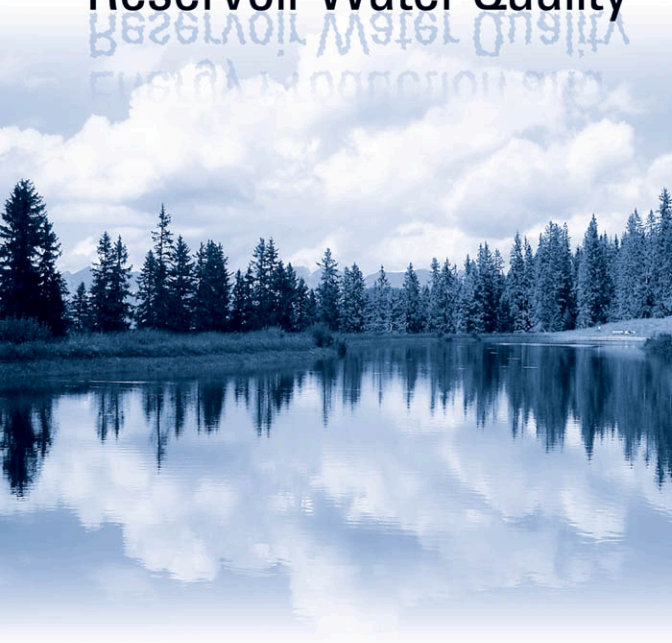
Energy Production and Reservoir Water Quality



A Guide to the Regulatory, Technical, and Theoretical Basis for Required Studies

EDITED BY James Martin John Higgins
John

ASCE

ENERGY PRODUCTION AND RESERVOIR WATER QUALITY

A Guide to the Regulatory, Technical, and Theoretical Basis for Required Studies

SPONSORED BY
Environmental Effects Committee of the Energy Engineering Division
of the American Society of Civil Engineers

EDITED BY
James Martin
John Edinger
John Higgins
John Gordon

ASCE American Society of Civil Engineers
1801 ALEXANDER BELL DRIVE
RESTON, VIRGINIA 20191–4400

Library of Congress Cataloging-in-Publication Data

Energy production and reservoir water quality : a guide to the regulatory, technical, and theoretical basis for required studies / sponsored by Environmental Effects Committee of the Energy Engineering Division of the American Society of Civil Engineers ; edited by James Martin ... [et al.].
p. cm.
Includes bibliographical references and index.
ISBN-13: 978-0-7844-0896-4
ISBN-10: 0-7844-0896-3
1. Water quality. 2. Reservoir ecology. 3. Limnology. 4. Water quality management. 5. Hydroelectric power plants--Environmental aspects. 6. Coal-fired power plants--Environmental aspects. I. Martin, James Lenial, 1947- II. American Society of Civil Engineers. Environmental Effects Committee.
TD370.E54 2007
628.1'683--dc22

2007030020

American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia, 20191-4400

www.pubs.asce.org

ISBN 13: 978-0-7844-0896-4
ISBN 10: 0-7844-0896-3
Manufactured in the United States of America.

Foreword

The ASCE Energy Engineering Division held a Workshop 2000 attended by all committee chairs to discuss problems of mutual interest for which task committees might be formed. The Environmental Effects Committee, the Fossil Generation and the Hydropower Committee brought up the problem of the effect of water quality regulations on power generation operations. This was truly a joint problem since power generation at both fossil and hydropower operations could affect the water quality within and downstream of impoundments and water quality conditions within a reservoir could often limit hydropower generation. In addition, many steam electric power plants are located along hydropower reservoirs; the thermal discharges from these plants can affect reservoir water quality, and the plants' withdrawals can entrain resident or migratory fish and other aquatic organisms.

A result of Workshop 2000 was to form a small group from the two committees to more specifically define the objectives of a task committee and to seek funding to support it. The group decided to form a task committee on "Energy Production and Reservoir Water Quality" within the Environmental Effects Committee. The objective of the task committee was to produce a guideline document on study methods and procedures for investigating the interrelationship between energy production and water quality in reservoirs.

The group applied for and obtained support through an ASCE Opportunity Fund award. The ASCE Opportunity Fund was created by the ASCE Board of Direction, and administered through the Opportunity Fund Committee, to encourage development of innovative programs that promote civil engineering and its goals, enhance value to members, or advance the public image of the profession. Additional funds for final manuscript preparation were made available through the ASCE TAC budget to the Energy Engineering Division. The task committee assembled to undertake the study and prepare the guidelines is shown in the list of contributors. Each of these individuals volunteered their own time to the task committee for meetings, correspondence, document writing and assembly. Some of their employees funded portions of the expenses of meetings, made facilities available for meetings, and provided editorial and library assistance. The volunteer contributions of time and their own employer resources leveraged the ASCE funding contributions by about 10:1.

There are a large number of steps in bringing a working group and document like this together. A detailed outline of the document was prepared and distributed to the contributors in early 2001. Working sessions were held in the Spring and Fall of 2001 with different groups of contributors to further revise the outline and to make writing assignments. Drafts of chapters prepared following these sessions underwent

extensive review, re-write, and reorganization at a working session in the Spring of 2002. Contributors to individual chapters met and corresponded among themselves during the Fall and Winter of 2002, and chose a lead author for each chapter to bring the ii contributions together. The chapter lead authors met in the Spring of 2003 to review an assembled draft of the document, do further editing, and to prepare remaining material for copyediting and formatting. A small internal editorial group met to review the copyedited document, select and contact final outside reviewers, and prepare any required revisions in response to outside reviewer comments. The final document was submitted to ASCE Publications for printing and distribution in 2006.

At the time the Environmental Effects Task Committee was beginning this project, the ASCE TAC Engineering Mechanics Division (EMD) was completing a ASCE Publications report on Environmental Fluid Mechanics. The EMD made available draft summaries of its text chapters to the Task Committee for review, to serve as a reference and to minimize duplication of effort. In addition, the Task Committee held a session on its work at the EMD annual conference in 2002. As a result, this publication and the EMD report are highly complementary; the EMD report deals mostly with the theoretical aspects of environmental fluid mechanics, while this document is intended primarily to assist with resolving actual situations.

J. Russell Manson
John Eric Edinger
Task Committee Co-chairs
Environmental Effects Committee
ASCE Energy Engineering Division

Contributors

Jerad D. Bales
Water Resources Engineer
United States Geological Survey
3916 Sunset Ridge Road
Raleigh NC 27607

Jeffery A. Ballweber
Assoc, Dir. for Governmental Affairs
Water Resource GeoResources Inst.
Mississippi State University Box 9652
Mississippi State, MS 39762

Edward M. Buchak
Manager
Surfacewater Modeling Group
ERM Inc.
350 Eagleview Boulevard, Suite 200
Exton, PA 19341-1180

Sharon G. Campbell
Aquatic Ecologist
U.S. Geological Survey
2150 Center Avenue
Ft Collins, CO 80526-8118

John Eric Edinger
Consultant
63 Crestline Rd.
Wayne, PA 19087

John A. Gordon
Professor Emeritus
Tennessee Tech University
1318 Dave Huddleston Road
Cookeville, TN 38501

Craig Hesterlee
USEPA REGION 4
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

John M. Higgins
Program Manager
Tennessee Valley Authority
1101 Market Street (LP 3D-C)
Chattanooga, TN 37402

Mary Ann Hosko
Hydropower Consultant
250 North 24th St.
Camp Hill, PA 17011

Rajeev Jain
Principal
QUALMOD, LLC
2300 Placid Way
Ann Arbor, MI 48105

G. Lynn Jarrett
Cumberland Environ. Group, LLC
P.O. Box 446
Henryville, IN 47126

George Krallis
Surfacewater Modeling Group
ERM Inc.
350 Eagleview Boulevard, Suite 200
Exton, PA 19341-1180

Katherine F. Lindquist, PE
(Deceased)
Former Manager, Hydrothermal Team
Tennessee Valley Authority
PO Box 1649
Norris, TN 37828

J. Russell Manson
Computational Scientist
Macaulay Land Use Research Institute
Craigiebuckler
Aberdeen
Scotland

James L. Martin
Prof. and Kelly Gene Cook, Sr. Chair
Department of Civil Engineering
Mississippi State University
Box 9546
Mississippi State, MS 39762

Jerry Miller
Water Quality Scientist
U.S Bureau of Reclamation
Upper Colorado Region
125 South State Street
(UC-242)
Salt Lake City, Utah 84138-1147

Greg Pelletier
Department of Ecology
P.O. Box 47600
300 Desmond Drive
Olympia, WA 98504-7600

Scott Wells
Professor and Chair
Department of Civil Engineering
Portland State University
1719 S.W. 10th
PO Box 751
Portland OR 97207-0751

Table of Contents