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Streamflow and spring discharge in Garden and Huachuca Canyons, Fort Huachuca Military Reservation, Arizona

By

Rodney H. Roeske

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Administrative report
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STREAMFLOW AND SPRING DISCHARGE IN GARDEN AND HUACHUCA CANYONS, FORT HUACHUCA MILITARY RESERVATION, ARIZONA

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INTRODUCTION

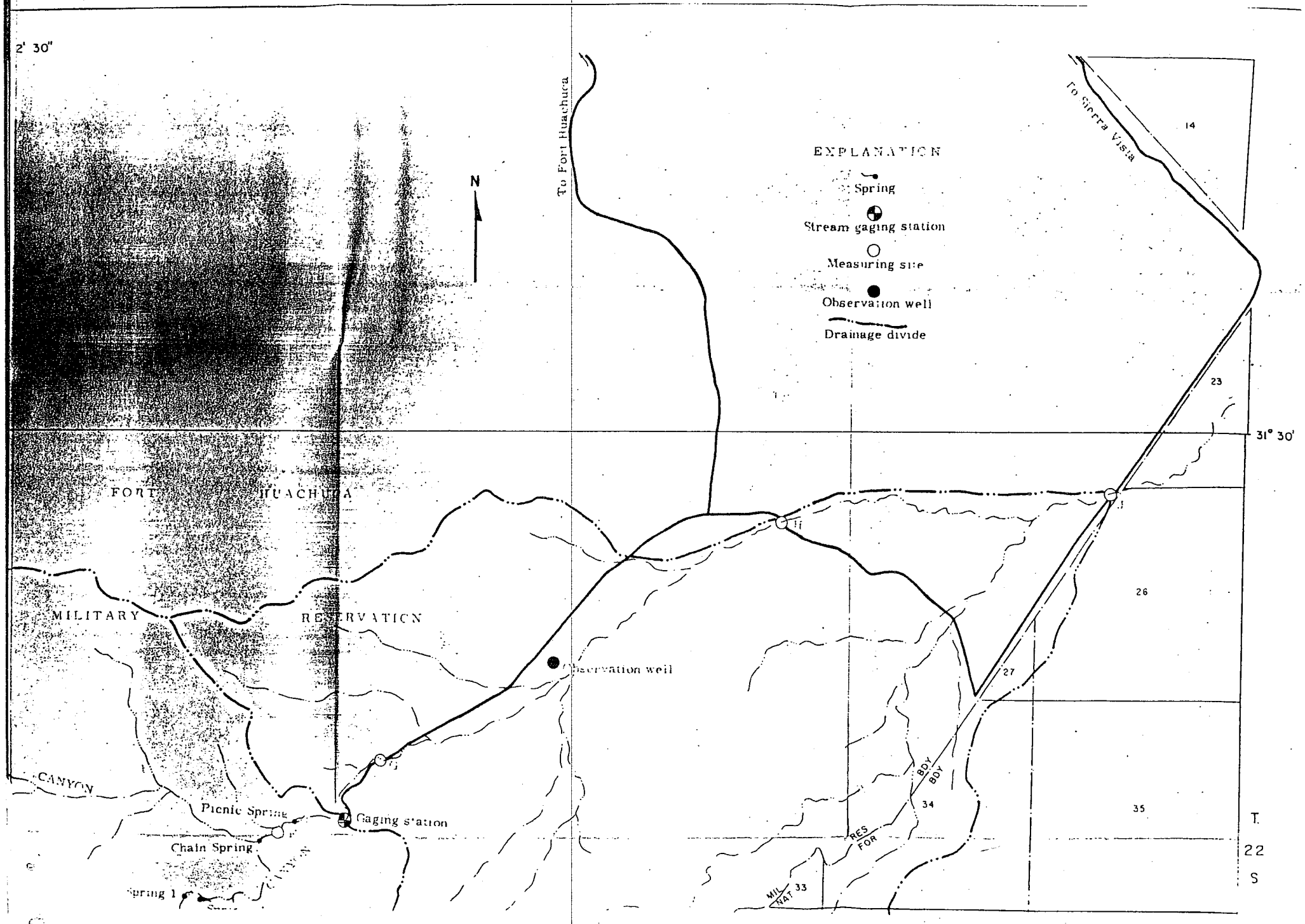
An investigation of the water resources of the Fort Huachuca Military Reservation was started in the fall of 1959 to aid in intelligent planning for the use and conservation of the available water supply. The results of the investigation through June 1963 have been presented to the Fort (written communication, Brown, Davidson, Kister, and Thomsen, 1964). The present report analyzes the streamflow and spring-discharge data for Garden and Huachuca Canyons through April 1964. In addition, the results of seepage investigations made in Garden Canyon from September 1963 to June 1964, the relation of precipitation to runoff, and the relation of runoff from Garden Canyon to the water needs of the Fort are discussed.

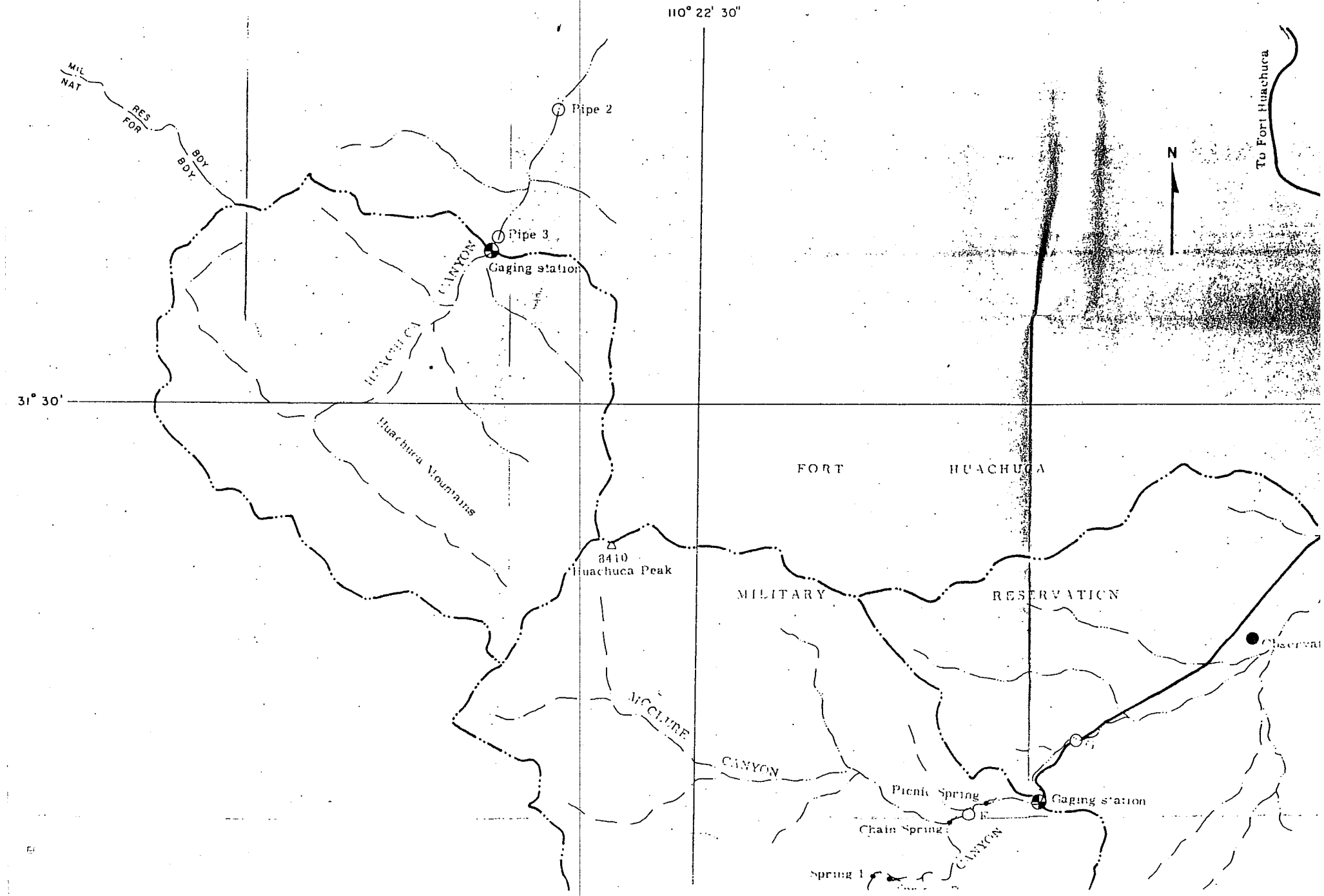
Garden and Huachuca Canyons are on the northeast slopes of the Huachuca Mountains and drain a faulted complex of granite, carbonate rocks, claystone, sandstone, and conglomerate (written

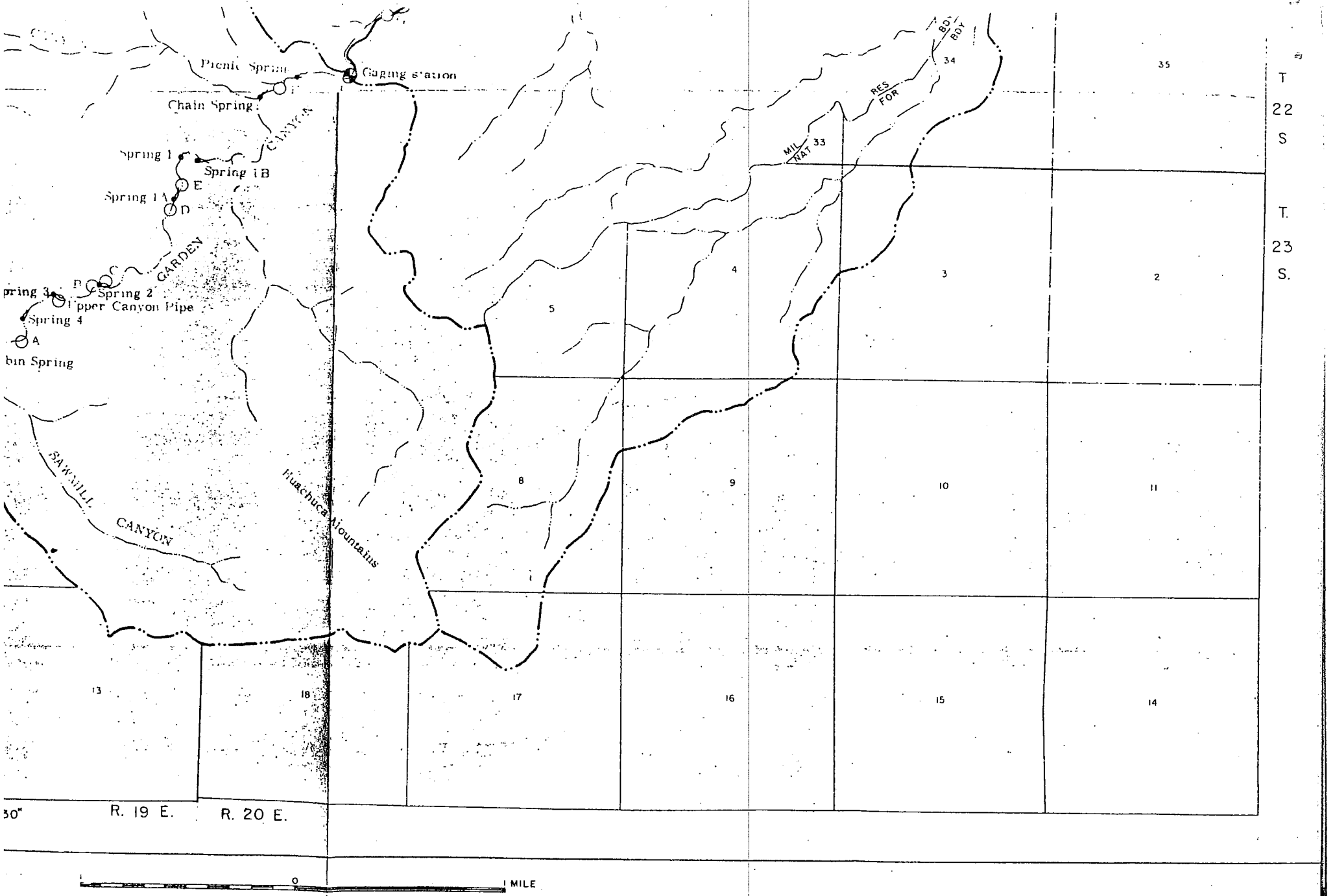
communication, Brown and others, 1964). Altitudes range from about 5,200 feet at the mouths of the canyons to 8,410 feet at Huachuca Peak. Garden Canyon drains eastward into the San Pedro River, and Huachuca Canyon drains northward into the Babocomari River (fig. 1).

STREAMFLOW IN GARDEN CANYON

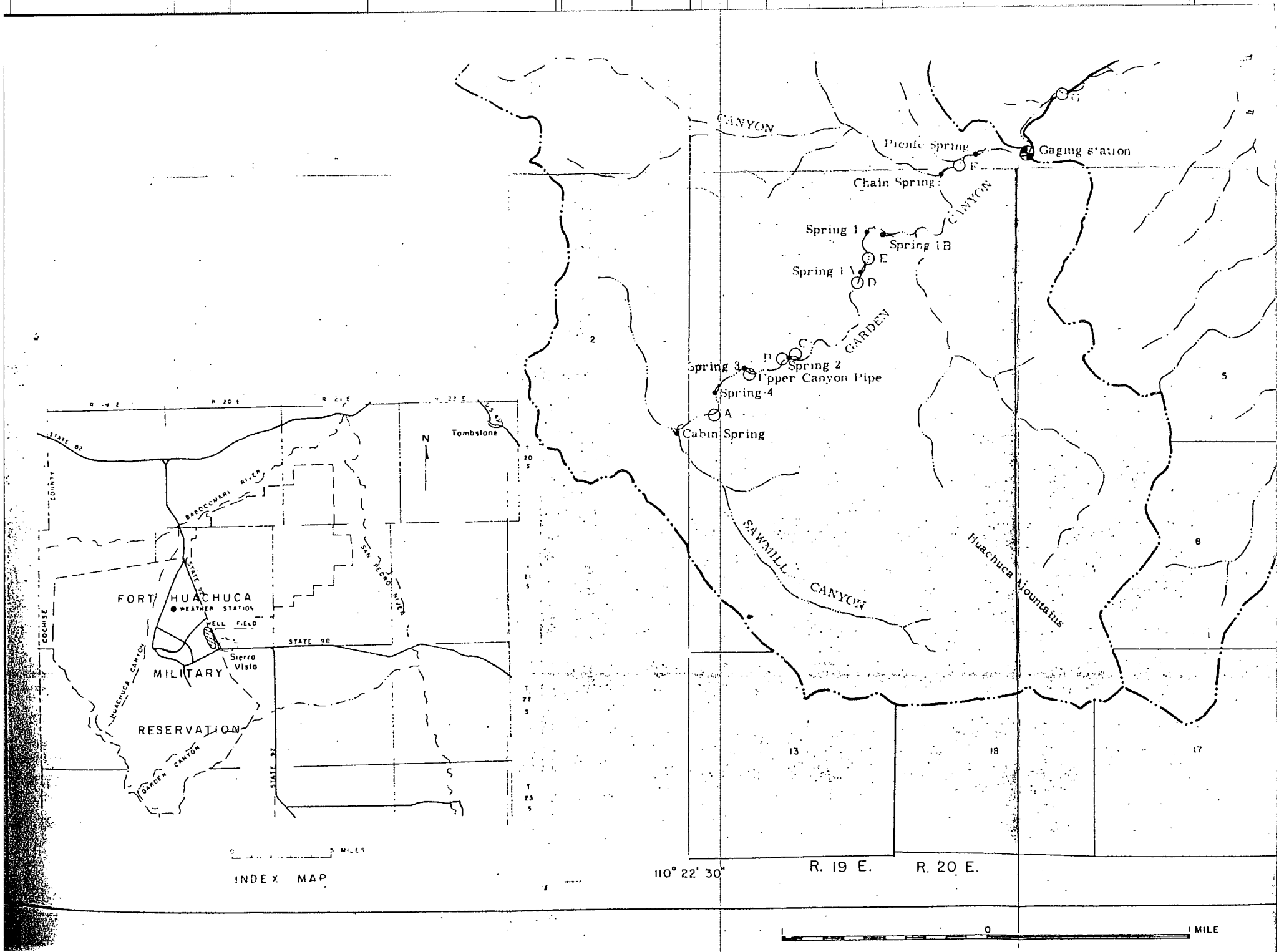
The Garden Canyon gaging station is near the mouth of the canyon at an altitude of 5,300 feet. The drainage area above the gaging station is 8.38 square miles. The annual runoff pattern for the period of record, October 1959 to April 1964 (fig. 2), shows that peak flows occurred in January, August, and September and low flows occurred in June and July. In January, February, and March the median (middle value) flow was fairly constant, ranging from 0.3 to 0.5 cfs (cubic feet per second), but in August and September the median flow ranged from 0.2 to 3.6 cfs, reflecting the flashy runoff caused by summer thunderstorms. From October 1959 through September 1963 the yearly discharge ranged from 95 to 1,720 acre-feet (table 1). The maximum daily discharge was 47 cfs (21,100 gpm [gallons per minute]) on January 12, 1960, but from May 29 to September 7, 1961, there was no flow except for intermittent runoff resulting from thunderstorms. There was also no flow from June 3 to July 27, 1963 (table 1).







of Garden and Huachuca Canyons, showing springs, stream gaging stations, and measuring sites.



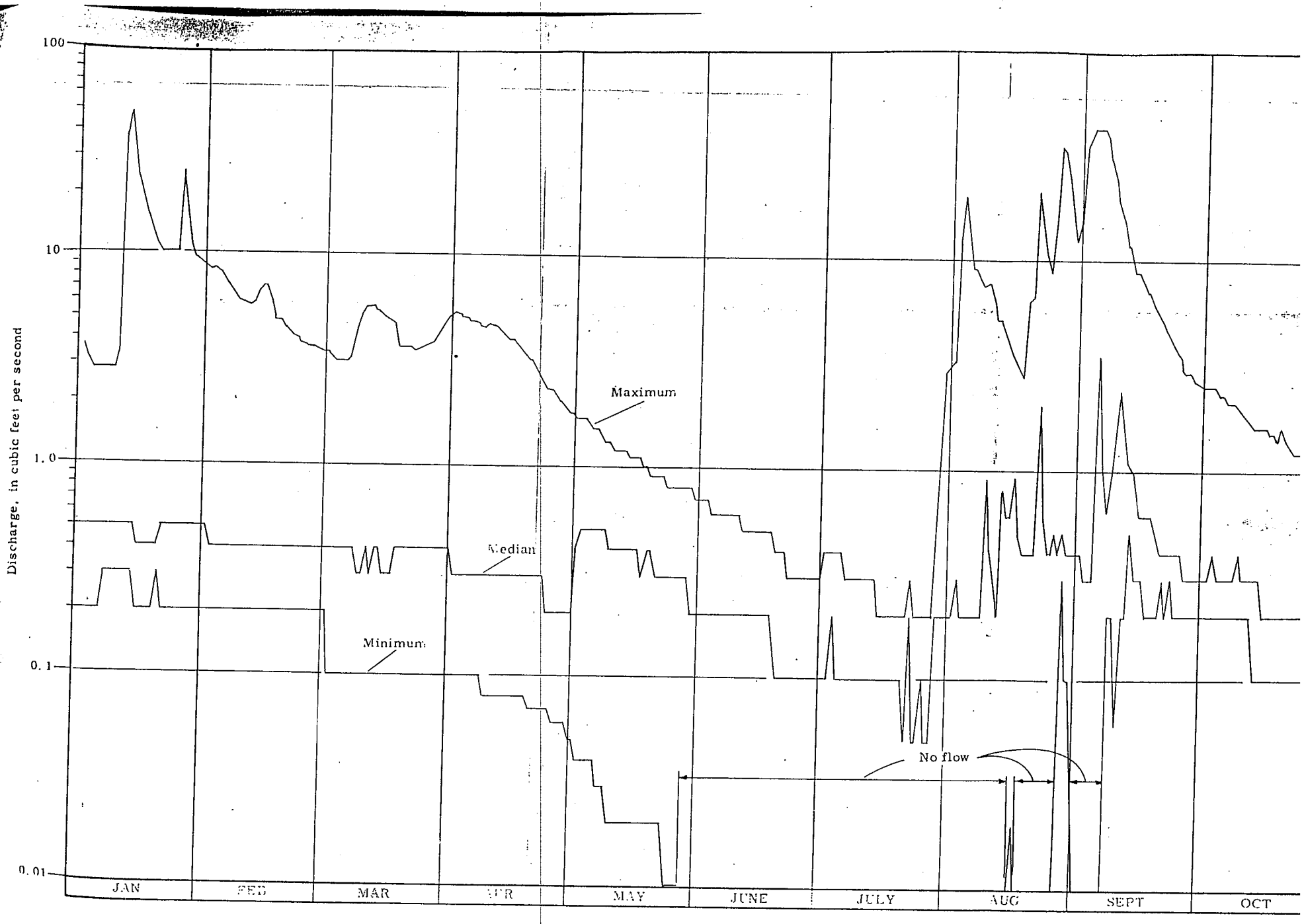
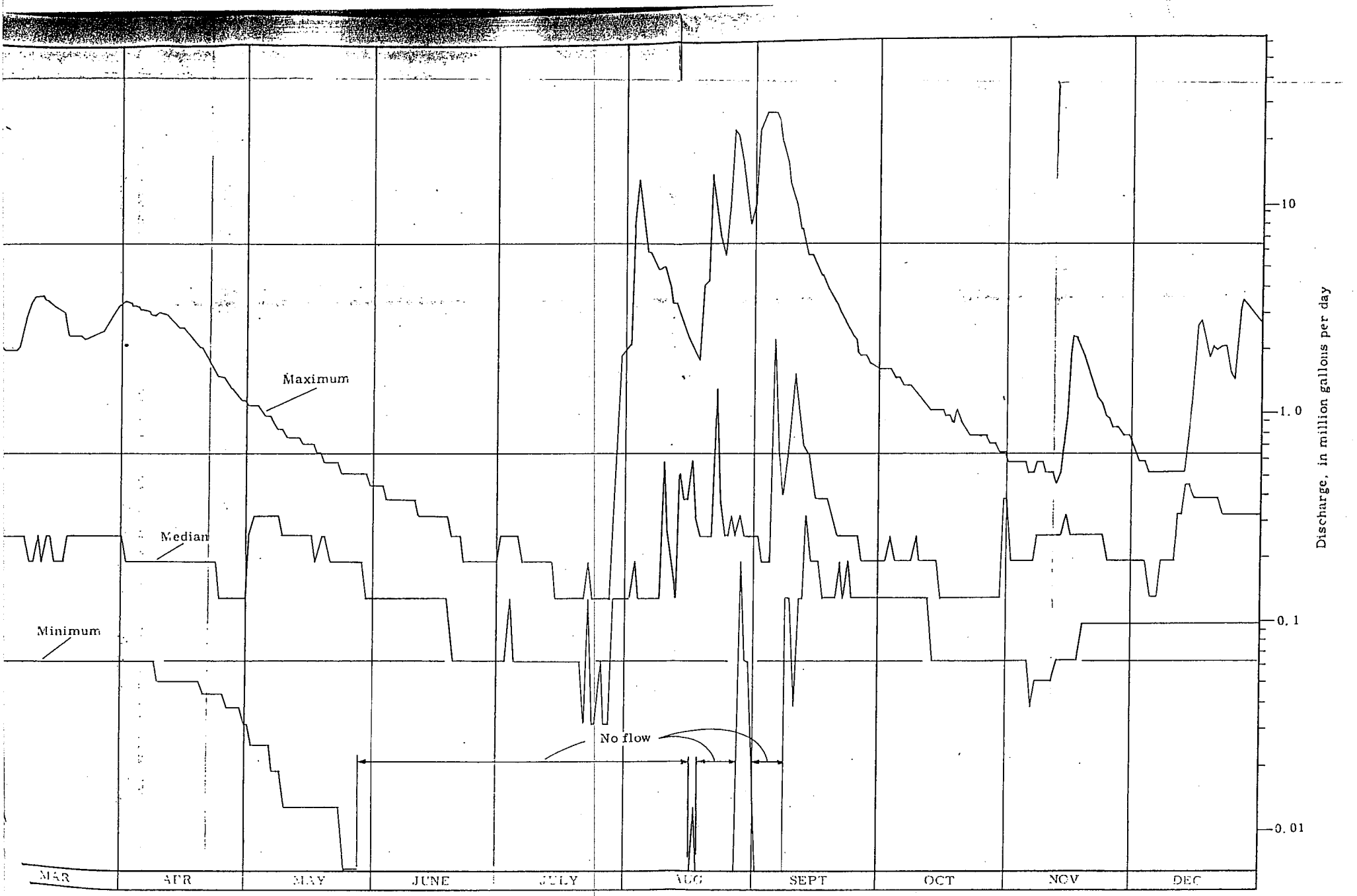


Figure 2.--Hydrographs of maximum, median, and minimum daily discharge of Garden Canyon near Fort Huachuca, Ariz., October 1, 1959 to April 30,



Graphs of maximum, median, and minimum daily discharge of [illegible] near Fort Huachuca, Ariz., October 1, 1959 to April 30, 1964.

Table 1.--Discharge of [illegible] Canyon at the [illegible] station near Fort Huachuca, Ariz.

Period	Total discharge		Mean daily discharge		Maximum daily discharge		Minimum daily discharge	
	Acre-feet	Millions of gallons	cfs	gpm	cfs	gpm	cfs	gpm
Oct. 1, 1959 through Sept. 30, 1960	1,720	561	2.36	1,060	47	21,100	0.2	90
Oct. 1, 1960 through Sept. 30, 1961	95	31	.134	60	.9	400	1/ 0	0
Oct. 1, 1961 through Sept. 30, 1962	1,150	375	1.59	714	24	10,800	.1	45
Oct. 1, 1962 through Sept. 30, 1963	1,660	541	2.29	1,030	42	18,900	2/ 0	0
Oct. 1, 1963 through April 30, 1964	272	89	.645	290	2.5	1,120	.2	90

1/ No flow from May 29 to September 7, 1961, except for intermittent flow resulting from thunderstorm runoff.

2/ No flow during most of June and July 1963.

STREAMFLOW IN HUACHUCA CANYON

The Huachuca Canyon gaging station is about 2-1/2 miles upstream from the mouth of the canyon at an altitude of 5,800 feet. The drainage area above the gaging station is 3.24 square miles. The station was established in October 1961 at a V-notch weir that was constructed at the beginning of this study in 1959. Prior to the installation of the gaging station, discharge measurements were made periodically at the weir. Using these measurements and their correlation with the hydrograph for Garden Canyon, a hydrograph was constructed for Huachuca Canyon for the period October 1, 1959, to September 30, 1961. The runoff for this period was estimated to be 140 acre-feet from October 1, 1959, to September 30, 1960, and 12 acre-feet from October 1, 1960, to September 30, 1961 (table 2). The measured runoff from October 1, 1961, to April 30, 1964, ranged from 18 to 190 acre-feet per year and totaled 238 acre-feet (77.6 million gallons). The total runoff from October 1, 1959, to April 30, 1964, was estimated to be 390 acre-feet (130 million gallons), which is less than one-tenth of the runoff of Garden Canyon for the same period. The maximum recorded daily discharge was 28 cfs (12,600 gpm) on September 3, 1963. There was no flow from May 27 to August 2, 1963 (table 2).

Table 2.--Discharge of Huachuca Canyon at the gaging station near Fort Huachuca, Ariz
(Note: figures in parentheses are estimates)

Period	Total discharge		Mean daily discharge		Maximum daily discharge		Minimum daily discharge	
	Acre-feet	Millions of gallons	cfs	gpm	cfs	gpm	cfs	gpm
Oct. 1, 1959 through Sept. 30, 1960	(140)	(46)	(0.19)	(85)	----	-----	----	-----
Oct. 1, 1960 through Sept. 30, 1961	(12)	(3.9)	(.017)	(7.6)	----	-----	----	-----
Oct. 1, 1961 through Sept. 30, 1962	190	62	.262	118	6.8	3,100	0.02	9.0
Oct. 1, 1962 through Sept. 30, 1963	30	9.8	.042	19	28	12,600	1/ 0	0
Oct. 1, 1963 through April 30, 1964	18	5.9	.043	19	----	-----	----	-----

1/ No flow from May 26 to August 2, 1963.

SPRINGS IN GARDEN AND HUACHUCA CANYONS

Springs in Garden and Huachuca Canyons are fed by water moving along fractures, faults, and solution channels in the rocks. Several springs or seeps also occur in the stream channel in Garden Canyon where underflow moving through the alluvium is forced to the surface. These springs were measured by a series of seepage runs.

Measurements of spring discharge have been made periodically since October 1959 at three sites in Garden Canyon—Spring 1, Spring 2, and Upper Canyon Pipe—and two sites in Huachuca Canyon—Pipe 2 and Pipe 3 (table 3).

Garden Canyon

Cabin Spring.--Cabin Spring is the uppermost spring in Garden Canyon. It is fed mainly by underflow that moves through the shallow alluvium. The spring is dry most of the year but flows 15 to 25 gpm in wet weather.

Springs 3 and 4.--Springs 3 and 4 issue from fractures in the limestone beds of the Permian and Pennsylvanian Naco Group (fig. 3). Part of the flow from Springs 3 and 4 is collected in an old pipeline;

Table 3.--Discharge measurements of spring flow in Huachuca and Garden Canyons

Date	GARDEN CANYON			HUACHUCA CANYON	
	Measured discharge (gpm) [1]			Measured discharge (gpm) [1]	
	Spring 1 [2]	Spring 2	Upper Pipe	Pipe 2 [2]	Pipe 3
1959					
t. 21-22	-----	108	-----	18.4	13.5
3 4	102	96.0	57.0	18.4	13.9
1-2	139	164	52.1	17.5	22.9
ec. 15-16	173	171	58.8	19.3	21.5
1960					
an. 4-5	489	289	92.0	21.1	25.6
20	534	1,180	95.6	28.3	72.3
2	557	1,130	95.6	30.5	79.0
eb. 16	476	186	98.7	31.4	76.3
Mar. 1-2	426	220	98.7	31.4	67.3
Mar. 16-17	467	618	99.6	30.1	49.4
Mar. 31	395	449	89.8	28.3	44.4
Apr. 19-20	224	225	67.3	26.9	35.9
Apr. 28	130	180	61.0	25.6	31.4
May 18-19	176	118	48.0	23.8	23.8
June 1	126	98.7	36.8	22.4	20.2
June 15-16	117	80.8	30.1	20.2	17.5

Table 3.--Discharge measurements of spring flow in Huachuca and Garden Canyons—Continued

Date	GARDEN CANYON			HUACHUCA CANYON	
	Measured discharge (gpm) [1]			Measured discharge (gpm) [1]	
	Spring 1 [2]	Spring 2	Upper Pipe	Pipe 2 [2]	Pipe 3
June 30	97.4	71.4	22.4	18.4	14.8
July 21	100	62.5	12.3	20.8	14.2
Aug. 2	85.3	53.9	10.8	19.7	13.9
Aug. 31	-----	-----	-----	18.8	18.0
Sept. 1	112	80.8	2.9	-----	-----
Oct. 4	105	79.4	2.7	19.8	15.3
Oct. 31	74.9	59.7	1.4	19.3	12.1
Dec. 2	73.6	45.3	2.7	18.0	10.8
1961					
Jan. 10	69.6	43.5	33.2	23.3	12.1
Feb. 1	84.4	56.6	39.9	17.5	10.8
Mar. 2	69.1	42.2	29.2	29.6	13.0
Apr. 3-4	64.2	39.0	23.8	28.3	12.1
May 2	54.2	34.9	18.4	15.3	10.8
June 5	40.4	29.6	13.5	14.8	8.5
July 5	42.1	28.9	11.9	13.8	8.0
Aug. 10	67.8	28.9	9.3	12.5	8.2
Oct. 3	87.1	65.1	14.4	7.7	33.8

Table 3.--Discharge measurements of spring flow in Huachuca and Garden Canyons—Continued

Date	GARDEN CANYON			HUACHUCA CANYON	
	Measured discharge (gpm) [1]			Measured discharge (gpm) [1]	
	Spring 1 [2]	Spring 2	Upper Pipe	Pipe 2 [2]	Pipe 3
Oct. 31	148	130	19.3	3.0	18.4
Dec. 8	-----	-----	-----	.4	27.4
Dec. 14	458	246	4.5	-----	-----
1962					
Jan. 12	359	245	0	1.4	73.2
Jan. 29	642	186	2.3	1.1	79.4
Mar. 6	370	400	5.5	-----	-----
Mar. 8	-----	-----	-----	.1	67.3
Apr. 27	361	383	5.8	0	56.1
June 13	130	101	2.2	0	21.5
July 25	87.1	68.2	26.5	0	16.6
Sept. 26	89.3	65.8	0	0	18.4
Nov. 9	55.6	43.7	0	16.5	18.2
1963					
Jan. 8	94.2	76.3	3.1	14.4	18.8
Feb. 11	134	75.4	-----	13.9	22.2
Mar. 29	112	67.3	-----	11.7	24.2
May 10	65.5	47.1	8.5	11.7	20.6

Table 3.--Discharge measurements of spring flow in Huachuca and Garden Canyons—Continued

Date	GARDEN CANYON			HUACHUCA CANYON	
	Measured discharge (gpm) [1]			Measured discharge (gpm) [1]	
	Spring 1 [2]	Spring 2	Upper Pipe	Pipe 2 [2]	Pipe 3
Oct. 31	148	130	19.3	3.0	18.4
Dec. 8	-----	-----	-----	.4	27.4
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1962					
Jan. 12	359	245	0	1.4	73.2
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Mar. 6	370	400	5.5	-----	-----
Mar. 8	-----	-----	-----	.1	67.3
Apr. 27	361	383	5.8	0	56.1
June 13	130	101	2.2	0	21.5
July 25	87.1	68.2	26.5	0	16.6
Sept. 26	89.3	65.8	0	0	18.4
Nov. 9	55.6	43.7	0	16.5	18.2
1963					
Jan. 8	94.2	76.3	3.1	14.4	18.8
Feb. 11	134	75.4	-----	13.9	22.2
Mar. 29	112	67.3	-----	11.7	24.2
May 10	65.5	47.1	8.5	11.7	20.6

Table 3.--Discharge measurements of spring flow in Huachuca and Garden Canyons—Continued

Date	GARDEN CANYON			HUACHUCA CANYON	
	Measured discharge (gpm) 1/			Measured discharge (gpm) 1/	
	Spring 1 2/	Spring 2	Upper Pipe	Pipe 2 2/	Pipe 3
June 11	40.4	35.5	7.2	10.8	15.3
July 24	49.9	38.0	4.5	5.2	15.3
Aug. 28	629	3,360	66.0	2.7	36.8
Sept 18	494	732	69.6	-----	-----
Sept. 26	503	473	68.7	-----	-----
Oct. 3	422	323	67.4	53.9	18.0
Oct. 23	285	206	66.4	16.2	41.3
Nov. 14	193	150	65.1	-----	-----
Dec. 9-10	160	122	64.2	4.0	44.5
1964					
Feb. 7	119	93.0	39.1	4.0	35.5
Mar. 25	147	83.5	37.3	1.3	36.4
May 11	98.7	59.7	0	0	32.8
June 25	66.0	40.2	13.6	0	21.2

1/ Discharge measurements are rounded to three significant figures, except for those less than 10 gpm where they are rounded to the nearest one-tenth.

2/ Discharge utilized by Fort Huachuca.

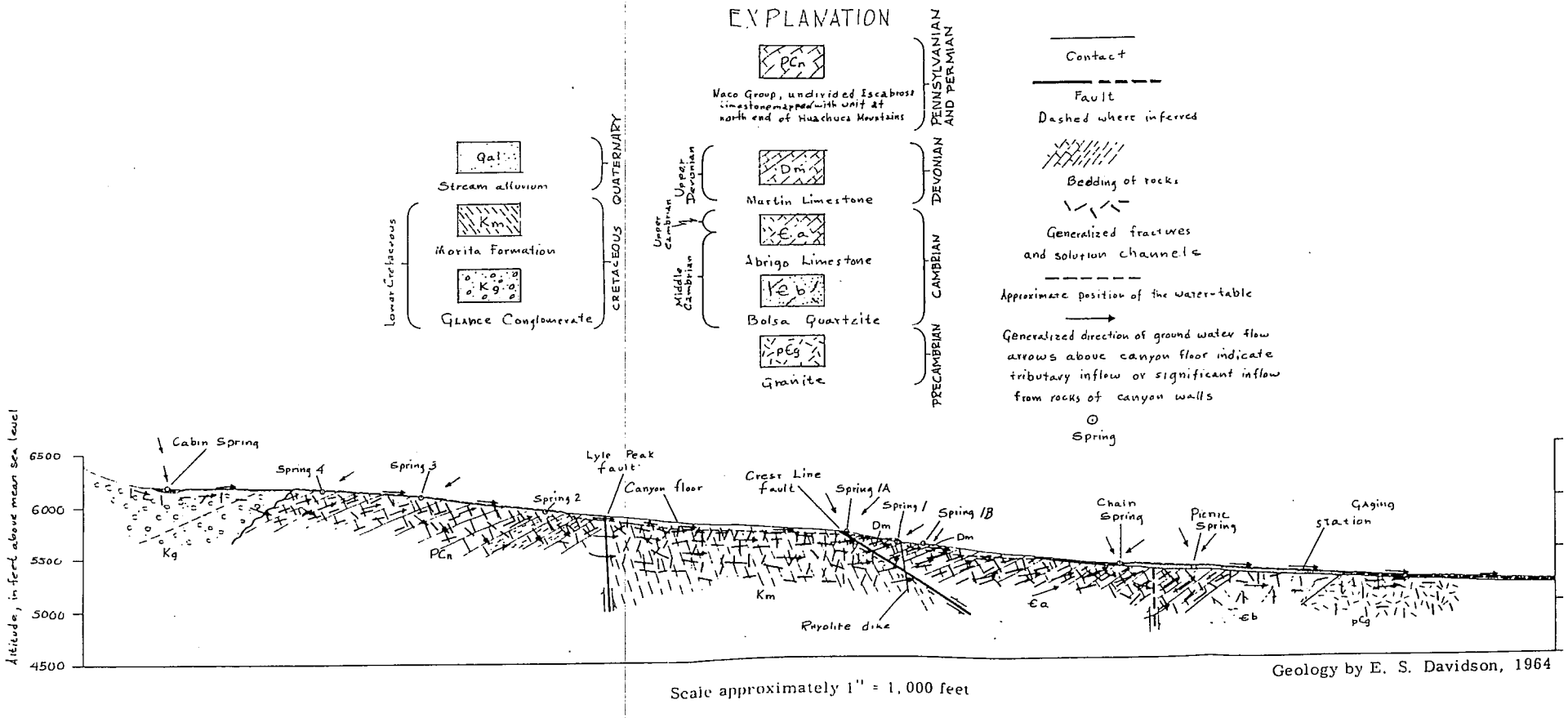


Figure 3.--Diagrammatic cross section of Garden Canyon near Fort Huachuca, Ariz.

the pipeline was cut to measure the discharge of the springs at a measuring point called Upper Canyon Pipe. The maximum flow measured at this point was 99.6 gpm—probably the capacity of the pipe—on March 16, 1960. Observations of no flow were made on January 12, September 26, and November 9, 1962, and on May 11, 1964. The average of 56 measurements, including the four observations of no flow, is 35.3 gpm.

Spring 2.--Spring 2 issues from fractures in limestone beds of the Naco Group. Most of the discharge of Spring 2 is collected in a concrete box and runs into a pipeline, which was cut off a short distance downstream so that the discharge could be measured. When the carrying capacity of the pipeline was exceeded, the box overflowed and the overflow was measured separately. Seepage runs showed increases in streamflow at Spring 2 even when the box was not overflowing, indicating seepage around the box. The maximum flow measured from Spring 2, including seepage, was 3,360 gpm on August 28, 1963, and the minimum flow of 28.9 gpm was measured on July 5 and August 10, 1961. The average of 59 measurements is 237 gpm.

Spring 1A.--Spring 1A issues from the Upper Devonian Martin Limestone along the Crest Line fault. Flow from this spring has been observed only after long periods of rain; however, several seepage

runs disclosed small increases in streamflow when there had been very little precipitation. A discharge of 4,940 gpm was measured on August 28, 1963, following thunderstorms.

Spring 1.--Spring 1 is a perennial spring that discharges from the Martin Limestone. The discharge from Spring 1 is collected in a concrete box and piped to the Fort. The maximum discharge measured at the spring was 642 gpm on January 29, 1962, and the minimum was 40.4 on June 5, 1961, and June 11, 1963. The average of 58 measurements is 208 gpm.

Spring 1B.--Spring 1B is on the south bank of the canyon and is an ephemeral spring issuing from the Martin Limestone. A discharge of 593 gpm was measured on August 28, 1963.

Chain Spring.--Chain Spring probably is caused by underflow moving downstream in the shallow alluvium along McClure Canyon and discharging to the surface when it reaches the already saturated alluvium of Garden Canyon. Seepage runs have shown an increase in streamflow in this area of as much as 340 gpm after thunderstorms; however, most of the year the spring is dry.

Picnic Spring.--Shallow bedrock downstream from the Picnic Spring area forms a barrier to ground-water movement and forces

water to the surface in this area. Measurements showed that on September 18, 1963, 800 gpm was contributed to streamflow in this area.

Huachuca Canyon

Spring discharge in Huachuca Canyon was measured from two pipes that collect flow from several small springs upstream from the gaging station.

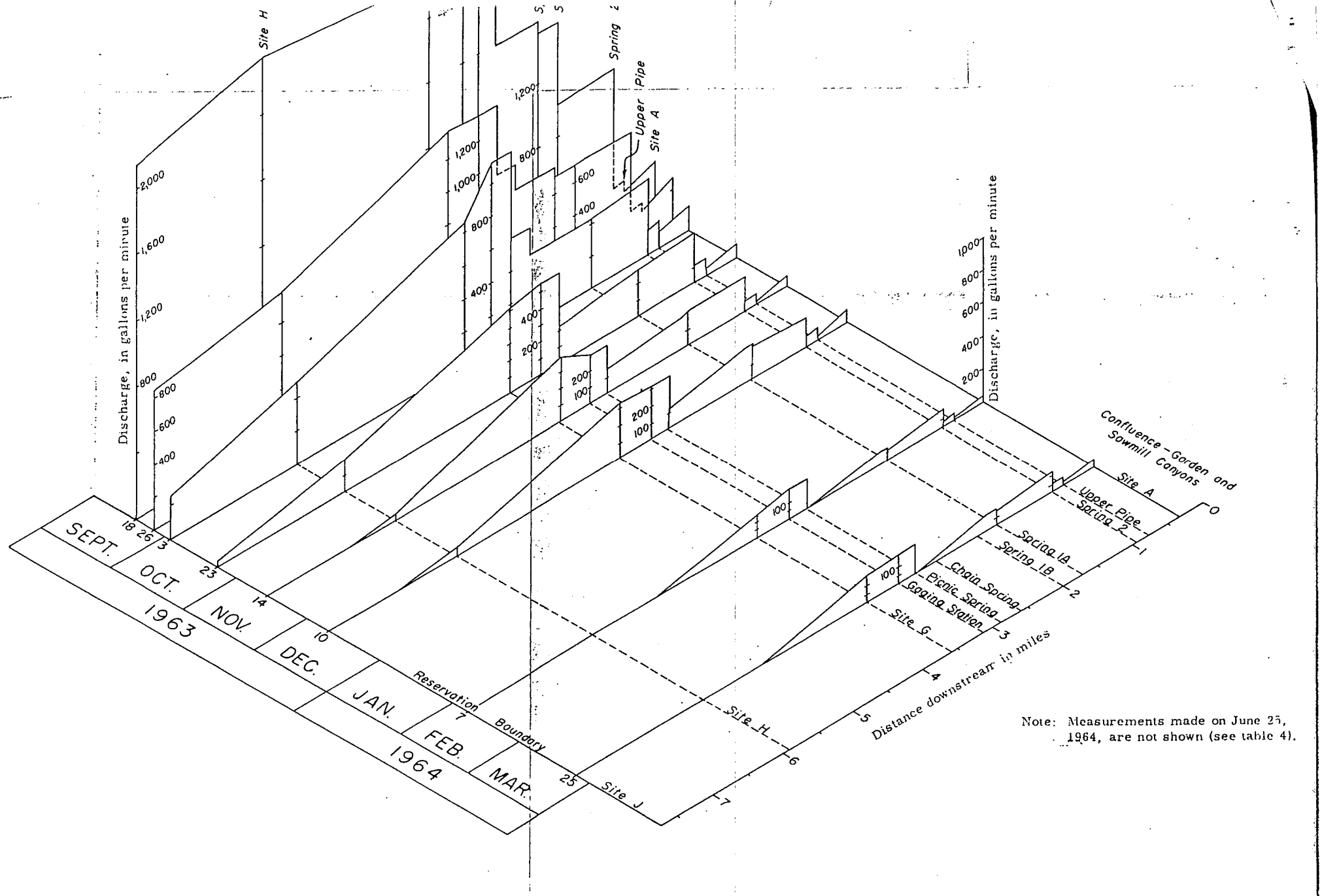
Pipe 3.--Pipe 3 was cut at a point just downstream from the gaging station. The maximum measured discharge from the pipe was 79.4 gpm on January 29, 1962, and the minimum was 8.0 gpm on July 5, 1961. The average of 56 discharge measurements is 20.8 gpm.

Pipe 2.--The discharge from Pipe 2 was measured about three-fourths of a mile downstream from the gaging station where a sleeve splice was inserted in the pipeline so that flow is maintained to the Post. The maximum measured flow in the pipe was 53.9 gpm on October 3, 1963. Four observations of no flow were made between April 27 and September 26, 1962, and two between May 11 and June 25, 1964. The average of 56 discharge measurements, including the six observations of no flow, is 15.4 gpm.

VARIATIONS IN FLOW IN GARDEN CANYON

From September 18, 1963, to June 25, 1964, nine series of measurements were made in Garden Canyon in order to determine the gains and losses in streamflow down the canyon. Each series consisted of measurements of streamflow and spring discharge at selected sites beginning near the head of the canyon and ending where the stream leaves the military reservation (figs. 1 and 4; table 4). These measurements were made in a period of general streamflow recession following the summer thunderstorms. Streamflow reached a peak for the summer on September 2, 1963, when an instantaneous discharge of 59 cfs (26,500 gpm) was recorded at the gaging station. A steady decline in streamflow followed, and on June 25, 1964, 0.01 cfs (4 gpm) was measured at the gage.

The first series of measurements was made on September 18, 1963, and showed the points of major gains in streamflow to be at Spring 2, Spring 1A, and Picnic Spring. Subsequent runs showed general declines in spring discharge. Spring 2 declined from 732 gpm on September 18, 1963, to 40 gpm on June 25, 1964; in the same period discharge from Picnic Spring declined from 800 to 4 gpm. Spring 1A was dry by September 26, Spring 1B by October 3, and Chain Spring by October 23, 1963. Later measurements showed small amounts of



Note: Measurements made on June 25, 1964, are not shown (see table 4).

Figure 4.--Graphs of flow in Garden Canyon Creek, showing discharge at selected measuring sites.

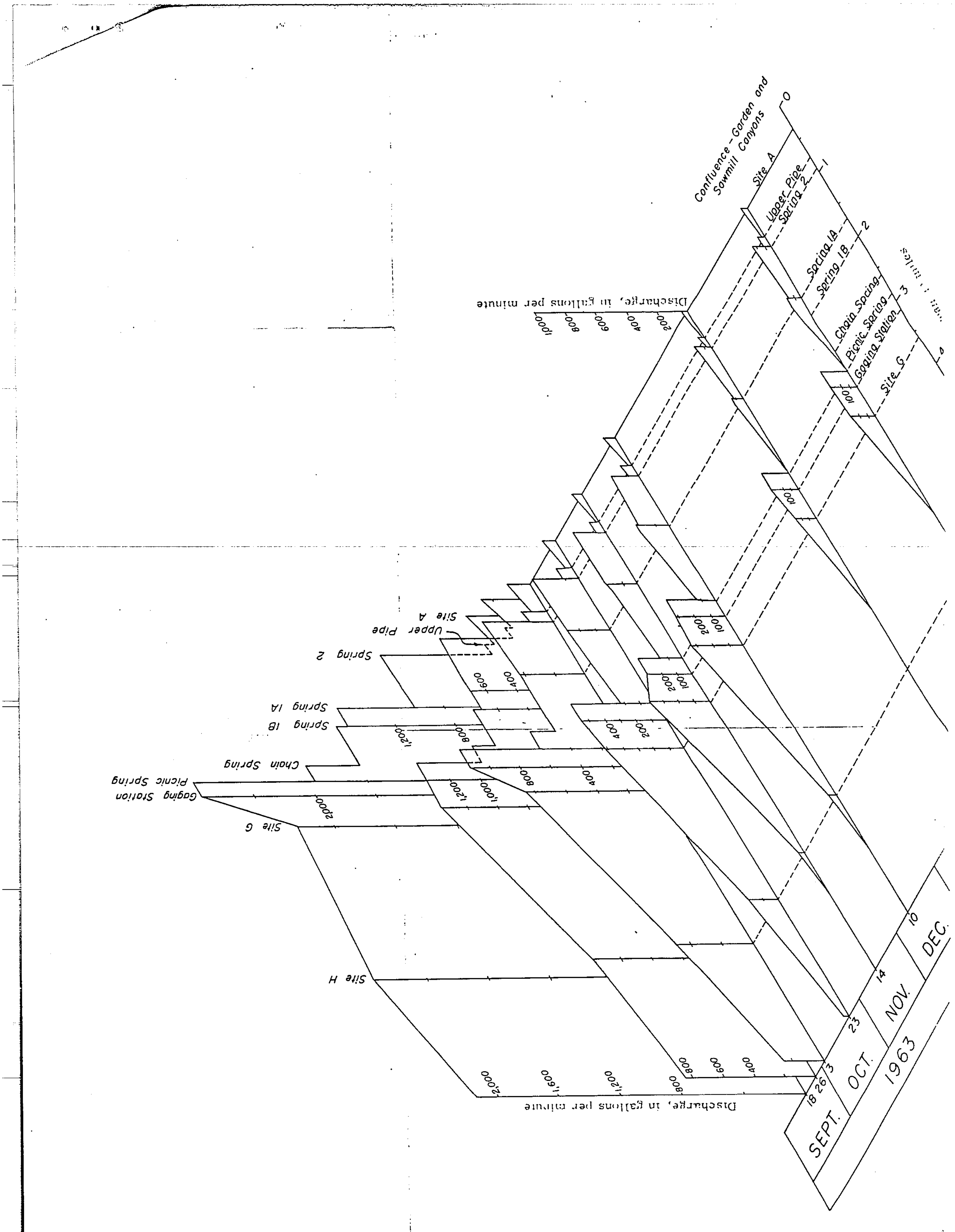

Confluence - Garden and Sawmill Canyons
Site A
Upper Pipe
Spring 2
Spring 1A
Spring 1B
Chain Spring
Picnic Spring
Gaging Station
Site G
Site H
Discharge, in gallons per minute
SEPT.
OCT.
NOV.
DEC.
1963
18
26
3
23
14
10

Table 4.--Discharge measurements in Garden Canyon near Fort Huachuca, Ariz., from September 18, 1963, to June 25, 1964

(Note: figures in parentheses are inferred spring inflows)

Site	Distance downstream (miles)	Discharge in gallons per minute																	
		1963												1964					
		September 18		September 26		October 3		October 23		November 14		December 10		February 7		March 25		June 25	
		Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow	Spring inflow	Streamflow
Confluence of Garden and Sawmill Canyons	0.0																		
Site A	.3		305		275		160		90		63		67		36		27		2
Upper Canyon Pipe	.75	70		69		67		66		65		64		39		37		14	
Site B	.9-		280		215		145		99		54		53		36		31		0
Spring 2	.9	732		473		323		206		150		122		93		84		40	
Site C	.9+		1,010		688		468		305		204		180		129		115		40
Site D	1.65		990		705						210		195		63		72		
Spring 1A	1.7	(520)										(15)		(9)		(9)			
Site E	1.8		1,510		695		430		280		185		210		72		81		13
Spring 1 1/	1.95	494		503		422		285		193		160		119		147		66	
Spring 1B	2.0	85		67															
Chain Spring	2.6	(340)		(145)		(165)													
Site F	2.75		1,940		905		595		225		145		115		0		0		0
Picnic Spring	2.85	(800)		(435)		(535)		(325)		(145)		(200)		(180)		(165)		(4)	
Gaging station	3.1		2,740		1,340		1,130		550		290		315		180		165		4
Site G	3.55		2,240		1,360		870		515		385		330		135		155		0
Site H	5.9		2,350		980		495		190		36		58		0		0		0
Site J (reservation boundary)	7.7		2,140		845		260		27		0		0		0		0		0

1/ Discharge from Spring 1 is piped to the Fort and therefore does not contribute to streamflow.

effluent seepage in the area of Spring 1A. The point of maximum streamflow in the canyon was usually at the gaging station. The gage is near the mouth of the canyon where bedrock occurs at shallow depth. Some underflow bypasses the gage through the alluvium, but the amount is probably small, and most of the downcanyon flow is measured at the gage.

On three occasions the streamflow at Site G (0.4 mile below the gage) slightly exceeded the flow at the gage; however, twice there was a sharp decrease in flow between these two points. Between Sites G and H the flow generally diminished gradually, except on September 18 when there was an increase. Site H includes a much larger drainage area than Site G, and, as there was a storm a few days before, the increase was probably due to runoff from the intervening area. By November 14, there was no flow at Site J, the farthest downstream site at the reservation boundary (4.6 miles below the gage); by February 7, 1964, there was no flow at Site H (2.8 miles below the gage); and by June 25, 1964, there was no flow at Site G (0.4 mile below the gage).

Losses in streamflow are due to evapotranspiration and infiltration to ground-water storage. The seepage runs showed an average loss in streamflow above the gaging station of about 50 gpm per mile of channel. However, upstream from the gaging station most

streamflow that infiltrates to the water table is returned to the stream as spring discharge. Below the gaging station the average loss was about 140 gpm per mile of channel. Some of the loss below the gaging station reached the water table, as indicated by the water-level changes in an observation well 1-1/2 miles below the gaging station and about 500 feet from the stream channel. The water-level fluctuations in the well reflect the variations of streamflow past the Garden Canyon gaging station (fig. 5).

PRECIPITATION AND RUNOFF

In the Fort Huachuca area precipitation varies with the seasons and is distributed unevenly over the area (Harlin, 1963)—more precipitation occurs near the mountains than on the plains. Precipitation is greatest in the summer and least in the spring; many of the brief but intense summer thunderstorms produce more rain over the plains than over the mountains. The fall and winter precipitation is distributed more evenly over the mountains and tapers off rapidly over the plains (Harlin, 1963, p. 5). The areal variability in precipitation explains the general lack of correlation between precipitation measured at the Fort Huachuca weather station and runoff measured at the Garden Canyon gaging station (fig. 5). The weather station is 7-1/2 miles north of the Garden Canyon gaging station (fig. 1) at an altitude of

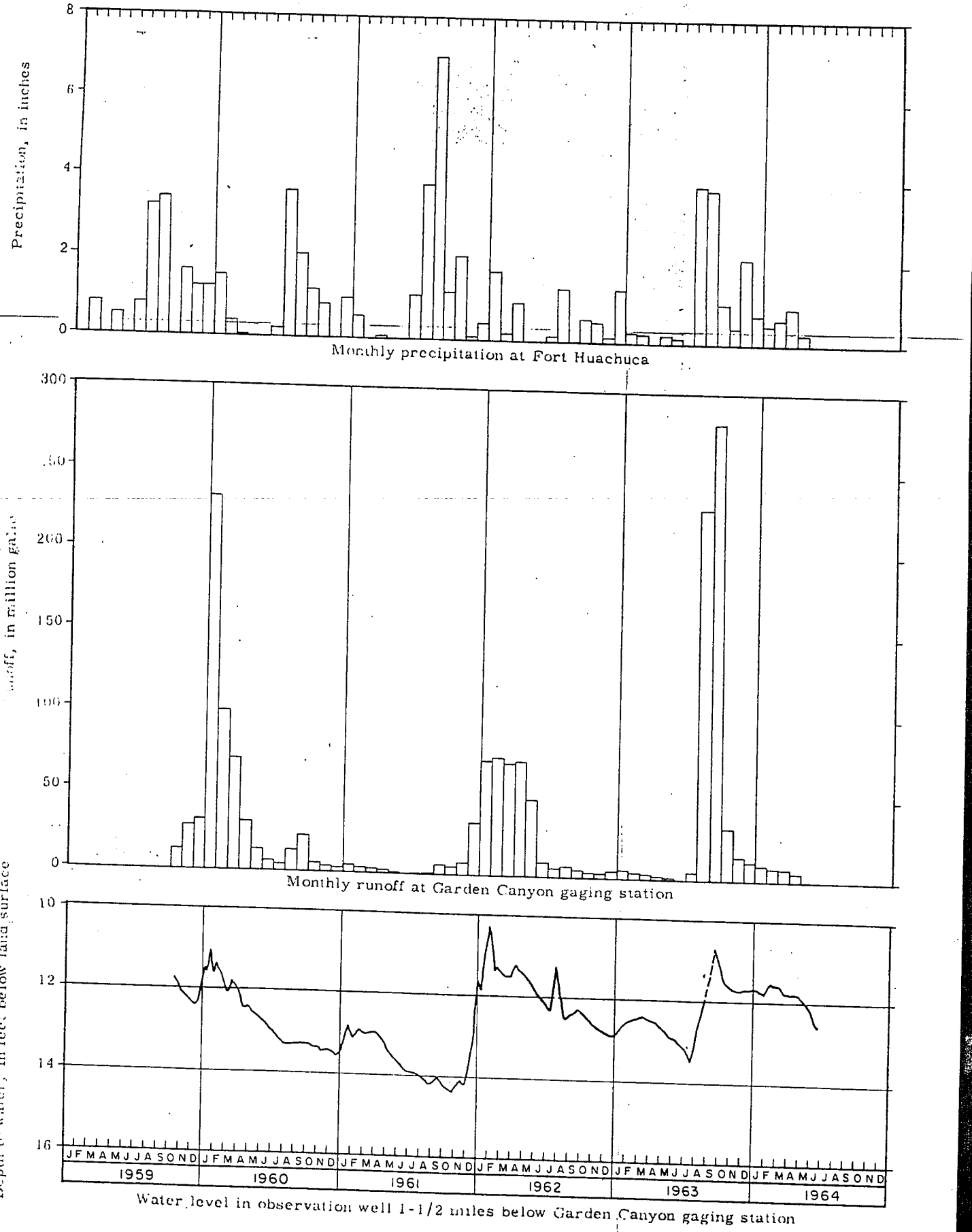


Figure 5. --Comparison of monthly runoff from Garden Canyon with water level in an observation well near Garden Canyon [illegible]

4,664 feet, whereas altitudes in the Garden Canyon drainage range from 5,300 feet at the gaging station to 8,410 feet at Huachuca Peak.

The average annual precipitation was 15.31 inches for the 24 years of complete record at the weather station. During this study, from 1960 to 1963, the average annual precipitation was 11.75 inches; therefore, this was a period of below-normal precipitation at the weather station. Two of the three surrounding weather stations also recorded below-normal precipitation, which may reflect below-normal precipitation over the entire Garden Canyon drainage area.

A comparison of monthly runoff from Garden Canyon with monthly pumpage from the Fort Huachuca well field (figs. 1 and 6) shows that since October 1959 runoff from Garden Canyon exceeded pumpage from the well field only in January and February 1960, January through March 1962, and August and September 1963. For extended periods the runoff was less than 10 million gallons per month—notably from October 1960 through November 1961 and from June 1962 through July 1963. Runoff past the Garden Canyon gaging station would have supplied the Fort's water needs in the three periods shown in figure 7. In the 4 years from October 1959 through September 1963 the total runoff from Garden Canyon would have supplied 44 percent of the Fort's water needs.

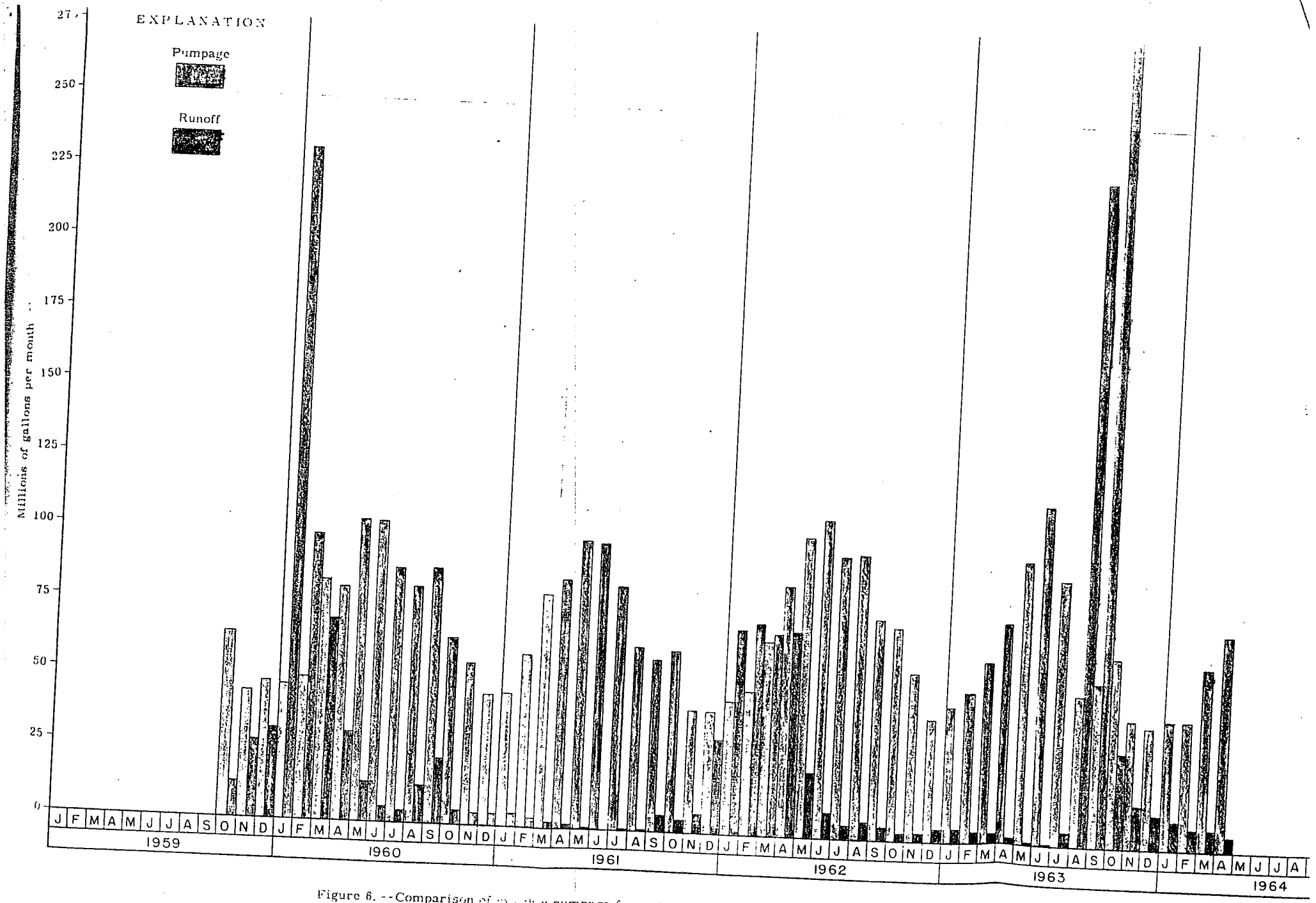


Figure 6. --Comparison of monthly pumpage from the Fort [illegible] well field with monthly runoff from Garden, Carson.

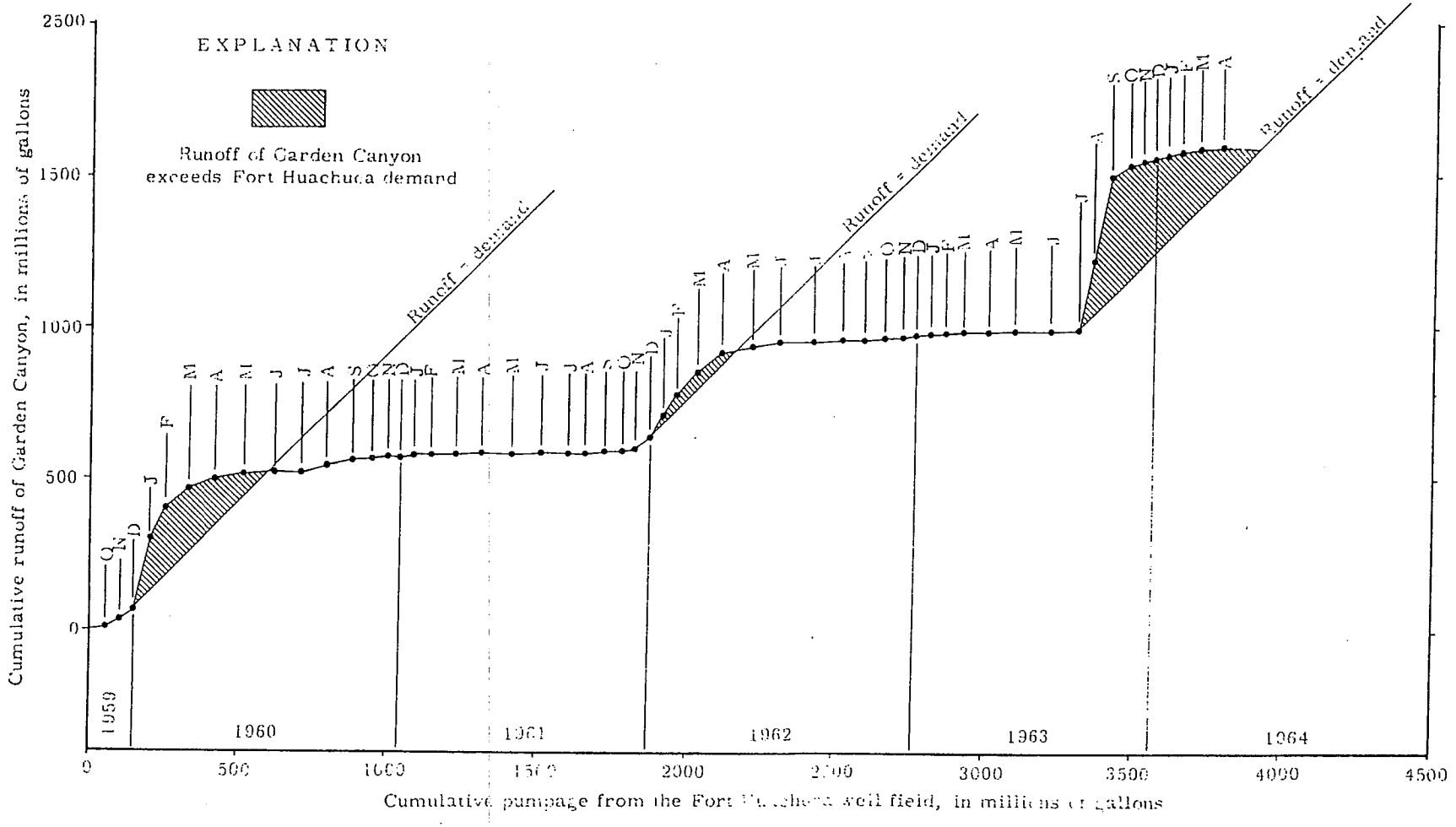


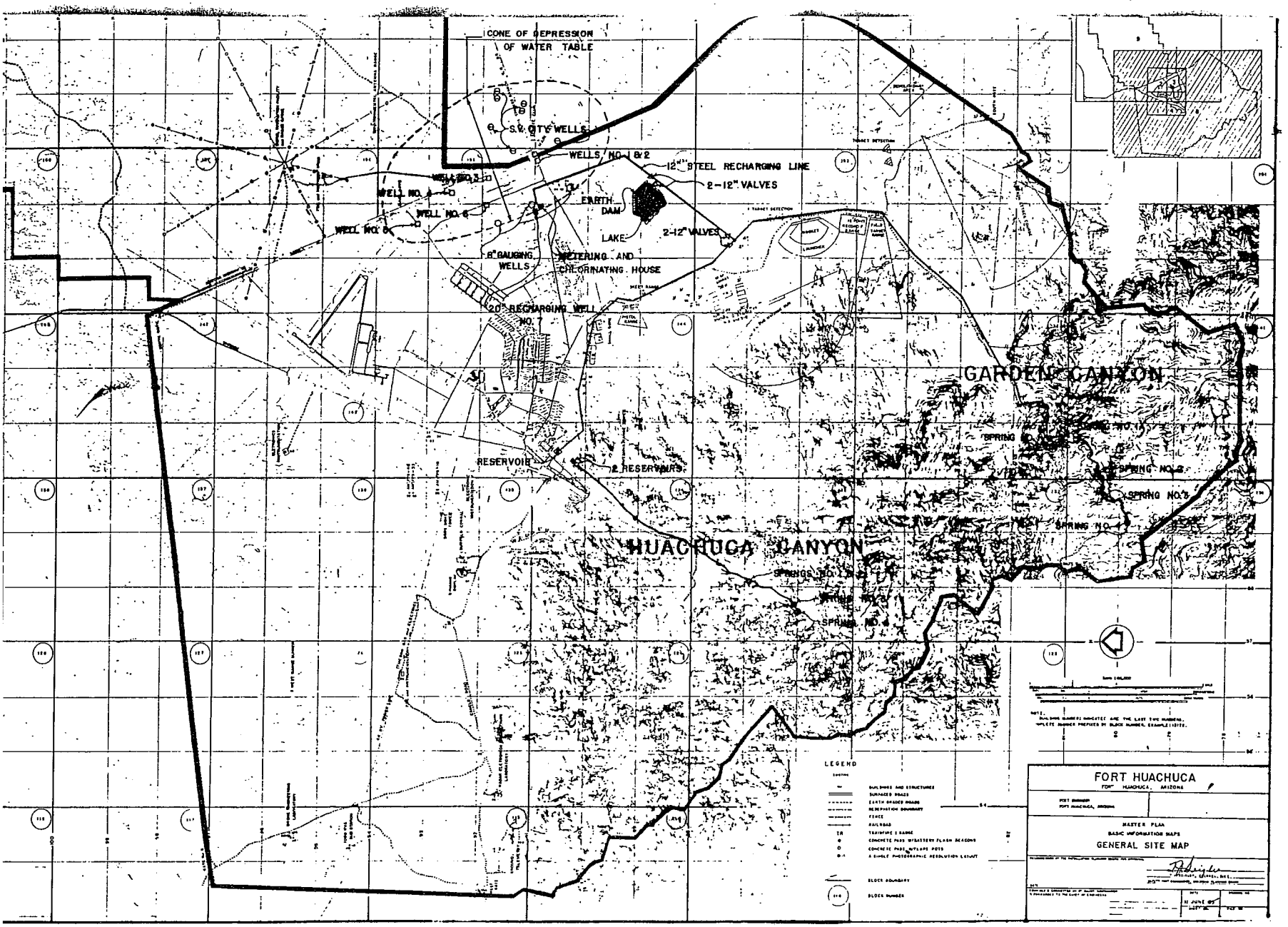
Figure 7.--Double mass curve of runoff from Garden Canyon and pumpage from the Fort Huachuca well field.

SUMMARY

Runoff from Garden Canyon from October 1959 through April 1964 was 4,900 acre-feet or 1.6 billion gallons. Runoff from Huachuca Canyon was less than one-tenth of this amount for the same period. The greatest runoff from Garden Canyon was in January, August, and September and the least was in June and July. The major springs in Garden Canyon are Spring 2, Spring 1, and Picnic Spring. Springs 2 and 1 flowed continuously and averaged 237 and 208 gpm, respectively. Seepage investigations showed that the point of maximum streamflow in Garden Canyon was near the gaging station. Below the gaging station, the streamflow diminished rapidly due to evapotranspiration and some recharge to ground-water storage. The runoff past the Garden Canyon gaging station for the 4 years, October 1959 through September 1963, amounted to 44 percent of the Fort's water needs for that period.

REFERENCES CITED

Harlin, B. W., 1963, Precipitation over the Fort Huachuca high density small scale meteorological network from November 1960 through March 1963: U. S. Weather Bureau Research Station open-file report, Fort Huachuca, Ariz.



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