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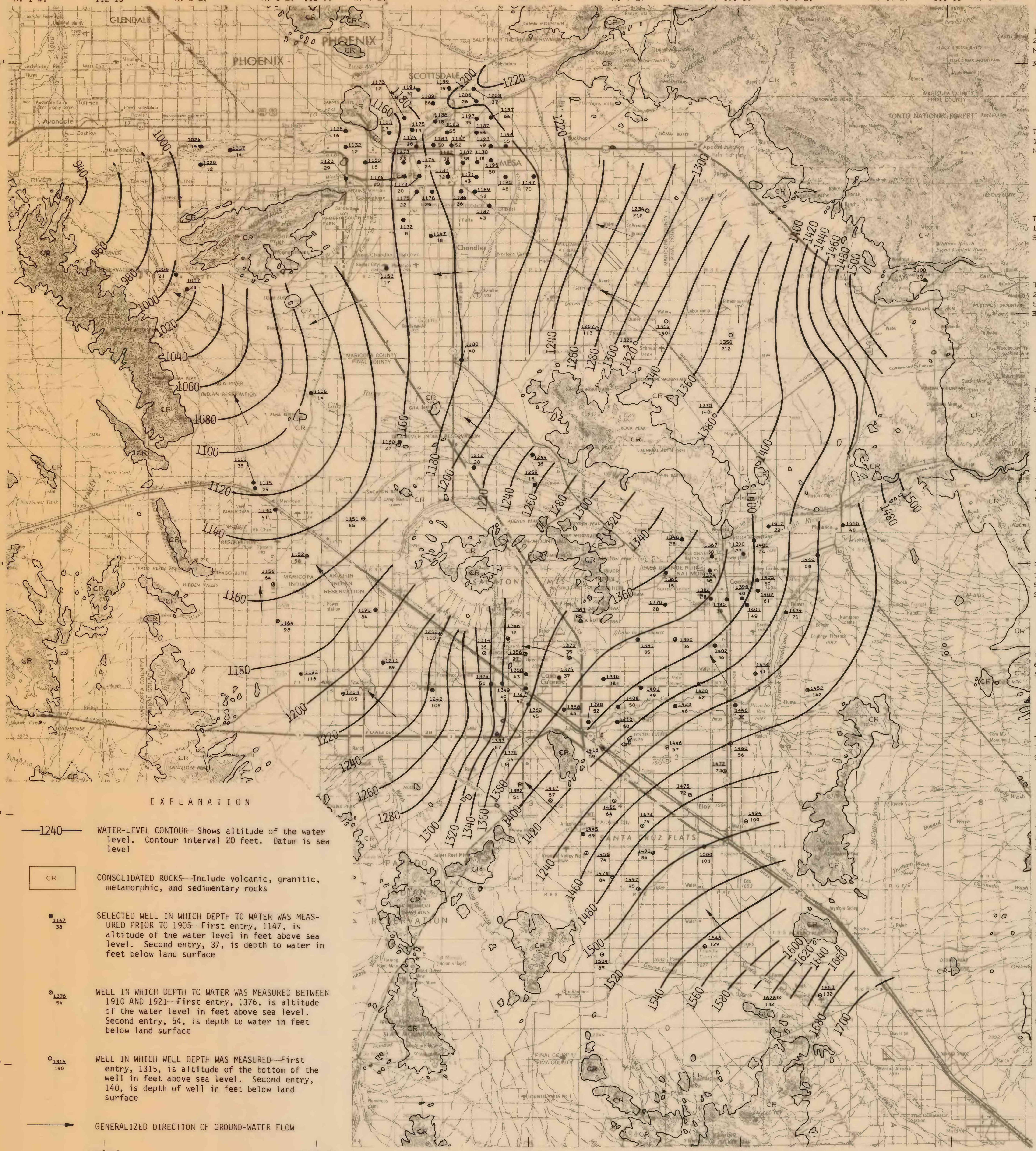
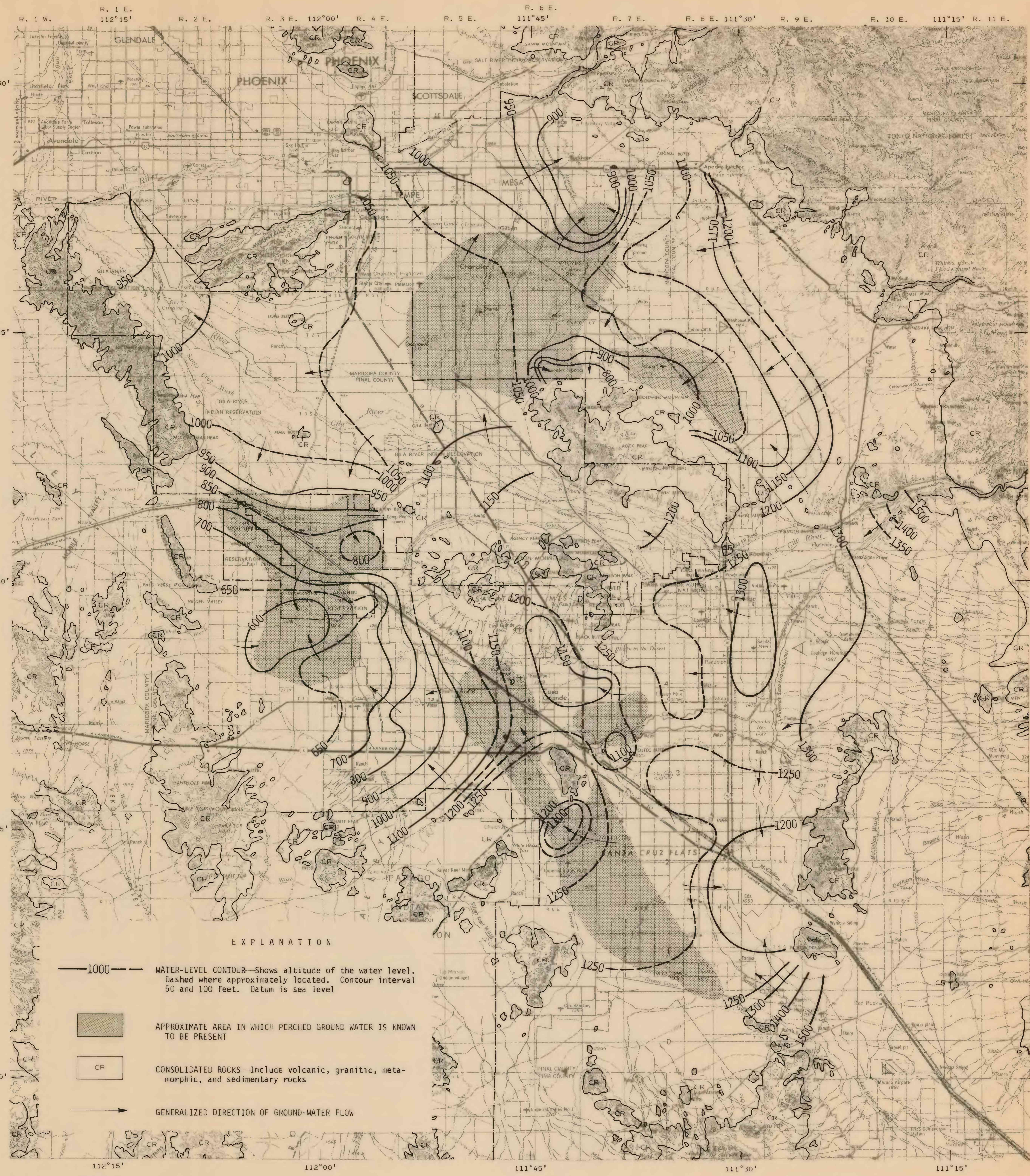
WATER-RESOURCES INVESTIGATIONS REPORT 85-4073
SHEET 1 OF 2



BASE FROM U.S. GEOLOGICAL SURVEY, 1:250,000
AJO, 1953-69; MESA, 1954-69; PHOENIX,
1954-69; AND TUCSON, 1956-62

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ALTITUDE OF THE WATER LEVEL, ABOUT 1900



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ALTITUDE OF THE WATER LEVEL, 1983

Introduction

The study area includes about 2,200 mi² in south-central Arizona, of which about 580 mi² is in the Gila River Indian Reservation. The reservation is partly within the Salt River Valley and the lower Santa Cruz basin, which are two of the largest agricultural areas in the State. Parts of these two major ground-water areas are included in the study in order to evaluate the ground-water resources of the reservation. The Ak-Chin (Maricopa) Indian Reservation and the northern tip of the Papago Indian Reservation are within the study area; the Salt River Indian Reservation adjoins part of the north border.

The area is characterized by broad flat valleys surrounded by low mountains. The mountains are composed of consolidated rocks, which include volcanic, granitic, metamorphic, and sedimentary rocks. The valleys are underlain by thousands of feet of permeable sediments that contain large quantities of ground water. The mountains form physical boundaries for surface-water and ground-water flow.

The principal water resources of the area include the streamflow of the Gila and Salt Rivers and the ground water stored in the underlying sediments. Little or no streamflow from the Santa Cruz River reaches the study area. The average annual precipitation is about 8 in., and the average annual lake evaporation is about 75 in. (Sellers and Hill, 1974). Irrigated agriculture, which became a prominent industry in the 1940's, uses most of the available surface water and between 1 and 2 million acre-feet of ground water each year.

The hydrologic data on which these maps are based are available, for the most part, in computer-printout form for consultation at the Arizona Department of Water Resources, 99 East Virginia, Phoenix, and at U.S. Geological Survey offices in: Federal Building, 300 West Congress Street, Tucson, and 3738 N. 16th Street, Suite E, Phoenix. Material from which copies can be made at the requester's expense is available at the Tucson and Phoenix offices of the U.S. Geological Survey.

Aquifer Characteristics

The main water-bearing unit consists of sediments that are several thousand feet thick in places. The sediments include unconsolidated clay, silt, sand, and gravel and variably consolidated sediments including caliche, mudstone, siltstone, sandstone, conglomerate, and evaporites. The degree of sorting and cementation and the distribution of the materials differ areally and with depth. Interbedding and lensing are common, and lateral discontinuities caused by high-angle faults may be present in some lower units (R. L. Laney and M. E. Hahn, U.S. Geological Survey, written commun., 1983).

The sediments have been divided into geohydrologic units on the basis of their geologic and hydrologic properties (Hardt and Cattany, 1965; U.S. Bureau of Reclamation, 1977; R. L. Laney and M. E. Hahn, written commun., 1983). The three units that probably best describe the area as a whole are an upper alluvial unit, a middle fine-grained unit, and a lower conglomerate unit (U.S. Bureau of Reclamation, 1977). The upper and lower units are present throughout most of the area. The middle fine-grained unit is present in the Mesa-Chandler area, the Coolidge-Eloy area, and the Maricopa-Stanfield area. The fine-grained material was deposited in closed basins and is thickest and finest grained near the center of those basins and is absent on the margins (U.S. Bureau of Reclamation, 1977).

The upper alluvial unit is mainly silt, sand, and gravel and ranges in thickness from a few tens of feet to several hundred feet. In general, this unit is highly permeable and yields as much as 4,000 gal/min of water to wells (R. L. Laney and M. E. Hahn, written commun., 1983). In places, however, the unit contains layers of fine-grained material that are relatively impermeable and that support perched ground water. The middle fine-grained unit, which is present in only parts of the area, is generally low in permeability and yields 50 gal/min or less of water to wells (R. L. Laney and M. E. Hahn, written commun., 1983). The lower conglomerate unit is moderately permeable and yields more water to wells than the middle fine-grained unit but less water than the upper alluvial unit. Where the middle fine-grained unit is present, water in the lower unit is confined. Where the middle fine-grained unit is absent, water in the upper and lower units is in a common and generally unconfined water body. The consolidated rocks may yield from zero to as much as a few tens of gallons per minute of water to wells.

Ground-Water Conditions, About 1900

The water-level contours represent the earliest information available on the ground-water system. An arbitrary date of about 1900 was used for these contours because the first records on wells and depths to water were compiled during 1897-1905. The water-level contours for about 1900 are based on the water levels for 1923 (Anderson, 1968) but have been modified to conform to earlier data in the Mesa area (Lee, 1905), the Florence-Coolidge area (Davis, 1897; Lee, 1904), the Magma-Queen Creek area (W. T. Lee, U.S. Geological Survey, field notes, 1903; U.S. Geological Survey, 1907), and the Casa Grande area (G. E. P. Smith, University of Arizona, written commun., 1921). Water-level contours are substantiated by water-level data in much of the Eloy-Casa Grande and Maricopa-Stanfield areas (G. E. P. Smith, University of Arizona, written commun., 1921), and in the Florence-Coolidge area (Olberg, U.S. Indian Irrigation Service, written commun., 1915). Water-level contours in the Eloy area match the ground-water contours for 1915 published by G. E. P. Smith (1940). Riverbed elevations were used as an aid in drawing water-level contours in the western third of the reservation, which was an area of ground-water discharge in 1903 (Lee, 1904).

Records indicate that white settlers started diverting water from the Gila River and its tributaries upstream from the Gila River Indian Reservation in the 1860's (Olberg, 1919). Pumping of ground water for irrigation began in the late 1890's (Davis, 1897), but only a small amount of ground water was withdrawn until the 1940's (Anderson, 1968). When the white settlers arrived, water levels were shallow—from less than 10 ft to about 70 ft below the land surface—and the surface of the underground water was a comparatively regular plain that sloped in general with the gradient of the Gila River (Lee, 1904). Water levels were about 100 to 130 ft below the land surface in wells measured between 1910 and 1921 in the Eloy-Picacho and Stanfield areas. The direction of ground-water movement was from the northeast, east, and southeast toward the northwest; discharge occurred through the gap between South Mountain and Sierra Estrella. The ground-water system was altered little by pumping until the 1940's. In places, the diversion of surface water for irrigation reduced recharge along the streams, created new areas of recharge along unlined irrigation canals and under irrigated fields, and caused minor changes in ground-water flow patterns. Prior to 1923, the hydrologic system in central Arizona was considered to be in equilibrium; that is, inflow was equal to outflow (Anderson, 1968).

Ground-Water Conditions, 1983

Water levels have declined and the direction of ground-water movement has been changed greatly because millions of acre-feet of water have been pumped from the ground-water reservoir (U.S. Geological Survey, 1983). In 1900, the general direction of ground-water flow was toward the northwest. In 1983, the ground water flowed toward the center of cones of depression east of Mesa; near Chandler Heights, Eloy, and Arizona City; and in the Maricopa-Stanfield area.

The depth to water below the land surface in 1983 ranged from less than 50 ft near Gila Crossing to more than 700 ft near Stanfield. As the ground-water levels have been lowered by pumping, extensive perched water remains, apparently supported by layers of fine-grained material within the upper alluvial unit. The perched water may result, in part, from irrigation water returning to the ground-water system. The perched water is readily evidenced by shallow water levels in the shallow wells and by cascading water in the deeper wells that are open to both the upper and lower units. The withdrawal of ground water and the resultant water-level declines in the alluvial sediments have resulted in land subsidence in the Mesa-Chandler, Coolidge-Eloy, and Maricopa-Stanfield areas (Schumann, 1974).

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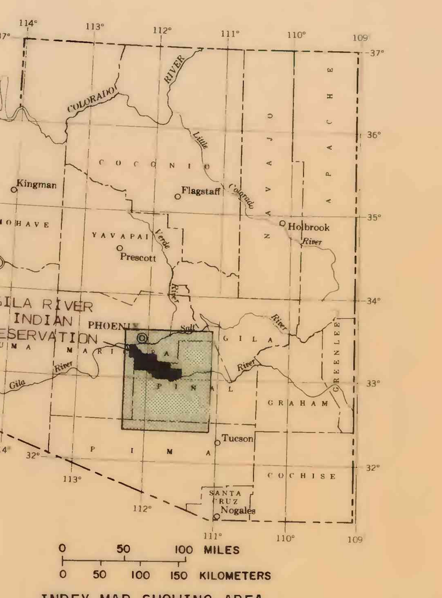

INDEX MAP SHOWING AREA OF REPORT (SHADED)

GROUND-WATER CONDITIONS IN AND NEAR THE GILA RIVER INDIAN RESERVATION, SOUTH-CENTRAL ARIZONA

BY

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