Investigation of the Water Resources of the Nevares Property in Death Valley National Monument, California

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U. S. GEOLOGICAL SURVEY
GROUND WATER BRANCH

INVESTIGATION OF THE WATER RESOURCES OF THE NEVARES PROPERTY IN DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA

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Engineer, Ground Water Branch
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Introduction

The United States National Park Service, in January, 1951, requested the United States Geological Survey to investigate the ground-water resources on a tract of land owned by Adolph Nevares in Death Valley National Monument. This information was needed by the Park Service in connection with Federal condemnation of the tract of land.

As a result of this request, the writer, T. W. Robinson, District Engineer of the Water Resources Division, Ground Water Branch, for Nevada, at Carson City, was assigned to the investigation. On April 17, 1951, the writer, accompanied by Mr. T. R. Goodwin, Superintendent of the Monument, visited the area for the purpose of becoming familiar with general conditions and details of the problem. At this time, entry on the Nevares land was prohibited, except for a short distance upstream in the south wash near the southwest corner of the tract. Consequently, this was the only entry made on the property.

Following the filing of a Declaration of Taking in the United States District Court, Southern District of California, Northern Division, on May 4, 1951, and the court's order for possession on June 15, arrangements were made for a field investigation during October, 1951.

During the period October 15 to 19, inclusive, the writer, assisted by Mr. O. J. Loeltz, Engineer, Geological Survey, of the Carson City office, made a field investigation of the source and amount of water discharged by springs on the Nevares tract.

Location and Description of the Area

The Nevares tract is in Inyo County, California, within the exterior boundaries of Death Valley National Monument. Specifically, the lands are described as the west half of the northeast quarter, south half of the northwest quarter, north half of the southwest quarter, northeast quarter of the northwest quarter, and northwest quarter of the southeast quarter, of Sec. 36, T. 28 N., R. 1 E., San Bernardino Base and Meridian. (See accompanying map.) The land is located about two miles east of the Death Valley National Monument Headquarters, on the east side of Death Valley.

The land surface of the tract slopes steeply westward toward the floor of Death Valley. Nearly all of the tract is mantled to an unknown depth with alluvial material, largely sand and gravel, derived from higher land masses lying to the east. Bedrock is exposed near the middle of the east boundary. Travertine deposits are present and may easily be seen in the bottom and sides of the washes. The largest deposit occurs as a prominent mound in the east central part of the tract. The mound has been built by the deposition of minerals from the mineralized thermal spring water that issues from the top of the mound. The spring area atop this mound is the principal source of water within the tract.

The tract is drained by two normally dry washes and their tributaries. The wash draining the north part (not shown on map) is known as North Cow Creek, and that draining the south part as Main Cow Creek, but referred to on the accompanying map as South Wash. For the most part, they are typical steep-sided desert washes that, in places, have intrenched themselves as much as 50 feet below the general land surface. The washes normally do not carry any water where they enter the tract. However, the detrital material in the bottom of the main washes indicates that during or following periods of heavy rainfall in the upper parts of their drainage areas, they do occasionally carry large quantities of water.

The ridges on either side of the washes are, for the most part, barren of vegetation. In the vicinity of springs, in the bottom of the washes, particularly South Wash and along the outlet ditch for the principal spring area, there is a dense cover of vegetation. Nearly all of the vegetation noted in these areas were typical desert plants that depend on ground water for their source of water supply. The principal ones observed were saltcedar, mesquite, arrowweed, saltgrass, and an association of water grasses and tules.

In the vicinity of some of the spring orifices, plant growth was so dense and vigorous that it was very difficult to explore the area.

Purpose and Scope

The investigation was for the purpose of supplying the National Park Service with certain information and data in connection with its condemnation of the lands owned by Adolph Navares. The information and data desired may be divided into three parts as follows: (1) Location of the spring areas on the tract and a determination of the source of the water discharged from them; (2) A determination of the amount of measurable water discharged by springs or seeps within the tract, and; (3) A determination of the amount of water crossing the property line on the downstream or western edge of the tract.

Ground Water

All of the water within the Nevares tract occurs as ground water in the form of spring discharge. The springs are thermal in character, for the water has a temperature appreciably above the mean annual temperature of the atmosphere in the vicinity of the springs. According to records of the U. S. Weather Bureau, the mean annual temperature at Cow Creek station, (Death Valley National Monument Headquarters) is 76.8° F. The temperature of the water from the larger spring orifices ranged from 87° to 104° F.

The thermal character of the water is indicative of a deep-seated source. Although no geologic studies were made, it is almost certain the springs are related to faulting on the east side of Death Valley, not only in the vicinity of the springs, but also to the north and south.

There are four areas of spring discharge on the Nevares tract. For the purpose of this report, they have been designated as Spring Area Nos. 1, 2, 3, and 4. They are shown on the map accompanying this report and are described separately in the following pages.

Spring areas. Spring Area No. 1 is the principal source of water in the Nevares tract. The springs issue from the top of the travertine mound between the altitudes of 930 and 940 feet. This mound, the top of which is nearly level, rises boldly about 50 feet above a small mesa-like area on which the Nevares cabin is situated. On the top of the mound there are many spring orifices in the form of small pools. The temperature of the water where it emerged from the ground at three of the pools was 102½, 104, and 104° F, respectively. These pools have been connected by a system of trenches, that, in turn, is connected to the present main ditch. This ditch conveys the water in a southwest direction across the top of the mound and thence down the southwest side of the mound. At the base of the mound, a shallow tunnel-like excavation, which is, in reality, an integral part of the ditch, extends a short distance into the mound. A small flow of thermal water is discharged from the excavation into the ditch. From the base of the mound, the main ditch conveys the water westerly across the tract to the property line. The water flowing in the ditch was measured at point A by means of a rectangular contracted weir at the Nevares cabin about 400 feet southwest of the base of the travertine mound.

In addition to the springs described above, two other small springs are considered as being included in Spring Area No. 1. These two are located about 75 feet apart on the south side of the mound near its base. They are about 25 feet lower in altitude and about 400 feet south of the springs on top of the mound. The discharge of the two springs merges into a single stream about 100 feet downstream from the largest, which is also the northernmost one. The temperature of the water of the water of this spring where it emerges from the ground was 100.5° F on October 16. The discharge was 16 gallons a minute on October 16, and 17 gallons a minute on October 18. The combined flow of the two springs was measured at point B about eight feet below the confluence of the streams.

The water from these springs flowed southwest down the channel of South Wash. About 300 feet below the measuring point, an eastward extension of the gravel bar shown on the accompanying map formed a partial dam across the wash. Here, all of the water disappeared, only to reappear again in a few feet as a spring. Beginning a short distance below the measuring point, the flow decreased progressively until at a point about 450 feet down the wash, there was no flow and the channel was dry. Conditions along the 450 feet of stream channel indicated that the water was dissipated in two ways: (1) In part, by percolation into the gravel in the bottom of the wash; and (2) In part, by transpiration of riparian vegetation. The bottom and sides of the wash in this reach were covered with a luxuriant jungle-like growth of brush and trees. This vegetation was the water-loving type—plants that grow only where a supply of water is readily available.

The total measurable flow from Spring Area No. 1 is considered as the sum of the flows as measured at points A and B.

Spring Area No. 2 lies between 900 feet and 1,500 feet south and a little west of the center of Spring Area No. 1. (See map.) It is located on a west-sloping hillside between the altitudes of 900 and 930 feet. The area is featured by three distinct plots covered with grass and some brush which mark the locations of the spring orifices. Much of the surface in and adjacent to these plots of grass and brush is covered with a mineral deposit in the form of a white, bitter-tasting efflorescence.

There were many spring orifices in the area, but all were small, as was the discharge from each. The water from even the larger ones was dissipated within less than 100 feet of its source, and none reached the channel of South Wash. Although no observations of water temperature were made, the water is believed to be thermal, for it was warm to both feel and taste. It was apparent that no measurable water was being discharged from the area, and consequently, no measurements of discharge were attempted.

Spring Area No. 3 was considered to be that part of the channel in South Wash beginning at a point about 1,100 feet east of the west property line at an altitude of about 755 feet and continuing southwest to the property line, altitude, 670 feet. The eastern limit of the area is marked by a spring that issues from a shallow excavation at the bottom of the north bank of the wash. It was not feasible to measure the discharge of this spring, but it was estimated to be from 3 to 5 gallons a minute. The temperature of the water at the point where it issued from the ground was 87° F. The spring area for its entire length may be described as a seep area, for there were literally many tens of small openings from which water merely seeped or oozed. One other spring was noted from which the discharge may have been as much as 5 gallons a minute, but the tall, dense growth of grass in and around the spring precluded any measurement of the discharge.

The spring area for practically its entire length supported a dense growth of water-loving grasses, brush, and trees. This was particularly true for the bottom of the channel and for the bank on the north side of the wash. In places, the vegetation was so dense that it would support the weight of a man, and the writer found it necessary, in a few instances when supported in this manner, to cut away the vegetation beneath his feet in order to determine the exact location of the channel in which water was flowing.

An inspection of the channel carrying the spring discharge indicated that the flow of water increased progressively from the upstream end of the area to about midpoint, but that there was little change in flow from about the midpoint to the downstream end of the area. As a result of this inspection, two measuring points were established in the spring area. The uppermost one, designated E, was located at a point where the stream flow cascaded as falls over a deposit of travertine about 4 feet in height. This point was about 600 feet downstream from the uppermost spring at the eastern end of the area. The other measuring point, designated G, was situated at the property line at the west end of the spring area. Measurements of flow at the travertine falls, point E, gave the amount of measurable water rising in the upper part of the spring area. Measurements at the property line, point G, gave not only the increase or decrease of flow between the travertine falls and the property line, but also the flow at the property line. The measurements at these two points are given in the section dealing with results of measurements.

Spring Area No. 4 (see map) is located between altitudes of 715 and 755 feet on the north side of the main ditch and between about 500 and 300 feet east of the west property line. This area was the most difficult of all the spring areas to examine, due to the extremely dense and luxuriant cover of grass, brush, and trees. However, as shown by the map and as indicated by the vegetative cover and from the localities in which water was discharging into the main ditch, there were two principal areas of spring discharge about 200 feet apart. The bulk of the water from the upper or eastern area of discharge entered the main ditch from the north through a well-defined channel. This flow was measured at point D and found to be about 30 gallons a minute. Downstream or west from this point, some water was observed entering the ditch for a distance of about 50 feet. No water was observed to enter the ditch for the next 160 feet. However, in the next 200 feet, water was visible seeping into the ditch from the north side or dripping down the north ditch bank. It was not feasible to measure this inflow, but a careful estimate indicated that it was about 50 percent of the measured inflow at point D.

Dye Tests

Determination of the amount of measurable water discharged by springs or seeps in the tract involved the possibility of measuring the same water twice. That is, did part of the water from the springs at a higher altitude, after being measured, percolate into the ground and reappear as springs at a lower altitude? Such a condition was possible between Spring Area No. 1 and Spring Area Nos. 3 and 4. The points at which the discharge from Spring Area No. 1 was measured was from 100 to 180 feet higher than the spring orifices in Spring Area Nos. 3 and 4. Part of the water from Spring Area No. 1 was known to percolate into the ground after being measured. In view of the favorable physical condition for securing spring discharge, it was desirable, if possible, to trace underground the water lost by percolation.

To this end, tests were made with fluorescein dye, a coal tar product that stands at the top of the list of chemicals and dyes used for tracing water underground. This substance is a powder having a reddish-orange color when dry but when dissolved in water and diluted, appears a brilliant green by reflected light. Its value as an aid to tracing ground water lies in the fact that minute quantities can be detected by the eye without resort to chemical analysis. One part of fluorescein in 40,000,000 parts of water will be visible to the naked eye, and 1 part in 10,000,000,000 can be detected with the aid of a long glass tube so prepared as to give full value to the green color.

Tests were made at two locations. In the first location, dye was introduced into the spring discharge just below measuring point B and in the second location at measuring point A. Details of the test are described below.

At measuring point B, the dye was introduced into the discharge of the two small springs that issue from the south side of the travertine mound in Spring Area No. 1, about 10 feet below the point of measurement. In this test, one fourth pound of dye was dissolved in 3 gallons of water. The flowing water was dosed with the solution by allowing the solution to drip from a bucket suspended over the stream for a period of 20 minutes. Thus, the dye was introduced at the rate of about

1 gallon in 7 minutes. As the discharge at measuring point B was at the rate of 22 gallons a minute, the one fourth pound of dye was, in effect, introduced into 440 gallons of water (22 gallons a minute for 20 minutes). The resulting concentration of dye was about 1 part of dye in 15,000 parts of water. This is about 2,600 times the concentration visible to the naked eye. Introduction of the dye solution into the stream of water began at 3:10 p.m., October 16, 1951, and endedinished at 3:30 p.m.

At measuring point A, essentially the same procedure was followed. Here, three fourths pound of dye was dissolved in 3 gallons of water. The resulting solution was introduced into the water ponded by the weir in the main ditch for a 30-minute period, or at the rate of 1 gallon in 10 minutes. As the flow over the weir was at the rate of 236 gallons a minute, approximately 7,000 gallons of water was dyed. This represents a concentration of about 1 part of dye in 75,000 parts of water, which is more than 500 times the concentration that may be seen with the naked eye. At measuring point A, the dye was introduced between 10:35 a.m. and 11:05 a.m., on October 17, 1951.

The concentration of the dosage at both locations was, no doubt, many times that actually needed to detect the green color in the effluent. However, since the dilution to which the dyed water would be subjected was unknown, it was decided to err on the side of too much, rather than too little.

As the hydraulic gradient, based on probable points of inflow and outflow was steep, ranging from 300 to 400 feet a mile, and as the character of the material through which the water would move, judging from the character of surface exposures, was coarse, it would be expected that the movement of the water underground would be rapid. Thus, if the water was moving underground to Spring Area Nos. 3 and 4, the colored water would be expected to appear in the discharge of the springs in these areas in a relatively short time—that is, in a matter of hours, or, at most, a few days. However, no dye was detected in the discharge from either spring area, although careful observations were made from the afternoon of October 16, until completion of field work late in the afternoon of October 19. Observations at intervals were continued by Mr. T. R. Goodwin until November 6, and he reports that as of that date, no dye had been observed in either of the spring areas.

1400'+ hours?

It was reported by Mr. Goodwin that other dye tests had been made on two previous occasions in past years, but that no dye was detected in the discharge of the lower springs.

Discharge Measurements

On October 15, 1951, a preliminary examination of the springs and ditches indicated that measurement of the water at seven points would be desirable. Accordingly, seven points of measurement were established. These measuring points, for the purpose of this report, are designated A to G, inclusive, and their locations are shown on the accompanying map. A brief description of each measuring point, the method used, the time and result of each observation follows. The rate of discharge is given in both gallons a minute and in southern California miner's inches. (One southern California miner's inch is equivalent to a flow of 9 gallons a minute.)

Measuring point A. A one-foot contracted rectangular weir installed in the main ditch from Spring Area No. 1, about 15 feet below a footbridge over the ditch at the Nevares cabin. Results of observations.

Date	Time	Head on weir crest, feet	Rate of discharge Gallons per minute	S. Calif. miner's inches
Oct. 15	5:00 p.m.	0.30	236	26.2
16	9:00 a.m.	.30	236	26.2
17	10:30 a.m.	.30	236	26.2
18	9:15 a.m.	.30	236	26.2
	5:25 p.m.	.30	236	26.2
19	11:20 a.m.	.30	236	26.2
	4:55 p.m.	.30	236	26.2

Measuring point B. Flow measured volumetrically by means of 5-gallon container and stop watch at a point about 8 feet below confluence of discharge from two spring orifices after diversion through a short length of 4-inch pipe. Results of observations.

Date	Time	Time to fill 5-gal. container, seconds	Rate of discharge Gallons per minute	S. Calif. miner's inches
Oct. 16	3:00 p.m.	13.4	22	2.4
18	9:55 a.m.	13.4	22	2.4
19	11:55 a.m.	13.9	22	2.4

Measuring point C. A 90-degree triangular notch weir installed on main ditch at old turnout box, about 1,500 feet by ditch below measuring point A. Results of observations.

Date	Time	Head on weir crest, feet	Rate of discharge Gallons per minute	S. Calif. miner's inches
Oct. 16	5:00 p.m.	0.46	162	18.0
17	10:00 a.m.	.46	162	18.0
18	8:30 a.m.	.46	162	18.0
	5:05 p.m.	.47	171	19.0
19	10:15 a.m.	.47	171	19.0
	4:45 p.m.	.465	167	18.6

Measuring point D. Flow of two principal springs in Spring Area No. 4 measured volumetrically by means of 5-gallon container and stop watch, after diversion through a pipe. Point D is located on north edge of main ditch and about 500 feet by ditch downstream from measuring point C. The unmeasured discharge of Spring Area No. 4 downstream from point D was estimated on Oct. 18 as 50 percent of the measured discharge.

Date	Time	Time to fill 5-gal. container, seconds	Rate of discharge Gallons per minute	S. Calif. miner's inches
Oct. 17	4:00 p.m.	9.4	32	3.6
18	8:40 a.m.	10.0	30	3.3
	5:10 p.m.	10.0	30	3.3
19	10:30 a.m.	10.1	30	3.33
	4:35 p.m.	10.0	30	3.3

The total discharge of Spring Area No. 4, based on the measured discharge at point D and the unmeasured discharge below point D is estimated as about 45 gallons per minute.

Measuring point E. Flow measured volumetrically by means of a 5-gallon container and stop watch, at travertine falls, which is about 600 feet downstream from uppermost spring, after diversion through a length of pipe. Results of observations.

Date	Time	Time to fill 5-gal. container, seconds	Rate of discharge Gallons per minute	S. Calif. miner's inches
Oct. 17	4:45 p.m.	9.8	31	3.4
18	8:55 a.m.	10.2	29	3.2
	5:15 p.m.	10.6	28	3.1
19	10:50 a.m.	11.4	26	2.9
	4:40 p.m.	12.0	25	2.8

Measuring point F. A one-foot contracted rectangular weir, installed on main ditch, about 25 feet east of west property line of Nevares tract. Results of observations.

Date	Time	Head on weir crest, feet	Rate of discharge Gallons per minute	S. Calif. miner's inches
Oct. 17	1:30 p.m.	0.25	181	20.1
18	10:45 a.m.	.25	181	20.1
	4:20 p.m.	.26	192	21.3
19	10:05 a.m.	.265	197	21.9
	4:15 p.m.	.265	197	21.9

Measuring point G. Flow measured volumetrically by means of 5-gallon container and stop watch, at west property line of Nevares tract after diverting through a length of pipe. Results of observations.

Date	Time	Time to fill 5-gal. container, seconds	Gallons per minute	S. Calif. miner's inches
Oct. 18	12:10 p.m.	12.3	24	2.7
	4:55 p.m.	13.0	23	2.6
19	9:15 a.m.	13.0	23	2.6
	4:25 p.m.	14.8	20	2.2

In addition to the measurements just described, two measurements were made of the combined flow that passed the west property line from the main ditch and from Spring Area No. 3. The water from these two sources was conveyed by ditch and pipeline to a 6- by 10-foot concrete collector tank, and thence by pipeline to the Park headquarters to operate a hydroelectric turbine. The capacity of the pipeline, however, was not large enough to carry all the water, and there was overflow from the collector tank. A 3-inch Parshall flume had been installed by the Park Service to measure the water in the ditch carrying the overflow. By shutting down the turbine, no water would pass through the pipe from the collector tank, but would, instead, flow down the overflow ditch. Under these conditions, the flow in the ditch should be equal to the amount passing the property line at measuring points F and G, minus any loss. An inspection of the ditch and pipeline did not show any visible loss. The results of the observations on the Parshall flume are as follows:

Date	Time	Head, feet	Rate of discharge	
			Gallons per minute	S. Calif. miner's inches
Oct. 18	4:30 p.m.	0.624	215	23.9
19	9:05 a.m.	.63	219	24.3

A comparison of the sum of the discharges at points F and G with the discharge at the Parshall flume at comparable times indicates essential agreement as shown below:

	Rate of discharge			
	Oct. 18		Oct. 19	
	Gallons per minute	S. Calif. miner's inches	Gallons per minute	S. Calif. miner's inches
Points F and G	215	23.9	220	24.4
Parshall flume	215	23.9	219	24.3

Analysis of dye tests and discharge measurements

The results of the dye tests and measurements of discharge give information on which it is possible to base conclusions as to the source, loss and recurrence of water, the amount of measurable water and amount of water passing the west property line. However, before discussing these conclusions, it is believed a brief historical background concerning the diversion of water from the springs on top of the travertine mound in Spring Area No. 1 would be helpful.

For the past several years, according to Mr. Goodwin, the water from these springs had been diverted in such a manner that there was only a small flow in the main ditch, and this flow reached only a few feet below the cabin area. Subsequent to the filing of the Declaration of Taking, Mr. Goodwin, with a work crew, on August 2, 1951, cleaned the main ditch and rediverted all possible water into it. In the course of this work, the condition of that section of the ditch from the cabin area to Spring Area No. 4 indicated that it had not carried water for possibly everal years. It was dry, and blocked with weeds, dry grass, and tree ranches. This section of the ditch had a very high seepage loss, as t required two days for the water to reach from the cabin area to pring Area No. 4, even though cement was added to the stream as an aid o sealing the ditch bottom.

During the period of investigation, the loss in this section as still high, as shown by the difference in flow at measuring points A and C. The loss in this section, a distance of about 1,500 feet by ditch, ranged from 65 to 74 gallons a minute during the period October 16 to 19, 1951. In an effort to reduce this loss, the Park Service added about 450 pounds of cement, over a period of several hours, to the stream about 500 feet below measuring point A. The addition of the cement which began at 10:00 a.m. on October 18, resulted in reducing the seepage because by 5:05 p.m., the flow at measuring point C had increased 9 gallons a minute. A similar increase in flow was observed at point F.

It is reported by Mr. Goodwin that there has always been discharge of water from Spring Area No. 4 regardless of the manner in which water in Spring Area No. 1 was diverted. He also reports no noticeable change in the flow of water from this area after water had been rediverted back into the main ditch beginning on August 2, 1951. The reports by Mr. Goodwin and the negative result of the dye tests, although not conclusive, indicate that water measured at points A and B was not included in the measured and estimated discharge from Spring Area No. 4.

Conditions at Spring Area No. 3 are similar to those at Spring Area No. 4. According to Mr. Goodwin, there was no noticeable change in the discharge of this spring area after water was rediverted to the main ditch on August 2, 1951. His reports indicate that the discharge from this area as observed at the west property line, has remained rather constant for the past several years. The reports by Mr. Goodwin, and the negative results of the dye tests, although not conclusive, suggest indicate that water measured at points A and B was not included in the measured discharge from Spring Area No. 3.

On this basis, the measurable water in the Nevares tract is the sum of the discharges of Spring Areas Nos. 1, 3, and 4. The sum of the discharges is equal to the discharges measured at points A, B, D, and E, plus the estimated discharge of Spring Area No. 4 below point D. Undoubtedly, the total discharge of these spring areas is greater than the measurable discharge because of unavoidable natural losses, principally by transpiration of plants.

It will be noted that the rate of discharge at point B decreased at a rather uniform rate from 31 gallons per minute at 4:45 p.m. on October 17 to 25 gallons a minute at 4:40 p.m. on October 19. A similar decrease from 25 gallons a minute at 12:10 p.m. on October 18 to 20 gallons a minute at 4:25 p.m. on October 19 occurred at point G. It is interesting that the decrease at both points from the morning measurement on October 18 to the afternoon measurement on October 19 is the same, 4 gallons a minute. This decrease in rate of flow is believed due to an increased rate of draft by transpiration and evaporation. During the period of observation, the days were hot and clear, and the humidity low, a condition favorable for a high transpiration and evaporation rate. The rather constant discharge of the other spring areas is attributed to the fact that the water was measured within a short distance of the springs. At Spring Area No. 3, however, the water traveled from 600 to 1,100 feet before passing the measuring point, affording a better opportunity for evapo-transpiration discharge before reaching the measuring points.

Summary

The hydrologic conditions observed and the information obtained during the course of the investigation point to the fact that all of the water rising on the Nevares tract is deep seated thermal ground water. During the period of the investigation, the evidence for recurring water in Spring Areas Nos. 3 and 4 although not conclusive was negative.

The total amount of measurable water, as has been discussed, is the sum of the flows measured at points A, B, D, and E, and estimated below point D. The flows for that period of the investigation during which observations were made at all these points are given below:

Date and Time	Point of measurement A	B	D*	E	Rate of discharge Total Gallons per minute	S. Calif. miner's inches
	Gallons per minute					
Oct. 18 a.m.	236	22	45	29	332	36.9
p.m.	236	22	45	28	331	36.8
Oct. 19 a.m.	236	22	45	26	329	36.6
p.m.	236	22	45	25	328	36.4
Average					330	36.7

* Includes estimated discharge below point D.

The flow past the west property line is the sum of the flows passing points F and G. The flows for the period of the investigation during which observations were made at these two points are given below:

Date and time	Point of measurement F (Gallons per minute)	Point of measurement G (Gallons per minute)	Rate of discharge: Gallons per minute	Rate of discharge: Total S. Calif. miner's inches
Oct. 18 a.m.	181	24	205	22.8
p.m.	192	23	214	23.9
Oct. 19 a.m.	197	23	220	24.4
p.m.	197	20	217	24.1
	Average		214	23.8

The increase in discharge on the afternoon of October 18 and during October 19 at point F is believed due to a reduction of seepage loss in the main ditch, resulting from the addition of cement below point A.

Robinson report - Death Valley - Nevares property

Nov. 1951

pages 9-12 - Dye tests for velocity

site A to spring area No. 3 = 1600' air line

site B to " " " " = 2400' " "

$$V_e = \frac{PS}{7.5 P_e};$$

$$V_e = \frac{10000 \times 400}{7.5 \times .25 \times 5280} = 400^{\pm}/\text{day}$$

assume $P = 10,000$

$P_e = 25\%$

$h/l = 400'/\text{mile}$

4 days A to D @ $P = 10,000$ + $h/l = 400/5280$, $P_e = 25\%$

(4 hrs - A to D @ $P = 240,000$ - fantastic)