Weatherford Water

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In 1948, the town of Weatherford, Oklahoma, installed a completely new water system consisting of thirteen soft-water wells. Previous to this time there had been only three wells and the water was extremely hard. In 1952 two more wells were added and in 1953 another, making a total of sixteen wells in use today. Each of the sixteen wells is approximately 130 feet deep with the water standing 90 feet in each well or 40 feet from the surface. The wells are located about two miles east of Weatherford on the western edge of the out-crop of the Rush Springs sandstone (Figure 1).

Because these wells have yielded such an abundance of water of good quality, additional private wells have been drilled in the Rushsprings sandstone in the Weatherford area for the purpose of irrigation. Additional drilling is being planned.

The present study is a report on the water levels and changes in water hardness expressed in parts per million in fourteen of the Weatherford wells over the two year period from Feb. 1952 to Feb. 1954.

The Rushsprings Sandstone

The town of Weatherford is in the southeastern corner of Custer County. It lies on the western edge of the out-crop of the Rush Springs sandstone, which was classed for many years as a member of the Whitehorse formation (Figure 2). Geologic maps show that nearly the full thickness of the Rush Springs sandstone is present under the town of Weatherford. According to Davis (1), well logs show the Rush Springs sandstone to be as much as 334 feet thick where none of it has been removed. It has been eroded in its outcrop area, however, so that the thickness differs greatly from place to place.

As described by Schoff (2), the western, or upper, boundary of the Rush Springs crosses the CRI and P Railroad about two miles west of Weatherford, loops eastward into the northwestern part of the town, and then runs northwest and passes about two miles east of Custer City.

The Rush Springs sandstone contains large amounts of ground water under water-table conditions, and this ground water is becoming increasingly more important to industry, agriculture, and domestic users alike. Ground water, like surface water comes from precipitation that falls on the earth's surface. Some evaporates, but much of this water is carried away by rivers and their tributaries; some is caught and stored in reservoirs and lakes, and the rest soaks in the ground and slowly filters through the underlying sands. The sand, because of its porous nature, can hold a great deal of water, and there is nothing to prevent the water from slowly flowing underground for great distances from where it originally fell. Weatherford is enjoying a plentiful water supply at the moment, but only because nature has put more water into the soil than man is taking out. If water usage is increased because of greater population, industry, irrigation, air conditioning, washing machines, garbage disposers, or just plain wastefulness, to the point where it exceeds the amount of water that nature puts in the soil, Weatherford will have a water shortage. Just how much water is in the Rush Springs sandstone, how much can be taken out with safety, or how much rain we will have in the future to replace it, are all matters of speculation. However, the indications are that the supply stored in the underground reservoir is very large compared with present withdrawals.

There are ways, however, to check on what is happening to this water supply. As long as the water stands at about the same level in the wells,

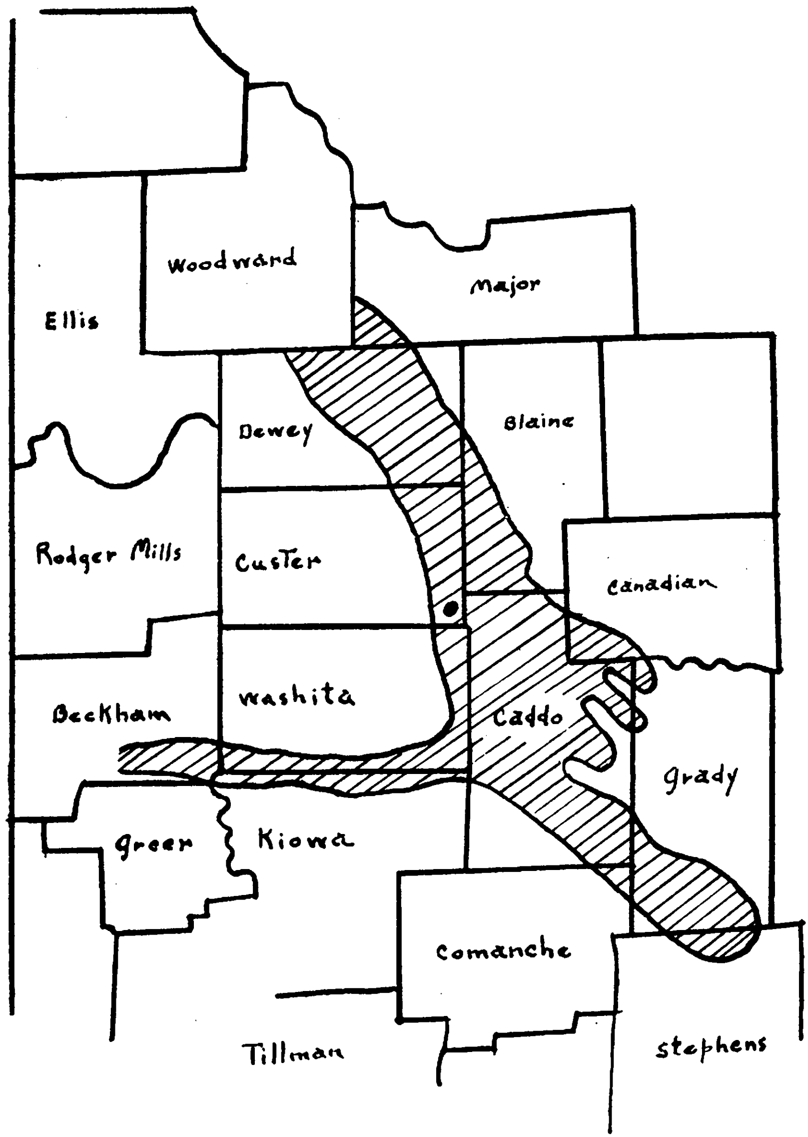

FIGURE 1. Map of Western Oklahoma Showing the Extent of the Rush Springs Sandstone and the Location of the Town of Weatherford in Custer County.

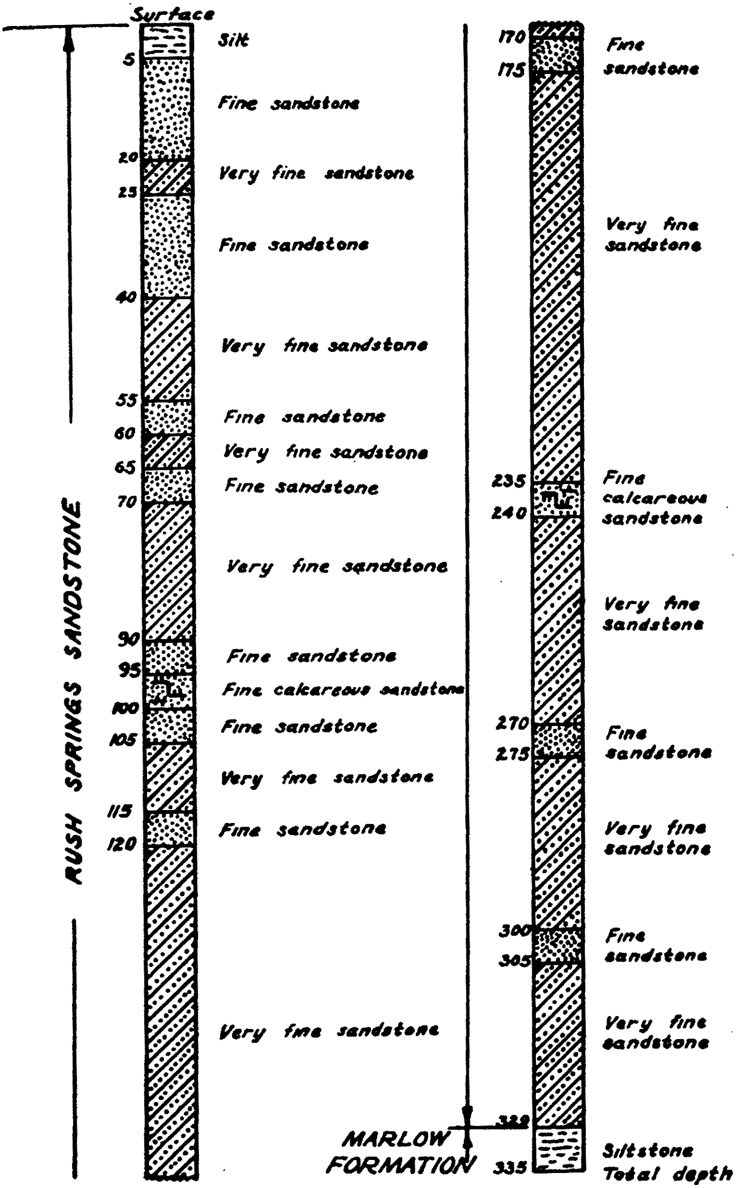

FIGURE 2. Graphic Log Illustrating Character of Rush Springs Sandstone, Caddo County Well 14 (3).

and as long as the chemical composition remains about the same, we can assume that all is well. However, if either or both of these should show any appreciable change we should regard it as a danger signal and look not only for the cause, but also for a solution.

In the Rush Springs sandstone area there are about 80 irrigation wells in operation. Within a ten mile radius of Weatherford, there are about 18 new irrigation wells, and there are prospects for many more being added in the near future. These wells will average a maximum yield of 500-600 gallons per minute by actual test. One well, two miles north of Weatherford, by actual test, yielded 964 gallons per minute and still had 70 feet of draw-down available. This same well, which is 259 feet deep is normally pumped at 660 gallons per minute and draws the water level down to 110 feet below the surface.

Method of Determining Water Hardness

The method of determining the hardness of water consisted of the titration of the hardness, with the use of a color-change indicator to determine the end point. The titrating agent was disodium dihydrogen ethylenediaminetetraacetate. This compound, with stablizer, reacts with calcium and magnesium to form complex ions. In this way the calcium and magnesium are rendered inactive, yet no precipitate is formed. The solution remains perfectly clear. The end point of the titration is detected by the use of an indicator that changes sharply from wine-red to true blue when the last of the calcium and magnesium is tied up by the standard solution. A buffer is added at the beginning of the titration to create and maintain the proper *p*H. In actual test 50 ml. of the water sample are measured and poured into a 250 ml. flask; 1 ml. of indicator is then added which gives the solution a wine-red color. This is titrated with the standard titrating solution until the sample changes from red to a pure blue. The total hardness is calculated by multiplying the milliliters of the titrating solution required in the titration by 20 to obtain the total hardness as parts per million.

Results

During the past two years from Feb. 1952 to Feb. 1954, periodic checks have been made on the Weatherford wells with reference to water level and total hardness. Each well is approximately 130 feet deep. Water

TABLE I

Variation of Hardness in Parts-Per-Million of Water from Different Wells

Well No.	Feb. 14 1952	Aug. 14 1952	Nov. 21 1952	Feb. 17 1953	June 24 1953	Nov. 7 1953	Feb. 14 1954
1	102	102	122	102	102	102	102
2	102	102	104	102	102	102	102
3	118	112	112	118	112	112	112
4	110	112	102	110	90	100	100
5	110	106	108	110	100	105	105
6	90	98	94	90	90	90	90
7	108	108	104	108	110	106	106
8	120	124	126	120	90	100	100
9	126	130	128	126	100	110	110
10	130	130	130	130	104	126	126
11	154	—	150	154	90	130	136
12	150	156	150	150	90	128	134
13	150	160	150	150	100	120	120
14	—	106	—	—	96	100	100
Average	120	118	121	120	96	109	112

stands 90 feet in each well or 40 feet from the surface. The water level in the wells has dropped only five feet since they went into service in 1948. This is not of any great significance, especially as it is never possible to shut all wells down long enough for water levels to rise completely. Tests of the hardness of the water, in parts per million are shown in Table I.

The figures for hardness in Table I were obtained by the Hach modification of the Schwarzenbach method for hardness in water. By this method low hardness is considered less than 250 parts per million; intermediate hardness, from 250 ppm to less than 750 ppm; and very hard water from 750 ppm. up. It should be mentioned that these standards differ from those of the U. S. Geological Survey which considers water with 0 to 75 ppm. of hardness as soft, from 76 to 150 ppm. as moderately soft, from 151 to 250 ppm. as hard, and any water over 250 ppm. as very hard (3).

Conclusions

Inspection of Table I will show that very little change has occurred in the hardness of some of the wells, for example, well No. 2; and that the average hardness for the group varied but little until June 24, 1953, when it dropped 24 ppm. This drop reflects the fact that the hardness of the water from 11 of the 14 wells decreased substantially during the four months from February 17-June 24, 1953. Whether or not this represents a genuine trend toward less hardness will become apparent only as the tests are repeated. It is encouraging, however, that the heavy withdrawals of ground water in the Weatherford area seem not to have had an adverse effect.

Literature Cited

1. Davis, L. V. 1950. Ground water in the Pond Creek basin, Caddo County, Oklahoma. Oklahoma Geol. Survey, Mineral Rep. No. 22.

2. Schoff, S. L. Personal Communication.

3. Sundstrom, R. W., W. L. Broodhurst, and B. C. Dwyer. 1949. Public water supplies in central and north-central Texas. U. S. Geol. Survey, Water-Supply-Paper No. 1069.