

Introduction



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Improvement of water management is essential to reduce water demands, to augment water supplies, to optimize water allocation, to enhance wastewater treatment and recycling, and to improve water conservation in the Kingdom of Saudi Arabia. Through the adoption of new and advanced water technologies, the Kingdom has been able to meet the increasing water demands by using seawater desalination and limited groundwater resources. It has managed to face the immediate water challenges arising from the drastic increase of water demands that accompanied the rapid development of the country especially during the past two decades. Water professors and scientists at Saudi Universities and research centres have been involved in applied research to solve water management problems in domestic, industrial and agricultural sectors. Original technologies have been developed to help in improving water resources assessment, development, utilization, operation, control, protection and conservation in different regions of the Kingdom. To disseminate the advanced knowledge and experience among water scientists and specialists on local and international levels, the University has been organizing an Annual Water Conservation Workshop since 1997. This is also to celebrate the Water Day as announced by United Nations on 22 March every year.

I would like to express my gratitude and appreciation to Professor Asit K. Biswas for devoting a special theme issue to: "Water Management in Saudi Arabia". This is intended to help in disseminating the successful Saudi experience and technologies among water specialists worldwide.

The theme issue includes eight articles on various specialized aspects of water management, which were presented at the Third Annual Water Conservation Workshop, organized by the University on 3–5 April, 2000. The first article by Professor J. W. Lloyd explains various aspects of desalination and the recycling of sewage and industrial waste waters with respect to aquifer protection and aquifer value as a storage medium in Saudi Arabia. Rasheeduddin *et al.* have

used numerical simulation techniques to clarify groundwater flow conditions in the multi-aquifer system in the Eastern Province. They use the developed model to predict the future declines in groundwater conditions under different water pumping scenarios, and suggest suitable water pumping policy to protect the productivity and quality of groundwater in the Province. Sharaf *et al.* delineate the areas affected by upconing and saline water intrusion in the lower part of Wadi Fatimah and the areas towards the Red Sea coast in Western Saudi Arabia using hydrogeological, hydrochemical and electrical resistivity methods. They have suggested restrictions on well drilling, and the implementation of monitoring programmes and water conservation measures to control these negative impacts. Hussein sheds light on principles of groundwater rights and their application to major aquifer systems. In the same article, a legislation model has been suggested for groundwater allocation in aquifers shared by more than one state or country. Awad and Al-Bassam describe their developed and successfully tested computer program (HYDCOND) to calculate hydraulic conductivity from grain size distribution in all types of aquifers in Saudi Arabia and other regions of the world. The use of such a program will help in achieving a major reduction in the costs of field measurements and a better understanding of aquifer features. This is necessary for better groundwater management and conservation. Abderrahman in his article explains how in Saudi Arabia, where water resources are limited, the availability of energy resources including natural gas and electricity, helped in solving the challenges of satisfying rapid and substantial increases in water demands for drinking, industrial and agricultural purposes. The adoption of advanced technologies in the Kingdom is continuing to reduce power consumption and water demands so as to conserve energy and water, and to minimize negative impacts on the environment. Bushnak outlines in his article the dynamics of the privatization of water supply and sanitation in Saudi Arabia. He has also given a summary of the projected requirements of desalination plants' capacity and the estimated capital investment needed for water supply and sanitation services. Then, the article gives a summary of public and private initiatives to privatize water services in Saudi Arabia. Abderrahman *et al.* present an original and dynamic model to schedule and operate large irrigation projects containing a large number of fields according to changing field conditions related to water, climate, soil, plant and irrigation systems. The model is called "Computerized and Dynamic Irrigation Water Management System (CDIWMS)". The model is supported by a comprehensive and dynamic database management system. The model performs several functions including the dynamic modification of field information and operation conditions such as delay or suspension of irrigation. The CDIWMS was tested and implemented successfully in several large irrigation schemes in Saudi Arabia, and resulted in saving about 25% of water, energy and costs of operation and maintenance, and in increasing agricultural production.

I hope this Special Issue will help in improving water management in other arid countries, and will be beneficial to the water community worldwide.

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Guest Editor of the Special Issue

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