

PREFACE

With two thirds of the earth's surface covered by water and the human body consisting of 75 percent of water, it is needless to say that water is one of the prime elements responsible for life on earth. Without water life is impossible. As long as there is life on earth, water will be there and the vice-versa. In all parts of the world, the major rivers played a significant role in the evolution of man. The earliest civilizations of man started near rivers, the Nile, the Tigris and the Euphrates, where man began to establish himself on the earth. The rivers of Punjab also played a great role in developing the ancient Indian civilization.

The state of Punjab occupies 1.57% of the country's total geographic area and is a part of the Indo-Gangetic plains formed due to alluvial deposits by rivers and tributaries. Due to the abundant availability of water, from the ancient times itself the state is densely populated and supports 2.4% of the country's present population with a population density of 484 persons per sq km. The climate is typically subtropical. Land use in the state is shared by agriculture, forests, water bodies, built up areas, barren land etc. The hydrological features of the state are mainly governed by the presence of Shiwalik ranges, Kandi belt and alluvial plains. The geo-morphological features of the state are characterized by high hills, table lands, inter-montane valleys, piedmont plains, alluvial plains, sand dunes, paleo-channels, etc. However, most of these areas have experienced drastic changes in the past few decades due to excessive human interventions, water bodies being no exceptions.

Punjab is very rich as far as water resources are concerned. The name Punjab itself is self explanatory and stands for abundance of water. Although, after the partition of the country, it is no more the same land of five ancient rivers, it is still endowed with some major rivers of national and international importance. The rivers Sutlej and Beas, traverse the state and rivers Ravi and Ghaggar touch its northern and southern borders, respectively. There are a number of other small rivers, wetlands, lakes, ponds, and drains flowing all over the state. The state is well irrigated through the network of canals which was one of the important contributors in the Green Revolution of the state. However, unfortunately, in an effort to produce more grains, the state has been over exploiting its land and water resources by changing traditional cropping pattern and resorting to high input-agriculture with higher demands of water, nutrients, energy etc. Increased cultivation of high water requiring crops has put undue pressure on the state's surface and groundwater resources, the effects of which are increasingly being felt now and warrant immediate action for mitigation.

Recognizing the importance of addressing the various issues related to the water resources of the state, the National Institute of Hydrology, Roorkee decided to organize a Regional Workshop on "Water Availability and Management in Punjab", so that the various policy makers, stake holders, field engineers, academicians, researchers, scientists, administrators, managers and non governmental organizations sit together, interact and discuss the various issues and come out with practically workable recommendations and strategies for conservation and proper management of the water resources of the state for the welfare of our future generations as well as economic development of the state. It is worth mentioning here that the North-West Regional Centre of the Central Ground Water Board, Chandigarh and the CAS, Department of Geology, Panjab University, Chandigarh joined hands with NIH in organizing the Regional Workshop. We are happy that an overwhelming response has been received from various organizations for participation in the workshop and a number of research and policy papers have been presented.

This publication, which is the proceedings of the Regional Workshop, is an outcome of the valuable contributions made by various researchers, scientists, academicians, field engineers and managers, who are in some way or the other related with the water resources of Punjab state. We have made sincere efforts to put together the various research papers in proper perspective by arranging them into important themes so that the document serves as a useful ready reference for everyone and anyone from the policymaker to the stake holder. The volume has been broadly divided theme wise into five sections namely (i) water quality assessment and management, (ii) simulation and modelling studies in Punjab, (iii) water management for agriculture, (iv) applications of modern techniques in water resources and (v) water availability, regulation and management. We sincerely hope that this publication will go a long way in assisting the various related individuals and organizations, in the cause of development, conservation and management of the water resources of the state of Punjab.

Editors