

# Drainage and Reclamation

## network of observation wells in Coachella Valley permits anticipation of possible drainage problems

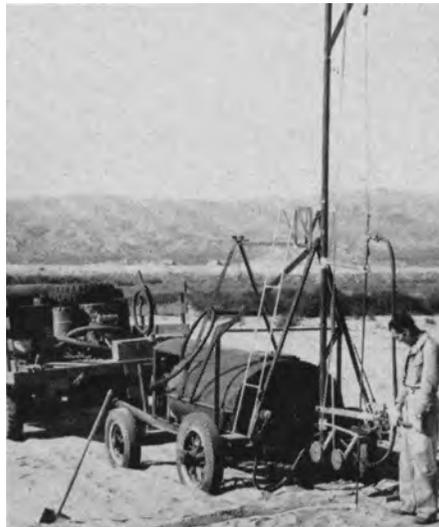
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*The following article is based on studies undertaken cooperatively by the Coachella Valley County Water District, the Salinity Laboratory of the United States Department of Agriculture, the Bureau of Reclamation, United States Department of Interior, and the Department of Irrigation and Soils, University of California.*

**The Coachella Valley**—part of the great Colorado desert with virtually no effective rainfall—has been receiving for almost five years supplemental irrigation water from the Colorado River through the All-American canal.

Some 70,000 acres can be served by the water distribution system—over 40,000 acres are now developed—and additional land can be served in the future by pumping. The extent of the ultimate development will be limited by the available supply of imported water and ground water.

The soils of the Coachella Valley range from permeable sands around the sides and in the upper reaches of the Valley, to relatively tight clay loams and clays in the lower trough and near the Salton Sea. In the past years, the most favorable farming areas which are scattered throughout the Valley have been transformed from desert into productive farms. This early development—before Colorado River water was imported—depended entirely upon the local ground water. Water tables were lowered, and the supply was too meager to warrant reclaiming the saline soils. Thus there were no significant drainage or reclamation problems existing on the approxi-



Picture of the jetting rig used to install the grid network of piezometers.

mately 20,000 acres developed with local water. However, previous hydrological studies had shown that drainage would undoubtedly become a problem with the importation of water, and soil studies indicated that many saline lands would have to be reclaimed to provide sufficient acreage for economic development.

The initiation and conduct of cooperative investigations of drainage and salinity conditions are making it possible to meet these problems as they arise.

The objectives of the cooperative studies are threefold:

1. To devise methods of continuously observing ground water conditions so that drainage problems can be forecast in time to apply corrective measures without serious damage to land and crop;

2. To supply such information as required for the design of practical and economical drainage systems; and

3. To develop techniques for the reclaiming of saline and alkali lands.

This approach has been unique in that it has permitted the anticipation of problems, and the partial determination—before the need arises—of the measures required for correction.

### Observation Network

If the full impact of importing Colorado River water was to be evaluated, it was essential to obtain a complete picture of the ground water status throughout the Valley before this water arrived.

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**View of the flushing experiments. The salt removed by flushing was shown to be insignificant in relation to the total salt in the profile.**



**Oat crop on leaching plots. Growth was closely correlated with the amount of leaching water passed down through the profile, to about 4' depth.**



## DRAINAGE

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The water levels in deep wells had been observed for over 30 years. These records are invaluable for water supply information but they do not provide adequate information on the position and trends of the shallow water tables, which affect the need for drainage and the nature of drainage measures required. New equipment and procedures had to be developed which were convenient and were also economical.

Small diameter pipe has been used in the past for shallow observation wells which measure the pressure of the water at the bottom of the pipe. These are called piezometers. Installing these at different locations and to different depths provides a means of studying waterflow in both vertical and horizontal directions, in addition to giving the elevation of the water table. In early work on this project a technique was developed to jet those piezometers into the soil. This improved the speed of installation, and permitted them to be placed to much greater depths. A secondary benefit from this new technique was that the qualitative nature of the material penetrated could be detected. Thus it is known whether the sub-surface material is clay, silt, sand or gravel, with exact depths of textural changes being observed. Such information has proven valuable in studying the movement of ground water and in predicting drainage measures.

Some 800 piezometers have been installed throughout the Valley on a half mile grid pattern, and are read periodically to show the rise and fall of the water table and the direction of ground-water movement. At spots where potential danger is indicated, additional pie-



Drilling an experimental drainage well.

zometers are placed at closer spacing and in batteries which consist of piezometers at varying depths.

In addition to the piezometers, there is a network of 42 small hydraulic-rotary drilled observation wells. These, cased with 2" asbestos-cement pipe, provide permanent reference points for the observation network. A special pump has been developed for use in these wells, and representative ground water samples are obtained periodically for chemical analysis.

As a result of thorough ground water and subsoil investigations, the most suitable type of drainage facility is being determined before the need for drainage arises, and the design criteria are being improved. In those portions of the Valley where drainage is now a problem, tile

drains have been shown to be most effective. Farmers are now having tile systems installed under the guidance of the Water District.

## Reclamation

Studies have shown that the saline soils can be reclaimed by leaching with Colorado River water. Unless there is a drainage problem which must first be corrected the land should be leveled and the surface ponded to pass about 4' of water through the profile. Soil improvement and final leaching can be obtained by frequent flood irrigations of a salt-tolerant crop. On the finer textured soils one or more drying out periods may be required during the original leaching. In some instances, high boron may be found. This requires more leaching, and then a salt-tolerant crop that is also tolerant of boron.

Irrigation practices in the Coachella Valley have an important bearing upon the drainage problems. Over-use of irrigation water, through using too small a head of water per furrow, strip, or check, through inadequate leveling, and through keeping the water on too long, seriously aggravates drainage conditions. Poor irrigation practices are probably responsible for many drainage facilities being needed at all, and a continuation of such practices overtaxes and makes less efficient even the best of drainage installations.

Only by careful management and more efficient irrigation can a drainage problem be corrected without high investment and some loss in production.

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*The above progress report is based on Research Project No. 860-A.*

A tile laying machine used in the installation of a drainage system in the Coachella Valley.



A typical commercial leaching operation, part of a reclamation program.

