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ARIZONA WATER COMMISSION

BULLETIN 7

ANNUAL REPORT ON GROUND WATER IN ARIZONA SPRING 1972 TO SPRING 1973

PREPARED UNDER THE DIRECTION OF
H. M. BABCOCK, DISTRICT CHIEF OF THE
U. S. GEOLOGICAL SURVEY IN ARIZONA

PREPARED BY THE GEOLOGICAL SURVEY
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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
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May 17, 1974

ISERS OF GEOLOGICAL SURVEY HYDROLOGIC DATA:

is a copy of the report entitled "Annual Report on Ground
Arizona, Spring 1972 to Spring 1973," prepared under the
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Arizona. The report was prepared by the Geological
cooperation with the Arizona Water Commission and is a
and analysis of the hydrologic data collected under the state-
nd-water program during the period spring 1972 to spring
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This folder will enable the user to quickly determine what
on on water is already available and what studies are underway.

Sincerely yours,

H. M. Babcock

H. M. Babcock
District Chief

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ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1972 TO SPRING 1973

Prepared under the direction of H. M. Babcock,
District Chief of the U. S. Geological Survey in Arizona

INTRODUCTION

In Arizona the availability of adequate and potable water supplies has a great influence on the location of cities and agricultural areas and on the location and type of industrial enterprises. Agriculture is dependent almost entirely on irrigation because rainfall is inadequate for raising crops. Some surface water is available in a few areas, but the amount is not sufficient to meet the continually increasing demand. For many years, nearly two-thirds of Arizona's water supply has been withdrawn from the ground-water reservoirs; the principal use of the ground water is for the irrigation of crops, although municipal and industrial uses are increasing steadily. A comprehensive knowledge of the natural behavior of the components of the ground-water system and of the effects of pumping large amounts of water is necessary for proper management of this valuable resource.

Since 1939, a planned program of ground-water studies has been conducted by the U. S. Geological Survey in cooperation with the State of Arizona. The State is represented by the Arizona Water Commission, and the program is under the immediate supervision of H. M. Babcock, district chief of the U. S. Geological Survey in Arizona. The program includes the collection and analysis of the geologic and hydrologic data necessary to evaluate the ground-water resources of the State.

This report is a result of the cooperative ground-water program and contains graphs showing water levels in selected wells and estimated annual ground-water pumpage in most of the developed areas in the State. The report also includes maps showing: (1) hydrologic conditions in Sacramento and Hualapai Valleys (pls. 1, 2, and 3), (2) potential well production by areas, (3) depth to water in selected wells in spring 1973, and (4) change in water levels in selected wells from 1968 to 1973. In areas where ground-water development has taken place the potential well-production values are based on the actual measured production of existing wells. In other areas the potential

well-production values are based on the extrapolation of the known production of a few wells that penetrate the several water-bearing units and on the inferred hydrologic characteristics of the units. Figure 1 shows the areas for which ground-water data are given, and the well-numbering system used in Arizona is explained and illustrated in figure 2.

For this report, metric units are given in parentheses following English units in the text, and English and metric units are shown on the illustrations. The following factors may be applied to convert English units to metric units.

Multiply English units	By	To obtain metric units
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)
gallons per minute (gpm)	3.785	liters per minute (l/m)
acre-feet (ac-ft)	1.233×10^{-3}	cubic hectometers (hm^3)
acres (ac)	.4047	hectares (ha)

Scope of the Federal-State Cooperative Ground-Water Program

The Federal-State cooperative ground-water program in Arizona consists of three major parts: (1) the collection of basic hydrologic data under the statewide ground-water survey; (2) comprehensive ground-water investigations in selected areas; and (3) research and other programs related to specific hydrologic problems. The three parts of the program are related closely and to a large extent are interdependent.

Collection of basic hydrologic data. --The statewide ground-water program provides for the collection of data that give a historical record of the results of ground-water withdrawal and the basic hydrologic and geologic data that are necessary to evaluate the ground-water resources of the State. The work includes well inventories, periodic water-level measurements, collection of water samples for chemical analysis, and collection and cataloging of drill cuttings from wells. Water levels are measured in about 880 wells, and the discharge is measured at several hundred wells each year. Water samples from selected wells are collected annually for chemical analysis. The results of the work are available in the files of the U. S. Geological Survey or are published in the "Annual report on ground water in Arizona" and in reports on individual areas.

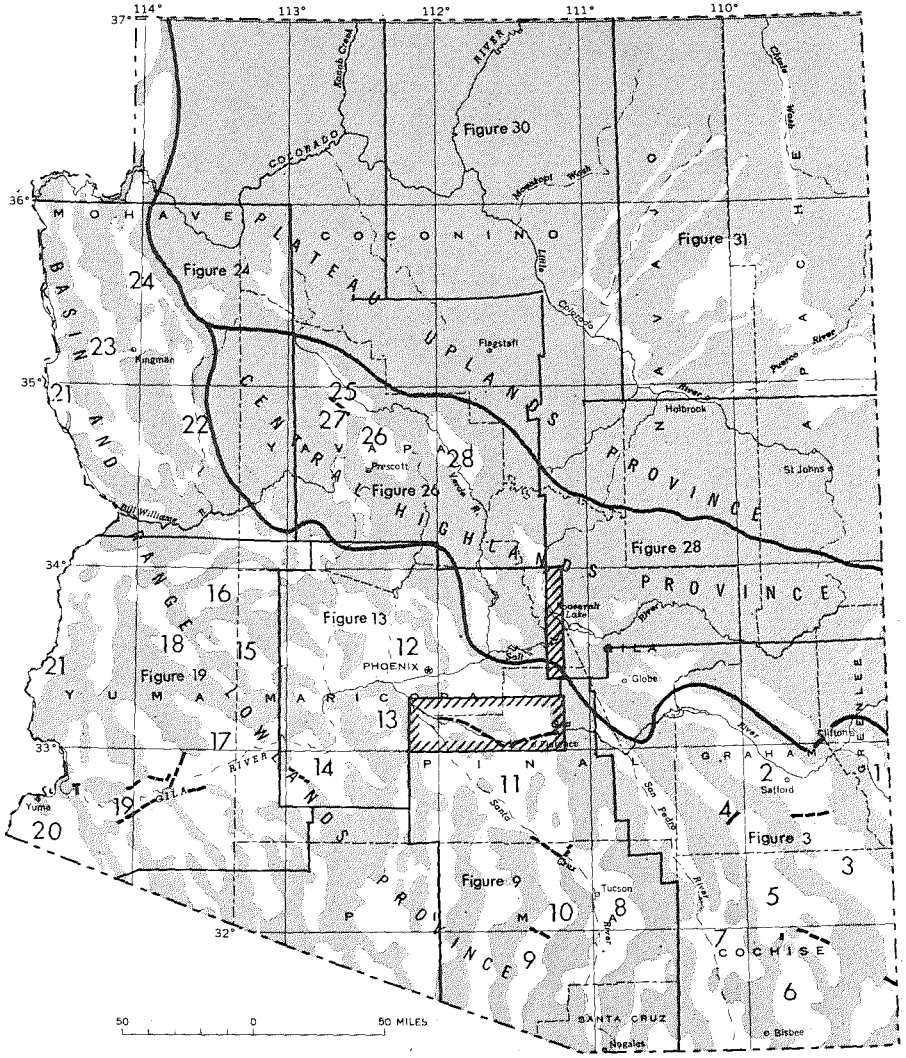


FIGURE 1.--AREAS FOR WHICH GROUND-WATER DATA ARE GIVEN.

EXPLANATION

BASIN AND RANGE LOWLANDS PROVINCE

Ground water mostly from alluvial deposits; small amounts from fractures in consolidated rocks

1. DUNCAN BASIN
2. SAFFORD BASIN
3. SAN SIMON BASIN
4. ARAVAIPA VALLEY
5. WILLCOX BASIN
6. DOUGLAS BASIN
7. SAN PEDRO RIVER VALLEY
8. UPPER SANTA CRUZ BASIN
9. ALTAR VALLEY
10. AVRA VALLEY
11. LOWER SANTA CRUZ BASIN
12. SALT RIVER VALLEY
13. WATERMAN WASH AREA
14. GILA BEND BASIN
15. HARQUAHALA PLAINS AREA
16. MCMULLEN VALLEY
17. GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL
18. RANEGRAS PLAIN AREA
19. WELLTON-MOHAWK AREA
20. YUMA AREA
21. COLORADO RIVER FLOOD PLAIN FROM DAVIS DAM TO IMPERIAL DAM
22. BIG SANDY VALLEY
23. SACRAMENTO VALLEY
24. HUALAPAI VALLEY

CENTRAL HIGHLANDS PROVINCE

Ground water from alluvial deposits in a few small valleys and from fractures and joints in consolidated rocks; many springs issue from fractures

25. BIG CHINO VALLEY
26. LITTLE CHINO VALLEY
27. WILLIAMSON VALLEY
28. VERDE VALLEY

PLATEAU UPLANDS PROVINCE

Ground water mostly from fine-grained sandstone units in consolidated rocks; siltstone and claystone layers act as aquicludes; moderate amounts of ground water from narrow alluvial deposits

ALLUVIAL DEPOSITS

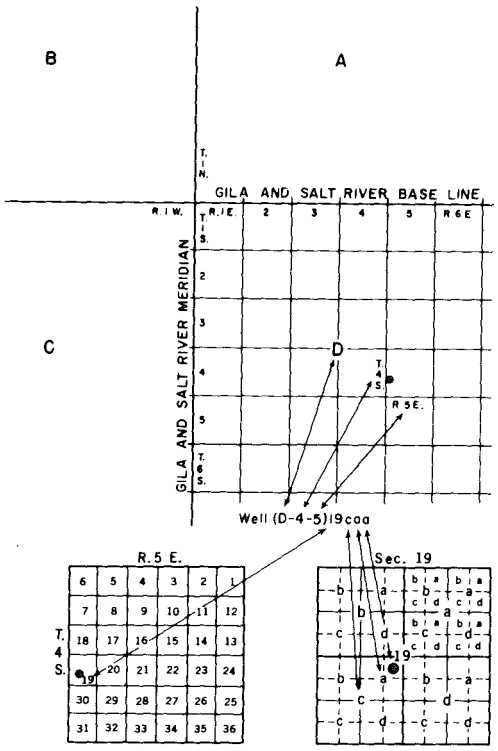
CONSOLIDATED ROCKS

AREA BOUNDARIES NOT DEFINED BY CONTACT BETWEEN ALLUVIAL DEPOSITS AND CONSOLIDATED ROCKS

Figure 13

GROUND-WATER DATA FOR AREA OUTLINED SHOWN ON INDICATED FIGURE; HACHURES INDICATE MAP OVERLAP AREA

FIGURE 1.--AREAS FOR WHICH GROUND-WATER DATA ARE GIVEN.



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 meridian and base line, which divide the State into four quadrants. 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 (64.8-hectare) tract, the second the 40-acre (16.2-hectare) tract, and the third the 10-acre (4.0-hectare) tract. These letters also are assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within the 10-acre (4.0-hectare) 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 more than one well is within a 10-acre (4.0-hectare) tract, consecutive numbers beginning with 1 are added as suffixes.

FIGURE 2.--WELL-NUMBERING SYSTEM IN ARIZONA.

Individual areas for which studies currently are in progress include the lower Hassayampa area and the Dateland-Hyder area. The reports that result from these studies will be published in the Arizona Water Commission bulletin series, and copies will be available to the public.

Comprehensive areal ground - water investigations. --Areal studies are undertaken to develop more detailed information and an understanding of the ground-water system in areas where conditions are critical owing to overdevelopment of the water supply, in areas where development of the water supply is beginning, or in areas where there is some special problem or interest. Four areal studies presently are in various stages of completion under the Federal-State ground-water cooperative program: (1) Water resources of southern Coconino County; (2) Water resources of the Big Sandy area; (3) Effects of ground-water withdrawals and strip mining on the hydrology of the Black Mesa area; and (4) Ground-water resources in southern Navajo County.

Comprehensive areal investigations conducted in cooperation with other agencies also benefit the State of Arizona. Two studies in the lower Colorado River region were completed recently—(1) a study of the ground-water resources and (2) a study of the quality of the ground water. Studies currently are in progress in the Safford basin, Lake Mead area, and in the Navajo and Hopi Indian Reservations.

Research and other programs. --The research programs of the U. S. Geological Survey in Arizona are directed toward developing a broader understanding of the hydrology of arid and semiarid lands. Other programs apply geology and hydrology to engineering and the public welfare. Current programs are the Tucson-Phoenix urban pilot and the companion Resource and Land Information (RALI) studies. The investigation of ground-water return flows to the lower Colorado River includes applied research in instrumentation and techniques in ground-water measurements.

Programs in Cooperation with Other Agencies

In 1972-73 ground-water studies were being conducted in cooperation with the following agencies:

City of Flagstaff
City of Tucson
International Boundary and Water Commission

Navajo Tribal Council
Navajo Tribal Utility Authority
Salt River Valley Water Users' Association
University of Arizona
U. S. Bureau of Indian Affairs
U. S. Bureau of Reclamation
U. S. National Park Service

Current Publications of the Arizona District

The following reports on the water resources and geology of Arizona were published or released to the open file from July 1, 1972, through June 30, 1973.

Geology and ground-water system in the Gila River Phreatophyte Project area, Graham County, Arizona, by W. G. Weist, Jr.: U. S. Geol. Survey Prof. Paper 655-D, 1971. 22 p., 3 pls., 10 figs., 2 tables.

Applications of remote sensing in Arizona State Government, by C. C. Winikka and H. H. Schumann, in Eighth international symposium proceedings on remote sensing of environment, volume 1: Ann Arbor, Michigan Environmental Research Inst., 1972. p. 3-5.

Bibliography of U. S. Geological Survey water-resources reports for Arizona, May 1965 through June 1971, compiled under the direction of H. M. Babcock: Arizona Water Comm. Bull. 2, September 1972. 60 p.

Changing the consumptive use on the Gila River flood plain, southeastern Arizona, by R. L. Hanson, F. P. Kipple, and R. C. Culler, in Age of changing priorities for land and water: Am. Soc. Civil Engineers, Irrig. and Drainage Specialty Conf., Spokane, September 26-28, 1972. p. 309-330, 7 figs., 1 table.

Channel changes of the Gila River in Safford Valley, Arizona, 1846-1970, by D. E. Burkham: U. S. Geol. Survey Prof. Paper 655—G, 1972. 24 p., 5 pls., 9 figs., 3 tables.

Chemical quality of the water in the Tucson basin, Arizona, by R. L. Laney: U. S. Geol. Survey Water-Supply Paper 1939-D, 1972. 46 p., 5 pls., 5 figs., 6 tables.

Electrical-analog analysis of the hydrologic system, Tucson basin, southeastern Arizona, by T. W. Anderson: U. S. Geol. Survey Water-Supply Paper 1939-C, 1972. 34 p., 6 pls., 8 figs., 1 table.

Hydrologic regimen of lower Tonto Creek basin, Gila County, Arizona—a reconnaissance study, by H. H. Schumann and B. W. Thomsen: Arizona Water Comm. Bull. 3, November 1972. 39 p., 14 figs., 1 table.

Investigation of floods from small drainage basins in Arizona, by B. N. Aldridge, in Twenty-first annual Arizona conference on roads and streets proceedings: Arizona Univ., Arizona Transp. and Traffic Inst., 1972. p. 107-126, 12 figs.

Water resources data for Arizona, 1971—Part 1. Surface water records, by U. S. Geological Survey: U. S. Geol. Survey open-file report, 1972. 253 p., 4 figs.

Annual report on ground water in Arizona, spring 1971 to spring 1972, prepared under the direction of H. M. Babcock: Arizona Water Comm. Bull. 5, June 1973. 48 p., 32 figs., 1 table.

Evaluating the reliability of specific-yield determinations, by R. L. Hanson: U. S. Geol. Survey Jour. Research, v. 1, no. 3, 1973. p. 371-376, 5 figs., 2 tables.

Geohydrology of the Needles area, Arizona, California, and Nevada, by D. G. Metzger and O. J. Loeltz: U. S. Geol. Survey Prof. Paper 486-J, 1973. 54 p., 3 pls., 25 figs., 11 tables.

Hydrologic conditions in the San Pedro River valley, Arizona, 1971, by R. H. Roeske and W. L. Werrell: Arizona Water Comm. Bull. 4, March 1973. 76 p., 2 pls., 5 figs., 5 tables.

Monitoring of streamflow in the Verde River by ERTS-1 Data Collection System (DCS), by H. H. Schumann, in Symposium on significant results obtained from the Earth Resources Technology Satellite-1—volume 1: Technical Presentations, section A, S. C. Freden, E. P. Mercanti, and M. A. Becker, eds.: Natl. Aeronautics and Space Adm. SP-327, 1973. p. 769-776, 3 figs.

Roughness coefficients for stream channels in Arizona, by B. N. Aldridge and J. M. Garrett: U. S. Geol. Survey open-file report, 1973. 87 p., 4 figs., 7 tables.

Water resources data for Arizona, 1970—Part 2. Water quality records, by U. S. Geological Survey: U. S. Geol. Survey open-file report, 1973. 146 p., 2 figs., 4 tables.

SUMMARY OF GROUND-WATER CONDITIONS

Nearly two-thirds of Arizona's water supply comes from the ground-water reservoirs. Although municipal and industrial uses are increasing, the greatest use is for the irrigation of crops. For the 20th consecutive year, the withdrawal of ground water exceeded 4 million acre-feet (about 5,000 cubic hectometers); in three of the years—1961, 1967, and 1971—the withdrawal of ground water exceeded 5 million acre-feet (about 6,000 cubic hectometers). In 1972 the withdrawal of ground water was nearly 5 million acre-feet (about 6,000 cubic hectometers); through 1972, nearly 144 million acre-feet (about 178,000 cubic hectometers) of ground water has been withdrawn from the ground-water reservoirs in Arizona. Table 1 shows the amount of water pumped in each of the major developed areas in 1972 and the accumulated total since the beginning of record.

Ground water occurs under different conditions in each of the three water provinces in Arizona (fig. 1)—the Basin and Range lowlands province, the Central highlands province, and the Plateau uplands province. The use of ground water and the effects of this use on the ground-water reservoirs in each of the three provinces are discussed separately in the following sections.

Basin and Range Lowlands Province

The Basin and Range lowlands province (fig. 1) is the most highly developed of the three water provinces. Although the province covers only about 45 percent of the State, it contains more than 90 percent of the cultivated land and more than 80 percent of the population. In most of the province large amounts of ground water are pumped each year, and water levels are declining.

Table 1.--Estimated ground-water pumpage in Arizona, by areas

[Numbers rounded to nearest thousand acre-feet. Area: See figure 1 for location. Other areas: Aravaipa Valley, Big Sandy Valley, Date Creek area, Peeples Valley, Skull Valley, Verde Valley, Little Colorado River basin, areas in the Plateau uplands, and small areas not identifiable with any particular basin]

Area	Pumpage, in thousands of acre-feet	
	1972	Accumulated total through 1972
Duncan basin	25	668
Safford basin	130	3,088
San Simon basin	104	1,503
Willcox basin	292	4,374
Douglas basin	89	1,752
San Pedro River valley	91	1/547
Upper Santa Cruz basin	253	6,404
Avra Valley	146	2,910
Lower Santa Cruz basin	798	34,662
Salt River Valley	1,800	66,981
Waterman Wash area	57	1,005
Gila Bend basin	238	4,114
Harquahala Plains area	108	2,343
McMullen Valley	112	1,310
Gila River drainage from Painted Rock Dam to Texas Hill	125	1,492
Ranegras Plain area	19	291
Wellton-Mohawk area	2/201	3,322
Yuma area 3/	257	3,794
Colorado River flood plain from Davis Dam to Imperial Dam	19	191
Sacramento Valley	6	38

See footnotes at end of table.

Table 1. --Estimated ground-water pumpage in Arizona, by areas—Continued

Area	Pumpage, in thousands of acre-feet	
	1972	Accumulated total through 1972
Hualapai Valley	4	34
Big Chino Valley	8	393
Little Chino Valley.	12	385
Williamson Valley	2	46
Other areas.	100	2,215
Total	4/4,996	4/143,862

1/ Pumpage for San Pedro River valley was not computed prior to 1966. Thus, accumulated total is for 1966-72 only. Estimated pumpage before 1966 is included under other areas.

2/ Withdrawal for drainage purposes only.

3/ Yuma area includes South Gila Valley, Yuma Mesa, and Yuma Valley. Beginning in 1947 in Yuma Valley and in 1961 in South Gila Valley, part of the pumpage was for drainage of waterlogged lands.

4/ The number of significant figures in total pumpage is the result of small increments in the early years when ground-water pumpage was small and is not intended to imply that the data are accurate to the extent indicated.

The Salt River Valley and the lower Santa Cruz basin are the largest agricultural areas in the State. Through 1972, nearly 67 million acre-feet (about 83, 000 cubic hectometers) of ground water had been withdrawn in the Salt River Valley, and nearly 35 million acre-feet (about 43, 000 cubic hectometers) had been withdrawn in the lower Santa Cruz basin. In the last few years the amount of ground water pumped in these areas has been somewhat less than that pumped in the middle 1950's and early 1960's, and the rates of water-level decline have decreased accordingly; however, the decline rates remain the largest in the province. Other areas in the Basin and Range lowlands province where ground-water withdrawals have caused large water-level declines are the Willcox basin, San Simon basin, upper Santa Cruz basin, Avra Valley, Gila Bend basin, Harquahala Plains, and McMullen Valley.

Figures 3, 9, 13, 19, and 24 show the depth to water in spring 1973 and the change in water levels from 1968 to 1973 in selected wells in the Basin and Range lowlands province. Graphs (figs. 4, 5, 6, 7, 8, 10, 11, 14, 17, 18, 20, 21, 22, 23, and 25) showing the depth to water in selected wells and estimated annual pumpage are included for most areas in the province. Graphs showing the cumulative average change in water levels for areas in the lower Santa Cruz basin and the Salt River Valley and estimated annual pumpage are given in figures 12, 15, and 16.

Central Highlands Province

The Central highlands province is the smallest of the three water provinces; only a few thousand acres of land is under cultivation, and ground-water pumpage is small. Chino and Verde Valleys are the main areas under cultivation, and some surface water is available for irrigation. The small amount of ground-water withdrawal has not resulted in any notable declines except in parts of Chino Valley, where a decline of a few feet per year has been measured in the artesian aquifer.

Figures 26 and 28 show the depth to water in spring 1973 and the change in water levels from 1968 to 1973 in selected wells in the area. Graphs showing depth to water in selected wells and estimated annual pumpage in several areas in the province are given in figure 27.

Plateau Uplands Province

In the Plateau uplands province ground-water development is small compared to that in the Basin and Range lowlands province, but

it is somewhat greater than that in the Central highlands province. The use of ground water is largely confined to scattered farms and homesites; only about 35,000 acres (about 14,000 hectares) of land is under cultivation. In a few population centers, such as Flagstaff, Holbrook, and the White Mountains recreational areas, ground water is the main source of supply. The Navajo and Hopi Indian Reservations make up a large part of the province.

Figures 26, 28, and 30 show the depth to water in spring 1973 and the change in water levels from 1968 to 1973 in selected wells in the province; figure 31 shows depth to water in spring 1973. Graphs showing water levels in selected wells are given in figure 29.

REFERENCES CITED

Gillespie, J. B., and Bentley, C. B., 1971, Geohydrology of Hualapai and Sacramento Valleys, Mohave County, Arizona: U.S. Geol. Survey Water-Supply Paper 1899-H, 37 p.

Twenter, F. R., 1962, Geology and promising areas for ground-water development in the Hualapai Indian Reservation, Arizona: U.S. Geol. Survey Water-Supply Paper 1576-A, 38 p.

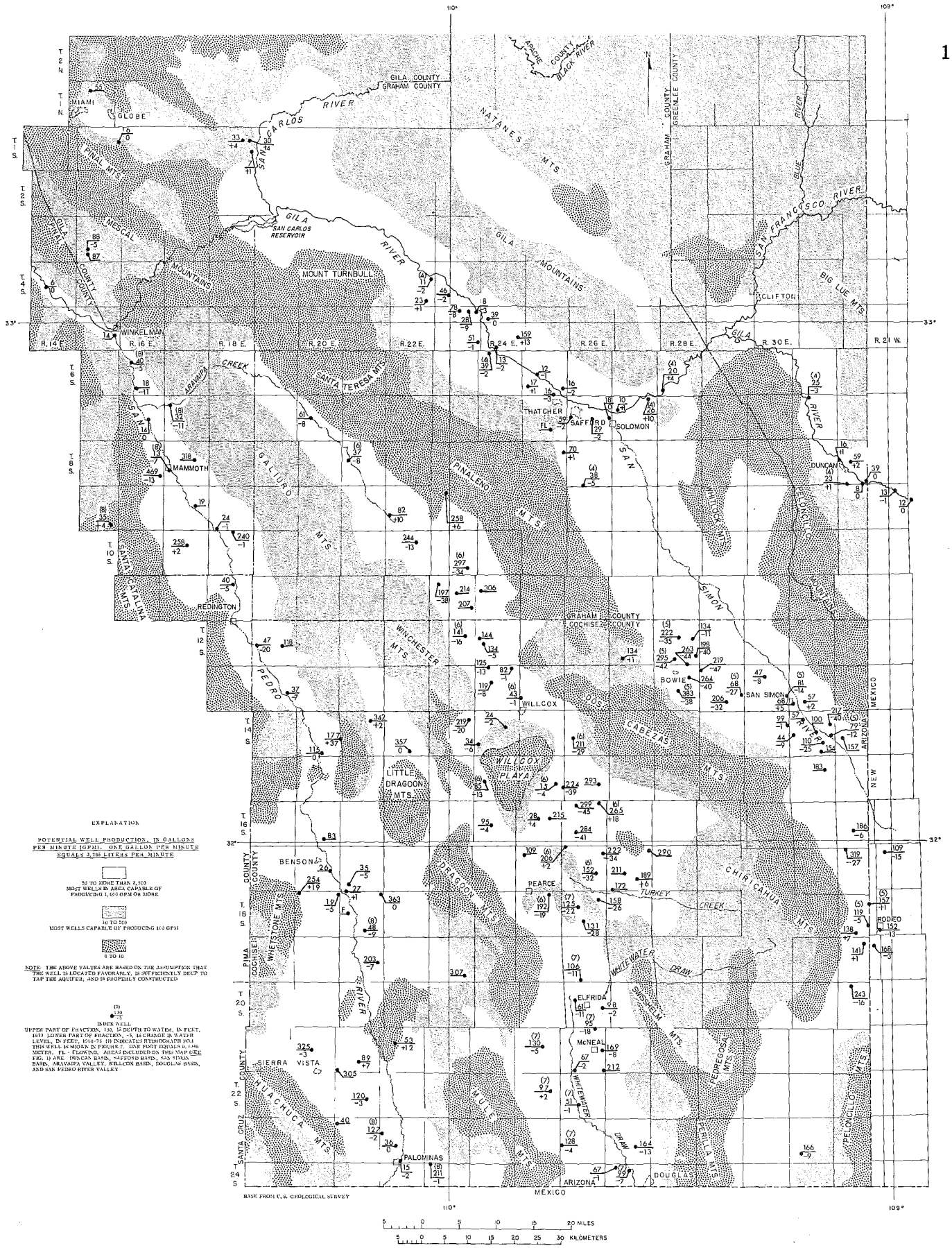


FIGURE 3.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE SOUTHEAST PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

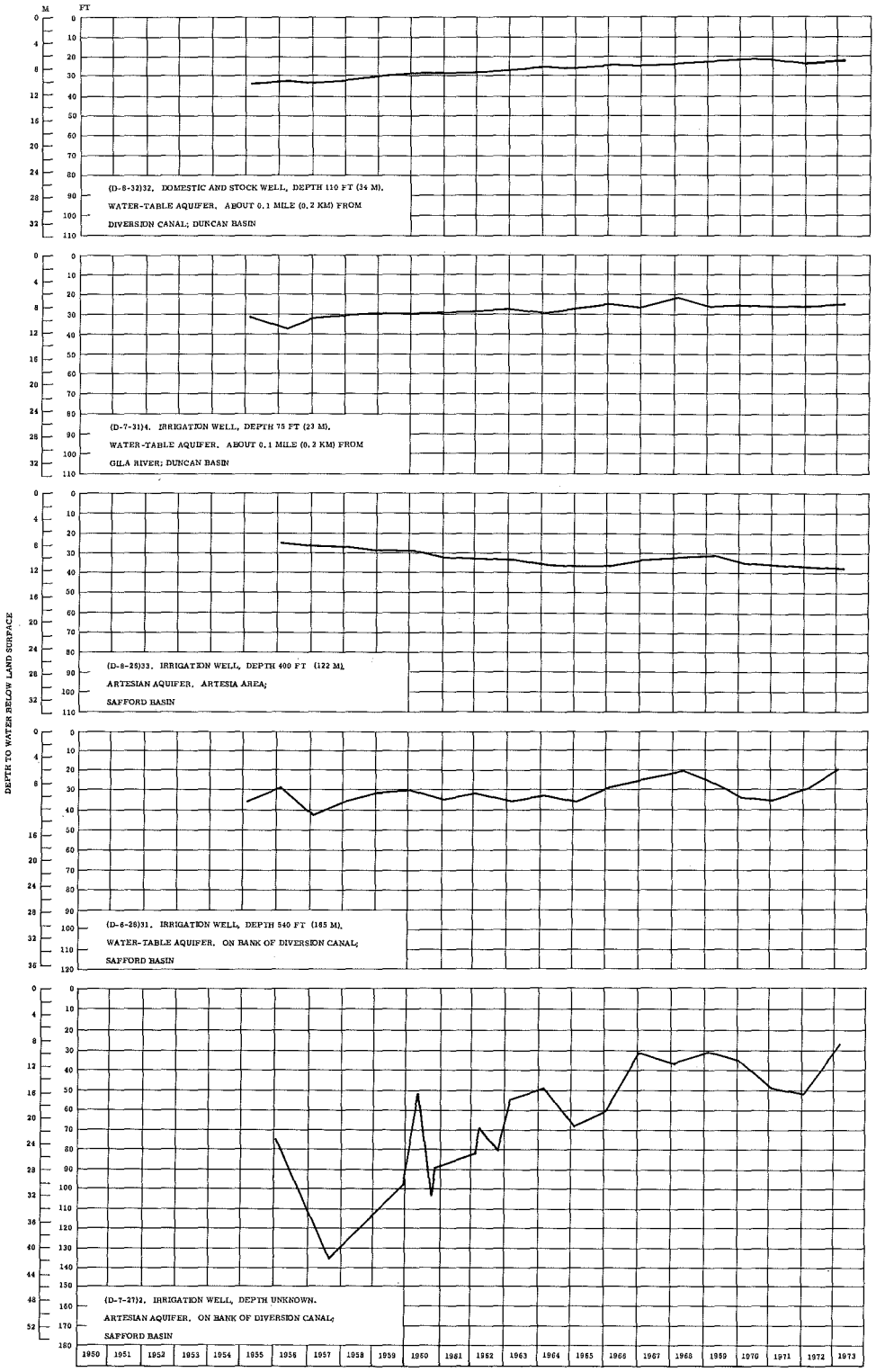


FIGURE 4. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE DUNCAN AND SAFFORD BASINS.
(IN TWO SHEETS.)

SHEET 1 OF FIGURE 4.

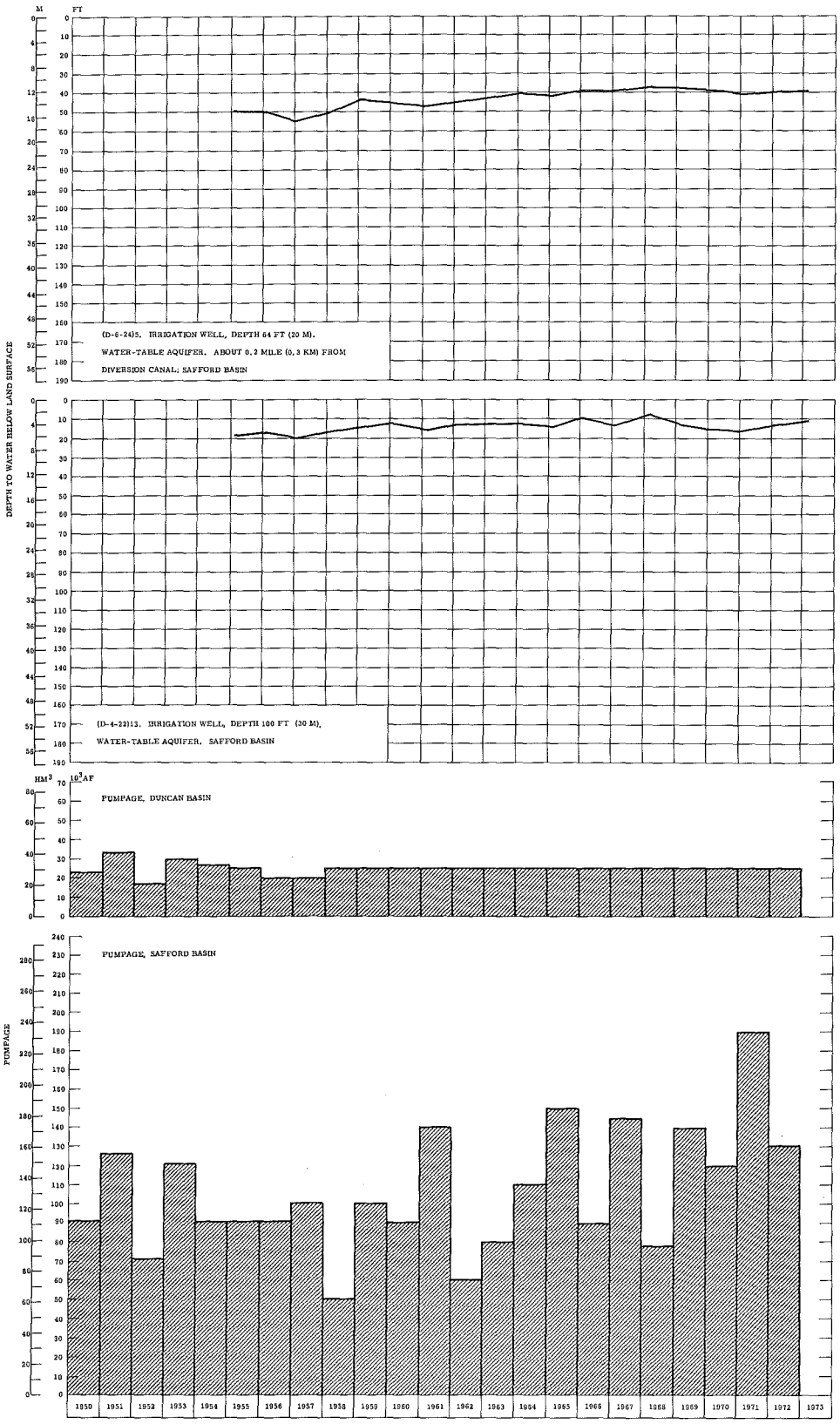


FIGURE 4.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE DUNCAN AND SAFFORD BASINS.
(IN TWO SHEETS.)

SHEET 2 OF FIGURE 4.

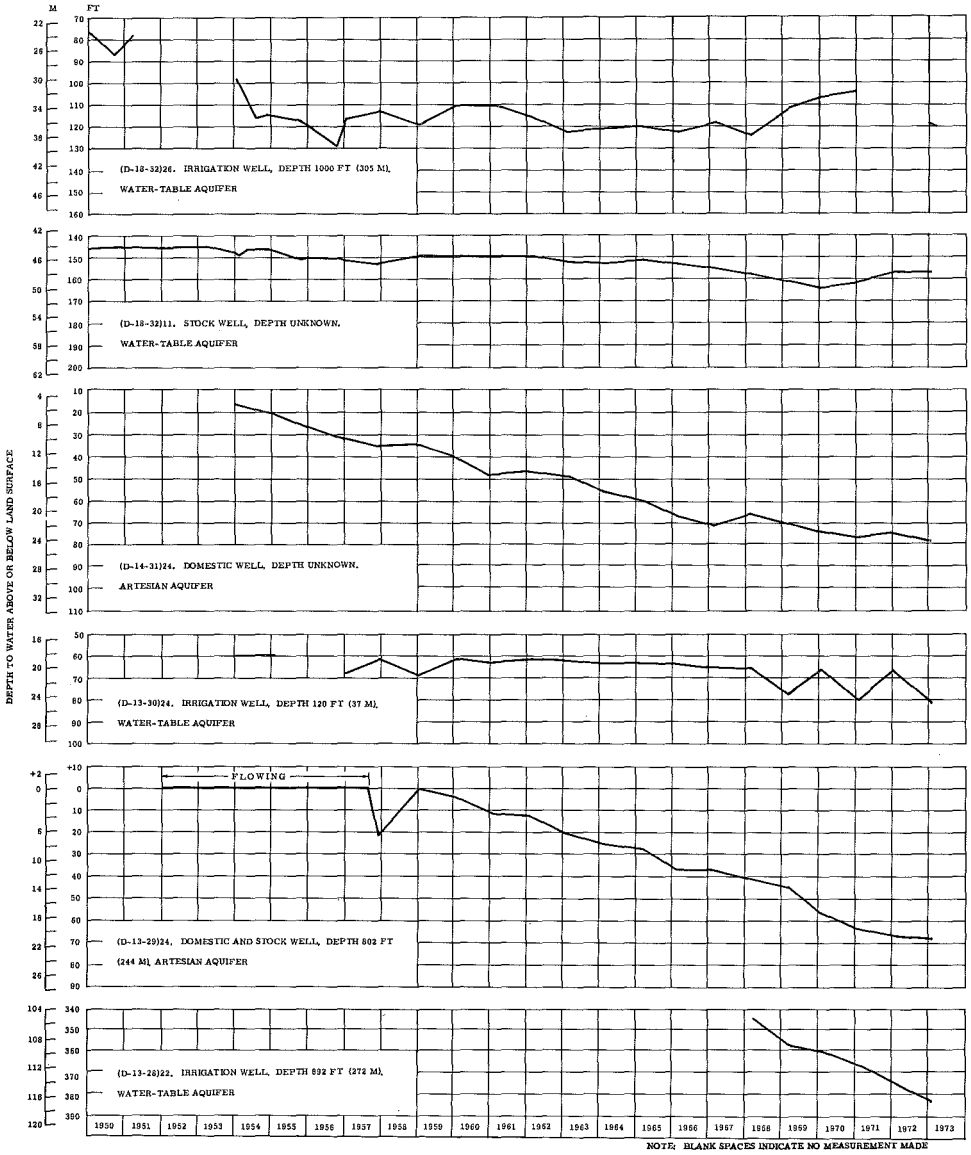


FIGURE 5. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN SAN SIMON BASIN. (IN TWO SHEETS.) SHEET 1 OF FIGURE 5.

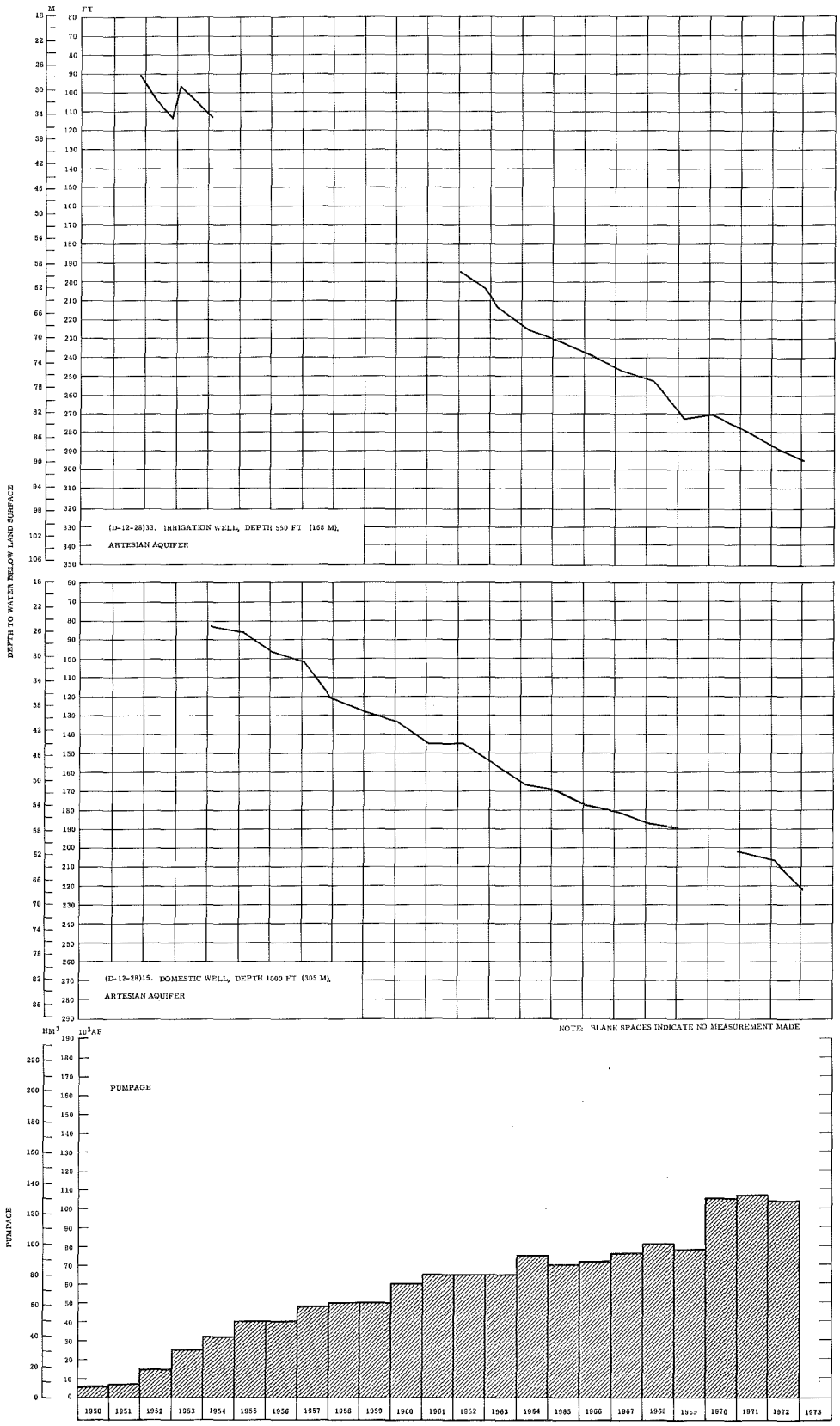


FIGURE 5. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN SAN SIMON BASIN.
(IN TWO SHEETS.) SHEET 2 OF FIGURE 5.

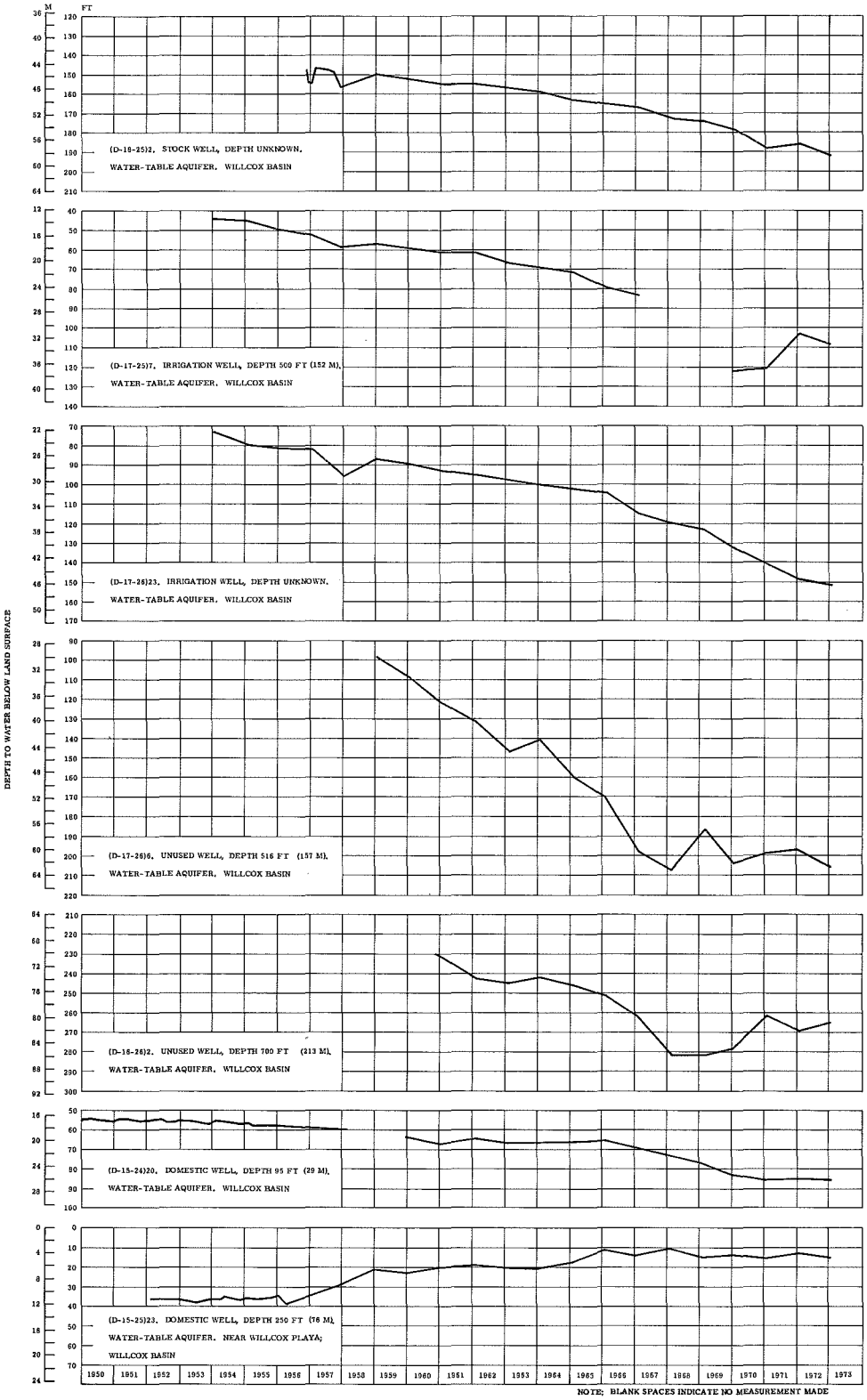


FIGURE 6.--DEPTH TO WATER IN SELECTED WELLS IN WILLCOX BASIN AND ARAVAIPA VALLEY AND ESTIMATED ANNUAL PUMPAGE IN WILLCOX BASIN.
(IN TW'O SHEETS.)

SHEET 1 OF FIGURE 6.

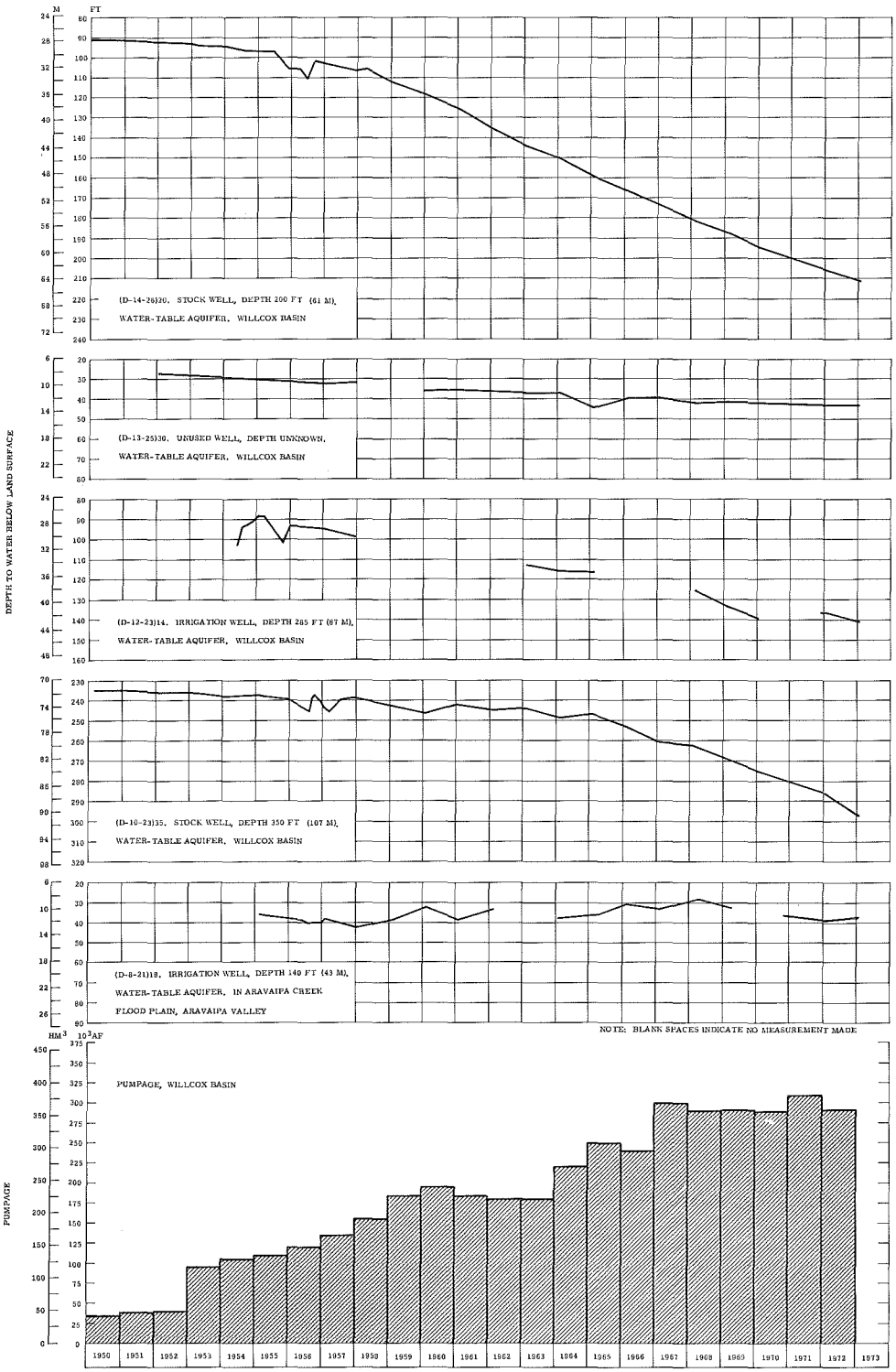


FIGURE 6. --DEPTH TO WATER IN SELECTED WELLS IN WILLCOX BASIN AND ARAVAIPA VALLEY AND ESTIMATED ANNUAL PUMPAGE IN WILLCOX BASIN.
(IN TWO SHEETS.)

SHEET 2 OF FIGURE 6.

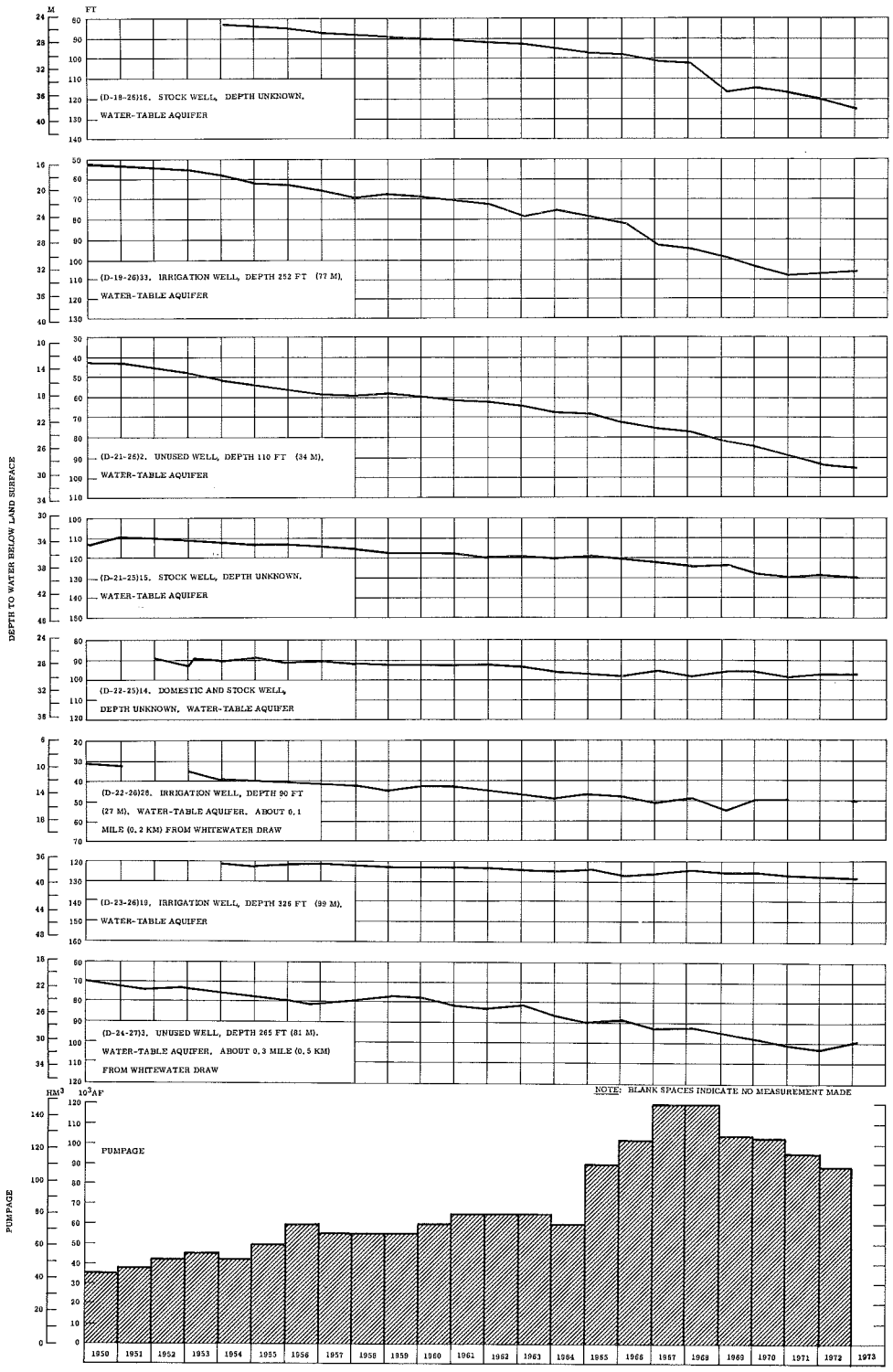


FIGURE 7. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN DOUGLAS BASIN.

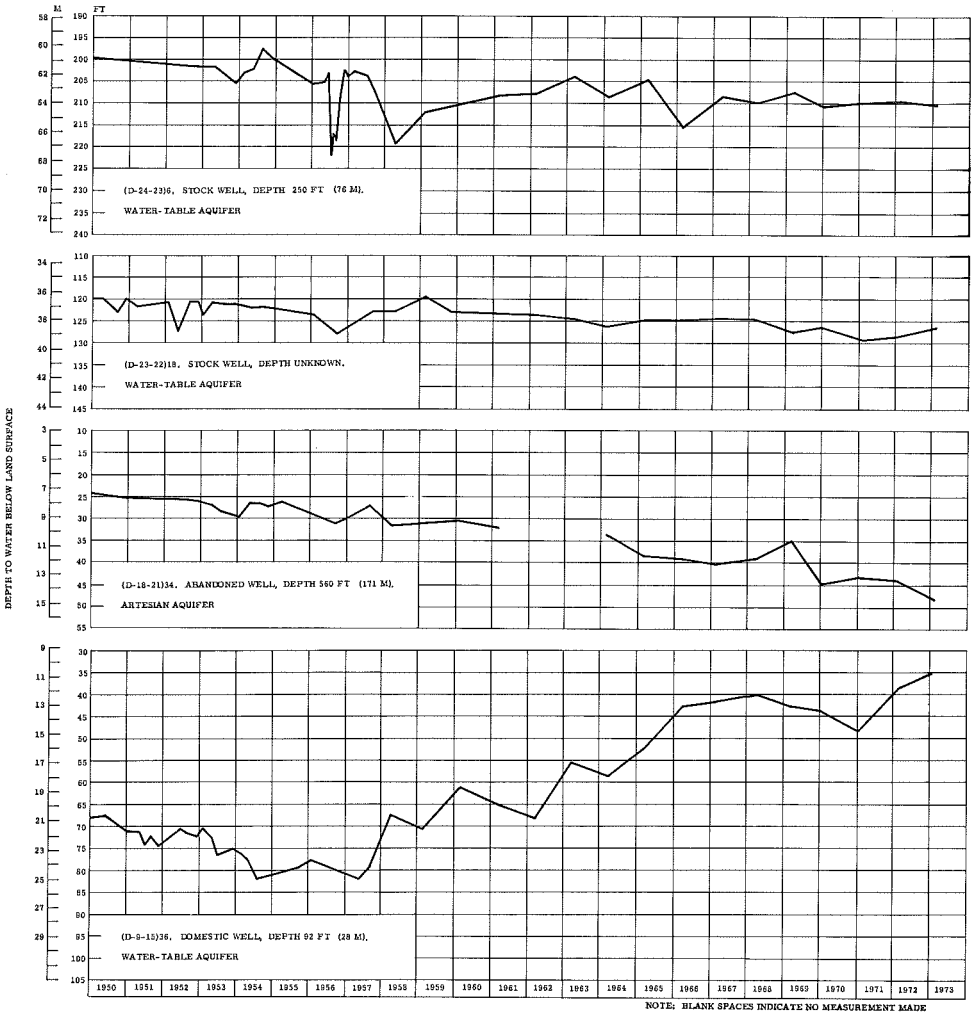


FIGURE 8.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE SAN PEDRO RIVER VALLEY. (IN TWO SHEETS.) SHEET 1 OF FIGURE 8.

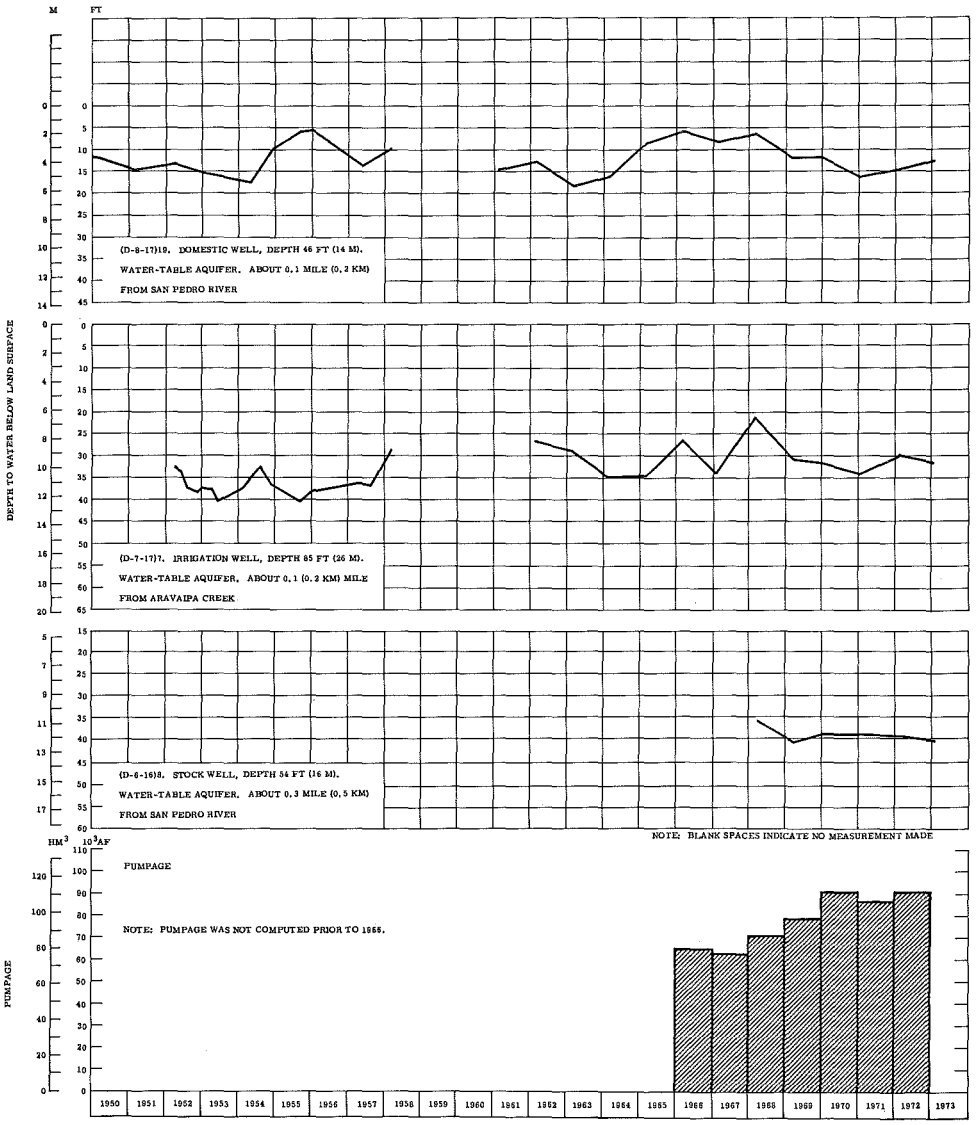


FIGURE 8.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE SAN PEDRO RIVER VALLEY. (IN TWO SHEETS.) SHEET 2 OF FIGURE 8.

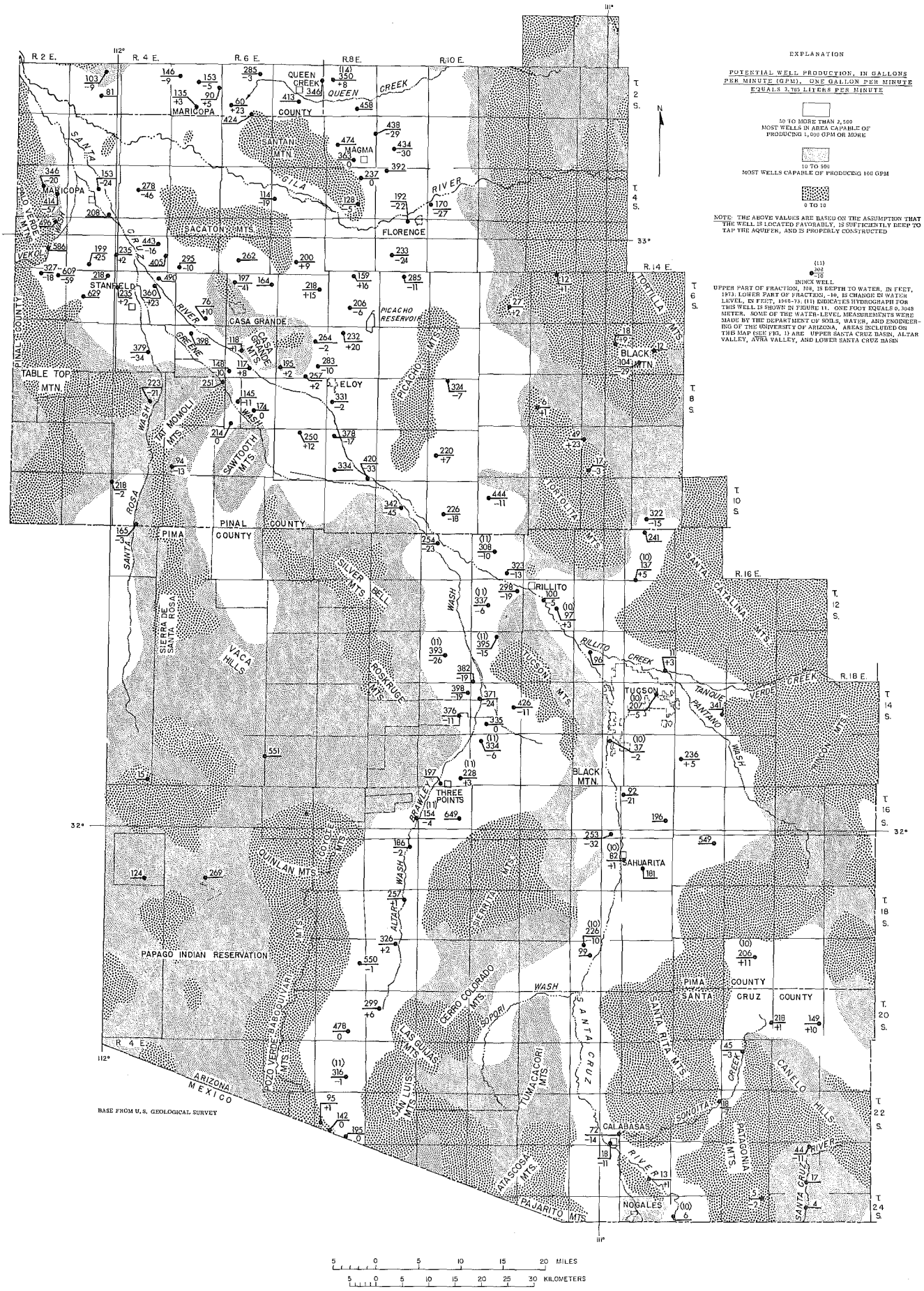


FIGURE 9.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE SOUTH-CENTRAL PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

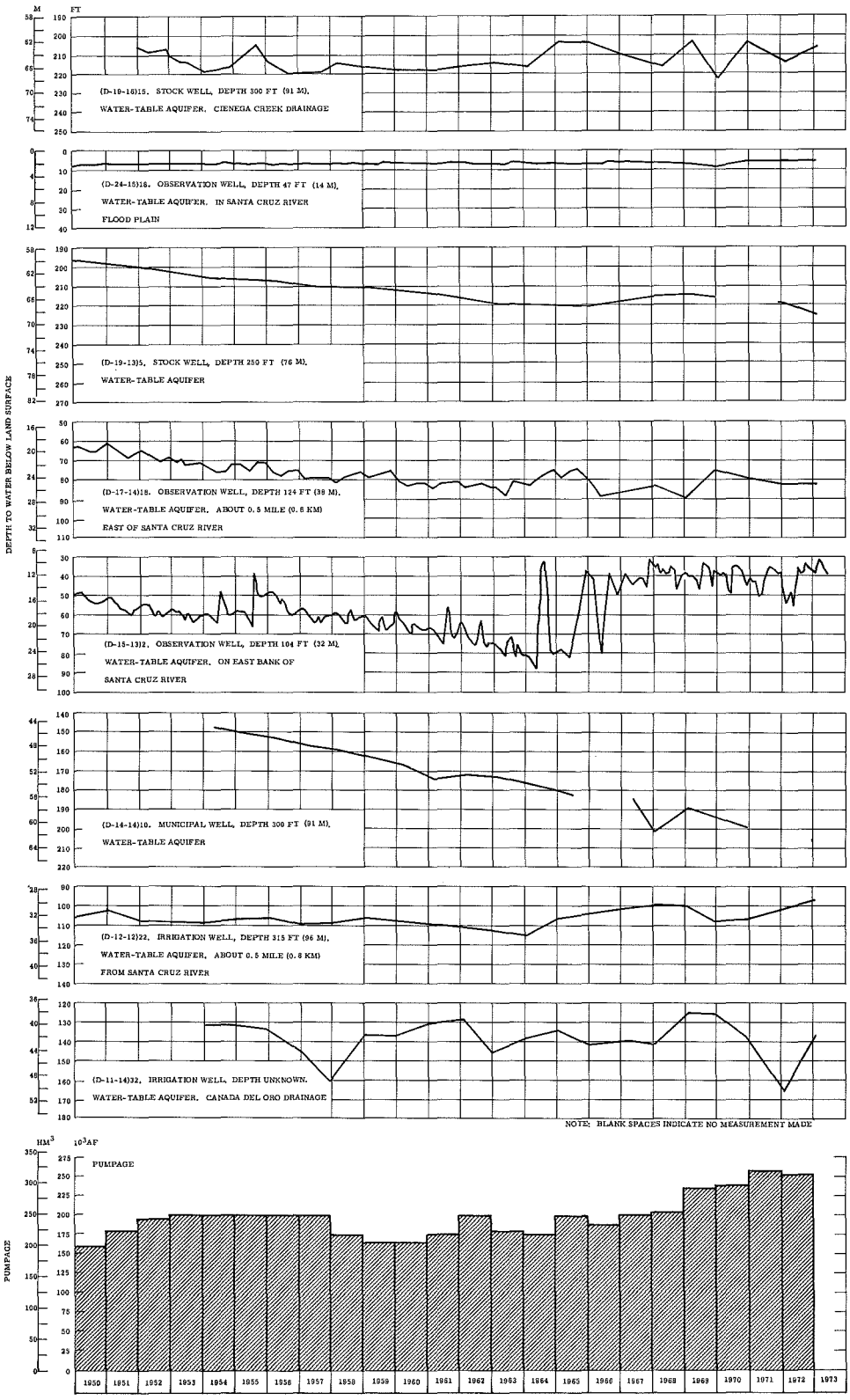


FIGURE 10. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE UPPER SANTA CRUZ BASIN.

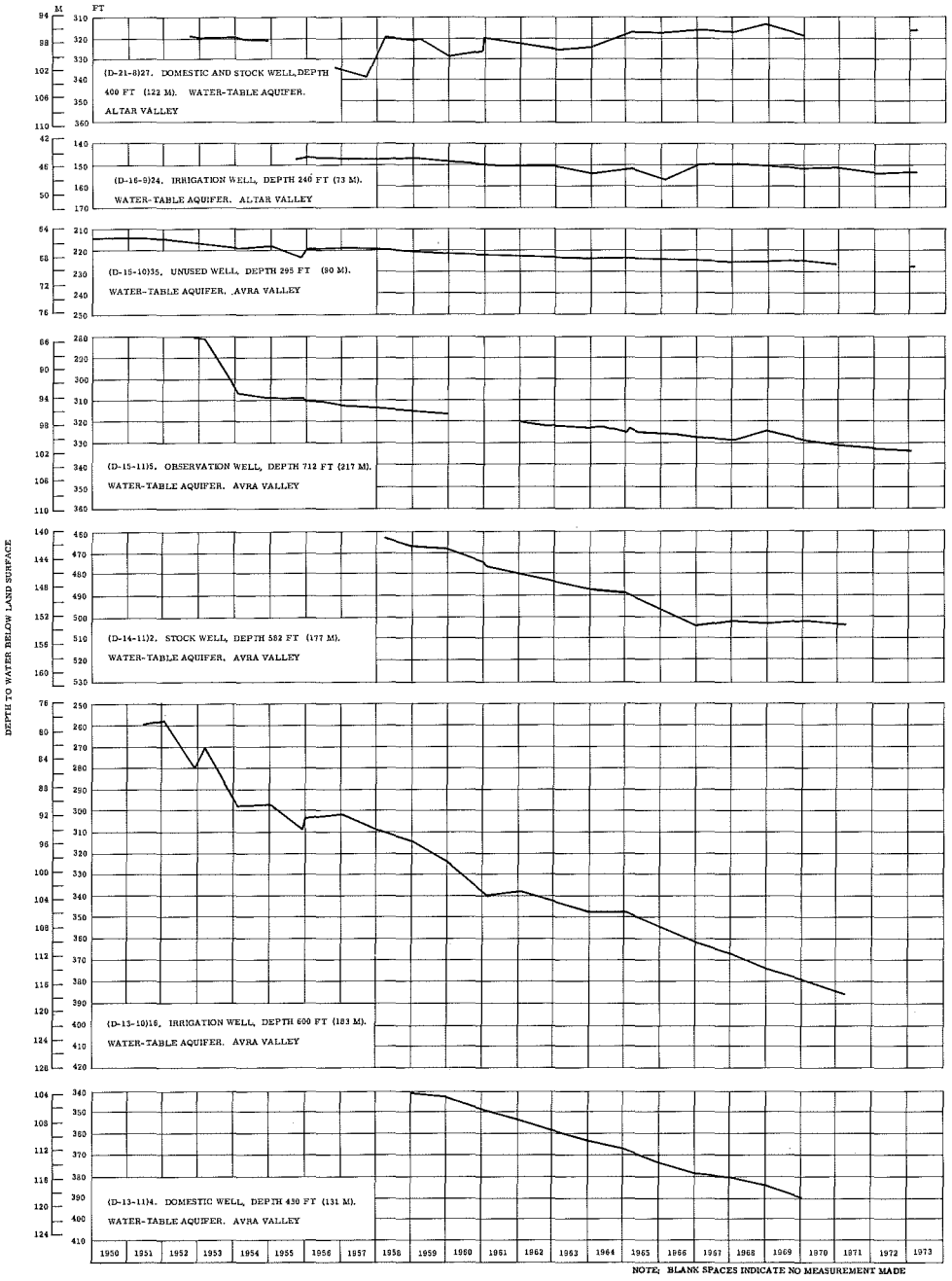


FIGURE 11. --DEPTH TO WATER IN SELECTED WELLS IN ALTAR AND AVRA VALLEYS AND ESTIMATED ANNUAL PUMPAGE IN AVRA VALLEY.
(IN TWO SHEETS.) SHEET 1 OF FIGURE 11.

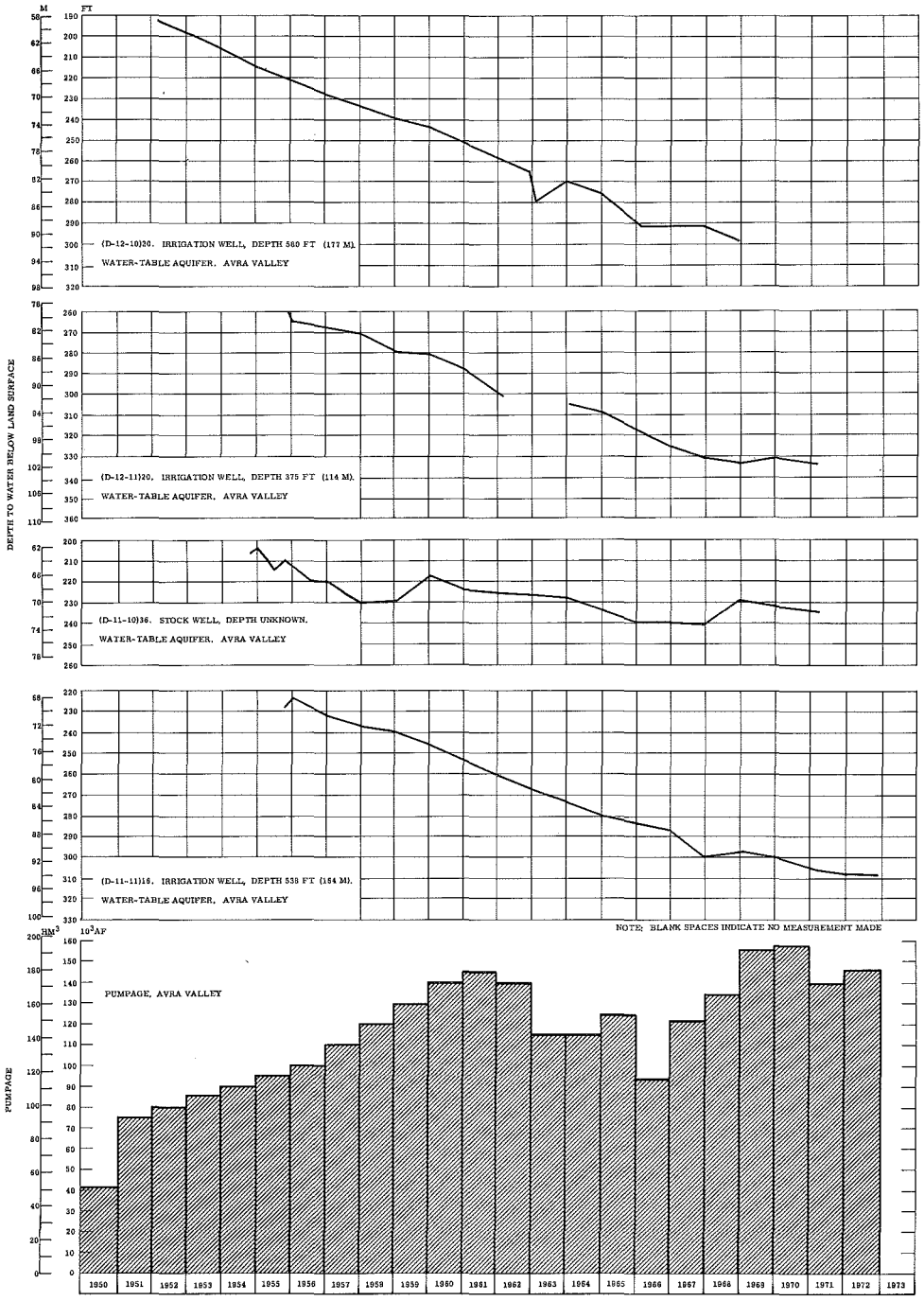


FIGURE 11.--DEPTH TO WATER IN SELECTED WELLS IN ALTAR AND AVRA VALLEYS AND ESTIMATED ANNUAL PUMPAGE IN AVRA VALLEY.
(IN TWO SHEETS.)

SHEET 2 OF FIGURE 11.

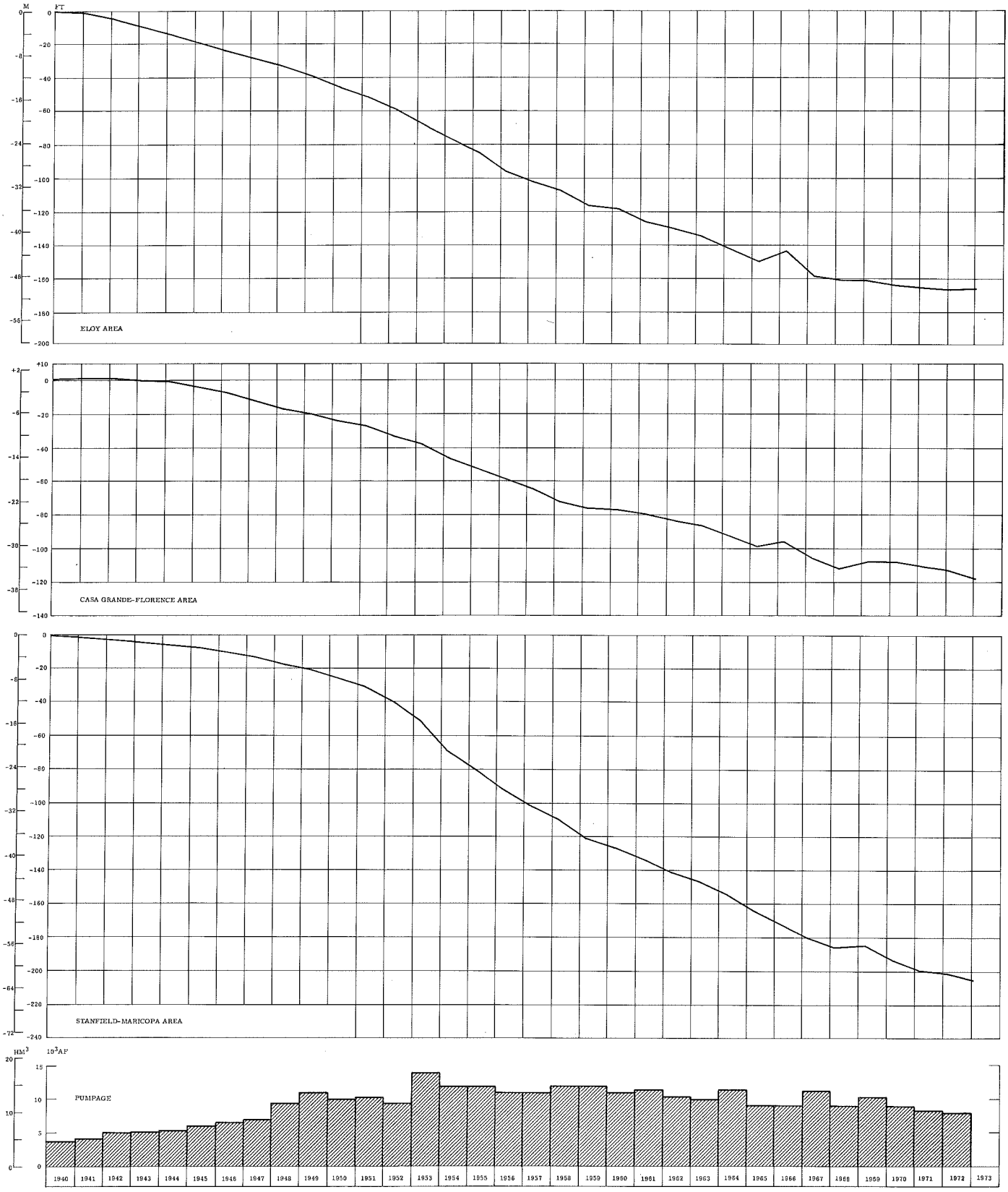


FIGURE 12.--CUMULATIVE AVERAGE CHANGE IN WATER LEVEL BY AREAS AND ESTIMATED ANNUAL PUMPAGE IN THE LOWER SANTA CRUZ BASIN.

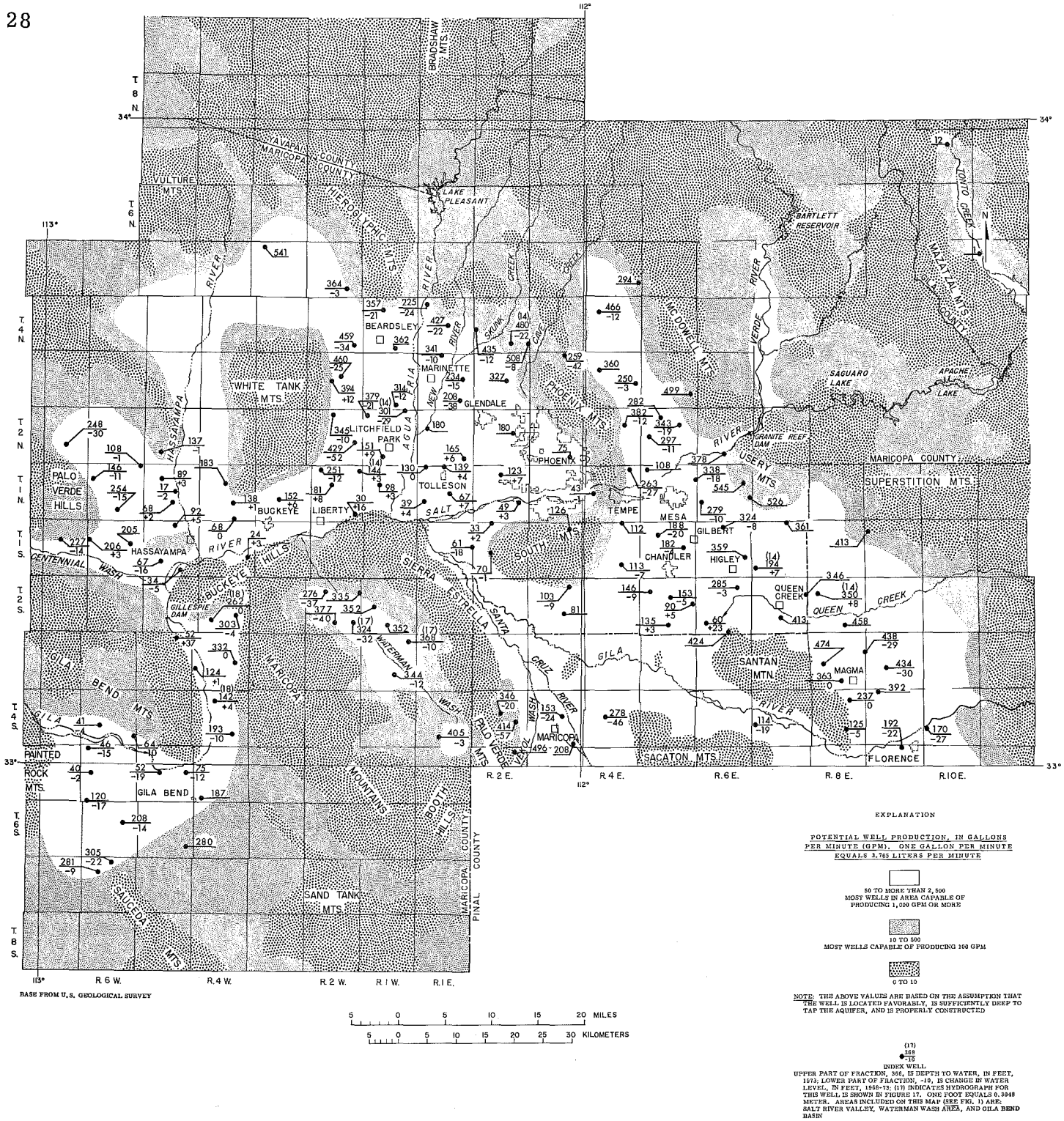


FIGURE 13.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE CENTRAL PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

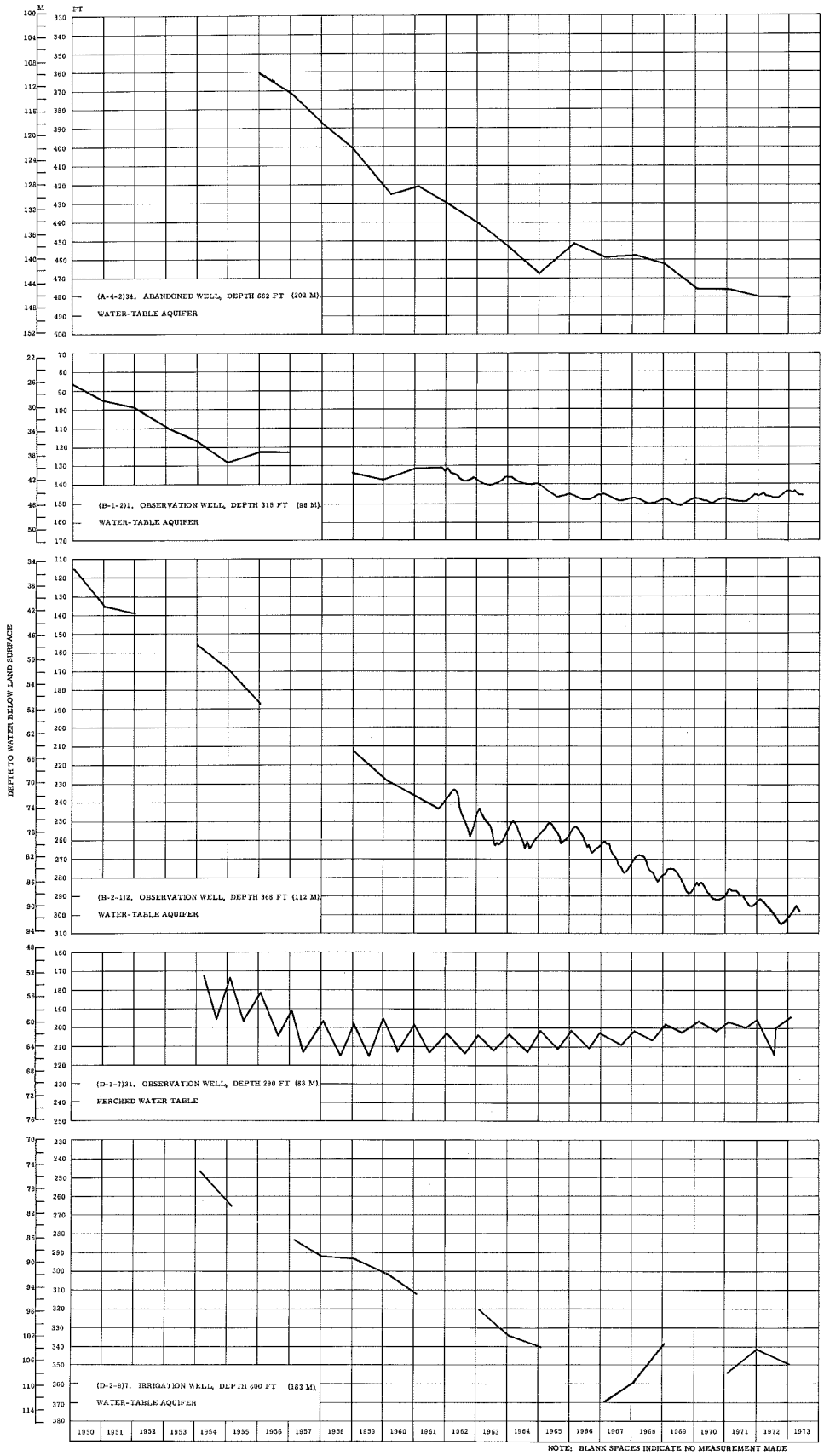


FIGURE 14. --DEPTH TO WATER IN SELECTED WELLS IN THE SALT RIVER VALLEY.

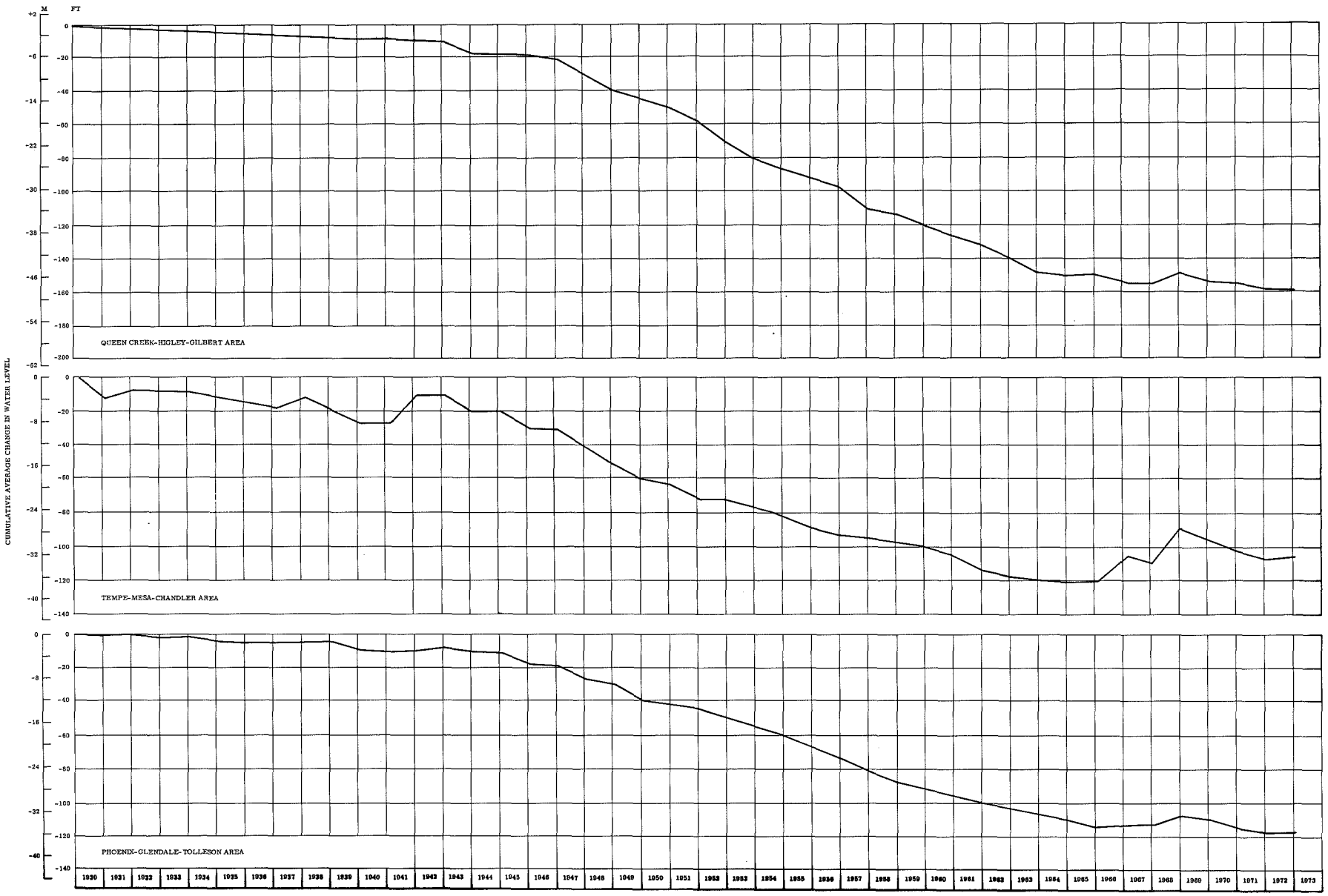


FIGURE 15.--CUMULATIVE AVERAGE CHANGE IN WATER LEVEL IN THE QUEEN CREEK-HIGLEY-GILBERT, TEMPE-MESA-CHANDLER, AND PHOENIX-GLENDALE-TOLLESON AREAS OF THE SALT RIVER VALLEY.

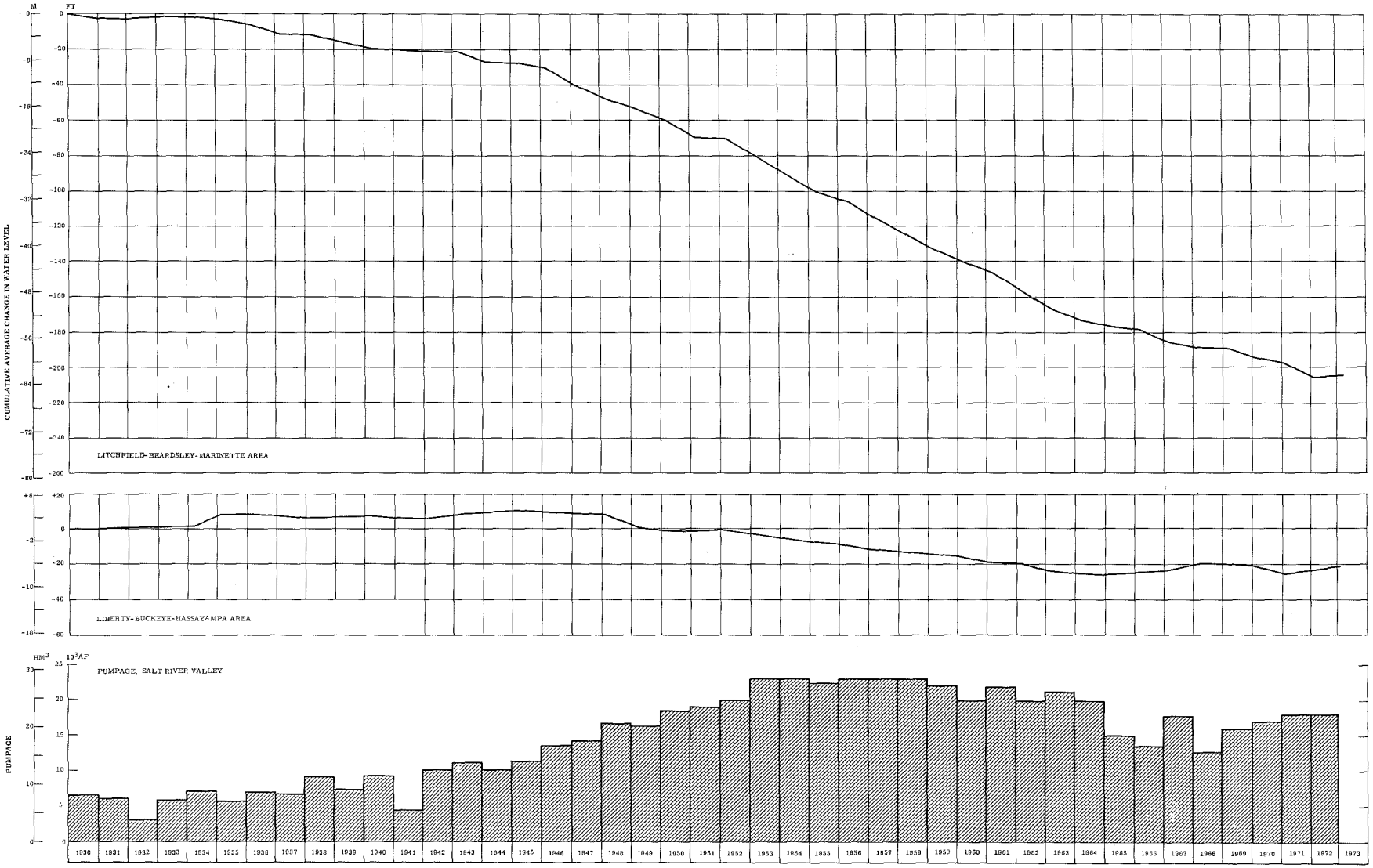


FIGURE 16.--CUMULATIVE AVERAGE CHANGE IN WATER LEVEL IN THE LITCHFIELD-BEARDSLEY-MARINETTE AND LIBERTY-BUCKEYE-HASSAYAMPA AREAS AND ESTIMATED ANNUAL PUMPAGE IN THE SALT RIVER VALLEY.

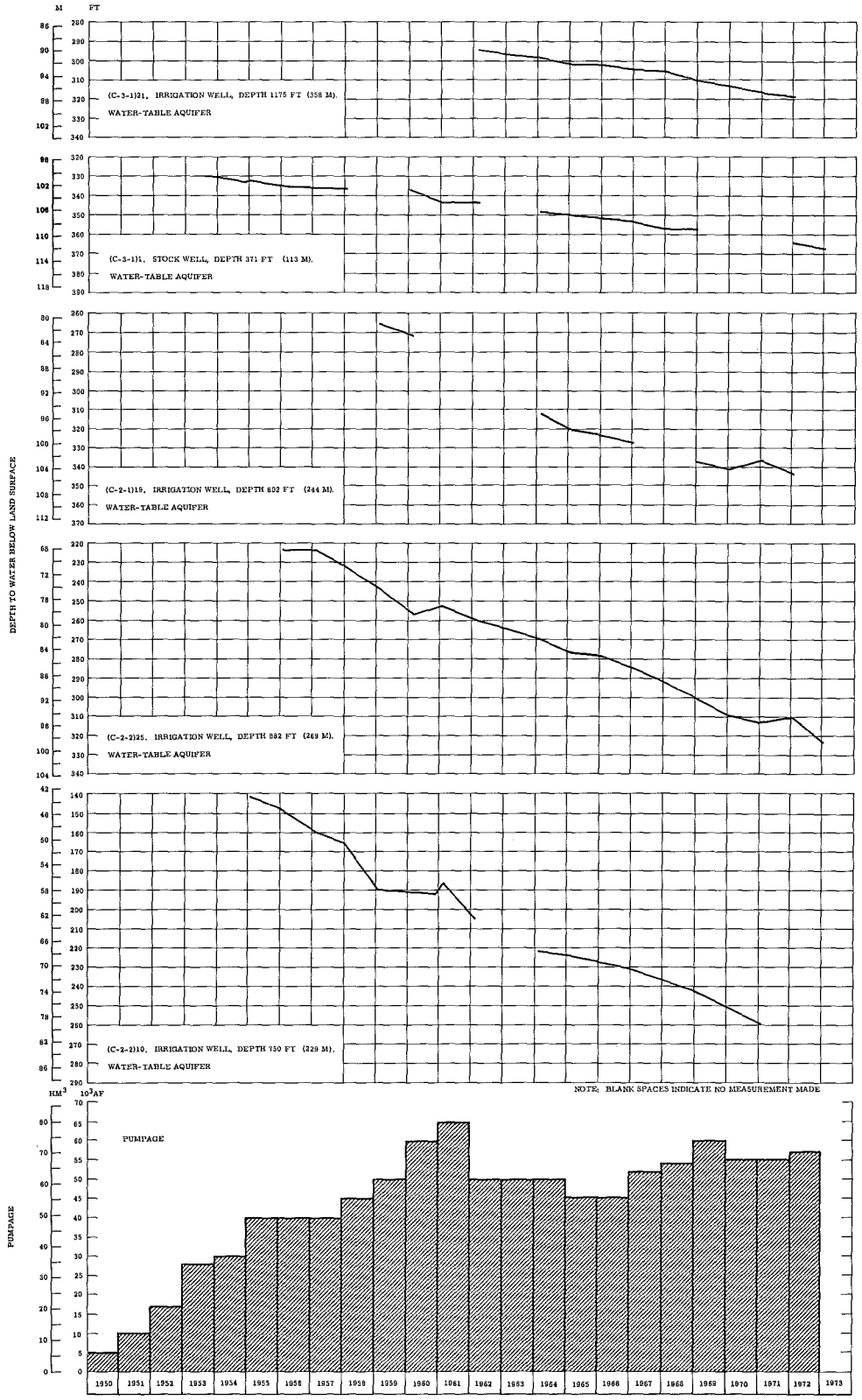


FIGURE 17.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE WATERMAN WASH AREA.

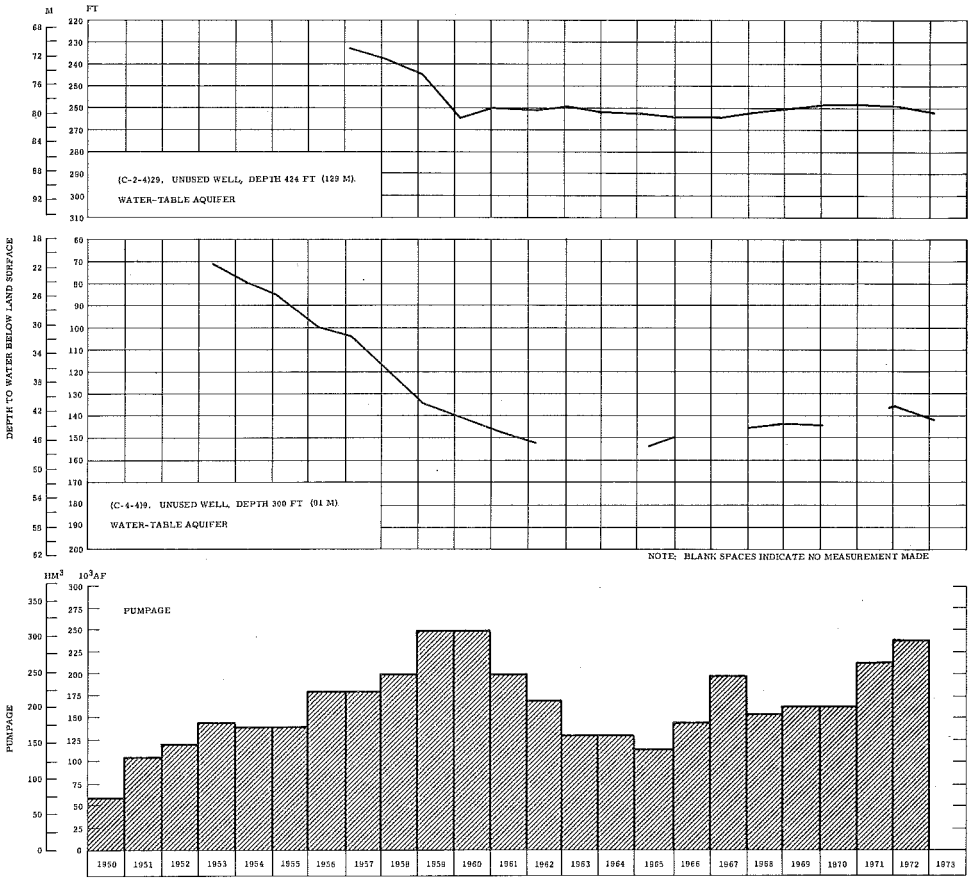


FIGURE 18.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE GILA BEND BASIN.

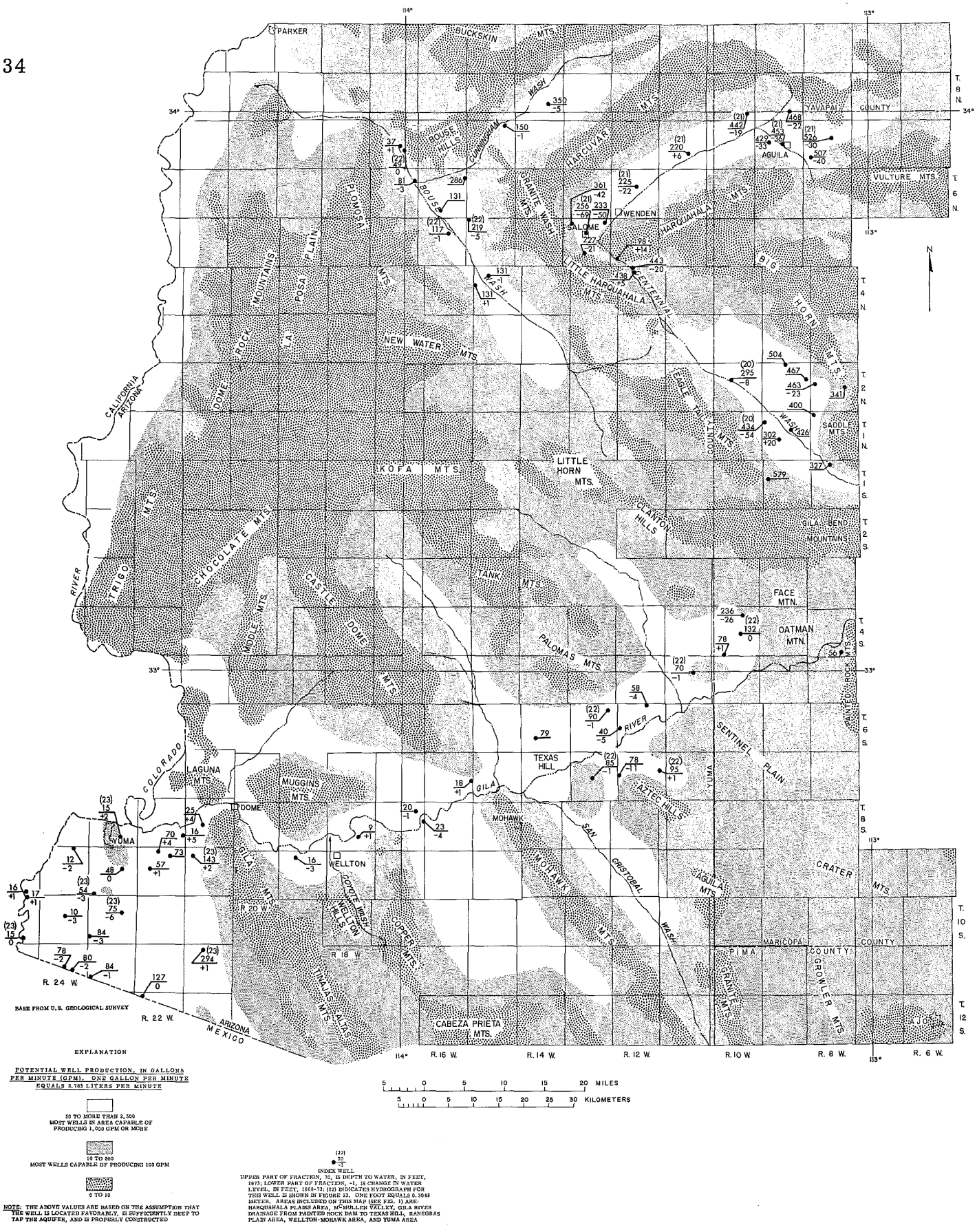


FIGURE 19.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE SOUTHWEST PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

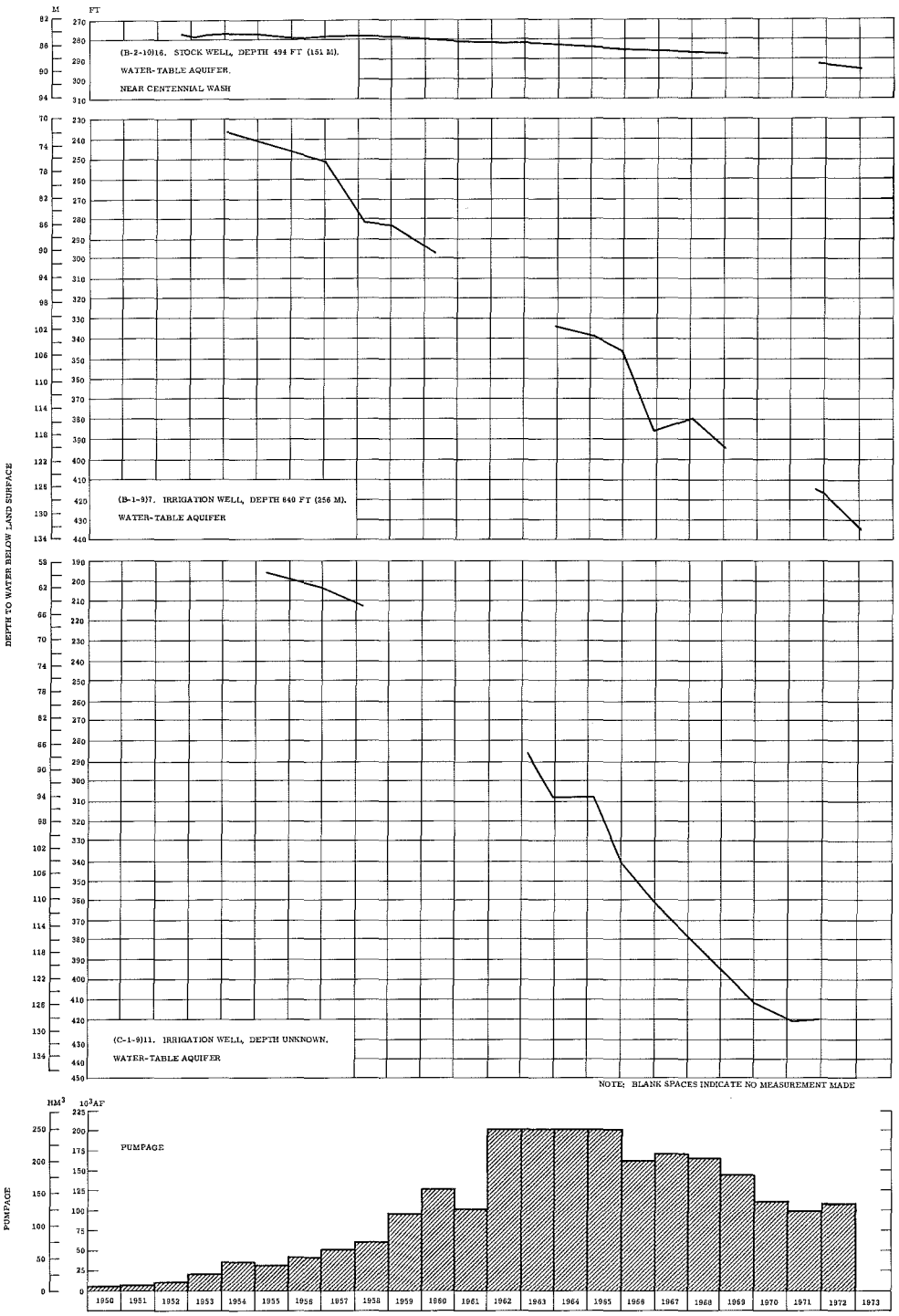


FIGURE 20. --DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE HARQUAHALA PLAINS AREA.

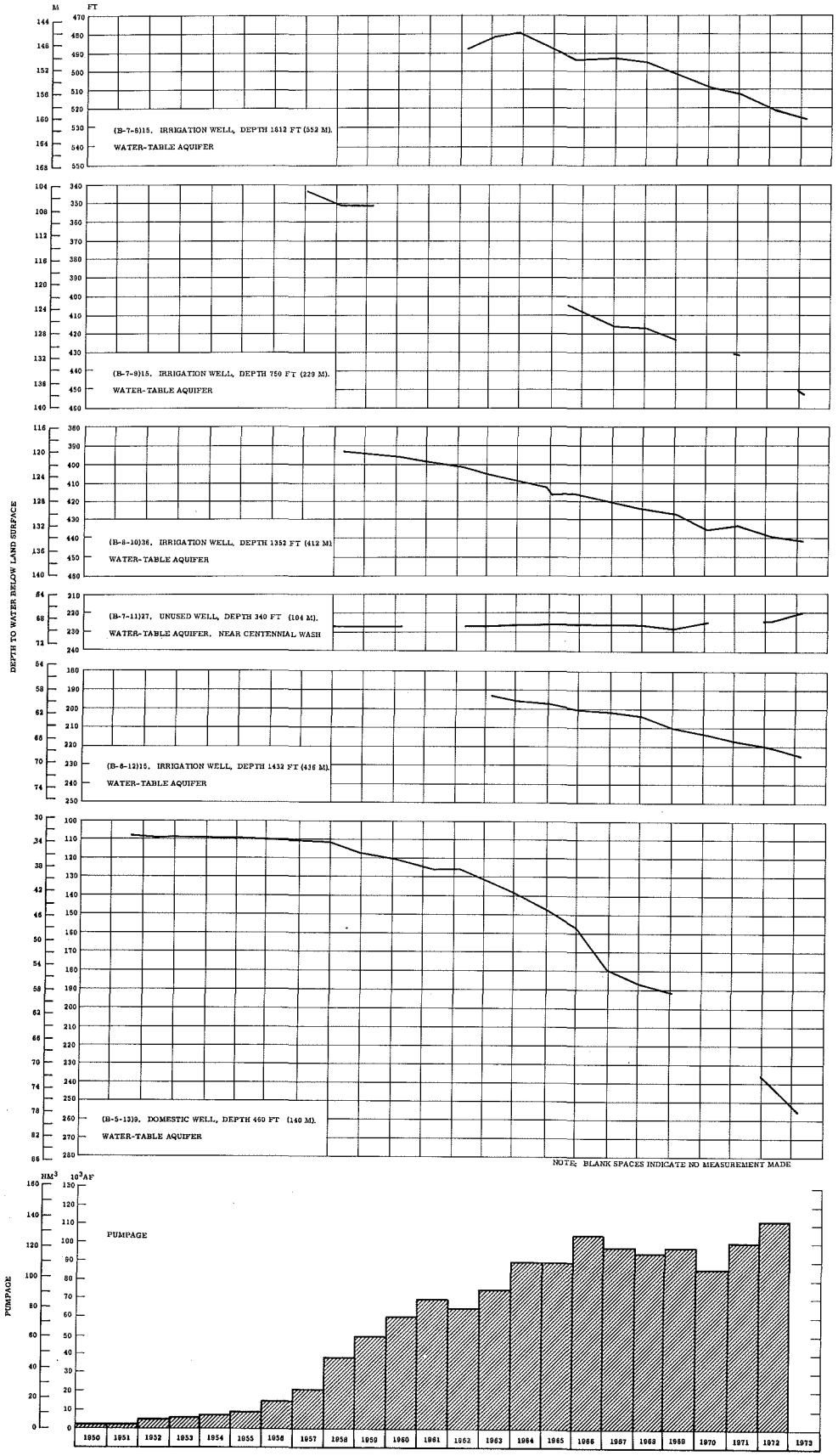


FIGURE 21.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN M^C MULLEN VALLEY.

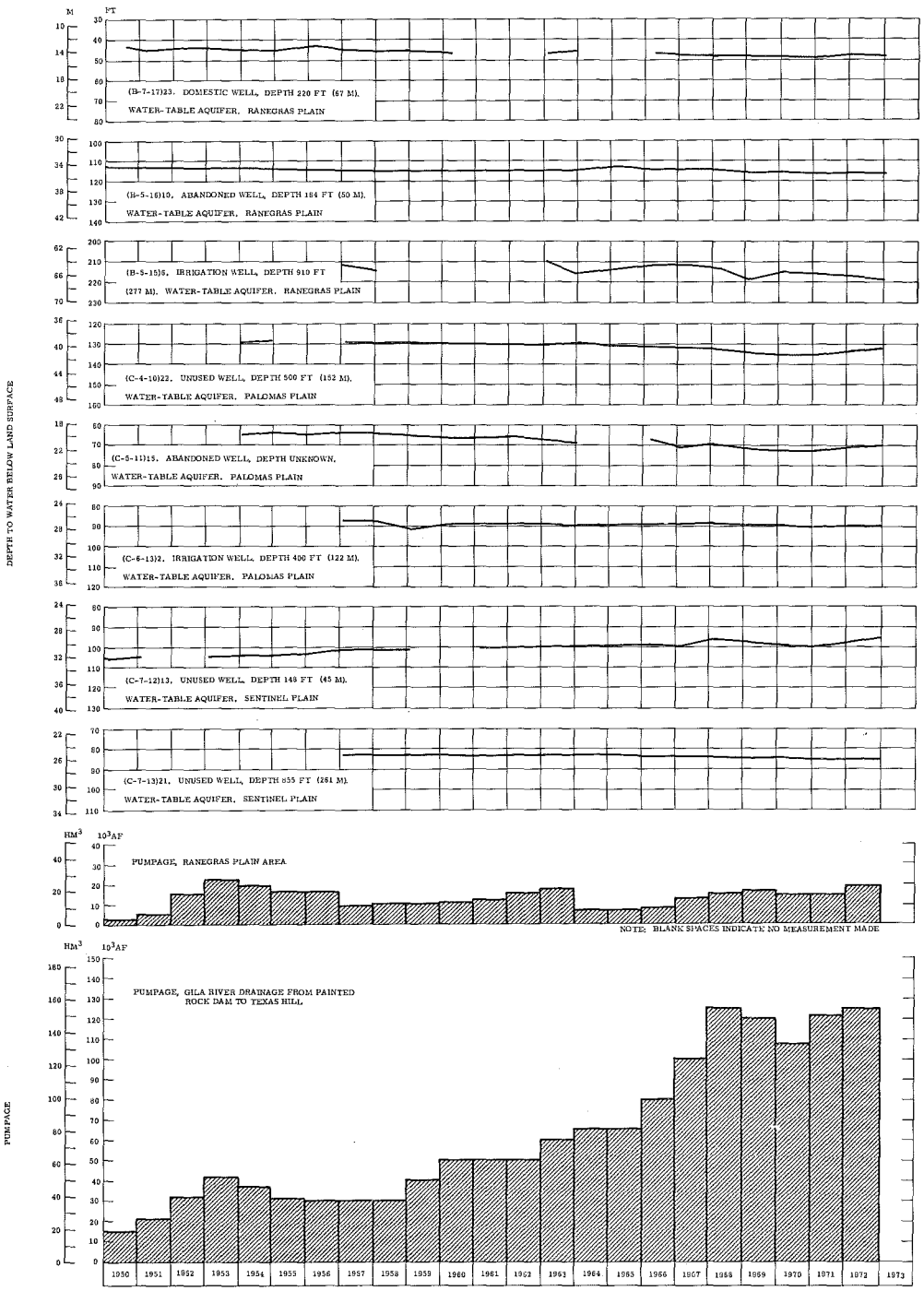


FIGURE 22.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE GILA RIVER DRAINAGE FROM PAINTED ROCK DAM TO TEXAS HILL AND IN THE RANEGRAS PLAIN AREA.

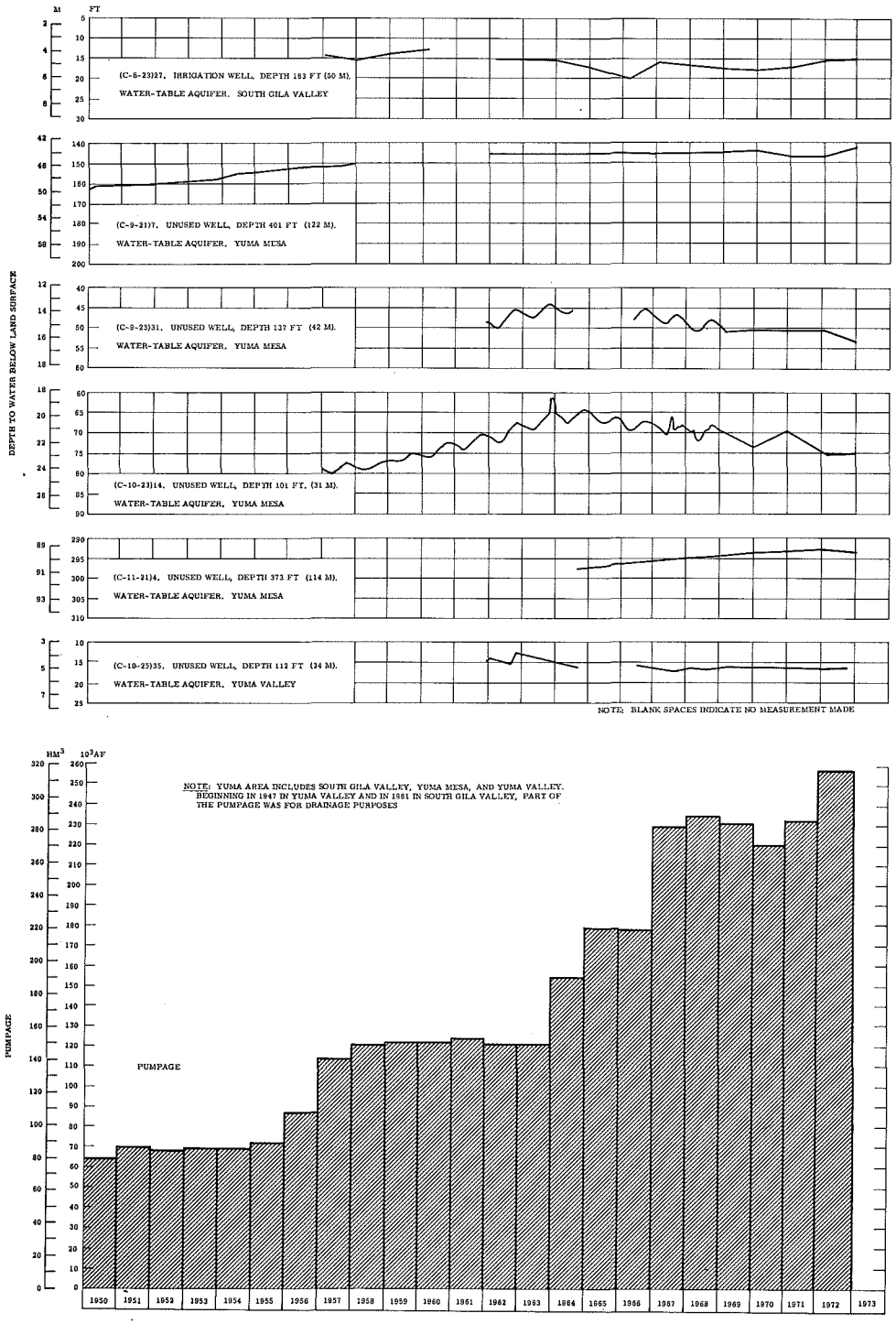


FIGURE 23.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN THE YUMA AREA.

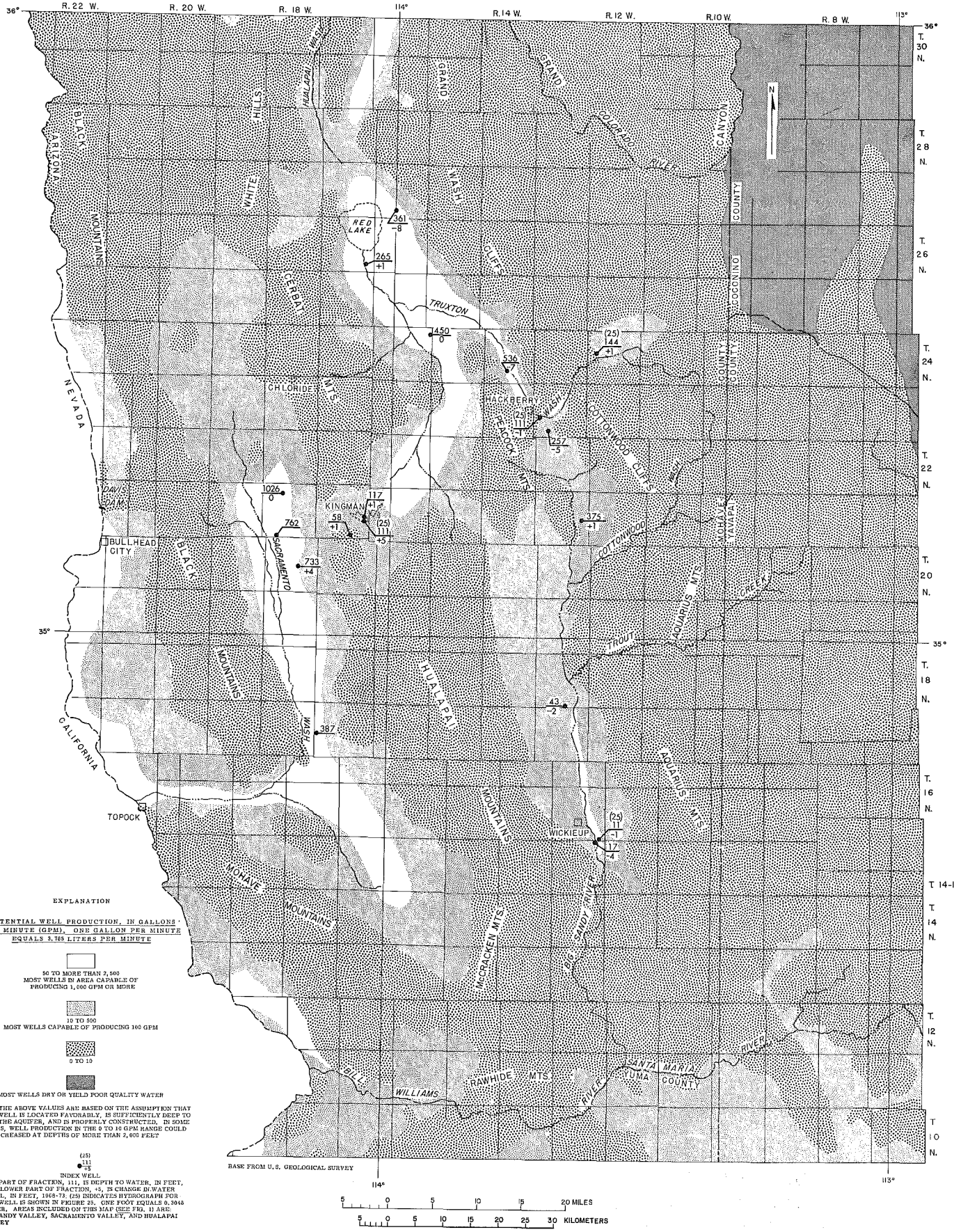


FIGURE 24.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE NORTHWEST PART OF THE BASIN AND RANGE LOWLANDS PROVINCE.

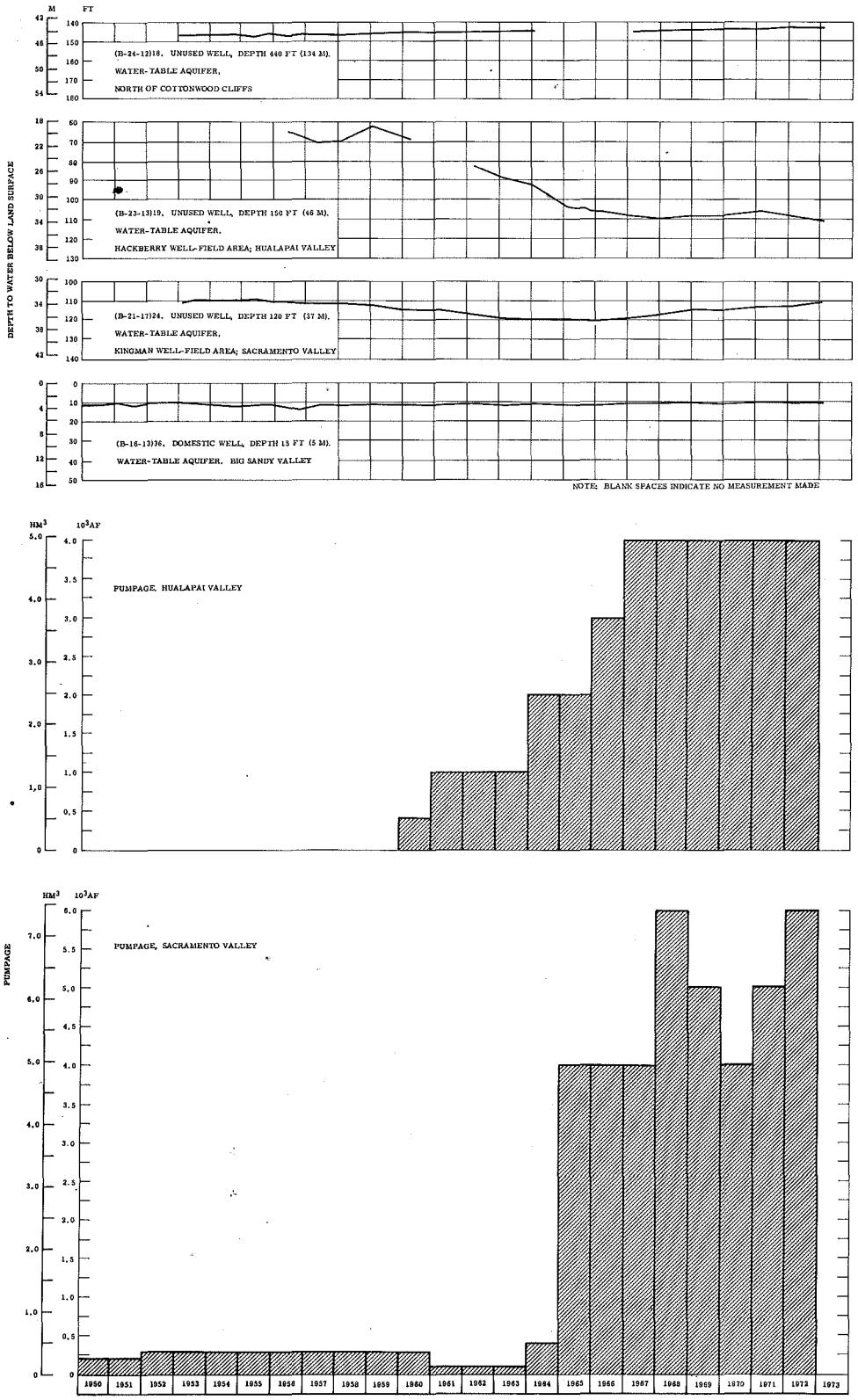
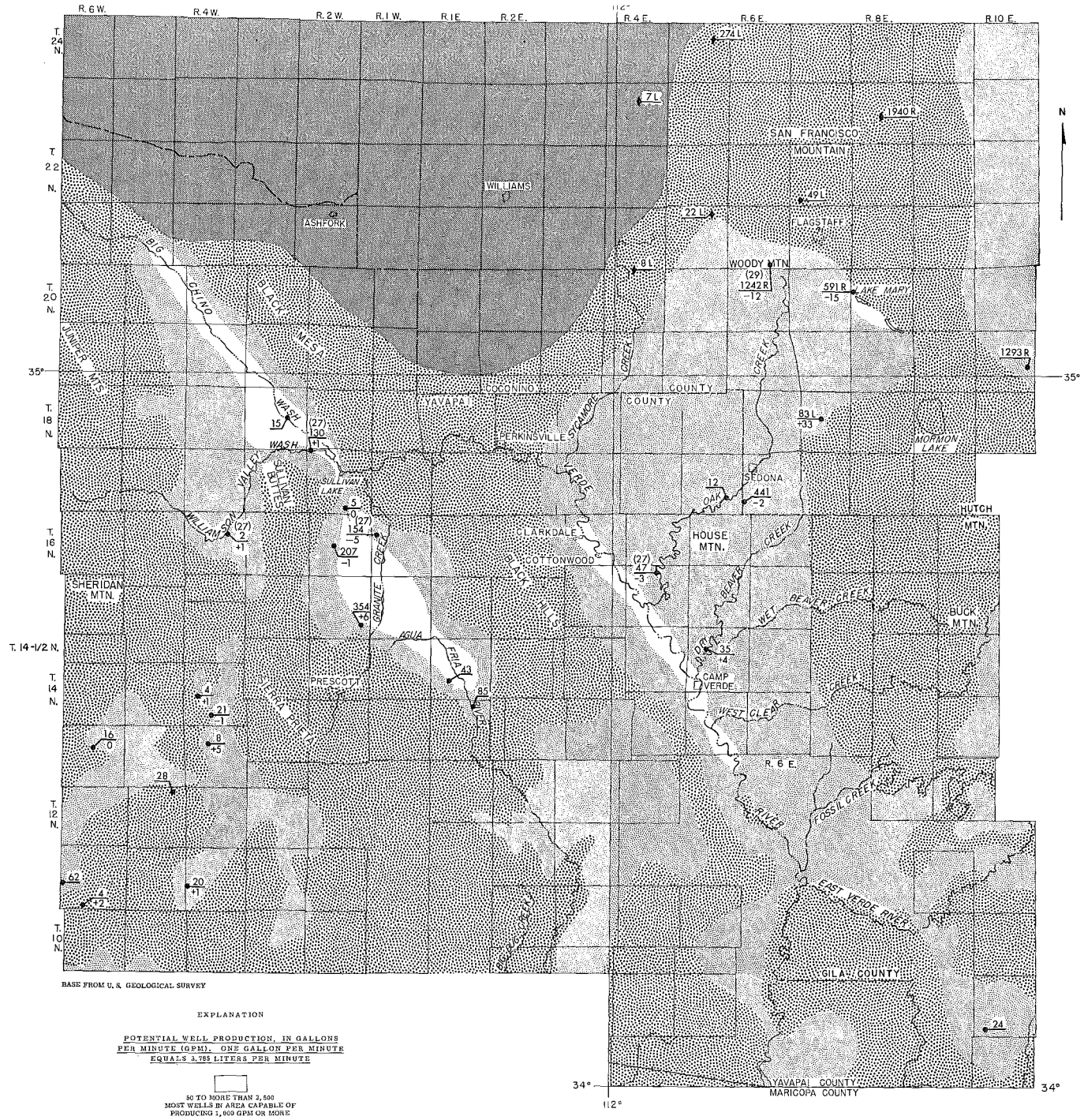


FIGURE 25.--DEPTH TO WATER IN SELECTED WELLS IN THE NORTHWEST PART OF THE BASIN AND RANGE LOWLANDS PROVINCE AND ESTIMATED ANNUAL PUMPAGE IN HUALAPAI AND SACRAMENTO VALLEYS.



BASE FROM U. S. GEOLOGICAL SURVEY

EXPLANATION

POTENTIAL WELL PRODUCTION, IN GALLONS PER MINUTE (GPM). ONE GALLON PER MINUTE EQUALS 3.785 LITERS PER MINUTE

50 TO MORE THAN 2,500
MOST WELLS IN AREA CAPABLE OF PRODUCING 1,000 GPM OR MORE

10 TO 500
MOST WELLS CAPABLE OF PRODUCING 100 GPM

0 TO 10

MOST WELLS DRY OR YIELD POOR QUALITY WATER

NOTE: THE ABOVE VALUES ARE BASED ON THE ASSUMPTION THAT THE WELL IS LOCATED FAVORABLY, IS SUFFICIENTLY DEEP TO TAP THE AQUIFER, AND IS PROPERLY CONSTRUCTED. IN SOME AREAS, WELL PRODUCTION IN THE 0 TO 10 GPM RANGE COULD BE INCREASED AT DEPTHS OF MORE THAN 2,000 FEET

(27)
47
-3

INDEX WELL

UPPER PART OF FRACTION, 47, IS DEPTH TO WATER, IN FEET, 1973; LOWER PART OF FRACTION, -3, IS CHANGE IN WATER LEVEL, IN FEET, 1968-73; (27) INDICATES HYDROGRAPH FOR THIS WELL IS SHOWN IN FIGURE 27. ONE FOOT EQUALS 0.3048 METER.
R = WELL TAPS REGIONAL AQUIFER OF GREAT AREAL EXTENT;
L = WELL TAPS LOCAL AQUIFER OF LIMITED AREAL EXTENT.
AREAS INCLUDED ON THIS MAP (SEE FIG. 1) ARE: BIG CHINO VALLEY, LITTLE CHINO VALLEY, WILLIAMSON VALLEY, VERDE VALLEY, AND ADJACENT AREAS

274L

WELL WHERE MISCELLANEOUS WATER-LEVEL MEASUREMENTS WERE MADE DURING PERIOD 1968-72; 274 IS DEPTH TO WATER, IN FEET, DURING PERIOD 1968-72. ONE FOOT EQUALS 0.3048 METER. USED WHERE 1973 DATA ARE NOT AVAILABLE AND CHANGES IN WATER LEVELS ARE NEGLIGIBLE

FIGURE 26.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE WEST PART OF THE CENTRAL HIGHLANDS PROVINCE AND THE SOUTH-CENTRAL PART OF THE PLATEAU UPLANDS PROVINCE.

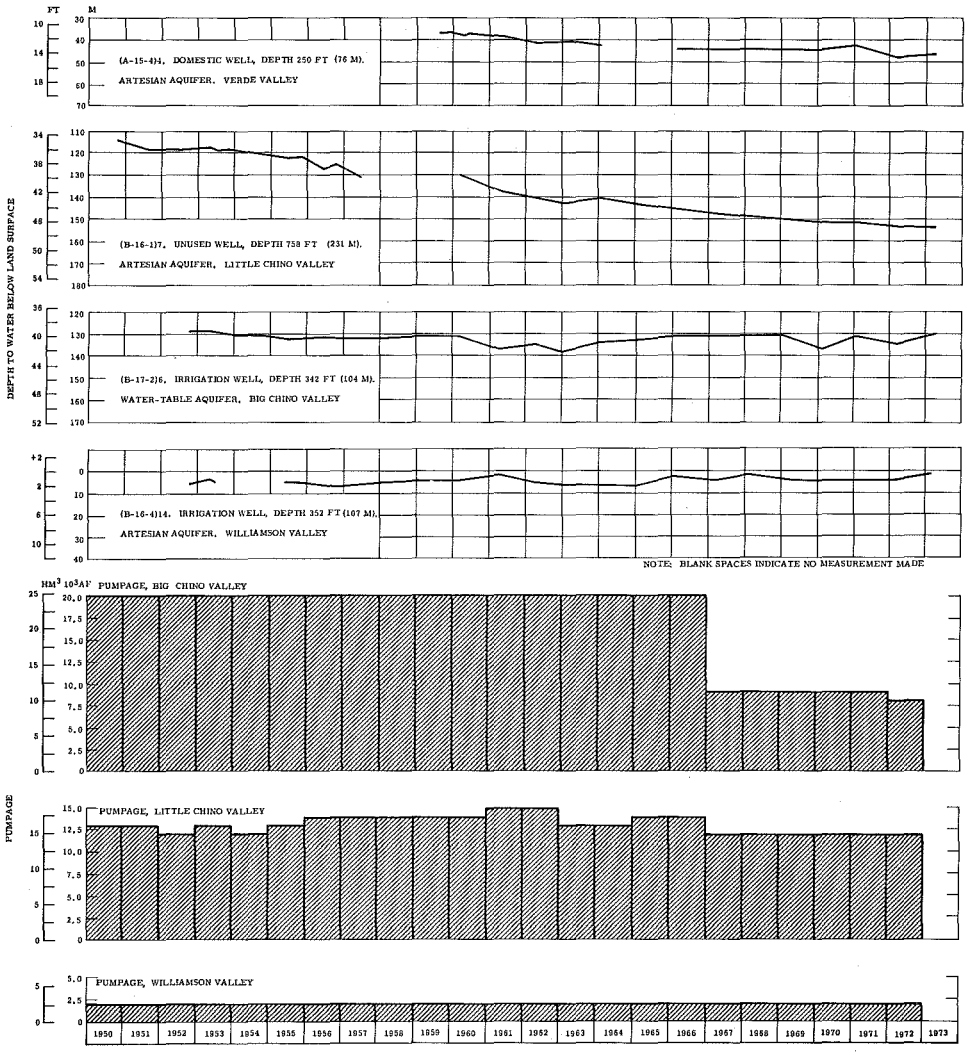


FIGURE 27.--DEPTH TO WATER IN SELECTED WELLS AND ESTIMATED ANNUAL PUMPAGE IN SEVERAL AREAS IN THE CENTRAL HIGHLANDS PROVINCE.

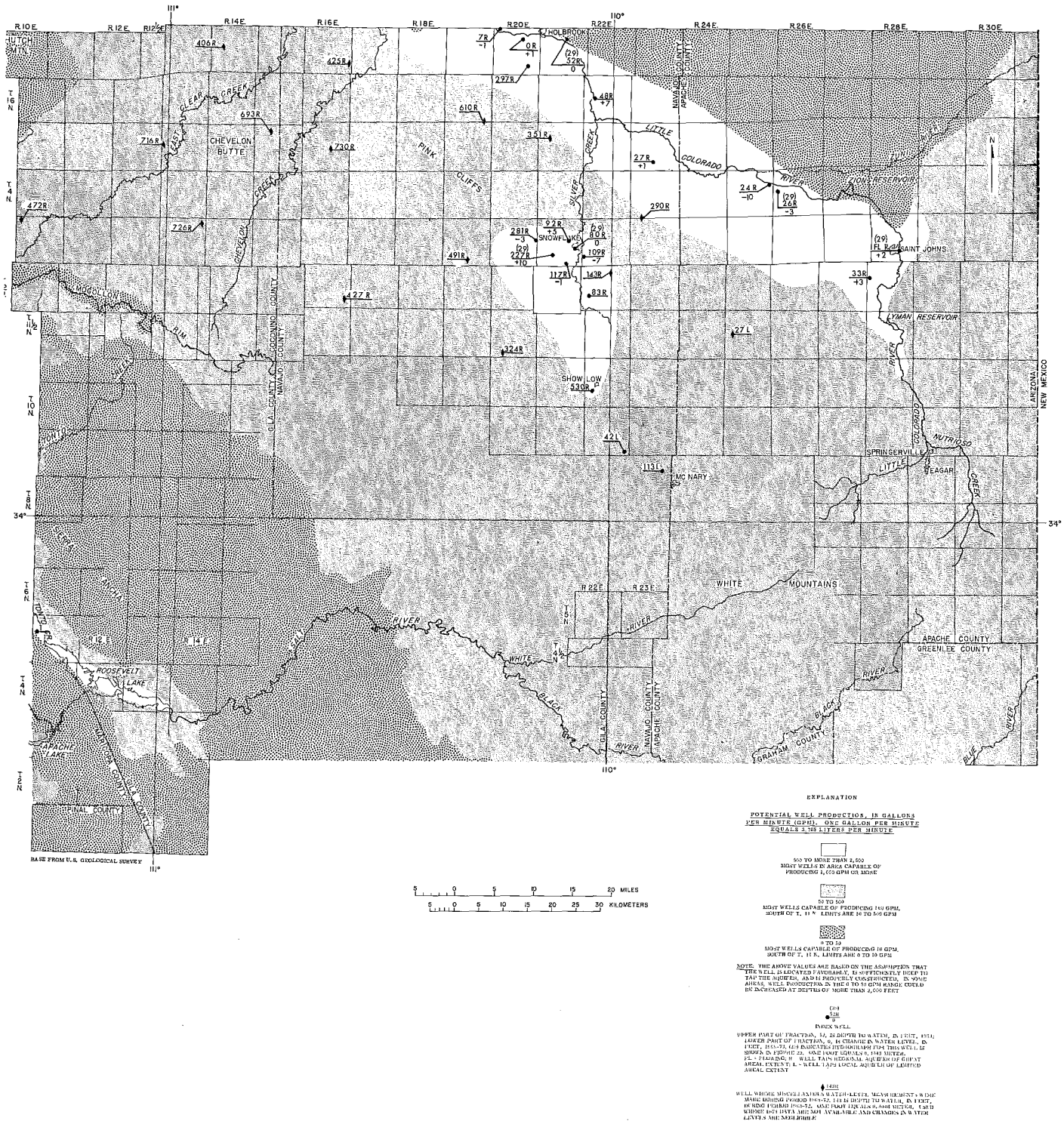


FIGURE 28.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE EAST PART OF THE CENTRAL HIGHLANDS PROVINCE AND THE SOUTHEAST PART OF THE PLATEAU UPLANDS PROVINCE.

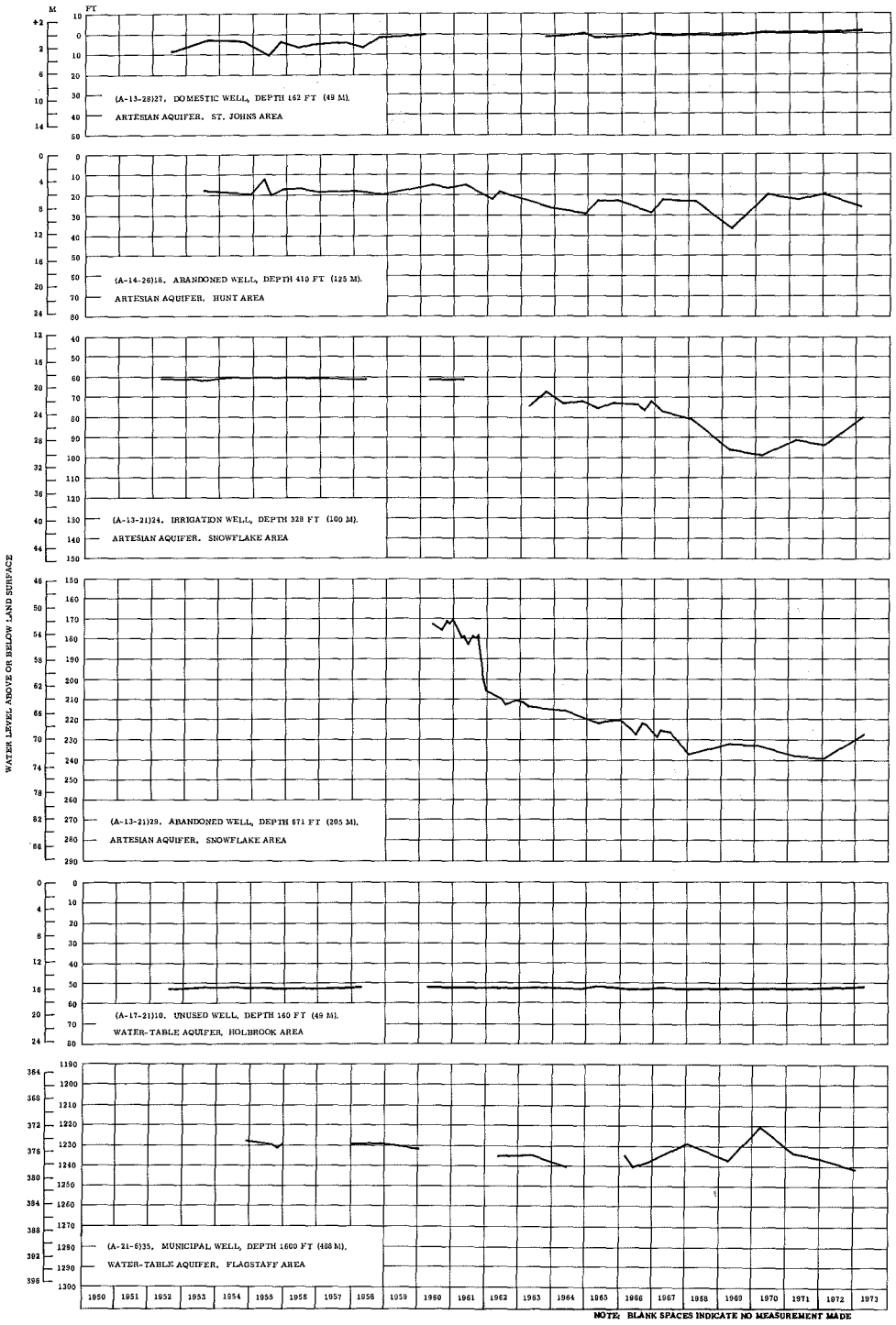


FIGURE 29.--DEPTH TO WATER IN SELECTED WELLS IN SEVERAL AREAS IN THE PLATEAU UPLANDS PROVINCE.

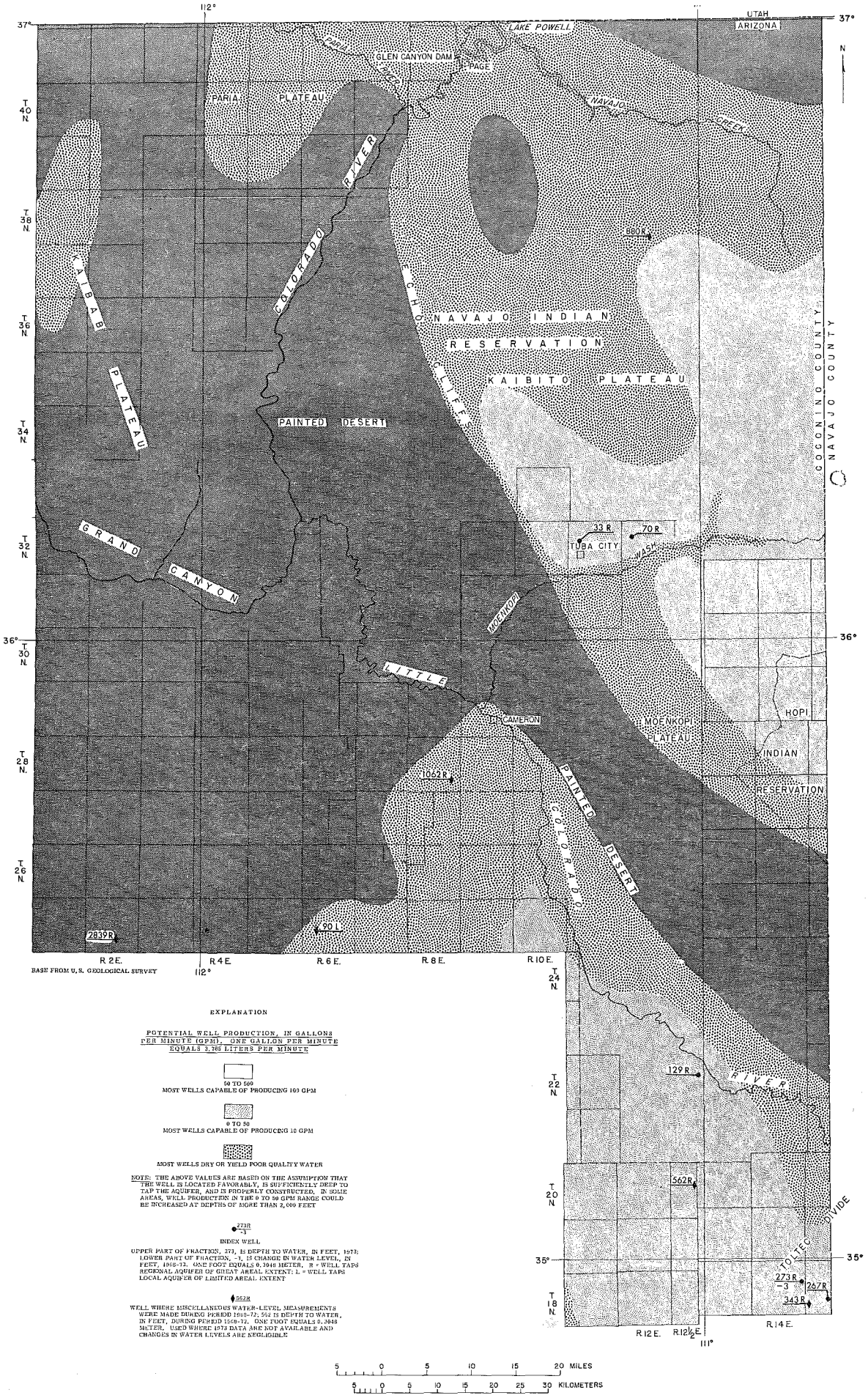


FIGURE 30.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE NORTH-CENTRAL PART OF THE PLATEAU UPLANDS PROVINCE.

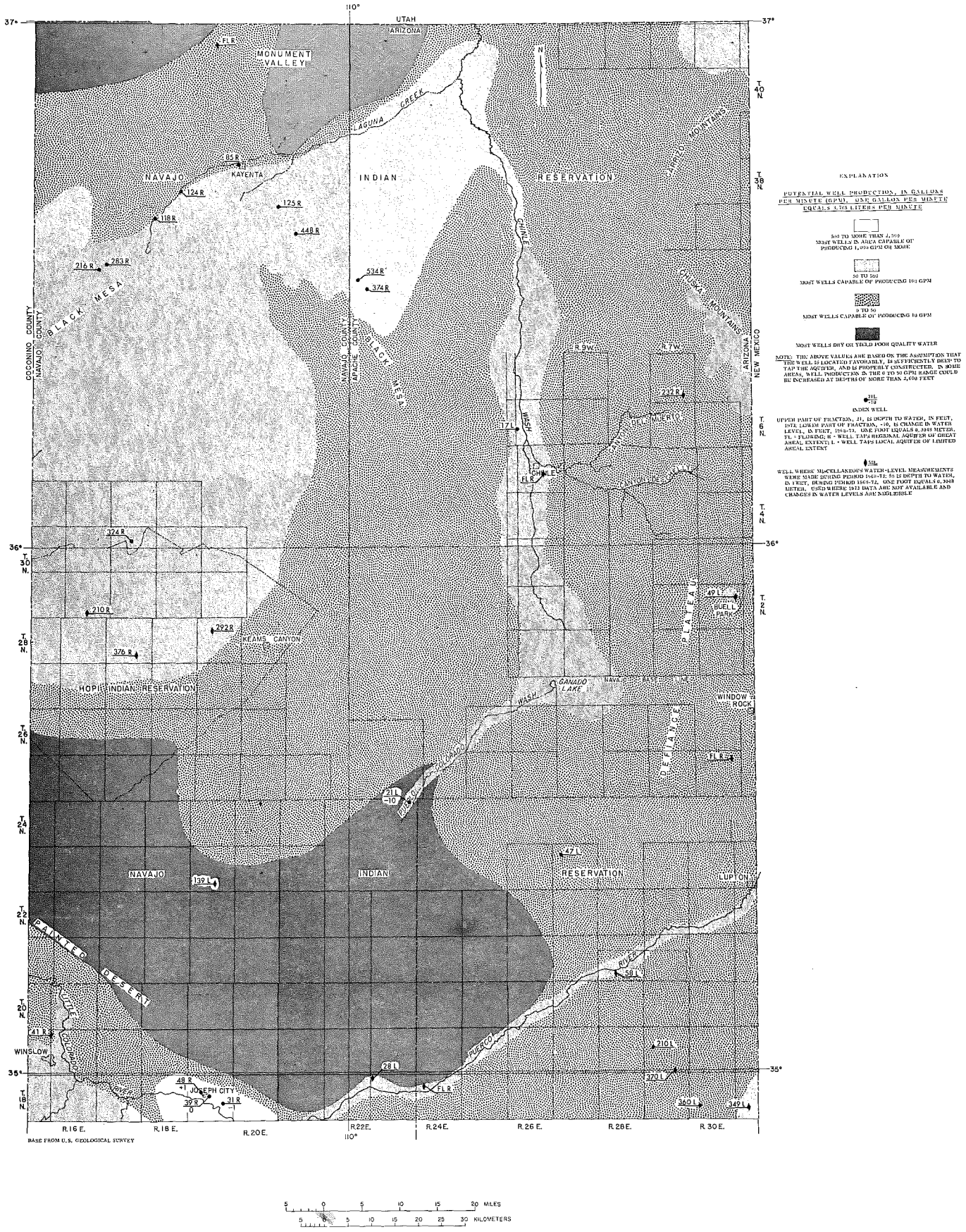


FIGURE 31.--POTENTIAL WELL PRODUCTION, DEPTH TO WATER, 1973, AND CHANGE IN WATER LEVEL, 1968-73, IN SELECTED WELLS IN THE NORTHEAST PART OF THE PLATEAU UPLANDS PROVINCE.