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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
Geological Survey

PROPERTY OF U. S. GEOLOGICAL SURVEY  
GROUND WATER DIVISION  
TUCSON, ARIZONA

Memorandum on ground-water conditions in  
parts of Tps. 10 and 11 S., Rs. 23 and 24 W.  
Yuma County, Ariz.

By

P. W. Johnson

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GROUND WATER BRANCH

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Prepared in cooperation with the  
Arizona State Land Department  
Roger Ernst, Commissioner

Tucson, Arizona  
January 1954

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In response to a request from J. R. Burger, Acting State Land Commissioner, dated September 24, 1953, a brief reconnaissance was made of ground-water conditions in southwestern Yuma County, Ariz. This memorandum is based on the reconnaissance and on a review of data available from other agencies.

The area for which information was desired is in the extreme southwestern corner of the State and is bordered on the north by the northern line of T. 10 S., on the south by the International Boundary, on the east by the eastern line of R. 23 W., and on the west by the terrace escarpment that divides Yuma mesa from the flood plain of the Colorado River. The area is on the mesa and ranges in altitude from 150 feet to 200 feet above sea level.

The earliest investigations in the Yuma area date back to 1891, when the University of Arizona made a study of character of the soils and an investigation of the silt deposited by the Colorado River. Since then numerous investigations have been made by the University of Arizona, Bureau of Plant Industry, Bureau of Chemistry and Soils, Bureau of Agricultural Engineering, and the Bureau of Reclamation. Those investigations have emphasized mainly the classification of soils and land, which

must be taken into consideration if proper evaluation and decision are to be reached regarding the over-all usefulness of the land. The Bureau of Reclamation has for some years carried on a large program in the vicinity of Yuma. This program has included the construction of about 500 test wells, many of which are in the area under present consideration. Data from these wells were obtained from the Bureau of Reclamation, and include well locations, logs, analyses of drill cuttings, altitude above sea level, depth to water, chemical analyses of the waters, and maps showing locations of wells and contours of the water table. The cooperation of the Bureau of Reclamation in providing this information is greatly appreciated. The data were used to help formulate the conclusions reached in this report.

The area is underlain by ground water at depths at which range from 68 to 93 feet below the land surface, as indicated by water-level measurements made in test wells in September 1953. The area is entirely undeveloped and therefore there are no pumped wells. This makes it impossible to ascertain the well yields or pumping lifts that might be expected. Although it was reported that there were some wells located across the border in Mexico, upon investigation it was found that none of these wells were located in the mesa.

In 1947 water samples from most of the test wells in the area were collected and analyzed. The results of this sampling program indicate

that the water is within the acceptable limits for irrigation, ranging in dissolved solids content from about 600 to 1,000 parts per million.

It can be concluded from the above data that the ground-water conditions are rather favorable for the development of this area by irrigation. There is also a possibility that surface water could be brought in by diversion canals for irrigation use should the need arise.

Perhaps the major point to be considered is not the quantity and quality of the available water, but rather the type of soil that prevails in this area, and also the high rate of evaporation.

Logs of the test wells indicate that the land surface of this area is underlain by loose, coarse- to medium-coarse-grained sand, ranging in thickness from 10 to 50 feet. The soil map that accompanies the publication "Soil survey of the Yuma-Wellton Area, Arizona-California" by F. O. Youngs and others, U. S. Dept. Agr., No. 20, Series 1929, shows that the type of soil that prevails in a strip roughly 2 to 3 miles wide parallel to the terrace escarpment on the west is known as the Superstition sand. The map shows that the soil in the rest of the area, with perhaps the exception of a few small isolated areas, is classed as the Hummocky phase of the Superstition sand. Youngs' comments concerning these two types of soil are as follows:

Superstition sand---In general it may be said that this soil is coarse, has a low water-holding capacity, is poor in nitrogen, and is not especially rich in other plant-food elements. However, it is comparatively free from harmful accumulation of alkali salts.

Superstition sand, hummocky phase, has a loose surface layer of wind-drifted sand which is hummocky in many places and in some places forms small dunes. Only a very small proportion of this land has been cleared and leveled for cultivation, and attempts to farm it have met with failure. The soil is so extremely loose that it is very hard to irrigate, requires water at frequent intervals, and blows very badly. In fact, the blowing sand often cuts off or buries young vegetation.

The Bureau of Reclamation published a report in May 1949 entitled "Land classification report Unit One, Yuma Mesa Division of the Gila Project, Arizona" in which they have classified the lands according to a system which would reflect the relative value for irrigation farming. The classes designated are:

- Arable
  - Class 2
  - Class 3
- Nonarable
  - Class 6

According to maps that accompany the above mentioned report, the area under consideration falls mostly in Class 6, which corresponds to the Superstition sand--Hummocky phase, and the rest of the area, except for a few isolated areas of Class 2, is designated as Class 3. The lands of these two classes have soil of the Superstition sand type. The low moisture-holding capacity of these sandy soils of the Yuma mesa was one of the most important factors considered by the Bureau of Reclamation in determining the classification. The soil in the area under consideration is reported to have an average moisture retention of about 5 percent for Class 6 land to about 8 percent for Class 3 land.

The Yuma area has the highest evaporation rate in the State.

Figures published by the University of Arizona show that the Yuma mesa has an average of 117.98 inches, or nearly 10 feet, of evaporation annually. It can be seen that, with the low percentage of moisture retention due to the coarse, loose, sandy texture of the soil, combined with the high evaporation rate, it would be necessary to apply water frequently in order to produce any crop. The Bureau of Reclamation, in its land-classification report, included figures indicating the estimated water requirements and yields when raising alfalfa on an acre of Class 2, 3, or 6 land. Depending on the grade of soil within the class, it is estimated that an acre of Class 6 soil will require from 15 to 22 acre-feet of water per year and produce 2 to 3 tons of hay, while Class 3 soil will use from 10 to 15 acre-feet of water per year and produce 3 to 4 tons of hay. This will give some idea of what could be expected from development of this type of soil.

In conclusion, it appears that the possibilities of development of the area are limited, owing not to unfavorable ground-water conditions but to unfavorable soils.

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