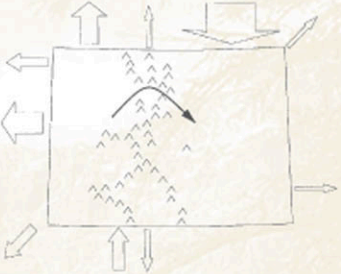
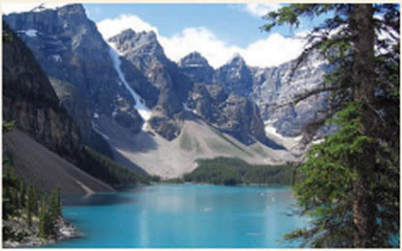


THE ROLE OF TECHNOLOGY IN WATER RESOURCES PLANNING AND MANAGEMENT



EDITED BY
Elizabeth M. Perez, P.E.
Warren Viessman, Jr., P.E.

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Preface

This book is the culmination of three years of dedicated study by a Task Committee that was sponsored by the Environmental and Water Resources Institute within the American Society of Engineers. The goal of the Task Committee was to study the role of technology in water resources planning and management. The Task Committee included both experienced and emerging leaders in water resources planning and technology. Historical, current, and future trends in the use of technology to manage water resources are discussed through case studies. Summary sections are included in the first and final chapters of the book.

This book is intended to be a resource for students of water resources of all ages and abilities—from the executive water manager to the student at the university level. This book is a snapshot of the role of technology in water resources planning and management in 2008. This book is one of the most thorough discussions of this important topic and the authors hope that the book will inspire a new generation of water managers to use the best technology the field has to offer.

Acknowledgments

The information presented in *The Role of Technology in Water Resources Planning and Management* was obtained from numerous publications, web pages, and other sources. The authors are grateful for the support of the Environmental and Water Resources Institute and the American Society of Engineers for their support of this Task Committee. The authors are also indebted to those who authored the publications referenced in this publication and to those who were responsible for the material accessed on the Internet. The Task Committee would also like to offer our sincere thanks to Mr. Kyle Schilling, Dr. Eric Loucks, Dr. Timothy Feather, Dr. Wayne Losano, and our many supportive colleagues at Jones Edmunds & Associates in Gainesville—in addition to our many colleagues that reviewed individual case studies. References are documented at the end of each chapter and after each of the case studies presented to make them more easily accessible to those interested in a particular subject.

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CHAPTER 1

INTRODUCTION

Background

Whether proposed water resources policies and plans are implemented depends on their acceptability to decision makers. Final decisions are made politically, but they can be influenced by analyses made by water resources planners and researchers. The extent to which such studies are considered depends on: the credibility of the analyst, an understanding of the political and social climate of the planning region, and the directness of stakeholder input. Thus it is important to understand the role that technology has played and can be expected to play in supporting sound decisions regarding the allocation and protection of global water resources. Selected case studies covering a variety of settings and technologies provide an understanding of ways in which technology has supported water management policies and plans. Finally, a look to the future provides an insight into emerging technological approaches. See also (ASCE 1998; Dzurik 2002; and Loucks and van Beek, 2005).

Benefits of the Analysis

The authors believe that this publication will be a valuable reference for those engaged in water resources planning, management, and research. The book is not prescriptive. The intent is to show the role that technology has played historically, is playing at the outset of the 21st century, and is expected to play in the future. The authors hope that the information in this document will extend the knowledge of those charged with developing and managing the nation's water resources. The study does the following:

- Indicates the spectrum of technologies applicable to water resources planning, management, and policy making.
- Illustrates the emergence of new technologies such as adaptive management, shared vision modeling, and geographic information systems.
- Serves as a foundation for further exploration of similar topics.

Book Organization

Chapter 2 reviews the evolution of technology as applied to water resources planning and management. Applications of technology are illustrated in selected case studies in Chapters 3 through 5. Chapter 6 summarizes observations made during the study and presents expectations for the future. References appear at the end of each chapter, with the exception of Chapters 3, 4, and 5, where they are cited immediately after each case study. The modification to the standard reference format in Chapters 3 through 5 was made to conveniently refer the reader to additional information on each case study.

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CHAPTER 2

EVOLUTION OF WATER RESOURCES TECHNOLOGY

Introduction

People have been planning, designing, and developing infrastructure and policies for the management and use of water for centuries, indeed arguably since the beginning of civilization. Few functions have been more important historically than managing water. Human demands and nature's supplies do not often coincide. Since we cannot live or function without water, engineering technology has been central to providing what we want and where and when we want it. Engineers have learned how to treat, control, and allocate water and then how to collect and treat wastewater before returning it to ground or surface waters. The multiple purposes of water— to meet agriculture, domestic, and industrial water supply demands; navigation; the production of hydropower; recreation—all depend on engineering technology.

During much of the 19th and 20th centuries, water resources planning and management activities were typically dominated by engineers and engineering technology. Dam building was an important component of traditional water-supply planning. Civil engineers had a major role in the construction and maintenance of the world's dams. An 1824 act of Congress established the United States Army Corps of Engineers (USACE) as the nation's preeminent water resources manager. Legislation passed in 1850 added water resources planning to the USACE's responsibilities, and in 1879 a Mississippi River Commission was established, with the USACE in charge of planning for an entire river basin. The USACE's interest in planning and managing the nation's waterways continues to this day in the form of numerous activities, including channelization and restoration projects, dredge-and-fill activities, harbor improvements, floodplain protection and management, and the construction and maintenance of a vast system of locks and dams on the nation's largest rivers.

In 1902, a second engineer-dominated federal agency—the U.S. Bureau of Reclamation—was created to deal with the physical and hydrologic conditions unique to the western United States. The Bureau's mission was to "reclaim" desert lands for agricultural and municipal uses. The Bureau, like the USACE, developed into a powerful planner and manager of water resources during the 20th century. A third federal agency, the Tennessee Valley Authority (TVA), was created in 1933 to integrate the use of all natural resources in the Tennessee River Basin.

Throughout most of the 20th century, the USACE, the Bureau of Reclamation, and the TVA used the concepts of conservation and multipurpose development to guide their planning of water resources projects. Conservation at the turn of the century meant using a scarce resource such as water to the fullest extent possible. It dovetailed with the multipurpose idea, in that the construction of a dam, for example, would not only provide flood control but would also store waters behind the dam for use as drinking water, for recreation, and for irrigation of crops.