Sediment and Contaminant Transport in Surface Waters

Sediment and Contaminant Transport in Surface Waters

WILBERT LICK

Publishing

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

Printed in the United States of America on acid-free paper
10 9 8 7 6 5 4 3 2 1

International Standard Book Number-13: 978-1-4200-5987-8 (Hardcover)

Library of Congress Cataloging-in-Publication Data

Lick, Wilbert J.
Sediment and contaminant transport in surface waters / author, Wilbert Lick.
p. cm.
"A CRC title."
Includes bibliographical references.
ISBN 978-1-4200-5987-8 (alk. paper)
1. Water--Pollution. 2. Sediment transport. 3. Contaminated sediments. 4. Streamflow. 5. Limnology. 6. Environmental geochemistry. I. Title.

TD425.L52 2009
628.1'68--dc22 2008023728

Visit the Taylor & Francis Web site at
http://www.taylorandfrancis.com

and the CRC Press Web site at
http://www.crcpress.com

Contents

Dedication

To
Jim and Sarah

Preface

This book began as brief sets of notes prepared for a graduate class of students at the University of California at Santa Barbara (UCSB). The course emphasized the transport of sediments and contaminants in surface waters. The students were mainly from engineering, but there also were students from the departments of environmental sciences and biology. The course was later given twice as a short course (with the same emphasis) in Santa Barbara to professionals in the field, primarily to personnel from the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers but also to personnel from other federal and state agencies, consulting companies, and educational institutions.

Sediment and contaminant transport is an enormously rich and complex field and involves physical, chemical, and biological processes as well as the mathematical modeling of these processes. Many books and articles have been written on the general topic, and much work is currently being done in this area. Rather than review this extremely large set of investigations, the emphasis here is on topics that have been recently investigated and not covered thoroughly elsewhere — for example, the erosion, deposition, flocculation, and transport of fine-grained, cohesive sediments; the effects of finite rates of sorption on the transport and fate of hydrophobic contaminants; and the effects of big events such as floods and storms. Despite this emphasis, the overall goal is to present a general description and understanding of the transport of sediments and contaminants in surface waters as well as procedures to quantitatively predict this transport.

Much of the work described in this book is based on the research done by graduate students and post-doctoral fellows in the author's research group at UCSB and previously at Case Western Reserve University. For their work, inspiration, and input, I am enormously grateful. Because they are quite numerous, it is difficult to list them with their specific contributions here; hopefully, I have thoroughly referenced their contributions in the text itself. I am also grateful to June Finney, who did much of the typing and assisted in many other ways. Several researchers (Lawrence Burkhard, USEPA; Earl Hayter, U.S. Army Corps of Engineers; Doug Endicott, Great Lakes Environmental Center; and Craig Jones, Sea Engineering) have each reviewed two or more chapters of the text. Their comments and suggestions were of great help.

About the Author

Wilbert Lick is currently a research professor in the Department of Mechanical and Environmental Engineering at the University of California at Santa Barbara (UCSB). His main expertise is in the environmental sciences, fluid mechanics, mathematical modeling, and numerical methods. His present interests are in understanding and predicting the transport and fate of sediments and contaminants in surface and ground waters and the effects of these processes on water quality. This work involves laboratory experiments and numerical modeling with some fieldwork for testing devices and data verification. He has researched these problems in the Great Lakes, the Santa Barbara Channel, New York Harbor, Long Beach Harbor, the Venice Lagoon in Italy, and Korea.

Lick is the author of more than 100 peer-reviewed articles and is a consultant to federal and state agencies as well as private companies. Previous to UCSB, he taught at Harvard University and Case Western Reserve University, with visiting appointments at the California Institute of Technology and Imperial College, University of London. His Ph.D. is from Rensselaer Polytechnic Institute.