

Aquifer Storage and Recovery and Managed Aquifer Recharge Using Wells: Planning, Hydrogeology, Design, and Operation

reviewed by Andrew T. Fisher

Robert Maliva and Tom Missimer have produced an ambitious and timely book that mostly succeeds in filling an important niche. Although there are aquifer storage and recovery (ASR) and managed aquifer recharge (MAR) projects running throughout the world, many management districts do not currently operate these kinds of projects, and their benefits are not widely appreciated outside the technical community. Between rising global demand for groundwater and decreasing recharge due to changing land use practices and ongoing climate change, ASR and MAR are going to be increasingly common and important in coming years.

The authors define ASR as “...*storage of water in [an]...aquifer through a well... and recovery of the same or similar water using a well...*” This is less restrictive than the other common definition, that of water injected and recovered using the same well(s), but it omits the topic of recharge using infiltration ponds and other structures. In presenting and discussing (many) real-world examples of ASR projects, the authors focus on the United States, although selected sites from around the world are described.

This book has 12 main sections, beginning with an introduction and a discussion of ASR project development and planning. The next two book sections digress to discuss fundamentals of hydrogeology and aquifer characterization, before returning to ASR-specific topics (well design, performance, and system operation). There follows sections on water pretreatment, regulation and permitting, specific ASR applications, and case studies of ASR projects. The book ends with a brief conclusions section, followed by 35 pages of references, lists of abbreviations and symbols, and an extensive index.

The book jacket suggests that this volume is intended as a reference for water resource professionals and as a university textbook. I suspect it will be most successful when used as a reference, particularly for technical non-experts, managers, and regulators who are involved in ASR planning, implementation, or evaluation. Most university students who are advanced enough in their studies to explore ASR will have completed one or more introductory hydrogeology courses (most likely including physical and chemical hydrogeology) and perhaps a modeling class as well, making the sections on aquifer hydrogeology and characterization somewhat redundant (particularly because this is the second book in a series, the first focusing on “Methods in Water Resources Evaluation”). To be fair, including these sections allows the authors to specify their preferred nomenclature and illustrate concepts that are applied later. The book also lacks worked problems, and there do not appear to be any instructor supplements such as question banks, data to be used for case study analyses, or digital copies of illustrations. That’s a shame, because the quality of the illustrations and data plots is outstanding, some of the best I have seen in recent years. The writing is similarly clear and direct.

The content of this book is broadly comprehensive, for example discussing how ASR can fit into watershed-based planning, and how different kinds of feasibility studies can be designed and completed. I appreciated the detailed presentations on ASR system construction and testing, well design and installation, clogging and strategies for rehabilitation, and geochemical interactions (including computational tools useful for evaluation of chemical mixing between water types). MODFLOW is the only general groundwater flow model discussed, but seven solute transport codes are described. The discussion of ASR regulatory considerations emphasizes U.S. federal regulations, but rules for selected individual states are noted as well.

Earth and Planetary Sciences Department, University of California, Santa Cruz, CA 95064; afisher@ucsc.edu

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doi: 10.1111/gwat.12006

The section I most enjoyed reading was the case studies and lessons learned from decades of experience shared by the co-authors in designing, installing, and managing ASR systems. This section is broken down by aquifer type (a nice touch), and there are summaries of common issues associated with each kind of aquifer and setting. The referencing in these last sections tends to emphasize gray literature (contractor reports, agency evaluations, presentations and papers from conferences), but this is mainly an indication of where work on ASR and related topics is being done and published. I plan to

work through the case studies and the rest of this book more carefully and anticipate returning to it periodically when I have questions about these increasingly important water supply systems.

Aquifer Storage and Recovery and Managed Aquifer Recharge Using Wells: Planning, Hydrogeology, Design and Operation, by Robert G. Maliva and Thomas M. Missimer (2010), is published by Schlumberger (ISBN 9780978853068). The 578-page volume is available at the NGWA bookstore (\$135 for members; \$169 for nonmembers).



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