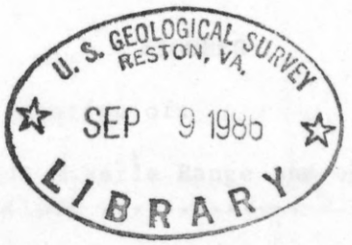
ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1985

U.S. GEOLOGICAL SURVEY
Open-File Report 86-401

Prepared in cooperation with
WHITE SANDS MISSILE RANGE

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1985

By R. R. Cruz



U.S. GEOLOGICAL SURVEY
Open-File Report 86-401-W

September 12, 1986

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Prepared in cooperation with
WHITE SANDS MISSILE RANGE

Albuquerque, New Mexico

1986

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

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CONVERSION FACTORS

In this report, values for measurements are given in inch-pound units only. The following table contains factors for converting to International System (SI) units.

Multiply inch-pound units	By	To obtain SI units
foot	0.3048	meter
mile	1.609	kilometer
gallon	3.785	liter
acre-foot	1,233	cubic meter

ANNUAL WATER-RESOURCES REVIEW,

WHITE SANDS MISSILE RANGE,

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ABSTRACT

Hydrologic data were collected at White Sands Missile Range in 1985. The total ground-water withdrawal in 1985 was 676,433,800 gallons. The 11 supply wells in the Post Headquarters well field produced 642,056,000 gallons, or about 95 percent of the total. The six Range area supply wells produced 34,377,800 gallons. The total ground-water withdrawal was 8,841,200 gallons less in 1985 than 1984.

Water samples from six Post Headquarters supply wells were collected for major chemical analysis. The greatest dissolved-sodium concentration was 33 milligrams per liter in water from supply well SW-22, and the greatest dissolved-chloride concentration was 27 milligrams per liter in water from supply well SW-16. Water from supply well SW-11 had the greatest concentrations of dissolved calcium (69 milligrams per liter) and dissolved sulfate (120 milligrams per liter).

Water samples from 19 other wells were collected for pH and specific-conductance analysis. The pH ranged from 7.6 in water from test well T-6 to 8.3 in water from test wells T-8 and T-17. The specific conductance ranged from 254 microsiemens per centimeter at 25 degrees Celsius in water from test well T-17 to 2,010 microsiemens per centimeter at 25 degrees Celsius in water from test well T-14.

Depth-to-water measurements in the Post Headquarters supply wells showed seasonal fluctuations as well as continued long-term declines. Three of the four test wells equipped with continuous recorders continued to show water-level declines in 1985.

INTRODUCTION

This report presents water-resources data that were collected at White Sands Missile Range (fig. 1) during 1985 by personnel of the U.S. Geological Survey and White Sands Missile Range. Ground-water pumpage, water-level measurements, and chemical-quality data summarized in this report were obtained as a result of the continuing water-resources hydrologic-data-collection program sponsored by the Installation Support Directorate, White Sands Missile Range.

This report is the eighteenth Annual Water-Resources Review prepared for White Sands Missile Range. The 1968 report and subsequent annual reports are available for inspection at the District Office of the U.S. Geological Survey, Water Resources Division, Albuquerque, New Mexico.

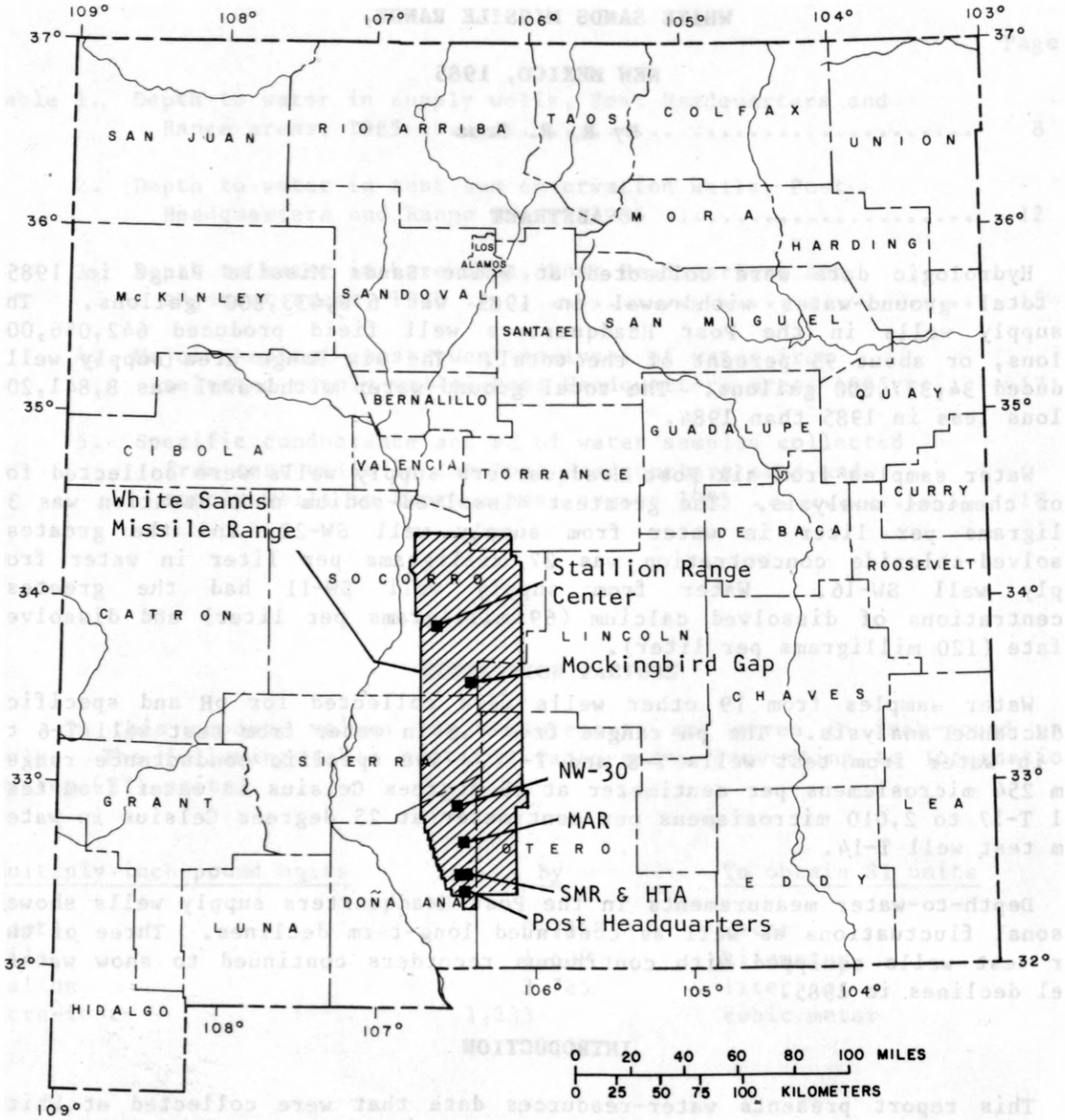
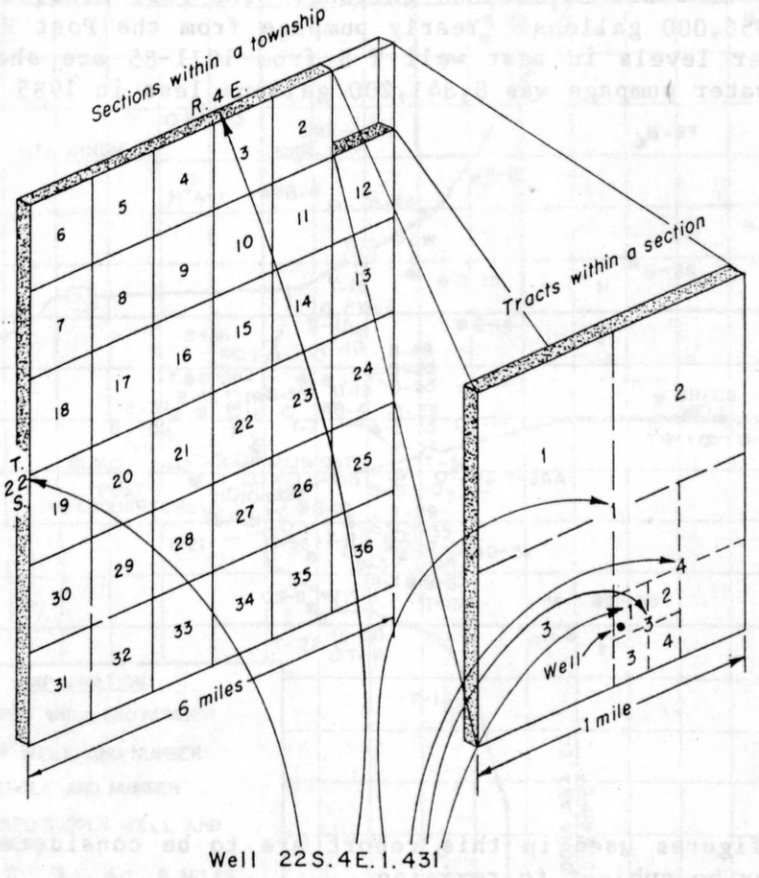


Figure 1.--Location of White Sands Missile Range and areas of hydrologic observations.

Well-Numbering System

Wells are located according to the system of common subdivision of sectionized land used throughout the State by the U.S. Geological Survey. The number of each well consists of four segments separated by periods and locates the well's position to the nearest 10-acre tract of land. The segments denote, respectively, the township south of the New Mexico base line, the range east of the New Mexico principal meridian, the section, and the particular 10-acre tract within the section.

The fourth segment of the number consists of three digits denoting, respectively, the quarter section or approximate 160-acre tract, the quadrant (approximately 40 acres in size) of the quarter section, and the quadrant (approximately 10 acres in size) of the 40-acre tract in which the well is located. The system of numbering quarter sections and quadrants, which is done in reading order, as well as the usual numbering of sections within a township is shown below. For example, well 22S.4E.1.431 is located in the NW¼ of the SW¼ of the SE¼, section 1, Township 22 South, Range 4 East. If more than one well has the same location number, the letter "a" is assigned to the second well, the letter "b" to the third well, and so on.



DATA-COLLECTION PROGRAM

The program to collect hydrologic data at White Sands Missile Range has been continuous since 1953. The original program consisted of water-level measurements in five wells in the Post Headquarters area. The hydrologic-data-collection program has expanded over the years to keep up with expansion of the White Sands Missile Range facilities. Currently, the program consists of depth-to-water measurements in 95 wells, chemical-quality analysis of water samples from 25 wells, and measurement of ground-water withdrawals from 17 wells in the Post Headquarters and Range areas (figs. 1-4).

Ground-Water Pumpage

Total ground-water pumpage* at White Sands Missile Range in 1985 was 676,433,800 gallons. The Hazardous Test Area Well (HTA-1), Small Missile Range well (SMR-1), Multifunction Array Radar wells (MAR-1 and MAR-2), and the Stallion Range Center wells (SRC-1 and SRC-2) produced five percent of the total pumpage, or about 34,377,800 gallons. The Post Headquarters well field produced 642,056,000 gallons. Yearly pumpage from the Post Headquarters well field and water levels in test well T-8 from 1971-85 are shown in figure 5. Total ground-water pumpage was 8,841,200 gallons less in 1985 than 1984.

*The pumpage figures used in this report are to be considered as preliminary figures and may be subject to revision.

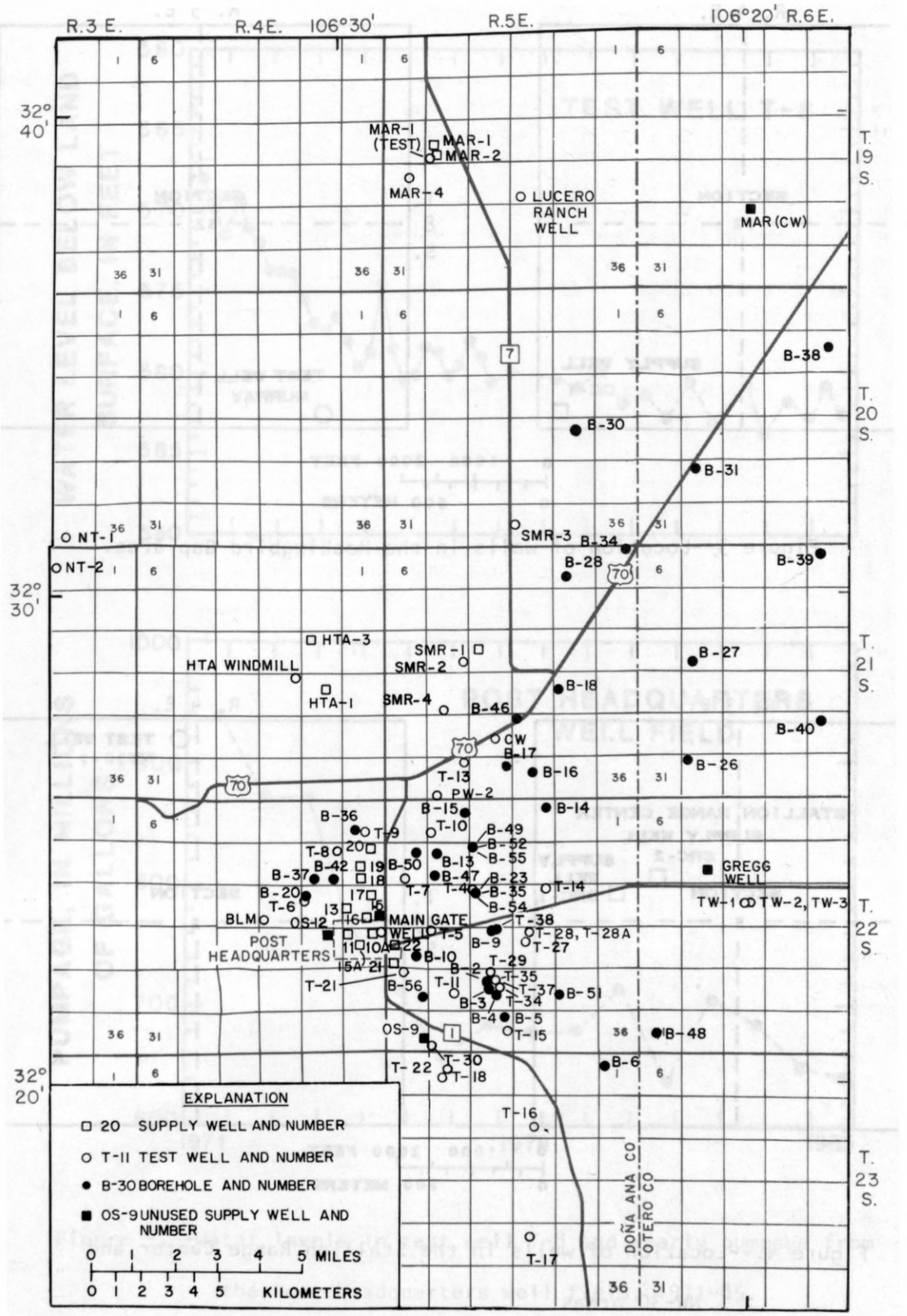


Figure 2.--Location of supply wells, test wells, boreholes, and unused supply wells in the Post Headquarters and adjacent areas.

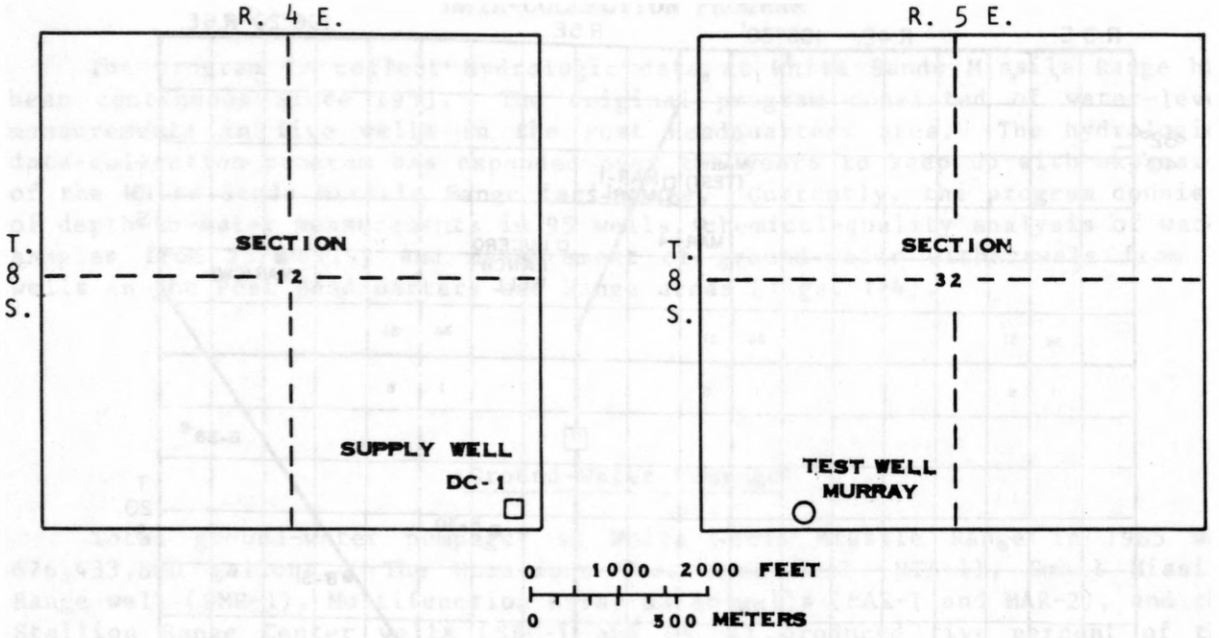


Figure 3.--Location of wells in the Mockingbird Gap area.

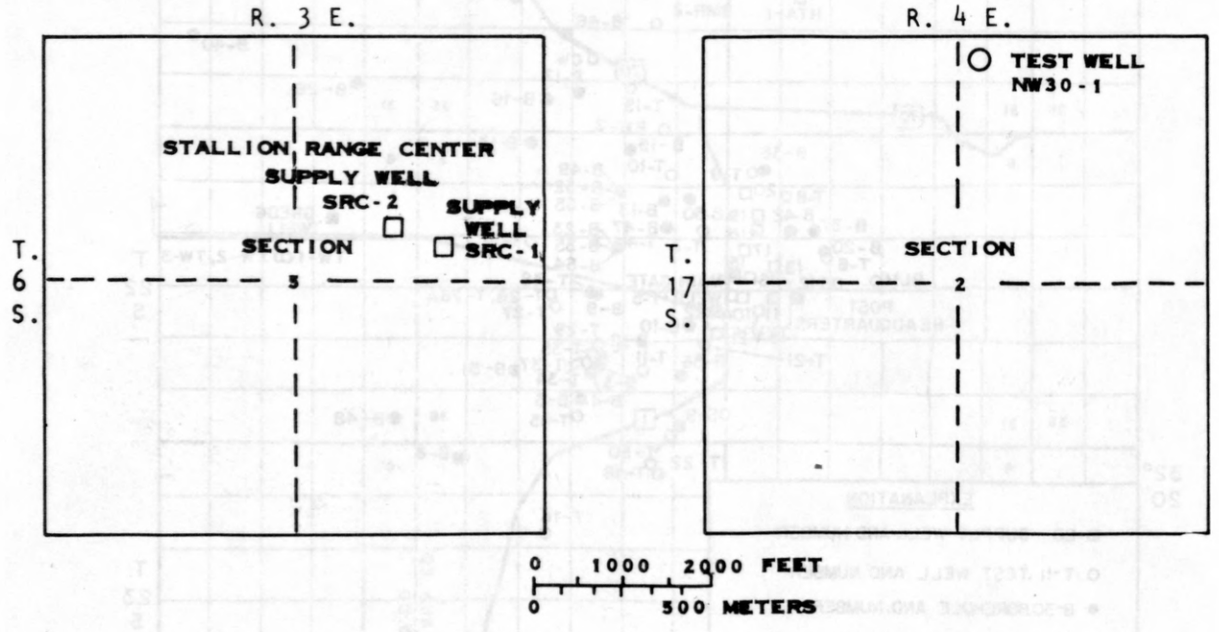


Figure 4.--Location of wells in the Stallion Range Center and NW-30 areas.

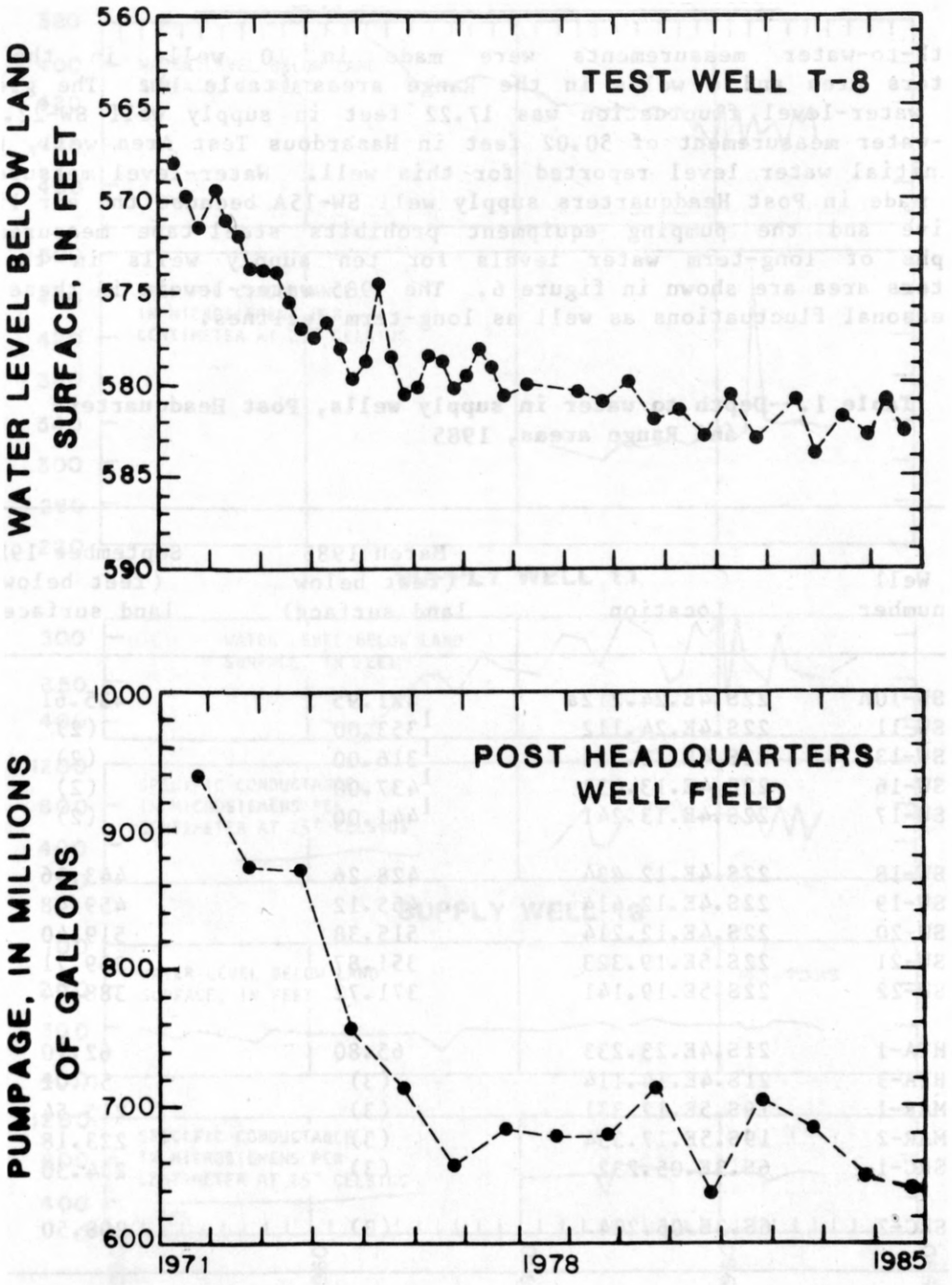


Figure 5.--Water levels in test well T-8 and yearly pumpage from the Post Headquarters well field, 1971-85.

Water-Level Measurements in Supply Wells

Depth-to-water measurements were made in 10 wells in the Post Headquarters area and 6 wells in the Range areas (table 1). The greatest seasonal water-level fluctuation was 17.22 feet in supply well SW-22. The depth-to-water measurement of 50.02 feet in Hazardous Test Area well, HTA-3, is the initial water level reported for this well. Water-level measurements were not made in Post Headquarters supply well SW-15A because the air line is inoperative and the pumping equipment prohibits steel-tape measurements. Hydrographs of long-term water levels for ten supply wells in the Post Headquarters area are shown in figure 6. The 1985 water-levels in these wells showed seasonal fluctuations as well as long-term declines.

Table 1.--Depth to water in supply wells, Post Headquarters and Range areas, 1985

Well number	Location	March 1985 (feet below land surface)	September 1985 (feet below land surface)
SW-10A	22S.4E.24.212a	421.95	435.61
SW-11	22S.4E.24.112	[1]353.00	(2)
SW-13	22S.4E.13.311	[1]316.00	(2)
SW-16	22S.4E.13.432	[1]437.00	(2)
SW-17	22S.4E.13.241	[1]441.00	(2)
SW-18	22S.4E.12.434	428.26	443.46
SW-19	22S.4E.12.414	455.12	459.48
SW-20	22S.4E.12.214	515.38	519.40
SW-21	22S.5E.19.323	351.87	359.71
SW-22	22S.5E.19.141	371.72	388.94
HTA-1	21S.4E.23.233	65.80	62.10
HTA-3	21S.4E.14.114	(3)	50.02
MAR-1	19S.5E.17.331	(3)	215.54
MAR-2	19S.5E.17.334	(3)	223.18
SRC-1	6S.3E.05.232	(3)	214.30
SRC-2	6S.3E.05.234	(3)	208.50

1 Air-line reading
2 Air line inoperative
3 Pumping

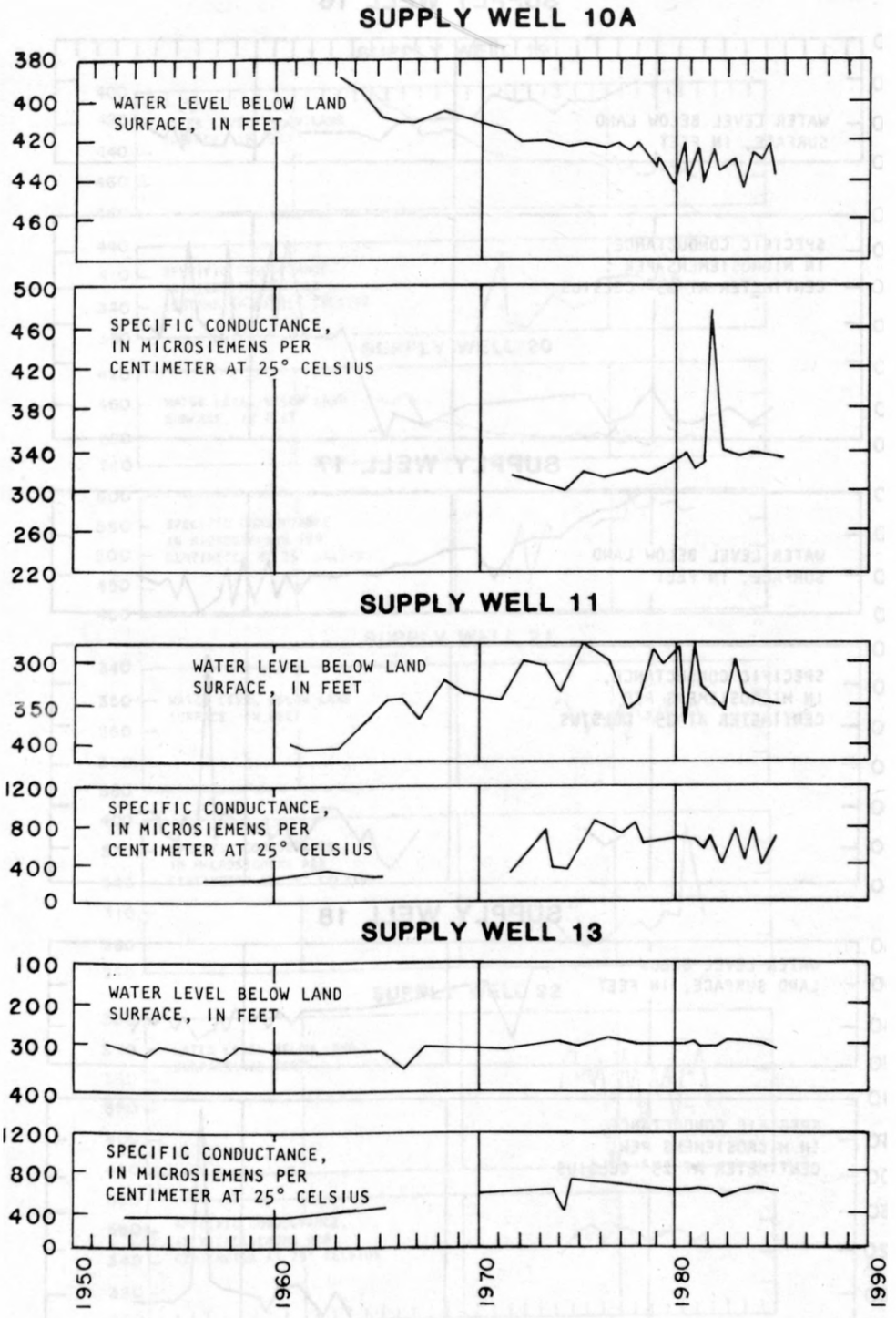


Figure 6.--Water levels and specific conductance for period of record available in selected supply wells.

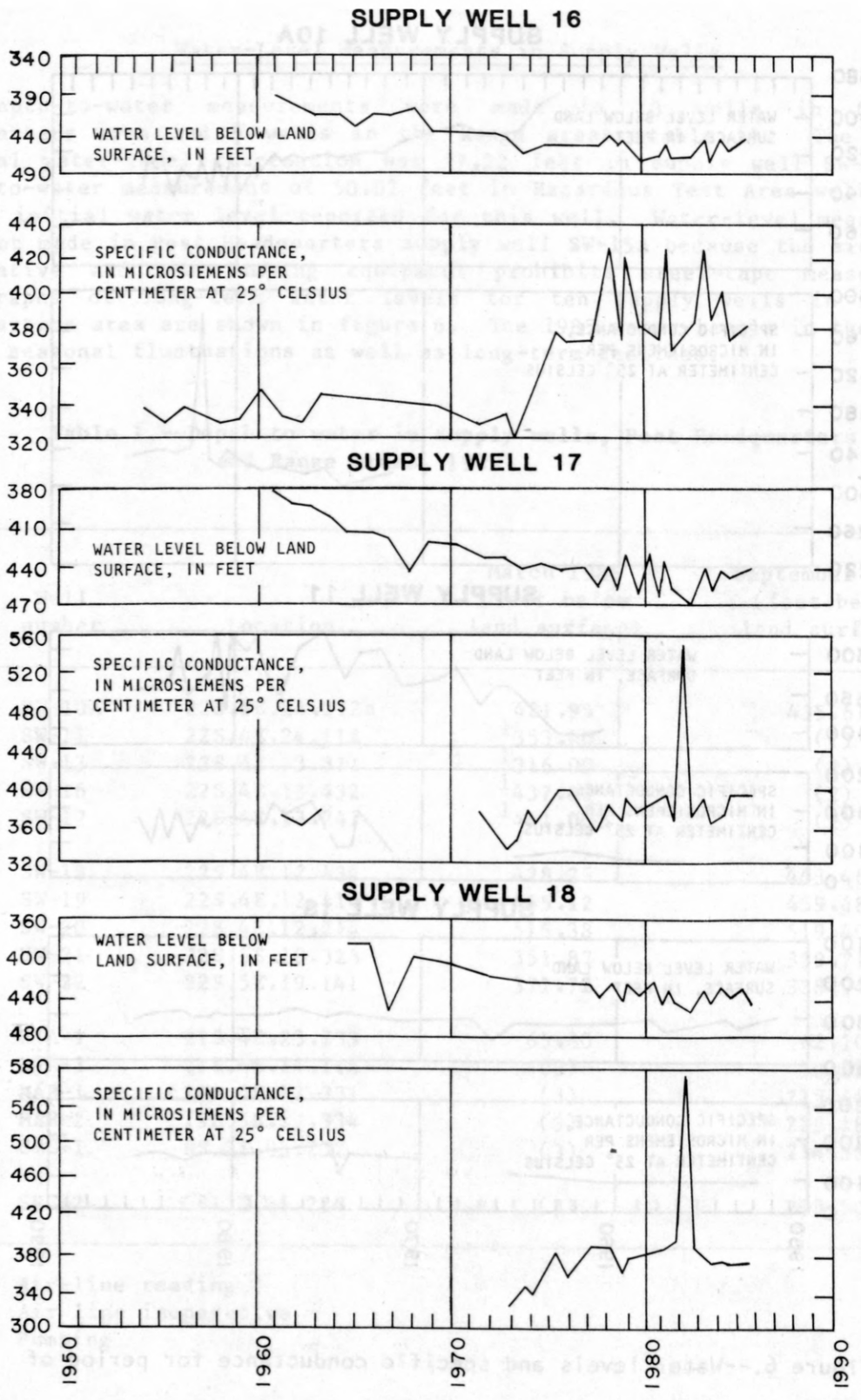


Figure 6.--Water levels and specific conductance for period of record available in selected supply wells - Continued.

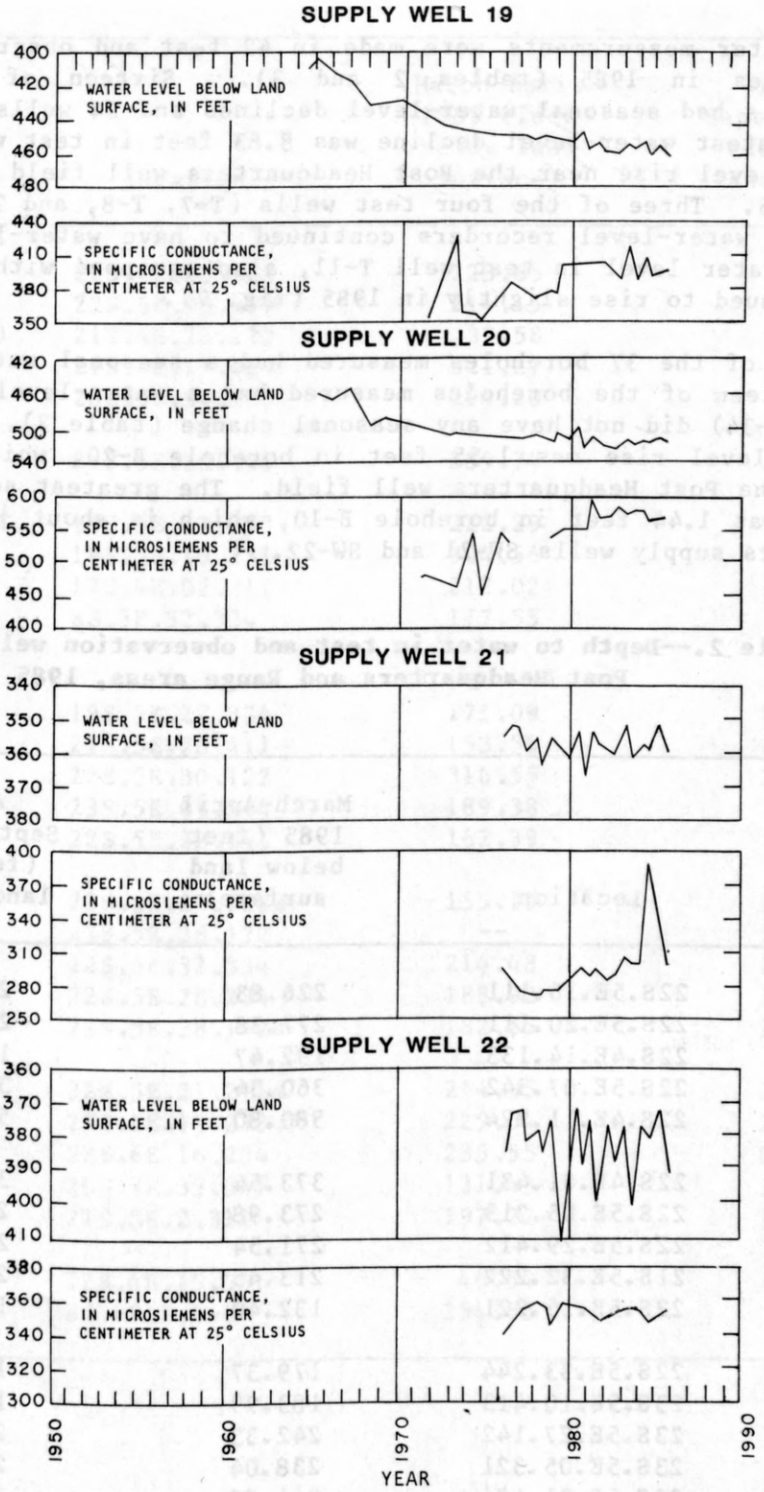


Figure 6.--Water levels and specific conductance for period of record available in selected supply wells - Concluded.

Water-Level Measurements in Test Wells, Observation Wells, and Boreholes

Depth-to-water measurements were made in 42 test and observation wells, and 37 boreholes in 1985 (tables 2 and 3). Sixteen of the test and observation wells had seasonal water-level declines and 24 wells had seasonal rises. The greatest water-level decline was 8.83 feet in test well T-7. The greatest water-level rise near the Post Headquarters well field was 1.81 feet in test well T-6. Three of the four test wells (T-7, T-8, and T-10) equipped with continuous water-level recorders continued to have water-level declines in 1985. The water level in test well T-11, also equipped with a continuous recorder, continued to rise slightly in 1985 (fig. 7).

Twenty-two of the 37 boreholes measured had a seasonal water-level rise in 1985. Thirteen of the boreholes measured had a water-level decline, and one borehole (B-34) did not have any seasonal change (table 3). The greatest seasonal water-level rise was 1.55 feet in borehole B-20, which is about 2 miles west of the Post Headquarters well field. The greatest seasonal water-level decline was 1.44 feet in borehole B-10, which is about ½ mile east of Post Headquarters supply wells SW-21 and SW-22.

Table 2.--Depth to water in test and observation wells, Post Headquarters and Range areas, 1985

Well number	Location	March-April 1985 (feet below land surface)	August-September 1985 (feet below land surface)
T-4	22S.5E.16.111	226.83	226.45
T-5	22S.5E.20.111	277.28	276.89
T-6	22S.4E.14.133	192.47	190.66
T-7	22S.5E.07.342	360.34	369.17
T-8	22S.4E.11.224	580.80	582.51
T-9	22S.4E.01.431	373.54	372.93
T-10	22S.5E.05.313	273.98	274.46
T-11	22S.5E.29.412	271.54	271.43
T-13	21S.5E.32.222	213.45	213.61
T-14	22S.5E.15.221	132.40	131.51
T-15	22S.5E.33.244	179.37	179.11
T-16	23S.5E.10.413	183.99	182.11
T-17	23S.5E.27.142	242.33	242.26
T-18	23S.5E.05.321	238.04	237.84
OS-9	22S.5E.31.424	244.79	244.51

Table 2.--Depth to water in test and observation wells, Post Headquarters and Range areas, 1985 - Concluded

Well number	Location	March-April 1985 (feet below land surface)	August-September 1985 (feet below land surface)
OS-12	22S.4E.23.214	223.65	233.25
Gregg	22S.6E.08.414	214.15	214.23
HTA (wm)	21S.4E.22.222	37.58	36.71
SMR-2	21S.5E.17.424	321.27	321.01
SMR-3	20S.5E.34.133	294.20	295.56
SMR-4	21S.5E.20.344	289.74	289.92
MAR-1 (test)	19S.5E.17.333	222.29	223.44
MAR-4	19S.5E.19.231	304.56	304.86
NW30-1	17S.4E.02.211	212.02	212.91
Murray	8S.5E.32.334	177.55	177.51
Lucero Ranch	19S.5E.22.334	171.09	171.04
CW	21S.5E.28.411	153.56	154.43
T-21	22S.5E.30.122	316.55	316.75
T-22	23S.5E.05.144	189.38	189.00
T-27	22S.5E.22.141	162.39	162.20
T-28A	22S.5E.22.122a	155.10	155.01
T-29	22S.5E.28.122	--	188.80
T-30	22S.5E.32.334	214.48	214.40
T-34	22S.5E.28.234	188.92	188.82
T-35	22S.5E.28.142a	182.55	190.24
T-38	22S.5E.21.211a	214.35	216.10
TW-1	22S.6E.16.233	229.04	229.99
TW-2	22S.6E.16.234	235.55	235.53
NT-1	20S.3E.35.341	131.43	128.28
NT-2	21S.3E.2.311	197.22	177.33
BLM	22S.4E.15.331	46.54	49.19
DC-1	8S.4E.2.444	254.65	--

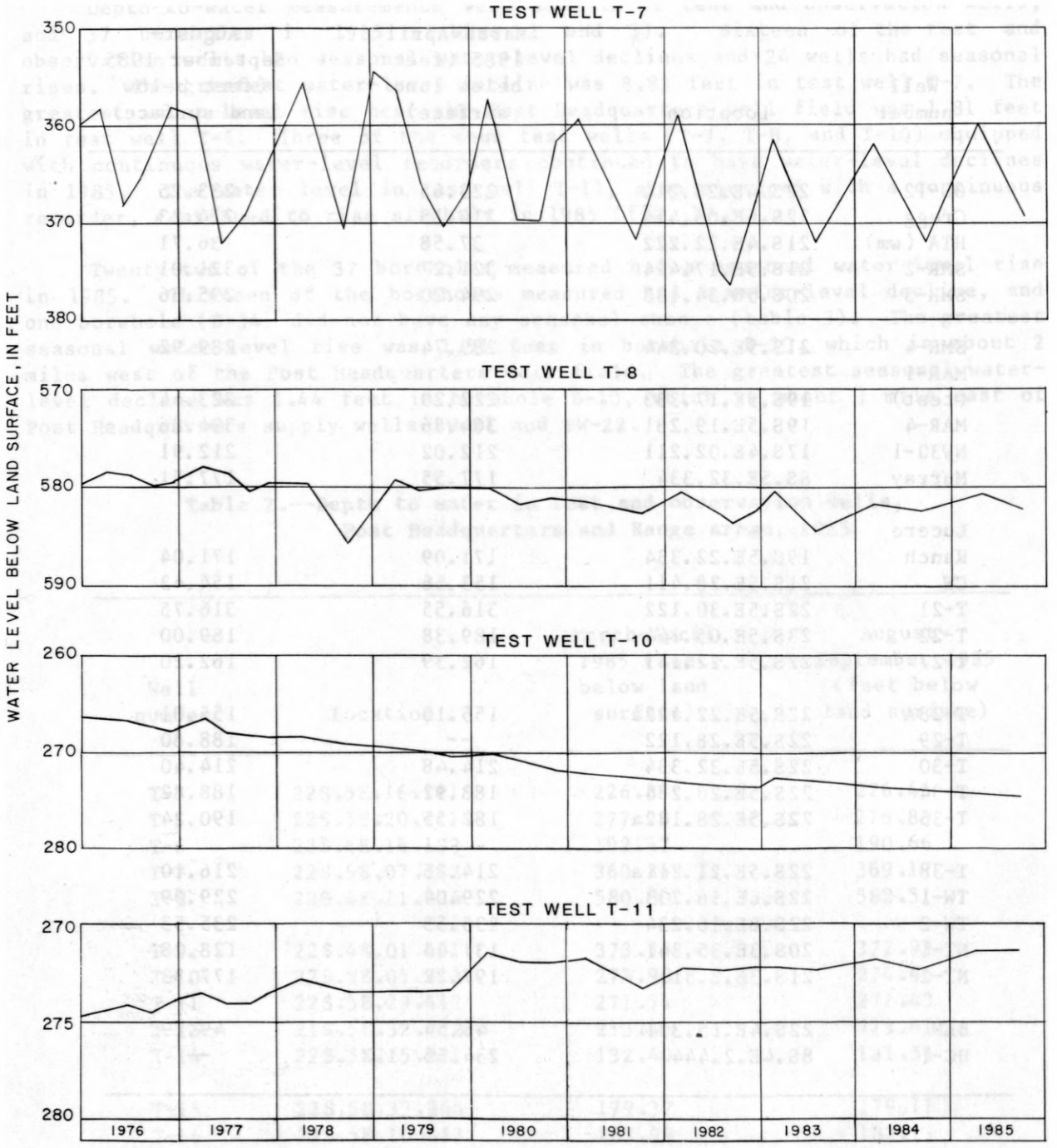


Figure 7.--Water levels in test wells T-7, T-8, T-10, and T-11, 1976-85.

Table 3.--Depth to water in boreholes, Post Headquarters and adjacent areas, 1985

Borehole number	Location	March-April 1985 (feet below land surface)	August-September 1985 (feet below land surface)
B-2	22S.5E.28.124	195.97	196.03
B-3	22S.5E.28.142	202.10	201.95
B-4	22S.5E.28.233	196.10	195.88
B-5	22S.5E.33.223	187.29	187.15
B-6	23S.5E.01.113	133.70	133.79
B-9	22S.5E.21.211	225.02	224.90
B-10	22S.5E.19.414	304.74	306.18
B-13	22S.5E.08.141	244.90	245.00
B-14	22S.5E.03.221	112.47	112.53
B-15	22S.5E.05.242	174.84	174.79
B-16	21S.5E.34.213	109.53	109.65
B-17	21S.5E.33.242	111.77	111.89
B-18	21S.5E.23.134	104.66	104.72
B-20	22S.4E.14.134	349.50	347.95
B-23	22S.5E.16.111	225.22	224.60
B-26	21S.6E.32.114	141.13	141.11
B-27	21S.6E.17.314	119.83	120.04
B-28	21S.5E.02.341	140.33	140.42
B-30	20S.5E.23.213	89.33	89.72
B-31	20S.6E.29.123	123.25	123.22
B-34	21S.5E.01.221	126.29	126.29
B-36	22S.4E.01.323	212.28	212.03
B-37	22S.4E.11.344	388.39	387.57
B-38	20S.6E.11.234	129.67	129.78
B-39	21S.6E.02.142	156.28	156.18
B-40	21S.6E.26.142	188.62	188.50
B-42	22S.4E.11.444	370.04	369.04
B-46	21S.5E.27.113	135.25	136.17
B-47	22S.5E.08.334	274.42	274.90
B-48	22S.6E.31.322	204.52	204.44

Table 3.--Depth to water in boreholes, Post Headquarters and adjacent areas, 1985 - Concluded

Borehole number	Location	March-April 1985 (feet below land surface)	August-September 1985 (feet below land surface)
B-49	22S.5E.09.113	202.84	--
B-50	22S.5E.07.242	308.08	307.48
B-51	22S.5E.26.312	147.34	146.30
B-52	22S.5E.09.113	211.10	211.05
B-54	22S.5E.16.111	230.03	229.98
B-55	22S.5E.09.113	213.65	214.79
B-56	22S.5E.30.424	276.35	276.03

Chemical Quality

Water samples were collected from six supply wells in the Post Headquarters area for major chemical-constituent analysis in 1985 (table 4). The dissolved-sodium concentrations ranged from 23 milligrams per liter in water from supply wells SW-10A and SW-19 to 33 milligrams per liter in water from supply well SW-22. The dissolved-chloride concentrations ranged from 8.5 milligrams per liter in water from supply well SW-15A to 27 milligrams per liter in water from supply well SW-16. The long-term specific conductance of water samples collected from ten supply wells in the Post Headquarters area is shown in figure 6. Monthly pH, specific conductance, and pumpage for 11 supply wells are shown in figure 8.

Nineteen water samples, 15 from Post Headquarters test and observation wells and 4 from Range area supply wells, were collected for pH and specific-conductance analyses (table 5). The pH ranged from 7.6 in water from test well T-6 to 8.3 in water from test wells T-8 and T-17. Specific conductance ranged from 254 microsiemens per centimeter at 25 degrees Celsius in water from test well T-17 to 2,010 microsiemens per centimeter at 25 degrees Celsius in water from test well T-14.

Table 4.—Major chemical-constituent analyses of water from selected supply wells, Post Headquarters area, 1985

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; deg C, degrees Celsius]

Well number	Location	Date of sample	Specific conductance, lab (µS/cm)	pH, lab (standard units)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium-adsorption ratio	Percent sodium	Potassium, dissolved (mg/L as K)
SW-10A	22S.4E.24.212a	09-09-85	352	8.1	1.8	35	8.0	23	.9	29	1.9
SW-11	22S.4E.24.112	09-09-85	627	7.9	8.1	69	17	29	.8	20	2.7
SW-15A	22S.4E.24.144	09-09-85	359	8.2	.65	34	6.0	28	1	35	2.0
SW-16	22S.4E.13.432	09-09-85	458	8.2	4.1	48	11	26	.9	25	2.2
SW-19	22S.4E.12.414	09-09-85	378	8.2	1.3	41	8.0	23	.9	27	2.0
SW-22	22S.5E.19.141	09-09-85	362	8.2	.85	34	5.1	33	1	40	1.9

Well number	Date of sample	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Solids, residue at 180 deg C, dissolved (mg/L)	Hardness (mg/L as $CaCO_3$)	Hardness, noncarbonate (mg/L as $CaCO_3$)	Alkalinity, lab (mg/L as $CaCO_3$)
SW-10A	09-09-85	19	49	.30	44	230	235	120	35	86
SW-11	09-09-85	24	120	.40	44	380	425	240	119	124
SW-15A	09-09-85	8.5	42	.40	36	220	233	110	12	98
SW-16	09-09-85	27	56	.30	42	270	299	170	67	98
SW-19	09-09-85	11	34	.10	41	230	251	140	18	118
SW-22	09-09-85	11	52	.40	33	230	237	110	4	102

Table 5.--Specific conductance and pH of water samples collected from test wells in the Post Headquarters area and supply wells in Range areas, summer 1985

[μS/cm, microsiemens per centimeter at 25 degrees Celsius]

Well number	Specific conductance, lab (μS/cm)	pH (lab)	Sampling point (feet below land surface)
Post Headquarters			
T-4	310	7.9	325
T-5	387	7.8	330
T-6	437	7.6	350
T-7	350	7.9	444
T-8	643	8.3	915
T-9	872	7.8	550
T-10	330	8.2	513
T-11	274	8.0	550
OS-12	478	7.8	350
T-13	499	8.0	320
T-14	2,010	8.1	300
T-15	310	8.0	400
T-16	361	7.8	300
T-17	254	8.3	350
T-18	709	8.0	350
Range areas			
SMR-1	694	8.0	pumping
HTA-1	745	8.0	do.
MAR-1	779	7.8	do.
MAR-2	745	7.7	do.

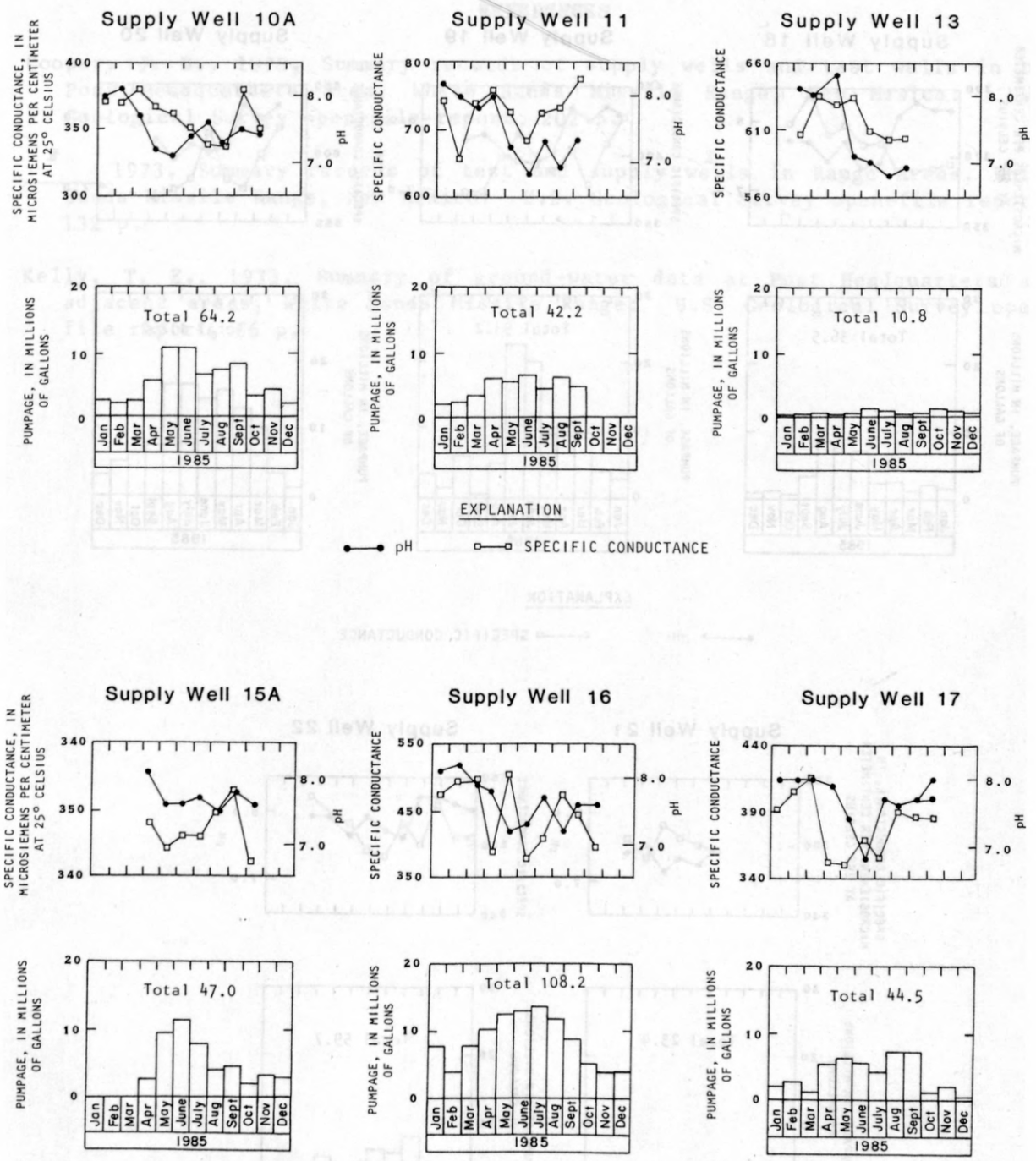


Figure 8.--Monthly specific conductance, pH, and pumpage for Post Headquarters supply wells.

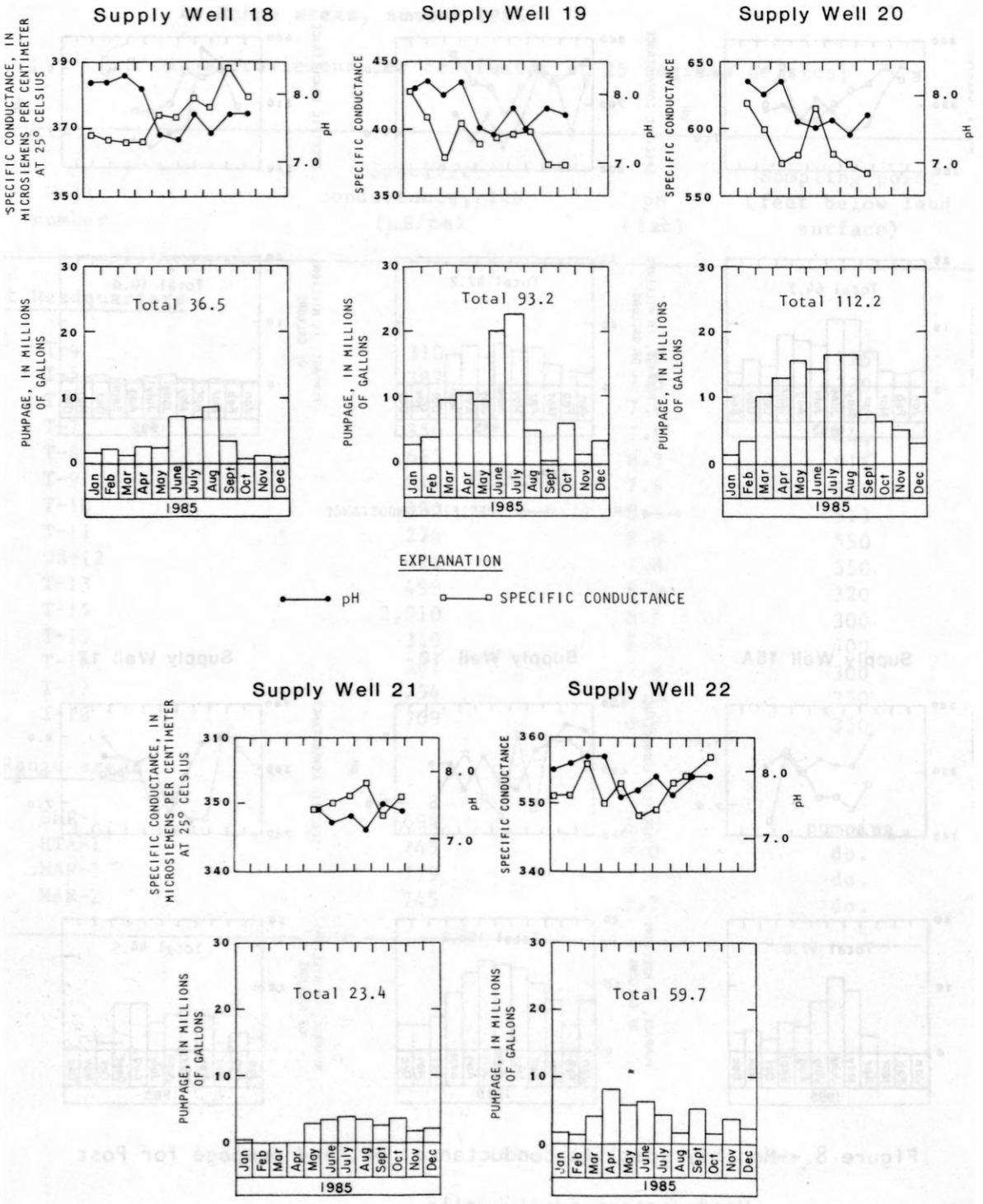


Figure 8.--Monthly specific conductance, pH, and pumpage for Post Headquarters supply wells - Concluded.

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