

MEMORANDUM ON A WATER SUPPLY FOR CRATERS OF THE MOON

NATIONAL MONUMENT, IDAHO - 1968

Introduction

A memorandum report describing briefly the geohydrology of the Little Cottonwood Creek basin and recommending a location for a test well in the Craters of the Moon National Monument was provided the National Park Service in April 1967 by the U.S. Geological Survey. However, because it was felt that more specific data were needed prior to actual development of a water supply in the basin, additional work was undertaken by the Survey at the request of the Park Service.

The purpose of this report is to describe the work accomplished in the Little Cottonwood Creek basin during the period September 1967 to June 1968. Included are: (1) measurements made of flow from springs and in streams; (2) estimates of average annual recharge to the alluvium in the basin; (3) results obtained from chemical analyses of water samples collected; and (4) recommendation of two sites for test drilling. The brief generalized description of the geography, geology, and hydrology given in the attached April 1967 report should be referred to prior to reading this report.

Measurement of Spring flows and Streamflows

The measurements listed below give the flow at selected times of the four springs presently being used as a water supply, and the flow of the two streams (Little Cottonwood and unnamed - see attached map) in Little Cottonwood basin.

Discharge Measurements - Little Cottonwood basin

Craters of the Moon National Monument, Idaho

Date	Discharge						
	Unnamed Creek		Little Cottonwood Creek				
	gpm	acre-ft/yr	gpm	acre-ft/yr			
September 14, 1967	37	60	28	45			
March 11, 1968	59	95	78	126			
May 24, 1968	85	137	170	275			
	Little Cottonwood Springs						
	No. 1		No. 2		No. 3		
	gpm	ac-ft/yr	gpm	ac-ft/yr	gpm	ac-ft/yr	
	September 14, 1967	16	26	23	37	12	19
	March 11, 1968	8	13	24	39	12	19
May 24, 1968	30	48	30	48	12	19	

The September 1967 measurements are indicative of the total water supply available at a time of near peak use (Labor Day weekend) in the Monument. The May 1968 measurements were made at or near a time of peak flow. However, because a generally light snowpack occurred during the preceding winter, the flows given probably are below the average peak flow experienced in this area. Minimum flows usually occur in March

immediately prior to the time of spring snowmelt. Unfortunately, snowmelt occurred unusually early in 1968 so that the March measurements made do not indicate minimum flows. Despite these climatic effects, the measurements made are indicative of the water supply available to the Little Cottonwood basin, and they were used in estimating the quantity of water available for ground-water recharge.

Estimation of Average Annual Ground-Water Recharge

An estimate of the average annual recharge to ground water from streamflow in the area was made as follows: The average annual surface runoff from that part of Little Cottonwood basin above the stream measuring sites was estimated by correlating the combined measured flow in the two streams plus the piped outflow from Little Cottonwood Springs with the flow in Antelope Creek, a gaged stream located about 12 miles to the north. On this basis, the average annual surface runoff, from the 1.3 square mile area above the measuring sites, was estimated to be 355 acre-feet per year or 273 acre-feet per square mile. Using these figures, the average annual quantity of surface water available for ground-water recharge to the alluvium in Little Cottonwood basin (2.1 sq. miles) is estimated to be about 575 acre-feet per year or 360 gpm (gallons per minute). This is a lesser quantity than was assumed in the previous report. If the present quantity of spring flow, about 60 gpm, continues to be piped out of the basin, then the average quantity available for recharge must be reduced by this amount (60 gpm) to 300 gpm. There also is a small but unknown amount of subsurface flow entering the alluvium where it borders bedrock.

As is shown on the map, streamflow measurements were made upstream from the contact between granitic rocks and alluvium. Even during periods of high flow, the water in the stream disappeared into the alluvium within a distance of about 100 feet below the contact, whenever observed by the author. If that condition prevails at all times, then the conclusion is justified that all calculated streamflow is available for recharge. The question of whether the water is wholly or in part retained in the alluvium, or whether it percolates to the deep, regional water table is unresolved.

Quality of Water Sources

Chemical analyses of water samples taken from Little Cottonwood Springs and Little Cottonwood Creek indicate that the water is moderately hard and has a low dissolved-solids content. (See chemical analysis table.) None of the concentrations measured exceed the limits recommended by the U.S. Public Health Service for public water supplies.

Chemical Analysis of Water

(Analytical results in milligrams per liter unless otherwise indicated)

	Springs 1, 2, 3	Spring 4	Little Cottonwood Creek	Maximum concentration recommended by USPHS for public water supplies ¹
Date collected	March 1, 1968	March 1, 1968	May 24, 1968	
Water temp. (°C)	4	4	-	-
Silica (SiO ₂)	7.4	8.6	12	-
Calcium (ca)	29.0	29.0	35	-
Magnesium (Mg)	2.9	3.4	5.0	-
Sodium (Na)	2.4	2.7	4.2	-
Potassium (K)	.9	1.3	1.3	-
Bicarbonate (HCO ₃)	94.0	90.0	122	-
Carbonate (CO ₃)	0	0	0	-
Sulfate (SO ₄)	4.4	9.6	12	250
Chloride (Cl)	4.0	3.0	4.0	250
Fluoride (F)	.1	.2	.1	1.5
Nitrate (NO ₃)	4.9	6.3	1.2	45
Boron (B)	.03	.02	.00	-
Dissolved Solids	96.0	108.0	148	500
Residue on evapo- ration at 180°C				
Hardness as CaCO ₃	84.0	86.0	108	-
Specific conductance (microhomas at 25°C)	176	185	225	-
pH units	7.8	7.8	7.9	-
Color units	5	5	0	15

¹ U.S. Public Health Service, 1962, Drinking water standards, 1962: U.S. Public Health Service
Publication 956, 61 p.

Recommendations

One or more test wells should be drilled to depths of about 100 feet to evaluate the hydrogeologic conditions of the proposed ground-water source. In the initial memorandum report of April 1967, a test well was recommended for the lower end of the valley of Little Cottonwood Creek (point B on the map). However, if the proposed campground is not located in this basin, the related problem of contamination may not be of concern. Under these conditions, an alternate test site location farther down-valley at site A is proposed. This new location should make available a thicker section of alluvial materials and should enable interception of a larger part of the recharge being contributed to the basin.

The major unknown factor concerning the location of a successful production well is the lack of knowledge of the subsurface hydrogeology. The surface contact between the lava of the Snake River Group and the alluvium is shown on the map. This contact does not indicate the subsurface extent of the lava. It is quite possible that the lava extends beneath the alluvium northward at a shallow depth to the lower parts of both stream valleys and past test site A. If this is so, a well constructed in the valley of Little Cottonwood Creek at site B could penetrate a greater thickness of saturated alluvium than the proposed test well at site A and thus be a better location for a supply well.

Surface observations of the area indicate that there should be a considerable amount of water available in the alluvium at an economically feasible pumping depth. However, it is possible that the streamflow seeping into the valley alluvium percolates directly down through the alluvium to the regional water table which is in the Snake Plain aquifer and is greater than 1,000 feet below the land surface. Whether the alluvium has the characteristics necessary to retain in storage the required quantity of water is uncertain. The pre-existing surface drainage may have been dammed by the lava flows in the lower part of the valley causing ponding. Such ponding would have been conducive to deposition of layers or beds of fine-grained sediments (silt or clay) in the valley fill. These layers could prevent or at least retard the downward movement of water in the alluvium. Test wells would indicate whether or not such layers are present and if there is enough ground water in storage to provide a perennial water supply for the Monument. If possible, both proposed test wells (A and B) should be drilled and pumping tests made as an aid in planning future development in the basin.

Memorandum on Water Supply for proposed new Campground,

Craters of the Moon National Monument, Idaho

On November 30, 1966, Eugene Walker of the Water Resources Division, U.S. Geological Survey, made a reconnaissance of the proposed new campground at the Craters of the Moon National Monument, with the purpose of locating a well for water supply. Mr. Walker was accompanied by Superintendent Paul Fritz and Ranger Martin Denham. Mr. Fritz pointed out the proposed site.

The proposed site is on the floor of a meadow just below the junction of the valleys of Little Cottonwood Creek and the unnamed creek immediately to the west. This site lies in an embayment in the mountain-front, about $1\frac{1}{2}$ miles northwest of the Monument Headquarters and the present campground.

The meadow is enclosed on the northeast and southwest by mountain slopes, and extends for a short distance up the valley of Little Cottonwood Creek.

The meadow is covered with tall grass, indicating a relatively wet soil much of the year. A few scattered clumps of willows and aspen on the meadow and its margins also testify to the presence of moisture at shallow depth. The adjoining dry hill slopes are vegetated with sage brush and grass.

Present water supply for the Monument and campground

The Headquarters and present campground are at present adequately supplied with water, via a pipeline and storage tank, from four springs - the Little Cottonwood Springs - located at an elevation of about 7,000 feet in the upper part of the basin of Little Cottonwood Creek. These springs, numbered 1 to 4, have been developed and boxed in, with pipes leading to the main pipeline.

The flow of these springs is reported (data from National Park Service, measurements by Lynn Spalding, Engineer) to have been 48 gpm in 1957, 70 gpm in 1958, and 86 gpm in 1960. The season of the year when the measurements were made is not known.

Proposed Development

The proposed new campground in the mountain-front meadow offers more space than can be conveniently developed on the naked lava where the present campground is located; it will be more protected from the wind, and it will give opportunities for hiking and nature-watching in the valleys of the mountain front. The Monument boundary includes all but a small part of the drainage basin of Little Cottonwood Creek and the smaller drainage to the west.

The National Park Service wishes to develop a water supply for this campground from a well, which will be less subject to possible contamination than the present springs.

Geology and Hydrology

The mountain slopes that border the meadow and form the basins of Little Cottonwood Creek and the creek to the west, are underlain by a granite prophyry that shows some primary brecciation. The only openings in this bedrock are joints and cracks that probably grow fewer and tighter within a few tens of feet below the surface.

The valley floors and meadow are underlain by gravel brought down from the mountains. This gravel is pervious, as shown by the fact that no water was flowing across the meadow on November 30, although both the tributary streams were flowing about 20 gpm or more not far above the meadow.

A flow of young lava of the Snake River Group has spread into the mountain-front embayment and the rough outcrops of this lava form the down-valley limits of the meadow and proposed campground. It is quite possible that lava may extend farther north, beneath the surface, perhaps to the head of the meadow.

A well would have to be located above the campground, to avoid contamination arising from occupation of the camp. The logical location for a well would be in the valley of Little Cottonwood Creek, which is wide enough to offer the prospect of finding a reasonable thickness of water-bearing alluvium, and which drains a much larger area with correspondingly larger yield of water than the smaller creek to the west.

Water yield of Little Cottonwood Creek Basin

The basin of Little Cottonwood Creek above the meadow and proposed campground has an area of about 1.5 square miles, or 950 acres. Assuming, from data on gaged streams in this part of Idaho, a water yield of about 1 foot per acre, the total yield of the basin might average about 950 acre-feet a year, or about 590 gpm if delivered at an even rate.

The late summer flow from the basin, though much smaller than the average, would suffice for all needs of the Monument and the proposed new campground. The flow of the springs high up in the basin of the creek supplies all present needs, although it represents only a part, perhaps half, of the total yield of the basin.

Development of Ground Water

A large part of the underflow down the valley of Little Cottonwood Creek could be developed by one or two wells located on the valley floor a hundred yards above the proposed campground. At this place the valley is about 100 yards wide. The projection of the slopes of the valley wall (about 25 degrees) suggests that the deepest part of the valley may be about 70 feet below the surface of the ground.

The valley is probably underlain by fairly coarse-grained alluvium which would be water-yielding. Water might also occur in fractures in the upper few feet of bedrock. Thickness of water-saturated material would depend on the depth to water, which may be no more than 20 feet. Therefore, as much as 50 feet of water-saturated material may exist beneath the surface at the site of the proposed well. The foregoing estimates are based on little evidence, and one or more test wells should be drilled to test the geological and hydrological conditions before planning a production well. It is especially important that at least one season of water-level information be gained before the final decision is made to construct a production well. If the annual recharge to this alluvium is not retained within the alluvium throughout the summer season, the well may not yield sufficient quantities near the end of the year when need is greatest.

Recommendations

The total flow of the four springs that are now developed for water supply should be measured during the summer of 1967, to determine the yield, now little known.

Two test wells should be drilled as soon as possible in the flat-bottomed valley of Little Cottonwood Creek, about 100 yards above the limits of the proposed campground. The locations of these wells can be spotted by a WRD geologist. Two holes drilled in a line across the valley should suffice to locate the deepest part of the valley and the thickest section of alluvium. Temporary casing and screening should be installed in the wells and pumping tests should be run in both wells to provide data on the hydrologic properties of the alluvium. Pumping rates for these tests need not exceed 100 or 200 gallons per minute.



Geological Survey, Craters of the Moon National Monument, Idaho, 1957

Showing geology, stream-measuring sites and recommended test-well sites, Craters of the Moon National Monument

0 1/2 1 Mile