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ANNUAL WATER-RESOURCES REVIEW

WHITE SANDS MISSILE RANGE NEW MEXICO

1979

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White Sands Missile Range

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WHITE SANDS MISSILE RANGE, NEW MEXICO, 1979

By R. R. Cruz

Open-File Report 80-753

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Albuquerque, New Mexico

May 1980

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INCH-POUND TO METRIC UNIT CONVERSION FACTORS

In this report figures for measurements are given in English units only. The following table contains factors for converting to metric units.

Multiply U.S. Customary units	By	To obtain metric units
°F (Fahrenheit)	(°F-32)/1.8	°C (Celsius)
in (inch)	25.4	mm (millimeter)
ft (foot)	.3048	m (meter)
mi (mile)	1.609	km (kilometer)
gal (gallon)	.003785	m^3 (cubic meter)
acre-foot (acre-foot)	1233	m^3 (cubic meter)

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ABSTRACT

Ground-water data were collected in 1979 at White Sands Missile Range in south-central New Mexico. Total ground-water pumpage from the Post Headquarters well field, which produces more than 98 percent of the water used at White Sands Missile Range, was 1.4 million gallons more in 1979 then in 1978. The most significant seasonal water-level declines observed in 1979 were in supply well 22 (36.35 feet) and test well T-7 (15.98 feet). The chemical quality of water samples collected in 1979 was similar to that collected at comparable depths and periods in 1978.

INTRODUCTION

This report presents water-resources information that was collected at White Sands Missile Range during 1979 by personnel of the U.S. Geological Survey. 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 Facilities Engineering Directorate, White Sands Missile Range.

The 1967 report and reports prior to 1967 received administrative release only. The 1968 report and subsequent annual reports are open-file reports and are available for inspection at the U.S. Geological Survey, Water Resources Division, District Office in Albuquerque, New Mexico.

CONTINUING OBSERVATIONS

The program to collect hydrologic data at White Sands Missile Range (fig. 1) has been continuous since 1953. The original program consisted of water-level observations in five test wells in the Post Headquarters area. Over the years the program has expanded. In 1979, the program consisted of semiannual water-level measurements in 16 supply wells, 25 test and observation wells, and 39 boreholes. In addition, 51 water samples were collected for laboratory specific conductance measurements, 13 samples were collected for complete chemical analysis, and 2 were collected for partial chemical analysis.

Pumpage and water-level fluctuations

Total ground-water pumpage* at White Sands Missile Range in 1979, according to records provided by the Facilities Engineering Directorate, was 692,572,000 gallons. The Post Headquarters well field produced 681,796,000 gallons; Stallion Range Center wells (SRC-1 and -2) 8,223,000 gallons; and Hazardous Test Area well (HTA-1), Small Missile Range (SMR-1), and Multifunction Array Radar (MAR-1 and -2) wells combined produced 2,553,000 gallons in five months of available record for 1979. The Post Headquarters well field, which produced more than 98 percent of the water used at White Sands Missile Range, pumped approximately 1.4 million gallons more in 1979 than in 1978.

Figure 2 shows pumpage by month and total gallons pumped per year in the Post Headquarters well field, 1965-79. Hydrographs on figure 3 show water-level fluctuations in wells T-7, T-8, T-10, and T-11, 1970-79. The location of supply wells, test wells, and boreholes on White Sands Missile Range is shown on figure 4, 5, and 6.

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

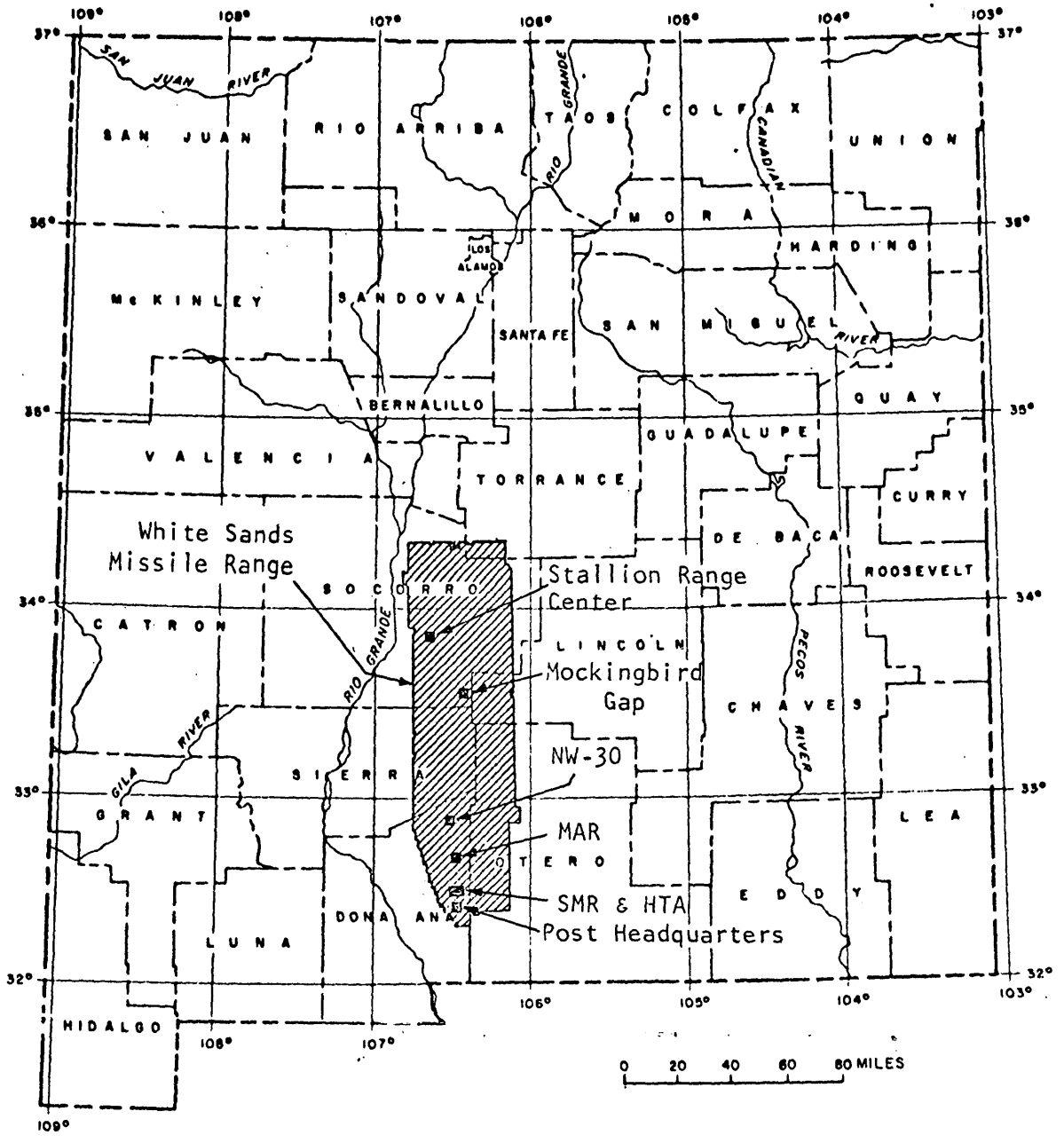


Figure 1.--White Sands Missile Range and areas of hydrologic observations.

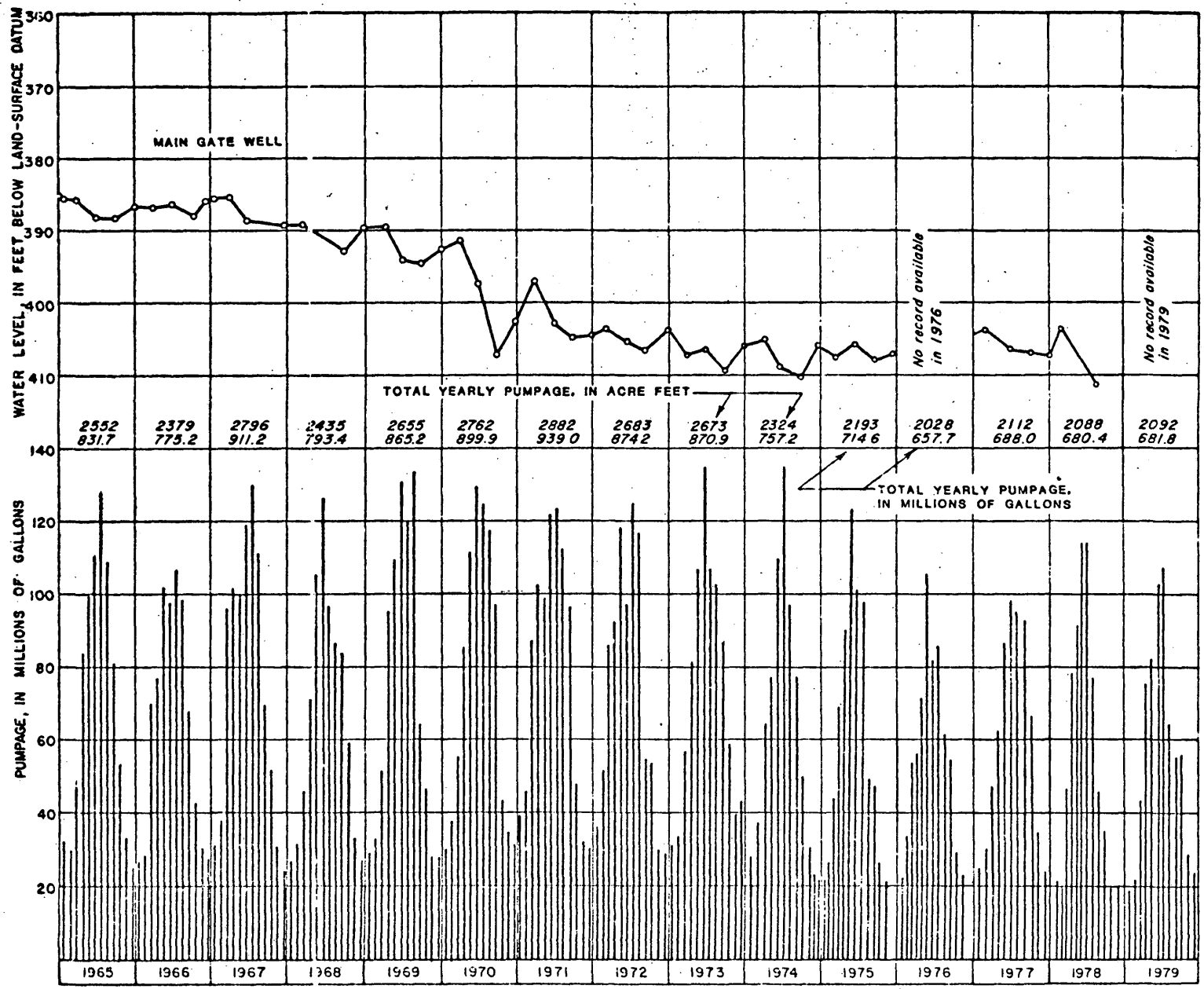


Figure 2.--Monthly and yearly pumpage in the Post Headquarters well field and water-level fluctuations in the Main Gate well, 1965-79.

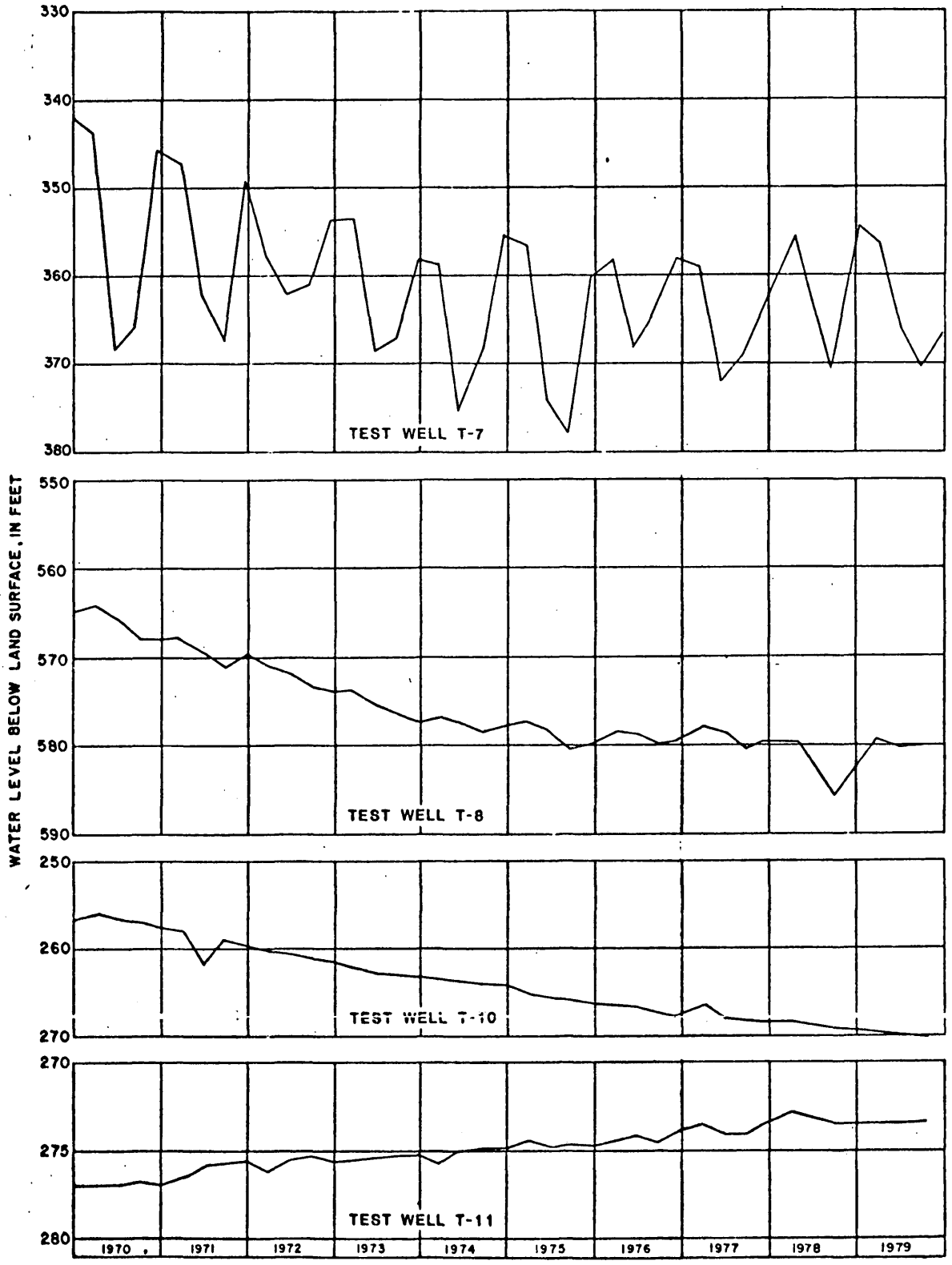


Figure 3.--Water-level fluctuations in test wells T-7, T-8 T-10 and T-11, 1970-79.

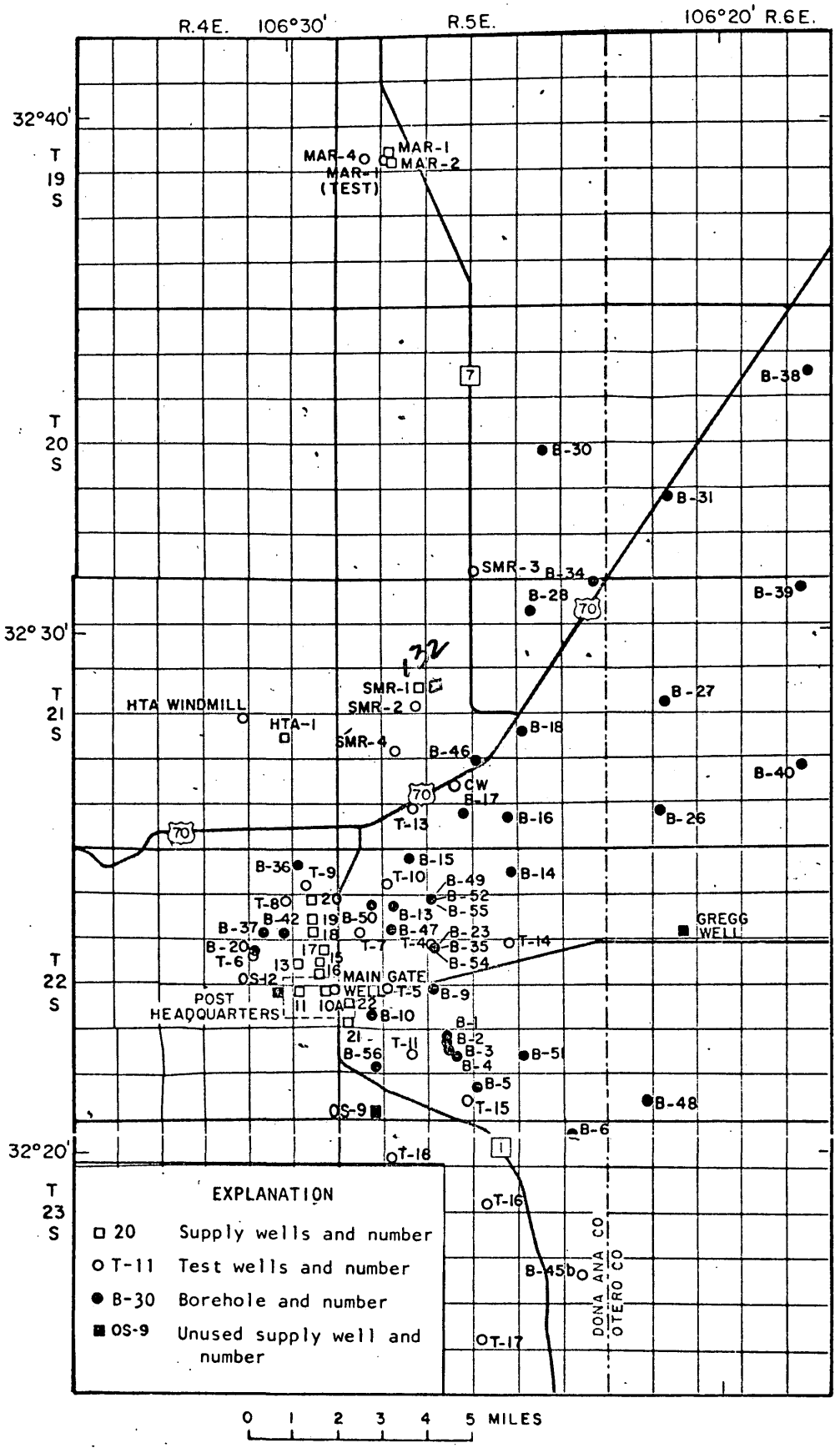


Figure 4.--Location of supply wells, test wells, observation wells, and boreholes in the Post Headquarters and adjacent areas.

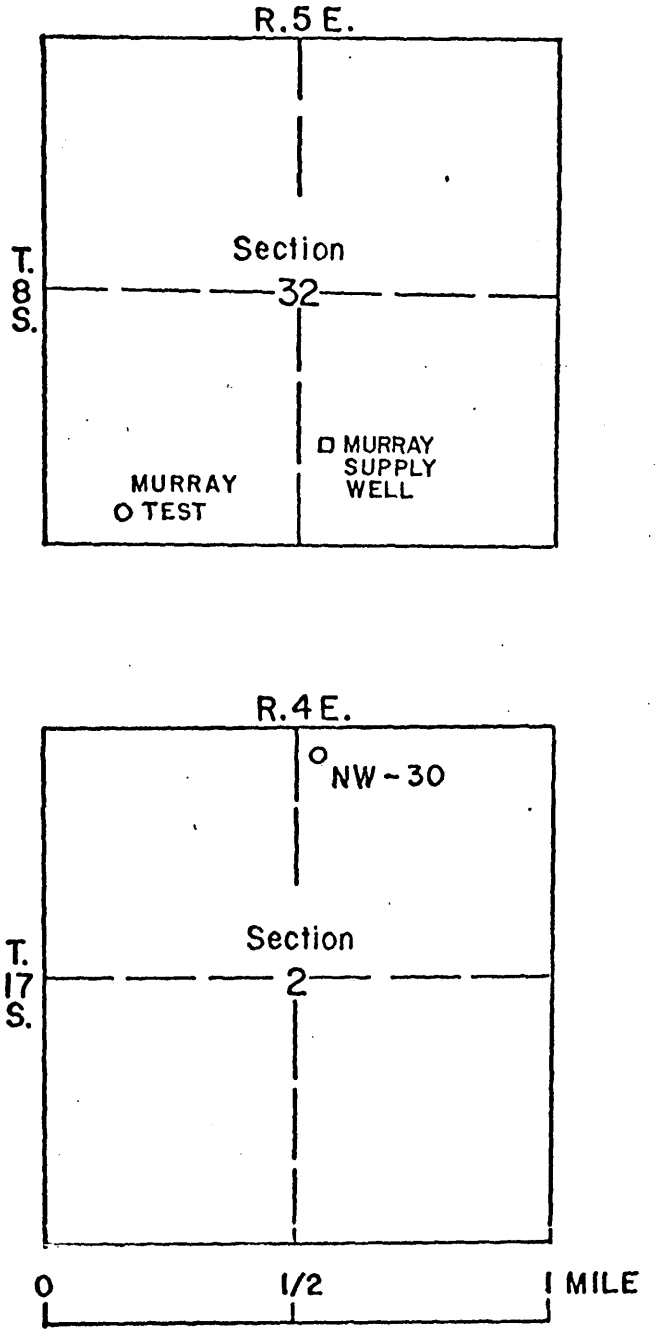


Figure 5.--Location of wells in Mockingbird Gap and NW-30 areas.

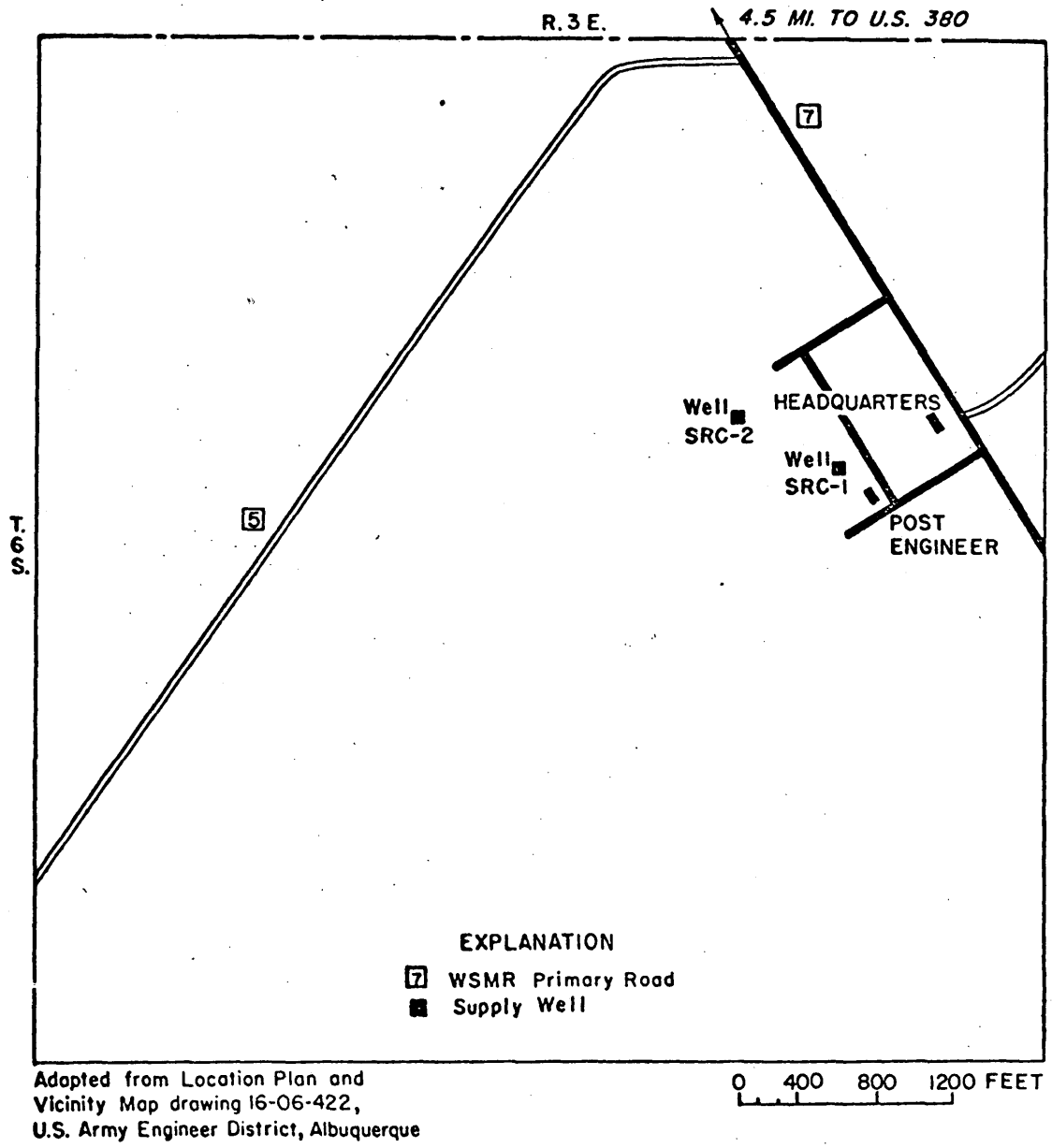


Figure 6.--Location of supply wells, Stallion Range Center.

Water-level measurements in supply wells

Semiannual depth-to-water measurements were made in 11 supply wells in the Post Headquarters area and in 5 supply wells in the Range areas, as shown in table 1. Hydrographs of the supply wells in the Post Headquarters well field for period of record are shown on figures 7 through 9.

Water-level measurements in test wells, observation wells, and boreholes

Semiannual depth-to-water measurements were made in 25 test or observation wells and 39 boreholes. The measurements were made in February and August 1979 and are listed in tables 2 and 3. Four of the test wells in the Post Headquarters area are equipped with continuous recorders. Hydrographs of these test wells are shown in figure 3. The map of water-table contours in the Post Headquarters area is shown in figure 10.

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

Well	February 1979 (feet below land surface)	August 1979 (feet below land surface)
10a	424.04	439.54
11	274.40*	316.00*
13	297.29	300.86
15	429.60*	452.00*
16	437.60*	465.00*
17	433.28	461.52
18	421.59	437.00
19	448.85	454.20
20	508.09	513.46
21	354.10	361.63
22	374.97	411.32
SMR-1	303.59	-
MAR-1	214.01	214.00
MAR-2	219.65	218.72
SRC-1	205.00	208.70
SRC-2	209.42	214.11

* Air line reading

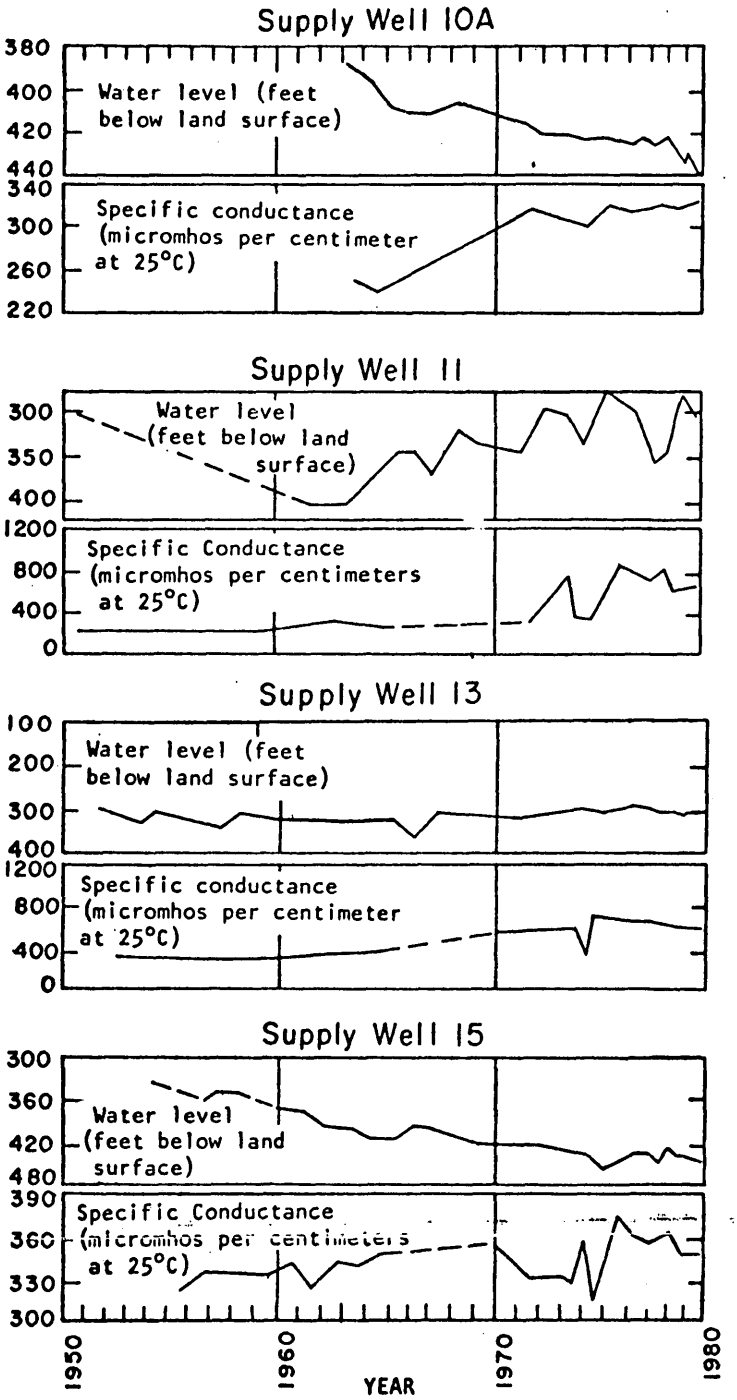


Figure 7.--Water level and specific conductance for period of record available in supply wells 10a, 11, 13, and 15.

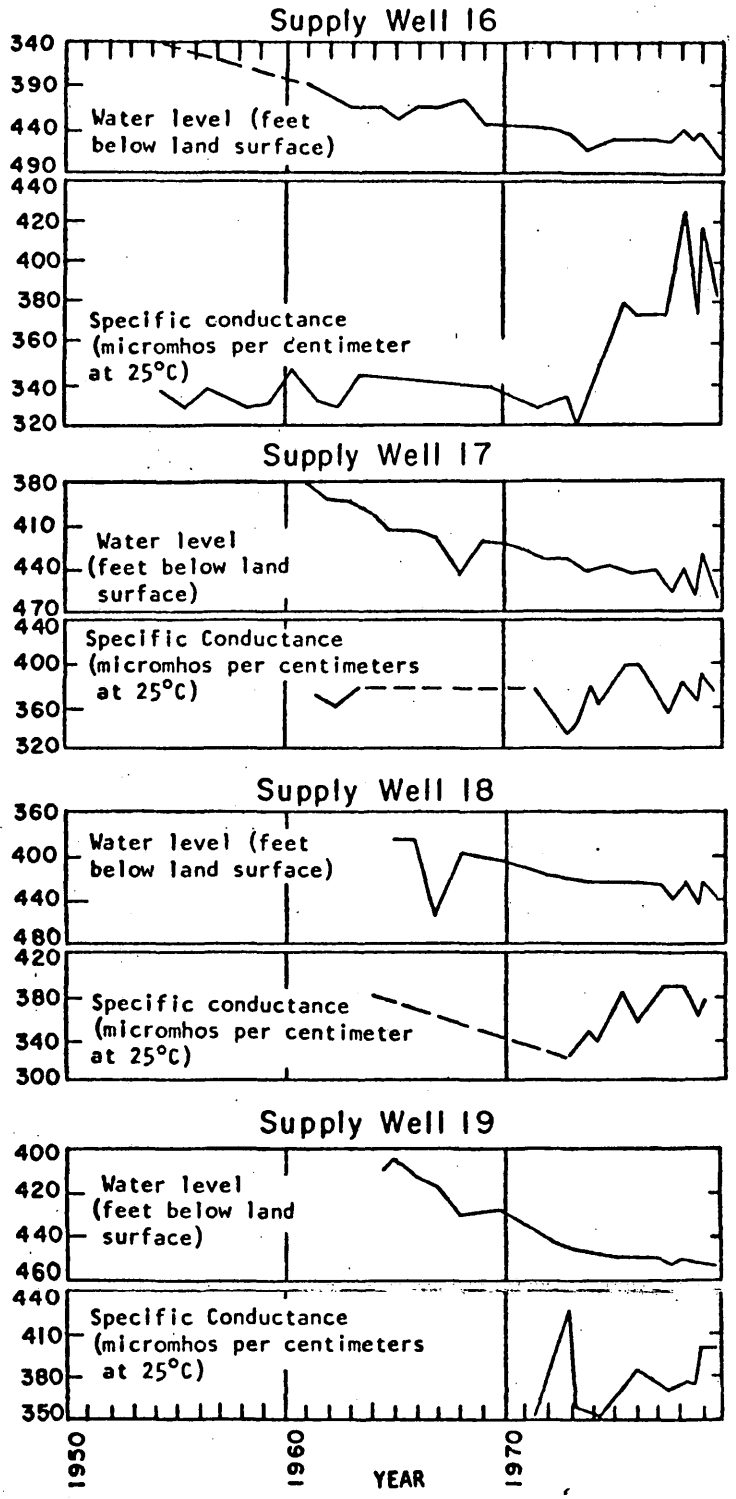


Figure 8.--Water level and specific conductance for period of record available in supply wells, 16, 17, 18, and 19.

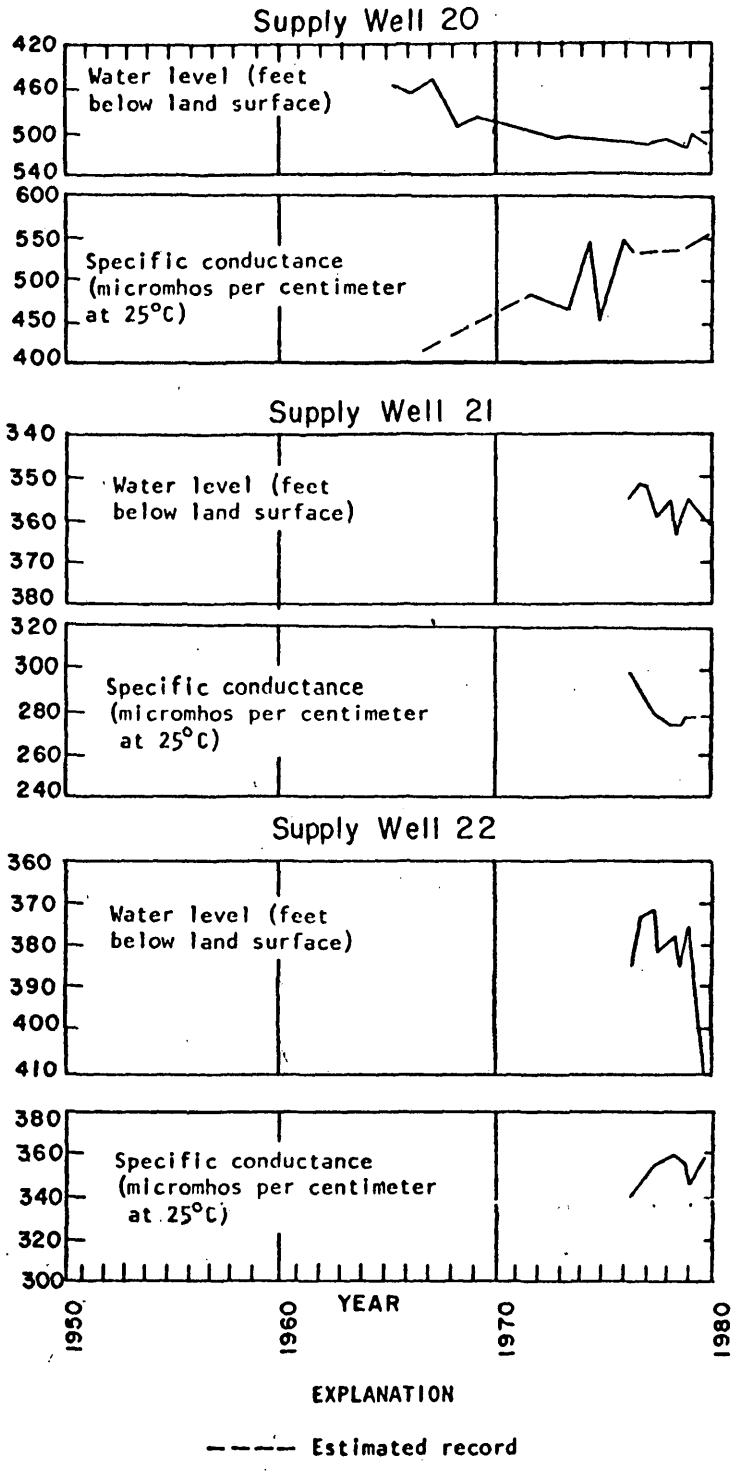
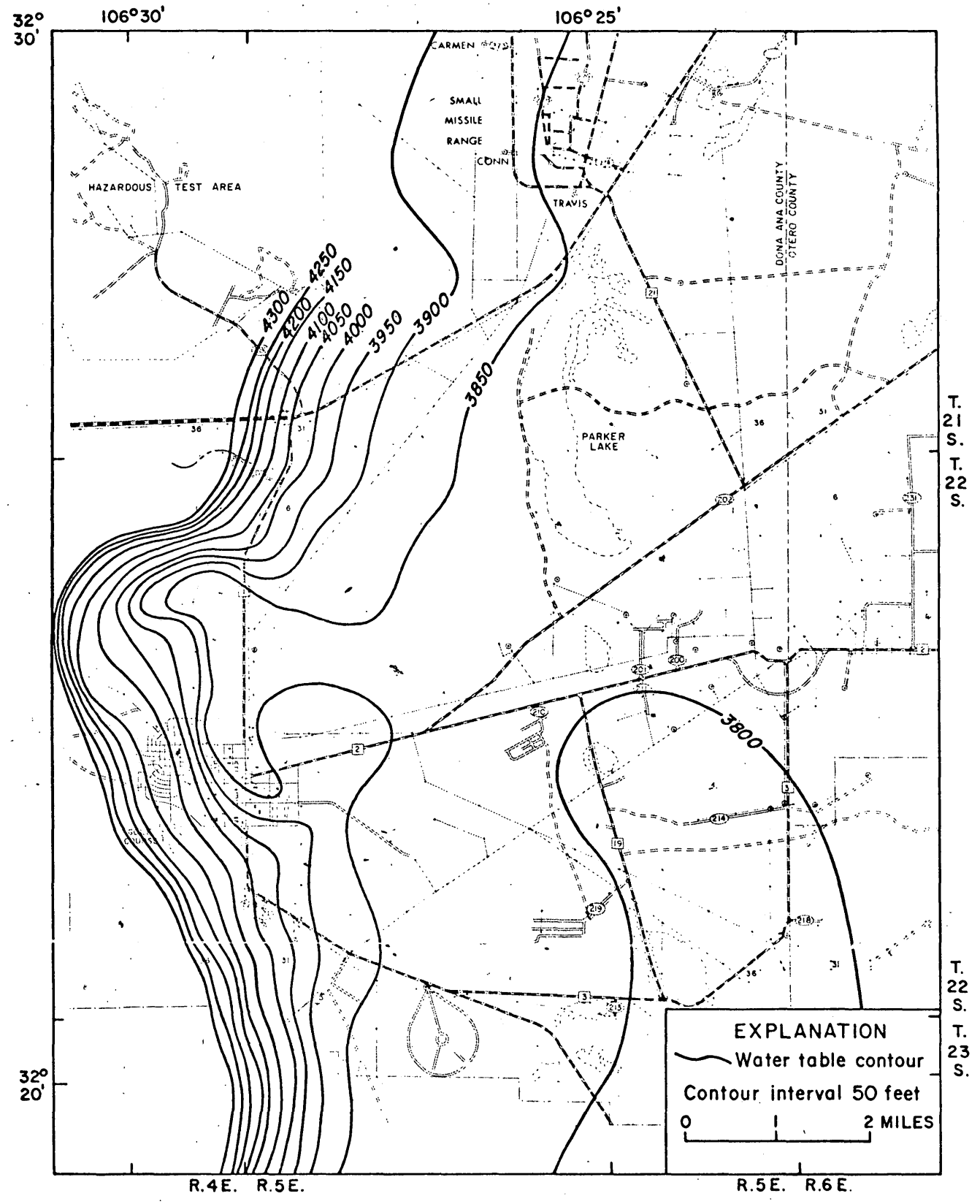


Figure 9.--Water level and specific conductance for period of record available in supply wells 20, 21, and 22.



Base from White Sands Missile Range Master Plan Basic Information Maps, 1972

Compiled by S. F. Richey

Figure 10.--Water-table contours in the Post Headquarters area, February, 1979.

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

Well number	February 1979 (feet below land surface)	August 1979 (feet below land surface)
T-4	225.97	226.29
T-5	275.75	275.89
T-6	209.79	207.74
T-7	355.44	371.42
T-8	580.25	580.82
T-9	400.58	400.84
T-10	269.69	270.13
T-11	273.34	273.51
T-13	-	217.66
T-14	132.90	132.02
T-15	178.55	178.54
T-16	186.20	185.61
T-17	242.24	242.47
T-18	240.21	240.40
Gate	Dry	Dry
OS-9	250.00	250.39
OS-12	248.87	248.04
Gregg	213.58	213.85
HTA	39.89	36.40
SMR-2	317.12	316.92
SMR-3	295.42	295.61
SMR-4	-	286.00
MAR-1	220.79	220.82
MAR-4	303.76	303.88
NW-30	212.45	212.44
Murray	176.74	176.97

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

Well number	February 1979 (feet below land surface)	August 1979 (feet below land surface)
B-1	193.68	193.68
B-2	196.80	196.48
B-3	203.91	203.99
B-4	197.84	198.00
B-5	188.14	188.18
B-6	134.04	134.18
B-9	225.35	225.55
B-10	305.75	306.63
B-13	240.35	240.87
B-14	111.92	111.87
B-15	171.58	172.03
B-16	108.81	109.08
B-17	111.06	111.41
B-18	103.67	103.83
B-20	348.17	348.44
B-23	224.00	224.47
B-26	140.68	140.98
B-27	119.55	119.80
B-28	139.84	139.90
B-30	89.46	89.54

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

Well number	February 1979 (feet below land surface)	August 1979 (feet below land surface)
B-31	123.02	123.34
B-34	126.02	126.10
B-35	227.14	225.07
B-36	213.91	213.10
B-37	409.88	408.65
B-38	129.29	129.37
B-39	156.14	156.27
B-40	188.53	188.53
B-42	385.75	386.02
B-46	135.10	135.91
B-47	271.77	272.80
B-48	204.32	204.49
B-49	199.34	198.84
B-50	301.60	302.07
B-51	146.88	146.78
B-52	209.62	209.98
B-54	228.44	228.67
B-55	214.09	214.50
B-56	280.16	280.34

Chemical quality

Fifty-one samples were collected for laboratory specific conductance determination and pH values (see table 4). Thirteen water samples from 12 wells in 1979 were collected for complete chemical analyses, one for fluoride analysis and one for nitrate-nitrite analysis (table 5). Specific conductance and pH values for selected wells in the Post Headquarters area are shown on figure 11.

All the water samples collected in 1979 from test wells were obtained using the U.S. Geological Survey New Mexico District's geophysical-logging equipment, with the exception of the water sample collected from test well T-13. An electrically controlled stainless-steel sampling tube was lowered to the desired depth in each well with the sampler ports closed. The entry ports at the top of the tube were then opened and remained open until the tube was filled; the ports were then closed and the tube was raised to the surface. Each sample was then put in appropriate containers for transportation to the laboratory.

The water samples from the supply wells were collected after a minimum of one hour of pumping time by White Sands Missile Range personnel. The water samples from the boreholes were collected with a small-diameter bailer. Test well T-13 was equipped with a pump. Water from this well and from a new well (figure 4), referred to as CW (Construction Well), was used in the construction work on an approximately 10-mile portion of Interstate 70 (from 3 miles southwest of the SMR gate northeast to the Dona Ana-Otero County line). Water samples from T-13 and CW were collected in the same manner as those from the supply wells.

Table 4.--Specific conductances of water samples collected from supply wells, test wells, and boreholes, 1979

Part I.--Supply wells

Well number	1979 Specific conductance (lab) (micromhos per centimeter at 25°C) winter	summer	Remarks
10-A	318	323	Sample collected after 1 hour pumping time.
11	671	694	Do.
13	609	615	do.
15	351	352	do.
16	414	384	do.
17	386	379	do.
18	380	-	do.
19	402	398	do.
20	558	554	do.
21	279	-	do.
22	351	359	do.
HTA-1	695	-	do.
SMR-1	785	785	do.
MAR-1	883	894	do.
MAR-2	780	769	do.
SRC-1	3,470	3,460	do.
SRC-2	3,490	3,460	do.
SRC-(Product water)	429	363	do.
Murray	1,050	-	do.

Table 4.--Specific conductances of water samples collected from supply wells, test wells, and boreholes, 1979 - concluded

Part II.--Test wells

Well number	1979 Specific conductance (lab) (micromhos per centimeter at 25°C)		Sampling points (feet below land surface)
	winter	summer	
T-4	-	279	325
T-5	-	361	330
T-6	-	443	350
T-7	-	349	444
T-7	-	421	840
T-8	-	678	610
T-8	-	647	915
T-9	-	866	550
T-10	-	349	513
T-11	-	303	570
T-13	498	-	well being pumped
T-14	-	1,120	200
T-14	-	1,915	300
T-15	-	597	400
Part III.--Boreholes			
B-23	-	216	226
B-35	-	214	226
B-54	-	239	228

Table 5.--Chemical analyses of water from selected wells, White Sands Missile Range

(milligrams per liter)

Well	T-13	15	16	17	19	
Laboratory No	790608	790603	790604	790605	790606	
Date of collection	2-22-79	2-16-79	2-16-79	2-16-79	2-16-79	
Depth sampled (feet)	-	-	-	-	-	
Silica (SiO_2)	35	37	40	32	38	
Iron* (Fe)	0	10	10	0	0	
Manganese* (Mn)	0	0	0	0	0	
Calcium (Ca)	51	35	45	38	41	
Magnesium (Mg)	11	5.9	9.0	5.5	8.6	
Sodium (Na)	34	30	27	40	29	
Potassium (K)	3.6	2.1	2.4	2.1	2.2	
Bicarbonate (HCO_3)	146	134	117	122	146	
Carbonate (CO_3)	0	0	0	0	0	
Alkalinity as $CaCO_3$	120	110	96	100	120	
Sulfate (SO_4)	94	55	55	72	65	
Chloride (Cl)	26	-	25	18	16	
Fluoride (F)	0.9	0.4	0.4	0.5	0.4	
Nitrate (NO_3)	1.9	0.79	2.7	1.1	1.1	
Nitrite (NO_2)						
Phosphorous, ortho, Dissolved as P	0.01	0.02	0.03	0.00	0.00	
Boron* (B)	70	30	50	40	30	
Dissolved Solids (calculated)	336	235	274	273	277	
Hardness as $CaCO_3$	170	110	150	120	140	
Noncarbonate hardness as $CaCO_3$	53	2	53	18	18	
Sodium Adsorption Ratio (SAR)	1.1	1.2	1.0	1.6	1.1	
Specific conductance Lab (micromhos at 25°C)	510	367	427	390	406	
pH (lab)	7.7	7.9	7.9	8.0	8.0	
Temperature, °Celsius (C)						
Carbon dioxide (CO_2)	3.8	2.2	1.9	1.6	1.9	

* Micrograms per liter

Table 5.--Chemical analyses of water from selected wells, White Sands Missile Range - Continued

(milligrams per liter)

Well	MAR-2	CONST.	HTA-1	11	22
Laboratory No	790591	790609	790607	790592	791489
Date of collection	2-16-79	2-22-79	2-16-79	2-16-79	8-09-79
Depth sampled (feet)	-	-	-	-	-
Silica (SiO_2)	20	31			35
Iron* (Fe)	0	10			0
Manganese* (Mn)	60	10			0
Calcium (Ca)	73	74			33
Magnesium (Mg)	41	14			4.8
Sodium (Na)	36	45			35
Potassium (K)	2.5	3.8			2.3
Bicarbonate (HCO_3)	256	134			122
Carbonate (CO_3)	0	0			0
Alkalinity as $CaCO_3$	210	110			100
Sulfate (SO_4)	180	140			61
Chloride (Cl)	33				9.5
Fluoride (F)	0.3	2.3	4.6		0.3
Nitrate (NO_3) / Nitrite (NO_2)	0.93	2.4		9.2	.92
Phosphorous, ortho, Dissolved as P	0.70	0.00			0.01
Boron* (B)	80	70			40
Dissolved Solids (calculated)	518	387			245
Hardness as $CaCO_3$	350	240			100
Noncarbonate hardness as $CaCO_3$	140	130			2
Sodium Adsorption Ratio (SAR)	0.8	1.3			1.5
Specific conductance Lab (micromhos at 25°C)	801	676	711	703	359
pH (lab)	7.8	7.8	7.9	7.7	8.1
Temperature, °Celsius (C)					
Carbon dioxide (CO_2)	5.2	2.8			1.3

* Micrograms per liter

Table 5.--Chemical analyses of water from selected wells, White Sands Missile Range - Concluded

(milligrams per liter)

Well	T-4	T-5	T-7	T-7	T-8
Laboratory No	791484	791485			
Date of collection	8-08-79	8-08-79	8-07-79	8-07-79	8-09-79
Depth sampled (feet)	325	330	444	840	915
Silica (SiO_2)	26	35	32	34	31
Iron* (Fe)	30	20	0	10	0
Manganese* (Mn)	1	0	0	0	30
Calcium (Ca)	25	34	33	29	58
Magnesium (Mg)	4.0	6.4	4.7	10	20
Sodium (Na)	25	28	38	48	46
Potassium (K)	2.5	2.5	2.4	2.6	3.7
Bicarbonate (HCO_3)	79	102	122	122	134
Carbonate (CO_3)	0	0	0	0	0
Alkalinity as $CaCO_3$	65	84	100	100	110
Sulfate (SO_4)	47	63	47	72	140
Chloride (Cl)	15	18	19	28	38
Fluoride (F)	0.3	0.3	0.3	0.4	0.7
Nitrate (NO_3) / Nitrite (NO_2)	1.2	2.6	1.9	1.5	1.7
Phosphorous, ortho, Dissolved as P	0.00	0.00	0.01	0.00	0.0
Boron* (B)	50	30	60	30	50
Dissolved Solids (calculated)	189	249	245	291	411
Hardness as $CaCO_3$	79	110	100	110	230
Noncarbonate hardness as $CaCO_3$	14	27	2	14	120
Sodium Adsorption Ratio (SAR)	1.2	-	1.6	2.0	0.56
Specific conductance Lab (micromhos at 25°C)	281	368	353	426	654
pH (lab)	8.3	8.1	8.0	8.1	7.9
Temperature, °Celsius (C)	26.5	27.0	27	27.5	27.0
Carbon dioxide (CO_2)	.5	1.1	1.6	1.3	2.2

* Micrograms per liter

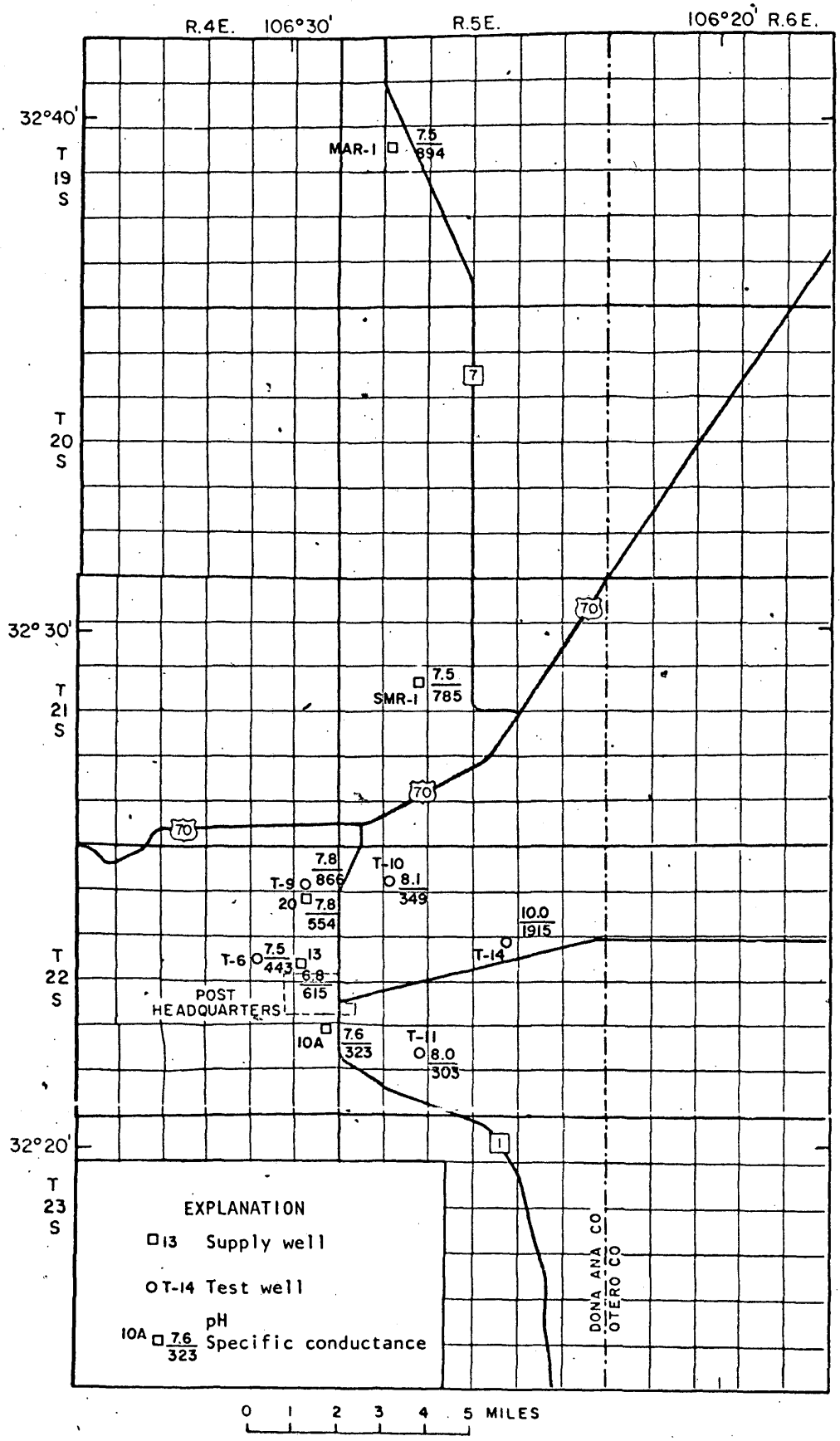


Figure 11.--Specific conductance and pH values of water from selected wells, Post Headquarters and Range areas, 1979.

MISCELLANEOUS OBSERVATIONS

Slug-tests were performed on seven boreholes (B-12, B-35, B-37, B-46, B-51, B-54, and B-55) in March 1979 to determine if there was any hydraulic connection between these wells and the water table in the surrounding formation. Previous total-depth measurements in these boreholes indicated sand and silt had filled the casing to a level above the perforated interval. Approximately three gallons of water were injected into each of these wells to impose a head, then water-levels were monitored. Water levels in all of the wells, except B-12, declined to static or approached static levels in less than 1 hour. Borehole B-12 never did return to static level, therefore it was concluded B-12 was plugged and measurements were discontinued.

The specific conductance in test well T-14 at the two sampling depths has changed somewhat over the years. The specific conductance at a depth of 200 feet was 404 in 1975 as compared to 1,120 in 1979. The specific conductance at a depth of 300 feet was 2,780 in 1975 as compared to 1,915 in 1979.

The water-level declines from 1978 to 1979 noted in and around test well T-13 and the construction well, which supplied water for highway construction, ranged from less than 1 foot in boreholes B-15, B-17, and B-46 to 6.5 feet in test well T-13.

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