

Book Reviews

Groundwater Hydrology: Conceptual and computational models by Rushton. Wiley 2003, £60 hardback: 416 pp. ISBN 0-470-85004-3

‘There are many similarities between *detective stories* and *groundwater investigations*,’ writes Ken Rushton in the introduction to this book. Continuing with the analogy, he stresses that groundwater studies depend on teamwork, in contrast to many detective stories where the vital breakthrough is usually made by a famous individual. However, this book presents an individual view, based on a lifetime’s work on groundwater hydraulics and acknowledging the contribution of numerous co-workers. Groundwater Hydrology summarizes the concepts of groundwater flow and conceptual models, using an approach and examples which are familiar to the many groundwater professionals who are former students or colleagues of the author. One of Ken Rushton’s major contributions to quantitative groundwater assessment is the emphasis on development of coherent conceptual models, requiring rigour and clarity of thought.

The book describes the fundamental principles and recent advances in both conceptual and numerical modelling. It focuses on the study of groundwater flow, with a thorough analysis of practical applications based on real case studies. It gives insights into the interpretation of field information, including examination of all the data collected, not just the apparently ‘good’ data points. The text covers the development of conceptual models, the use of analytical and numerical models, the assessment of the adequacy and reliability of models, and their use for predictive purposes. The book also brings many analytical solutions to a new generation of groundwater practitioners, who may not need to derive their own solutions from first principles, but can nonetheless benefit from this approach.

The book is divided into three sections. The first section covers the basic principles of groundwater flow, recharge estimation using soil moisture balance techniques, and interaction between surface and groundwater. Part II focuses on radial flow to boreholes, covering multi-layered aquifers and practical applications. Part III concentrates on regional groundwater flow including multi-layered systems where vertical flows are important or hydraulic conductivity changes with depth. All topics are illustrated with a selection of case histories and examples drawn from studies of the major UK aquifers and wide international experience. The comprehensive list of references spans 50 years of quantitative evaluation of groundwater resources. The text is well written and concepts are clearly explained. The inevitable equations are covered fully, but could be avoided by those allergic to complex mathematics without losing the key points of the discussion. The illustrations are clear and

legible, but rather clunky, which gives the book an old fashioned appearance.

The book is suitable for practising hydrogeologists, groundwater and irrigation engineers and mathematical modellers, but would also be useful for hydrologists, engineers and scientists involved in water resources assessment and management. The book forms an essential and comprehensive text for postgraduate students in these specialist areas, and useful reference material for undergraduates. This book draws together many of the mathematical aspects of groundwater flow, in a similar way to classic texts of the 1970s, such as Hantush’s book and the Wageningen publications. It too has the potential to become a classic for hydrogeologists and an essential reference on groundwater flow and the concepts of modelling.

Jane Dottridge

Introduction to Hydrogeology by J.C. Nonner. *A A Balkema Publishers*, Lisse (NL). 2003. €28.00, softback; 248pp. ISBN: 90-265-1930-3.

Hydrogeology is served by few introductory-level texts. The classic of the genre remains Michael Price’s book ‘Introducing Groundwater’, which forms the inevitable yardstick against which analogous texts tend to be judged. It is a very exacting yardstick, to be fair. Sadly Nonner’s ‘Introduction to Hydrogeology’ does not measure up to it. Published in a series flagged as ‘IHE Delft Lecture Notes’, the text thankfully doesn’t read like a collation of lecture handouts; in fact the production standard is very impressive, especially in view of the modest price. The strong points of the book are its accuracy and clarity. However, the ordering of material is not well designed for a newcomer to the topic. For instance, the presentation of groundwater flow processes in Chapter 3 takes a very mathematical approach, holding back the more accessible notion of groundwater budgets to the following chapter. It would have made the presentation of continuity (using the classic elementary volume approach) far more accessible to the novice if this order had been reversed.

The geological aspects of the text are rather disappointing. Brief and simplistic generalizations about different rock types are compounded by a disturbing lack of correspondence between photographic images and the comments made upon them in the text. For instance a comment on page 56 referring to Figure 2.7 is clearly intended to refer to the facing Figure 2.11, but even if that adjustment is made, the reference to *unsorted* deposits is at odds with the obvious graded bedding visible in the photo. Figure 2.7, meanwhile, purports to show *the dense nature* of gneiss, but the image includes blast-induced radial fractures, and a fracture-like feature, which I take actually to be the shadow of an

overhanging tree branch; both of these would confuse the novice seeking to understand what a *dense gneiss* might be expected to look like in the field. (Many of the other photographs in the book are rather pointless and/or poorly framed; e.g. Figs 1.3, 1.4, 1.8, 1.11, 1.15, 1.21, 4.17, 6.1 etc). The text also ignores the international discourse on hydrostratigraphy, preferring instead to perpetuate the use of obsolete terms such as *aquiclude* and *aquifuge*, which most practising hydrogeologists in the English-speaking world have long since consigned to the dust-bin. Groundwater chemistry is not introduced until the penultimate chapter, and the presentation is wholly inadequate. No mention is made of the standard plotting techniques (Piper, Stiff etc), and the quantitative approach which typified the groundwater flow chapters is utterly abandoned here: no saturation index calculations, let alone mass balance models. The final chapter purports to cover applied issues, yet fails to offer any comments on the major issues of pollution that now bedevil aquifers worldwide. The reference list is poor; it is mainly a listing of other textbooks and unpublished theses, with scant citations of journal papers. The overall atmosphere is that of an old-fashioned book which has had a re-spray job from publishers with a healthy budget for colour print. I cannot recommend it.

Paul L. Younger

Urban Groundwater Pollution edited by *David N. Lerner*. International Association of Hydrogeologists (IAH). Vol 24. Contributions to hydrogeology, AA Balkema, 2004, €89.00 hardback; 278pp. ISBN: 90-5809-629-7

This is an excellent book, which is the culmination of many years work and effort, and not least the result of two very successful conferences. The book therefore draws heavily upon the International Association of Hydrogeologists (IAH) 27th Congress on 'Groundwater in the Urban Environment' which took place in Nottingham, UK, in 1997 and the IAH 30th Congress on 'Past achievements and future challenges' which was held in Cape Town, South Africa in 2000. The standard of presentation is very good, the book is informative and easily read or accessed for specific issue information. To present such a complex and varied area of groundwater management in such a manner is a credit. Chapters 1-3 present an introduction and overview; chapter 2 the conflicts between; water supply, effluent disposal, amenity use of resources and ecology; chapter 3, the major groundwater pollutants and environmental impacts from urban areas on groundwater, and, chapters 4-9 present case studies. These case studies break that normal routine of city by city explanations by concentrating on different environmental themes; mature industrial cities; arid zone cities; weathered crystalline aquifers in

sub-Saharan Africa; Cities overlying karst aquifers, alluvial aquifer systems and shallow aquifers in Mediterranean climates. Who will use and read the book? – it is aimed at a wide readership – regulators and governments, urban planners, professional advisors and the water supply and sanitation industry. Yes, I do believe they would all find this book useful in carrying out urban management activities. With urban expansion and access to clean drinking water and sound sanitation an ever growing society issue and recognized in the millennium goals, this book starts all those professionals off with an excellent reference point to move these and other related hydrogeological issues forward in a sustainable manner for future generations.

Phil Aldous

Wastewater Re-Use and Groundwater Quality edited by *Joop Steenvoorden & Theodore Endreny*. 2004, IAHS Publication no 285, £30, 112 pp. ISBN 1-901502-52-X

The global need for a good supply of high quality drinking water is not only increasing with population but with a rise in income. The availability of such a supply of potable water is already uncertain over a large percentage of the world but the uncertainty is exacerbated by factors such as global warming.

The reuse of wastewater for irrigation is one solution to meet this need – where the world population is expected to increase by 2 billion in 20 years – but there are obvious concerns over health issues with the use of untreated wastewater.

The book is a selection of papers presented at the XXXIII General Assembly of the International Union of Geodesy & Geophysics, Sapporo, Japan in 2003. Topics covered include the production, treatment of wastewater noting its reuse potential. The survival of organic constituents and pathogens with the modelling of their movement in the soil environment is also reviewed. Case studies are taken from around the world.

One major conclusion, particularly for developing countries, is the need to move from the existing technology where wastewater is treated by costly, centrally located works with expensive infrastructures (i.e. a lengthy sewer network) to more appropriate locally sustainable solutions. Such a concept, it is suggested, would require new thinking by local governments who assume 'western methods are best'.

Obviously, a considerable number of these papers concentrate on the polluting effects of wastewater reuse on groundwater quality (e.g. nitrate, chloride, heavy metals, pathogens) but reuse also is able to act as a treatment process itself so that the reclaimed water is then suitable for irrigation. In Europe, reuse is a very essential method of conserving local groundwater resources that would otherwise be lost to surface waters or taken to neighboring catchments. Artificial

recharge of groundwater, used in the correct hydrogeological condition, successfully removes pathogens but also is used to store the treated water in the aquifer for further use. It is noted that each site is different from the next so removal rates must be determined on a site-by-site basis before a reuse scheme is put into operational use.

The review concludes with several interesting laboratory (column) studies to assess removal rates in effluent recharge experiments. Modelling is described which simulates these experiments under different redox conditions. This work concluded that there is a need for more complex 2D or 3D modelling for a realistic simulation of water quality variations in column experiments. There is also a useful paper on the use a risk matrix to identify the more suitable sites for recharge based on the latest GIS 3D modelling techniques.

The book is a useful introduction to current work in the field of effluent reuse as a resource. It provides a general review useful to those wishing to find out more, with a good reference list for further research by the interested water resource engineer or hydrogeologist.

I feel that the title would be better as 'A Review of Groundwater Quality during Wastewater Reuse'.

K.M. Baxter

Handbook of Slope Stabilisation edited by *Alberto Ortigao and Alberto Sayao*. Springer 2004. £115.50 hardback. 478pp. ISBN 0-540-41646-3.

The Handbook of Slope Stabilisation is a compendium of chapters written by a group of 8 notable Brazilian geotechnical specialists. It should really be subtitled '*... in steep slopes of tropically-weathered soils and rocks, especially in Brazil, but with brief mentions of Hong Kong*', as it does not set out to cover a wider remit. Nevertheless, it succeeds in being thorough and readable. It is written in clear English (but not without the occasional typographic error), and is copiously illustrated.

Above all, it is illustrated with colour, particularly towards the front of the book. If one or two of the photographs are a little dark, then that is offset by the quality of the others: a number of them show spectacular failures. Most of the line drawings are heavily shaded with grey tints, and there are many black and white photographs as well as coloured ones. Figure captions are sometimes rather short and unhelpful.

After an introductory chapter by the Editors, there is a useful chapter on geology, and how geological structure and weathering give rise to certain landslide types. Most of the body of the book is concerned with detailed design of surface water drainage, anchors and nails, and retaining walls; shotcreting and mesh covering are presented in less detail. Reflecting the practical experience

of the Authors, key points are all made with reference to particular case records. Such theory as presented is simple, and couched in terms of limit equilibrium methods. The book closes with a review of instrumentation systems, and a description of the use of a rain gauge system for landslide early warning.

The index runs to 11 pages, and references are listed Chapter by Chapter. A small number of the references are, as might be expected, in Portuguese.

I found this to be a fascinating, practical and useful book, which I recommend to other geotechnical specialists dealing with slope instability, even if they do not practice in the tropics or Brazil. Students in general may well find the geographical and environmental limits to be somewhat restrictive, but students of the geotechnical sciences studying in, or contemplating working in, the tropics will want this book as one of their course texts.

Eddie Bromhead

Urban Geology in Wales by *Douglas Nichol, Michael G Bassett & Valerie K Deisler*. National Museum & Galleries of Wales, Geological Series No. 23, 2004, £18 softback 256pp. ISBN: 0 7200 0549 3.

The title aims right at the core of the concerns of many within the ground engineering industry who are grappling with the problems of redevelopment and regeneration of urban areas in formerly industrialized regions. Unfortunately, the volume fails to focus on what many might consider to be the principle issues, including groundwater, contamination and the character of anthropogenic ground. Perhaps use of terms such as 'applied geology', 'built environment' or 'mining legacy' rather than 'urban geology' might have more successfully conveyed the concepts which this volume encompasses.

This book presents a compilation of 35 papers concerning a wide variety of projects, but there is little text to draw the threads together. Indeed, 20% of the papers are not strictly concerned with urban areas in Wales at all, such as mineral resources (e.g. Paper 31 on exploration for gold) and civil engineering in the country (e.g. Paper 15 on the maintenance of the Severn Tunnel). The balance of the book's content presumably reflects the contributions received for the seminar held on 14th September 2004 in Cardiff, which had the same name as the book's title. The editors are to be commended for publishing the deliberations so promptly, so permitting a wider readership to benefit without the delay experienced following so many conferences. However it is rather a shame that the opportunity has not been taken by delaying publication 6 months or so, which would have allowed the discussions on the day to have been incorporated along with a broader view of the topics pertinent to urban geoscience.

The contributions are arranged in four main sections, with a fifth encompassing the remainder, entitled 'General Projects'.

The first section, entitled 'Urban Areas', presents accounts of the natural geology encountered in a number of urban centres, but not all. Cardiff, Bangor and Newtown are included, but Aberystwyth, Bridgend, Newport, and Rhondda are not. However, it is understood that a second volume is being planned, to be published in 2005, and so hopefully the other urban centres will be covered there. The Swansea-Llanelli region is discussed as an update to the mapping which took place ten years earlier, but unfortunately the maps which have been included are far too small for any details to be discerned; this is not helped by the lack of colour (which is a missed opportunity since the publication has been printed in two colours throughout, black for the text and blue for the headings). Whereas it is interesting to read accounts of the industrial history, there is disappointingly little indication of the extent or properties of the associated ground which has been produced by human activities. Knowledge of the previous landuse is an essential precursor to any ground investigation, but knowledge of the component materials, ground profiles and properties is equally important - what are these likely to be, where should the investigators look for guidance, and what are the potential hazards? The reader will have to look elsewhere.

The second section, 'Construction' looks at specific projects and the fourth, 'Geoenvironmental issues', focuses primarily on the mining legacy. The third section, entitled 'Geohazards', focuses primarily, quite reasonably, on mining-related issues. However, it is a shame that the various scales of landsliding are not addressed in more detail, or at least clear links provided with the extensive literature (especially the Museum's own excellent publications 18 and 22), and the paper on estuarine soils is astonishingly brief. The karstic solution that affected the M4 construction, problems of shrink-swell, and fault reactivation could all have been usefully included, and some discussion of seismicity would have been welcome, both natural and related to mining and mine-water recovery.

The integration of all the references in a single block at the end is to be commended, thereby avoiding repetition and facilitating the more detailed study of particular aspects of interest. There is no index. Notwithstanding the title, this volume represents excellent value for money as a compendium of recent applied geological studies in parts of Wales and it is most pleasing to see a publication appear so quickly after the papers have been submitted by the authors.

Mike Rosenbaum