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ARIZONA STATE LAND DEPARTMENT

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ANNUAL REPORT ON GROUND WATER IN ARIZONA SPRING 1956 TO SPRING 1957

BY

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ANNUAL REPORT ON GROUND WATER IN ARIZONA — SPRING 1956 TO SPRING 1957

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ABSTRACT

The collection and interpretation of basic hydrologic data are integral parts of the investigation of the ground-water resources of Arizona conducted by the U. S. Geological Survey in cooperation with the State Land Department. This annual report is the summary of the basic hydrologic data collected during the year spring 1956 to spring 1957.

Pumpage of ground water in Arizona in 1956 was about 4,500,000 acre-feet, approximately the same annual rate as for the last 3 years. The trend of water levels in the heavily pumped areas continued downward, although in some areas, such as the upper Santa Cruz basin, some rises did occur. Illustrations include: (1) Hydrographs showing fluctuations in selected wells, and (2) maps showing change in water levels for the 5-year period 1952-57 for the Salt River Valley, lower Santa Cruz, Willcox, and Douglas areas.

INTRODUCTION

Pumping of ground water in relatively large quantities in the State of Arizona began in the 1920's, when most of the pumpage was from drainage wells used to reclaim waterlogged land. In the 1930's the pumping of ground water increased, owing primarily to the utilization of water for irrigation. The State Legislature observed this increase in the development of ground water for irrigation and recognized the need for information on the occurrence and storage of ground water. In 1939 it appropriated funds for investigations of the ground-water resources of the State and a cooperative agreement providing for the studies was made between the State Water Commission and the U. S. Geological Survey. Succeeding State Legislatures have appropriated funds for a continuation of these investigations. Since 1942 the State Land Department has been the cooperating agency. These State funds are matched by Federal funds for ground-water investigations in the State.

The work done under the cooperative program includes the collection of basic hydrologic data, geological and ground-water investigations of individual areas, and studies related to the solution of specific hydrologic problems. This report is a compilation and interpretation of the basic-data-collection part of the program in 1956. The other parts are discussed briefly under "Current projects in Arizona."

This report contains summary statements of changes or trends in the ground-water conditions throughout the State by counties and the pumpage is tabulated according to basins. Hydrographs are included to show comparative changes in the stage of water levels in selected wells. Maps showing the changes in ground-water levels for 5-year periods in the Salt River Valley, lower Santa Cruz, Willcox, and Douglas areas are included.

Scope of Basic-Data Program

The collection of basic hydrologic data is an integral part of the investigation necessary to evaluate the ground-water resources of Arizona. The periodic measurement of water levels, collection of data on the amount of water discharged from wells, and collection of water samples for chemical analysis are the principal types of work done.

The objectives of this data-collection program are: (1) To evaluate the trends in ground-water levels as related to ground-water pumping; (2) to delineate the present areas of greatest development and record the virgin ground-water conditions of areas of potential future development; (3) to determine the geologic and hydrologic characteristics of areas as related to the ground-water regimen; (4) to determine the changes in quality of water; (5) to provide continuous records of fluctuation of water levels in representative wells; (6) to determine, approximately, the quantity of ground water pumped each year in the various basins; and (7) to add to the knowledge of subsurface geology by the collection, cataloging, and study of drill cuttings from selected water wells and oil tests.

The collection of basic data provides a basis for hydrologic research and a framework for the compilation of records in any detailed regional investigation. The data are necessary for the evaluation of the yearly changes and trends in ground-water conditions in Arizona and are used in the compilation of annual water-level reports.

Under the cooperative program, about 3,000 water-level measurements were made in 1,900 wells in 1956. The rate of discharge, in gallons per minute, was measured for about 1,300 wells. Water-level measurements and chemical analyses of water samples are available in the open files in the offices of the Geological Survey, Ground Water Branch, at Phoenix and Tucson.

Current Projects in Arizona

Ground-water studies made by the Geological Survey in Arizona are financed in the following manners: (1) Cooperative agreement with the State; (2) cooperative agreements with municipalities and water districts; (3) noncooperative Federal funds; and (4) transfer of Federal funds from other Federal agencies. The areas of active projects are shown on figure 1.

The cooperative program with the State includes: (1) Collection of basic hydrologic data (discussed under "Scope of basic-data program"); (2) geological and ground-water investigations of specific areas; and (3) studies related to the solution of specific hydrologic problems.

Geological and ground-water investigations of specific areas consist of geologic studies, complete well inventories and descriptions of the hydrologic conditions. This preliminary work, preferably done prior to extensive development, is invaluable as a basis for long-range studies of the ground-water resources. Two such investigations completed recently are those in the Harquahala Plains and Palomas Plain areas (fig. 1). Similar current projects include those in the lower San Pedro basin, Snowflake-Taylor area, McMullen Valley, and a part of Apache County south of the Navajo Indian Reservation.

Studies related to the solution of specific hydrologic problems will provide a more accurate quantitative determination of the ground-water resources of the State, area by area. These studies have been undertaken because of the necessity for obtaining more specific information on the occurrence, movement, recharge, storage, discharge, fluctuation, and chemical quality of ground water in areas of heavy present or prospective development. The studies involve an analysis of available basic geologic and hydrologic data and the collection of basic data specifically related to these problems. Current projects of this nature are the determination of productivity of deep aquifers and of changes in the chemical quality of ground water at depth in the Salt River Valley, and the analysis of geologic and hydrologic data collected since 1903 in the Florence-Casa Grande-Maricopa area in Pinal County.

Cooperation with municipalities is exemplified by the current projects with the cities of Safford and Flagstaff. The cooperation with the city of Safford covers an investigation of the Bonita Creek area. The Flagstaff cooperation consists of determining the feasibility of developing ground water as a supply for the city; the success of the deep wells to date is discussed in this report under "Coconino County." Cooperative work also is performed with water districts. Projects of this type include the Navajo Tribal well-development program.

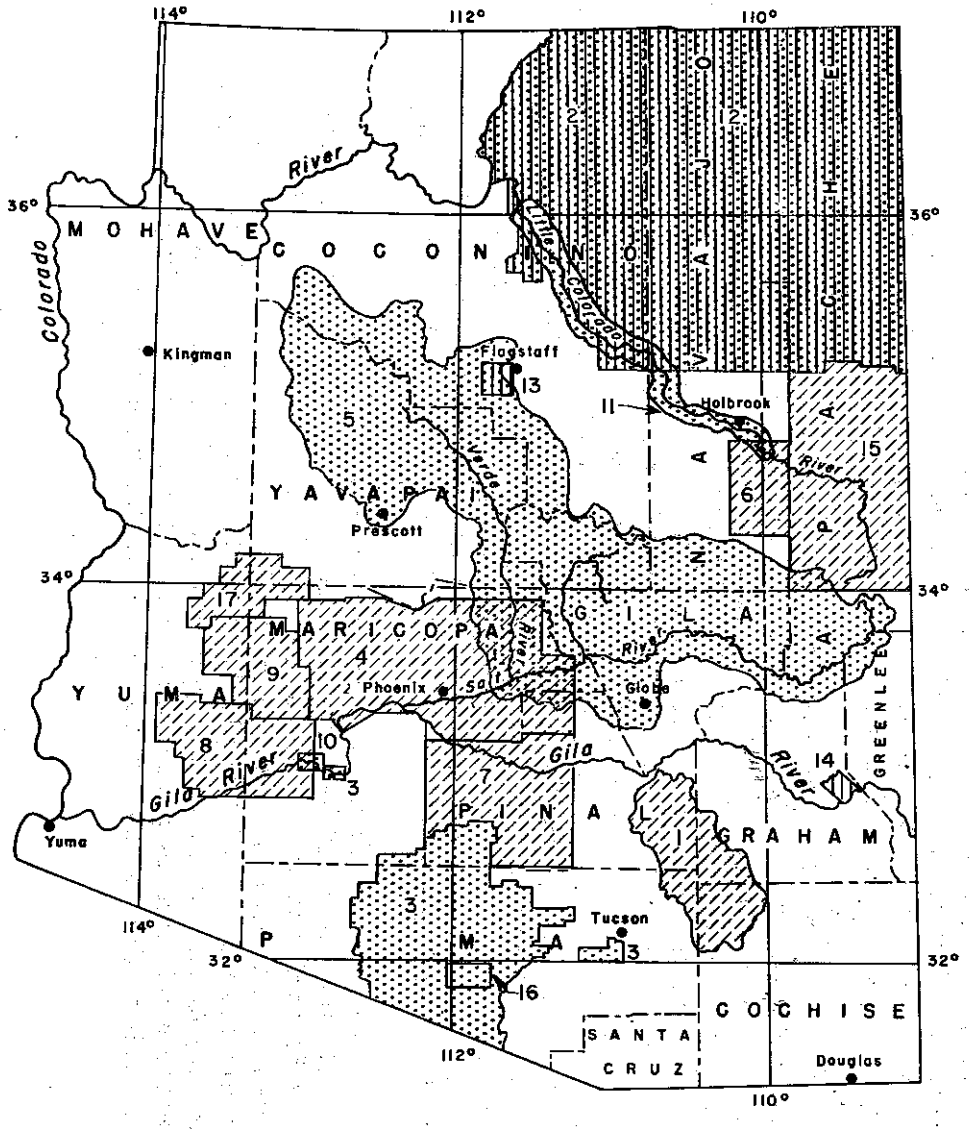


Figure 1.-- Map of Arizona showing areas of ground-water investigations

PROJECTS BY AREAS

1. Lower San Pedro River basin
2. Navajo-Hopi Indian Reservations
3. Papago Indian Reservations
4. Salt River Valley
5. Mogollon Rim region
6. Snowflake-Taylor area
7. Northwestern Pinal County
8. Palomas Plain area
9. Harquahala Plains area
10. Painted Rock reconnaissance
11. Little Colorado River basin
12. Navajo Tribal well-development program
13. City of Flagstaff
14. City of Safford
15. Apache County area
16. Sells Hospital site
17. McMullen Valley

Basic hydrologic data part of State cooperative program covers entire State

Investigations financed jointly with State and Federal matching funds

Investigations financed jointly with other cooperative non-Federal agencies and Federal matching funds

Investigations financed with noncooperative Federal funds and transfer of Federal funds from other Government agencies

Work financed entirely with Federal funds is done in areas where the Federal Government has a specific interest not related to that of the State and local cooperating agencies. Projects of this type cover the Navajo-Hopi and Papago Indian Reservations and the Mogollon Rim region (fig. 1). Other Federal projects are the Little Colorado River basin study, the Sells (Papago) Hospital site, and the Painted Rock dam site. Field work in the Navajo-Hopi Indian Reservations was completed in 1955.

List of Publications

The following reports on ground-water resources of Arizona were prepared and released to the open file by the Geological Survey in 1956:

Pumpage and ground-water levels in Arizona in 1955, by P. W. Johnson, N. D. White, and J. M. Cahill, Arizona State Land Department, Water Resources Report No. 1, 69 p., 30 figs., 1 table.

Analysis of basic data concerning ground water in the Yuma area, Arizona, by R. H. Brown, J. W. Harshbarger, and H. E. Thomas, mimeographed, 117 p., 2 pls., 43 figs., 2 tables.

Late Cretaceous stratigraphy of Black Mesa, Navajo and Hopi Indian Reservations, Ariz., by C. A. Repenning and H. G. Page, Am. Assoc. Pet. Geol. Bull., v. 40, no. 2, p. 255-294.

Agricultural Resume for 1956

According to G. W. Barr (Arizona Agriculture 1957: Arizona Agr. Expt. Sta. Bull. 281, January 1957), approximately 1,150,000 acres were irrigated in Arizona in 1956. About 1,000,000 acres were supplied principally with ground water, or a combination of surface water and ground water; the remainder with surface water. The largest acreages under cultivation were in cotton (340,000 acres) and alfalfa (212,000 acres). The counties having the largest acreages under cultivation are: (1) Maricopa, 465,000 acres; (2) Pinal, 275,000 acres; and (3) Yuma, 175,000 acres.

Barr (1957) states that a near-record production on Arizona farms and ranches was achieved in 1956 in spite of cotton-acreage limitations, decline of water levels, and general drought. The cash value of the agricultural production amounted to 380 million dollars; of this, cotton accounted for 165 million dollars. This is the 10th year in which cotton was the principal money crop in the State.

An interesting item discussed by Barr (1957) is that "Yuma is now the second county in agricultural importance in Arizona as measured by the value of the agricultural plant." This is due to an ample supply of surface irrigation water, diversity of production, and strategic location in regard to markets. At the present time the Wellton-Mohawk Division of the Gila Project has about half the proposed 75,000 acres under irrigation with Colorado River water.

Precipitation

The precipitation in Arizona in 1956 was considerably below the long-term averages (Torbitt, H. E., Annual Summary, 1956, U. S. Dept. Commerce, Weather Bureau); the year was the driest on record in most of the State. Many of the southern and western parts of the State received less than half their long-term average precipitation – one station, Davis Dam, received only 0.07 inch for the entire year. Table 1 shows the total precipitation in 1956 at selected stations and departures from the long-term average.

The heaviest rainfall throughout the State occurred in July; March and November were the driest months. According to data for the Weather Bureau stations at Phoenix, Prescott, and Yuma, 1956 was the driest year on record. The precipitation at these stations was 4.37, 10.28, and 3.10 inches below normal, respectively; that is, it was only 39, 36, and 9 percent of normal.

Surface-Water Diversions

The amount of surface water diverted for irrigation in 1956 amounted to about 2,100,000 acre-feet. More than half this amount, or about 1,200,000 acre-feet, was diverted from the Colorado River for use by: (1) Colorado River Indian Reservation below Parker; (2) Valley Division of the Yuma Project; (3) Yuma Mesa Auxiliary Project; and (4) Wellton-Mohawk Project. These projects use only surface water for irrigation.

The remaining 900,000 acre-feet of diverted water was used in combination with ground water for irrigation. About 700,000 acre-feet was diverted at Granite Reef Dam for use in the Salt River Valley. Other diversions include about 73,000 acre-feet from the Ashurst-Hayden Dam for use on the San Carlos Project, and about 43,000 acre-feet from the Gila River for use in the Safford basin. Smaller diversions include those from the Gila River for the Buckeye Irrigation District, Agua Fria River at Carl Pleasant Dam, Salt and Verde Rivers above the dams, and Little Colorado River.

Table 1.--Total precipitation in 1956 at selected stations and departures from long-term means (From Climatological Data, Arizona, Annual Summary 1956: U. S. Dept. Commerce, Weather Bureau).

Station	Precipitation (inches)	Departure (inches)
Bowie	3.01	-
Buckeye	1.40	-
Casa Grande	7.22	-0.86
Chandler	2.41	-
Chino Valley	6.49	-
Davis Dam	0.07	-
Douglas Smelter	5.81	-5.81
Duncan	3.49	-
Eloy	5.71	-
Fairbank	7.93	-3.62
Flagstaff	10.37	-8.16
Gila Bend	2.02	-3.89
Globe	8.22	-7.18
Holbrook	4.79	-2.96
Kingman	3.94	-
Litchfield Park	2.81	-5.05
Mesa	2.83	-4.86
Nogales	9.33	-
Payson	12.19	-8.32
Phoenix Airport	2.82	-4.37
Pinedale	9.11	-8.11
Prescott Airport	5.75	-10.28
Safford	3.77	-4.95
St. Johns	7.10	-4.27
Salome	1.28	-6.47
Snowflake	10.17	-1.56
Tucson, University of Arizona	5.82	-4.61
Wellton	0.66	-
Wikieup	1.00	-
Willcox	5.82	-
Williams	12.28	-8.85
Yuma Airport	0.30	-3.10

Well-Numbering System

The well numbers used by the Geological Survey in Arizona are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River base line and meridian which divide the State into four quadrants (fig. 2). These quadrants are designated counterclockwise by the capital letters A, B, C, and D. All land north and east of the point of origin is in A quadrant, that north and west in B quadrant, that south and west in C quadrant, and that south and east in D quadrant. The first digit of a well number indicates the township, the second the range, and the third the section in which the well is situated. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract (fig. 2), the second the 40-acre tract, and the third the 10-acre tract. These letters are also assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within a 10-acre tract, three lowercase letters are shown in the well number. In the example shown, well number (D-4-5)19caa designates the well as being in the $NE\frac{1}{4}NE\frac{1}{4}SW\frac{1}{4}$ sec. 19, T. 4 S., R. 5 E. Where there is more than one well within a 10-acre tract, consecutive numbers beginning with 1 are added as suffixes.

Personnel

Most of the personnel of the Arizona District have worked on the basic-data project, either in the collection of field data or in the compilation and preparation of the report. Personnel of the Phoenix area office who worked on this project are J. M. Cahill, P. M. Johnson, William Kam, R. S. Stulik, and H. N. Wolcott (deceased). Personnel of the Tucson area office who worked on this project are R. S. Allison, M. B. Booher, R. E. Cattany, C. S. English, J. W. Harshbarger, L. A. Heindl, M. F. Howard, C. L. Jenkins, P. W. Johnson, Henry Leon, K. D. Lepley, R. A. McCullough, E. K. Morse, N. A. Tilghman, and N. D. White. The project and report were coordinated by D. G. Metzger.

Acknowledgments

Many irrigation districts, power companies, and individuals provided splendid cooperation in furnishing much of the information in this report. The following organizations were particularly helpful in furnishing data on which pumpage figures were based: Arizona Public Service Co.; Buckeye Irrigation District; Bu-Gas Distributors; Citizens Utility Co.; City of Douglas; City of Nogales; City of Phoenix; City of

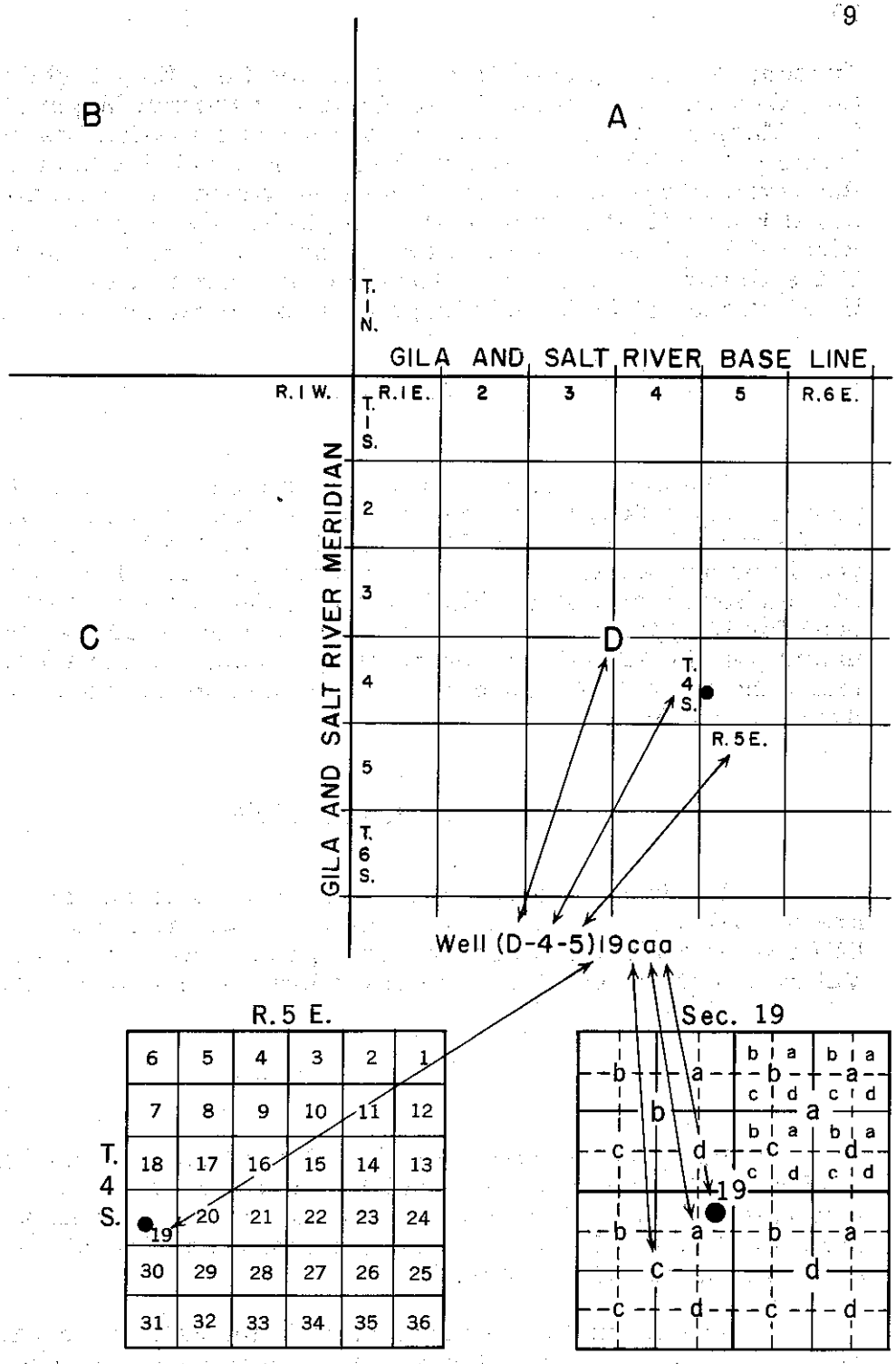


Figure 2.-- Sketch showing well-numbering system in Arizona.

Tucson; Cortaro Farms; Duncan Utilities Co.; Eloy Light and Power Co.; Gila Water Commissioner; Goodyear Farms; Magma Natural Gas Co.; Maricopa County Municipal Water Conservation District; Mohawk Municipal Water Conservation District; Natural Gas Service Co.; Roosevelt Irrigation District; Roosevelt Water Conservation District; Rural Electrification Administration; Safford Municipal Utilities; Salt River Valley Water Users' Association; San Carlos Irrigation District; Trico Electric Cooperative; Tucson Gas Electric Light and Power Co.; U. S. Bureau of Indian Affairs; and U. S. Bureau of Reclamation.

PUMPAGE

The amount of ground water pumped in Arizona in 1956 was approximately 4,500,000 acre-feet; this amount is not significantly different from that pumped in 1954 and 1955. For the last three years, the yearly pumpage has been nearly constant in spite of the fact that pumping lift has been increasing. Most of the 4,500,000 acre-feet pumped has been for irrigation use; only about 300,000 acre-feet has been used for municipal, industrial, and domestic purposes. Figure 3 shows graphically the amount of ground water pumped from individual basins in Arizona in 1956.

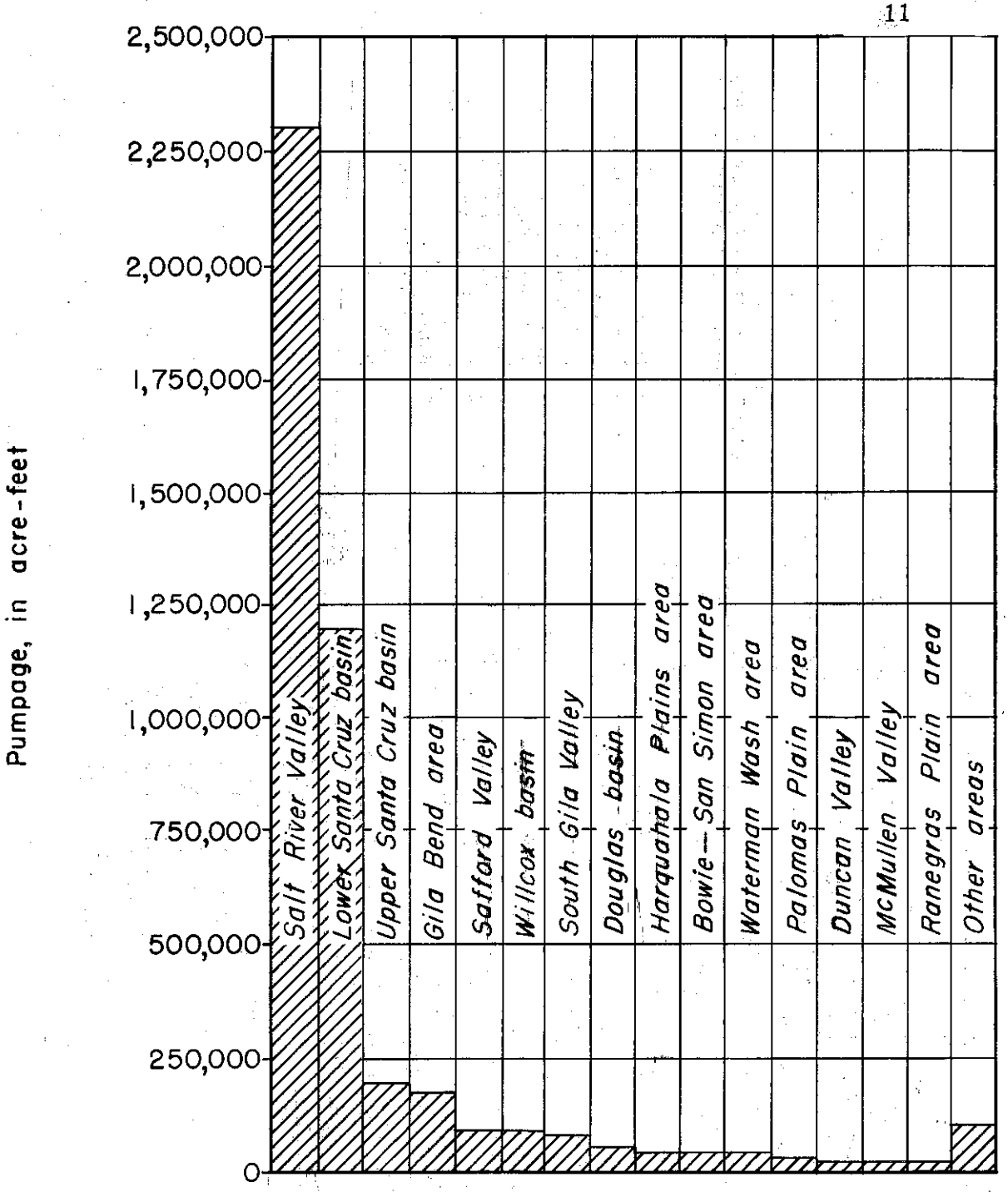
Principal Areas

The two principal areas of ground-water pumping in Arizona are the Salt River Valley and the lower Santa Cruz basin. More than half the total amount of ground water pumped was from the Salt River Valley and about one-fourth from the lower Santa Cruz basin.

Salt River Valley

Pumpage in 1956 in the Salt River Valley area (fig. 4) amounted to about 2,300,000 acre-feet, which does not differ significantly from the pumpage for 1955. Outlying areas included in this basin are Deer Valley, north of Phoenix; Paradise Valley, northeast of Phoenix; and the Tonopah area, northwest of Buckeye.

The production of some wells in the Salt River Valley has been decreasing, but in some places deepening wells has successfully increased production. The development of irrigation wells has continued in noncritical areas and the pumpage has been nearly constant during the past four years.



Note.--

The locations of the basins are shown on figure 4.

Figure 3.--Graph showing ground-water pumpage from basins in Arizona—1956.

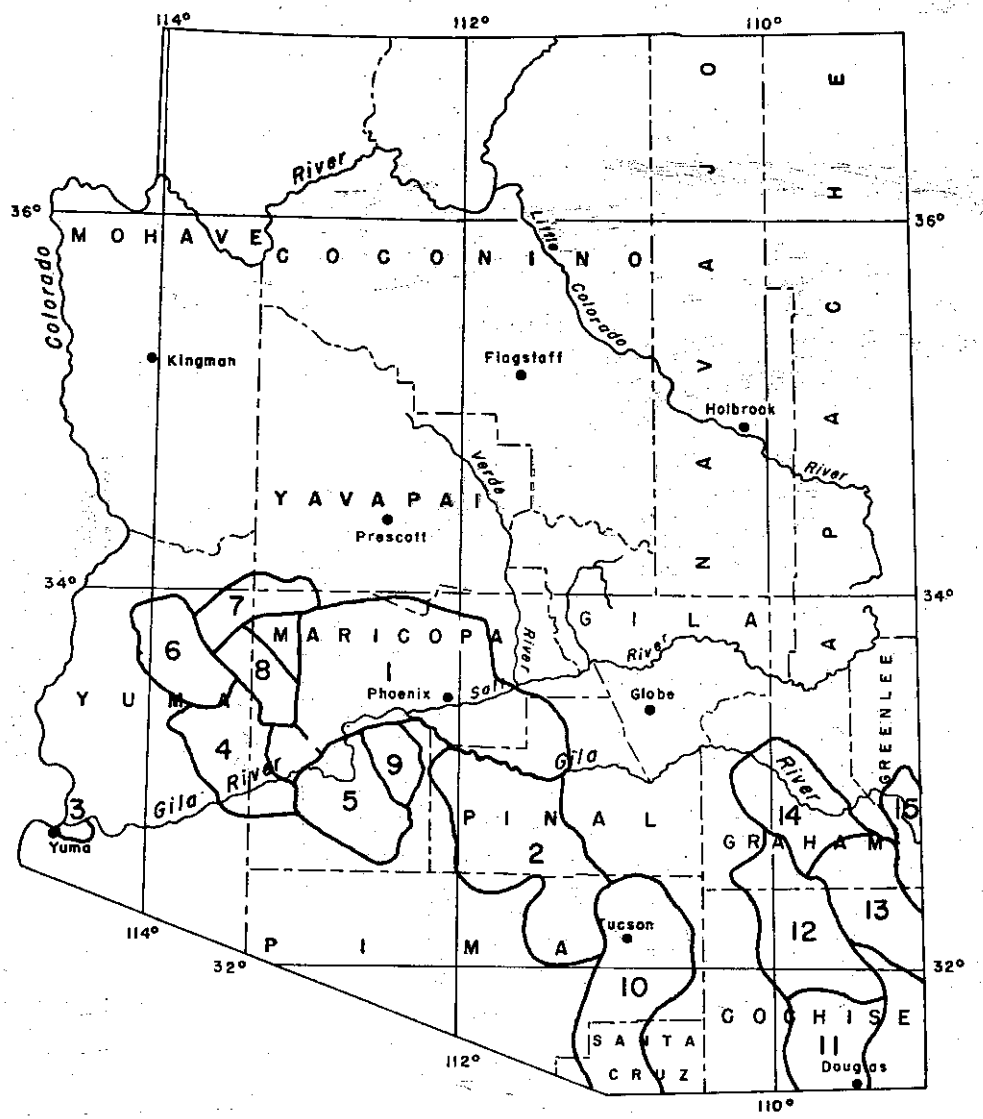


Figure 4.-- Map showing ground-water basins in Arizona for which pumpage is computed.

GROUND-WATER BASINS FOR WHICH PUMPAGE IS COMPUTED

1. Salt River Valley
2. Lower Santa Cruz basin
3. South Gila Valley
4. Palomas Plain area
5. Gila Bend area
6. Ranegras Plain area
7. McMullen Valley
8. Harquahala Plains area
9. Waterman Wash area
10. Upper Santa Cruz basin
11. Douglas basin
12. Willcox basin
13. Bowie-San Simon area
14. Safford Valley
15. Duncan Valley

There are approximately 1,600 active irrigation wells in the Salt River Valley. Discharges range from slightly over 100 gpm (gallons per minute) to about 5,000 gpm. The average pumping level within the Salt River Valley Water Users' Project was about 210 feet in 1956 compared to approximately 203 feet in 1955 (Hollensworth, W. P., personal communication). Barr (1957) states that in 1956 the average pumping lift in Maricopa County was about 260 feet. Most of the irrigation wells in this area are equipped with electric motors, but a few are powered by natural gas and liquid fuel.

Lower Santa Cruz Basin

Pumpage of ground water in the lower Santa Cruz basin (fig. 4) for 1956 amounted to about 1,200,000 acre-feet. Of this amount about 5,000 acre-feet was pumped by private or municipal domestic water systems; the remainder was pumped for irrigation. Although more power was consumed for well operation in 1956, the amount of water pumped in the Pinal County part of the lower Santa Cruz basin was about 100,000 acre-feet less than in 1955. Greater pumping lifts, resulting from continued water-table declines, are a major contributing factor to the decrease in pumpage. Within the basin more than 1,600 irrigation wells are in use, the discharges ranging from about 250 to nearly 4,000 gpm. Most of the wells in the Maricopa-Stanfield area are powered by natural gas; the power used for pumping of water in the Eloy area is largely electricity; in the Casa Grande-Coolidge-Florence sector power for pumping wells is more or less equally divided between natural gas and electricity; and the predominant source of power in the Avra-Marana sector is natural gas. In addition, a small number of butane- or diesel-powered wells are scattered throughout the basin. In the basin as a whole, approximately 40 percent of the wells are powered by natural gas.

Subordinate Areas

Smaller areas of agricultural development account for the remainder of ground water pumped in Arizona. The amount pumped in these subordinate areas is about one-fourth the total figure. Thirteen basins are discussed individually and the remainder are discussed under "Other areas."

South Gila Valley

In the South Gila Valley (fig. 4), pumpage in 1956 amounted to approximately 80,000 acre-feet. This was about 40 percent greater than in the previous year. The production of the irrigation wells in this area has been increasing as the water table rises in response to irrigation of the Yuma Project with water from the Colorado River. The discharges of these wells range from about 1,500 to about 3,600 gpm; the majority pump more than 2,800 gpm. With the limited amount of land available in this area for irrigation, any increase or decrease in pumpage will depend primarily on the demand for water. In 1956, there were approximately 70 active irrigation wells, with pumps powered by electric motors.

Palomas Plain Area

In the Palomas Plain area (fig. 4) the pumpage was about 30,000 acre-feet in 1956. There are 57 active irrigation wells in the area, the discharges ranging from about 200 to 2,800 gpm. Pumpage in the future probably will continue to increase because additional wells are being drilled north of Hyder. There are some liquid-fuel-powered pumps in the area, but the majority of the pumps are powered by electricity.

Gila Bend Area

Pumpage in the Gila Bend area (fig. 4) amounted to about 180,000 acre-feet in 1956, about 30 percent more than in 1955. More than half of this water is pumped into a canal and transported with surface water to irrigate land west of Gila Bend. Well discharges in the Gila Bend area range from about 500 to about 3,000 gpm. In 1956 there were about 90 active irrigation wells in the Gila Bend area, all but 4 of which had pumps powered by electric motors. Of the 4 exceptions, 2 were powered by natural gas and 2 by liquid fuel. Pumpage in the Gila Bend area has been steadily increasing owing to the development of new wells. In the future, however, pumpage should be about the same or slightly decreased, because of the declining water table in the northern part of the basin.

Ranegras Plain Area

In the Ranegras Plain area (fig. 4) pumpage amounted to approximately 20,000 acre-feet in 1956, about the same yearly rate as during the past three years. There were 20 active irrigation wells in the Ranegras Plain area, all but one powered by electricity.

McMullen Valley

Pumpage in the McMullen Valley area (fig. 4) amounted to approximately 20,000 acre-feet in 1956 as compared to about 4,000 acre-feet in 1955. Additional wells are being drilled in the area and pumpage will increase as the wells are put into use. Discharges range from about 200 to 2,800 gpm.

Harquahala Plains Area

In the Harquahala Plains area (fig. 4) pumpage in 1956 amounted to about 40,000 acre-feet, an increase of about 30 percent over 1955. There were 33 active irrigation wells in 1956, as compared to 23 in 1955. Pumpage in the Harquahala Plains area will tend to increase in future years, because many new wells are being developed in the area. A few wells have been drilled recently at the northwest end of the basin to supplement water that is pumped in Harrisburg Valley and transported in canals to irrigate fields in the Harquahala Plains area. During the early development in the area most pumps were powered by liquid fuel but the trend now is to convert to the use of electric power and natural gas. Discharges from wells in this area range from about 800 to about 3,500 gpm.

Waterman Wash Area

Pumpage in the Waterman Wash area (fig. 4) amounted to about 40,000 acre-feet in 1956, approximately the same as in 1955. Most of the irrigation wells are in the northern part of the basin and have discharges ranging from about 1,900 to about 3,000 gpm. The agricultural development in the area appears to have stabilized and at present there are no indications of expansion of the irrigated acreage.

Upper Santa Cruz Basin

Pumpage in the upper Santa Cruz basin (fig. 4) occurs in two major areas, Tucson-Continental and Amado-Nogales. The pumpage of ground water in these areas for 1956 was about 200,000 acre-feet. Of this amount, about 50,000 acre-feet was pumped for domestic and commercial use. More than 600 irrigation wells are in use in these areas, the discharges ranging from about 100 to more than 4,000 gpm. The predominant source of power in the Tucson-Continental area is electricity; the Amado-Nogales area utilizes electricity for the most part, but a few butane- and diesel-powered pumps are in use.

Douglas Basin

Pumpage of ground water in the Douglas basin (fig. 4) in 1956 amounted to about 60,000 acre-feet, an increase of 10,000 acre-feet over 1955 due to an increase in acreage under irrigation. Domestic use accounted for about 2,000 acre-feet of this total. More than 400 irrigation wells are in use in this area ranging in discharge from about 100 to more than 2,000 gpm. Most of the pumps are powered by electricity.

Willcox Basin

Pumpage of ground water in the Willcox basin (fig. 4) in 1956 amounted to about 90,000 acre-feet, about 10,000 acre-feet more than in 1955. The increase in pumpage was directly related to the increased development of irrigated lands in the Kansas Settlement area. Pumpage of ground water for domestic use, which is small by comparison, is not included in the total pumpage for the Willcox basin. More than 300 irrigation wells are in use in the basin, and discharges from these wells range from about 100 to more than 2,000 gpm. With the exception of a few wells powered by natural gas in the Kansas Settlement area, the pumps are powered by electricity.

Bowie-San Simon Area

About 40,000 acre-feet of water was pumped in the Bowie-San Simon area (fig. 4) in 1956, the same as in 1955. Approximately one-third of the 150 irrigation wells in the area are near Bowie and for the most part are powered by natural gas. The majority of the wells in the San Simon area are pumped by electricity. Wells in the Bowie-San Simon area yield from about 100 to nearly 3,000 gpm.

Safford Valley

Pumpage of ground water in Safford Valley (fig. 4) in 1956 was about 90,000 acre-feet, the same as in 1954 and 1955. Approximately 700 irrigation wells are in use within the Safford Valley, the discharges ranging from about 100 to nearly 3,000 gpm. Most of the pumps in the valley are powered by electricity or natural gas, in about equal numbers. A few pumps are powered by butane or diesel fuel.

Duncan Valley

Pumpage of ground water in Duncan Valley (fig. 4) in 1956 amounted to about 20,000 acre-feet, about 5,000 acre-feet less than in 1955. More than 100 irrigation wells are in use in this area, the discharges ranging from about 100 to more than 3,000 gpm. Natural gas and electricity are about equally divided as power sources.

Other Areas

Smaller irrigated areas occur throughout the State for which no records of pumpage have been collected. These areas include the Big Sandy Valley, Cactus Flat-Artesia area, Chino Valley, Date Creek area, Dendora Valley, Hunt area, Joseph City area, Parker area, Peeples Valley, San Pedro Valley, Skull Valley, Snowflake-Taylor area, St. Johns area, Valentine area, Wellton-Mohawk area, Williamson Valley, and Woodruff area. It is estimated that these areas contributed about 100,000 acre-feet to the total pumpage for the State, and that amount is included in the totals for them (fig. 3).

WATER-LEVEL FLUCTUATIONS

The general trend of water levels in Arizona in 1956 continued downward. Maximum net declines again occurred in Maricopa and Pinal Counties. The fluctuations of water levels are discussed by counties.

Apache County

In that part of Apache County south of the Navajo Indian Reservation, most of the wells derive their water from either the Coconino sandstone of Permian age or shallower aquifers of Triassic age. Water

in most of these wells is under artesian pressure and water levels in wells used for irrigation range from at or above the land surface to about 75 feet below the surface. Water levels in some of the stock wells are as much as 300 feet below land surface. Slight fluctuations in the water level were observed in a few wells but no general trend could be established. Pumping of ground water for irrigation is confined to relatively small areas in the vicinity of the towns of Hunt, St. Johns, and Springerville.

The successful development of a deep well in the St. Johns area in 1956 supplements the surface-water supply from Lyman reservoir and may prove to be an impetus to further development of ground-water supplies in that part of the county.

Cochise County

There are four principal areas of irrigation development in Cochise County: (1) The Willcox basin; (2) the Douglas basin; (3) the Bowie-San Simon area; and (4) the upper San Pedro Valley.

Willcox basin.--There are two main cultivated areas in the Willcox basin (fig. 5), the Stewart area and the Kansas Settlement area.

In the Stewart area, water-level fluctuations for the period spring 1956 to spring 1957 ranged from a rise of about 1 foot to a decline of about 7 feet. In the 5-year period spring 1952 to spring 1957, water levels in wells in the area declined by amounts ranging from about 10 feet along the fringe areas to about 20 feet in the centers of the heavily pumped areas (fig. 5). The water level in well (D-13-24)16 (fig. 6) in the heavily pumped area shows a decline of about 6 feet for the period spring 1956 to spring 1957, about 30 feet for the period spring 1952 to spring 1957, and about 44 feet for the period spring 1947 to spring 1957. In the spring of 1957 the range in depth to water in the Stewart area was from about 25 feet near Willcox to about 115 feet on the northern edge of the irrigated area.

In the Kansas Settlement area water-level fluctuations for 1956 ranged from a slight rise near the Willcox playa to a decline of about 30 feet in the eastern portion, which is newly developed. In the 5-year period spring 1952 to spring 1957 declines ranged from about 10 feet along the west side of the area to about 30 feet in most parts of the irrigated areas (fig. 5). The water level in well (D-14-26)20 (fig. 6), in the northern part of this area, showed almost no change in 1956. However, a gradual decline of about 12 feet took place during the 10-year period spring 1947 to spring 1957, about 10 feet of this decline occurring since 1952. In the spring of 1957 the range in depth to water in this area was from about 30 to about 200 feet.

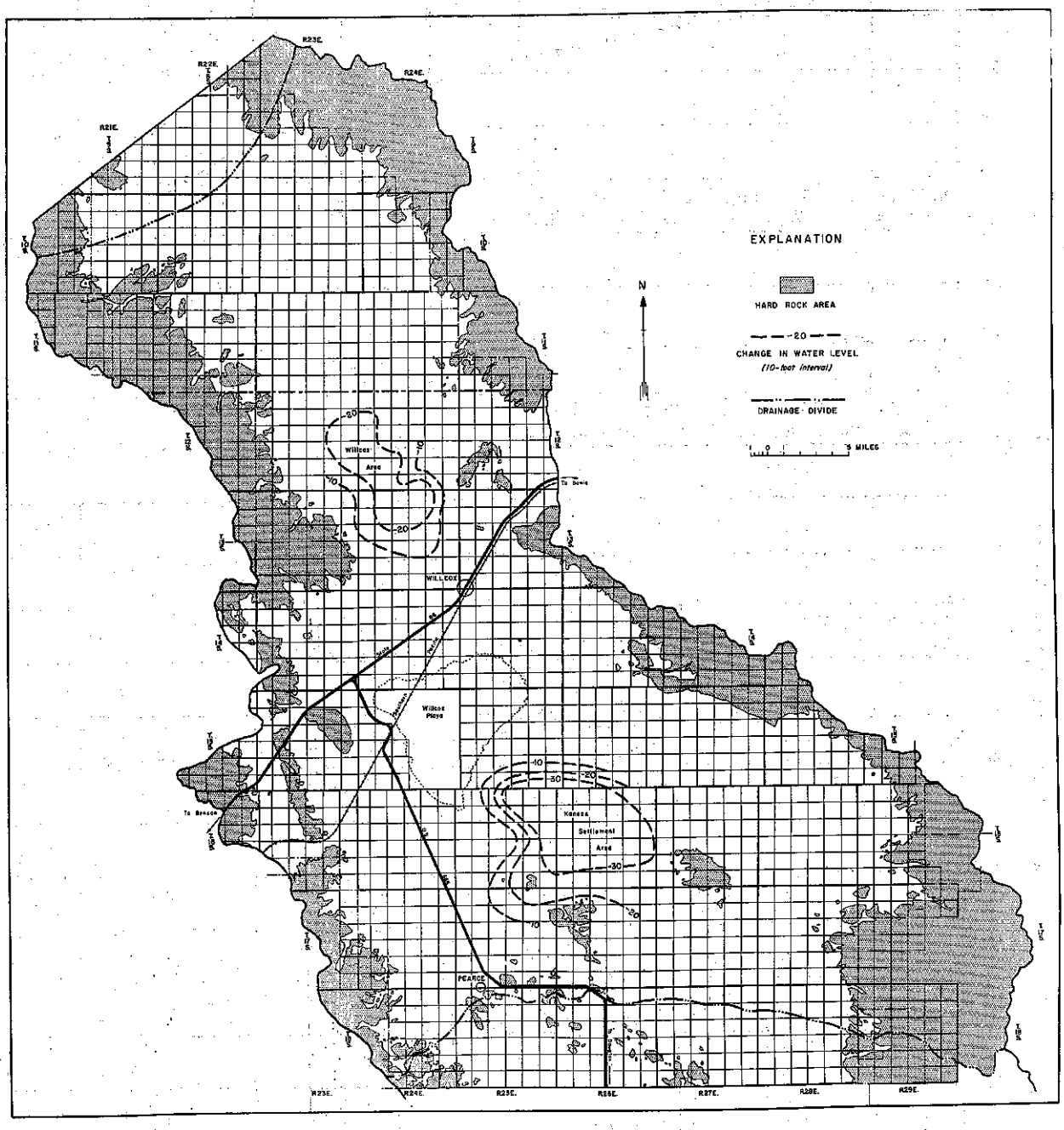


Figure 5.--Map of Willcox basin, Cochise County, Arizona, showing change in ground-water level from spring 1952 to spring 1957.

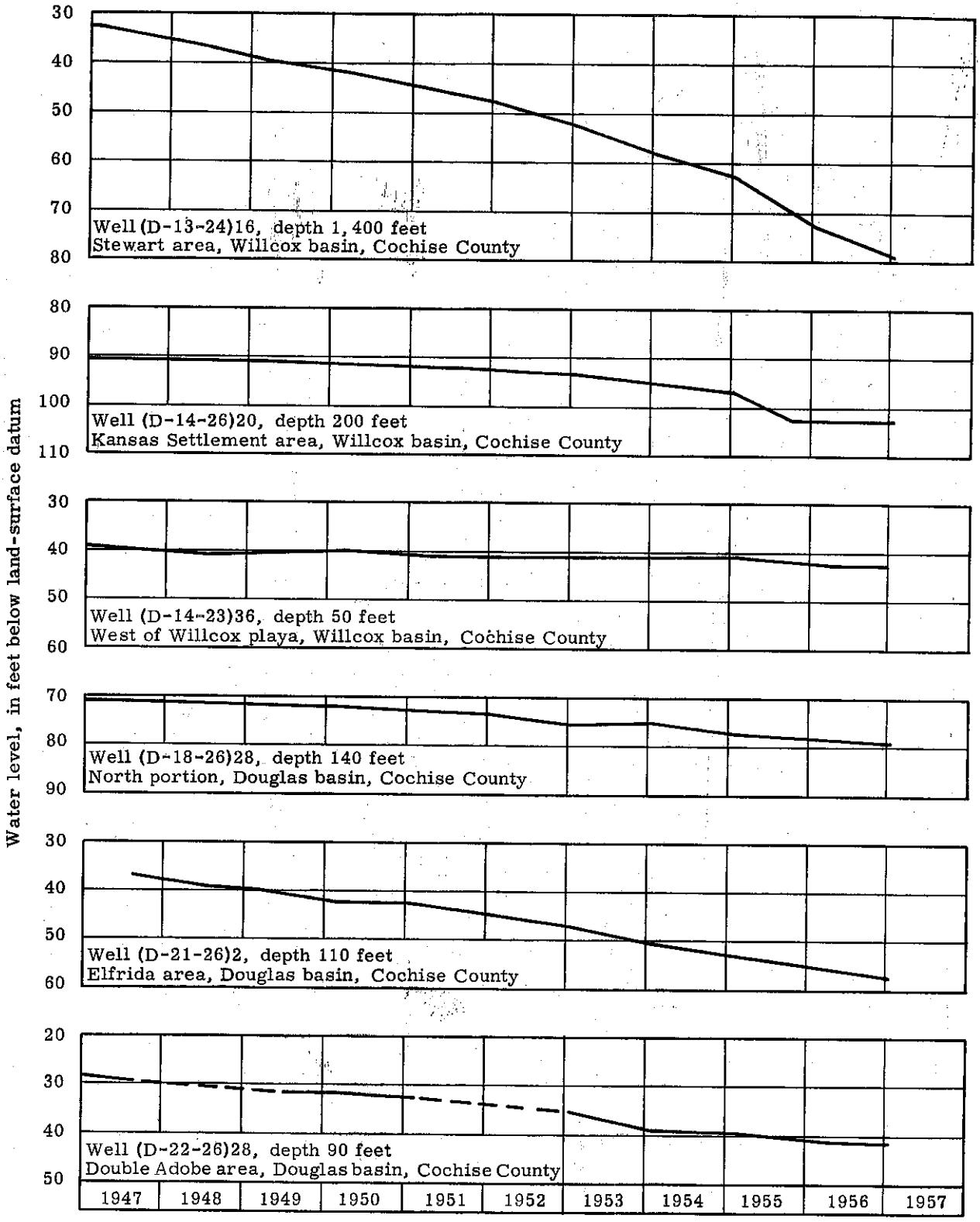


Figure 6.--Water levels in selected wells in the Willcox and Douglas basins, Cochise County.

The water level in well (D-14-23)36 (fig. 6), outside the cultivated area on the west side of the Willcox playa, has shown only minor changes during the period of record.

Douglas basin.--Water-level fluctuations in Douglas basin for 1956 ranged from a rise of about 2 feet along the west side of the basin to a decline of nearly 5 feet on the east side of the irrigated area. In the 5-year period spring 1952 to spring 1957 water levels in wells in the Elfrida and McNeal areas showed a decline of about 10 feet; about 5 feet of decline was indicated for the Double Adobe-Douglas area and the northern portion of the basin (fig. 7). The water level in well (D-18-26)28 (fig. 6) in the northern part of the basin has shown an accelerated decline during the last 5 years. That in well (D-21-26)2 (fig. 6) in the center of the heavily pumped Elfrida-McNeal area showed a decline of about 12 feet for the 5-year period spring 1952 to spring 1957 and more than 20 feet for the 10-year period spring 1947 to spring 1957. The water level in well (D-22-26)28 (fig. 6), in the Double Adobe-Douglas area where the declines have not been so great, showed a decline of slightly more than 12 feet in the 10-year period spring 1947 to spring 1957. In the spring of 1957 the range in depth to water in the basin was from about 30 to about 130 feet.

Bowie-San Simon area.--In the Bowie portion of the Bowie-San Simon area water levels in wells indicated declines ranging from about 6 to nearly 20 feet for 1956. The water level in well (D-13-29)6 (fig. 8) indicates the maximum recorded annual decline for this area; the water level in this well began to decline about 1951 when the heavy pumping for irrigation began in this area. In the spring of 1957 the depth to water in the area ranged from about 110 to about 315 feet.

In the San Simon portion of the Bowie-San Simon area the water levels in the wells indicated fluctuations ranging from a slight rise to a decline of about 7 feet for 1956. The water level in well (D-14-31)3 (fig. 8) showed a decline of about 3 feet during 1956, and about 30 feet for the 10-year period spring 1947 to spring 1957. The depth to water ranged from about 10 to about 115 feet in the spring of 1957.

Upper San Pedro Valley.--Water-level fluctuations in this area ranged from a rise of about 2 feet to a decline of nearly 3 feet for 1956. The water level in well (D-16-20)34 (fig. 8) near Pomerene showed a slight decline during 1956 and for the 10-year period spring 1947 to spring 1957 indicated an overall decline of nearly 6 feet. The water level in well (D-20-20)32 (fig. 8) showed a rise of about 1 foot during 1956 and a net decline of slightly more than 1 foot for the 10-year period. In the spring of 1957 the range in depth to water was from about 10 to about 290 feet.

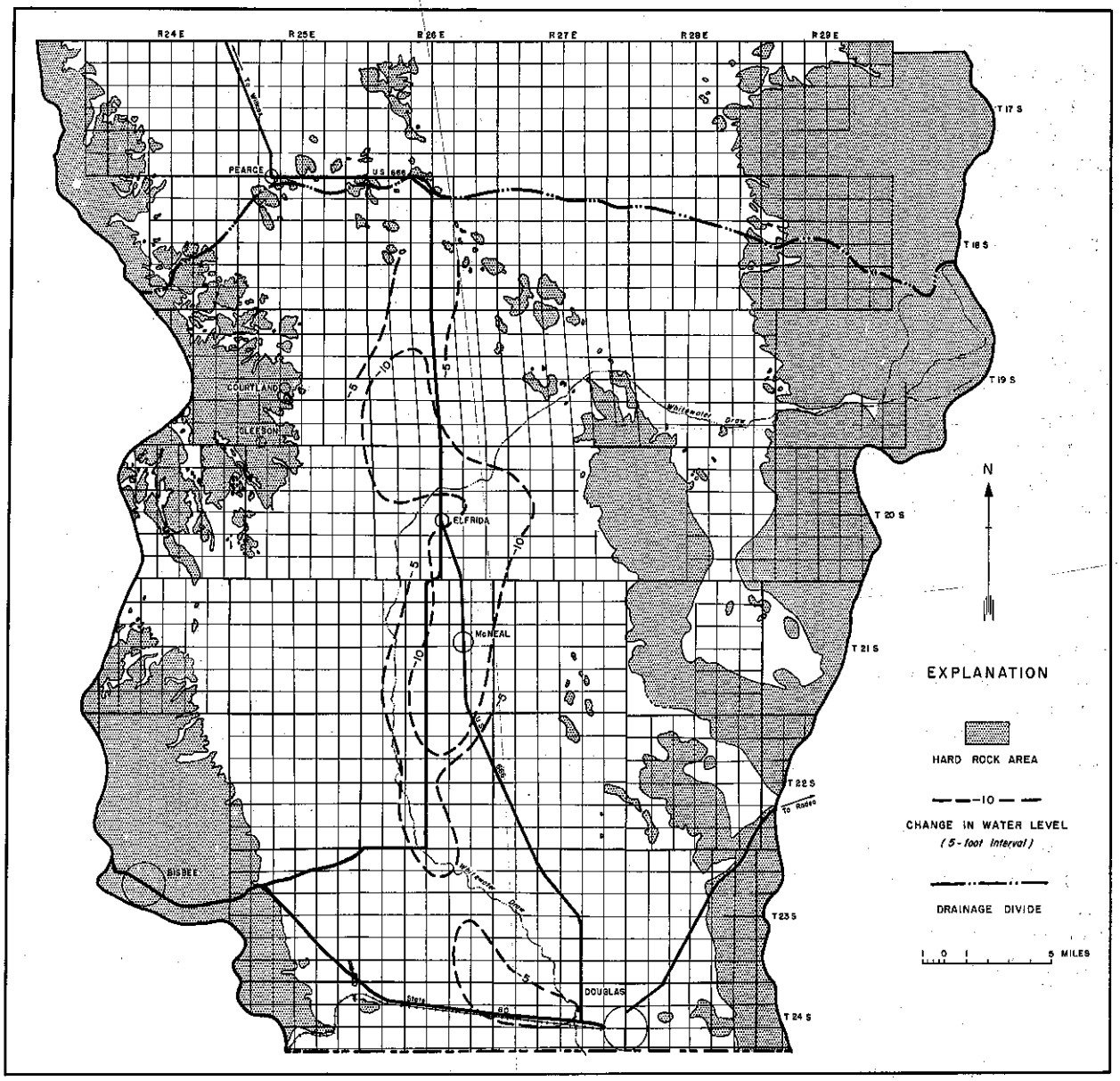


Figure 7.--Map of Douglas basin, Cochise County, Arizona, showing change in ground-water level from spring 1952 to spring 1957.

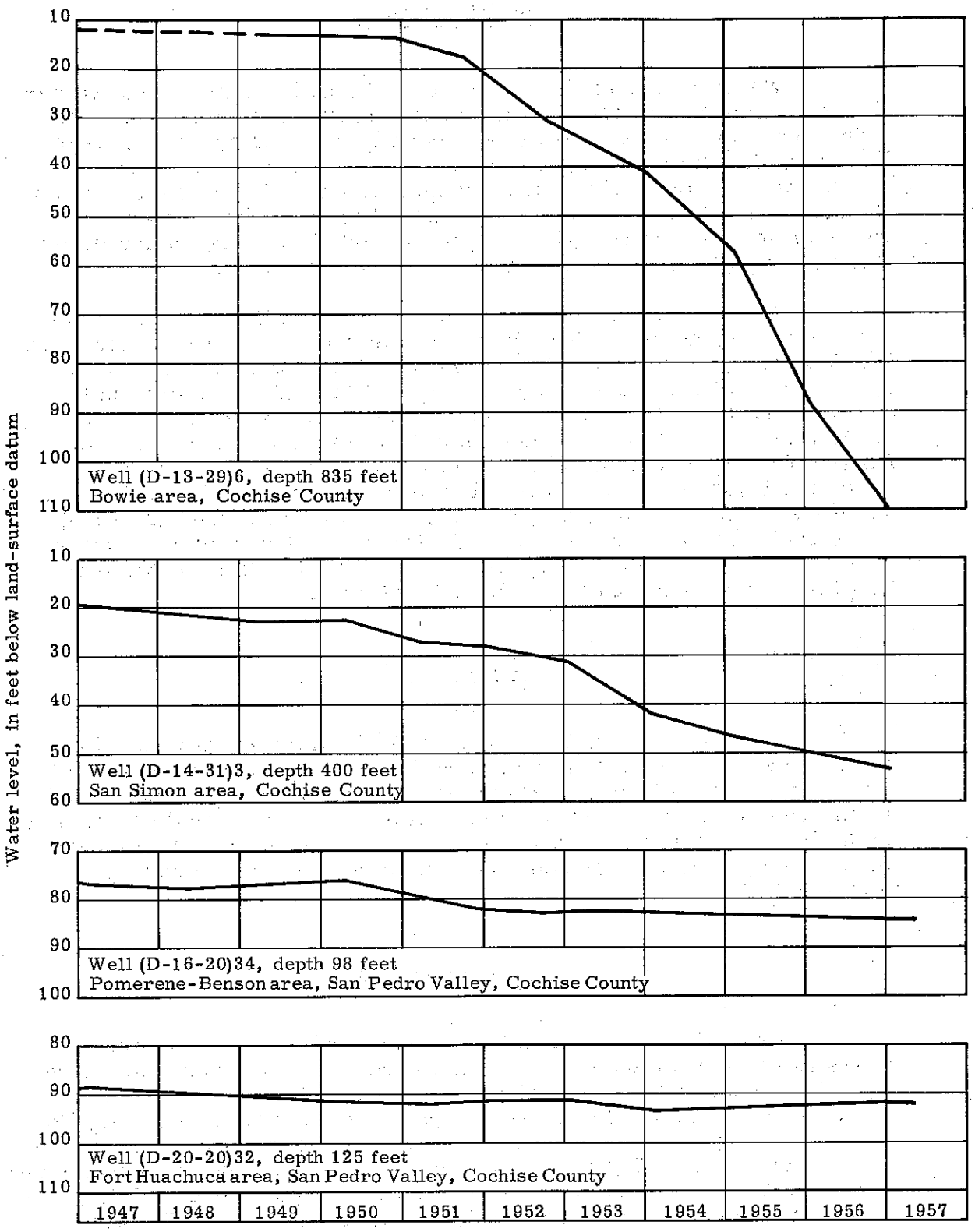


Figure 8.--Water levels in selected wells in the Bowie-San Simon area and upper San Pedro basin, Cochise County.

Coconino County

Water levels in shallow wells in Coconino County showed declines ranging from about half a foot to slightly more than 1 foot in 1956. The shallow water wells are readily affected by precipitation. The range in depth to water in the spring of 1957 was from about 2 feet at the abandoned Challender Ranger Station near Williams to about 132 feet at Fort Valley, near Flagstaff. Figure 9 shows graphically the depth to water in well (A-22-6)26 at Fort Valley and indicates that there have been minor fluctuations in the water levels.

Water levels in deep wells in the Flagstaff area range from about 900 to 1,900 feet. The depths of these drilled wells range from 1,000 to 2,300 feet and production ranges from about 10 to about 320 gpm. Two wells completed by the city of Flagstaff were drilled to depths of 1,600 and 1,746 feet and had depths to water of 1,228 and 1,247 feet, respectively. The depths to water in other wells in the Flagstaff area were about 970 feet in the Palmer well (A-20-7)32, south of Flagstaff; about 900 feet in the Hechethorne well (A-20-7)12, southwest of the Palmer well; and about 1,270 feet in well (A-22-8) in the Doney Park area northeast of Flagstaff. The depths to water in two wells northwest of Flagstaff, drilled by the El Paso Natural Gas Co., were reported to be about 1,900 feet.

Gila County

In the upper Pinal Creek area wells along Pinal Creek are shallow and water levels fluctuated widely during 1956 in response to surface flow and pumping. Water levels in these wells in the period spring 1947 to spring 1957 fluctuated similarly and showed essentially no decline. Water levels in wells in the foothills above Pinal Creek show small, more or less continuous declines for the preceding 10-year period.

Graham County

Water-level fluctuations in the Safford Valley indicated declines ranging from about 3 to about 13 feet in 1956. The water level in well (D-6-28)31 (fig. 9) at the head of the valley showed a decline of about 13 feet in 1956. In the 5-year period spring 1952 to spring 1957 the decline in this area was about 15 feet, and nearly 18 feet in the 10-year period spring 1947 to spring 1957. The water level in well (D-6-24)5 (fig. 9) in the cultivated area below Pima, indicated about a 5-foot decline in the past 5 years, and nearly 14 feet since 1947. The water level in well (D-4-22)13 (fig. 9) in the downstream portion of the Safford

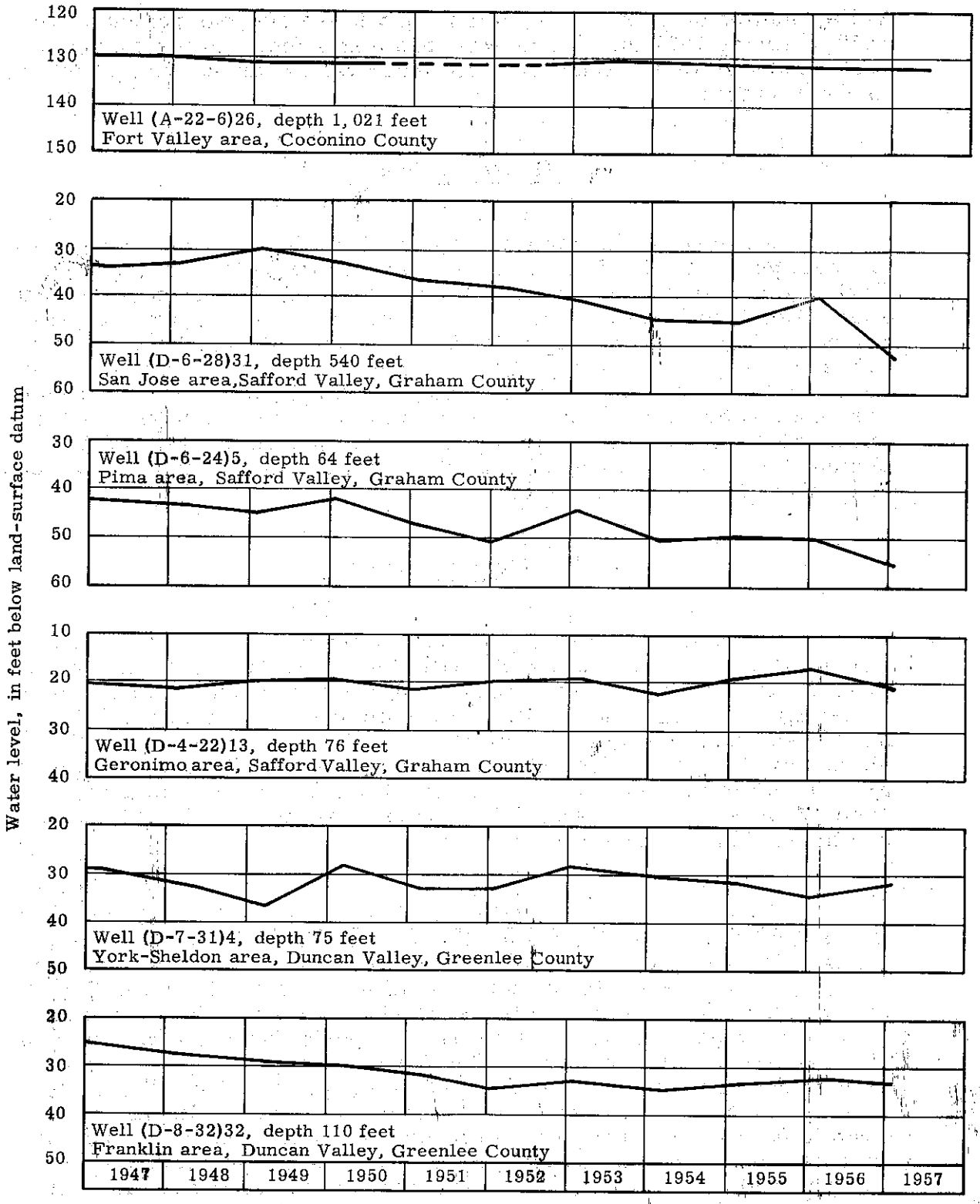


Figure 9.--Water levels in selected wells, Coconino, Graham, and Greenlee Counties.

Valley showed only small fluctuations and in the 10-year period spring 1947 to spring 1957 the decline was less than 1 foot. In the spring of 1957 depths to water in the irrigated inner valley ranged from about 15 to about 60 feet.

Greenlee County

Water-level fluctuations in Duncan Valley indicated both rises and declines in 1956. The water level in well (D-7-31)4 (fig. 9) in the York-Sheldon area along the Gila River showed a rise of about 2 feet in 1956. Declines in water levels in this area were small; in the 5-year period spring 1952 to spring 1957 the water table dropped about 1 foot; in the 10-year period spring 1947 to spring 1957 there was a decline of about 3 feet. The water level in well (D-8-32)32 (fig. 9) in the Franklin area showed about a 2-foot decline in the 5-year period spring 1952 to spring 1957, and nearly 8 feet in the 10-year period spring 1947 to spring 1957. In the spring of 1957 the depth to water in the valley ranged from about 30 to about 110 feet.

Maricopa County

There are five principal areas of development in Maricopa County: (1) Salt River Valley; (2) Gila Bend area; (3) Waterman Wash area; (4) Harquahala Plains area; and (5) Dendora area. The Salt River Valley has the largest agricultural development in Arizona, and it is subdivided into the following areas: Queen Creek-Higley-Gilbert-Magma area; Tempe-Mesa-Chandler area; Phoenix-Glendale-Tolleson area; Paradise Valley area; Litchfield-Beardsley-Marinette area; Liberty-Buckeye-Hassayampa area; lower Hassayampa-Tonopah area; and lower Centennial-Arlington area.

Queen Creek-Higley-Gilbert-Magma area.--Changes in water levels for 1956 ranged from a decline of about 22 feet approximately 6 miles north of Higley to a rise of about 5 feet in wells which received recharge from canal seepage south of Gilbert. Water levels in the vicinity of Magma and Queen Creek showed declines ranging from less than 1 foot to about 13 feet. In the 5-year period spring 1952 to spring 1957 water-table declines in the Queen Creek-Higley-Gilbert-Magma area ranged from about 40 to about 60 feet (fig. 10). The largest declines occurred in the areas between Queen Creek and Magma, and Granite Reef Dam and Higley. In these areas only a small amount of surface water is available, and ground water is the principal source for irrigation. The range in depth to water in the cultivated area in the spring of 1957 was from about 139 feet near Higley to about 420 feet south of Granite Reef Dam. The water level in well (A-1-6)23

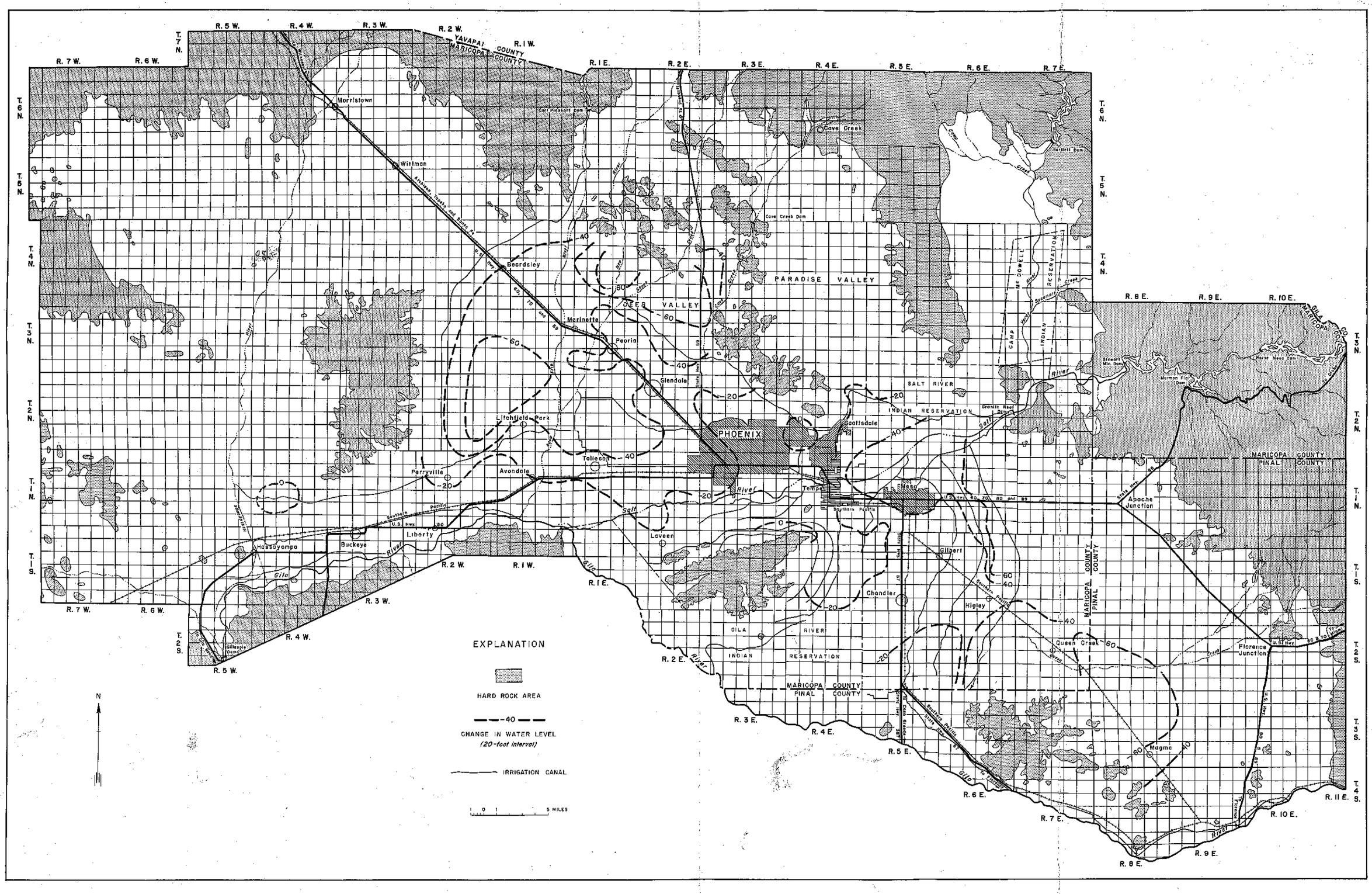


Figure 10.--Map of Salt River Valley area, Maricopa and Pinal Counties, Arizona, showing change in ground-water level from spring 1952 to spring 1957

(fig. 11) in a heavily pumped area showed a large decline, while the water level in well (D-2-10)8 (fig. 11) in the fringe area showed only a minor decline.

Tempe-Mesa-Chandler area.--During 1956 the water table continued to decline in the Tempe-Mesa-Chandler area at about the same rate as in 1955. Declines ranged from about 11 feet south of Chandler to about 2 feet southeast of the Salt River Mountains. Water levels in wells in the area showed declines of less than 1 foot to about 40 feet in the 5-year period spring 1952 to spring 1957 (fig. 10). Declines were largest in the vicinity of Mesa and smallest near the Salt River Mountains where the ground-water reservoir received recharge from canal seepage. In the spring of 1957 depths to water ranged from about 70 feet in wells south of Chandler to about 230 feet north of Mesa. The water level in well (D-2-5)15 (fig. 12) showed a steady downward trend.

Phoenix-Glendale-Tolleson area.--In the period spring 1952 to spring 1957 in the Phoenix-Glendale-Tolleson area (fig. 10) declines ranged from less than 1 foot, in the areas northeast and southwest of Phoenix where canal seepage occurs, to about 80 feet in the Deer Valley area between New River and Skunk Creek. The largest declines occurred in Deer Valley where no surface water is available for irrigation. From spring 1956 to spring 1957 water-level fluctuations ranged from a rise of slightly less than 1 foot in well (A-4-1)14 to declines of about 20 feet in the area south of this well. In other areas where surface water is applied the water-table fluctuations were as follows: Vicinity of Glendale, about 7 to 11 feet of decline; vicinity of Tolleson, about 2 to 4 feet of decline; and west of Phoenix, about 6 feet of decline. The depth to water in the Phoenix-Glendale-Tolleson area in the spring of 1957 ranged from about 13 feet northeast of Phoenix to about 440 feet in the northern part of Deer Valley. Wells are the only source of irrigation water in Deer Valley, and the water level in well (A-3-2)12 (fig. 12) showed a considerable decline. In the Tolleson area, where surface water is supplemented by pumped water, the water level in well (A-1-1)6 (fig. 13) showed a smaller decline.

Paradise Valley.--In Paradise Valley water-level fluctuations from spring 1956 to spring 1957 ranged from a decline of about 3 feet in the northwestern portion of the valley to a rise of about 7 feet in wells approximately 2 miles north of the Arizona Canal. Pumpage in this area was small compared to other areas in the Salt River Valley and the water-table trend continued downward at a slower rate. The water level in well (A-3-3)1 (fig. 13) showed the trend of the water table in a part of the area. The depth to water in the spring of 1957 ranged from more than 700 feet in the northern part of the valley to about 146 feet near the Arizona Canal.

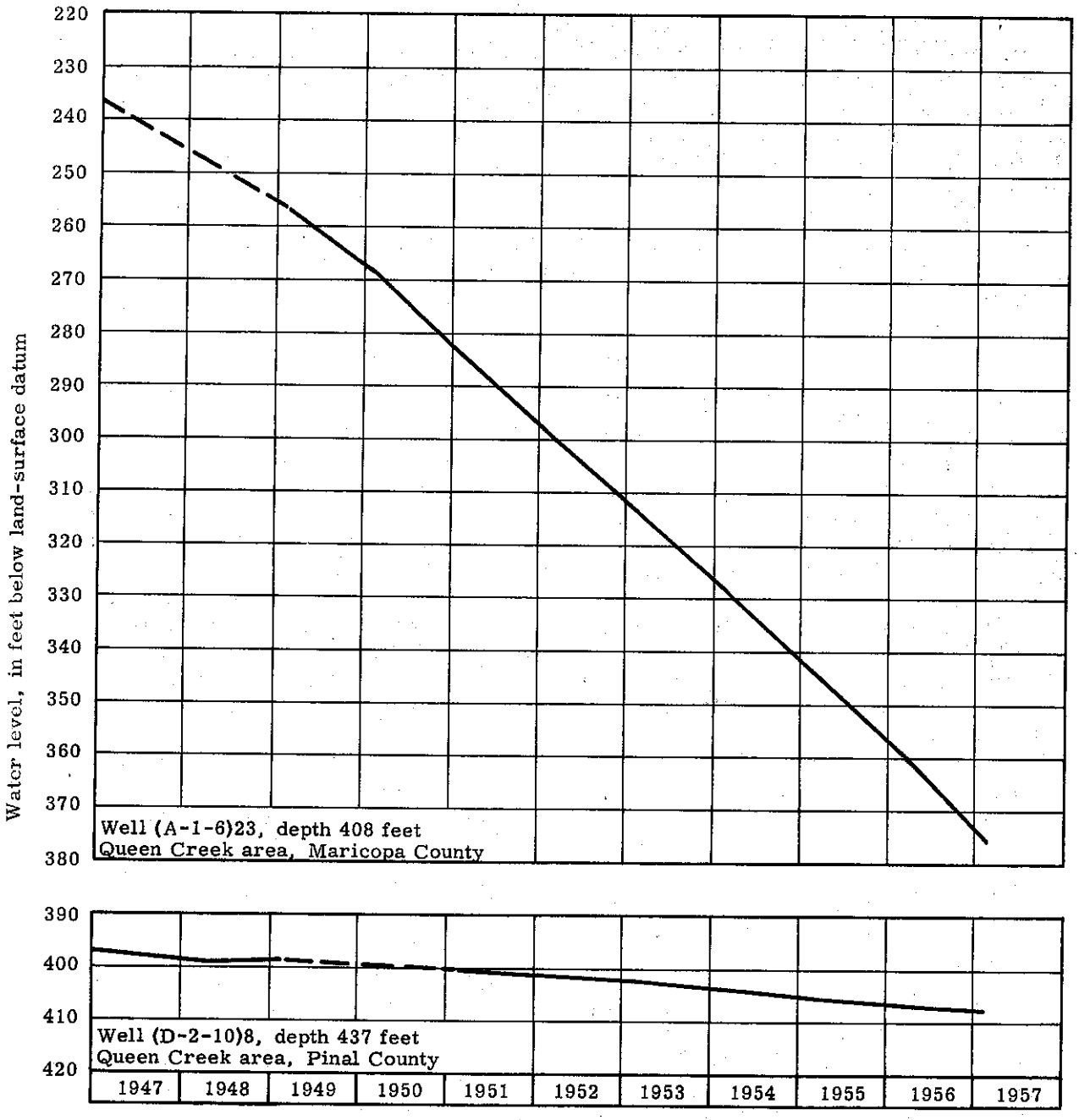


Figure 11.--Water levels in selected wells in Queen Creek area, Maricopa and Pinal Counties.

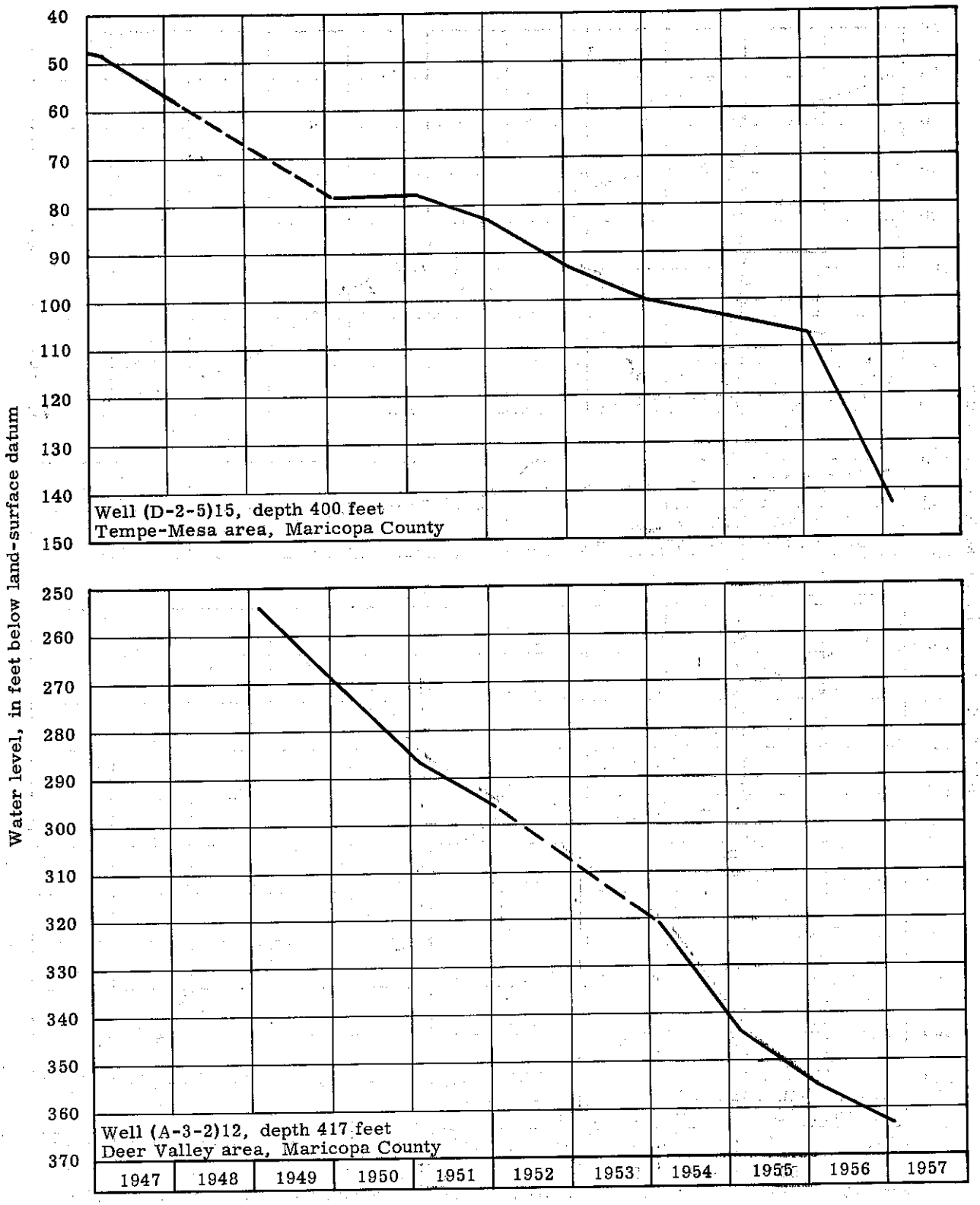


Figure 12.--Water levels in selected wells in Tempe-Mesa and Deer Valley areas, Maricopa County.

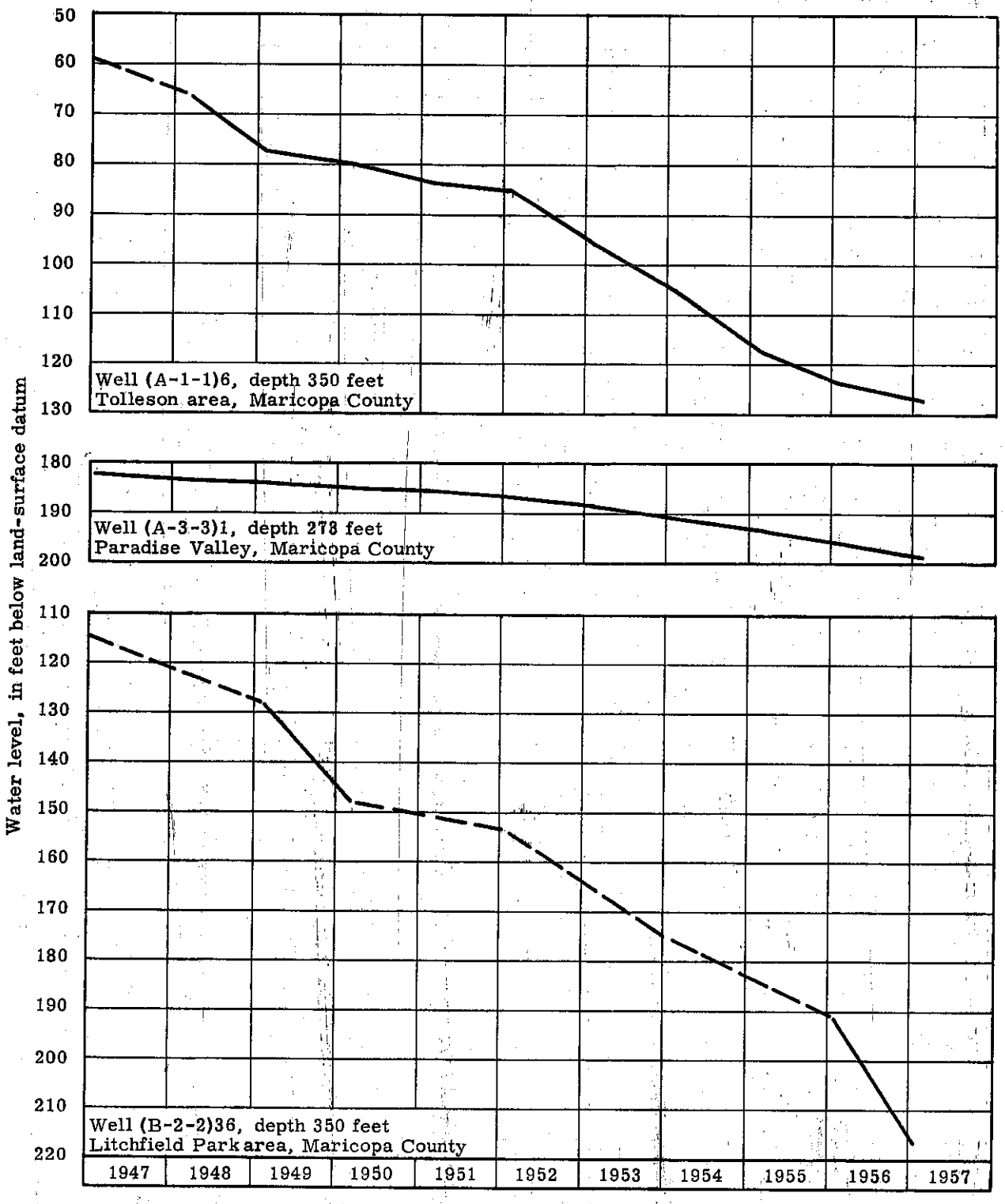


Figure 13. --Water levels in selected wells in Tolleson, Paradise Valley, and Litchfield Park areas, Maricopa County.

Litchfield Park-Beardsley-Marinette area.--During 1956 the largest water-level declines in the Salt River Valley were in the Litchfield Park-Beardsley-Marinette area. The declines ranged from about 2 feet 14 miles west of Beardsley to about 25 feet in the vicinity of Litchfield Park. Water levels in the majority of irrigation wells measured between Beardsley and Litchfield Park showed declines of more than 10 feet. The water level in well (B-2-2)36 (fig. 13) showed a continuous decline. Figure 10 shows declines in the 5-year period spring 1952 to spring 1957 ranging from about 80 feet in the area north of Marinette to more than 20 feet south of Litchfield Park. Most of the land under cultivation in this area depends chiefly on ground water for irrigation. The withdrawal of ground water accounts for the large declines of the water table. In the spring of 1957 the depths to water in irrigation wells ranged from 136 feet along the Agua Fria River to 388 feet south of Beardsley.

Liberty-Buckeye-Hassayampa area.--Fluctuations of the water table from spring 1956 to spring 1957 ranged from approximately 6 feet of rise north of Hassayampa to about 8 feet of decline in the vicinity of Perryville. Figure 10 shows that from spring 1952 to spring 1957 water-level declines ranged from less than 1 foot to about 40 feet. Throughout most of the area declines were less than 20 feet but the largest declines in the area were near Perryville. This area is at the outflow end of the Salt River Valley basin. The water level in well (B-1-3)32 (fig. 14) near Buckeye showed a decline of 1 foot for the period spring 1956 to spring 1957. In the irrigated area the depth to water in the spring of 1957 ranged from about 197 feet north of Perryville to 12 feet along the Hassayampa River.

Lower Hassayampa-Tonopah area.--Agricultural development in the lower Hassayampa-Tonopah area has increased in the last 2 years and additional irrigation wells have been drilled. Water-level declines from spring 1956 to spring 1957 ranged from about 1 foot to about 5 feet in the cultivated area. The downward trend of the water level in well (B-2-7)26 near Tonopah is shown in figure 14. In the spring of 1957 the range in depth to water in the cultivated area was from 88 to 202 feet.

Lower Centennial-Arlington area.--Declines in the undeveloped portions ranged from about 1 foot to about 5 feet in the period spring 1956 to spring 1957. In the heavily pumped part of the area the water table has declined, but there are not enough water-level measurements to permit any estimate of the extent of the decline. In the spring of 1957 depths to water in wells within the area ranged from about 73 to more than 220 feet.

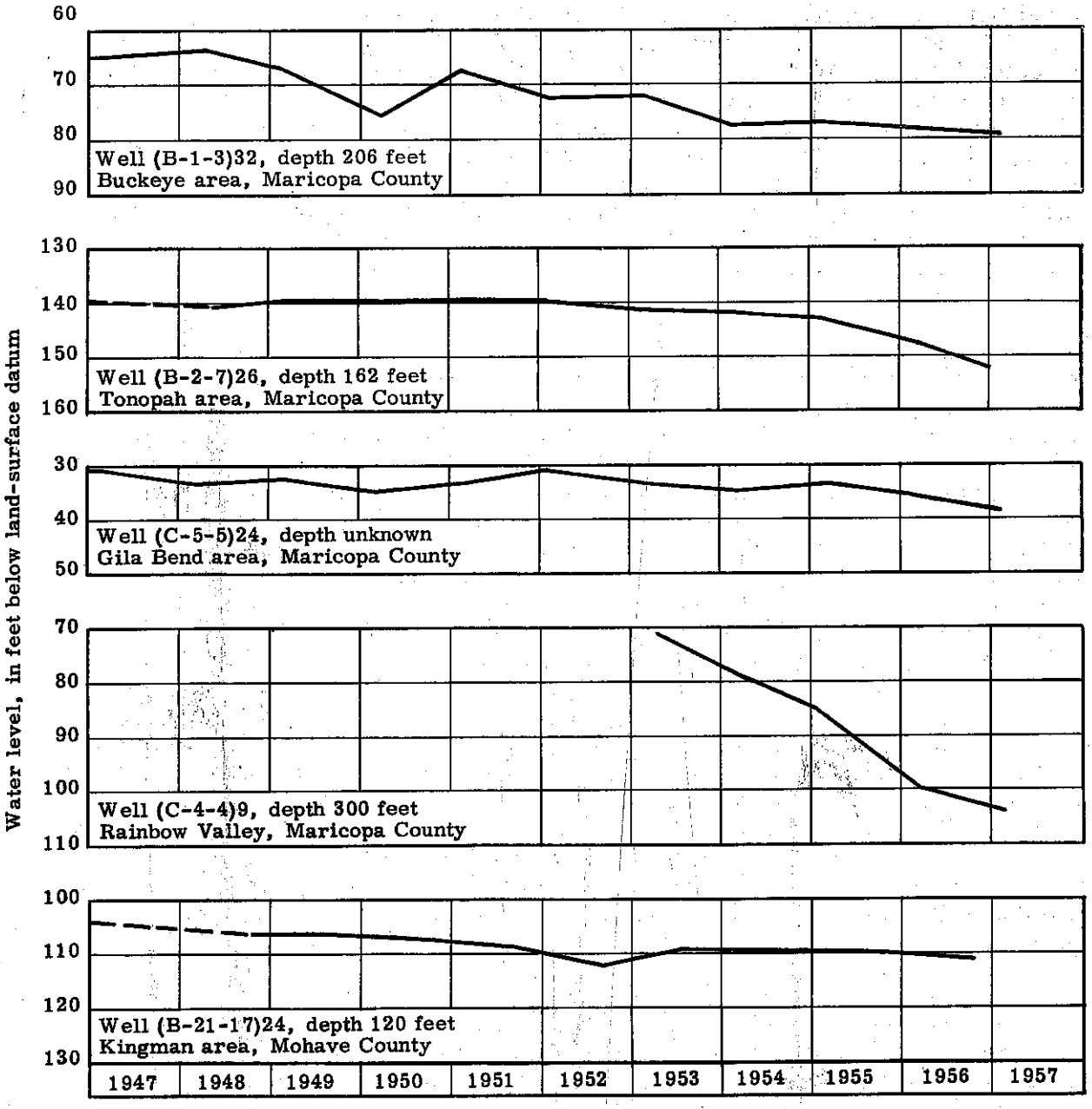


Figure 14.--Water levels in selected wells, Maricopa and Mohave Counties.

Gila Bend area.--Water-level fluctuations in the Gila Bend area for 1956 ranged from a slight rise near the Painted Rock Mountains to about a 5-foot decline in the Rainbow Valley area. The water level in well (C-5-5)24 (fig. 14) 3 miles north of Gila Bend showed no appreciable decline; the water level in well (C-4-4)9 (fig. 14) in the Rainbow Valley area showed about a 5-foot decline. At the end of 1956 depths to water in irrigation wells in the Gila Bend area ranged from about 300 feet in Rainbow Valley to approximately 35 feet northwest of Gila Bend.

Waterman Wash area.--During 1956 water-level fluctuations in wells in the Waterman Wash area ranged from a decline of about 12 feet in the northern part of the cultivated area to no decline at the southern end of the basin. In the spring of 1957 depths to water in the cultivated area ranged from about 120 to 300 feet.

Harquahala Plains area.--The water levels in the Harquahala Plains area indicated declines for 1956 but the records are not long enough to show any definite trend. At the end of 1956 depths to water in irrigation wells ranged from about 340 feet in the northwestern part of the basin to approximately 25 feet in the southeastern part.

Dendora area.--The water level in well (C-4-8)23 declined about 2 feet for 1956 as compared to a 2-foot rise for 1955. There is very little fluctuation of the water table in this area.

Mohave County

The decline in water levels in wells in the Big Sandy Valley near Wickieup ranged from about 1 foot to about 5 feet for 1956. The wells are shallow and the water levels are readily affected by recharge from the Big Sandy River. At the end of 1956 depths to water in this area ranged from about 15 to about 115 feet.

In the Kingman and Hackberry areas the water table showed seasonal changes ranging from a slight rise in the vicinity of Kingman to a decline of about 3 feet near Hackberry. The water level in well (B-21-17)24 (fig. 14) at Kingman is indicative of water-level fluctuations in this area. In the spring of 1957 water levels ranged from about 52 feet east of Hackberry to more than 500 feet just north of the railroad siding at Antaris.

Navajo County

Most wells in that part of Navajo County south of the Navajo Indian Reservation obtain water from the Coconino sandstone, but some of the shallow wells receive water from the Moenkopi formation. Generally, the ground water is under artesian pressure, and water levels in wells supplying water for irrigation purposes range from flowing at the surface to about 160 feet below land surface. Depths to water of more than 500 feet have been measured in some of the stock wells in the area.

Irrigation with ground water is limited to small acreages and in many areas serves only to supplement surface-water supplies. No appreciable trend in the fluctuation of the water table has been discerned for the past 5 years, although locally both rises and declines in water levels have been observed.

The feasibility of obtaining a water supply for a proposed pulp mill installation in the Snowflake area has been established owing to the successful completion of a number of test wells.

Pima County

Water-level fluctuations in Pima County are discussed as follows: (1) Avra-Marana area; (2) Rillito-Tucson area; (3) Tucson-Continental area; and (4) Tanque Verde-Pantano area.

Avra-Marana area.--Water-level declines in the Avra-Marana area in the period spring 1956 to spring 1957 ranged from less than 1 foot to more than 10 feet. The water level in well (D-11-10)32 (fig. 15) showed a decline of about 28 feet in the 5-year period spring 1952 to spring 1957, and a decline of about 34 feet in the 10-year period spring 1947 to spring 1957. The accelerated decline in water levels after 1951 coincides with the beginning of heavy pumping for irrigation within this area. Fluctuations of the water level in well (D-15-10)35 (fig. 15) located in the southern part of Avra Valley showed the effects of nearby pumping. Between 1947 and 1952 the water level in this well declined about 2 feet; between 1952 and 1957 the water level declined about 4 feet. The range in depth to water in the area in spring 1957 was from about 180 to 320 feet. The shallower depths to water are in the northern part of this area near the Pima-Pinal County line.

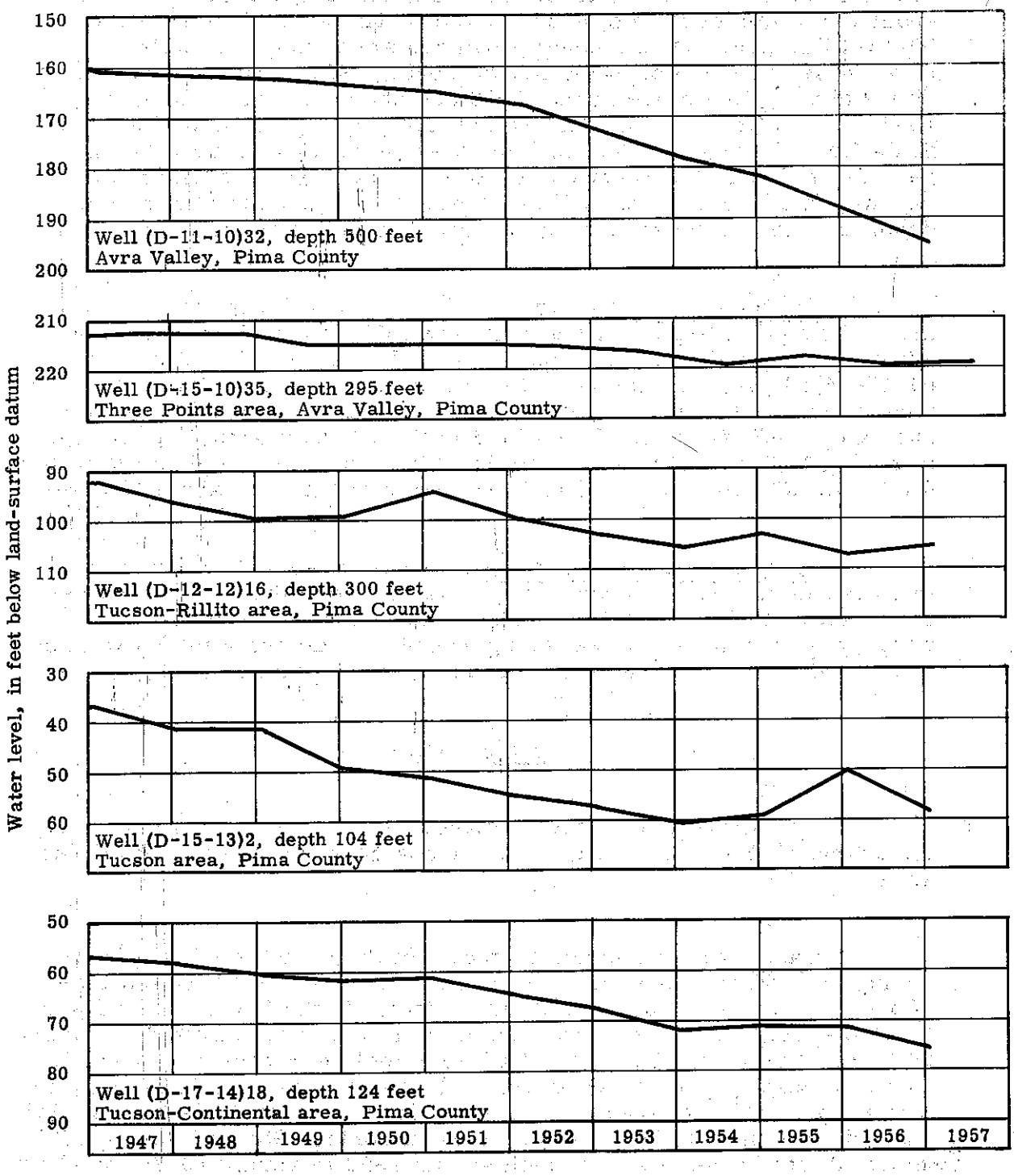


Figure 15.--Water levels in selected wells, Pima County.

Rillito-Tucson area.--During the period spring 1956 to spring 1957 fluctuations in water levels in this area ranged from a rise of about 1 foot to a decline of about 11 feet. The water level in well (D-12-12)16 (fig. 15) in a heavily pumped area along the Santa Cruz River rose about 1 foot in the period spring 1956 to spring 1957, but declined about 5 feet since spring 1952 and about 13 feet since spring 1947. The water level in well (D-15-13)2 (fig. 15) located along the Santa Cruz River near Tucson fluctuates seasonally, rising during periods of flow in the Santa Cruz River. Since 1947 the water level in this well has declined more than 20 feet. In the spring of 1957 the depth to water in the area ranged from about 40 to about 200 feet.

Tucson-Continental area.--Water-level fluctuations in this area in the period spring 1956 to spring 1957 ranged from a rise of about 2 feet to a decline of about 8 feet. The water level in well (D-17-14)18 (fig. 15) showed a decline of about 4 feet in the period spring 1956 to spring 1957; in the 5-year period spring 1952 to spring 1957 a decline of nearly 10 feet; and in the 10-year period spring 1947 to spring 1957 a decline of nearly 18 feet. The range in depth to water for the area in the spring of 1957 was from about 40 to about 100 feet.

Tanque Verde-Pantano area.--Water-level fluctuations in this area during 1956 ranged from a rise of more than 2 feet to a decline of nearly 8 feet. In the spring of 1957 the range in depth to water was from about 20 feet along Tanque Verde and Pantano Washes to more than 250 feet in the foothills near the mountains.

Pinal County

The areas of irrigation development in Pinal County are: (1) Casa Grande-Florence area; (2) Maricopa-Stanfield area; and (3) Eloy area.

Casa Grande-Florence area.--In the period spring 1956 to spring 1957 water-level fluctuations in this area ranged from a rise of about 1 foot to a decline of about 30 feet. In the 5-year period spring 1952 to spring 1957 water-level declines in the area ranged from about 20 to about 60 feet. The area of 60-foot decline covers only a small part of a heavily pumped area (fig. 16); the 20-foot decline is characteristic of the fringe areas. The water level in well (D-6-6)7 (fig. 17) showed a decline of about 10 feet between spring 1956 and spring 1957; about 40 feet in the 5-year period spring 1952 to spring 1957; and about 55 feet in the 10-year period spring 1947 to spring 1957. The range in depth to water in the area in the spring of 1957 was from about 60 to about 220 feet.

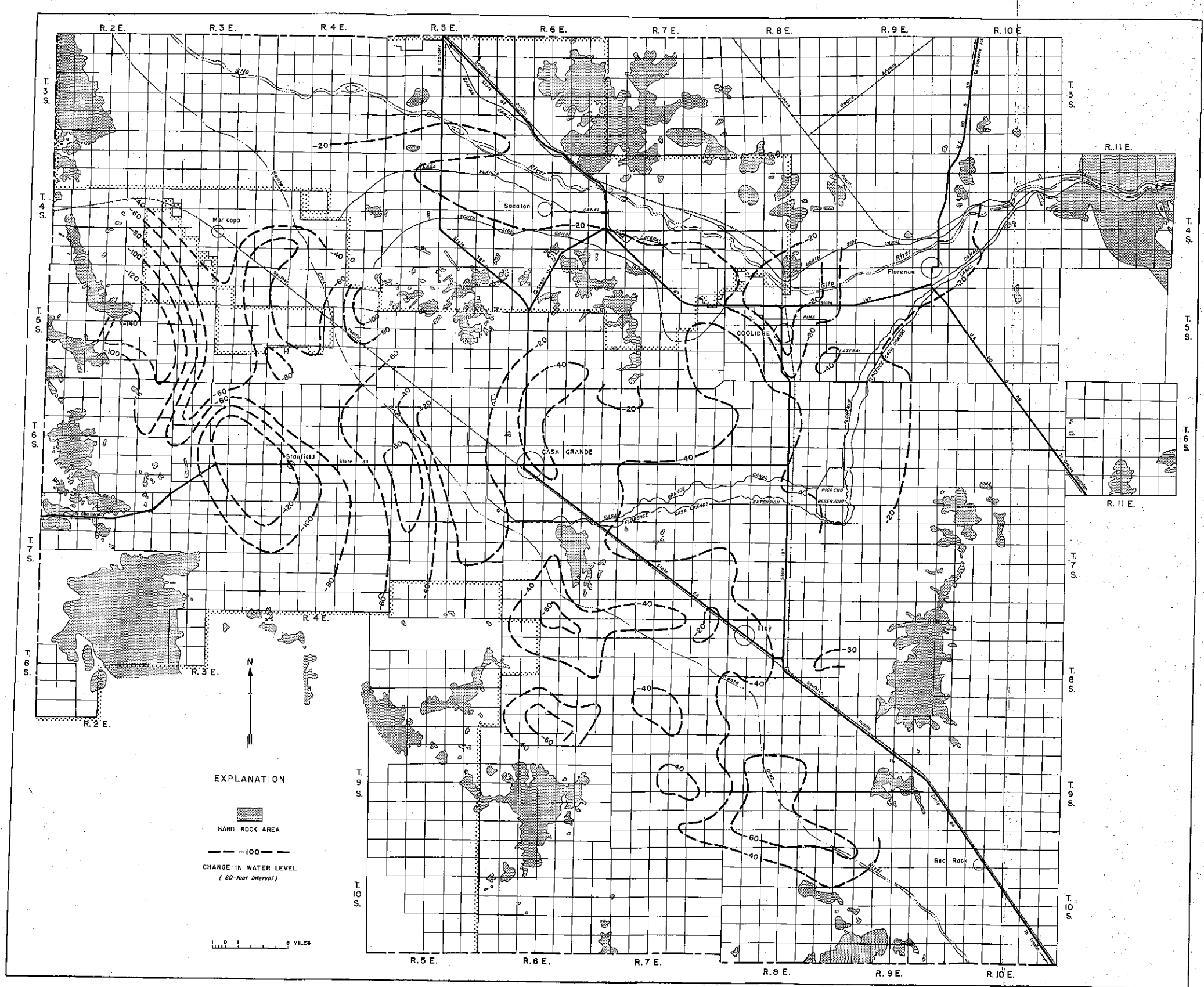


Figure 16.--Map of lower Santa Cruz basin and adjacent areas, Pinal County, Arizona, showing change in ground-water level from spring 1952 to spring 1957

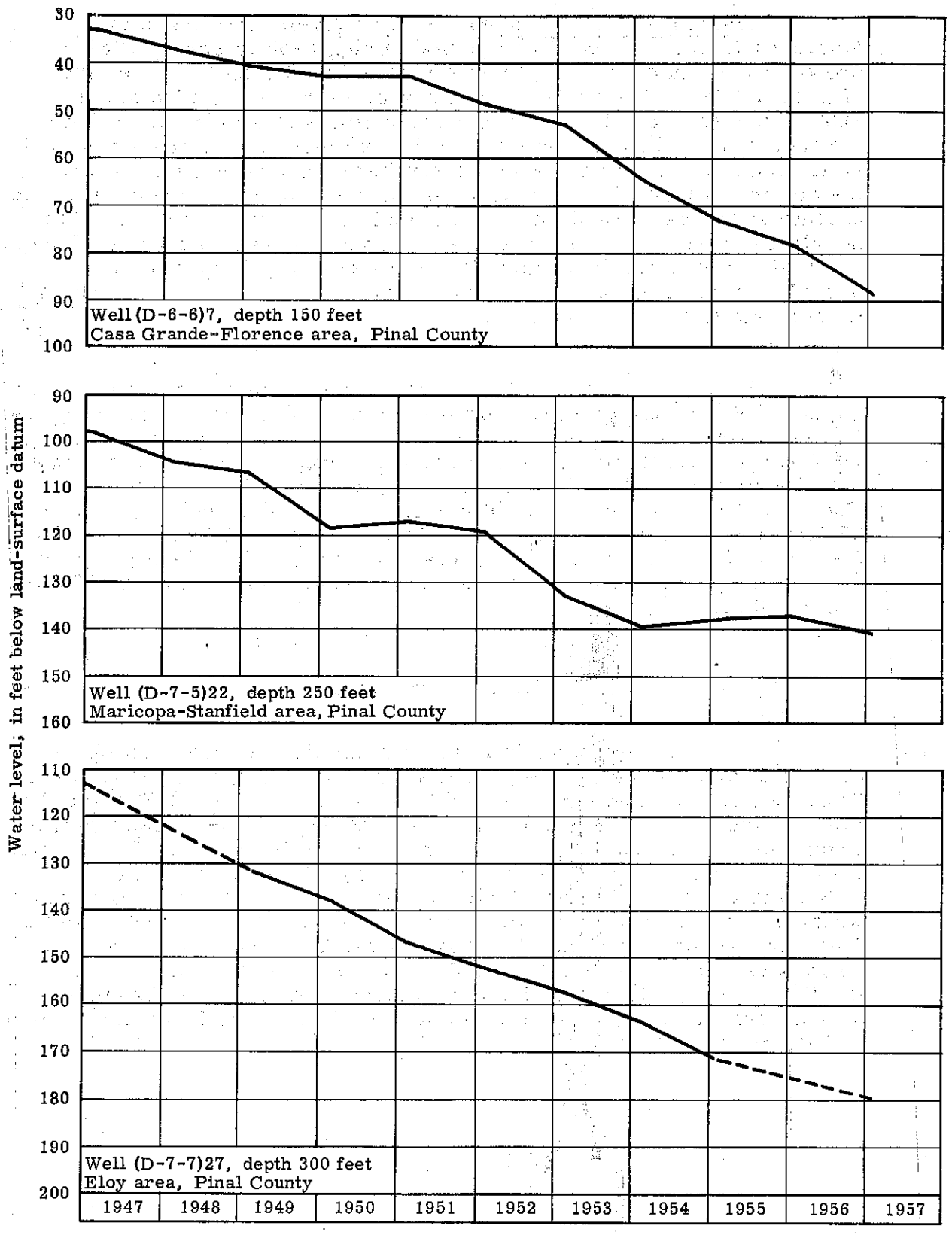


Figure 17. --Water levels in selected wells, Pinal County.

Maricopa-Stanfield area.--Water levels in wells in the Maricopa-Stanfield area in the period spring 1956 to spring 1957 showed fluctuations ranging from a rise of about 1 foot to a decline of about 30 feet. Water-level declines in the 5-year period spring 1952 to spring 1957 showed maximum declines in 3 localities: About 6 miles west of Casa Grande where the declines ranged from about 20 to about 60 feet; about 14 miles southwest of Casa Grande where the declines ranged from about 80 to about 120 feet; and about 20 miles northwest of Casa Grande where the declines ranged from about 60 to nearly 140 feet. One well near the mountains showed a decline of about 150 feet. The water level in well (D-7-5)22 (fig. 17) indicates the overall trend. The range in depth to water in the spring of 1957 was from about 70 to about 400 feet.

Eloy area.--Water-level fluctuations in this area between spring 1956 and spring 1957 ranged from a rise of about 1 foot to a decline of more than 25 feet. In the 5-year period spring 1952 to spring 1957 water-level declines ranged from about 20 to about 60 feet (fig. 16); the 60-foot declines occurred in the more heavily pumped areas. The water level in well (D-7-7)27 (fig. 17) showed a decline of about 25 feet in the 5-year period spring 1952 to spring 1957 and nearly 65 feet in the 10-year period spring 1947 to spring 1957. The range in depth to water in the area in the spring of 1957 was from about 160 to about 280 feet.

Santa Cruz County

Water levels in wells in the Amado-Nogales area showed a decline of about 1 foot in the period spring 1956 to spring 1957. Near Tubac water levels in wells ranged from a rise of about 2 feet to a decline of about 5 feet. Near Calabasas water-level fluctuations ranged from a decline of about 15 feet to a rise of nearly 18 feet. The greatest rise in water level occurred a few miles downstream from the mouth of Sonoita Creek. Between Calabasas and the International Boundary water-level fluctuations ranged from no change to a decline of about 20 feet. In the spring of 1957 the range in depth to water along the Santa Cruz River was from about 10 to 50 feet. The water level in well (D-22-13)35 (fig. 18) in the heavily pumped area near Calabasas showed a rapid response to recharge from surface flow in the Santa Cruz River and its major tributaries.

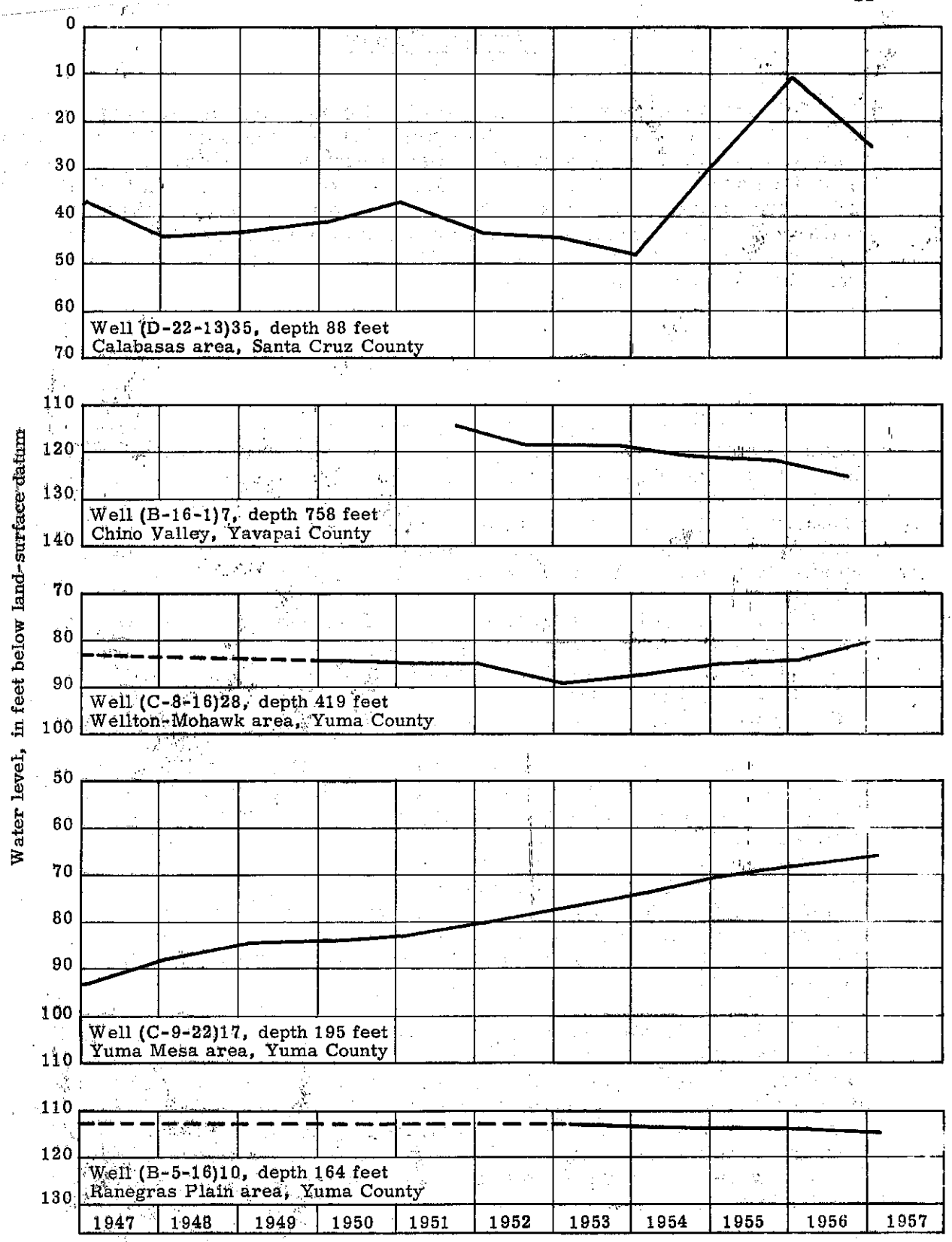


Figure 18.--Water levels in selected wells, Santa Cruz, Yavapai, and Yuma Counties.

Yavapai County

Ground-water levels in Yavapai County declined during 1956. Water-level measurements in the Chino Valley area showed fluctuations ranging from no change to about 9 feet of decline. In the Peeples Valley area declines ranged from about 1 foot to about 5 feet; in Skull Valley, from approximately 1 foot to about 6 feet. Water levels in the deeper wells in Yavapai County showed a definite downward trend. The water level in well (B-16-1)7 (fig. 18) in Chino Valley showed a downward trend in the water table.

Yuma County

The water table in the Wellton-Mohawk area rose during 1956 because fewer wells were pumped as additional surface water from the Colorado River became available for irrigation. The rises in water level in the area ranged from about 1 foot to about 5 feet in 1956. Figure 18 shows that prior to application of surface water, the water level in well (C-8-16)28 had a downward trend and that after surface water became available in 1953 the water table began to rise.

In the south Gila Valley and the Yuma-Mesa areas, water levels continued to rise as in the past 10 years. The rise is attributed to recharge from surface water used for irrigation and ranged from about 1 foot to about 2 feet in 1956. The water level in well (C-9-22)17 (fig. 18) showed an upward trend.

Fluctuations in the water table in the Palomas Plain area ranged from about a 5-foot rise to about a 2-foot decline for 1956. In the spring of 1957 depths to water in wells ranged from about 26 feet to more than 280 feet.

During 1956 water levels in wells in the Ranegras Plain area in northern Yuma County showed fluctuations ranging from a rise of less than 1 foot to a decline of about 3 feet. The water level in well (B-5-16)10 (fig. 18) showed a decline of less than 2 feet in the period 1947-57.

In the McMullen Valley area (fig. 4) water levels showed little change between spring 1956 and spring 1957 with the exception of the Harrisburg Valley where water-level measurements showed declines of about 20 feet. The period of record in the Aguila and Wenden areas, where most of the recent development is occurring, is too brief to indicate any definite trend of the water table. In the spring of 1957 the depth to water in irrigation wells in the area ranged from about 70 to about 385 feet.