Arizona's Water Problem

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That Arizona faces a serious problem in securing a permanent water supply for its present needs and future requirements is well known. The 400,000-acre expansion in irrigated acreage in the 5-year period 1948-1953, was for the most part in pump areas.

This development was principally in areas where the draft upon groundwater storage had already resulted in an accelerated rate of lowering of water levels. The finest water-bearing formations have been uncovered by lowering water levels. In general, specific yields of the aquifer decrease with depth, the volume of groundwater in storage is reduced, well capacities decrease, and total pumping lifts increase with lowering water tables.

The speculative appeal of large profits, almost guaranteed by price supports for cotton, was a most important factor in this increase in pump irrigated acreage. Cotton acreage controls and increasing pumping costs with decreasing water supplies will result in the elimination of marginal producers.

Surface Water Appropriated

Surface waters in Arizona are subject to appropriation and for the most part they were appropriated many years ago. Expansion of irrigated acreage with surface waters in recent years has been limited to that from Colorado River waters.

Variation in annual runoff of Arizona streams is extremely wide and subject to even greater fluctuation than is the rainfall upon which it depends. Even the Salt River Valley Project with its almost complete control by storage of the Salt and Verde rivers may suffer from drouth.

For instance, storage from the runoff in 1941, of 3,127,000-acre feet, was used to carry the Project through the seven-year drouth which followed. Unfortunately other areas in this State do not have the same adequacy of water supply and storage facilities. However, even the Salt River Project has found it necessary to draw upon groundwater storage for a substantial part of its water supply.

Recharge to groundwater basins is principally from influent seepage from the sandy channels of surface streams, canal or ditch seepage and deep percolation from irrigated fields. The primary source of all surface and groundwater is precipitation, and while their immediate sources are often inseparable the loss of one is the gain of the other.

The annual precipitation for the State of Arizona averages a little over 12 inches, or approximately 75,000,000-acre-feet per year. It varies from 3.6 inches at Yuma to about 37 inches at an elevation of 8,000 feet in the Catalina Mountains near Tucson. Annual variations are wide—at Tucson a minimum of 5.16 inches in 1925 and a maximum of 24.17 in 1905, and at Phoenix a minimum of 2.85 inches in 1953 and a maximum of 19.73 inches in 1905. Only years of much greater than average rainfall or in which heavy rainfall is concentrated in a short period of time produce significant runoff or groundwater recharge. Years of average rainfall might almost be termed drouth years in this respect.

How limited the quantity of water available for additional groundwater recharge or surface diversion may be, is indicated by rainfall-runoff studies in the Santa Cruz basin above Tucson. The drainage area is 2,170 square miles and the average rainfall for the period 1923-1941 was 16.6 inches. The average annual runoff was only 12,600 acre-feet or only 0.6 percent of the rainfall. These figures point out the comparatively small quantities of water with which we may be dealing in some areas.

Just how much the water supply of the state may be increased, without considering the Colorado River or the possibilities of cloud seeding, is unknown. The following suggestions have been made for increasing the present supply of both surface and groundwater.

1. Reduction of waste, evaporation and transpiration losses in distribution.

2. Elimination of phreatophytes in shallow water and channel areas by fire, chemical or mechanical methods and their continued control thereafter.

3. Collection and concentration of surface runoff in temporary storage for release in areas and under conditions favorable to groundwater recharge.

4. Control of native range vegetation with elimination of deep rooted shrubs and replacement with range grasses. (In areas of low rainfall it appears doubtful whether either runoff or groundwater recharge can be increased by this method.)

5. Provide additional upstream storage to salvage losses from present uncontrolled peak flood flows. For example, dams at Charleston on the San Pedro, at the Buttes site on the Gila, above Wickenburg on the Hassayampa and above Calabasas on Sonoita Creek. (Such a program should reduce the requirements for flood control at the Painted Rock site on the lower Gila.)

Use of Water

An inventory of man-made consumptive use of water in Arizona is not available, but the following estimate in acre-feet, excluding reservoir evaporation losses which might properly be chargeable to irrigation, power or stock water, are believed reasonable.

	Acre Feet
1. Irrigation — 1,300,000 acres	4,225,000
2. Municipal and domestic — population 900,000	150,000
3. Industrial and other	75,000
ESTIMATED TOTAL, 1953	4,450,000

San Pedro River at Mammoth showing flood-peak flow of approximately 50,000 second feet. Corresponding peak flow at proposed Charleston Dam site was 31,000 second feet. A dam at Charleston would have taken off a considerable portion of the flood peak shown above.
(Photo by Surface Water Branch, U. S. Geological Survey.)