

installing a private tubewell is amortized in a period of 2 or 3 years. Therefore, in regions developed by private tubewell owners the underground water supplies will benefit primarily the larger farmers. Ordinary market forces cannot be expected to moderate the price of private tubewell water to small farmers because each small farmer will be located in a position that can be served by at most one or two large tubewells. In this circumstance, it may be advisable to regulate the price of private tubewell water just as the terms for farm tenancy are now regulated. This regulation should not be so stringent that it erodes substantially the incentive for the installation of private tubewells where they are appropriate.

This all adds up to a complicated mesh of considerations that cannot be resolved finally until we have more experience with the operation of the private wells. Tentatively it appears that the private wells, being more responsive to local day-by-day requirements, are preferable in areas where they can be installed and operated profitably, and where considerations of control of groundwater quality are not overriding. They are managerially simpler to operate and they mobilize resources of private management and capital the government cannot tap. But where land reclamation or groundwater quality control are commanding considerations, and in areas from which surface water supplies should be diverted in the interests of overall economy, then the government tubewell developments are the method of choice. In the long run, there is also the question of coordinated operation of the canals and the tubewells in order to maximize the benefit from the high river flows of summer. We have suggested that it may be possible to do this with either private or public wells, but this should be tested. In any case, both sorts of wells have useful roles to play in the overall development of the Indus Plain.

QUALITY OF THE GROUNDWATER

Serious questions have been raised, most forcibly by Ghulam Mohammad [4], about the quality of the underground water in the former Punjab and Bahawalpur. These concern the salinity, or total salt concentration, of the water and the possibility of soil damage from an excessive sodium content in the presence of relatively high concentrations of carbonate and bicarbonate ions. Insufficient information exists to discuss such other problems as the potential hazards from boron, but we believe these are small.

Salinity

The Ground Water Development Organization of the Irrigation Department, and later the Water and Soil Investigation Division of the West Pakistan Water and Power Development Authority, made several thousand chemical analyses of water samples from nearly a thousand test holes, throughout 34 million