

Groundwater Quantity and Quality Management

Edited by

Mustafa M. Aral and Stewart W. Taylor

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GROUNDWATER QUANTITY AND QUALITY MANAGEMENT

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Stewart W. Taylor



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CHAPTER 1

INTRODUCTION

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1.1 Groundwater Management

Groundwater is an essential resource both in the U.S. and the rest of the world. As a water-supply source, groundwater has several advantages when compared to surface water: it is generally of higher quality, better protected from chemical and microbial pollutants, less subject to seasonal and perennial fluctuations, and more uniformly spread over large regions than surface water (Zektster 2006). Water-use data compiled by Kenny et al. (2009) for the U.S. indicate that groundwater supplies 33%, 98% and 42% of the water for public supply, domestic use and irrigation use, respectively. About 67% of the fresh groundwater withdrawals in 2005 were for irrigation, while about 18% were for public supply. Outside of the U.S., groundwater is the only water supply for some countries (e.g., Denmark, Malta, Saudi Arabia), while groundwater use exceeds 70% of the total water consumption and is the main source of municipal domestic and drinking water supply in most European countries (Zektser 2006). While its “in-stream” value, as is the case with rivers, has not been widely acknowledged, the critical role groundwater plays in maintaining important surface water systems, riparian and other types of vegetation as well as vital ecosystems is also increasingly recognized (Villholth and Giordano 2007). Estimates from a water balance model indicate that about 36% of river runoff is contributed by groundwater on a global basis (Döll et al. 2002), whereas in the U.S. the groundwater contribution to streamflow, estimated to be 52%, is even greater (Winter et al. 1998). Clearly, groundwater is one our most important natural resources.

Given the demands and desirability of groundwater as a water resource, it comes as no surprise that the resource has been overexploited both domestically and abroad. The consequences of overuse vary widely but can include water level decline and depletion of aquifers as a result of groundwater pumping, depletion of surface water resources due to groundwater-surface interactions, land subsidence as a result of groundwater development, and saltwater intrusion into coastal aquifers. In addition waste management practices have led to chemical and microbial contamination of shallow aquifers, degrading water quality and rendering the water supply unsuitable for public and domestic use. Similarly, applications of fertilizers, pesticides, and herbicides for agricultural purposes have adversely impacted the water quality of shallow aquifers on regional scales. Effective management of the resource, from both quantity and quality perspectives, is vital to the health of our economies, environment, and quality of life.