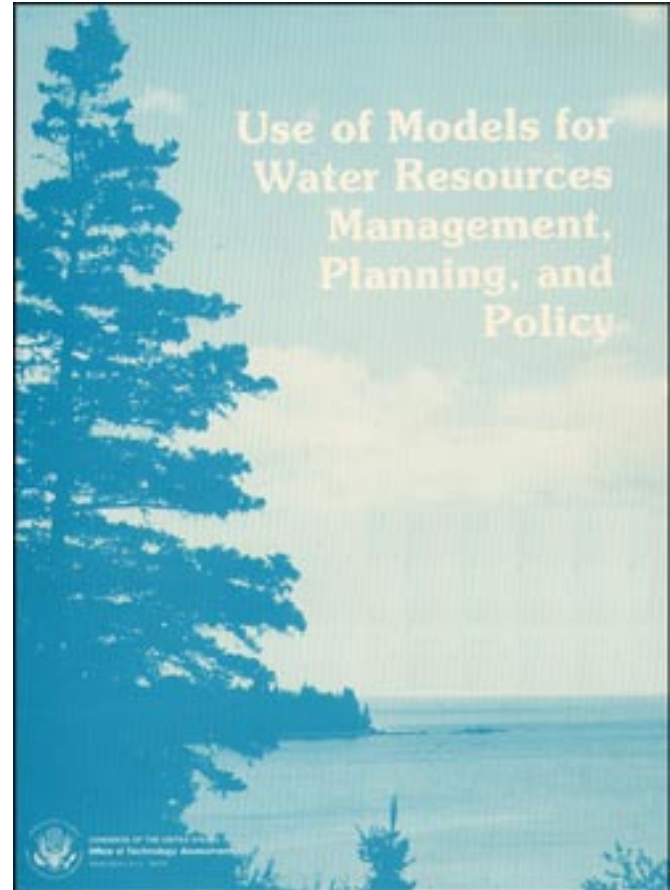


*Use of Models for Water Resources  
Management, Planning, and Policy*

August 1982

NTIS order #PB83-103655



Library of Congress Catalog Card Number 82-600556

For sale by the Superintendent of Documents,  
U.S. Government Printing Office, Washington, D.C. 20402

# Foreword

The Nation's water resource policies affect many problems in the United States today—food production, energy, regional economic development, environmental quality, and even our international balance of trade. As the country grows, and excess water supplies diminish, it becomes increasingly important to manage existing supplies with the greatest possible efficiency. In recent years, successful management and planning of water resources has increasingly been based on the results of mathematical models.

Leaving aside the mystique of computers and complex mathematics, mathematical models are simply tools used for understanding water resources and water resource management activities. This part of water resource management, though not as apparent as dams and reservoirs or pipes and sewers, is a vital component in meeting the Nation's water resource needs. Sophisticated analysis, through the use of models, can improve our understanding of water resources and water resource activities, and help prevent wasting both water and money.

This assessment of water resource models is therefore not an assessment of mathematical equations or computers, but of the Nation's ability to use models to more efficiently and effectively analyze and solve our water resource problems. The assessment considers not only the usefulness of the technology—the models—but the ability of Federal and State water resource agencies to apply these analytic tools effectively.

The capabilities of water resource models vary greatly from issue to issue. In a number of areas, further research and development is needed, but in other areas, usable and reliable tools currently exist. However, as often occurs, these technologies have outstripped the capabilities of Federal, State, and local agencies to support and effectively use them. Today, model use is increasing the efficiency and lowering the cost of water resource management, but the potential for further improvement remains great.

This report presents options that focus on ways of improving Federal, State, and local use of available technologies to analyze water resource problems. Opportunities are identified for congressional action to improve water resource management capabilities through selective model use—throughout the Federal Government, within individual Federal agencies, and among State and local governments. The importance of water resources to the Nation's well-being, and the magnitude of potential water resource problems in the coming decades, makes this technology an important tool for assuring our ability to provide for the water needs of current and future generations.

About 40 water resources professionals from Federal and State agencies, universities, and the private sector contributed to this report. Many more provided useful comments on draft materials. OTA was also aided by representatives from 27 Federal agencies and offices, and from all 50 States, who provided information in response to OTA surveys and inquiries regarding model use, as well as by Federal, university, and private sector participants in two series of workshops on modeling issues. OTA expresses sincere appreciation to all these individuals for helping bring an imposing amount of collective wisdom to this analysis.



JOHN H. GIBBONS  
Director

# Contributors to This Report

David Allee  
Cornell University

Mary Anderson  
University of Wisconsin, Madison

Neil Armstrong  
University of Texas at Austin

John Bredehoeft  
U.S. Geological Survey

James Chalmers  
Mountain West Research, Inc.

Jared Cohon  
Johns Hopkins University

Charles Faust  
GeoTrans, Inc.

A. J. Frederick  
Private consultant

James Geraghty  
Geraghty & Miller

Warren Hall  
Colorado State University

James Heany  
University of Florida

Wayne Huber  
University of Florida

Richard Hyde  
Holcomb Research Institute

L. Douglas James  
Utah State University

William Johnson  
U.S. Army Corps of Engineers

William Lane  
Bureau of Reclamation

Arun Malik  
Johns Hopkins University

James Mercer  
GeoTrans, Inc.

Ronald North  
University of Georgia

Donald O'Connor  
Manhattan College

John Peters  
U.S. Army Corps of Engineers

Charles ReVelle  
John Hopkins University

Richard Ribbens  
Bureau of Reclamation

Donald Robey  
U.S. Army Corps of Engineers

Leonard Shabman  
Virginia Polytechnic Institute

Daniel Sheer  
Interstate Commission on the Potomac River Basin

Soroosh Sorooshian  
Case Western Reserve University

Clair Stalnaker  
U.S. Fish and Wildlife Service

Roland Steiner  
Johns Hopkins University

James Thomas  
Bureau of Reclamation

Harry Torno  
U.S. Environmental Protection Agency

Richard Tucker  
Dames & Moore

Andrew Waldo  
National Counsel Associates, Inc.

Porter Ward  
U.S. Geological Survey

Walter Wunderlich  
Tennessee Valley Authority

Jeffrey Wright  
Johns Hopkins University

OTA appreciates the assistance of many additional people who contributed to this report:

- Participants in the two OTA water resource modeling workshops.
- Federal agency personnel who responded to the OTA Federal agency survey.
- State agency personnel who responded to the OTA State agency survey, and directors of the State water resources research institutes who suggested appropriate respondents.
- The professional societies that reviewed technical materials, including the American Geophysical Union, the American Society of Civil Engineers, the American Water Resources Association, and the National Water Well Association.

---

# OTA Water Resource Models Assessment Staff

John Andelin, Assistant *Director, (ITA*  
*Science, Information, and Natural Resources Division*

Robert W. Niblock, *Oceans and Environment Program Manager*

## Project Staff

Robert M. Friedman, *Project Director*

Chris Ansell, *Research Assistant*

Stuart Diamond, \* *Writer/Editor*

Nancy Ikeda, *Policy Analyst*

Yacov Y. Haimes, *Consultant*

## Administrative Staff

Kathleen A. Beil

Linda G. Wade

Jacquelynne R. Mulder

# OTA Publishing Staff

John C. Holmes, *Publishing Officer*

John Bergling

Kathie S. Boss

Debra M. Datcher

Joe Henson

---

●OTA contract personnel