
Although many hydrogeologists and water resources managers consider groundwater resources and availability for a designated study area, aquifer or region, rarely is there a body of work that considers the spatial distribution and availability of groundwater on an international, continental and global scale. An assessment of the presence and potential value of groundwater stores at a large scale is essential to strategic water resource managers, planners and policy-makers working on the inter-regional and international trans-boundary scale. Furthermore, an understanding of groundwater on a continental and global scale has an important role in the management of population increase and associated increasing competition or collaboration for freshwater resources; to establish consistency of approach between neighbouring states utilizing interconnected aquifer systems; and to understand the drivers to sustainably manage fragile aquatic ecosystems at the macro-scale. Through collation of considerable datasets, referenced publications and factual understanding, this well-presented and well-structured book establishes a valuable reference for use by policy-makers, planners, geographers and educationists, whilst providing a valuable source of information to groundwater professionals and water resources managers seeking to assess new and existing reserves of groundwater.

The opening chapters present collated data, including quantification of continental-scale groundwater stores, country statistics on groundwater use and replenishment, fundamentals of the hydrological cycle, and groundwater availability in arid and semi-arid regions. This establishes a good basis for the next chapter, entitled ‘Geography of the world’s groundwater systems’, which includes an overview of the distribution of the main aquifer types, groundwater provinces and global groundwater regions based on their geology, structural basins or orogenic position, and respective climatic controls. This chapter also presents an understanding of hydrogeological maps and ‘mega-aquifer’ systems.

This publication mainly focuses on groundwater resources, availability, management and use. The fourth chapter includes a robustly referenced assessment of the availability of groundwater, which considers the quantity and quality of groundwater resources. This chapter includes an overview of global reserves of fresh, brackish and connate groundwater, and presentations of persistent and wide-scale pollutants, with specific reference to the global distribution of excessive arsenic and fluoride in groundwater. This assessment distinguishes between renewable and non-renewable groundwater resources and provides a helpful qualitative and quantitative assessment for the management of both types of resource. Furthermore, this chapter considers the fragility and vulnerability of groundwater resources, focusing, in particular, on where population pressures are affecting and threatening the long-term sustainable use and replenishment of currently utilized groundwater systems. A brief overview of augmentation of groundwater with surface water resources and the distribution of artificial recharge systems is also included in this chapter.

The fifth chapter considers global volumes of groundwater abstraction, identifying where groundwater use is most intensive. Well-presented maps and statistical tables on a country-by-country basis support this quantified and qualified assessment. Furthermore, an assessment of the temporal development of groundwater abstraction volumes, rates, sector and use within the twentieth century and projection into the twenty-first century provides an understanding of the development and potential challenges associated with groundwater resources management in particular regions and nation states. The socio-economic context of this resource development is considered in terms of population growth, economic development and groundwater policy trends.

The sixth chapter turns the reader’s attention to the growing demands for groundwater and the pressures on a constrained natural resource. As part of this assessment, identification of the long-term regional decline in over-exploited groundwater reserves is quantitatively illustrated by groundwater level trends using many examples from around the world. Implications of these long-term trends on communities, agriculture, infrastructure and economic growth are considered, particularly in regions experiencing substantive groundwater depletion. This helps identify the numerous small-, large- and macro-scale challenges facing, in particular, densely populated, substantially industrialized or groundwater stressed regions, all leading to an unsustainable or fragile balance between groundwater replenishment and use. Building on this, the pressures on groundwater resources availability associated with climate change and sea-level rise are considered in terms of their potential impacts on groundwater recharge, evapotranspiration, surface water flows and the modification of groundwater availability, demands and use. The risks to groundwater are also considered in terms of groundwater quality degradation, and the potential for pollution to increase the pressure on the availability and use of groundwater resources. Challenges in assessing and presenting the scale and distribution of groundwater resources, depletion and degradation are also discussed.

The penultimate chapter considers water resources management strategies. This includes an assessment of the objectives and methods used in managing groundwater resources from data collection through to large-scale volumetric supply–demand balance determination. A well-referenced short discussion on water rights and legislation associated with groundwater abstraction and development is included in this chapter. The role of groundwater as part of an integrated water resources management to establish an optimal supply–demand balance that includes equitable socio-economic welfare without compromise to ecosystem sustainability is also discussed. The types, application and benefits of computer-based numerical groundwater simulation models are considered, including integration with components of economic management models and the potential for their integration into a more complex basin management modelling framework. This chapter discusses strategies and approaches to combat some of the challenges of overdevelopment of groundwater resources and associated stresses as identified earlier in the book, including addressing the impacts of groundwater withdrawal on the environment, supported through the presentation of case study examples. This includes strategic use and scientific monitoring of groundwater to manage fragile or vulnerable water resources, quality and groundwater-dependent ecosystems, through to policy development and public engagement with and understanding of groundwater. Details of trans-boundary considerations with respect to groundwater resources management are also presented, with case studies, references and illustrations used to support proven and potential approaches.
The final chapter recognizes both the value and limits of the information presented in this book. Recommendations are made regarding the importance of targeted and informed data collection to build on the assessments made and to facilitate and develop the understanding of macro-scale groundwater resources management.

This chapter also draws together the theme of the book and identifies and addresses some of the major issues of present-day and future groundwater management, illustrated through case study examples.

This extremely well-illustrated book provides a valuable resource and unique perspective through collation of considerable datasets, maps, tables and reference material to help gain a quantified and qualified understanding of groundwater resources at the macro-scale. This book has a broad appeal; and has particular value as a textbook for geographers, and water resources and environmental managers. It also should gain the attention of strategic planners and policy-makers. It makes a good read for hydrogeologists, and those interested in environmentally sustainable socio-economic development. Governmental and non-governmental agencies and advisors involved with the political and socio-economic aspects of trans-boundary and macro-scale resource development would also benefit from the purchase of this book. The insights presented in this book are of heightened importance with increasing demand on constrained, vulnerable resources; and an expectation that it will be often open on a desk.

Chase of this book for inclusion in an office bookcase should accompany an expectation that it will be often open on a desk. Not content with detailing the hydraulic theory and methods of construction for a wide range of dewatering methods, the type and size of the pump and associated pipework necessary to achieve the designed dewatering system are detailed in Chapter 13. Chapter 14 considers the design, operation, maintenance and challenges of long-term and permanent groundwater control and dewatering systems; including their legacy, decommissioning, and impact on other abstractors, receptors and the aquatic environment.

Chapter 15 is an excellent presentation of the considerations necessary for assessing the environmental impacts from groundwater lowering and dewatering systems. This includes assessment of the impacts from pumped dewatering systems, ground settlement, effects on groundwater quality and contaminated land, impacts on groundwater flow paths, environmental impacts from groundwater barriers, and impacts on groundwater and surface water environments from discharges.

Chapter 16 considers the design, data requirements and methods necessary to monitor and maintain groundwater lowering and dewatering systems. An up-to-date overview of the health and safety, contractual implications including form of contract and cost estimation, and environmental regulation associated with groundwater control and dewatering systems and associated challenges are presented in Chapter 17. The final chapter, written by Toby Roberts, considers the development of groundwater lowering systems, advances in their technology and monitoring, the legislative regulatory setting and future prospects.

A purchase of this excellent resource is highly recommended for hydrogeological practitioners, design stage civil engineers, geotechnical engineers and site supervisors involved in groundwater lowering and dewatering. The authors have written a demonstrably invaluable reference book for any student or tutor advancing their knowledge of groundwater lowering and dewatering. The book is an essential and highly practical tool for all hydrogeologists and geotechnical and civil engineers involved in the quantified design and planning, construction, monitoring, operation, decommissioning, regulation and assessment of environmental impacts of groundwater lowering and dewatering systems. For such professionals, a purchase of this book for inclusion in an office bookcase should accompany an expectation that it will be often open on a desk.

This three-volume series of books has formed an indispensable part of the equipment in any engineering or geological soils testing laboratory since its launch in 1982. The third edition of the series was launched with Volume 1 in 2006, which dealt with basic classification and index tests along with compaction. Volume 2, which forms the subject of this review, deals with permeability, shear strength and compressibility, and Volume 3, which is due out in 2014, will deal with effective stress tests.

As with Volume 1, the basic premise is to take British Standard test methods (primarily those contained in BS1377—Methods of Test for Soils for Civil Engineering) as a starting point and to provide further explanation of the principles and operation of the tests, to highlight points of potential difficulty, and, most importantly, to provide a step-by-step guide to executing the test methods correctly. Where appropriate, guidance is given on other test methods, such as some ASTM standards and European Technical Specifications (the latter including the fall cone procedure for the measurement of shear strength). It does therefore go considerably beyond the material presented in the British Standard and is truly a working manual.

This volume opens with Chapters 8 and 9, picking up the numbering from the end of Volume 1. They deal with equipment, laboratory practice and the preparation of test specimens. Chapter 10 deals with permeability and erodibility tests, and Chapter 11 with the CBR test. Chapters 12, 13 and 14 cover direct shear tests, undrained compression tests and oedometer consolidation tests, respectively.

An appendix details units and symbols along with reference data that form a useful guide to specimen dimensions. A six-page errata document is easily downloadable from the publisher’s website and deals with typesetting errors. An errata document at this stage might be a touch disappointing, but it may also demonstrate a willingness to update the material and to share those updates with the readers of the book; I am inclined towards the latter view.

This remains the definitive text on the subject and a vital addition to BS1377 and other standards. It is worth noting that a full set of BS1377 currently costs £872 for Members (£1744 for non-Members), both figures representing a 49% price increase since I reviewed Volume 1 for this journal in early 2011. This series of three books appears to be a veritable bargain at around £330 for the set.

I will look forward to the publication of Volume 3 on effective stress tests, which will complete the revision of this important series.

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