available: 1939-48. Jan. 7, 36.13. Measurements discontinued.

4156. Charles Reynard. SW¼SE¼ sec. 7, T. 14 S., R. 15 E. Records available: 1939-48.

Jan. 26	183.12	Apr. 29	183.48	July 28	183.63	Oct. 25	184.06
Feb. 25	183.16	May 26	183.40	Aug. 26	183.79	Nov. 26	184.07
Mar. 29	183.27	June 28	183.52	Sept.30	183.95	Dec. 28	184.30

4375. E. L. Rogers. SE¼SE¼ sec. 34, T. 14 S., R. 13 E. Records available: 1939-42, 1944-48.

Jan. 7	(a)	July 28	55.62	Sept.30	55.84	Nov. 26	53.16
May 21	52.00	Aug. 24	56.00	Oct. 25	54.80		

a Pumping.

4379. Hal Manning. SE¼NW¼ sec. 35, T. 14 S., R. 13 E. Records available: 1940-47. Sealed, measurements discontinued, Oct. 28, 1947.

4450. Pima County. NW¼NW¼ sec. 6, T. 14 S., R. 12 E. Records available: 1940-42, 1944-48. May 25, 87.75; Oct. 21, 71.30.

4452. Pima County. NW¼NW¼ sec. 17, T. 14 S., R. 12 E. Records available: 1940-42, 1945-48. May 25, 77.30; Oct. 21, 79.98.

4453. Pima County. NE¼SW¼ sec. 21, T. 14 S., R. 12 E. Records available: 1940-42, 1944-48. May 25, 60.78; Oct. 21, 58.98.

4454. State of Arizona. SE¼SW¼ sec. 21, T. 14 S., R. 12 E. Records available: 1940-42, 1944-48. May 25, 59.95; Oct. 21, 61.20. Damaged by caving, measurements discontinued.

4601. J. Burrell. Sec. 10, T. 14 S., R. 10 E. Records available: 1940-42, 1944, 1946-48. May 25, 21.28; Oct. 7, 21.60.

4602. J. Burrell. Sec. 10, T. 14 S., R. 10 E. Records available: 1940-42, 1944, 1946-48. May 25, 17.78; Oct. 7, 15.78.

4604. Frank R. Rendon. SW¼ sec. 24, T. 14 S., R. 10 E. Records available: 1940-42, 1944, 1946-48. May 25, 306.62; Oct. 7, 306.05.

6404. Everett Inscho. NE¼NE¼ sec. 29, T. 15 S., R. 10 E. Records available: 1940-42, 1944-48. May 25, 143.39.

6405. C. W. Van Camp. NW¼SE¼ sec. 33, T. 15 S., R. 10 E. Records available: 1940-42, 1944-48. May 25, 150.72; Oct. 7, 150.13.

6410. C. W. Van Camp. NE¼NE¼ sec. 35, T. 15 S., R. 10 E. Records available: 1940-42, 1944, 1946-48. May 25, 213.18; Oct. 7, 212.17.

6575. H. C. Barker. NE¼SW¼ sec. 1, T. 15 S., R. 13 E. Records available: 1939-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	54.34	July 28	55.87	Sept.30	57.79	Nov. 24	56.84
May 20	56.35	Aug. 24	56.65	Oct. 26	57.13		

6582. San Xavier School. NE¼NE¼ sec. 15, T. 15 S., R. 13 E. Records available: 1939-48.

Jan. 7	43.85	July 28	45.30	Sept.30	44.46	Nov. 26	44.90
May 21	45.60	Aug. 24	44.80	Oct. 28	44.35		

6593. Office of Indian Affairs, U. S. Dept. of Interior. San Xavier Reservation. SW¼SE¼ sec. 22, T. 15 S., R. 13 E. Records available: 1939-48.

Jan. 7	30.58	July 28	32.75	Sept.30	34.39	Nov. 24	32.40
May 21	33.95	Aug. 24	32.55	Oct. 25	32.61		

6612. City of Tucson. SW¼SW¼ sec. 2, T. 15 S., R. 13 E. Records available: 1942-48.

Jan. 26	41.45	Apr. 29	44.80	July 28	45.85	Oct. 25	48.08
Feb. 25	41.27	May 26	45.77	Aug. 26	45.04	Nov. 26	47.07
Mar. 29	42.67	June 28	47.61	Sept.30	47.10	Dec. 28	42.31

7152. State of Arizona. NW¼NE¼ sec. 7, T. 16 S., R. 14 E. Records available: 1939-47. Dry, measurements discontinued, Sept. 26, 1947.

7166. Lane Farms. SE¼SW¼ sec. 31, T. 16 S., R. 14 E. Records available: 1941-48. Jan. 28, 52.80; May 20, 59.17; July 28, 59.45.

8578. Lane Farms. SE¼NW¼ sec. 13, T. 17 S., R. 13 E. Records available: 1939-47. Filled, measurements discontinued, Aug. 28, 1947.

8686. State Highway Department. NE¼SW¼ sec. 18, T. 17 S., R. 14 E. Records available: 1939-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	58.11	July 28	64.45	Sept.30	63.55	Nov. 24	62.03
May 20	62.41	Aug. 24	64.46	Oct. 26	62.50		

9230. J. B. Bull. NW¼SW¼ sec. 1, T. 18 S., R. 13 E. Records available: 1939-48.

Jan. 28	52.45	July 28	62.66	Sept.30	60.41	Nov. 24	57.94
May 20	58.43	Aug. 24	(a)	Oct. 26	58.35		

a Pumping.

10,477. Intercontinental Ranch Co. well W 1. SW¼NW¼ sec. 3, T. 19 S., R. 13 E. Records available: 1939-48.

Jan. 28	57.10	July 28	59.79	Sept.30	58.78	Nov. 24	58.75
May 20	58.55	Aug. 24	59.26	Oct. 26	58.77		

10,483. Gustavo Amado. NW¼SW¼ sec. 29, T. 19 S., R. 13 E. Records available: 1939-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 28	34.50	July 28	(a)	Sept.30	33.40
May 20	(a)	Aug. 24	33.20	Nov. 24	34.02

a Pumping.

PINAL COUNTY

By R. L. Cushman and M. B. Booher

Ground-water studies in Pinal County during 1948 consisted of making depth-to-water measurements in selected wells in and near the cultivated areas along the Gila and Santa Cruz Rivers; making an inventory of the total volume of water pumped from wells; and making detailed studies of geology and ground-water resources of the part of the area near Eloy. These data were made available to the Arizona State Land Commissioner to assist him in evaluating the ground-water resources of the Eloy area.

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

Water-level fluctuations in wells 890, 890A, and 975 are typical of ground-water conditions in the Casa Grande-Coolidge-Florence area where the land is irrigated with surface water supplemented by water pumped from wells. The general trend of water levels in wells in this area was upward in the period 1940-42 because large amounts of surface water were available for irrigation and pumping from wells was comparatively light. Water levels started to decline in 1943 as surface water became depleted and more water was pumped from wells to supplement the supply of water for

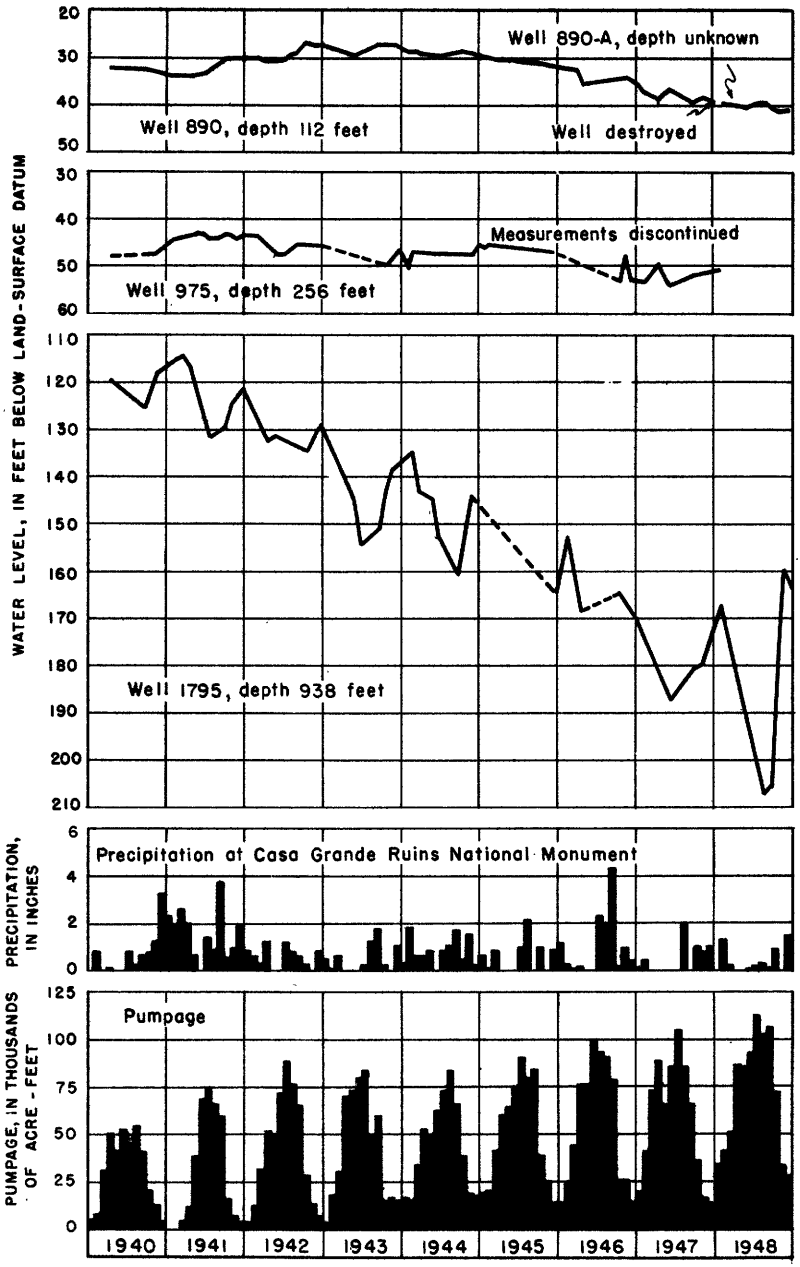

Figure 8.--Graphs showing fluctuations of water level in observation wells in the Casa Grande-Eloy area, Pinal County, Arizona.

irrigation. Water levels declined an average of 24 feet in this area during the period 1943-48. The decline of the water level in seven wells averaged about 6½ feet in 1948. These wells are spaced so as to be representative of ground-water conditions in this area.

Water-level fluctuations in well 1795 are typical of ground-water conditions near the center of the heavily pumped Eloy area. Lands in the Eloy area are irrigated entirely from wells. Water levels declined an average of 42 feet in the Eloy area in the period of record, 1940-48. In the center of the pumped area the decline was as much as 60 feet during this period. Water levels declined an average of 7½ feet in this area in 1948; this followed a decline of about 7 feet in 1947. The rise in water level in well 1795 shown by the November 1948 measurement was the result of encountering a partially confined aquifer while deepening the well.

Water levels in 17 wells in the Maricopa-Stanfield area declined an average of 25 feet in the period of record, 1942-48. The rate of decline was accelerated in 1947 and 1948 because of the increased pumpage from wells. This area, like the Eloy area, is irrigated entirely from wells.

The precipitation, amounting to 4.38 inches at the Casa Grande Ruins National Monument during 1948, was 5.07 inches below normal. Below-normal precipitation on the upstream watershed has resulted in a decreased supply of surface water during the last few years. Large amounts of ground water have been pumped to make up for the scarcity of surface water for irrigation. The following table summarizes the annual quantities of ground water pumped in Pinal County since 1939:

Year	Pumpage, in acre-feet	Year	Pumpage, in acre-feet
1940	372,000	1945	610,000
1941	351,000	1946	660,000
1942	500,000	1947	700,000
1943	515,000	1948	950,000
1944	530,000		

Most of the increased pumpage in 1948 was used to irrigate new acreage brought under cultivation.

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-Coolidge, Maricopa, and Eloy areas, south of the Gila River.

Well descriptions and water-level measurements

22. Hart Mullins. NW¼SE¼ sec. 35, T. 1 S., R. 10 E. Records available: 1940-48. Apr. 19, 18.89. Measurements discontinued.

23. Hart Mullins. NW¼SE¼ sec. 35, T. 1 S., R. 10 E. Records available: 1939-48. Apr. 19, pumping; Sept. 16, 23.98.

35. E. M. Little. SW¼SW¼ sec. 8, T. 2 S., R. 10 E. Records available: 1940-48. Apr. 19, 398.71; Sept. 16, 398.03; Dec. 21, 398.22.

41. W. A. Barkley. NW¼SE¼ sec. 27, T. 2 S., R. 8 E. Records available: 1940-48. Apr. 20, 232.08.

71. Magma Arizona Railroad. NE¼NE¼ sec. 35, T. 3 S., R. 8 E. Records available: 1940-48. Apr. 20, 163.13; Sept. 21, 174.80.

123. Office of Indian Affairs, U. S. Dept. of Interior well 61. SW¼NE¼ sec. 36, T. 3 S., R. 4 E. Records available: 1942-48. Feb. 2, 28.41; June 2, 28.98.

174. G. W. Yancy. NW¼SE¼ sec. 18, T. 4 S., R. 3 E. Records available: 1942-48. Feb. 2, 27.84; June 2, 28.32; Oct. 25, 29.26.

257. Office of Indian Affairs, U. S. Dept. of Interior well 44. SE¼SW¼ sec. 19, T. 4 S., R. 7 E. Records available: 1942-46. Sealed, measurements discontinued, Nov. 25, 1946.

258. Office of Indian Affairs, U. S. Dept. of Interior well 42. SW¼NE¼ sec. 20, T. 4 S., R. 7 E. Records available: 1942-45. Measurements discontinued, Feb. 16, 1945.

259. Office of Indian Affairs, U. S. Dept. of Interior well 43. SE¼NE¼ sec. 30, T. 4 S., R. 7 E. Records available: 1942-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 3	31.00	July 26	33.45	Sept.28	34.48	Nov. 24	35.09
June 3	32.50	Aug. 24	33.89	Oct. 26	34.56		

278. Arizona Ranches, Inc. SW¼SW¼ sec. 2, T. 4 S., R. 8 E. Records available: 1941-48. Apr. 20, 173.18; Sept. 21, 176.26.

324. Office of Indian Affairs, U. S. Dept. of Interior well 1. SE¼SW¼ sec. 21, T. 4 S., R. 10 E. Records available: 1942-48. Sealed, measurements discontinued, Oct. 25, 1946.

327. Office of Indian Affairs, U. S. Dept. of Interior well 4. NE¼SE¼ sec. 31, T. 4 S., R. 10 E. Records available: 1942-47. Sealed, measurements discontinued, Feb. 3, 1948.

341. Office of Indian Affairs, U. S. Dept. of Interior well 7. SW¼SW¼ sec. 7, T. 4 S., R. 11 E. Records available: 1942-48.

Feb. 3	40.86	July 26	41.30	Sept.28	42.70	Nov. 24	44.14
June 3	40.67	Aug. 24	41.34	Oct. 27	42.96		

437. Office of Indian Affairs, U. S. Dept. of Interior well 76. SE¼NE¼ sec. 29, T. 5 S., R. 9 E. Records available: 1942-48.

Feb. 3	134.85	July 26	145.25	Sept.28	148.04	Nov. 24	145.87
June 3	146.45	Aug. 24	146.34	Oct. 27	147.77		

493. H. R. Montierth. SW¼NW¼ sec. 32, T. 5 S., R. 8 E. Records available: 1942-48. Feb. 3, 76.66.

503. L. D. Ulmer. NE¼NE¼ sec. 1, T. 5 S., R. 8 E. Records available: 1942-48.

503--Continued.

Date	Water level	Date	Water level	Date	Water level
Feb. 3	49.42	July 26	52.93	Oct. 27	53.80
June 3	51.27	Aug. 24	54.12	Nov. 24	53.34

554. Witcherley & Hancock. SE¼NW¼ sec. 13, T. 5 S., R. 7 E. Records available: 1942-47. Measurements discontinued, Oct. 1, 1947.

616. H. D. Murphy. SE¼NE¼ sec. 4, T. 5 S., R. 4 E. Records available: 1942-48. Feb. 2, 90.55; June 2, dry at 90.7 feet; July 27, dry at 90.7 feet. Measurements discontinued.

618. Fugua. Formerly owned by J. R. Ross. NW¼SW¼ sec. 30, T. 5 S., R. 4 E. Records available: 1942-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 2	101.50	July 27	a109.07	Sept.27	111.18	Nov. 22	110.08
June 2	105.22	Aug. 24	110.18	Oct. 25	109.62		

a Irrigation well, 1,000 feet northwest, pumping.

653. Bernice White. SE¼SW¼ sec. 3, T. 5 S., R. 3 E. Records available: 1942-48. Feb. 2, 66.40; July 27, 66.10; Aug. 24, 66.48; Sept. 27, dry at 66.6. Measurements discontinued, Nov. 22, 1948.

738. A. A. Wallace. SW¼NW¼ sec. 9, T. 6 S., R. 3 E. Records available: 1942-48.

Feb. 2	148.50	July 27	(a)	Sept.27	163.15	Nov. 22	151.45
June 2	(a)	Aug. 24	154.49	Oct. 25	152.64		

a Pumping.

887. Paul Knobloch. SE¼NE¼ sec. 9, T. 6 S., R. 5 E. Records available: 1940-48. Feb. 2, 46.20; June 2, 46.75; Oct. 25, 47.66.

890. Mrs. Gus Dratzka. NE¼NE¼ sec. 15, T. 6 S., R. 5 E. Measurements discontinued, Nov. 5, 1947.

890A. Mrs. Gus Dratzka. SE¼NE¼ sec. 15, T. 6 S., R. 5 E., 200 feet west of county road, 100 feet southwest of house, 1.9 miles north of State Highway 84, 3.5 miles northwest of Casa Grande. Used drilled well, diameter 6 inches, depth unknown. Measuring point, bottom of slot in east side, top of casing, at land-surface. Records available: 1948.

Feb. 2	39.95	July 27	39.83	Sept.27	40.30	Nov. 22	41.14
June 2	40.02	Aug. 24	39.84	Oct. 25	41.26		

893. P. H. Ethington. SE¼NE¼ sec. 16, T. 6 S., R. 5 E. Records available: 1940-48. Feb. 2, 55.52; June 2, 61.38; Oct. 25, 59.78.

906. Office of Indian Affairs, U. S. Dept. of Interior well 100. SE¼NE¼ sec. 23, T. 6 S., R. 5 E. Records available: 1942-48. Feb. 2, 43.65; June 2, 43.32; Oct. 25, 44.40.

907. Burris Bros. SE¼SE¼ sec. 23, T. 6 S., R. 5 E. Records available: 1940-48. Feb. 2, 49.00; June 2, 48.80; Oct. 25, 51.96.

961. Floyd Smith. NE¼NE¼ sec. 7, T. 6 S., R. 6 E. Records available: 1940-48.

Feb. 3	37.00	July 26	47.28	Sept.27	45.84	Nov. 22	42.30
June 2	44.40	Aug. 24	a 68.28	Oct. 25	43.26		

a Nearby irrigation well pumping.

967. E. E. Rosenberry. SE¼SW¼ sec. 10, T. 6 S., R. 6 E. Records available: 1941-46. Measurements discontinued, Feb. 12, 1946.

968. C. E. Sherrill. SE¼SW¼ sec. 13, T. 6 S., R. 6 E. Records available: 1940-48. Feb. 3, 55.42; June 3, pumping; Oct. 26, pumping.

975. Gilbert Bros. SE¼SE¼ sec. 17, T. 6 S., R. 6 E. Records available: 1940-48. Feb. 3, 40.70; June 3, redrilled well and sealed entrance to casing by resetting pump. Measurements discontinued.

981. Gilbert Bros. SE¼SE¼ sec. 20, T. 6 S., R. 6 E. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 3	51.30	July 26	54.54	Sept.28	55.55	Nov. 23	54.90
June 3	52.64	Aug. 23	54.68	Oct. 26	55.19		

991. Mrs. Emma Pennington. SE¼SE¼ sec. 25, T. 6 S., R. 6 E. Records available: 1940-48.

Feb. 3	59.37	July 26	68.70	Sept.28	69.40	Nov. 23	63.72
June 3	65.60	Aug. 23	69.90	Oct. 26	64.42		

1002. Office of Indian Affairs, U. S. Dept. of Interior well 103. SW¼SW¼ sec. 33, T. 6 S., R. 6 E. Records available: 1942-48. Feb. 4, 50.35; June 2, 52.60; Oct. 26, pumping.

1066. Diwan Singh. SE¼NW¼ sec. 22, T. 6 S., R. 7 E. Records available: 1939-47. No measurement made in 1948.

1072. Office of Indian Affairs, U. S. Dept. of Interior well 85. SE¼SE¼ sec. 27, T. 6 S., R. 7 E. Records available: 1942-48.

Feb. 3	91.98	July 26	97.65	Sept.27	100.13	Nov. 23	103.34
June 3	97.25	Aug. 23	97.79	Oct. 26	102.88		

1079. Office of Indian Affairs, U. S. Dept. of Interior well 84. NE¼NE¼ sec. 35, T. 6 S., R. 7 E. Records available: 1942-47. No measurements made in 1948.

1118. Dick Shiflet. SE¼NE¼ sec. 4, T. 6 S., R. 8 E. Records available: 1940-47. No measurements made in 1948.

1153. Office of Indian Affairs, U. S. Dept. of Interior well 82. SW¼SW¼ sec. 30, T. 6 S., R. 8 E. Records available: 1942-48. Mar. 2, 113.93.

1157. Office of Indian Affairs, U. S. Dept. of Interior well 78. NE¼NW¼ sec. 35, T. 6 S., R. 8 E. Records available: 1942-48.

Feb. 3	57.07	July 26	64.71	Sept.27	66.92	Nov. 23	67.45
June 3	59.24	Aug. 24	67.00	Oct. 26	68.57		

1162. Mr. McFarland. SW¼SW¼ sec. 27, T. 6 S., R. 8 E. Records available: 1942-48. Feb. 3, 96.85.

1172. W. W. Ray. SW¼SW¼ sec. 20, T. 6 S., R. 8 E. Records available: 1944-48. Feb. 3, 108.96; June 3, 130.85, pumping recently; Oct. 26, 127.85, pumping recently.

1331. D. C. Roberts. SE¼SE¼ sec. 20, T. 7 S., R. 8 E. Records available: 1942-47. Sealed, measurements discontinued, Nov. 5, 1947.

1405. S. C. McFarland. SE¼SW¼ sec. 11, T. 7 S., R. 7 E. Records available: 1942-48. Feb. 3, pumping; June 3, pumping; Oct. 26, 143.81.

1422. D. S. Cramer. SE¼SW¼ sec. 29, T. 7 S., R. 7 E. Records available: 1941-44. Dry, measurements discontinued, Aug. 2, 1944.

1430. Les Milligan. SW¼NE¼ sec. 2, T. 7 S., R. 7 E. Records available: 1944-48. Feb. 3, pumping; June 3, pumping; Oct. 26, 136.71.

1476. D. A. Trekell. NE¼SE¼ sec. 7, T. 7 S., R. 6 E. Records available: 1940-47. Filled, measurements discontinued, June 6, 1947.

1479. Paul Brophy. SW¼SW¼ sec. 12, T. 7 S., R. 6 E. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	78.80	July 26	85.22	Sept.27	87.90	Nov. 22	88.32
June 2	82.17	Aug. 24	86.24	Oct. 26	89.21		

1485. F. W. Shedd. SE¼SE¼ sec. 27, T. 7 S., R. 6 E. Records available: 1940-48. Feb. 4, 80.85.

1489. Albert Steinfeld. SE¼NE¼ sec. 30, T. 7 S., R. 6 E. Records available: 1942-48.

Feb. 4	69.40	July 27	73.75	Sept.27	74.47	Dec. 7	77.77
June 2	70.95	Aug. 25	75.58	Nov. 22	71.04		

1532. Phoenix Church of Brethren. SE¼NE¼ sec. 7, T. 7 S., R. 5 E. Records available: 1940-47. Destroyed, measurements discontinued, Feb. 2, 1948.

1539. W. S. Stephenson Estate. SE¼SE¼ sec. 22, T. 7 S., R. 5 E. Records available: 1942, 1944-48. Feb. 2, 104.57; Oct. 25, 107.21.

1716. Smith-Thornburg Co. SW¼NE¼ sec. 29, T. 8 S., R. 6 E. Records available: 1941-48.

Feb. 4	76.23	July 27	77.90	Sept.27	78.50	Nov. 22	78.84
June 2	77.37	Aug. 25	78.35	Oct. 26	78.59		

1725. State of Arizona. SE¼NW¼ sec. 21, T. 8 S., R. 6 E. Records available: 1942-45. Measurements discontinued, Feb. 19, 1945.

1776. S. C. Milligan. SE¼NE¼ sec. 9, T. 8 S., R. 7 E. Records available: 1941-48. Feb. 4, 148.20; Oct. 28, 158.46.

1787. Sam Phillips. SE¼SE¼ sec. 15, T. 8 S., R. 7 E. Records available: 1941-48. No measurements made in 1948.

1791. S. G. Wilson. SE¼NE¼ sec. 22, T. 8 S., R. 7 E. Records available: 1940-48. Feb. 4, pumping; June 3, 185.86.

1795. Jack Pretzer, Jr. SE¼SE¼ sec. 25, T. 8 S., R. 7 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 4	177.03	July 27	(a)	Sept.28	214.20
June 3	(a)	Aug. 25	217.44	Nov. 23	169.40

a Pumping.

1855. D. A. Trekell. SE¼SE¼ sec. 7, T. 8 S., R. 8 E. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	172.85	July 26	185.41	Sept.28	188.20	Nov. 23	190.30
June 3	182.67	Aug. 25	a187.08	Oct. 28	186.70		

a Nearby irrigation well pumping.

1864. John Arujo. NW¼SE¼ sec. 18, T. 8 S., R. 8 E. Records available: 1944-46. Dry, measurements discontinued, Nov. 27, 1946.

1884. Arizona Farm Products Co. Known locally as Jack Pretzer well 6. SE¼SW¼ sec. 33, T. 8 S., R. 8 E. Records available: 1940-48. Feb. 4, 189.55; June 3, 208.70; Aug. 25, pumping; Oct. 28, 201.30.

2104. P. G. Wolfe. SE¼NE¼ sec. 20, T. 9 S., R. 8 E. Records available: 1942-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 4	188.55	July 27	(a)	Oct. 29	202.24
June 3	(a)	Aug. 23	(a)	Nov. 23	199.63

a Pumping.

2108. J. F. Nutt. SE¼SE¼ sec. 26, T. 9 S., R. 8 E. Records available: 1942-45. No measurements made in 1948.

2173. R. W. Dickey well 2. SE¼SE¼ sec. 15, T. 9 S., R. 7 E. Records available: 1942-48. Feb. 4, 159.21.

2174. R. H. Washburn. Formerly owned by Carl West. SE¼SE¼ sec. 16, T. 9 S., R. 7 E. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 4	141.53	July 27	(a)	Sept.28	179.90	Nov. 23	155.55
June 3	181.20	Aug. 25	(a)	Oct. 29	174.06		

a Pumping.

2233. J. Sevak. SE¼SE¼ sec. 24, T. 9 S., R. 6 E. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 4	96.85	Aug. 23	a103.67	Oct. 29	100.25
June 3	107.75	Sept.28	101.84	Nov. 23	99.75

a Irrigation well, 300 feet west, pumping.

2236. B. F. Nelssen. SW¼SE¼ sec. 3, T. 9 S., R. 6 E. Records available: 1940-44. Measurements discontinued, Aug. 3, 1944. Measurements reported for this well in Water-Supply Papers 1028, 1076, and 1101, were made in well 2239, 0.3 mile south of well 2236.

2239. B. F. Nelssen. NW¼NE¼ sec. 10, T. 9 S., R. 6 E., 0.3 mile south of old stone house, 3.5 miles east of Papago Indian Reservation line, 12 miles southwest of Eloy, and 15 miles south of Casa Grande. Unused drilled well, diameter 12 inches. Measuring point, lower edge of discharge pipe, 1.0 foot above land-surface datum. Records available: 1942, 1945-48.

Mar. 14, 1942	100.77	June 4, 1947	120.05	June 2, 1948	125.12
Aug. 1, 1945	114.15	Sept.30	122.44	Aug. 25	127.12
Dec. 20, 1946	118.00	Feb. 3, 1948	123.40	Oct. 26	128.51
Feb. 11, 1947	118.40				

2311. J. C. Kinney. NW¼ sec. 3, T. 10 S., R. 7 E. Records available: 1941-47. No measurements made in 1948.

2332. J. C. Kinney. SE¼SE¼ sec. 5, T. 10 S., R. 8 E. Records available: 1941-48. Feb. 4, 181.24; June 3, 187.87; Aug. 19, 187.44; Nov. 23, 187.85.

2351. J. C. Kinney. NW¼SE¼ sec. 5, T. 10 S., R. 9 E. Records available: 1941-46. Dry, measurements discontinued, Oct. 25, 1946.

2354. H. H. Cake. SW¼NW¼ sec. 10, T. 10 S., R. 9 E. Records available: 1941-48.

2354--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 6	159.75	July 27	157.77	Sept.27	158.27	Nov. 24	159.64
June 3	163.80	Aug. 23	158.00	Oct. 25	(a)		

a Pumping.

2363. King Investment Co. Formerly owned by H. B. Aguirre. SE¼SE¼ sec. 36, T. 10 S., R. 9 E. Records available: 1939, 1940-44. Water-level measurements reported for this well in 1945-47 were measured in well 2363A, 100 feet northwest of well 2363. Measurements discontinued, July 18, 1944.

2363A. King Investment Co. SE¼SE¼ sec. 36, T. 10 S., R. 9 E., 300 feet northwest of frame house at King Ranch, 4.0 miles south of county road, 4.7 miles west of State Highway 84. Used drilled irrigation well, diameter 16 inches, depth 219 feet. Measuring point, 1-inch hole in pump base, south side, 1.3 feet above land-surface datum. Records available: 1942-43, 1945-48.

Date	Water level	Date	Water level	Date	Water level
Dec. 21, 1942	137.63	July 25, 1946	152.43	May 8, 1947	(a)
Jan. 15, 1943	138.80	Oct. 22	150.70	Oct. 9	150.40
Oct. 11, 1945	140.26	Dec. 4	140.42	June 24, 1948	(a)
Dec. 7	(a)	Feb. 18, 1947	(a)	Oct. 8	151.75

a Pumping.

2383. Tom Soleng. SW¼SE¼ sec. 34, T. 10 S., R. 10 E. Records available: 1942-47. No measurements made in 1948.

SANTA CRUZ COUNTY

By R. L. Cushman and M. B. Booher

A total of 48 water-level measurements were made in 8 wells in the Santa Cruz River Valley of Santa Cruz County. Most of the wells used for water-level observations are in the cultivated area adjacent to the river channel. The stage of the water in these wells is regulated principally by the following two factors: (1) gains in ground-water storage resulting from seepage losses from intermittent flows in the river; and (2) losses in ground-water storage resulting from pumping water from wells.

Figure 9 shows graphs of water-level fluctuations in wells 915 and 1525; volume of water discharged monthly in the Santa Cruz River near Nogales; monthly precipitation at Nogales; and monthly quantities of water pumped from wells.

The general downward trend of the water level in well 915 is typical of ground-water conditions in the heavily pumped areas in the Santa Cruz River Valley. Drought and the resulting heavy pumping from wells are causing withdrawals from ground-water storage in excess of the amount being recharged.

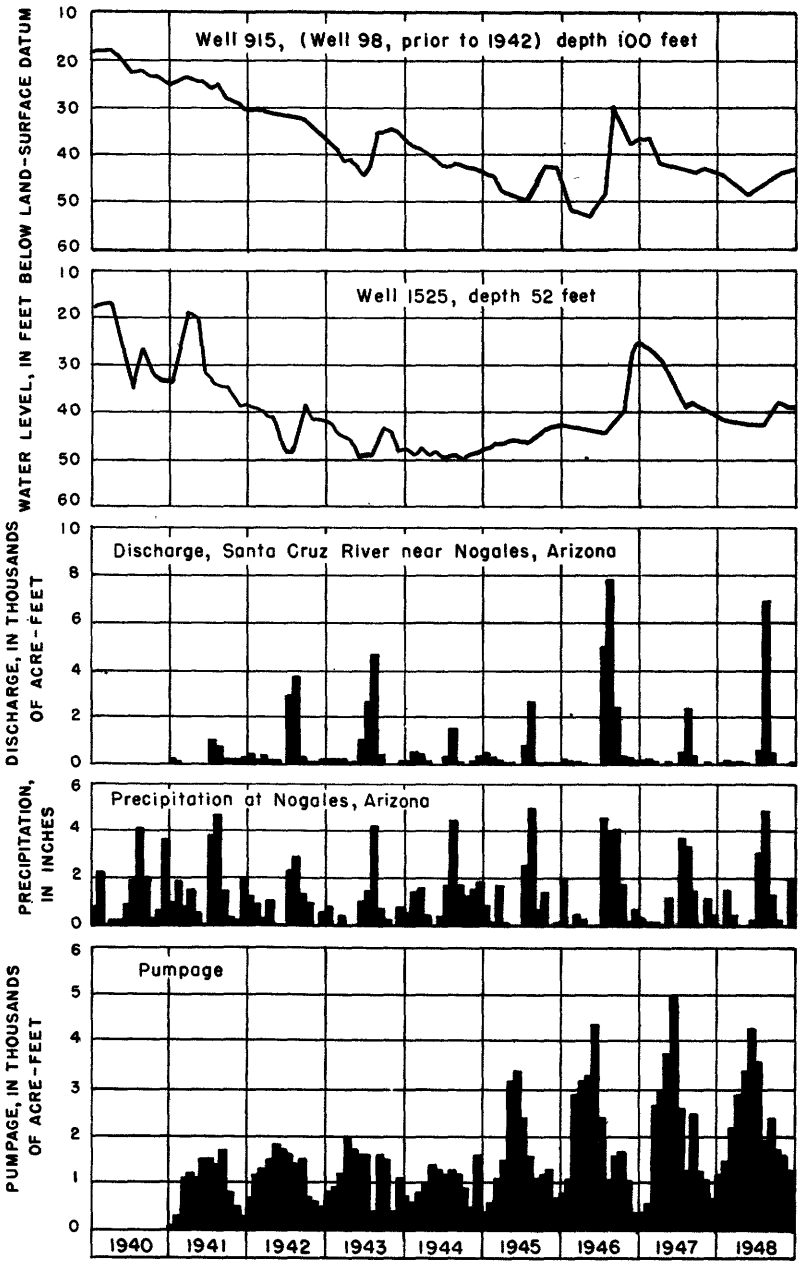

Figure 9.--Graphs showing fluctuations of water level in observation wells in the Santa Cruz Valley, Santa Cruz County, Arizona.

Well 1525 is a few miles upstream from well 915 and is in a "narrows" in the valley fill. The water level in this well fluctuates in response to changes in stage of the underflow through the narrows. The City of Nogales obtains its public water supply from an infiltration gallery located a few hundred feet upstream from well 1525. Pumping from the gallery is relatively constant and does not cause a large fluctuation in the water level in the well.

It can be seen in figure 9 that rises in water levels in wells 1525 and 915 do not always coincide. Some flows passing through the narrows at well 1525 are so small that they are lost underground before reaching well 915. These small flows cause the water level in well 1525 to rise but have no immediate effect on the water level in well 915. Sometimes pumping from wells near well 915 offsets the rise in water level that otherwise would result from recharge from river flows.

Precipitation at Nogales totaled 13.92 inches in 1948, or 1.73 inches above normal. The average annual precipitation is insufficient to mature crops completely; however, some of the summer rains are sufficiently heavy to reduce the amount of water needed from wells.

Approximately 28,000 acre-feet of water was pumped from wells in Santa Cruz County in 1948, an increase of 3,000 acre-feet over that pumped in 1947. The increase in total pumpage probably was the result of heavier pumping during the winter months in 1948.

Well descriptions and water-level measurements

5. R. W. Littlejohn. SE¼NE¼ sec. 13, T. 20 S., R. 12 E. Records available: 1940-47. Dry, measurements discontinued, Oct. 28, 1947.

79. Mrs. Schenkel. SW¼NW¼ sec. 32, T. 20 S., R. 13 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 28	28.94	Aug. 24	30.93	Oct. 26	30.85
May 20	(a)	Sept.30	30.83	Nov. 24	30.94

a Pumping.

908. T. T. Pendleton. SW¼SE¼ sec. 16, T. 22 S., R. 13 E. Records available: 1940-48.

May 20	49.80	Aug. 24	41.10	Oct. 26	18.64
July 28	49.55	Sept.30	18.82		

915. T. T. Pendleton. SE¼SE¼ sec. 35, T. 22 S., R. 13 E. Records available: 1940-48. Jan. 28, 44.18; May 20, 48.30; Oct. 26, 43.82; Nov. 24, 43.51.

1504. J. F. Dalton. SW¼NW¼ sec. 19, T. 23 S., R. 14 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	13.25	July 28	17.28	Sept.30	16.43	Nov. 24	17.20
May 20	13.98	Aug. 24	16.15	Oct. 26	16.75		

1513. Dines Nelson. NE¼NW¼ sec. 27, T. 23 S., R. 14 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 28	18.62	July 28	21.80	Sept.30	20.54
May 20	19.17	Aug. 24	20.97	Oct. 26	21.00

1525. T. Griffin. Formerly owned by Camberos Bros. NW¼NW¼ sec. 36, T. 23 S., R. 14 E. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	41.85	July 28	42.44	Sept.30	38.22	Nov. 24	38.97
May 20	42.45	Aug. 24	40.55	Oct. 26	38.10		

1912. Simon Mastick. SW¼NE¼ sec. 8, T. 24 S., R. 14 E. Records available: 1940-48.

Jan. 28	26.59	July 28	26.82	Sept.30	25.33	Nov. 24	25.78
May 20	25.96	Aug. 24	24.80	Oct. 26	25.26		

2007. Nelson Brown. Buena Vista Land Grant, approximately SE¼ sec. 7, T. 24 S., R. 15 E. Records available: 1947-48.

Jan. 28	9.78	July 28	10.42	Sept.30	10.02	Nov. 24	9.79
May 20	10.20	Aug. 24	9.50	Oct. 26	10.26		

YUMA COUNTY

By H. M. Babcock

A total of 53 water-level measurements was made in 21 selected observation wells in Yuma County in 1948, and an inventory was made of the amount of water pumped for irrigation. Water-level measurements have been made in the county by the Geological Survey since 1943, and records of the amount of ground water pumped for irrigation have been kept since 1944. A publication entitled "Wellton-Mohawk area, Yuma County, Arizona, Records of wells, well logs, water analyses, and maps showing location of wells," was released in July 1948.

In 1948, 109,000 acre-feet of water was pumped from wells for irrigation in the county. The following table shows the amount of water pumped, in acre-feet, during the period of record.

Year	1944	1945	1946	1947	1948
Dateland area	4,000	4,000	4,000	4,000	5,300
Wellton-Mohawk area	37,000	35,000	38,000	43,000	49,900
South Gila Valley	20,000	22,000	32,000	35,000	53,800
	61,000	61,000	74,000	82,000	109,000

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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 very little change in the water table since measurements began.

Well 680 is a drilled well 5 miles east and 2 miles north of Roll, in the river bottom a short distance from an area of heavy pumping. The water level in this well continued to decline in 1948.

Well 710 is 6½ miles east of Roll, in the river bottom near a group of large irrigation wells. The water level in this well shows a steady lowering as a result of pumping of water for irrigation.

Well 1280, a few hundred feet from a large irrigation canal near Blaisdell, showed a rise in water level during 1948. This rise was caused by greater-than-average recharge from the nearby canal.

Well 1520 is in the Yuma Mesa Irrigation Project. The water level began rising in the fall of 1946, when a nearby sandy area was irrigated for the first time. The water level continued to rise during 1948.

Well descriptions and water-level measurements

155. Western Farm Management Co. NE¼NW¼ sec. 19, T. 6 S., R. 12 W. Records available: 1945-48. Mar. 1, pumping; Sept. 7, 38.16.

195. H. P. Johnson. NE¼NW¼ sec. 13, T. 7 S., R. 12 W. Records available: 1945-47. No measurements made in 1948.

200. Owner unknown. NW¼SW¼ sec. 18, T. 7 S., R. 12 W. Records available: 1945-48. Mar. 1, 21.75; Sept. 7, 23.05.

248. Mr. Ludweid. SW¼SW¼ sec. 22, T. 5 N., R. 13 W. Records available: 1945-46. Measurements discontinued, Feb. 19, 1946.

312. Owner unknown. SE¼SE¼ sec. 1, T. 7 S., R. 13 W. Records available: 1945-48. Mar. 1, 82.79; Sept. 7, 82.90.

575. Mohawk Municipal Water Conservation District. NE¼SE¼ sec. 30, T. 7 S., R. 15 W. Records available: 1945-47. No measurements made in 1948.

628. Ray Tompson. SW¼NW¼ sec. 7, T. 6 N., R. 16 W., near water tower, 1.7 miles west of State Highway 72, 2.1 miles southeast of Bouse. Used drilled stock well, diameter 12 inches, depth 900 feet. Measuring point, top of casing, west side, 1.1 feet above land-surface datum. Records available: 1945-46, 1948.

Date	Water level	Date	Water level	Date	Water level
Jan. 9, 1945	63.02	Feb. 20, 1946	63.14	June 8, 1948	66.11
June 10	63.03	Nov. 17	64.29	Oct. 20	63.70
Oct. 3	61.92				

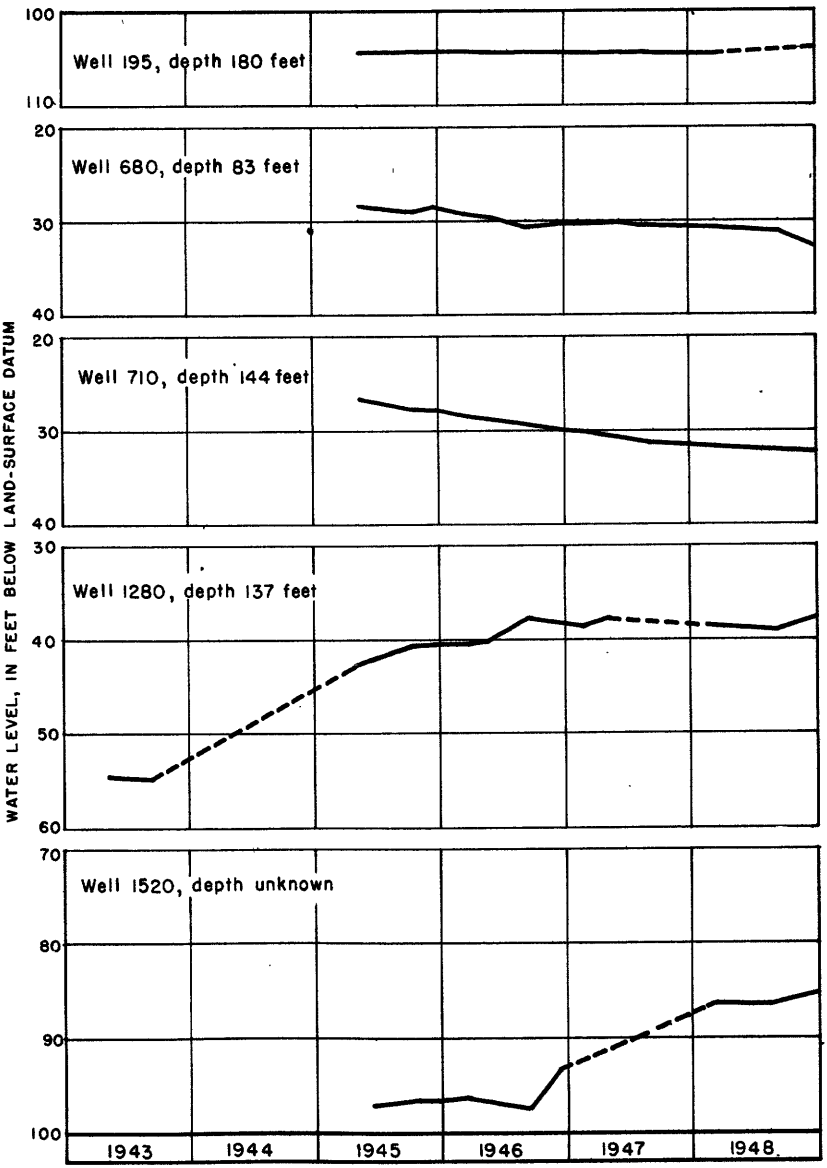

Figure 10.--Graphs showing fluctuations of water level in observation wells in the Lower Gila region, Yuma County, Arizona.

680. Mohawk Municipal Water Conservation District. NE¼NE¼ sec. 33, T. 7 S., R. 16 W. Records available: 1945-48. Mar. 2, 30.71; Sept. 8, 31.03.

710. Western Farm Management Co. NE¼NW¼ sec. 11, T. 8 S., R. 16 W. Records available: 1945-48. Mar. 1, 31.57; Sept. 7, 32.02.

722. Smiley Air Field. NE¼NW¼ sec. 28, T. 8 S., R. 16 W. Records available: 1945-47. No measurements made in 1948.

758. Judge Bellows. NW¼ sec. 22, T. 7 N., R. 17 W. Records available: 1945-47. No measurements made in 1948.

760. V. C. Tarpley. SW¼ sec. 23, T. 7 N., R. 17 W. Records available: 1945-48. June 8, 43.23; Oct. 20, 44.07.

762. Owner unknown. NW¼ sec. 23, T. 7 N., R. 17 W. Records available: 1945-48. June 8, 56.65; Oct. 20, 57.17.

764. Julian M. Jones. Sec. 26, T. 7 N., R. 17 W. Records available: 1945-48. June 8, 32.78; Oct. 20, 33.10.

784. Mohawk Municipal Water Conservation District. SE¼NE¼ sec. 2, T. 8 S., R. 17 W. Records available: 1945-48. Mar. 2, 35.75; Sept. 8, 36.16.

795. Roy Killen. SE¼NE¼ sec. 13, T. 8 S., R. 17 W. Records available: 1945-48. Mar. 1, 29.07.

817. Gust Svensen. SW¼NW¼ sec. 33, T. 8 S., R. 17 W. Records available: 1945-48. Mar. 1, 107.80.

865. R. B. Deason. NE¼NE¼ sec. 27, T. 8 S., R. 18 W. Records available: 1946-48. Mar. 1, 23.21; Sept. 8, 23.23.

900. Robert Welch. NE¼SW¼ sec. 5, T. 9 S., R. 18 W. Records available: 1945-48. Mar. 1, 57.78; Sept. 7, 58.50.

975. Owner unknown. SE¼SW¼ sec. 4, T. 9 S., R. 19 W. Records available: 1945-48. Sept. 7, 23.90.

1280. Owner unknown. SW¼NW¼ sec. 21, T. 8 S., R. 21 W. Records available: 1943, 1945-48. Mar. 2, 38.40; Sept. 8, 38.66.

1474. J. L. Moorish. SE¼SE¼ sec. 25, T. 8 S., R. 22 W. Records available: 1946-48. Mar. 2, 34.02; Sept. 8, 32.67.

1485. Owner unknown. NW¼NW¼ sec. 34, T. 8 S., R. 22 W. Records available: 1945-48. Mar. 2, 27.83.

1520. Owner unknown. SE¼SE¼ sec. 17, T. 9 S., R. 22 W. Records available: 1945-48. Feb. 6, 87.95; June 21, 86.39; Sept. 8, 86.75.

2045. Bureau of Reclamation, U. S. Dept. of Interior. SW¼SE¼ sec. 2, T. 11 S., R. 25 W., about 35 feet east of West Main Canal, 0.5 mile north of U. S.-Mexican International Boundary, 1.5 miles east of San Luis. Driven sand point, diameter 1¼ inches, depth 22.5 feet. Measuring point, top of casing, 5.2 feet above land-surface datum and 93.63 feet above mean sea level. Measurements by Bureau of Reclamation. Records available: 1916-48.

Date	Water level	Date	Water level	Date	Water level
June 1916	5.25	Jan. 1917	7.40	July 1917	3.15
July	5.30	Feb.	7.05	Aug.	5.85
Aug.	7.00	Mar.	5.75	Sept.	6.65
Sept.	7.75	Apr.	6.75	Oct.	7.45
Oct.	8.40	May	5.05	Nov.	7.35
Dec.	6.30	June	3.75	Dec.	6.45

2045--Continued.

Date	Water level	Date	Water level	Date	Water level
Jan. 1918	6.95	Feb. 1926	5.27	Apr. 1932	4.8
Mar.	5.95	Apr.	3.87	May	3.5
Apr.	6.08	May	1.27	June	3.1
May	6.08	June	1.37	July	4.9
Nov.	8.17	July	2.57	Aug.	6.8
Mar. 1919	7.57	Aug.	3.27	Sept.	5.4
Apr.	7.17	Sept.	3.67	Nov.	6.0
May	5.67	Oct.	3.87	Jan. 1933	6.1
June	3.57	Nov.	3.97	Feb.	6.9
July	5.77	Dec.	2.57	Mar.	6.9
Aug.	7.17	Jan. 1927	2.87	May	6.9
Sept.	8.57	Feb.	1.57	Nov.	9.0
Dec.	6.27	Mar.	1.47	Jan. 1934	8.2
Apr. 1920	5.37	Apr.	1.47	Feb.	7.7
June	.37	May	1.37	Mar.	8.0
Nov.	6.37	June	1.77	Apr.	8.7
Feb. 1921	5.97	July	2.57	May	9.3
June	.57	Aug.	2.77	June	9.5
July	2.27	Sept.	2.37	July	10.4
Sept.	4.97	Oct.	2.37	Aug.	11.0
Dec.	6.17	Nov.	2.77	Sept.	11.4
Feb. 1922	6.27	Dec.	2.97	Oct.	11.6
May	3.27	Jan. 1928	2.37	Nov.	11.5
June	.57	Feb.	2.07	Dec.	11.1
July	3.97	Mar.	.77	Jan. 1935	9.6
Aug.	4.97	Apr.	1.37	Feb.	8.8
Sept.	6.47	July	1.87	Mar.	8.9
Oct.	6.87	Aug.	2.0	Apr.	9.1
Nov.	6.87	Oct.	4.8	May	9.7
Dec.	5.77	Nov.	3.4	June	9.9
Jan. 1923	5.77	Dec.	2.9	July	9.2
Feb.	5.77	Feb. 1929	2.7	Aug.	9.6
Mar.	5.67	Mar.	3.0	Sept.	9.6
Apr.	4.27	Apr.	4.0	Oct.	9.7
May	2.07	May	.4	Nov.	8.9
July	1.47	June	.9	Dec.	8.4
Aug.	2.27	Aug.	2.4	Jan. 1936	8.5
Sept.	2.57	Dec.	4.0	Feb.	8.6
Oct.	3.47	Jan. 1930	4.4	Mar.	8.5
Nov.	3.07	Feb.	4.0	Apr.	8.3
Dec.	1.87	Mar.	3.8	May	9.0
Jan. 1924	2.77	Apr.	4.1	June	9.2
Feb.	2.77	May	2.4	July	9.0
Apr.	2.57	June	1.9	Aug.	10.0
May	3.17	July	2.8	Sept.	9.7
June	1.77	Sept.	4.3	Oct.	9.8
July	3.37	Oct.	5.2	Nov.	9.5
Aug.	4.37	Nov.	4.7	Dec.	9.0
Sept.	4.67	Dec.	3.5	Jan. 1937	8.8
Oct.	4.77	Jan. 1931	3.4	Feb.	8.2
Nov.	4.97	Feb.	4.4	Mar.	7.9
Dec.	4.77	Mar.	5.0	Apr.	7.9
Jan. 1925	5.57	Apr.	5.1	May	8.7
Feb.	5.17	May	6.1	June	8.8
Mar.	5.77	June	6.2	July	9.0
Apr.	3.47	July	6.7	Aug.	9.4
May	4.07	Aug.	6.6	Sept.	9.2
June	3.47	Sept.	7.9	Oct.	9.0
Aug.	4.67	Oct.	6.8	Nov.	9.2
Sept.	5.07	Nov.	7.5	Dec.	8.9
Oct.	5.47	Dec.	7.4	Jan. 1938	8.6
Nov.	5.87	Jan. 1932	7.1	Feb.	7.9
Dec.	5.67	Feb.	4.3	Mar.	7.7
Jan. 1926	5.57	Mar.	4.8	Apr.	7.6

2045--Continued.

Date	Water level	Date	Water level	Date	Water level
May 1938	8.2	Dec. 1941	5.0	July. 1945	7.2
June	9.1	Jan. 1942	5.1	Aug.	7.9
July	9.7	Feb.	4.7	Sept.	7.1
Aug.	9.8	Mar.	4.7	Oct.	7.2
Sept.	9.6	Apr.	5.1	Nov.	7.1
Oct.	9.4	May	5.6	Dec.	6.9
Nov.	8.9	June	6.6	Jan. 1946	6.5
Dec.	8.3	July	7.3	Feb.	6.5
Jan. 1939	8.2	Aug.	7.7	Mar.	6.2
Feb.	7.4	Sept.	8.2	Apr.	6.0
Mar.	7.1	Oct.	8.0	May	6.9
Apr.	7.6	Nov.	7.8	June	7.6
May	7.7	Dec.	7.1	July	8.4
June	8.8	Jan. 1943	6.7	Aug.	7.7
July	9.0	Feb.	6.6	Sept.	8.1
Aug.	9.4	Mar.	6.4	Oct.	7.4
Sept.	8.8	Apr.	6.3	Nov.	2.9
Oct.	8.5	May	7.0	Dec.	6.2
Nov.	7.9	June	7.4	Jan. 1947	7.0
Dec.	7.7	July	7.0	Feb.	6.4
Jan. 1940	7.1	Aug.	7.8	Mar.	4.8
Feb.	7.2	Sept.	7.8	Apr.	5.7
Mar.	7.0	Oct.	7.6	May	3.8
Apr.	6.8	Nov.	6.7	June	7.2
May	7.7	Dec.	6.6	July	7.1
June	8.1	Jan. 1944	6.0	Aug.	6.0
July	8.8	Feb.	6.4	Sept.	7.5
Aug.	9.0	Mar.	6.3	Oct.	5.0
Sept.	9.8	Apr.	6.3	Nov.	5.2
Oct.	8.4	May	6.7	Dec.	6.3
Nov.	7.0	June	7.3	Jan. 1948	5.8
Dec.	7.2	July	7.9	Feb.	5.1
Jan. 1941	6.8	Aug.	7.8	Mar.	4.3
Feb.	6.7	Sept.	7.8	Apr.	4.3
Mar.	6.6	Oct.	6.7	May	6.1
Apr.	6.8	Nov.	4.3	June	6.6
May	6.7	Dec.	6.6	July	7.5
June	6.0	Jan. 1945	6.6	Aug.	7.2
July	7.3	Feb.	6.6	Sept.	6.9
Aug.	7.3	Mar.	5.9	Oct.	6.9
Sept.	6.9	Apr.	5.7	Nov.	3.7
Oct.	6.1	May	6.1	Dec. 13	4.7
Nov.	5.5	June	7.1		

CALIFORNIA

By A. A. Garrett, O. J. Wittman,
M. A. Warren, and G. F. Worts, Jr.

SCOPE OF WATER-LEVEL PROGRAM

This report shows the progress made in 1948 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 4,128 water-level measurements during 1948 in 528 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 in 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 1948

County	Number of observation wells			Number of records of water levels in this report	Number of wells with water-stage recorders (R) or float gages (F)		
	Established during 1948[a]	Discontinued in 1948	At year end		Throughout 1948	Part of 1948	At year end
Kern County:							
Antelope Valley, part	0	0	c 3	10	0	0	0
Los Angeles County:							
Antelope Valley, part	6	13	d121	b299	1R	1R	1R
San Gabriel River basin	0	0	1	366	1R	0	1R

a Includes wells established prior to 1948 but for which water-level records are renewed or are given for the first time in this report.

Distribution of observation wells in California in 1948--Continued

County	Number of observation wells			Number of records of water levels in this report	Number of wells with water-stage recorders (R) or float gages (F)		
	Established during 1948[a]	Discontinued in 1948	At year end		Throughout 1948	Part of 1948	At year end
Los Angeles County--Continued							
Coastal plain	0	0	13	381	0	0	0
Orange County:							
Coastal plain	0	0	22	b488	0	0	0
Riverside County:							
San Jacinto Valley	0	0	8	35	0	0	0
San Bernardino County:							
Chino basin	4	0	4	201	1R	3R	4R
Mojave River basin	7	6	c 77	b150	0	0	0
Santa Ana River basin	0	0	10	90	0	0	0
San Diego County:							
San Luis Rey River basin	1	0	17	115	0	0	0
San Dieguito River basin	0	0	6	24	0	0	0
San Diego River basin	3	0	23	94	0	0	0
Sweetwater River basin	0	0	d 1	4	0	0	0
Otay River basin	0	0	d 1	6	0	0	0
Tia Juana River basin	0	0	4	22	0	0	0
San Joaquin County:							
Mokelumne River basin	1	1	22	260	0	0	0
Santa Barbara County:							
Carpinteria basin	0	1	17	117	0	0	0
Goleta basin	1	1	25	288	1F	1R	1R, 1F
Middle Santa Ynez Valley	0	0	16	120	0	0	0
Lower Santa Ynez Valley	4	1	62	577	0	1R	1R
San Antonio Valley	0	0	4	39	0	0	0
Santa Maria Valley area	0	0	40	381	0	1F	0
Cuyama Valley	0	0	8	61	0	0	0
The State	27	23	505	4,128	3R, 1F	6R, 1F	8R, 1F

a Includes wells established prior to 1948 but for which water-level records are renewed or are given for the first time in this report.
b In 1948 only; previous water levels also given in this report.
c 4 additional wells in which no measurements were made in 1948.
d 1 additional well in which no measurements were made in 1948.

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 western portion of the San Fernando Valley in the city of Los Angeles monthly measurements were made in about 65 piezometer wells by the Soil Conservation Service, United States Department of Agriculture, in cooperation with the city of Los Angeles and the San Fernando Valley Soil Conservation District. In the San Bernardino Valley, the San Bernardino

Valley Water Conservation District continued measurements in about 300 wells and summarized the fluctuations of ground-water level in an annual mimeographed statement. In the Imperial Valley, measurements of ground water were made by the Imperial Irrigation District in cooperation with the Division of Irrigation of the Soil Conservation Service, United States Department of Agriculture, as follows: in the East Mesa area in continuation of observations begun in 1942 by the Bureau of Reclamation, United States Department of the Interior, quarterly in about 37 observation wells; semiannually in 28 observation wells in the West Mesa area; in about 11 observation wells in the Pilot Knob area; and annually in 30 artesian wells in the valley floor area. Chemical analyses of these well waters were made by the Imperial Irrigation District from samples collected by the Division of Irrigation of the Soil Conservation Service. 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, 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. The assembled records for 1946 have been published in the Division's Bulletin 39-0 which continues the series beginning with Bulletin 39, published in 1932.

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.

Programs of water-level measurement by local agencies in the South Coastal Basin in 1948

Subarea and agency	Frequency of measurements			
	Semi-annually	Quarterly	Monthly	More frequently
Coastal Plain, Los Angeles County:				
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+	

Programs of water-level measurement by local agencies in the South Coastal Basin in 1948--Continued

Subarea and agency	Frequency of measurements: Semi-annually	Quarterly	Monthly	More frequently
Coastal plain, Orange County:				
Orange County Flood Control District		20	445	57
Orange County Water District (Santa Ana Gap)			16	
San Fernando Valley:				
Los Angeles Department of Water and Power	194		95	49
Los Angeles County Flood Control District	140		58	
Soil Conservation Service (Western part of valley)			65	
San Gabriel Valley:				
Los Angeles County Flood Control District	260		50	
San Gabriel Valley Protective Association			100[1]	
Upper Santa Ana Valley:				
Chino Basin				
San Bernardino County Flood Control District	500			
San Bernardino Valley				
San Bernardino Valley Water Conservation District	Measurements in about 300 wells and fluctuations of ground-water level summarized in an annual mimeographed report.			

RAINFALL AND SNOWFALL

The following general summary of precipitation in California for the calendar year 1948 is quoted from the annual report of climatological data issued by the Weather Bureau.[1]

> "At the beginning of 1948 the State of California was faced with a serious water shortage. This critical drought was cause for much concern. By order of the Governor of California, power was curtailed for many weeks leaving many cities in near darkness. After fourteen months of comparative drought, generous rains and snow in March alleviated this serious situation to a considerable extent. Above normal amounts of precipitation occurred in all months from March through June. The late rains and attending much below normal temperatures caused most fruits, vegetables, and field crops to develop slowly. Generally below normal temperatures continued throughout the rest of the year, contributing to slow growth in most crops and delaying the date of maturity of many crops."

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 greatest

[1] U. S. Department of Commerce, Weather Bureau, Climatological data, California Section, Vol. 52, No. 13, 1948.

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 52 years ending with 1948. The second table shows the relative wetness of the water year ending September 30, 1948, 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, 1947-48 was considerably less than the average for the 50-year period ending with 1939-40.

The 15-station average was only 74 percent of the 50-year average, extremes in the table ranging from 37 percent at Indio to 110 percent at Eureka. Rainfall ranged from about average in the Northern Coast Ranges and in the Sierra Nevada to about 40 percent of average in the Great Basin (desert area). In the larger agricultural areas of the State, rainfall ranged from 50 to 80 percent of normal. The records show that 1948 was the third consecutive year of below-average rainfall with 1945 being slightly above average and 1944 slightly below. Thus, since 1943 ground-water replenishment essentially has been below average and ground-water storage has been depleted. The extent of the depletion in many of the basins in the State is shown by the records of water levels in the ensuing sections of this report.

State-wide average monthly and yearly precipitation in California, in inches, based on the 52-year period 1897-1948[2]

October	1.29	April	1.72
November	2.43	May	.94
December	3.88	June	.33
January	4.59	July	.08
February	4.46	August	.10
March	3.68	September	.42
	20.33		3.59
The year			23.92

2 From "Climatological Data", op. cit., monthly and seasonal precipitation for the season July 1947 to June 1948, inclusive, and for the months July-September 1948.

Precipitation and relative wetness for the year ending September 30, 1948, at 15 representative climatologic stations in California

Province	Station and county	Precipitation, 1947-48	
		Inches	Percentage of 50-year average[a]
Northern Coast Ranges	Eureka, Humboldt	42.45	110
Coast Ranges of central and southern California	San Francisco, San Francisco	15.72	78
	San Luis Obispo, San Luis Obispo	15.50	74
	Santa Barbara, Santa Barbara	9.20	51
	Los Angeles, Los Angeles	7.12	49
	San Bernardino, San Bernardino	10.69	66
	San Diego, San Diego	6.65	68
	Cuyamaca, San Diego	28.77	74
Great Valley (California Trough)	Red Bluff, Tehama	22.86	99
	Stockton, San Joaquin	11.36	81
	Fresno, Fresno	7.96	84
Sierra Nevada	Nevada City, Nevada	51.21	105
	West Point, Calaveras	38.45	97
Great Basin (Southwestern Bolson province)	Indio, Riverside	1.22	37
	Needles, San Bernardino	1.87	42

a Average for years ending Sept. 30, 1891, to 1940.

RUNOFF

The runoff in California streams during the water year ending September 30, 1948, was generally below normal in the southern part of the State to normal in the portion north of San Francisco Bay. 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 120 percent of normal; for the combined flow of the Sacramento and San Joaquin Rivers and tributaries, about 78 percent; and for Kings River at Piedra, in the southern Sierra drainage, 66 percent.

The 1947-48 runoff in southern California streams ranged from no flow to 94 percent of the average seasonal runoff. However, only 3 percent of the stations exceeded 59 percent of their average seasonal runoff and at

42 percent of the stations the runoff did not exceed 9 percent of their average seasonal runoff. The extreme dryness of the 1947-48 water year is further indicated by the fact that at 77 percent of the gaging stations the runoff was less than 30 percent of the average.

Only in two small areas along the San Gabriel and Santa Ana Rivers, where the flow is largely derived from ground-water seepage, did the 1947-48 seasonal runoff equal or exceed 60 percent of the average seasonal runoff. Representing the greatest runoff during the year from the mountain drainage areas, the runoff in the streams of the San Bernardino and San Jacinto Mountains ranged from 40 to 60 percent of the average. However, from these mountain areas of greatest runoff, the seasonal runoff showed a gradual decrease in all directions to the less than 10 percent of average for most of the coastal and desert areas.

SUMMARIES OF PROGRAMS, HYDROLOGIC CONDITIONS, AND WATER-LEVEL FLUCTUATIONS

Coastal plain in Los Angeles and Orange Counties

Program of work

Although no program of water-level measurement was undertaken by the Geological Survey in the coastal plain in Los Angeles and Orange Counties for 1948 the extensive programs for periodic measurements of observation wells are being continued by several local agencies--in Orange County 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, the city of Long Beach, and the California Division of Water Resources. For the observation wells tabulated in this annual report, water-level measurements have been furnished by one or more of these agencies.

In 1948, the Geological Survey concluded its investigation of ground-water conditions in the Torrance-Santa Monica area in cooperation with the Los Angeles County Flood Control District and certain municipalities. The interpretive final report concerning this area was released in May.[3]

The investigation was continued for the Corps of Engineers, United States Army, pertaining to ground-water conditions along the Rio Hondo and

3 Poland, J. F., Garrett, A. A., Sinnott, Allen, Geology, hydrology, and chemical character of the ground waters in the Torrance-Santa Monica area, Los Angeles County, Calif.: U. S. Geol. Survey duplicated report, 472 pp., appendix, May 1948.

lower Los Angeles River, in connection with a proposed program for flood control.

In this report, records are included for 35 wells in the main coastal basin in Los Angeles and Orange Counties, and in the so-called West basin southwest of the Newport-Inglewood uplift in Los Angeles County. Of these wells, records for 30 have been furnished by local agencies. Of six wells measured by the Geological Survey, one was measured monthly; the other five are "permanent" observation wells, of which three were visited twice and two were visited once during the year.

Of the 68 wells for which records for 1947 were published in Water-Supply Paper 1101, 33 do not appear in this report. These wells, which were discontinued in 1947 either at year-end or earlier, are listed in the following table.

Wells in which water levels were measured by the Geological Survey in 1947 but not in 1948

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	14F1
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 in the calendar-year 1948 was about 45 percent of normal. In the water year ending September 30, 1948, rainfall on the area was about 50 percent of normal. This small difference in rainfall for the two periods is caused by a slightly greater rainfall near year-end 1948 than near year-end 1947.

The following table shows rainfall records for both the calendar-year 1948 and for the water-year 1947-48. The use of the water year, which spans the rainy season, gives a more consistent approach to the relation of rainfall to runoff and to ground-water replenishment. However, because water-level records are tabulated in the annual reports on a calendar-year basis, rainfall records are also tabulated on that basis.

Because of a severe deficiency of rainfall during the early part of the year, pumping for irrigation began unusually early. As a result, the spring recovery of water levels in the main coastal basin, as indicated by several observation wells, was markedly suppressed.

Average rainfall, in inches, for three stations[a] 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 1947	0.65	0.10	-0.55	-85
November	.92	.28	-.64	-70
December	2.76	1.74	-1.02	-37
January 1948	2.51	0	-2.51	-100
February	3.00	1.21	-1.79	-60
March	2.21	2.13	-.08	-4
April	.92	1.15	+.23	+25
May	.39	0	-.39	-100
June	.07	.17	+.10	+143
July	0	0	0	0
August	.04	0	-.04	-100
September	.24	0	-.24	-100
The water year 1947-48	13.71	6.78	-6.93	-51
October	.65	.06	-.59	-91
November	.92	0	-.92	-100
December	2.76	2.64	-.12	-4
The calendar year 1948	13.71	7.36	-6.35	-46

a Los Angeles, Long Beach, and Santa Ana.

The following table summarizes water-level fluctuations in 29 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 1947 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 West basin southwest of the Newport-Inglewood uplift. Within the main coastal basin, 15 index wells in Orange County show an average net drop of 6.4 feet in the year 1948 and a net drop of 2.6 feet since 1936; 5 index wells in Los Angeles County show an average net drop of 6.3 feet in 1948, a net drop of 7.9 feet since 1936. Within the West basin of Los Angeles County, 5 index wells show an average net drop of 3.7 feet during 1947 and a net drop of about 30 feet since 1936.

Summary of water-level fluctuations in 29 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	1947	1948	1936-48	1947-48
Wells in the main coastal basin--Orange County					
3/11-36Q2	18.2	26.1	18.3	+0.1	-7.8
4/9-7B1[b]	11.2	37.4	Dry	....	....
4/10-22L2	10.2	21.9	7.5	-2.7	-14.4
4/11-19K1	10.9	14.3	6.0	-4.9	-8.3
5/10-9D1	10.0	16.7	9.5	-.5	-7.2
5/11-2E1	4.4	8.1	3.3	-1.1	-4.8
5/11-16D2	2.0	4.7	.4	-1.6	-4.3
5/11-25P1	3.5	4.9	-5.9	-9.4	-10.8
5/11-28A1	.6	.7	-5.6	-6.2	-6.3
5/11-29C4[b]	...	1.5	-1.5	....	-3.0
5/12-12P1	.9	2.1	1.2	+.3	-.9
6/10-1E1	.2	5.0	-2.4	-2.6	-7.4
6/10-1L2	17.1	20.0	17.9	+.8	-2.1
6/10-5C1	3.5	6.3	0.0	-3.5	-6.3
6/11-13G2	.8	.9	-2.1	-2.9	-3.0
I-9F1	-1.8	3.1	-3.9	-2.1	-7.0
Averages:	5.8	9.6	3.2	-2.6	-6.4
Wells in the main coastal basin--Los Angeles County					
2/12-13A1	133.5	152.8	138.7	+5.2	-14.1
3/12-8L3	62.6	64.5	59.2	-3.4	-5.3
3/13-8L2	35.4	9.9	c 6.4	-29.0	-3.5
4/11-5D1	14.5	28.1	d 18.4	+3.9	-9.7
4/12-8P1	-14.2	-31.2	-30.3	-16.1	+.9
Averages:	46.4	44.8	38.5	-7.9	-6.3
Wells in the West (coastal) basin, tapping the Silverado water-bearing zone of Pleistocene age or its equivalent					
2/15-34H1	-0.8	-4.1	-3.2	-2.4	+0.9
3/13-18G2	13.4	-36.1	d-43.6	-57.0	-7.5
3/14-3K1[b]	....	-32.6	d-53	....	-20.4
3/14-21B1	-11	-38.7	d-43	-32	-4.3
3/14-36M3[e]	-13.5	-22.1	-23.8	-10.3	-1.7
4/13-14L1[f]	.3	.1	-2.6	-2.9	-2.7
4/13-23G2	-34.3	-62.3	-67.1	-32.8	-4.8
4/13-33D1	-30.5	-52.4	-55.2	-24.7	-2.8
Averages:	-12.6	-38.7	-42.4	-29.8	-3.7

a Chiefly interpolated.
b Excluded from averages.
c Measurement on Dec. 30, 1948.
d Measurement on Dec. 28, 1948.
e Taps shallow deposits of Pleistocene age; excluded from averages.
f Taps Gaspur 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 1948 in 124 wells. These included six wells of which four were established during 1948 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 one well were measured by continuous water-stage recorder during the entire year and in another from January to June; in 12 wells measurements were made at approximately monthly intervals; 16 were measured bimonthly; and in most of the remainder only one measurement 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 1947 to the fall of 1948 was about 4.2 feet. The greatest declines were shown in T. 7 N., Rs. 10 and 11 W., 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 1948 in 77 wells. These included six wells which were established during 1948, 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. During 1948, the levels in most of the wells were measured in April, May, November, and December.

During the water year ending September 30, 1948, the discharge of the Mojave River near Victorville was 40 percent of the 23-year average, and there has been no flow at Barstow since March 23, 1947.

Measurements of water levels in 16 wells in the upper Mojave River basin (the area between the confluence of Deep Creek and West Fork of the Mojave River and Barstow) show an average net decline of 4.02 feet. Of the group two wells showed a slight rise and one well was flowing.

Wells in the area between Barstow and near Daggett varied considerably. Twenty wells indicated an average net decline of 0.83 foot, the greatest range being between well 9/1W-13B1, which showed a decline of 8.12 feet, and well 8/4W-31D1, which showed a rise of 2.12 feet.

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In the area east of Daggett, 28 wells showed an average net decline of 1.17 feet. The net change varied from a decline of 7.37 feet in well 9/1E-18E1 to a rise of 2.41 feet in well 9/3E-3D1. One well, 5/4W-35A1, was flowing about 1/2 second-foot on December 1.

Mokelumne River basin, San Joaquin County

During 1948 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 260 measurements were made during the year.

Of the original 24 wells, 1 was destroyed in September 1946, 3 more were destroyed or abandoned because of lowering water table before the end of 1947, and 1 was replaced in 1948. As a rule, a nearby well has been measured to replace each abandoned well. The following table correlates the average yearly water-level changes in the index wells (21 in 1948) with the fluctuations in yearly rainfall, beginning with 1944. In this table the accumulated changes begin with 1934, as shown in the report for 1945. The water level in the Mokelumne area declined for the sixth consecutive year. The decline in 1948 was about a fourth of that in the preceding 2 years, but the trend was still towards lower water levels. Rainfall at the three stations was 97 percent of average, a considerable increase over that for 1947, which was only 62 percent of average.

Average yearly rise or decline of water level in 24 observation wells, and yearly rainfall in the Mokelumne area, 1944-48

	Water level		Rainfall[a]	
Year	Yearly rise (+) or decline (-) (feet)	Accumulated rise (+) or decline (-)[b] feet	Excess (+) or deficiency (-) (inches)	Accumulated excess (+) or deficiency (-)[b] (inches)
1944	-2.32	+0.57	+0.46	+22.67
1945	-.06	+.51	+9.50	+32.17
1946	c -2.24	c -1.73	-8.92	+23.25
1947	d -2.80	d -4.53	-14.69	+8.56
1948	d -.78	d -5.31	-.89	+7.67

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 1948 during the periods of increasing and of diminishing withdrawals for irrigation, respectively. This table shows that recharge sarly in 1948 was insufficient to offset the withdrawals for irrigation, as indicated by the average decline of 1 foot. During the last half of the year, water levels rose slightly so that the average net change for the year was a decline of 0.8 foot.

Seasonal changes in water level, in feet, in 21 observation wells in the Mokelumne area, 1948

Period	Greatest rise	Greatest recession	Average change
Jan. 1 to May 31 (increasing withdrawal for irrigation)	+5.04	-6.20	-1.01
June 1 to Dec. 31 (diminishing withdrawal)	+4.45	-4.32	+.23
The year	+1.92	-3.10	-.78

San Gabriel River basin, Los Angeles County

A continuous water-stage recorder was in operation throughout 1948 on well 1S/10-18, at Baldwin Park, in the upper San Gabriel Valley. The water level in this well declined steadily from a mean daily elevation of 291.58 feet above sea level on January 1 to an elevation of 278.44 feet, the lowest of the year on December 31. On that date the stage was 13.14 feet below the highest stage of the year, and below the mean daily stage of December 31, 1947, was 50.7 feet below the record high stage of 329.1 feet on May 19, 1916, and 21.3 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 37 wells in San Diego County in 1948 indicate net declines during the year in all of the 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 4.18 feet in 3 wells in the Tia Juana River basin to 5.12 feet in 15 wells in the San Diego River basin. In the Otay River basin, the net change in water level is indicated by one measurement in well 18/2W-22, a net rise of 1.07 feet. This was the only well in the entire series that showed a net rise. In the Sweetwater River basin observations of two wells indicated declines. Well 17/1W-19 was dry on April 1 and well 17/1W-19a went dry by July 15. The greatest net decline

in any of the measured wells was 12.14 feet in well 15/1E-17B1 in the San Diego River basin.

During the calendar year 1948, 7 observation wells in the county went dry, measurement of 2 wells was discontinued, and measurement of 4 wells was begun.

Summary of net water-level changes, in feet, in 37 observation wells in San Diego County, 1948

Basin	Number of wells	Number of measurements	Greatest net rise	Greatest net decline	Average net change
San Luis Rey River, Bonsall basin	7	5	a 2.89	5.10	-0.68
San Luis Rey River Mission basin	6	4 & 12	0	9.29	-5.60
San Dieguito River, San Pasqual Valley	5	5	0	2.90	-1.72
San Diego River, below El Capitan Dam	15	5	0	b12.14	-5.12
Sweetwater River basin	2	1 & 4	0	.....	.....
Otay River, at Otay	1	6	1.07	0	+1.07
Tia Juana River, below San Ysidro	3	6	0	7.29	-4.18

a Well 10/3W-1c, San Luis Rey River basin
b Well 15/1E-17B1, San Diego River basin.

Santa Ana River basin, Riverside and San Bernardino Counties

Chino Basin

Beginning in 1947 the Geological Survey in cooperation with San Bernardino County started a program to investigate the ground-water conditions at the lower end of the Chino Basin with special reference to ground-water outflow from the basin. By the end of 1948, considerable progress on the investigation had been made. As a part of the field program, water-stage recorders were established on four wells in the Chino Basin--one in 1947 and three in 1948. All wells are within or adjacent to the area of ground-water escape. These records were collected near one edge of the basin for special study purposes and are not to be considered as representative of conditions throughout the basin.

San Bernardino area

Observations of water level in the San Bernardino area were continued in 1948 in 10 wells; in 8 of these, levels were measured in February, May, August, and November; in well 1S/3W-17C1, the Williams well, at weekly intervals; and in well 1S/3W-20B1, at monthly intervals.

The water level in the Williams well, near Redlands, fluctuated from 27.86 feet below land-surface datum on January 3 to 27.20 feet on February 28, the highest observed stage of the year, then declined continuously to 39.28 feet on December 25, the lowest observed stage of the year. The net decline in water level for the year was 11.4 feet. The lowest observed level of record was 55.68 feet below land-surface datum on October 24, 1936--16.4 feet lower than the lowest level of the year. During 1892-93 the water level stood at the top of the casing, which was 3.8 feet above land surface.

The average net decline in water level during the year in seven wells in the San Bernardino area, as indicated by the February measurements of 1948 and 1949, was 5.55 feet. The net change between those two dates, in all of the nine wells ranged from a decline of 14.2 feet in well 1S/3W-3N1 to a rise of 1.2 feet in well 1S/3-16L1.

San Jacinto valley

Observations of water level in the San Jacinto valley were continued in 1948 in eight wells by measurements made during February, April, August, and November.

The net change in water levels during the year is best indicated by comparisons of the measurements made on February 6, 1948, and February 24, 1949. Excluding three wells because of incomplete record, the average net change in water level between those dates in the other five wells distributed over the valley was a decline of 1.1 feet. Net changes shown in the five wells ranged from a decline of 6.4 feet in well 5/1W-2N1 to a rise of 1.81 feet in well 3/2W-35Q1.

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 1948 in cooperation with the Santa Barbara County Water Agency. Water-Supply Paper 1068[3]

3 La Rocque, G.A., Jr., Upson, J. E., and Worts, G. F., Jr., Wells and water levels in principal ground-water basins in Santa Barbara County, Calif.: U. S. Geol. Survey Water-Supply Paper 1068, 1950.

contains tabulated descriptions for 2,246 wells in the seven ground-water basins in Santa Barbara County. This publication also contains many water-level measurements made prior to 1942 by the Federal Geological Survey, city of Santa Barbara, Santa Maria Valley Water Conservation District, San Joaquin Power Division of Pacific Gas and Electric Company, Union Sugar Company, Union Oil Company, and other organizations and individuals.

The six principal ground-water basins in the county are: the Carpinteria, Goleta, Middle 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,[4] the south-coast basins[5]--the Carpinteria and Goleta areas--the Santa Maria Valley,[6] and the Cuyama Valley,[7] have been prepared.

Water levels are also observed in the San Antonio Valley, the seventh ground-water basin. It is about 20 miles long and lies 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. Beginning in January 1948, water-level fluctuations have been observed in one well in the city of Santa Barbara.

In 1948 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. Of the 170 observation wells being maintained at the end of 1947, 3 were discontinued during 1948 and 5 new wells were established, making a total of 172 active at the end of the year. During 1948 most of these wells were visited monthly; a few were equipped with water-stage recorders or "high-low" float gages.

4/ Upson, J. E., Thomasson, H. G., Jr., and others, Geology and water resources of the Santa Ynez River Valley, Santa Barbara County, Calif.: U. S. Geol. Survey Water-Supply Paper 1107 (in course of preparation).

5 Upson, J. E., Thomasson, H. G., Jr., and others, Geology and ground-water resources of the south-coast basins of Santa Barbara County, Calif. with a section on surface-water resources: U. S. Geol. Survey Water-Supply Paper 1108 (in course of preparation).

6 Worts, G. F., Jr., and Thomasson, H. G., Jr., Geology and ground-water resources of the Santa Maria Valley area, Santa Barbara County, Calif. with a section on surface-water resources: U. S. Geol. Survey Water-Supply Paper 1000 (in course of preparation).

7 Upson, J. E., and Worts, G. F., Jr., Ground water in the Cuyama Valley, Calif.; U. S. Geol. Survey Water-Supply Paper 1110 (in course of preparation).

Rainfall in Santa Barbara County for the year ending September 30, 1948, was appreciably below normal, making the fourth consecutive year of below-normal rainfall. Rainfall at two stations with long records, Santa Barbara and Santa Maria, was 9.20 and 8.21 inches, respectively. The average annual rainfall for the 81-year record at Santa Barbara is 18.10 inches and for the 63-year record at Santa Maria is 14.17 inches. On the basis of these and about 20 additional records, rainfall over most of the county for the year ending September 30, 1948, appeared to range from 40 to 60 percent of normal.

Due to low precipitation, recharge to the ground-water reservoirs was small and withdrawals by pumpage for irrigation were above average. As a result the water levels in most areas continued to decline.

In 1948 the total pumpage of ground water for irrigation and for municipal, industrial, domestic, and stock use in Santa Barbara County is estimated to have been 175,000 acre-feet--somewhat less than that estimated for 1947. The city of Santa Barbara began to pump from wells for municipal use in February 1948, and during the remainder of the year pumped about 3,000 acre-feet of ground water. The balance of the municipal water supply was obtained from Gibralter Lake, by seepage from Mission and Cold Springs Tunnels, and from the Montecito County Water District, which supplied about 300 acre-feet. In addition to pumpage of ground water for municipal use a small quantity was pumped for irrigation and industries from privately owned wells within the city limits.

The Montecito County Water District began pumping from wells within the district in June 1948, and during the year pumped an estimated 65 acre-feet from wells. The balance of its water supply was obtained from Jameson Lake, by seepage from Doulton Tunnel, and from wells in the gravel deposits of the Santa Ynez River downstream from Jameson Lake. Within the boundaries of the Montecito County Water District additional ground water was also pumped from private wells for irrigation and domestic use.

Total pumpage for irrigation alone in Santa Barbara County is estimated to have been about 160,000 acre-feet. Because in some areas a part of the water applied to crops seeps downward to return to the water table, the figure for total pumpage is not the amount 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 for irrigation is roughly estimated for the year 1948 as 140,000 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 used during the year for pumping ground water for irrigation by the 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 rainfall at 3 stations for the 8-year period, 1941-48. The hydrographs show that in most areas there was a general rise of water levels through 1943 and in some areas this rise extended through 1944 into the spring of 1945. In 1948 the ground-water levels were substantially below those of 1944.

Because hydrologic conditions differ considerably from one ground-water basin to another the fluctuations of water levels are discussed separately.

Carpinteria basin

The total pumpage of ground water within the Carpinteria basin is estimated to have been 5,200 acre-feet for the period May 1, 1948, to April 30, 1949. This amount is about 900 acre-feet less than the pumpage during the preceding 12 months, but is still about three times the estimated perennial yield of 1,700 acre-feet a year.[8/] This continued heavy draft has caused the ground water levels to continue to decline.

Due to low precipitation during the fall of 1947 and winter of 1948, pumping for irrigation continued during the winter months. This caused the seasonal high levels in the spring of 1948 to be considerably below the spring levels of 1947. The maximum water levels of 1948 occurred in most wells about the end of April, and for 15 observation wells distributed over the basin the maximum levels ranged from 10 feet below the 1947 maximum levels in the western part of the basin to about 45 feet below in the eastern part of the basin. The average net decline was about 24 feet for the basin as a whole. In well 4/25-27Q2 (fig. 11), near the center of the Carpinteria basin, the maximum level of 1948 was about 24 feet below the

8/ Upson, J. E., Thomasson, H. G., Jr., and others, op. cit., p. 136.

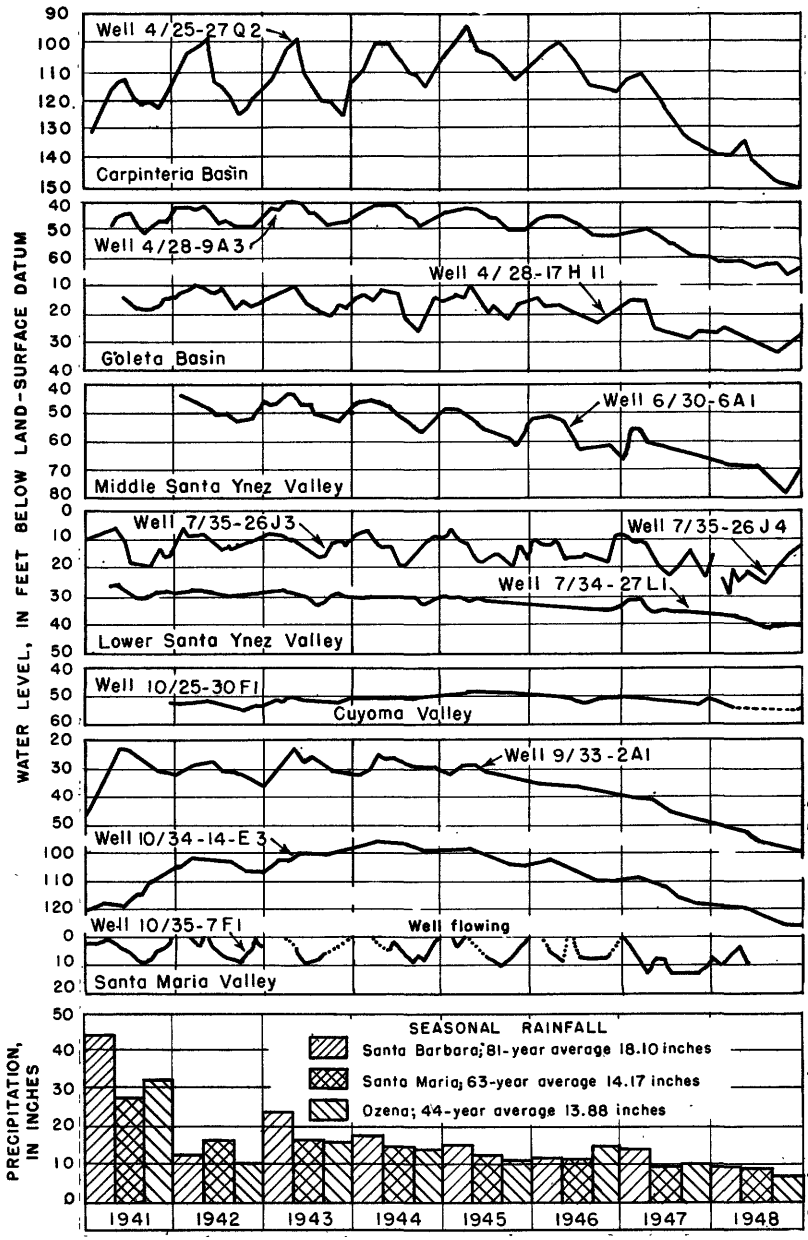

Figure 11.-- Graphs showing water -level fluctuations in 10 wells in Santa Barbara County, California, and seasonal rainfall at Santa Barbara, Santa Maria, and Ozena for the years 1941-48.

maximum level of 1947. In this well the water level at the end of 1948 was about 14 feet lower than at the end of 1947.

The average decline in water levels between the end of 1947 and the end of 1948 was about 12 feet for the basin as a whole, and ranged from slight rises in the western part of the area near the coast to declines of as much as 30 feet in the eastern part. Thus, the decline of water levels has been less in the western part of the basin than in the central and eastern parts. This difference has been due largely to concentration of the pumping in the central and eastern parts of the basin. However, near the coast, in the western part of the basin, the aquifers may be in hydraulic connection with the ocean and, if so, water levels there may be sustained primarily by the ocean-water head. Wells near the coast now are being sampled periodically for chemical analyses in order to determine whether ocean-water encroachment is occurring.

At the end of 1948 static water levels in wells in nearly all of the main lowland part of the basin were below sea level--at places as much as 30 feet.

Goleta basin

Total ground-water pumpage in the Goleta basin during the 12-month period May 1, 1948, to April 30, 1949, is roughly estimated to have been 9,000 acre-feet, which is about three times the estimated perennial yield of 3,100 acre-feet a year.[9] Excessive pumpage combined with lack of recharge due to low rainfall during the past 4 years caused the water levels to continue to decline. For 13 wells tapping the confined portion of the main ground-water body beneath the central part of the alluvial plain, the maximum levels in 1948 ranged from 2 to 14 feet below the maximum levels of 1947 and averaged about 8-1/2 feet below. Water levels in the same 13 wells at the end of 1948 ranged from 2 to 9 feet lower than at the end of 1947, averaging about 5-1/2 feet lower. For wells in the marginal part of the basin, in the recharge area, the average decline from maximum water levels in 1947 to maximum water levels in 1948 was about 12 feet, ranging in 10 observation wells from 2.5 to 18.5 feet. Water levels in the same 10 wells averaged nearly 10 feet lower at the end of 1948 than at the end of 1947 and ranged from 4 to 14 feet lower in individual wells. For the

9 Upson, J. E., Thomasson, H. G., Jr., op. cit., p. 210.

Goleta basin as a whole, the average decline in water levels between the spring peaks of 1947 and 1948 was about 10 feet and the average decline between the year-end water levels was about 7 feet.

The greater decline for the maximum water levels, which occur in the spring of each year, than for the year-end water levels, was due to abnormally large winter irrigation during the winter of 1947-48 which did not allow the water levels as much opportunity for recovery as ordinarily occurs during the winter months. From July 1, 1947, to March 12, 1948, only 2.33 inches of rain was recorded at the Santa Barbara Airport, near Goleta.

The hydrographs of two wells, 4/28-9A3 and 4/28-17H11 (fig. 11), illustrate the general conditions in the years 1941 to 1948. Both wells are in the area of confined water and heavy withdrawals and are fairly representative of average conditions in the Goleta area. For the basin as a whole the average decline from the spring peak water levels of 1945 to those of 1948 was about 16 feet; from the end of 1945 to the end of 1948 it was about 18 feet. At the end of 1948 water levels were below mean sea level in about half of 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 expanded as water levels throughout the basin have declined.

In the Goleta basin two observation wells, 4/28-16F3 and 4/28-17H3, tap a shallow water body in the area of confined water from which there is essentially no pumping. During the year 1948 the water level in these wells declined from 1 to 2 feet.

Middle Santa Ynez valley

Total pumpage in the Middle Santa Ynez valley during 1948 is estimated to have been 15,000 acre-feet, about 3,000 acre-feet less than the estimated pumpage for 1947. Water levels in wells along the Santa Ynez River declined only slightly during 1948, the approximate average net decline being about 1 foot during the year. The water level in most wells in this reach generally go through a seasonal fluctuation which varies from 1 or 2 feet to 10 feet or more, depending largely on the location of each well with respect to pumped irrigation wells and the rate at which water is pumped from these wells during the irrigation season. Even though 1948 was the

fourth year of subnormal rainfall and comparatively heavy pumping, the slight decline indicates that there was sufficient recharge to the ground-water bodies adjacent to the Santa Ynez River nearly to equal the quantity of water used.

In the Santa Ynez upland, north of the Santa Ynez River, ground-water levels continued to decline during 1948. The rate of decline for the area as a whole was about the same as during 1947. The decline, although it varied considerably in individual wells, was greater in the northern and central parts of the Santa Ynez upland than in the southern part. In well 7/31-23P1, at Los Olivos, the average rate of decline since 1945 has been about 7 feet a year, although the net change in water level during 1948 was 15 feet. In wells 6/30-6A1, 6/31-2K1, 7/31-36G2, and 7/31-36L2, all in the northern or central parts of the upland, the average decline since 1945 has ranged from 4 to 5 feet a year. The hydrograph for well 6/30-6A1, 3 miles southeast of Los Olivos, is shown on figure 11. The net decline in this well from the end of 1947 to the end of 1948 was about 2 feet, compared with a decline of 10 feet for the preceding year. However, the average decline since 1945 has been about 4.7 feet a year. In wells 6/30-7K1, 6/30-9N1, and 6/31-13D1, respectively, about 2-1/4, 1-1/4, and 1-1/2 miles north of the Santa Ynez River, the decline in water levels since 1945 has averaged 1.2, 0.7, and 1.6 feet a year, respectively.

Lower Santa Ynez valley

Total pumpage in the Lower Santa Ynez valley during 1948 is estimated to have been about 15,000 acre-feet, about 30 percent less than that in 1947. During the year, pumpage from wells by the city of Lompoc and Camp Cooke was 570 and 615 acre-feet, respectively. Water levels, in general, continued to decline during 1948. In 22 observation wells in the Lompoc plain that end in the principal water-bearing sands and gravel, the water levels averaged about 1 foot lower at the end of 1948 than at the end of 1947, but in individual wells the water levels at the end of 1948 ranged from about 7 feet above to 4 feet below those at the end of 1947. There has been a general net decline in most wells since the spring of 1945, and in the 22 observation wells referred to above this has averaged 1.4 feet a year for the past 4 years. The decline has been greatest just northwest of Robinson Bridge in the eastern part of the Lompoc plain, where records for

observation wells indicate an average decline during the past 4 years of about 2-1/2 feet a year. Water levels have declined the least near the western end of the Lompoc plain. In well 7/35-20J1, 1.4 miles east of Surf, near the southern boundary of the Lompoc plain, the decline has averaged 0.8 foot a year since 1945.

Hydrographs for two representative wells that illustrate these conditions 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. Well 7/34-27L1 is in the eastern part of the plain where the water body is not confined.

San Antonio valley

In 1948 pumpage from 12 to 20 irrigation wells in the San Antonio valley probably did not amount to more than 2 to 3 thousand acre-feet. Average decline of water levels in observation wells in this area from the end of 1947 to the end of 1948 was about 1-1/2 feet.

Santa Maria valley area

Total pumpage in the Santa Maria valley area during 1948 is estimated to have been about 100,000 acre-feet, which is about twice the estimated perennial yield of 53,000 acre-feet.[10/] During the calendar-year 1948 the city of Santa Maria pumped 2,170 acre-feet. Because rainfall was low and because there was very little recharge to the ground-water body, most of the water pumped came from storage.

Ground-water levels in the Santa Maria valley area were higher during the period 1941 to 1945 than at any time since the late twenties. The peak water levels that occurred within this period did not occur simultaneously in all wells. The water levels in wells closest to the Santa Maria and Sisquoc Rivers in the central and eastern part of the valley were first to reach their peak levels, whereas wells in the southern and western parts of the valley did not attain their peak levels until the latter part of this period, but by the end of 1945 the water levels, in general, were declining in all wells. In the central and eastern parts of the Santa Maria valley area, the ground water is unconfined and occurs in permeable sand and gravel deposits. No marked seasonal rise occurs following the end of the irrigation season, as commonly occurs where the ground water is confined.

10/ Worts, G. F., Jr., and Thomasson, H. G., Jr., op. cit., p. 233.

Furthermore, in many wells the water levels declined continually during 1948 and the highest level in 1948 was about the same as the lowest level in 1947. Accordingly, for the Santa Maria valley area the year-end levels of 1948 are compared with the year-end levels of 1947 and with the highest levels of 1945.

Considering the area as a whole, the average decline from the end of 1947 to the end of 1948, as indicated by 33 observation wells, was about 6-1/2 feet, and the average decline from the maximum level of 1945 to the end of 1948 was about 25 feet. In the central and eastern parts of the Santa Maria valley, the average decline in 22 observation wells from the end of 1947 to the end of 1948 was about 8-1/2 feet, and the average decline from the maximum level in 1945 to the end of 1948 was about 32 feet.

In the Sisquoc River valley, from Fugler Point upstream about 4 miles, the average decline in water level during 1948, as indicated by three observation wells, was about 14 feet. The average decline in these three wells from the maximum level in 1945 to the end of 1948 was about 40 feet. From Fugler Point for 5 miles downstream in the Santa Maria valley to the northwest, the average decline during 1948, as indicated by six observation wells, was 10-1/2 feet. The decline in these wells from 1945 to the end of 1948 averaged about 42 feet. South of Fugler Point and west of Garey the average decline shown by three observation wells during 1948 was about 7-1/2 feet. In the vicinity of the city of Santa Maria, which is near the center of the valley, the average decline in six observation wells during 1948 was about 7 feet. In these wells the average decline was about 26 feet from 1945 to the end of 1948.

In the western 8 miles of the Santa Maria valley, where the water body is confined, measurements in 11 wells near the end of 1948 averaged about 2 feet lower than the measurements made in these wells near the end of 1947, but in individual wells the change ranged from a rise of 4 feet to a decline of 5 feet. The average decline from the maximum water level of 1945 to the end of 1948 was about 12-1/2 feet, being greatest at the eastern boundary of the area of confined water where it averaged about 17 feet.

Figure 11 shows hydrographs for three representative 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 Point. The graph of this well shows

a nearly steady decline from May 1945 to December 1948, which amounted to about 34 feet. Well 10/34-14E3 is in Santa Maria at the City Water Works plant. The record for this well was started in 1917, and the lowest stage recorded was 132.7 feet below land surface in October, 1936. At the end of 1948 the water level in this well was 125.34 feet--only 7.4 feet above the record low. The decline during 1948 was about 8 feet. Well 10/35-7F1 is in the area of confined water near Guadalupe. During the years 1941 to 1946 the water level in this well recovered sufficiently at the end of each year to cause the well to flow, but at the end of 1947 the water level was nearly 7 feet below the land surface. At the end of 1948 the water level was about 3 feet below land surface. The net rise of about 4 feet was probably due to less nearby pumping near the end of 1948 than near the end of 1947, allowing the water level to recover locally.

Cuyama valley

Pumping for irrigation in the Cuyama valley, which began in 1939, has increased each year. The estimated ground-water pumpage in 1946 was 17,000 acre-feet, and in 1947 and 1948 the pumpage was probably on the order of 20,000 acre-feet. The greatest decline in water level occurred in the upper part of the valley. In well 9/24-19Q1, near the Cuyama ranger station, water levels declined 8 feet during 1948--slightly more than the annual decline during 1946 and 1947. In well 7/24-13C1, 11 miles upstream from the Cuyama ranger station, at Apache School, in Ventura County, the water level declined about 4-1/2 feet during the year.

Most of the pumping for irrigation occurred in the broader portion of the valley which begins about 5 miles downstream from the Cuyama ranger station. The declines in water level in this area during 1948 ranged from less than 1 foot to 3 feet, and were about the same as during 1947. The average decline in the eastern part was greater than in the western part.

The hydrograph for well 10/25-30F1 (fig. 11), in the area of heavy pumping, shows fluctuations for the period 1941-48. In 1948, this well was found pumping at the time of each visit during the summer and fall months. A static water-level measurement on December 28 indicated a net decline of about 2 feet during the year.

Other investigations by the Geological Survey

In addition to the programs described on preceding pages, for which water-level fluctuations have been summarized, the Ground Water Branch of the Geological Survey started several other investigations in 1948 for which no water-level measurements are included in this report.

In March a cooperative agreement was made between the California Division of Water Resources, Department of Public Works, and the Geological Survey, providing for an investigation of ground-water basins of the State with special reference to geologic features. Under this agreement, the Geological Survey has commenced a study of the Sacramento Valley to obtain an estimate of total ground-water storage capacity to a depth of 200 feet below the land surface. In addition, the proposed report will include a section on geology, describing the water-bearing deposits with respect to physical and hydrologic character, thickness, distribution, and structural features.

The investigation in the Sacramento Valley does not include measurement of depth to water in wells. The field program is chiefly one of collecting well logs from drillers and from public agencies and locating the logged wells in the field. Work in the Sacramento Valley was begun in May. By year-end about 4,000 well logs had been collected from well drillers and from public agencies, and 1,800 had been verified in the field.

In Solano County, northeast of San Francisco, the usable underground storage capacity of the Putah Creek fan has become important in connection with the proposed construction of Monticello dam by the Bureau of Reclamation. Accordingly, the Geological Survey has been asked by the Bureau (1) to make an estimate of the storage capacity of the ground-water basins underlying the extent of the Solano project; (2) to ascertain the effective or usable capacity (recharge capacity) of the basins; and (3) to determine where and how recharge can be accomplished. With these objectives, field investigation in Solano County was started in April 1948. As of December 1948 the field canvass of water wells for the Putah area was about three-quarters completed. It is planned that the investigation will be concluded in 1951.

At the request of the Bureau of Yards and Docks, Department of the Navy, the Geological Survey has made an investigation of the ground-water conditions beneath the southern part of the Oxnard plain in Ventura County, with special reference to water supply for the Point Mugu Naval Base. This study was begun in February 1948 and was completed in September, with submittal of a report to the Navy that has now been released.[11]

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 description and records are given by counties in alphabetical sequence, and for each county by valleys or ground-water basins. Thus, each group of the data pertains to a distinct ground-water area as indicated by subheadings in the record. Under each subhead the records are presented in numerical order of the location symbols.

WELL DESCRIPTIONS AND WATER-LEVEL MEASUREMENTS

Kern County

Antelope Valley

9/12-16R1. Robert Rubeen. Records available: 1945-46. No measurements made in 1948.

9/12-21D1. Southern Pacific Lands Agency. Measurements by Los Angeles County Flood Control District. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 21	45.80	July 14	46.8	Dec. 6	46.5
Mar. 3	45.20	Oct. 14	46.9		

9/13-14H1. Records available: 1946. No measurements made in 1948.

9/13-20H1. Harry White. Measurements by Los Angeles County Flood Control District. Records available: 1944-48. Mar. 2, 73.65; July 14, 80.75; Oct. 14, 82.45; Dec. 1, 77.7.

9/13-20H2. Harry White. Records available: 1944, 1946. No measurements made in 1948.

9/13-35P1. P. D. Gaskill. Records available: 1945-47. No measurements made in 1948.

11. Poland, J. F., Garrett, A. A., and Mann, J. F., Progress report on water supply for the Point Mugu Naval Base, Ventura County, Calif.: U. S. Geol. Survey typewritten report, 51 pp., November 1948.

947807 O—51——7

9/14-24K1. De Fone. Records available: 1941, 1943, 1946. No measurements made in 1948.

9/14-24Q1. De Fone. Measurements made by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 1, 109.8.

9/14-29M1. Records available: 1945-47. No measurements made in 1948.

9/14-32D1. Sears. Records available: 1945-47. No measurements made in 1948.

Los Angeles County

Antelope Valley

5/9-6B1. Records available: 1945-48. Nov. 8, 39.94.

5/9-20J1. L. M. Nixon. Records available: 1940-48. Nov. 29, 240.9.

5/9-28A1. R. C. Wiess. Records available: 1947-48. Nov. 8, 124.60.

5/10-6N1. Little Rock Irrigation District. Water-stage recorder installed Apr. 10, 1947. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 14	90.4	Mar. 23	90.4	May 12	95.4	June 10	95.2
21	90.8	Apr. 7	90.4	27	95.5	July 15	(a)
Feb. 19	90.5	30	92.6	June 3	94.2	Aug. 11	(a)
26	90.5	May 6	91.9	3	95.5	Dec. 10	(a)

a Dry at 96.4.

5/10-7E1. Calavalley. Measurements by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 14, 134.9.

5/10-7R1. Tamarack Park. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 20, 219.0.

5/10-12B1. Ed Sanner. Records available: 1945-48.

Jan. 5	51.40	Apr. 27	51.78	July 26	52.25	Oct. 26	52.78
Feb. 2	51.53	May 26	51.90	Aug. 25	52.39	Nov. 29	52.96
Mar. 1	51.55	June 24	52.04	Sept.27	52.60	Dec. 27	53.17
29	51.77						

5/10-21J1. Records available: 1945-48. Nov. 8, 21.45.

5/10-26B1. R. J. Darling. Records available: 1945-48. Nov. 8, 50.19.

5/11-4E1. SW¼NW¼ sec. 4, 70 feet north of bend on Pear Blossom Highway, 70 feet north of lane (about Avenue 54), 275 feet east of 47th Street E. Measuring point, hole in base of pump at oil line, 0.4 foot above land-surface datum, and 2,695 feet above sea-level datum, from U. S. Geol. Survey topographic map. Records available: 1948. Dec. 14, 149.4.

5/11-4R1. Joe Martin. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 14, 150.1.

5/11-9Q1. Records available: 1945-46, 1948. Dec. 14, 50.2.

5/11-10R1. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Jan. 14	91.00	Apr. 30	91.30	Aug. 11	94.2	Nov. 9	94.25
Feb. 25	90.83	June 10	92.5	Sept.10	94.10	Dec. 14	95.15
Mar. 3	90.50	July 15	93.2	Oct. 15	94.15		

5/11-12H1. Wheelock. Records available: 1945. No measurements made in 1948.

5/11-12Q1. Wheelock. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 14, 142.1.

5/11-12R1. SE¼SE¼ sec. 12, T. 5 N., R. 11 W., 175 feet west of 87th Street E., 700 feet north of Avenue U. Diameter 14 inches, depth 602 feet. Measuring point, cast iron pump base, at land-surface datum. No measurements made in 1948.

5/11-13J1. Little Rock Irrigation District. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 14, 227.1.

5/11-22D1. Totem Pole Ranch. Measurements by Los Angeles County Flood Control District. Records available: 1947-48. Jan. 6, pumping; Apr. 14, 29.65; Dec. 9, 34.25.

6/8-10N1. Robert Barnett. Formerly owned by W. G. Baguet. Records available: 1944-47. No measurements made in 1948.

6/8-10N2. Robert Barnett. Records available: 1947-48. Nov. 15, 27.35.

6/8-18D1. Hoff. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 5	159.72	Mar. 1	159.60	Nov. 15	(a)
Feb. 2	(a)	29	(a)		

a Pumping.

6/8-32P1. M. B. Scofield. Records available: 1944-48. Nov. 15, 193.09.

6/9-4H1. Wilsona School. Records available: 1945-48. Nov. 15, 115.81.

6/9-31R1. Barlow. Records available: 1945-48. Nov. 8, 33.12.

6/10-9E1. Records available: 1945-46, 1948. Nov. 10, 192.8.

6/10-9Q1. N. C. & O. C. Riley. Records available: 1945-48. Oct. 10, 149.09.

6/10-10Q1. Records available: 1945-48. Nov. 10, 73.32.

6/10-20P1. Mrs. Johnson. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 5	161.58	Apr. 27	176.40	Aug. 25	(a)	Nov. 10	(b)
Feb. 2	161.20	May 26	178.43	Sept.27	(b)	29	(b)
Mar. 1	167.81	June 24	179.02	Oct. 26	(b)	Dec. 27	195.62
29	166.58	July 26	182.84				

a Dry at 200 feet.
b Obstruction in casing; below 183.7.

6/10-27B1. Records available: 1943, 1945-48. Nov. 10, 150.22.

6/10-27B3. Alternate for well 6/10-27B1. Records available: 1945. No measurements made in 1948.

6/10-32E1. McAlester. Records available: 1945-47. No measurements made in 1948.

6/10-32F1. McAlester. Records available: 1945-48. Nov. 10, 113.06.

6/11-4C1. Lyons Bros. Records available: 1945-46, 1948. Nov. 8, 184.55.

6/11-5A1. Lyons Bros. Records available: 1944-46. No measurements made in 1948.

6/11-8E1. Palmdale Irrigation District. Records available: 1942-48. Nov. 8, 196.7.

6/11-8R1. Records available: 1944-48. Nov. 8, 213.95, nearby well pumping.

6/11-9F1. Elmer Benson. Records available: 1945-47. No measurements made in 1948.

6/11-12M1. E. J. Ball. Records available: 1945-48. Nov. 10, 197.62.

6/11-12Q1. E. J. Ball. Records available: 1941-48. Nov. 10, 194.63.

6/11-18P1. Elmer Richardson. Formerly owned by Charles Richie. Records available: 1940, 1947-48. Nov. 8, 236.8.

6/11-19E1. Palmdale Irrigation District. Measurements by Los Angeles County Flood Control District. Records available: 1945-48. Jan. 21, 257.15; Aug. 26, 254.0.

6/11-20P1. Alternate for well 6/11-20R2. Mrs. F. C. Smith. Records available: 1945. No measurements made in 1948.

6/11-20R2. Records available: 1946-48. Nov. 8, 240.9.

6/11-26J1. Replacement for well 6/11-26R1. L. A. Hudson. Records available: 1947. No measurements made in 1948.

6/11-28N1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 14, 95.1.

6/11-32P1. Palmdale Rancho. Records available: 1945-46. No measurements made in 1948.

6/11-33Q1. Alternate for 6/11-33R1. Pete Mikalivnas. Records available: 1941-43, 1946. No measurements made in 1948.

6/11-33R1. Alternate for 6/11-33Q1. Thornberg. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 14, 128.9.

6/12-25N1. Measurements by Los Angeles County Flood Control District. Records available: 1927-30, 1937-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 14	294.0			July 15	283.2	Oct. 14	285.0
Feb. 25	294.60	June 9	282.0	Aug. 11	283.7	Nov. 9	289.3
Mar. 3	294.90						

6/13-12J1. Glick. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 13, 248.6.

7/9-28M1. NW¼SW¼ sec. 28, T. 7 N., R. 9 W., 800 feet east of 160th Street E. produced, 1,280 feet south of Avenue K-8. Equipped with belt-driven Pomona pump. Used for irrigation. Replaces 7/9-28N1. Measuring point, top of 14-inch casing, at land-surface datum. Records available: 1948. Nov. 15, 140.33.

7/9-17N1. Ernest Koch. Records available: 1945-48. Mar. 1, 136.96.

7/10-5M1. Ella E. Cunningham. Records available: 1944-46. No measurements made in 1948.

7/10-5N3. Ella E. Cunningham. Records available: 1945-47. No measurements made in 1948.

7/10-6R1. Mrs. Jessie Hollingsworth. Records available: 1945-48. Nov. 9, 125.6.

7/10-7B1. Boege. Records available: 1944-48. Mar. 29, 78.9; Apr. 27, 80.8; May 26 and Nov. 9, dry at 81.6.

7/10-12H1. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Apr. 27	125.12	July 26	126.66	Sept.27	172.96	Nov. 29	128.84
May 26	125.78	Aug. 25	127.38	Oct. 26	128.32	Dec. 27	129.06
June 24	125.92						

7/10-21A1. Records available: 1945-48. Nov. 10, 160.32.

7/10-30G1. E. J. Ball. Records available: 1941-43, 1946-47. No measurements made in 1948.

7/10-31N1. H. O. Bakken. Records available: 1943, 1945-48. Nov. 10, 195.5.

7/11-1Q1. H. L. Gordon. Records available: 1943-46, 1948. Nov. 9, 123.87.

7/11-8P1. MacAvery. Records available: 1944-48. Nov. 9, 73.01.

7/11-16B1. Records available: 1945-48. Nov. 9, 103.28.

7/11-19N1. Records available: 1945-48. Nov. 9, 149.37.

7/11-23L1. Barnes. Records available: 1943, 1945-48. Nov. 9, 141.86.

7/11-24C1. Stevenson. Records available: 1944-48.

Jan. 5	137.15	Apr. 27	142.69	July 26	148.42	Nov. 26	149.16
Feb. 2	136.48	May 26	144.56	Aug. 25	151.64	29	146.69
Mar. 1	135.42	June 24	146.40	Sept.27	151.29	Dec. 27	144.73
29	(a)						

a Pumping.

7/11-27F1. James N. Provonyance. Records available: 1940-41, 1943, 1947-48. Nov. 9, 162.80.

7/11-28E1. Leshin. Records available: 1943, 1945-48. Nov. 9, 161.84.

7/11-28L1. Records available: 1944-48. Nov. 8, 149.52.

7/12-4P2. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 21	8.60	July 14	12.3	Dec. 7	11.75
Mar. 2	7.80	Oct. 15	14.4		

7/12-6D1. Measurement by Los Angeles County Flood Control District. Records available: 1945, 1947-48. Dec. 7, 30.6.

7/12-8D1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 7, 15.4.

7/12-10P1. Antelope Valley Laundry. Records available: 1943, 1946. No measurements made in 1948.

7/12-15F1. A. H. Powell. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 21	46.0	July 14	60.2	Dec. 7	53.4
Mar. 3	44.6	Oct. 15	62.8		

7/12-15F2. Los Angeles County Water District 4. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 7, 89.5.

7/12-22J1. F. La Horgue. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 25	106.30	June 9	110.9	Aug. 12	113.3	Nov. 19	114.1
Mar. 3	105.90	July 14	(a)	Sept.10	114.9	Dec. 7	113.2
Apr. 30	106.05	15	111.2	Oct. 15	116.4		

a Pumping.

7/12-29P1. Records available: 1945-47. No measurements made in 1948.

7/12-34E1. G. Lane. Measurement by Los Angeles County Flood Control District. Records available: 1944, 1947-48. Dec. 13, 185.8.

7/13-3D1. F. Gorrindo. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 75.0.

7/13-3D2. F. Gorrindo. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 54.55.

7/13-6A1. Records available: 1944, 1945. No measurements made in 1948.

7/13-11C1. Records available: 1945-46. No measurements made in 1948.

7/13-11D1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 4.85.

7/13-11D3. Long. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 20	34.15	Mar. 3	33.70	Oct. 14	51.2
Mar. 2	(a)	July 14	50.8	Dec. 8	39.4

a Pumping.

7/13-17D1. Measurement by Los Angeles County Flood Control District. Records available: 1944-48. Nov. 30, 124.3.

7/13-21J1. Measurement by Los Angeles County Flood Control District. Records available: 1946-48. Dec. 9, 84.2.

7/13-21J2. L. H. Benson. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 15, 86.65.

7/13-21J3. L. H. Benson. Measurement by Los Angeles County Flood Control District. Records available: 1942-44, 1946-47. No measurements made in 1948.

7/13-27N1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 15, 148.7.

7/13-28P1. Crenmer. Measurement by Los Angeles County Flood Control District. Records available: 1945-47. No measurements made in 1948.

7/13-35E1. George Lane. Measurement by Los Angeles County Flood Control District. Records available: 1944-48. Dec. 13, pumping; Dec. 15, 193.4.

7/14-10F1. F. A. Ullman. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 20	188.55	July 14	190.7	Dec. 11	192.9
Mar. 2	188.25	Oct. 14	a191.4		

a Pumping recently.

8/9-4N2. U. S. Army Reservation. Records available: 1944-48. Nov. 9, 14.80.

8/9-4P1. U. S. Army Reservation. Records available: 1945-48. Nov. 9, 24.39.

8/9-6N1. U. S. Army Reservation. Records available: 1945-48. Nov. 9, 12.80.

8/9-6R1. U. S. Army Reservation. Records available: 1945-47. No measurements made in 1948.

8/10-2P1. U. S. Army Reservation. Records available: 1945-48. Nov. 9, 18.96.

8/10-8R3. J. G. Walsh. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 2	28.08	Apr. 27	(a)	July 26	34.36	Oct. 26	38.07
Mar. 1	28.55	May 26	28.62	Aug. 25	(a)	Nov. 29	30.83
29	(a)	June 24	(a)	Sept.27	34.97	Dec. 27	30.42

a Pumping.

8/10-9M1. J. M. Hamilton. Records available: 1944-48.

Jan. 5	23.25	Apr. 27	23.67	July 26	24.29	Oct. 26	25.13
Feb. 2	23.33	May 26	23.81	Aug. 25	24.62	Nov. 29	25.08
Mar. 1	23.36	June 24	24.07	Sept.27	24.87	Dec. 27	25.09
29	23.48						

8/10-19Q1. Union Trust & Savings Bank. Records available: 1943-48. Nov. 9, 84.64.

8/10-32N1. John Demuth. S½SW¼ sec. 32, T. 8 N., R. 10 W., 600 feet east and 250 feet north of SW. corner sec. 32. Used domestic well, diameter 8 inches, depth 97 feet. Equipped with windmill. Drilled in 1936. Altitude of land surface about 2,379 feet. Records available: 1948.

Feb. 2	68.00	Apr. 27	(a)	July 26	76.70	Oct. 26	76.32
Mar. 1	68.38	May 26	74.50	Aug. 25	77.60	Nov. 29	73.82
29	67.60	June 24	75.88	Sept.27	(a)	Dec. 27	72.69

a Pumping.

8/11-8P1. Records available: 1945-48. Nov. 9, 12.59.

8/11-10N1. E. R. Siple. Records available: 1945-48. Nov. 9, 23.47.

8/11-20L1. Records available: 1945-47. Nov. 9, dry at 30.3.

8/11-22N2. Lewis Prothro. Records available: 1936-37, 1942-47. No measurements made in 1948.

8/11-22N3. Lewis Prothro. Records available: 1944-48. Nov. 9, 72.13.

8/11-30R1. Records available: 1945-48. Nov. 9, 37.17.

8/12-4K1. Measurements by Los Angeles County Flood Control District. Records available: 1945-47. No measurements made in 1948.

8/12-20B1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 7, 21.9.

8/12-21C1. Hoffman Gun Club. Records available: 1945-46. No measurements made in 1948.

8/12-22D1. Measurements by Los Angeles County Flood Control District. Records available: 1945-48. Oct. 14, 22.1; Dec. 7, 11.65.

8/12-22M1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 7, 9.95.

8/12-22M2. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 7, 10.0.

8/12-22R1. I. B. Wibigler. Measurement by Los Angeles County Flood Control District. Records available: 1941-48. Dec. 7, 13.0.

8/12-22R2. I. B. Wibigler, Antelope Valley Gun Club. Records available: 1945-46. No measurements made in 1948.

8/12-24R1. Records available: 1945-48. Nov. 9, 17.23.

8/12-30Q1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 7, 19.3.

8/13-2C1. Alternate for well 9/13-35P1. Records available: 1945, 1948. Dec. 8, 49.0.

8/13-7H1. Lone Butte Ranch. Measurement by Los Angeles County Flood Control District. Records available: 1946-48. Dec. 8, 121.7.

8/13-8C1. A. Boulin. Measurements by Los Angeles County Flood Control District. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 21	109.01	Mar. 3	108.50	Oct. 14	116.8
Mar. 2	(a)	July 14	115.1		

a Pumping.

8/13-8D1. Rogers School. Alternate for well 8/13-7H1. Records available: 1944. No measurements made in 1948.

8/13-20M1. O. T. Kelly & Son. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 125.5.

8/13-22K1. A. G. Andrews. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 76.8.

8/13-23M1. A. G. Andrews. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 71.2.

8/13-32N1. Pedro Lizarraga. Measurement by Los Angeles County Flood Control District. Records available: 1946-48. Dec. 8, 120.65.

8/13-33Q2. Measurements by Los Angeles County Flood Control District. Records available: 1946-48. Dec. 8, 81.62.

8/14-2R1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 9, 145.3.

8/14-12A1. H. G. Ranch No. 1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 138.15.

8/14-12D1. H. G. Ranch No. 1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 154.0.

8/14-14R1. Measurement by Los Angeles County Flood Control District. Records available: 1945-48. Dec. 8, 155.9.

8/14-17Q1. Marl Craven, Tibola. Measurement by Los Angeles County Floot Control District. Records available: 1946-48. Dec. 1, 161.0.

8/14-23A1. Alternate for well 8/14-14R1. No measurements made in 1948.

8/14-25C1. Alternate for well 8/14-25C2. No measurements made in 1948.

8/14-25C2. Measurement by Los Angeles County Flood Control District. Records available: 1945, 1947-48. Dec. 8, 148.8.

8/14-25D1. Records available: 1946, 1948. Dec. 8, 157.2.

8/15-10P1. Scott. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 20	139.95	Apr. 30	(a)	July 14	(a)	Dec. 1	138.5
Feb. 25	140.20	July 13	(a)	Oct. 31	138.7		

a Pumping.

8/15-17R1. Canfield. Equipped with water-stage recorder. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Jan. 20	118.55	Apr. 30	116.65	July 13	115.35	Oct. 13	114.0
Feb. 25	117.80	May 26	116.16	Aug. 12	114.9	Nov. 30	113.5
Mar. 23	117.35	June 9	115.98	Sept.14	114.47		

8/15-20N1. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Jan. 20	155.30	Mar. 23	154.80	July 13	154.5	Nov. 29	154.0
Feb. 25	154.80	Apr. 30	154.70	Oct. 13	154.3		

8/15-22N1. Barnes. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Jan. 20	174.20	Mar. 23	173.45	July 13	172.0	Dec. 1	170.8
Feb. 25	173.59	Apr. 30	173.50	Oct. 13	171.13		

8/15-24B2. Charles L. Schneider. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 20	(a)	Mar. 2	143.30	Oct. 14	148.1
21	144.05	July 14	147.7	Dec. 1	147.4

a Pump locked, no measurement made.

8/15-27R1. I. T. Brandt. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Jan. 20	140.4	Mar. 2	140.35	Oct. 13	140.7
Feb. 25	(a)	July 14	a140.5	Nov. 29	140.5

a Pumping.

8/15-29M1. Soil Conservation Service, U. S. Dept. of Agriculture. Measurements by Los Angeles County Flood Control District. Records available: 1947-48. Dry at 189 feet from Jan. 20 to Nov. 29, 1948.

8/15-33G1. Correll. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 20	200.9	Apr. 30	200.75	Oct. 13	202.5
Feb. 25	200.85	July 13	202.8	Dec. 1	202.2

8/15-36M1. Fairmont School. Measurement by Los Angeles County Flood Control District. Records available: 1944-47. No measurements made in 1948.

8/16-5N1. Carpy (International Harvester Co.). Measurements by Los Angeles County Flood Control District. Records available: 1942-48.

Jan. 20	197.4	July 13	196.8	Nov. 29	197.0
Mar. 2	196.6	Oct. 13	196.3		

8/16-14K1. Snyder. Measurements by Los Angeles County Flood Control District. Records available: 1946-48.

Jan. 20	113.30	Mar. 2	112.75	Oct. 23	113.25
Feb. 25	109.80	July 13	113.3	Nov. 29	113.6

8/16-14L1. Snyder. Measurement by Los Angeles County Flood Control District. Records available: 1945-47. No measurements made in 1948.

8/16-18H1. Neenach School. Measurement by Los Angeles County Flood Control District. Records available: 1944-48. Dec. 1, 96.2.

8/17-14E1. P. M. Barnes. Measurement by Los Angeles County Flood Control District. Records available: 1945, 1947. Nov. 29, could not get tape down to water surface. Pump pulled 4 months ago. Water level 40± feet below land surface at that time. (Reported by owner.)

8/17-14E2. About 2.92 miles west of Neenach School, 70 feet north of State Highway 138, 190 feet east of dirt road, 12 feet northwest of F. C. well 10741. Not in use. Diameter of casing 6 inches. Measuring point, top of casing, 1.7 feet above land-surface datum which is about 3,046.7 feet above sea level (from U. S. Geol. Survey topographic map). Records available: 1948. Dec. 1, 44.7.

San Gabriel River basin

1S/10-18. Key well U. S. 75. At Baldwin Park. Equipped with water-stage recorder. Records available: 1903-48.

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	95.42	291.58	96.38	290.62	96.87	290.13	97.47	289.53
2	95.43	291.57	96.40	290.60	96.88	290.12	97.46	289.54
3	95.46	291.54	96.42	290.58	96.90	290.10	97.46	289.54
4	95.48	291.52	96.43	290.57	96.93	290.07	97.47	289.53
5	95.50	291.50	96.46	290.54	96.96	290.04	97.47	289.53
6	95.52	291.48	96.50	290.50	96.98	290.02	97.49	289.51
7	95.52	291.48	96.53	290.47	97.02	289.98	97.49	289.51
8	95.54	291.46	96.53	290.47	97.06	289.94	97.49	289.51
9	95.56	291.44	96.48	290.52	97.10	289.90	97.50	289.50
10	95.58	291.42	96.46	290.54	97.16	289.84	97.51	289.49
11	95.63	291.37	96.53	290.47	97.21	289.79	97.52	289.48
12	95.69	291.31	96.55	290.45	97.28	289.72	97.53	289.47
13	95.72	291.28	96.54	290.46	97.33	289.67	97.55	289.45
14	95.73	291.27	96.53	290.47	97.36	289.64	97.54	289.46

1S/10-18--Continued.

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
15	95.76	291.24	96.56	290.44	97.36	289.64	97.55	289.45
16	95.82	291.18	96.58	290.42	97.39	289.61	97.57	289.43
17	95.84	291.16	96.59	290.41	97.36	289.64	97.59	289.41
18	95.85	291.15	96.60	290.40	97.38	289.62	97.62	289.38
19	95.90	291.10	96.61	290.39	97.38	289.62	97.65	289.35
20	96.00	291.00	96.63	290.37	97.41	289.59	97.68	289.32
21	96.05	290.95	96.64	290.36	97.42	289.58	97.71	289.29
22	96.05	290.95	96.64	290.36	97.39	289.61	97.72	289.28
23	96.06	290.94	96.67	290.33	97.39	289.61	97.74	289.26
24	96.11	290.89	96.71	290.29	97.40	289.60	97.78	289.22
25	96.14	290.86	96.75	290.25	97.44	289.56	97.81	289.19
26	96.19	290.81	96.77	290.23	97.42	289.58	97.84	289.16
27	96.26	290.74	96.79	290.21	97.42	289.58	97.88	289.12
28	96.29	290.71	96.80	290.20	97.43	289.57	97.94	289.06
29	96.28	290.72	96.83	290.17	97.43	289.57	97.99	289.01
30	96.32	290.68			97.41	289.59	97.99	289.01
31	96.34	290.66			97.44	289.56		

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	97.99	289.01	99.60	287.40	99.80	287.20	102.08	284.92
2	97.99	289.01	99.64	287.36	99.86	287.14	102.13	284.87
3	98.00	289.00	99.65	287.35	99.91	287.09	102.20	284.80
4	98.03	288.97	99.68	287.32	99.95	287.05	102.25	284.75
5	98.07	288.93	99.71	287.29	99.99	287.01	102.31	284.69
6	98.11	288.89	99.74	287.26	100.05	286.95	102.39	284.61
7	98.15	288.85	99.76	287.24	100.12	286.88	102.46	284.54
8	98.18	288.82	99.81	287.19	100.21	286.79	102.54	284.46
9	98.24	288.76	99.84	287.16	100.30	286.70	102.62	284.38
10	98.31	288.69	99.83	287.17	100.40	286.60	102.69	284.31
11	98.38	288.62	99.78	287.22	100.47	286.53	102.77	284.23
12	98.44	288.56	99.76	287.24	100.57	286.43	102.84	284.16
13	98.50	288.50	99.75	287.25	100.67	286.33	102.92	284.08
14	98.58	288.42	99.75	287.25	100.75	286.25	103.03	283.97
15	98.66	288.34	99.75	287.25	100.81	286.19	103.13	283.87
16	98.70	288.30	99.74	287.26	100.88	286.12	103.17	283.83
17	98.79	288.22	99.71	287.29	100.94	286.06	103.24	283.76
18	98.85	288.15	99.67	287.33	101.01	285.99	103.31	283.69
19	98.89	288.11	99.64	287.36	101.07	285.93	103.37	283.63
20	98.94	288.06	99.59	287.41	101.15	285.85	103.43	283.57
21	99.01	287.99	99.55	287.45	101.24	285.76	103.52	283.48
22	99.05	287.95	99.56	287.44	101.34	285.66	103.58	283.42
23	99.12	287.88	99.53	287.42	101.42	285.58	103.64	283.36
24	99.18	287.82	99.59	287.41	101.48	285.52	103.70	283.30
25	99.24	287.76	99.61	287.39	101.54	285.46	103.77	283.23
26	99.30	287.70	99.61	287.39	101.60	285.40	103.83	283.17
27	99.36	287.64	99.63	287.37	101.68	285.32	103.90	283.10
28	99.42	287.58	99.64	287.36	101.76	285.24	103.97	283.03
29	99.46	287.54	99.67	287.33	101.85	285.15	104.03	282.97
30	99.52	287.48	99.72	287.28	101.92	285.08	104.08	282.92
31	99.55	287.45			102.01	284.99	104.16	282.84

18/10-18--Continued.

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	104.26	282.74	106.13	280.87	107.26	279.73	108.41	278.59
2	104.38	282.62	106.16	280.84	107.28	279.72	108.44	278.56
3	104.47	282.53	106.21	280.79	107.30	279.70	108.48	278.52
4	104.55	282.45	106.26	280.74	107.32	279.68	108.53	278.47
5	104.60	282.40	106.33	280.67	107.35	279.65	108.55	278.45
6	104.65	282.35	106.40	280.60	107.38	279.62	108.56	278.44
7	104.72	282.28	106.42	280.58	107.41	279.58	108.58	278.42
8	104.81	282.19	106.46	280.54	107.47	279.53	108.59	278.41
9	104.87	282.13	106.50	280.50	107.50	279.50	108.60	278.40
10	104.90	282.10	106.54	280.46	107.52	279.47	108.62	278.38
11	104.96	282.04	106.58	280.42	107.58	279.42	108.65	278.35
12	105.02	281.98	106.64	280.36	107.67	279.33	108.67	278.33
13	105.08	281.92	106.69	280.31 a	107.72 a	279.28	108.68	278.32
14	105.14	281.86	106.72	280.28 a	107.78 a	279.22	108.70	278.30
15	105.20	281.80	106.75	280.25 a	107.84 a	279.16	108.72	278.28
16	105.26	281.74	106.78	280.22	107.89	279.11	108.72	278.28
17	105.32	281.68	106.82	280.18	107.91	279.09	108.73	278.27
18	105.39	281.61	106.84	280.16	107.95	279.05	108.73	278.27
19	105.47	281.53	106.86	280.14	107.96	279.04	108.71	278.29
20	105.51	281.49	106.89	280.11	107.99	279.01	108.67	278.33
21	105.55	281.45	106.92	280.08	108.05	278.95	108.66	278.34
22	105.59	281.41	106.95	280.05	108.07	278.93	108.64	278.36
23	105.64	281.36	106.99	280.01	108.10	278.90	108.64	278.36
24	105.68	281.32	107.04	279.96	108.13	278.67	108.64	278.36
25	105.75	281.25	107.08	279.92	108.17	278.83	108.63	278.37
26	105.79	281.21	107.11	279.89	108.21	278.79	108.61	278.39
27	105.85	281.15	107.16	279.84	108.27	278.73	108.61	278.39
28	105.90	281.10	107.22	279.78	109.31	278.69	108.61	278.39
29	106.01	280.99	107.26	279.74	109.34	278.66	108.59	278.41
30	106.10	280.90	107.27	279.73 a	109.38 a	278.62	108.56	278.44
31			107.28	279.72			108.56	278.44

a Clock stopped; record computed on basis of range in stage.

Coastal Plain

28/12-13A1. Lycan Bros. Records furnished by San Gabriel Valley Protective Association. Records available: 1928-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 7	28.14	Apr. 7	27.62	July 7	30.15	Oct. 6	39.80
14	28.08	14	27.43	14	31.06	13	40.31
21	28.08	21	27.38	21	32.00	20	40.72
28	28.09	28	27.64	28	32.81	27	41.08
Feb. 4	28.08	May 5	27.76	Aug. 4	33.64	Nov. 3	41.38
11	27.91	12	28.06	11	34.41	10	41.64
18	27.85	19	28.57	18	35.14	17	41.97
25	27.79	26	29.11	25	35.85	24	42.28
Mar. 3	27.79	June 2	29.76	Sept. 1	36.55	Dec. 1	42.55
10	28.02	9	29.66	8	37.26	8	42.84
17	28.23	16	28.63	15	37.95	15	42.99
24	28.09	23	28.78	22	38.58	22	42.90
31	27.84	30	29.38	29	39.19	29	42.45

28/15-34H1. Don Benshoof. All water levels are below sea level. Records furnished by California Division of Water Resources. Records available: 1929-48.

Feb. 4	132.8	June 7	132.4	Aug. 26	135.1	Nov. 28	135.0
Mar. 8	133.8	28	135.5	Sept. 29	135.5	Dec. 31	134.5
May 17	132.9	July 26	134.2	Oct. 26	135.3		

3S/12-8L3. Los Angeles County Farm. Records furnished by San Gabriel Valley Protective Association. Records available: 1930-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 5	27.81	Apr. 5	28.71	July 5	40.16	Oct. 4	41.41
12	27.73	12	29.05	12	43.50	11	40.71
19	29.50	19	34.14	19	42.53	18	38.85
26	29.74	26	34.96	26	41.94	25	38.33
Feb. 2	30.17	May 3	33.34	Aug. 2	42.50	Nov. 1	37.87
9	28.40	10	36.22	9	42.11	8	38.17
16	29.45	17	37.97	16	41.94	15	38.04
23	29.75	24	38.95	23	42.23	22	38.51
Mar. 1	31.86	31	37.43	30	41.55	29	37.71
8	34.10	June 7	38.65	Sept. 6	41.97	Dec. 6	36.97
15	32.94	10	40.26	13	42.08	13	35.99
22	30.08	21	40.30	20	41.39	20	34.31
29	29.08	28	40.42	27	40.33	27	33.08

3S/13-8L2. H. N. Edison. Records furnished by California Division of Water Resources. Records available: 1930-48.

Feb. 3	115.7	May 17	120.6	July 28	124.2	Oct. 30	126.7
Mar. 5	116.4	June 2	123.4	Aug. 27	126.4	Nov. 29	124.4
22	116.1	July 1	123.2	Sept.29	128.6	Dec. 30	121.4

3S/13-18G2. Union Oil Co. All water levels are below sea level. Records furnished by California Division of Water Resources. Records available: 1930-48.

Feb. 3	168.7	May 17	175.8	July 29	178.8	Oct. 28	177.4
Mar. 5	170.5	June 2	179.4	Aug. 31	178.3	Nov. 27	176.0
31	169.8	30	180.1	Sept.27	179.8	Dec. 28	175.1

3S/14-3K1. Southern California Water Co., Yukon plant well 1. All water levels are below sea level. Records furnished by Southern California Water Co. Records available: 1941-48.

Jan. 7	108	Apr. 7	108	July 7	141	Oct. 7	135
14	102	14	108	14	142	14	135
21	102	21	112	21	136	21	135
28	109	28	117	28	137	28	135
Feb. 7	102	May 7	120	Aug. 7	138	Nov. 7	134
14	102	14	125	14	138	14	132
21	108	21	130	21	138	21	130
28	108	28	133	28	137	28	130
Mar. 7	110	June 7	136	Sept. 7	136	Dec. 7	130
14	110	14	136	14	138	14	125
21	108	21	140	21	138	21	126
28	110	28	140	28	136	28	127

3S/14-21B1. Southern California Water Co., Rosecrans plant well 1. All water levels are below sea level. Records furnished by Southern California Water Co. Records available: 1931-48.

Jan. 7	101	Apr. 7	105	July 7	109	Oct. 7	110
14	101	14	105	14	112	14	108
21	102	21	107	21	112	21	108
28	101	28	107	28	112	28	109
Feb. 7	101	May 7	109	Aug. 7	112	Nov. 7	109
14	101	14	109	14	112	14	108
21	102	21	111	21	112	21	108
28	102	28	111	28	111	28	108
Mar. 7	107	June 7	111	Sept. 7	111	Dec. 7	106
14	107	14	111	14	111	14	106
21	106	21	109	21	111	21	106
28	107	28	108	28	111	28	106

3S/14-36M3. H. T. Potomkin. All water levels are below sea level. Records furnished by California Division of Water Resources. Records available: 1910, 1928-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	73.4	Apr. 27	74.8	Aug. 4	76.3	Oct. 26	75.7
Feb. 24	73.5	May 25	76.3	30	75.9	Nov. 29	75.6
Mar. 22	73.6	June 28	75.2	Sept.27	76.0		

4S/11-5D1. V. Capovilla. Records furnished by Orange County Flood Control District. Records available: 1930-48.

Jan. 23	20.04	Apr. 23	38.28	July 14	a 56.18	Oct. 26	43.29
Feb. 26	27.25	June 2	a 45.74	Aug. 24	a 55.40	Nov. 24	39.75
Mar. 23	31.05	24	a 48.82	Sept.23	a 55.07	Dec. 28	27.30

a Below sea level.

4S/12-8P1. Montana Land Co. All water levels are below sea level. Records furnished by city of Long Beach. Records available: 1903, 1914-19, 1942-48.

Jan. 5	99.92	Apr. 5	99.36	July 5	104.83	Oct. 4	113.30
12	99.18	12	99.48	12	107.22	11	113.80
19	100.00	19	101.47	19	107.52	18	112.77
26	101.11	26	102.29	26	107.62	25	109.18
Feb. 2	101.92	May 3	103.09	Aug. 2	107.93	Nov. 1	108.30
9	102.17	10	103.97	9	108.18	8	106.04
16	102.93	17	104.72	16	108.36	15	108.98
23	104.04	24	104.52	23	110.93	22	106.70
Mar. 1	105.27	31	103.96	30	111.92	29	108.14
8	104.28	June 7	103.14	Sept. 6	112.40	Dec. 6	107.45
15	104.03	14	104.80	16	112.20	13	105.97
22	101.38	21	105.66	20	111.62	20	101.09
29	100.08	28	104.79	27	110.72	27	99.00

4S/13-14L1. Southern California Edison Co., Ltd. All water levels are below sea level. Records furnished by city of Long Beach. Records available: 1930-48.

Jan. 5	28.75	Apr. 12	28.81	July 12	29.64	Oct. 11	29.73
12	28.62	19	28.88	19	29.85	18	29.76
19	29.26	26	28.86	26	30.41	25	29.75
Feb. 2	29.52	May 3	29.36	Aug. 2	30.46	Nov. 1	29.91
9	29.05	10	30.56	9	30.38	8	29.98
16	29.56	17	30.61	16	30.36	15	30.16
23	29.76	24	30.26	23	30.32	22	30.32
Mar. 1	29.81	31	29.81	30	30.22	29	30.12
8	30.14	June 7	29.73	Sept. 6	30.24	Dec. 6	30.15
15	30.01	14	29.94	13	30.01	13	30.01
22	29.81	21	29.85	20	29.86	20	30.39
29	29.31	28	29.86	27	29.78	27	29.77
Apr. 5	29.21	July 5	29.89	Oct. 4	29.74		

4S/13-23G2. City of Long Beach. All water levels are below sea level. Records furnished by city of Long Beach. Records available: 1932-48.

Jan. 5	85.9	Apr. 1	88.8	July 12	99.7	Oct. 1	87.6
12	87.5	12	90.6	19	98.8	11	88.5
19	92.7	19	94.9	26	99.3	18	97.9
26	89.0	26	95.1	Aug. 2	100.4	25	86.7
Feb. 2	86.9	May 3	94.6	9	98.9	Nov. 1	89.1
9	86.0	10	94.2	16	97.8	8	90.5
16	86.7	17	96.5	23	101.2	15	91.2
24	88.3	24	97.8	Sept. 1	100.9	22	90.6
Mar. 1	89.1	June 2	95.7	7	97.3	Dec. 1	91.1
8	89.3	14	96.2	13	91.8	13	91.7
15	88.7	21	97.9	20	87.6	20	90.7
22	88.5	July 1	99.8				

4S/13-33D1. City of Los Angeles, Wilmington plant well 14. All water levels are below sea level. Records furnished by California Division of Water Resources. Records available: 1931-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 29	86.0	Apr. 29	97.2	Aug. 26	95.8	Oct. 8	88.7
Feb. 26	86.1	May 28	99.8	Sept.20	91.6	Nov. 9	88.6
Mar. 27	87.5	Aug. 2	95.2				

Orange County

Coastal Plain

3S/11-36Q2. M. Del Giorgio. Records furnished by Orange County Flood Control District. Records available: 1930-48.

Jan. 7	64.16	Apr. 7	67.92	July 7	85.21	Oct. 6	85.49
14	65.47	14	68.10	14	86.58	13	86.86
21	70.41	21	70.03	21	87.99	20	85.44
28	71.50	28	72.91	28	87.27	27	83.23
Feb. 4	72.77	May 5	72.35	Aug. 4	89.55	Nov. 3	82.09
9	68.64	12	74.04	11	89.07	10	83.04
11	67.84	19	81.69	18	88.96	17	83.32
18	67.45	26	80.92	25	89.37	24	85.33
25	68.73	June 2	79.79	Sept. 1	87.43	Dec. 1	82.24
Mar. 3	70.82	9	80.64	8	88.29	8	80.51
10	74.56	16	81.05	15	88.71	15	79.36
17	73.27	23	81.41	22	86.75	22	75.39
24	70.48	30	83.29	29	86.66	29	73.46
31	68.84						

4S/9-7B1. Dowling & Prentice. Records furnished by Orange County Flood Control District. Records available: 1928-48.

Jan. 7	177.26	Mar. 17	178.84	June 16	183.19	Sept. 1	194.81
14	177.82	31	179.04	23	184.02	8	194.08
21	177.68	Apr. 14	179.09	30	184.47	15	195.26
28	177.80	21	178.99	July 7	185.32	29	197.74
Feb. 4	178.67	28	178.95	14	186.17	Oct. 6	198.33
11	178.54	May 5	178.93	28	192.33	13	197.44
18	178.26	12	179.52	Aug. 4	192.33	20	198.19
25	178.28	19	180.24	11	192.89	27	198.16
Mar. 3	178.34	June 2	187.27	18	193.41	Dec. 16	(a)
10	178.79	9	189.04	25	193.54		

a Obstruction in well at 195 feet below land surface.

4S/10-22L2. Halderman & Callens. Records furnished by Orange County Flood Control District. Records available: 1928-39, 1941-48.

Jan. 13	114.06	May 14	119.21	Aug. 10	127.72	Oct. 15	126.84
Feb. 13	115.84	June 15	121.34	31	a127.50	Nov. 16	127.03
Mar. 9	119.52	July 7	126.16	Sept.10	127.71	Dec. 16	129.15
Apr. 13	116.97						

a Pump shut off prior to measurement.

4S/11-19K1. Los Alamitos Sugar Co. Records furnished by city of Long Beach. Records available: 1901, 1903, 1905, 1929-48.

Jan. 5	14.41	Mar. 1	b 31.36	Apr. 18	25.57	June 1	ab 33.80
12	15.05	2	b 31.94	26	26.88	7	b 33.36
19	19.36	8	b 32.58	27	a 27.18	14	b 32.47
26	22.44	15	b 33.62	30	a 28.09	21	b 33.14
30	a 26.98	22	b 31.45	May 3	27.58	28	b 31.97
Feb. 2	b 28.57	29	b 29.06	10	b 28.95	29	ab 32.05
9	b 29.23	29	ab 29.06	17	b 30.61	July 5	b 35.68
16	b 29.75	Apr. 5	26.47	24	b 31.28	12	b 39.83
23	b 30.25	12	24.28	31	b 33.62	19	b 41.88

a By Geological Survey.
b Below sea level.

4S/11-19K1--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
July 26	b 42.06	Aug. 30	b 37.94	Sept.27	ab 36.23	Nov. 15	b 28.70
28	b 41.88	30	b 37.94	27	b 36.64	22	28.02
30	ab 42.33	31	ab 37.73	Oct. 4	b 37.54	29	28.02
Aug. 2	b 40.93	Sept. 1	b 38.02	11	b 34.80	30	a 27.74
4	b 41.93	6	b 37.71	18	b 34.18	Dec. 6	27.14
9	b 40.70	8	b 38.06	25	30.80	13	28.40
11	b 41.41	13	b 37.34	Nov. 1	ab 29.60	20	24.56
16	b 39.99	15	37.75	1	29.57	27	22.27
23	b 39.26	30	b 37.60	8	28.45	31	a 22.47
25	b 39.78						

a By Geological Survey.
b Below sea level.

5S/10-9D1. Julio Martinez. Records furnished by Orange County Flood Control District. Records available: 1922-48.

Jan. 13	59.09	Apr. 13	65.26	July 7	(a)	Oct. 15	72.35
Feb. 13	63.32	May 14	68.48	Aug. 10	78.05	Nov. 16	69.70
Mar. 9	70.29	June 15	(a)	Sept.10	73.78	Dec. 16	67.28

a Pumping.

5S/10-28B1. John Sturtevant. Records furnished by Orange County Flood Control District. Records available: 1935-48.

Jan. 15	36.38	Apr 15	49.30	July 15	57.48	Oct. 19	(a)
Feb. 17	(a)	May 18	(a)	Aug. 12	58.46	Nov. 18	(a)
Mar. 12	(a)	June 17	(a)	Sept.14	(a)	Dec. 15	(a)

a Pumping.

5S/11-2E1. Western Trust & Savings Bank. Records furnished by Orange County Flood Control District. Records available: 1929-48.

Jan. 9	40.06	Apr. 9	54.25	July 12	67.44	Oct. 14	56.97
Feb. 6	51.71	May 11	49.87	Aug. 5	70.14	Nov. 12	55.43
Mar. 5	57.83	June 11	52.38	Sept. 8	60.23	Dec. 14	48.57

5S/11-16D2. Anaheim Sugar Co. Records furnished by Orange County Flood Control District. Except as noted, water levels are below sea level. Records available: 1929-48.

Jan. 7	a 11.27	Apr. 14	22.56	July 7	23.68	Oct. 6	25.64
14	a 13.72	21	22.03	14	26.54	13	23.70
21	17.06	28	21.30	21	27.40	20	23.96
28	21.10	May 5	19.96	28	28.01	27	22.63
Feb. 4	26.74	12	20.47	Aug. 4	28.71	Nov. 3	21.09
11	27.35	19	20.95	11	28.21	10	21.07
18	29.47	20	21.42	18	27.45	17	21.68
25	32.05	26	21.94	25	26.16	24	21.42
Mar. 3	33.75	June 2	21.67	Sept. 1	26.09	Dec. 1	19.38
10	34.62	9	20.98	8	27.10	8	18.89
17	32.33	16	21.72	15	28.15	15	18.11
24	29.97	23	21.82	22	27.61	22	16.88
31	28.83	30	22.12	29	26.74	29	a 15.72
Apr. 7	25.66						

a Above sea level.

5S/11-18N1. U. S. Naval Depot. Records available: 1941-48. Feb. 4, 4.11; Dec. 30, 4.05.

5S/11-18P1. U. S. Naval Depot. Records available: 1941-48. Feb. 4, 2.04; Dec. 30, +0.05.

5S/11-25P1. E. J. Lecrivain. Records furnished by Orange County Flood Control District. Records available: 1930-48.

5S/11-25P1--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 15	44.04	Apr. 15	a 52.31	July 15	a 52.96	Oct. 19	a 51.35
Feb. 17	a 58.73	May 18	a 50.07	Aug. 12	a 53.79	Nov. 18	a 49.81
Mar. 12	a 60.81	June 17	a 49.96	Sept.14	a 53.04	Dec. 15	a 49.50

a Below sea level.

5S/11-28A1. A. Ruoff. Records furnished by Orange County Flood Control District. Records available: 1930-48.

Jan. 15	6.78	Apr. 15	a 16.30	July 15	a 16.78	Oct. 19	a 19.58
Feb. 17	a 23.68	May 18	a 11.12	Aug. 12	a 18.23	Nov. 18	a 18.83
Mar. 12	(b)	June 17	a 15.54	Sept.14	a 23.75	Dec. 15	a 14.14

a Below sea level.
b Pumping.

5S/11-29C4. Sunset Land & Water Co. Records furnished by Orange County Flood Control District. Records available: 1941-48.

Jan. 15	6.14	Apr. 15	a 13.33	Aug. 12	a 17.56	Oct. 19	a 16.35
Feb. 17	a 17.26	June 17	a 11.67	Sept.14	a 18.60	Dec. 15	a 10.60
Mar. 12	a 19.61	July 15	a 14.63				

a Below sea level.

5S/11-29E1. U. S. Government. Records available: 1941-48. Dec. 30, 4.90.

5S/11-29E2. U. S. Government. Records available: 1941-48. Dec. 30, 4.76.

5S/12-12P1. U. S. Naval Depot. All water levels are below sea level. Records furnished by city of Long Beach. Records available: 1930-48.

Feb. 17	21.78	May 14	20.35	Aug. 6	23.77	Oct. 29	21.09
Mar. 9	24.49	June 4	20.80	27	23.35	Nov. 19	19.74
30	23.88	25	21.07	Sept.17	24.12	Dec. 10	18.75
Apr. 23	21.04	July 16	22.51	Oct. 8	23.12	31	17.13

5S/12-13D1. U. S. Naval Depot. Records available: 1942-48. Feb. 4, 22.88; Dec. 30, 22.82.

6S/10-1E1. Frank Ey. Except as noted, all water levels are below sea level. Records furnished by Orange County Flood Control District. Records available: 1930-48.

Jan. 12	a 28.66	Apr. 5	57.46	July 19	49.86	Oct. 11	45.39
19	35.88	12	49.52	26	53.57	18	45.26
26	43.64	19	49.65	Aug. 2	54.29	25	43.66
Feb. 2	49.41	26	49.48	9	53.72	Nov. 1	43.71
9	48.66	May 3	43.18	16	51.81	8	43.17
16	49.75	10	43.05	23	50.14	22	40.83
Mar. 1	53.97	17	43.59	30	47.42	29	41.29
8	55.22	24	43.03	Sept.13	46.53	Dec. 6	39.00
15	55.31	June 7	42.56	20	44.91	13	39.63
22	63.85	14	42.89	27	46.02	20	39.44
29	58.65	21	44.11	Oct. 4	45.67	27	37.42

a Above sea level.

6S/10-1L2. I. A. W. Henry. Records furnished by Orange County Flood Control District. Records available: 1904, 1921-48.

Jan. 16	20.02	Apr. 16	25.41	July 20	28.59	Oct. 21	25.71
Feb. 19	21.53	May 21	23.05	Aug. 13	28.22	Nov. 19	23.92
Mar. 16	24.99	June 18	24.53	Sept.16	27.13	Dec. 17	22.68

6S/10-5C1. Robert Gisler. Except as noted, all water levels are below sea level. Records furnished by Orange County Flood Control District. Records available: 1931-48.

947807 O—51——8

6S/10-5C1--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 12	a 13.97	Apr. 12	27.11	July 19	26.19	Oct. 11	23.19
19	a 16.67	19	24.95	26	(b)	18	22.97
26	23.33	26	(b)	Aug. 2	(b)	25	22.01
Feb. 2	27.45	May 3	21.61	9	(b)	Nov. 1	21.60
9	32.17	10	22.01	16	26.51	8	21.09
16	(b)	17	21.63	23	26.61	22	21.19
Mar. 1	(b)	24	(b)	30	25.72	29	21.55
8	(b)	June 7	(b)	Sept. 13	25.23	Dec. 6	21.35
15	(b)	14	21.30	20	25.09	13	21.04
22	(b)	21	21.52	27	24.22	20	20.59
29	(b)	July 6	23.78	Oct. 4	23.76	27	19.73
Apr. 5	29.06	12	24.90				

a Above sea level.
b Pumping.

6S/11-13G2. Surf Land & Water Co. All water levels are below sea level. Records furnished by Orange County Flood Control District. Records available: 1930-48.

Jan. 7	3.76	Apr. 7	8.93	July 7	4.85	Oct. 6	4.96
14	7.13	14	7.40	14	6.13	13	4.60
21	7.40	21	6.29	21	6.25	20	4.26
28	12.28	28	5.39	28	6.32	27	3.87
Feb. 4	13.62	May 5	5.06	Aug. 4	6.41	Nov. 3	3.76
11	14.43	12	5.13	11	6.75	10	3.83
18	14.59	19	4.59	18	6.30	17	3.96
25	15.25	26	5.10	25	6.34	24	4.26
Mar. 3	15.01	June 2	4.64	Sept. 1	6.52	Dec. 1	4.29
10	16.13	9	4.84	8	6.21	8	5.36
17	15.25	16	4.67	15	6.15	15	5.48
24	14.26	23	4.67	22	5.78	22	5.39
31	13.57	30	4.91	29	4.89	29	5.06

I-9F1. The Irvine Co. Except as noted, all water levels are below sea level. Records furnished by the Orange County Flood Control District. Records available: 1932-48.

Jan. 7	a 45.82	May 5	(b)	July 21	(b)	Oct. 13	68.15
Feb. 4	a 49.96	12	(b)	28	(b)	20	65.55
11	a 50.76	19	(b)	Aug. 4	76.19	27	65.34
18	54.03	26	66.25	11	75.51	Nov. 3	61.67
Mar. 3	62.19	June 9	(b)	25	72.08	10	60.57
10	71.79	16	(b)	Sept. 1	70.12	17	59.66
24	75.43	23	(b)	8	69.56	24	58.92
31	(b)	30	66.85	15	(b)	Dec. 1	60.34
Apr. 14	(b)	July 7	68.79	29	68.45	8	59.90
21	66.00	14	(b)	Oct. 6	68.65	15	59.40
28	62.82						

a Above sea level.
b Pumping.

Riverside County

Santa Ana River basin, San Jacinto valley

3/2W-35Q1. I. E. Facemire. Records available: 1945-48. Feb. 6, pumping; Apr. 26, pumping; Aug. 26, 21.30; Nov. 24, 26.18.

4/2W-7J1. Albert McDonald. Records available: 1946-48.

Feb. 6	83.33	May 28	86.55	Aug. 26	92.36	Nov. 24	94.36
Mar. 30	81.54	June 23	89.81	Sept. 28	93.19	Dec. 22	86.56
Apr. 26	83.64	July 27	91.23	Oct. 27	95.08		

4/3W-32E1. James Malcomb. Key well. Records available: 1936-48. Feb. 7, 64.50; Apr. 26, 62.45; Aug. 26, 62.89; Nov. 24, 62.91.

4/4W-1L1. B. H. LeCont. Records available: 1945-48. Feb. 7, 40.01; Apr. 26, 40.06; Aug. 26, 40.96; Nov. 24, 41.43.

5/1W-2N1. J. A. Barger. Records available: 1945-48. Feb. 6, 70.58; Apr. 26, 70.78; Aug. 26, 71.69; Nov. 24, 74.18.

5/2W-24A1. L. Wilhelm. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 7	35.50	Apr. 26	(a)	Aug. 26	41.66
Mar. 30	(a)	May 28	(a)	Nov. 24	41.79

a Pumping.

5/2W-27E2. L. L. Whiting. New measuring point, beginning Apr. 26, top of 2 by 8 inch plank set in concrete base 2½ by 4 feet and 0.8 foot above land surface. Records available: 1945-48. Apr. 26, 33.29; Aug. 26, 31.96; Nov. 24, 31.97.

6/3W-4A2. Menifee School. Records available: 1945-48. Feb. 7, 57.03; Apr. 26, 59.89; Aug. 26, 61.27; Nov. 24, 60.97.

San Bernardino County

Chino Basin

3S/7W-8A. U. S. Government. Formerly owned by Chino Gun Club. California Division of Water Resources serial No. D-783 and location No. 16766. About 6 miles southeast of Chino, 390 feet east of Serrano Road and 40 feet south of McCarty Avenue, at edge of olive orchard. Unused well, diameter 12 inches, depth 409.8 feet. Measuring point, top of casing, 3.3 feet above land-surface datum and 539.80 feet above mean sea level. Water-stage recorder maintained on well since June 21, 1947, by Geological Survey. Additional measurements 1930-32 and 1939-48 by Orange County Flood Control District; and intermittently 1930-48 by J. R. Shoemaker, Chino Basin Protective Association, and San Bernardino County Flood Control District. Records available: 1948.

June 12, 1947	26.00	Apr. 26, 1948	27.16	Aug. 30, 1948	28.22
Jan. 5, 1948	27.05	May 3	27.22	Sept. 7	28.28
20	27.09	10	27.28	13	28.32
21	27.11	17	27.59	20	28.39
22	27.07	24	27.58	27	28.45
26	27.07	June 1	27.59	Oct. 4	28.53
Feb. 2	27.08	7	27.62	11	28.55
9	27.02	14	27.66	18	28.56
16	27.03	21	27.68	25	28.59
23	26.96	28	27.73	Nov. 1	28.62
Mar. 1	27.04	July 6	27.85	8	28.64
8	27.06	12	27.82	15	28.66
15	27.06	19	27.87	22	28.67
22	27.08	26	27.94	29	28.68
29	27.07	Aug. 2	27.99	Dec. 6	28.68
Apr. 5	27.07	9	28.08	13	28.66
12	27.08	16	28.13	20	28.64
19	27.14	23	28.19	27	28.59

3S/7W-8B. U. S. Government. California Division of Water Resources serial No. D-783c and location No. 16766A. About 6 miles southeast of Chino, 125 feet west of Serrano Road and 20 feet south of the centerline of McCarty Avenue, extended. Unused well, diameter 10 inches, depth 41.2 feet. Measuring point, top of ½-inch nipple welded into casing cover, 0.88 foot above land-surface datum and 533.65 feet above mean sea level. Water-stage recorder maintained on well since Jan. 21, 1948, by Geological Survey. Additional measurements 1939-48 by Orange County Flood Control District. Records available: 1948.

3S/7W-8B--Continued.

Date	Water level	Date	Water level	Date	Water level
June 12, 1947	26.02	Apr. 26, 1948	26.94	Aug. 30, 1948	28.01
Jan. 5, 1948	27.04	May 3	27.00	Sept. 7	28.07
20	27.19	10	27.10	13	28.12
21	27.04	17	27.09	20	28.19
22	27.04	24	27.16	27	28.25
26	27.00	June 1	27.17	Oct. 4	28.31
Feb. 2	27.00	7	27.30	11	28.34
9	26.93	14	27.29	18	28.39
16	26.93	21	27.33	25	28.41
23	26.81	28	27.42	Nov. 1	28.46
Mar. 1	26.91	July 6	27.59	8	28.49
8	26.91	12	27.52	15	28.50
15	26.92	19	27.59	22	28.50
22	26.93	26	27.68	29	28.48
29	26.91	Aug. 2	27.75	Dec. 6	28.50
Apr. 5	26.86	9	27.84	13	28.46
12	26.87	16	27.90	20	28.48
19	26.91	23	27.98	27	28.43

3S-7W-9D. Test well 1. Constructed by Geological Survey on property of the U. S. Government. About 6 miles southeast of Chino, 500 feet west of Mill Creek, 70 feet south of McCarty Road, at east end of olive orchard on hillside. Bored water-table well, diameter 8 inches, depth 19.5 feet. Measuring point, top of casing, 3.3 feet above land-surface datum and 514.27 feet above mean sea level. Water-stage recorder maintained on well since Mar. 3, 1948. Records available: 1943.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 25	9.02	May 10	9.43	July 26	11.05	Oct. 11	11.59
Mar. 1	9.11	17	9.73	Aug. 2	11.23	18	11.25
8	8.96	24	9.87	9	11.34	25	11.20
15	8.95	June 1	9.65	16	11.45	Nov. 1	10.92
22	8.89	7	9.88	23	11.56	8	10.86
29	8.87	14	10.14	30	11.65	15	10.70
Apr. 5	8.78	21	10.29	Sept. 7	11.80	22	10.54
12	8.55	28	10.42	13	11.89	29	10.33
19	8.84	July 6	10.65	20	11.81	Dec. 6	10.11
26	9.00	12	10.82	27	11.69	13	9.93
May 3	9.23	19	10.93	Oct. 4	11.77	20	9.72

3S/7W-17K. U. S. Government. In Riverside County. California Division of Water Resources serial No. D-7881 and location No. 1676?C. About 8 miles southeast of Chino, 0.7 mile east of Prado Road, 150 feet northwest of Serrano Road, and 20 feet southwest of fence line. Unused well, diameter 16 inches, depth 69.0 feet. Measuring point, top of ½-inch nipple welded into casing cover, at land-surface datum and 486.50 feet above mean sea level. Water-stage recorder maintained on well since Jan. 22, 1948, by Geological Survey. Additional measurements 1941-48 by Orange County Flood Control District. Records available: 1948.

Date	Water level	Date	Water level	Date	Water level
June 13, 1947	5.91	Apr. 5, 1948	4.59	July 6, 1948	7.09
Jan. 2, 1948	5.45	12	4.85	12	7.23
22	5.29	19	5.19	19	7.30
26	5.31	26	5.35	26	7.37
Feb. 2	5.29	May 3	5.51	Aug. 2	7.45
9	4.84	10	5.74	9	7.53
16	4.97	17	5.97	16	7.55
23	4.96	24	6.15	23	7.54
Mar. 1	5.04	June 1	6.15	30	7.53
8	5.02	7	5.34	Sept. 7	7.58
15	4.96	14	6.56	13	7.61
22	4.89	21	6.71	20	7.51
29	4.85	28	6.88	27	7.44

38/7W-17K--Continued.

Date	Water level	Date	Water level	Date	Water level
Oct. 4	7.43	Nov. 8	6.90	Dec. 6	6.44
11	7.33	15	6.79	13	6.29
18	7.16	22	6.71	20	6.19
25	7.06	29	6.61	27	5.98
Nov. 1	6.94				

Mojave River basin

3/3W-6E1. Mike Spranger. Records available: 1939-48. June 3, 14.26; Nov. 24, dry.

3/3W-6E2. About 20 feet north of 3/3W-6E1. Diameter of casing 12 inches, depth 61 feet. Measuring point, top edge of airline hole in cast-iron pump base, 0.7 foot above land-surface datum. Records available: 1948. Nov. 24, 37.80.

3/4W-12J1. Olive. Records available: 1939-48. May 6, 5.53; Dec. 1, dry at 25.5.

3/4W-13B1. Olive. Records available: 1939-48. May 6, 70.52; Dec. 16, 84.76.

4/3W-1M1. E. D. S. Pope. Records available: 1939-48. May 6, 200.68; Dec. 1, 202.75.

4/3W-6B1. A. J. Lintner. Records available: 1939-48. Mar. 25, 52.24; Apr. 28, 53.80; May 27, 54.02; Dec. 1, 55.60.

4/3W-6D1. A. W. Phillips. Records available: 1939-48. Mar. 25, 53.62; Apr. 28, 54.13; May 27, 54.73; Dec. 1, 56.35.

4/3W-17M1. Arrowhead Reservoir & Power Co. Records available: 1939-48. May 6, 21.99; Dec. 1, dry at 24.8.

4/3W-18E1. C. O. Evans. Records available: 1939-48. May 6, 26.73; Dec. 1, 29.93.

4/3W-19G1. G. W. McLister. Records available: 1939-48. May 6, 33.08; Dec. 1, 37.35.

4/3W-19R1. Arrowhead Reservoir & Power Co. Records available: 1939-48. May 6, 34.46; Dec. 1, 38.50.

4/3W-20L1. J. M. Allison. Records available: 1939-48. May 6, 34.57; Dec. 1, 38.03.

4/3W-21A1. W. O. Wade. Records available: 1939-48. May 6, 251.7; Dec. 1, 257.15.

4/3W-30E1. A. W. Cole. Records available: 1939-48. May 6, 42.25; Dec. 1, 46.30.

5/3W-3D1. Dick Lewis. NW¼NW¼ sec. 3, T. 5 N., R. 3 W., about 600 feet south and 500 feet east at northwest corner of section, and 150 yards southeast from ranch house. Domestic and irrigation well, diameter 12 inches, depth unknown. Equipped with Pomona electric pump. Measuring point, top of 12-inch casing 0.2 foot above land-surface datum. Records available: 1948. May 7, 71.80; Nov. 19, 71.9.

5/3W-9K1. F. A. Fletcher. Records available: 1939-48. May 7, 88.68; Nov. 19, 88.71.

5/3W-13D1. Eva V. Case. NW¼NW¼ sec. 13, T. 5 N., R. 3 W., about 0.15 mile south and 0.20 mile east of northwest corner of section, and about 100 feet north of three small quonset huts on knoll. Used domestic well, diameter 6 inches, depth unknown. Equipped with automatic electric pump. Measuring point, top of 6 inch casing, 0.6 foot above land-surface datum. Records available: 1948. May 7, 89.21; Nov. 19, 89.22.

5/3W-18F1. J. D. Humiston. Records available: 1939-48. May 7, 107.90; Nov. 19, 107.92.

5/3W-22A1. Jack Rothwell. NE¼NE¼ sec. 22, T. 5 N., R. 3 W., about 200 feet south and 640 feet west of northeast corner of section, and about 550 feet southwest of ranch house. Used drilled domestic and irrigation well, diameter 12 inches, depth unknown. Equipped with 20 horsepower Pomona electric pump. Measuring point, top of 1¼-inch pipe nipple set at 45 degree angle in concrete block around casing. Slope distance down from measuring point to land-surface datum is 1.2 feet. Records available: 1948. May 7, 88.87; Nov. 19, 89.19.

5/3W-24N1. Douglas. SW¼SW¼ sec. 24, T. 5 N., R. 3 W., about 80 feet north and 625 feet east of southwest corner of section, and 150 feet southeast of ranch house. Used drilled domestic well, diameter 12 inches, depth unknown. Equipped with windmill. Measuring point, top of 12-inch casing flush with concrete block, 1 foot above land-surface datum. Records available: 1948. May 7, 89.04; Dec. 2, 89.28.

5/4W-10M1. In Victorville. Records available: 1939-48. May 7, 44.49; Nov. 24, 44.53.

5/4W-11P1. Lee Saul. Records available: 1939-48. May 7, 54.09; Dec. 2, 54.14.

5/4W-11P2. Lee Saul. Records available: 1939-48. May 7, 47.68; Dec. 2, 48.92.

5/4W-35A1. A. Sorenson. Records available: 1939-48. Dec. 1, flows about ½ sec.-ft.

5/4W-36N1. Verde Ranch. The reference point was destroyed and the land surface heavily graded at the site of this well. Measurements withheld from publication due to uncertainties in elevations of land surface and measuring point. Records available: 1939-48.

6/3W-28R1. SE¼SE¼ sec. 28, T. 6 N., R. 3 W., about 500 feet north and 675 feet west of southeast corner of section, and 12 feet west of old ranch house. Drilled used domestic and irrigation well. Equipped with turbine pump driven by diesel engine. Measuring point, top of hole in southeast corner of pump base, 0.8 foot above land-surface datum. Records available: 1948. May 13, 125.70; Nov. 19, 125.81.

7/4W-30C1. Records available: 1939-48. May 14, 57.91; Nov. 18, 57.92.

8/3E-3E1. C. W. Beaverstock. Records available: 1939-48. May 19, 5.46; Nov. 23, 6.71.

8/3E-3F1. Measuring point beginning Jan. 21, 1937, top of 7-inch steel casing in old 10-inch casing, 1.7 feet above land-surface and 1,825.74 feet above sea level. Note: correction of +0.6 foot to all published water levels from Jan. 21, 1937 to Nov. 18, 1947; except Nov. 30, 1939 referred to original measuring point. Records available: 1937-48. May 19, 21.68; Nov. 23, 21.76.

8/3E-4B1. Lyle Graham. Records available: 1939-48. May 19, 3.93; Nov. 23, 3.89.

8/3E-4B2. Lyle Graham. Records available: 1939-48. May 19, 6.00, pumped May 18 and 19 before measurement. Nov. 23, 4.23.

8/3W-4M1. Everett Swing. Records available: 1939-48. May 14, 13.27; Nov. 18, 15.53.

8/4E-7E1. Records available: 1945-48. Nov. 23, 23.51.

8/4E-9C1. Old No. L32A. NE¼NW¼ sec. 9, T. 8 N., R. 4 E. Where Highway No. 66 crosses Troy Dry Lake near upper or southern end. Groundwater surface in borrow pit. Measuring point, 3 notches near west end of south bridge rail 2.5 feet above floor of bridge, 8 feet above land-surface datum and 1,783.17 feet above sea level. Records available: 1947-48. Nov. 18, 1947, 1.83; May 19, 1948, 2.14; Nov. 23, 1948, 0.09.

8/4E-12L1. Mojave Camp service station. Records available: 1939-48. May 19, 30.24; Nov. 23, 30.51.

8/4W-2Q1. Records available: 1939-48. May 14, 23.83; Nov. 18, dry at 26.5.

8/4W-12Q1. Holcomb Bros. Records available: 1939-48. May 14, 8.73; Nov. 18, 10.83.

8/4W-20N1. Lord. Records available: 1939-47. No measurements made in 1948.

8/4W-31D1. F. H. Merrell. Records available: 1939-48. May 14, 46.30; Nov. 18, 42.19.

8/4W-31R1. Records available: 1939-48. May 14, 15.48; Nov. 18, 16.69.

9/1E-12D1. Records available: 1939-48. May 18, 42.44; Nov. 22, 43.77.

9/1E-13E1. Records available: 1939-48. May 19, 63.75; Nov. 23, 65.15.

9/1E-13E2. Records available: 1939-48. May 19, 64.57; Nov. 23, 66.05.

9/1E-18E1. B. A. Funk. Records available: 1939-48. May 17, 12.8; Nov. 22, 25.0.

9/1E-24D1. Records available: 1939-48. May 19, 68.43; Nov. 23, 69.98.

9/1W-10A1. Gibbs. Records available: 1939-48. May 17, 13.52; Nov. 18, 14.35.

9/1W-10D2. R. E. Hettick. Records available: 1946-48. May 17, 10.88.

9/1W-10M1. Greystone Auto Camp. Records available: 1939-47. No measurements made in 1948.

9/1W-13B1. F. Ryerse. Records available: 1939-48. May 17, 20.22.

9/2E-3A1. Bruce McCormick. Records available: 1939-48. May 18, 14.03; Nov. 22, 17.19.

9/2E-3A2. Bruce McCormick. Records available: 1939-48. Nov. 22, 20.30.

9/2E-4D1. Records available: 1939-48. May 18, 18.81; Nov. 22, 19.91.

9/2E-8J1. Annie Escholtz. Records available: 1939-48. May 19, 38.65; wet casing, poor measurement; Nov. 23, 39.91.

9/2E-12N1. Hunter. Records available: 1939-48. May 19, 4.64; Nov. 23, 4.93.

9/2E-14N1. Scobel & Haimut. Records available: 1939-48. May 19, 22.35; Nov. 23, pumping.

9/2E-14N2. Scobel & Haimut. Records available: 1939-48. May 19, 17.09; Nov. 23, 17.36.

9/2E-14N3. Scobel & Haimut. Records available: 1939-48. May 19, 17.49; Nov. 23, 17.61.

9/2E-18F1. Records available: 1939-48. May 19, 53.35; Nov. 23, 54.50.

9/2E-20Q1. Daggett Airport. Records available: 1945-48. May 20, 44.85; Nov. 23, 45.72.

9/2W-19B1. Shobel. Records available: 1939-48. May 18, 63.22; Nov. 18, 63.98.

9/3E-3D1. Records available: 1939-48. May 20, 42.05; Nov. 23, 41.90.

9/3E-10D1. Bozarth. Records available: 1939-48. May 20, 35.64; Nov. 23, 35.94.

9/3E-12E1. B. Nicholas. Records available: 1939-48. May 20, 25.35; Nov. 23, 25.57.

9/3E-19E1. Records available: 1919, 1922, 1930-32, 1935, 1938-48. May 19, 1.30; Nov. 23, 1.85. Destroyed, measurements discontinued.

9/3E-19P1. Frey. Records available: 1942-47. No measurements made in 1948.

9/3E-34D1. Clinkenbeard. Records available: 1939-48. May 20, 29.81; Nov. 23, 30.16.

9/3W-10P1. Records available: 1939-48. May 14, 88.87; Nov. 18, 89.23.

9/3W-10R1. Osborn. Records available: 1939-48. May 14, caved and dry at 13.6; Nov. 18, caved and dry at 13.6.

9/3W-14D1. Bullock. Records available: 1939-48. May 14, 21.42; Nov. 18, 18.56.

9/3W-28A1. J. Slagill. Records available: 1939-48. May 14, 8.01; Nov. 18, 18.98.

9/3W-34R1. Nellie Storey. Records available: 1939-48. May 14, 125.55; Nov. 18, 125.90.

9/4E-31K1. A. M. Monroe. Records available: 1939-48. May 19, 13.23; Nov. 23, 13.44.

10/1W-31C1. Nelson. Records available: 1939-48. May 17, 47.79; Nov. 18, 48.59.

10/2E-32P1. Yermo Mutual Water Co. Records available: 1939-48. May 18, 26.60; Nov. 22, 28.01.

10/2E-34L1. Records available: 1939-48. May 18, 56.34; Nov. 22, 57.80.

10/2W-19P1. Loftus. Records available: 1939-48. May 17, 67.34; Nov. 18, 67.65.

10/2W-30N1. J. D. Rich. Records available: 1939-48. May 17, 23.94, pumping nearby; Nov. 18, 24.65, pumping nearby.

10/3W-32C1. Records available: 1939-48. May 17, 58.12; Nov. 18, 58.14.

10/3E-34E2. G. M. Bond. Records available: 1947-48. May 20, 8.56; Nov. 23, 9.40.

11/3W-28R1. S. F. Edwards. Records available: 1944-48. May 17, 26.78; Nov. 18, 26.82.

11/3W-34F1. Records available: 1939-48. May 17, 33.84; Nov. 18, 34.00.

Santa Ana River basin, San Bernardino area

1N/4W-28R1. S. F. Kelley. Records available: 1945-48. Nov. 23, 62.30.

1N/4W-36F1. G. M. Cooley. June 30, 1948, placed 1¼-inch galvanized pipe with 1½-inch well point inside old casing. Total clear length inside of 1¼-inch pipe 80.6 feet. New measuring point, top of 1¼-inch pipe cap with ⅜-inch hole in center, 0.7 foot above land-surface datum and 1,145.94 feet above mean sea level. Reference point, top of 5/8-inch bolt set in concrete block surrounding casing, 1,145.64 feet above mean sea level. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level
May 5	51.00	July 1	52.67	Nov. 23	56.79
June 30	52.54	Aug. 10	54.68		

1S/3W-3N1. R. C. Gerber. Records available: 1945-48. Feb. 11, 98.73; May 5, 100.35; Aug. 10, 104.83; Nov. 29, 111.76.

1S/3W-16L1. S. Ronzone. Records available: 1945-48.

Feb. 4	88.88	June 29	88.08	Nov. 23	(a)
May 5	82.49	Aug. 10	(a)		

a Dry.

1S/3W-17C1. Known as Williams well. Records furnished by Gage Canal Co. Records available: 1936-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 3	27.86	Apr. 3	27.62	July 3	31.53	Oct. 2	37.53
10	27.70	10	27.53	10	32.03	9	37.86
17	28.95	17	27.62	17	32.53	16	38.12
24	28.20	24	27.62	24	33.03	23	38.53
31	28.36	May 1	27.88	31	33.70	30	38.53
Feb. 7	28.45	8	28.03	Aug. 7	34.12	Nov. 6	38.78
14	28.06	15	28.45	14	34.28	13	38.53
21	27.45	22	28.95	21	34.62	20	38.70
28	27.20	29	29.45	28	35.36	27	38.86
Mar. 6	27.86	June 5	29.87	Sept. 4	35.95	Dec. 4	39.06
13	28.12	12	30.20	11	36.36	11	39.12
20	27.20	19	31.62	17	36.87	18	39.20
27	27.53	26	31.03	25	37.20	25	39.28

1S/3W-20B1. Emmet Martin. Key well U. S. 101. Records available: 1945-48.

Jan. 29	42.33	Apr. 29	44.09	July 28	46.50	Oct. 28	47.40
Mar. 1	42.45	June 23	45.68	Sept. 28	47.61	Nov. 23	48.28
29	42.58						

1S/3W-28E1. George Hinckley. Records available: 1945-48. Feb. 4, 47.28; May 5, 49.84; Aug. 10, 52.66; Nov. 23, 54.86.

1S/3W-29K1. J. Yount. Records available: 1945-48. Feb. 4, 38.26; May 5, 39.38; Aug. 10, 41.87; Nov. 23, 43.52.

1S/3W-32C1. W. H. Martin. Records available: 1945-48. Feb. 4, 65.03; May 4, 65.65; Aug. 10, 67.17; Nov. 23, 68.16.

1S/4W-4K1. W. J. Walsh. Records available: 1945-48. Feb. 4, 11.59; May 5, 13.76; Aug. 10, 20.06; Nov. 23, 17.98.

San Diego County

San Luis Rey River basin

10/3W-1. San Luis Rey Ranch. Records available: 1937-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 5	6.89	July 12	10.72	Oct. 4	14.00
Apr. 5	6.71	Aug. 17	12.83		

10/3W-1a. San Luis Rey Ranch. Records available: 1937-48.

Jan. 5	8.80	July 12	9.15	Oct. 4	11.38
Apr. 5	8.53	Aug. 17	9.41		

10/3W-1b. San Luis Rey Ranch. Records available: 1937-48.

Jan. 5	7.17	July 12	7.59	Oct. 4	9.74
Apr. 5	6.90	Aug. 17	7.71		

10/3W-1c. Fallbrook Public Utility District observation well, San Luis Rey Ranch. Records available: 1939-48.

Jan. 5	12.73	July 12	8.95	Oct. 4	9.34
Apr. 5	8.91	Aug. 17	9.19		

10/3W-15. Gird Ranch. Records available: 1937-48.

Jan. 5	9.71	July 12	10.60	Oct. 4	13.16
Apr. 5	9.79	Aug. 17	11.81		

10/3W-20P3. Formerly listed as 10/3W-20. Bonsall School. Records available: 1937-48. Jan. 5, 9.81; Apr. 5, 8.88; Oct. 4, 10.53.

10/3W-29C1. Formerly listed as 10/3W-20a. Sickler Ranch. At Bonsall. Records available: 1943-48. Jan. 5, 17.34; Apr. 5, 15.94; July 12, 21.55; Aug. 17, 18.74. Well discontinued because of use as reservoir for water pumped from new well 10/3W-29C2.

10/3W-29C2. F. M. Sickler. NE¼NW¼ sec. 29, T. 10 S., R. 3 W., 60 feet south of Bonsall School well 10/3W-20P3. Domestic well, diameter 12 inches, depth 48 feet. Measuring point, top of casing, 1.5 feet above land-surface datum. After Aug. 17, measurement, casing was cut off at land surface. New measuring point, top of 12-inch casing, at land-surface datum. Records available: 1948. Aug. 17, 9.38; Oct. 4, 9.98.

10/3W-30. Fallbrook Public Utility District observation well. Records available: 1939-48.

Jan. 5	11.00	July 12	11.92	Oct. 4	13.04
Apr. 5	10.80	Aug. 17	12.39		

11/4W-5. City of Oceanside observation well. Measurements by city of Oceanside. Records available: 1939-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 10	20.07	Apr. 5	20.81	July 5	23.81	Sept. 6	26.40
Feb. 9	20.48	May 10	22.15	Aug. 9	25.32	Oct. 9	26.57
Mar. 8	20.65	June 7	22.94				

11/4W-8. Carlsbad Mutual Water Co. observation well. Measurements by Carlsbad Mutual Water Co. Records available: 1939-48. Jan. 5, 16.55; Apr. 6, 17.19; July 7, dry; Oct. 4, dry at 21.35.

11/4W-9F1. City of Oceanside observation well. Measurements by city of Oceanside. Records available: 1940-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 10	19.43	Apr. 5	19.76	July 5	23.56	Oct. 9	28.10
Feb. 9	19.68	May 10	21.85	Aug. 9	26.27	Nov. 11	26.97
Mar. 8	19.93	June 7	23.52	Sept. 6	25.68	Dec. 11	28.60

11/4W-18. Carlsbad Mutual Water Co. observation well. Measurements by Carlsbad Mutual Water Co. Records available: 1939-48. Jan. 5, 27.35; Apr. 6, 26.09; July 7, 41.80; Oct. 4, 37.30.

11/5W-13a. City of Oceanside. Measurements by city of Oceanside. Records available: 1939-48.

Jan. 10	14.42	Apr. 5	14.83	July 5	21.33	Oct. 9	20.75
Feb. 9	13.17	May 10	19.42	Aug. 9	21.50	Nov. 11	20.83
Mar. 8	17.25	June 7	19.33	Sept. 6	20.75	Dec. 11	21.58

11/5W-13b. City of Oceanside. Measurements by city of Oceanside. Records available: 1939-48.

Jan. 10	14.83	Apr. 5	15.16	July 5	18.62	Oct. 9	20.17
Feb. 6	15.00	May 10	15.92	Aug. 9	19.50	Nov. 11	19.33
Mar. 8	15.00	June 7	17.00	Sept. 6	19.83	Dec. 11	20.25

11/5W-13c. City of Oceanside. Measurements by city of Oceanside. Records available: 1939-48.

Jan. 10	12.91	Apr. 5	13.17	July 5	17.58	Oct. 9	17.75
Feb. 9	12.42	May 10	15.33	Aug. 9	17.58	Nov. 11	17.75
Mar. 8	14.18	June 7	15.91	Sept. 6	17.00	Dec. 11	18.12

11/5W-15. City of Oceanside. Measurements by city of Oceanside. Records available: 1939-48.

Jan. 10	7.66	Apr. 5	7.81	July 5	11.86	Oct. 9	12.00
Feb. 9	7.33	May 10	9.75	Aug. 9	11.71	Nov. 11	11.92
Mar. 8	8.42	June 7	10.42	Sept. 6	11.71	Dec. 11	12.66

San Dieguito River basin

12/1W-31H2. City of San Diego. Records available: 1937-48.

Date	Water level	Date	Water level	Date	Water level
Apr. 2	9.38	Sept. 2	12.16	Dec. 29	11.83
July 19	11.65	Oct. 13	12.86		

12/1W-32. County Road Station. Records available: 1943-48.

Apr. 2	23.05	Sept. 2	23.13	Dec. 29	(a)
July 19	21.16	Oct. 13	23.12		

a Plugged.

12/1W-33. H. G. Fenton. Records available: 1937-48.

Apr. 2	17.40	Sept. 2	19.39	Dec. 29	18.99
July 19	18.93	Oct. 13	20.09		

12/1W-33a. F. B. Gierman. Records available: 1943-48.

Apr. 2	4.70	Sept. 2	7.16	Dec. 29	6.79
July 19	4.95	Oct. 13	7.11		

12/1W-35K1. June Chase. Records available: 1945-48.

Apr. 2	10.54	Sept. 2	(a)	Dec. 29	13.30
July 19	11.18	Oct. 13	(a)		

a Pumping.

12/1W-36D1. Jorgensen. Records available: 1945-48.

Date	Water level.	Date	Water level	Date	Water level
Apr. 2	12.50	Sept. 2	(b)	Dec. 29	22.18
July 19	(a)	Oct. 13	(b)		

a Well and adjacent land flooded.
b Pumping.

San Diego River basin

14/1W-36R1. City of San Diego. SE¼SE¼ sec. 36, T. 14 S., R. 1 W. About 200 feet west of concrete paved road to San Vicente dam and 200 feet south of main building in Foster Park. Diameter of casing 16-inches, depth 75 feet. No pump. Measuring point, top of casing, 1.5 feet above land-surface datum. Records available: 1948. July 20, 34.26; Aug. 18, 33.11; Oct. 12, 33.83; Dec. 30, 34.70.

15/1E-2. San Diego County. Records available: 1938-48.

Mar. 29	44.65	Aug. 18	36.75	Dec. 30	50.28
July 20	(a)	Oct. 12	48.98		

a Pumping.

15/1E-7. San Diego Products Co. Records available: 1938-48.

Mar. 29	18.12	Aug. 18	19.47	Dec. 30	(a)
July 20	20.10	Oct. 12	(a)		

a Dry.

15/1E-10. SW¼ sec. 10, T. 15 S., R. 1 E. About 400 feet east of dirt road to river bed from Foster Dairy and 1,000 feet north of oiled County road. Diameter of casing, 12 inches, depth, 110 feet. Measuring point, top of casing, 0.5 foot above land-surface datum. Records available: 1948. Aug. 18, 27.96; Oct. 12, 33.22; Dec. 30, 34.15, 15 H. P. motor driven turbine pump installed.

15/1E-16C1. Pratt test well. Records available: 1938-47. Dry. No measurements made in 1948.

15/1E-17a. Dr. Irey Ranch. Records available: 1938-47. No measurements made in 1948.

15/1E-17b. San Diego County. Records available: 1938-48. Mar. 29, 25.65.

15/1E-17B1. Truttman Ranch. Mar. 29, 1948, new measuring point: top of 16-inch casing, 3.0 feet above former measuring point and 2.2 feet above land-surface datum; July 20, 1948, original measuring point, top of 2-inch coupling 0.8 foot below land-surface datum, restored. Records available: 1938-48.

Mar. 29	37.89	Aug. 18	48.55	Dec. 30	52.24
July 20	46.00	Oct. 12	51.31		

15/1E-17H6. Irrigation District Well. Records available: 1938-48.

Mar. 29	41.18	Aug. 18	55.37	Dec. 30	57.83
July 20	52.18	Oct. 12	58.47		

15/1E-19. Davidson & Brown. Formerly owned by Langdon. Records available: 1938-48.

Mar. 29	16.62	Aug. 18	20.21	Dec. 30	21.77
July 20	19.20	Oct. 12	21.71		

15/1E-20B1. De Matteo. NW¼NE¼ sec. 20, T. 15 S., R. 1 E., 300 feet south of intersection with oiled county road, about on east side of dirt road to Quail Canyon Reservoir. Domestic well, diameter 6 feet, depth 37 feet. Measuring point, top of curb, at land-surface datum. Records available: 1948. Oct. 12, 35.06; Dec. 30, 33.37.

15/1W-13N2. Riverview well 3. Records available: 1938-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 29	10.28	Aug. 18	15.40	Dec. 30	16.41
July 20	14.56	Oct. 12	16.82		

15/1W-13R5. Leyi. Records available: 1938-48.

Mar. 29	18.70	Aug. 18	24.39	Dec. 30	24.94
July 20	22.87	Oct. 12	25.51		

15/1W-23H3. City of San Diego. Records available: 1946-48.

Mar. 29	10.11	Aug. 18	12.13	Dec. 30	13.81
July 20	11.56	Oct. 12	13.20		

15/1W-24a. E. G. Squires. Records available: 1945-48.

Mar. 29	16.50	Aug. 18	21.64	Dec. 30	21.22
July 20	20.83	Oct. 12	21.56		

15/1W-24D7. Riverview well 2. Records available: 1938-48.

Mar. 29	11.32	Aug. 18	20.48	Dec. 30	16.43
July 20	19.56	Oct. 12	21.20		

15/1W-27. On County Farm. Records available: 1938-48.

Mar. 29	11.32	Aug. 18	15.60	Dec. 30	15.29
July 20	14.33	Oct. 12	15.92		

15/1W-28. Dr. Good. Records available: 1938-48.

Mar. 29	13.54	Aug. 18	15.10	Dec. 30	15.74
July 20	14.53	Oct. 12	15.89		

16/2W-16. Jaussaud. Records available: 1938-48.

Mar. 29	15.40	Aug. 18	21.87	Dec. 30	18.95
July 20	19.50	Oct. 12	20.11		

16/2W-16a. Jaussaud. New measuring point beginning Dec. 30, 1948, top of concrete curb, at land-surface datum. Records available: 1938-48.

Mar. 29	15.21	Aug. 18	21.62	Dec. 30	19.63
July 20	20.10	Oct. 12	20.39		

16/3W-22. H. Tatreau. Records available: 1938-48. Mar. 29, 14.95; July 20, well dry.

16/3W-23. S. H. McIntosh. Records available: 1938-48.

Mar. 29	9.50	Aug. 18	11.24	Dec. 30	12.25
July 20	11.12	Oct. 12	11.96		

16/3W-24. R. I. Officer. Records available: 1938-48.

Mar. 29	10.64	Aug. 18	13.41	Dec. 30	14.73
July 20	12.26	Oct. 12	14.36		

Sweetwater River basin

17/1W-19. L. C. Kincaid. Records available: 1938-48. Well dry on April 1, 1948.

17/1W-19a. California Water & Telephone Co. Formerly owned by L. C. Kincaid. Records available: 1944-48. Jan. 2, 35.60; Apr. 1 36.96; dry on July 15 and Dec. 27.

Otay River basin

18/2W-22. G. W. St. Clair. Records available: 1938-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 2	22.31	July 15	23.87	Oct. 8	25.08
Apr. 1	22.16	Aug. 16	24.57	Dec. 27	23.38

18/2W-22a. N. Bard. Records available: 1944-47. No measurement made in 1948.

Tia Juana River basin

18/2W-33. On Hewitt Bros. Hog Ranch. Records available: 1938-48.

Jan. 2	13.07	July 15	18.49	Oct. 8	(a)
Apr. 1	13.81	Aug. 16	19.01	Dec. 27	(a)

a Well dry.

18/2W-34. P. Vanderpool. Records available: 1938-48.

Jan. 2	16.81	July 15	18.85	Oct. 8	20.22
Apr. 1	13.86	Aug. 16	20.12	Dec. 27	18.90

18/2W-34a. On Evans Ranch. Records available: 1938-48.

Jan. 2	9.91	July 15	12.72	Oct. 8	13.55
Apr. 1	9.35	Aug. 16	13.03	Dec. 27	13.07

19/2W-4. At Nestor Bridge. Records available: 1938-48.

Jan. 2	9.30	July 15	14.82	Oct. 8	17.55
Apr. 1	8.92	Aug. 16	16.61	Dec. 27	16.59

San Joaquin County

Mokelumne River basin

3N/6-17D1. Otto Helmie. Records available: 1936-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	15.36	Apr. 1	15.60	July 1	16.55	Oct. 1	19.18
Feb. 2	15.13	May 3	14.56	Aug. 2	20.22	Nov. 1	17.55
Mar. 1	16.08	June 1	15.22	Sept. 1	20.64	Dec. 1	16.45

3N/6-36R2. Leland W. Bunch. Records available: 1926-29, 1935-48.

Jan. 2	27.34	Apr. 1	28.09	July 1	29.82	Oct. 6	a 33.47
Feb. 2	27.51	May 3	26.92	Aug. 2	31.06	Nov. 1	30.63
Mar. 1	28.47	June 1	27.56	Sept. 1	a 32.25	Dec. 1	29.92

a Pumping recently.

3N/7-3C1. Jacob Knoll. Records available: 1935-48.

Jan. 6	38.95	Apr. 1	38.49	July 1	34.80	Oct. 7	38.63
Feb. 2	39.10	May 3	37.84	Aug. 2	36.34	Nov. 1	38.80
Mar. 1	39.10	June 1	36.90	Sept. 1	37.63	Dec. 1	38.97

3N/7-6M8. R. E. and Ruth F. Coker. Records available: 1935-48.

Jan. 5	27.52	Apr. 1	30.78	July 1	28.13	Oct. 6	28.28
Feb. 2	29.44	May 3	28.25	Aug. 2	28.39	Nov. 1	28.09
Mar. 1	30.06	June 1	28.82	Sept. 1	28.62	Dec. 1	28.77

3N/7-7M1. J. and Rachel Goetken. Records available: 1935-48.

Jan. 5	33.92	Apr. 1	41.13	July 1	38.54	Oct. 6	37.69
Feb. 2	35.33	May 3	40.93	Aug. 2	40.00	Nov. 1	36.37
Mar. 1	42.18	June 1	38.52	Sept. 1	38.97	Dec. 1	35.44

3N/7-10L3. Edward Preszler. Records available: 1935-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 6	45.30	May 3	46.48	Aug. 2	44.31	Oct. 7	47.27
Feb. 2	a 47.21	June 1	46.29	11	43.88	Nov. 1	49.94
Mar. 1	51.50	July 1	46.18	Sept. 1	46.82	Dec. 1	48.52
Apr. 1	48.25						

a Pumping nearby.

3N/7-10L4. Edward Preszler. Records available: 1935-48.

Jan. 6	44.72	Apr. 1	57.06	July 1	52.28	Sept. 1	53.79
Feb. 2	a 63.52	May 3	52.63	Aug. 2	54.79	Oct. 7	50.45
Mar. 1	58.73	June 1	50.22	11	55.54	Nov. 1	48.70

a Pumping nearby.

3N/7-15P2. Eugene R. Hieb. Records available: 1935-48.

Jan. 6	48.59	Mar. 1	a 51.47	June 1	52.81	Sept. 1	(b)
21	48.18	Apr. 1	53.48	July 1	52.74	Nov. 1	53.81
Feb. 2	48.06	May 3	53.30	Aug. 2	(b)	Dec. 1	52.96

a Pumping nearby.
b Dry 54.1 feet below land-surface datum.

3N/7-18N12. Joe Garnero. Records available: 1946-48.

Jan. 5	32.72	Apr. 1	39.38	July 1	40.38	Oct. 6	37.77
Feb. 2	34.46	May 3	39.54	Aug. 2	40.98	Nov. 1	36.32
Mar. 1	38.49	June 1	38.92	Sept. 1	40.15	Dec. 1	35.29

3N/7-27F3. John F. Heitzmann. Records available: 1935-48.

Jan. 5	45.98	Apr. 1	45.89	July 1	(a)	Oct. 7	(a)
15	45.67	May 3	45.54	Aug. 2	(a)	Nov. 1	(a)
Feb. 2	45.22	June 1	47.23	Sept. 1	(a)	Dec. 1	(a)
Mar. 1	45.74						

a Dry 50 feet below land-surface datum.

4N/6-12R1. G. A. Jahant. Records available: 1926-29; 1935-48. Destroyed, measurements discontinued.

Jan. 5	38.45	Apr. 1	38.48	June 1	38.43	Aug. 2	44.64
Feb. 2	38.19	May 3	38.32	July 1	41.41	Sept. 1	46.33
Mar. 1	38.78						

4N/6-12R11. A. T. Carlson. About 4.5 miles north of Lodi, 75 feet north and 300 feet west of southeast corner of sec. 12, and 100 feet west of well 4N/6-12R1 which it replaces. Domestic and irrigation well, diameter 8 inches, reported depth 150 feet. Measuring point, lower edge of 1½-inch pipe in southeast corner of concrete pump foundation, 0.6 foot above land-surface datum which is 57.95 feet above mean sea level (altitude by East Bay Municipal Utility District). Records available: 1948. Oct. 6, 47.22; Oct. 27, 43.33; Nov. 1, 43.17; Dec. 1, 42.09.

4N/6-34R1. E. M. Smith. Records available: 1926-29, 1935-48.

Jan. 2	15.29	May 3	(b)	July 1	a 17.42	Oct. 1	a 15.51
Feb. 2	15.73	7	17.66	Aug. 2	a 18.11	Nov. 1	14.37
Mar. 1	a 16.17	7	16.93	Sept. 1	a 16.49	Dec. 1	14.29
Apr. 1	(ab)	June 1	15.61				

a Pumping nearby.
b Dry at 16.9 feet below land-surface datum.

4N/6-36D1. D. D. Smith and S. H. and I. Zimmerman. Records available: 1926-29, 1935-48.

Jan. 2	25.19	Apr. 1	29.67	July 1	25.95	Oct. 4	24.66
Feb. 2	25.57	May 3	25.92	Aug. 2	27.27	Nov. 1	24.07
Mar. 1	29.51	June 1	27.86	Sept. 1	25.73	Dec. 1	23.81

4N/7-15B3. Robert L. Carter. Records available: 1935-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 6	57.66	Apr. 1	55.34	July 1	(a)	Oct. 8	(a)
Feb. 2	55.70	May 3	55.14	Aug. 2	(a)	Nov. 1	(a)
Mar. 1	55.48	June 1	55.61	Sept. 1	(a)	Dec. 1	(a)

a Dry 57.6 feet below land-surface datum.

4N/7-18N3. Martha Eddlemon. Records available: 1935-48.

Jan. 5	40.40	May 3	42.97	July 1	(a)	Oct. 6	(a)
Feb. 2	41.06	10	42.76	Aug. 2	(a)	Nov. 1	(a)
Mar. 1	44.09	12	42.53	Sept. 1	(a)	Dec. 1	(a)
Apr. 1	42.86	June 1	41.82				

a Dry 44.7 feet below land-surface datum.

4N/7-22Q4. Adolphus Eddlemon. Records available: 1935-48.

Jan. 6	45.70	Apr. 1	46.82	July 1	48.65	Oct. 8	(a)
Feb. 2	45.44	May 3	47.08	Aug. 2	(a)	Nov. 1	49.73
Mar. 1	46.19	June 1	47.18	Sept. 1	(a)	Dec. 1	48.13

a Dry 49.5 feet below land-surface datum.

4N/7-22Q5. Adolphus Eddlemon. Records available: 1935-48.

Jan. 6	45.81	Apr. 1	49.46	July 1	55.62	Oct. 8	51.07
Feb. 2	47.30	May 3	48.46	Aug. 2	57.89	Nov. 1	49.27
Mar. 1	50.49	June 1	49.03	Sept. 1	55.88	Dec. 1	48.12

4N/7-27P1. Frank H. and Leonard W. Buck. Records available: 1935-48.

Jan. 6	36.08	Apr. 1	36.46	July 1	30.59	Oct. 8	35.98
Feb. 2	36.42	May 3	34.72	Aug. 2	34.18	Nov. 1	35.93
Mar. 1	37.15	June 1	32.48	Sept. 1	35.63	Dec. 1	35.76

4N/7-30E4. Charles Weber. Records available: 1941-48.

Jan. 5	35.39	Apr. 1	40.70	July 1	40.88	Oct. 6	43.31
Feb. 2	35.62	May 3	40.55	Aug. 2	42.56	Nov. 1	38.61
Mar. 1	42.91	June 1	39.39	Sept. 1	41.64	Dec. 1	37.69

4N/7-31M3. Charles H. Woest. Records available: 1935-48.

Jan. 5	28.08	Apr. 1	32.73	July 1	26.29	Oct. 6	26.93
Feb. 2	28.08	May 3	29.56	Aug. 2	27.05	Nov. 1	26.33
Mar. 1	31.59	June 1	27.35	Sept. 1	26.98	Dec. 1	a 26.18

a Pumping recently.

4N/7-31N5. Jacob Goehring. Records available: 1935-48.

Jan. 5	13.32	Apr. 1	11.89	July 1	7.99	Oct. 6	9.94
Feb. 2	13.63	May 3	9.91	Aug. 2	9.71	Nov. 1	10.12
Mar. 1	14.63	June 1	8.62	Sept. 1	9.77	Dec. 1	10.56

4N/7-34G1. John J. Schmiedt. Records available: 1935-48.

Jan. 6	11.08	Apr. 1	11.74	July 1	5.27	Oct. 7	10.08
Feb. 2	11.53	May 3	8.65	Aug. 2	8.37	Nov. 1	10.18
Mar. 1	12.39	June 1	6.04	Sept. 1	9.82	Dec. 1	10.00

Santa Barbara County

Carpinteria basin

4/25-19F4. M. F. Lewis. Records available: 1942-48.

Jan. 27	111.53	June 28	111.68	Aug. 31	115.14	Dec. 21	116.96
May 4	110.16	July 26	113.14	Sept. 28	116.32		

4/25-19J5. Lyman & Young. Records available: 1942-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Mar. 1	79.86	May 4	75.03	July 26	a 83.23	Dec. 21	85.30
29	78.61	June 28	82.91	Aug. 31	a 85.67		

a Nearby well pumping.

4/25-20Q2. J. D. Romero. Records available: 1941-48.

Jan. 27	64.91	May 4	58.15	July 26	65.23	Sept.28	67.03
Mar. 1	60.69	June 28	64.28	Aug. 31	67.43	Dec. 21	64.99
29	58.86						

4/25-21N2. E. S. Pillsbury. Records available: 1938, 1941-47. Measurements discontinued.

4/25-21R1. B. Moore. Records available: 1941-48.

Jan. 27	95.99	May 4	96.35	July 26	102.07	Sept.28	106.54
Mar. 29	96.99	June 28	100.32	Aug. 31	104.62	Dec. 21	110.50

4/25-26A1. Moses Mesa Associates Co. Records available: 1946-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 29	280.44	Aug. 31	a297.31	Dec. 21	307.88
May 4	272.96	Sept.28	b298.85		

a Pumped recently
b Nearby well pumping.

4/25-26C2. Shephard Mesa Mutual Water Co. Records available: 1946-48. Jan. 27, 286.83; Mar. 29, 284.85; May 4, 278.26; Dec. 21, 317.30.

4/25-27G3. H. S. Russell. Records available: 1938, 1941, 1947. No measurements made in 1948.

4/25-27Q2. A. F. Heimlich. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 27	138.75	May 4	133.33	July 26	143.16	Sept.28	147.28
Mar. 1	137.88	June 28	140.85	Aug. 31	146.18	Dec. 21	151.12
29	136.45						

4/25-27R2. W. H. Yule. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 27	145.47	Mar. 29	136.61	Aug. 31	a157.03
Mar. 1	140.77	May 4	133.00	Dec. 21	158.98

a Pumped recently.

4/25-28J1. W. C. and C. A. Catlin. Records available: 1919, 1930, 1937-38, 1940-48. Mar. 29, 93.51; July 26, 106.06, pumped recently; Aug. 31, 140.59, pumping; Dec. 21, 110.62.

4/25-28M1. Mrs. A. Baylor. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 27	68.30	May 4	53.92	July 26	73.83	Sept.28	77.82
Mar. 1	58.94	June 28	79.55	Aug. 31	a 82.34	Dec. 21	72.64
29	57.02						

a Nearby well pumping.

4/25-29D1. H. Sturmer. Records available: 1928-29, 1938, 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 27	49.17	Mar. 29	41.43	June 28	a 46.33	Sept.28	48.14
Mar. 1	42.91	May 4	38.43	Aug. 31	50.07	Dec. 21	44.23

a Nearby well pumping.

4/25-29R1. Carpinteria Union High School. Records available: 1941-48.

Jan. 27	34.13	May 4	25.90	July 26	a 49.75	Sept.28	a 53.94
Mar. 1	29.81	June 28	47.29	Aug. 31	a 48.18	Dec. 21	42.86
29	28.66						

a. Nearby well pumping.

4/25-30D1. Sandyland Beach Club. Records available: 1947-48.

Jan. 27	30.76	May 4	26.04	July 26	37.63	Sept.28	37.97
Mar. 1	26.20	June 28	30.96	Aug. 31	37.93	Dec. 21	31.23
29	26.23						

4/25-35B1. R. Nichols. Records available: 1941-48.

Jan. 27	83.85	May 4	69.97	July 26	100.01	Sept.28	a114.79
Mar. 1	a 88.42	June 28	96.92	Aug. 31	a100.69	Dec. 21	112.98
29	76.34						

a Nearby well pumping.

4/26-23A2. Frank Wymond. Records available: 1947-48.

Jan. 27	67.12	Mar. 29	54.45	Aug. 31	a 58.55	Dec. 22	57.39
Mar. 1	56.30	May 4	53.80	Sept.28	ab 96.46		

a Pumped recently.
b Nearby well pumping.

4/26-24F2. A. F. Thurmond. Records available: 1938, 1941-48.

Mar. 1	a 33.33	May 4	26.36	Aug. 31	a 33.82	Dec. 21	19.97
29	19.97	June 28	a 35.12	Sept.28	a 42.89		

a Nearby well pumping.

Goleta basin

4/27-6N1. John McCaughy. Records available: 1941-48.

Jan. 27	93.64	May 4	a 94.36	Aug. 30	95.32	Oct. 22	96.99
Feb. 24	93.77	June 28	94.34	Sept.28	97.35	Dec. 21	96.39
Mar. 29	93.44	July 26	95.52				

a Nearby well pumping.

4/27-21B1. City of Santa Barbara. In southwest section of city, 68 feet southeast of Victoria Street, 170 feet southwest of Rancheria Street in rectangular cement pit north of stucco water works building. Open casing in concrete pump foundation. Abandoned municipal supply well, diameter 16 inches, reported depth 454 feet. Measuring point, top of metal rim set in concrete pump foundation, 1.73 feet above pit floor, 0.30 foot above top of casing, 3.0 feet below land-surface datum and 65 feet above sea-level datum of city surveys. Records available: 1948.

Highest daily water level, from recorder charts

Jan. 26	37.09	Mar. 22	71.37	May 25	75.04	July 27	85.64
27	37.14	29	71.80	June 1	75.11	Aug. 3	86.90
Feb. 2	37.04	Apr. 5	72.07	8	75.82	10	89.14
9	37.15	12	72.23	14	78.42	11	89.33
16	57.66	19	73.07	21	81.13	18	90.62
24	63.77	26	73.98	28	83.12	31	93.11
Mar. 1	67.77	May 3	74.06	July 6	84.34	Sept. 7	93.90
8	69.55	10	75.07	13	84.46	14	94.84
15	70.63	17	75.45	20	84.90	21	91.03

4/27-21B1--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Sept.28	90.74	Nov. 2	78.74	Nov. 23	77.02	Dec. 13	76.47
Oct. 5	90.43	9	78.04	Dec. 1	76.75	20	75.72
12	88.37	16	77.40	9	76.50	22	74.92
19	82.38						

4/28-2N2. County of Santa Barbara. Tucker's Grove. Records available: 1943-48.

Jan. 27	37.89	May 4	40.05	Aug. 30	a 42.88	Oct. 22	a 43.99
Feb. 24	38.39	June 28	41.41	Sept.28	43.66	Dec. 21	44.84
Mar. 29	39.18	July 26	41.33				

a Nearby well pumping.

4/28-3E2. Peter Cavalletto. Records available: 1941-48.

Feb. 24	a 43.20	June 28	36.30	Aug. 30	a 40.28	Oct. 22	45.17
Mar. 29	35.04	July 28	40.04	Sept.28	a 43.28	Dec. 22	40.87
May 4	25.94						

a Nearby well pumping.

4/28-3M3. L. W. Fowler. Records available: 1947-48.

Jan. 27	a123.92	May 4	a135.39	Aug. 30	a129.46	Oct. 22	a126.39
Feb. 24	a114.14	June 29	a128.80	Sept.28	a134.37	Dec. 21	124.14
Mar. 29	114.95	July 26	a122.09				

a Nearby well pumping.

4/28-3Q2. A. J. Haverland. Records available: 1943-48.

Jan. 27	84.69	May 4	a115.71	Aug. 30	a128.12	Oct. 22	126.89
Feb. 24	a 89.52	June 28	a122.99	Sept.28	a129.05	Dec. 21	127.12
Mar. 29	a 90.14	July 25	a126.47				

a Nearby well pumping.

4/28-4Q2. R. S. Rowe. Records available: 1941-48.

Feb. 24	a 91.50	June 25	a 95.47	Aug. 30	96.42	Oct. 22	100.61
Mar. 29	87.07	July 26	a106.51	Sept.28	99.96	Dec. 21	99.99
May 4	88.67						

a Nearby well pumping.

4/28-5R4. E. J. Ewing. Records available: 1937-38, 1941, 1943-48.

Jan. 27	55.98	June 29	57.45	Aug. 30	61.32	Oct. 22	61.10
Feb. 24	56.05	July 26	60.51	Sept.28	61.08	Dec. 22	61.24
Mar. 29	56.29						

4/28-8C2. G. B. Cavalletto. Records available: 1941, 1945-48.

Jan. 27	67.99	May 4	67.20	Aug. 30	72.73	Oct. 22	74.91
Feb. 24	67.61	June 29	69.30	Sept.28	73.95	Dec. 22	76.54
Mar. 29	65.50	July 22	71.05				

4/28-9A3. L. M. Cavalletto. Records available: 1941-48. Undated entries are highest and lowers levels between dates of observation.

	59.95		61.11		63.04	Sept.28	63.82
	61.84		62.03	July 26	62.91		63.82
Jan. 27	61.68	May 4	61.47		62.90		64.40
	59.78		61.44		64.31	Oct. 22	64.66
	62.27		63.56	Aug. 30	63.41		63.99
Feb. 24	60.92	June 28	63.04		63.35		64.93
	62.25		62.49		63.89	Dec. 21	64.52
Mar. 29	61.37						

4/28-9E1. A. T. Spaulding. Records available: 1941, 1943-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 27	52.21	June 29	56.53	Oct. 22	58.38
Feb. 24	52.35	Aug. 30	a 77.52	Dec. 22	58.19

a Pumping.

4/28-10A1. C. C. Lee. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 27	120.41	May 4	117.83	Aug. 30	121.17	Oct. 22	125.29
Feb. 24	118.37	June 28	119.42	Sept.28	122.56	Dec. 21	124.82
Mar. 29	116.85	July 26	120.28				

4/28-10F1. J. S. Edwards. Records available: 1932-33; 1937-33, 1941-48.

Jan. 27	79.82	Apr. 1	79.57	July 26	81.91	Oct. 22	85.61
Feb. 24	79.58	May 5	79.37	Aug. 30	85.15	Dec. 21	85.76

4/28-10K2. Norman Troup. Records available: 1941-48. Jan. 27, 109.41; Apr. 1, 108.27; Aug. 30, 117.75, pumped recently; Dec. 21, 114.32.

4/28-11K4. Giovanni Cavalli. Records available: 1947-48.

Jan. 27	79.44	Apr. 1	80.47	Aug. 30	86.07	Oct. 22	90.47
Feb. 24	80.21	May 5	80.28	Sept.28	87.85	Dec. 22	88.07

4/28-12L4. L. More. Records available: 1941-48.

Feb. 24	63.76	June 29	93.18	Aug. 30	82.32	Oct. 22	89.71
Apr. 1	65.65	July 26	95.20	Sept.28	a 94.54	Dec. 22	81.69
May 5	71.06						

a Nearby well pumping.

4/28-15E1. A. J. Holloway. Records available: 1941-47. Destroyed, measurements discontinued.

4/28-16F2. John Begg. Records available: 1941, 1943-48.

Jan. 27	54.03	May 5	a 64.59	Aug. 30	75.10	Oct. 22	55.98
Feb. 24	49.54	June 29	78.37	Sept.28	a 64.80	Dec. 21	52.80
Apr. 1	52.06	July 26	73.85				

4/28-16F3. John Begg. Records available: 1941, 1943-48.

Jan. 27	a 15.94	May 5	a 16.06	Aug. 30	16.67	Oct. 22	17.02
Feb. 24	16.18	June 29	16.49	Sept.28	a 16.89	Dec. 21	17.38
Apr. 1	16.11	July 26	16.68				

a Nearby well pumping.

4/28-16R1. Pacific Lighting Corporation. Records available: 1941, 1945-48.

Jan. 27	a 25.26	May 5	26.19	Aug. 30	37.90	Oct. 22	31.81
Feb. 24	23.66	June 29	39.25	Sept.28	34.26	Dec. 22	30.22
Apr. 1	30.98	July 26	40.34				

a Nearby well pumping.

4/28-17H3. J. J. Mathews. Records available: 1941-48.

Jan. 27	8.70	May 4	8.44	Aug. 30	9.62	Oct. 22	9.84
Feb. 24	8.71	June 29	9.25	Sept.28	9.85	Dec. 21	9.94
Mar. 29	8.31	July 26	9.37				

4/28-17H11. Mrs. L. Oakley and Mrs. M. Bonetti. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 27	26.69	June 29	a 34.88	Aug. 30	a 34.77	Oct. 22	31.17
Feb. 14	25.59	July 26	a 35.79	Sept.28	34.02	Dec. 21	29.90
Apr. 1	27.02						

a Nearby well pumping.

4/28-18G2. T. B. Bishop Co. Records available: 1942-48.

Jan. 27	37.62	May 4	29.95	Aug. 30	33.90	Oct. 22	33.26
Feb. 24	40.84	June 29	29.65	Sept.28	38.05	Dec. 22	31.38
Mar. 29	29.18	July 26	44.51				

4/28-18N3. T. M. Storke. Records available: 1942-48.

Jan. 27	16.34	June 28	19.73	Aug. 30	18.96	Oct. 22	20.44
Feb. 24	15.83	Aug. 5	19.87	Sept.28	19.71	Dec. 22	18.25
Mar. 29	15.16						

4/29-13K2. T. B. Bishop Co. Records available: 1942-48.

Jan. 27	49.84	May 4	52.16	Aug. 30	53.03	Oct. 22	53.48
Feb. 24	50.94	June 29	51.66	Sept.28	54.01	Dec. 22	52.61
Mar. 29	49.80	July 26	53.34				

4/29-14A3. Frank Baker. Records available: 1942-48.

Jan. 27	77.24	May 4	77.50	Aug. 30	a 91.86	Oct. 22	80.64
Feb. 24	77.36	June 29	78.90	Sept.28	80.35	Dec. 22	80.39
Apr. 1	77.24	July 26	79.78				

a Pumping.

Middle Santa Ynez valley

6/30-6A1. Sam Torrence. Records available: 1942-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 25	67.02	Aug. 25	90.79	Oct. 21	77.16
June 24	78.16	Sept.24	75.16	Dec. 27	68.63

6/30-7K1. Mrs. W. Anderson. Records available: 1941-48. Apr. 27, 41.28; July 22, 42.95; Aug. 25, 39.82, pumping; Dec. 27, 43.47.

6/30-9N1. San Lucas Ranch. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 27	32.71	June 24	33.05	Aug. 26	33.19	Oct. 21	33.45
Apr. 27	32.84	July 22	33.12	Sept.24	33.23	Dec. 27	a 33.47

a Pumping.

6/30-29E1. Rancho Juan y Lolita. Records available: 1942-48.

Apr. 27	23.45	July 22	20.23	Sept.24	21.30	Dec. 15	22.50
June 24	23.38	Aug. 25	20.96	Oct. 21	21.66		

6/31-2K1. Sam de la Cuesta (Rancho Alamo Pintado). Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 25	29.12	July 22	32.25	Oct. 21	a 34.89
June 24	31.26	Aug. 25	33.41	Dec. 27	33.47

a Pumped recently.

6/31-13D1. Mrs. W. E. Parker. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 27	111.84	Apr. 27	109.47	Aug. 25	111.32	Oct. 21	109.88
Mar. 25	109.27	July 22	109.74	Sept.24	109.84	Dec. 15	109.99

6/31-17F1. J. R. Orton. Records available: 1942-48.

Jan. 31	a 18.75	Mar. 25	21.27	Aug. 25	22.61	Dec. 15	23.17
Feb. 27	21.98	July 22	22.95	Oct. 21	23.66	27	22.80

a Pumping.

6/31-21H2. Alisal Corporation. Records available: 1943-48.

Jan. 31	9.40	Apr. 27	a 9.83	Aug. 25	9.24	Oct. 21	9.67
Feb. 27	9.51	June 24	a 9.93	Sept.24	9.81	Dec. 27	10.37
Mar. 25	a 9.12	July 22	9.48				

a Nearby well pumping.

6/32-6K1. Mrs. M. Barker. Records available: 1942-48.

Jan. 28	18.19	June 24	17.38	Sept.24	17.58	Dec. 27	a 25.45
Mar. 5	17.17	Aug. 25	17.46	Oct. 21	a 24.55		

a Nearby well pumping.

6/32-9A1. Owen Hollister. Records available: 1941-48.

Jan. 28	33.15	Mar. 25	30.96	June 24	34.63	Sept.24	a 34.26
Mar. 5	33.70	Apr. 27	30.88	Aug. 25	a 41.74		

a Pumping.
b Nearby well pumping.

6/32-12J2. A. Bodine. Records available: 1941-48.

Jan. 28	34.28	Apr. 27	34.42	Aug. 25	29.91	Dec. 15	32.52
Mar. 5	32.61	June 24	34.59	Sept.24	32.05	27	33.68
25	33.30	July 22	31.18	Oct. 21	31.74		

6/32-16P3. Channing Peake. Records available: 1942-48.

Jan. 28	46.36	July 23	49.08	Sept.27	49.03	Dec. 15	48.97
Mar. 4	46.70	Aug. 26	48.85	Oct. 21	48.86	27	47.67
27	45.72						

7/31-23P1. F. L. Mattei. Records available: 1942-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 27	32.43	July 22	41.59	Oct. 21	45.85
Mar. 25	32.85	Aug. 25	a 45.93	Dec. 27	46.30

a Pumping.

7/31-25L1. Russell Smith. Records available: 1942-48.

Apr. 27	73.20	Aug. 25	74.53	Dec. 27	74.27
July 22	74.55	Oct. 21	74.35		

7/31-36G2. Laura Grossi. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	35.40	Apr. 27	35.08	Aug. 25	38.77	Oct. 21	39.26
Feb. 27	34.93	June 24	37.04	Sept.24	38.93	Dec. 27	39.45
Mar. 25	35.33	July 22	36.86				

7/31-36L2. D. B. Kilbourne. Records available: 1942-48.

Jan. 31	29.07	Mar. 25	27.27	July 22	29.21	Sept.24	32.43
Feb. 27	27.41	Apr. 27	26.93	Aug. 25	a 36.59	Dec. 27	32.02

a Pumping.

Lower Santa Ynez valley

6/33-9P1. Hollister Estate. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	43.11	Mar. 27	42.79	July 23	56.93	Oct. 21	47.35
Feb. 12	43.35	Apr. 29	43.47	Aug. 26	a 58.04	Dec. 15	a 54.69
Mar. 4	42.84	June 25	a 51.95	Sept.27	48.12	27	48.26

a Nearby well pumping.

6/34-2A1. C. Madsen. Records available: 1941-46. No measurements made in 1947 or 1948.

6/34-2A6. Hattie Madsen. Formerly owned by C. Madsen. About 2 miles east of Lompoc, on southwest side of walnut orchard, 15 feet northeast of edge of terrace remnant about 45 feet above inner channel of Santa Ynez River at Narrows, and 25 feet northwest of well 6/34-2A1, in metal pumphouse. Drilled irrigation well, diameter 16 inches, reported depth 185 feet, with deep-well turbine installed. Measuring point, top west side of pump base at hole, 1.56 feet above land-surface datum which is about 128 feet above mean sea level. Records available: 1948. Aug. 25, 48.50, pumping; Sept. 24, 42.06; Oct. 21, 42.06; Dec. 30, 41.57.

6/34-4D1. Peter Tognatti. Records available: 1941-48. Destroyed Oct. 21, measurements discontinued.

Jan. 28	40.50	June 24	40.31	Aug. 25	39.65	Oct. 21	36.29
Mar. 25	37.31	July 22	41.09	Sept.24	38.94		

6/34-6C2. Bank of America. Records available: 1943-48.

Jan. 28	66.39	July 22	67.30	Sept.24	64.75	Dec. 31	60.50
Mar. 4	66.47	Aug. 25	66.70	Oct. 21	62.87		

7/33-30C1. John Valla. Records available: 1941-48.

Jan. 28	151.70	Apr. 27	151.73	Aug. 25	a152.14	Oct. 21	a152.40
Mar. 5	a151.77	June 24	152.01	Sept.24	a152.21	Dec. 27	a152.57
25	151.83	July 22	a152.10				

a Nearby well pumping.

7/34-9H3. Geological Survey, U. S. Dept. of Interior. Union Oil Co. Purisima Lease. About 4.5 miles north of Lompoc, in bottom of small valley in upland area south of Purisima Hills, at south side of dilapidated wooden barn on west side of creek, in barbed-wire enclosure. Drilled observation well. Diameter 8 inches, depth 103 feet. Measuring point, top east side of inner casing, 1.89 feet above land-surface datum. Records available: 1948.

Highest daily water level, from recorder charts

Apr. 22	9.36	June 25	10.97	Aug. 31	9.93	Nov. 5	10.35
27	9.35	30	10.71	Sept. 5	9.84	10	9.60
May 1	9.39	July 5	10.73	10	9.93	13	10.02
5	9.52	10	10.85	15	9.84	19	9.48
10	9.63	15	10.66	20	10.08	25	9.91
15	9.63	19	10.61	25	9.96	30	10.59
20	9.85	25	10.61	30	10.04	Dec. 3	10.19
25	9.76	28	10.44	Oct. 5	10.12	7	10.26
31	10.36	Aug. 5	10.90	10	9.32	15	10.49
June 5	10.68	10	10.76	15	9.47	18	10.64
7	10.64	15	10.76	20	9.74	23	10.47
15	10.57	20	10.45	25	9.95	31	11.04
20	10.35	26	10.10	Nov. 1	10.02		

7/34-9H4. Geological Survey, U. S. Dept. of Interior. Union Oil Co. Purisima Lease. About 10 feet west of Geological Survey observation well 7/34-9H3, beneath 4 by 6 foot wood cover. Bored observation well, uncased diameter 4 inches, depth 15 feet. Measuring point, top of wooden peg on east side of well, at land-surface datum. Records available: 1948.

7/34-9H4--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Apr. 6	1.48	May 28	3.45	Aug. 3	4.71	Sept.23	5.22
9	1.40	June 4	3.57	13	4.75	30	5.32
15	1.67	14	3.35	19	4.87	Oct. 7	5.14
22	2.66	24	4.00	26	4.97	20	5.33
29	2.79	July 1	4.14	Sept. 2	5.05	Nov. 30	5.72
May 7	3.17	7	4.32	9	5.07	Dec. 16	5.68
14	3.17	13	4.33	16	5.13	31	5.59
24	3.39	21	4.44				

7/34-14F1. Walter F. Ziesche. Records available: 1947-48.

Jan. 28	195.09	June 24	195.65	Aug. 25	195.96	Oct. 21	196.09
Mar. 24	195.05	July 22	195.76	Sept.24	196.04	Dec. 27	196.07
Apr. 27	195.39						

7/34-21E1. Geological Survey, U. S. Dept. of Interior. Camp Cooke Military Reservation. About 2.7 miles north of Lompoc, in southeast corner of Camp Cooke Military Reservation, in valley bottom of Davis Canyon, at north end of cultivated field, at south side of dirt embankment and fence across valley, about 35 feet east of dirt road. Drilled observation well, open 8-inch casing with removable cap, depth 145 feet. Measuring point, top of casing, 1.0 foot above land-surface datum. Records available: 1948. Nov. 19, 19.60; Dec. 13, 19.24; Dec. 16, 19.27; Dec. 31, 19.08.

7/34-22H1. H. E. Harris. Records available: 1941-42, 1946-48.

Jan. 28	a 26.46	Mar. 24	27.78	July 22	25.82	Oct. 21	25.43
Mar. 5	28.03	June 24	27.06	Aug. 25	27.19	Dec. 27	b 25.40

a Nearby well pumping.
b Pumping.

7/34-22Q4. Geological Survey, U. S. Dept. of Interior. A. Scolari property. Records available: 1947-48.

Jan. 28	18.02	Apr. 29	18.25	Aug. 26	19.83	Oct. 21	20.35
Mar. 5	18.22	June 25	19.02	Sept.27	20.04	Dec. 31	19.79
26	17.43	July 23	19.42				

7/34-26A2. K. McConnell. Records available: 1941-48.

Jan. 28	39.65	Apr. 27	40.27	Aug. 25	42.01	Oct. 21	41.99
Mar. 5	40.06	June 24	41.18	Sept.24	42.01	Dec. 30	41.86
24	40.05	July 22	41.73				

7/34-27A4. Geological Survey, U. S. Dept. of Interior. L. H. Schuyler property. Records available: 1947-48.

Jan. 28	12.24	Apr. 29	12.70	Aug. 26	14.17	Oct. 21	14.65
Mar. 5	12.58	June 25	13.41	Sept.27	14.44	Dec. 31	14.62
26	12.61	July 23	13.75				

7/34-27J3. Geological Survey, U. S. Dept. of Interior. L. H. Schuyler property. Records available: 1943-45, 1947-48.

Jan. 28	20.86	Apr. 29	22.48	Aug. 26	24.16	Oct. 21	20.86
Mar. 5	21.68	June 25	22.99	Sept.27	24.25	Dec. 31	24.44
26	21.95	July 23	23.52				

7/34-27L1. Mrs. Susan Van Clief. Records available: 1941-48.

Apr. 29	37.87	July 23	40.21	Sept.27	40.01	Dec. 31	38.44
June 25	39.15	Aug. 26	40.65	Oct. 21	39.77		

7/34-28A2. Geological Survey, U. S. Dept. of Interior. S. B. Westrope property. Records available: 1947-48.

7/34-28A2--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	29.66	Apr. 29	30.63	Aug. 26	a 32.72	Oct. 21	32.17
Mar. 5	a 30.41	June 25	31.13	Sept.27	32.32	Dec. 31	30.35
26	30.15	July 23	32.50				

a Nearby well pumping.

7/34-28H2. T. M. Parks. Records available: 1942-48.

Jan. 28	31.97	Apr. 29	32.37	Aug. 26	36.52	Oct. 21	32.99
Mar. 5	32.73	June 25	35.53	Sept.27	33.67	Dec. 31	31.68
26	32.37	July 25	35.01				

7/34-28R1. A. C. Zvolanek. Records available: 1943-48.

Jan. 28	15.66	Apr. 29	14.89	Aug. 26	16.88	Oct. 21	15.28
Mar. 5	15.93	June 25	16.22	Sept.27	16.85	Dec. 31	13.94
26	17.24	July 23	18.03				

7/34-28R2. Geological Survey, U. S. Dept. of Interior. A. C. Zvolanek property. Records available: 1943-48.

Jan. 28	10.02	Apr. 29	10.16	Aug. 26	12.68	Oct. 21	13.19
Mar. 5	10.43	June 25	12.11	Sept.27	13.12	Dec. 31	12.68
26	10.78	July 23	12.04				

7/34-29A3. Geological Survey, U. S. Dept. of Interior. Charles Everett property. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 28	16.51	Mar. 26	17.13	June 24	16.69
Mar. 4	17.01	Apr. 27	17.15		

7/34-29E4. G. F. Sanor. Records available: 1945-48.

Jan. 28	35.35	Apr. 27	33.98	Aug. 26	30.91	Oct. 21	25.71
Mar. 4	35.62	June 24	33.27	Sept.25	28.24	Dec. 31	23.34
26	27.96	July 22	32.85				

7/34-29E5. Geological Survey, U. S. Dept. of Interior. G. F. Sanor property. Records available: 1945-48.

Jan. 28	21.86	Apr. 27	23.47	Aug. 26	23.29	Oct. 21	23.18
Mar. 4	23.08	June 24	23.25	Sept.24	23.58	Dec. 31	22.86
26	23.25	July 22	22.50				

7/34-30L2. Union Sugar Co. Records available: 1941-42, 1945-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 26	28.99	Aug. 26	32.06	Oct. 21	26.11
July 22	31.76	Sept.24	26.24	Dec. 21	21.33

7/34-30L3. Geological Survey, U. S. Dept. of Interior. Union Sugar Co. property. Records available: 1945-48.

Jan. 28	a 23.00	Apr. 27	21.77	Aug. 26	23.14	Oct. 21	22.12
Mar. 4	a 23.07	June 24	22.48	Sept.25	22.47	Dec. 31	21.13
26	23.27	July 22	23.33				

a Nearby well pumping.

7/34-30R1. Mrs. E. Manfrina. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	22.49	Apr. 27	23.98	Aug. 26	24.15	Oct. 21	22.97
Mar. 4	23.32	June 24	24.10	Sept.24	23.36	Dec. 31	22.63
26	23.35	July 22	24.14				

7/34-31C2. Union Sugar Co. Records available: 1947-48.

Mar. 25	30.33	June 24	42.99	Sept.24	46.38	Dec. 31	23.16
Apr. 27	a 45.36	Aug. 25	b 82.84	Oct. 21	c 28.51		

a Nearby well pumping
b Pumping.
c Pumped recently.

7/34-31C3. Geological Survey, U. S. Dept. of Interior. Union Sugar Co. property. Records available: 1947-48.

Jan. 28	17.26	Apr. 27	15.00	Aug. 25	16.06	Oct. 21	16.60
Mar. 4	a 17.47	June 24	14.65	Sept.24	16.42	Dec. 31	17.22
25	15.63	July 22	14.90				

a Nearby well pumping.

7/34-32A1. O. F. Benn. Records available: 1947-48.

Mar. 4	39.29	Apr. 27	40.45	Aug. 26	a 46.76	Dec. 31	30.28
26	36.82	June 24	39.61	Oct. 21	31.67		

a Pumping.

7/34-32A4. Geological Survey, U. S. Dept. of Interior. O. F. Benn property. Records available: 1947-48.

Jan. 28	a 26.43	Apr. 27	a 27.46	Aug. 26	a 28.65	Oct. 21	28.28
Mar. 4	26.52	June 24	28.60	Sept.24	28.36	Dec. 31	28.65
26	26.38	July 22	a 33.77				

a Nearby well pumping.

7/34-32P5. Geological Survey, U. S. Dept. of Interior. J. Bodger & Sons property. Records available: 1947-48.

Jan. 28	29.18	Apr. 27	30.09	Aug. 25	31.05	Oct. 21	30.29
Mar. 4	29.66	June 24	29.90	Sept.24	30.59	Dec. 31	29.66
25	29.52	July 22	30.50				

7/34-34H1. Mrs. M. Balaam. Records available: 1941-48.

Mar. 5	47.54	Apr. 29	47.43	Aug. 26	48.99	Oct. 21	a 50.80
26	46.41	July 25	49.29	Sept.27	49.16	Dec. 31	48.18

a Nearby well pumping.

7/34-34H2. Geological Survey, U. S. Dept. of Interior. Mary Skaarup property. Records available: 1943-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 28	a 45.48	Mar. 26	46.24	June 25	48.84
Mar. 5	46.27	Apr. 29	47.05		

a Nearby well pumping.

7/34-35F2. Valla Bros. Records available: 1943-48. Jan. 28, 28.28; Mar. 25, 30.59; Aug. 25, 46.74, nearby well pumping; Dec. 30, 29.13.

7/34-35F6. Geological Survey, U. S. Dept. of Interior. M. Schuyler property. Records available: 1943-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	49.12	Mar. 24	51.52	June 25	a 51.59	Oct. 21	52.21
Feb. 12	a 50.65	Apr. 29	a 50.73	Sept.27	a 51.56	Dec. 31	50.49

a Nearby well pumping.

7/34-35F16. M. Schuyler. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	51.04	June 23	a 53.25	Aug. 26	a 54.59	Oct. 21	53.51
Mar. 26	a 52.57	July 23	a 54.48	Sept.27	a 52.92	Dec. 31	50.96
Apr. 29	a 51.49						

a Nearby well pumping.

7/34-35K2. Mrs. M. McDonald. Records available: 1941-48.

Jan. 28	14.11	Apr. 27	16.31	Aug. 25	17.61	Oct. 21	15.46
Mar. 5	14.87	June 24	16.69	Sept.24	18.07	Dec. 30	15.05
25	14.61	July 22	16.62				

7/34-35P1. W. P. and N. L. Robinson. Records available: 1941-48. Jan. 28, 47.54; Mar. 5, 51.90; Dec. 31, 48.80.

7/35-18J1. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1941-48.

Jan. 28	0.86	Apr. 27	1.44	Aug. 25	1.80	Oct. 21	1.75
Mar. 4	.57	June 24	1.41	Sept.24	1.82	Dec. 31	.11
26	.29	July 22	1.56				

7/35-20J1. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1941-48.

Jan. 28	9.96	Apr. 27	10.12	Aug. 25	10.79	Oct. 21	10.94
Mar. 4	9.81	June 24	10.53	Sept.24	11.00	Dec. 31	9.84
26	9.58	July 22	10.71				

7/35-22F2. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1947-48.

Jan. 28	5.04	May 26	5.76	Aug. 25	5.61	Oct. 21	6.28
Mar. 4	4.99	June 24	5.63	Sept.24	6.16	Dec. 31	5.41
26	4.96	July 22	5.40				

7/35-22J1. Union Sugar Co. Records available: 1941, 1945-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 4	17.35	Aug. 25	a 21.95	Dec. 31	14.40
26	14.80	Oct. 21	17.07		

a Pumped recently.

7/35-22M1. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	10.99	Mar. 26	10.44	Aug. 25	14.17	Oct. 21	13.38
Mar. 4	10.25	May 26	13.88	Sept.24	14.43	Dec. 31	10.59

7/35-22M2. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1947-48.

Jan. 28	14.06	Mar. 26	13.84	Aug. 25	14.56	Oct. 21	14.95
Mar. 4	13.90	May 26	14.09	Sept.24	14.83	Dec. 31	14.66

7/35-23E2. Union Sugar Co. Records available: 1941-43, 1945-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 4	20.45	Apr. 27	22.76	Dec. 31	19.14
26	19.06	Oct. 23	21.38		

7/35-23E4. Geological Survey, U. S. Dept. of Interior. Union Sugar Co. property. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	a 20.04	Apr. 27	21.32	Aug. 26	a 22.79	Oct. 21	21.17
Mar. 4	20.31	June 24	a 22.40	Sept.24	22.34	Dec. 31	20.48
26	20.39	July 22	22.67				

a Nearby well pumping.

7/35-23J2. Union Sugar Co. Records available: 1947-48.

Mar. 26	21.16	July 22	a 23.74	Sept.24	21.32	Dec. 31	17.44
June 24	a 29.91	Aug. 26	29.92	Oct. 21	19.89		

a Nearby well pumping.

7/35-23J3. Geological Survey, U. S. Dept. of Interior. Union Sugar Co. property. Records available: 1947-48.

Jan. 28	a 21.13	July 22	23.15	Sept.24	22.11	Dec. 31	20.17
June 24	22.58	Aug. 26	22.94	Oct. 21	21.69		

a Nearby well pumping.

7/35-23N2. Union Sugar Co. Records available: 1945-48.

Jan. 28	a 14.15	Apr. 27	11.67	Aug. 25	14.06	Oct. 21	14.71
Mar. 4	14.14	June 24	a 13.15	Sept.24	14.83	Dec. 31	13.88
26	13.88	July 22	a 13.76				

a Nearby well pumping.

7/35-24J1. T. M. Parks. Records available: 1941-43, 1947-48.

Mar. 26	33.58	June 24	33.86	Aug. 26	33.53	Oct. 21	32.55
Apr. 27	35.83	July 22	34.01	Sept.24	33.59	Dec. 31	30.80

7/35-24J2. Geological Survey, U. S. Dept. of Interior. T. M. Parks property. Records available: 1947-48.

Jan. 28	a 25.60	Apr. 27	27.84	Aug. 26	27.93	Oct. 21	27.35
Mar. 4	a 26.67	June 24	28.17	Sept.24	27.16	Dec. 31	28.27
26	27.36	July 22	28.00				

a Nearby well pumping.

7/35-25F5. Union Sugar Co. Records available: 1945-48. Jan. 28, 30.86, nearby well pumping; Oct. 21, 18.72.

7/35-25F6. Union Sugar Co. Records available: 1945-48.

Jan. 28	10.16	Apr. 27	a 9.70	Aug. 26	11.75	Oct. 21	12.15
Mar. 4	a 11.85	June 24	a 12.93	Sept.24	12.70	Dec. 31	11.20
26	7.47	July 22	13.86				

a Nearby well pumping.

7/35-26F1. Union Sugar Co. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 26	14.55	Sept.24	15.76	Dec. 31	10.40
Aug. 26	16.60	Oct. 21	13.30		

7/35-26F3. Union Sugar Co. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	a 10.79	Apr. 27	a 10.37	Aug. 26	10.98	Oct. 21	11.29
Mar. 4	a 10.19	June 24	a 10.76	Sept.24	9.48	Dec. 31	9.80
26	9.45	July 22	a 10.94				

a Nearby well pumping.

7/35-26J4. Key well U. S. 97. County of Santa Barbara, Artesia School District. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 28	23.88	Apr. 27	a 26.12	July 22	24.11	Oct. 21	15.17
Mar. 4	28.67	June 1	21.47	Aug. 26	19.18	Nov. 30	13.66
26	17.33	24	22.94	Sept.24	17.86	Dec. 31	12.01

a Pumped recently.

7/35-27C2. Southern Pacific Railroad. Records available: 1941-48. Mar. 4, 13.94; Aug. 25, 21.50, pumping; Sept. 24, 22.03; Dec. 31, 14.50.

7/35-35A3. Gus Aquistapace. Records available: 1947-48.

Jan. 28	15.13	Mar. 25	19.65	June 24	20.06	Sept.24	21.20
Mar. 4	17.19	Apr. 27	15.88	Aug. 25	17.31	Dec. 31	12.43

7/35-35A4. Geological Survey, U. S. Dept. of Interior. Gus Aquistapace property. Records available: 1947-48.

Jan. 28	13.69	Apr. 27	13.44	Aug. 25	15.11	Oct. 21	a 14.14
Mar. 4	13.60	June 24	14.32	Sept.24	14.29	Dec. 31	9.58
25	14.34	July 22	a 14.98				

a Nearby well pumping.

7/35-35C2. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1947-48.

Mar. 4	3.90	June 24	6.34	Aug. 25	5.53	Oct. 21	6.00
25	4.69	July 22	8.95	Sept.24	6.59	Dec. 31	2.21
Apr. 27	3.88						

7/35-35C4. Dept. of the Army, Camp Cooke Military Reservation. Records available: 1947-48.

Jan. 28	a 2.99	Apr. 27	4.02	Aug. 25	4.30	Oct. 21	4.09
Mar. 4	4.43	June 24	3.61	Sept.24	4.68	Dec. 31	3.25
25	2.56	July 22	3.44				

a Nearby well pumping.

7/35-36J6. Denholm Seed Co. Records available: 1947-48.

Mar. 25	27.80	June 24	32.81	Aug. 25	30.08	Oct. 21	25.84
Apr. 27	29.00	July 22	33.94	Sept.24	27.68	Dec. 31	23.16

7/35-36J7. Geological Survey, U. S. Dept. of Interior. Denholm Seed Co. property. Records available: 1947-48.

Jan. 28	a 26.76	Apr. 27	21.50	Aug. 25	26.93	Oct. 21	24.71
Mar. 4	a 26.83	June 24	26.87	Sept.24	25.97	Dec. 31	23.59
25	24.32	July 22	27.75				

a Nearby well pumping.

San Antonio Valley

8/32-3JK2. John Parma. Records available: 1943-48.

Jan. 31	2.09	Apr. 27	a 0.88	Aug. 25	a 4.58	Oct. 21	3.57
Feb. 27	1.83	June 24	2.87	Sept.24	a 4.52	Dec. 30	2.82
Mar. 27	.94	July 22	3.67				

a Nearby well pumping.

8/33-20K1. Virginia Barca. Records available: 1943-48.

Jan. 31	21.45	Apr. 27	a 34.65	Aug. 25	a 36.84	Oct. 21	24.93
Feb. 27	21.87	June 24	23.43	Sept.24	a 28.26	Dec. 30	23.29
Mar. 27	21.46	July 22	25.52				

a Nearby well pumping.

8/33-20R1. Virginia Barca. Records available: 1943-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Feb. 27	22.40	June 24	23.78	Aug. 25	a 32.79	Oct. 21	24.00
Mar. 27	21.93	July 22	24.43	Sept.24	30.03	Dec. 30	22.46

a Nearby well pumping.

8/34-23B1. Josephine Harris Estate. Records available: 1943-48.

Jan. 31	a 15.17	Apr. 27	a 17.33	Aug. 25	a 18.05	Nov. 30	16.42
Feb. 27	a 16.51	June 24	a 15.97	Sept.24	a 16.87	Dec. 30	a 16.15
Mar. 24	a 16.44	July 22	a 17.36	Oct. 21	a 16.56		

a Nearby well pumping.

Santa Maria Valley area

9/32-7N1. Valerio Tognazzini. Records available: 1924, 1930, 1932-33, 1938-48.

Jan. 1	a 66.25	Apr. 1	a 69.75	July 1	a 74.63	Oct. 1	a 79.20
31	67.36	26	70.40	Aug. 24	b 94.71	20	80.09
Feb. 25	69.47	June 23	73.75	Sept.23	81.57	Dec. 29	82.34
Mar. 24	69.79						

a By Santa Maria Valley Water Conservation District.
b Pumping.

9/32-17G1. E. C. Lyman. Records available: 1941-48.

Jan. 31	46.70	Mar. 24	46.19	Aug. 24	b 57.18	Dec. 29	57.34
Feb. 25	a 44.16	July 21	55.08	Oct. 20	a 57.81		

a Pumped recently.
b Pumping.

9/33-2A1. Santa Maria Realty Co. Records available: 1930-33, 1936, 1938-48.

Jan. 1	a 48.62	Mar. 24	51.15	Apr. 26	51.71	Oct. 1	ab 59.50
31	49.66	Apr. 1	a 51.17	July 1	ab 55.27	Dec. 29	60.59
Feb. 25	50.38						

a By Santa Maria Valley Water Conservation District.
b Pumped recently.

9/33-15D1. South Basin Oil Co. Records available: 1947-48.

Jan. 31	335.59	June 23	328.05	Aug. 24	329.64	Oct. 20	331.11
Feb. 26	337.72	July 21	328.63	Sept.23	330.23	Dec. 29	332.79
Apr. 26	326.42						

9/34-3N3. City of Santa Maria well 3. Measurements by city of Santa Maria. Records available: 1933-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 7	154.4	Apr. 3	154.2	Aug. 3	156.9
Mar. 3	154.4	June 10	155.5		

9/34-8K1. C. Miscio. Records available: 1947-48. Mar. 25, 148.34; Apr. 27, 150.01; Dec. 30, 151.71.

10/33-7R2. P. T. Bonetti. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	107.29	Apr. 26	108.04	Aug. 24	112.31	Oct. 20	115.20
Feb. 25	107.47	June 23	109.53	Sept.23	114.11	Dec. 29	116.39
Mar. 24	108.43	July 21	110.73				

10/33-18G1. La Brea Securities Co. well 8. Measurements by Santa Maria Valley Water Conservation District. Records available: 1939-48. Jan. 1, 110.50; Apr. 1, 112.83; July 1, 119.33, pumped recently; Oct. 1, 121.06.

10/33-19B1. Owen T. Rice. Records available: 1927, 1929-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	a107.80	Apr. 1	a108.17	Aug. 24	b114.10	Oct. 20	114.64
Feb. 25	108.03	26	108.24	Sept.23	114.79	Dec. 29	114.72
Mar. 24	108.26	July 1	ab112.17	Oct. 1	a115.17		

a By Santa Maria Valley Water Conservation District.
b Pumped recently.

10/33-21N2. Frank Costa, Jr. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 30	a103.55	Mar. 24	102.49	Dec. 29	114.95
Feb. 25	104.66	Apr. 26	104.95		

a Nearby well pumping.

10/33-27G1. W. C. Adam. Measurements by Santa Maria Valley Water Conservation District. Records available: 1929-33, 1936, 1938-48. Jan. 1, 71.97; Apr. 1, 77.20; July 1, 86.85, pumped recently; Oct. 1, 95.10, pumped recently.

10/33-27K1. Newhall Land & Farming Co. Records availabe: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	71.62	June 23	76.67	Aug. 24	a 85.45	Oct. 20	84.17
Mar. 24	72.25	July 21	79.70	Sept.23	a 83.83	Dec. 29	82.30
Apr. 26	72.15						

a Nearby well pumping.

10/33-28A1. Joe Soares. Records available: 1929-48.

Jan. 1	a 82.80	Apr. 1	a 85.63	Aug. 24	c 96.76	Dec. 29	96.72
Mar. 24	86.58	July 1	ab 92.50	Oct. 1	ab 99.13		

a By Santa Maria Valley Water Conservation District.
b Pumped recently.
c Nearby well pumping.

10/33-33H1. E. L. Sargent. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level
Feb. 25	a186.33	Apr. 26	187.29	Dec. 29	a192.40
Mar. 24	186.78	Aug. 24	a190.15		

a Pumping.

10/33-35B1. Newhall Land & Farming Co. Records available: 1944-48.

Mar. 24	52.44	Aug. 24	a 80.37	Oct. 20	58.18
Apr. 26	49.77	Sept.23	58.39	Dec. 29	55.70

a Pumping.

10/34-2R1. Gracio Apalatequi. Records available: 1929-30, 1933, 1938-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	a108.30	Apr. 1	a108.93	July 21	bc121.92	Oct. 1	a114.60
30	108.55	26	109.41	Aug. 24	d149.76	20	114.25
Feb. 25	108.76	June 23	b111.94	Sept.23	113.89	Dec. 29	113.44
Mar. 24	108.94	July 1	ac141.60				

a By Santa Maria Valley Water Conservation District.
b Nearby well pumping. c Pumped recently. d Pumping.

10/34-4R1. Gerald Donovan. Records available: 1945-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	94.07	Apr. 26	a 94.36	Sept.23	100.63	Dec. 29	100.63
Mar. 24	94.08	Aug. 24	b105.50	Oct. 20	100.03		

a Nearby well pumping.
b Pumping.

10/34-6N1. Grisingher & Signorelli. Records available: 1930, 1934, 1936-48.

Date	Water level	Date	Water level	Date	Water level
Jan. 1	a 64.50	July 1	a 70.67	Oct. 1	a 72.90
Apr. 1	a 64.40	Aug. 24	b 72.94	Dec. 29	69.87

a By Santa Maria Valley Water Conservation District.
b Pumped recently.

10/34-9F1. Mrs. A. E. Preisker. Records available: 1942-48. Jan. 1, 92.62; Apr. 1, 90.12; July 1, 96.20, pumping recently; Oct. 1, 96.20. Measurements by Santa Maria Valley Water Conservation District.

10/34-14E3. Key well U. S. 45. City of Santa Maria. Measurements by city of Santa Maria, except as indicated. Records available: 1920-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 4	117.40	Apr. 27	a118.35	July 21	a121.63	Oct. 17	125.13
11	117.42	May 2	a118.52	25	121.90	20	a125.12
18	117.54	9	118.67	Aug. 1	122.40	24	125.21
25	117.65	16	118.90	8	122.79	31	125.29
30	a117.66	23	119.08	15	123.13	Nov. 7	125.38
Feb. 26	a118.02	30	119.35	23	123.50	14	125.44
29	118.17	June 4	a119.47	24	a123.46	21	125.56
Mar. 7	118.38	6	119.67	29	123.79	28	125.60
14	118.44	13	119.88	Sept. 5	124.15	30	a125.49
21	118.54	20	120.15	12	124.33	Dec. 5	125.63
24	a118.41	23	a120.20	19	124.56	12	125.63
Apr. 4	118.35	27	120.48	23	a126.60	19	125.63
11	118.31	July 4	120.81	26	124.75	26	125.52
18	118.21	11	121.13	Oct. 3	124.90	29	a125.34
25	118.35	18	121.50	10	125.10		

a By Geological Survey.

10/34-20H1. Ulisse Tognazzini. Records available: 1944-48.

Jan. 21	82.41	Apr. 26	a 83.98	Aug. 24	b 95.56	Oct. 20	88.42
Feb. 26	85.86	June 23	85.03	Sept.23	88.31	Dec. 29	86.90
Mar. 24	81.84						

a Nearby well pumping.
b Pumping.

10/34-22R1. George J. Wheat. Records available: 1931, 1934, 1938-48.

Jan. 1	a108.92	Apr. 1	a109.90	July 21	114.43	Oct. 1	a116.25
30	111.05	26	110.56	Aug. 24	115.54	20	116.18
Feb. 26	110.04	June 23	112.86	Sept.23	115.96	Dec. 29	116.10
Mar. 24	110.34	July 1	a113.00				

a By Santa Maria Valley Water Conservation District.

10/34-23H1. Marion B. Rice. Records available: 1929-30, 1933, 1938-48.

Jan. 1	a125.83	Apr. 1	a126.67	July 1	ab130.67	Dec. 29	132.96
Mar. 24	126.96	26	127.03	Oct. 1	a133.10		

a By Santa Maria Valley Water Conservation District.
b Pumped recently.

10/34-31F1. Union Sugar Co. Records available: 1944-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	86.11	Apr. 27	86.54	Aug. 24	90.84	Oct. 20	91.08
Mar. 3	86.04	June 23	88.37	Sept.23	90.74	Dec. 30	90.14
25	85.98	July 21	89.27				

10/35-7F1. M. J. Ellis. Records available: 1929-36, 1938-48.

Jan. 1	a 7.20	Mar. 25	1.50	Aug. 27	c 9.50	Oct. 1	ac 18.03
31	b 10.42	Apr. 1	a 1.40	July 1	ac 19.70	Dec. 30	2.86

a By Santa Maria Valley Water Conservation District.
b Nearby well pumping.
c Pumped recently.

10/35-7G3. John Jenkins. Records available: 1942-48.

Jan. 31	a 10.81	Apr. 27	b 17.87	Aug. 24	23.90	Oct. 20	19.75
Mar. 3	b 17.51	June 23	22.61	Sept.23	20.26	Dec. 30	11.74
25	10.20	July 21	23.72				

a Float gage removed.
b Nearby well pumping.

10/35-9F1. Waller-Franklin Seed Co. Records available: 1930, 1933, 1935-36; 1938-48.

Jan. 1	ab 29.95	Apr. 1	a 21.83	July 21	bc 40.25	Oct. 1	a 36.67
31	32.94	June 23	b 40.95	Aug. 24	bc 40.63	20	33.62
Feb. 26	34.66	July 1	ab 41.25	Sept.23	36.13	Dec. 30	24.50
Mar. 25	21.95						

a By Santa Maria Valley Water Conservation District.
b Pumping recently.
c Nearby well pumping.

10/35-9N1. Agnes King. Measurements by Santa Maria Valley Water Conservation District. Records available: 1930, 1938-48. Jan. 1, 33.70, pumping recently; Apr. 1, 20.55; July 1, 38.30; Oct. 1, 47.30, pumping recently.

10/35-12M1. E. and G. LeRoy. Records available: 1924, 1927, 1930-32, 1938-48.

Jan. 1	a 52.20	Mar. 24	52.01	July 1	a 61.80	Oct. 1	a 64.40
Feb. 26	b 59.02	Apr. 1	a 51.77	Sept.23	64.16	Dec. 29	56.58

a By Santa Maria Valley Water Conservation District.
b Nearby well pumping.

10/35-21B1. C. P. Mathison. Records available: 1938-48.

Jan. 1	a 21.80	Apr. 1	a 15.82	Aug. 24	cd 63.92	Oct. 1	a 33.45
Mar. 3	26.61	July 1	ab 38.85	Sept.23	c 32.67	Dec. 30	18.74
25	16.09						

a By Santa Maria Valley Water Conservation District.
b Pumped recently.
c Pumping.
d Nearby well pumping

10/35-24B1. Union Sugar Co. Records available: 1934, 1938-48.

Jan. 1	a 55.25	Apr. 1	a 54.67	July 21	c 65.90	Oct. 1	a 63.20
31	60.21	27	b 60.69	Aug. 24	64.99	20	62.91
Mar. 3	58.23	June 23	64.47	Sept.23	64.24	Dec. 30	59.25
25	54.91	July 1	a 64.52				

a By Santa Maria Valley Water Conservation District.
b Pumped recently.
c Nearby well pumping.

11/34-19Q1. Frank Silva. Records available: 1947-48.

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11/34-19Q1--Continued.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 31	232.50	Apr. 26	231.24	Aug. 24	239.85	Oct. 20	237.24
Feb. 26	a233.36	June 23	235.30	Sept.23	239.27	Dec. 30	232.24
Mar. 24	229.05						

a Pumping.

11/34-30Q1. Mary Bolton. Records available: 1930, 1933, 1936, 1938-48.

Jan. 1	ab 66.17	June 23	62.18	Aug. 24	67.86	Dec. 30	67.79
Apr. 1	a 62.08	July 1	ab 65.50	Oct. 1	ab 70.83		

a By Santa Maria Valley Water Conservation District.
b Pumped recently.

11/34-34J1. L. O. Fox. Records available: 1947-48.

Feb. 25	96.26	Apr. 26	95.83	Aug. 24	a103.29	Oct. 20	105.00
Mar. 24	96.86	July 21	101.41	Sept.23	100.31		

a Pumping.

11/35-20E1. Union Sugar Co. Records available: 1938-48.

Jan. 1	ab27.00	Apr. 26	b 20.84	Aug. 24	12.76	Oct. 30	b 11.02
Mar. 24	6.17	July 1	ab 41.42	Oct. 1	ab 47.00	Dec. 30	5.52
Apr. 1	a 4.91	21	12.91				

a By Santa Maria Valley Water Conservation District.
b Pumping recently.

11/35-25H1. M. J. Mendoza. Records available: 1944-48.

Jan. 31	46.51	Apr. 26	47.30	Aug. 24	a 48.68	Oct. 20	a 49.48
Feb. 26	46.97	June 23	a 48.03	Sept.23	a 49.05	Dec. 30	50.28
Mar. 24	46.96	July 21	a 48.48				

a Nearby well pumping.

11/35-26M2. Sam Tognazzini. Records available: 1944-48.

Jan. 31	a 51.36	Apr. 26	a 43.47	Aug. 24	a 58.76	Oct. 20	a 56.79
Feb. 26	43.57	June 23	a 53.75	Sept.23	a 57.69	Dec. 30	42.11
Mar. 24	37.98	July 21	50.04				

a Nearby well pumping.

11/35-28M1. Union Sugar Co. Measurements by Santa Maria Valley Water Conservation District. Records available: 1934, 1938-48. Jan. 1, 20.17; Apr. 1, 18.50; July 1, 39.85; Oct. 1, 30.55.

11/35-33G1. H. E. Perroni. Records available: 1930, 1933-34, 1938-48.

Jan. 1	a 27.20	Apr. 26	b 37.00	July 21	43.34	Oct. 20	38.16
Mar. 24	27.63	June 23	41.23	Aug. 24	43.04	Dec. 30	29.98
Apr. 1	a 28.33	July 1	ab 43.10	Oct. 1	40.10		

a By Santa Maria Valley Water Conservation District.
b Pumping recently.

11/35-35A1. Bello Estate. Records available: 1925, 1930, 1938-48.

Jan. 1	a 49.25	Apr. 26	48.13	Sept.23	b 55.37	Oct. 20	b 54.79
Feb. 26	48.22	July 1	ab 58.20	Oct. 1	ab 53.40	Dec. 30	51.03
Apr. 1	a 46.75	Aug. 24	c 58.86				

a By Santa Maria Valley Water Conservation District.
b Pumping recently.
c Pumping.

Cuyama Valley

7/24-13C1. Ventura County, Apache School district. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	16.49	Apr. 26	16.13	Aug. 24	19.48	Oct. 20	20.31
Mar. 3	15.86	June 23	17.45	Sept.23	19.74	Dec. 28	21.33
23	15.10	July 21	18.08				

9/24-19Q1. Key well U. S. W. C. Ramelli. Records available: 1941-48.

Jan. 30	45.40	Apr. 26	45.77	Aug. 24	49.47	Oct. 20	a 50.54
Mar. 3	45.52	June 23	47.95	Sept.23	50.06	Dec. 28	51.83
23	45.93	July 21	48.53				

a Pumping.

10/25-21G1. E. H. Mettler. Records available: 1947-48. Jan. 30, 81.54, nearby well pumping; Mar. 23, 82.14; Aug. 24, 98.87, pumping; Dec. 28, 87.70.

10/25-30F1. Adolph Kirschenmann. Records available: 1942-48. Mar. 3, 53.61; Mar. 23, 54.10; Dec. 28, 54.93.

10/26-9R2. H. S. Russell. Records available: 1947-48.

Jan. 30	24.30	Apr. 26	26.96	Aug. 24	a 32.72	Oct. 20	27.13
Mar. 3	22.94	June 23	27.20	Sept.23	30.74	Dec. 28	24.21
23	24.29	July 21	30.91				

a Nearby well pumping.

10/26-22A1. Edward Kirschenmann. Records available: 1941-48.

Jan. 30	8.21	Apr. 26	14.80	Aug. 24	15.44	Oct. 20	5.03
Mar. 3	1.34	June 23	9.20	Sept.23	8.80	Dec. 28	5.96
23	11.97	July 21	10.46				

10/27-11C1. A. P. Anderson. Records available: 1947-48.

Date	Water level	Date	Water level	Date	Water level
Mar. 3	28.79	Apr. 26	28.04	Oct. 20	25.77
23	27.71	Aug. 24	a 75.32	Dec. 28	30.06

a Pumping.

10/27-12R1. William Kirschenmann Estate. Records available: 1941-48.

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 30	43.47	Mar. 23	44.17	July 21	46.26	Sept.23	53.41
Mar. 3	43.37	June 23	46.72	Aug. 24	45.55	Dec. 28	43.63

HAWAII

By D. A. Davis

PROGRAM OF WORK

Measurement of water levels in observation wells in Hawaii was continued in 1948 in cooperation with the Hawaii Division of Hydrography. Systematic studies of the geology and ground-water resources of the island of Kauai were continued, and data pertaining to geology and ground water were gathered throughout the islands.

The records in the accompanying tables show measurements of artesian heads or water levels, in feet, with reference to both sea level and to land-surface datum. They are shown in two columns designated A and B; those in column A are in feet above mean sea level and those in 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 water level in the well, measured directly; 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 1948 the Geological Surveymade 355 water-level measurements and 361 chloride determinations on 127 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 220 measurements in 96 wells, 90 of which were measured more than once. The Geological Survey maintained 1 automatic water-stage recorder and the Board of Water Supply maintained 15.

Improvement in rainfall conditions during 1948 is shown by the following table of rainfall indices for the year which are based on the monthly rainfall at selected stations in the Honolulu watershed area, expressed in percentage of the normal rainfall during the last 59 years. The annual index for 1948 is 109, which is higher than that for any previous year since 1939

except 1942 for which the index was also 109. The data are from a table prepared by C. K. Wentworth for the Honolulu Board of Water Supply.[1/]

Rainfall in the Honolulu area, in percentage of normal, 1948

Month	Rainfall	Month	Rainfall	Month	Rainfall
January	209	May	115	September	74
February	71	June	54	October	66
March	114	July	67	November	156
April	116	August	91	December	176
Index for the year					109

In all basal artesian areas, except Mokuleia (Area 12), water levels in wells indicative of water-level conditions showed a net gain during 1948. This rise in water level ranged from a maximum of 4.67 feet in the Makiki-Pacific Heights area (Area 12) to a minimum of 0.15 foot in the Wilhelmina Rise area (Area 5). In the Mokuleia area the net drop ranged between 0.30 and 0.58 foot. Improvement in water-level conditions may also be seen in the comparison in the following table of water levels in certain wells in 1948 with those for 1926. During 1948 levels in 6 of the 11 wells shown in the table rose above the level of 1926, in contrast with the year 1947 in which only 2 of the wells had water levels above those of 1926. In general, there was little change in chloride content of water in the basal artesian areas.

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, 1948

Area	Name	Well	High	Low	Net gain or loss
1	St. Louis Heights	2	December	January	+2.35
2	Makiki-Pacific Heights	83	December	January	+2.67
3	Kapalama	132	December	January	+2.23
4	Moanalua	T-24	December	January	+1.83
5	Wilhelmina Rise	a Shaft 7	December	August	+.15
6	Pearl Harbor	201	March	October	+1.45
		244	March	October	+2.37
		266	March	October	+1.67
7	Waialua	326	September and October	June	+.32
8	Kahuku	356	December	July	+1.71
		396	April	October	+.40
9	Kahana	405	May	December	+.17
10	Kaaawa	406	May and July	January	+.32
11	Gilbert	T5	December	July	+.47
12	Mokuleia	286	March	May	-.30
		308	January	May	-.58

a Nonartesian but indicative of artesian conditions.

Lowest head and net changes in head, in feet above sea level, in observation wells on Oahu in 1926 and 1948

Well No.	Artesian area		Head			Net change
	No.	Name	1926	1947	1948	1926-48
2	1	St. Louis Heights	20.88	21.44	25.25	+4.37
83	2	Makiki-Pacific Heights	23.52	23.19	26.13	+2.61
132	3	Kapalama	24.84	22.55	25.40	+.56
T24	4	Moanalua	a24.00	20.24	22.32	-1.68
201	6	Pearl Harbor	17.09	15.02	16.86	-.23

1 Wentworth, C. K., Board of Water Supply, City and County of Honolulu, 12th Biennial Rept., 1947-48, p. 50, 1949.

Lowest head and net changes in head, in feet above sea level, in observation wells on Oahu in 1926 and 1948--Continued

Well No.	Artesian area No.	Name	Head 1926	Head 1947	Head 1948	Net change 1926-48
244	.	.....	17.27	16.07	18.15	+0.88
266	.	.....	15.75	14.09	16.01	+.26
326	7	Waialua	10.34	9.69	10.14	-.20
356	8	Kahuku	13.05	9.28	10.01	-3.04
396	.	.....	18.78	17.30	17.99	-.79
308	12	Mokuleia	17.55	17.75	17.84	+.29

a Estimated from head in well 144.

Water levels, in feet, in four test borings in the Pearl Harbor and Waialua areas, 1948

(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		T27		T28	
		A	B	A	B	A	B	A	B
Jan.	7	17.68	6.72	19.10	63.10	18.43	28.57	10.58	24.42
	14	17.44	6.96	18.95	63.25	18.30	28.70	.....	.....
	21	17.42	6.98	18.50	63.70	18.17	28.83	10.62	24.38
	28	18.12	6.28	20.85	61.35	18.90	28.10	.f...	.....
Feb.	4	18.18	6.22	21.25	60.95	19.23	27.77	11.19	23.81
	11	18.25	6.15	20.05	61.15	19.31	27.69	11.00	24.00
	18	18.15	6.25	20.45	61.75	19.26	27.74	10.95	24.05
	25	18.00	6.40	19.90	62.30	19.06	27.94	10.84	24.16
Mar.	3	18.51	5.89	22.00	60.20	19.75	27.25	11.03	23.97
	10	18.62	5.78	21.90	60.30	19.85	27.15	10.93	24.07
	17	18.70	5.70	21.95	60.25	19.98	27.02	10.92	24.08
	24	18.66	5.74	21.00	61.20	19.84	27.16	10.87	24.13
	31	18.63	5.77	20.90	61.30	19.80	27.20	10.74	24.26
Apr.	7	18.72	5.68	20.75	61.45	19.87	27.13	10.66	24.34
	14	18.57	5.83	21.70	60.50	20.00	27.00	10.73	24.27
	21	18.39	6.01	20.80	61.40	19.82	27.18	10.65	24.35
	28	18.40	6.00	20.50	61.70	19.61	27.39	10.71	24.29
May	5	18.30	6.10	19.80	62.40	19.39	27.61	10.62	24.38
	12	18.19	6.21	19.55	62.65	19.21	27.79	10.65	24.35
	19	18.31	6.09	19.40	62.80	19.16	27.84	10.67	24.33
	26	18.07	6.33	19.15	63.05	19.04	27.96	10.60	24.40
June	2	18.32	6.08	19.90	62.30	19.31	27.69	10.60	24.40
	9	18.12	6.28	19.30	62.90	19.08	27.92	10.68	24.32
	16	18.01	6.39	19.05	63.15	18.94	28.06	10.54	24.46
	23	17.89	6.51	18.75	63.45	18.82	28.18	10.44	24.56
	30	17.80	6.60	18.70	63.50	18.74	28.26	10.38	24.62
July	7	17.83	6.57	18.65	63.55	18.82	28.18	10.08	24.92
	14	17.69	6.71	18.65	63.55	18.66	28.34	.....	.....
	21	17.85	6.55	18.50	63.70	18.66	28.34	10.16	24.84
	28	17.52	6.88	.....	.....	18.54	28.46	10.09	24.91
Aug.	4	17.60	6.80	17.90	64.30	18.48	28.52	10.11	24.89
	11	17.80	6.60	18.55	63.65	18.62	28.38	.....	.....
	18	17.85	6.55	18.45	63.75	18.67	28.33	.....	.....
	25	17.85	6.55	18.15	64.05	18.55	28.45	.....	.....
Sept.	1	17.75	6.65	18.15	64.05	18.41	28.59	.....	.....
	8	17.77	6.63	18.50	63.70	18.52	28.48	10.47	24.53
	15	17.62	6.78	18.00	64.20	18.26	28.74	10.56	24.44
	22	17.43	6.97	17.95	64.25	18.15	28.85	10.61	24.39
	29	17.80	6.60	17.73	64.47	18.30	28.70	10.71	24.29
Oct.	6	17.48	6.92	17.75	64.65	18.15	28.85	.....	.....
	13	17.38	7.02	17.26	64.94	17.99	29.01	.....	.....
	20	17.38	7.02	17.15	65.05	17.92	29.08	10.46	24.54
	27	17.52	6.88	17.05	65.15	17.90	29.10	10.44	24.56
Nov.	3	17.84	6.56	18.80	63.40	18.40	28.60	.....	.....
	10	.....	....	20.37	61.83	18.85	28.15	.....	.....
	17	18.30	6.10	20.15	62.05	19.05	27.95	.....	.....
	24	18.38	6.02	19.50	62.70	19.10	27.90	.....	.....
Dec.	1	18.52	5.88	20.20	62.00	19.25	27.75	.....	.....
	8	18.55	5.85	20.25	61.95	19.35	27.65	10.35	24.65
	15	18.68	6.72	20.00	62.20	19.45	27.55	11.04	23.96
	22	18.70	5.70	20.10	62.10	19.50	27.50	10.99	24.01
	29	18.80	5.60	20.25	61.95	19.65	27.35	10.93	24.07
	31	18.80	5.60	20.13	62.07	19.62	27.38	10.91	24.09

Artesian head, in feet, in five wells and one test boring in the Honolulu area, 1948
(Mean daily measurements furnished by Board of Water Supply, City and County of Honolulu, from recorder charts)

Area		1		2		3	
Well No.		2		83		132	
		A	B	A	B	A	B
Jan.	7	25.25	11.75	26.13	0.87	25.40	17.60
	14	25.30	11.70	26.19	.81	25.50	17.50
	21	25.34	11.66	26.40	.60	.....	.....
	28	25.61	11.39	.....	.....	25.74	17.26
Feb.	4	25.56	11.44	.....	.....	25.99	17.01
	11	25.56	11.44	.....	.....	26.20	16.80
	18	25.50	11.50	.....	.....	26.31	16.69
	25	25.59	11.41	27.37	+.37	26.48	16.52
Mar.	3	25.77	11.23	.....	.....	26.64	16.36
	10	25.82	11.18	27.71	+.71	26.83	16.17
	17	25.82	11.18	27.78	+.78	26.96	16.04
	24	25.81	11.19	.....	.....	27.01	15.99
	31	25.67	11.35	28.01	+1.01	27.20	15.80
Apr.	7	25.82	11.18	.....	.....	27.34	15.66
	14	25.90	11.10	28.19	+1.19	27.39	15.61
	21	25.72	11.28	28.45	+1.45	27.34	15.66
	28	25.57	11.43	28.34	+1.34	27.41	15.59
May	5	25.73	11.27	28.40	+1.40	27.37	15.63
	12	25.51	11.49	.....	.....	27.24	15.76
	19	25.78	11.22	.....	.....	27.16	15.84
	26	25.70	11.30	.....	.....	.....	.....
June	2	25.88	11.12	27.98	+.98	27.05	15.95
	9	25.83	11.17	.....	.....	.....	.....
	16	25.81	11.19	.....	.....	26.74	16.26
	23	25.58	11.42	.....	.....	26.52	16.48
	30	25.68	11.32	27.39	+.39	.....	.....
July	7	25.83	11.17	.....	.....	.....	.....
	14	.....	.....	.....	.....	.....	.....
	21	.....	.....	.....	.....	.....	.....
	28	.....	.....	27.02	+.02	.....	.....
Aug.	4	25.48	11.52	.....	.....	.....	.....
	11	.....	.....	.....	.....	.....	.....
	18	25.86	11.14	.....	.....	25.79	17.21
	25	25.96	11.04	.....	.....	25.79	17.21
Sept.	1	25.87	11.13	26.64	.36	25.77	17.23
	8	.....	.....	26.76	.24	25.88	17.12
	15	25.64	11.36	26.72	.28	25.82	17.18
	22	.....	.....	26.74	.26	25.86	17.14
	29	25.90	11.10	26.93	.07	26.16	16.84
Oct.	6	25.98	11.02	27.03	+.03	26.21	16.79
	13	26.09	10.91	27.11	+.11	26.19	16.81
	20	26.02	10.98	27.15	+.15	26.11	16.89
	27	26.30	10.70	27.18	+.18	26.17	16.83
Nov.	3	26.53	10.47	27.31	+.31	26.33	16.67
	10	26.58	10.42	27.40	+.40	26.46	16.54
	17	26.74	10.26	27.55	+.55	26.57	16.43
	24	26.93	10.07	27.72	+.72	26.75	16.25
Dec.	1	27.06	9.94	27.90	+.90	26.93	16.07
	8	27.04	9.96	28.15	+1.15	27.07	15.93
	15	27.18	9.82	28.29	+1.29	27.20	15.80
	22	27.32	9.68	28.42	+1.42	27.32	15.68
	29	27.48	9.52	28.55	+1.55	27.45	15.55
	31	27.47	9.53	28.58	+1.58	27.44	15.56

Artesian head, in feet, in five wells and one test boring in the Honolulu area, 1948--Continued
(Mean daily measurements furnished by Board of Water Supply, City and County of Honolulu, from recorder charts)

Area		4		5		5	
Well No.		T-24		1-A		Shaft 7	
		A	B	A	B	A	B
Jan.	7	22.37	36.03	7.97	10.03	9.20	150.80
	14	22.35	36.05	7.93	10.07	9.20	150.80
	21	22.32	36.08	7.94	10.06	9.24	150.76
	28	22.62	35.78	8.01	9.99	....	.....
Feb.	4	22.88	35.52	8.07	9.93	.....	.....
	11	23.05	35.35	8.11	9.89	9.35	150.65
	18	23.10	35.30	8.05	9.95	9.36	150.64
	25	23.22	35.18	8.08	9.92	9.33	150.67
Mar.	3	23.49	34.91	8.05	9.95	9.36	150.64
	10	23.64	34.76	8.07	9.93	9.31	150.69
	17	23.77	34.63	8.03	9.97	9.32	150.68
	24	23.79	34.61	8.01	9.99	9.29	150.71
	31	23.81	34.59	8.02	9.98	9.32	150.68
Apr.	7	23.85	34.55	8.01	9.99	9.29	150.71
	14	23.92	34.48	8.00	10.00	9.29	150.71
	21	23.83	34.57	7.94	10.06	9.26	150.74
	28	23.75	34.65	7.96	10.04	9.27	150.73
May	5	23.52	34.88	7.94	10.06	9.23	150.77
	12	23.38	35.02	7.93	10.07	9.26	150.74
	19	23.31	35.09	7.91	10.09	9.22	150.78
	26	23.29	35.11	7.90	10.10	9.20	150.80
June	2	23.30	35.10	7.85	10.15	9.19	150.81
	9	23.24	35.16	7.85	10.15	9.20	150.80
	16	23.09	35.31	7.85	10.15	9.24	150.76
	23	22.98	35.42	7.90	10.10	9.29	150.71
	30	23.05	35.35	7.93	10.07	9.26	150.74
July	7	23.23	35.17	7.93	10.07	9.25	150.75
	14	23.36	35.04	7.92	10.08	9.25	150.75
	21	23.27	35.13	7.86	10.14	9.18	150.82
	28	23.18	35.22	7.82	10.18	9.14	150.86
Aug.	4	23.09	35.31	7.81	10.19	9.12	150.88
	11	23.18	35.22	7.83	10.17	9.14	150.86
	18	23.14	35.26	7.87	10.13	9.13	150.87
	25	23.10	35.30	7.89	10.11	9.16	150.84
Sept.	1	23.03	35.37	7.87	10.13	9.17	150.83
	8	23.06	35.34	7.94	10.06	9.20	150.80
	15	22.93	35.47	7.90	10.10	9.18	150.82
	22	22.85	35.55	7.92	10.08	9.17	150.83
	29	22.94	35.46	7.98	10.02	9.20	150.80
Oct.	6	23.01	35.39	7.99	10.01	9.20	150.80
	13	22.88	35.52	7.98	10.02	9.22	150.78
	20	22.82	35.58	7.97	10.03	9.21	150.79
	27	22.85	35.55	7.99	10.01	9.25	150.75
Nov.	3	23.05	35.35	8.02	9.98	9.26	150.74
	10	23.25	35.15	8.13	9.87	.....	.....
	17	23.41	34.99	8.13	9.87	9.32	150.68
	24	23.54	34.86	8.12	9.88	9.36	150.64
Dec.	1	23.66	34.74	8.17	9.83	9.38	150.62
	8	23.77	34.63	8.12	9.88	9.35	150.65
	15	23.85	34.55	8.13	9.87	9.32	150.68
	22	23.90	34.50	8.16	9.84	9.36	150.64
	29	24.01	34.39	8.14	9.86	9.35	150.65
	31	24.04	34.36	8.18	9.82	9.34	150.66

Schofield Barracks shaft 4. Static level determined when pumps were shut down. Records available: 1936-48.

Water level, in feet, from recorder charts

Date	Water level		Date	Water level	
	A	B		A	B
Jan. 2	275.21	574.79	July 1	278.62	571.38
Feb. 1	275.48	574.52	Aug. 1	279.12	570.88
Mar. 1	276.00	574.00	Sept. 1	279.38	570.62
Apr. 1	276.56	573.44	Oct. 1	279.44	570.56
May 2	277.22	572.78	Nov. 1	279.23	570.77
June 1	277.91	572.09	Dec. 1	279.01	570.99

Artesian head, in feet, and chloride, in parts per million, in typical wells in Oahu

Well 1B (area 5). Bishop Estate, north side of Waialae Golf Links, Kaimuki. Records available: 1935-48.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 22	7.96	10.26	195	July 27	7.82	10.40	216
Feb. 27	8.13	10.09	178	Aug. 26	7.92	10.30	221
Mar. 23	8.00	10.22	195	Sept.28	7.92	10.30	244
Apr. 27	7.92	10.30	188	Oct. 29	7.97	10.25	208
May 26	7.86	10.36	205	Nov. 23	8.14	10.08	192
June 24	7.92	10.30	213	Dec. 20	8.13	10.09	164

Well 9 (area 1). J. J. Gouveia. Kapahulu Road, Honolulu. Records available: 1935-48.

Jan. 22	25.48	+9.40	58	July 27	25.62	+9.54	59
Feb. 24	25.47	+9.39	57	Aug. 26	25.94	+9.86	60
Mar. 23	25.77	+9.69	59	Sept.28	25.38	+9.30	59
Apr. 27	25.27	+9.19	57	Oct. 29	26.55	+10.47	57
May 26	25.09	+9.01	58	Nov. 23	26.94	+10.86	57
June 22	25.42	+9.34	60	Dec. 21	27.25	+11.17	58

Well 81 (area 2). A. Young. Young Street, Honolulu. Records available: 1935-48.

Jan. 22	26.24	+8.20	63	July 27	26.78	+8.74	80
Feb. 24	27.03	+8.99	66	Aug. 26	26.75	+8.71	86
Mar. 23	27.78	+9.74	73	Sept.28	26.64	+8.60	81
Apr. 27	28.33	+10.29	74	Oct. 29	27.11	+9.07	81
May 25	27.83	+9.79	76	Nov. 23	27.60	+9.56	81
June 22	27.27	+9.23	77	Dec. 21	28.11	+10.07	81

Well 119 (area 3). Honolulu Gas Co. Honolulu. Records available: 1935-48.

Jan. 27	24.95	+20.73	402	July 27	25.04	+20.82	406
Feb. 24	26.34	+22.12	395	Aug. 31	24.94	+20.72	403
Mar. 23	26.74	+22.52	398	Sept.28	25.55	+21.33	396
Apr. 27	26.44	+22.22	403	Oct. 26	24.94	+20.72	403
May 25	25.84	+21.62	383	Nov. 23	26.21	+21.99	390
June 22	24.39	+20.17	388	Dec. 21	26.22	+22.00	403

Well 153 (area 4). S. Damon Estate. Moanalua Gardens, Honolulu. Records available: 1935-48.

Jan. 22	22.39	+2.01	54	July 26	23.35	+2.97	54
Feb. 27	23.33	+2.95	53	Aug. 26	23.08	+2.70	54
Mar. 23	23.49	+3.11	53	Sept.27	22.99	+2.61	54
Apr. 27	23.84	+3.46	53	Oct. 28	22.97	+2.59	52
May 25	22.99	+2.61	52	Nov. 23	23.57	+3.19	54
June 23	23.04	+2.66	53	Dec. 21	24.01	+3.63	53

Well 187B (area 6). U. S. Navy. Near Aiea railroad station. Records available: 1936-48.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 22	19.39	+9.46	157	July 26	19.89	+9.96	168
Feb. 24	a17.57	+7.64	162	Aug. 24	19.91	+9.98	196
Mar. 23	20.80	+10.87	186	Sept.27	19.82	+9.89	178
Apr. 28	20.52	+10.59	186	Oct. 29	19.70	+9.77	152
May	.....	.....	....	Nov. 23	20.68	+10.75	149
June 22	18.89	+8.96	145	Dec. 21	21.20	+11.27	145

a Pumping.

Well 190 (area 6). C. B. Cooper. Half a mile west of Aiea. Records available: 1935-48.

Jan. 22	19.38	3.35	180	July 26	19.98	2.75	203
Feb. 24	20.05	2.68	180	Aug. 24	19.97	2.76	208
Mar. 23	20.83	1.90	191	Sept.27	19.82	2.91	203
Apr. 27	20.54	2.19	191	Oct. 29	19.69	3.04	205
May 25	20.16	2.57	198	Nov. 23	20.70	2.03	202
June 22	19.94	2.79	200	Dec. 21	21.16	1.57	207

Well 193 (area 6). L. L. McCandless Estate. In Waimalu Valley, 1 mile northwest of Aiea. Records available: 1935-48.

Jan. 22	a18.8	+5.8	150	July 26	a19.0	+6.0	169
Feb. 24	a19.3	+6.3	142	Aug. 24	a19.0	+6.0	172
Mar. 23	a20.3	+7.3	148	Sept.27	a18.8	+5.8	172
Apr. 27	a19.9	+6.9	158	Oct. 29	a18.9	+5.9	169
May 25	a19.6	+6.6	165	Nov. 23	a19.7	+6.7	154
June 23	a18.9	+5.9	164	Dec. 21	a20.2	+7.2	148

a Estimated by comparison with well 195.

Well 201 (area 6). Bishop Estate. In Pearl City. Records available: 1935-48.

Jan. 22	17.18	+8.01	784	July 26	17.62	+8.45	846
Feb. 24	17.94	+8.77	855	Aug. 24	17.60	+8.43	915
Mar. 23	18.72	+9.55	967	Sept.27	17.20	+8.03	830
Apr. 27	18.47	+9.30	975	Oct. 29	16.86	+7.69	870
May 25	17.95	+8.78	790	Nov. 23	17.86	+8.69	787
June 23	17.71	+8.54	853	Dec. 21	18.42	+9.25	913

Well 244 (area 6). Bishop Estate. In Waipahu. Records available: 1935-48.

Jan. 22	19.48	+9.01	113	July 26	19.17	+8.70	114
Feb. 24	20.07	+9.60	116	Aug. 24	18.99	+8.52	122
Mar. 23	20.87	+10.40	113	Sept.27	18.47	+8.00	112
Apr. 27	20.37	+9.90	117	Oct. 29	18.15	+7.68	107
May 25	19.52	+9.05	115	Nov. 23	20.14	+9.67	107
June 22	19.31	+8.84	114	Dec. 21	20.85	+10.38	108

Well 266 (area 6). Honouliuli Ranch. 1.75 miles northeast of Ewa. Records available: 1935-48.

Jan. 22	17.55	+4.89	229	July 26	17.48	+4.82	218
Feb. 24	18.37	+5.71	205	Aug. 24	16.99	+4.33	222
Mar. 23	19.47	+6.81	202	Sept.27	16.43	+3.77	221
Apr. 27	18.88	+6.22	187	Oct. 29	16.01	+3.35	217
May 25	17.73	+5.07	206	Nov. 23	18.54	+5.88	200
June 22	17.56	+4.90	211	Dec. 23	18.73	+6.07	206

Well 276 (area 11). Ewa Plantation Co. 4.5 miles west of Ewa. Records furnished by owner; figures are monthly averages. Records available: 1936-48.

Jan.	12.52	28.06	536	July	12.12	28.46	568
Feb.	12.66	27.92	557	Aug.	11.98	28.60	573
Mar.	12.99	27.59	547	Sept.	11.89	28.69	573
Apr.	12.57	28.01	564	Oct.	11.56	29.02	566
May	12.24	28.34	565	Nov.	12.56	28.02	546
June	12.23	28.35	570	Dec.	12.44	28.14	550

Well 286 (area 12). Waialua Agricultural Co. In Mokuleia. Measuring point, 0.33 foot above land-surface datum and 11.87 feet above sea level. Records available: 1935-48.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 23	17.33	+5.79	230	July 28	16.74	+5.20	166
Feb. 27	17.41	+5.87	220	Aug. 23	16.94	+5.40	183
Mar. 22	17.49	+5.95	228	Sept.28	16.87	+5.33	220
Apr. 26	17.06	+5.52	232	Oct. 27	16.78	+5.24	203
May 26	16.65	+5.11	232	Nov. 24	17.24	+5.70	161
June 24	16.74	+5.20	154	Dec. 22	17.25	+5.71	186

Well 308 (area 12). J. F. Mendonca. 1.5 miles west of Waialua Mill. Records available: 1935-48.

Jan. 23	18.95	+10.49	112	July 28	17.86	+9.40	93
Feb. 27	18.94	+10.49	114	Aug. 23	18.26	+9.80	99
Mar. 22	18.54	+10.08	119	Sept.28	18.86	+10.40	93
Apr. 26	18.24	+9.78	119	Oct. 27	18.54	+10.08	95
May 26	17.84	+9.38	116	Nov. 24	18.61	+10.15	95
June 24	18.09	+9.36	102	Dec. 22	18.62	+10.16	97

Well 326 (area 7). Waialua Agricultural Co. About 0.5 mile south of Waialua. Records available: 1935-48.

Jan. 23	10.80	+4.61	90	July 28	10.16	+3.97	98
Feb. 27	10.89	+4.70	90	Aug. 23	10.51	+4.32	99
Mar. 22	10.84	+4.65	95	Sept.28	10.90	+4.71	94
Apr. 26	10.72	+4.53	95	Oct. 27	10.90	+4.71	90
May 26	10.44	+4.25	95	Nov. 24	11.31	+5.12	92
June 24	10.14	+3.95	95	Dec. 22	11.31	+5.12	90

Well 337 (area 8). Waialee Training School for Boys. Records available: 1935-48.

Jan. 23	12.10	9.35	100	July 28	12.37	9.08	113
Feb. 27	12.34	9.11	...	Aug. 19	12.77	8.68	123
Mar. 22	12.35	9.10	103	Sept.28	12.85	8.60	116
Apr. 26	12.26	9.19	103	Oct. 27	12.75	8.70	117
May 26	11.97	9.48	107	Nov. 24	13.31	8.14	110
June 24	12.55	8.90	112	Dec. 22	13.39	8.06	113

Well 356 (area 8). Kahuku Plantation Co. At sugar mill in Kahuku. Records available: 1935-48.

Jan. 23	10.94	+2.11	365	July 28	10.01	+1.18	468
Feb. 27	12.44	+3.61	300	Aug. 23	11.55	+2.72	310
Mar. 22	12.04	+3.21	292	Sept.28	11.14	+2.31	295
Apr. 16	12.03	+3.20	312	Oct. 27	12.31	+3.48	284
May 26	10.44	+1.61	383	Nov. 24	12.05	+3.22	241
June 24	10.21	+1.38	448	Dec. 22	13.32	+4.49	248

Well 396 (area 8). Kahuku Plantation Co. In Hauula. Records available: 1935-48.

Jan. 23	18.38	+8.02	71	July 28	18.87	+8.51	69
Feb. 27	19.16	+8.80	69	Aug. 23	18.92	+8.56	70
Mar. 22	19.75	+9.39	69	Sept.28	18.64	+8.28	68
Apr. 17	19.76	+9.40	68	Oct. 27	17.99	+7.63	68
May 26	19.12	+8.76	68	Nov. 24	19.05	+8.69	67
June 24	18.75	+8.39	67	Dec. 22	19.20	+8.84	66

Well 405 (area 9). M. E. Foster Estate. In Kahana. Records available: 1936-48.

Jan. 23	16.57	+10.81	40	July 28	17.28	+11.52	40
Feb. 27	17.36	+11.60	38	Aug. 23	17.53	+11.77	39
Mar. 22	17.36	+11.60	39	Sept.28	16.98	+11.22	39
Apr. 17	17.69	+11.93	38	Oct. 27	17.46	+11.70	37
May 26	17.76	+12.00	37	Nov. 24	16.63	+10.87	38
June 24	17.61	+11.85	37	Dec. 22	16.54	+10.78	39

Well 406 (area 10). F. M. Swanzy. In Kaaawa Valley. Records available: 1935-48.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 23	13.77	+3.50	232	July 28	15.02	+4.75	239
Feb. 27	14.38	+4.11	230	Aug. 23	14.84	+4.57	238
Mar. 22	14.66	+4.39	232	Sept.28	14.72	+4.45	236
Apr. 26	14.83	+4.56	227	Oct. 27	14.53	+4.26	238
May 26	15.02	+4.75	222	Nov. 24	14.47	+4.20	226
June 24	14.99	+4.72	226	Dec. 22	14.27	+4.00	227

Water levels, in feet, and chloride, in parts per million, in test borings in Oahu

Test boring Oahu T1 (tributary to area 12). Waialua Agricultural Co. In Kaukonahua Gulch, 4 miles south of Waialua. Records available: 1938-48.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 8	15.91	257.70	31	Aug. 4	15.78	257.83	21
Feb. 28	15.40	258.21	21	Sept. 1	15.88	257.73	21
May 7	15.57	258.04	31	Oct. 2	15.83	257.78	31
July 1	15.93	257.68	21	Dec. 6	13.63	259.98	21

Test boring Oahu T2 (tributary to area 7). Waialua Agricultural Co. Near Anahulu Canyon, 3.5 miles east of Haleiwa. Records available: 1938-48.

Jan. 7	5.61	337.27	104	July 1	6.21	336.67	104
Feb. 5	5.28	337.60	52	Aug. 4	4.71	338.17	73
28	4.93	337.95	62	Sept. 1	4.91	337.97	94
Apr. 8	5.08	337.80	62	Oct. 2	4.81	338.07	62
May 8	5.24	337.64	104	Dec. 6	4.74	338.14	31
June 2	5.04	337.84	73				

Test boring Oahu T5 (tributary to area 11). Surburban Water Works, Honolulu. 5 miles west of Ewa, on main highway. Records available: 1939-48.

Jan. 26	4.39	74.74	13	July 27	3.84	75.29	345
Feb. 26	4.63	74.50	14	Aug. 27	4.21	74.92	191
Mar. 24	4.19	74.94	78	Sept.27	4.33	74.80	117
Apr. 28	3.91	75.22	97	Nov. 3	4.46	74.67	124
27	3.70	75.43	93	26	4.57	74.56	136
June 23	3.83	75.30	203	Dec. 23	4.67	74.46	155

Test boring Oahu T15. Suburban Water Works, Honolulu. 1.8 miles above mouth of Nanakuli Gulch. Records available: 1940-48.

Jan. 26	1.90	476.74	91	July 27	1.88	476.76	92
Feb. 26	2.14	476.50	90	Aug. 27	1.74	476.90	93
Mar. 24	2.06	476.58	91	Sept.27	1.78	476.86	92
Apr. 28	1.96	476.68	91	Nov. 3	1.68	476.96	86
May 27	1.92	476.72	91	Nov. 26	1.73	476.91	90
June 23	1.99	476.65	91	Dec. 23	1.97	476.67	95

Test boring Oahu T20 (tributary to area 6). U. S. Navy. 2 miles northwest of Ewa, on main highway to Waianae. Records available: 1942-48.

Jan. 26	17.10	122.40	201	July 27	16.60	122.90	213
Feb. 26	17.33	122.17	210	Aug. 27	16.61	122.89	222
Mar. 24	17.70	121.80	206	Sept.27	16.64	122.86	208
Apr. 28	17.30	122.20	206	Nov. 3	16.66	122.84	202
May 27	16.91	122.59	212	26	17.26	122.24	195
June 23	16.52	122.98	212	Dec. 23	17.42	122.08	194

ISLAND OF MAUI

In all wells of the Hawaiian Commercial and Sugar Company water levels showed a net rise in 1948, ranging from 0.01 foot to 1.40 feet. In Pioneer Mill Company wells the water levels also showed a gain during the year, the maximum of which was 1.28 feet.

During 1948, 82,924 million gallons of water were delivered to the Maui Isthmus in East Maui Irrigation Company ditches. This is 8,807 million gallons more than was delivered in 1947. Pumpage of ground water on Maui for the year was 38,864 million gallons, 13,414 million gallons less than in 1947.

Data in the following table were furnished by the Hawaiian Commercial and Sugar Company and the Pioneer Mill Company.

Chloride, in parts per million, and water levels and net gain or loss in static level, in feet above sea level on Maui

Records available: 1940-48.

Location	Geol. Survey well No.	Average chloride for year	Date	Water level	
				Height	Loss or gain
Hawaiian Commercial & Sugar Co.					
1 (Kihei)	14	381	Dec. 31	4.34	.....
2	25	402	Dec. 31	5.34	+0.30
3	22	372	Dec. 31	3.96	+.23
4	24	452	Dec. 31	4.46	+1.40
5	19	439	Dec. 31	4.13	+.23
6	18	421	Dec. 31	4.84	+.14
7	16	303	Dec. 31	5.44	+.30
8 (Mill)	17	442	Dec. 31	5.00	+.25
3 (Kihei)	15	406	Dec. 31	6.56	+.33
Maui Agricultural Co.					
Lower Paia (Pumps	30	384	Dec. 31	3.80	+.35
Kaheka (Pumps 3 and 4)	27	183	Dec. 31	6.35	+.04
Paia School (Pump 7)	28	231	Dec. 31	3.96	+.01
Mill (Pumps 8 and 13)	29	297	Dec. 31	4.02	+.10
Kuau (Pump 12)	31	216	Dec. 31	3.78	+.04
Maliko (Pumps 10 and 11)	32	634	Dec. 31	3.71	+.02
Pioneer Mill Co.					
Kaanapali	3	618	Dec. 31	2.98	+1.23
Kahoma	5	144	Dec. 31	3.78	+1.28
Lahaina	9	427	Dec. 31	2.83	+.08
Mill	7	564	Dec. 31	3.60	+.10
Olowalu	10	248	Dec. 31	3.66	+.31
Ukumehame	12	392	Dec. 31	5.57	+.09

Water levels, in feet, and chloride, in parts per million, in test borings in Maui
(Measurements furnished by Wailuku Sugar Co.)

Test boring Maui T102 (Iao Valley). Geological Survey, U. S. Dept. of Interior. In Iao Valley, 1 mile west of Wailuku. Measurements for January through October adjusted to correct for stretch in measuring line. Measurements for November and December from automatic water-stage recorder. Records available: 1940-48.

Test boring Maui T102--Continued.

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Jan. 14	27.3	426.6	19	July 16	25.0	428.9	19
Feb. 18	26.8	427.1	18	Aug. 13	22.6	431.3	20
Mar. 18	26.5	427.4	18	Sept.15	23.0	430.9	21
Apr. 16	26.1	427.8	21	Oct. 15	19.0	434.9	21
May 14	25.7	428.2	20	Nov. 16	23.5	434.4	25
June 15	24.6	429.3	19	Dec. 15	24.2	429.7	22

Test boring Maui T110 (Puu Hele). Wailuku Sugar Co. 2 miles north of Maalaea. Measurements for January through October adjusted to correct for stretch in measuring line. Records available: 1940-48.

Jan. 14	6.9	305.8	261	July 16	6.0	306.7	253
Feb. 18	7.3	305.4	253	Aug. 13	6.0	306.7	255
Mar. 18	7.2	305.5	268	Sept.15	6.1	306.6	255
Apr. 16	7.2	305.5	297	Oct. 15	6.7	306.0	249
May 14	7.0	305.7	257	Nov. 16	6.6	306.1	251
June 15	6.3	306.4	253	Dec. 15	6.6	306.1	249

Test boring Maui T112. Wailuku Sugar Co. 0.5 mile southwest of Wailuku. Measurements for January through September adjusted to correct for stretch in measuring line. Measurements for October, November, and December from automatic water-stage recorder. Records available: 1944-48.

Jan. 14	27.4	429.7	14	July 16	25.2	431.9	14
Feb. 18	27.0	430.1	15	Aug. 13	22.0	435.1	11
Mar. 18	26.7	430.4	15	Sept.15	22.8	434.3	13
Apr. 16	26.3	430.8	16	Oct. 15	19.6	437.5	...
May 14	25.7	431.4	13	Nov. 16	21.9	435.2	..
June 15	24.0	433.1	12	Dec. 15	22.5	434.6	..

Test boring Maui T113. Wailuku Sugar Co. At Wailuku Mill. Records available: 1944-48.

Jan. 14	17.97	163.12	101	July 16	17.38	163.71	114
Feb. 18	17.78	163.31	99	Aug. 13	17.14	163.95	106
Mar. 18	17.70	163.39	102	Sept.15	16.83	164.26	106
Apr. 16	17.71	163.38	100	Oct. 15	16.64	164.45	107
May 14	17.60	163.49	102	Nov. 16	18.14	162.95	109
June 15	17.37	163.72	106	Dec. 15	18.28	162.81	110

Shaft 33. Wailuku Sugar Co. 0.5 mile southwest of Wailuku. Measurements discontinued. Records available: 1944-47.

ISLAND OF MOLOKAI

Total ground-water pumpage on Molokai for 1948 was 46 million gallons, or 29 million gallons greater than in 1947.

Water levels, in feet, in observation wells in Molokai

Kamalo well. Half a mile northeast of Kamalo wharf. Records available: 1938-1948.

Feb. 7	a3.85	39.38	...	May 14	a3.70	39.53	...
8	4.75	38.48	...	30	4.45	38.78	...
11	4.80	38.43	...	July 19	a3.36	39.87	...
Mar. 16	4.55	38.68	...	Aug. 26	4.16	39.07	67

a Pumping.

Ualapue well. 2.75 miles east of Kamalo well. Records available: 1938-48.

Feb. 7	5.31	38.40	...	May 30	4.99	38.72	...
11	5.27	38.44	...	July 19	5.01	38.70	...
Mar. 16	5.01	38.70	...	Aug. 26	4.73	38.98	51
May 14	a4.80		...				

Conant-Kawela well. Molokai Ranch Co. 5 miles east of Kaunakakai. Records available: 1947-48.

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Feb. 7	3.68	33.96	...	May 13	3.34	34.30	32
11	3.67	33.97	...	30	3.41	34.23	...
Mar. 16	3.60	34.04	...	July 19	3.60	34.04	...
Apr. 27	....	.....	18	Aug. 26	3.17	34.47	18

Test boring Molokai T4. County of Maui. In Kaunakakai, 0.25 mile north of post office. Records available: 1947-48.

Feb. 7	2.42	12.96	...	May 30	2.19	12.19	...
11	2.52	12.86	...	July 19	2.40	12.98	...
Mar. 16	2.40	12.98	...	Aug. 26	2.25	13.13	264
May 14	2.21	.....	...				

ISLAND OF LANAI

In Maunalei shaft 1 the water level ranged from a low of 2.40 feet above sea level to a high of 2.67 feet. Pumpage on the island increased from 288 million gallons for 1947 to 327 million gallons for 1948. The additional pumpage was principally from wells 1 and 2 drilled for the purpose of irrigation.

Maunalei shaft 1. 4 miles north-northeast of Lanai City. Records furnished by Hawaiian Pineapple Co. Records available: 1936-48.

Date	Water level		Date	Water level		Date	Water level	
	A	B		A	B		A	B
Jan. 1	2.65	291.35	May 1	2.40	291.60	Sept. 1	2.42	291.58
Feb. 1	2.67	291.33	June 1	2.46	291.54	Oct. 1	2.43	291.57
Mar. 1	2.63	291.37	July 1	2.37	291.63	Nov. 1	2.40	291.60
Apr. 1	2.50	291.50	Aug. 1	2.42	291.58	Dec. 1	2.39	291.61

ISLAND OF HAWAII

In the Olaa shaft the water level ranged from a high of 17.38 feet above sea level on December 28 to a low of 13.51 feet on September 11. During the year there was a net rise in water level of 1.05 feet. In the Paauilo shaft of Hamakua Mill Company the water level was 3.3 feet above sea level on December 31, 1948, or 0.8 foot above the level of December 31, 1947. The average chloride content of the water during the year was 175 parts per million.

Total ground-water draft on the island of Hawaii during 1948 was 6,997 million gallons, 2,144 million gallons less than in 1947.

Olaa shaft. Records furnished by Olaa Sugar Co., Ltd. Records available: 1936-48.

Date	Water level		Date	Water level		Date	Water level	
	A	B		A	B		A	B
Jan. 3	15.90	204.10	Feb. 7	14.72	205.28	Mar. 13	14.54	205.46
10	15.43	204.57	14	14.56	205.44	20	14.53	205.47
17	15.53	204.47	21	14.11	205.89	27	14.40	205.60
24	15.19	204.81	28	14.31	205.69	Apr. 3	14.85	205.15
31	14.93	205.07	Mar. 6	14.54	205.46	10	17.04	202.96

Olaa shaft--Continued.

Date	Water level		Date	Water level		Date	Water level	
	A	B		A	B		A	B
Apr. 17	16.73	203.27	July 17	14.69	205.31	Oct. 16	13.77	206.23
24	16.28	203.72	24	14.86	205.14	23	13.77	206.23
May 1	16.07	203.93	31	14.34	205.66	30	14.37	205.63
8	15.92	204.08	Aug. 7	14.25	205.75	Nov. 6	14.49	205.51
15	15.87	204.13	14	14.19	205.81	13	15.21	204.79
22	15.59	204.41	21	14.17	205.83	20	15.70	204.30
29	15.47	204.53	28	13.98	206.02	27	16.04	203.96
June 5	15.36	204.64	Sept. 4	13.79	206.21	Dec. 4	16.44	203.56
12	15.40	204.60	11	13.51	206.49	11	16.52	203.48
19	15.09	204.91	18	13.86	206.14	18	17.19	202.81
26	15.11	204.89	25	13.81	206.19	25	17.19	202.81
July 3	15.11	204.89	Oct. 2	13.86	206.14	31	17.38	202.62
10	15.47	204.53	9	13.59	206.41			

Ookala shaft. Records furnished by Kaiwiki Sugar Co. All measurements in old (domestic supply) tunnel. Records available: 1937-48.

Water level, in feet, and chloride in parts per million

Date	Water level		Chloride	Date	Water level		Chloride
	A	B			A	B	
Feb. 5	4.66	295.34	24	June 1	.....	.....	26
17	4.75	295.25	31	7	.....	.....	15
24	5.00	295.00	32	14	4.50	295.50	12
Mar. 1	....	.....	16	21	4.50	295.50	16
9	....	.....	25	July 6	4.25	295.75	11
16	4.42	295.58	24	20	4.33	295.67	15
27	4.75	295.25	19	Aug. 20	....	.....	10
Apr. 5	4.42	295.58	18	25	5.66	294.34	15
16	....	.....	19	31	....	.....	12
19	....	.....	20	Sept. 7	....	.....	31
26	5.00	295.00	15	Oct. 4	....	.....	29
May 4	....	.....	20	Nov. 1	4.66	295.34	7
10	....	.....	14	15	....	.....	9
19	....	.....	19	22	5.50	294.50	8
24	....	.....	27	29	4.50	295.50	9

ISLAND OF KAUAI

In the Kealia and Wailua areas of Kauai water levels during 1948 were slightly lower than those of 1947. In the Koloa area there was no appreciable change. In the early months of 1948 water levels in the Kekaha area stood a little more than a foot higher than in the same period of 1947, but in the latter part of the year a decline carried the levels to nearly a foot below those of December 1947. There was no consistent change in chloride content of ground water on the island during the year.

Artesian head, in feet, and chloride, in parts per million, in typical artesian wells in Kauai

Well 2F. Kealia, Kauai. Records furnished by East Kauai Water Co. Records available: 1937-48.

Date	Head		Chloride	Date	Head		Chloride
	A	B			A	B	
Jan. 20	9.86	+1.81	45	July 22	9.17	+1.16	43
Mar. 24	9.17	+1.12	44	Aug. 24	9.50	+1.45	43
Apr. 22	9.24	+1.19	41	Sept. 23	9.77	+1.72	43
May 26	9.16	+1.11	43	Nov. 5	9.82	+1.77	43
June 24	9.20	+1.15	43	Dec. 3	9.90	+1.85	39

Well 7. Wailua, Kauai. Records available: 1937-48.

Date	Water level A	Water level B	Chloride	Date	Water level A	Water level B	Chloride
Feb. 19	.....	.....	150	June 18	.....	.....	149
Mar. 18	.....	.....	154	Oct. 8	.....	.....	151
Apr. 20	.....	.....	155	Dec. 6	.....	.....	150
May 17	.....	.....	148				

Well 8. Wailua, Kauai. Records available: 1937-48.

Feb. 19	10.02	1.93	137	June 18	9.55	2.40	142
Mar. 18	9.88	2.07	141	Oct. 8	9.80	2.15	154
Apr. 20	9.81	2.14	140	Dec. 6	9.88	2.07	140
May 17	9.66	2.29	144				

Well 14N. Koloa, Kauai. Records furnished by Koloa Sugar Co. Records available: 1937-48.

Mar. 1	30.52	55.50	41	Aug. 3	30.77	55.25	41
27	30.42	55.60	41	Oct. 7	30.82	55.20	..
Apr. 29	30.47	55.55	37	Nov. 12	30.62	55.40	37
June 1	30.52	55.50	37	29	30.72	55.30	37
June 30	30.62	55.40	37				

Artesian head, in feet, and chloride, in parts per million, in the Kekaha Sugar Co.'s artesian wells, Kauai
(Records furnished by Kekaha Sugar Co.)

Well 35. Near Kekaha. Records available: 1937-48.

Date	Head A	Head B	Chloride	Date	Head A	Head B	Chloride
Jan. 15	7.86	+0.04	431	July 15	8.47	+0.65	540
Feb. 17	9.80	+2.02	224	Aug. 16	8.82	+1.00	486
Mar. 15	8.77	+.95	340	Sept.15	8.54	+.72	564
Apr. 20	8.53	+.71	485	Oct. 18	8.63	+.81	528
May 15	8.82	+1.00	474	Nov. 15	8.82	+1.00	297
June 15	8.68	+.86	285	Dec. 15	8.81	+.99	285

Well 37. 4 miles northwest of Kekaha. Records available: 1937-48.

Jan. 15	10.18	+0.20	103	July 15	8.68	1.30	212
Feb. 17	10.95	+.97	97	Aug. 16	8.08	1.90	267
Mar. 15	10.28	+.30	97	Sept.15	8.83	1.15	261
Apr. 20	10.34	+.36	85	Oct. 18	8.76	1.22	285
May 15	(a)	(a)	(a)	Nov. 15	8.78	1.20	407
June 15	8.69	1.29	207	Dec. 15	9.02	.96	237

a No record for May because of broken pipe.

The following table gives the draft from all the major ground-water installations in the Territory of Hawaii for irrigation, domestic, and industrial supplies. The numbers in parentheses in the records for Oahu and Maui are those used by the Federal Geological Survey.

Total draft during 1948 was 156,904 million gallons, 32,972 million gallons less than the draft in 1947. The decrease was due to reduction of pumping of water for irrigation purposes on the islands of Hawaii, Maui, and Oahu on all of which the draft was less than in 1947. On Kauai, Lanai, and Molokai use of ground water increased during the year, principally for domestic purposes. The decrease in pumpage for irrigation resulted from general increase in rainfall during the year throughout the islands.

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Draft from wells entering the main basalt aquifer of Oahu, which are not included in the table, is estimated to be about 25 million gallons a day.

Pumpage, in millions of gallons, from wells and tunnels in the Territory of Hawaii, 1948
(Data furnished by owners)

Island of Hawaii				**Island of Lanai**		
Hamakua Mill Co.				Hawaiian Pineapple Co.		
Paauilo well		a 630		Tunnel 1	82	
Hawaiian Agricultural Co.				Shaft 2	84	
Pahala shaft		347		Well 1	20	
Hutchinson Sugar Plantation Co.				Well 2	141	
Honuapo well		a 727		Total		327
Kaiwiki Sugar Co.				**Island of Maui**		
Domestic tunnel	a 56			Hawaiian Commercial and Sugar Co.		
Cane-cleaning plant tunnel	384	440		H. C. & S. Section		
Kohala Sugar Co.				Pump 1 (14) Kihei	367	
Hoea pump	729			Pump 2 (25)	1,450	
Kohala pump	1,675			Pump 3 (22)	1,758	
Waikane pump	299			Pump 4 (24)	1,226	
Honokane tunnel	a1,571	4,274		Pump 5 (19)	815	
Olaa Sugar Co.				Pump 6 (18)	2,605	
Olaa shaft		520		Pump 7 (16)	3,376	
Pepeekeo Sugar Co.		a 59		Pump 8 (17)	3,560	
U. S. Navy				Pump 3 (15) Kihei	2,761	
Hilo air station		(b)		Central power plant (20)	1,116	
Total		6,997		M. A. Section		
Island of Kauai c/				Lower Paia (30) (pumps 1, 5, and 6)	670	
County of Kauai				Kaheka (27) (pumps 3 and 4)	1,498	
Waimea Water Works	188			Pump 7 (28)	1,842	
Hanapepe Water Works	96	284		Maliko (32) (pumps 10 and 11)	539	
Kekaha Sugar Co.				Pump 12 (31)	507	
Well 9	650			Mill (29) (pumps 8 and 13)	3,737	27,827
Wells K-1 to K-5	386			Pioneer Mill Co.		
Wells M-1 to M-12	1,533			Pump A (9) Lahaina	1,783	
Kekaha pump	714			Pump B (8) Lahaina	544	
Mana pump	89			Pump C (7) Mill	2,054	
Waiawa pump	377			Pump D (3) Kaanapali	1,648	
Well 16	3	3,752		Pump F (2) Honokowai	737	
Lihue Plantation Co.				Pump G (4) Hahakea	558	
Domestic shaft	508			Pump H (3) Kaanapali	1,659	
Kealia wells	a 200			Pump L (6) Wahikuli	.....	
Hanamaulu shaft	a 10	718		Pump M (5) Kahoma	871	
Grove Farm Co.				Pump N (10) Olowalu	147	
Mahaulepu pump		a 1		Pump O (11) Olowalu	6	
Olokele Sugar Co.				Pump P (12) Ukumehame	136	d10,143
Domestic shaft		a 527		Maui Pineapple Co.		
				Kahului Cannery (11)		a 100
				Puunene Airport (shaft 33)		a e 62
				Wailuku Sugar Co.		
				Wailuku Shaft		732
Total		5,282		Total		38,864

* See footnotes at end of table.

Pumpage, in millions of gallons, from wells and tunnels in the Territory of Hawaii, 1948--Continued
(Data furnished by owners)

Island of Molokai		
County of Maui		
Conant-Kawela well	2	
Kamakana well	13	
Kamalo well	2	
Ualapue well	9	26
California Packing Corp.		
Kualapuu well		18
Libby, McNeill and Libby		
West Molokai well		3
Total		47

Island of Oahu		
Ewa Plantation Co.		
Pump 1 (268)	1,394	
Pump 2 (257)	1,048	
Pump 3 (264)	3,639	
Pump 4 (264)	3,150	
Pump 5 (259)	2,108	
Pump 6 (259)	2,734	
Pump 7 (263)	2,286	
Pump 8 (270)	598	
Pump 10 (276)	2,809	
Pump 11 (276)	1,767	
Pump 12 (276)	1,264	
Pump 13 (276)	96	
Pump 15 (Shaft 3)	3,163	
Pump 16 (Shaft 3)	3,859	
Pump 20 (dug well 20)	572	
Pump 21 (dug well 21)	371	
Pump 22 (dug well 22)	300	
Pump 23 (dug well 23)	2,393	
Pump 24 (dug well 24)	614	
Pump 25 (254)	345	34,510
California Packing Corp.		
Kunia well (330-5)	a	14
Hawaiian Electric Co.		
Wells and tunnel (199-1 and Shaft 8)	3,914	
Kaluaoopu Spring	2,912	6,826
Honolulu Board of Water Supply		
Kalihi Station (Shaft 6)	3,705	
Waialae Station (Shaft 7)	155	
Halawa Station (Shaft 12)	2,822	
Kaimuki Station (7)	1,238	
Beretania Station (88)	2,449	
Kalihi Station (128)	1,521	11,890
Honolulu Suburban Water System		
Aiea (190-1-B)	27	
Pearl City (Shaft 9)	..	
Pearl City (202)	..	
Waipahu (241)	163	
Nanakuli (dug well 16)	1	

Island of Oahu--Continued		
Honolulu Suburban Water System--Cont.		
Lualualei (Shaft 2)	22	
Waialua (well 333)	126	
Hauula (394)	...	
Kaaawa (Shaft 10)	25	
Haiku tunnel	637	
Luluku tunnel	...	
Kahaluu tunnel	365	
Waimanalo tunnel	80	
Waianae tunnels	207	1,653
Kahuku Plantation Co.		
Pump 1 (353)	743	
Pump 2 (341)	1,876	
Pump 3 (362)	1,823	
Pump 5 (352)	1,831	
Pump 6 (362-1)	323	
Pump 7 (363)	343	
Pump 8 (357)	185	
Pump 12 (361)	102	
Pump 14 (338)	a 472	
Pump 15 (348)	120	
Pump 17 (362)	143	
Pump 20 (377)	790	
Pump 23 (387)	134	
Pump 25 (373)	81	
Pump 26 (392)	86	
Pump 27 (396)	131	
Mill pump (355)	a 703	9,886
Oahu Sugar Co.		
Waipahu Section		
Pump 1 (247)	1,056	
Pump 2 (249)	1,298	
Pump 3 (249)	193	
Pump 4 (248)	507	
Pump 5 (274)	1,411	
Pump 6 (239)	1,392	
Pump 7 (246)	2,985	
Pump 8 (Waikele Spring)	1,933	
Pump 9 (Waiawa Spring)	219	
Aiea Section		
Pump 2 (196)	668	
Pump 3 (186)	724	
Pump 4 (197)	1,210	
Pump 5 and 5B (189)	1,231	
Pump 6 (Kalawao Spring)	554	
Pump 16 (199-1)	(f)	
Pump 21 and 21B (Shaft 13)	318	15,699
Private wells in Honolulu		g4,573
U. S. Army		
Schofield (Shaft 4)		1,357
U. S. Navy		
Aiea (Shaft 5)	1,627	
Red Hill (Shaft 11)	2,620	
Barbers Point (Shaft 14)	872	

* See footnotes at end of table.

Pumpage, in millions of gallons, from wells and tunnels in the Territory of Hawaii, 1948--Continued
(Data furnished by owners)

Island of Oahu--Continued		
U. S. Navy		
Aiea wells (187)	198	
Wahiawa Radio Station (330-2)	a10	
Moanalua (156)	0	
Pearl City wells	1,024	
Ewa Junction	0	
Waiawa Pump	0	
Lualualei tunnel	137	6,488
Wahiawa Water Co.		
Deep well (330-3)		85
Waialee Training School		
Sunset Beach (337-1 & 2)	a 9	
School Pump (337-1 & 2)	a 31	40

Island of Oahu--Continued		
Waialua Agricultural Co.		
Pump 1 (321)	480	
Pump 2 (322)	3,840	
Pump 3 (331)	1,328	
Pump 4 (334)	781	
Pump 5 (285)	914	
Pump 6 (298, 299, & 301)	186	
Pump 7 (324)	482	
Pump 8 (329)	256	
Pump 9 (327)	101	
Pump 10 (323)	652	
Pump 11 (296)	46	
Pump 12 (332)	103	
Pump 13 (328)	122	
Pump 15 (317)	52	
Pump 16 (316)	80	
Mill (319)	2,948	12,367
Total		105,388
Grand Total		156,905

a Estimated.
b Operation by U. S. Navy discontinued.
c McBryde Sugar Co. not included. Three pumps in Hanapepe and one pump at Lawai Valley pump both surface water and ground water. It is not possible to separate the ground-water draft from the surface water.
d Of this, 3,253 million gallons were wasted.
e Reported by Hawaiian Commercial & Sugar Co. Formerly reported by U. S. Navy.
f Pumpage from Pump 16 (199-1) included with that of Hawaiian Electric Co.
g Reported by Honolulu Board of Water Supply. Includes pumpage from wells belonging to military establishments in Honolulu.

NEW MEXICO

INTRODUCTION

By C. S. Conover

PROGRAM OF WORK

Investigation of ground-water resources in various areas in New Mexico was continued in 1948 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 the major part of the recovery from pumping effects of the previous pumping season has taken place and comparison with water levels in former years can best be made. The winter measurements of water level indicate the amount of ground water in storage, and comparisons of water-level measurements between years show the change of storage which results from changes in recharge, as represented primarily from precipitation, and in discharge, as represented primarily by pumping for irrigation. 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 part played by artificial withdrawal on the yearly changes in water level.

In all, about 2,945 measurements of water level were made during the year in about 1,140 observation wells, exclusive of Hidalgo County, and including about 198 measurements of water level made in 29 of the observation wells that were equipped with water-stage recorders for which daily records are presented.

Changes of water level

The net annual decline of ground-water levels in 1948 in areas in New Mexico where ground water is used for irrigation was, in general, somewhat less than in 1947 as a result of generally more favorable precipitation which reduced the amount of pumping normally necessary for irrigation. Water levels in most of the observation wells reached their lowest winter-time levels on record by the end of 1948.

Pumpage of ground water for irrigation in 1948 in New Mexico is estimated at 500,000 acre-feet and the irrigated acreage as about 230,000 acres as compared with about 530,000 acre-feet and 200,000 acres, respectively, in 1947. About half of the total acreage and about two-thirds of the total pumpage in New Mexico in 1948 was in the Roswell basin.

The artesian pressures in the Roswell basin reached their lowest mean annual pressures on record in three of the six wells equipped with water-stage recorders. The mean annual artesian pressures for 1948 were below the previous low mean annual pressures--from 2.6 feet in the northern part of the basin to 19.0 feet in the southern part of the basin--and were below the highest levels on record, from 7.0 to 34.8 feet, respectively.

The water table in the shallow aquifer in the Roswell basin showed a net lowering for 1948 of more than 2 feet over an area of about 121 square miles and more than 4 feet over about 10 square miles, as compared with like declines in 1947 over 263 and 126 square miles, respectively. A major decline in water table of as much as 55 feet has occurred in the heavily pumped area southwest of Hagerman since 1927, when records began.

Water levels in the Carlsbad area west of the canal showed large net declines of as much as 14 feet in 1947 and as much as 8 feet in 1948. To the east of the canal net rises of more than 4 feet were observed in 1948, as compared with net declines of more than 10 feet in 1947. The maximum net 2-year lowering east of the canal, near Otis, is about 8 feet, as compared with about 14 feet west of the canal.

In Lea County, where extensive development of ground water has recently taken place, the water levels showed significant net declines for 1948 in the areas of concentrated pumping. Net declines of water level for 1948 of more than 1 foot over about 94 square miles and more than 2 feet over about 24 square miles were observed. Net declines in excess of 5 feet were observed in two pumped wells.

Water levels in the Mimbres Valley, in Luna County, in 1948 continued the decline of the previous years. Because of increased development of ground water for irrigation, water levels declined more than 1 foot over about 177 square miles and more than 2 feet over about 69 square miles as compared with like declines in 1947 over 157 and 63 square miles, respectively.

Decreased pumping in 1948 in the House area, Quay County, caused by favorable summer precipitation, resulted in a smaller decline in water level than for any year since 1944. The water levels declined more than 1 foot over about 5 square miles, as compared with a like decline in 1947 of about 18 square miles.

A smaller decline in water level occurred in 1948 in Portales Valley than in 1947 as a result of decreased pumping caused by the favorable precipitation. Net declines in excess of 1 foot occurred over about 61 square miles and more than 2 feet over about 17 square miles. In the last 7 years, 1942 to 1949, water levels have declined 20 feet, an average of nearly 3 feet a year, over an area of about 11 square miles.

The increased development of ground water for irrigation in Estancia Valley, Torrance County, resulted in greater net declines in water level in 1948 than in previous years. The water level declined more than 1 foot over about 72 square miles and more than 2 feet over about 4 square miles in 1948, as compared with more than 1 foot over about 17 square miles in 1947.

Surface water from Bluewater Reservoir was used for irrigation in the Bluewater-Toltec Irrigation District, in Valencia County, in 1948, the first year since about 1944. Recharge from the surface-water supply raised water levels in the upper part of the district about 7 feet, compared with declines of about 12 feet in 1946 and 8 feet in 1947. In the lower part of the district the water levels declined about 1 foot, as compared with about 3 feet in 1947. The average change in water level in 14 wells distributed over the area was a rise of 0.17 foot in 1948, as compared with a decline of 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 in the Virden Valley of the Gila River, in Hidalgo County, and the thermal wells in the Hot Springs area, in Sierra County, is based on the common subdivisions in sectionized land, and, by means of it, the well number, in addition to designating the well, indicates 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 where all the wells are within a single quadrant, 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 SW¼NE¼NW¼ 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 locate accurately 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 (1) 113 114	121 122 (2) 123 124	211 212 (1) 213 214	221 222 (2) 223 224
[1]		[2]	
131 132 (3) 133 134	141 142 (4) 143 144	231 232 (3) 233 234	241 242 (4) 243 244
311 312 (1) 313 314	321 322 (2) 323 324	411 412 (1) 413 414	421 422 (2) 423 424
[3]		[4]	
331 332 (3) 333 334	341 342 (4) 343 344	431 432 (3) 433 434	441 442 (4) 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 the counties, except for the Virden Valley in Hidalgo County, 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 of the present year, and highest and lowest recorded water levels in January or February, in feet below land-surface datum, and change from January or February of the preceding year to January or February of the present year, in feet.

Part 3. Water levels, in feet below land-surface datum, showing seasonal changes during the year.

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 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 1948 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 some 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. When a 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 revisions of the well location number, descriptions of new wells and reference 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, nine 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 at odd hour.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.

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.

CHAVES AND EDDY COUNTIES (ROSWELL BASIN)

By C. S. Conover

Part 1. General discussion

The program of maintaining records of water level and artesian head in the Roswell basin was continued in 1948 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	Shallow-water levels
1925-35	777	109-114	.....
1936	817	195-197	.....
1937	840	252-254	.....
1938	845	279-282	.....
1926-38	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	225-250

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 1948 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 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 1948 to show the change in ground-water storage and the change in recharge to the artesian aquifer. A total of 32

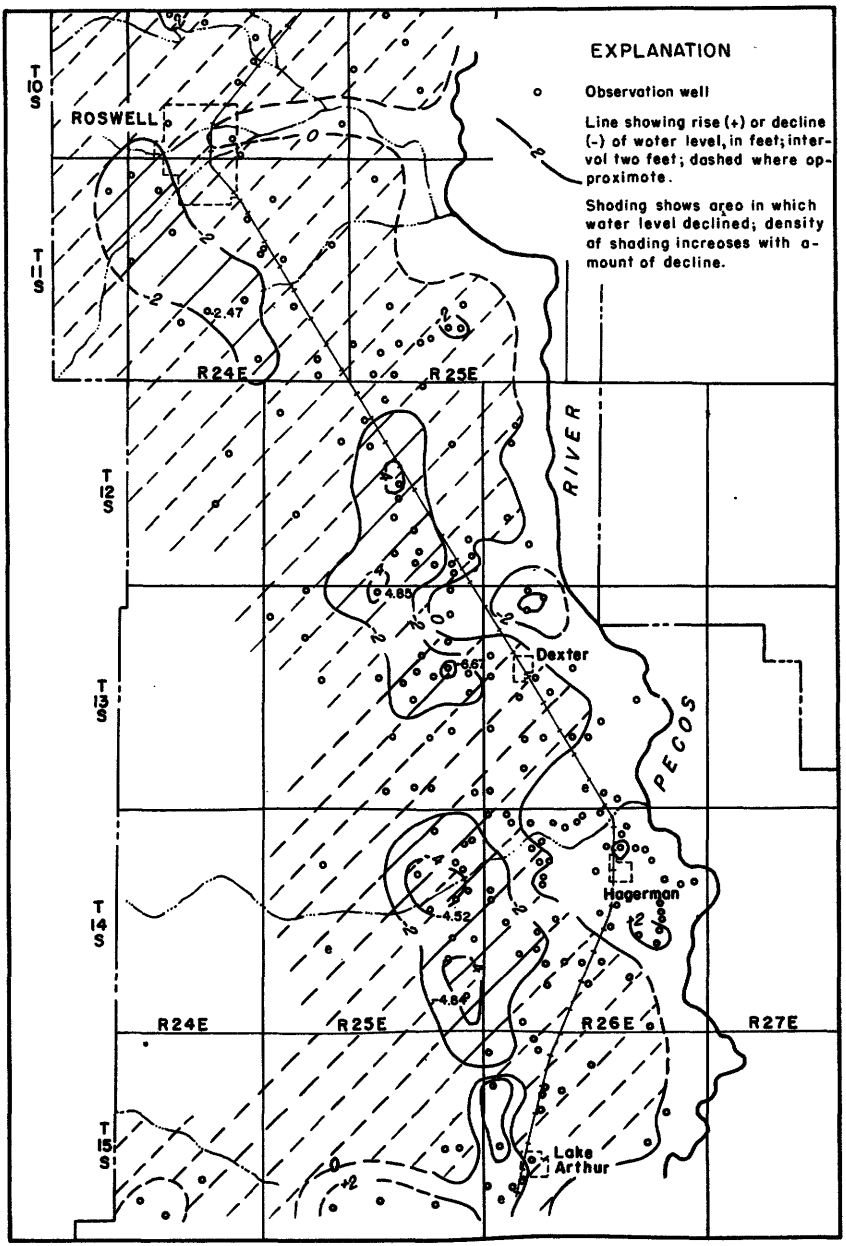

Figure 12.--Map of northern part of Roswell shallow ground-water basin, Chaves County, New Mexico, showing change in water level from January-February 1948 to January-February 1949.

measurements was made during the year on the artesian-intake wells, all of which 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 1948, most of which had been measured in January or February 1947. Water levels were also measured in about 55 of the wells at bimonthly intervals and water-stage recorders were maintained intermittently on 5 of the wells. A total of 821 measurements was made during the year on the shallow wells including 260 measurements made on the bimonthly observation wells and about 40 made on the recorder wells. Of the observation wells, 270 are in Chaves County and 125 in Eddy County.

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 1948, as reported by the U. S. Weather Bureau, was below normal at all stations in the Roswell basin, except at Hagerman, but greater than in the preceding year. The precipitation at Roswell, as estimated, was 72 percent of normal, at Hagerman, 111 percent of normal, at Artesia, 86 percent of normal, and at Carlsbad, 81 percent of normal. Precipitation during the main part of the growing season, April through September, was generally deficient, except during June when about 6 inches of rain fell, most of which fell the first two days of the month and caused floods on the Hondo and Penasco Rivers. In spite of the high total rainfall for the year, the distribution was such that for agricultural purposes the year may be classified as deficient in precipitation.

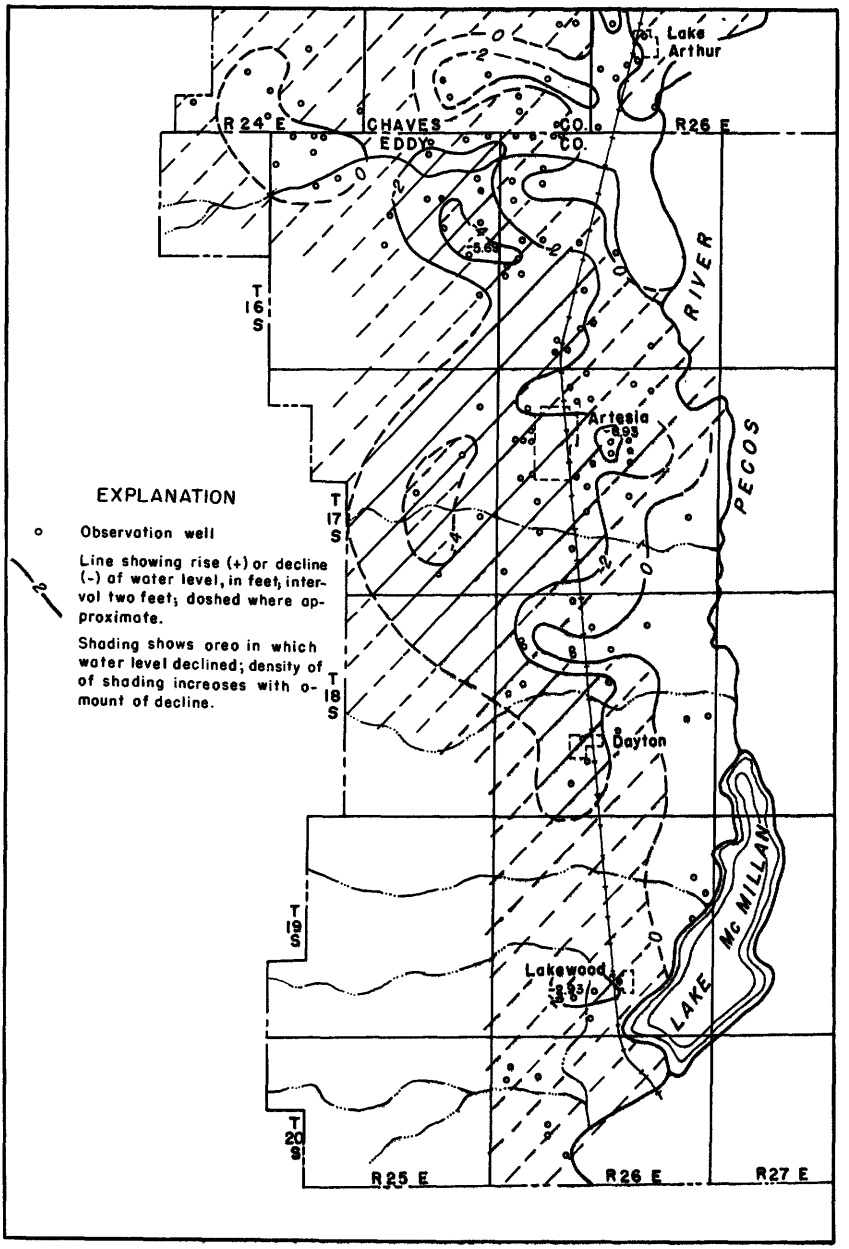

Figure 13.--Map of southern part of Roswell shallow ground-water basin, Eddy County, New Mexico, showing change in water level from January 1948 to January 1949.

Precipitation and departures from normal, in inches, at stations in Roswell basin and vicinity, 1948

Month	Roswell		Hagerman		Artesia		Carlsbad	
	Precipitation	Departure	Precipitation	Departure	Precipitation	Departure	Precipitation	Departure
Jan.	0.37	-0.16	0.50	+0.07	0.60	+0.24	0.09	-0.25
Feb.	1.39	+.80	1.69	+1.33	1.40	+.89	.41	+.02
Mar.	.26	-.48	0	-.53	.10	-.54	.04	-.51
Apr.	.28	-.61	.40	-.45	.30	-.68	.12	-.68
May	.22	-.87	1.25	-.84	.12	-1.35	.91	-.28
June	....	....	6.48	+4.51	5.94	+4.66	6.24	+4.61
July	.99	-1.27	1.99	+.40	1.35	-.62	1.26	-.89
Aug.	.14	-2.01	2.11	+.33	.17	-1.36	.04	-1.76
Sept.	.23	-1.88	.42	-1.44	.04	-1.67	.47	-1.44
Oct.	.21	-1.21	.58	-.18	.64	-.60	.88	-.53
Nov.	.15	-.70	T	-.38	T	-.57	0	-.53
Dec.	....	....	.23	-.28	.44	-.14	.27	-.31
Total			15.65	+2.54	11.10	-1.74	10.73	-2.55
Apr.-Sept.			12.65	+2.51	7.92	-1.02	9.04	-0.44

T - Trace.

The precipitation during 1948 was somewhat more favorable for the growing of crops than in 1947. A preliminary study of the records of power and fuel used in 1948 for 824 wells, for which comparable records were also available in 1947, indicates that, on the average, probably 6 percent less water was pumped in 1948 than in 1947. It is probable, therefore, that about 211,000 acre-feet of artesian water and about 121,000 acre-feet of shallow water was used for irrigation in 1948 in the main part of the Roswell basin. Additional ground water of an undetermined amount was pumped on newly developed lands in the north extension of the Roswell basin, in the vicinity of Salt Creek and Macho Draw.

High use of ground water for irrigation continued in 1948 because of continued favorable crop prices, which has resulted in a high percentage of the water-right land being farmed, in increased application of water, and in some increase in farming of nonwater-right land.

Changes in artesian head and water level

Artesian wells

New record low mean annual artesian heads were set in 1948 in three of the six artesian wells equipped with automatic water-stage recorders in the Roswell basin. The record low annual artesian heads occurred in the Berrendo-Smith and Mountain View wells, in the northern part of the basin, and in the Artesia well, in the southern part of the basin. The mean annual artesian head for the Berrendo well, which is also in the northern part of the basin, showed a comparatively large annual decline for this well of

1.8 feet and reached a mean annual head in 1948 only 1.8 feet above the previous mean annual low head set in 1940. The mean annual artesian head for the remaining two wells, Orchard Park and Greenfield, which are near the middle of the basin where there was greater precipitation, showed rises of 0.52 foot and 2.59 feet, respectively, from the record low mean annual artesian head set in these wells in 1947.

Departures from the average mean annual artesian head ranged from -3.3 feet in the Berrendo well to -23.7 feet in the Artesia well, which, for the Artesia well is 5 feet more than for 1947. The average departure of the mean annual heads in 1948 in the six artesian wells from the average since the beginning of records is a decline of 9.27 feet, as compared with a decline of 8.52 feet in 1947.

The larger than usual annual declines of artesian pressures in the northern part of the basin apparently were caused from an increase in total pumpage in this area in 1948 in spite of some slackening of pumping in June when there was heavy precipitation.

The effect of the reduction in pumping owing to the favorable precipitation in June was noticeable in the water levels in these six wells. Normally, slight rises in water level occur in April and May followed in June by a resumption of declines. However, the rise in water level continued into June in 1948 and resulted in higher water levels in June 1948 than in June 1947 in all of the wells except Berrendo. In the Greenfield well the mean monthly water level for June 1948 was 24.5 feet higher than in 1947 and 6.5 feet above the normal June level for this well.

In spite of the favorable water levels in June, pumping was so intensive in July and particularly in August that record low mean monthly artesian heads were set in all of the wells in August. The new record low mean monthly artesian head set in August for the Artesia well was 11.6 feet lower than the previous low mean monthly head set in this well in 1947, which, in turn, was 13.1 feet lower than that previously set in 1946.

The difference in artesian heads between the highest mean annual, which was in 1941 or 1942 for all the wells, and the lowest mean annual, which was in 1947 or 1948 for 5 of the 6 wells, ranges from 7.4 feet in the Berrendo-Smith well, in the northern part of the basin, to 34.8 feet in the Artesia well, in the southern part of the basin. Of the decline in mean

annual heads in the Artesia well from 1942 to 1948, 23.3 feet has occurred in the last 3 years. Mean annual artesian heads for 1948 are below the previous low mean annual heads of 1940 and 1941--2.6 feet in the Berrendo-Smith well to 19.0 feet in the Artesia well. The effect of the increased pumpage in the last 3 years is evident in the increased rate of decline of the artesian pressure.

Departure from average since beginning of record and change since 1947 of mean monthly and mean annual artesian heads in artesian wells in Roswell basin in 1948, in feet

Name	Berrendo		Berrendo-Smith		Mountain View		Orchard Park		Green-field		Artesia	
Location No.	10.24. 9.330		10.24. 21.212		11.24. 29.242		12.25. 23.110		13.25. 27.211		18.26. 5.330	
	Avg. to 1948	1947 to 1948	Avg. to 1948	1947 to 1948	Avg. to 1948	1947 to 1948	Avg. to 1948	1947 to 1948	Avg. to 1948	1947 to 1948	Avg. to 1948	1947 to 1948
Jan.	-1.6	-2.00	-2.5	-1.93	-3.3	-2.46	+6.1	-3.38	+1.5	-4.37	-14.6	-11.27
Feb.	-1.1	-1.73	-2.0	-1.40	-2.5	-1.44	+4.0	+5.84	+3.4	+9.37	-16.1	-9.88
Mar.	-1.0	-.70	-1.8	-.54	-2.6	-.91	-10.7	+3.42	-7.6	+5.76	-21.7	-10.38
Apr.	-3.5	-2.41	-4.6	-2.73	-5.1	-2.63	-25.5	-7.13	-20.6	-7.28	-28.6	-14.26
May	-3.5	-3.27	-4.6	-3.59	-4.9	-4.15	-13.8	-9.25	-17.4	-15.50	-27.5	-12.99
June	-2.1	-.19	-1.0	+.59	-2.0	+.47	-2.1	+16.28	+6.5	+24.48	-14.4	+8.64
July	-4.5	-1.63	-4.7	-1.65	-5.2	-1.47	-26.0	+3.23	-24.0	+3.88	-28.1	-.06
Aug.	-5.6	-2.36	-5.2	-3.19	-5.7	-2.11	-31.9	-5.46	-24.7	-2.90	-38.9	-11.64
Sept.	-5.7	-2.31	-5.7	-2.69	-6.8	-2.39	-19.2	-.54	-15.3	+2.07	-35.2	-5.25
Oct.	-4.4	-.87	-4.9	-1.20	-6.0	-1.04	-4.6	+6.93	-4.6	+12.08	-24.4	-.75
Nov.	-3.7	-1.58	-4.3	-1.53	-5.0	-1.27	+.7	+1.40	+2.7	+5.54	-17.5	-.27
Dec.	-3.8	-2.06	-4.5	-2.22	-5.3	-2.38	-1.3	-5.10	0	-2.04	-18.9	-5.38
Year	-3.3	-1.76	-4.3	-1.82	-5.1	-1.84	-10.2	+.52	-9.0	+2.59	-23.7	-6.12
Beginning of record	June 1926		June 1940		July 1940		Aug. 1925		May 1940		April 1931	

Mean monthly and mean annual artesian heads in artesian wells in Roswell basin in 1948 and highest and lowest mean annual and mean monthly artesian heads, 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	
1948	Days of record	Water level	Days of record	Water level	Days of record	Water level	Days of record	Water level	Days of record	Water level	Days of record	Water level
Jan.	31	3568.91	31	3569.03	31	3566.84	27	3539.49	25	3530.11	31	3375.81
Feb.	29	3569.16	29	3568.96	29	3567.13	22	3533.61	24	3524.90	29	3371.57
Mar.	31	3568.19	31	3567.41	31	3564.70	24	3511.01	31	3497.69	j31	3360.46
Apr.	30	3563.90	30	3561.29	30	3558.10	j28	3487.82	30	3469.38	30	3346.03
May	31	3564.01	31	3562.64	27	3558.97	25	3502.00	31	3480.36	31	3350.52
June	30	3565.05	30	3563.78	30	3560.61	28	3512.06	30	3498.72	30	3361.13
July	24	3561.50	31	3559.19	31	3555.67	j25	3486.22	31	3467.64	j26	3344.84
Aug.	31	3559.71	31	3557.17	31	3552.78	j31	3477.89	19	3459.79	j21	3330.64
Sept.	30	3560.96	30	3559.17	30	3553.87	30	3497.57	30	3481.46	24	3339.67
Oct.	31	3564.25	31	3563.40	24	3559.25	j31	3523.85	31	3512.72	21	3360.37
Nov.	30	3565.80	30	3565.50	30	3562.68	30	3533.81	30	3527.35	25	3371.67
Dec.	31	3566.36	31	3566.15	31	3563.67	j28	3533.32	31	3527.60	31	3371.95
Mean annual	359	3564.82	366	3563.64	355	3560.35	j329	3511.55	343	3498.14	j330	3357.06
Mean annual:	Date	Water level	Date	Water level	Date	Water level	Date	Water level	Date	Water level	Date	Water level
Highest	1942	3571.8	1942	3571.0	1942	3569.6	1942	3528.1	1941	3517.5	1942	3391.9
Lowest	1940	3563.0	1948	3563.64	1948	3560.35	1947	3511.03	1947	3495.55	1948	3357.06
First year of record	1927	3571.2	1941	3566.2	1941	3564.2	1926	3525.7	1941	3517.5	1932	3384.6
Mean monthly:	Date	Water level	Date	Water level	Date	Water level	Date	Water level	Date	Water level	Date	Water level
Highest	Dec'26	3574.8	Jan'43	3574.4	Jan'43	3573.7	Jan'42	3544.0	Jan'42	3535.4	Jan'43	3402.1
Lowest	Aug'48	3559.71	Aug'48	3557.17	Aug'48	3552.78	Aug'48	3477.89	Aug'48	3459.79	Aug'48	3330.64
Beginning of record	June 1926		June 1940		July 1940		August 1925		May 1940		April 1931	

j A few days estimated.

Records of artesian head

10.24.9.330. Berrendo well. Measuring point, top of floor of recorder shelter, 0.66 foot above land-surface datum, and 3,586.82 feet above mean sea level. Highest and lowest recorded water levels: Mar. 8, 14, 15, 16.68; Aug. 17, 26.65. Maximum recorded daily fluctuation: Apr. 2, 3.37 feet.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	17.21	16.85	16.85	18.94	20.95	20.76	23.58	24.25	25.52	22.90	20.70	19.75
2	17.18	16.83	16.80	19.32	20.93	20.53	23.96	24.02	25.67	22.80	20.64	19.73
3	17.18	16.84	16.90	19.53	20.83	20.28	24.01	24.17	25.81	22.71	20.60	19.68
4	17.25	16.82	16.84	19.64	20.97	20.13	23.72	24.37	25.49	22.58	20.62	19.62
5	17.25	16.79	16.77	19.84	22.13	20.02	23.55	25.21	25.34	22.45	20.63	19.60
6	17.35	16.82	16.73	20.10	21.87	20.00	23.84	25.45	25.17	22.37	20.56	19.57
7	17.23	16.80	16.70	20.33	21.70	19.92	.....	25.47	25.54	22.27	20.46	19.54
8	17.20	16.87	16.68	20.55	20.83	19.98	.....	24.79	25.98	22.17	20.46	19.52
9	17.26	16.82	16.69	20.73	20.62	19.99	.....	25.22	25.77	22.10	20.41	19.55
10	17.19	16.82	16.78	20.93	20.53	19.91	.....	24.89	25.96	21.99	20.35	19.49
11	17.07	16.84	16.74	20.96	20.48	19.88	.....	24.75	25.83	21.95	20.33	19.46
12	17.14	16.76	16.73	20.85	20.57	19.87	.....	25.05	24.91	21.92	20.32	19.49
13	17.20	16.73	16.71	22.07	20.67	19.73	24.42	24.87	24.75	21.88	20.32	19.47
14	17.13	16.80	16.68	22.24	20.72	19.69	24.20	25.24	24.80	21.86	20.27	19.44
15	17.10	16.76	16.68	21.57	20.75	19.74	23.87	25.29	24.53	21.82	20.21	19.42
16	17.22	16.75	16.80	22.15	20.78	19.80	23.85	26.04	24.25	21.80	20.20	19.42
17	17.09	16.89	16.89	21.90	20.77	19.79	23.64	26.65	24.08	21.70	20.16	19.41
18	17.07	16.87	16.91	21.82	21.08	19.88	24.31	26.24	23.95	21.65	20.15	19.58
19	17.05	16.86	17.05	22.23	21.30	19.96	23.70	26.52	23.59	21.54	20.06	19.50
20	17.03	16.88	17.23	21.94	21.44	19.95	23.40	25.96	23.47	21.50	20.03	19.46
21	17.00	16.88	18.07	21.97	21.55	20.22	23.19	25.62	23.54	21.47	20.07	19.49
22	16.96	16.77	18.13	21.75	21.92	20.52	23.13	25.53	23.42	21.36	20.02	19.48
23	16.96	16.77	18.46	21.66	21.82	20.90	23.01	25.42	23.35	21.28	19.98	19.45
24	16.94	16.90	18.70	21.59	22.17	21.18	23.08	25.57	23.30	21.19	19.90	19.43
25	17.01	16.84	18.95	21.18	22.48	21.13	22.94	25.67	23.24	21.12	19.89	19.43
26	16.98	16.89	18.67	21.05	22.44	21.53	22.74	25.73	23.29	21.05	19.84	19.36
27	17.02	16.85	18.53	21.14	22.54	21.40	23.02	25.49	23.25	20.98	19.83	19.32
28	16.91	16.93	18.57	21.21	22.45	21.63	23.97	25.29	23.17	20.90	19.85	19.32
29	16.88	16.87	18.45	21.19	22.42	22.24	23.99	25.00	23.01	20.85	19.82	19.40
30	16.86		18.68	21.08	21.36	22.65	24.13	24.80	22.95	20.80	19.79	19.37
31	16.85		18.97		21.12		24.12	25.14		20.73		19.37

10.24.21.212. Berrendo-Smith well. Measuring point, top of casing, 1.75 feet above land-surface datum, and 3,582.40 feet above mean sea level. Highest and lowest recorded water levels: Feb. 2, 11.32; Aug. 25, 22.98. Maximum recorded daily fluctuation: Apr. 12, 5.03 feet.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.74	11.40	11.64	15.01	17.12	16.27	19.70	21.05	22.93	18.65	15.65	14.45
2	11.68	11.32	11.58	15.75	17.02	15.96	19.81	20.39	22.79	18.50	15.59	14.45
3	11.67	11.46	11.67	16.17	16.81	15.62	20.18	20.52	22.80	18.36	15.53	14.37
4	11.64	11.48	11.74	16.20	17.03	15.42	19.43	20.87	22.37	18.20	15.50	14.33
5	11.60	11.45	11.65	16.74	17.06	15.33	19.00	21.04	21.79	18.03	15.52	14.27
6	11.65	11.48	11.60	17.18	16.77	15.25	19.47	21.18	21.50	17.89	15.40	14.19
7	11.62	11.48	11.65	17.48	16.40	15.12	19.65	21.50	22.37	17.76	15.26	14.19
8	11.57	11.56	11.60	17.70	16.35	15.14	19.78	20.98	21.64	17.63	15.26	14.14
9	11.61	11.45	11.69	17.87	16.22	15.11	19.99	20.49	21.35	17.52	15.19	14.18
10	11.58	11.56	11.72	18.17	16.08	15.14	20.18	21.50	22.03	17.36	15.11	14.12
11	11.50	11.55	11.65	17.93	16.10	15.15	19.34	21.28	22.00	17.24	15.08	14.07
12	11.53	11.40	11.68	17.71	16.26	15.18	19.39	21.69	20.98	17.15	15.05	14.14
13	11.65	11.35	11.65	18.65	16.44	14.91	20.19	21.34	20.78	17.10	15.07	14.10
14	11.60	11.47	11.73	18.76	16.48	14.82	20.36	21.58	21.10	17.10	15.02	14.08
15	11.55	11.40	11.70	18.46	16.55	15.12	20.42	21.02	20.95	17.08	14.92	14.09
16	11.65	11.41	11.93	18.79	16.50	15.27	20.65	20.73	20.60	17.08	14.89	14.10
17	11.52	11.71	12.10	18.80	16.37	15.26	20.13	21.95	20.28	17.06	14.94	14.10
18	11.49	11.68	12.15	18.57	16.73	15.40	19.88	22.13	20.20	16.89	14.97	14.54
19	11.53	11.68	12.39	18.22	17.64	15.50	19.84	22.70	19.83	16.70	14.82	14.41
20	11.51	11.72	12.80	18.90	17.58	15.54	19.83	22.76	19.58	16.65	14.76	14.35
21	11.52	11.70	12.85	18.69	17.92	15.88	19.67	22.73	19.64	16.64	14.78	14.45

10.24.21.212--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
22	11.43	11.47	12.79	18.28	18.18	16.57	19.97	22.60	19.69	16.45	14.74	14.44
23	11.48	11.48	13.64	18.23	17.63	17.31	19.64	22.47	19.54	16.36	14.75	14.41
24	11.40	11.70	14.12	17.90	17.43	17.73	19.83	22.81	19.58	16.25	14.73	14.42
25	11.48	11.50	14.55	17.08	18.12	17.34	19.16	22.98	19.42	16.17	14.66	14.38
26	11.43	11.70	14.70	16.78	17.68	18.12	18.86	22.86	19.27	16.12	14.62	14.25
27	11.54	11.61	14.99	17.30	18.12	17.70	19.78	22.40	19.12	16.09	14.58	14.18
28	11.57	11.75	14.97	17.55	18.17	17.79	20.61	22.53	18.99	16.00	14.59	14.15
29	11.36	11.70	14.40	17.54	17.98	19.20	20.40	22.27	18.74	15.90	14.50	14.34
30	11.35		15.08	17.28	17.61	19.52	20.55	22.05	18.60	15.81	14.55	14.33
31	11.37		15.41		16.89		20.84	22.40		15.74		14.35

11.24.29.242. Mountain View well. Measuring point, top of casing, 3.94 feet above land-surface datum, and 3,631.12 feet above mean sea level. Highest and lowest recorded water levels: Feb. 23, 59.60; Aug. 28, 75.37. Maximum recorded daily fluctuation: Mar. 29, 2.43 feet.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	60.40	59.91	59.87	66.00	67.80	67.13	69.17	72.32	74.83	70.25	65.62	63.58
2	60.30	59.87	60.21	67.12	67.33	66.73	69.65	71.79	75.01	.....	65.52	63.59
3	60.29	59.93	60.38	67.52	67.15	66.46	69.78	71.94	74.98	.....	65.39	63.48
4	60.24	59.95	60.49	67.50	.....	66.32	69.21	72.23	74.83	.....	65.33	63.37
5	60.20	59.97	60.38	67.53	.....	66.01	68.95	72.80	74.48	.....	65.27	63.33
6	60.25	60.00	60.33	68.01	.....	65.65	69.59	72.94	74.20	.....	65.14	63.25
7	60.21	60.07	60.30	68.50	67.51	65.56	70.04	73.37	74.77	.....	64.94	63.16
8	60.19	60.08	60.31	69.03	67.61	65.42	70.18	73.23	74.61	68.93	64.90	63.13
9	60.27	59.97	60.55	69.03	67.33	65.34	70.36	72.95	74.20	68.74	64.79	63.21
10	60.25	59.87	60.69	69.40	67.18	65.33	70.70	73.67	74.27	68.47	64.65	63.12
11	60.11	60.12	60.59	68.89	67.34	65.35	70.48	73.93	74.15	68.39	64.54	63.02
12	60.13	59.90	60.67	68.67	67.41	65.39	70.10	74.25	73.38	68.22	64.52	63.18
13	60.42	59.82	60.77	69.70	67.39	65.05	70.81	74.24	73.14	68.04	64.45	63.13
14	60.39	59.97	60.82	69.67	67.34	64.95	71.06	74.17	73.21	67.95	64.37	63.18
15	60.32	59.87	60.75	69.55	67.44	65.22	71.16	73.61	73.18	67.82	64.23	63.17
16	60.50	59.85	61.30	69.62	67.33	65.33	71.48	73.37	72.98	67.81	64.25	63.15
17	60.27	59.95	61.53	69.72	67.23	65.40	71.65	74.04	72.64	67.65	64.14	63.24
18	60.20	59.90	61.58	69.03	67.70	65.49	71.37	74.12	72.74	67.38	64.14	63.33
19	60.34	59.89	62.00	68.80	67.98	65.60	71.07	74.30	72.12	67.25	64.02	63.43
20	60.35	60.00	62.32	69.16	68.30	65.65	71.30	74.32	71.85	67.22	63.95	63.37
21	60.32	59.91	62.39	68.96	68.52	65.52	71.46	74.53	71.93	67.12	64.06	63.47
22	60.20	59.67	62.47	68.54	68.60	66.08	71.78	74.28	71.90	66.95	63.95	63.49
23	60.24	59.60	63.13	68.62	68.21	66.63	71.58	73.97	71.80	66.83	63.90	63.51
24	60.15	60.00	63.60	68.47	68.01	67.22	71.50	74.75	71.72	66.57	63.85	63.59
25	60.15	60.00	64.23	67.74	68.43	67.30	71.09	74.89	71.66	66.44	63.83	63.40
26	60.11	59.91	64.76	67.54	68.50	67.63	70.82	75.15	71.26	66.30	63.83	63.23
27	60.27	59.79	65.03	67.73	68.54	67.65	71.67	75.10	71.13	66.15	63.83	63.15
28	60.16	60.04	65.07	67.80	68.55	67.59	72.03	75.37	70.92	66.06	63.74	63.20
29	59.93	59.89	64.80	67.91	68.53	68.26	72.29	74.62	70.51	65.92	63.67	63.59
30	59.93		66.00	67.90	68.21	68.90	72.43	74.28	70.33	65.85	63.70	63.48
31	59.96		66.42		67.97		72.61	74.70		65.70		63.59

12.25.23.110. Orchard Park well. Measuring point, top of casing, 0.40 foot above land-surface datum, and 3,546.59 feet above mean sea level. Highest and lowest recorded water levels: Jan. 2, 4.21; Aug. 13, 74.47. Maximum recorded daily fluctuation: Aug. 29, 9.31 feet.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.48	....	22.80	50.10	51.07	.....	52.18g	65.30	60.60	32.58	14.20	10.53
2	4.21	....	22.80	56.22	45.37	33.07	53.10g	66.10	60.41	30.35	14.76	10.13
3	4.34	....	24.05	57.59	43.21	30.90	52.17	66.91	59.03	29.12	13.87	10.48
4	4.50	....	19.86	59.62	45.47	29.26	51.75	69.94	56.13	28.63	13.34	9.73
5	4.22	8.08	18.03	58.45	44.78	28.46	50.97	69.82	51.22	27.75	14.17	9.38
6	4.55	7.37	19.62	62.60	45.17	27.27	51.23	70.75	48.84	27.50	13.65	9.80
7	4.90	7.19	22.80	64.00	45.50	26.66	.....	71.64	52.45	27.27	13.73	9.88
8	5.18	6.94	23.13	64.30	42.22	27.15	.....	70.76	52.75	26.78	13.87	9.42
9	5.63	6.32	.....	64.72	37.70	27.89	.....	69.86	50.16	25.98	13.59	9.33

g Estimated.

12.25.23.110--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
10	5.39	6.56	22.23	.....	37.23	28.93	.....	71.05	50.05	24.90	12.98	9.50
11	5.27	7.49	21.32	63.39	38.80	28.35	.....	71.76	50.80	24.53	12.55	9.29
12	5.30	5.13	23.90	61.25	41.37	27.92	62.32	73.28	49.98	24.44	12.42	9.01
13	6.11	4.70	25.87	65.00	42.24	27.02	66.22	74.47	47.93	23.77	12.16	9.72
14	....	8.02	26.18	65.05	42.60	26.89	69.57	74.32	50.22	23.04	11.90	11.56
15	....	8.47	25.30	62.93	41.75	27.86	61.00	72.65	48.96	21.88	11.68	12.80
16	....	10.06	28.22	61.00	40.21	28.13	60.84	66.10	47.80	21.45	11.63	13.30
17	8.44	11.84	31.06	61.07	39.42	29.00	62.20	68.65	45.20	20.23	11.60	14.51
18	7.89	13.77	34.72	59.33	44.86	30.00	58.75	69.43	45.88	19.42	10.99	15.03
19	7.88	.....	36.27	57.75	46.14	32.15	57.84	67.85	43.60	19.01	10.00	14.63
20	7.82	.....	38.85	56.94	48.04	29.15	60.52	67.03	42.49	19.37	9.67	13.62
21	8.75	16.41	38.42	54.85	48.03	29.69	61.51	66.70	43.83	19.29	10.19	.....
22	8.74	16.23	39.65	51.48	48.14	31.85	58.33	63.38	46.62	18.38	10.51	.....
23	8.10	16.94	42.00	51.15	45.59	34.88	56.30	62.24	46.58	17.53	10.36	.....
24	7.11	18.85	46.50	51.60	43.61	37.33	.....	65.62	46.23	17.18	10.91	16.59
25	7.39	17.63	48.22	44.02	46.35	41.42	55.92	64.88	43.35	16.51	10.95	12.19
26	6.85	19.73	51.67	41.82	.....	45.07	55.48	64.55	39.60	16.12	11.18	10.67
27	6.50	19.97	.....	45.93	.....	44.73	56.71	65.07	38.28	16.00	11.88	12.18
28	5.60	22.12	53.12	50.00	.....	44.40	62.47	65.17	35.42	15.24	11.47	13.59
29	5.15	22.65	52.43	49.03	.....	48.60	64.15	56.14	33.53	15.00	10.82	13.76
30	5.35		55.55	51.25	.....	51.08	64.45	52.43	32.95	15.38	10.80	15.51
31	5.63		52.75		.....		65.58	57.23		14.67		15.19

13.25.27.211. Greenfield well. Measuring point, top of casing, 13.92 feet above land-surface datum, and 3,537.68 feet above mean sea level. Highest and lowest recorded water levels: Jan. 5, +11.24; Aug. 11, 67.79. Maximum recorded daily fluctuation: July 5, 14.98 feet.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	10.55	40.58	47.44	28.00	44.10	58.89	50.54	22.95	+1.36	+6.77
2	.....	+8.25	11.40	50.05	40.35	23.11	46.20	57.74	49.92	19.09	1.20	+7.26
3	+9.23	+7.68	11.92	54.73	39.08	19.58	48.66	61.05	47.16	17.69	+1.00	+6.36
4	+10.87	+6.65	6.18	51.65	44.44	18.07	45.50	63.88	49.20	18.57	+1.53	+7.42
5	+11.24	+7.52	4.78	49.02	43.30	17.23	43.65	63.37	43.47	17.76	+1.54	+7.72
6	+9.77	+7.97	6.07	57.07	45.00	14.98	42.03	66.05	41.55	18.69	+2.38	+6.84
7	+9.05	+7.97	9.00	58.50	41.71	14.44	48.95	65.71	44.97	18.72	+2.48	+6.19
8	+9.57	+8.51	9.93	59.84	35.66	16.44	53.04	63.92	41.77	18.54	+3.50	+6.73
9	+9.00	.....	13.02	62.10	32.10	19.10	55.80	64.57	39.64	17.66	+3.89	+6.97
10	+9.48	+7.04	8.48	61.64	32.17	20.00	53.87	64.27	41.55	13.88	+4.87	+7.02
11	+9.58	.....	7.62	57.65	34.20	18.13	52.82	67.79	45.40	13.54	+5.70	+8.23
12	+9.52	.....	11.48	55.29	35.95	17.83	48.69	.....	44.05	15.05	+5.09	+8.32
13	+7.47	.....	16.12	60.98	36.12	16.14	54.07	.....	40.94	13.93	+4.28	+7.23
14	+6.62	+7.87	14.53	60.30	36.97	17.77	59.70	.....	45.10	11.37	+4.52	+5.97
15	+5.22	+8.12	12.02	57.92	35.43	17.08	60.61	.....	44.40	10.64	+5.47	+4.82
16	+5.81	+6.84	15.40	55.40	33.83	18.13	61.16	.....	39.65	10.97	+5.77	+4.01
17	+6.30	+2.48	19.90	53.73	31.88	18.06	60.38	.....	36.48	7.58	+6.02	+1.60
18	+6.93	.75	22.55	50.96	38.88	18.95	55.60	.....	41.77	6.65	+5.89	+1.79
19	+6.93	.65	23.24	49.12	42.32	23.09	54.05	.....	38.56	7.47	+6.41	+3.26
20	+5.82	.98	29.59	53.14	44.32	17.86	59.32	.....	36.76	5.97	+6.80	+4.17
21	+5.36	.82	26.03	47.32	45.05	17.98	58.32	.....	37.88	5.10	+6.69	+1.67
22	+3.75	.96	27.03	44.50	45.07	19.83	51.70	.....	40.82	5.90	+6.71	+.05
23	+6.22	1.05	33.12	46.88	40.64	22.89	50.42	.....	39.08	3.40	+5.70	+1.70
24	+7.25	4.78	35.67	44.52	37.85	22.67	51.67	63.16	36.35	1.50	+4.20	+2.57
25	+5.62	5.10	40.83	39.40	42.54	29.47	47.07	60.88	33.25	1.22	+4.39	+6.10
26	+3.94	6.04	41.75	36.59	47.76	31.61	46.13	59.05	29.95	2.38	+3.65	+6.92
27	.....	6.38	42.61	43.19	51.40	31.67	47.55	60.29	29.17	1.17	+5.23	+7.04
28	.....	9.38	45.19	47.14	48.13	32.65	54.37	57.92	26.93	.83	+5.90	+5.70
29	.....	10.07	42.49	44.26	38.13	42.20	55.32	46.22	25.85	1.22	+6.31	+3.35
30	.....		48.45	47.94	36.04	42.67	58.73	43.51	25.10	.77	+6.52	+1.98
31	+7.85		50.90		31.20		59.13	46.04		+1.00		+2.25

18.26.5.330. Artesia well. Measuring point, top of casing, 4.83 feet above land-surface datum, and 3,399.33 feet above mean sea level. Highest and lowest recorded water levels: Jan. 3, 15.40; Aug. 24, 65.54. Maximum recorded daily fluctuation: June 1, 5.12 feet.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	15.68	19.72	25.83	45.52	40.62	39.55	43.53	.....	64.12	40.89	.....	19.88
2	15.42	20.03	26.66	46.70	38.55	36.39	45.18	.....	64.37	40.29	.....	19.97
3	15.40	20.80	27.25	47.84	37.90	34.40	46.20	.....	64.25	39.09	.....	20.08
4	15.55	21.46	24.84	47.26	38.41	32.93	45.32	.....	64.15	38.28	.....	20.59
5	15.80	21.45	23.57	47.85	38.54	31.63	44.81	.....	62.95	38.86	.....	20.61
6	16.45	20.97	23.65	49.57	39.11	30.28	43.55h	62.27	62.00	38.95	24.81	20.43
7	16.62	20.79	24.21	50.25	39.47	29.85	42.73	61.46	61.74	39.79	24.28	20.65
8	17.00	19.74	24.99	50.40	40.07	29.55	43.07	61.65	60.97	39.22	24.00	20.55
9	17.38	19.17	25.98	50.14	39.90	29.07	44.50	61.95	60.50	37.51	23.91	21.02
10	17.68	20.02	25.13	50.10	39.83	28.58	45.53	63.05	59.63	36.12	23.58	21.07
11	17.44	20.18	24.24	48.63	40.75	27.92	43.68	64.51	59.46	35.69	23.49	20.68
12	17.84	19.02	25.28	47.77	41.24	27.13	42.82	64.00	.....	35.41	23.40	20.68
13	18.76	18.63	27.58	48.87	41.35	26.63	42.99	64.33	.....	35.29	23.43	20.49
14	18.94	20.37	27.98	49.70	41.87	26.35	44.56	63.50	.....	34.90	23.14	20.76
15	18.95	20.37	28.65	49.50	41.88	26.65	45.24	61.58	.....	34.28	22.86	20.75
16	19.18	20.33	30.17	50.19	40.53	27.44	44.91	60.14	.....	34.01	22.56	21.89
17	19.56	21.00	32.30	49.81	39.73	27.78	45.80	62.40	.....	33.29	22.08	22.33
18	19.14	21.94	33.34	48.47	42.33	29.00	46.08	63.26	53.33	32.54	21.98	22.45
19	19.56	22.93	33.75	47.88	43.79	29.75	45.88	64.04	50.80	31.97	21.47	22.26
20	20.04	24.51	35.16	48.90	44.64	30.13	48.77	64.80	49.79	31.52	21.30	21.99
21	20.31	25.09	35.74	46.95	45.95	30.57	49.83	64.92	48.31	30.79	21.37	23.36
22	20.63	24.82	35.80	45.64	46.93	32.09	51.64	64.93	47.84	.....	21.02	23.81
23	20.67	24.42	38.44	45.25	46.37	34.08	53.18	63.87	46.66	.....	20.73	24.29
24	20.15	25.63	40.00	46.33	46.06	36.67	54.81	65.54	45.83	.....	20.61	24.42
25	20.30	26.02	41.96	44.19	47.44	38.39	54.16	.....	45.14	.....	20.60	23.79
26	19.86	26.38	43.17	43.67	48.03	39.14	54.62	.....	43.18	.....	20.46	23.17
27	19.57	26.10	44.73	44.70	47.94	38.25	.....	.....	42.57	.....	20.37	22.93
28	18.65	26.85	45.12	44.57	47.89	38.06	.....	.....	42.29	.....	20.00	23.56
29	18.36	26.20	44.90	42.82	47.04	40.50	.....	63.64	41.95	.....	19.90	24.65
30	19.00		46.07	41.73	48.30	42.67	.....	62.84	41.65	.....	19.91	25.21
31	19.38		45.94		44.60		.....	63.91		.....		25.77

h Tape measurement at odd hour.

Wells in intake area of Roswell artesian basin

The water levels in the observation wells in the intake area of the artesian basin, as based upon bimonthly measurements, generally reached their highest levels in February and their lowest levels in September, mainly in response to the draft on the artesian aquifer by the artesian wells to the east. A slight decrease in the rate of decline of water level during the summer was noticed in these wells from May to July. This decreased rate of decline was probably, for the most part, the result of the slackening of the pumping caused by the excessive precipitation in June. As the Hondo River, in the northern end of the basin near Roswell, and the Penasco River, in the southern part of the basin near Dayton, had floods during June, some recharge undoubtedly was contributed to the artesian aquifer in the intake area and was partly responsible for the decreased rate of decline of water level noted in the observation wells from measurements made in May and July. In the Clements well, west of Dayton, a decided

decrease in the rate of decline of water level occurred from May to July, whereas, in the previous year an increased rate of decline occurred. In the Coffin well, west of Lakewood, the water level rose about 3.7 feet from May to September, as compared with a rise of 0.6 foot in the preceding year.

The slight reduction of pumpage from the artesian aquifer and the increase in recharge in 1948, as compared with 1947, resulted in a smaller net decline in ground-water storage in 1948 than in 1947. The average net decline for the intake wells in 1948 was about 2.5 feet, as compared with about 4.5 feet in 1947 and about 1.0 foot in 1946. Water levels in the wells in the intake area at the end of 1947 were still somewhat above, though approaching, 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 of Roswell basin, showing seasonal changes during 1948

Location number	11.22. 1.312	12.23. 5.320	14.23. 8.340	16.23. 15.323	18.23. 5.333	19.23. 27.111
Owner	H. L. Wood	J. Herbst	Diamond A Cattle Co.	D. W. Runyan	Joe Clements	C. R. Coffin
Jan. 7, 8	258.90	238.82	264.54	218.77	b399.24	374.10
Mar. 12, 16	259.25	238.22	264.25	a219.15	399.78	372.68
May 12, 18	260.74	.....	265.72	220.30	a400.05	b378.54
July 13, 19	261.72	.....	a266.43	221.40	400.08	376.62
Sept. 14, 16, 20	263.96	.....	a268.09	222.24	401.15	374.98
Nov. 5, 6, 9	262.84	.....	a268.08	222.00	402.28	a374.75
Change:						
Jan. 47-48	-2.49	j-2.35	-3.25	-3.26	j-11.78	j-1.77
Jan. 48-49	-2.00	.....	-2.56	-3.24	j-4.32	-.50

a Pumping.
b Pumping recently.
j Influenced by pumping.

High and low January water levels

Location number	High	Year	Low	Year	Record began	Year missing
11.22.1.312	253.75	45	258.90	48	45	..
12.23.5.320	228.74	43	243.33	41	41	..
14.23.8.340	258.00	45	270.01	41	41	..
16.23.15.323	211.92	45	225.70	41	41	..
18.23.5.333	387.46	47	b399.24	48	47	..
19.23.27.111	368.83	46	379.30	41	41	45

b Pumping recently.

Shallow wells

The water table in the Roswell basin lowered from January 1948 to January 1949 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 121 square miles, more than 4 feet

over about 10 square miles, and more than 6 feet over less than 1 square mile. These areas are considerably less than those in 1947 when the water table lowered 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. The greatest declines occurred in the southern part of the basin, in Eddy County, where in 1947 the greatest increase of pumpage occurred. (See accompanying figures.)

In Chaves County the water table declined from January 1948 to January 1949 more than 2 feet over an area of about 48 square miles and more than 4 feet over an area of about 4 square miles. The declines were the greatest in the heavily pumped areas, west of Dexter and southwest of Hagerman. The maximum net decline observed southwest of Hagerman was 4.8 feet in 1948 compared with 7.9 feet in 1947. In the center of this area of heavy pumping, southwest of Hagerman, a major decline of water level of more than 35 feet has occurred since 1938 and as much as 55 feet since 1927, when records began. Scattered areas in which the water level showed a net rise in 1948 are related, in general, to a decrease in pumpage in 1948, such as in the area a couple of miles northwest of Lake Arthur where, because of excessive pumpage in 1947, net declines of as much as 10.5 feet were observed, as compared with net rises of as much as 3.8 feet in 1948. In spite of the rise of water level in this area in 1948, the water level at the end of 1948 was more than 5 feet lower than at the end of 1946. In the area east of the Hagerman Canal the water levels generally showed a net rise in 1948. In this area pumping is done to supplement water obtained from the canal and, because of the application of canal water to the lands and the relatively small pumpage, only small rises or declines occur from year to year, dependent upon the amount of canal and ground water used.

In the Eddy County part of the Roswell basin the water table declined more than 2 feet over an area of about 73 square miles, more than 4 feet over about 6 square miles, and more than 6 feet over less than 1 square mile. The maximum declines of water level occurred in the heavily pumped areas northwest and east of Artesia and near Dayton.

In the pumped area about 6 miles northwest of Artesia the water levels showed a net decline of more than 5 feet in 1948 and more than 8 feet in 1947, with an observed decline in the last 2 years of more than 11 feet in 8 wells. The water levels in the heavily pumped area south of Artesia

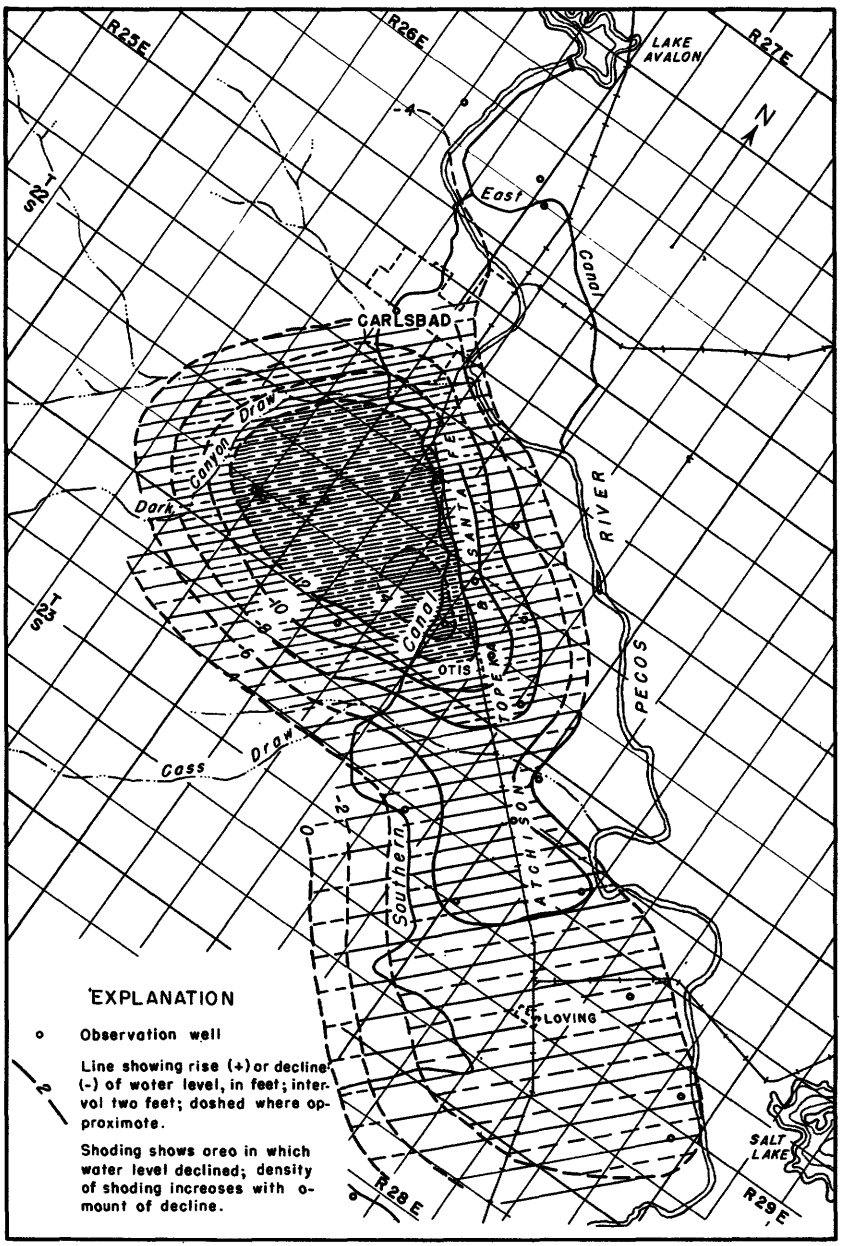

Figure 14.--Map of Carlsbad area, Eddy County, New Mexico, showing change of ground-water level from January or February 1947 to January 1948.

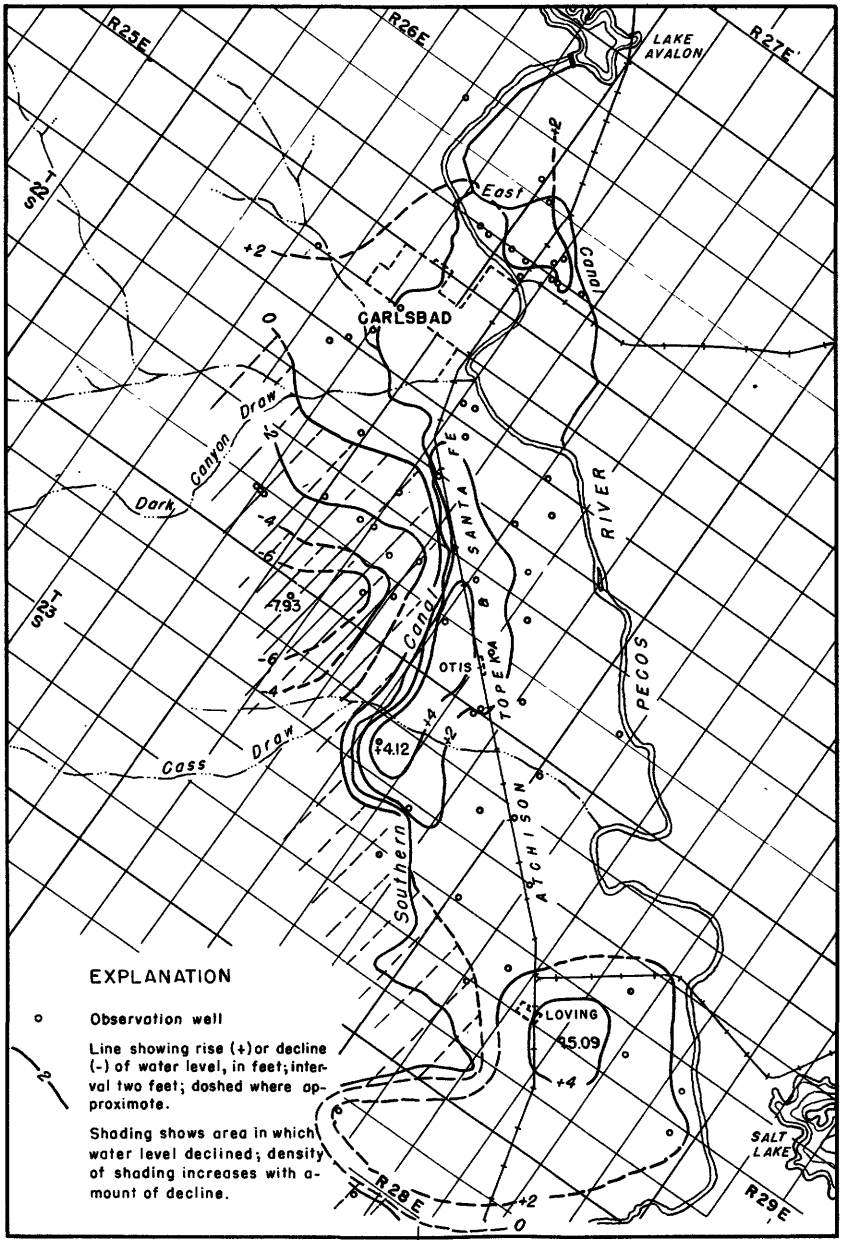

Figure 15.--Map of Carlsbad area, Eddy County, New Mexico, showing change of ground-water level from January 1946 to January 1949.

showed small declines for 1948 of generally less than 1 foot, as compared with declines of more than 12 feet in 1947. In spite of the small declines in 1948 south of Artesia, the water levels have declined more than 10 feet in the last 2 years in 6 of the observation wells.

Yearly declines of water level have averaged more than 3 feet a year during the past years over much of the areas where pumping is practiced. Such large declines, if continued, will eventually result in uneconomical pumping lifts in certain areas and may cause abandonment of some wells when farm profits decline.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Higheet		Lowest		Be-	Years
			Level	Day	1947-48	Level	Year	Level	Year	gan	missing
10.24.8.111	O. S. Stockton	.	38.26	j4	+4.18	38.26	48	45.79	45	38	42,44
8.333	Ira Lee	3	42.79	j4	-2.12	40.67	47	42.79	48	47	
15.342	W. C. Crawford	.	12.64	j4	....	8.82	38	12.99	41	38	39,42, 44,47
16.133	G. D. Perrine	5	25.79	j4	-1.40	22.85	43	28.70	41	38	
17.111	C. C. Henry & G. P. Mabry	3	41.33	j4	-2.10	38.92	46	41.33	48	46	
17.122	Mr. Howard	.	.....	..	....	24.58	42	33.67	41	38	48
18.424	L. T. Lewis	.	40.28	j4	-2.13	34.32	42	44.50	41	38	
20.344	E. E. Crockett	.	.....	..	....	36.54	42	46.65	41	38	39,45, 47,48
22.322	A. B. Carpenter	.	14.49	j4	-.69	11.19	42	19.70	41	38	
27.111	Jack Taylor	.	18.76	j4	-.63	15.20	42	25.17	38	38	
32.111	F. W. Lewis	3	30.17	j4	-1.72	27.48	46	30.17	48	46	
33.244	J. Westover	.	6.52	j4	....	5.35	43	6.52	48	41	47
34.333	Elmer Butler	.	e 4.90	j4	....	2.67	42	4.94	45	41	48
36.222	State of New Mexico	.	3.15	j4	-1.02	2.13	47	4.15	41	41	
10.25.17.344	P. E. Cannon	.	7.63	j4	-1.01	4.16	42	7.65	41	41	
18.222	J. R. Pendergrass	.	9.18	j4	-1.35	3.28	42	9.18	48	41	
19.331	F. C. Smith, Jr.	3	34.20	j4	-.14	30.76	42	34.20	48	41	46
29.222	U. S. Government	.	.95	j4	+.26	.95	48	3.15	41	41	
11.23.1.433	S. M. Wiggins	3	58.10	j4	-2.03	56.07	47	58.10	48	47	
12.221	S. P. Hannifin	.	.....	..	....	51.57	43	61.14	40	38	41,42, 47,48
11.24.6.311	R. B. Wirtz	.	47.45	j4	....	37.61	39	51.87	41	39	40,47
6.433	Mr. Watkins	.	39.65	j4	-4.27	28.98	42	41.29	41	38	
6.444	Morrie Huff	.	37.80	j4	-2.27	31.20	43	42.06	41	39	
9.122	Raymond McCutchen	.	e 33.28	j3	....	27.25	42	34.83	k41	38	48
10.114	Claude Hobbs	.	21.31	j3	-.77	16.85	42	26.60	41	40	
10.224	C. E. Smith	3	15.31	j3	-1.67	11.69	42	b19.61	39	38	
10.321	G. A. Oney	.	26.29	j3	-.61	21.13	42	28.64	40	38	39
13.144	Frank Peters	.	11.93	j3	+1.89	11.93	48	16.08	43	38	46
14.331	Leo Cowan	3,5	27.58	j3	....	.....	..	.....	..	48	
15.421	M. L. Barnett	.	35.91	j3	-2.10	30.09	42	41.49	41	38	
15.431	M. L. and S. Barnett	.	36.93	j3	-2.24	31.30	k42	42.80	41	38	
17.121a	D. H. Johnson	.	55.31	j3	-2.08	48.96	43	55.31	48	42	46
18.333	G. V. Coker	.	86.20	j3	-2.10	79.36	43	90.84	41	39	

*See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Years missing
11.24.22.333	John Tweedy	.	46.49	j3	-2.27	40.03	42	52.26	41	38	
23.411a	H. E. Babcock, Jr.	.	12.54	j3	-.74	10.35	42	17.34	41	38	45
23.433a	Tweedy Gin	.	17.72	j3	+2.68	16.43	46	20.40	47	46	
28.113	Rocky Arroyo school	3	64.13	j3	-2.34	53.52	42	69.20	41	38	
29.144	Mr. Ferrell	5	82.13	j3	-1.90	69.82	42	85.65	41	38	
29.333	F. W. Clow	.	87.94	j3	-2.10	78.91	42	87.94	48	42	45,46
34.411b	Belle Hurst	.	46.20	j3	-1.59	40.40	43	51.63	41	39	
36.133	Wiley Grizzle	.	29.03	j3	-.78	25.28	43	36.02	40	39	42
36.211	Harold Allison	5	.....	..	....	15.44	42	24.88	40	38	45,48
36.333	Wiley Grizzle	5	32.12	j3	-1.44	28.45	42	35.55	39	39	40,41
11.25.6.123a	J. P. White & Co.	.	c26.10	j4	-1.17	13.26	43	14.97	46	43	44,47
6.421a	do	3	7.63	j4	-1.04	4.44	42	7.63	48	41	
22.333	Mrs. T. E. Whitney	.	7.22	j2	+.63	5.36	42	7.85	47	38	
28.234	E. Whitney	.	8.93	j2	-.23	5.35	42	8.93	48	38	
28.244	R. O. Whitney	.	8.59	j2	-.44	4.07	42	8.59	48	38	43
28.333	Unknown	.	12.31	j2	-2.54	5.34	44	12.31	48	38	39-43
29.111	Farmers Incorporated	.	8.72	j3	-.42	5.47	39	8.74	43	38	
29.343	Albert Hobson	.	9.54	j2	-1.99	4.38	40	9.54	48	39	
29.444	Glenn Wheeler	4	10.75	j2	-1.79	f 4.59	42	f11.84	48	38	
30.333	J. P. White & Co.	.	14.79	j3	-1.56	9.24	42	17.07	40	38	
31.223	Ruby Brown	.	14.26	j2	-1.13	8.60	42	14.58	41	39	
31.433a	Albert Watson	.	.....	..	....	19.85	42	30.98	40	38	47,48
31.433b	do	.	29.61	j2	-1.37	25.60	43	30.68	40	39	42
31.433c	do	.	28.97	j2	-1.66	27.31	47	28.97	48	47	
32.333	George Bogart	.	28.28	j2	-3.99	16.89	42	28.28	48	38	41
12.24.13.111	W. T. Weldy	3	68.59	j2	-2.74	62.36	43	68.59	48	42	
23.441a	Monte Goodin	.	80.79	j2	-2.27	75.53	43	83.95	40	38	41
12.25.2.Lot 3	B. F. Heine	.	17.04	j2	-.75	9.80	42	17.04	48	38	
2.Lot 4	V. H. Hodges	.	15.05	j2	-1.21	7.27	42	15.05	48	38	
3.334	J. W. Young	.	32.24	j2	-1.77	21.21	42	32.24	48	39	
7.144a	Olivia Etz	.	42.15	j2	-1.67	37.08	43	45.00	38	38	
9.422	Cumberland townsite	3	51.85	j2	-2.50	39.60	42	51.85	48	38	
13.111	M. E. Colclazier	.	17.40	j2	-1.54	11.23	43	18.15	46	39	
16.111	Ernest Nelson	.	35.02	j2	-1.84	29.50	43	35.98	41	38	
16.222	State of New Mexico	.	59.77	j2	-2.73	42.25	38	59.77	48	38	
22.231	W. T. Clardy	.	85.81	j2	-4.92	51.84	39	85.81	48	39	
25.413	Ann E. Freeman	.	33.49	31	+2.76	17.90	42	36.25	47	38	40,41

*See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest		Be-	Years
			Level	Day	1947-48	Level	Year	Level	Year	gan	missing
12.25.26.311	J. K. Murphey	.	71.82	31	-4.87	40.62	38	71.82	48	38	
27.211	W. T. Clardy	.	82.20	31	-5.99	48.70	39	82.20	48	39	
30.222	Ivy Woodman	.	80.27	31	-.08	78.24	43	81.50	41	38	
33.112	H. D. Wager	.	92.73	31	-4.63	67.07	39	92.73	48	39	41
34.211	Donald Corn	.	71.04	31	-5.61	39.09	38	71.04	48	38	39-41
34.431	Jack Mask	.	66.79	31	-3.82	43.14	42	66.79	48	39	
35.111	C. E. Smith	.	61.81	31	-4.51	34.00	42	61.81	48	40	
35.131	do	.	63.58	31	-3.63	47.14	44	63.58	48	44	
35.311b	H. G. Moberly	.	.....	..	....	36.42	42	55.79	46	38	47,48
35.311c	Jack Mask	.	59.78	31	-2.88	56.90	47	59.78	48	47	
35.411a	A. C. Stone	3	56.03	31	+1.30	40.23	45	57.33	47	45	
36.133	H. Kuykendall	.	40.59	31	....	23.91	42	40.59	48	38	45,47
36.142	O. B. Berry	.	27.60	31	+5.12	13.85	42	32.72	47	38	46
36.211	Unknown	.	.....	..	....	24.55	44	27.01	45	44	46,48
36.313	M. L. Kuykendall	.	36.06	31	+8.00	22.84	38	44.06	47	38	42
12.26.7.421	Cecil Johnson	.	1.26	1 2	+.17	(n)	(n)	5.60	38	38	42
18.221	do	.	16.12	1 2	+6.13	10.87	42	16.12	48	42	46
18.221a	do	3	15.74	1 2	-.65	14.57	45	15.74	48	45	
29.333	T. S. Lawing	3	16.30	1 2	-.11	14.20	40	17.98	46	39	
30.213	Lowman Wiley	.	24.46	1 2	-.63	13.32	42	24.46	48	38	
13.25.1.111	M. L. Kuykendall	.	26.62	31	-4.38	12.78	42	26.62	48	38	40
1.111a	do	5	28.43	31	....	.....	..	.....	..	48	
1.331	Will Schaaphok	.	24.13	31	+.04	9.77	42	24.17	47	38	
3.111	Grace Stanley	.	72.81	31	-3.83	45.40	38	72.81	48	38	
5.111	W. H. Belcher	.	66.37	30	-4.16	60.70	42	66.37	48	38	44
6.333	R. L. Lowe	.	80.87	30	.00	78.22	38	82.16	44	38	
8.133	W. H. Jeffries	3	66.56	30	-3.82	59.61	42	70.33	41	39	
10.344	H. W. Reinicke	.	.....	..	....	57.30	38	66.98	45	38	41,46-48
11.111	Kermit Southard	.	.....	..	....	36.01	42	51.21	46	39	47,48
11.343	J. E. Brockman	.	61.57	30	-1.62	42.21	42	61.57	48	38	
11.433	do	.	52.53	30	-1.59	32.75	42	52.53	48	40	
12.133	M. E. Colclazier	.	(a)	..	....	17.93	42	37.00	47	38	45,46,48
12.311	Mr. Boyle	5	1 38.86	31	-3.98	16.23	42	138.86	48	39	46
13.113	W. F. Kerr	.	46.04	30	+.69	29.95	42	46.73	47	38	
13.131	Fletcher Bros.	.	46.58	30	-1.29	29.05	42	46.58	48	38	

*See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Years missing
13.25.13.133	Fletcher Bros.	.	47.81	30	....	32.76	42	49.69	46	42	47
13.233a	W. F. Kerr	.	35.76	30	-1.21	21.05	42	35.76	48	38	
13.233b	do	.	36.62	30	-1.37	22.96	42	36.62	48	38	
13.311	Fletcher Bros.	.	49.05	30	....	32.13	42	52.59	46	40	41,47
13.433	Mrs. J. W. Weir	.	39.67	30	-1.98	25.54	42	39.67	48	38	
14.131	M. C. Conn	.	67.57	30	-3.09	48.65	42	67.57	48	38	
14.231	William Zappe	3	59.18	30	-1.38	40.12	42	59.18	48	40	
15.311	Rex Richmond	.	83.85	30	-1.91	68.88	38	83.85	48	38	43,45
15.422	A. A. Gilland	.	68.35	30	-3.45	49.63	42	68.35	48	38	40,41
17.411	R. Thaman	3	69.05	30	+4.21	55.08	42	73.26	47	39	40,44
23.111	I. F. Wortman	.	52.38	30	-2.62	51.21	42	65.17	41	38	
24.333	Hal Bogle	.	57.43	26	-3.95	41.34	42	57.43	48	38	
26.211	Belle Hurst	.	64.25	26	-3.40	47.33	42	64.25	48	38	40,41
26.222	do	.	.....	..	....	41.42	42	56.63	46	38	48
27.111	Hal Bogle	.	1 86.62	26	....	69.30	38	1 86.62	48	38	46,47
27.211b	do	.	76.66	26	-1.73	61.95	42	76.66	48	39	40,41, 44
32.411	William Brashler (Measurements discontinued)					b76.52	38	85.49	44	38	47,48
34.323	L. D. & W. F. Kerr	3,5	86.79	26	....	.....	..	.....	..	48	
35.311a	do	.	79.27	26	-4.64	74.63	47	79.27	48	46	
35.322	W. F. Kerr	.	76.28	26	-4.50	58.73	43	76.28	48	43	
36.421a	R. M. Ware	.	53.53	26	+.77	39.00	38	55.44	46	38	41,45
36.421c	do	.	60.25	26	-5.01	39.79	42	60.25	48	38	
13.26.5.111	R. H. Aston	.	16.08	31	-.44	7.40	42	16.08	48	39	
5.231b	C. P. Sterrett	.	14.98	31	-.97	7.43	42	14.98	48	38	
5.231c	do	.	19.47	31	-1.08	18.39	47	19.47	48	47	
5.331	W. W. Harris	.	17.87	31	+.40	13.27	42	18.27	47	38	
7.333	Howard Amason	4	16.10	30	-2.10	f 6.28	42	f16.34	48	40	
8.332	G. M. Sterrett	.	8.02	30	+.31	5.77	46	10.29	38	38	40
14.331	G. C. and H. E. Saunders (Measurements discontinued)					.26	42	3.33	46	41	48
16.114a	U. S. Government (fish hatchery)	.	12.59	30	-.87	8.01	43	12.59	48	38	
16.114b	do	.	9.17	30	-.84	4.81	43	9.17	48	39	
16.114c	do	.	9.41	30	-.65	5.19	43	9.41	48	39	40
17.321	Leo Nowak	3	10.48	29	....	8.90	39	14.24	44	38	47
17.443	H. Vandenbout	.	14.45	29	-.49	11.28	42	14.45	48	38	
17.444	do	.	14.41	30	-.54	11.56	42	14.41	48	38	
18.311	W. F. Kerr	.	23.30	30	-.49	11.50	42	23.30	48	38	

* See footnotes at end of table.

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Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Be-gan	Record: Years missing
13.26.19.222	A. T. Stone	.	21.36	30	+0.02	18.22	39	22.83	46	38	
19.333	Hal Bogle	.	18.95	29	-.75	18.20	47	33.32	46	38	44
19.343	do (Measurements discontinued; well filled)					16.15	42	27.68	46	38	48
19.432	Tom Bogle	.	12.90	29	+.95	6.19	42	14.94	46	38	
20.113	A. T. Stone	.	.....	..	.....	17.25	42	23.20	46	38	47,48
20.333	Mrs. O. W. Lockhead	.	.....	..	.....	10.89	42	17.85	47	38	46,48
22.331	E. B. Clay	.	6.89	29	-.99	5.90	47	6.89	48	47	
23.111	do	3,5	7.12	28	.....	3.55	42	7.12	48	38	47
28.111	Joe Nowak	.	21.06	26	-1.08	9.66	42	26.02	38	38	
28.121	Geo. Grassie	3	21.16	28	-1.29	14.82	39	21.16	48	38	42
28.221	Hal Bogle (Measurements discontinued)					6.90	46	10.84	41	38	47,48
28.221b	do	.	12.45	28	-2.69	9.76	47	12.45	48	47	
28.311	Joe Giles and Anna Heinzel	.	17.38	26	-3.94	10.42	39	17.38	48	38	
29.111	J. H. Reid	.	.....	..	....	9.67	39	15.72	40	39	42,45-48
29.113	K. O. Southard	.	.....	..	....	13.39	42	17.60	44	38	46-48
29.113a	do	5	20.80	26	....	.....	..	.....	..	48	
29.211	J. H. Reid	.	14.00	26	+.18	7.22	39	14.55	43	38	41
29.333	M. Y. Monical	.	18.26	26	+.22	11.04	42	18.48	47	38	
31.241	Hal Bogle	.	19.45	26	-1.20	6.03	42	19.45	48	38	
31.311	E. O. Moore	.	56.20	26	-4.08	35.30	38	56.20	48	38	
33.421	K. O. Southard	.	19.50	26	+.42	15.62	42	19.92	47	38	
34.313	Elton Lankford	.	12.06	26	+.21	8.28	39	12.27	47	38	
34.431	Mrs. Elizabeth Cole	.	20.90	26	-.45	20.55	47	32.79	44	41	46
14.25.1.343	V. F. Flores	5	72.42	24	.....	43.20	38	72.42	48	38	40,47
1.344	do	3,5	70.13	24	-4.15	36.04	36	70.13	48	36	
2.233a	L. T. Lewis	3	a91.03	24	-18.38	52.13	42	72.65	47	40	
2.431	J. V. Thomas	.	91.77	24	-4.35	67.69	43	91.77	48	43	
2.444	do	.	.....	..	.....	48.50	38	71.17	46	38	41,45, 47,48
8.411	Ray Mathes	.	96.22	22	-.54	93.24	42	96.22	48	39	
11.333	A. W. Langnegger	5	1106.29	22	-3.96	78.83	42	1106.29	48	42	46
12.133a	C. H. Whitman	.	89.05	22	-5.21	60.82	42	89.05	48	42	
12.133b	do (Measurements discontinued)					58.17	38	e 83.0	47	38	47,48
12.313	L. T. Lewis	5	i 92.54	22	-4.97	60.75	38	i 92.54	48	38	41
12.314	L. T. Lewis	.	90.31	22	-5.12	71.35	44	90.31	48	44	
13.213	Calvin Graham	.	87.60	22	-5.20	59.54	42	87.60	48	42	
13.311a	E. O. Moore	.	94.06	21	-4.93	80.38	45	94.06	48	45	
14.131	A. W. Langnegger	5	1108.50	22	-4.44	84.52	39	1108.50	48	39	46

* See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
14.25.20.443	Breeb Hurst	3	76.00	21	-0.83	71.46	42	76.00	48	38	
24.133	E. O. Moore	.	85.45	21	-5.45	56.73	38	85.45	48	38	
24.421	Henry Johnson	5	72.33	21	....	.....	..	.....	..	48	
25.111	J. M. Norris	.	82.08	21	-4.13	56.05	38	82.08	48	38	
25.111a	do	.	78.93	21	-4.01	59.92	43	78.93	48	43	
25.221	do	.	.....	..	....	24.50	26	p59.93	47	26	27-37, 48
36.111	C. H. Foster	.	a89.84	21	-21.53	55.69	43	68.31	47	42	
36.211	do	.	76.06	21	-4.26	60.83	44	76.06	48	44	
14.26.3.111	Flora West	.	15.99	24	-.16	12.03	39	15.99	48	38	40,41
3.243	Mary Brown	.	15.23	26	+1.57	12.45	45	a16.80	47	45	
3.413	Howard Menefee	.	11.85	24	-.04	8.35	39	11.85	48	38	
3.442	John Langnegger (Measurements discontinued, well filled)					16.10	38	19.38	47	38	48
4.133a	W. E. Jacobson	.	23.28	24	+.67	18.43	39	23.95	47	38	
4.141	Roy Lockhead	.	23.96	24	+.70	18.47	39	24.66	47	38	
4.231	G. E. Wade	.	21.24	24	+.42	15.82	39	21.66	47	38	
5.131	L. M. Harter	.	32.95	24	+.06	21.70	42	33.01	47	38	
5.211	M. D. Menoud	.	28.72	24	+.93	22.20	42	29.65	47	38	
5.243	J. D. S. McKinistry	.	24.81	24	+.95	20.00	39	25.76	47	38	
5.433	D. L. Newsom (Measurements discontinued, well filled)					25.62	38	p34.79	47	38	41,48
5.433a	J. D. Jones	.	35.53	23	-.91	34.62	47	35.53	48	47	
6.111	Wiley Grizzle	.	37.20	24	-4.02	16.30	38	37.20	48	38	
6.142	W. L. Heitmann (Measurements discontinued)				....	19.77	42	28.11	45	40	46-48
6.211	Wiley Grizzle	.	36.65	24	-2.63	18.54	38	36.65	48	38	
6.232	Tom Andrews	.	42.01	24	-2.29	26.82	42	42.01	48	40	
6.241	do	.	.....	..	....	23.80	38	32.43	46	38	42,47,48
7.443	W. W. Adams	3	bp56.00	22	-2.74	30.25	36	bp56.00	48	36	
8.112	G. L. Truitt	.	42.15	23	-3.47	21.80	38	42.15	48	38	
8.243	P. Flores, Jr.	.	42.09	23	-3.89	19.83	38	42.09	48	38	
8.312	N. C. Newsom	.	69.30	23	-4.76	41.54	42	69.30	48	42	
8.433a	Tom Ferguson	.	.....	..	....	35.32	36	67.15	47	36	44,48
8.433b	do	5	75.49	23	....	.....	..	.....	..	48	
9.143	V. R. Barnett	.	31.89	23	-.67	26.06	39	31.89	48	38	
9.434	Cave Bros.	.	.....	..	....	8.35	38	21.23	47	38	45,48
9.442	Oscar Cave	.	20.80	24	-2.13	12.25	42	20.80	48	38	41
10.121	S. W. Smith	.	e16.38	24	....	12.22	39	14.91	43	38	47,48
10.221	John Langnegger	.	13.32	24	-.07	10.88	42	13.35	44	42	
10.244	do	.	15.17	24	-.52	10.69	45	15.17	48	38	
11.111	do	.	18.53	24	-.71	14.52	46	18.53	48	38	

* See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
14.26.11.121	H. A. Kiper	.	18.21	24	-0.64	15.13	39	18.21	48	38	43
11.231	Royce Langford	5	15.36	24	....	.....	..	.....	..	48	
11.444	W. E. Utterback	.	7.99	24	+3.62	7.99	48	11.61	47	38	
12.131	do (Measurements discontinued, well filled)		.....			20.98	42	22.02	46	38	48
12.433b	Mr. Commins	3	15.90	24	+.60	12.50	42	16.88	41	40	
13.121	L. M. Lang	.	16.44	24	+.94	14.30	42	17.50	41	38	
14.212	B. L. Barnett	.	13.38	26	-.15	11.36	42	13.40	41	40	46
14.421	Jim Michelet	.	14.33	26	-1.32	10.49	43	14.33	48	43	
14.441	do	.	16.42	26	-1.28	10.04	42	16.42	48	38	
14.443	Unknown	.	15.36	26	-1.43	11.22	44	15.36	48	44	
15.113	State of New Mexico	.	.....	..	....	13.40	42	21.06	47	38	48
15.322	F. H. Evans	3	13.40	22	-1.27	5.55	42	13.40	48	42	
15.333	Dub Andrus	3	35.47	22	-4.50	16.42	38	35.47	48	38	
17.122a	R. A. & T. A. Bledsoe	5	74.26	22	....	.....	..	.....	..	48	
17.211a	William Salomon	.	a82.39	22	-16.07	55.10	45	66.32	47	45	
17.444	Pearson Bros.	.	70.39	22	-5.94	38.42	38	70.39	48	38	
18.113	R. G. Campbell	.	79.42	22	-5.06	50.57	39	79.42	48	39	
18.131	William Cooke	5	179.12	22	....	50.83	42	179.12	48	42	47
18.131a	do	.	80.02	22	-5.10	74.92	47	80.02	48	47	
19.211	Pearson Bros.	.	72.32	22	-5.05	39.68	38	72.32	48	38	45
19.242	Oscar H. Pearson	3	84.33	22	-5.02	48.05	38	84.33	48	38	
19.311	Henry Johnson	.	p70.13	21	-4.10	36.12	38	p70.13	48	38	
19.444	E. E. Lane	3	84.29	21	-7.70	49.10	38	84.29	48	38	
20.143	Pearson Bros.	5	84.55	22	-3.56	48.15	38	84.55	48	38	45
20.334	E. Langnegger (Measurements discontinued)				....	64.36	42	73.34	44	40	45-48
20.343	do	.	93.16	21	-7.17	56.26	38	93.16	48	38	41
21.333	G. E. Wade, Jr.	.	63.96	21	-6.27	33.38	42	63.96	48	38	44,45
22.141	Wayne Adams	.	37.64	22	-3.82	21.66	42	37.64	48	38	
23.131	E. A. White	.	16.57	26	-2.44	6.89	42	16.57	48	38	
23.214a	F. E. Pilley	.	16.56	26	-2.18	13.96	45	16.56	48	45	
23.413	E. A. White	.	16.53	26	-1.93	8.99	42	16.53	48	42	
27.111	J. L. Ogle	.	20.66	22	-3.05	8.43	42	20.66	48	38	
27.424a	M. C. Brown	.	27.90	21	-2.50	25.40	47	27.90	48	46	
28.111	William Langnegger	.	c62.71	21	-4.73	32.32	42	c62.71	48	42	
28.211	L. T. Lewis	.	44.66	21	-4.44	24.18	42	44.66	48	38	41
28.423	do	.	28.89	22	-6.11	14.14	42	28.89	48	42	
29.112	P. E. Stoes	.	96.32	21	-7.23	58.80	38	96.32	48	38	40,41

* See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
14.26.29.213	P. K. Stoes	.	87.46	21	-7.94	49.52	38	87.46	48	38	
29.441a	J. W. Wiggins	.	61.73	21	-5.05	32.25	38	61.73	48	38	
29.441b	do	.	61.95	21	-5.70	31.20	38	61.95	48	38	41
32.131a	B. F. Knoll	.	.....	..	....	53.09	43	72.50	47	42	48
32.331	B. E. Spencer	3	56.29	20	+.74	32.85	38	57.03	47	38	
35.344	J. Q. Mitchell	3	70.85	21	-1.21	65.68	43	70.85	48	41	
15.24.23.344	Carroll Jackson	.	66.68	19	+.07	65.87	44	a67.35	46	38	
27.344	S. A. Lanning	.	58.69	19	+.11	58.49	46	61.75	38	38	
28.244	State of New Mexico	.	88.10	19	+.30	88.10	48	92.30	41	38	43,46
32.211	Carl Mangum	3	44.58	19	-3.18	37.63	45	50.72	41	40	
34.341	S. A. Lanning	.	29.55	19	+3.68	29.55	48	39.82	42	38	41
35.143	E. P. Malone	.	17.82	19	+4.84	16.81	44	27.70	38	38	
36.243	State of New Mexico	(Measurements discontinued)...				37.67	42	41.88	45	38	46-48
36.244	W. F. Waller	5	45.62	19	....	.....	..	.....	..	48	
15.25.12.111a	E. H. Corzine	.	b53.98	20	....	35.64	42	45.20	46	38	47
12.212b	Unknown	.	54.35	20	-3.86	41.92	44	54.35	48	44	
12.421	C. H. Foster	.	61.35	20	-7.46	41.66	44	61.35	48	44	
24.111	Hal Bogle	.	15.26	20	-2.25	12.06	42	15.26	48	38	
24.211	do	.	19.59	20	-3.29	7.65	42	19.59	48	38	41
26.423	R. T. Spence	.	8.38	20	-4.73	3.59	42	8.38	48	42	
27.321	Pearson Bros.	5	36.25	19	-6.05	17.50	42	36.25	48	38	
28.331	T. C. Sexton	.	38.56	19	-6.22	27.64	45	38.56	48	38	40,41,43
28.331a	do	.	42.90	19	-3.19	26.48	45	42.90	48	44	
33.112	Carroll Jackson	.	b26.92	19	-5.64	11.18	42	b26.92	48	38	39
35.111	M. M. Spence	3	26.70	19	+2.53	15.51	42	29.56	46	38	
35.311	Z. C. Robinson	.	40.70	19	+.04	28.85	42	40.74	47	38	40,46
35.311a	do	.	29.36	19	+2.25	29.05	46	31.61	47	46	
36.333	J. M. Norris (Measurements discontinued, well filled)					24.20	42	29.52	46	38	40, 41, 43, 48
36.333b	do	5	29.63	19	....	.....	..	.....	..	48	
15.26.4.444	Harry Cowan	3	42.26	21	-2.07	33.14	42	42.26	48	40	
5.121	B. E. Spencer	3	52.54	20	-.72	34.80	38	52.54	48	38	
5.142	A. Russell Estate	.	46.51	20	-1.38	25.55	43	46.51	48	38	
6.311	Calvin Graham	.	51.66	20	-3.46	28.66	38	51.66	48	38	
7.312	C. H. Foster	.	58.89	20	-9.87	36.25	44	58.89	48	44	
8.411	E. M. George	.	31.57	20	-1.98	16.08	44	31.57	48	44	
8.413	do	.	31.04	20	-1.91	15.53	44	31.04	48	44	
9.133	do	.	24.15	20	-2.05	16.68	42	24.15	48	40	

* See footnotes at end of table.

Part 2. Water levels in January or February 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January or February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
15.26.14.222	Breeb Hurst	.	7.93	21	-1.10	2.38	42	7.93	48	41	
14.433	Peck Dority	5	12.16	21	....	.....	..	.....	..	48	
17.211	E. M. George	.	29.93	20	-4.49	12.06	44	29.93	48	44	
18.112	R. T. Spence	.	52.56	20	-10.55	31.29	44	52.56	48	44	
19.211	Lake Arthur Cemetery	3	39.96	20	-4.31	23.87	42	39.96	48	42	
19.442	Paul Robinson	.	.....	..	.....	5.47	42	12.44	46	38	47,48
20.144	J. W. Webb	.	30.73	20	-2.00	18.30	42	30.73	48	38	
20.431a	Unknown	.	e21.00	20	.....	16.94	45	e21.00	48	45	48
29.111	E. C. Jackson	.	10.66	20	-2.29	3.68	42	10.66	48	38	
30.131	Paul Robinson	.	7.92	20	-.46	2.10	40	7.92	48	39	42
30.224	Mrs. G. R. Pate	.	13.93	20	-2.42	6.27	42	13.93	48	38	
30.411	do	.	16.63	20	-1.76	13.35	43	16.63	48	43	
31.111	E. J. Gromo	.	10.62	20	+1.91	9.55	42	13.73	41	38	
31.333	B. E. Spencer	.	19.02	20	-1.37	15.12	42	19.02	48	42	
32.231	Mrs. H. C. Evans	.	9.59	20	-.33	7.70	42	9.64	40	38	

a Pumping.
b Pumping recently.
c Nearby well pumping.
e Dry at depth given.
f From recorder chart.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.
j February.
k Also 1940.
m Also 1943.
n Flowing in 1939, 1940, 1941.
p Measurement uncertain.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Location number / Owner	10.24. 8.333 Lee	10.24. 17.111 Henry & Mabry	10.24. 32.111 Lewis	10.25. 19.331 Smith	11.23. 1.433 Wiggins	11.24. 10.224 Smith	11.24. 14.331 Cowan	11.24. 28.113 School
Feb. 3, 4	42.79	41.33	30.17	34.20	58.10	15.31	27.58	64.13
Mar. 9, 11	42.86	41.39	29.61	34.31	58.28	b16.43	29.21	63.51
May 11, 12	46.28	44.67	30.93	34.64	63.31	b23.70	40.10	68.67
July 13, 14	(a)	c50.73	31.95	a35.14	66.22	30.14	b47.10	.....
Sept.15	50.15	48.63	33.66	35.49	68.48	30.74	47.34	75.68
Nov. 3, 4	46.89	45.39	33.64	34.96	63.08	18.70	32.14	72.05

Location number / Owner	11.25. 6.421a White	12.24. 13.111 Newman	12.25. 9.422 Townsite	12.25. 35.411a Stone	12.26. 18.221a Johnson	12.26. 29.333 Lawing	13.25. 8.133 Jeffries	13.25. 14.231 Zappe
Jan. 30, 31	.....	.....	.....	56.03	.....	.....	66.56	59.18
Feb. 2, 4	7.63	68.59	51.85	.....	15.74	16.30	.....	.....
Mar. 11-13	8.98	68.18	51.20	58.39	15.55	17.28	66.28	64.24
May 11, 12, 14	9.70	a75.81	55.42	c67.67	15.34	18.13	72.97	c84.00
July 14, 15	b12.03	b75.34	b55.53	c80.13	15.72	18.13	.....	c85.08
Sept.15, 16	11.14	78.58	b58.65	70.09	16.12	18.33	.....	c86.50
Nov. 3-5	8.80	73.87	55.93	62.77	15.82	17.22	.....	70.72

Location number / Owner	13.25. 17.411 Thaman	13.25. 34.323 Kerr	13.26. 17.321 Nowak	13.26. 23.111 Clay	13.26. 28.121 Grassie	14.25. 1.344 Flores	14.25. 2.233a Lewis	14.25. 20.443 Hurst
Jan. 21, 24, 26, 28-30	69.05	86.79	10.48	7.12	21.16	70.13	a91.03	76.00
Mar. 12, 13, 15	.....	86.31	11.76	16.67	18.55	68.56	a90.42	76.10
May 12, 14	81.88	86.63	b21.71	a40.63	b23.34	71.31	83.37	76.15
July 15	81.73	87.19	a15.44	a35.43	27.11	73.87	a102.14	75.94
Sept.16, 17	90.15	87.50	12.45	8.84	b22.44	78.08	a107.44	75.95
Nov. 4, 5	76.63	87.79	11.57	7.43	b27.04	77.87	84.71	76.13

Location number / Owner	14.26. 7.443 Adams	14.26. 12.433b Commins	14.26. 15.322 Evans	14.26. 15.333 Andrus	14.26. 19.242 Pearson	14.26. 19.444 Lane	14.26. 32.331 Spencer	14.26. 35.344 Mitchell
Jan. 20-22, 24	bj56.00	15.90	13.40	35.47	84.33	84.29	56.29	70.85
Mar. 13, 15	j62.13	(a)	10.99	34.64	85.25	.....	56.67	70.72
May 14, 17	46.63	16.52	12.72	36.03	e95.77	86.98	61.45	a83.62
July 15, 16	40.58	a35.22	8.51	33.80	.....	188.46	55.71	71.29
Sept.17	35.56	15.55	12.46	33.31	.....	89.93	52.85	b74.03
Nov. 5, 6	39.28	15.90	12.93	34.58	.....	89.24	54.94	71.69

Location number / Owner	15.24. 32.211 Mangum	15.25. 35.111 Spence	15.26. 4.444 Cowan	15.26. 5.121 Spencer	15.26. 19.211 Cemetery
Jan. 19-21	44.58	26.70	42.26	52.54	39.96
Mar. 15	45.28	b31.10	43.80	52.63	39.72
May 15, 17	a47.28	b36.44	45.31	52.73	39.56
July 16	a49.20	b33.67	44.65	52.76	37.92
Sept.17	a49.75	34.10	43.90	52.64	38.75
Nov. 6, 8	a47.95	b29.80	43.28	52.66	38.32

a Pumping.
b Pumping recently.
c Nearby well pumping.
e Dry at depth given.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.
j Measurement uncertain.

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: June 15, 9.56; Sept. 20, 15.27.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.47	10.41	10.82	.....	12.03	12.86	.....	12.45g	13.98	.....	15.22	12.30
2	11.22	10.65	11.32	.....	12.28	11.65	.....	12.30	14.09	.....	15.38	12.29
3	11.20	10.73	11.78	12.90	12.59	11.25	.....	12.68	.....	.....	15.49	12.70
4	11.71	10.72	11.98	12.81	12.75	11.03	.....	12.77	.....	.....	15.08	12.96
5	11.79	10.69	11.58	12.92	12.80	10.91	.....	12.92	.....	.....	14.89	13.16
6	11.41	10.62	11.32	12.69	12.92	10.67	.....	13.12	.....	.....	14.96	13.39
7	11.06	10.59	11.12	12.06	12.73	10.44	.....	g13.30	.....	.....	14.36	13.59
8	.....	10.57	10.94	11.50	12.19	10.28	.....	g13.47	.....	.....	14.10	13.80
9	.....	10.48	10.81	10.62	11.79	10.20	.....	g13.64	.....	.....	14.00	13.91
10	.....	10.40	10.71	10.70	11.65	10.12	.....	g13.82	.....	.....	13.86	13.80
11	.....	10.42	10.57	11.41	11.77	10.02	13.25	13.78	.....	.....	13.78	13.71
12	.....	10.36	10.50	11.89	12.14	9.81	12.86	13.45	.....	.....	13.56	13.63
13	.....	10.34	10.49	12.09	12.35	9.67	12.51	g13.14	.....	.....	13.44	13.53
14	11.26	10.30	11.13	12.39	12.50	9.58	12.27	g13.15	.....	.....	13.65	13.48
15	11.66	10.25	11.82	12.57	12.63	9.56	12.08	13.44	h14.94	.....	14.10	13.41
16	11.84	10.23	12.33	12.41	12.73	9.71	11.94	13.56	15.00	.....	14.34	13.34
17	11.28	10.21	12.65	12.14	12.80	10.39	11.82	13.68	15.05	.....	14.52	13.28
18	11.04	10.15	12.92	11.74	12.92	10.48	11.77	13.80	15.16	.....	14.48	13.22
19	10.89	10.16	.....	11.61	12.95	10.77	12.38	13.90	15.24	.....	14.36	13.15
20	10.77	10.14	.....	12.01	12.82	10.86	12.84	14.04	15.27	.....	14.21	13.12
21	10.62	10.14	.....	12.22	13.02	11.42	12.93	14.21	14.76	.....	14.67	13.09
22	10.53	10.09	.....	12.05	13.23	11.75	13.11	14.31	14.77	.....	14.85	13.04
23	10.41	10.09	.....	12.30	12.99	12.13	12.52	.....	.....	.....	14.24	13.02
24	10.37	10.14	.....	12.55	12.99	12.41	12.56	.....	.....	.....	13.65	13.01
25	10.26	10.14	.....	12.76	13.18	12.65	12.76	.....	.....	.....	13.28	12.97
26	10.15	10.13	.....	12.33	13.34	12.84	12.93	.....	.....	.....	12.98	12.91
27	10.10	10.76	.....	11.68	13.36	12.94	12.75	.....	.....	.....	12.74	12.86
28	10.03	11.07	.....	11.39	13.50	13.23	13.07	.....	.....	.....	12.73	12.87
29	10.02	10.90	.....	11.48	13.64	13.38	.....	.....	.....	14.81	12.68	12.85
30	10.12		.....	11.80	13.72	.....	.....	13.73	.....	14.89	12.45	12.83
31	10.27		.....		13.75		12.84	13.73		14.98		12.77

g Estimated.
h Tape measurement at odd hour.

13.26.7.333. Howard Amason. Highest and lowest recorded water levels: June 20, 13.98; Apr. 10, 18.19.

Highest daily water level, from recorder charts

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1	16.34	Jan. 22	16.07	Feb. 12	16.03	Mar. 13	h16.80
2	16.30	23	16.07	13	16.02	15	h16.90
3	16.28	24	16.06	14	16.05	16	16.90
4	16.26	25	16.06	15	16.04	17	16.91
5	16.25	26	16.06	16	16.03	18	16.99
6	16.23	27	16.06	17	16.03	19	17.07
7	16.22	28	16.07	18	16.02	20	17.17
8	16.20	29	16.08	19	16.02	21	17.24
9	16.19	30	16.08	20	16.01	22	17.33
10	16.19	31	16.09	21	16.00	27	17.82
11	16.18	Feb. 1	16.09	22	15.99	28	17.85
12	16.17	2	16.10	23	15.98	29	17.91
13	16.17	3	16.10	24	15.98	30	17.95
14	16.17	4	16.08	25	15.98	31	17.99
15	16.16	5	16.08	26	15.97	Apr. 1	18.03
16	16.15	6	16.07	27	15.97	2	18.06
17	16.14	7	16.06	28	15.97	3	18.08
18	16.12	8	16.06	29	16.00	10	18.19
19	16.11	9	16.05	Mar. 1	16.07	11	18.13
20	16.09	10	16.04	2	16.13	12	18.05
21	16.09	11	16.03	7	16.44	13	17.97

h Tape measurement at odd hour.

13.26.7.333--Continued.

Highest daily water level, from recorder charts

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Apr. 14	17.89	May 18	16.31	June 20	13.98	Sept.16	16.25
15	17.82	19	16.31	July 15	h15.28	17	16.23
22	h17.32	20	16.34	16	15.32	18	16.21
26	16.92	21	16.36	17	15.41	19	16.19
27	16.87	22	16.35	18	15.50	20	16.16
28	16.85	31	16.24	19	15.57	21	16.14
29	16.82	June 1	16.20	20	15.58	22	16.12
30	16.79	6	15.35	21	15.56	23	16.10
May 8	16.53	7	15.20	22	15.54	Nov. 4	h16.52
9	16.45	8	15.04	Aug. 16	h16.46	5	16.52
10	16.38	9	14.90	17	16.47	6	16.55
11	16.38	10	14.79	18	16.49	7	16.58
12	16.37	11	14.66	19	16.50	8	16.59
13	16.37	12	14.53	20	16.54	9	16.61
14	16.35	13	14.45	21	16.55	10	16.62
15	16.34	18	14.08	22	16.58	11	16.63
16	16.32	19	14.03	23	16.61	12	16.63
17	16.31						

h Tape measurement at odd hour.

Part 5. Miscellaneous data concerning observation wells

10.24.16.133. Perrine. Reference point, top of concrete pump base, 0.05 foot below land-surface datum.

11.24.14.331. Cowan. 70 feet northwest of white stucco house, 10 feet southeast of old power shed, 70 feet northeast of U. S. Highway 285. Drilled irrigation well, equipped with turbine pump, diameter 8 inches. Reference point, top of casing, 0.94 foot above land-surface datum. May 13, 1947, 33.39; July 11, 1947, 47.02; Sept. 11, 1947, 46.68; Nov. 4, 1947, 32.39.

11.24.29.144. Ferrell. Reference point, top of casing, 0.60 foot below land-surface datum.

13.25.1.111a. Kuykendall. 75 feet north of rock house. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 200 feet. Reference point, top of concrete pump base, 0.20 foot above land-surface datum.

13.25.12.311. Boyle. Reference point, top of new concrete base placed on top of old base, 1.00 foot above land-surface datum.

13.25.34.323. Kerr. Drilled stock well, equipped with pump jack and windmill tower, diameter 12 inches. Reference point, top of steel casing, north side of well, level with concrete base, and 0.30 foot above land-surface datum.

13.26.23.111. Clay. Reference point, top of concrete pump base, 1.00 foot above land-surface datum.

13.26.29.113a. Southard. In shed 20 feet southeast of house. Domestic and stock well, equipped with pressure pump, diameter 7 inches, depth 140 feet. Reference point, top of casing west side of well, 0.40 foot above land-surface datum.

14.25.1.343. Flores. Reference point, top of concrete well curb, 0.20 foot below land-surface datum.

14.25.1.344. Flores. Well cleaned out to 100 feet.

14.25.11.333. Langnegger. Pit filled, cased with 12½-inch steel casing, equipped with turbine pump.

14.25.12.313. Lewis. Reference point, top of concrete pump base, 0.75 foot above land-surface datum.

14.25.14.131. Langnegger. Reference point, established Jan. 22, 1948, top of casing, 0.15 foot above land-surface datum.

14.25.24.421. Johnson. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 1.00 foot above land-surface datum.

14.26.8.433b. Ferguson. 50 feet southeast of well 14.26.8.433a. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, at land-surface datum.

14.26.11.231. Langford. 120 feet northeast of house. Drilled stock well, equipped with windmill and pump, diameter 6 inches. Reference point, top of steel casing, 0.25 foot above land-surface datum.

14.26.17.122a. Bledsoe. 54 feet northwest of observation well 14.26.17.122, south of house and north of earthen tank. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 192 feet. Reference point, top of concrete pump base, 1.00 foot above land-surface datum.

14.26.18.131. Cooke. Reference point, established Jan. 22, 1948, top edge of steel barrel, level with concrete pump base, at land-surface datum.

14.26.20.143. Pearson. Reference point, established Jan. 22, 1948, top of concrete pump base, 0.55 foot above land-surface datum.

15.24.36.244. Waller. 75 feet northeast of artesian well. Drilled irrigation well, equipped with turbine pump, diameter 16 inches. Reference point, top of concrete pump base, 1.50 feet above land-surface datum.

15.25.27.321. Pearson. Reference point, established Jan. 19, 1948, top of casing, 0.10 foot below land-surface datum.

15.25.36.333b. Norris. Drilled irrigation well, equipped with turbine pump, diameter 16 inches. Reference point, top of casing, north side of well, at land-surface datum.

15.26.14.433. Dority. About 25 feet west of frame house. Drilled stock and domestic well, equipped with pump jack, diameter 6 inches, depth about 75 feet. Reference point, top of steel casing, 0.25 foot above land-surface datum.

EDDY COUNTY

By C. S. Conover

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.

Carlsbad area

The Carlsbad area lies in the southeastern part of New Mexico, principally west of the Pecos River. Results of a study of the ground-water conditions are given in a report completed in 1945 by W. E. Hale "Ground-water conditions in the vicinity of Carlsbad, New Mexico." The possibilities of

obtaining ground water for the Carlsbad Army Air Base are covered in the report "Memorandum on ground-water conditions in the vicinity of the city airport southwest of Carlsbad, New Mexico" by W. E. Hale and C. V. Theis, 1942. These reports prepared by the Geological Survey in cooperation with the State engineer of New Mexico will be published in the forthcoming biennial reports of the State engineer of New Mexico.

Measurements of water level have been made at monthly to bimonthly intervals in the three airfield wells since their completion in 1942, and in two nearby wells since June 1944, in cooperation with the State engineer of New Mexico. Measurements made in these wells since the beginning of record through 1947 and a discussion of the changes in water level have been published in Geological Survey Water-Supply Paper 1101.

Water levels were measured in 64 additional wells in January 1948 and in 11 of them bimonthly thereafter, in cooperation with the Bureau of Reclamation, U. S. Department of Interior, and the New Mexico State engineer. A water-stage recorder was installed on the D. N. Vest well, 22.26.24.224, November 12, 1948. A total of 135 measurements of depth to water was made in observation wells in 1948 including 66 measurements made in the 16 wells measured bimonthly. Water levels were measured by the Bureau of Reclamation in January and February 1947, and at various other times in 1946 and 1947, in about 23 of the wells that were measured in January 1948. The measurements made in 1946 and 1947 that could be referenced to measurements made in 1948 are given in part 5 for the pertinent wells.

About 21,500 acres of land constituting the Carlsbad Irrigation Project of the Bureau of Reclamation lie east of, and are furnished water from, the Southern Canal. Shortages of surface water in the last few years resulted in many privately owned irrigation wells being drilled to supplement the surface supply. Many irrigation wells have also been drilled to furnish water for newly developed land not having surface-water rights. Much of this development lies west of the Southern Canal and east of the airfield.

The precipitation at Carlsbad in 1948 was 2½ inches less than normal, but nearly 4 inches greater than occurred in 1947. The precipitation during the main part of the growing season, April to September, was 9 inches, only 1.7 inches less than the total for the year. However, the distribution of precipitation during the growing season was not, in general, favorable for crops as more than 6 inches of the total occurred in a few days in June. The heavy rains in June caused a flood in Dark Canyon Draw.

Pumping of ground water for irrigation on the Carlsbad Project lands was probably less in 1948 than in 1947 because of the greater quantity of surface water available, whereas the pumping of ground water for irrigation of lands served exclusively by pumps, mainly west of the Southern Canal, was probably only slightly less than in 1947. The pumps probably were not, in general, operated during the period of heavy precipitation in June 1948.

The airfield wells, since deactivation of the air base, furnish water to a Government housing project at the field. The reported annual pumpage has increased gradually from 28 million gallons, estimated in 1946, to 45 million gallons in 1947, and 69 million gallons in 1948. The pumpage during 1948 varied from a minimum of slightly more than 3 million gallons for February to a maximum of about 10½ million gallons for August. The pumpage at the airfield, though greater than in 1947, is somewhat less than the 4 million gallons a month pumped during the winter to more than 16 million gallons a month during the summer when the air base was in operation.

Changes of water level

Large-scale pumping of ground water for irrigation in the Carlsbad area began in 1947, a year of deficient precipitation when only about 26 percent of normal precipitation was recorded at Carlsbad during the main part of the growing season, April through September. Deficiency of precipitation on the watershed of the Pecos River resulted in an inadequate supply of surface water for the lands of the Carlsbad Project which lie mainly east of the Southern Canal and west of the Pecos River.

Because of the large-scale pumping and the deficient recharge in 1947, the ground-water levels showed large net declines for the year from January 1947 to January 1948. The maximum observed decline was 14 feet and occurred in a well about 1 mile northwest of Otis. Declines in water level of more than 12 feet were observed in 6 wells in the vicinity of the airport and eastward to the canal. The largest declines of water level occurred west of the canal where irrigation is exclusively by ground water. Net declines of water level in 1947 were also comparatively large in the vicinity of Otis where declines of more than 10 feet were observed in 2 wells. The one observation well in the vicinity of Carlsbad showed a net decline of water level of 6 feet. Water levels in the vicinity of Loving apparently showed net declines of between 4 and 6 feet. The water levels over the area as a

whole declined more than 6 feet over about 48 square miles, more than 8 feet over about 30 square miles, and more than 12 feet over about 13 square miles.

During 1948 the surface water delivered and the precipitation were greater than in 1947. Also, surface water was available for the full growing season in 1948 as compared with a lack of water after July in 1947. As a consequence, pumping of ground water for the project lands was reduced in 1948 from what it was in 1947 and the ground-water levels rose in the area east of the canal but declined west of the canal.

The areas of principal net rises of water level from January 1948 to January 1949 are at Otis and Loving, the largest rises of more than 4 feet occurring over about 24 square miles. In spite of these rises, the water levels in the area east of the canal at the end of 1948 were, in general, lower than in January 1947, when first observed. The net lowering at Otis is about 8 feet for the 2-year interval.

In the area west of the canal the water levels for 1948 again showed net declines as in 1947, though not as great. The maximum observed decline was about 8 feet, as compared with nearly 14 feet in the preceding year though not in the same wells. The maximum total net decline of water level west of the canal for the 2 years is more than 15 feet.

As water is pumped for irrigation in the area east of the canal, mainly as a supplement to the surface water, the water levels will, in general, show net annual rises or declines dependent upon the amount of surface water available. In the area west of the canal, pumping of ground water is necessary every year and the water levels will show a general year-to-year decline. As the natural gradient of the water table is small and to the east, lowering of water levels in the area west of the canal may tend to draw the poorer quality of water from east of the canal toward the wells.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	Year	Record: Began	Years missing
			Roswell basin								
16.25.1.Lot 3	Pearson Bros.	.	14.84	19	- 0.02	10.61	44	19.40	38	38	
1.Lot 13a	Charles Buck	.	18.26	19	+.32	14.66	44	18.89	45	43	
1.344	Buck Bros.	3	b17.90	17	-4.78	9.50	42	b17.90	48	38	
2.Lot 9	Ralph Pearson	.	b17.07	19	+1.20	14.07	44	a20.90	45	38	39
2.Lot 15	do	.	18.85	19	+.94	17.35	44	20.32	46	40	
4.Lot 12	J. E. Taylor	.	.....	..	....	10.58	42	13.74	39	38	48
5.Lot 4	E. P. Malone, Jr.	.	a12.78	19	-2.72	9.22	42	13.35	45	38	
5.Lot 5	do	.	10.93	19	-.30	9.48	42	14.17	45	42	
5.Lot 13	Fred Groem	5	5.86	19	-2.74	3.12	47	15.72	38	38	
5.443	W. M. Ault	.	17.96	19	-5.53	8.27	42	18.66	46	38	
6.Lot 4	F. M. Nelson	3	13.06	19	-.28	11.42	42	a15.40	38	38	
6.313	Frank Childress	4	28.22	19	+.52	f27.27	42	f30.30	41	38	
8.111	Pearson Bros.	.	b30.63	19	-4.49	24.27	45	a31.39	40	38	39
10.333	Orval Gray	.	57.16	17	....	56.55	44	60.48	46	44	47
10.334	do	.	53.93	17	-1.97	48.60	42	53.93	48	38	40,41
11.133	J. J. Terry	.	39.62	17	-2.34	34.46	44	39.62	48	44	
11.233	Noah Buck	5	136.77	17	-2.09	28.45	42	136.77	48	38	
12.124	Buck Bros.	.	c30.49	17	-10.63	15.45	42	19.86	47	38	
12.412	T. J. Terry	.	.....	..	....	10.85	42	14.17	41	38	46,48
13.211	do	.	36.14	17	-8.67	19.64	42	36.14	48	39	
14.213	L. T. Lewis	.	42.00	17	-3.08	30.70	42	42.00	48	38	
15.233	J. H. Everest	.	85.32	17	-7.02	64.20	39	85.32	48	39	40,41
15.331	do	.	96.13	17	-2.02	82.78	38	96.13	48	38	40,41
24.212	Monroe Howard	.	47.19	16	-5.92	30.42	42	47.19	48	38	
25.211	James Buck	5	67.83	16	....	.....	..	.....	..	48	
16.26.5.Lot 3	Ed Taylor	.	j13.40	19	+15.72	22.73	42	29.12	47	38	
5.Lot 4	H. V. Parker	.	33.82	19	-.82	27.35	42	33.82	48	38	45
5.331	J. L. Taylor	5	120.74	17	-1.36	16.21	38	120.74	48	38	
6.Lot 2	H. V. Parker	.	31.80	19	+.31	24.07	42	32.11	47	38	41,43
6.Lot 4	do	.	33.95	19	+.63	27.15	42	34.58	47	38	40,41
6.Lot 4a	do	.	21.02	19	-.80	19.99	46	29.06	45	44	
7.121	L. T. Lewis	.	31.99	17	-17.61	7.20	42	31.99	48	38	
7.321	T. J. Frink	.	23.22	17	-12.78	3.09	42	23.22	48	38	
8.111	Ira S. Reser	.	19.30	17	-1.62	12.45	42	19.30	48	38	
15.333	Carl Manda	.	13.81	16	-1.77	9.66	42	13.81	48	42	
16.313	V. L. Gates	.	9.64	16	-1.64	3.80	42.	9.64	48	38	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan., 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	Year	Record: Began	Years missing
16.26.17.311	W. R. Roberts	.	31.66	16	-3.62	16.68	42	31.66	48	38	
17.331	Elzie Swift	.	(a)	16	....	6.12	43	15.99	47	38	42,48
18.331	Monroe Howard	.	(a)	16	....	14.32	42	24.70	47	38	46,48
18.411	Ira S. Reser	.	29.71	16	-4.19	13.29	42	29.71	48	38	41
19.113	H. E. Hall	.	35.92	16	-8.90	16.19	42	35.92	48	39	
19.133	E. Jeffers	.	34.63	16	-6.65	16.54	42	34.63	48	38	
19.211	H. V. Parker	.	26.92	16	-7.21	9.34	42	26.92	48	38	
19.411	E. Jeffers	3	32.81	16	+1.35	27.84	42	37.18	46	38	
21.333	J. H. Everest	.	13.97	16	-5.04	2.09	42	13.97	48	38	
28.333	H. L. Williams	3	26.67	16	-8.17	9.57	42	26.67	48	38	
28.431	R. E. Coleman	.	20.29	16	-3.59	8.72	42	20.29	48	38	
31.413	T. F. Wilson	.	d68.51	16	-19.40	35.33	38	49.11	47	38	
32.231	B. E. Green	.	41.75	16	-12.12	20.41	43	41.75	48	43	
32.411	do	.	38.56	16	-12.96	15.20	42	38.56	48	38	41
32.421	Smith Bros.	.	33.47	16	-1.17	13.78	42	33.47	48	38	45
35.113	J. T. Fulton	.	13.47	15	-1.35	7.86	43	13.47	48	43	
17.25.12.211	Artesia Country Club	5	90.09	16	....	....	..	.....	..	48	
13.131	L. G. Monsehke	.	109.26	15	-6.04	85.20	42	109.26	48	38	41
22.224	J. M. Jackson	.	160.59	15	-4.91	135.66	42	160.59	48	38	40
24.433	do	.	109.98	15	-10.86	82.40	42	109.98	48	38	46
26.222	Mildred and M. L. Doss	.	116.10	15	-6.66	91.56	42	116.10	48	38	46
35.411	Ed Kissinger Estate	3	127.90	14	-5.41	107.95	43	127.90	48	38	
17.26.2.133	Fred Savoie	.	11.36	15	-1.71	5.62	42	11.36	48	38	
3.231	H. R. Rogers	.	12.24	15	-1.75	4.61	42	12.24	48	38	
3.333	A. T. Woelk	.	.....	..	....	7.04	42	12.63	46	42	47,48
3.433	Mrs. R. W. Box	.	b16.28	15	-5.90	5.23	42	b16.28	48	38	43
4.121a	State of New Mexico	.	19.96	16	-3.36	16.60	47	19.96	48	47	
4.331a	Howard Stroup	5	j67.63	15	....	.10	38	8.32	41	38	46,47
4.331b	do	.	14.5	15	-1.1	.55	42	14.5	48	39	
4.413	Fred Crawford	.	22.56	15	-5.08	9.48	41	22.56	48	38	40,42,44,45
5.422	J. L. McCabe	.	17.54	15	-2.07	9.83	42	17.54	48	38	
6.213	Martin Yates, Jr.	.	60.78	16	-14.41	42.73	46	60.78	48	46	
6.413	Fred and B. A. Savoie	.	(a)	16	....	34.75	42	42.24	45	38	46-48
7.131	J. W. Collins	.	a75.71	16	-15.17	42.87	42	c60.54	47	38	40
7.221	Buck Jernigan	.	55.68	16	-12.72	32.74	44	55.68	48	44	
7.344	E. E. Scoggins	3	58.67	15	-8.24	31.53	42	58.67	48	40	
7.421	Ivan Rogers	.	45.50	16	-9.60	19.24	42	45.50	48	38	41
7.423	C. A. Houghton	5	143.44	16	-8.86	15.87	42	143.44	48	40	46

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	Year	Record: Began	Years missing
17.26.7.433	Ed Stone	.	53.23	15	-8.77	26.90	42	53.23	48	38	41
7.444	Albert Blake	5	46.30	15	-9.33	20.98	42	46.30	48	38	
10.333	V. L. Gates	3	8.72	15	+1.17	4.60	42	10.61	41	39	
10.433	D. D. Sullivan	.	19.85	14	-.13	14.41	42	19.85	48	38	46
15.113	R. L. Vogel	.	11.37	15	-1.46	1.48	42	11.37	48	38	41,43
15.121	do	.	a19.45	15	-2.61	5.00	42	a19.45	48	38	41
15.211	J. M. Vogel	.	17.51	14	-.54	11.57	42	17.64	46	38	
15.411	W. M. Jackson	.	17.93	14	-.75	11.25	42	22.90	46	38	
16.333	Artesia Cemetery	3	25.68	15	-6.41	6.14	42	25.68	48	38	
16.411	G. G. Armstrong & Son	.	123.12	15	-2.29	11.34	42	123.12	48	39	
17.423	H. A. Denton	.	.....	..	....	17.93	45	21.58	47	38	40,42,48
18.433	A. C. Baca	.	66.91	16	-10.72	38.61	42	66.91	48	38	
18.442	Mrs. Murphy	.	55.50	15	-11.71	26.30	42	55.50	48	38	41
20.133	J. W. Sharp & G. V. McCrary	.	55.51	14	-13.76	25.48	42	55.51	48	38	43
21.112	Roger Durand	.	26.73	15	-6.56	8.63	42	26.73	48	38	46
21.341	W. S. Hogsett	.	14.27	14	-3.79	.53	43	14.27	48	38	42
22.233	R. L. Paris	.	25.36	14	-1.87	18.34	42	25.36	48	38	
24.333	Mary E. Yates	3	3.82	14	-.67	2.13	42	3.82	48	41	
27.413	W. L. Martin	.	15.45	14	-.95	11.16	42	15.45	48	38	40,41
27.423	do	.	.....	..	.....	10.38	42	15.90	41	38	48
28.331	C. E. Martin	.	27.08	14	-6.14	8.78	42	27.08	48	38	
29.131a	do	.	53.45	14	-12.65	26.04	42	53.45	48	38	
31.133	G. R. Brainard	.	78.73	14	-7.08	56.57	43	78.73	48	38	
18.25.23.111	Mrs. G. M. Phelps	3	115.26	14	-11.89	90.67	42	115.26	48	42	
18.26.2.333	S. O. Higgins	.	14.56	14	-1.11	10.75	46	14.55	48	38	41
4.111b	Frank Watkins	3	31.99	14	-3.57	18.19	43	31.99	48	k38	
4.433	W. M. Schneider	.	26.54	14	-2.33	16.82	43	26.54	48	38	46
7.234a	C. H. Hutsonpillar	4	60.72	14	-4.25	f43.62	43	f61.21	48	39	
7.234c	do	.	59.32	14	-2.74	53.73	44	59.32	48	39	42
9.133	Martin Yates, Jr.	.	40.34	14	-3.31	26.01	43	40.34	48	43	
9.311	C. T. McCauley	5	39.43	14	-2.67	26.62	43	39.43	48	39	40
10.233	(Incomplete designation used previously for well 18.26.10.311, which see)										
10.311	Charles Rogers (Measurements discontinued, well filled)		9.80			42		15.92	47	38	39,41,48
10.311a	do	5	18.30	14	....	....	..	....	..	48	
15.133	J. D. Terry Estate	.	22.46	14	+1.87	15.78	42	24.33	47	38	41
15.311	Charles Martin	.	20.65	14	+1.04	14.16	42	22.02	40	38	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
18.26.18.241	W. B. McCrary	.	55.91	14	-4.59	37.50	43	55.91	48	38	40
18.323	do	.	58.46	14	-1.78	38.49	43	58.46	48	38	40
21.344	Town of Dayton	4	49.76	13	-4.39	f32.97	43	f50.00	48	39	
22.314	Mrs. W. D. Eads	.	17.28	13	-2.43	8.16	43	17.28	48	38	40,41
23.213	A. W. Boyce	.	.....	..	....	17.55	42	27.80	41	38	47,48
24.131	R. G. Goodwin	.	21.66	13	+1.11	14.16	43	22.77	47	43	
24.223	P. R. Ramuz (Measurements discontinued, well dry)..					1.26	42	6.47	46	39	48
24.223a	do	3,5	8.39	13	....	.....	..	.....	..	48	
28.143	Town of Dayton	.	58.20	13	-5.33	52.87	47	58.20	48	47	
33.111	L. T. Lewis	.	174.71	13	.....	64.22	45	174.71	48	38	47
19.26.12.323	Forrest Lee	.	e32.18	13	.....	15.74	42	27.57	46	39	48
12.323b	do	3,5	34.38	13	.....	.....	..	.....	..	48	
12.333	Ollie Banks	.	e37.68	13	.....	22.21	43	32.76	47	41	42,48
13.211a	R. L. House	.	25.12	13	-6.02	19.10	47	25.12	48	47	
13.344	R. W. Rankin	3,5	e16.08	13	.....	2.70	42	e16.08	48	42	45,48
14.431a	Albert Lee	3,5	.....	..	.....	11.75	45	15.88	46	45	47,48
14.431b	do	3	26.86	13	-10.43	16.43	47	26.86	48	47	
27.233	Lakewood school	3	b59.08	13	-9.57	40.73	43	b59.08	48	38	40
28.334	F. M. Conner	.	67.49	13	-9.92	46.20	42	67.49	48	38	40
28.441	L. T. Lewis	.	73.48	13	....	53.11	42	73.48	48	38	47
33.412	J. H. Everest	.	56.17	13	-5.62	39.63	42	56.17	48	38	
20.26.6.431	J. G. Moutry & Sons	.	59.07	13	-6.92	35.67	42	59.07	48	38	
7.122	P. S. Campbell	3,5	57.88	13	-6.26	36.57	42	57.88	48	38	
7.421	E. Manthei	.	50.03	13	....	30.99	42	50.03	48	38	39,46,47
8.112	J. G. Moutry & Sons	.	45.19	13	-7.35	24.15	42	45.19	48	38	
17.231	J. E. Howell	5	160.43	13	-4.93	55.50	47	160.43	48	47	
17.411	J. H. Angell	.	49.88	13	-4.90	43.00	42	49.88	48	38	46
21.112	Manuel Hernandez	.	21.70	13	-4.39	17.31	47	21.70	48	46	

a Pumping.
b Pumping recently.
c Nearby well pumping.
d Nearby well pumping recently.
e Dry at depth given.
f From recorder chart.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.
j Measurement uncertain.
k March.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January or February 1947 to January 1948, in feet

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest		Be-	Years
			Level	Day	1947-48	Level	Year	Level	Year	gan	missing
					Carlsbad area						
21.26.23.131	Judson Boyd	5	37.72	6	- 3.7	34.0	47	37.72	48	47	
24.424	L. F. Rayroux	5	150.34	6	- .3	50.0	47	150.34	48	47	
21.27.19.334	F. R. Dickson	3,5	130.25	6	-3.4	26.8	47	130.25	48	47	
22.26.12.112	Joe Boyd	5	28.70	7	-6.0	22.7	47	28.70	48	47	
25.432	R. V. Barfield	3	125.21	12	-13.37	111.41	45	125.21	48	45	
35.222	Carlsbad Airfield 3	3	153.15	12	-13.81	135.70	43	153.15	48	43	
36.111	do 1	3	152.69	12	-13.45	135.09	43	152.69	48	43	45
36.111a	do 2	3	152.21	12	-13.30	134.75	43	152.21	48	43	
22.27.15.333	Frei Forni	5	142.39	7	-6.5	35.9	47	142.39	48	47	
20.122	Mr. Calvanis	5	48.87	7	-12.0	36.9	47	48.87	48	47	
20.313	Frank Zugary	5	75.11	8	-12.76	62.35	47	75.11	48	47	
26.114	Caeser Grandi	5	33.49	9	-8.2	25.3	47	33.49	48	47	
27.113	do	5	145.28	9	-10.3	35.0	47	145.28	48	47	
30.133	W. H. Merchant	3	112.37	12	-13.31	98.94	45	112.37	48	45	
34.111	L. T. Lewis	5	155.52	14	-14.0	41.5	47	155.52	48	47	
35.111	W. Craft	5	138.59	12	-11.9	26.7	47	138.59	48	47	
36.133	Brantley & Williams	5	26.99	12	-8.3	18.7	47	26.99	48	47	
23.27.2.122	Jim Derrick	5	39.48	m 9	-11.4	28.1	47	39.48	48	47	
14.124	A. M. House	5	74.05	14	-4.2	69.8	47	74.05	48	47	
23.28.6.131	Julius Roberson	5	16.23	12	-3.8	12.4	47	16.23	48	47	
7.113	G. Brantly	5	24.96	12	-6.5	18.5	47	24.96	48	47	
8.421	E. D. Rosson	5	33.36	12	-6.2	27.2	47	33.36	48	47	
11.114	Bonney Yarbro	5	a129.30	13	....	15.7	47	.....	..	47	
15.411	Joe Yarbro	5	14.53	12	-5.0	9.5	47	14.53	48	47	
18.333	L. T. Lewis	5	62.85	13	-6.3	56.5	47	62.85	48	47	
24.134	Buford Yarbro	5	143.64	m 9	-4.1	39.5	47	143.64	48	47	
25.213	Ray Howard	5	140.62	13	-4.9	35.7	47	140.62	48	47	
24.28.17.231	Carleton & Kraft	5	23.18	13	+1.9	23.18	48	25.1	47	47	

a Pumping.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface datum.
m February.

Part 2. Water levels in January 1948 in observation wells having records beginning January 1948

Location number	Owner	See also Part	Water level	Day
	Carlsbad area			
21.26.25.344	Unknown	5	19.55	6
36.212	do	5	22.99	6
21.27.29.311	T. Ives	5	11.50	6
29.434	Fred O'Chesky	5	19.91	6
30.442	T. Ives	3,5	10.63	6
31.112	Jim Stagner	5	11.47	6
31.211	G. A. Blitz	5	11.10	6
31.214	Unknown	5	16.42	6
32.111	L. E. Loman	5	14.65	6
32.112	do	5	7.66	6
22.26.3.344	O. G. Willis	3,5	77.91	7
11.443	Unknown	5	50.19	7
12.311	A. J. Bradley	5	39.75	7
14.213	H. E. Stevenson	3,5	68.70	7
24.224	D. N. Vest	3,5	85.32	7
22.27.8.313	George Mashaw	5	23.23	7
8.314	do	5	19.45	7
10.333	Mrs. M. Enifer	3,5	11.58	7
15.411	Fred Forni	5	15.09	7
17.124	W. W. Glaze	5	30.69	7
21.344	Dr. Pate	5	54.93	9
22.421	Enea Grandi	3,5	34.79	9
28.133	I. L. Skeen	3,5	62.36	14
29.133	Frank Gentry	5	92.00	8
29.413	Mr. Rogers	5	77.47	14
30.243	Mr. Yarbro	5	98.46	8
32.233	Mr. Brenningstool	5	86.69	14
33.131	Unknown	5	72.97	14
35.433	Munoz Methola	3,5	36.54	12
22.28.30.443	Calvani Bros.	5	11.93	12
23.27.6.213	J. A. & W. A. Ashbacher	5	123.23	14
10.143	A. A. Crabb	5	11.95	14
12.233	Bird Bros.	5	36.00	12
23.211	Unknown	3,5	23.44	14
23.28.18.222	Mr. Carter	5	26.38	12
20.144	do	5	54.90	13
22.333	J. L. Seal	5	46.12	13
23.133	A. R. Donaldson	3,5	51.29	13
29.411	Unknown	5	20.66	13
24.28.7.231	L. T. Lewis	5	20.22	13
25.123	J. E. Montgomery	5	5.84	13

Part 3. Water levels, in feet, showing seasonal changes during 1948

Roswell basin

Location number	16.25. 1.344	16.25. 6.Lot 4	16.26. 19.411	16.26. 28.333	17.25. 35.411	17.26. 7.344	17.26. 10.333	17.26. 16.333
Owner	Buck Bros.	Nelson	Jeffers	Williams	Kissinger	Scoggins	Gates	Cemetery
Jan. 14-17, 19	b17.90	13.06	32.81	26.67	127.90	58.67	8.72	25.68
Mar. 15, 16	b17.73	11.79	33.94	26.97	128.48	60.86	14.90	32.22
May 15, 17, 18	a29.68	10.49	30.98	31.44	132.52	68.32	(a)	44.54
July 16, 17, 19	36.17	11.10	28.48	32.57	132.94	68.99	20.05	41.46
Sept.17, 18, 20	a31.39	12.01	25.44	35.48	135.39	72.55	b26.17	42.69
Nov. 8	18.92	12.45	28.78	32.55	134.13	66.52	14.90	28.69

Location number	17.26. 24.333	18.25. 23.111	18.26. 4.111b	18.26. 24.223a	19.26. 12.323b	19.26. 13.344	19.26. 14.431a	19.26. 14.431b
Owner	Yates	Phelps	Watkins	Ramuz	Lee	Rankin	Lee	Lee
Jan. 13, 14	3.82	115.26	31.99	8.39	34.38	e16.08	.....	26.86
Mar. 15, 16	2.99	122.92	32.88	7.40	35.46	14.97	.....	24.19
May 17, 18	3.36	133.72	.....	7.03	35.60	14.07	29.82	29.82
July 17, 19	4.18	136.12	36.39	6.32	33.41	13.57	c38.49	a44.22
Sept.18, 20	5.85	139.21	a46.34	7.64	34.32	13.75	29.63	29.34
Nov. 8	3.34	124.52	34.85	7.80	34.25	14.48	25.65	25.37

Location number	19.26. 27.233	20.26. 7.122
Owner	School	Campbell
Jan. 13	b59.08	57,88
Mar. 16	60.33	56.29
May 17	64.62	58.39
July 19	a63.00	162.75
Sept.20	a64.82	65.44
Nov. 9	a59.92	60.91

Carlsbad area

Location number	21.27. 19.334	21.27. 30.442	22.26. 3.344	22.26. 14.213	22.26. 24.224	22.26. 25.432	22.26. 35.222	22.26. 36.111
Owner	Dickson	Ives	Willis	Stevenson	Vest	Barfield	Airfield	Airfield
Jan. 6, 7, 12	30.25	10.63	77.91	68.70	85.32	125.21	153.15	152.69
Feb. 9	29.80	.....	.....	.....	.....	.....	.....	.....
Mar. 22, 24	.....	9.76	.....	.....	.....	126.48	.....	153.68
May 19, 20	.....	9.35	.....	.....	.....	131.78	166.12	165.51
July 20, 22	28.51	8.14	c76.38	66.90	83.35	.....	166.04	165.41
Sept.21, 23	29.15	8.94	c76.44	67.51	84.09	.....	172.41	171.33
Nov. 10, 12	29.45	9.55	c76.04	67.82	84.20	.....	164.13	163.04

Location number	22.26. 36.111a	22.27. 10.333	22.27. 22.421	22.27. 28.133	22.27. 30.133	22.27. 35.433	23.27. 23.211	23.28. 23.133
Owner	Airfield	Enifer	Grandi	Skeen	Merchant	Methola	Swearingen	Donaldson
Jan. 7, 9, 12-14	152.21	11.58	34.79	62.36	112.37	36.54	23.44	51.29
Mar. 22, 24	153.27	12.84	.....	.....	114.09	38.00	23.48	51.33
May 19, 20	165.16	11.47	.....	.....	125.34	39.01	23.89	51.47
July 20, 22, 23	165.11	13.56	33.77	a82.83	126.20	39.59	23.20	47.76
Sept.21-23	171.15	9.90	32.35	b80.60	129.19	37.51	22.94	48.54
Nov. 10, 12	162.86	9.33	30.60	70.99	.....	31.99	23.10	47.52
Dec. 20, 21	.....	10.17	31.79	.....	.....	.....	.....	.....

a Pumping.
b Pumping recently.
c Nearby well pumping.
e Dry at depth given.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

16.25.6.313. Frank Childress.

Highest daily water level, from recorder charts

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2	h28.15	Feb. 18	27.91	Apr. 2	28.00	June 11	28.03
3	28.17	19	27.92	3	27.94	12	28.01
4	28.32	20	28.01	10	27.78	13	28.03
5	28.24	21	27.99	11	27.74	18	28.08
6	28.28	22	27.80	12	27.75	19	28.08
7	28.19	23	27.73	13	27.92	20	28.05
8	28.13	24	27.74	14	28.03	21	27.98
9	28.14	25	28.11	15	27.95	22	27.99
10	28.20	26	27.91	16	27.93	23	28.10
11	28.07	27	27.80	17	27.88	24	28.18
12	28.07	28	27.94	22	27.76	25	28.17
13	28.32	29	27.86	23	27.67	July 16	h28.45
14	28.17	Mar. 1	27.86	24	27.67	17	28.48
15	28.01	2	27.93	25	27.81	18	28.48
16	28.11	3	27.97	26	27.81	19	28.45
17	27.99	4	27.97	27	27.86	20	28.44
18	28.11	5	28.12	28	27.95	21	28.47
19	28.11	6	27.90	29	27.74	22	28.48
20	28.15	7	27.88	May 8	27.72	23	28.57
21	28.03	8	27.87	9	27.77	24	28.61
22	27.88	9	27.79	10	27.87	Aug. 12	28.63
23	27.99	10	27.80	11	27.98	13	28.62
24	27.94	11	28.11	12	28.04	14	28.62
25	28.11	12	28.12	13	28.02	15	28.69
26	28.17	13	27.92	14	27.90	16	28.75
27	28.22	14	27.72	15	27.90	17	28.73
28	28.07	15	27.75	16	27.93	18	28.73
29	28.07	16	27.90	17	27.97	19	28.74
30	28.05	17	27.89	18	27.89	Sept. 17	h28.85
31	28.05	18	27.68	19	27.91	18	28.81
Feb. 1	28.09	19	27.85	20	27.96	19	28.72
2	28.05	20	27.85	21	27.90	20	28.72
3	27.93	21	27.88	22	27.89	21	28.72
4	27.93	22	27.93	31	28.10	22	28.68
5	27.95	23	27.93	June 1	28.18	23	28.66
6	28.01	24	27.88	2	28.10	24	28.67
7	28.01	25	27.81	3	28.03	Nov. 8	28.50
8	28.04	26	27.84	4	27.99	9	28.55
9	28.03	27	27.98	5	27.99	10	28.42
10	27.74	28	27.92	6	28.05	11	28.35
11	27.77	29	27.79	7	28.08	12	28.37
14	28.15	30	27.72	8	28.04	13	28.49
15	28.06	31	27.74	9	28.03	14	28.48
16	28.08	Apr. 1	27.96	10	28.04	15	g28.40
17	28.07						

g Estimated.
h Tape measurement at odd hour.

18.26.7.234a. C. H. Hutsonpillar. Highest and lowest recorded water levels: Feb. 21, 59.90; Sept. 18, 68.57.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Nov.	Dec.
1	61.21	60.23	.....	61.71	.....	65.89	.....	.....	.....	.....	.....
2	61.12	60.20	.....	61.83	.....	65.54	.....	.....	.....	.....	.....
3	61.11	60.19	.....	61.96	.....	65.54	.....	.....	.....	.....	61.58
4	61.06	60.19	.....	.....	.....	65.54	.....	.....	.....	.....	61.47
5	61.03	60.21	.....	.....	.....	65.42	.....	.....	.....	.....	61.44
6	60.98	60.18	h60.50	.....	.....	65.27	.....	.....	.....	.....	61.34
7	60.94	60.17	60.10	.....	.....	65.15	.....	.....	.....	.....	61.27
8	60.89	60.19	60.24	.....	h64.66	64.90	.....	.....	.....	h63.91	61.21

h Tape measurement at odd hour.

18.26.7.234a--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Nov.	Dec.
9	60.87	60.13	60.24	.....	64.67	64.90	.....	.....	.....	63.79	61.19
10	60.81	60.04	60.24h	62.78	64.67	64.83	.....	.....	.....	63.67	g61.07
11	60.77	60.06	60.27	62.83	64.75	64.72	.....	.....	.....	63.57	.....
12	60.76	60.07	60.27	62.91	64.83	64.55	.....	.....	.....	63.49	.....
13	60.75	60.05h	60.25	63.07	64.90	.....	.....	.....	.....	63.38	.....
14	60.68	60.07	60.23	63.22	64.90	.....	.....	.....	.....	63.28	.....
15	60.62	60.03	60.28	63.35	64.94	.....	.....	.....	.....	63.17	.....
16	60.62	60.03	60.49	63.46	64.97	.....	.....	h66.67	.....	.....	.....
17	60.60	60.00	60.52	63.56	64.98	.....	h62.93	66.73	.....	.....	.....
18	60.53	59.94	.....	63.62	65.03	h63.88	62.95	66.82	68.57	.....	.....
19	60.52	59.94	.....	.....	65.13	63.86	63.00	66.92	68.52	.....	.....
20	60.51	59.91h	60.67	.....	65.23	63.74	63.04	67.00	68.45	.....	.....
21	60.48	59.90	60.71	.....	65.33	63.63	63.16	67.10	68.38	.....	.....
22	.....	60.07	60.79h	64.12	65.44	63.53	63.30	67.19	68.35	.....	.....
23	60.36	60.03	60.84	64.17	.....	63.45	63.45	67.27	68.31	.....	.....
24	60.34	60.07	60.86	64.29	.....	63.37	63.61	67.33	68.28	.....	.....
25	60.36	60.13	60.88	64.42	.....	63.30	63.74	.....	68.25	.....	.....
26	60.35	60.07	60.99	64.46	.....	.....	.....	.....	.....	.....	.....
27	60.35	60.04	61.15	64.50	.....	.....	.....	.....	.....	.....	.....
28	60.30	.....	61.26	64.55	.....	.....	.....	.....	.....	.....	h60.06
29	60.27	.....	61.35	64.58	.....	.....	.....	.....	.....	.....	60.10
30	60.25		61.45	.....	.....	.....	.....	.....	.....	.....	60.04
31	60.24		61.55		65.91		.....	.....			59.96

g Estimated.
h Tape measurement at odd hour.

18.26.21.344. Town of Dayton. Highest and lowest recorded water levels: Jan. 29-31, Mar. 10, 49.52; Oct. 12, 54.47.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	50.00	49.53	49.74	50.25	51.49	51.91	51.94	52.58	.....	54.46	.....	53.24
2	49.96	49.55	49.74	50.27	51.52	51.91	51.94	52.61	.....	54.45	.....	53.25
3	49.96	49.56	49.67	.....	51.55	52.22	51.94	52.65	.....	54.44	.....	53.21
4	49.94	49.59	49.62	.....	51.53	g52.22	51.93	52.69	.....	54.43	54.09	53.17
5	49.92	49.59	49.62	.....	51.57	52.21	51.92	52.71	.....	54.42	54.07	53.18
6	49.88	49.60	49.61	.....	51.58	52.20	51.91	52.74	.....	54.45	53.96	53.14
7	49.86	49.60	49.56	.....	51.57	52.19	51.90	52.76	.....	54.44	53.95	53.13
8	49.84	49.62	49.56	50.61	51.60	52.18	51.89	52.79	.....	54.45	53.90	53.11
9	49.84	49.65	49.53	50.63	51.64	52.16	51.87	52.82	.....	54.46	53.84	53.11
10	49.81	49.63	49.52	50.68	51.66	52.15	51.87	52.88	.....	54.45	53.81	53.05
11	49.78	49.64	49.55	50.73	51.70	52.12	51.86	52.91	.....	54.46	53.79	53.03
12	49.79	49.65	49.55	50.78	51.73	52.11	51.87	52.95	.....	54.47	53.76	53.04
13	49.76	49.65	49.57	50.88	51.74	52.10	51.88	52.99	.....	54.46	53.74	53.03
14	49.73	49.67	49.55	50.94	51.76	52.07	51.87	53.03	.....	54.45	53.67	52.99
15	49.69	49.70	49.60	50.98	51.78	52.07	51.90	53.08	.....	54.44	53.66	52.98
16	49.72	49.70	49.66	51.03	51.80	52.06	51.90	53.11	.....	54.43	53.67	52.96
17	49.66	49.71	49.67	51.09	51.80	52.05	51.93	53.16	.....	54.45	53.60	52.93
18	49.66	49.75	49.67	51.13	51.83	.....	51.96	53.20	.....	54.43	53.63	52.92
19	49.66	49.74	49.73	51.17	51.86	.....	52.00	53.24	.....	54.42	53.56	52.87
20	49.64	49.75	49.77	51.21	51.89	.....	52.05	53.27	54.30	54.41	53.56	52.86
21	49.63	49.74	49.81	51.24	51.92	.....	52.14	53.31	54.34	54.41	53.54	52.86
22	49.59	49.78	49.84	51.27	51.94	52.00	52.20	53.35	54.35	54.39	53.50	52.82
23	49.59	49.78	49.86	51.31	51.97	51.99	52.25	53.39	54.36	54.38	53.48	52.79
24	49.57	49.76	49.88	51.36	51.99	51.97	52.29	53.42	54.39	54.37	53.41	52.78
25	49.57	49.77	49.91	51.38	52.02	51.96	52.33	53.46	54.42	.....	53.40	52.77
26	49.57	49.80	49.92	51.41	52.04	51.96	52.36	53.52	54.43	.....	53.37	52.74
27	49.57	49.78	49.92	51.43	52.07	51.95	52.40	53.56	54.44	.....	53.39	52.69
28	49.53	49.78	50.03	51.44	52.10	51.97	52.43	53.61	54.44	.....	53.35	52.69
29	49.52	49.78	50.06	51.44	52.14	51.96	52.48	53.64	54.45	.....	53.31	52.69
30	49.52		50.12	51.46	52.15	51.95	52.50	53.67	54.44	.....	53.29	52.64
31	49.52		50.17		52.01		52.54	.....		.....		52.60

g Estimated.

Part 5. Miscellaneous data concerning observation wells

16.25.5.Lot 13. Croom. Reference point, established Jan. 19, 1948, top of casing, 0.86 foot above land-surface datum.

16.25.11.233. Buck. Reference point, established Jan. 17, 1948, top of casing, west side of well, 3.34 feet above land-surface datum.

16.25.25.211. Buck. South of old pump shed. Drilled irrigation well, equipped with turbine pump, diameter 12 inches. Reference point, top edge of casing, northwest side of well, at land-surface datum.

16.26.5.331. Taylor. Well cleaned, well casing possibly disturbed.

17.25.12.211. Artesia Country Club. Drilled irrigation well, equipped with turbine pump, diameter 12 inches. Reference point, top of steel casing, north side of well, 1.00 foot above land-surface datum.

17.26.4.331a. Stroup. Well deepened in 1947, upper water probably cased off.

17.26.7.423. Houghton. Top of casing raised to 1.85 feet above land-surface datum.

17.26.7.444. Blake. Well abandoned, pressure pump moved to well 25 feet north. Reference point, established Jan. 15, 1948, top of concrete well curb, center of well, 0.17 foot below land-surface datum.

18.26.9.311. McCauley. New turbine pump installed, 10-inch casing run inside of 14-inch casing. Reference point, established Jan. 14, 1948, top of 10-inch casing, 1.50 feet above top of 14-inch casing, 1.10 feet above land-surface datum.

18.26.10.311a. Rogers. About 20 feet north of well 18.26.10.233. Drilled irrigation well, equipped with turbine pump, diameter 14 inches. Reference point, top of concrete base, at land-surface datum.

18.26.24.223a. Ramuz. 75 feet northwest of house, beside road. Drilled irrigation well, equipped with turbine pump, diameter 12½ inches, depth 63 feet. Reference point, top of casing, south side of well, 0.50 foot below land-surface datum. May 17, 1947, +5.05; July 17, 1947, +34.93, pumping; Sept. 12, 1947, +11.20; Nov. 10, 1947, +9.88.

19.26.12.323b. Lee. 6 feet west of observation well 19.26.12.323. Drilled irrigation well, no equipment, diameter 12 inches. Reference point, top of steel casing, 0.40 foot above land-surface datum.

19.26.13.344. Rankin. Correction to water level published in Water-Supply Paper 949: Jan 12, 1942, 2.70.

19.26.14.431a. Lee. Casing has been extended to surface, no equipment. Reference point, established May 17, 1948, top edge of casing at high point northwest side of well, 0.11 foot above land-surface datum.

20.26.7.122. Campbell. Windmill removed, pressure pump installed, reference point destroyed July 1948. Reference point, beginning Nov. 9, 1948, top of concrete floor of concrete block pump shed. southeast side of well, 0.29 foot above land-surface datum.

20.26.17.231. Howell. Casing cut off, turbine pump installed. Reference point, top of concrete base and casing, at land-surface datum.

Carlsbad area

21.26.23.131. Boyd. Drilled irrigation well, no equipment, used prior to 1948, diameter 16 inches, depth 144 feet. Reference point, lower edge of 2-inch hole in east side of casing, 0.80 foot above land-surface datum. Feb. 8, 1947, 34.0; Oct. 20, 1947, 39.74; Feb. 9, 1948, 37.53.

21.26.24.424. Rayroux. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 320 feet. Reference point, top of concrete pump base, at land-surface datum. Feb. 1947, 50.0; Oct. 10, 1947, 50.11.

21.26.25.344. Unknown. In a small pecan grove, about 100 feet west of another well. Drilled irrigation well, equipped with turbine pump. Reference point, top of 3- by 3-foot concrete pump base, 0.23 foot above land-surface datum. Oct. 9, 1947, 19.32.

21.26.36.212. Unknown. In small pecan grove. Drilled irrigation well, equipped with turbine pump, diameter 12 inches. Reference point, top of casing, south side of well, 0.50 foot above land-surface datum. Oct. 9, 1947, 22.64.

21.27.19.334. Dickson. 50 feet west of house, about 300 feet northwest of windmill and tank. Drilled irrigation well, equipped with turbine pump, depth 320 feet. Reference point, top of concrete pump base, 2.10 feet above land-surface datum. Oct. 16, 1946, 30.0; Feb. 6, 1947, 26.8; Oct. 10, 1947, 30.09, possible discrepancy of a few tenths of a foot between present and previous land-surface data.

21.27.29.311. Ives. In northeast corner of field near pipe fence corner, about 600 feet east of house, on north side of road. Drilled irrigation well, equipped with centrifugal pump, diameter 16 inches, depth 236 feet. Reference point, top of casing, south side of well, 0.50 foot above land-surface datum. Oct. 10, 1947, 11.23.

21.27.29.434. O'Chesky. Drilled domestic well, equipped with centrifugal pressure pump, diameter 8 inches, depth 324 feet. Oct. 13, 1947, 19.78.

21.27.30.442. Ives. In pump shed, 50 feet northwest of house. Drilled domestic well, equipped with centrifugal pressure pump, diameter 7 inches, depth 256 feet. Reference point, top of concrete pump base, 2.50 feet above land-surface datum. Oct. 27, 1947, 9.92.

21.27.31.112. Stagner. In small shed behind house, on northeast corner of tract. Drilled irrigation well, equipped with centrifugal pump, diameter 9 inches. Reference point, top of concrete platform around well, 1.00 foot above land-surface datum. Oct. 20, 1947, 11.20.

21.27.31.211. Blitz. In shed about 100 feet northeast of white house. Drilled irrigation and domestic well, equipped with centrifugal and pressure pumps, diameter 9 inches, depth 220 feet. Reference point, top surface of concrete floor of shed, 0.30 foot above land-surface datum. Oct. 10, 1947, 10.95; Dec. 20, 1948, 9.81.

21.27.31.214. Unknown. In adobe pump shed, about 200 feet west of railroad, 50 feet north of road. Dug and drilled irrigation well, equipped with centrifugal pump, diameter 8 inches. Reference point, top of concrete floor of well pit, 8.20 feet below land-surface datum. Oct. 10, 1947, 15.75.

21.27.32.111. Loman. In northwest corner of field, south of a small white house. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 70 feet. Reference point, top of casing, west side of well, at land-surface datum. Oct. 13, 1947, 13.73.

21.27.32.112. Loman. Between white house and red barn. Drilled irrigation and domestic well, equipped with centrifugal and pressure pumps, diameter 6 inches, depth 305 feet. Reference point, top of concrete pump base, 0.23 foot above land-surface datum. Oct. 13, 1947, 7.49.

22.26.3.344. Willis. South of stone house, north of water tank and small pressure pump on domestic well. Drilled irrigation well, equipped with turbine pump, diameter 14 inches, depth 360 feet. Reference point, top of casing, 1.15 feet below land-surface datum.

22.26.11.443. Unknown. In southwest corner of field, about an eighth of a mile northeast of a gravel pit. Drilled irrigation well, no equipment, diameter 9 inches. Reference point, top of concrete well curb, 0.65 foot above land-surface datum. Oct. 23, 1947, 49.89.

22.26.12.112. Boyd. In northwest corner of field, southeast of bridge over irrigation canal. Drilled irrigation well, equipped with turbine pump, diameter 14 inches, depth 209 (?) feet. Reference point, top of concrete pump base and top of casing, 0.27 foot above land-surface datum.

22.26.12.112--Continued.

Date	Water level	Date	Water level	Date	Water level
Aug. 22, 1946	27.0	Oct. 19, 1947	28.38	Dec. 24, 1948	27.38
Feb. 8, 1947	22.7	Feb. 9, 1948	28.22		

22.26.12.311. Bradley. North of stucco house and east of elevated wooden tank. Drilled irrigation and domestic well, equipped with turbine pump, diameter 8 inches, depth 55 feet. Reference point, top of concrete pump base, 0.70 foot above land-surface datum. Oct. 24, 1947, 37.02.

22.26.14.213. Stevenson. In pump shed east of elevated water tank, south of farmhouse. Drilled irrigation well, equipped with turbine pump, depth 200+ feet. Reference point, top of concrete floor, 0.35 foot above land-surface datum. Oct. 23, 1947, 68.42.

22.26.24.224. Vest. On small rise, about 150 feet west of road and telephone line. Drilled irrigation well, automatic water-stage recorder installed Nov. 12, 1948, diameter 10-3/4 inches, depth 200 feet. Reference point, top of casing, at land-surface datum.

22.27.8.313. Mashaw. West of irrigation ditch, north of National Guard building. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 90 feet. Reference point, top of concrete pump base, 0.34 foot below land-surface datum. Nov. 3, 1947, 22.68.

22.27.8.314. Mashaw. North of metal grain shed, about 300 feet northwest of house. Drilled irrigation well, equipped with turbine pump, diameter 10 inches, depth 110 feet. Reference point, top of concrete pump base, 0.88 foot above land-surface datum. Nov. 3, 1947, 18.60.

22.27.10.333. Enifer. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 0.86 foot above land-surface datum. Sept. 29, 1947, 11.13.

22.27.15.333. Forni. 50 feet southeast of small house, 150 feet north of windmill well. Drilled irrigation well, no equipment, depth 174 feet. Dec. 12, 1946, 35.0; Feb. 7, 1947, 35.9; Oct. 9, 1947, 43.30, possible discrepancy of a few tenths of a foot between present and previous land-surface data; Feb. 9, 1948, 43.20.

22.27.15.411. Forni. North of irrigation lateral canal, about 200 feet south and west of another well. Drilled irrigation well, equipped with turbine pump. Reference point, top of lower ledge of concrete pump base, 0.40 foot above land-surface datum. Sept. 9, 1947, 30.29, nearby well pumping; Dec. 21, 1948, 13.62.

22.27.17.124. Glaze. At end of small field in a draw, about 100 feet northwest of pipe at fence corner, about 500 feet east and a little north of a red windmill. Drilled irrigation well, diameter 16 inches, depth 123 feet. Reference point, top of casing, south side of well, 0.70 foot above land-surface datum. Nov. 5, 1947, 29.04.

22.27.20.122. Calvanis. West of barn and east of canal, 20 feet north of another well. Drilled irrigation well, equipped with turbine pump. Reference point, top of cemented brick pump base, 0.70 foot above land-surface datum. Dec. 12, 1946, 33.4; Feb. 7, 1947, 36.9.

22.27.20.313. Zugary. In southwest corner of field. Drilled irrigation well, equipped with turbine pump, depth 212 feet. Reference point, top of upper part of concrete pump base, 0.40 foot above land-surface datum. Oct. 23, 1946, 62.35; Feb. 8, 1947, 62.35; Oct. 3, 1947, 77.87; Feb. 9, 1948, 75.45.

22.27.21.344. Pate. At south end of wedged shape field adjoining U. S. Highway 285, about an eighth of a mile north of House and galvanized sheet-iron barn. Drilled irrigation well, no equipment, diameter 16 inches. Reference point, top of casing, north side of well, 1.00 foot above land-surface datum. Dec. 21, 52.56.

22.27.22.421. Grandi. Southwest of three transformers. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 150 feet. Reference point, top of concrete pump base, 1.16 feet above land-surface datum. Sept. 26, 1947, 93.95, pumping.

22.27.26.114. Grandi. About equal distance from houses to northwest, southwest, and northeast. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 70 feet. Reference point, surface of 3- by 3-foot concrete pump base, 0.30 foot above land-surface datum. Aug. 30, 1946, 35.0; Feb. 7, 1947, 25.3; Oct. 9, 1947, 34.34; Feb. 9, 1948, 33.95.

22.27.27.113. Grandi. South side of house, northeast of galvanized sheet-iron barn, about 12 feet east of domestic well. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 1.10 feet above land-surface datum. Aug. 30, 1946, 38.0; Feb. 7, 1947, 35.0; Feb. 9, 1948, 46.40.

22.27.28.133. Skeen. 100 feet northeast of three transformers on power poles, 5 feet north of 12-foot pole. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 160 feet. Reference point, top of concrete pump base, 0.80 foot above land-surface datum. Oct. 1, 1947, 66.50.

22.27.29.133. Gentry. In southwest corner of field, near road intersection, north of small house. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 185 feet. Reference point, top of concrete pump base, at land-surface datum. Oct. 2, 1947, 94.75.

22.27.29.413. Rogers. About 50 feet north of 3 transformers on 2 power poles. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete base, at land-surface datum. Oct. 2, 1947, 82.18.

22.27.30.243. Yarbro. In southwest corner of wire enclosed field. Drilled irrigation well, equipped with turbine pump, diameter 14 inches. Reference point, top of concrete pump base, 0.80 foot above land-surface datum.

22.27.32.233. Brenningstool. 25 feet north of road, about 350 feet southwest of house with green roof and 200 feet east of house with gray roof. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 1.35 feet above land-surface datum. Oct. 2, 1947, 84.38.

22.27.33.131. Unknown. Northwest side of earthen tank, 100 feet east of north-south road. Drilled irrigation well, equipped with turbine pump, diameter 14 inches. Reference point, top of concrete base, 0.55 foot above land-surface datum. Oct. 1, 1947, 70.99.

22.27.34.111. Lewis. About 100 feet northwest of house. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 300 feet. Feb. 8, 1947, 41.5; Oct. 1, 1947, 52.96; Feb. 9, 1948, 56.28.

22.27.35.111. Craft. Near 3 transformers between 2 power poles, about 500 feet east of several school buildings. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 110 feet. Reference point, top of concrete pump base, 0.18 foot above land-surface datum. Sept. 27, 1946, 28.6; Feb. 7, 1947, 26.7; Sept. 25, 1947, 87.70, pumping; possible discrepancy of a few tenths of a foot between present and previous land-surface data; Feb. 9, 1948, 63.45, pumping.

22.27.35.433. Methola. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 245 feet. Reference point, top of casing, east side of well, 0.50 foot above land-surface datum. Sept. 25, 1947, 61.40, pumping.

22.27.36.133. Brantly & Williams. Near three transformers on two power poles, east of and across the road from house. Drilled irrigation well, equipped with turbine pump, depth 190 feet. Reference point, top of concrete pump base, 3.08 feet above land-surface datum.

22.27.36.133--Continued.

Date	Water level	Date	Water level	Date	Water level
July 26, 1946	22.7	Feb. 7, 1947	18.7	Dec. 21, 1948	24.83
Aug. 5	23.5	9, 1948	27.23		

22.28.30.443. Calvani Bros. In southwest corner of field, about 25 feet east of road, about 400 feet west of several trees. Drilled irrigation well, no equipment, diameter 18 inches, depth 136 feet. Reference point, top of casing, 0.83 foot above land-surface datum. Oct. 15, 1947, 11.30.

23.27.2.122. Derrick. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 186 feet. Reference point, top of casing, 1.70 feet above land-surface datum. Oct. 25, 1946, 26.4; Feb. 8, 1947, 28.1; Sept. 26, 1947, 70.06, pumping.

23.27.6.213. Ashbacher Bros. 10 feet east of fence, 20 feet east of telephone line. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 190 feet. Reference point, top of concrete base, 0.63 foot above land-surface datum.

23.27.10.143. Crabb. In corner of field, 15 feet north of fence, and 40 feet east of canal. Drilled irrigation well, no equipment, diameter 16 inches. Reference point, top of casing, north side of well, at high point near flared edge, 0.85 foot above land-surface datum. Oct. 15, 1947, 9.62.

23.27.12.233. Bird Bros. In corner of field, 100 feet east of several small trees. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 160 feet. Reference point, top of 3- by 3-foot concrete base, 0.48 foot above land-surface datum. Oct. 9, 1947, 39.92, pumping.

23.27.14.124. House. About 150 feet north of main concrete-lined canal, about 75 feet southwest of tree. Drilled irrigation well, no equipment, diameter 16 inches, depth 230 feet. Aug. 12, 1946, 75.4; Feb. 8, 1947, 69.8; Oct. 15, 1947, 74.82.

23.27.23.211. Unknown. Drilled irrigation well, no equipment, diameter 12 inches. Nov. 10, 1947, 22.84.

23.28.6.131. Roberson. Beside road, across from three electric transformers on power poles. Drilled irrigation well, equipped with turbine pump, depth 127 feet. Reference point, top of concrete base, 1.00 foot above land-surface datum. Aug. 13, 1946, 14.5; Feb. 7, 1947, 12.4; Sept.26, 1947, 16.30.

23.28.7.113. Brantly. Beside road near its intersection with U. S. Highway 285, 20 feet southeast of 3 transformers on 2 power poles, 100 feet southeast and across road from small house. Drilled irrigation well, equipped with turbine pump, depth 165 feet. Reference point, top of concrete pump base, 1.25 feet above land-surface datum. Sept. 5, 1946, 21.8; Feb. 7, 1947, 18.5; Feb. 9, 1948, 25.33.

23.28.8.421. Rosson. Northwest of large earthen tank, near corner of field. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 89 feet. Reference point, top of casing, northwest side of well, 1.00 foot above land-surface datum. Aug. 26, 1946, 33.2; Feb. 7, 1947, 27.2; Sept. 24, 1947, 34.25.

23.28.11.114. Yarbro. At irregularly shaped earthen tank, about 750 feet northeast of white house with green roof. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 100 feet. Reference point, top of concrete pump base, 4.00 feet above land-surface datum. Feb. 7, 1947, 15.7; Sept. 24, 1947, 28.61, pumping; possible discrepancy of a few tenths of a foot between present and previous land-surface data.

23.28.15.411. Yarbro. Near fence and ditch, 300 feet southwest of white house, 200 feet southwest of barn and windmill. Drilled irrigation well, no equipment, diameter 16 inches, depth 88 feet. Reference point, top of concrete pump base, 1.30 feet above land-surface datum. Feb. 8, 1947, 9.5; Sept. 23, 1947, 30.73, pumping.

23.28.18.222. Carter. Near intersection of U. S. Highway 285 and road to United States potash refinery, near 3 electric transformers on 2 power poles, and southwest of 3 small houses. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 1.10 feet above land-surface datum. Sept. 24, 1947, 42.15, nearby well pumping.

23.28.18.333. Lewis. 75 feet northwest of house. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 278 feet. Reference point, top of concrete pump base, at land-surface datum. Feb. 8, 1947, 56.5; Sept. 24, 1947, 78.00; Feb. 9, 1948, 62.31.

23.28.20.144. Carter. At end of power line, 30 feet south of pole. Drilled irrigation well, equipped with turbine pump, depth 250 feet. Reference point, top of concrete pump base, 0.68 foot above land-surface datum.

23.28.22.333. Seal. 25 feet north of road, about 500 feet northwest of gravel pit, 150 feet northeast of road culvert. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 150 feet. Reference point, surface of concrete pump base, 0.50 foot above land-surface datum. Oct. 3, 1947, 69.90, pumping.

23.28.23.133. Donaldson. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 148 feet. Reference point, top of concrete pump base, 0.65 foot above land-surface datum. Sept. 22, 1947, 51.56.

23.28.24.134. Yarbro. 20 feet west of small elevated aluminum-painted tank, about 50 feet west of white house with green roof, and shelter with green top over engine. Drilled irrigation well, equipped with turbine pump, depth 96 feet. Reference point, top of concrete pump base, 1.00 foot above land-surface datum. Sept. 5, 1946, 41.0; Feb. 8, 1947, 39.5; Sept. 24, 1947, 50.85, pumping; possible discrepancy of a few tenths of a foot between present and previous land-surface data.

23.28.25.213. Howard. 20 feet southwest of corral, 20 feet northwest of earthen tank, about 200 feet south of windmill, and 30 feet east of road. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 200 feet. Nov. 6, 1946, 36.3; Feb. 8, 1947, 35.7; Sept. 23, 1947, 39.30, possible discrepancy of a few tenths of a foot between present and previous land-surface data; Feb. 9, 1948, 38.73.

23.28.29.411. Unknown. 50 feet south of road, about 100 feet northeast of barn, about 100 feet south of shed, 12 feet east of ditch. Drilled irrigation well, no equipment, diameter 14 inches. Reference point, top of casing, 0.77 foot abovs land-surface datum.

24.28.7.231. Lewis. In corner of field near irrigation ditch, about 40 feet south of concrete diversion gates. Drilled irrigation well, no equipment, diameter 12 inches. Reference point, top of casing, east side of well, 0.30 foot above land-surface datum. Oct. 22, 1947, 17.71; Dec. 20, 1948, 14.76.

24.28.17.231. Carleton & Kraft. 200 feet southeast and across canal from small house, 75 feet northeast of another house, about 20 feet southeast of wheel on drop gate in canal. Drilled irrigation well, no equipment, diameter 18 inches. Reference point, top of casing, east side of well, at land-surface datum. Oct. 22, 1946, 25.9; Feb. 8, 1947, 25.1; Oct. 22, 1947, 23.51; Feb. 9, 1948, 24.87.

24.28.25.123. Montgomery. 50 feet northeast of house, under windmill tower. Drilled domestic, stock, irrigation, and fishpond well, equipped with centrifugal pump, diameter 6 inches, depth 100 feet. Reference point, top of casing, at high point, east side of well, 0.40 foot above land-surface datum. Oct. 22, 1947, 6.56, pumping.

HIDALGO COUNTY (VIRDEN VALLEY)

By R. L. Cushman and M. B. Booher

The Virden Valley is in the New Mexico portion of the Duncan-Virden Valley, which lies along the Gila River in Hidalgo County, New Mexico, and Greenlee County, Arizona.

Figure 4 in the Greenlee County, Arizona, section of this paper (p. 26) shows graphs of water-level fluctuations in wells 232 and 201 in the Virden Valley. The upward trend of the hydrographs for these wells in 1948 is not a true representation of ground-water conditions for the year. The 1948 water-level fluctuations were graphed as a straight line between a water-level measurement in May 1948 and one in March 1949. The depth to water in March 1949 was out of line with the actual trend of water levels in 1948, because of large gains in ground-water storage that started in December 1948 as a result of above-normal flows in the Gila River. Water-level fluctuations in wells in the Virden Valley actually trended downward in 1948 as the result of heavy pumping from wells to make up for dwindling surface-water supplies for irrigation, then rose sharply at the end of the year.

Well descriptions and water-level measurements

181. P. Lunt. SW¼NW¼ sec. 32, T. 18 S., R. 21 W. Records available: 1940-48. Feb. 13, 53.30; May 19, 49.30.

185. J. Pierce. SE¼SE¼ sec. 32, T. 18 S., R. 21 W. Records available: 1940-48. Feb. 13, 32.50; May 19, 32.10.

201. J. E. Payne. NW¼SE¼ sec. 2, T. 19 S., R. 21 W. Records available: 1940-48. Feb. 13, 46.65; May 19, 46.79.

202. Byron Echols. SW¼SW¼ sec. 2, T. 19 S., R. 21 W. Records available: 1939, 1942-48. Feb. 13, 16.18; May 19, 16.42. Measurements discontinued.

202A. Byron Echols. SW¼SW¼ sec. 2, T. 19 S., R. 21 W. Used drilled irrigation well, diameter 20 inches, depth unknown. Records available: 1948. Feb. 13, 17.52; May 19, 17.15.

217. Nancy O. Pace. NE¼SE¼ sec. 12, T. 19 S., R. 21 W. Records available: 1940-48. Feb. 13, 19.50; May 18, 22.00.

232. Floyd Johns. NE¼NW¼ sec. 18, T. 19 S., R. 20 W. Records available: 1940-48. Feb. 13, 28.32.

LEA COUNTY (TATUM-LOVINGTON-HOBBS AREA)

By C. S. Conover

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 1948 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 will 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:

Year of record	Water-Supply Paper	Page numbers
1929-1940	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 were measured in 112 wells in January 1948 (see part 2), and in about 28 of them in March, May, July, September, and November (see part 3). Two water-stage recorders were in operation during the year. (See part 4.) A total of 263 measurements of water level was made during the year including 12 tape measurements made upon the recorder wells.

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 1948, as reported by the U. S. Weather Bureau, was 12.00 inches at Tatum--4.11 inches below normal, 11.77 inches at

Lovington exclusive of a missing record for March--about 2.8 inches below normal, 8.76 inches at Hobbs--6.96 inches below normal, and 9.36 inches at Pearl--4.32 inches below normal. The precipitation in 1948 was, in general, greater than in 1947 when below-normal amounts were also recorded at these stations. Precipitation during the growing season of 1948 was also below normal, with the exception of June when more than 2.2 inches of rain fell at Tatum, Lovington, and Pearl, which at Pearl was 3.29 inches--1.68 inches above normal.

The acreage of land served by pumps in Lea County increased greatly during 1948. The acreage of land irrigated in 1948 is roughly estimated by W. E. Flint, county agricultural extension agent, at 25,000 acres, an increase of 15,700 acres over 1947, which, in turn, showed an increase of 4,300 acres over 1946. The greater part of the increased acreage has been planted to cotton of which, it is estimated, about 15,500 acres were irrigated in 1948. Acreages of grasses for permanent pasture and alfalfa, which in 1947 amounted to about 2,000 acres, probably increased to about 2,500 acres in 1948. The greater part of the remaining acreage was planted to row feed crops. The exact number of pumps used for irrigation in 1948 is not known but was probably about 300. The total number of irrigation wells drilled by the end of 1948 exceeded this amount, the known wells being about 385.

On the basis of metered electric power consumed in 1948 by 32 irrigation pumps that furnished water for about 2,940 acres and for which measurements of water discharged per power consumed were obtained in 1948, it is estimated that 39,000 acre-feet of water was pumped for irrigation in 1948, an increase of about 20,000 acre-feet over that pumped in 1947. Because of the increase in population, pumpage increased from about 160 acre-feet in 1947 to about 190 acre-feet in 1948 for Lovington, and from 2,085 acre-feet in 1947 to an estimated 2,500 acre-feet in 1948 for Hobbs. Pumpage of ground water for drilling of oil wells has probably decreased. Pumpage for stock, municipal, and industrial use is estimated as 8,000 acre-feet in 1948.

Changes 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 1948 were at relatively low levels as compared with January 1947 because of the below-normal precipitation and the increase in pumping in 1947. The additional increase in pumping in 1948 caused a further decline in water levels so that by January 1949 significant net declines in water level were observed in nearly all 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, in general, greater than for any previous year because of the increased pumping of ground water for irrigation. The accompanying map shows the areas of net decline in water levels from January 1948 to January 1949. In this period water levels showed a net decline of more than 1 foot over about 94 square miles and more than 2 feet over about 24 square miles.

In the pumped area surrounding Lovington the water levels declined generally more than 2 feet from January 1948 to January 1949 with a maximum observed net decline of 5.22 feet in an irrigation well about 2 miles northeast of Lovington. It was in this same well that the maximum net decline of 6.64 feet was observed in 1947. In the pumped area near McDonald and Prairieview the water levels declined generally from 1 to 2 feet from January 1948 to January 1949, slightly in excess of the declines in 1947. The maximum observed decline in this area was 5.9 feet in a well about 4 miles east of McDonald. In the lightly pumped area near and east of Humble City, water levels declined generally 1 foot, and in a well about a mile northwest of Humble City, declined 1.9 feet. In the pumped area east and north of Hobbs water levels declined generally 1 foot. The maximum observed decline in this area was 3.8 feet and occurred in two wells, one in the eastern part and the other in the northeastern part of Hobbs.

The water levels in the outlying area, generally west of the middle of R. 35 E. (see accompanying map), showed net rises in the period January 1948 to January 1949. As this area is distant from the area of irrigation wells, the water levels exhibit mainly the changes in the recharge derived

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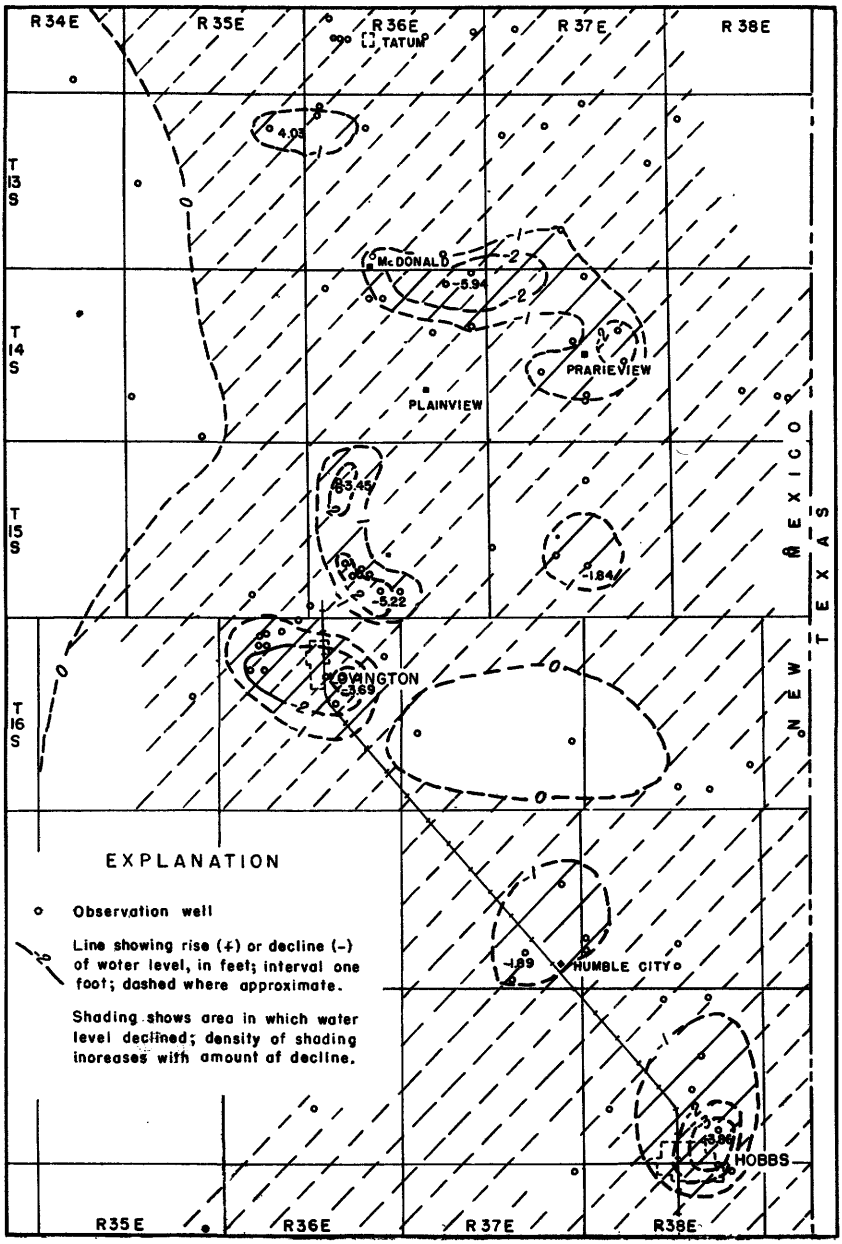

Figure 16.--Map of Tatum-Lovington-Hobbs area, Lea County, showing change of ground-water level from January 1948 to January 1949.

from precipitation. The water level in an unused well, 14.35.33.433, has shown a continuous rise since mid-1941. The rise of water level in this well was quite rapid following the heavy rains of late 1941 and early 1942. The rate of rise continued at a slackening rate until essentially a static water level was reached in 1945 and 1946. Beginning in 1947 the water level again began rising as a result of the excess precipitation in 1946. From the record of this well it appears that, in the areas remote from the effects of pumping, there has been a natural rise in the water level since 1941 which, in the areas of pumping, has been offset by the declines caused by pumping.

The seasonal fluctuations of water level in 1948 in the areas of pumping were, in general, considerably greater than the fluctuations which occurred during the preceding years. Water levels, as measured in unused wells that had previously shown practically no seasonal fluctuations, showed seasonal lowerings in 1948 of as much as 4 feet, the amount of lowering being dependent upon the distance from pumped wells and the amount of pumping. The seasonal lowering, from the highest level to the lowest level, in an unused well, 14.37.27.134, about 1½ miles south of Prairieview, was 1.8 feet in 1948, and less than 0.7 foot in 1947, whereas no seasonal lowering occurred in the preceding years. The seasonal lowering in 1948 in an unused well, 15.36.8.131, was 4.3 feet, whereas in previous years no significant seasonal lowering was observed. The declines of water level during the pumping season in 1948 reflect the effects of the increased pumping.

At the end of 1948 water levels in areas distant from the heavy pumping were generally above the previous low levels reached in early 1941, but in the pumped areas they were at their lowest recorded level. Of 72 wells having records beginning in 1941 or earlier, the lowest level on record was January 1941 in 36 of them and January 1949 in 26. 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 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
12.34.13.112	A. D. Jones Estate	3,5	29.68	14	....	.....	..	.....	..	48	
35.411	do	5	36.72	14	....	.....	..	.....	..	48	
12.36.19.223	O. V. Fisher	.	b26.79	14	-.12	22.13	43	a32.05	41	39	
24.434	Jerry Clay	.	8.55	15	-2.81	+1.32	42	all.05	46	41	
24.434a	do	3,5	22.85	15	....	.....	..	.....	..	48	
24.434b	do	5	22.25	15	....	.....	..	.....	..	48	
25.222	State of New Mexico	(Measurements discontinued)				20.18	47	24.60	41	36	48
27.212	do	3	34.52	15	-1.38	32.04	42	37.21	41	36	
29.110	(Incomplete designation used previously for well 12.36.29.112, which see)									..	..
29.111	E. D. Holt	3	30.80	14	-.08	30.72	47	30.80	48	47	
29.112	do	.	30.03	14	-.40	f27.69	44	f34.25	41	30	
29.122	do	4	28.40	14	-.52	27.88	47	f28.44	48	47	
12.37.20.331	W. O. Dunlap	.	+.09	15	-7.27	+15.24	43	+.09	48	41	
12.38.4.312	G. C. Copeland	.	40.35	15	-.05	39.15	43	43.35	41	41	
13.35.11.222	Ashley Green	.	31.59	14	-1.96	29.14	43	33.22	39	30	32-38
19.211	Clara Elkins	.	46.44	14	-1.62	44.75	46	49.07	41	41	
13.36.6.221	R. W. Duncan (Measurements discontinued, well dry)					33.45	47	36.27	41	39	48
6.231	do	5	36.54	14	....	.....	..	.....	..	48	
6.413	do	5	44.94	14	....	.....	..	.....	..	48	
9.111	Bob Baum	.	40.02	14	-1.84	38.18	47	40.02	48	47	
33.321	Lewis Beaman	.	43.40	14	-3.24	40.16	47	43.40	48	39	
35.323	M. J. McClish	.	39.49	15	-2.72	36.07	45	39.49	48	39	
13.37.3.131	J. H. Simpson	.	c39.07	15	-1.33	37.74	47	39.86	41	39	
3.133	do	.	(a)	15	....	33.83	43	35.67	41	40	42,48
7.234	W. D. Patton	3	29.57	15	+.04	29.57	48	29.61	47	47	
9.111	A. P. Breckon	5	36.33	15	....	.....	..	.....	..	48	
13.132	A. M. Brownfield	3	28.52	15	+.01	26.46	42	30.09	41	30	
28.230	A. F. Hight	.	.....	..	....	33.76	46	33.76	46	46	47,48
28.413	Mr. Dorn	.	34.32	15	-1.42	31.70	45	34.32	48	45	
13.38.6.341	Opal Fulton	.	43.83	15	+.11	43.02	45	45.62	41	40	
14.35.30.134	W. A. Anderson	.	46.50	14	+.07	45.46	45	48.93	41	39	
30.141	(Incomplete designation used previously for well 14.35.30.134, which see)									..	..
33.433	W. A. Anderson	3	39.89	14	+.17	39.89	48	42.37	30	30	
14.36.1.211	H. L. Wade	5	33.80	15	....	.....	..	.....	..	48	
2.410	C. M. King	.	40.55	15	-.84	39.02	45	40.88	41	39	
6.420	(Incomplete designation used previously for well 14.36.6.421, which see)									..	..
6.421	S. A. and W. B. Richardson	.	39.70	14	-.43	39.03	44	40.96	41	40	45
9.111	A. C. Drake	.	39.92	14	-.56	38.36	44	40.77	41	39	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
14.36.9.210	(Incomplete designation used previously for well 14.36.9.211, which see)										
9.211	O. M. Woodward	.	b42.98	14	- 2.22	40.46	43	b42.98	48	39	
13.211	Mattie Chambers	3	35.77	15	.0	35.74	46	j37.18	41	30	
14.121	V. M. Chambers	.	40.82	15	- .03	40.75	46	42.09	41	39	
14.37.3.113	Lois C. Hobbs	.	32.37	15	- .39	31.40	45	34.72	40	39	42
14.112	M. E. Powell	3	35.36	15	- .80	34.53	45	36.69	41	39	
16.421	School land	.	30.50	15	-1.05	28.86	43	31.42	39	39	
20.412	G. O. Durham	.	35.73	15	-1.80	33.30	45	35.73	48	40	
23.213	Lee Whitman	.	35.25	15	-1.35	33.90	47	35.25	48	46	
27.130	(Incomplete designation used previously for well 14.37.27.134, which see)									..	..
27.134	J. R. Fort	3	36.65	15	- .51	36.14	47	37.89	41	30	
27.311	do	5	35.13	15	...	.....	..	.....	..	48	
14.38.27.233	M. M. Gaines	.	36.98	15	- .81	34.57	43	36.98	48	43	
27.240	do	.	38.82	15	- .77	36.80	46	40.14	41	39	43-45
28.120	(Incomplete designation used previously for well 14.38.28.121, which see)									..	..
28.121	Illa Cox	3,5	26.53	15	-1.03	24.28	42	26.94	41	30	
15.35.35.112	B. B. Queen	.	40.53	14	- .55	39.60	43	41.51	41	40	
15.36.8.131	Orren Beatty	3	40.31	17	- .38	39.93	47	41.65	41	30	
8.311	M. G. Adams	5	40.13	17	...	.....	..	.....	..	48	
14.131	Ben Graham (Measurements discontinued)				...	42.38	45	43.52	41	41	46-48
28.133	J. R. Hale	.	48.62	15	- 4.09	44.53	47	48.62	48	47	
29.112	Arthur Fisher	5	44.90	17	....	.....	..	.....	..	48	
29.410	D. A. Hudgens	.	46.95	15	- 2.57	41.89	42	46.95	48	39	46
29.421	H. R. Fleming	5	47.69	15	....	.....	..	.....	..	48	
29.441	do (Measurements discontinued)				....	41.55	42	a43.95	41	41	45-48
31.311	Mr. Payton	5	47.35	14	....	.....	..	.....	..	48	
33.211	Spencer Nymeyer	.	55.78	15	- 6.64	49.14	47	55.78	48	47	
34.111	Fred Nymeyer	5	44.12	15	....	.....	..	.....	..	48	
15.37.10.113	W. A. Simpson	.	34.93	15	- .02	34.66	45	36.63	39	38	40-42,44
19.311	Otto Dean	5	44.74	15	....	.....	..	.....	..	48	
21.330	(Incomplete designation used previously for well, 15.37.21.334, which see)									..	..
21.334	R. W. Dean	3	b30.86	15	- .69	29.20	45	a39.46	41	31	
27.111	C. L. Naul	5	32.83	15	-1.60	29.38	43	32.83	48	42	45
15.38.22.441	J. W. Motsenbocker	.	32.23	17	- .56	28.72	42	32.50	41	40	
16.36.1.400	(Incomplete designation used previously for well 16.36.1.431, which see)..									..	..
1.431	Lorene Easley	.	41.22	17	+.71	39.65	45	43.84	41	39	
4.Lot 2	W. L. Barbee	.	47.64	14	-1.05	46.59	47	47.64	48	47	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
16.36.4.Lot 12	E. H. Byers	4	46.06	13	- 0.32	f43.50	43	46.20	47	35	
4.433	City of Lovington	.	53.89	18	....	52.66	40	53.89	48	40	42-47
5.Lot 10	Mrs. Mary Coxey	(Measurements discontinued, well dry)				44.53	42	46.82	47	40	48
5.Lot 14	W. B. Phillips	.	51.75	17	-2.11	45.23	42	51.75	48	39	
5.Lot 15	I. D. Phillips	5	50.09	17	....	.....	..	.....	..	48	
5.321	J. T. Gwinn	.	51.56	17	-3.20	44.81	42	51.56	48	39	
5.411	Mrs. E. J. Robinson	.	53.40	17	-3.22	45.72	42	53.40	48	39	
8.111	C. C. Chambers	5	49.89	17	....	.....	..	.....	..	48	
8.211	H. W. Gillette	5	53.67	17	....	.....	..	.....	..	48	
8.424	E. B. Yarbo	.	e51.65	17	....	50.76	44	52.48	41	38	48
10.233	J. E. Simmons	.	54.02	17	-2.03	50.22	42	54.02	48	40	
11.133	C. G. Hudgens	5	50.71	17	....	.....	..	.....	..	48	
11.232	Lorene Easley	5	53.97	17	....	.....	..	.....	..	48	
15.240	J. C. Griffin	.	50.42	16	-1.90	46.72	43	50.42	48	39	
27.133	State of New Mexico	(Measurements discontinued)				49.33	47	50.85	41	39	48
16.37.19.200	H. T. Montieth	.	30.75	17	-.43	28.60	42	30.90	41	38	
24.431	R. L. Robinson	5	36.20	17	....	.....	..	.....	..	48	
33.110	Elbert Shipp	5	.....	..	....	27.48	42	30.63	41	39	47,48
16.38.25.144	J. S. and Rose Eaves	.	33.12	17	-.47	31.90	42	34.61	41	41	
34.131	Ralph Moe	3	36.53	17	-1.14	35.39	47	36.53	48	47	
35.110	Mrs. P. S. Bennett	.	37.23	17	-2.06	34.02	44	37.23	48	40	
16.39.20.131	O. D. Ferguson	5	32.47	17	....	.....	..	.....	..	48	
17.34.35.130	Phillips Petroleum Co.	3	90.06	16	+.02	90.06	48	91.98	41	41	
17.35.35.213	do	3	38.60	16	+.04	38.60	48	41.45	41	41	
17.36.3.333	State of New Mexico	3	42.22	16	-.11	42.02	44	44.29	41	39	
27.131	Wallace Mitchell	3,5	33.14	16	....	.....	..	.....	..	48	
17.37.13.310	(Incomplete designation used previously for well 17.37.13.312, which see)									..	..
13.312	John Catchings	.	26.95	16	-.41	26.05	44	28.84	41	39	
26.333	Mrs. D. B. Wilhoit	.	28.88	16	-1.73	26.21	43	30.62	46	38	
34.441	M. J. Waltman	.	26.03	16	-.86	24.60	43	27.22	41	41	
36.141	State of New Mexico	(Measurements discontinued)				23.78	42	26.15	40	39	41,46-48
17.38.27.133	W. E. Manning	.	26.64	16	-1.09	25.55	47	26.64	48	46	
30.113	W. H. Martin	.	27.82	16	-2.20	23.97	42	27.95	41	38	
30.312	C. M. Hawkins	3	29.22	16	-1.14	26.47	42	30.44	41	30	
34.113	W. E. Busby	.	26.31	16	-.97	24.78	44	26.31	48	44	
18.36.27.111	State of New Mexico	3	39.86	16	-.37	38.13	43	41.66	41	39	
18.38.2.131	Sam Dalmont	.	28.77	16	-.45	27.20	43	30.64	40	39	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
18.38.4.232	J. R. Isaacs	3	23.67	16	-0.60	22.17	43	25.59	40	30	
15.241	Mr. Harris	3	28.17	16	-.57	26.77	43	29.16	41	40	
22.411	S. C. Albertson	.	35.37	16	-.74	34.43	43	35.67	41	40	
22.412	M. C. Younger	.	.....	..	....	37.09	43	38.69	41	40	47,48
23.131	Charles Mills	(Measurements discontinued)				40.59	45	40.62	44	44	46-48
26.343	J. F. Mattox	.	43.82	16	-1.72	k40.30	43	b44.23	45	40	
30.200	Mrs. Sadie Davis	3	23.19	16	+.12	23.19	48	27.56	31	31	
19.35.13.211	Clara Fowler	3	20.83	16	-1.76	18.38	42	a26.67	30	30	
24.222	F. K. Turner	.	18.76	16	-.98	17.78	47	20.38	41	39	
19.36.19.113	L. S. Evans	.	15.82	16	-.76	15.06	47	17.93	41	39	
19.411	C. R. Jordan	.	16.52	16	-.17	16.35	47	m16.57	44	42	
32.111	S. P. Jordan	.	16.47	16	-1.18	15.15	42	18.60	40	39	
32.321	E. T. Childers	.	.....	..	....	23.80	42	26.77	46	42	48
32.323	do	.	.....	..	....	23.17	42	26.18	46	42	48
19.37.1.231	Hobbs Country Club	.	25.87	16	-1.12	24.75	47	25.87	48	45	
32.241	Mrs. E. A. Anderson	3	12.30	16	-.23	11.50	33	12.31	37	30	
32.241a	do	5	12.30	16	....	.....	..	.....	..	48	
19.38.2.122	A. C. Cheser	.	48.50	16	-1.41	43.59	42	48.50	48	40	
2.242	J. E. Nixson	.	45.74	16	-.98	44.38	42	46.97	41	41	
2.424	A. C. Cheser	.	b50.12	16	-7.03	43.09	47	46.54	41	41	42
20.35.1.222	J. L. Wood	3	20.64	16	+.41	19.70	44	25.63	41	30	
20.37.9.110	W. H. Laughlin	3	30.40	16	-.96	27.18	43	42.40	38	30	36,37
9.110a	do	3	29.55	16	-.90	26.36	43	37.12	41	41	

a Pumping.
b Pumping recently.
e Dry at depth given.
f From recorder charts.
j Also 1937.
k March 30.
m Also 1946.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Location number Owner	12.34. 13.112 Jones	12.36. 24.434a Clay	12.36. 27.212 State of N.M.	12.36. 29.111 Holt	13.37. 7.234 Patton	13.37. 13.132 Brown-field	14.35. 33.433 Ander-son	14.36. 13.211 Cham-bers
Jan. 14,15	29.68	22.85	34.52	30.80	29.57	28.52	39.89	35.77
Mar. 26	29.57	a24.35	34.76	c31.36	29.57	28.56	39.87	35.80
May 24-26	29.62	a24.10	34.94	31.34	29.64	28.58	39.86	35.86
July 26	29.79	23.08	35.26	31.76	29.70	28.62	39.83	36.13
Sept.27	33.53	23.20	e34.27	31.69	29.77	28.66	39.82	36.48
Nov. 17,18	30.90	a23.18	.....	31.61	29.80	28.69	39.80	36.68

Location number Owner	14.37. 14.112 Powell	14.37. 27.134 Fort	14.38. 28.121 Cox	15.36. 8.131 Beatty	15.37. 21.333 Dean	16.38. 34.131 Moe	17.34. 35.130 Petro-leum	17.35. 35.213 Petro-leum
Jan. 15-17	35.36	36.65	26.53	40.31	b30.86	36.53	90.06	38.60
Mar. 25,26	35.33	36.80	26.26	40.27	30.10	36.09	89.98	38.78
May 24,25	35.45	37.38	26.57	41.67	30.23	a56.35	89.96	38.81
July 24,26	36.30	37.98	27.42	43.28	30.47	42.57	89.95	38.85
Sept.25,27	37.33	38.46	27.20	44.64	30.85	39.33	89.99	38.90
Nov. 16-18	37.62	38.10	27.47	44.09	31.02	37.35	89.96	38.91

Location number Owner	17.36. 3.333 State of N.M.	17.36. 27.131 Mitch-ell	17.38. 30.312 Haw-kins	18.36. 27.111 State of N.M.	18.38. 4.232 Isaacs	18.38. 15.241 Harris	18.38. 30.200 Davis	19.35. 13.211 Fowler
Jan. 16	42.22	33.14	29.22	39.86	23.67	28.17	23.19	20.83
Mar. 25,26	42.28	35.90	29.36	39.85	23.72	28.09	23.17	21.10
May 24,25	42.45	35.20	29.43	39.91	23.88	35.61	23.37	21.27
July 23,24	42.64	33.19	29.16	39.97	24.80	33.07	23.53	21.36
Sept.25,27	42.55	33.17	29.32	40.04	24.24	34.06	23.77	21.52
Nov. 16,17	42.55	33.10	29.75	40.05	24.23	30.80	23.79	21.64

Location number Owner	19.37. 32.241 Ander-son	20.35. 1.222 Wood	20.37. 9.110 Laugh-lin	20.37. 9.110a Laugh-lin
Jan. 16	12.30	20.64	30.40	29.55
Mar. 25	12.29	20.73	30.22	29.33
May 24	12.32	20.80	30.55	29.70
July 23	12.32	20.55	30.81	29.96
Sept.25	12.28	20.94	31.12	30.26
Nov. 16	12.32	21.09	31.16	30.32

a Pumping.
b Pumping recently.
c Nearby well pumping.
e Dry at depth given.

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: Feb. 10, 23, 28.35; Nov. 9, 29.26.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	28.42	28.38	28.37	28.61	28.73	28.82	29.01	29.14	29.22	29.22	29.19	29.21
2	28.39	28.39	28.38	28.62	28.73	28.81	29.03	29.13	29.21	29.23	29.20	29.22
3	28.39	28.37	28.38	28.63	28.73	28.80	29.05	29.13	29.20	29.22	29.18	29.22
4	28.44	28.37	28.40	28.65	28.72	28.79	29.06	29.14	29.19	29.21	29.18	29.20
5	28.43	28.37	28.39	28.66	28.72	28.79	29.08	29.17	29.19	29.20	29.21	29.22
6	28.44	28.38	28.39	28.67	28.75	28.80	29.09	29.19	29.19	29.20	29.23	29.21
7	28.42	28.38	28.39	28.69	28.77	28.83	29.10	29.22	29.19	29.22	29.23	29.21
8	28.39	28.39	28.38	28.71	28.80	28.85	29.11	29.24	29.19	29.22	29.24	29.21
9	28.40	28.38	28.38	28.70	28.82	28.87	29.11	29.24	29.21	29.21	29.26	29.22

12.36.29.122--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
10	28.41	28.35	28.39	28.68	28.84	28.87	29.12	29.24	29.20	29.21	29.25	29.21
11	28.38	28.37	28.42	28.68	28.85	28.87	29.11	29.23	29.19	29.21	29.24	29.20
12	28.38	28.37	28.41	28.69	28.85	28.86	29.10	29.22	29.18	29.22	29.25	29.21
13	28.42	28.37	28.37	28.70	28.83	28.83	29.10	29.22	29.18	29.22	29.25	29.21
14	28.38	28.39	28.36	28.69	28.82	28.86	29.09	29.22	29.19	29.22	29.25	29.20
15	28.37	28.38	28.38	28.70	28.82	28.85	29.09	29.22	29.21	29.22	29.23	29.21
16	28.38	28.38	28.40	28.72	28.81	28.85	29.12	29.22	29.22	29.22	29.23	29.22
17	28.38	28.38	28.41	28.74	28.81	28.85	29.14	29.21	29.25	29.24	29.21	29.22
18	28.37	28.37	28.40	28.75	28.82	28.85	29.16	29.19	29.25	29.22	29.22	29.22
19	28.39	28.37	28.46	28.77	28.84	28.86	29.15	29.19	29.25	29.21	29.23	29.22
20	28.38	28.37	28.48	28.79	28.87	28.87	29.16	29.18	29.19	29.21	29.22	29.21
21	28.37	28.37	28.52	28.80	28.84	28.87	29.17	29.18	29.25	29.21	29.23	29.21
22	28.36	28.36	28.54	28.81	28.85	28.87	29.18	29.18	29.24	29.22	29.23	29.22
23	28.37	28.35	28.55	28.79	28.83	28.90	29.20	29.17	29.24	29.22	29.22	29.21
24	28.37	28.40	28.56	28.79	28.83	28.92	29.20	29.16	29.24	29.21	29.21	29.21
25	28.39	28.40	28.58	28.79	28.82	28.94	29.20	29.16	29.24	29.20	29.21	29.23
26	28.39	28.37	28.60	28.78	28.83	28.96	29.18	29.17	29.25	29.19	29.22	29.22
27	28.40	28.36	28.62	28.77	28.82	28.98	29.18	29.21	29.23	29.19	29.22	29.21
28	28.38	28.39	28.62	28.77	28.82	28.99	29.16	29.23	29.22	29.19	29.25	29.20
29	28.37	28.38	28.60	28.74	28.81	28.99	29.16	29.23	29.21	29.19	29.24	29.22
30	28.37		28.59	28.73	28.81	29.00	29.16	29.23	29.21	29.19	29.23	29.23
31	28.37		28.59		28.81		29.15	29.23		29.18		29.22

16.36.4.lot 12. E. H. Byers. Highest and lowest recorded water levels: Mar. 14, 18, 30, 45.88; Sept. 21, 49.47.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	45.97	.....	45.90	47.04	47.84	48.01	48.73	.....	48.66	47.78	47.51
2	.....	.....	.....	45.90	47.07	47.79	48.15	48.70	.....	48.61	47.76	47.51
3	.....	.....	.....	45.89	47.08	47.73	48.14	48.80	.....	48.57	47.74	47.50
4	.....	.....	.....	45.89	47.19	47.67	48.06	48.93	.....	48.51	47.73	47.49
5	.....	.....	.....	45.89	47.27	47.62	47.97	48.96	.....	48.47	47.73	47.49
6	.....	.....	.....	45.89	47.38	47.57	47.95	48.97	.....	48.43	47.72	47.48
7	.....	.....	.....	45.97	47.46	47.53	48.08	48.89	.....	48.39	47.72	47.47
8	.....	.....	.....	46.15	47.53	47.50	48.23	48.79	.....	48.35	47.72	47.48
9	.....	.....	.....	46.33	47.59	47.46	48.26	48.75	.....	48.32	47.72	47.48
10	.....	.....	.....	46.40	47.59	47.41	48.28	48.82	.....	48.29	47.68	47.46
11	.....	.....	.....	46.41	47.58	47.38	48.33	48.96	.....	48.25	47.68	47.46
12	.....	.....	.....	46.42	47.64	47.36	48.34	49.03	.....	48.21	47.67	47.46
13	46.05	.....	.....	46.43	47.72	47.33	48.39	49.06	.....	48.18	47.65	47.45
14	46.03	.....	45.88	46.55	47.78	47.29	48.43	49.10	.....	48.15	47.64	47.44
15	46.02	.....	45.89	46.69	47.85	47.29	48.46	49.13	.....	48.13	47.62	47.46
16	46.02	.....	45.90	.....	47.92	47.38	48.51	49.12	.....	48.10	47.62	47.45
17	46.00	.....	45.90	.....	47.95	47.56	48.56	49.13	.....	48.10h	47.60	47.45
18	46.00	.....	45.88	46.71	47.96	47.77	.....	49.07	.....	48.11	47.61	47.45
19	46.00	.....	45.90	46.70	47.98	47.88	.....	49.09	49.44	48.11	47.59	47.43
20	45.99	.....	45.90	46.80	48.02	47.84	.....	49.17	49.45	48.11	47.59	47.43
21	45.99	.....	45.90	46.78	48.05	47.78	.....	49.21	49.47	48.11	47.59	47.43
22	45.98	.....	45.90	46.74	48.10	47.73	.....	49.24	.....	48.11	47.56	47.41
23	45.99	.....	45.91	46.71	48.16	47.66	.....	49.23	.....	48.11	47.56	47.43
24	45.98	.....	45.91	46.69	48.17	47.64h	48.81	49.27	.....	47.98	47.54	47.43
25	45.99	.....	45.89	46.66	48.19	47.61	48.85	49.29	49.09	47.97	47.54	47.43
26	45.99	.....	45.90	46.64	48.21	47.57	48.80	.....	49.00	47.95	47.53	47.43
27	45.99	.....	45.90	46.64	48.22	47.53	48.77	.....	48.91	47.94	47.53	47.43
28	45.98	.....	45.89	46.73	48.15	47.53	48.79	.....	48.83	47.93	47.53	47.41
29	45.98	.....	45.89	46.86	48.06	47.65	48.87	.....	48.77	47.91	47.52	47.41
30	45.98		45.88	46.94	47.98	47.82	48.90	.....	48.71	47.80	47.52	47.41
31	45.97		45.89		47.90		48.83	.....		47.78		47.41

h Tape measurement at odd hour.

Part 5. Miscellaneous data concerning observation wells

12.34.13.112. Jones. Drilled irrigation well, equipped with turbine pump, diameter 13 inches, depth 110 feet. Reference point, beginning January 1948, top of concrete base, 0.40 foot above land-surface datum. May 22, 1947, 30.72.

12.34.35.411. Jones. Drilled irrigation well, equipped with turbine pump, diameter 15 inches, depth 130 feet. Reference point, surface of concrete pump base, 0.67 foot above land-surface datum.

12.36.24.434a. Clay. 45 feet northwest of artesian well 12.36.24.434, 75 feet north of house. Drilled domestic well, equipped with windmill, diameter 6 inches. Reference point, top of concrete pump base, at land-surface datum. Nov. 15, 1947, 22.90.

12.36.24.434b. Clay. About 20 feet south of well 12.36.24.434. Drilled well, no equipment, diameter 6 inches. Reference point, top of concrete around well casing, 0.60 foot above land-surface datum.

13.36.6.231. Duncan. South of house. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 103 feet. Reference point, top of concrete pump base, 0.50 foot above land-surface datum.

13.36.6.413. Duncan. Drilled irrigation well, equipped with turbine pump, diameter 14 inches, depth 105 feet. Reference point, surface of concrete pump base at northwest side of well, 0.50 foot above land-surface datum.

13.37.9.111. Breckon. Drilled well, no equipment, diameter 12 inches, depth 242 feet. Reference point, top of concrete base, 0.50 foot above land-surface datum. July 23, 1946, 36.65.

14.36.1.211. Wade. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 132 feet. Reference point, top of 2½- by 2½-foot concrete pump base, 0.26 foot above land-surface datum.

14.37.27.311. Fort. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 130 feet. Reference point, top of concrete pump base, 0.10 foot above land-surface datum.

14.38.28.121. Cox. Reference point not located. Reference point, established July 26, 1948, top of well cribbing east side of well, near center, 0.14 foot below land-surface datum.

15.36.8.311. Adams. About 30 feet east of road, in fence corner. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 110 feet. Reference point, top of concrete base, 0.65 foot above land-surface datum. Nov. 17, 44.72.

15.36.29.112. Fisher. Drilled irrigation well, equipped with turbine pump. Reference point, surface of concrete pump base, 0.50 foot above land-surface datum.

15.36.29.421. Fleming. Drilled irrigation well, equipped with turbine pump, diameter 14 inches. Reference point, top of concrete pump base, at land-surface datum.

15.36.31.311. Payton. Drilled irrigation well, equipped with turbine pump. Reference point, top of 2½- by 2½-foot concrete pump base, 0.58 foot above land-surface datum.

15.36.34.111. Nymeyer. 10 feet south of section-line road and fence. Drilled irrigation well, equipped with turbine pump. Reference point, top of 3- by 3-foot concrete pump base, 1.00 foot above land-surface datum.

15.37.19.311. Dean. Drilled irrigation well, equipped with turbine pump, depth 108 feet. Reference point, top of concrete pump base, 0.25 foot above land-surface datum.

15.37.27.111. Naul. Reference point, established Jan. 15, 1948, top of concrete pump base, 0.41 foot above land-surface datum.

16.36.5.Lot 15. Phillips. Drilled irrigation well, equipped with turbine pump. Reference point, top edge of 3- by 3-foot concrete base, east side of well, 1.00 foot above land-surface datum.

16.36.8.111. Chambers. Drilled irrigation well, equipped with turbine pump, diameter 10 inches, depth about 75 feet. Reference point, top of 3- by 3-foot concrete base, 0.75 foot above land-surface datum.

16.36.8.211. Gillette. Drilled irrigation well, equipped with turbine pump. Reference point, top of 2½- by 2½-foot concrete pump base, 0.17 foot above land-surface datum.

16.36.11.133. Hudgens. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 0.43 foot above land-surface datum. July 28, 1944, 50.78.

16.36.11.232. Easley. About half a mile north of an artificial lake. Drilled well, equipped with turbine pump. Reference point, surface of concrete pump base, 0.22 foot above land-surface datum.

16.37.24.431. Robinson. In a tile brick shed. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 100 feet. Reference point, top of concrete base, 0.23 foot above land-surface datum.

16.37.33.110. Shipp. Aug. 14, 29.17.

16.39.20.131. Ferguson. About 100 feet south of house and 100 feet east of road. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 132 feet. Reference point, top of casing and concrete pump base, 0.26 foot above land-surface datum. May 24, 1946, 32.09.

17.36.27.131. Mitchell. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, west side of well, 0.50 foot above land-surface datum. Nov. 17, 1947, 33.52.

19.37.32.241a. Anderson. East of Amerada Oil Co. well 4, D. F. Larseen, about 50 feet south of observation well 19.37.32.241. Drilled domestic well, with windmill tower. Reference point, top of circular concrete well curb, at northwest side of well, 0.85 foot above land-surface datum of well 19.37.32.241.

LUNA COUNTY (MIMBRES VALLEY)

By C. S. Conover and H. O. Reeder

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 1948 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 Luna County in past years have been published in the following Geological Survey water-supply papers:

Year of record	Water-Supply Paper	Page numbers
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 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 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 142 wells distributed throughout the area in January 1948. Water levels were also measured in about 63 of these wells in March, May, July, September, and November. Water-stage recorders were operated throughout the year on the same 4 wells as in preceding years. A total of 466 water-level measurements was made during the year on the observation wells, including 25 tape measurements made on the recorder wells. All measurements of water level were made by H. O. Reeder, except those in January which were made by C. R. Murray, and those in March which were made by C. S. Conover and H. O. Reeder.

Precipitation and pumpage

Precipitation on the Mimbres Valley, particularly on the headwaters of the Mimbres River, is the eventual source of the water stored in the aquifer. Precipitation also furnishes part of the water requirement of the crops and, consequently, at such times reduces the amount of pumping

necessary. In 1948 the precipitation at Deming, as reported by the U. S. Weather Bureau, was 5.26 inches, 4.45 inches below normal and 0.20 inch less than in 1947. The precipitation at Columbus, near the Mexican border, was 6.91 inches, 2.78 inches below normal while that at Mimbres Ranger Station in the area of the headwaters of the Mimbres River, was 16.98 inches, 1.39 inches below normal. The precipitation at Gage was 10.05 inches which is normal. As precipitation during the main part of the growing season, April to September, amounted to only 1.41 inches, 4.98 inches below normal, practically all the water required by the crops was furnished by irrigation.

The acreage irrigated in the Mimbres Valley has continued to increase year by year, with an estimated 24,000 acres being irrigated in 1948, an increase of about 5,000 acres over 1947. 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 195 comparable pumps, it is estimated that about 7 percent more water was required for crops in 1948 thanin 1947, and that about 56,000 acre-feet of water was pumped for irrigation in 1948. An additional 2,200 acre-feet is estimated to have been used for domestic and industrial purposes, a slight decrease from 1947, mainly as a result of decreased use for the Deming swimming pool. The city of Deming used slightly more water for domestic purposes in 1948 than in 1947.

Changes of water level

The ground-water levels declined from January 1948 to January 1949 more than 1 foot over all of the irrigated area except a small area of less than 1 square mile east of Deming, as shown on the accompanying map. The ground-water levels declined more than 1 foot over an area of about 177 square miles, and more than 2 feet over an area of about 69 square miles. The area in which water levels declined more than 3 feet was about 19 square miles, practically all of which was south of Deming. It is in this area of large decline that most of the recent development has occurred.

The two wells in the north half of section 28, T. 23 N., R. 8 W., where a rise is indicated, were measured 11 days after the surrounding wells because of impassable roads across the Mimbres River. Before and during this time water flowed in the normally dry river and undoubtedly

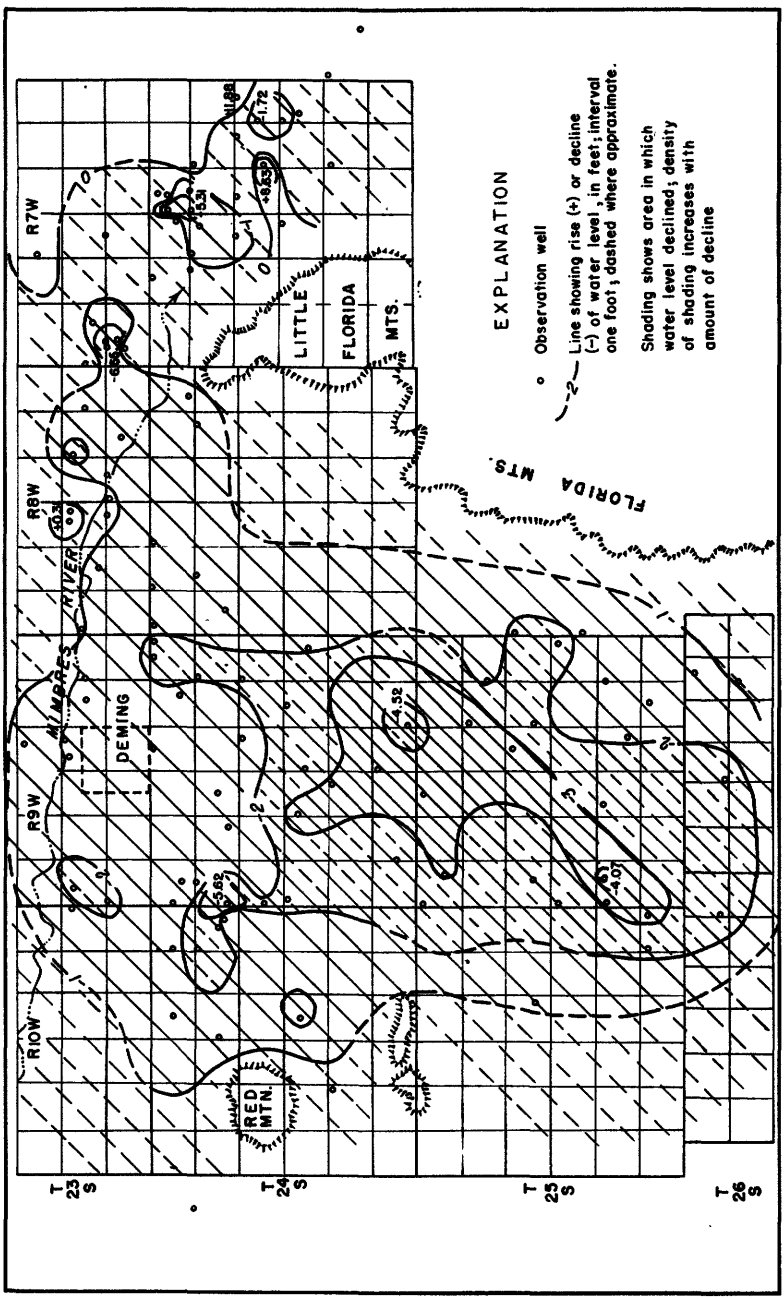

Figure 17.-- Map of Mimbres Valley, Luna County, N. Mex., showing decline of ground-water level from January 1948 to January 1949.

contributed recharge to the ground-water body, as evidenced by the rise in water levels in these two wells. In this same moderately pumped area along the Mimbres River the water levels declined more than 2 feet from January 1948 to January 1949 over an area of about one-fourth of a square mile, as compared with a like decline in an area of about 7 square miles in 1947.

The area of decline of water level of more than 1 foot in the irrigated area northeast of the Little Florida Mountains covered about 3 square miles, as compared with 5 square miles in the preceding year. In this area two deep wells, drilled several years ago, showed declines in water level of 3.1 feet and 5.3 feet, respectively. However, in two shallow wells that are close to two deep wells, drilled during 1948, the water level rose 11.9 feet and 8.6 feet, respectively. This decline in level of the deep water and rise of the shallow water is the result, in part, of leakage of water from the lower aquifers, penetrated by the deep wells, to the upper aquifers. The rise in water level in the shallow wells and the decline in the deep wells is also due, in part, to a reduction in pumpage from the shallow wells and an increase in pumpage from the deeper wells, as a result of transfer of some pumps from shallow to deep wells. The depth to water in the shallow wells in secs. 3, 4, 9, and 10, T. 24 S., R. 7 W. is approximately 50 to 70 feet greater than the depth to water in the deep wells that are sealed off from the shallow aquifers in the same area. The water level in the deep wells is probably dependent in part upon the effectiveness of the sealing of the well casings.

Water levels in three wells in sec. 31, T. 23 S., R. 7 W. showed declines in excess of 5 feet in the period January 1948 to January 1949, as compared with declines of more than 4 feet in the previous year. These wells are evidently to the east of a presumed underground dam that extends northward from the Little Florida Mountains. The lowering of water level by pumping in the area to the west of this underground dam may have reduced the flow of ground water eastward across the dam and, thus, contributed partly to the large lowering of water level in the wells in sec. 31.

Water levels in observation wells near the Mimbres River, about 13 miles northwest of Deming, showed declines of from 0.5 foot to more than 1 foot from January 1948 to January 1949. Two wells very near the Mimbres River, where the river leaves the hills and enters upon the alluvial plain, showed slight rises in water level. The declines indicate deficient recharge from the Mimbres River during 1948, but the slight rises close to the river channel indicate some recharge had been contributed from the flow in the river that occurred at the beginning of 1949.

The increased area of decline of water levels in 1948, 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 during the year of more than:

Year	1 foot	2 feet	3 feet
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
1948	177	69	19

As the water pumped in the Mimbres Valley is being taken from groundwater 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, but the decline will continue as the pumage is primarily from storage.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
21.10.6.112	Tom Tigner	3	9.35	17	+0.41	6.57	33	9.76	47	29	
21.11.13.411c	Claude Irwin	3	49.85	17	-5.17	38.77	46	49.85	48	45	
35.310	State of New Mexico	3	34.85	17	-1.18	18.76	32	34.85	48	30	
22.10.18.121	do	3	77.11	17	-.91	68.51	30	77.11	48	29	
20.210	do	.	93.26	17	-.97	88.72	40	93.26	48	40	42
22.11.2.210	do	3	35.18	17	-1.11	21.11	30	35.18	48	30	
13.122	do	3	68.94	17	-.85	59.07	30	68.94	48	29	
13.221	do	3	75.58	17	-.88	66.06	30	75.58	48	29	
13.411	do	.	77.05	17	-.75	76.30	47	77.05	48	47	
14.222	do (Measurements discontinued)			..	....	50.23	32	59.46	46	29	36-39,47,48
23.222	do	3	55.78	17	-.89	47.43	42	60.30	37	29	31,33-35
24.211	do	.	77.87	17	-.82	77.05	47	77.87	48	47	
23.7.17.242	Jack Smyer	.	94.89	12	....	92.90	42	94.89	48	42	44,47
21.311	Unknown	3	71.53	12	-.57	69.56	45	71.53	48	45	
30.433	John Kelly	.	66.18	12	-.94	58.42	40	66.18	48	40	
30.Lot 16	H. T. Foster	3	29.57	16	-.87	22.62	32	29.57	48	32	33,38
31.111	William Haas	.	61.05	16	-4.51	39.49	40	61.05	48	40	46
31.111a	do	.	60.20	16	-4.25	55.95	47	60.20	48	47	
31.132	do	.	63.48	16	-4.68	40.60	40	63.48	48	40	46
31.133	do	3	51.17	16	-2.31	48.86	47	51.17	48	47	
33.211	Lewis and R. S. Smyer	.	67.00	12	....	59.99	40	67.00	48	40	47
23.8.3.322	U. S. Government	3	133.08	17	-.38	131.14	42	133.08	48	42	43
13.411	E. P. Peeples	.	40.14	17	....	34.67	30	40.14	48	30	31-36,44,47
25.311	Ed Remondini	.	26.30	16	-2.49	20.75	40	26.30	48	40	
26.131	W. L. Bankston	3	41.18	16	....	28.26	28	41.18	48	28	31,33,47
28.231	C. R. Lewis, Jr.	.	53.30	16	-2.78	43.50	42	53.30	48	42	
28.241	do (Measurements discontinued, well inaccessible)					40.23	40	49.93	47	40	48
29.433	E. Krenek	.	53.50	16	-1.83	42.56	39	53.50	48	39	
30.133	H. A. Norvell	.	51.99	15	-2.43	44.96	39	51.99	48	39	
32.323	H. H. Holiday	(Measurements discontinued)				33.22	29	e45.8	47	29	33,48
33.221	Geo. Dowdle	.	46.40	16	-3.42	35.66	40	46.40	48	40	
34.111	do	3	43.49	16	-2.87	33.52	40	43.49	48	40	
34.211	E. B. Law	3	41.65	16	-2.58	27.50	29	41.65	48	29	
35.233	Joe Remondini	.	a43.16	16	-13.69	29.14	44	30.44	45	44	
23.9.7.240	P. D. Torres	.	100.75	17	-.65	97.06	40	100.75	48	40	
22.213	Roy Perkins	3	65.25	15	-.72	58.77	32	65.25	48	29	30,31,33-36
25.311	Albert Ernst	3	59.63	15	-1.08	50.40	28	59.63	48	28	31,33

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
23.9.26.410	H. H. Ruebush	.	59.28	15	-0.90	53.64	39	59.28	48	39	
27.142	H. J. Thomas	3	64.10	15	-.52	54.75	32	64.10	48	j29	30,31,33,34
27.221	J. D. McDaniels	3	60.64	15	-.08	52.18	30	60.64	48	j29	31,33
30.142	J. M. Mazac	.	84.80	16	-1.41	83.39	47	84.80	48	47	
31.110	Glen Neighbors	.	80.82	16	-1.70	75.38	40	80.82	48	40	
23.10.25.242	J. M. Mazac	.	84.17	16	-1.33	82.84	47	84.17	48	47	
24.6.29.300	Bill Birchfield	.	68.22	12	-.20	66.89	j41	a68.26	44	j41	42
30.111	do	.	69.52	12	-.42	66.16	j41	69.52	48	j41	
24.7.3.311	G. D. Hatfield	3	16.74	17	-6.00	7.36	46	16.74	48	45	
3.321	Lewis Smyer	5	88.90	12	....	.....	..	.....	..	48	
4.424	G. D. Hatfield	3	89.72	12	+.15	65.36	29	89.87	47	29	30,33
5.211	R. M. Williamson	3	87.89	12	-1.15	66.90	32	87.89	48	32	33,38
8.212	J. M. McDougall	.	c103.54	12	-18.57	78.47	40	84.97	47	40	44
9.111	Smyer Bros.	3	86.67	12	-.40	77.25	39	86.67	48	39	
9.111a	do	3	42.24	12	-4.02	38.22	47	42.24	48	47	
9.241	G. D. Hatfield	3	90.34	12	+1.19	84.60	40	91.80	44	40	
9.241a	do	.	33.51	12	-5.0	21.49	45	33.51	48	45	
10.111	do	3,5	67.09	12	....	20.73	47	91.67	44	40	46
10.211	Fred Hassman	3	92.32	12	+.03	82.47	40	92.35	47	40	
11.111	Edith E. Pollard	.	89.25	12	-.07	74.69	39	90.49	46	39	42
13.212	F. S. Dale	.	73.84	12	-1.66	66.53	40	73.84	48	40	
13.311	Mr. Miramontes	.	81.21	12	-1.87	69.97	39	81.21	48	39	
14.221	J. H. Winslow	4	85.07	12	-1.45	f72.11	39	f85.25	48	39	
14.331	Cecil and Roger Miller	.	84.71	12	-2.48	76.38	40	84.71	48	40	
15.122	J. L. Caudill	.	90.92	12	-1.46	79.36	39	90.92	48	39	
16.211b	Geo. Snyder	3,5	88.63	12	-.94	81.08	42	88.63	48	42	
21.222	C. W. Geurin	.	79.37	12	-.96	70.19	40	79.37	48	40	
24.111	Jasper Wilson	3	78.31	12	-1.16	69.79	40	78.31	48	40	
24.312	Bill Birchfield	3	74.08	12	-.69	68.60	41	74.08	48	41	
26.113	do	3	72.86	12	-.64	69.59	43	72.86	48	43	
24.8.1.333b	F. K. Kretek	3	21.02	16	-1.47	15.86	45	21.02	48	40	
4.111	Foy Riley	4	42.30	16	-1.87	35.59	41	f42.30	48	41	
5.111	R. A. Hackebeil	.	48.37	16	-1.56	34.52	29	48.37	48	29	31-33,35-37
6.112	Deming Air Base	3	54.67	15	-1.43	49.22	43	54.67	48	43	
7.431	Paul Hrna	.	45.69	13	-1.85	39.06	42	45.69	48	42	43
8.121	Mrs. J. F. Holiday	.	47.40	16	-1.41	40.21	39	47.40	48	39	
11.221	F. K. Kretek	3	20.30	16	-1.34	12.60	34	20.30	48	32	33,35

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
24.9.1.211	Deming Air Base	3	60.19	15	- 1.36	55.64	43	60.19	48.	43	
1.222	do	3	57.32	15	- 1.44	54.69	44	57.32	48	44	
2.421	Roscendo Trujillo	3	59.50	15	- 1.02	48.10	33	59.50	48	32	34,35
3.121	Jim Swartz		(Measurements discontinued)			59.09	42	62.34	46	42	47,48
3.122	Unknown	.	63.89	15	- 1.47	62.42	47	63.89	48	47	
6.311	J. B. Wells	.	81.53	16	- 1.43	61.35	28	81.53	48	28	31,33
6.431	State of New Mexico	3	74.29	16	- 4.19	f57.45	42	74.29	48	42	
7.211	Emanuel Vocale	.	80.95	16	- 9.65	67.49	42	80.95	48	39	
7.331	S. R. Moir	3	82.18	16	- 1.75	66.10	30	82.18	48	30	31,33
8.441	F. A. Bredecko	.	77.83	15	- 2.31	68.60	40	77.83	48	40	
9.411	Joe Clary	3	71.35	15	- .32	65.16	39	71.35	48	39	
12.111	E. H. Hatcher	.	60.33	13	- 1.45	47.68	28	60.33	48	28	31,32
13.111	Mary E. Barrett	3	56.02	15	- 3.04	14.92	28	56.02	48	28	31,33
15.221	Joe Lutonsky	5	65.67	15	+1.73	61.60	40	67.40	47	40	
15.221a	do	5	64.65	15	....	.....	..	.....	..	48	
18.311	Chas. Peter	.	80.26	15	- 1.86	72.38	40	80.26	48	40	
19.111	Francis Ligocky	.	81.40	15	- 2.01	72.82	40	81.40	48	40	
21.131	L. L. Gaskill	3	78.80	15	- 1.54	59.33	29	78.80	48	28	33
22.311	Joe Hrna	.	76.14	15	- 2.79	69.50	45	76.14	48	45	
23.211	Emanuel Vocale	.	75.56	13	- 2.23	58.12	30	75.56	48	30	33
24.421	W. F. Roberts	.	65.05	13	- 1.87	57.99	41	65.05	48	40	
26.211	Unknown	.	.....	..	....	.....	..	.....	..	47	48
28.221	John Hrna		(Measurements discontinued)			62.88	41	74.65	47	41	48
32.311	D. D. Roderick	.	80.88	14	- 3.02	69.00	40	80.88	48	40	
34.111a	V. V. Norwood	.	72.85	15	- 4.62	65.94	46	72.85	48	46	
35.331	J. E. Howell	3,5	71.12	13	....	.....	..	.....	..	48	
24.10.1.311	R. V. Griggs	3	84.69	16	- .78	78.45	42	84.69	48	41	
3.411	A. M. and B. L. Speir	3	92.41	16	- .76	79.17	30	92.41	48	30	31,33,34
3.411b	do	3	84.55	16	-1.21	75.34	42	84.55	48	41	
10.311	Jim Hurt	3	86.74	15	- 1.38	76.53	30	86.74	48	30	33,34,36
12.111	Morgan Garratt	.	85.73	16	- .31	79.69	39	85.73	48	39	46
12.431	Steve Hrna	4	84.08	16	- 1.32	f78.08	40	f84.38	48	40	
12.432a	do	5	84.56	16	- 1.59	77.29	40	84.56	48	40	
12.432b	do	.	85.10	16	- 1.81	78.05	40	85.10	48	40	
22.211	E. F. Hurt	3	74.42	15	- 1.43	69.61	42	74.42	48	42	
29.222	State of New Mexico	3	66.47	15	- .66	63.87	41	66.47	48	41	
24.11.1.333	J. D. Smith	.	100.97	16	- .62	99.78	44	100.97	48	44	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
25.8.18.111	Spencer McCann	.	57.47	13	- 1.55	50.00	40	57.47	48	40	
19.331	Unknown	3	64.41	13	- 1.36	59.01	42	64.41	48	42	44
25.9.4.211	Val Miller	4	76.28	14	- 2.98	63.70	41	f76.37	48	41	
6.111	P. M. Yates	.	73.42	14	- 2.73	65.14	41	73.42	48	41	
6.421	Albert Janecka	3,5	78.76	14	- 3.59	66.41	39	78.76	48	39	
11.111	R. J. Bishop	3	71.87	14	- 2.76	60.01	39	71.87	48	39	
12.311	Jo Willa Cheek	5	65.34	13	- 2.42	56.69	40	65.34	48	40	
14.311	C. W. Gaines	.	65.09	14	- 1.62	57.10	40	65.09	48	40	
15.211	C. H. Paulk	.	b70.55	14	- 2.98	59.78	39	b70.55	48	39	
18.211	S. P. Walker	.	77.95	14	- 3.65	74.30	47	77.95	48	47	
18.412	Tom Marcak	.	77.91	14	- 4.54	73.37	47	77.91	48	47	
19.111	do	.	(a)	14	....	62.41	40	69.81	47	40	48
21.311	A. W. Speir	.	74.16	14	....	63.48	39	74.16	48	39	46,47
24.222	D. J. Schmelzla		(Measurements discontinued)			42.26	28	53.74	47	28	33,48
24.222a	do	.	54.82	13	- 1.39	52.15	46	54.82	48	46	
25.111	Alan Crotchett	.	53.29	14	- 1.48	47.54	40	53.29	48	40	
27.422	Ted Zacaz	.	60.87	14	- 1.81	53.42	40	60.87	48	40	
28.121	Leonard Zumwalt	3	74.78	14	- 2.41	66.03	42	74.78	48	42	
30.111	M. M. Robertson	.	69.49	14	- 3.89	55.78	40	69.49	48	40	42
30.212	Ernest Marsh	5	71.73	14	....	.....	..	.....	..	48	
30.222	Ernest Welch		(Measurements discontinued, well filled)					....	..	47	48
35.211	Joe Marcak	3	54.45	14	- 1.35	47.21	39	54.45	48	39	
25.10.15.422	C. H. Graves	.	61.29	14	- 1.14	57.18	40	61.29	48	40	
36.111	State of New Mexico	3,5	67.50	14	- 1.97	58.84	40	67.50	48	40	45
36.222	do	.	69.38	14	- 2.26	56.94	39	69.38	48	39	
26.9.2.221	T. R. Taylor	3	44.27	13	- 1.18	39.69	41	44.27	48	41	42
4.331	R. E. Smyer	.	57.02	14	....	52.28	41	57.02	48	41	47
11.211	State of New Mexico	3	41.21	13	-.73	37.30	40	41.21	48	40	
26.10.1.310	Fred Chambers	.	64.35	14	-1.22	55.42	28	64.35	48	28	33,36-39
27.8.8.411	Bill Birchfield	3	24.15	13	-.19	23.45	42	24.29	40	40	
27.9.12.111	Waterloo school	3	27.67	13	-.24	27.12	46	27.67	48	45	
28.8.34.444	Mrs. Hoover	5	38.64	13	....	.....	..	.....	..	48	
29.7.4.111	Francis S. Connatt	5	1.45	13	....	.....	..	.....	..	48	
18.211	R. M. Marshall	.	6.93	13	-4.08	.50	41	14.53	44	j40	43
29.8.12.244	A. G. Anderson	.	7.60	13	-.12	7.07	j40	7.60	48	j40	
13.111	L. L. Burkhead	.	6.82	13	-.14	6.44	jk40	6.82	48	j40	

a Pumping.
b Pumping recently.
c Nearby well pumping.
e Dry at depth given.
f From recorder charts.
j March.
k Also 1942.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Location number Owner	21.10. 6.112 Tigner	21.11. 13.411c Irwin	21.11. 35.310 State of N.M.	22.10. 18.121 State of N.M.	22.11. 2.210 State of N.M.	22.11. 13.122 State of N.M.	22.11. 13.221 State of N.M.	22.11. 23.222 State of N.M.
Jan. 17	9.35	49.85	34.85	77.11	35.18	68.94	75.58	55.78
Mar. 23	9.82	a68.66	35.19	77.27	35.48	69.11	75.75	55.99
May 18	9.85	a68.70	35.44	77.38	35.70	69.23	75.85	56.11
July 20	10.40	a89.42	35.70	77.57	35.94	69.43	76.04	56.33
Sept.17	10.17	a89.69	35.82	77.72	36.06	69.57	76,18	56.46
Nov. 16	10.07	51.78	36.03	77.89	36.28	69.72	76.30	56.63
Location number Owner	23.7. 21.311 Unknown	23.7. 30.L.16 Foster	23.7. 31.133 Haas	23.8. 3.322 U. S. Gov't	23.8. 26.131 Bankston	23.8. 34.111 Dowdle	23.8. 34.211 Law	23.9. 22.213 Perkins
Jan. 12, 15-17	71.53	29.57	51.17	133.08	41.18	43.49	41.65	65.25
Mar. 22-24	71.42	29.41	51.40	133.21	(c)	a97.67	(a)	65.18
May 18,20	71.64	30.20	51.79	133.26	(c)	b54.41	46.41	66.58
July 19,20, 22	71.76	30.65	52.25	133.35	(a)	(a)	(a)	67.69
Sept.17,20	(k)	30.56	52.75	133.44	50.77	(a)	(a)	68.35
Nov. 16,18	71.86	30.00	52.54	133.58	45.80	47.25	45.38	66.89
Location number Owner	23.9. 25.311 Ernst	23.9. 27.142 Thomas	23.9. 27.221 Mc-Daniels	24.7. 3.311 Hatfield	24.7. 4.424 Hatfield	24.7. 5.211 Williamson	24.7. 9.111a Smyer Bros.	24.7. 9.111 Smyer Bros.
Jan.12,15, 17	59.63	64.10	60.64	16.74	89.72	87.89	42.24	86.67
Mar.23,24	59.53	64.57	60.75	15.27	87.95	b88.12	(a)	85.80
May 18,20	(a)	65.28	a61.72	23.44	92.87	a89.27	(a)	a98.51
July20,22,23	a93.03	(d)	a61.29	32.94	95.27	88.74	bc120.72	(ac)
Sept.17,20	(a)	(k)	61.40	c40.78	97.27	b89.66	(ac)	(ac)
Nov.16,18	61.37	(k)	61.50	24.12	92.98	a91.29	59.48	88.75
Location number Owner	24.7. 9.241 Hatfield	24.7. 10.111 Hatfield	24.7. 10.211 Hassman	24.7. 16.211b Snyder	24.7. 24.111 Wilson	24.7. 24.312 Birchfield	24.7. 26.113 Birchfield	24.8. 1.333b Kretek
Jan. 12,16	90.34	67.09	92.32	88.63	78.31	74.08	72.86	21.02
Mar. 24	89.74	61.21	94.90	88.68	78.25	74.22	72.95	20.54
May 20,21	90.69	90.84	102.48	86.86	81.07	74.30	.....	22.38
July 22	c90.01	.....	105.48	90.78	82.57	74.44	a77.87	25.62
Sept.20,21	92.00	.....	c107.03	a103.79	79.53	74.60	.....	24.73
Nov. 18	92.64	.....	96.12	90.22	79.81	74.67	.....	24.06
Location number Owner	24.8. 6.112 Air Base	24.8. 11.221 Kretek	24.9. 1.211 Air Base	24.9. 1.222 Air Base	24.9. 2.421 Trujillo	24.9. 6.431 State of N.M.	24.9. 7.331 Moir	24.9. 9.411 Clary
Jan. 15,16	54.67	20.30	60.19	57.32	59.50	74.29	82.18	71.35
Mar. 23,24	54.85	20.01	60.46	.....	59.71	73.74	d84.29	c81.14
May 18-20	55.16	20.89	60.78	.....	c68.57	78.88	85.29	75.88
July 20-22	55.60	21.63	61.04	.....	c71.72	ac121.53	(c)	c88.03
Sept.17,18, 20,21	55.81	22.43	61.45	b59.47	68.66	.....	.....	c89.70
Nov. 16-18	56.21	22.44	61.84	58.97	61.68	78.38	.....	75.23

* See footnotes at end of Part 3.

Part 3. Water levels, in feet, showing seasonal changes during 1948--Cont.

Location number Owner	24.9. 13.111 Barrett	24.9. 21.131 Gaskill	24.9. 35.331 Howell	24.10. 1.311 Griggs	24.10. 3.411 Speir Bros.	24.10. 3.411b Speir Bros.	24.10. 10.311 Hurt	24.10. 22.211 Hurt
Jan.13,15, 16	56.02	78.80	71.12	84.69	92.41	84.55	86.74	74.42
Mar.23,24	55.02	78.28	70.82	84.82	92.33	85.10	86.83	74.50
May 18-20	60.93	c87.82	(a)	c98.74	92.61	86.09	87.43	75.49
July20-22	(a)	c88.52	a101.49	c104.67	c94.07	a111.85	d88.59	c79.66
Sept.17,18, 20	72.86	c89.54	83.01	104.05	93.89	88.98	88.90	c79.79
Nov.16,17	64.94	83.44	76.63	87.44	.....	86.29	88.53	76.90

Location number Owner	24.10. 29.222 State of N.M.	25.8. 19.331 Unknown	25.9. 6.421 Janecka	25.9. 11.111 Bishop	25.9. 28.121 Zumwalt	25.9. 35.211 Marcak	25.10. 36.111 State of N.M.	26.9. 2.221 Taylor
Jan.13-15	66.47	64.41	78.76	71.87	74.78	54.45	67.50	44.27
Mar.23	66.59	63.98	77.90	71.99	73.21	54.42	b79.72	44.16
May 19	66.58	a67.40	81.35	(a)	(a)	55.49	(a)	a52.92
July20-22	67.10	a67.28	(a)	(a)	a79.20	a65.98	(c)	a55.25
Sept.18,20	67.00	a67.81	90.24	(a)	82.91	57.64	77.53	45.65
Nov. 16,17	67.17	66.73	83.40	76.41	(a)	56.68	71.25	45.31

Location number Owner	26.9. 11.211 State of N.M.	27.8. 8.411 Birch-field	27.9. 12.111 School
Jan. 13	41.21	24.15	27.67
Mar. 23	41.32	23.85	27.55
May 19,29	41.40	24.37	28.08
July 21	41.58	24.41	28.40
Sept.20	41.84	23.99	28.71
Nov. 17	42.06	23.90	28.48

a Pumping.
b Pumping recently.
c Nearby well pumping.
d Nearby well pumping recently.
k Dry.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

24.7.14.221. J. H. Winslow. Highest and lowest recorded water levels: Apr. 2, 4, 5, 83.83; Sept. 30, Oct. 1, 2, 86.70.

Highest daily water level, from recorder charts

Day	Jan.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	85.25	.....	83.84	84.52	84.87	85.49	86.01	86.37	86.70	86.43	86.09
2	85.23	.....	83.83	84.55	84.90	85.50	86.03	86.39	86.70	86.42	86.09
3	.....	.....	83.84	84.57	84.91	85.52	86.03	86.39	86.69	86.40	86.08
4	85.20	.....	83.83	84.59	84.93	85.55	86.05	86.41	86.68	86.40	86.05
5	85.18	.....	83.83	84.61	84.95	85.56	86.07	86.42	86.68	86.39	86.05
6	85.16	.....	83.85	84.64	84.97	85.58	86.09	86.43	86.68	86.36	86.03
7	85.14	.....	83.85	84.66	84.99	85.60	86.10	86.44	86.67	86.35	86.02
8	85.12	.....	83.89	84.68	85.00	85.61	86.11	86.45	86.66	86.35	86.01
9	85.10	.....	83.92	84.70	85.03	85.63	86.11	86.47	86.65	86.34	86.00
10	85.08	.....	83.93	84.74	85.05	85.65	86.13	86.48	86.63	86.31	85.98
11	85.06	.....	83.95	84.76	85.08	85.67	86.13	86.49	86.63	86.31	85.96
12	85.05	.....	83.97	84.77	85.10	85.68	86.15	86.50	86.62	86.30	85.95
13	85.04	.....	84.02	84.77	85.12	85.71	86.16	86.52	86.61	86.29	85.95
14	85.01	.....	84.06	84.78	85.14	85.73	86.17	86.53	86.60	86.28	85.93
15	84.99	.....	84.09	84.78	85.16	85.74	86.19	86.54	86.59	86.27	85.93
16	84.98	.....	84.12	84.77	85.19	85.77	86.19	86.55	86.59	86.26	85.91
17	84.96	.....	84.15	84.76	85.21	85.78	86.20	86.56	86.59	86.23	85.90
18	84.94	.....	84.18	84.76	85.23	85.80	86.21	86.57	86.57	86.23	85.89
19	84.95	.....	84.21	84.76	85.25	85.81	86.22	86.58	86.57	86.21	85.88

24.7.14.221--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
20	84.93	.....	84.24	84.75	85.27	85.83	86.23	86.59	86.56	86.21	85.86
21	84.90	.....	84.26	84.73	85.29	85.85	86.24	86.60	86.55	86.20	85.86
22	84.87	.....	84.28	84.72	85.31	85.87	86.26	86.61	86.54	86.19	85.83
23	84.85	.....	84.31	84.71	85.34	83.10	86.27	86.62	86.53	86.18	85.83
24	84.85	83.92	84.34	84.71	85.37	84.52	86.28	86.64	86.51	86.16	85.82
25	.....	83.91	84.38	84.72	85.39	85.53	86.29	86.66	86.50	86.16	85.81
26	.....	83.91	84.40	84.73	85.41	85.82	86.31	86.68	86.49	86.14	85.79
27	.....	83.90	84.44	84.75	85.43	85.91	86.31	86.69	86.48	86.15	85.76
28	.....	83.88	84.46	84.77	85.45	85.95	86.33	86.69	86.48	86.14	85.77
29	.....	83.86	84.49	84.80	85.47	85.97	86.34	86.69	86.47	86.12	85.76
30	.....	83.84	84.51	84.82	85.49	85.99	86.35	86.70	86.45	86.11	85.74
31	.....	83.84		84.84		86.00	86.36		86.45		85.72

24.8.4.111. Foy Riley. Highest and lowest recorded water levels: Mar. 24, 25, 42.04; Oct. 23-29, 44.67.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	42.21	.....	42.12	.....	42.92	.....	43.67	44.16	44.56	44.66	44.51
2	.....	42.20	.....	42.13	.....	42.93	.....	43.69	44.18	44.57	44.65	44.51
3	.....	42.19	.....	42.14	.....	42.93	.....	43.70	44.20	44.57	44.65	44.50
4	.....	42.18	.....	42.16	.....	42.93	.....	43.72	44.22	44.58	44.64	44.48
5	.....	42.18	.....	42.17	.....	42.94	.....	43.73	44.23	44.59	44.64	44.48
6	.....	42.18	.....	42.18	.....	42.95	.....	43.74	44.24	44.59	44.64	44.48
7	.....	42.17	.....	42.20	.....	42.95	.....	43.76	44.26	44.60	44.63	44.47
8	.....	42.17	.....	42.22	.....	42.97	.....	43.77	44.28	44.61	44.63	44.46
9	.....	42.16	.....	42.24	.....	42.97	.....	43.78	44.31	44.61	44.63	44.46
10	.....	42.13	.....	42.24	.....	42.98	.....	43.79	44.33	44.61	44.63	44.45
11	.....	42.13	.....	42.25	.....	43.00	.....	43.81	44.34	44.61	44.62	44.44
12	.....	42.14	.....	42.26	.....	43.01	.....	43.82	44.37	44.62	44.62	44.43
13	.....	42.13	.....	42.28	.....	43.03	.....	43.84	44.37	44.62	44.62	44.43
14	.....	.....	.....	42.30	.....	43.04	.....	43.85	44.37	44.63	44.61	44.41
15	.....	.....	.....	42.32	.....	43.05	.....	43.87	44.38	44.63	44.60	44.41
16	42.30	.....	.....	42.33	.....	43.07	.....	43.89	44.39	44.63	44.60	44.40
17	42.29	.....	.....	42.34	.....	43.08	.....	43.90	44.40	44.64	44.58	44.40
18	42.28	.....	.....	42.35	.....	43.09	.....	43.92	44.40	44.65	44.58	44.39
19	42.28	.....	.....	42.37	.....	43.11	.....	43.93	44.44	44.65	44.58	44.38
20	42.28	.....	.....	42.37	h42.82	43.12	.....	43.95	44.45	44.66	44.57	44.37
21	42.27	.....	.....	42.39	42.82	43.13	.....	43.96	44.46	44.66	44.57	44.36
22	42.25	.....	.....	42.41	42.83	43.14	h43.56	43.97	44.48	44.66	44.57	44.36
23	42.25	.....	.....	42.43	42.84	43.15	43.57	43.98	44.49	44.67	44.57	44.34
24	42.23	.....	42.04	42.45	42.84	43.17	43.58	44.00	44.49	44.67	44.56	44.34
25	42.23	.....	42.04	42.47	42.85	.....	43.59	44.01	44.50	44.67	44.55	44.33
26	42.23	.....	42.05	.....	42.87	.....	43.60	44.03	44.52	44.67	44.54	44.33
27	42.23	.....	42.05	.....	42.87	.....	43.61	44.06	44.53	44.67	44.54	44.32
28	42.22	.....	42.06	.....	42.88	.....	43.62	44.08	44.53	44.67	44.54	44.32
29	42.22	.....	42.07	.....	42.89	.....	43.63	44.10	44.53	44.67	44.53	44.32
30	42.22		42.08	.....	42.90	.....	43.64	44.12	44.55	44.66	44.53	.....
31	42.22		42.08		42.91		43.66	44.13		44.66		.....

h Tape measurement at odd hour.

24.10.12.431. Steve Hrna. Highest and lowest recorded water levels: Mar. 24, 25, 83.02; Sept. 17, 90.45.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	84.38	83.71	83.26	83.28	85.47	85.98	87.66	88.91	90.06	90.15	89.10	88.05
2	84.35	83.68	83.22	83.32	85.46	86.03	87.70	88.94	90.09	90.12	89.06	88.02
3	84.34	83.65	83.19	83.39	85.47	86.09	87.75	88.98	90.13	90.09	89.02	87.98
4	84.31	83.62	83.23	83.44	85.44	86.15	87.79	89.02	90.16	90.06	88.99	87.95
5	84.28	83.64	83.19	83.49	85.44	86.22	87.84	89.06	90.18	90.03	88.96	87.92
6	84.27	83.61	83.14	83.55	85.44	86.29	87.88	89.10	90.22	90.00	88.91	87.90
7	84.23	83.59	83.13	83.62	85.40	86.34	87.92	89.14	90.25	89.97	88.88	87.87
8	84.21	83.62	83.12	83.76	85.39	86.40	87.95	89.17	90.27	89.94	88.85	87.84
9	84.19	83.55	83.09	83.88	85.40	86.43	87.99	89.21	90.31	89.91	88.81	87.81

24.10.12.431--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
10	84.16	83.48	83.12	84.00	85.41	86.47	88.03	89.25	90.34	89.88	88.76g	87.79
11	84.13	83.53	83.16	84.11	85.40	86.53	88.06	89.29	90.36	89.85	88.73g	87.75
12	84.12	83.52	83.15	84.24	85.41	86.59	88.10	89.33	90.39	89.81	.....g	87.73
13	84.12	83.51	83.13	84.39	85.42	86.65	88.15	89.36	90.40	89.78	.....g	87.70
14	84.08	83.49	83.12	84.51	85.43	86.70	88.19	89.40	90.42	89.75	.....g	87.68
15	84.03	83.48	83.18	84.59	85.46	86.77	88.24	89.44	90.42	89.72	.....g	87.65
16	84.03	83.48	83.21	84.68	85.48	86.84	88.28	89.47	90.44	89.69	.....	87.62
17	83.98	83.46	83.17	84.77	85.49	86.91	88.33	89.51	90.45	89.65	88.50	87.59
18	83.95	83.42	83.16	84.86	85.50	86.98	88.37	89.54	90.43	89.62	88.48	87.57
19	83.97	83.41	83.22	84.97	85.46	87.04	88.40	89.58	90.44	89.59	88.43	87.53
20	83.95	83.38	.....	85.05	85.48	87.12	88.44	89.61	90.43	89.56	88.41	87.50
21	83.91	83.37	.....	85.12	85.51	87.17	88.48	89.65	90.41	89.53	88.38	87.49
22	83.85	83.31	.....	85.20	85.53	87.24	88.54	89.68	90.39	89.48	88.34	87.44
23	83.85	83.28	83.03	85.26	85.55	87.31	88.58	89.72	90.37	89.45	88.31	87.42
24	83.83	83.34	83.02	85.32	85.58	87.36	88.62	89.76	90.34	89.41	88.27	87.40
25	83.82	83.33	83.02	85.37	85.61	87.41	88.65	89.80	90.31	89.38	88.23	87.37
26	83.80	83.30	83.05	85.42	85.65	87.45	88.68	89.84	90.29	89.33	88.20	87.35
27	83.82	83.30	83.07	85.44	85.67	87.47	88.71	89.88	90.26	89.29	88.18	87.32
28	83.80	83.27	83.09	85.46	85.72	87.52	88.75	89.92	90.23	89.25	88.15	87.31
29	83.77	83.22	83.09	85.45	85.77	87.56	88.79	89.95	90.20	89.22	88.11	87.30
30	83.76		83.11	85.46	85.83	87.61	88.83	89.99	90.17	89.18	88.07	87.25
31	83.73		83.17		85.91		88.87	90.02		89.15		87.22

g Estimated.

25.9.4.211. Val Miller. Highest and lowest recorded water levels: Jan. 1-3, 76.19; Dec. 28-30, 79.58.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Sept.	Oct.	Nov.	Dec.
1	76.19	76.37	.....	76.56	76.87	77.16	77.56	.....	78.96	79.24	79.43
2	76.19	76.37	.....	76.57	76.88	77.19	77.57	.....	78.97	79.24	79.44
3	76.19	76.37	.....	76.57	76.89	77.20	77.59	.....	78.98	79.24	79.44
4	76.20	76.38	.....	76.58	76.89	77.21	77.60	.....	78.98	79.25	79.44
5	.....	76.38	.....	76.58	76.91	77.22	77.62	.....	78.99	79.26	79.46
6	.....	76.39	.....	76.59	76.92	77.23	77.63	.....	79.01	79.26	79.46
7	.....	76.39	.....	76.61	76.93	77.24	77.65	.....	79.02	79.27	79.46
8	.....	76.40	.....	76.62	76.93	77.25	77.66	.....	79.03	79.27	79.47
9	.....	.....	.....	76.63	76.95	77.25	77.68	.....	79.03	79.27	79.48
10	.....	.....	.....	76.63	76.96	77.27	77.69	.....	79.04	79.27	79.48
11	.....	.....	.....	76.64	.....	77.28	77.69	.....	79.05	79.28	79.48
12	.....	.....	.....	76.66	.....	77.29	77.72	.....	79.06	79.31	79.49
13	.....	.....	.....	76.67	.....	77.31	77.74	.....	79.07	79.32	79.49
14	76.28	.....	.....	76.67	.....	77.32	77.75	.....	79.08	79.33	79.50
15	76.28	.....	.....	76.69	.....	77.33	77.77	.....	79.08	79.33	79.51
16	76.31	.....	.....	76.70	.....	77.35	77.79	.....	79.10	79.34	79.51
17	76.31	.....	.....	76.71	.....	77.36	77.80	.....	79.11	79.33	79.52
18	76.32	.....	.....	76.73	.....	77.37	77.82h	78.79	79.12	79.36	79.52
19	76.33	.....	.....	76.74h	77.04	77.38	77.83	78.81	79.12	79.36	79.53
20	76.33	.....	.....	76.75	77.05	77.40	77.84	78.83	79.13	79.36	79.53
21	76.32	.....	.....	76.76	77.05	77.41	77.85	78.84	79.14	79.38	79.54
22	76.31	.....	.....	76.77	77.07	77.43	.....	78.86	79.15	79.39	79.54
23	76.33	.....	76.53	76.77	77.08	77.44	.....	78.87	79.16	79.39	79.54
24	76.33	.....	76.52	76.80	77.08	77.45	.....	78.88	79.17	79.39	79.56
25	76.34	.....	76.53	76.80	77.10	77.47	.....	78.89	79.17	79.40	79.55
26	76.34	.....	76.53	76.81	77.11	77.48	.....	78.91	79.18	79.40	79.57
27	76.36	.....	76.54	76.83	77.13	77.50	.....	78.92	79.19	79.42	79.55
28	76.35	.....	76.54	76.83	77.14	77.52	.....	78.92	79.19	79.43	79.58
29	76.36	.....	76.54	76.84	77.15	77.53	.....	78.93	79.19	79.43	79.58
30	76.37		76.54	76.86	77.16	77.55	.....	78.94	79.19	79.43	79.58
31	76.37		76.56		77.18		.....		79.19		79.57

h Tape measurement at odd hour.

Part 5. Miscellaneous data concerning observation wells

24.7.3.321. Smyer. At southwest corner of earthen tank. Dug and drilled irrigation well, equipped with turbine pump. Reference point, top of concrete well curb, at land-surface datum.

24.7.10.111. Hatfield. Well deepened in March 1946 to 803 feet. Water level rose 73 feet due to artesian pressure in lower aquifers. Measurements since May 19, 1947, when pump was placed on well, were probably made on the outside of the inner casing, which seals off the lower strata, and do not show the true water level in the lower aquifers.

24.7.16.211b. Snyder. Windmill pump removed, turbine pump installed in well. Reference points established Apr. 14, 1944, destroyed. Reference point, established May 20, 1948, top of 12-inch casing, at land-surface datum.

24.9.15.221. Lutonsky. Pump removed to new well about 15 feet south prior to Jan. 15, 1948.

24.9.15.221a. Lutonsky. Under shed 15 feet south of observation well 24.9.15.221, west of dwelling. Drilled irrigation well, equipped with turbine pump. Reference point, top of casing, 1.35 feet above land-surface datum of well 24.9.15.221.

24.9.35.331. Howell. Drilled irrigation well, equipped with turbine pump, diameter 14 inches, depth 210 feet. Reference point, top of 2½- by 2½-foot concrete pump base, 0.57 foot above lower concrete base, 0.60 foot above land-surface datum.

24.10.12.432a. Hrna. Well deepened from 230 feet to 400 feet, September 1948. Casing perforated from 90 feet to 400 feet. Nov. 17, 87.27.

25.9.6.421. Janecka. Well deepened to 375 feet in 1947.

25.9.12.311. Cheek. Pump removed to new well about 15 feet east, prior to Jan. 13, 1948.

25.9.30.212. Marsh. At southwest corner of earthen tank, northeast of house. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 130 feet. Reference point, top of concrete pump base, 1.50 feet above land-surface datum.

25.10.36.111. State of New Mexico. Pump removed to new well approximately 60 feet south, prior to July 21, 1948.

28.8.34.444. Hoover. Dug well, equipped with hand pump, depth 41 feet. March 1940, 38.48.

29.7.4.111. Connatt. Abandoned well, diameter 8 inches, depth 185 feet. Reference point, top edge of casing, at land-surface datum. March 1940, 2.77.

QUAY COUNTY (HOUSE AREA)

By C. S. Conover

Part 1. General discussion

The investigation of the ground-water resources of the House area, in Quay County, was continued in 1948 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:

Year of record	Water-Supply Paper	Page numbers
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 were measured in 68 wells in January 1948 of which about 25 were measured at bimonthly intervals. Water-stage recorders were operated on two of these wells in order to obtain a continuous record of the water level. A total of 196 measurements of water level was made during the year including 12 tape measurements made on the recorder wells.

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 of precipitation is a rise in water levels. The precipitation in 1948 at House was nearly 14 inches and at Hassell, about 8 miles northwest of House, 10 inches--5.8 inches below normal. The precipitation during the growing season, April to September, was 9.08 inches at House and 7.23 inches at Ragland--5.10 inches below normal. The first 5 months of the year were particularly dry; however, in each of the months June, July, August, and October, more than 2 inches of rain fell at House.

The pumping of ground water for irrigation in 1948 began about mid-April, about 3 weeks later than in 1947, and ended about the first part of October, about 4 weeks earlier than in 1947. Because of the favorable summer rains and the decrease in acreage of high water requirement crops, the pumpage per acre in 1948 probably was less than in 1947. It is estimated that 3,800 acres were irrigated in 1948, an increase of 700 acres from 1947. It is probable that about 4,300 acre-feet of water was pumped for irrigation in 1948, a reduction from 1947 when about 7,750 acre-feet was

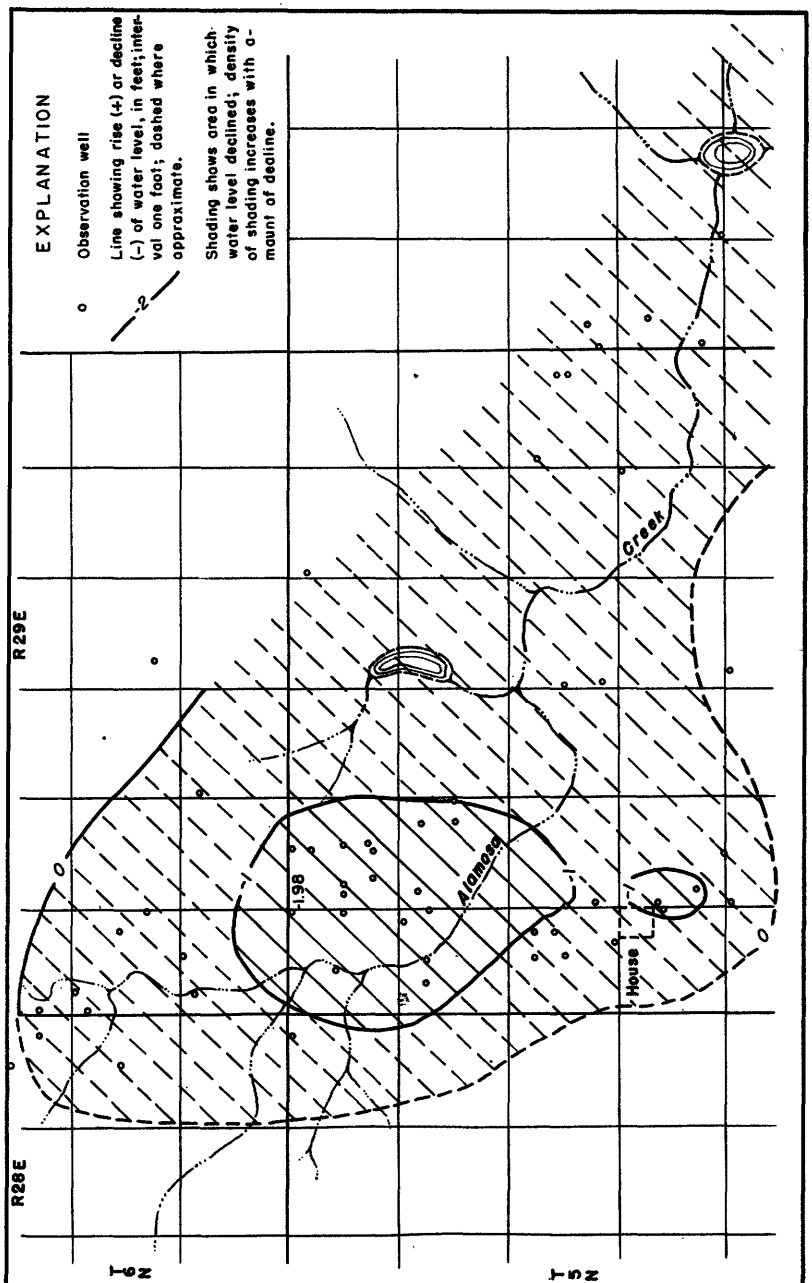

Figure 18.--Map of House area, Quay County, New Mexico, showing decline in ground-water level from January 1948 to January 1949.

pumped. The amount of land irrigated has increased gradually since 1939 and, in general, there has been an increase each year in the amount of water used. However, the amount of water used per acre varies from year to year depending upon the amount and distribution of precipitation in a particular year and the type of crops grown.

Changes of water level

Fluctuations of water level in the House area in 1948 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 the reduced pumpage in 1948, the decline in water levels was less than in any year since 1944. The water levels declined more than 1 foot from January 1948 to January 1949 over an area of about 5 square miles as compared with a like decline in 1947 of about 18 square miles. This area of decline encompassed most of the region in which ground water was pumped for irrigation and extended north of House from about half a mile to about 4 miles and had a maximum width of about 2 miles. The maximum observed net decline, nearly 2 feet, occurred in a well 3 miles north of House.

The water levels at the end of 1948 were below the previous low levels that were observed in early 1941 prior to the heavy rains in late 1941 and early 1942. 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 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
5.28.1.221	D. C. Wyatt	3	47.62	20	- 0.69	46.93	47	47.62	48	47	
5.29.2.131	O. G. Miller	5	24.22	19	....	.....	..	.....	..	48	
5.211	R. H. Currence	.	51.87	19	- .30	48.68	44	51.87	48	44	
5.231	do	.	46.38	19	- 1.01	42.35	45	46.38	48	44	
5.312	Troy Pendergrass	.	44.16	19	- 1.40	42.76	47	44.16	48	47	
5.321	J. F. Wallace	.	43.80	19	- 1.31	40.70	46	43.80	48	46	
5.341	William Martin	.	36.73	20	- 2.11	29.73	43	36.73	48	42	
5.342	do	4	36.67	20	- 1.78	30.15	43	f36.91	48	41	
5.411	A. R. Wallace	.	43.47	19	- 1.40	37.95	43	43.47	48	43	
5.413	do	.	37.47	20	- 1.87	f30.96	43	37.47	48	42	
6.144	F. I. Austin	.	27.38	20	- 1.59	23.45	44	27.38	48	44	
6.222	L. L. Poe	3	53.33	19	- .96	52.37	47	53.33	48	46	
6.422	do	.	40.42	19	-1.57	36.24	45	40.42	48	45	
7.141	D. L. Birch	3	35.14	19	-1.95	29.26	43	35.14	48	43	
7.142	do	.	20.80	19	-2.13	14.31	42	21.00	41	41	
7.221	J. W. Balling	.	31.80	19	-2.07	25.49	42	31.80	48	42	
7.242	C. P. McBride	.	22.70	19	-2.32	18.44	44	22.70	48	44	
8.114	J. C. Davenport	.	29.44	19	-2.00	22.75	42	29.44	48	41	
8.232	G. W. Turner	3	40.27	20	-1.51	34.19	43	40.27	48	42	
8.412	W. W. Kuykendall	.	34.06	20	-1.57	27.94	43	34.06	48	42	
8.422a	Bill Dwight	.	35.16	20	-1.31	32.03	45	35.16	48	45	
9.400	W. Y. Head	3	b26.77	20	-3.27	21.33	42	23.97	46	42	
13.121	W. F. and Wylie Hudman	3	.....	..	....	a76.94	46	79.13	41	41	48
13.131	do	3	57.99	19	-.65	56.80	45	59.19	41	41	
13.243	H. S. Crosby	.	50.22	19	+.09	50.22	48	50.31	j46	45	
13.421	W. F. and Wylie Hudman	.	47.62	19	-.03	46.61	43	47.97	42	41	
14.321	R. A. Tullis	.	.....	..	....	35.55	45	37.38	47	45	48
15.311b	do	3	21.00	19	-.57	17.91	43	21.00	48	43	
15.331	R. A. Tullis	.	35.27	19	....	34.48	45	35.27	48	43	47
17.133	W. W. Kuykendall	4	38.33	19	-3.03	f29.68	42	f38.54	48	41	
17.331	M. M. McEndree	.	41.68	19	-3.05	32.92	42	41.68	48	41	
18.213	Dayton Harris	.	40.48	19	-1.36	35.07	43	40.48	48	41	
18.223	Carl Johnson	.	35.85	19	-1.93	31.89	45	35.85	48	45	
18.233	M. R. Wallace	.	50.92	19	-2.07	45.74	42	50.92	48	41	
18.243	L. M. Bright	.	39.28	19	-2.08	34.83	45	39.28	48	45	
18.433	Frank Davis	5	57.6	19	-3.6	51.42	44	57.6	48	44	
18.434	Charles Willis	3,5	53.82	19	....	.....	..	.....	..	48	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
5.29.18.444	L. V. Vaughn (Measurements discontinued, well filled)					36.70	42	42.30	47	41	48
19.244	Lester McCasland	.	52.98	19	-1.84	46.66	42	52.98	48	41	
20.131a	J. M. Thompson		(Measurements discontinued)			48.49	43	52.62	47	43	48
20.131b	do	.	54.71	19	-1.88	48.79	43	54.71	48	43	
20.133	Welton Henry	.	.....	..	....	48.32	44	50.54	47	44	48
20.314	Stanley Elliott	.	53.97	19	-.89	52.20	45	53.97	48	45	
20.433b	D. J. Speed	.	50.64	19	-.68	f46.99	43	50.64	48	41	
23.222	E. C. Harris	3,5	30.27	19	....	.....	..	.....	..	48	
27.112	E. D. Gallehon	3	71.05	19	-.17	70.88	47	71.05	48	47	
29.111	C. A. Morrow	3	67.74	19	-.30	65.91	43	67.74	48	41	
36.242	State of New Mexico	.	94.86	19	+.12	94.86	48	96.28	42	42	43-46
5.30.18.323	Jerry Thompson	.	41.30	19	-1.46	39.73	46	41.30	48	46	
18.331	do	3	36.73	19	-1.77	34.80	46	36.73	48	45	
19.132a	Ralph Hendrix	.	28.77	19	-1.24	26.17	44	28.77	48	44	
19.313	do	.	19.79	19	-1.01	15.94	42	19.79	48	42	
20.333	W. F. & Wylie Hudman	3	23.99	19	-.93	16.82	42	23.99	48	42	
31.442	T. W. Coleman	3	99.10	19	-.15	98.95	47	99.77	44	44	
6.28.1.232	C. M. Brown	3,5	66.82	20	....	.....	..	.....	..	48	
13.232	Irwin Estate	.	60.86	20	+.04	60.86	48	61.84	45	45	
13.333	Ollie Dameron	5	100.47	20	....	.....	..	.....	..	48	
23.112	William Upton	3	74.22	20	+.13	74.22	48	74.35	47	47	
24.233	Byers Irwin	3	80.81	20	-1.86	78.12	45	80.81	48	45	
24.423	W. W. Addison	.	65.43	20	-1.43	62.83	45	65.43	48	42	
25.411	R. A. Davenport	3	53.61	20	-.23	52.20	45	53.61	48	44	
6.29.19.313	R. W. Dean	.	54.64	20	-.84	53.50	47	54.64	48	46	
27.332	J. D. Green	3	43.76	19	+.08	43.76	48	44.20	45	45	
30.112	L. M. McDaniels	3	50.80	20	-.88	48.08	43	51.12	41	41	
30.113	do	.	54.14	20	-1.01	51.29	43	54.34	41	41	
30.412	R. W. Dean	3	74.63	20	-.80	73.83	47	74.63	48	47	
30.424	do	.	82.37	20	-1.95	78.23	46	82.37	48	46	
31.114	Clyde Kuykendall	.	41.44	20	-1.54	36.40	42	41.44	48	41	
31.122	G. H. Griggs	.	57.34	20	-1.11	53.57	44	57.34	48	44	
32.111	Sam Morrow	.	75.21	20	-1.46	70.99	46	75.21	48	46	
33.131	Frank Morrow	3	54.98	19	-.33	54.26	44	54.98	48	43	
35.314	P. R. Gates	3	39.14	19	-.68	38.36	46	39.14	48	46	
7.28.9.342	W. B. Giles (Measurements discontinued, well dry)					25.69	45	e27.8	46	45	48
35.333	do	3	129.47	20	-.09	129.32	46	129.62	45	45	

a Pumping. b Pumping recently. e Dry at depth given. f From recorder charts. j Also 1947.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Location number / Owner	5.28. 1.221 Wyatt	5.29. 6.222 Poe	5.29. 7.141 Birch	5.29. 8.232 Turner	5.29. 9.400 Head	5.29. 13.121 Hudman	5.29. 13.131 Hudman	5.29. 15.311b Tullis
Jan. 19,20	47.62	53.33	35.14	40.27	b26.77	.....	57.99	21.00
Apr. 1	47.74	53.00	35.25	39.85	a25.67	77.15	.....	21.11
May 30,31	47.79	56.41	35.64	47.69	a29.90	a77.50	.....	21.15
July 30	47.94	56.52	35.93	44.32	a40.93	(a)	61.21	21.28
Oct. 1	48.24	56.88	36.27	b49.22	27.53	78.28	a82.44	21.37
Nov. 23	48.26	55.88	36.51	42.21	(a)	a78.84	.....	21.40

Location number / Owner	5.29. 18.434 Willis	5.29. 23.222 Harris	5.29. 27.112 Gallehon	5.29. 29.111 Morrow	5.30. 18.331 Thompson	5.30. 20.333 Hudman	5.30. 31.442 Coleman	6.28. 1.232 Brown
Jan. 19,20	53.82	30.27	71.05	67.74	36.73	23.99	99.10	66.82
Apr. 1	52.69	30.38	70.93	67.86	36.08	a23.94	99.12	72.93
May 30	55.68	35.32	72.14	68.21	41.00	a25.15	99.16	67.25
July 30	56.78	35.10	71.46	68.11	39.78	a26.32	99.42	a67.84
Oct. 1	a63.92	32.48	71.13	68.02	37.75	b25.36	100.12	67.24
Nov. 23	55.88	31.32	71.05	68.09	37.11	a25.95	99.42	67.92

Location number / Owner	6.28. 23.112 Upton	6.28. 24.233 Irwin	6.28. 25.411 Davenport	6.29. 27.332 Green	6.29. 30.112 McDaniels	6.29. 30.412 Dean	6.29. 33.131 Morrow	6.29. 35.314 Gates
Jan. 19,20	74.22	80.81	53.61	43.76	50.80	74.63	54.98	39.14
Apr. 1	74.28	80.09	53.57	43.74	50.73	74.59	54.87	38.67
May 30,31	74.96	80.82	53.53	43.75	51.30	74.55	56.02	b46.51
July 30	74.21	81.61	53.60	43.74	51.26	74.72	56.16	47.20
Oct. 1	73.73	82.82	(a)	43.72	51.70	74.91	55.30	45.08
Nov. 23	73.73	81.39	54.29	43.70	51.38	74.70	55.17	39.93

Location number / Owner	7.28. 35.333 Giles
Jan. 20	129.47
Apr. 1	129.54
May 30	129.53
July 30	129.54
Oct. 1	129.54
Nov. 23	.....

a Pumping.
b Pumping recently.

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: Apr. 10, 35.85; Oct. 1, 2, 39.69.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	36.52	36.17	35.98	36.22	36.96	37.74	38.40	39.15	39.69	39.18	38.70
2	.....	36.51	36.18	35.97	36.32	36.98	37.76	38.44	39.17	39.69	39.17	38.70
3	36.91	36.48	36.17	35.93	36.35	36.98	37.76	38.48	39.21	39.68	39.14	38.69
4	36.89	36.49	36.18	35.94	36.37	37.03	37.76	38.52	39.25	39.65	39.10	38.63
5	36.86	36.46	36.16	35.94	36.41	37.05	37.76	38.55	39.30	39.62	39.13	38.65
6	36.85	36.46	36.12	35.91	36.44	37.06	37.77	38.58	39.30	39.61	39.09	38.62
7	36.83	36.46	36.14	35.92	36.42	37.13	37.74	38.62	39.37	39.60	39.07	38.61
8	36.82	36.45	36.12	35.93	36.43	37.14	37.75	38.65	39.41	39.58	39.07	38.59
9	36.82	36.41	36.12	35.92	36.51	37.15	37.77	38.65	39.41	39.55	39.05	38.62
10	36.78	36.39	36.15	35.85	36.57	37.15	37.77	38.66	39.43	39.55	39.03	38.58
11	36.75	36.43	36.15	35.87	36.63	37.17	37.77	38.70	39.45	39.53	39.02	38.54
12	36.78	36.38	36.12	35.91	36.65	37.17	37.76	38.71	39.50	39.53	39.02	38.55
13	36.76	36.39	36.09	36.00	36.64	37.19	37.75	38.75	39.50	39.52	38.97	38.54

5.29.5.342--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
14	36.73	36.40	36.04	35.95	36.64	37.23	37.75	38.81	39.50	39.46	38.98	38.52
15	36.71	36.35	36.07	35.95	36.65	37.25	37.72	38.84	39.50	39.47	38.94	38.52
16	36.72	36.37	36.10	35.95	36.70	37.28	37.78	38.88	39.50	39.46	38.94	38.51
17	36.66	36.34	36.05	35.92	36.70	37.30	37.84	38.91	39.50	39.44	38.91	38.50
18	36.66	36.32	35.98	35.91	36.70	37.37	37.85	38.92	39.50	39.42	38.91	38.48
19	36.66	36.33	36.01	35.92	36.71	37.40	37.89	38.92	39.49	39.40	38.89	38.46
20	36.65	36.31	36.01	35.95	36.73	37.44	37.93	38.96	39.48	39.39	38.87	38.44
21	36.62	36.28	36.04	35.95	36.73	37.45	37.99	38.97	39.49	39.38	38.87	38.46
22	36.60	36.26	36.01	35.96	36.75	37.50	38.00	38.97	39.51	39.37	38.84	38.44
23	36.59	36.26	36.02	35.98	36.76	37.54	38.07	38.97	39.52	39.33	38.81	38.42
24	36.59	36.31	35.99	36.02	36.79	37.58	38.08	38.97	39.60	39.31	38.78	38.43
25	36.60	36.28	36.00	36.05	36.81	37.59	38.09	38.98	39.61	39.30	38.80	38.40
26	36.59	36.18	36.05	36.09	36.83	37.64	38.17	39.00	39.68	39.27	38.77	38.39
27	36.61	36.16	36.01	36.12	36.83	37.66	38.19	39.00	39.68	39.25	38.77	38.36
28	36.55	36.25	35.96	36.14	36.86	37.72	38.23	39.01	39.68	39.25	38.77	38.37
29	36.55	36.18	35.94	36.12	36.87	37.74	38.26	39.09	39.68	39.22	38.75	38.37
30	36.55		35.93	36.16	36.90	37.74	38.31	39.09	39.68	39.21	38.73	38.36
31	36.53		35.95		36.91		38.36	39.12		39.17		38.32

5.29.17.133. W. W. Kuykendall. Highest and lowest recorded water levels: Apr. 4, 37.58; Sept. 28, 40.40.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	38.18	37.89	37.61	38.11	38.86	39.26	.....	40.11	40.10	40.18	39.85
2	.....	.....	37.88	37.60	38.13	38.90	39.28	.....	40.13	40.11	40.19	39.85
3	38.54	.....	37.87	37.59	38.17	38.91	39.30	.....	40.15	.....	40.18	39.85
4	38.53	.....	37.87	37.58	38.22	38.93	39.31	.....	40.15	.....	40.18	39.83
5	38.52	.....	.....	.....	38.23	38.95	39.33	.....	40.17	.....	40.19	39.83
6	38.51	.....	37.85	.....	38.28	38.97	39.37	.....	40.04	.....	40.10	39.77
7	38.50	38.11	37.84	.....	38.30	38.98	39.39	.....	39.98	.....	40.08	39.77
8	38.48	38.11	37.83	37.72	38.31	38.98	39.41	.....	39.98	.....	40.10	39.77
9	38.47	38.09	37.82	37.71	38.32	38.98	39.42	.....	40.00	.....	40.10	39.77
10	38.45	38.08	37.82	37.68	38.36	38.98	.....	.....	.....	40.12	40.11	39.77
11	38.43	38.08	.....	37.67	38.41	38.97	.....	.....	40.08	40.13	40.10	39.77
12	38.43	.....	.....	37.68	38.44	38.97	.....	.....	40.11	40.13	40.10	39.69
13	.....	.....	37.77	37.70	38.46	38.97	.....	.....	40.15	40.13	40.00	39.69
14	.....	38.06	37.75	37.70	38.49	38.98	.....	.....	40.18	40.12	40.01	39.69
15	.....	38.04	37.75	37.70	38.51	38.99	.....	.....	40.20	40.13	40.02	39.69
16	.....	38.04	37.75	37.71	38.54	38.99	.....	.....	40.23	.....	40.02	39.69
17	38.35	38.02	37.73	37.73	38.58	38.99	.....	h39.72	40.25	.....	40.02	39.69
18	38.34	38.00	37.72	37.74	38.60	39.00	.....	.. ..	40.25	.....	40.02	39.59
19	38.32	38.00	37.72	37.77	38.64	39.03	.....	.....	40.24	.....	40.02	39.59
20	38.31	37.98	37.70	37.81	38.69	39.04	.....	.....	40.27	.....	40.01	39.59
21	38.29	37.97	37.70	37.84	38.74	39.06	.....	40.13	40.29	.....	40.01	39.59
22	38.28	37.95	37.69	37.87	38.78	39.07	.....	40.13	40.32	.....	39.99	39.59
23	38.26	37.94	37.69	37.87	38.81	39.10	.....	40.14	40.35	40.21	h39.98	39.59
24	38.26	37.95	37.67	37.92	38.85	39.12	.....	40.15	.....	40.25	39.98	39.51
25	38.25	37.94	37.66	37.95	38.88	39.14	.....	40.11	.....	40.26	39.97	39.53
26	38.24	37.91	37.66	38.00	38.87	39.18	.....	40.10	40.37	40.26	39.96	39.53
27	.....	37.91	37.67	38.02	38.89	39.19	.....	.....	40.39	40.26	39.95	39.53
28	.....	37.90	37.65	38.05	38.92	39.22	.....	40.09	40.40	40.26	39.94	39.53
29	.....	37.89	37.64	38.07	38.94	39.23	.....	40.09	.....	40.26	39.92	39.53
30	.....		37.63	38.09	38.84	39.25	h39.56	40.10	.....	40.18	39.87	39.46
31	38.19		37.63		38.84		.....	40.10		**40.18**		39.46

h Tape measurement at odd hour.

Part 5. Miscellaneous data concerning observation wells

5.29.2.131. Miller. Drilled irrigation, stock, and domestic well, equipped with windmill and pump, diameter 14 inches, depth 132 feet. Reference point, top of concrete base, 1.90 feet above land-surface datum.

5.29.18.433. Davis. Pump removed to new well about 400 feet east, casing pulled.

5.29.18.434. Willis. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 87 feet. Reference point, top of concrete pump base, 0.50 foot above land-surface datum. Mar. 28, 1946, 49.82; Nov. 24, 1947, 55.93.

5.29.23.222. Harris. Drilled irrigation well, equipped with turbine pump until October 1948, diameter 16 inches, depth 80 feet. Well abandoned October 1948, casing, pump, and circular concrete base moved to new well, 33 feet west.

Date	Water level	Date	Water level	Date	Water level
Apr. 1, 1947	30.12	Aug. 1, 1947	30.07	Nov. 24, 1947	30.26
May 30	29.93	Sept.18	30.31		

6.28.1.232. Brown. 16 feet north of windmill well. Drilled well, equipped with pumpjack September 1947, depth 98 feet. Reference point, top edge of circular concrete well curb, south side of well, 1.70 feet above land-surface datum.

Apr. 1, 1947	66.95	Aug. 1, 1947	66.78	Nov. 25, 1947	c67.10
May 30	66.79	Sept.17	b66.95		

b Pumping recently.
c Nearby well pumping.

6.28.13.333. Dameron. Drilled irrigation well, equipped with turbine pump, diameter 16 inches. Reference point, beginning May 30, 1948, top of concrete pump base, 0.25 foot above land-surface datum. May 30, 101.49, possible discrepancy of a few tenths of a foot between present and previous land-surface data.

ROOSEVELT COUNTY (PORTALES VALLEY)

By C. S. Conover

Part 1. General discussion

The investigation of the ground-water resources of Portales Valley, which began in 1931, was continued during 1948 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 will 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:

947807 O—51——17

Year of record	Water-Supply Paper	Page numbers
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
1947	1101	274-297

In January 1948, 187 wells were measured. (See part 2.) Of these about 51 were also measured in March, May, July, September, and November. (See part 3.) Water-stage recorders were operated on four wells during 1948 in order to obtain a continuous record of water levels. (See part 4.) A total of 459 measurements of water level was made during the year, including 25 tape measurements made on recorder wells.

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 that occurs 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 1948 was considerably greater than in 1947 and averaged approximately 89 percent of normal. The precipitation at Floyd was 12.58 inches, not including missing record for November; at Portales Evaporation Station, 16.70 inches, 2.12 inches below normal; at Portales, 19.71 inches, not including missing record for October; and at Arch, 11.85 inches, not including missing record for January. The precipitation during the growing season, April through September, averaged about normal and was generally above normal in June, July, and August. The precipitation during the growing season was greatest near the center of the valley, and amounted to 16.85 inches at Portales, 3.23 inches above normal. The precipitation during the growing season was considerably less in the upper and lower parts of the valley than near the center of the valley and amounted to only 9.86 inches at Arch, 2.51 inches below normal.

The amount of ground water pumped for irrigation in Portales Valley in 1948 was somewhat less than in the preceding year. The decrease in pumping which was caused by the excessive rainfall, particularly during the summer, was offset, in part, by an increase in pumpage caused by the increase in irrigated acreage. On the basis of electric power records for 209 comparable wells, it is estimated that nearly the same amount of water was pumped per acre from these wells in 1948 as in 1947. Pumps, powered other than by electricity, probably were not used as much in 1948 as in 1947 as many of these pumps are used mainly to supplement the precipitation on row crops. The acreage served by pumps in 1948 is estimated as about 30,000 acres, an increase of 2,500 acres over 1947. The pumpage in 1948 is estimated as 35,000 acre-feet, a decrease of 9,500 acre-feet from 1947.

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 from a dry year to a normal year.

Changes of water level

The ground-water levels in Portales Valley declined from January 1948 to January 1949 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 1948 to January 1949 was less than for the preceding year, primarily as a result of the decrease in pumping in 1948 and possibly an increase of recharge from the excess precipitation. The decline in water level of less than 2 feet in the area of greatest concentration of pumps surrounding Portales was decidedly less than occurred in the previous year when declines in excess of 5 feet were observed. However, in the pumped area about 6 miles northwest of Portales the net decline in 1948 was more than 3 feet, nearly as great as in 1947. The effect of the excess precipitation in reducing the pumping in the central part of the valley is reflected in the smaller decline of ground-water level in that area. Net

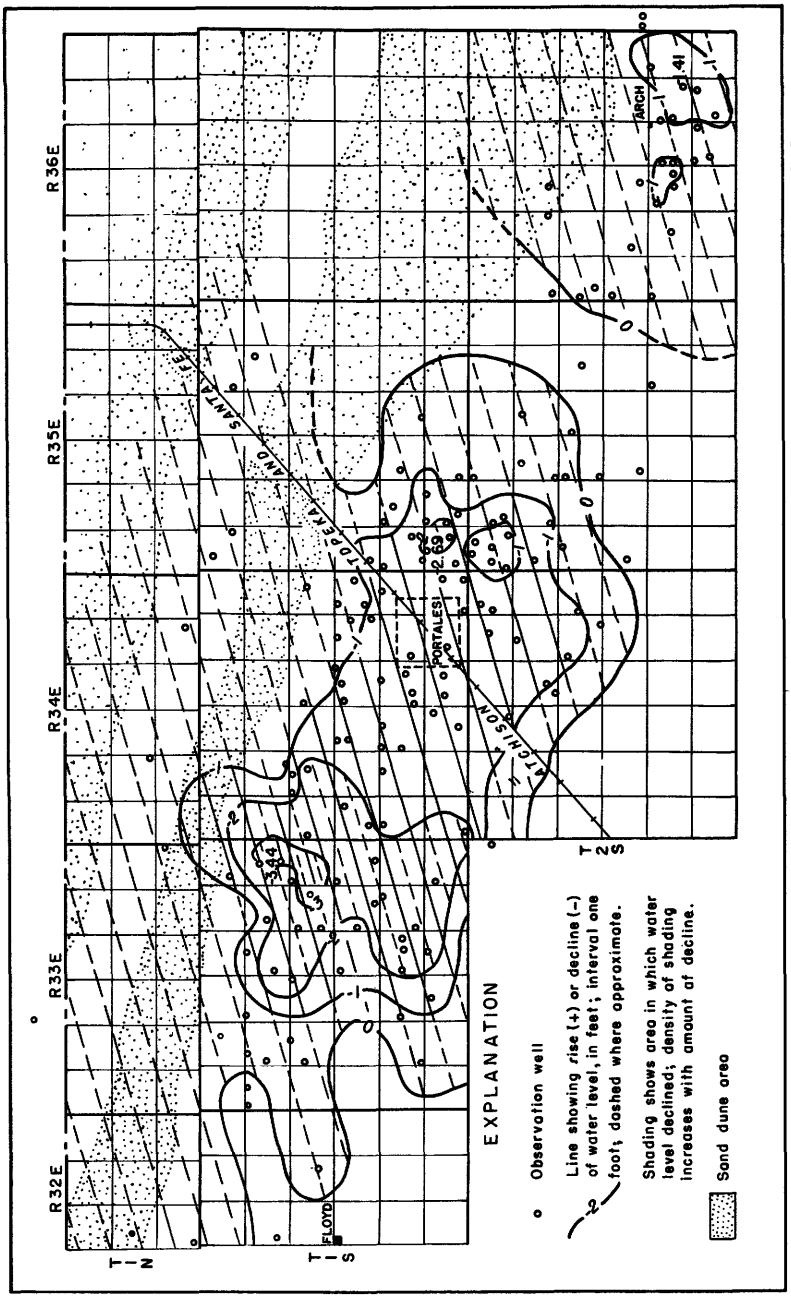

Figure 19.--Map of Portales Valley, Roosevelt County, N. Mex., showing decline in ground-water level from January 1948 to January 1949.

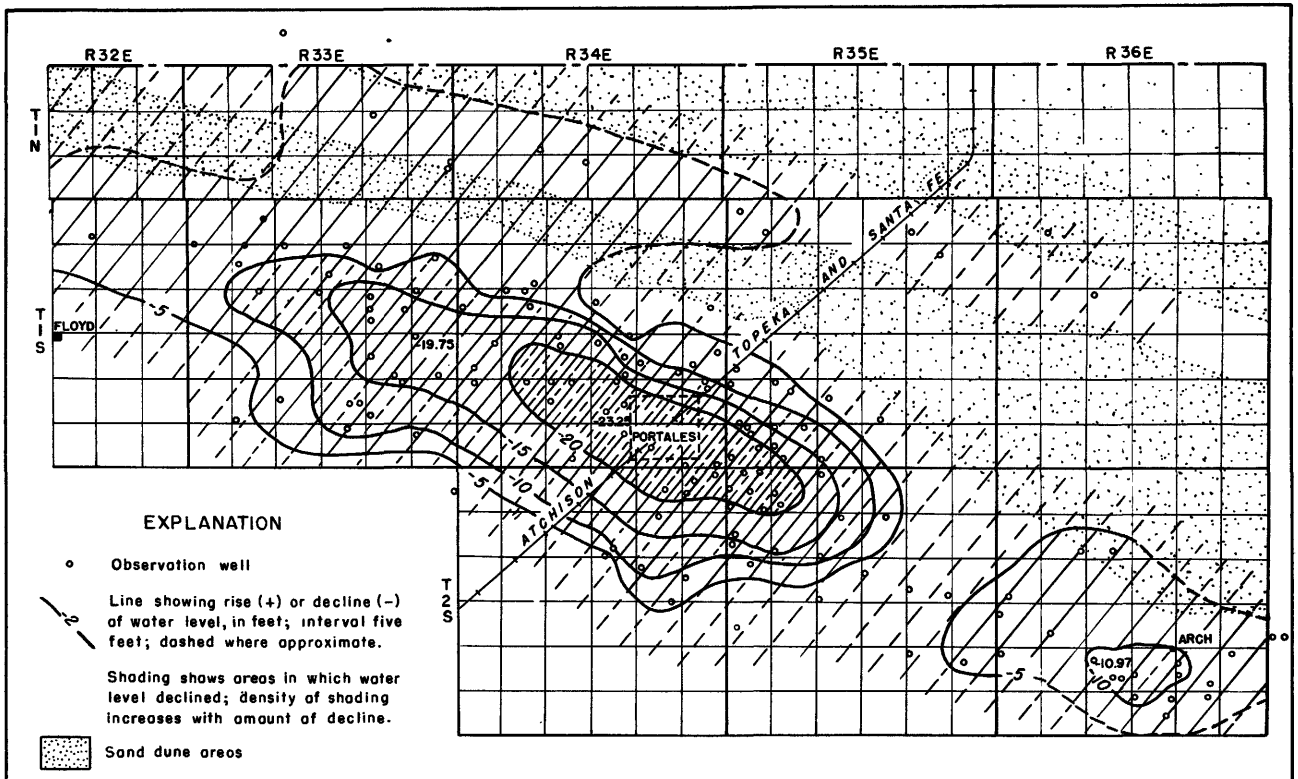

Figure 20.-- Map of Portales Valley, Roosevelt County, N. Mex., showing decline in ground-water level from January 1942 to January 1949.

declines of water level in excess of 1 foot occurred in 1948 in the lightly pumped area around Arch, as compared with declines of more than 2 feet in 1947.

The ground-water level in Portales Valley showed a net decline of more than 1 foot from January 1948 to January 1949 over an area of about 61 square miles, more than 2 feet over an area of about 17 square miles, and more than 3 feet over an area of about 1 square mile. The area of greatest decline was centered about 6 miles northwest of Portales.

In the 7-year period from January 1942, when the water levels were at or near their highest recorded levels, to January 1949, the water levels in the Portales Valley lowered more than 10 feet in an elliptical area of about 50 square miles that extends along the axis of the valley from about 10 miles northwest of Portales to about 6 miles southeast of Portales and has a maximum width of 4 miles near Portales. The water level also declined more than 10 feet in a nearly circular area of about 2 square miles that has its center about 1 mile west of Arch. In this 7-year period the water levels declined more than 20 feet, nearly 3 feet a year, in an elliptical area of 11 square miles centered at Portales. It is in the areas of large decline where the greatest concentration of pumps occur and also where pumping has been practiced the longest.

The water levels at the end of 1948 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 8 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 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	Year	Began	Years missing
1N.32.7.300	W. J. Crenshaw	3	16.02	6	+0.08	14.93	43	18.78	41	32	
27.321	Carl Essary	3,5	45.41	6	....	.....	..	.....	..	48	
30.421	A. R. Dillard	.	60.46	6	-2.51	57.95	47	60.46	48	47	
32.133	Virgie Hawkins	.	65.92	6	-.51	65.41	47	65.92	48	47	
34.333	Robert Newman	5	42.88	6	....	.....	..	.....	..	48	
1N.33.16.100a	Mr. Hardwick	(Measurements discontinued)				19.24	42	26.14	41	41	47,48
16.100c	(Incomplete designation used previously for well 1N.33.16.112, which see)									..	..
16.112	Mr. Hardwick	5	23.71	8	+.97	20.00	42	24.68	47	42	
16.131	do	5	25.83	8	....	.....	..	.....	..	48	
26.120	Mary E. Miller	.	a10.90	8	-3.22	3.54	42	12.06	39	39	43
36.400a	A. C. Woodburn	4	4.78	8	-1.80	f+1.57	42	f 8.23	41	32	
36.400b	do	3	a13.20	8	-6.73	1.98	42	13.97	41	32	37,38
1N.34.29.444	J. N. Tefertiller	.	17.15	7	-1.22	10.78	42	20.62	41	39	
33.224	Mrs. Lee Garrett	.	a20.18	7	-2.58	10.96	42	23.15	41	39	
35.432	Earl McCollum	.	19.66	7	-.69	18.97	47	22.88	44	39	45,46
1.31.1.222	B. C. Weeks	3	75.34	6	-.36	75.20	46	75.60	45	45	
1.32.3.440	M. Nall	3	34.39	6	-1.82	24.35	42	39.68	32	32	
10.331	J. R. Meadows	3	46.37	6	-1.14	45.23	47	46.37	48	47	
14.432	Robert Morrison	3	47.14	6	-2.20	43.63	45	47.14	48	45	
1.33.1.331	A. C. Woodburn	5	41.13	8	....	.....	..	.....	..	48	
5.432	Clay Jones	.	20.76	6	-.83	13.10	43	23.51	37	35	
7.111	E. L. Sisk	3	20.49	6	-1.70	12.17	42	22.02	41	40	
7.211	A. Q. Smith	.	20.44	6	-1.59	15.29	45	20.44	48	45	
8.112	(Incomplete designation used previously for well 1.33.8.121, which see)									..	..
8.121	A. Q. Smith	5	20.64	6	-1.60	11.69	43	22.30	37	35	
8.311	E. E. Marcus	.	i21.62	6	-1.43	12.28	43	23.00	41	39	
9.111	Earl Plank	.	22.26	6	-1.86	13.36	43	22.86	41	39	
9.442	John Adams (Measurements discontinued, well dry)					12.58	43	22.48	37	35	36,48
10.211	O. B. Sherman	.	26.08	6	-1.76	18.63	43	26.08	48	39	41
10.313a	Jim Allen	3	25.56	6	-3.07	22.49	47	25.56	48	47	
11.312	C. F. Williams	.	26.78	6	-2.44	18.17	43	26.78	48	35	39
12.144	A. C. Woodburn	3	35.95	8	-2.25	28.61	32	35.95	48	32	34,37
13.111	E. Elkins	.	29.26	8	-3.73	17.83	43	29.26	48	35	
14.131	J. V. Miller	.	28.68	6	-3.66	13.89	42	28.68	48	35	44
14.311	Claude Elder	.	27.55	6	-3.65	11.81	42	27.55	48	36	40,41
14.331c	J. E. Stacey	3	28.01	6	-3.45	19.37	45	28.01	48	45	
14.412	A. D. Pinkert	5	31.25	8	....	.....	..	.....	..	48	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
1.33.14.421a	A. D. Pinkert	(Measurements discontinued)				24.53	46	26.38	47	46	48
15.212	O. D. Minick	.	.....	.	....	13.44	42	23.20	41	35	47,48
16.222	Bethel Church	3	23.23	6	-3.19	11.13	43	23.23	48	42	
17.131	Marvin Wormington	5	21.92	6	....	.....	..	.....	..	48	
17.211	Bertha Campbell	3	22.73	6	-2.07	20.66	47	22.73	48	47	
22.111	Mrs. E. J. Smith	.	25.12	6	-2.63	22.49	47	25.12	48	47	
23.311a	D. H. Smith	.	30.82	6	-3.46	25.61	46	30.82	48	46	
23.433	H. A. Miller	.	29.88	8	-3.98	15.73	42	29.88	48	36	
24.111	J. E. Dictson	.	35.25	8	-3.82	18.40	42	35.25	48	35	
24.433	J. E. Jones	.	32.19	8	-4.21	15.82	42	32.19	48	36	
26.221	D. E. Thomas	.	29.69	8	-3.97	15.54	42	29.69	48	36	
26.331	C. G. Norton	.	33.93	6	-3.60	22.56	43	33.93	48	37	
27.311	J. A. Henley	.	45.76	6	-2.70	36.55	43	45.76	48	41	42,46
27.411	W. W. McClary	.	37.65	6	-3.16	27.20	43	37.65	48	41	
27.421	Luther Cooper	.	34.40	6	-3.42	23.31	43	34.40	48	42	
28.311	C. C. Ramey	3	46.27	6	-1.70	39.39	43	47.30	41	39	
29.333	M. H. Rea	3	34.04	6	-.45	29.73	43	37.03	41	41	
31.244	Luther Cox	.	45.25	6	-.64	44.61	47	45.25	48	47	
31.313	Webbie Starr	.	58.02	6	+.05	58.02	48	58.07	47	47	
33.211	W. R. McAffee	.	41.48	6	-2.37	39.11	47	41.48	48	47	
34.211	R. T. Bilberry	3	29.80	6	-2.96	19.72	43	29.80	48	40	
36.131	Edwin Johnson	.	41.29	6	-2.77	31.89	43	41.29	48	39	
1.34.8.434	Bob Ledbetter	.	34.25	7	-1.21	28.33	43	36.64	41	37	
13.412	Ben Donathan	3	53.46	7	-.73	51.50	44	56.44	41	39	
15.131	E. R. Kemp	3	52.10	7	-1.54	49.25	46	52.10	48	46	
17.111	W. D. Ware	.	36.50	7	-2.00	28.16	43	36.50	48	36	38
17.122	Bob Ledbetter	.	34.99	7	-1.61	27.59	43	36.34	41	37	
17.233	L. E. Allison	(Measurements discontinued)			....	25.10	43	35.20	41	32	48
17.241	B. F. Ray	(Measurements discontinued)			....	22.52	43	31.81	41	35	47,48
17.411a	O. L. Spencer	3,5	34.40	7	....	.....	..	.....	..	48	
18.133	J. E. Tucker	.	37.15	8	-3.52	25.64	42	37.15	48	42	43
19.223	Mr. Mathis	.	36.46	8	-3.25	19.03	42	36.46	48	35	
19.341	Floyd Horne	(Measurements discontinued)	.		....	16.62	42	30.61	47	41	48
19.341a	Wayne Welch	5	33.49	8	....	.....	..	.....	..	48	
21.121	L. H. Lee	.	43.13	7	-3.14	26.36	42	43.13	48	35	43
21.141	R. L. Ledbetter	.	44.25	7	-3.41	25.82	42	44.25	48	35	43
22.131	Mrs. W. E. Jergins	.	42.71	7	-2.58	27.47	42	42.71	48	35	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	year	Record: Began	Years missing
1.34.22.211	Mrs. A. J. Goodwin	5	42.37	7	....	35.66	35	42.37	48	35	41-47
22.222	do	3	42.48	7	- .93	38.17	43	43.52	41	32	
22.421	R. C. Grunig (Measurements discontinued; well filled)					28.89	42	40.28	47	39	48
22.443	Mable Jernigan (Measurements discontinued)				....	23.65	42	38.88	47	35	48
23.211	Pope Long	.	41.36	7	-1.21	36.89	42	41.99	41	37	46
23.313a	R. E. McDonald (Measurements discontinued)				....	27.47	43	37.75	47	32	48
23.422	E. L. Yandell	.	34.48	7	-1.52	27.73	43	34.48	48	35	
23.442a	S. B. Fletcher	.	38.01	7	-2.11	28.34	43	38.01	48	41	
24.112a	J. A. Pinson	.	38.47	7	-1.06	37.41	47	38.47	48	47	
24.243	J. T. Gorrell	.	48.40	7	-1.13	42.45	43	48.40	48	37	
24.312a	W. A. Cummings	.	36.10	7	-1.63	29.40	43	36.10	48	42	
25.200	J. B. H. Young and Smith Feed Pens	(Measursments discontinued)				29.20	42	38.48	47	35	38,48
25.211	J. B. H. Young	4	42.78	7	-2.54	32.54	32	42.78	48	32	
26.313	Unknown	.	39.91	7	-3.39	28.53	35	39.91	48	35	39-47
27.211	A. L. Tiffin	.	40.47	8	-3.08	20.95	42	40.47	48	32	
27.331a	G. A. Whitmire	5	39.10	8	....	.....	..	.....	..	48	
27.341	B. F. Smith	.	38.93	8	-3.46	17.24	42	38.93	48	35	
27.412	J. E. Plummer	.	39.72	7	-3.31	20.17	42	39.72	48	35	45
28.111	G. C. Morris	.	b37.77	7	-3.20	18.84	42	b37.77	48	42	
28.133a	Lee Daniels	.	39.70	8	-3.33	20.49	42	39.70	48	39	
28.211	G. B. Thomson	.	38.97	7	-2.61	19.74	42	38.97	48	35	38,39
29.211	J. W. King	.	36.48	7	-2.63	17.98	42	36.48	48	35	
30.121	M. A. Pember	.	33.31	8	-3.97	16.55	42	33.31	48	35	
33.223a	W. W. Blakeley	.	b35.26	8	-3.72	28.84	46	b35.26	48	46	
33.431	W. A. Moore	3	22.70	10	-3.36	7.24	42	22.70	48	32	
34.143	J. A. Sanders	.	40.46	8	-3.67	24.00	43	40.46	48	35	42
34.232	J. W. Owens	.	39.67	8	-4.54	19.90	42	39.67	48	35	36
34.234	do	5	39.33	8	....	.....	..	.....	..	48	
34.322	(Incomplete designation used previously for well 1.34.34.411, which see)								..	..	
34.411	W. L. Patton	5	.....	.	....	20.70	42	35.35	47	35	48
35.312	Eastern N. Mex. College	.	39.78	8	-4.67	20.06	42	39.78	48	35	
36.331	Jim Landiss	5	39.98	10	-5.75	18.84	42	39.98	48	41	
36.333	(Incomplete designation used previously for well 1.34.36.331, which see)								..	..	
36.421	Earl McCollum	.	39.01	10	-4.15	26.64	44	39.01	48	35	42,43,46
36.443	Foy Williams	.	40.65	10	-4.89	19.37	42	40.65	48	35	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
1.35.2.300	Eastern N. Mex. State Park	3	44.63	7	-0.16	43.52	44	48.07	40	36	
6.141	F. K. Montague	3	7.58	7	-1.50	.54	42	10.70	41	39	
6.400	J. C. Brown	3	11.77	7	-1.03	5.24	42	15.46	41	32	
11.241	Eunice McPherson	3	15.97	7	-.49	14.03	43	19.02	41	41	
19.332	S. D. Foreman	.	j45.48	13	-2.08	37.80	43	j45.48	48	35	44,45
19.411	E. T. Hensley	.	48.95	11	-1.65	47.30	47	48.95	48	47	
27.344a	H. J. McCroary	3	31.09	13	-.67	30.42	47	31.09	48	47	
28.143	C. A. Kerby	3	47.37	13	-.65	44.24	43	51.49	41	35	
29.111	Clara Nullmeyer	.	43.01	13	-2.63	35.26	43	43.01	48	40	
29.142	R. E. Lee	.	40.90	13	-1.93	33.15	43	40.90	48	35	
30.111	E. F. Foreman	.	42.53	13	-2.05	33.65	43	42.53	48	35	
30.343	T. E. Livingston	.	36.98	13	-3.25	22.67	43	36.98	48	35	
30.441	J. H. Breshears	.	38.12	10	-2.91	26.85	35	38.12	48	35	39-46
31.122	Mary M. Kenyon	.	37.78	13	-3.99	22.00	43	37.78	48	35	
31.231	W. R. McCollum	(Measurements discontinued; well dry)				19.23	43	31.60	41	35	48
31.331a	R. A. Young	.	38.49	10	-4.18	34.31	47	38.49	48	47	
31.342	E. F. Moore	.	138.80	10	-4.44	19.37	43	138.80	48	35	46
31.412	Henry Beebe	.	37.44	10	-4.58	30.40	46	37.44	48	46	
32.111	Alvin George	.	33.59	10	-3.09	19.65	43	33.59	48	35	37
32.212	R. H. Green	.	29.56	13	-2.41	18.45	43	29.56	48	40	
32.311	O. W. Doak	.	35.15	10	-4.68	17.41	42	35.15	48	35	
32.332	C. E. Lane	.	35.96	10	-4.70	17.12	42	35.96	48	36	37
32.413	Q. L. Hanies	(Measurements discontinued, well dry)				14.77	42	25.55	41	35	47,48
33.331	L. C. Green	.	.....	..	....	13.03	42	24.03	41	35	48
1.36.5.300	W. H. McDaniel	3	a34.08	7	-.11	32.84	43	36.01	41	40	
6.100	O. W. Bivine	(Measurements discontinued)				....	37.08	42	40.73	41	40	46-48
16.100	State of New Mexico	3	b19.46	7	-.36	b18.40	45	a30.20	40	40	46
2.33.1.422	W. B. and H. R. Skeen	.	27.61	10	-.68	26.58	46	27.61	48	46	
5.113	Kenneth Nunn	.	53.33	6	-.29	53.04	47	53.33	48	47	
7.232	(Incomplete designation used previously for well 2.33.7.241, which see)									..	..
7.241	John Morgan	5	49.30	6	+.26	49.30	48	49.94	46	46	
2.34.1.114	Jack Clark	.	40.02	10	-5.47	18.24	42	40.02	48	35	36,37
1.133	W. F. Clifton	.	38.26	10	-5.11	18.18	42	38.26	48	35	
1.221	Foy Williams	.	.....	..	....	18.98	42	35.46	47	35	48
2.233	Louisa Trout	4	53.78	9	-5.28	f33.04	42	f53.98	48	32	
4.441	Maud Wallace	3	8.25	9	-3.01	+4.17	42	8.25	48	39	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	Year	Record: Began	Years missing
2.34.6.112	Clyde Collis	.	30.49	10	- 1.93	28.56	47	30.49	48	47	
10.324	Henry Walker	3	26.86	9	- 2.08	23.45	46	26.86	48	46	
10.343	J. E. Bollen	.	34.63	9	- .68	32.25	43	36.03	41	35	
11.122	D. W. Bedinger	.	35.80	9	- 3.95	19.20	42	35.80	48	41	
13.133	L. J. Sanders	3	23.98	9	- 1.16	19.09	45	23.98	48	45	
14.113	J. P. Tarlton	.	31.46	9	- 2.02	20.56	42	31.46	48	35	
14.113a	do	5	31.10	9	....	.....	..	.....	..	48	
14.443	W. A. Schaffer	.	37.12	9	- 1.21	29.22	42	37.12	48	35	
2.35.4.111	E. S. Weber	3	28.05	10	- 3.80	12.94	42	28.05	48	35	36,37
5.311	R. C. Dale	.	32.89	10	- 4.43	12.87	42	32.89	48	35	
5.341	H. R. Sadler	.	32.43	10	- 4.49	13.45	42	32.43	48	35	
6.121	Dallas Clark	3	38.04	10	- 4.76	16.73	42	38.04	48	32	
6.213	Beulah Ownby	.	38.39	10	- 5.16	16.87	42	38.39	48	35	37,46
6.312a	C. H. Dawdy	.	36.81	13	- 5.32	24.37	45	36.81	48	45	46
6.331	J. A. Akens	.	31.14	10	- 4.16	12.96	42	31.14	48	35	36-38
6.411	F. A. Jewell	.	35.83	10	- 5.17	14.25	42	35.83	48	39	
6.443	Ora Johnson (Measurements discontinued, well filled)					f13.07	42	27.92	47	35	48
6.443a	do	3,5	32.20	10	....	.....	..	.....	..	48	
7.134	A. L. Kelly	.	38.75	10	-3.22	24.01	42	38.75	48	37	
7.312	W. E. Elliott (Measurements discontinued, well dry)					7.04	42	18.18	47	32	48
8.331	(Incomplete designation used previously for well 2.35.8.332, which see)....								..	..	
8.332	D. L. Ray	5	32.28	10	-3.38	18.28	42	32.28	48	35	
9.122	L. D. Griffith	3	22.85	10	-2.28	20.57	47	22.85	48	47	
9.333	C. E. Clark	.	30.80	10	-3.04	23.60	45	30.80	48	45	
10.211	S. H. Hare	.	19.49	10	-1.09	10.30	42	19.52	41	40	
14.313	1st Nat'l Bank, Portales	3	12.07	9	-1.35	6.79	42	12.07	48	39	
14.414	do	3	3.63	9	-1.08	+.07	43	3.63	48	40	
15.131	do	3	4.27	9	-1.63	+.02	42	4.27	48	39	
16.111	Robert Stokes	.	27.20	10	-2.68	24.52	47	27.20	48	47	
16.333	A. J. Cline	3	9.46	10	-1.16	4.12	42	9.46	48	39	
18.211	State of New Mexico	3	8.14	10	-2.28	(k)	42	8.14	48	39	
19.134	Roy Faircloth	3	28.16	9	-.61	27.55	47	28.16	48	47	
21.333	L. V. Campbell	5	41.32	9	....	.....	..	.....	..	48	
25.114	R. C. Watkins	.	25.25	9	-.72	24.53	47	25.25	48	47	
26.111	T. M. McCrary	.	31.50	9	-.11	28.07	42	32.98	41	41	
2.36.7.332	Loren Johnson	3	20.21	10	-1.29	16.60	45	20.21	48	45	
8.432	S. W. Davis	.	19.83	10	-1.18	13.26	42	20.94	41	39	

* See footnotes at end of table.

Part 2. Water levels in January 1948 and highest and lowest recorded levels in January or February, and change from January 1947 to January 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
2.36.9.431	T. E. Polly	.	20.42	10	-0.80	15.67	43	21.63	41	39	
18.311	H. H. McLain	5	15.09	10	....	.....	..	.....	..	48	
18.341	Bob Stokes	3	16.13	10	-1.15	9.42	42	18.26	33	32	
19.113	R. C. Marchbank	.	23.03	9	-1.22	16.93	42	23.03	48	41	
20.321	W. O. Davis	3	15.85	9	-1.32	8.12	42	16.50	32	32	
21.432	C. C. Statts	.	17.64	9	-1.84	10.39	43	17.64	48	39	42
25.112	W. D. Pate	.	15.44	9	-1.97	8.13	42	16.50	41	39	
26.131	L. L. Bugg	3	14.57	9	-2.18	5.29	42	14.57	48	32	
26.311	J. S. Riley	.	14.13	9	-2.17	5.09	42	14.13	48	36	
26.423	W. B. Cox	.	16.07	9	-2.10	8.15	42	16.09	41	35	38,39
27.111	B. L. Kennedy	.	16.41	9	-2.28	6.27	42	16.41	48	40	
27.131	do (Measurements discontinued, well dry)					6.54	42	15.26	37	36	41,48
27.211	M. O. Pate (Measurements discontinued, well dry)					5.58	42	14.79	37	37	48
27.311	J. M. Riley	.	16.88	9	-2.17	7.04	42	16.88	48	32	
27.311a	do	3,5	16.67	9	....	.....	..	.....	..	48	
28.114b	Morgan Trammell	4,5	17.28	9	-2.00	f 7.37	42	f17.29	48	33	
28.411	C. A. Tevis	.	17.10	9	-2.16	7.06	42	17.10	48	36	
28.421	do	.	18.05	9	-2.13	8.26	42	18.05	48	35	
28.441	E. C. Sanders	.	18.78	9	-2.14	11.60	43	18.78	48	35	42
29.411	Unknown	5	18.82	9	....	.....	..	.....	..	48	
30.111	L. B. Thornton	3	5.41	9	-1.41	.70	42	5.41	48	42	
34.111	D. J. Patton	.	17.70	9	-2.22	8.18	42	17.70	48	36	
34.111a	do	5	17.70	9	....	.....	..	.....	..	48	
34.222	W. H. Davenport	.	12.33	9	-2.43	4.01	42	12.33	48	35	
34.312	L. W. Walker	3,5	18.13	9	....	.....	..	.....	..	48	
34.341	W. J. Murrill	.	20.89	9	-2.01	12.39	42	20.89	48	36	
34.421	F. F. Dacus	.	e10.38	9	....	4.24	42	10.64	41	39	48
35.212	A. E. Whitehead (Measurements discontinued)				....	3.81	42	12.96	32	32	38,48
35.212a	Mrs. Eunice Harrison	3,5	10.93	9	....	.....	..	.....	..	48	
35.311	Mr. Stokes	5	11.24	9	....	.....	..	.....	..	48	
2.37.19.331	W. H. McDougal	3	18.32	9	-1.70	12.74	42	20.19	41	39	
19.341	C. R. Anderson	.	17.99	9	-1.32	12.97	42	19.84	41	39	
21.312	O. E. Pattison	.	14.15	9	-.73	12.86	46	14.15	48	46	

a Pumping.
b Pumping recently.
e Dry at depth given.
f From recorder charts.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.
j Measurement uncertain.
k Above land-surface datum, well inaccessible.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Location number Owner	1N.32. 7.300 Cren-shaw	1N.32. 27.321 Essary	1N.33. 36.400b Wood-burn	1.31. 1.222 Weeks	1.32. 3.440 Nall	1.32. 10.331 Meadows	1.32. 14.432 Morri-son	1.33. 7.111 Sisk
Jan. 6,8	16.02	45.41	a13.20	75.34	34.39	46.37	47.14	20.49
Mar. 29	a17.42	b47.35	8.10	74.99	34.09	45.96	46.66	20.00
May 28	a17.04	51.96	8.70	75.97	36.54	47.00	49.57	23.43
July 29	a17.34	46.48	9.34	76.30	35.20	46.22	50.55	a35.70
Sept.30	a17.40	48.27	a12.42	76.67	35.74	47.07	c54.35	20.81
Nov. 22	a17.39	46.48	a10.64	76.17	.....	46.40	50.00	20.17

Location number Owner	1.33. 10.313a Allen	1.33. 12.144 Wood-burn	1.33. 14.331c Stacey	1.33. 16.222 Bethel Church	1.33. 17.211 Camp-bell	1.33. 28.311 Ramey	1.33. 29.333 Rea	1.33. 34.211 Bil-berry
Jan. 6,8	25.56	35.95	28.01	23.23	22.73	46.27	34.04	29.80
Mar. 29	a42.75	35.70	27.61	c26.50	21.50	.....	33.87	29.48
May 28	34.30	38.80	a48.66	28.12	23.76	47.96	a35.10	a59.70
July 29	(a)	43.74	a49.69	c29.15	23.84	48.36	a34.05	a58.78
Sept.30	34.53	39.21	33.35	28.90	25.03	48.67	a34.71	34.47
Nov. 22	b28.23	40.18	31.04	26.72	23.98	47.76	34.09	32.63

Location number Owner	1.34. 13.412 Dona-than	1.34. 15.131 Kemp	1.34. 17.411a Spencer	1.34. 22.222 Good-win	1.34. 33.431 Moore	1.35. 2.300 State Park	1.35. 6.141 Monta-gue	1.35. 6.400 Brown
Jan. 7,10	53.46	52.10	34.40	42.48	22.70	44.63	7.58	11.77
Mar. 28,29, 31	53.58	51.64	34.63	42.73	22.73	44.88	7.40	11.96
May 27,28	53.74	53.13	38.88	42.89	23.53	45.06	7.47	11.94
July 27-29	53.97	52.57	41.32	42.94	23.12	45.17	7.78	12.04
Sept.28-30	54.02	53.16	41.57	42.92	24.15	45.11	8.10	12.20
Nov. 19,22	54.03	52.83	36.82	43.09	24.46	45.08	12.36	12.37

Location number Owner	1.35. 11.241 McPher-son	1.35. 27.344a Mc-Croary	1.35. 28.143 Kerby	1.36. 5.300 Mc-Daniel	1.36. 16.100 State of N.M.	2.34. 4.441 Wallace	2.34. 10.324 Walker	2.34. 13.133 San-ders
Jan. 7,9,13	15.97	31.09	47.37	a34.08	b19.46	8.25	26.86	23.98
Mar. 28,31	16.01	31.22	47.46	33.80	a26.30	8.70	27.27	b24.82
May 27	16.13	31.37	48.24	33.84	19.40	8.81	29.07	26.66
July 27,28	16.22	31.44	47.77	a34.07	19.48	7.19	28.45	25.60
Sept.28,29	16.35	31.23	47.79	33.87	b19.63	8.49	28.18	26.73
Nov. 19,20	16.30	31.17	47.42	a34.02	a28.50	e8.76	28.10	25.19

Location number Owner	2.35. 4.111 Weber	2.35. 6.121 Clark	2.35. 6.443a John-son	2.35. 9.122 Griff-ith	2.35. 14.313 Bank	2.35. 14.414 Bank	2.35. 15.131 Bank	2.35. 16.333 Cline
Jan. 9,10	28.05	38.04	32.20	22.85	12.07	3.63	4.27	9.46
Mar. 28,30	27.51	36.96	32.68	23.04	11.51	3.18	4.06	9.26
May 27	b33.95	41.31	a65.36	24.58	11.82	3.70	4.79	13.83
July 27,28	31.66	41.48	36.43	23.87	11.37	2.76	2.76	8.27
Sept.28,29	(a)	42.18	37.05	24.24	.....	4.11	5.42	8.64
Nov. 20	28.73	39.78	34.46	23.43	.....	3.77	4.64	8.92

Location number Owner	2.35. 18.211 State of N.M.	2.35. 19.134 Fair-cloth	2.36. 7.332 John-son	2.36. 18.341 Stokes	2.36. 20.321 Davis	2.36. 26.131 Bugg	2.36. 27.311a Riley	2.36. 30.111 Thorn-ton
Jan. 9,10	8.14	28.16	20.21	16.13	15.85	14.57	16.67	5.41
Mar. 30,31	7.91	28.69	20.46	16.22	15.58	14.42	16.39	4.97
May 27,29	8.64	30.74	21.26	16.37	a24.26	15.74	(a)	6.31
July 27,28	5.68	29.65	20.33	16.08	17.35	15.78	119.87	6.08
Sept.28,29	7.45	29.61	19.45	15.50	(a)	15.83	19.97	7.16
Nov. 19,20	8.17	29.27	19.75	16.00	16.58	15.71	17.89	6.46

* See footnotes at end of Part 3.

Part 3. Water levels, in feet, showing seasonal changes during 1948--Cont.

Location number	2.36. 34.312	2.36. 35.212a	2.37. 19.331
Owner	Walker	Harrison	McDougal
Jan. 9	18.13	10.93	18.32
Mar. 31	17.81	11.32	18.54
May 29	c22.46	12.30	18.86
July 28	18.78	13.22	19.02
Sept. 29	18.92	13.32	18.91
Nov. 20	19.06	12.57	19.13

a Pumping.
b Pumping recently.
c Nearby well pumping.
e Dry at depth given.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

1N.33.36.400a. A. C. Woodburn. Highest and lowest recorded water levels: Feb. 27, 4.59; Oct. 6-9, 17, 6.15.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.79	4.74	4.60	4.62	4.80	....	5.81	5.86	6.11	5.97	5.76
2	4.78	4.73	4.60	4.62	4.82	....	5.77	5.88	6.11	5.95	5.76
3	4.78	4.72	4.60	4.61	4.84	....	5.75	5.90	6.12	5.94	5.76
4	4.78	4.71	4.60	4.61	4.86	....	5.61	5.91	6.13	5.92	5.75
5	4.78	4.68	4.61	4.61	4.87	....	5.53	5.94	6.13	5.91	5.75
6	4.77	4.66	....	4.61	4.90	....	5.49	5.95	6.15	5.91	5.73
7	4.77	4.66	....	4.61	4.93	....	5.45	5.97	6.15	5.91	5.73
8	4.78	4.65	....	4.62	4.95	5.45	5.43	5.98	6.15	5.90	5.73
9	4.78	4.64	....	4.63	4.97	5.47	5.43	5.97	6.15	5.89	5.73
10	4.78	4.62	....	4.62	5.00	5.50	5.43	5.95	6.12	5.89	5.73
11	4.78	4.62	....	4.62	5.03	5.53	5.44	5.95	6.13	5.87	5.73
12	4.78	4.64	....	4.62	5.04	5.56	5.46	5.95	6.13	5.85	5.73
13	4.80	4.63	....	4.63	5.05	5.59	5.48	5.96	6.13	5.85	5.73
14	4.78	4.63	....	4.64	5.08	5.62	5.47	5.97	6.13	5.84	5.72
15	4.78	4.62	....	4.64	5.10	5.65	5.47	5.98	6.13	5.83	5.72
16	4.78	4.61	....	4.65	5.13	5.67	5.47	5.99	6.14	....	5.72
17	4.76	4.61	....	4.66	5.16	5.69	5.48	6.00	6.15	....	5.72
18	4.76	4.61	....	4.66	5.19	5.71	5.49	6.01	6.11	....	5.72
19	4.76	4.61	....	4.67	5.22	5.73	5.50	6.03	6.11	5.81	5.71
20	4.76	4.62	....	4.68	5.25	5.75	5.51	6.03	6.09	5.80	5.71
21	4.75	4.61	....	4.70	5.27	5.76	5.53	6.04	6.08	5.80	5.71
22	4.75	4.60	....	4.69	5.31	5.78	5.57	6.03	6.07	h5.79	5.71
23	4.74	4.60	....	4.68	5.34	5.79	5.60	6.04	6.05	5.79	5.71
24	4.74	4.60	....	4.68	5.37	5.78	5.64	6.05	6.05	5.78	5.71
25	4.75	4.61	....	4.69	....	5.77	5.68	6.06	6.04	5.77	5.71
26	4.74	4.60	....	4.71	....	5.78	5.72	6.07	6.04	5.77	5.71
27	4.74	4.59	....	4.73	....	5.79	5.75	6.09	6.03	5.77	5.71
28	4.75	4.60	....	4.75	....	5.80	5.78	6.08	6.02	5.77	5.71
29	4.75	4.60	4.62	4.77	....	5.81	5.81	6.08	6.01	5.77	5.71
30	4.74		4.61	4.79	....	5.83	5.83	6.10	5.99	5.77	5.71
31	4.74		4.61		....	5.82	5.84		5.98		5.71

h Tape measurement at odd hour.

1.34.25.211. Young & Hatch. Highest and lowest recorded water levels: Mar. 19, 42.26; Oct. 1, 48.33.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	42.61	42.40	42.34	44.10	45.14	44.85	46.30	47.13	48.33	.....	45.24
2	.....	42.60	42.40	42.34	44.14	45.08	44.84	46.17	47.11	48.28	.....	45.28
3	.....	42.58	.....	42.34	44.26	45.02	44.84	46.09	47.11	48.15	.....	45.25
4	.....	42.58	.....	42.35	44.22	45.00	45.09	46.00	47.11	48.10	.....	45.20

1.34.25.211--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5	.....	42.55	.....	42.36	44.37	44.99	45.30	45.90	47.15	.....	.....	45.25
6	.....	42.56	.....	42.40	44.46	44.98	45.66	45.80	47.16	.....	.....	45.21
7	.....	42.56	42.35	42.44	44.55	44.96	45.92	45.73	47.19	.....	.....	45.17
8	.....	42.56	42.35	42.48	44.63	44.95	.....	45.68	47.22	.....	.....	45.17
9	.....	42.54	.....	42.48	44.71	44.96	.....	45.63	47.17	.....	.....	45.19
10	.....	42.52	.....	42.46	44.74	44.97	.....	45.58	47.12	.....	.....	45.16
11	42.75	42.57	42.35	42.48	44.72	44.99	.....	45.55	47.04	.....	.....	45.13
12	42.75	42.52	42.32	42.53	44.78	45.45	.....	45.59	47.00	.....	.....	.....
13	42.74	42.52	42.30	42.58	44.89	45.33	.....	45.65	46.94	.....	.....	.....
14	42.73	42.52	42.30	42.58	45.00	45.28	.....	45.74	46.90	.....	.....	.....
15	42.72	42.51	42.32	42.78	45.01	45.25	.....	45.65	46.84	.....	.....	.....
16	42.73	42.52	42.30	42.84	45.07	45.21	.....	45.55	46.79	.....	.....	.....
17	42.71	42.51	42.28	42.82	45.09	45.20	.....	45.50	.....	.....	.....	.....
18	42.71	42.49	42.30	42.82	45.13	45.31	.....	45.46	.....	.....	.....	.....
19	42.70	42.50	42.26	42.94	45.16	45.19	.....	45.56	.....	.....	45.48	.....
20	42.69	42.48	.....	43.08	45.20	45.21	.....	46.03	.....	.....	45.47	.....
21	42.67	42.47	.....	43.16	45.32	45.17	.....	46.38	.....	.....	45.50	44.81
22	42.66	42.45	.....	43.14	45.38	45.13	.....	46.63	.....	.....	45.42	.....
23	42.66	42.45	.....	43.13	45.37	45.08	.....	46.66	.....	.....	45.40	.....
24	42.65	42.47	.....	43.15	45.35	45.04	.....	47.07	.....	.....	45.34	.....
25	42.66	42.44	.....	43.24	45.41	45.00	.....	47.19	.....	.....	45.36	.....
26	42.66	42.42	.....	43.35	45.42	44.97	.....	47.23	.....	.....	45.33	.....
27	42.67	42.44	42.30	43.46	45.43	44.94	46.46	47.45	.....	.....	45.34	.....
28	42.63	42.42	42.28	43.68	45.36	44.93	46.35	47.41h	48.07	.....	45.32	.....
29	42.63	42.40	42.28	43.81	45.31	44.89	46.30	47.30	.....	.....	45.30	.....
30	42.62		42.28	43.95	45.25	44.87	46.22	47.22	48.20	.....	45.28	.....
31	42.61		42.31		45.19		46.16	47.15		.....		44.80

h Tape measurement at odd hour.

2.34.2.233. Louisa Trout. Highest and lowest recorded water levels: Mar. 14, 18, 52.64; Sept. 7, 60.00.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	53.98	53.27	52.78	54.16	55.60	56.80	56.80	58.18	59.17	59.17	57.00	56.30
2	53.93	53.21	52.83	54.05	55.52	56.51	57.09	57.91	59.19	59.15	56.88	56.39
3	53.91	53.18	52.94	54.02	55.50	56.39	57.26	57.71	59.82	58.89	56.79	56.29
4	53.85	53.18	52.90	54.33	55.55	56.32	56.94	57.50	59.98	58.60	56.76	56.32
5	53.81	53.15	52.83	54.50	55.68	56.39	56.84	57.34	59.41	58.51	57.08	56.43
6	.....	53.12	52.79	54.72	55.85	56.26	57.29	57.20	59.32	58.47	57.21	56.21
7	.....	53.15	52.78	54.77	56.26	56.21	57.50	57.21	60.00	58.46	57.21	56.19
8	.....	53.12	52.73	54.50	56.44	56.78	57.57	57.20	59.40	58.40	56.99	56.10
9	53.72	53.09	52.72	54.42	56.35	56.91	57.42	57.12	59.10	58.23	56.88	56.07
10	53.68	53.07	52.78	54.50	56.30	56.67	57.72	57.41	58.84	58.18	56.92	55.98
11	53.65	53.10	52.75	54.58	56.36	56.58	57.50	57.56	58.63	58.20	56.80	56.02
12	53.67	53.02	52.72	54.57	56.32	56.50	57.40	57.79	58.48	58.10	56.69	56.02
13	53.63	53.01	52.70	54.55	56.28	56.42	58.05	58.43	58.39	58.10	56.58	56.01
14	53.50	53.02	52.64	54.60	56.33	56.38	56.44	57.91	58.33	58.22	56.56	55.93
15	53.58	52.99	52.66	54.92	56.72	56.51	58.38	57.60	58.29	58.29	56.50	55.89
16	53.59	53.00	52.70	55.13	56.69	57.10	58.39	57.32	58.54	58.31	56.54	55.85
17	53.50	52.97	52.71	55.23	56.61	57.19	58.39	57.27	58.58	58.15	56.47	55.78
18	53.50	52.92	52.64	55.50	56.57	57.09	58.27	57.39	58.71	58.06	56.52	55.78
19	53.49	52.92	52.81	55.49	57.20	57.52	58.16	57.61	58.64	58.00	56.40	55.71
20	53.48	52.90	52.92	55.24	57.16	57.17	58.38	57.74	58.70	57.90	56.39	55.77
21	53.40	52.89	53.05	55.12	57.36	56.90	58.10	58.82	58.89	57.68	56.51	55.81
22	53.39	52.85	53.08	55.05	57.42	56.78	57.98	58.28	59.00	57.51	56.40	55.71
23	53.38	52.84	53.15	55.04	57.50	56.72	58.58	58.20	59.03	57.47	56.32	55.70
24	53.38	52.97	53.34	55.10	57.14	56.69	.....	58.43	58.78	57.35	56.29	55.70
25	53.38	52.89	53.38	55.06	56.90	56.92	.....	58.66	58.71	57.29	56.49	55.67
26	53.35	52.80	53.40	55.05	56.69	56.82	.....	59.44	58.74	57.24	56.49	55.58
27	53.33	52.78	53.41	55.20	56.51	56.59	.....	59.63	58.75	57.29	56.65	55.50
28	53.29	52.87	53.70	55.28	56.48	56.50	58.32	59.58	58.86	57.24	56.54	55.53
29	53.29	52.80	54.02	55.86	56.40	56.38	58.41	59.00	58.94	57.30	56.47	55.52
30	53.28		53.86	55.65	56.30	56.33	58.50	58.90	59.05	57.23	56.40	55.48
31	53.27		53.80		56.28		58.55	59.10		57.08		55.41

2.36.28.114b. Morgan Trammell. Deepened July 31, 1948, to 44.5 feet. Highest and lowest recorded water levels: Apr. 10-12, 17.00; Oct. 1-4, 19.38.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	17.19	17.12	17.05	17.34	18.26	.....	18.91	18.65	19.38	19.01	18.62
2	.....	17.18	17.11	17.05	17.38	18.28	.....	18.90	18.62	19.38	19.00	18.62
3	.....	17.18	17.11	17.04	17.40	18.28	.....	18.88	18.60	19.38	18.98	18.61
4	17.29	17.18	17.11	17.03	17.45	18.29	.....	18.87	18.58	19.38	18.97	18.59
5	17.29	17.18	17.10	17.03	17.48	18.30	.....	18.84	18.56	19.37	18.96	18.58
6	17.29	17.19	17.09	17.02	17.53	18.31	.....	18.82	18.55	19.36	18.94	18.57
7	17.28	17.20	17.09	17.01	17.54	18.31	.....	18.80	18.50	19.34	18.92	18.57
8	17.27	17.20	17.09	17.02	17.55	18.31	.....	18.79	18.50	19.33	18.91	18.57
9	17.28	17.18	17.08	17.01	17.56	18.31	.....	18.78	18.50	19.31	18.89	18.56
10	17.27	17.17	17.08	17.00	17.58	18.32	.....	18.78	18.51	19.30	18.87	18.55
11	17.26	17.18	17.08	17.00	17.60	18.32	.....	18.80	18.53	19.28	18.86	18.54
12	17.27	17.16	17.07	17.00	17.62	18.32	.....	18.83	18.55	19.27	18.84	18.56
13	17.27	17.16	17.06	17.03	17.63	18.32	.....	18.83	18.56	19.26	18.83	18.55
14	17.25	17.16	17.04	17.03	17.67	18.32	.....	18.84	.....	19.25	18.82	18.53
15	17.25	17.15	17.04	17.03	17.71	18.32	.....	18.85	.....	19.23	18.81	18.53
16	17.26	17.15	17.05	17.02	17.75	18.32	.....	18.85	.....	19.23	18.81	18.52
17	17.24	17.14	17.03	17.03	17.82	18.32	.....	18.85	.....	19.24	18.79	18.51
18	17.24	17.12	17.02	17.04	17.89	18.32	.....	18.86	.....	19.25	18.78	18.51
19	17.24	17.13	17.03	17.05	17.92	18.32	.....	18.88	.....	19.24	18.76	18.48
20	17.23	17.12	17.02	17.07	17.96	18.32	.....	18.88	.....	19.23	18.76	18.48
21	17.22	17.12	17.02	17.09	17.99	18.32	.....	18.89	.....	19.21	18.78	18.47
22	17.22	17.12	17.01	17.09	18.03	18.32	.....	18.90	.....	19.19	18.76	18.46
23	17.22	17.11	17.02	17.10	18.06	18.32	.....	18.90	.....	19.17	18.75	18.46
24	17.22	17.13	17.04	17.11	18.10	18.32	.....	18.86	.....	19.14	18.73	18.45
25	17.23	17.13	17.06	17.15	18.13	18.32	.....	18.84	.....	19.13	18.72	18.44
26	17.23	17.11	17.08	17.17	18.16	18.32	.....	18.81	.....	19.11	18.69	18.44
27	17.23	17.11	17.10	17.19	18.18	18.32	.....	18.78	.....	19.09	18.69	18.42
28	17.22	17.15	17.08	17.25	18.20	.....	e18.82	18.75	.....	19.08	18.66	18.42
29	17.21	17.12	17.07	17.27	18.23	.....	.....	18.74	19.37	19.07	18.65	18.42
30	17.21		17.06	17.29	18.25	.....	.....	18.70	19.37	19.05	18.63	18.41
31	17.20		17.05		18.26		18.93	18.67		19.03		18.40

e Dry at depth given.

Part 5. Miscellaneous data concerning observation wells

1N.32.27.321. Essary. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 105 feet. Reference point, top of concrete pump base, and top of casing, 0.70 foot above land-surface datum. Mar. 29, 1947, 44.78; July 31, 1947, 45.96; Sept. 14, 1947, 47.37; Nov. 19, 1947, 45.82.

1N.32.34.333. Newman. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 117 feet. Reference point, top of concrete pump base, east side of well, 0.50 foot above land-surface datum. May 28, 43.82.

1N.33.16.112. Hardwick. Incompletely designated formerly as 1N.33.16.100c.

1N.33.16.131. Hardwick. Drilled domestic well, equipped with windmill tower and pressure pump, diameter 8 inches, depth 48± feet. Reference point, top of concrete floor of pump shed, 0.86 foot above land-surface datum.

1.33.1.331. Woodburn. At west end of earthen tank, about 0.1 mile east of road. Drilled well, no equipment, diameter 12 inches, depth 90 feet. July 30, 1947, 41.25.

1.33.8.121. Smith. Previously designated incorrectly as 1.33.8.112.

1.33.14.412. Pinkert. Drilled irrigation well, equipped with turbine pump. Reference point, top of circular concrete curb, 1.00 foot above land-surface datum.

1.33.17.131. Wormington. Drilled irrigation well, equipped with turbine pump.

1.34.17.411a. Spencer. Drilled irrigation well, no equipment, diameter 12 inches, depth 85 feet.

Date	Water level	Date	Water level	Date	Water level
Mar. 29, 1947	31.74	July 30, 1947	35.44	Nov. 19, 1947	35.30
May 28	32.70	Sept.15	38.23		

1.34.19.341a. Welch. 300 feet south of house and well 1.34.19.341. Drilled irrigation well, equipped with turbine pump, diameter 17 inches, depth 92 feet. Reference point, top edge of casing, level with top of 4- by 4-foot concrete base, 1.25 feet above land-surface datum.

1.34.22.211. Goodwin. Equipped with turbine pump. Measurements resumed.

1.34.27.331a. Whitmire. About 10 feet south of well 1.34.27.331. Drilled well, equipped with turbine pump. Reference point, top of concrete pump base, 0.64 foot above land-surface datum.

1.34.34.234. Owens. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 101 feet. Reference point, top of hexagonal concrete pump base, 0.55 foot above land-surface datum.

1.34.34.411. Patton. Previously designated incorrectly as 1.34.34.322.

1.34.36.331. Landiss. Previously designated incorrectly as 1.34.36.333.

2.33.7.241. Morgan. Previously designated incorrectly as 2.33.7.232.

2.34.14.113a. Tarlton. About 15 feet northwest of well 2.34.14.113. Used drilled irrigation well, equipped with turbine pump. Reference point, top of 3- by 3-foot concrete well curb, north side of well, 1.00 foot above land-surface datum.

2.35.6.443a. Johnson. 12 feet north of well 2.35.6.443. Drilled irrigation well, equipped with turbine pump, diameter 14 inches. Reference point, top of casing, 1.00 foot above land-surface datum.

Mar. 28, 1947	27.86	July 29, 1947	35.27	Nov. 20, 1947	33.59
May 26	27.94	Sept.16	36.91		

2.35.8.332. Ray. Previously designated incorrectly as 2.35.8.331.

2.35.21.333. Campbell. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 86 feet. Reference point, top of concrete pump base, 1.00 foot above land-surface datum.

2.36.18.311. McLain. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete base, south side of well, at land-surface datum.

2.36.27.311a. Riley. Drilled irrigation well, equipped with turbine pump. Nov. 20, 1947, 17.16.

2.36.28.114b. Trammell. Well deepened to 44.5 feet, July 31, 1948. Reference point, established July 31, 1948, top of Geological Survey washer in the northeast anchor post for windmill tower about 3 feet northeast of well, 2.22 feet above land-surface datum.

2.36.29.411. Unknown. Drilled irrigation well, equipped with turbine pump. Reference point, top of circular concrete pump base, north side of well, 0.75 foot above land-surface datum.

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2.36.34.111a. Patton. About 60 feet north of well 2.36.34.111. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete curb, 0.23 foot above land-surface datum.

2.36.34.312. Walker. 150 feet southeast of house. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 65 feet. Reference point, top of casing at high point, north side of well, 1.00 foot above land-surface datum. Mar. 31, 1947, 15.95; July 30, 1947, 16.98; Sept. 16, 1947, 18.35; Nov. 20, 1947, 18.26.

2.36.35.212a. Harrison. 20 feet northeast of observation well 2.36.35.212. Drilled irrigation well, equipped with turbine pump. Reference point, top of concrete pump base, 0.80 foot above land-surface datum. July 30, 1947, 11.15; Nov. 20, 1947, 11.23.

2.36.35.311. Stokes. Drilled irrigation well, equipped with turbine pump. Reference point, top of 3- by 3-foot concrete base, 0.75 foot above land-surface datum.

SIERRA COUNTY (HOT SPRINGS AREA)

By C. S. Conover and H. O. Reeder

Part 1. General discussion

Thermal water area

Water levels were measured in the thermal observation wells at Hot Springs during 1948 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 will 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 numbers
1939-40	911	235-240
1941	941	270-274
1942	949	336-340
1943	991	295-299
1944	1021	290-294
1945	1028	290-295
1946	1076	300-304

Water levels were measured in 13 thermal 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 93 measurements of water level was made in the thermal area during the year including about 33 made on the recorder wells. Measurements from January through July were made by C. R. Murray, those in

September by C. R. Murray and H. O. Reeder, and those in November by H. O. Reeder.

Nonthermal water area

In 1945 the United States Geological Survey, upon the request of and in cooperation with the State engineer of New Mexico, began an investigation of the nonthermal artesian-water basin lying south of Hot Springs. The report "Ground-water conditions in the nonthermal artesian water basin south of Hot Springs, Sierra County, N. Mex." by C. R. Murray will be published in a forthcoming biennial report of the State engineer.

A number of flowing artesian wells have been developed on the west side of the Rio Grande south of Hot Springs. Such wells extend from Mud Springs Draw, just southwest of Hot Springs, to Arrey, about 18 miles south of Hot Springs. Development has been concentrated in three areas, namely, Mud Springs Draw, Animas Creek, and Percha Creek, but there are also a number of wells along the Rio Grande valley proper. The latter wells are within 2 miles of the Rio Grande, or Caballos Reservoir, but in Animas and Percha Creeks, flowing wells have been obtained as far as 4 miles from the river. The wells considered here are in Mud Springs Draw, about a mile southwest of Hot Springs and within a mile of the Rio Grande. The artesian wells in this vicinity furnish the municipal water supply for the city of Hot Springs, but most of the wells in the area are used for combined domestic and irrigation purposes.

The water occurs in sands, gravels, and silts in the poorly consolidated Tertiary or Quaternary deposits which fill the Rio Grande structural depression. Artesian conditions are believed to be brought about by confinement of the water in the aquifers by clay strata, which are interbedded with the coarser materials, the whole sequence having an easterly dip toward the river. Water is believed to enter the aquifers west of the area of artesian development, to flow through the aquifers toward the Rio Grande, and to be discharged indirectly to the river by upward percolation through imperfect confining beds to the overlying shallow-water aquifers and thence to the river.

Water-level measurements were made in four wells in the nonthermal area in January by C. R. Murray. Of these, two are flowing artesian wells, 14.4.6.441 and 14.4.6.442, one is a shallow driven well, 14.4.5.310, and one is a deep well which failed to produce artesian pressure, 14.4.6.110a.

Changes of water level

Thermal water area

Artesian pressures at Hot Springs declined an average of 0.50 foot from January 1948 to January 1949 as compared with a decline of 0.09 foot in the preceding year. All of the 13 wells reached their lowest levels on record at the end of 1948.

The highest observed level in the thermal wells for the year was reached in March and the lowest in November with an average range of about 0.75 foot, as compared to a high in March and low in September with an average range of about 0.4 foot for the previous year. Part of this greater annual decline and greater seasonal range of fluctuation may have been the result of increased use of the thermal waters, which is probably due to more wells being drilled since the area was reopened to drilling in August 1947.

Nonthermal water area

Measurements of head and water level in the nonthermal area have not been made over a sufficiently long period of time to evaluate the record. The shallow well, 14.4.5.310, showed a rise of water level of 0.5 foot from January 1948 to February 1949, as compared with a decline of about 1.5 feet the preceding year. The water level in the deep well, 14.4.6.110a, declined 2.5 feet in 1948, as compared to a rise of about 0.1 foot in 1947. The other two wells, 14.4.6.441 and 14.4.6.442, showed large declines in water level from January 1948 to February 1949 which was caused by the wells flowing when the 1949 measurements were taken.

Part 2. Water levels in January 1948 and highest and lowest recorded levels[1] and change from January 1947 to January 1948, in feet

Field No.	Location Lot	Location Block	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
			Hot Springs--thermal wells										
2	17	1	H. L. Lockhart	3	+0.27	17	- 0.09	+1.20	42	+0.27	48	41	46
3	17	1	do	3	+.30	17	- .11	+1.23	42	+.30	48	41	46
4	21	2	C. E. James	3	+.28	17	- .14	+1.28	42	+.28	48	39	
5	12	9	J. E. Malone	3	.76	17	- .17	+.13	42	.76	48	39	
6	4	8	C. E. James	4	+.54	17	- .05	f+1.57	42	f+.41	48	41	
6a	4	8	do	4	1.82	17	- .16	f1.24	42	f1.95	48	42	
12	8	40	Mr. Mathis	3	+3.65	17	- .07	+4.53	42	+3.65	48	39	
18	7	105	W. R. Whitehead	3	1.85	17	- .09	1.19	42	1.92	39	39	
19	12	105	Bill Green	3	1.01	17	- .08	.20	42	1.01	48	39	
25	4	93	Jim Knox	4	7.82	17	- .03	f6.95	42	f7.99	44	39	
27	4	42	Ben Graham	3	+2.12	17	- .03	+2.97	42	+2.12	48	39	
30	1	102	G. L. Mills	3	1.49	17	- .07	.63	42	1.48	40	39	
33	2	106	C. E. James	3	.53	17	- .09	+.28	42	.53	48	41	

Location number	Owner	See also Part	Water levels: Jan. 1948 Level	Jan. 1948 Day	Change 1947-48	Highest Level	Highest Year	Lowest Level	Lowest Year	Record: Began	Record: Years missing
	Hot Springs--nonthermal wells										
14.4.5.310	Cauthen Packing House	5	9.69	24	- 1.43	8.26	47	9.69	48	47	
6.110a	Dave Gray	5	98.15	24	+.13	98.15	48	98.28	47	47	
6.441	Roy Howe	5	+57.90	24	- .40	+58.30	47	+57.90	48	47	
6.442	Mrs. Arnold	5	+55.57	24	+.63	+55.57	48	+54.94	47	47	

[1] Mar. 1939, Feb. 1940, Feb. 1941, Mar. 1942, Apr. 1943, Jan. 1944-47.
f From recorder chart.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Field No. Owner	2 Lock-hart	3 Lock-hart	4 James	5 Malone	12 Mathis	18 White-head	19 Green	27 Gra-ham
Jan. 17	+0.27	+0.30	+0.28	0.76	+3.65	1.85	1.01	+2.12
Mar. 26,27	+.53	+.57	+.60	.46	+3.91	1.58	.56	+2.38
May 28	+.48	+.53	+.53	.55	+3.88	1.63	.63	+2.35
July 20	+.33	+.36	+.42	.65	+3.74	1.72	1.11	+2.29
Sept.15	.05	.00	.....	1.09	+3.36	2.05	1.26	.....
Nov. 15,16	.34	.....	.....	.....	+3.10	2.31	2.53	.....

Field No. Owner	30 Mills	33 James
Jan. 17	1.49	0.53
Mar. 26	1.23	.27
May 28	1.26	.29
July 20	1.43	.41
Sept.15	1.77	.74
Nov. 15	2.07	....

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

6 Lot 4, block 8. C. E. James. Highest and lowest recorded water levels: June 2, +0.98; Nov. 15, 22, +0.08.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	+0.44	+0.68	+0.82	+0.87	+0.82	+0.80	+0.73	+0.68	+0.62	.....	.....	+0.16
2	+.44	+.69	+.80	+.88	+.82	+.98	+.74	+.68	+.62	.....	.....	+.13
3	+.44	+.72	+.81	+.90	+.83	+.93	+.75	+.67	+.59	+.25	.....	+.16
4	+.44	+.76	+.77	+.90	+.83	+.91	+.74	+.62	.....	+.24	.....	+.17
5	+.46	+.77	+.76	+.91	+.83	+.89	+.73	+.63	.....	+.28	.....	+.11
6	+.43	+.75	+.77	+.91	+.83	+.89	+.72	+.63	.....	.....	.....	+.12
7	+.42	+.75	+.76	+.89	+.83	+.89	+.72	+.62	.....	.....	.....	+.13
8	+.41	+.72	+.77	+.82	+.91	+.82	+.72	+.63	.....	.....	.....	+.16
9	+.42	+.76	+.79	+.88	+.82	+.81	+.73	+.63	.....	.....	.....	+.14
10	+.42	+.78	+.80	+.90	+.82	+.81	+.72	+.61	.....	.....	.....	+.17
11	+.45	+.77	+.76	+.92	+.82	+.81	+.72	+.58	.....	.....	.....	+.17
12	+.44	+.72	+.78	+.90	+.82	+.81	+.72	+.61	.....	.....	.....	+.15
13	+.48	+.73	+.81	+.82	+.82	+.80	+.72	+.61	.....	.....	.....	+.12
14	+.54	+.70	+.82	+.82	+.81	+.80	+.71	+.61	.....	.....	.....	+.16
15	+.55	+.72	+.82	+.82	+.81	+.81	+.72	+.60	+.36	+.24	+.08	+.17
16	+.56	+.72	+.79	+.91	+.81	+.79	+.72	+.57	+.36	+.21	+.10	+.15
17	+.60	+.75	+.82	+.91	+.82	+.81	+.72	+.58	+.36	+.13	+.12	+.16
18	+.60	+.76	+.83	+.92	+.82	+.81	+.71	+.58	+.34	+.14	+.11	+.16
19	+.57	+.77	+.82	+.92	+.82	+.81	+.72	+.58	+.35	+.17	+.13	+.13
20	+.59	+.77	+.82	+.93	+.82	+.79	+.73	+.58	+.32	+.17	+.13	+.13
21	+.62	+.76	+.82	+.95	+.86	+.79	+.73	+.60	+.32	+.17	+.09	+.13
22	+.65	+.82	+.81	+.95	+.82	+.79	+.72	+.56	+.32	+.17	+.08	+.14
23	+.63	+.81	+.81	+.91	+.82	+.75	+.73	+.56	+.30	+.15	+.09	+.18
24	+.67	+.76	+.87	+.88	+.81	+.79	+.72	+.60	+.29	+.12	+.12	+.17
25	+.65	+.87	+.87	+.82	+.82	+.80	+.71	+.60	+.28	.....	+.13	+.13
26	+.67	+.91	+.81	+.82	+.81	+.80	+.71	+.60	+.26	.....	+.10	+.13
27	+.64	+.87	+.81	+.82	+.81	+.78	+.71	+.57	+.25	.....	+.11	+.18
28	+.67	+.81	+.82	+.82	+.81	+.76	+.71	+.59	+.24	.....	+.09	+.17
29	+.66	+.82	+.87	+.82	+.81	+.75	+.71	+.61	+.25	.....	+.11	+.13
30	+.67		+.90	+.82	+.79	+.73	+.70	+.62	+.25	.....	+.13	+.17
31	+.68		+.90		+.80		+.70	+.63		.....		+.19

6a Lot 4, block 8. C. E. James. Highest and lowest recorded water levels: June 2, +1.00; Nov. 15, 16, 23, 2.15.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.94	1.67	1.58	1.54	....	1.62	1.62	1.65	1.67	2.05	....	2.10
2	1.94	1.67	1.52	1.53	....	+1.00	1.63	1.66	1.67	2.06	....	2.09
3	1.94	1.65	1.52	1.52	....	+.98	1.63	1.67	1.69	2.08	....	2.09

6a Lot 4, block 8--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
4	1.94	1.62	1.56	1.52	....	+0.21	1.63	1.70	....	2.07	....	2.07
5	1.93	1.60	1.59	1.51	....	.41	1.63	1.71	....	2.06	....	2.08
6	1.94	1.60	1.61	1.51	....	1.13	1.65	1.72	....	2.04	....	2.08
7	1.94	1.59	1.61	1.51	1.52	1.32	1.66	1.72	....	2.04	....	2.09
8	1.94	1.60	1.62	1.52	1.52	1.39	1.65	1.71	....	2.04	....	2.08
9	1.94	1.61	1.62	1.51	1.53	1.43	1.65	1.70	....	2.03	....	2.07
10	1.94	1.60	1.61	1.51	1.56	1.47	1.65	1.71	....	2.02	....	2.06
11	1.94	1.59	1.61	....	1.58	1.49	1.66	1.73	....	2.02	....	2.06
12	1.94	1.61	1.61	....	1.58	1.51	1.66	1.73	....	2.02	....	2.05
13	1.93	1.61	1.59	....	1.57	1.52	1.67	1.73	....	2.02	....	2.05
14	1.89	1.62	1.59	....	1.56	1.53	1.67	1.73	....	2.01	....	....
15	1.86	1.62	1.58	....	1.57	1.55	1.67	1.74	1.93	2.01	2.15	....
16	1.84	1.61	1.59	....	1.56	1.56	1.67	1.75	1.91	2.02	2.15	....
17	1.81	1.62	1.60	....	1.57	1.57	1.66	1.76	1.90	2.06	2.14	....
18	1.79	1.63	1.59	....	1.58	1.57	1.66	1.76	1.91	2.08	2.13	....
19	1.79	1.64	1.59	....	1.57	1.57	1.65	1.76	1.93	2.09	2.14	....
20	1.78	1.58	1.59	....	1.56	1.58	1.64	1.75	1.94	2.08	2.12	2.07
21	1.77	....	1.58	....	1.55	1.59	1.65	1.75	1.95	2.08	2.13	2.07
22	1.75	....	1.58	....	1.57	1.59	1.64	1.75	1.97	2.07	2.14	2.07
23	1.74	....	1.57	....	1.58	1.60	1.62	1.77	1.98	2.07	2.15	2.06
24	1.73	....	1.55	....	1.59	1.61	1.62	1.75	1.99	2.09	2.13	2.05
25	1.72	....	1.54	....	1.60	1.60	1.62	1.74	2.00	2.10	2.12	2.06
26	1.71	....	1.54	....	1.61	1.59	1.62	1.73	2.00	....	2.12	2.06
27	1.71	....	1.55	....	1.60	1.59	1.63	1.73	2.01	....	2.12	2.05
28	1.71	2.15	1.54	....	1.59	1.59	1.63	1.72	2.03	....	2.13	2.04
29	1.70	1.76	1.54	....	1.60	1.61	1.63	1.71	2.04	....	2.12	2.04
30	1.70		1.54	....	1.62	1.61	1.64	1.70	2.04	....	2.11	2.04
31	1.69		1.53		1.63		1.64	1.69		....		2.04

25 Lot 4, block 93. Jim Knox. Highest and lowest recorded water levels: June 2, 7.43; Nov. 15, 21, 22, 24, 8.26.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.92	7.69	7.57	....	7.56	7.63	7.69	7.77	8.14	....	8.19
2	7.91	7.69	7.58	....	7.43	7.61	7.69	7.77	8.12	....	8.22
3	7.92	7.68	7.56	....	7.44	7.59	7.70	7.79	8.09	....	8.21
4	7.91	7.66	7.60	....	7.47	7.60	7.75	7.79	8.06	....	8.18
5	7.90	7.63	7.62	....	7.47	7.62	7.75	7.81	8.03	....	8.25
6	7.92	7.65	7.62	....	7.47	7.63	7.75	7.82	8.04	....	8.23
7	7.90	7.65	7.63	....	7.48	7.64	7.75	....	....	....	8.22
8	7.91	7.69	7.61	....	7.49	7.63	7.75	....	....	....	8.20
9	7.90	7.66	7.58	....	7.50	7.63	7.75	....	....	....	8.20
10	7.91	7.62	7.57	....	7.51	7.63	7.76	....	....	....	8.19
11	7.90	7.63	7.60	....	7.51	7.63	7.78	....	....	....	8.18
12	7.90	7.67	7.60	....	7.52	7.64	7.77	....	....	....	8.20
13	7.88	7.66	7.58	....	7.55	7.65	7.77	....	....	....	8.22
14	7.82	7.68	7.54	....	7.55	7.65	7.77	....	8.10	....	8.19
15	7.81	7.66	7.53	....	7.55	7.65	7.78	8.02	8.09	8.26	....
16	7.80	7.67	7.57	....	7.56	7.65	7.81	8.02	8.12	8.24	....
17	7.75	7.64	7.54	h7.64	7.54	7.65	7.80	8.03	8.21	8.22	....
18	7.74	7.62	7.51	....	7.55	7.66	7.80	8.05	8.19	8.23	....
19	7.77	7.62	7.56	....	7.54	7.65	7.81	8.03	8.17	8.21	....
20	7.76	7.62	7.53	....	7.57	7.65	7.80	8.05	8.19	8.21	8.21
21	7.75	7.63	7.52	....	7.56	7.65	7.79	8.05	8.18	8.26	8.21
22	7.73	7.58	7.54	....	7.56	7.65	7.80	....	8.17	8.26	8.20
23	7.72	7.56	7.51	....	7.59	7.65	7.81	8.07	8.19	8.25	8.18
24	7.70	7.60	7.49	....	7.57	7.65	7.79	8.08	....	8.26	8.18
25	7.71	7.52	7.47	....	7.56	7.66	7.78	8.09	....	8.21	8.22
26	7.70	7.46	7.50	....	7.56	7.66	7.79	8.12	....	8.23	8.21
27	7.72	7.51	7.49	....	7.60	7.66	7.79	8.12	....	8.23	8.19
28	7.70	7.55	7.50	....	7.60	7.68	7.79	8.13	....	8.25	8.19
29	7.70	7.56	7.50	7.53	7.61	7.67	7.77	8.12	....	8.22	8.22
30	7.71		7.49	7.56	7.63	7.68	7.77	8.14	....	8.22	8.20
31	7.70		7.51	7.56		7.68	7.77		....		8.18

h Tape measurement at odd hour.

Part 5. Miscellaneous data concerning observation wells

14.4.5.310. Cauthen. Driven well, diameter 6 inches, depth 40 feet. Reference point, top of casing, 0.50 foot above land-surface datum. June 19, 1946, 8.45; Jan. 29, 1947, 8.26, possible discrepancy of a few tenths of a foot between present and previous land-surface data.

14.4.6.110a. Gray. Drilled well, diameter 12 inches, depth 334 feet. Reference point, top of casing, 1.00 foot above land-surface datum. Jan. 22, 1947, 98.28.

14.4.6.441. Howe. Drilled domestic and irrigation artesian well, diameter 10 inches, depth 302 feet. Reference point, top surface of 4-inch discharge pipe immediately south of gate valve on casing, 2.00 feet above land-surface datum. Jan. 22, 1947, +58.30; Mar. 28, 1947, +49.44.

14.4.6.442. Arnold. Drilled domestic and irrigation artesian well, diameter 10 inches, depth 305 feet. Reference point, top of 10-inch casing, 2.32 feet above land-surface datum. Oct. 17, 1945, +37.86; Jan. 22, 1947, +54.94; Mar. 28, 1947, +47.66.

TORRANCE COUNTY (ESTANCIA VALLEY)

By C. S. Conover and H. O. Reeder

Part 1. General discussion

The program of measuring water levels in observation wells, started in Estancia Valley in 1941 in cooperation with the State engineer of New Mexico, was continued in 1948. Most of the irrigated area is in Torrance County, but new development has extended the area northward into the southern part of Santa Fe County. 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 numbers
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 100 wells in March, 54 wells in May, 55 wells in August, and 48 wells in October, making a total of 257 measurements during the year, including 4 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.) The measurements in March and May were made by C. R. Murray, those in August by C. R. Murray and H. O. Reeder, and those in October by H. O. Reeder.

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.

Recharge to the ground-water body in 1948 was less than normal as indicated by the deficient precipitation. The precipitation at Otto was 7.67 inches, 4.81 inches below normal; at McIntosh, 8.47 inches, 5.56 inches below normal; at Estancia, 7.14 inches, 6.08 inches below normal; at Tajique, 12.84 inches, 7.44 inches below normal; and at Mountainair, for which records for October are missing, estimated about 10 inches. Precipitation was less than in 1947 and generally slightly above normal for February and June, but below normal for the rest of the year.

There was an increase in ground-water development in Estancia Valley in 1948. It is estimated that about 6,000 acres were watered from wells in 1948 and that about 5,400 acre-feet of water was pumped, as compared with about 5,000 acres watered in 1947 with about 5,000 acre-feet of water pumped. About half of the new development has been spread throughout the Torrance County part of the irrigated area with the other half concentrated within about 3 miles north of the county line, in the southern part of Santa Fe County.

Changes of water level

Water levels from March 1948 to February 1949 rose in 5 observation wells and fell in 74 observation wells for which records are comparable. The average change for these wells was a decline of 1.10 feet as compared with an average decline in 67 wells of 0.20 foot in 1947. As the water levels in 1948 were measured in March, 1 month later than in 1949, the observed net declines may be somewhat larger than if the water levels in 1948 had been measured in February.

The areas in Estancia Valley in which the water table declined from March 1948 to February 1949 are shown on the accompanying map. The ground-water levels declined more than 1 foot over an area of about 72 square miles and more than 2 feet over an area of about 4 square miles.

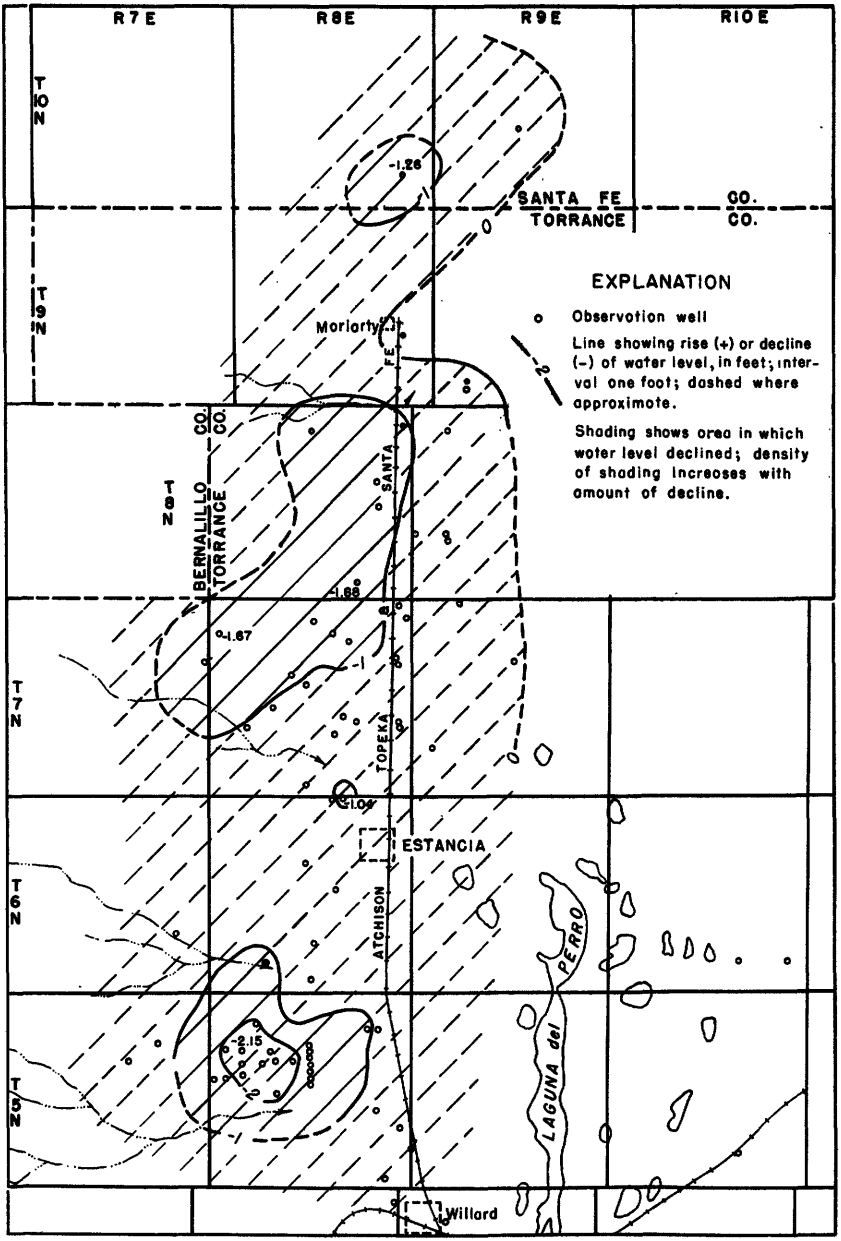

Figure 21.--Map of Estancia Valley, Torrance County, New Mexico, showing decline of ground-water level from March 1948 to February 1949.

The largest declines in water level occurred in the area of largest pumpage of ground water, about 7 miles southwest of Estancia. The maximum observed decline of 2.15 feet, well 5.8.8.331, was in this area. The ground-water levels showed a net decline of more than 1 foot over an area of about 24 square miles and more than 2 feet over a circular area of about 4 square miles centered at the northeast corner of sec. 17, T. 5 N., R. 8 E. A net decline of more than 1 foot occurred over an area of about 17 square miles at approximately the same location in the preceding year.

Between Estancia and Moriarty, just west of the railroad, the water levels showed a net decline for 1948 of more than 1 foot over an area of about 42 square miles, as compared to small declines of less than 1 foot in this area in the preceding year.

In the southern part of Santa Fe County the water level apparently declined more than 1 foot over an area of about 6 square miles centered at well 10.8.36.111. Irrigation in this area was developed in 1948, and it is expected that the declines will increase greatly in the next few years as a result of additional development.

An abnormal decline of water level of 21.6 feet from March 1948 to February 1949 was observed in well 7.8.16.142, about 6 miles northwest of Estancia. In March 1948, prior to the measurement of water level, this well was deepened from 200 to 232 feet and struck a limestone cavity. The artesian pressure encountered in the cavity caused the water level to rise about 53 feet to within 11 feet of the land surface. However, heavy pumping of this well during 1948 and possible leakage into the upper aquifers probably caused most of the large decline in the water level. Some of the decline of water level may be due to other wells having been drilled into this formation.

The net decline of water levels from March 1948 to February 1949 in observation wells in the remainder of Estancia Valley was less than 1 foot, but was greater than the decline of the preceding year.

Part 2. Water levels in March 1948 and highest and lowest recorded levels in January or February, and change from February 1947 to March 1948, in feet

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
4.8.1.144	J. M. Harper	.	53.48	24	+0.31	52.91	46	54.70	44	42	
24.222	M. E. Ottoson	.	55.87	23	+.03	55.87	48	57.23	41	41	
4.9.5.344	Morris Ottoson	.	30.33	24	-.19	30.14	47	30.33	48	47	
7.441	Unknown	.	52.99	23	-.04	52.68	43	53.39	44	42	
10.133	Homer Arnn	3	17.23	24	-.08	17.15	47	18.22	41	41	
5.7.11.411	O. H. Brown	3,5	86.81	23	....	.....	..	.....	..	48	
15.212	Ewing school	.	116.24	23	-.67	115.33	46	117.88	41	41	
5.8.4.343	Unknown	.	.....	..	....	30.24	42	a32.71	44	42	48
5.344	O. R. Etheridge	3	52.70	23	-1.56	51.14	47	52.70	48	47	
7.431	John Ingle	.	71.96	23	-1.75	70.21	47	71.96	48	47	
8.231	E. F. Richards	.	57.40	23	-1.59	55.81	47	57.40	48	47	
8.331	Madison Davis	.	55.94	23	-1.70	54.24	47	55.94	48	47	
8.424	Arlington Austin	3,5	62.03	23	....	.....	..	.....	..	48	
9.423	Carter Bowden	.	53.65	22	-1.13	52.52	47	53.65	48	47	
10.331	Charles Rattan	.	19.28	22	-1.03	18.25	47	19.28	48	47	
10.331a	do	3,5	19.79	22	....	.....	..	.....	..	48	
10.333	do	.	18.37	22	-1.05	17.32	47	18.37	48	47	
11.221a	J. V. Chamberlin	.	10.27	22	+.70	9.78	45	10.97	47	45	
12.111	do	3	14.47	22	+.42	12.04	43	17.10	41	41	
15.113	D. S. Bailey	.	19.04	23	-1.13	17.91	47	19.04	48	47	
15.131	Joe Begley	.	15.39	23	-.94	14.45	47	15.39	48	46	
15.131a	do	3	17.48	23	-1.19	16.29	47	17.48	48	47	
15.311	Charles Rattan	.	20.61	23	-1.17	19.44	47	20.61	48	47	
15.313	do	.	21.51	23	-1.18	20.33	47	21.51	48	46	
16.111	Arlington Austin	5	54.17	23	....	.....	..	.....	..	48	
16.211	Ben Mullen	5	45.96	22	....	.....	..	.....	..	48	
17.113	Madison Davis	3	46.81	23	-1.69	45.01	46	46.81	48	46	
17.212	R. O. Brown	5	51.99	23	....	.....	..	.....	..	48	
17.241	do (Measurements discontinued)				....	40.78	43	41.82	46	42	48
17.311	do	.	29.79	23	-1.59	26.92	42	30.43	41	41	
17.311a	do	5	29.50	23	....	.....	..	.....	..	48	
17.323	do	.	29.14	23	-1.51	26.05	42	29.66	41	41	
17.334	do	.	13.01	23	-1.53	9.80	42	13.61	41	41	
18.233	S. W. Hodgson	3	40.30	23	-1.61	38.69	47	40.30	48	47	
18.312	Willard Hodgson	.	40.02	23	-1.45	38.57	47	40.02	48	47	
18.313	do	.	33.66	23	-1.43	32.23	47	33.66	48	47	
18.421	F. H. Ayres	.	28.70	23	-1.81	26.89	47	28.70	48	47	

* See footnotes at end of table.

Part 2. Water levels in March 1948 and highest and lowest recorded levels in January or February, and change from February 1947 to March 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
5.8.21.111	R. B. Ford	.	28.58	23	-1.35	27.23	47	28.58	48	46	
24.311	E. B. Wallace	3	22.73	23	+.15	21.93	46	22.88	47	46	
25.212	Homer Arnn	3	25.32	23	-.48	22.45	42	25.32	48	42	
30.121	Unknown	.	e27.79	23	....	22.68	42	29.66	41	41	48
36.341	Mrs. Iva Moe	.	45.15	23	-.04	45.11	47	46.69	41	41	
5.9.31.331	Homer Arnn	3	32.65	23	-.09	32.56	47	34.10	41	41	
5.10.27.444	Unknown	.	40.34	24	+.03	40.34	48	40.78	41	41	
6.7.25.113	C. E. Clark	5	73.23	23	....	.....	..	.....	..	48	
6.8.1.244	J. H. Wiggins	.	20.81	24	-.03	20.78	47	21.62	45	42	
2.111	Ellison Timmins	5	16.06	24	....	.....	..	.....	..	48	
3.221	do	3	26.68	24	-.01	26.18	42	26.86	46	41	
15.444	Estancia Cemetery	3	30.47	22	-.09	29.99	43	31.04	41	41	
16.222	McGee Estate	.	58.93	23	-.13	58.66	44	59.47	41	41	
24.111	Aurileo Brito	.	9.61	24	+.34	6.22	42	10.78	46	41	
27.134	R. M. Spruill	.	20.79	23	-.26	19.59	43	a21.49	45	42	
30.434	J. W. Langley	.	(a)	..	....	25.63	42	40.69	41	41	48
32.212	O. R. Etheridge	3	24.02	23	-.80	23.22	47	24.02	48	47	
34.311	John Chamberlin	3	17.00	23	-.89	16.11	47	17.00	48	47	
6.9.9.222	Unknown	(Measurements discontinued)..				4.84	45	11.93	43	41	48
6.10.25.344	C. A. Blackwell	.	41.75	24	+1.06	41.75	48	42.38	42	42	
27.444	Major Dean	.	20.20	24	+.01	20.20	48	20.77	41	41	
7.7.12.444	C. B. Roland	3	42.74	25	-1.37	41.37	47	46.45	41	41	
7.8.1.231	Myrtle Homan Estate	3	c25.99	24	-.89	c25.10	47	c26.27	44	42	
1.423	Floyd Stump	.	24.55	25	-.62	23.93	47	24.79	42	41	
3.140	Wayne Laws	5	55.66	25	....	.....	..	.....	..	48	
3.300	Neal Jenson	5	3.27	25	....	.....	..	.....	..	48	
7.121	C. T. Norman	5	75.40	25	....	.....	..	.....	..	48	
9.444	do	.	58.50	25	-.78	57.72	47	62.45	41	41	
10.221	Neal Jenson	3	15.66	25	+.52	15.66	48	17.52	42	42	
10.244	Ted Maxfield	.	(a)	25	....	17.13	47	a22.37	45	42	48
11.132	Neal Jenson	5	7.48	25	....	.....	..	.....	..	48	
12.433	Arthur Schmidt	.	21.73	24	-.08	21.65	47	23.53	41	41	
12.433a	do	3,5	21.59	24	....	.....	..	.....	..	48	
16.142	J. J. Thomas	3,5	10.92	25	....	10.92	48	63.53	47	47	
16.422	Jim Ergood	.	44.13	25	-.19	43.88	46	45.61	41	41	45
20.240	C. A. Burns	3,5	86.70	24	....	.....	..	.....	..	48	
20.334	Marion Gates	5	110.20	24	....	.....	..	.....	..	48	

* See footnotes at end of table.

Part 2. Water levels in March 1948 and highest and lowest recorded levels in January or February, and change from February 1947 to March 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
7.8.23.311	O. L. Austin	.	18.00	24	-0.20	17.80	47	18.33	41	41	
23.324	do	3	1.74	24	+.16	1.74	48	2.45	41	41	
24.431	R. T. Floyd	3,5	22.34	24	....	.....	..	.....	..	48	
24.433	do	.	24.34	24	.00	23.68	42	25.20	46	41	
25.411	H. P. Brunnell	.	21.59	24	-.11	21.26	42	22.13	41	41	
26.141	Mr. Richter	5	5.50	24	-1.40	4.10	47	5.50	48	46	
27.221	Wagner Estate	4	19.54	24	-.30	f19.21	47	f19.84	48	41	
27.434	Lilburn Homan	(Measurements discontinued)				....	.....	..	.....	..	47	48
33.123	B. A. Kinchelos	3	30.28	24	-.29	29.24	42	32.35	41	41	
33.424	E. C. Hayes Estate	.	52.44	24	+.01	52.44	48	53.34	42	41	
34.222	Lilburn Homan	3,5	18.68	24	....	.....	..	.....	..	48	
35.111	W. W. Dunn	.	18.71	24	-.21	17.95	42	19.22	41	41	
7.9.5.211	Unknown	.	18.80	25	+.06	18.80	48	19.22	42	42	
10.333	Mr. Price	.	14.82	25	-.01	14.81	47	15.40	45	42	43,44
30.412	W. L. Davidson	5	11.34	24	....	.....	..	.....	..	48	
8.8.1.434	Unknown	3,5	29.12	25	....	.....	..	.....	..	48	
10.111	W. H. Woodman	5	108.05	25	....	.....	..	.....	..	48	
10.244	Dennis Willie	.	67.22	25	....	65.21	43	67.22	48	43	45,47
13.311	B. M. Maxwell	5	21.87	25	....	.....	..	.....	..	48	
13.324	do	5	47.97	25	....	.....	..	.....	..	48	
24.131	Buck and Cunningham	5	10.55	25	....	.....	..	.....	..	48	
26.222	Unknown	3	(a)	..	....	6.64	47	7.52	42	42	48
35.322	A. C. Hibner	3,5	51.08	25	....	.....	..	.....	..	48	
8.9.8.111	Unknown	.	24.98	25	-.53	23.77	42	25.34	46	42	
29.111	Mrs. Harry Bigger	.	21.40	24	+.66	20.89	42	b22.06	47	42	
29.111a	do	.	21.69	24	-.06	20.93	46	21.70	44	44	
30.111	G. I. King	3,5	20.13	24	....	.....	..	.....	..	48	
9.8.2.242	Valley Irrigation Co.	5	56.20	25	....	.....	..	.....	..	48	
24.330	do	5	40.50	25	....	.....	..	.....	..	48	
26.121	Unknown	.	.....	..	....	19.60	43	21.00	46	42	48
9.9.32.131	G. L. Dean	3	6.01	25	-.37	5.64	47	6.88	41	41	44
32.131a	do	3	6.64	25	-.94	5.70	47	6.68	44	44	
10.8.36.111	Valley Irrigation Co.	3,5	34.91	25	....	.....	..	.....	..	48	
10.9.21.431	Everett Shockey	3	25.05	25	-.42	24.63	47	25.05	48	47	

a Pumping. b Pumping recently. c Nearby well pumping.
f From recorder chart.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.
j Also 1942.

Part 3. Water levels, in feet, showing seasonal changes during 1948

Location number / Owner	4.9. 10.133 Arnn	5.7. 11.411 Brown	5.8. 5.344 Ethe-ridge	5.8. 8.424 Austin	5.8. 10.331a Rattan	5.8. 12.111 Cham-berlin	5.8. 15.131a Begley	5.8. 17.113 Davis
Mar. 22-24	17.23	86.81	52.70	62.03	19.79	14.47	17.48	46.81
May 18,19	.....	86.80	54.63	66.15	22.59	15.10	20.33	49.40
Aug. 10	17.42	87.07	b61.11	.....	25.71	14.73	c30.49	(a)
Oct. 25,26	18.46	87.32	56.57	66.35	22.46	14.97	21.10	50.98

Location number / Owner	5.8. 18.233 Hodg-son	5.8. 24.311 Wal-lace	5.8. 25.212 Arnn	5.9. 31.331 Arnn	6.8. 3.221 Tim-mins	6.8. 15.444 Estan-cia Cemetery	6.8. 32.212 Ethe-ridge	6.8. 34.311 Cham-berlin
Mar. 22-24	40.30	22.73	25.32	32.65	26.68	30.47	24.02	17.00
May 18,19	c42.89	22.70	25.35	32.68	26.60	30.30	24.11	16.60
Aug. 9,10, 12	c43.10	26.06	25.46	32.75	27.20	30.80	25.21	17.89
Oct. 25,26	43.71	23.64	25.60	32.79	c29.09	31.18	25.27	18.09

Location number / Owner	7.7. 12.444 Roland	7.8. 1.231 Homan	7.8. 10.221 Jenson	7.8. 12.433a Schmidt	7.8. 16.142 Thomas	7.8. 20.240 Burns	7.8. 23.324 Austin	7.8. 24.431 Floyd
Mar. 24,25	42.74	c25.99	15.66	21.59	10.92	86.70	1.74	22.34
May 19,20	43.16	26.17	15.95	21.78	.....	86.83	3.68	23.23
Aug. 10,11	43.53	26.49	16.70	23.33	a28.42	87.16	5.72	25.66
Oct. 26,27	43.87	26.70	17.15	22.27	33.94	87.30	3.40	22.93

Location number / Owner	7.8. 33.123 Kinch-eloe	7.8. 34.222 Homan	8.8. 1.434 Un-known	8.8. 26.222 Un-known	8.8. 35.322 Hibner	8.9. 30.111 King	9.9. 32.131 Dean	9.9. 32.131a Dean
Mar. 24,25	30.28	18.68	29.12	(a)	51.08	20.13	6.01	6.64
May 19,20	30.30	18.64	29.60	6.99	51.85	20.99	6.10	6.18
Aug. 10,11	30.68	a39.68	c34.70	7.88	52.47	21.35	6.77	6.88
Oct. 26,27	.....	21.14	30.23	8.86	52.97	20.45	6.63	6.73

Location number / Owner	10.8. 36.111 Irriga-tion Co.	10.9. 21.431 Shockey
Mar. 25	34.91	25.05
May 20	(a)	25.57
Aug. 11	40.40	25.58
Oct. 27	37.98	25.85

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: June 27, July 1-8, 19.31; Sept. 20, 22.06.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	19.84	19.75	19.66	19.55	19.49	19.35	19.31	20.86	21.48	21.87	21.17	20.74
2	19.83	19.74	19.66	19.55	19.49	19.34	19.31	20.86	21.50	21.83	.....	20.74
3	19.83	19.73	19.65	19.54	19.49	19.34	19.31	20.87	21.51	.....	.....	20.72
4	19.83	19.73	19.67	19.54	19.48	19.34	19.31	20.89	21.51	21.77	.....	20.69
5	19.83	19.73	19.66	19.53	19.47	19.34	19.31	20.92	21.57	21.73	.....	20.77
6	19.83	19.73	19.65	.....	19.47	19.34	19.31	20.95	21.59	21.70	.....	20.76
7	19.82	19.73	19.65	19.53	19.46	19.34	19.31	20.97	21.66	21.70	.....	20.74
8	19.82	19.74	19.64	19.54	19.47	19.34	19.31	21.03	21.70	21.67	.....	20.76
9	19.82	19.71	19.63	19.53	19.49	19.33	19.32	21.06	.....	21.64	.....	20.79

7.8.27.221--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
10	19.80	19.70	19.63	19.52	19.48	19.34	19.33	21.10	.....	21.63	.....	20.78
11	19.80	19.71	19.64	19.52	19.45	19.34	19.34	21.13	21.88	21.62	.....	20.77
12	19.80	19.71	19.65	19.57	19.44	19.33	19.40	21.17	21.89	21.61	20.91	20.77
13	19.81	19.71	19.63	19.57	19.44	19.33	19.47	21.19	21.92	21.60	20.90	20.77
14	19.80	19.70	19.60	19.58	19.43	19.33	19.56	21.23	21.95	21.56	20.89	20.77
15	19.79	19.71	19.61	19.58	19.42	19.33	19.64	21.23	21.97	21.56	20.89	20.76
16	19.79	19.71	19.61	19.57	19.42	.....	19.75	21.23	21.96	21.52	20.87	20.77
17	19.78	19.71	19.59	19.57	19.41	.....	19.83	21.33	21.97	21.52	20.85	20.76
18	19.78	19.70	19.57	19.57	19.38	19.32	19.92	21.33	21.98	.....	20.84	20.76
19	19.79	19.71	19.59	19.58	19.36	19.32	20.02	21.32	22.01	.....	20.85	20.75
20	19.79	19.71	19.57	19.58	19.35	19.32	20.10	21.30	22.06	.....	20.82	20.74
21	19.77	19.69	19.58	19.56	19.35	19.32	20.21	21.28	22.05	21.32	20.82	20.74
22	19.76	19.67	19.58	19.54	19.34	19.32	20.32	21.26	22.02	21.31	20.82	20.73
23	19.76	19.66	19.57	19.54	19.34	19.33	20.42	21.25	22.00	21.30	20.81	20.73
24	19.76	19.68	19.54	.....	19.35	19.32	20.52	21.23	21.97	21.29	20.80	20.73
25	19.77	19.70	19.53	.....	19.35	19.32	20.61	21.23	21.95	21.29	20.79	20.75
26	19.76	19.68	19.55	.....	19.35	19.32	20.68	21.24	21.95	21.22	20.79	20.73
27	19.77	19.68	19.56	.....	19.34	19.31	20.72	21.32	21.95	21.21	20.79	20.71
28	19.76	19.68	19.55	.....	19.33	19.32	20.76	21.36	21.95	21.20	20.80	20.71
29	19.76	19.66	19.54	19.49	19.33	19.32	20.81	21.40	21.93	21.18	20.79	20.74
30	19.76		19.53	19.48	19.33	19.32	20.87	21.42	21.89	21.17	20.78	20.72
31	19.76		19.54		19.33		20.87	21.42		21.17		20.70

Part 5. Miscellaneous data concerning observation wells

5.7.11.411. Brown. Drilled irrigation well, diameter 16 inches, depth 275 feet. Reference point, top surface of concrete pump base, 0.50 foot above land-surface datum. Sept. 14, 1947, 86.35.

5.8.8.424. Austin. Drilled irrigation well, equipped with turbine pump, diameter 20 inches, depth 204 feet. Reference point, top of casing, level with concrete pump base, 0.80 foot above land-surface datum.

5.8.10.331a. Rattan. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 158 feet. Sept. 14, 1947, 22.59.

5.8.16.111. Austin. Drilled irrigation well, equipped with turbine pump, diameter 20 inches, depth 200 feet. Reference point, top of 20-inch casing west side of well, 1.00 foot above land-surface datum. Sept. 14, 1947, 68.06; Aug. 10, 1948, 69.35, pumping recently.

5.8.16.211. Mullen. Drilled irrigation well, equipped with turbine pump, diameter 20 inches, depth 187 feet. Reference point, top of casing, 1.15 feet above land-surface datum. Sept. 14, 1947, 49.09.

5.8.17.212. Brown. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 201 feet. Sept. 14, 1947, 56.72.

5.8.17.311a. Brown. Drilled irrigation well, equipped with turbine pump. Reference point, surface of concrete pump base, 0.65 foot above land-surface datum. May 27, 1947, 30.07; Sept. 14, 1947, 32.27; May 18, 1948, 31.84, nearby well pumping.

6.7.25.113. Clark. Drilled irrigation test well, diameter 14 inches, depth 302 feet. Reference point, top of casing, north side, 0.90 foot above land-surface datum. Aug. 9, 73.62.

6.8.2.111. Timmins. Drilled irrigation well. Reference point, top of casing, level with concrete pump base, 0.50 foot above land-surface datum.

7.8.3.140. Laws. Drilled irrigation well, equipped with turbine pump, diameter 18 inches. Reference point, top edge of casing, east side of well, 0.20 foot above land-surface datum. Sept. 16, 1947, 54.25.

7.8.3.300. Jenson. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 84 feet. Reference point, top of casing, 5.00 feet above land-surface datum. May 28, 1947, 5.34; Sept. 16, 1947, pumping.

7.8.7.121. Norman. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 200 feet. Reference point, top of casing, 1.00 foot above land-surface datum. May 28, 1947, 75.18; Sept. 16, 1947, 75.26.

7.8.11.132. Jenson. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 2 50 feet. Reference point, top of casing, 1.00 foot above land-surface datum. May 28, 1947, 9.21; Sept. 16, 1947, +11.07.

7.8.12.433a. Schmidt. Drilled irrigation well, equipped with turbine pump, diameter 8 inches, depth 103 feet. Reference point, top surface of concrete pump base, 0.30 foot above land-surface datum. Sept.16, 1947, 22.18.

7.8.16.142. Thomas. Well deepened to 232 feet in March 1948.

7.8.20.240. Burns. Drilled irrigation well. Reference point, top of concrete pump base, 0.70 foot above land-surface datum.

7.8.20.334. Gates. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 202 feet. Reference point, top of concrete pump base, 0.50 foot above land-surface datum.

7.8.24.431. Floyd. Drilled irrigation well, equipped with turbine pump, diameter 12 inches, depth 300 feet. Reference point, top of concrete pump base, 0.50 foot above land-surface datum. May 28, 1947, 21.77; Sept. 15, 1947, 23.23.

7.8.26.141. Richter. Reference point, top of Geological Survey washer in stake 2 feet southeast of well, 0.20 foot below land-surface datum. Casing at well removed. Possible discrepancy of a few tenths of a foot between present and previous land-surface data.

7.8.34.222. Homan. Drilled irrigation well, equipped with turbine pump, diameter 18 inches, depth 129 feet. Reference point, top of casing, 4.00 feet above land-surface datum. May 29, 1947, 18.51; Sept. 16, 1947, 18.60.

7.9.30.412. Davidson. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 540 feet. Reference point, top of casing, south side of well, 0.50 foot above land-surface datum.

8.8.1.434. Unknown. Drilled irrigation well, equipped with turbine pump, diameter 16 inches.

8.8.10.111. Woodman. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 425 feet. Reference point, top edge of casing, 1.00 foot above land-surface datum.

8.8.13.311. Maxwell. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 200 feet. Sept. 16, 1947, 21.78.

8.8.13.324. Maxwell. Drilled irrigation well, equipped with turbine pump, diameter 10 inches, depth 200 feet. Sept. 16, 1947, 49.61, pumping recently.

8.8.24.131. Buck & Cunningham. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 187 feet.

8.8.35.322. Hibner. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 228 feet. Reference point, top of casing, 0.75 foot above land-surface datum. May 28, 1947, 50.12; Sept. 16, 1947, 51.13.

8.9.30.111. King. Drilled irrigation well, equipped with turbine pump, diameter 16 inches, depth 200 feet.

9.8.2.242. Valley Irrigation Co. Drilled irrigation well, diameter 12½ inches, depth 550 feet. Sept. 15, 1947, 56.66; May 20, 1948, 56.52.

9.8.24.330. Valley Irrigation Co. Drilled irrigation well, diameter 16 inches. Reference point, top edge of casing, south side of well, 0.50 foot above land-surface datum. May 20, 40.57.

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10.8.36.111. Valley Irrigation Co. Drilled irrigation well, diameter 12½ inches, depth 309 feet. Sept. 15, 1947, 34.91.

VALENCIA COUNTY (GRANTS-BLUEWATER AREA)

By C. S. Conover

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 continued in 1948 in cooperation with the State engineer of New Mexico. Records of water level in 1946 and 1947 have been published in Geological Survey Water-Supply Papers 1076, pp. 311-316, and 1101, pp. 306-316, respectively.

Water levels were measured in 38 wells in February 1948, after the water levels had recovered, in large part, from the effects of pumping for irrigation during the summer of 1947. 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 30 wells at bimonthly 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 179 measurements of water level was made during the year including 6 made in the recorder well.

Precipitation and pumpage

Precipitation is the eventual 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 1948 was 9.36 inches, about 1 inch below normal and slightly greater than in 1947. Precipitation during the main part of the growing season, April through September, was 6 inches, of which about 2 inches fell in June and practically none in April.

On the basis of measured power input and water output ratios and electric power records on 13 of the 19 used irrigation wells in 1948 and rough estimates of the pumpage from 6 wells, the pumpage of ground water for irrigation in 1948 is believed to have been 9,300 acre-feet, a decrease from the 10,300 acre-feet estimated as having been pumped in 1947. In addition to the ground water, 6,174 acre-feet of surface water was released from the Bluewater Reservoir for irrigation, according to records furnished by Mr. Clifford Young of the Bluewater-Toltec Irrigation District. Of this amount, 4,933 acre-feet, 80 percent, was delivered to farms and laterals. Seventy-three percent of the seepage loss reportedly occurred upstream from the canal division point in NE¼SE¼ sec. 9, T. 12 N., R. 11 W. Most of the surface water was used on lands in the upper part of the district which resulted in irrigating some lands that had been idle for the last three or more years. Ground-water pumpage in the upper part of the district was reduced, because of the use of surface water, from about 1,100 acre-feet in 1947 to about 230 acre-feet in 1948. The acreage irrigated in 1948 by surface and ground waters is believed to have been about 5,500 acres, about 1,000 acres more than was irrigated by ground water alone in 1947.

Changes of water level

Water levels in the area of ground-water pumping, in the lower part of the district, reached their highest stages in the early part of April before the beginning of the pumping season and about 1 month later than in 1947. During the pumping season the water levels declined steadily, with only minor rises during cessations of pumping, and reached their lowest stages generally in August, the end of the pumping season. Only a minor

amount of water was pumped the remainder of the year during which time the water levels steadily rose.

The recovery of water levels after cessation of the pumping in the area of heavy pumping was less than the drawdown during the pumping season, and, consequently, a net deficit of generally more than 1 foot in the stage of the water levels was exhibited at the end of the year. The net decline in this area in the preceding year was more than 3 feet.

The fluctuation of water level in 1948 in the lightly pumped area in the upper part of the district was considerably different than occurred in the preceding year when surface water was not available. The water level in the recorder well, 12.11.9.222, which is about a quarter of a mile northeast of the main canal, rose gradually until April 11, as a result of recovery from the effects of nearby pumping in 1947. A slight lowering then occurred, as a result of early pumping, until the water which was released from Bluewater Reservoir reached the canal. Beginning April 26 the water level in this well commenced rising and continued rising until about November 4, about 2 weeks after the release of water from the reservoir was stopped. Slight declines occurred during the remainder of the year. The water level in this well showed a net rise of 7.4 feet in 1948, as compared with net declines of 11.9 feet in 1946 and 8.3 feet in 1947.

The average net change in water levels from February 1948 to February 1949 in 14 wells, that were also measured in February 1946 and 1947, was a rise of 0.17 foot, as compared with declines in the same wells of 5.88 and 3.91 feet in 1946 and 1947, respectively. The maximum recorded decline from February 1948 to February 1949 was 2.1 feet and occurred in an irrigation well and a windmill well in NE¼ sec. 4, T. 11 N., R. 10 W., near the lower end of the district. The maximum recorded rise of 7.4 feet occurred in the recorder well, 12.11.9.222, in which the maximum recorded decline of 11.9 and 8.3 feet occurred in 1946 and 1947, respectively.

The large declines of water levels in the lightly pumped area in the upper part of the district that occurred during 1946 and 1947, when water was not released from the reservoir, as contrasted with the large rises that occurred in 1948, when water was released from the reservoir, seem to confirm the opinion that a part of the recharge to the aquifer, at least in the upper area of the district, is derived from losses that occur in the

canal in that area. The smaller decline in 1948 in the heavily pumped area in the lower part of the district, as compared with 1947, is due, in part, to a reduction in pumping in 1948, in part, to a natural decreasing rate of decline which results from pumping from ground-water storage, and, in part, to an increased amount of ground-water recharge which, in this area may, in large part, be due to increased precipitation on the outcrop of the aquifer in the Zuni Mountains to the southwest.

As pumping of ground water is a new discharge imposed upon a previously more or less stable ground-water system, over-all 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. In scattered years, when adequate water is available in Bluewater Reservoir to furnish a supply of surface water to the area, 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 not receiving ground water are not farmed. In view of these factors and as the decline of water level is greater in the initial period of pumping then later, it seems probable that the net decline of water levels in succeeding years will continue to be less than occurred during 1946 and 1947, unless an increase in irrigated acreage occurs.

Part 2. Water levels in February 1948 and highest and lowest recorded levels in February, and change from February 1947 to February 1948, in feet

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948 Level	Day	Change 1947-48	Highest Level	Year	Lowest Level	Year	Began	Years missing
9.10.10.432	Fred Mirabal	5	84.04	2	....	.....	..	.....	..	48	
10.9.26.224	Robert Gottlieb	3	a 8.75	2	.00	ak 8.75	48	b8.75	47	47	
10.10.10.200	Joe Padilla	3	10.88	2	-1.05	9.83	47	10.88	48	47	
11.10.4.111	M. C. Read	3	72.39	2	-3.14	69.25	47	72.39	48	47	
4.211	J. C. Church	3,5	65.75	2	-3.02	57.97	46	65.75	48	46	
4.222	E. E. Harden	3	63.03	2	-2.18	60.85	47	63.03	48	47	
5.214	V. M. Vidal	3	72.42	3	-3.43	68.99	47	72.42	48	47	
8.111	Salvador Milan	3	77.12	2	-3.37	73.75	47	77.12	48	47	
8.222	do	3	66.32	2	-3.28	57.85	46	66.32	48	46	
8.344	do	.	j56.21	3	-3.19	53.02	47	j56.21	48	47	
9.222	Dean Stanley & A. R. Card	3	62.42	2	-2.97	54.49	46	62.42	48	46	
9.242	A. R. Card	3	60.44	2	-3.11	52.24	46	60.44	48	46	
10.111	Milton Harding	5	.....	.	....	51.92	46	55.26	47	46	48
16.121	Frank Wilson	3	54.45	2	-3.03	46.47	46	54.45	48	46	
16.142	do	3	52.77	2	-2.92	45.50	46	52.77	48	46	
16.431	Salvador Milan	5	51.83	2	....	.....	..	.....	..	48	
17.222	do	.	.....	.	....	84.44	47	.....	..	47	48
26.411	City of Grants well 3	3	c11.17	2	-3.22	7.95	47	c11.17	48	47	
27.410	Cecil Moore	3	36.84	2	-1.25	35.59	47	36.84	48	47	
34.400	Unknown	3,5	14.41	2	....	.....	..	.....	..	48	
12.10.23.233	John Jacobs	3	123.02	2	-2.88	115.59	46	123.02	48	46	
29.434	Dean Stanley & A. R. Card	3,5	76.64	2	-2.88	69.23	46	76.64	48	46	
30.111	E. E. Harden	5	111.60	2	-3.62	107.98	47	111.60	48	47	
30.242	do	3	b94.57	2	-3.64	b90.93	47	b94.57	48	47	
30.332	J. C. Church	.	.....	.	....	106.54	47	.....	..	47	48
30.412	Fred Freas	3	99.03	3	-3.50	90.04	46	99.03	48	46	
30.421	Milton Harding	3	97.38	3	-3.63	88.38	46	97.38	48	46	
12.10.32.111	J. C. Church	3	90.70	2	-3.58	82.09	46	90.70	48	46	
12.11.9.114	do	5	144.69	3	....	.....	..	.....	..	48	
9.222	do	4	135.92	3	-8.29	115.70	46	f136.51	48	46	
9.424	George Rowley	3	105.00	3	-5.77	99.23	47	105.00	48	47	
11.343	Tietjen & Hassell	3,5	123.64	3	....	.....	..	.....	..	48	
15.341	Edward Freas	3	113.79	3	-7.72	106.07	47	113.79	48	47	
16.223	E. E. Harden	3	131.49	3	-7.81	123.68	47	131.49	48	47	

* See footnotes at end of table.

Part 2. Water levels in February 1948 and highest and lowest recorded levels in February, and change from February 1947 to February 1948, in feet--Continued

Location number	Owner	See also Part	Water levels							Record	
			Jan. 1948		Change	Highest		Lowest			
			Level	Day	1947-48	Level	Year	Level	Year	Began	Years missing
12.11.20.424	J. F. Nielson	3	250.58	3	- 6.73	243.85	47	250.58	48	47	
22.414	Mr. Hassell	3,5	129.07	3	- 8.01	110.59	46	129.07	48	46	
23.233	Harmon & Read	3	70.75	3	- 1.07	69.68	47	70.75	48	47	
25.223	J. C. Church	.	109.45	2	- 3.69	100.18	46	109.45	48	46	
25.223a	do	3	110.52	2	- 3.70	106.82	47	110.52	48	47	
25.311	Harmon & Read	.	127.48	3	- 2.98	124.50	47	127.48	48	47	
27.222	Harold Prewitt	5	156.12	3	....	.....	..	.....	..	48	

a Pumping.
b Pumping recently.
c Nearby well pumping.
f From recorder charts.
j Measurement uncertain.
k Also 1947.

Part 3. Water levels, in feet, showing seasonal changes during 1948

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	11.10. 8.222
Owner		Gott-lieb	Padilla	Read	Church	Harden	Vidal	Milan	Milan
Feb.	2,3	a8.75	10.88	72.39	65.75	63.03	72.42	77.12	66.32
Apr.	5	a8.65	11.26	72.40	(a)	63.25	72.25	76.90	66.25
June	10,11	8.36	11.06	j83.60	(a)	(a)	81.20	a102.50	a76.77
Aug.	4,5	8.27	12.70	77.49	a78.2	64.60	83.13	87.21	b75.88
Oct.	5	8.37	13.17	76.02	71.63	(a)	77.87	82.53	71.09
Dec.	9	8.84	11.64	74.36	69.70	65.08	74.90	79.65	69.81

Location number		11.10. 9.222	11.10. 9.242	11.10. 16.121	11.10. 16.142	11.10. 26.411	11.10. 27.410	11.10. 34.400	12.10. 23.233
Owner		Stanley & Card	Card	Wilson	Wilson	City of Grants	Moore	Un-known	Jacobs
Feb.	2	62.42	60.44	54.45	52.77	c11.17	36.84	14.41	123.02
Apr.	5	ak90.0	c63.17	54.60	a52.55	8.71	36.93	14.61	123.74
June	10,11	69.70	66.23	a89.32	54.40	13.79	38.76	15.99	(a)
Aug.	4	ak95.5	c71.13	a81.56	56.09	c14.72	39.70	16.70	a144.42
Oct.	5,6	67.63	65.19	59.55	56.68	c14.70	39.16	16.20	a141.55
Dec.	9	64.79	62.78	57.01	.....	c12.33	38.08	15.25	125.44

Location number		12.10. 29.434	12.10. 30.242	12.10. 30.412	12.10. 30.421	12.10. 32.111	12.11. 9.424	12.11. 11.343	12.11. 15.341
Owner		Stanley & Card	Harden	Freas	Harding	Church	Rowley	Tietzen & Hassell	Freas
Feb.	2,3	76.64	b94.57	99.03	97.38	90.70	105.00	123.64	113.79
Apr.	5,6	76.65	94.30	98.81	97.14	90.45	104.75	123.84	a139.5
June	10,11	ai101.35	a99.05	c109.15	a107.46	a102.29	103.19	123.73	(a)
Aug.	4,5	ak102.8	99.15	a112.81	c109.61	a104.29	102.79	123.79	ak175.7
Oct.	5,6	78.68	(a)	c104.77	a107.40	96.32	102.13	123.55	107.18
Dec.	9,10	77.87	96.63	101.45	99.78	93.12	102.39	123.47	106.99

Location number		12.11. 16.223	12.11. 20.424	12.11. 22.414	12.11. 23.233	12.11. 25.223a
Owner		Harden	Niel-son	Hassell	Harmon & Read	Church
Feb.	2,3	131.49	250.58	129.07	70.75	110.52
Apr.	5,6	130.7	249.97	128.47	70.80	110.18
June	11	.....	.....	127.28	a70.30	(a)
Aug.	4,5	126.73	247.13	126.66	67.82	(a)
Oct.	5,6	124.66	245.31	123.91	67.86	c116.34
Dec.	9,10	124.58	244.11	123.08	68.57	112.84

a Pumping.
b Pumping recently.
c Nearby well pumping.
i Possible discrepancy of a few tenths of a foot between present and previous land-surface data.
j Measurement uncertain.
k Air-gage reading.

Part 4. Highest daily water levels in wells equipped with automatic water-stage recorders

12.11.9.222. J. C. Church. Highest and lowest recorded water levels: Nov. 4, 127.52; Jan. 4, 136.51.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June
1	136.46	136.02	135.48	134.95	135.17	.....
2	136.46	135.96	135.52	134.93	134.96	.....
3	136.46	135.88	135.46	134.90	134.77	.....
4	136.51	135.88	135.51	134.90	134.47	.....
5	136.45	135.83	135.55	134.85	134.27	.....
6	136.46	135.85	135.46	134.76	134.05	.....
7	136.43	135.84	135.44	134.84	133.74	.....
8	136.36	135.94	135.36	134.94	133.51	.....
9	136.36	135.88	135.26	134.93	133.45	.....
10	136.32	135.68	135.29	134.84	133.36	.....

12.11.9.222--Continued.

Highest daily water level, from recorder charts

Day	Jan.	Feb.	Mar.	Apr.	May	June
11	136.25	135.68	135.34	134.74	133.29	131.83
12	136.28	135.83	135.47	134.85	133.24	131.76
13	136.36	135.84	135.34	134.93	133.12	131.65
14	136.30	135.92	.....	135.05	133.00	131.59
15	136.22	135.92	135.20	135.52	132.88	131.55
16	136.23	135.93	135.30	136.01	132.80	131.47
17	136.13	135.92	135.26	136.39	132.66	131.39
18	136.06	135.83	135.11	136.63	132.48	131.31
19	136.09	135.81	135.13	136.84	132.47	131.17
20	136.17	135.77	135.12	137.02	132.50	131.11
21	136.17	135.76	135.13	136.50	132.44	130.95
22	136.03	135.57	135.16	136.11	132.38	130.93
23	136.01	135.46	135.14	136.32	132.40	130.91
24	135.95	135.63	135.12	136.64	132.40	130.93
25	135.97	135.71	134.99	136.57	132.38	130.98
26	135.97	135.59	.....	136.63	132.36	130.91
27	136.01	135.59	135.09	136.35	.....	130.90
28	136.02	135.60	135.05	136.02	.....	130.90
29	136.01	135.51	134.92	135.70	.....	130.83
30	136.01		134.85	135.39	.....	130.76
31	136.02		134.82		.....	

Highest daily water level, from recorder charts

Day	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	130.65	.....	128.96	128.08	127.70	.....
2	130.57	.....	128.83	128.14	127.76	.....
3	g130.53	.....	128.68	128.10	127.57	.....
4	g130.53	.....	128.64	127.96	127.52	.....
5	g130.51	129.85	128.59	127.80	127.68	.....
6	g130.51	129.84	128.55	127.85	127.77	.....
7	.....	129.77	128.48	127.97	127.66	.....
8	.....	129.73	128.49	127.93	127.67	.....
9	.....	129.71	128.48	127.86	127.78	h128.36
10	.....	129.69	128.44	127.81	127.74	128.23
11	.....	129.67	128.35	127.81	127.71	128.17
12	.....	129.66	128.30	127.88	127.76	128.31
13	.....	129.66	128.35	127.89	127.93	128.32
14	.....	129.67	128.35	127.80	127.95	128.26
15	.....	129.68	128.32	127.74	127.87	128.20
16	.....	129.68	128.32	127.77	127.94	128.33
17	.....	129.68	128.30	127.83	127.73	128.33
18	.....	129.68	128.18	127.78	127.77	128.35
19	.....	129.68	128.08	127.75	127.78	128.43
20	.....	129.65	128.07	127.74	127.76	128.34
21	.....	129.56	128.04	127.78	127.81	128.35
22	.....	129.55	127.98	127.86	127.95	128.35
23	.....	129.53	127.94	127.89	.....	128.29
24	.....	129.39	127.93	127.83	.....	128.35
25	.....	129.29	128.00	127.77	.....	128.51
26	.....	129.29	128.15	127.71	.....	128.51
27	.....	129.33	128.14	127.64	.....	128.33
28	.....	129.30	128.10	127.60	.....	128.35
29	.....	129.24	128.06	127.61	.....	128.57
30	.....	129.10	128.05	127.68	.....	128.58
31	.....	129.03		127.65		128.40

g Estimated.
h Tape measurement at odd hour.

Part 5. Miscellaneous data concerning observation wells

9.10.10.432. Mirabal. North of cattle stockade. Drilled stock well, diameter 9 inches. Reference point, top of casing, 0.73 foot above land-surface datum. Oct. 2, 1946, 84.03; Nov. 6, 1946, 84.15; Dec. 3, 1946, 84.19; July 7, 1947, 83.79.

11.10.4.211. Church. Deepened from 150 feet to 360 feet between measurements of February and April 1948.

11.10.10.111. Harding. June 10, 59.86, pumping.

11.10.16.431. Milan. Drilled irrigation well, equipped with turbine pump, diameter 14 inches, depth 150 feet. Reference point, top of concrete pump base, 0.98 foot above land-surface datum. Oct. 2, 1947, 54.07; Dec.10, 1947, 52.26; Apr. 5, 1948, 51.76.

11.10.34.400. Unknown. Dug domestic well, equipped with bucket and pulley, diameter 3- by 3-feet, depth 16 feet.

Date	Water level	Date	Water level	Date	Water level
June 4, 1947	14.83	Aug. 6, 1947	16.00	Oct. 2, 1947	14.90
July 7	15.52	Sept. 2	14.36	Dec. 10	14.58

12.10.29.434. Stanley & Card. Reference point destroyed.

12.10.30.111. Harden. June 11, 122.70, pumping.

12.11.9.114. Church. Drilled test well, no equipment, diameter 12 inches, depth 180 feet.

June 5, 1947	142.16	Aug. 7, 1947	151.18	Oct. 3, 1947	148.60
July 8	147.48	Sept. 3	148.30	Apr. 6, 1948	144.32

12.11.11.343. Tietjen & Hassell. Drilled well, no equipment, diameter 6 inches, depth 150 (?) feet. Reference point, top edge of casing, west side of well, 0.90 foot above land-surface datum.

July 8, 1947	123.65	Sept. 3, 1947	123.59	Dec. 11, 1947	123.69
Aug. 7	123.68	Oct. 3	123.62		

12.11.22.414. Hassell. Depth 520 feet on Feb. 3, 1948; 544 feet on Apr. 6, 1948.

12.11.27.222. Prewitt. Drilled stock well, equipped with windmill, diameter 6 inches, depth 170 feet. Reference point, top of concrete curbing around casing, 0.73 foot above land-surface datum. July 8, 1947, 162.86.

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