

## Book Reviews

### **Applied Environmetrics Hydrological Tables**

Tom Beer

Victoria, Australia, *Applied Environmetrics*, 1991,  
73 pp. + 1 diskette 360 Kb, US\$ 124.95

This package actually consists of a computer program with an accompanying manual. The software displays hydrological table values on the computer screen. The package seems to have been developed by someone who has been much more exposed to the use of printed tables than to up-to-date PC programming. Thus, the package lacks interfaces that would allow a smooth linking with other PC applications. Some of the tables look exactly as they would in a traditional book of tables. Others, however, give values of multiparameter formulas frequently used in hydrology.

The first group contains tables for:

- pressure conversions plus the physical properties of water;
- solar position, sunrise and sunset times and radiation through a cloudy atmosphere;
- solubility of oxygen, nitrogen, and argon in water at saturation;
- special functions used in hydrology;
- metric and imperial conversions.

The second group contains:

- evaporation from open water surfaces using the Penman combination method;
- open channel flow;
- small-catchment hydrology;
- sedimentation in water;
- sediment transport using the Ackers-White formula;
- soil moisture properties, matric potential, hydraulic conductivity;
- molecular transport properties of water and longitudinal dispersion;
- drought indexes;
- application of the drought index—spread of forest fire;
- extreme value statistics—Pearson Type III distribution.

The first group is unproblematic. The tables work exactly as printed tables. There is not even a good mechanism for transferring the relevant number to any other application.

The second group of tables relates to formulas that lack general validity and for which the selection of parameter values might not be very straightforward. They should only be used for well-defined purposes. The package is not recommended to professionals dealing with more general hydrological problems, as the sheer availability of the tabled functions may lead to applications to

cases where the use of a specific formula may be inappropriate. The formulas included in the package are actually those which the developer found useful in his previous work as environmental consultant to an oil company and in his work at the CSIRO Bushfire Research Unit. Thus, the package should mainly be of interest to professionals who routinely use some of the tabled formulas in their work.

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### **Drainage Guidelines**

Walter J. Ochs & Bishay G. Bishay

Washington, DC, *The International Bank for Reconstruction and Development/The World Bank*

(*Technical Paper Number 195*), 1992, 186 pp., price not given

This book is published as No. 195 in the series of 'World Bank Technical Papers'. It covers a wide range of topics related to land drainage projects for both irrigated and rainfed agriculture. The contents of the book are based on research results and experience with agricultural drainage and related subjects. The purpose is to guide the Bank staff, consultants and borrowing-country technicians as they work through the cycle of project planning, design, preparation, installation and maintenance. The book is prepared in the form of guidelines which aim towards improving the quality of drainage measures under a variety of conditions.

The book consists of an introduction, three chapters and six appendices. The main chapters are presented in 120 pages and cover drainage system design (60 pages) and project preparation, installation and maintenance (25 pages). The appendices provide information about several related issues including identification of soil drainability, calculating drain spacing by design formulas, establishing pilot demonstration for drainage parameter verification, estimating design discharge from peak surface runoff, cost estimates and crop tolerance to salinity. The six appendices are presented in 55 pages. The guidelines are supported with tables, drawings, sketches, graphs and nomographs.

Chapter 1 handles project planning in two stages: the identification stage and the feasibility studies stage. The investigations required at each stage are described and discussed. The collected information is used for diagnosis of the nature and cause of land drainage problems. They cover technical, economic, social, institutional and environmental aspects. Methods for collecting data and verifying drainage parameters are also included.

Design of drainage systems for varying conditions is discussed in Chapter 2. It covers the different types and functions of drains. Distinction is made between field and main systems, open and cover drains and drains for controlling the water-table and those to control surface water. The design of drainage systems for special hydrological conditions or for problem soils is also discussed. While

some drain spacing equations are described in Appendix 2, formulas for special conditions are given in Chapter 2. Some computing examples are given. The concept of controlling the water-table for subirrigation is briefly reviewed. Planning and design of mole drains to remove excess water from the field surface of fine-textured, slowly permeable, dense subsoil is also covered. Guidelines for designing main drains cross-sections and structures are given.

Chapter 3 covers the technical and organizational arrangements of the final project preparation phase which precedes the installation. It also discusses installation methods and techniques. Standards specifications and inspection of completed work are mentioned as measures for quality control of the installed system. Maintenance requirements of tube and open drains are briefly listed.

The book is an important addition specifically for giving systematic guidelines for steps and procedures to be followed when drainage projects are considered. It can be used by professionals involved in the planning, design and implementation of drainage systems under many financial arrangements and is not limited to those of the World Bank. The book covers a sufficiently wide scope but is less comprehensive about the maintenance and operation of drainage systems which involve more than simply what is described by the authors.

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### **Groundwater Treatment Technology (2nd edn)**

Evan K. Nyer

*New York, Van Nostrand Reinhold, 1992, 306 pp., £36.50*

This book provides a complete review of the technologies developed for groundwater treatment. It also explains the design techniques that are required to apply these technologies successfully in a groundwater clean-up.

Groundwater treatment is unique. In other types of treatment, we address the source of contamination only. The main goal of wastewater treatment is to stop or limit the amount of contaminant entering the body of water, e.g. river, lake or ocean. Once we stop putting the pollution into the water, then the body of water actually cleans itself. With groundwater treatment we are cleaning the body of water. Removing the sources of contamination is only the first step. Following this, the remediation process continues with cleaning of the aquifer water as in most cases the process of natural cleaning of groundwater, once the sources of contamination are removed, is very slow. The author introduces the components, parameters involved and the requirements for groundwater treatment system design in the first chapter. The design method for a groundwater treatment system as 'Life-cycle design' is described in the second chapter.

When a contaminant is released on to or into the ground, the main force on its movement is gravity. If the ground is porous, the contaminant will move

downward. The fate and transport of contaminant in the subsurface environment depends on the flow process, geologic structure, physical, hydrological and geochemical characteristics of the medium as well as the physical and chemical characteristics of groundwater. For organic contaminants, the physical and chemical methods of treatment such as air stripping, carbon adsorption, chemical oxidation and pure compound recovery are elaborated in detail in Chapter 3. Also, new techniques like thermal oxidation, chemical oxidation, membrane technology, supercritical extraction and other emerging technologies are explained.

One of the most promising treatment technologies for organic contaminants in groundwater is biological treatment. Biological treatment cannot be applied to every situation. In order to apply this correctly, we have to understand the biochemical reactions of the micro-organisms which are used, and we have to understand the equipment designs used to apply those organisms to groundwater. There is a great difference between what a bacteria can do with specific organic compounds and what an activated sludge treatment system can do with a specific groundwater situation. Accordingly, the author has devoted a complete chapter to biological treatment starting with a detailed review of micro-organisms and their biochemical reactions with hazardous organic compounds. Next, he reviews how these reactions have been applied to groundwater clean-ups. Finally, he discusses how these biochemical reactions can be applied directly in the ground or aquifer, or *in situ* treatment.

The final chapter, a review of treatment technologies, is on treatment methods for inorganic compounds. Inorganic contaminants in groundwater have not had as much attention as have organic contaminants in the past. This could be because most soils have an ion exchange capacity. As such the unsaturated zone has a limited ability to remove these contaminants from a spill, so that they never reach the aquifer. Nevertheless, there are incidences of groundwater contamination from nitrates, heavy metals, etc. The book provides comprehensive coverage of methods like chemical addition, removal of suspended solids, reverse osmosis, electrodialysis, distillation and ion exchange for removal of inorganic compounds from groundwater.

The concluding chapter is on field application of design methods, in which the author has dealt with representative case histories showing how the techniques of groundwater treatment have been applied in the field. Based on specific situations, a review is provided on design procedure, cost factor analysis, operation of the system and results obtained therefrom.

This book summarizes present knowledge and experiences in the clean-up of groundwater. It provides the reader with a general understanding of contaminated groundwater and specific knowledge in the application of existing groundwater clean-up technology. This book is an essential reference for wastewater engineers, industrial managers, hydrologists, soil experts, government officials and environmental lawyers who want to know about treatment technologies and the developments in this field.

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### Surveillance of Drinking Water Quality in Rural Areas

Barry Lloyd & Richard Helmer

Harlow, UK, Longman Scientific & Technical,  
1991, xvi + 171 pp., £9.99

There have been many books on planning, designing, implementing and evaluating water supply facilities, but few have touched the difficult area of drinking water quality surveillance for small communities in developing countries. This book fills the gap. It is based on the results of three pilot water quality surveillance projects in Indonesia, Peru and Zambia. The authors mention that the purposes of these projects are 'for implementing and evaluating' WHO's *Drinking Water Quality Control in Small Community Water Supplies*, which constitutes Volume 3 of WHO Drinking Water Guidelines published in 1984–85. In the end, it seems that the projects were also for testing the WHO Volume 3 guidelines, and this fact gives more value to the book.

After the first two chapters, an introduction and overview of the issue, the book describes the infrastructure of the three project areas. This chapter makes for rather difficult reading as it covers three projects, one after another, under each main heading: institutional components, organizational linkages, and so on. The reader might feel more comfortable if each project were described separately. However, this chapter provides an interesting insight into supporting components of the projects, in particular the surveillance training programmes which are presented in detail. A model training syllabus for a basic initial water surveillance course is suggested.

A chapter on surveillance planning follows, again drawing from the experience of the three pilot projects. The development strategy for extending water surveillance from the *preplan* project to a routine programme is reviewed. If any reader thinks that planning for a sustained drinking water quality surveillance programme is but a small feat, this chapter—accompanied by a check list, flowcharts and diagram—clearly illustrates that this is not so. It also helpfully complements the WHO Guidelines which do not deal with detailed planning for implementing drinking water quality surveillance.

Chapter 5 covers the steps leading to the identification of pollution problems at the source or point of abstraction. Survey procedures are described for various water supply systems: open dug wells, dug wells equipped with a handpump, shallow and deep tubewells with a handpump, deep boreholes with mechanical pumping, protected springs, gravity-fed piped distribution systems and rainwater catchment tanks. For each system, a risk-scoring system is suggested. Extensively illustrated with drawings and sample questionnaires, the chapter should provide pleasant training material to mid-level technicians.

Drinking water quality analysis, evaluation of surveillance results, and remedial actions form the main part of the book. As the reader might expect, but can still find interesting, drinking water quality at the three project sites depends primarily on the quality and protection of the sources but not on water treatment, which is non-existent or ineffective. Under these conditions, a classification of all water supplies based on the faecal coliform level has been developed. Water analysis was also focused primarily on faecal bacteria

indicators. In this respect, the section on 'Faecal coliform analysis on site' sounds as if this is simple work. The reviewer and his colleagues have had, on numerous occasions, problems in maintaining a correct and stable incubation temperature, after trying several models of field kits. It is better to make clear to the reader that the described procedures are for on-site sampling and sample processing, whereas incubation in a laboratory incubator is advisable.

Evaluation (or more exactly: interpretation) of surveillance results is covered in Chapter 7. Grading systems are proposed for bacteriological quality and sanitary conditions of the surveyed water. An evaluation approach is then presented based on a combination of the faecal grading and the sanitary risk scores. Besides drinking water quality, such an approach could also be useful in determining the water supply coverage level. Although this subject is discussed in the book, it is not clear to the reader how coverage is defined based on the surveillance results. This is rather unfortunate since, even after the Water and Sanitation Decade, many developing countries are still groping for an appropriate definition of coverage. Without such a clear definition, current statistics on water supply coverage are confusing at best, and most frequently dubious.

This book does not intend merely to boast of achievements. It is quite candid in some parts (such as the statement "the pilot projects all made serious common mistakes in the early phases"). Also, the book does not create an illusion for a quick fix. It states that a sustained surveillance programme requires "enormous corporate political will and public service commitment". As such, the book would be highly useful for people in developing countries who wish to learn from similar experience elsewhere before implementing a drinking water quality surveillance component in their projects.

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### **Disinfection Alternatives For Safe Drinking Water**

Edward A. Bryant, George P. Fulton & George C. Budd

*New York, Van Nostrand Reinhold,*

1992, 518pp., £43.50, ISBN 0-442-31841-3

The last decade saw the publication of a large number of books in the field of water treatment. This book, *Disinfection Alternatives For Safe Drinking Water*, specially focuses on the last but vital unit process, 'disinfection'. It covers both conventional and advanced types of disinfection alternatives, namely: chlorination, chloramination, ozonation, disinfection by chlorine dioxide, potassium permanganate, ultraviolet radiation, membrane filtration, air stripping and adsorption by activated carbon.

Written by three practising engineers with extensive experience in the design of water treatment plants, this book presents each disinfection technique in a simplistic approach. In addition to the three principal authors the chapters have

contributions from specialists on particular subject areas. The diagrams and schematics, some of which are drawn from renowned references, complement the refreshingly concise text. Therefore the reader can browse through this book with ease and yet gain a good understanding on the provision of efficient disinfection and minimization of unwanted side-effects. Each chapter is also supplemented by an extensive reference list, which would be very useful to a serious reader seeking in-depth details about a particular disinfection method.

Another interesting aspect of this book is that each chapter incorporates a detailed discussion on 'non-disinfective uses', such as oxidation of organic materials, removal of iron and manganese, colour removal, taste and odour removal, coagulation, algae control, etc. of each disinfection technique. This helps the reader to gain broader know-how on the advantages and potential drawbacks of adopting a particular disinfection technique.

This book extensively addresses the problem of formation of harmful by-products from disinfectants. The removal of the precursors of these harmful products by ozonation and by using activated carbon is also discussed. Present knowledge about the mechanisms of disinfection and the relative accuracy of the latest techniques for toxicity determination of chemicals are some of the other interesting topics discussed.

The authors give valuable information on reactivity, available commercial forms, chemistry, disinfection by product (DBP) formation, generation, storage conditions, feed pumps, equipment and piping, construction requirements, etc. of each of the disinfectant methods.

The chloroamines are presented as a secondary disinfectant and chlorine dioxide usage within prescribed limitations and the influence of raw water characteristics on certain disinfection procedures are also included. Typical plant requirements are given for each disinfection method.

One chapter describes the 'Relationship between disinfection and baseline water treatment processes', analysing the baseline processes like particulate removal processes, chemical coagulation, lime softening, rapid and slow sand filtration, and precoat filtration and compares baseline systems to optimize disinfection.

The final chapter is on the evaluation and planning of disinfection systems. It suggests methods for improving the performance of the existing baseline facilities by modifying current operational practices and upgrading the existing water treatment facilities and thereby meeting stringent new regulations like the Surface Water Treatment Rule (SWTR) of the USA. The book advocates sufficient flexibility in design to adjust to revised future regulation requirements that would be necessary with advancement of knowledge. Data presented in tabular form will aid an interested designer once the particular disinfection method is selected.

Non-conventional and low-cost disinfection alternatives for developing countries, if included, would have made this book more attractive. Also, the new concepts advocated for the design of effective and economical water treatment plants could have been complemented with details of design, calculation, methodology and a few case studies.

The usage of imperial units in this book makes it more acceptable to practising engineers in the United States. If the SI units were given within parentheses the

book would have been more user-friendly to a reader more familiar with the SI system of units.

This can be recommended as a useful reference book for designers of water treatment facilities, practising engineers and for trainers of water treatment personnel.

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