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**REPORT OF INVESTIGATION  
HOT SPRINGS ARTESIAN BASIN,  
NEW MEXICO**

By  
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Artesian Well Supervisor

**Roswell, New Mexico  
1941.**

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## REPORT OF INVESTIGATION HOT SPRINGS ARTESIAN BASIN, NEW MEXICO

E. G. MINTON, JR.  
Artesian Well Supervisor

### INTRODUCTION

The wells of the Hot Springs Artesian Basin were inspected during the first part of July, 1941, at the request of the State Engineer. Following is a report on the wells investigated, giving general information on each well and the condition thereof, together with recommendations for the improvement and repair of those wells which were not properly drilled and cased according to the rules and regulations of the State Engineer, and which may be wasting the limited artesian supplies of the basin.

### COLD WATER AREA

The main body of the cold water area of the Hot Springs Artesian Basin is approximately two miles west of the Town of Hot Springs, New Mexico, in Section 6, Township 14 South, Range 4 West, N.M.P.M. There are, however, other cold wells in the basin, scattered over a comparatively large area. Attention is called to a well owned by Mr. B. G. Iorio of Gallup, New Mexico. This well is located approximately 8 miles south of Hot Springs on the highway to Hatch, New Mexico. It is a flowing well, but as it is near the south boundary of the Hot Springs Artesian Basin and is a hot mineral well, it was not investigated and no report is included herein. Mr. George Cook, a driller at Hot Springs, mentioned several wells located north of the main cold water area in Section 6, but the writer did not check these wells. At the present time, most of the cold water being used comes from wells in Section 6.

It is desired at this time to acknowledge the assistance of Dr. T. B. Williams, Mayor of the Town of Hot Springs at the time the investigation was made. Much information was given by him in addition to his cooperation in making the town's facilities available during the course of the investigation. Acknowledgement is also given to Mr. Gene Goetz, Water Superintendent, who gave liberally of his time and assistance.

At the time the investigation was made, very little cold water was being used for irrigation purposes, the major use being for the water supply to the Town of Hot Springs. The wells located in this area were inspected and will be described in detail hereinafter. Most of the wells are located in the flood plain of Mud Springs Canyon, immediately below the hills upon the east and west side of the canyon floor. A few of the wells are located further up in the hills themselves.

## WATER SYSTEM OF THE TOWN OF HOT SPRINGS

The water supply for the Town of Hot Springs is collected in an underground concrete sump and reservoir located in the S $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ -NE $\frac{1}{4}$  of the above described Section 6. This sump has a capacity of 68,000 gallons and is supplied from the flow of three cold water wells, HS-11, HS-13 and HS-14, the first and last furnishing most of the water. Apparently these wells are not pumped, but are allowed to flow into the sump by means of an 8-inch pipe line running from the wells. The water is taken from the sump by two high-head Worthington 4-inch horizontal centrifugal pumps, electrically operated, with a capacity of 450 gallons per minute each. Only one pump is used at a time, the other pump being maintained as a stand-by. The water is pumped directly into the mains and carried to a 102,000 gallon capacity stand pipe situated on a hill immediately north of and inside the limits of the Town of Hot Springs, from which it feeds into the town mains by gravity flow. According to reports at the time of the investigation, both the water supply at the wells and the capacity of the stand pipe in town are inadequate. The description, condition and flows of the wells furnishing the town water supply will be found hereinafter.

### DETAIL OF WORK

During the investigation detailed checks were made of both the cold water and thermal wells to find whether or not the wells were properly constructed. Leakage tests were made and the condition of each casing checked.

### NON-THERMAL WELLS

Ten cold artesian wells were examined for leakage, their location and ownerships being as follows:

Well No. HS-19—Owner: Dr. T. B. Williams

Location: Center NW $\frac{1}{4}$ SW $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

Well No. HS-5—Owner: Bailey

Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

Well No. HS-21—Owner: Hefferman; Now owned by Town of Hot Springs

Location: SE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

Well No. HS-14—Owner: Town of Hot Springs

Location: NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West

Well No. HS-11—Owner: Town of Hot Springs

Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

Well No. HS-12—Owner: Town of Hot Springs

Location: Center SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

Well No. HS-7—Owner: George Cook

Location: Center SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

- Well No. HS-13—Owner: Town of Hot Springs  
Location: E $\frac{1}{2}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.
- Well No. HS-18—Owner: Giles  
Location: Center SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.
- Well No. HS- —Owner: James A. Slater  
Location: NW $\frac{1}{4}$ SW $\frac{1}{4}$  Sec. 7, Twp. 14 S., Rge. 4 West.
- Well No. HS-38—Owner: Sierra County Courthouse  
Location: NE Corner Blk. 64.
- Well No. HS-39—Owner: Unknown  
Location: NW Lot 43 Original Town of Hot Springs.

#### Well No. HS-19 (Dr. T. B. Williams)

Location: Center NW $\frac{1}{4}$ SW $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 West.

The well was checked for leakage on July 1, 1941. At that time, 3:30 p. m., the pressure was checked and found to be 16 pounds per square inch, at 4 feet above land surface. The well is used by Dr. Williams for the irrigation of 27.5 acres of land, and for the domestic supply of approximately 36 homesites in and near the well. A report made by the owner of the well stated that eventually all of the lands now being irrigated would be sold in 100 x 180 foot lots and water from the well would be used to supply water for these lots. The well is equipped with an inverted tee to gate valve by means of a close nipple. The top of the tee has a bull plug with a  $\frac{1}{4}$ -inch valve. The well is situated on a hill approximately 100 feet above the surrounding plain. Water is carried to irrigated lands below, through an 8-inch pipe, thereby attaining a pressure of approximately 44 pounds per square inch.

A check was made at a depth of 7 feet below the ground surface with the Hoff meter and the total flow through the 10-inch casing was found to be 634 gallons per minute. However, at a depth of 50 feet, where another check was made, the total flow was found to be 571 gallons per minute. From the owner, information was obtained to the effect that the 10-inch casing was set approximately 120 feet into the clay formation, while the 8-inch casing extended from about 20 feet below the surface to the bottom of the well. Following the leakage test, the top of the 8-inch casing was found to be at 93 feet. Following is a tabulation of the actual tests:

Depth	Velocities (Feet per second)	Discharge (Gallons per minute)
7	2.61	634.5
50	2.36	571.0
75	2.36	571.0
90	2.36	571.0
92	1.80	436.5
94	.91	144.0
125	.91	144.0
130	.91	144.0
175	.91	144.0
215	.91	144.0
225	.91	144.0
276	.91	144.0
300	.83	130.0
310	1.25	198.0
320	1.25	198.0
340	None	
355	Bottom of hole	

Nothing could be determined from the log turned in by the driller as to where the casing was set. However, it was determined that the 8-inch casing is at 93 feet rather than at 20 feet as it was reported to have been set. It is my opinion that the 8-inch dropped into the open hole, which had never been cased at the bottom. It is evident that much of the water produced rises between the 10-inch and 8-inch casing at the rate of about 292.5 gallons per minute, only 144 G.P.M. being produced through the 8-inch. Also, the well is producing a total of 198 G.P.M. at 310 feet, some of which is lost above that point. This loss of water into the formation between 276 and 310 feet could be due to a stratum with less artesian pressure, or a stratum carrying little or no water.

It is apparent that this well has been improperly constructed. The casing has been perforated where it was unnecessary or harmful. No seal has been placed between the 10-inch and 8-inch casing, causing a leakage at this point. Dr. Williams reports that after the well has been shut off for a period of time, water appears outside of the 10-inch at the surface. If the 10-inch casing had been cemented into the clay cap-rock, this leak undoubtedly would not have occurred. It is also evident that, by running unperforated casing from 275 to 310 feet, no loss would occur between these points and the flow would be increased approximately 54 gallons per minute.

#### Well No. HS-5 (H. O. Bailey) Previously owned by T. B. Williams

Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$  Section 6, Township 14 South, Range 4 West.

Pressure: 10.5 lbs. at 3 feet above land surface.

Remarks: The well casing extends into the air approximately 3 feet and a cap has been welded on to shut off all leaks. The gate valve extends from the side of the casing by means of a nipple welded to the casing. Water is used for a small garden and for stock water.

It was impossible to make a leakage test of this well since it would have been necessary to cut off the welded cap and to use a squeeze plug to shut off the water. The well is approximately comparable with well HS-19, the difference in pressure being due to the fact that HS-5 is located at a lower elevation. The pressure test would also indicate that the well is no doubt constructed the same as other wells in this area and, if action is taken to repair the cold wells in the basin, this well should be further checked.

### Well No. HS-21 A. O. Hefferman (Now owned by Town of Hot Springs)

Location: SE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$  Section 6, Township 14 South, Range 4 West.

Pressure: Could not make pressure test.

Remarks: The well is situated approximately north northwest of the two present city wells, about three-quarters of a mile from the well located in the NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$  of Section 6. The topography of the area surrounding the well is hilly and the well itself is located about half way up the immediate escarpment and is approximately 200 to 300 feet higher than the other city wells.

The well is lined with 8-inch I. D. casing, and at the surface a 10-inch tee has been placed over the 8-inch casing and cemented around same to shut off leakage. About 2 feet from the completed well, an 8-inch casing protrudes from the cement block and it is my understanding that this was the original uncompleted hole. However, this well penetrated the artesian water and is connected to the completed well underground.

From the leakage test made, it would seem that the uncompleted well is contributing approximately 140 gallons per minute to the total flow of the completed well, which was determined to be 371.7 gallons per minute. From a depth of 50 feet to 251 feet, the velocity of flow gradually lessened until at 403 feet, no velocity was encountered. It is possible that all of the water encountered under pressure is being obtained from 251 feet to about 400 feet, unless it has been cased off above 251 feet. Nothing has been done in this well to seal the casing at the caprock and the well can be leaking at this point. The old uncompleted hole should be plugged, even if the work should interfere with the flow of the completed well. It is very apparent that the driller did not adhere to the rules and regulations of the State Engineer in drilling the well.

Following is a tabulation of the flows determined by the leakage test:

Depth	Velocities (Feet per second)	Discharge (Gallons per minute)
9	2.36	371.7
50	1.47	231.8
100	1.18	185.9
150	1.33	211.5
200	1.25	198.0
251	1.58	202.5
300	1.02	162.0
351	.51	81.0
375	.39	63.0
403	None	
438	Bottom of hole	

#### Well No. HS-14 (Town of Hot Springs)

Location: NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$  Sec. 6, Township 14 S., Rge. 4 West.

Pressure: 13.5 lbs. at 3 ft. above land surface.

Remarks: It is my understanding that this well is the last well drilled by the town for water supply use. It is located approximately 1000 feet southwest of the town sump. The free flow of the well only is used, carried to the sump through an 8-inch pipe line connecting to the line from Well HS-11.

According to the log turned in by A. D. Turner, driller, 145 feet of 12-inch I. D. casing was set into an "adobe" formation and 268 feet of 10-inch I. D. casing was set into sand rock. The hole was drilled to a depth of 275 feet. Following are the results obtained from the leakage test:

Depth	Velocities (Feet per second)	Discharge (Gallons per minute)
11	.86	207.0
50	.87	211.5
100	.81	198.0
150	.97	234.0
201	.89	216.0
225	.93	225.0
251	.46	112.5
267	.50	121.5

From the above measurements, it would seem that approximately 35 gallons per minute is being lost at the base of the 12-inch casing. It was also noted that the hole filled from a depth of 275 feet to the bottom of the 10-inch casing, the formation in this section being sand and gravel. However, a movement of water was obtained by the meter at

267 feet, the bottom of the hole, showing that some water is contributed from the gravel and sand below 267 feet.

It is recommended that the well be cleaned out to the original depth and deepened to a point where 8-inch perforated casing could be set in a semi-hard or hard formation and extended up into the bottom of the 10-inch at least 5 feet; that the 12-inch casing be perforated from 140 to 145 feet, a plug set below 145 feet at about 150 feet and cement be forced outside the 12-inch to stop all leakage at this point.

### Well No. HS-11 (Town of Hot Springs)

Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 W.

Tested: July 10, 1941.

Pressure: Could not make pressure test.

Remarks: This well is one of the two new wells drilled by the town for water supply purposes. The well lies about 400 feet southwest of the town sump into which the free flow of the well discharges. The flow of the well was about 130 gallons per minute at the time of the measurement.

The well is cased with 12-inch I. D. casing, weighing 45 pounds per foot. A leakage test was made, using the Hoff 4-inch meter, and the following results were obtained:

Depth	Velocities (Feet per second)	Discharge (Gallons per minute)
12	.36	130.0
50	.37	130.0
75	.38	135.0
101	.40	139.0
125	.38	130.0
150	.41	144.0
175	.41	144.0
201	.41	144.0
226	.41	144.0
252	.39	135.0
275	.39	135.0
287	.00	00.0

It is apparent that about 14 gallons per minute is being lost, due to faulty well construction. Apparently little regard was paid to setting the perforated pipe at the proper depths. Also, none of the casing has been cemented into any kind of formation to seal off the artesian strata and to stop possible upward travel of water outside the casing.

It can be seen that 135 gallons per minute is obtained from below 240 feet, with about 9 gallons entering the well above that depth. The total depth was found to be 287 feet. There is less leakage in this well than in well HS-14.

It is recommended that the 12-inch casing be perforated from 143 to 150 feet, a plug set below this depth, and cement forced through the perforations against the adobe formation outside to shut off all leakage at this point.

### Well No. HS-12 (Town of Hot Springs)

Location: Center SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 W.

Pressure: Could not determine pressure.

Remarks: This well was one of the first wells used by the town for water supply, and is now abandoned to any use. Casing at the surface is 6 inches in diameter and equipped with a gate valve. The depth, at the time of the test, was found to be 132 feet. As this well will not flow while HS-7 is flowing, HS-7 was shut off while this test was made.

Following is a tabulation of the results:

Depth	Velocities (Feet per second)	Discharge (Gallons per minute)
Surface	.00	Estimated 5 G.P.M.
10	.00	
20	.00	
30	.00	
40	.00	
50	.00	
60	.00	
70	.00	
90	.00	
116	.00	Break in casing—hung water
118	.50	45.0
130	.50	45.0
132	.00	Meter in gravel & sand— bottom of hole

It can be seen that this well is losing the total flow at 118 feet, and it is recommended that since it is abandoned, it be plugged.

### Well HS-7 (George Cook)

Location: Approximately in center SE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  Sec. 6, Twp. 14 S., Rge. 4 W.

Pressure: Too small to measure.

Remarks: This 6-inch well is supposedly the discovery well of the cold water area, and was drilled by George Cook. At the time of the leakage test, it was found that the casing was corroded very badly, making it almost impossible to keep the meter operating. A bridge was found at a depth of 100 feet. It was removed by spudding a length of pipe until the bridge was broken. Following the removal of the bridge

23 small fish, which resembled small minnows, floated out the top of the casing.

The well was flowing approximately 25 gallons per minute. It is located about 50 feet west of HS-12 and, when flowing, HS-12 will not flow.

Mr. Cook uses this well to irrigate a small orchard and garden of about one acre and the well flows unchecked most of the time.

The bottom of the hole was found at 230 feet and, according to the driller, insufficient casing was set, allowing the hole to fill to this depth.

This well should be repaired by cementing the casing into the cap-rock and running a liner below the casing to hold the hole open through the water formation.

### Well No. HS-13 (Town of Hot Springs)

Location: SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  Section 6, Twp. 14 S., Rge. 4 W.

Pressure: Too small to measure.

Remarks: This well is located about 400 feet northwest of the town sump. The well, according to the permit, was drilled in 1935 and no records of the drilling were kept. The well is flowing at the surface approximately 15 gallons per minute. This well is also used for the town water supply and an 8-inch pipe line runs from the well to the sump. However, it is believed that this well is of little use, being of small flow.

No measurable velocity was encountered when the meter was lowered in the well and it is probable that the water is either plugged off by the caving of the formation, or that sand and gravel have entered the lower end of the casing, cutting off most of the flow. Too, it is possible that the casing has parted and is allowing water to escape above the adobe confining stratum.

This well should probably be plugged by the mud and cement method. By so doing, it is felt that other wells in the area would increase in volume of flow.

### Well No. HS-18 (Jess Giles)

Location: Center SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  Section 6, Twp. 14 S., Rge. 4 W.

Pressure: Could not measure.

Remarks: Well HS-18 is located above the plain on a rise at the edge of the hills running along the east side of Mud Springs Canyon. The well is used for domestic supply and for irrigation of a garden, of about 1.5 acres in extent, located immediately to the south below the hill on which the well is located. No well log was available. The casing at the surface was 8-inch standard casing and, from the leakage test, it was found to be 8-inch to the bottom.

Following is a tabulation of the results of the leakage test:

Depth	Velocity (Feet per second)	Discharge (Gallons per minute)
Surface	.78	121.50
10	.80	126.00
25	.76	119.70
50	.73	114.70
75	.78	121.50
100	.78	121.50
125	.76	119.70
150	.70	110.20
175	.72	112.50
201	.69	108.00
234	.66	103.50
240	.66	103.50
250	.66	103.50
255	.58	91.30
260	.48	75.60
265	None	00.00
Bottom of hole		

The difference in the quantities of water found at 125 and 150 feet indicates that the casing is seated somewhere between these two points. It is apparent that this well has been constructed as all other wells in the area, with no regard to the proper methods of drilling and casing. It is recommended that the well be repaired, as detailed in the discussion of the other wells in this area, and that such work should be done by an engineer who is familiar with artesian well procedure.

#### Well No. HS-38 (Sierra County Courthouse)

Location: NE Corner Blk. 64.

Remarks: Well was being drilled at time of inspection. Apparently it had been mined during drilling approximately one year previous.

#### Well No. HS-39 (Unknown)

Location: NW Lot 43, Original town of Hot Springs.

Remarks: Well is equipped with windmill and used for domestic purposes. Owner should file a "Declaration of Owner of Water Right."

### THERMAL WELLS

Twenty-six hot water wells were checked in detail during the time of the investigation. However, leakage tests were not made on any of the thermal wells for the reason that, in most cases, it was impossible to prepare the wells for leakage tests, or else the wells were located in such positions as to make it impossible to get to them. For example, many were inside small houses and enclosures where it was impossible

to get the leakage equipment in proper position. The wells are usually located in the rear of apartment houses, inclosed within small buildings, or located in enclosed pits; and a great many are equipped with some kind of centrifugal pump. In the thermal water area, within the town limits, there are both flowing and non-flowing wells. Most of flowing wells had such small discharge that it was necessary to pump them. Hereinafter is a detailed description of the thermal wells at the time of the investigation, with comments on the conditions of the wells and suggestions as to future work in the area regarding repair or replacement of those which are not satisfactory.

#### **Well No. 15 (U.S.G.S.) State Bath House (Reserve, Town of Hot Springs)**

Well is located under City Clerk's Office in the Community Building. Pump is located on the south side of the building just inside the public walk in a concrete box, at about ground level. It is impossible to check the well unless floor of Clerk's Office is removed. Some arrangements should be made for examination of the well.

#### **Well No. 4 (U.S.G.S.) James' Mineral Baths (Lot 2, Original Hot Springs)**

Well is located in rear of bath house. A 1¼-inch pipe is leaded into a 6-inch casing and connected to a horizontal centrifugal pump, powered by an electric motor. This well flows, when pump is set off, at approximately 2 gallons per minute.

#### **Well No. 33 (U.S.G.S.) (W. S. Lot 106, Original Hot Springs)**

Well is located immediately east across the street from James' Mineral Bath House. Well is abandoned and not used at the present time. It is capped and equipped with ¼-inch plug. This well has been used by the U. S. Geological Survey in making pressure tests. It should be plugged.

#### **Well No. 8 (U.S.G.S.) Carrie Tingley Hospital (Lot 5, Las Palomas)**

Well is housed over with stucco building, with the well in a concrete pit about 8 feet below ground surface. Casing at the surface is 7-inch and is reduced to 4-inch by a reducer plug above inverted tee. Cast iron 4-inch plug is reduced to a ¾-inch pipe which extends approximately 4 feet into air. A ¾-inch pipe connected to brass gate valves is fitted with tees at bottom and top and contains approximately 4 feet of gauge glass. Top of gauge glass is approximately at land surface. Well is equipped with a 4-inch Gardner-Denver high capacity, horizontal centrifugal pump, direct connected to an electric motor. Water is pumped into the Carrie Tingley Hospital approximately one-half mile south.

**Well No. 21 (U.S.G.S.) Sunshine Apartments (NW Lot 105,  
Orig. Town of Hot Springs)**

Owner: Mrs. Magnolia Ellis.

Well is located in drive on south side of apartment house, approximately 15 feet inside public walk and approximately 15 feet south of building. Casing is about 2 inches above land surface, with a wooden plug driven in same. Well is directly east of Community House door and across street. Owner states she is planning on using well sometime this fall. A  $\frac{3}{4}$ -inch hole was drilled into the wooden plug and cold water was found at the ground surface. Well is 71.6 feet deep.

**Well No. 17 (U.S.G.S.) Arizona Hotel (SW Lot 105, Orig.  
Town of Hot Springs)**

Well is located in the northwest corner of hotel. The 6-inch casing is reduced by a  $1\frac{1}{2}$ -inch ell and connected to a horizontal centrifugal pump powered by an electric motor. Water is pumped to wooden tank on roof of hotel for cooling and pressure purposes. Well and pump are enclosed in boiler plate box. Entire setup is above ground level.

**Well No. 19 (U.S.G.S.) Central Bath House (NE Lot 105,  
Orig. Town of Hot Springs)**

Owner: Mrs. R. S. Doughty.

Well is located by a door at the east end of the bath house. According to owner, well is 27.5 feet deep. It is equipped with a 2-inch, horizontal centrifugal pump, powered by an electric motor with V-belt drive. Well will flow at ground level. Owner states that well seems to have become warmer since the blasting started on hill near Vera Hotel about one block west. Water is pumped directly into tubs in bath house.

**Well No. 18 (U.S.G.S.) Texas Homes. (SE Lot 105, Original  
Town of Hot Springs)**

Owner: Mr. Joe A. Joerger.

Well is located in concrete box under awning of east row of apartments. Water stands approximately at ground level, with open casing extending about 3 feet above land surface. A  $1\frac{1}{2}$ -inch suction pipe extends into well and is tied to a new Myers  $1\frac{1}{2}$ -inch, horizontal centrifugal pump, direct connected to an electric motor. Water is pumped direct to tubs. Casing appears to be light weight, inserted joint pipe and in bad shape. Depth of well is not known. This well should be checked and, if leaking, repaired.

**Well No. 21 (U.S.G.S.) Mills Mineral Baths. (No. side Lot 105,  
Original Town of Hot Springs)**

Owner: Mrs. Henrietta F. Mills.

Well is located about 20 feet south of the front door of bath house and approximately 10 feet inside street. Well and pump are enclosed in a wooden box. A 1-inch suction pipe is cemented into the casing and connected to a 1-inch, horizontal centrifugal pump, powered by an electric motor. Owner states well has decreased in flow since blasting near Vera Hotel. Well flows when not pumped. Pump is leaking badly at packing gland.

**Well No. 30 (U.S.G.S.) Cozy Corner Apartments. (SW Blk.  
Orig. Town of Hot Springs)**

Owner: Dr. G. L. Mills.

Well is located in house under overhead tank. Hole is open and covered with burlap bag. Water is standing about 2 feet below land surface. A 1½-inch suction pipe extends from well to a horizontal centrifugal pump, direct connected to a 1 H.P. electric motor. Casing does not appear to be in very good condition. Well should be checked.

**Well No. 24 (U.S.G.S.) Anderson Apartments. (NE Blk. 102,  
Orig. Town of Hot Springs)**

Owner: W. H. Anderson. Dave E. Gray, Lessee.

Well is located in basement in rear of apartment house, approximately 10 feet below land surface. Well is closed with 1½-inch suction pipe cemented into casing. Pump is a 1½-inch, horizontal centrifugal pump direct connected to a 1 H.P. electric motor. Pump was operating during the inspection. Temperature of water did not seem as high as in other wells checked. Well should be examined for leakage.

**Well No. 1 (U.S.G.S.) Odell Apartments. (Blk. 2A Original  
Town of Hot Springs)**

Owner: Mrs. Marie Odell.

Well is located about 100 feet directly in front of main door of hotel in concrete box covered by a wooden lid. A 2-inch suction pipe from the covered well connects with a horizontal centrifugal pump, direct connected to a 2 H.P. electric motor. Pump and motor appear to be in good condition. Nothing could be ascertained as to the condition of the well proper.

**Well No. 2 (U.S.G.S.) Lochart, (7) (Blk. 1, Original Town of  
Hot Springs)**

Well is located in vacant lot about 100 feet due northwest of corner of Broadway and a street running north and south. Casing stands

about 3 feet above land surface and is equipped with a 6" x 2" reducer nipple with gate valve. Water stands about 18 inches below top of valve.

**Well No. 3 (U.S.G.S.) Lochart. (Blk. 1, Original Town of Hot Springs)**

This well is in the same location as well No. 2 and is equipped the same as above well. However, the water stands approximately 4 inches lower in this well than in Well No. 2. Both wells should be checked as to leakage.

**Well No. 12 (U.S.G.S.) Artesia Bath House. (Blk. 40, Las Palomas)**

Owner: W. S. Mathis.

Well is located at southeast corner of bath house at the rear. The 8-inch casing is equipped with an 8-inch ell and reduced to a 4-inch by means of a 8" x 4" reducer nipple. The 4-inch casing extends west to the bath house where it enters the building. Well is not pumped, only the artesian flow being used.

**Well No. 10 (U.S.G.S.) Hoosier Apartments. (W. S. Blk. 11, Las Palomas)**

Owner: Southern Hotel; owner of Hoosier apartments, H. B. Lots.

Little water is used by the Southern Hotel, most of the flow of the well being used in the Hoosier Apartments.

Well is located in the rear of the Hoosier Apartments and Southern Hotel. A 6-inch casing is reduced to 2-inch by means of a cap, which is equipped with a suction pipe connecting with a 2-inch horizontal centrifugal pump, directly connected to a 2 H.P. electric motor. Well flows when not pumped.

**Well No. 34 (U.S.G.S.) Bolander. (NW Blk. 102, Original Town of Hot Springs)**

Well is located about 100 feet south of Main Street and is in rear of Mulvaney Apartments. Casing stands up about 1 foot above land surface. Top of casing is filled with concrete. The well should be plugged.

**Well No. (Rear of State Bath House)**

Owner: (Unknown)

Well is now covered up and cannot be found. The well was reported to have been ruined during drilling and was abandoned. Well should be found and plugged.

**Well No. 33A James' Mineral Bath. (NW Blk. 102,  
Original Town of Hot Springs)**

Owner: James' Mineral Bath.

Well is on Simms Street, next to public sidewalk and about 50 feet from northwest corner of block. Well was equipped with an automatic recording pressure gauge by the U.S.G.S.

**Well No. 6 (West Side Blk. 8, Las Palomas)**

Well was equipped with an automatic recorder by the U.S.G.S.

**Well No. 7 (East Side Blk. 7, Las Palomas)**

Well is abandoned and capped. Should be plugged.

**Well No. 27 (Blk. 42, Las Palomas)**

Well reported to be an oil test well originally. Could not be located.

**Well No. 34A (Blk. 102, Original Town of Hot Springs)**

Well is capped and not used at the present time.

### SUMMARY

From conversation with various people who are interested in the artesian water supply of the Hot Springs Artesian Basin and from the results of the investigation by the writer, it is evident that, especially in the cold water area, the water users have not complied with the rules and regulations of the State Engineer's Office regarding the construction of artesian wells. In conversations with Mr. George Cook, who drilled most of the wells in the cold water area, I found that he does not believe that cementing the casing into the clay or adobe cap rock is feasible, or even that it can be done. In discussing methods of cementing with Mr. Cook, I learned that he had never seen this operation carried through, nor did he know that cementing the casing was necessary in this type of well. I found that, in spite of the rules and regulations set out by the State Engineer's Office as to the method of constructing wells in the basin, the drillers have usually constructed the wells as they saw fit. The last two wells drilled for the Town of Hot Springs, by Mr. A. D. Turner, are both cased with pipe lighter than that required in the regulations. In nearly all cases in the cold water area where leakage tests were made, it was found that water was escaping around the outside of the casing seat and was being lost to any beneficial use. It was further found that the casing extending through the water bearing strata was usually all perforated, rather than through each of the water bearing strata only. The fact that blank or unperforated pipe should have been run through those formations which do not carry water was disregarded. From information obtained in the

leakage tests, it seems probable that many of the water bearing strata are under lesser pressure than others and that water is escaping into these low pressure formations. Obviously this situation could be partially relieved by casing off low pressure strata with unperforated pipe. It is felt that, if the casing in the wells were properly perforated the volume of flow of the wells could be increased in every instance. Apparently not one well in the cold water area has been properly constructed. The poor condition of the wells is partly to blame for the fact that the pressure head in the cold water area has decreased alarmingly. At the present time, two of the wells belonging to the Town of Hot Springs and probably others in the basin should be plugged, as they are wasting a great deal of water from the basin.

### RECOMMENDATIONS

In view of the present condition of the wells in the Hot Springs Artesian Basin, the following suggestions and recommendations are made. The carrying out of these corrective measures would be very beneficial to the basin and would aid in stabilizing the pressure head, especially in the cold water area. Since the artesian supply of the basin is limited and since an ample water supply is necessary for the town of Hot Springs and for the Crippled Children's Hospital, it is urged that the following recommendations be made effective at as early a date as possible.

1. All of the wells in the cold water area should be repaired to meet the requirements of the State Engineer's Office in regard to construction, especially in cementing the bottom of the outside casing into the clay formation which is the confining bed of the artesian aquifer.
2. That the wells should be cased with the proper weight casings, as set out in the rules and regulations of the State Engineer's Office.
3. That no new well in the Hot Springs Basin should be drilled and constructed without cementing the casing into the clay or adobe cap rock overlying the artesian water.
4. That a representative of the State Engineer's Office should be present at the time of construction of all wells in the Hot Springs Basin in order that he may work with and educate the drillers as to the proper methods of procedure in drilling and constructing artesian wells in this area.
5. It is suggested that rotary type rigs could be used in the basin more beneficially than cable tool machines in that the holes could be drilled, mudded off and the casing set properly without damaging the water supply in the wells. After each hole was cased and cemented, the well could be developed by pumping the mud from the hole and cleaning up the gravel and sand strata which carry the water. This is the method largely used in the Roswell Artesian Basin in drilling shallow wells.

It was noted that many of the thermal wells in the town of Hot Springs were cased with very light inserted-joint casing. Due to the high mineral content of the water, the life of the casing is very short.

If the use of a heavy wrought iron or steel casing were required, the life of these wells could probably be doubled or trebled. The report of the investigation made by the Ground Water Division of the U. S. Geological Survey indicates that improved methods in the construction of wells in the thermal areas would be of little use in conserving the hot water supply. It was found that the thermal water rose to a depth of but two or three feet from the surface in the lower part of town, which indicates that the water carrying formation is badly broken and fractured, allowing water to escape and saturate much of the overlying valley fill in the lower part of the town. From the stand point of sanitation and public health, it is important that all of the upper surface water be cased off from the thermal waters if they are to be used for bathing and drinking purposes. It seems probable that a considerable part of the water, both in the cold and thermal areas, is being used illegally. The basin should be checked and such use stopped.

The writer did not have sufficient time in which to make a complete investigation of the basin and it is suggested that a representative of the State Engineer's Office should, at some future date, complete the study. The water supply of the basin is too limited and too valuable to allow present wasteful, non-beneficial uses to long continue.