UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN FILE 79-985

ANNUAL WATER-RESOURCES REVIEW

WHITE SANDS MISSILE RANGE NEW MEXICO

1978

Prepared in cooperation with
White Sands Missile Range

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By R. R. Cruz

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Albuquerque, New Mexico

May 1979

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U.S. CUSTOMARY TO METRIC UNIT CONVERSION FACTORS

In this report figures are given in U.S. Customary units only. Water temperatures are expressed in degrees Celsius. Below is a list 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 1978 at White Sands Missile Range in south-central New Mexico. Total ground-water pumpage in 1978 was 692,045,700 gallons or 7,248,300 less than in 1977. Wells at the Post Headquarters produced 98 percent of the total volume.

Water levels in test wells around the Post Headquarters well field show seasonal declines ranging from 14.78 feet at Well T-7 to 0.71 feet at Well T-9. The water samples collected from the supply wells show that the chemical quality of the water is slightly better during the period of greatest declines.

INTRODUCTION

This report presents water-resources information that was collected at White Sands Missile Range during 1978 by personnel of the U.S. Geological Survey. Ground-water pumpage, water-level measurements, and chemical-quality data are summarized in this report. The data 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 has been continuous since 1953 (fig. 1). The original program consisted of water-level observations in five test wells in the Post Headquarters area. Over the years the program has expanded. Currently, the program consists of semiannual water-level measurements in 16 supply wells, 27 test and observation wells, 31 boreholes, and annual collection of 10 water samples for complete chemical analysis and 41 water samples for laboratory specific-conductance measurements only.

Pumpage and water-level fluctuations

Total ground-water pumpage* at White Sands Missile Range in 1978, according to records provided by the Facilities Engineering Directorate, was 692,045,700 gallons. The Post Headquarters well field produced 680,414,000 gallons; well 1 Hazardous Test Area (HTA-1), 269,900 gallons; wells at Multifunction Array Radar (MAR-1 and 2), 1,619,000 gallons; Small Missile Range (SMR-1), 1,877,800 gallons; and wells SRC-1 and 2, 7,865,000 gallons.

Figure 2 shows pumpage by month and total gallons pumped per year in Post Headquarters well field, 1964-78, and the corresponding fluctuation of water level in the Main Gate well. Hydrographs on figure 3 show water-level fluctuations in test wells T-7, T-8, T-10, and T-11, 1969-78; hourly water-level fluctuations are recorded in these wells. The location of all White Sands Missile Range supply wells, test wells and boreholes is shown on figures 4, 5, and 6.

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

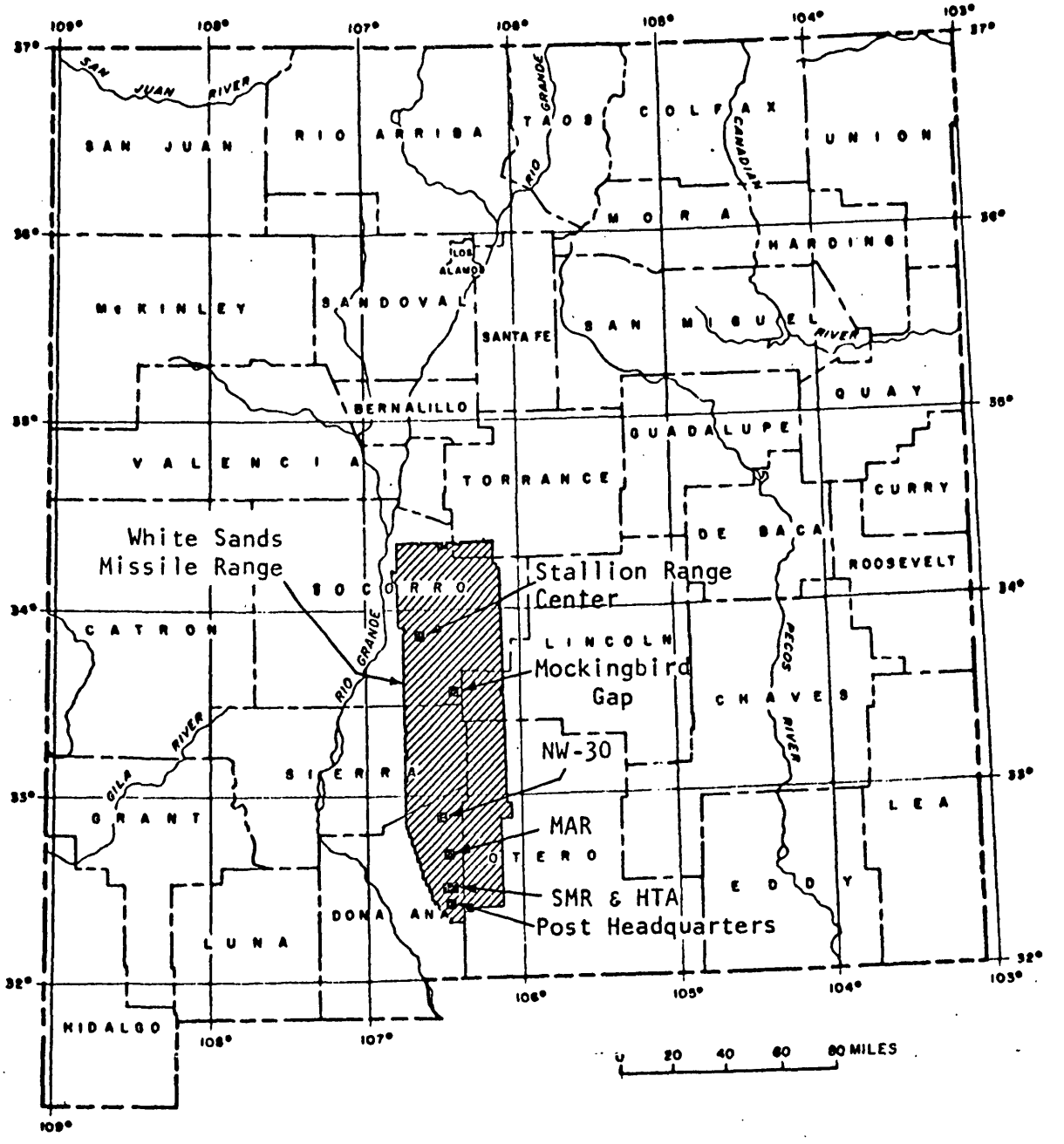


Figure 1.--White Sands Missile Range and areas of hydrologic observations.

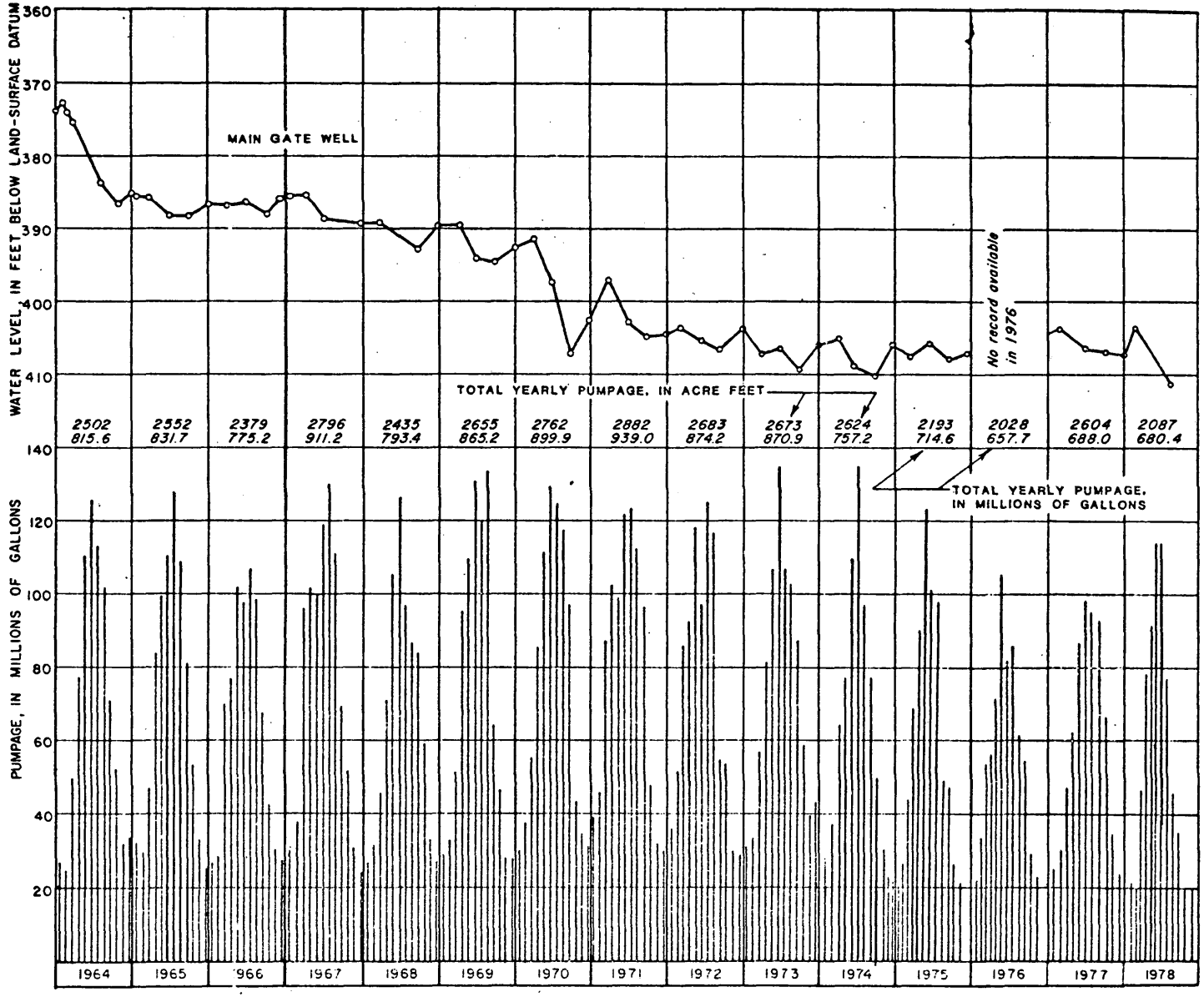


Figure 2.--Monthly and yearly pumpage in the Post Headquarters well field and water-level fluctuations in the Main Gate well, 1964-78.

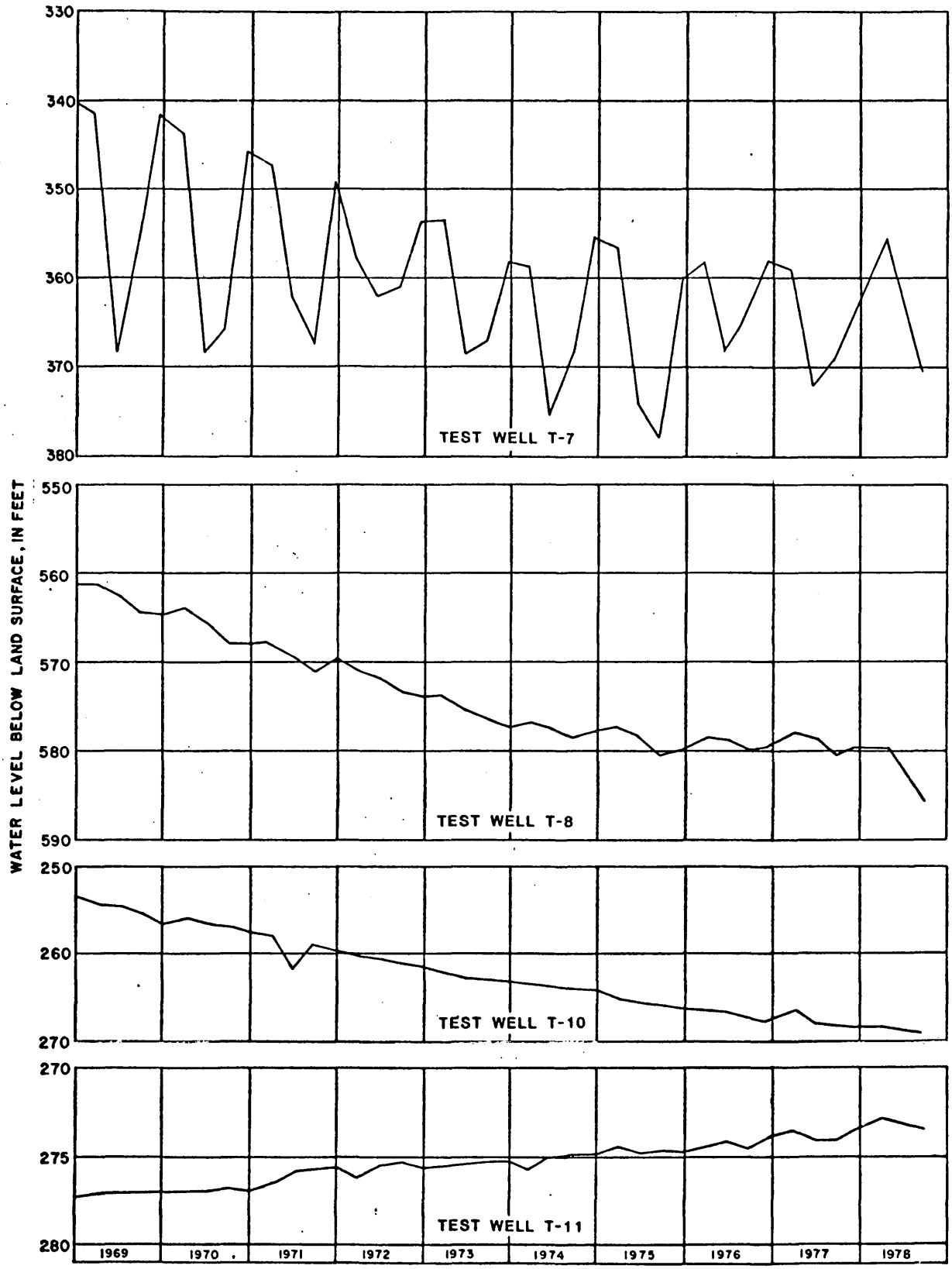


Figure 3.--Water-level fluctuations in test wells T-7, T-8, T-10 and T-11, 1969-78.

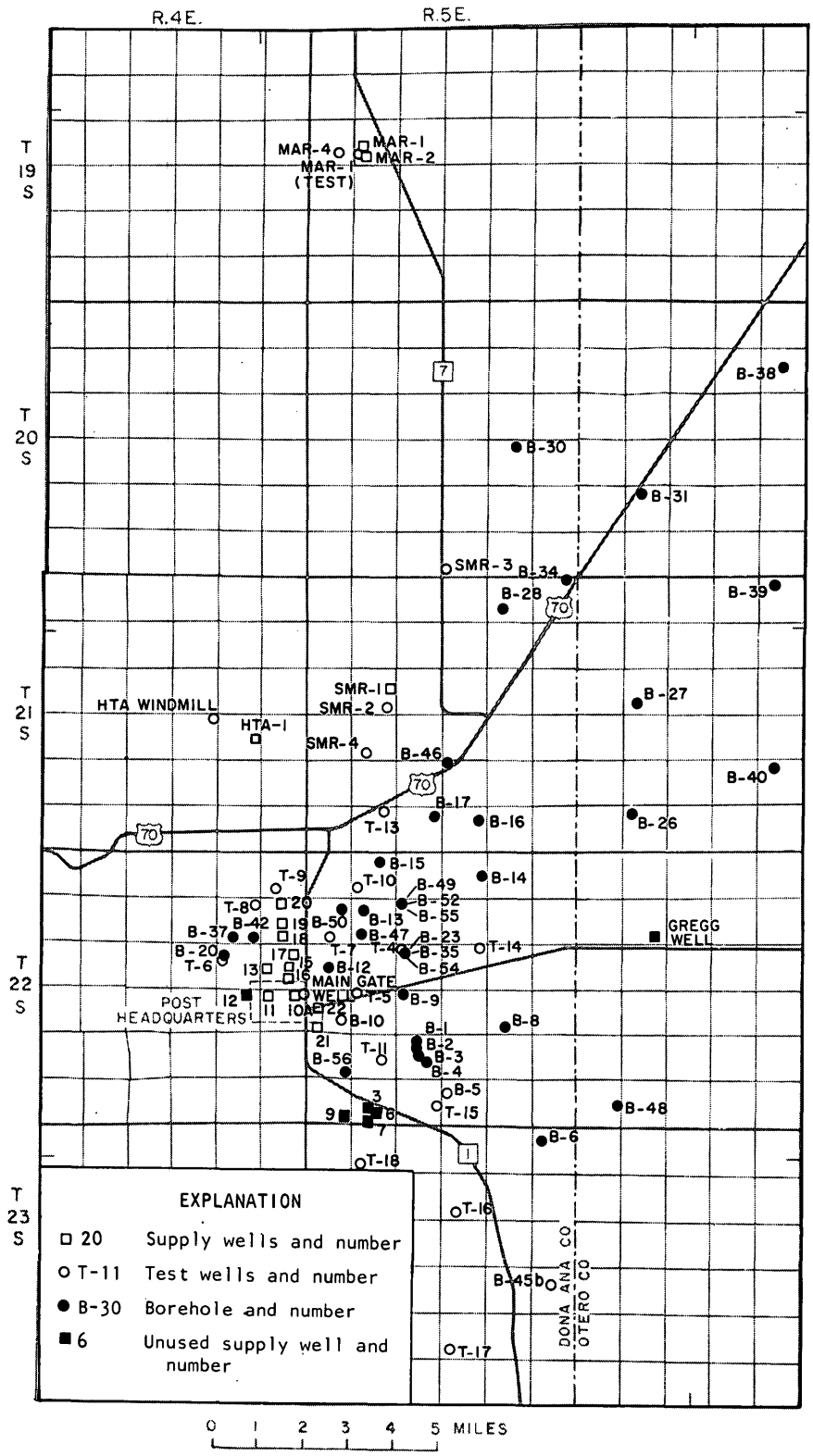


Figure 4.--Location of supply wells, test wells, observations wells, and boreholes in the Post Headquarters and adjacent areas.

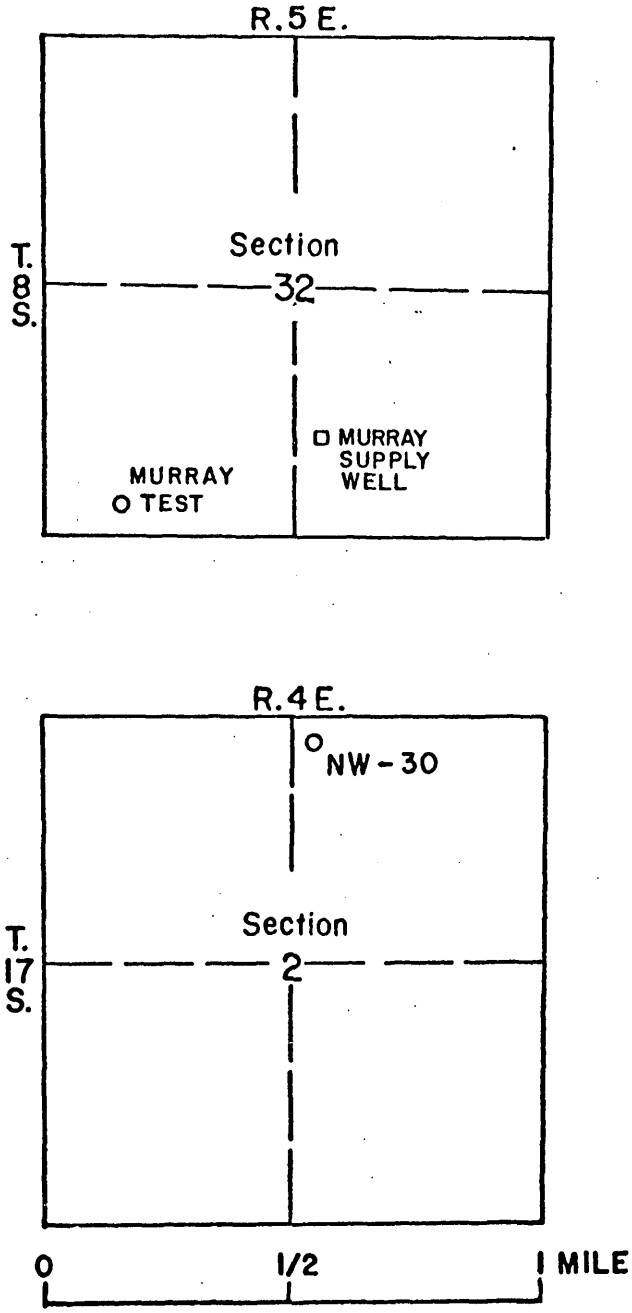
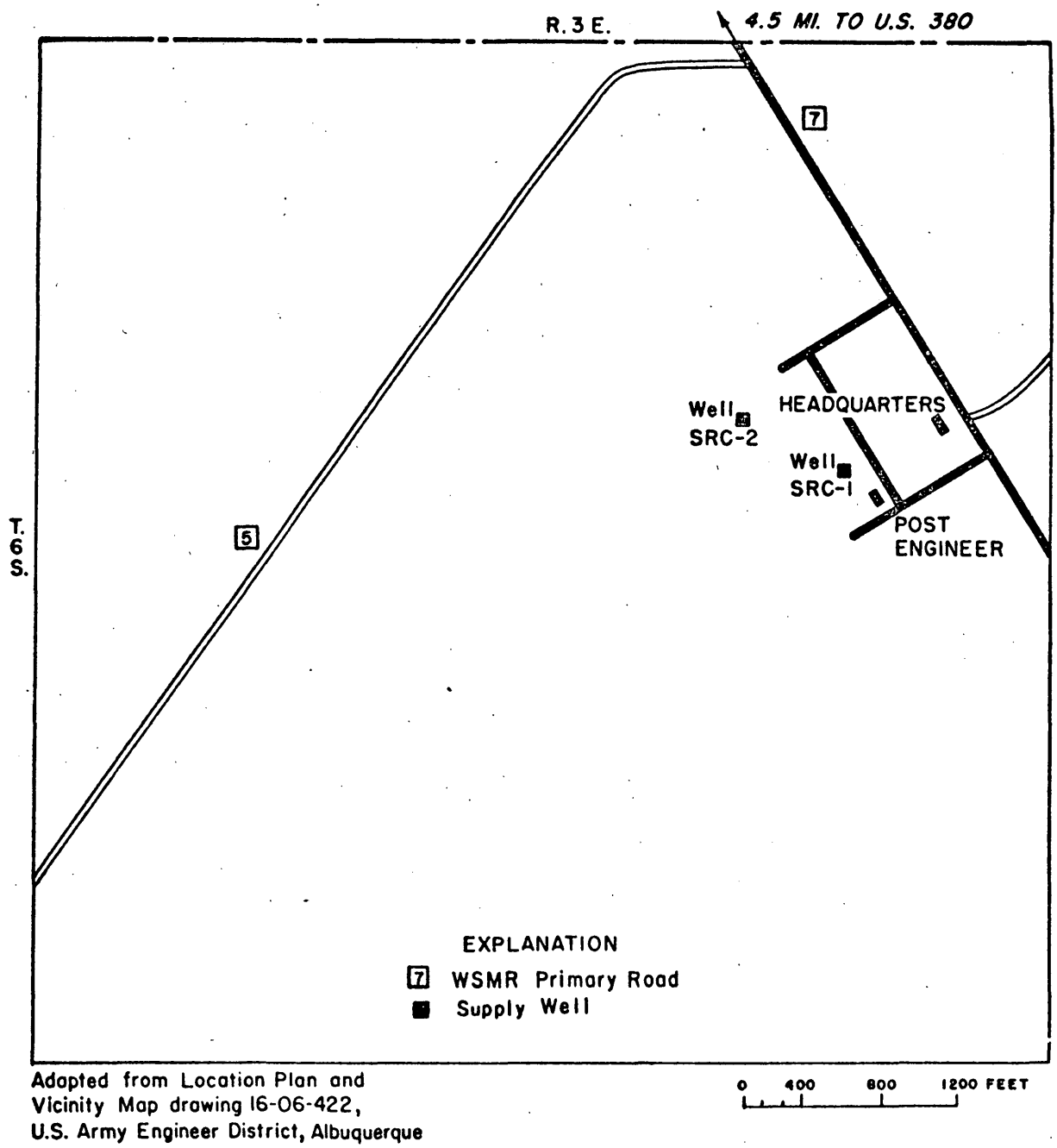


Figure 5.--Location of wells in Mockingbird Gap and NW-30 areas.



Adapted from Location Plan and Vicinity Map drawing 16-06-422, U.S. Army Engineer District, Albuquerque

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 7 supply wells in the Range areas, 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

Depth-to-water measurements made in February and August 1978 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.

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

Well	February 1978 (feet below land surface)	August 1978 (feet below land surface)
10a	422.00	432.90
11	288.30	279.00
13	302.89	315.10
15	426.02	438.00
16	443.33	450.00
17	434.00	452.46
18	423.75	443.71
19	451.10	453.29
20	511.00	514.30
21	355.00	363.99
22	378.50	385.79
HTA	69.96	69.40
SMR-1	293.50	298.47
MAR-1	216.00	213.86
MAR-2	223.50	219.65
SRC-1	205.04	205.70
SRC-2	212.49	213.05
Murray	204.01	204.71

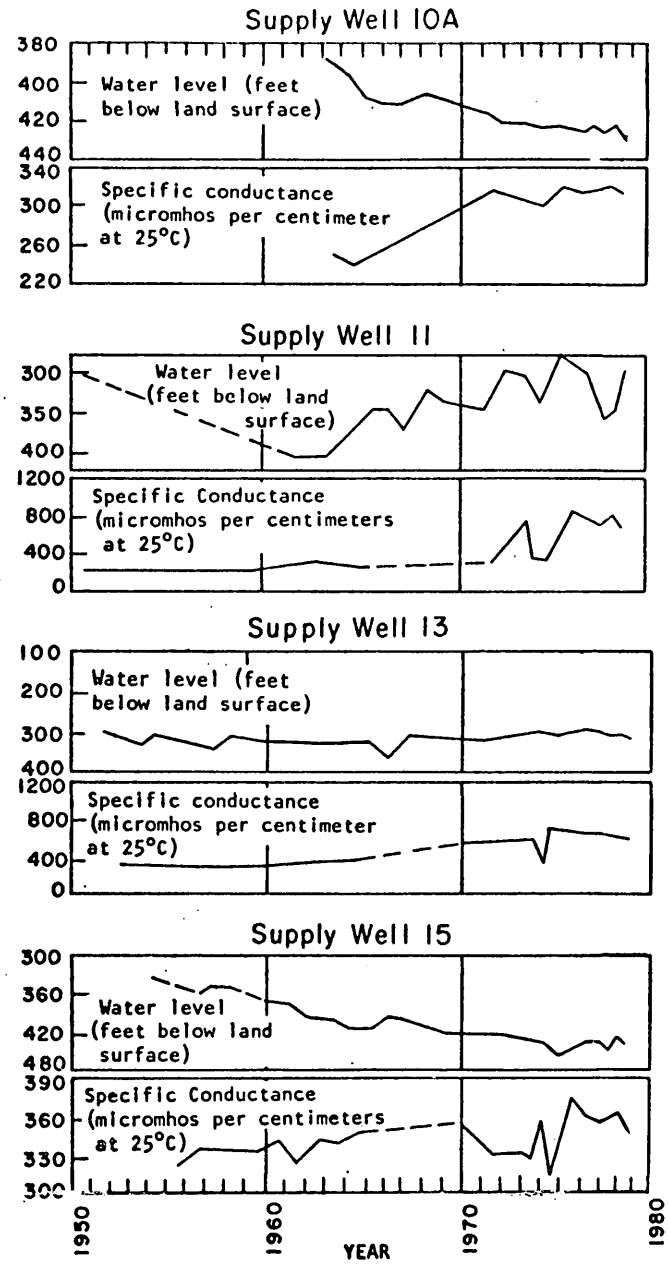


Figure 7.--Water level and specific conductance for period of record available in supply wells 10a, 11, 13 and 15.

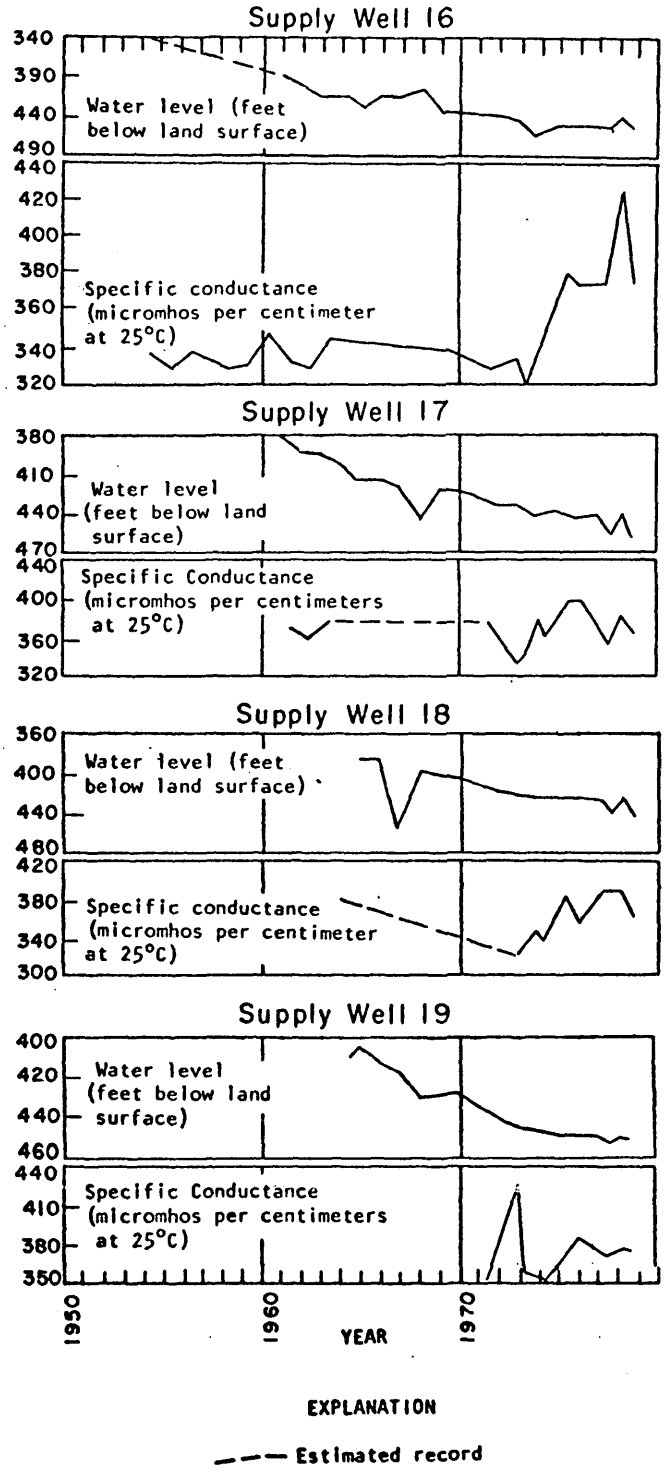


Figure 8.--Water level and specific conductance for period of record available in supply wells 16, 17, 18 and 19.

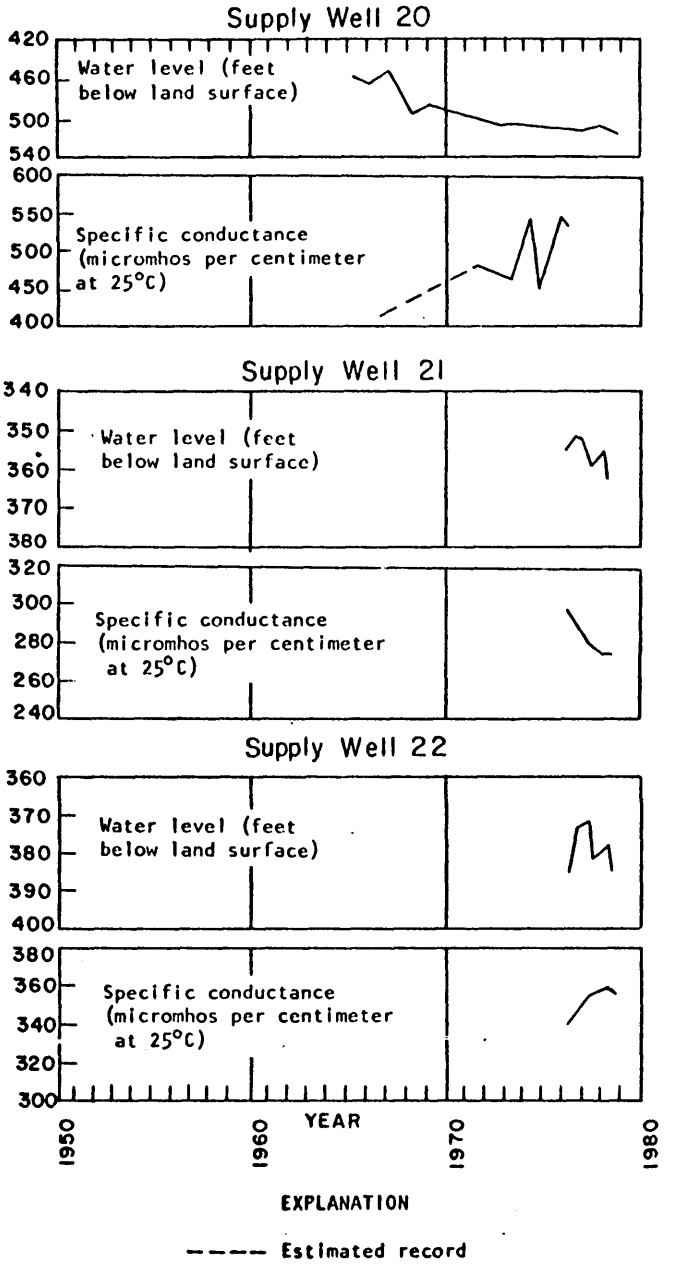


Figure 9.--Water level and specific conductance for period of record available in supply wells 20, 21 and 22.

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

Well number	February 1978 (feet below land surface)	August 1978 (feet below land surface)
T-4	225.78	225.87
T-5	275.57	275.51
T-6	210.14	209.93
T-7	355.81	370.59
T-8	579.93	586.77
T-9	399.48	400.19
T-10	268.56	269.09
T-11	273.35	273.53
T-13	211.05	211.09
T-14	131.90	139.92
T-15	178.50	178.50
T-16	185.89	185.85
T-17	242.15	242.25
T-18	240.23	240.34
Gate	403.62	411.09
OS-9	249.06	249.50
OS-12	249.02	249.23
Gregg	214.27	214.34
HTA	43.27	44.13
SMR-2	316.83	316.99
SMR-3	296.49	294.92
SMR-4	284.87	285.02
MAR-1	220.69	220.59
MAR-4	303.64	303.61
NW-30	212.30	212.33
Murray	176.88	176.84

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

Well number	February 1978 (feet below land surface)	August 1978 (feet below land surface)
B-1	194.19	194.13
B-2	197.22	196.54
B-3	204.20	204.17
B-4	198.07	198.08
B-5	188.17	188.23
B-6	134.09	134.09
B-9	225.52	225.62
B-10	305.17	307.78
B-12	262.46	262.98
B-13	239.73	239.76
B-14	111.45	111.59
B-15	170.90	171.11
B-16	108.35	108.38
B-17	110.40	110.46
B-18	104.03	103.84
B-20	347.98	348.10
B-23	224.17	224.29
B-26	140.64	140.80
B-27	119.70	119.73
B-28	139.93	139.79
B-30	89.49	89.37

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

Well number	February 1978 (feet below land surface)	August 1978 (feet below land surface)
B-31	123.10	123.32
B-34	126.13	125.97
B-35	228.38	227.05
B-36	213.79	213.79
B-37	410.28	410.17
B-38	129.23	129.34
B-39	156.15	156.27
B-42	386.28	386.40
B-45b	187.72	186.97
B-46	134.47	134.64
B-47	271.20	271.80
B-48	204.25	204.36
B-49	199.10	198.30
B-50	300.39	301.00
B-51	146.94	146.86
B-52	209.35	209.49
B-54	228.38	228.41
B-55	213.88	213.18
B-56	279.68	279.84

Chemical quality

The chemical quality of the water samples collected in 1978 was similar to that of the samples collected from the same sources at approximately the same periods in 1977. The laboratory specific conductances for supply wells listed in table 4 show that the chemical quality of the water is slightly better during the time of heaviest withdrawal.

Fifty-one water samples from 33 wells in the Post Headquarters and Range areas were collected in 1978. Eleven of these samples were collected for complete chemical analyses (table 5). The remainder were for laboratory specific conductance determination. Specific conductance and pH values for selected wells in the Post Headquarters area are shown on figure 10.

The water samples collected in 1978 from test wells were obtained using the U.S. Geological Survey New Mexico District's geophysical-logging equipment. An electically 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 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.

MISCELLANEOUS OBSERVATIONS

The peak discharge for the flood of August 19, 1978 was determined by the U.S. Geological Survey (by slope-area measurement of peak flow) to be 21,300 ft^3/s (gage height-13.4 ft) at the discontinued gaging station, which was 1 mile north of the Main Gate on White Sands Missle Range Primary Route No. 1. The frequency of occurrence of a flood of that magnitude is in excess of 100 years.

The water samples collected from the cluster of boreholes (B-23, B-35, and B-54) near T-4 had the lowest specific conductance of all the water samples collected on the Missle Range. The water samples were collected with a bailer and are from the very top of the column of water in the wells; whereas water samples from all of the other wells are representative of the water at various depths in the wells.

Table 4.--Specific conductances of water samples collected from supply wells, test wells, and boreholes, 1978

Part I.--Supply wells

Well number	1978 Specific conductance (micromhos per centimeter at 25°C)		Remarks
	winter	summer	
10-A	-	318	Sample collected after 1 hour pumping time.
11	837	719	Do.
13	606	600	do.
15	367	349	do.
16	423	371	do.
17	390	376	do.
18	389	365	do.
19	402	398	do.
20	564	538	do.
21	278	277	do.
22	358	354	do.
HTA-1	701	691	do.
SMR-1	794	784	do.
MAR-1	840	603	do.
MAR-2	799	789	do.
SRC-1	3,470	3,450	do.
SRC-2	3,440	3,450	do.
Murray	701	644	do.
SRC (Product water)	454	385	do.

Table 4.--Specific conductances of water samples collected from supply wells, test wells, and boreholes, 1978 - concluded

Part II.--Test wells

Well number	1978 Specific conductance (micromhos per centimeter at 25°C)		Sampling points (feet below land surface)
	winter	summer	
T-4	-	276	325
T-5	-	357	330
T-6	-	458	350
T-7	-	342	444
T-7	-	479	840
T-7	-	428	900
T-8	-	684	610
T-8	-	643	550
T-9	-	856	550
T-10	-	305	513
T-11	-	301	570
T-13	-	502	513
T-14	-	912	912
T-14	-	2,200	300
T-15	-	637	400
Part III.--Boreholes			
B-23	-	226	226
B-35	-	187	226
B-54	-	238	228

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

(milligram per liter)

Well	11	20	21	22	SRC
Laboratory No	780612	780613	780614	780615	780616
Date of collection	2-13-78	2-14-78	2-15-78	2-15-78	2-14-78
Depth sampled (feet)	-	-	-	-	-
Silica (SiO_2)	43	42	46	30	30
Iron* (Fe)	10	10	10	10	10
Manganese* (Mn)	0	0	0	10	0
Calcium (Ca)	97	61	28	30	22
Magnesium (Mg)	25	13	7.2	4.3	11
Sodium (Na)	36	31	18	39	49
Potassium (K)	3.2	2.4	1.7	2.3	0.8
Bicarbonate (HCO_3)	170	150	110	130	6
Carbonate (CO_3)	0	0	0	0	0
Alkalinity as $CaCO_3$	140	120	90	110	5
Sulfate (SO_4)	170	100	34	55	170
Chloride (Cl)	37	32	7.5	9.6	4.4
Fluoride (F)	0.4	0.6	0.4	0.5	0.1
Nitrate (NO_3) + Nitrite (NO_2)	12	3.0	1.4	0.99	0.20
Phosphorous, ortho, Dissolved as P	0.02	0.02	0.02	0.01	0.01
Boron* (B)	-	-	-	-	-
Dissolved Solids (calculated)	549	369	203	239	291
Hardness as $CaCO_3$	350	210	100	93	100
Nohcarbonate hardness as $CaCO_3$	210	83	9	0	95
Sodium Adsorption Ratio (SAR)	0.8	0.9	0.8	1.8	2.1
Specific conductance Lab (micromhos at 25°C)	837	564	278	358	454
pH	7.5	7.9	7.7	8.0	6.9
Temperature, °Celsius (C)	-	-	-	-	-
Carbon dioxide (CO_2)	-	-	-	-	-

* Microgram per liter

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

(milligram per liter)

Well	T-7	10A	13	18	SMR-1	MAR-1
Laboratory No	781691	781709	781711	781707	781708	781710
Date of collection	8-22-78	9-6-78	9-6-78	9-6-78	9-8-78	9-8-78
Depth sampled (feet)	840	-	-	-	-	-
Silica (SiO_2)	31	43	36	27	27	23
Iron* (Fe)	10	10	20	10	10	20
Manganese* (Mn)	0	0	0	0	10	20
Calcium (Ca)	38	31	69	35	74	91
Magnesium (Mg)	3.9	0	15	6.8	45	47
Sodium (Na)	56	19	32	29	26	36
Potassium (K)	2.7	2.0	2.6	2.1	2.0	2.3
Bicarbonate (HCO_3)	110	110	180	130	290	240
Carbonate (CO_3)	0	0	0	0	0	0
Alkalinity as $CaCO_3$	90	90	150	110	240	200
Sulfate (SO_4)	89	44	100	53	140	220
Chloride (Cl)	25	1.5	10	3.1	13	52
Fluoride (F)	0.5	0.3	0.5	0.4	1.0	0.3
Nitrate (NO_3) / Nitrite (NO_2)	2.2	1.1	7.7	1.3	1.3	1.4
Phosphorous, ortho, Dissolved as P	-	0.02	0.03	0.01	0.01	0.18
Boron* (B)	40	20	30	40	50	60
Dissolved Solids (calculated)	310	207	391	235	477	597
Hardness as $CaCO_3$	110	110	230	120	370	420
Noncarbonate hardness as $CaCO_3$	21	16	86	9	130	220
Sodium Adsorption Ratio (SAR)	2.3	0.8	0.9	1.2	0.6	0.8
Specific conductance Lab (micromhos at 25°C)	479	318	606	372	794	934
pH	8.0	7.7	7.4	7.8	7.8	7.4
Temperature, °Celsius (C)	27	-	-	-	-	-
Carbon dioxide (CO_2)	1.8	-	-	-	-	-

* Microgram per liter

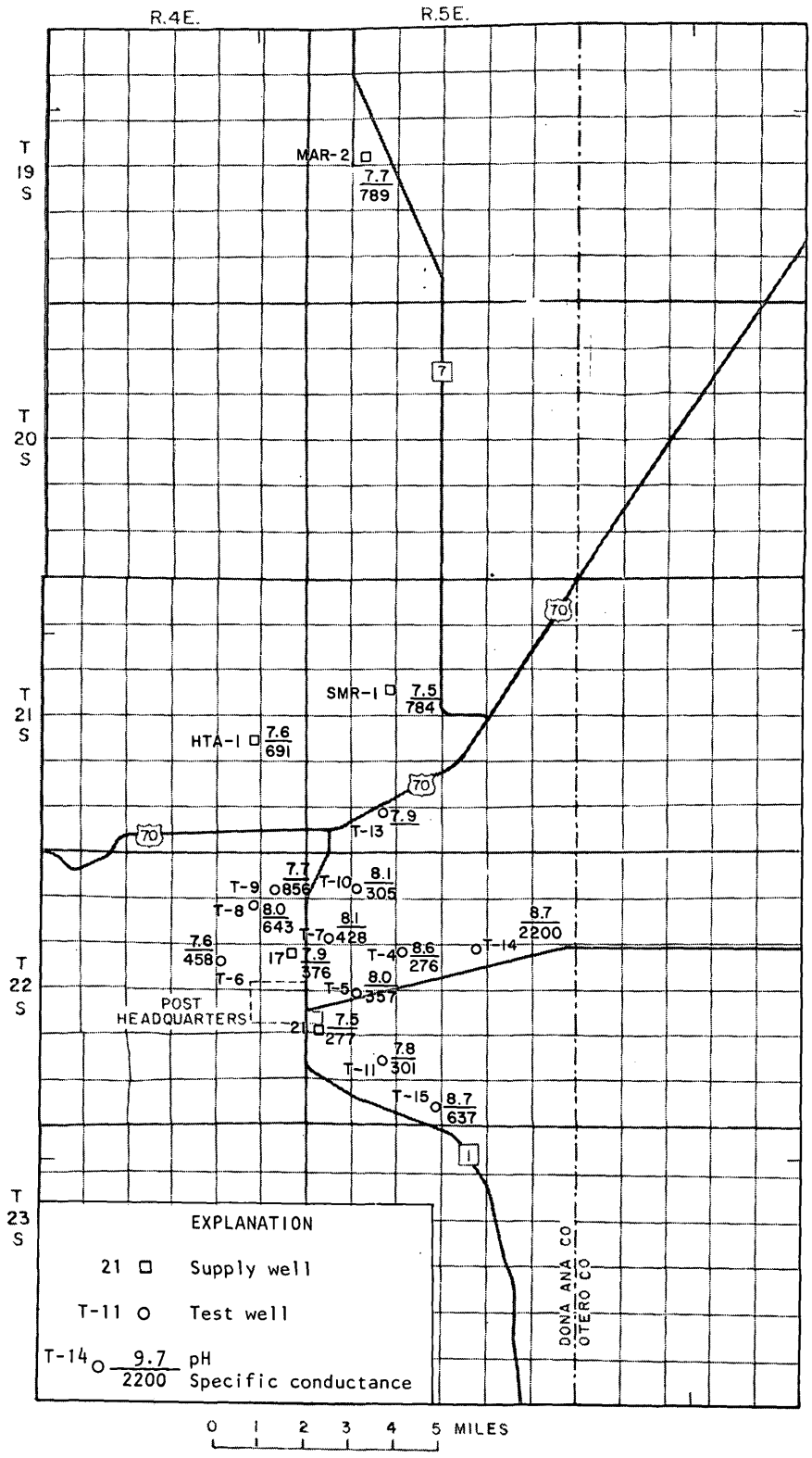


Figure 10.--Specific conductance and pH values in selected wells, Post Headquarters and Range areas, 1978.

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