

MK 25-1

Howard White

REPORT ON EXAMINATION OF MINERAL SPRINGS AND HOT WATER WELLS NEAR
THERMOPOLIS, WYOMING.

(By Albert B. Bartlett, State Geologist).

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At the request of the Thermopolis Chamber of Commerce, examination was made August 25th, 26th and 27th, 1925, of the Hot Springs and Hot Water Wells of Thermopolis. The Thermopolis Chamber of Commerce desired to know whether or not the drilling of water wells would result in the depletion of the flow of the Hot Springs.

The Springs come up through the Chugwater Red Beds and the wells also, are drilled through the lower part of this formation. The principal geologic features are an anticline running east and west, the Big Horn Hot Spring being near the crest of this anticline, and a fault. This anticline is a minor fold parralleling the Owl Creek Mountains on the south, and, in common with other anticlines in the Big Horn Basin, it has its steeper dips on the mountainward sides of the fold, the rocks in many places extending nearly vertical. This anticline is out by a fault, along which the Big Horn Valley is located.

West of the river, the dips on the sides of the anticline are difficult to determine in many places owing to absence of outcrops. To form an intelligent opinion as to whether drilling the water wells would effect the flow of the spring, it is necessary to take into consideration the geology and chemistry involved in the genesis of the springs and also the character of the water produced in the different wells in the springs. For this purpose a complete analyses of each water and spring should be obtained. At the time of examination, a sample of each was obtained and forwarded to the State Chemist and analyses were obtained. These analyses show the hardness to be 80 and the total solids from 241 to 244 in the McManigal Well No. 1, the upper well at the Garrett ranch, the Big Horn Hot Springs, the White Sulphur spring and the Black Sulphur Spring.

The McManigal Well No. 2 showed a hardness of 60, and the total solids 224.6.

In the opinion of Mr. L. E. Walter, State Chemist, the waters

are probably the same, the slight variations in the analyses being due to variations in the water which might occur from day to day.

Information obtained on the McManigal No. 1 Well from Mc. McManigal is as follows:

Location--about 100 feet due southwest from the E $\frac{1}{2}$ corner of Section 25, Township 43, Range 95.

Drilled--June 1, 1920.

Depth--450 feet, tools lost in the hole, water coming from the fourth water stratum, water from the third water stratum cased off.

0' to 50' --Travertine.

50' to 90' --River sand.

110' to 446 $\frac{1}{2}$ ', Red beds, Chugwater formation.

446 $\frac{1}{2}$ ' to 450'--Embar formation containing pyrite.

First water was encountered at 370' in amount sufficient to fill a one inch pipe, a soda water similar to Black Sulphur Spring.

Second water, a white sulphur water, was encountered at 390'-- about the same amount as first water.

Third water, 404-405 feet, black sulphur, waters were in blue mud, color of blue lime.

Temperature 112 $\frac{1}{2}$ F. at bottom, 122 F at top. Temperature as taken by the State Geologist, 124 F at top.

Rate of flow of this well by State Geologist showed a volume of .188 second feet or 121,508 gallons per day.

Well is cased with 6 5/8" , 24 pound standard casing.

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McManigal Well No. 2. (Information furnished by Mr. McManigal).

Location--450 feet south and 50 feet east of quarter corner on the east boundary of Section 25-43-95.

Surface elevation-- about 12 feet higher than mouth of No. 1 well.

Depth-- 510 feet.

In general, same formations as encountered in No. 1 Well, except that at the bottom 11 feet of very hard pyrite formation occurred, showing seeps of water. The well came in while the well crew was off duty and was muddy for 24 hours, also showing colors of oil.

Mr. McManigal reported the water as different from Well No. 1 which agrees with the report of the State Chemist as to hardness and total solids.

Temperature--~~report 130 F.~~
reported 130 F.

Temperature as determined by the State Geologist 124 F, according to rating by the State Geologist, volume of flow is 3.44 second feet of 2,223,330 gallons per day, cased with 6 5/8", 24 lb. Standard Casing.

The Big Horn Hot Springs gave a rating of 6.344 second feet or 4,100, 235 gallons per day.

Temperature - - 134 F.

Black Sulphur Spring, volume .035 sec. ft. or 22,621 gallons per day.

Temperature, 128 F.

White Sulphur Spring, volume .78 sec. ft. or 504,127 gallons per day.

Temperature 124 1/2 F.

Our ratings are all made with Current Meter No. 624, borrowed from the State Engineer's Office. They will be found to be somewhat in error especially on McManigal No. 2 Well, owing to the lack of suitable channels for measuring the velocity and cross section, and in the case of the Black Sulphur Springs Well, owing to the small volume of flow.

No rating was made of the Garrett well which appears to have a discharge of 1,000,000 gallons per day or more. There is another well on Garrett's place further down the river which was not examined.

The McManigal wells are used for the irrigation of some 100 acres of land and are situated about three-fourths of a mile distant from the three principal springs on the State Reserve.

No theory has yet been advanced to ~~account~~ ^{accounts} which / for the heat and the mineral constituents in the waters of these wells and springs. It has been noted that a number of ~~similar~~ ^{similar} Mineral Springs occur in other parts of Wyoming and have in common with the Thermopolis Springs, the point

that they come up through the Chugwater Red Beds.

In a number of places in Wyoming, wells drilled for oil, encountered hot water after drilling through the Chugwater formations, although such hot water is not always mineral but is often mineralized. It is therefore, very probable, that these Hot Mineral Waters have some connection with the lower members of the Chugwater formation or possibly with the ~~Embar~~ formation, rather than being due to intrusions of igneous rock still hot, or to a source at a depth sufficient to produce such temperatures.

McManigal reports that a well at his ranch house, not far from Well No. 2, dug to a depth of 32 feet, has water of 103 F temperature, and that the river sand enclosed in Well No. 2 had a temperature of 112 F.

Taking all present available information into consideration, it is believed that the temperature of the waters in the wells and springs is derived from chemical reaction among the elements present in the Chugwater and Embar formations, these reactions being assisted by free circulation along the fault.

The Big Horn Hot Spring has been credited with a flow of some 16,000,000, gallons per day or more than four times the amount determined by the State Geologist's rating. With the facilities available in rating this Spring, the maximum error might possibly be as great as 10% with a probable error not over 5%.

It is believed that the former figure of 18,000,000 gallons

per day, was due to an error in rating rather than to depletion of the flow as there was no evidence of depletion of flow of the spring. It is the belief of the State Geologist that wells now drilled have not caused any depletion of the Big Horn Hot Spring. From the evidence

and from the information available regarding the wells already drilled, it is apparent that there is a tremendous reserve of this hot mineral water. Analyses of the State Chemist show that the water is of the same character and therefore, must have underground connection. If this is true, it would be possible to eventually lower the flow of the springs of the State Reserve by the drilling of wells along the river valley, to the north as these wells would have a surface elevation considerably below that of the Big Horn Springs.

In conclusion, it is believed that the present wells have done no harm but that future drilling may be detrimental to the interests of the State and public as owners of the Springs on the Reserve. It is recommended that arrangements be made to make careful and correct continuous ratings of the flow of the three springs and the four wells already drilled and keep a record of these ratings. Provisions should be made that if other wells are to be drilled, same shall be under the supervision of the State Geologist, who shall have authority to have the wells shut in in case the flow of the springs on the State Reserve is diminished by such wells. Wells flowing such tremendous volumes of hot mineral water constitute a valuable asset to the State, and control of such wells should be permitted and even encouraged as long as they have no detrimental effect on the Springs in the State Reserve. All of these wells, however, should be under State supervision in order that the State's interest in the Reserve may be fully safe-guarded.

(Signed)

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State Geologist.