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EFFECTS OF GROUND-WATER WITHDRAWAL, 1954-63,
IN THE LOWER HARQUAHALA PLAINS,
MARICOPA COUNTY, ARIZONA

BY
R.S. STULIK

PREPARED BY THE GEOLOGICAL SURVEY,
UNITED STATES DEPARTMENT OF THE INTERIOR

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EFFECTS OF GROUND-WATER WITHDRAWAL, 1954-63,
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The lower part of the Harquahala Plains covers about 350 square miles of desertland in the western part of Maricopa County, Arizona (fig. 1). Almost 35,000 acres of this land has been converted to irrigated farmland. The increased utilization of ground-water resources for irrigation and the accompanying effects on the ground-water reservoir are discussed in this report. The report includes analyses of depth to water, configuration of the water table, and changes in water levels.

About 6,000 acres was under cultivation in the lower Harquahala Plains in 1954 (Metzger, 1957). The 33,000 acre-feet of groundwater used to irrigate this acreage was supplied by about 20 irrigation wells. The depth to water in 1954 ranged from about 20 to more than 320 feet below the land surface.

In December 1963 about 33,000 acres was under cultivation (fig. 4); the annual pumpage had increased to about 200,000 acre-feet; and the number of irrigation wells had increased to about 100. The depth to water ranged from about 40 to more than 400 feet below the land surface (fig. 2).

In 1954 ground water in the lower Harquahala Plains was moving toward the southeast along a very low gradient (Metzger, 1957). The altitude of the water table in most of the area was between 960 and 970 feet above sea level. The increasing rate of withdrawal of ground water since 1954 has altered the configuration of the water table, and, by 1957, had reversed the direction of ground-water movement (fig. 3). In 1963 most ground water was moving along relatively steep gradients toward a well-defined cone of depression centered near sec. 30, T. 2 N., R. 8 W. (fig. 4); some ground water was moving toward two smaller cones in the southwestern part of the area.

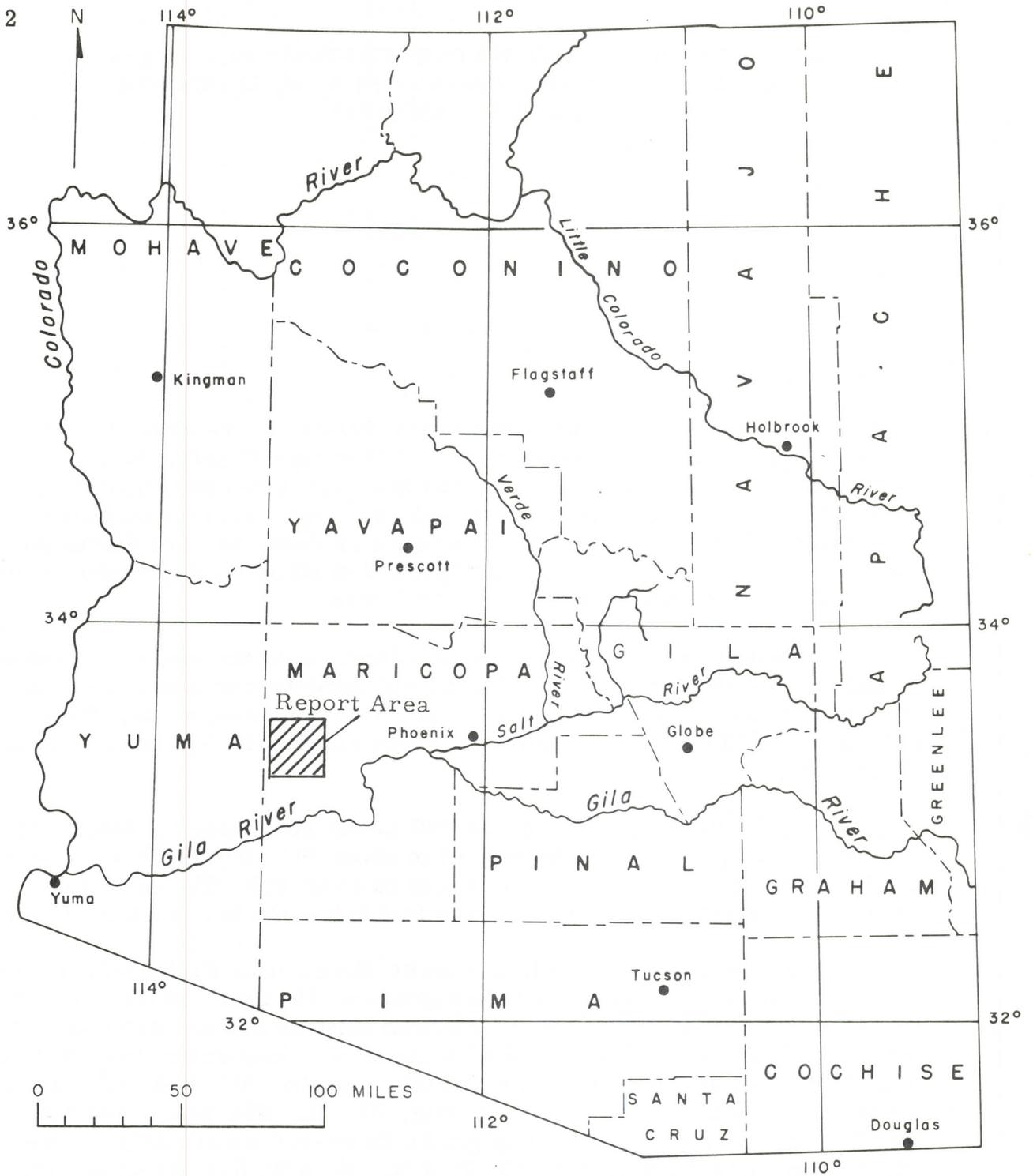


Figure 1. —Map of Arizona showing the lower Harquahala Plains.

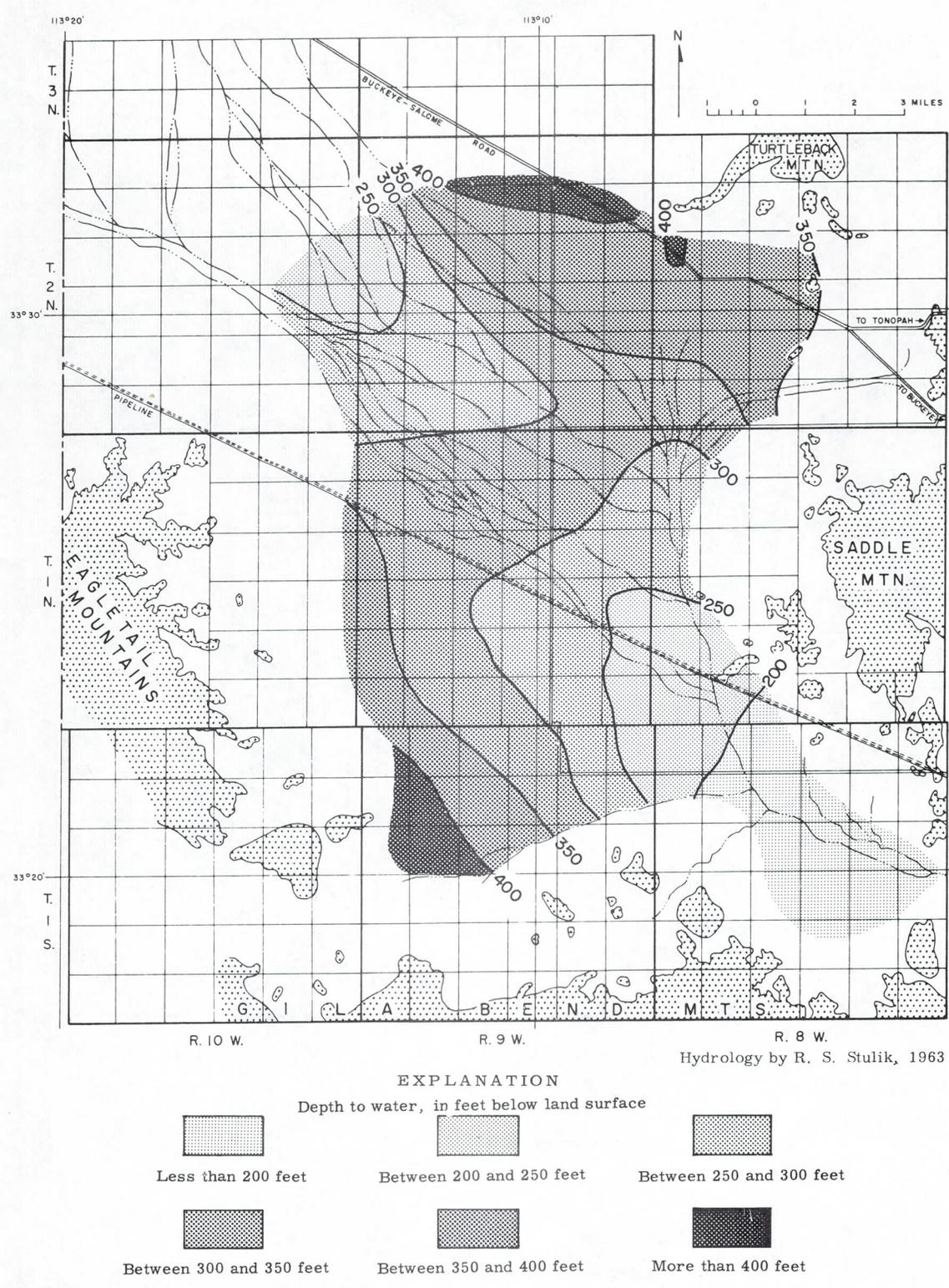
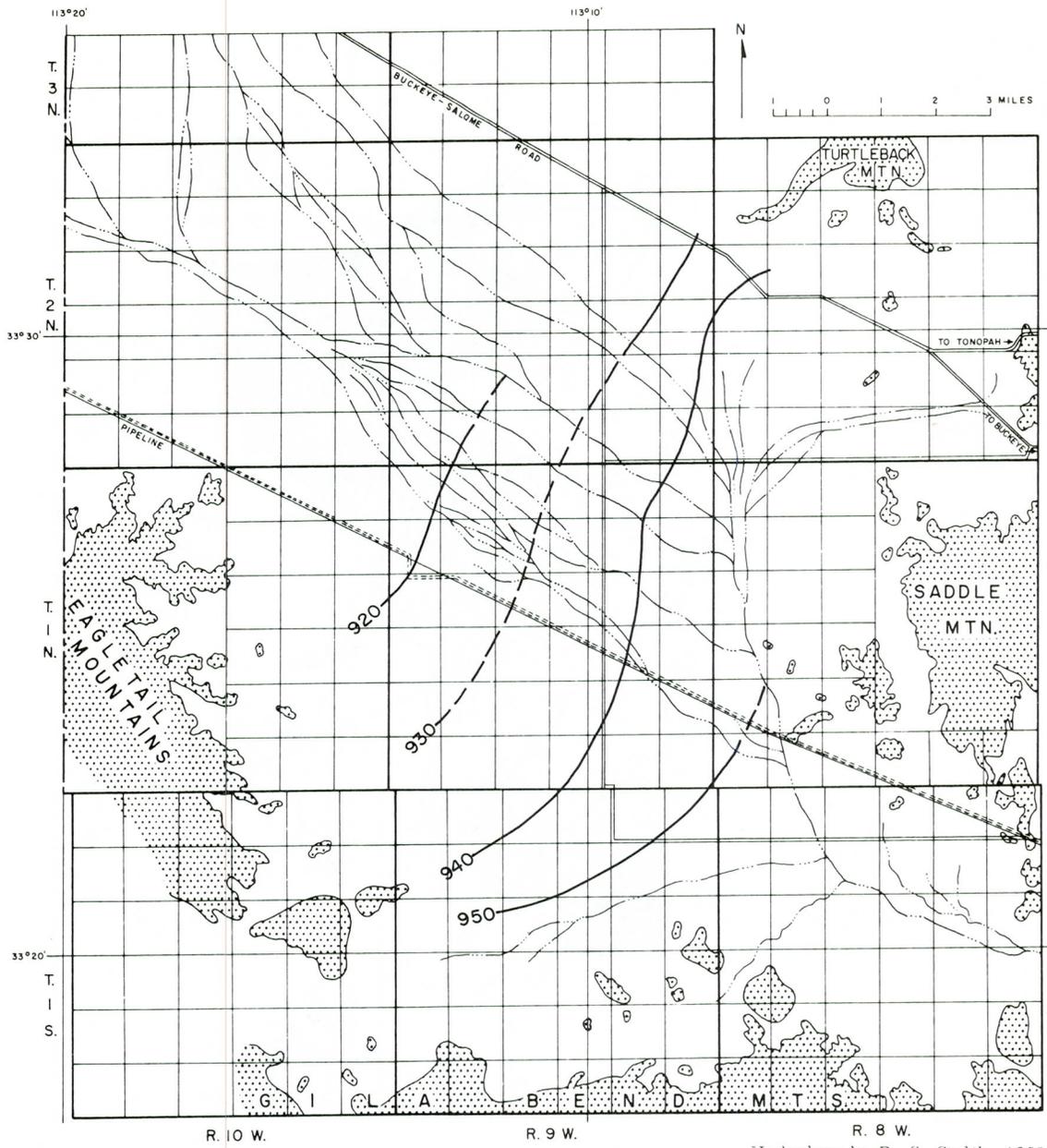


Figure 2. —Map of the lower Harquahala Plains showing depth to water, December 1963.



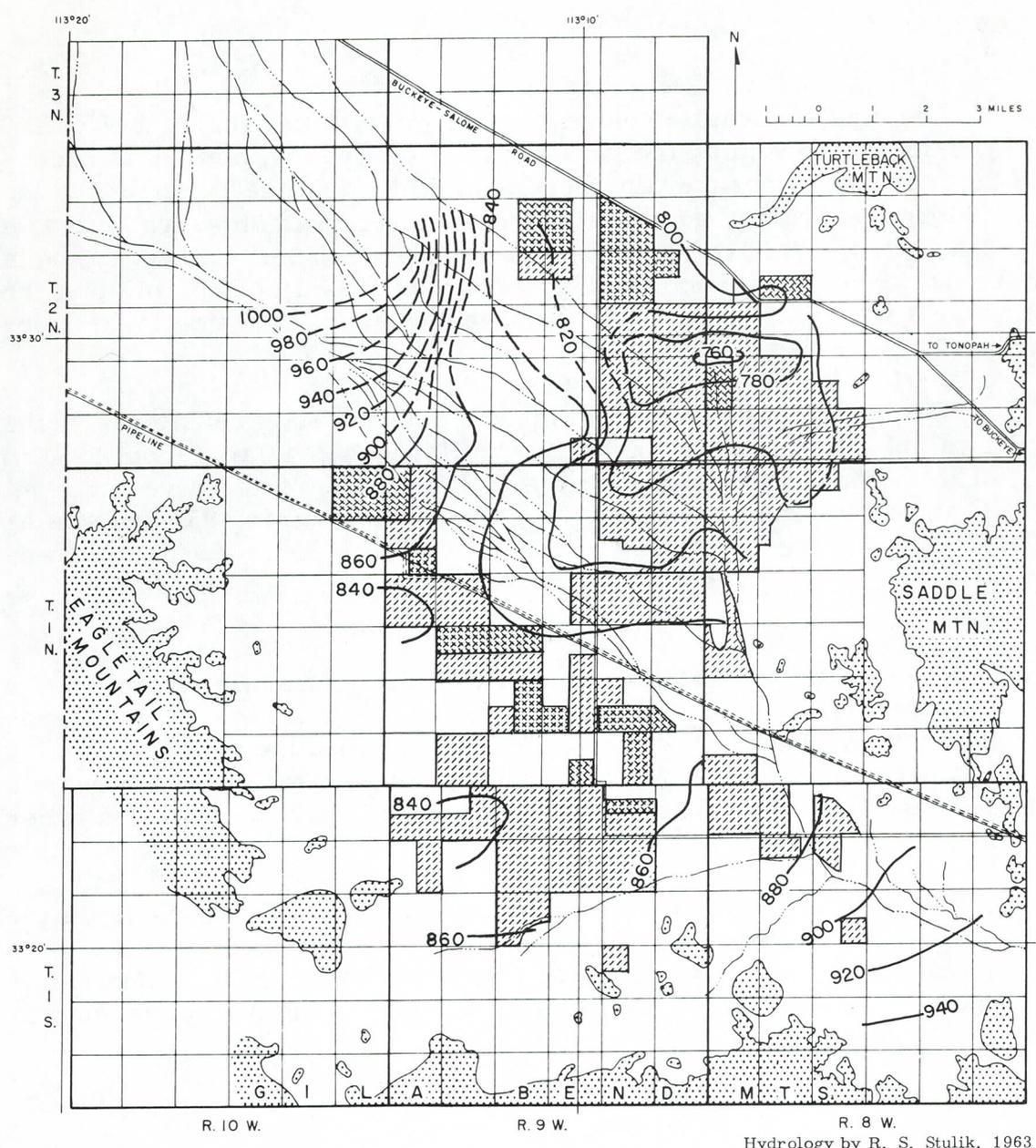
Hydrology by R. S. Stulik, 1963

EXPLANATION



 Water-table contour
 Dashed where inferred. Contour
 interval 10 feet; datum is mean
 sea level

Figure 3. —Map of the lower Harquahala Plains showing the altitude of the water table, August 1957.



Hydrology by R. S. Stulik, 1963

EXPLANATION

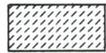
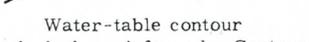
-  Cultivated area as of spring 1955
-  Cultivated area as of winter 1963
-  940 ———
-  940 - - - - -
- Water-table contour
Dashed where inferred. Contour interval 20 feet; datum is mean sea level

Figure 4. — Map of the lower Harquahala Plains showing cultivated area and altitude of the water table, December 1963.

The steep hydraulic gradient in the western part of T. 2 N., R. 9 W. (fig. 4) may be caused by the fact that the fine-grained materials underlying that part of the area drain more slowly than do the materials to the east. Along the western edge of the area of steep gradients, water levels in T. 2 N., R. 10 W. have remained the same since 1955, but water levels to the east have declined considerably. However, it is also possible that the water levels in T. 2 N., R. 10 W. represent a perched water table overlying the fine-grained material.

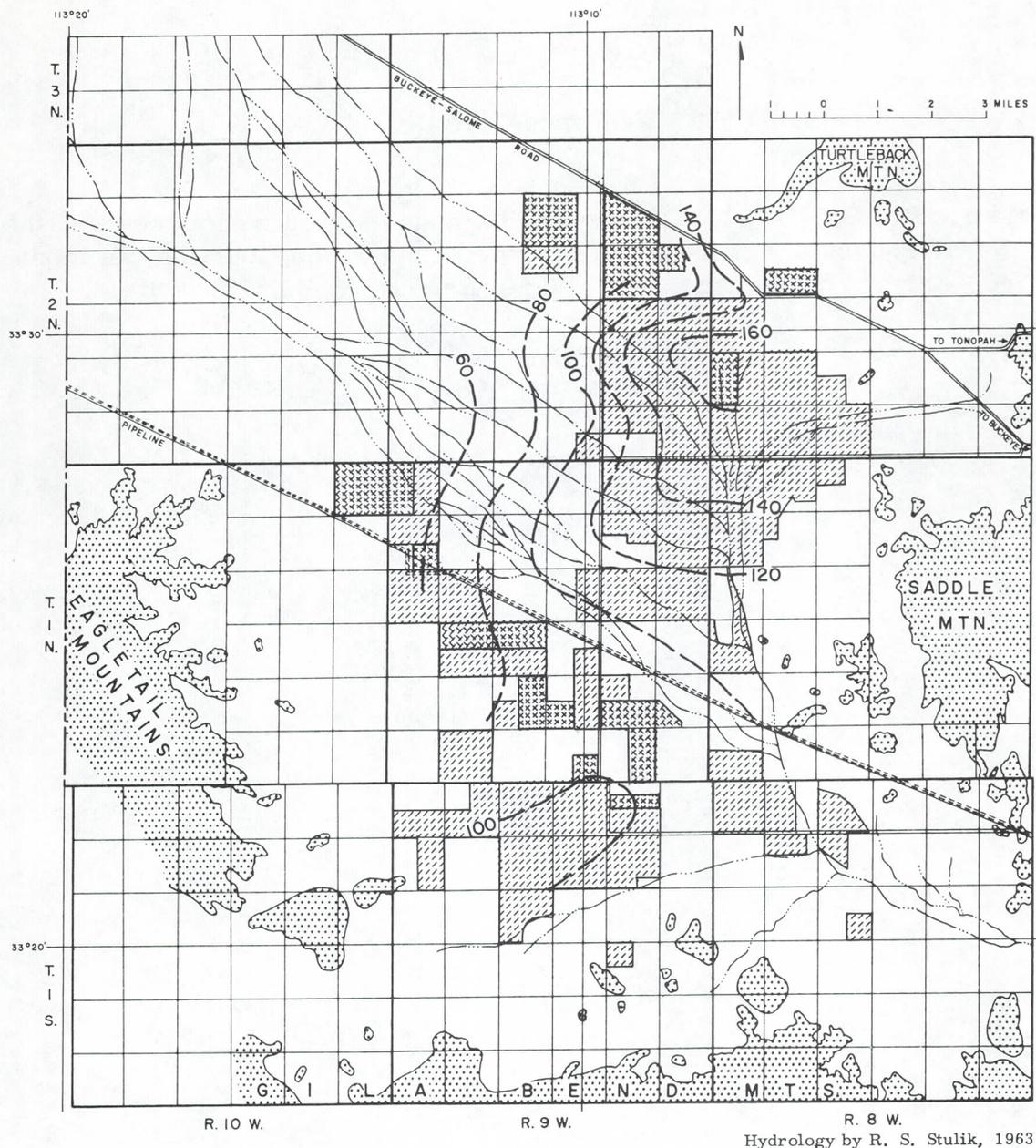
Water-level declines of as much as 200 feet have resulted from the withdrawal of ground water in the lower Harquahala Plains from 1954 to 1963. The average altitude of the water table was 960 feet above sea level in 1954; it ranged from 920 to 950 feet above sea level in 1957 and was as low as 760 feet above sea level in 1963. The decline from 1954 to 1957 was as much as 40 feet and from 1957 to 1963 it was as much as 160 feet (fig. 5).

The annual rate of decline obviously was increasing from 1954 to 1963. From 1954 to 1957 average declines in parts of the cultivated area were as much as 14 feet per year; from 1957 to 1963 they ranged from 10 to 27 feet per year. This increase in annual decline rates was due primarily to the increase in the annual pumpage as additional lands were placed under irrigation.

Geohydrologic studies show that the water-yielding capacity of the materials decreases with depth in the lower Santa Cruz and Phoenix basins and it is probable that, in this respect, the lower Harquahala Plains is similar to these basins; therefore, additional increases in the decline rates may be expected as the water table is lowered.

Summary

The annual pumpage of ground water in the lower Harquahala Plains has increased from about 33,000 acre-feet in 1954 to about 200,000 acre-feet in 1963. The increasing withdrawal of ground water resulting from further development has caused water levels to decline as much as 200 feet from 1954 to 1963. Because the water-yielding capacity of the materials probably decreases with depth, additional increases in the rate of decline may be expected as the water table is lowered.



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EXPLANATION

-  Cultivated area as of spring 1955
-  Cultivated area as of winter 1963
-  Contour showing change in water level.
Contour interval 20 feet; datum is mean sea level

Figure 5. — Map of the lower Harquahala Plains showing cultivated area and change in ground-water levels from August 1957 to December 1963.

References Cited

Metzger, D. G., 1957, Geology and ground-water resources of the Harquahala Plains area, Maricopa and Yuma Counties, Arizona: Arizona State Land Dept. Water Resources Rept. 3, 40 p.