UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Ground Water Branch

SECOND MEMORANDUM ON THE FLOW OF AGUA CALIENTE SPRING AFTER ROAD CONSTRUCTION AT PALM SPRINGS, CALIFORNIA

By

J. F. Poland and L. C. Dutcher

Prepared at the request of
the Bureau of Indian Affairs

OPEN-FILE REPORT

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Purpose of Memorandum

This memorandum was prepared at the request of Henry Harris, Acting Area Director, Bureau of Indian Affairs, Sacramento, Calif., to report on recent conditions at the Agua Caliente Spring, Palm Springs, Calif., and to suggest further possibilities for restoring the spring discharge to its pre-road-construction condition.

Observations on October 28

At Mr. Harris' request, the senior author, district geologist of the Ground Water Branch at Sacramento, went to Palm Springs on October 28 to inspect the present condition of the Agua Caliente Spring, arriving with Mr. Mitchell of the Bureau of Indian Affairs about 2:30 p. m. The junior author of the Long Beach office of the Geological Survey, was there, together with Messrs. Keefe and Selman of the Public Works Office of the city of Palm Springs.

A brief inspection indicated that the vent recently developed in pool no. 1 (see attached sketch of bathhouse) had closed up. There were slight concentrations of discharge at the initial orifice and near the west wall. Gas bubbles were rising intermittently and at random places within all four pool rooms.

About 3:00 p. m. the sump pump was started, to drain the water level down, and in about 1½ hours the level had been lowered about 18 inches, exposing part of the silty and sandy floor, covered locally by dirty black sediment containing organic debris. The water in the pools was muddy and dirty at all times during the afternoon.

Additional Jetting

After discussion of the present condition of the spring and possibilities for bringing it back to its former condition, Messrs. Keefe and Selman of the city of Palm Springs indicated that they would like to try a gentle jetting operation to see if the flow could be concentrated thereby in the old orifice, and a clear flow obtained. It was agreed by the Geological Survey representatives that this would do no harm and might succeed without attempting more complicated remedial measures. It was agreed also that the jetting should be at the old orifice, should be vertically downward or as close to vertical as possible, and that, if off vertical, the jet pipe should not be directed westward (so as not to disturb the unstable area to the west). The junior author agreed to be on hand for the operation, in conformance with the desire of the Bureau of Indian Affairs.

The gentle jetting operation was undertaken on October 29. It was begun at about 10:30 a. m., after the water in the pools was pumped down. Vertical jetting was attempted in the southeastern part of the original vent and an obstruction was encountered at 15 feet, apparently the same one encountered in the jetting done on October 5 by the city of Palm Springs. An attempt was made to jet down the original vent in the northeast (no. 3) pool room and the same obstruction was encountered.

It was sufficiently hard to dent the end of the 3/4-inch jet pipe when the pipe was raised and lowered.

Then jetting was attempted in the southwest (no. 1) pool room and progress was made to 24 feet. At this depth, the pipe plugged with sand each time the hose was uncoupled to add a new section of jet pipe. Therefore a garden hose was attached to a 10-foot length of jet pipe and jetting was continued in the southeast corner of the northwest (no. 4) pool room to a depth of about 40 feet.

The jet was worked up and down in the jet hole many times until the passage was relatively free and the jet pipe could be moved up or down at a rate of several feet a minute without any marked obstruction. The jet then was withdrawn from the hole.

Mr. Mitchell had arranged to have dune sand brought to the spring, and several inches of clean sand was added to the floor of each of the four pool rooms. Then the spring was left to see if it would clear up.

Spring Activity after Jetting

On Monday, November 2, Mr. Mitchell called the Long Beach office of the Geological Survey and reported that the spring discharge was still dirty. He indicated that it was desired to find out if possible whether the sediment making the water muddy was coming from the top few feet. It was suggested that a pipe be lowered in the present orifice to the desired depth and its top be held about at pool level so as to allow a slight spill, and that the water flow be observed to see if it would clear.

On Wednesday, November 4, Mr. Mitchell informed the Long Beach office that the spring had not cleared but that the major spring outlet then

appeared to be 2 feet west of the original spring center (at the intersection of the four pool walls). He reported that the large western cavity had opened and closed intermittently during the past few days. He reported further that an open pipe had been lowered in the orifice to the bottom of the opening but that the water discharging from it did not appear to clear up. He stated that a corked bottle was lowered on a stick to 11 feet, the cork was pulled, and the filled bottle brought to the surface. The water taken at 11 feet was also murky.

Suggested Possibilities for Stabilizing Spring Discharge

It appears that the surrounding sediments have become unstable owing to the various operations in the area over the past several months, and that hydrostatic uplift is sufficient to continue the unstability. One way to stabilize the mass is to reduce the hydrostatic uplift. It is believed that the simplest way to attempt this and at the same time return the spring to its old orifice is to insert a pipe vertically in the orifice to the depth necessary to reach clear rising spring water in the original chimney. This would reduce the hydrostatic head at the bottom of the pipe nearly to that at pool level; the only difference, which should be kept as small as possible, would be the head loss involved in movement of water into, through, and out of the pipe.

It is known that jetting has had some effect on the structure to a depth of 28 to 30 feet. Therefore the bottom of the pipe would have to be placed below 30 feet, and it is suggested that a depth of 35 feet be considered for an initial attempt. The pipe would have to be of such

construction as to allow the spring water to enter near the bottom, rise through the pipe with small head loss, and escape near the top. In order not to interfere with the natural appearance of the spring and not to be an obstruction in the way of bathers, who have been in the habit of treading the sand in the orifice until submerged 3 to 4 feet in the sand chimney, the top of the pipe would have to be placed 4 to 5 feet below the spring surface.

Two ways in which hydrostatic uplift probably could be relieved are (1) by use of permeable tile for the pipe to be inserted in the spring, and (2) by use of metal, composition, or plastic blank pipe, with perforated screens at each end, for this purpose.

If the tile pipe were used, the joints would have to be fastened together in some way, by belting or otherwise, and the ends would have to be plugged to keep the silt and fine sand out of the pipe. Also, the tile would have to be sufficiently permeable to permit entrance of essentially the full 25 gpm of spring flow in the bottom few feet and escape in the top few feet; otherwise, the head loss would not be decreased substantially by the entrance, upward travel, and exit from the 30-foot length of pipe.

Therefore, it is suggested that a metal, composition, or plastic pipe with screens at each end would be simpler to construct and insert than would permeable tile.

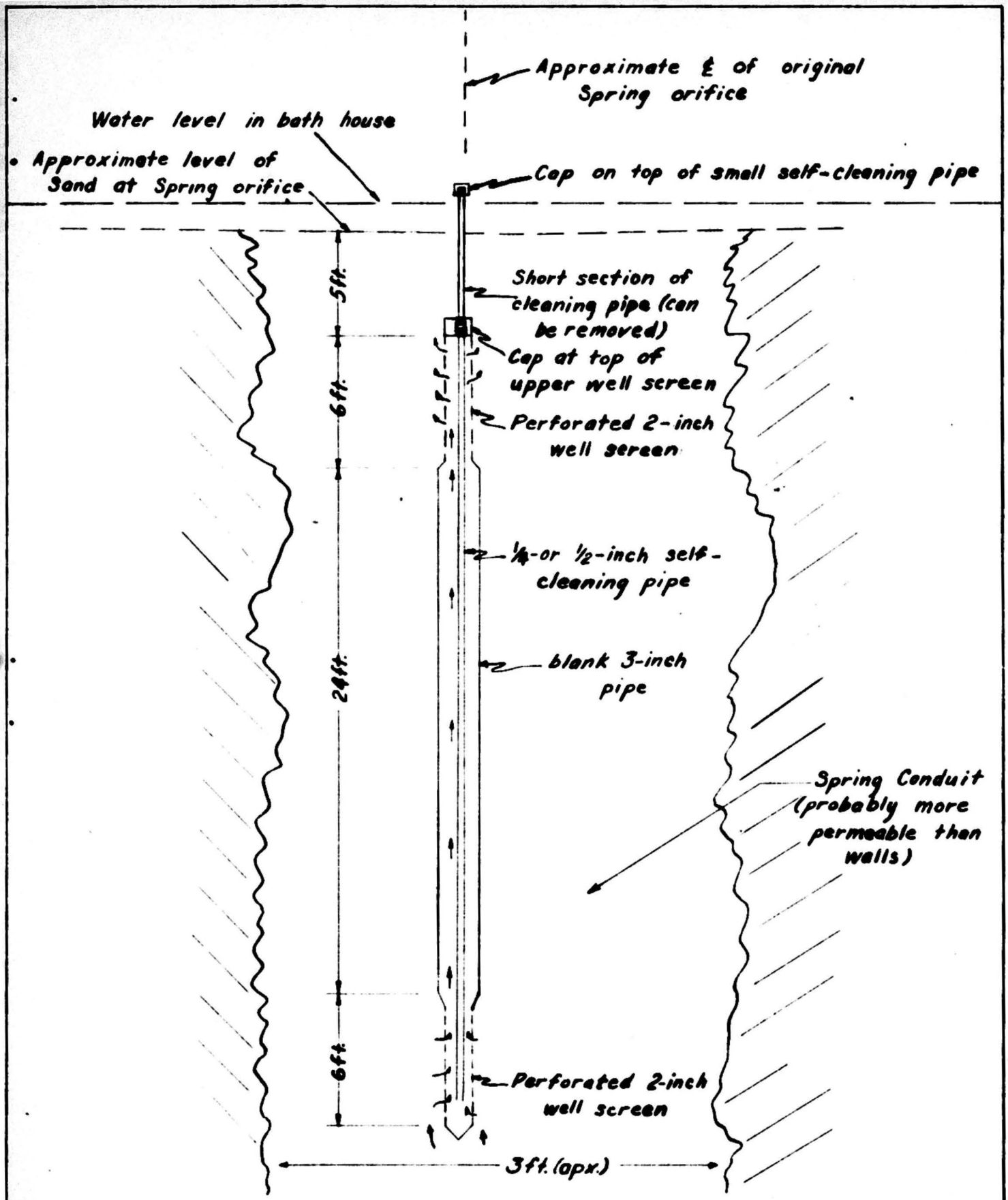
Pipe diameter.--Standard hydraulic tables (Cameron hydraulic data) indicate that the friction loss of head for a flow of 25 gpm in 100 feet of standard-weight steel pipe is 0.38 feet for 3-inch pipe, about 1.0

foot for 2½-inch pipe, and 2.35 feet for 2-inch pipe. Either 2½-inch or 3-inch pipe thus would develop only a small head loss for a flow of 25 gpm through a 30-foot length--about 0.3 foot and 0.13 foot, respectively. Doubtless the head loss would be greater through the entrance and exit screens, but it is believed that a screen of low head loss could be made for each end of the pipe by fastening together two well points 1½ to 2 inches in diameter and 3 to 4 feet long. The total head loss in screens and pipe should be considerably less than that for travel upward through the sediment. The over-all length of perforated and blank pipe should be such that the top of the lower perforations will be at least 35 feet below the land surface and the top of the upper perforations will be about 5 feet below the surface. This would require 24 feet of blank pipe if the perforated sections are 6 feet long.

In order that the pipe may be inserted vertically in the orifice it will have to be jetted down and will have to be made up as it is being placed in the jet hole, because there is only about 10 feet of vertical clearance below the pool-house ceiling. It is suggested that a strong anchor wire be fastened to the top of the perforated upper part of the pipe so that the pipe will not drift and also to assist in removing it from the hole should that become necessary.

Care should be used in selection of the screen size. The purpose is to obtain maximum permeability in the screen but at the same time use a sufficiently fine mesh to prevent the surrounding fine material from passing into and clogging the screen, because it would tend to increase the head loss and thus decrease the hydrostatic-uplift relief.

If thought advisable, a self-cleaning pipe of small diameter ($\frac{1}{4}$ to $\frac{1}{2}$ inch) could be installed inside the pipe and screen assembly so as to place its open bottom about a foot above the bottom of the lower screen, and to extend its top a few inches above the pool level. This cleaning pipe could be installed in two parts, the upper part being threaded into the cap at the top of the upper screen so that it could be removed at a later date if desired. (See attached sketch.) This top section, when in place, should be capped at the top (above pool level), so that by removing the cap any fine sediment that had entered the well-point assembly could be flushed through the small cleaner pipe. The residual head inside the pipe probably would be sufficient to cause upward flow in the cleaning pipe and discharge an inch or so above pool level. If not, the cleaning pipe could be pumped gently by supplying a slight suction. However, if it is desired to remove this top section of cleaner pipe, it would be necessary to place a seal or plug at the top of the lower section of cleaner pipe to prevent sediment from falling down the pipe.



Diagrammatic Sketch Showing Suggested Method of Installing Pressure-Relief Pipe in Agua Caliente Spring, Palm Springs, California

FLOOR PLAN

AUBA CALIENTE TRIBAL MINERAL BATHS
PALM SPRINGS, CALIFORNIA

[redacted]