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نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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WATER RESOURCES MANAGEMENT IN ARID/SEMI-ARID BASINS

submitted by

ENG. ADNAN GAMEEL MOHARAM

A Dessertation submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILIOSOPHY
in
IRRIGATION AND HYDRAULICS

FACULTY OF ENGINEERING
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ABSTRACT

WATER RESOURCES MANAGEMENT IN ARID/SEMI-ARID BASINS

Basins with mixed hydrological regimes, semi-arid in the upper part of the basin and arid in the majority of the basin, have special hydrologic features of large rainfall deficits, high variability of rainfall in time, excessive evaporation losses due to high temperature and wind speed; intermittent stream flow and tendency to be lost in desert before reaching the sea, and relatively small surface water and groundwater fluxes.

The main issues related to water resources management in arid/semi-arid basins are increasing water demands for irrigation, municipal, livestock, and industrial uses, risks to sustainability of the groundwater resources related to uncontrolled goundwater abstraction in the arid zone aquifer, and low economic returns as a result of inefficient water use. The long term economic development in arid/semi-arid basins is very much linked to the sustainability of water resources to produce food for present and future needs of a growing population. Therefore, an entegrated water resources management is required to optimally use the available water for irrigation and other demands.

In this research, a methodology that can produce water management scenarios in arid/semi-arid basins is developed to meet the water management issues and to maximize the benefits obtained from the available water. A water resources management model for arid/semi-arid basins (WRMIASB) is developed. The model is applied to a case study; Wadi Surdud in Yemen. WRMIASB is a simulation model designed primarily to provide projections of water demands and compares the projected water demands against available water supplies. It allows scenarios for water resources management to be simulated by answering a wide range of what if ? questions.

Seven scenarios for water resources management in the case study are developed on the basis of the perceived hydrological features and the water management issues. The main decision variables considered in formulating these scenarios are classified into three categories: one category is related to sources of water supply, another category is related to infrastructure and demand management, and the last one is related to the development in the basin.

Analysis of the simulation results of the proposed scenarios has showed that the main promosing options are: introduction of conjunctive use of surface water and groundwater for irrigating profitable crops, control of groundwater pumping, using modern irrigation methods, modification of the traditional planting dates to minimize crop water requirements, introducing improvment works in the wadi channel (*e.g.* diversion structures) and in the distribution system (*e.g.* linning channels), and construction of small dams for better water control.

The most attractive scenario for water resources management in the Wadi Surdud is then selected based on economic and groundwater sustainability criteria.

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Eng. Adnan G. Moharam