

## Chapter 7

### HYDROLOGY

#### Introduction

This chapter presents: (1) a brief description of the hydrological regime of the Indus Plain and the processes of waterlogging and salination of the farm lands; (2) a summary of the water budget for future development of the region; (3) a discussion of the hydrological factors that have a bearing on the selection of a practical size of project areas for intensive agricultural development; (4) an analysis of the problems associated with those regions in which the ground water or the soil have excessive salinity; and (5) an evaluation of the efficacy of tubewell schemes for combatting waterlogging and salinity and for providing supplemental water supply for increasing agricultural production. This evaluation includes (a) a review of the advantages associated with the ability of tubewells to provide supplemental water at all seasons of the year so that the intensity of cropping can be increased; (b) an examination of the factors that determine the proper number and spacing of wells within and outside of the project areas; (c) an investigation of the rate of lowering of the ground water table from waterlogged zones with different rates of pumping; (d) a study of the question whether to locate the wells in the project areas on high ground or low ground so as to gain the maximum efficiency in elimination of waterlogging; and (e) an analysis of the merits and limitations of lining canals, branches and watercourses with emulsion sealants as a means of reducing leakage and augmenting the water supply.

Many of our calculations were carried out with digital and analogue computers. The computers have been used in new ways to cope with complex hydrological problems that heretofore have defied analysis. This new methodology has an intrinsic value aside from its application to the hydrology of the Indus River basin. The computer techniques that were developed are useful in two ways: (1) in obtaining answers to questions relating to the "macro-design" in the Indus Plain of huge systems of water-control devices—dams, tubewells, canals and drains—that arose during the investigation of the Panel; and (2) as potentially valuable tools of engineering analysis for future detailed studies (micro-design) of specific project areas. Therefore in arranging the order of topics in this chapter it was expedient to include special sections of description of analogue and digital computer techniques and application. This has perturbed to some extent what otherwise would have been a logical ordering of the many topics and problems investigated. For example, there is no single section in the chapter dealing with problems associated with the control of salinity and alkalinity, since some of these were solved by the analogue computer, some by the digital computer and others by