

correlation coefficient; (2) the rate of siltation - with concomitant loss of live and dead storage - cannot be closely estimated; (3) our estimates of the efficiency of storage have been calculated on the basis of imprecise estimates of the marginal benefits of Rabi water relative to Kharif water (See discussion in Chapter 5). Optimal target drafts at the canal-heads for agriculture during the different seasons are closely related to economically efficient cropping patterns. At the present time it is not possible to delineate accurately the relative value of Rabi and Kharif diversion. Our calculations have been predicated on the assumption that Rabi water from reservoirs will have a high marginal utility, especially in the Former Sind where in some regions twelve-month cropping is possible.

Our calculations in the water balance have taken into consideration estimates of the effect of desiltation in reservoirs upon the magnitude of bank storage and ground water recharge of the rivers, and on recharge of ground water from the distribution system below the canal heads. While the magnitude of these effects cannot be predicted accurately we believe they are likely to be significant. Therefore in our analysis of the water and salt balance in the northern plain we have used the firm diversion (45 maf/yr) rather than the average diversion (48 maf/yr) in order not to underestimate the required investment in tubewells and appurtenant structures.

Water Budget for Future Development

In this section an analysis is made of the amount of water that can be made available for increased agricultural production and the control of salination. Although we are convinced that economic development should be continuous over the next several decades, for the purpose of setting out our hydrological considerations it is convenient to discuss two levels of development. In the first level it is assumed that the construction associated with the Indus Waters Treaty of 1960 will be carried forward and, moreover, that large networks of tubewells will be installed in the Former Punjab to recapture distribution system leakage and to mine the aquifer. It is further assumed that few, if any, new barrages for perennial irrigation will be built on the rivers. This level of development will be reached in perhaps fifteen or twenty years and will use river diversion in amounts not greatly exceeding those of the recent past. At the second level it is assumed that the diversions from the three western rivers - the Indus, Jhelum, and Chenab - will be increased and that this will be accomplished by increasing the amount of surface and ground water storage for river regulation to the ultimate practical degree of development so as to