

Bib key ID's: 173825
654900

SPRING DISCHARGE AT CEDAR BREAKS NATIONAL MONUMENT

AND ZION NATIONAL PARK, SOUTHWESTERN UTAH

by

C. T. Sumsion, Hydrologist
U.S. Geological Survey

ADMINISTRATIVE REPORT

Prepared by
the U.S. Geological Survey
in cooperation with the
National Park Service

Salt Lake City, Utah

1971

CONTENTS

	Page
Abstract-----	4
Introduction-----	5
Purpose and scope-----	5
Previous investigations and acknowledgments-----	6
Methods-----	7
Sunset View Spring-----	8
Lava Point Spring 2-----	13
Sawmill Spring-----	16
References-----	20

ILLUSTRATIONS

	Page
Figure 1. Map of Sunset View Spring and vicinity, Cedar Breaks National Monument-----	9
2. Map of Lava Point Spring 2 and vicinity, Zion National Park-----	14
3. Map of Sawmill Spring and vicinity, Zion National Park-----	17

TABLES

Table 1. Discharge and temperature of Sunset View Spring and precipitation at Cedar Breaks National Monument---	10
2. Chemical analyses of water from springs-----	12
3. Discharge and temperature of Lava Point Spring 2 and precipitation at Zion National Park-----	15
4. Discharge and temperature of Sawmill Spring and pre- cipitation at Zion National Park-----	18

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ABSTRACT

Periodic spring-discharge measurements have been made during the summers of 1969 and 1970 of Sunset View Spring in Cedar Breaks National Monument and of Lava Point Spring 2 and Sawmill Spring in Zion National Park. Based on preliminary evaluations of water requirements by National Park Service personnel, Sunset View Spring has sufficient discharge to provide supplementary water supplies, Lava Point Spring 2 will furnish sufficient water for the campground at Lava Point, but Sawmill Spring will not furnish sufficient water for all purposes at the East Rim campground area. Chemical analyses of water samples from Sunset View Spring and Lava Point Spring 2 collected in September 1970 are presented for comparison with earlier analyses; they show no significant change. A water sample was not obtained from Sawmill Spring in September 1970 because its discharge had decreased to a seep. Records for continued observations of spring discharge for at least 5 years, for their extremes and long-term average, will be needed by National Park Service personnel engaged in planning the development and management of water resources.

INTRODUCTION

Purpose and scope

The need for data and information about water resources in National Parks and Monuments is particularly great in Utah because of the rapid development of facilities, the general aridity of the region and scarcity of usable water, and the increasing numbers of visitors to these scenic areas.

The purpose of this investigation was to give a preliminary evaluation of range of discharge and quality of the water during the summer months at Sunset View Spring in Cedar Breaks National Monument and Lava Point Spring 2 and Sawmill Spring in Zion National Park. This report covers 2 years, the summers of 1969 and 1970, of a program of continuing observations. These data are needed in order to plan the development of supplementary water supplies in Cedar Breaks National Monument and for water supplies for the Lava Point and East Rim campsites in Zion National Park. The minimum period of observations should be about 5 years to provide decisive evaluations of spring discharge.

This report includes data from discharge measurements performed mainly by National Park Service personnel during the summers of 1969 and 1970. Chemical analyses of water from Sunset View Spring and from Lava Point Spring 2 were made for comparison with previous analyses (Sumsion, 1967, p. 11, and 1968, p. 7).

Previous investigations and acknowledgments

Water resources at the East Entrance area of Zion National Park and springs in Cedar Breaks National Monument were described in an administrative report to the National Park Service by Gates (1961).

The water resources of Cedar Breaks National Monument, including springs that have a potential for supplementary water supplies and the possibilities of obtaining water from wells, were described in an administrative report to the National Park Service by Sumsion (1967).

An investigation of the feasibility of obtaining water supplies from springs and wells in the Lava Point and East Rim campsite areas in Zion National Park were described in an administrative report to the National Park Service by Sumsion (1968).

The generous cooperation and assistance of personnel of the National Park Service at Cedar Breaks National Monument and at Zion National Park and of Messrs. G. S. Witucki and D. C. Barrett is gratefully acknowledged.

Methods

All measurements of spring discharge were made volumetrically, using a calibrated bucket and timing the discharge to the nearest second; measurements are presented in gallons per minute. Water temperatures were determined by direct-reading thermometer and are presented in degrees Celsius (to the nearest half a degree) and degrees Fahrenheit. Springs are classified as to their variability of discharge as follows:

$$\text{Variability in percent} = \frac{\text{maximum discharge} - \text{minimum discharge} \times 100}{\text{average discharge}}$$

constant - variability less than 25 percent;

subvariable - variability 25 to 100 percent; and

variable - variability more than 100 percent of the average discharge

(Meinzer, 1923, p. 53-54).

Five or more years of discharge records are necessary to make a reliable classification of variability.

Precipitation records for the weather stations in Cedar Breaks National Monument and in Zion National Park were provided by the National Weather Service (formerly the Weather Bureau, Environmental Science Services Administration) (1969-70) and by Mr. Arlo Richardson, State Climatologist (oral commun., 1970).

All chemical analyses were made by the U.S. Geological Survey.

SUNSET VIEW SPRING

Sunset View Spring in Cedar Breaks National Monument is in the western part of the Markagunt Plateau, about 22 miles east of Cedar City (fig. 1). Altitudes within the monument range from about 8,100 to 10,660 feet above mean sea level.

Normal annual precipitation for the period 1931-60 in the area of Cedar Breaks National Monument is slightly more than 40 inches (U.S. Weather Bur., 1963). Monthly precipitation records (June-September) at the monument are given in table 1 for comparison with rates of discharge of Sunset View Spring.

The geology and hydrology of the Markagunt Plateau, including Cedar Breaks National Monument, have been described by Wilson and Thomas (1964, p. 16-25). Sunset View Spring discharges from a perched water-bearing zone underlain by a relatively impermeable clay layer in limestone and marl of the Wasatch Formation, a lacustrine deposit of Eocene age (Samsion, 1967, p. 6-9).

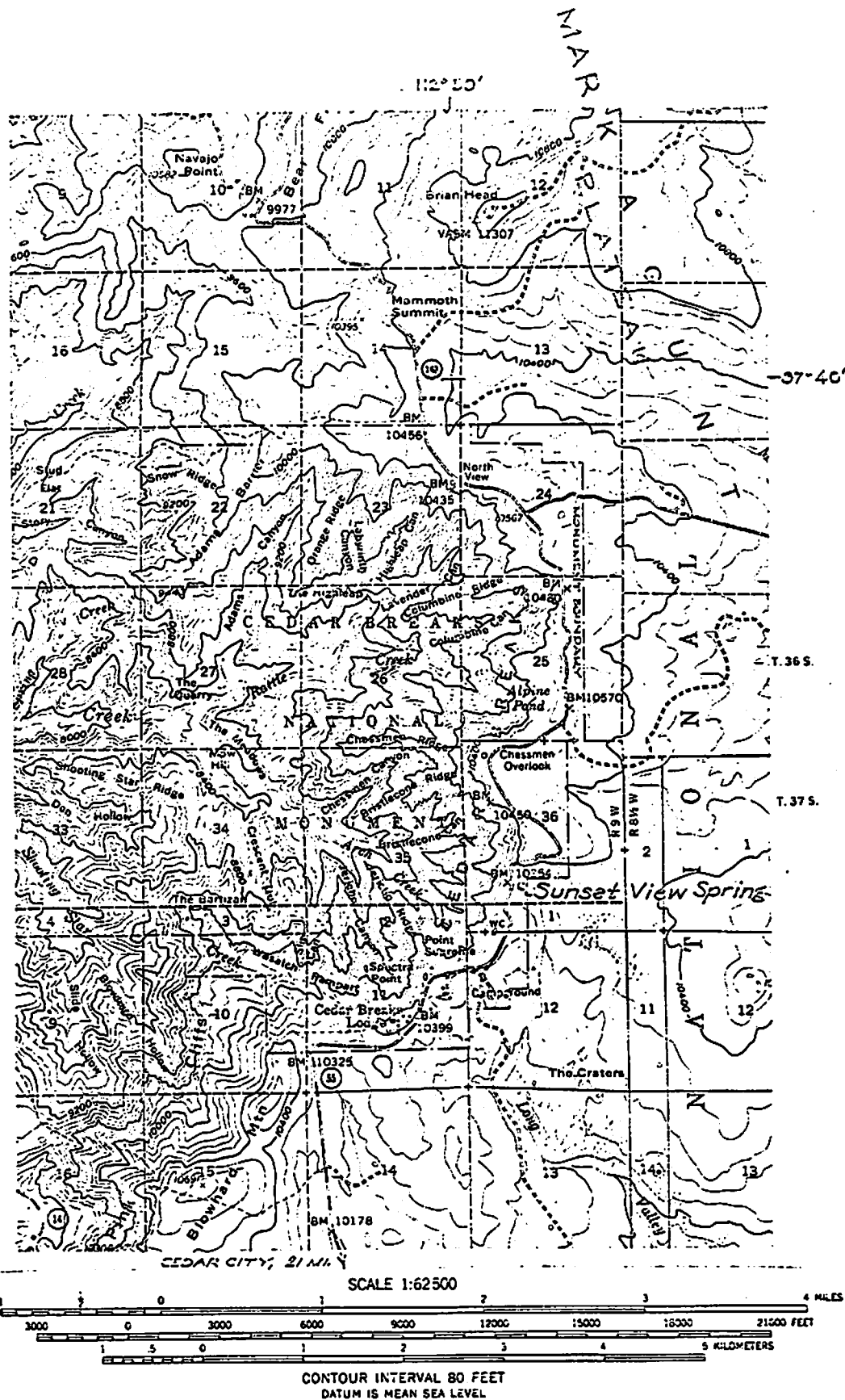


Figure 1.--Sunset View Spring and vicinity, Cedar Breaks National Monument.

Table 1.--Discharge and temperature of Sunset View Spring and precipitation at Cedar Breaks National Monument

<u>1969</u>	<u>Discharge gallons per minute</u>	<u>Temperature</u>		<u>Precipitation at Cedar Breaks Nat. Mon.</u>	
		<u>°C</u>	<u>°F</u>	<u>Month</u>	<u>Inches</u>
June 16	6.1 maximum	7.0	44.5		
24	5.9	7.0	44.5	June	2.05
July 9	5.5	7.0	44.5		
21	5.0	7.0	44.5	July	3.19
Aug. 12	4.5	7.0	44.5		
19	4.5	7.0	44.5		
27	4.1	7.0	44.5	Aug.	1.61
Sept. 3	3.8	7.0	44.5		
16	4.6	7.0	44.5	Sept.	2.41
<u>1970</u>					
June 9	5.5	7.0	44.5		
24	5.0	7.0	45.0	June	1.70
July 13	4.5	7.0	45.0		
21	3.9	7.0	45.0	July	4.42
Aug. 17	2.9	7.0	45.0		
31	2.8	7.0	45.0	Aug.	3.77
Sept. 3	2.4 minimum	7.0	45.0		
28	2.5	7.0	45.0	Sept.	4.56
Average	4.3				

Table 2.--Chemical analyses of water from springs

(Analyses are reported in milligrams per liter.)

	Sunset View Spring		Lava Point Spring 2		Sawmill Spring	PHS limits
Date of sample	8-3-67	9-3-70	11-8-63	9-3-70	8-3-67 ^{1/}	
Silica (SiO ₂)	17	20	19	24	15	-
Calcium (Ca)	51	62	29	33	103	-
Magnesium (Mg)	25	24	10	11	40	-
Sodium (Na)	-	1.0	4.2	4.7	-	-
Potassium (K)	-	.1	1.0	1.7	-	-
Calc. Na+K (as Na)	4.3	-	-	-	8.7	-
Bicarbonate (HCO ₃)	284	300	125	132	474	-
Sulfate (SO ₄)	5.2	4.0	15	25	44	250
Chloride (Cl)	2.1	5.0	3.5	3.5	6.0	250
Fluoride (F)	-	.5	.2	.5	-	1.7
Nitrate (NO ₃)	.2	.1	1.6	.8	.1	45
Boron (B)	-	.00	.02	.03	-	-
Iron (Fe)	-	.00	.05	.0	-	.3
Dissolved solids	239	252	157	171	468	500
Hardness as CaCO ₃	232	253	115	128	424	-
Temperature, °C	9.0	7.0	6.5	6.0	9.0	-
Specific conductance, micromhos at 25°C	410	438	240	260	759	-
pH	7.7	7.9	7.2	7.5	7.8	-

^{1/} No recent analysis available.

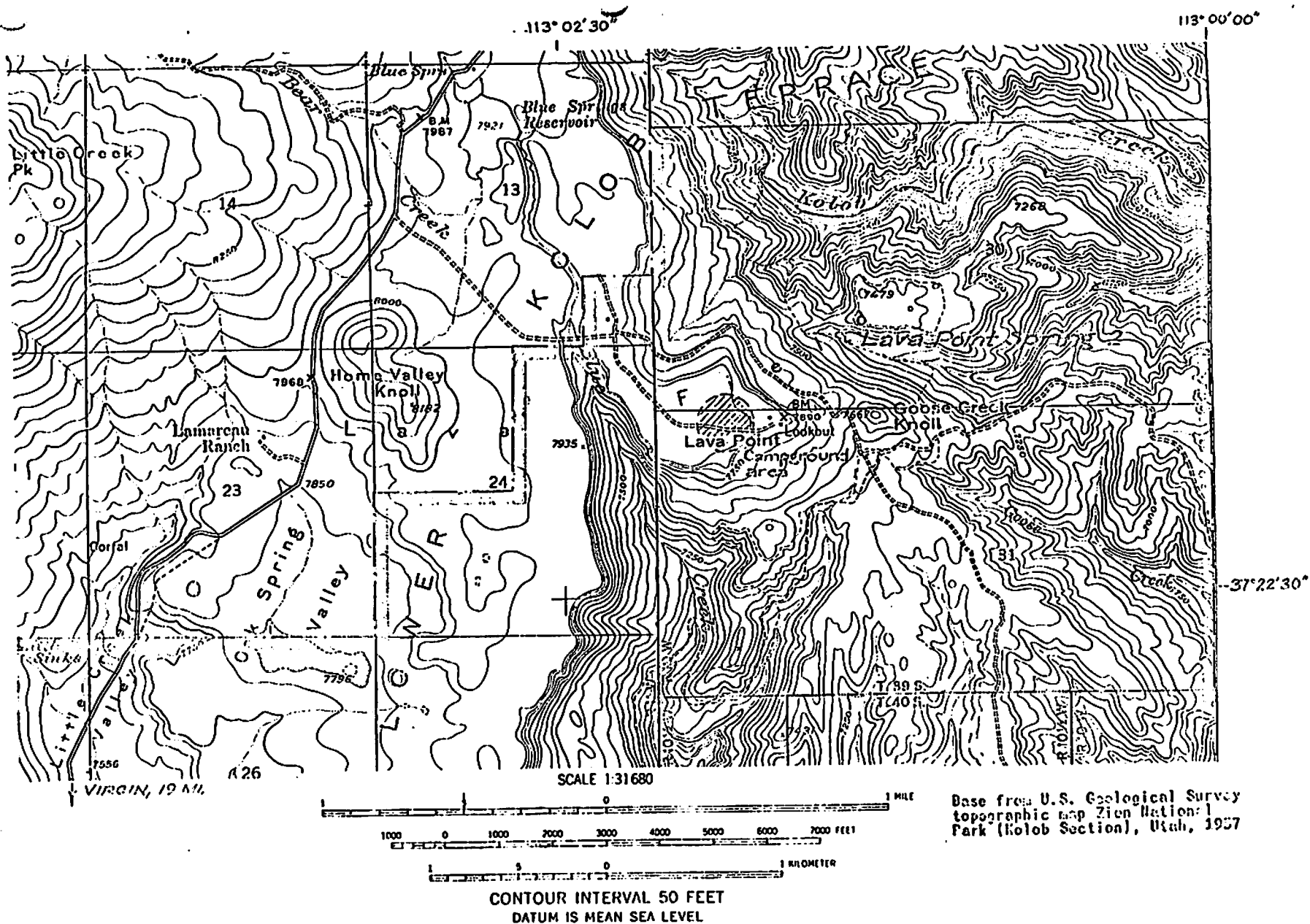


Figure 2.—Lava Point Spring 2 and vicinity, Zion National Park.

Table 3.--Discharge and temperature of Lava Point Spring 2 and
precipitation at Zion National Park

<u>1969</u>		<u>Discharge</u> <u>gallons</u> <u>per minute</u>	<u>Temperature</u>		<u>Precipitation at</u> <u>Zion National Park</u>	
			<u>°C</u>	<u>°F</u>	<u>Month</u>	<u>Inches</u>
June	30	38 maximum	6.0	43.0	June	0.24
July	7	38	6.0	43.0		
	30	36	6.0	43.0	July	.76
Aug.	12	34	6.0	43.0		
	29	36	6.0	43.0	Aug.	1.19
Sept.	18	36	6.0	43.0		
	28	36	6.0	43.0	Sept.	.45
<u>1970</u>						
June	29	30	6.0	43.0	June	.89
July	11	30	6.0	43.0		
	25	30	6.0	43.0	July	2.18
Aug.	1	30	6.0	43.0		
	22	30	6.0	43.0	Aug.	2.10
Sept.	3	27 minimum	6.0	43.0		
	25	30	6.0	43.0	Sept.	.60
Average		33				

Lava Point Spring 2 was subvariable $(\frac{38 - 27}{33} \times 100 = 33 \text{ percent})$ for the period of observation (table 3). The water supply needed at the Lava Point campground for the near future (Ranger G. A. Hoddenbach, oral commun., 1970) can be furnished by this spring.

Chemical analysis of the water shows no significant changes from August 1963 to September 1970 (table 2); all concentrations of chemical constituents are within the prescribed limits of the U.S. Public Health Service (1962, p. 6-8).

SAWMILL SPRING

Sawmill Spring, near the East Rim campground area, also is on the Kolob Terrace. The spring is about 18 miles by unpaved road northwest of a junction with State Highway 15 and about 6 miles by trail northwest of the East Entrance of Zion National Park (fig. 3). Altitude of the East Rim campground area is 6,400 feet above mean sea level--about 50 feet lower than the spring.

Normal annual precipitation at the East Rim area is about 20 inches (U.S. Weather Bur., 1963). Precipitation during June-September at Zion National Park is given in table 4 for comparison with the rate of discharge of Sawmill Spring. The nearest weather station is at the park headquarters.

Table 4.--Discharge and temperature of Sawmill Spring and
precipitation at Zion National Park

<u>1969</u>	Discharge gallons per minute	Temperature		Precipitation at Zion National Park	
		°C	°F	Month	Inches
June 30	4.3 maximum	9.0	48.0	June	0.24
July 26	3.0	9.0	48.0	July	.76
Aug. 29	2.8	9.0	48.0	Aug.	1.19
Sept. 26	.5	10.0	50.0	Sept.	.45
<u>1970</u>					
June 29	4.0	9.0	48.0	June	.89
July 31	2.5	9.0	48.0	July	2.18
Aug. 21	.9	10.0	50.0	Aug.	2.10
Sept. 3	(seep)	-	-		
25	(seep)	-	-	Sept.	.60
Average	2.0				

Sawmill Spring discharges from a perched water-bearing zone of limited extent underlain by thin, relatively impermeable shale layers, all in the Carmel Formation, which is mainly marine limestone of Jurassic age (Sumsion, 1968, p. 4-7).

There is no record of the use of water from Sawmill Spring. It is believed that a small amount is consumed by the occasional visitors (estimated to be fewer than 20 annually) to this undeveloped area.

Sawmill Spring was variable ($\frac{4.3 - 0}{2.0} \times 100 = 215$ percent) during the period of observation (table 4). The amount of water needed for all purposes at the East Rim campground area (Ranger G. A. Hoddenbach, oral commun., 1970) cannot be provided from the spring; in September 1970 it was merely a seep.

A sample of water for chemical analysis from Sawmill Spring was unobtainable in September 1970. Chemical quality of water from the spring when its discharge was about 4.5 gallons per minute on August 3, 1967, is given in table 2; all concentrations of chemical constituents are within the prescribed limits of the U.S. Public Health Service (1962, p. 6-8).

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