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Ground-water conditions in the vicinity of Enid, Oklahoma

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This memorandum summarizes matters discussed at a meeting of the City Commission of Enid, Oklahoma, on Thursday, January 15, 1948, at which the writer presented a brief analysis of the ground-water resources available to the City of Enid and answered questions brought up by the commissioners. The following points were covered:

1. Cooperative investigations in Oklahoma conducted by the Geological Survey, U. S. Department of the Interior, and the Oklahoma Geological Survey. The writer appeared at the meeting as a representative of both Surveys.

2. Type of investigations made:

(a) Areal projects.

(b) Municipal problems.

3. Ground-water geology of the Enid area, referred to the Geologic Map of Oklahoma, which was displayed:

(a) Areas colored in blue on the geologic map are underlain by relatively impermeable red-bed formations, in which it is exceedingly unlikely that water in quantities required by a city could be found. The water, where present, is generally rather highly mineralized.

(b) The yellow-dotted area on which Enid is located represents terrace deposits, in which buried channels of sand or gravel contain water that is readily available to wells. Development of this

terrace deposit by the City of Enid has been in progress since about 1900, and the possibilities of it appear to be about exhausted.

(c) The Enid terrace deposit is an isolated patch, cut off in all directions from similar deposits and resting on top of the impermeable red beds. Therefore the water supply in these deposits can be replenished only from the rain that falls on the surface of the immediate area.

(d) Another and much larger terrace deposit, similar to the one at Enid, stretches for many miles along the left (northeast) side of Cimarron River, and offers the best opportunity for Enid to expand its water supply. Like other terrace deposits, it is not everywhere the same in character. Test-drilling is required to find the more permeable portions of it, and sampling and analysis of waters is necessary to find the localities where the water is best in quality.

(e) The alluvium along Cimarron River is the deposit of the river at its present level. It is similar in both origin and character to the terrace deposit, and it contains water, but the water is likely to be harder and more saline than that in the terrace deposits. Furthermore, wells in the alluvium near the river channel may draw in river water, which is of inferior quality.

4. Investigations and proposals by Mr. Cecil H. Harrison, Enid Chief Engineer, and E. J. Archer & Company, Consulting Engineers, relate to the terrace deposit along Cimarron River. As this is the area that the Geological Survey regards as most favorable, it appears that the city is looking in the right direction. The test drilling and other data uncovered in the engineering investigations, representing an intensive and detailed piece of work, are better information than the Survey has in its files.

The following significant questions were asked and answered:

1. After a well is pumped, will it refill to the original water level?

Yes, if the period of pumping is short, the water from adjacent parts of the formation will come in to refill the well to about the original level. If the pumping period is protracted, a bigger cone of water table depression is created, which takes longer to refill. The cone cannot be completely filled and the level brought back to the original position until natural or artificial replenishment occurs.

2. Why do the water levels in the well fields go progressively lower?

The cone of depression has not expanded and deepened to the extent where the replenishment equals the rate of withdrawal, and at a given rate of withdrawal the levels will decline, though more and more slowly, until this occurrs. A decline does not necessarily indicate that the safe yield is being exceeded. On the basis of adequate records of pumping and water levels, it can be predicted if the levels will decline below the economical pumping lift or if the water-bearing formation will be unwatered. It is the purpose of ground-water investigations to obtain the information necessary for such predictions.

3. How much is the annual replenishment? How much of the annual precipitation goes into the ground?

Exhaustive tests are usually necessary to determine the annual replenishment even approximately, but we have a measure of it in the King Farm well field. According to Mr. Harrison, this well field, during the

eight years, has been pumped only for short periods to supplement the principal sources of supply, and the water levels have risen about one foot per year. If the effective porosity or specific yield of the sand or gravel is 30 percent, which would represent rather favorable conditions, the rise in water level means that a layer of water about 0.3 foot, or about 4 inches in depth, has been added per year. This means an annual addition of about 62,000,000 gallons per square mile where conditions are similar to those at the King Farm.

4. Is the Geological Survey appropriation large enough to permit it to make pumping tests?

The funds in Oklahoma are not sufficient to permit the making of pumping tests in the Enid area. However, as a part of the cooperative investigation the Survey will be glad to furnish information on the procedure for making such tests and will assist in analyzing the results.