

# Water-Quality Trading

## A Guide for the Wastewater Community

- Evaluate the needs of your facility
- Design and implementation guidelines
- Tools to assess local needs
- Regulatory compliance

CY JONES, LISA BACON, MARK S. KIESER,  
AND DAVID SHERIDAN

# Water-Quality Trading

A Guide for the Wastewater Community

*Cy Jones*

*Lisa Bacon*

*Mark S. Kieser*

*David Sheridan*

**McGraw-Hill**

New York Chicago San Francisco Lisbon London Madrid  
Mexico City Milan New Delhi San Juan Seoul  
Singapore Sydney Toronto

## The McGraw-Hill Companies

Cataloging-in-Publication Data is on file with the Library of Congress

Copyright © 2006 by the Water Environment Federation. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of the publisher.

*Water Environment Research*, *WEF*, and *WEFTEC* are registered trademarks of the Water Environment Federation.

1 2 3 4 5 6 7 8 9 0 DOC/DOC 0 1 0 9 8 7 6 5

ISBN 0-07-146418-2

*The sponsoring editor for this book was Larry S. Hager and the production supervisor was Pamela A. Pelton. It was set in Sabon by Lone Wolf Enterprises, Ltd. The art director for the cover was Anthony Landi.*

Printed and bound by RR Donnelley.



This book was printed on recycled, acid-free paper containing a minimum of 50% recycled, de-inked fiber.

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please write to the Director of Special Sales, McGraw-Hill Professional, Two Penn Plaza, New York, NY 10121-2298. Or contact your local bookstore.

### IMPORTANT NOTICE

The material presented in this publication has been prepared in accordance with generally recognized engineering principles and practices and is for general information only. This information should not be used without first securing competent advice with respect to its suitability for any general or specific application.

The contents of this publication are not intended to be a standard of the Water Environment Federation (WEF) and are not intended for use as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document.

No reference made in this publication to any specific method, product, process, or service constitutes or implies an endorsement, recommendation, or warranty thereof by WEF.

WEF makes no recommendation or warranty of any kind, whether expressed or implied, concerning the accuracy, product, or process discussed in this publication and assumes no liability.

Anyone using this information assumes all liability arising from such use, including but not limited to infringement of any patent or patents.

## ***Water Environment Federation***

Founded in 1928, the Water Environment Federation (WEF) is a not-for-profit technical and educational organization with members from varied disciplines who work toward the WEF vision of preservation and enhancement of the global water environment. The WEF network includes water quality professionals from 76 Member Associations in 30 countries. For information on membership, publications, and conferences, contact

Water Environment Federation  
601 Wythe Street  
Alexandria, VA 22314-1994  
(703) 684-2400  
[www.wef.org](http://www.wef.org)

## ***Water Environment Research Foundation***

The Water Environment Research Foundation (WERF) is a nonprofit organization that helps utilities and corporations preserve the water environment and protect public health by providing science and technology for enhanced management of our water resources. WERF subscribers are utilities and municipalities, environmental engineering and consulting firms, government agencies, equipment manufacturers, and industrial organizations, all with a common interest in promoting research and development in water quality science and technology.

Water Environment Research Foundation  
635 Slaters Lane, Suite 300  
Alexandria, VA 22314-1177  
Tel: (703) 684-2470  
Fax: (703) 299-0742  
[www.werf.org](http://www.werf.org)  
[werf@werf.org](mailto:werf@werf.org)

# Foreword

For much of the 20th century, the waters of the United States were in crisis—the Potomac River was an embarrassment to the country and its capital, Lake Erie was dying, and the Cuyahoga River had burst into flames. Many of the nation's rivers and beaches seemed to be little more than open sewers. In 1972, the Clean Water Act (CWA) was passed to restore and maintain the integrity of the nation's waters. This historic legislation launched an all-out assault on water pollution. It called for reductions in pollution discharges and established interim goals for protecting fish and improving wildlife and recreational uses and ambitious ultimate goals such as attaining “zero discharge” of pollutants.

Over the past 30 years, the primary focus of the CWA has been on the control of pollution from point sources. The application of technology-based discharge requirements and water-quality based effluent limits through the National Pollutant Discharge Elimination System (NPDES) permit program has achieved tremendous success and remains critical to maintaining water-quality goals. However, despite these accomplishments, approximately 40% of rivers, 45% of streams, and 50% of lakes that have been assessed still do not support the beneficial uses, such as swimming, for which they had been designated.

Today we face an array of challenges somewhat different than those we faced in 1972. Nonpoint-source pollution, not directly regulated by the CWA, is now the most significant source of water pollution. Nutrient and sediment loads from agriculture, urban runoff, atmospheric deposition, and wastewater treatment plants are significant contributors to such large-scale, water-quality problems as the “dead zone” in the Gulf of Mexico and the diminished biology

of the Chesapeake Bay. Finding solutions to these complex water-quality problems and the smaller-scale, but equally important, local ones will require greater efficiency and innovative approaches. Meeting water-quality standards, while accommodating growth and development, will be a constant challenge. At the same time, any new approaches we undertake must remain aligned with the core CWA programs that form the backbone of the nation's efforts to control water pollution.

Taking a market-based approach to water-quality goals is one such innovation that potentially offers greater efficiency. Water-quality (or watershed-based) trading would allow a discharger to meet its regulatory obligations by using pollutant reductions created by another discharger with lower pollution-control costs. Taking advantage of such cost differentials and capitalizing on economies of scale can reduce the overall costs of controlling pollution. As part of President Clinton's Clean Water Initiative, a proposal to reauthorize the Clean Water Act in 1994, the U.S. Environmental Protection Agency (U.S. EPA) estimated that the potential cost savings associated with water-quality trading ran from a low of \$658 million to a high of several billion dollars (U.S. EPA, 1994). Nitrogen trading among point sources in Connecticut was predicted to save over \$200 million during a 14-year period of controlling discharges to Long Island Sound. After its first year, the program has achieved over \$1 million of surplus nitrogen credits and cut nearly six years off the projected timeline for meeting water-quality standards (Johnson, 2003).

In the past, one of the greatest impediments to trading has been the lack of information and the relatively small number of actual trades, which has helped create the skeptical attitude that, "If trading is so great, why aren't there any trades?" However, progress has slowly but steadily been made to overcome this lack of information and skepticism, beginning with U.S. EPA's issuance of *Effluent Trading in Watersheds: Policy Statement* in 1996 (<http://www.epa.gov/owow/watershed/trading/tradetbl.htm>) and *Draft Framework for Watershed-Based Trading* (EPA-800/R-96-001), also in 1996 (<http://www.epa.gov/owow/watershed/trading/framework.html>). Over the past decade, a number of studies and pilot programs have been completed that demonstrate the environmental and economic benefits that trading offers.

Given the potential benefits of trading, one could ask, “Why isn't this thoroughbred racing along?” But perhaps the horse has come out of the gate in fine fashion and is just unfamiliar with the course. The thoroughbred need only get its bearings.

Water-quality trading is ready to move into large-scale implementation. The financial incentives are clear, and the policy groundwork has been laid. On January 13, 2003, U.S. EPA issued its final Water Quality Trading Policy (<http://www.epa.gov/owow/watershed/trading/finalpolicy2003.html>).

While this policy is built on the CWA and its implementing regulations, it signals U.S. EPA's strengthened and broadened support for water-quality trading. Existing regulations provide the legal framework for incorporating trading into water-quality standards, water-quality management plans, NPDES permits issued to point sources, and total maximum daily loads established to restore impaired waters. The policy provides guidance to states, tribes, and sources on how trading can be aligned with and incorporated to these programs. The challenge will be to overcome the many implementation issues that are sure to arise.

U.S. EPA's issuance of a new water-quality trading policy marked a milestone along the road to cleaner water. It signaled the agency's commitment to trading and other market-based initiatives as innovative tools to help achieve the goals of the CWA and encouraged states and tribes and the water-quality community, as a whole, to develop and implement such approaches.

G. Tracy Mehan, Assistant Administrator for the Office of Water until December 2003, recently said, “Water-quality trading is an idea whose time has come.” Now it is up to us to make it a reality and to achieve the environmental and economic benefits it offers.

Dave Batchelor

Senior Policy Advisor on Water-Quality Trading

U.S. EPA Office of Water, October 2001 to October 2003

## References

- Johnson, G. (2003) Reducing Hypoxia in Long Island Sound: The Connecticut Nitrogen Exchange. Presented at the National Forum on Water Quality Trading, Chicago, Illinois, July.
- U.S. Environmental Protection Agency (1994) *President Clinton's Clean Water Initiative: Analysis of Benefits and Costs*; EPA-800/R-94-002; Washington, D.C.

# Preface

Over the past decade, the Water Environment Research Foundation (WERF) sponsored five water-quality trading research projects across the country—the Connecticut Long Island Sound nitrogen trading program; the Cherry Creek, Colorado, phosphorus trading program; the Kalamazoo, Michigan, phosphorus trading program; an assessment of the potential for nitrogen trading in Maryland's portion of the Chesapeake Bay watershed; and the Fox/Wolf Basin phosphorus trading program in Wisconsin.

This book was inspired by these projects as well as efforts by many individuals and groups across the country to develop water-quality trading programs. The Water Environment Research Foundation provided funding to support the development of this book as well as oversight and review of the final product. It is a joint effort of WERF and the Water Environment Federation (WEF), with the goals of sharing information and lessons learned with the water-quality community, furthering the development of trading programs, and contributing to the achievement of the nation's water-quality goals.

A work such as this one is invariably the result of the dedication, hard work, and contributions of a great many people. This is truly the case with this book and I am deeply grateful to them all, whether I remember to mention them here or not. I would first like to acknowledge and thank my contributing authors, Lisa Bacon, Dave Sheridan, and Mark Kieser, who were a pleasure to work with and who, in addition to contributing chapters, did much to improve the book in general.

I am deeply grateful to Margaret Stewart, Linda Blankenship, and WERF for giving me the opportunity to undertake this effort and for providing unfailing support and assistance through the many trials and tribulations of producing the manuscript. Thanks are also due to Lorna Ernst at WEF for her adroit handling of the book project. Reaching far back into the past, I would also like to thank Raynetta Grant for getting me entangled in WERF's water-quality trading research efforts nearly a decade ago.

I cannot say enough about the book's peer reviewers—Lynda Hall, Paul Stacey, Leon Holt, Norm LeBlanc, Rob Greenwood, Allison Wiedeman, Julie Vlier, and Jim Keating. Their efforts at identifying the many flaws and omissions in the early drafts and in making numerous beneficial suggestions went far beyond the call of duty. They proved to be an extremely knowledgeable, hard-working, and generous group and the vast amount of insight and information they provided improved and enriched the book in countless ways. I am forever in their debt. Many other people provided information, inspiration, or support as well, chief among them Dave Batchelor, Mahesh Podar, Paul Calamita, Gary Johnson, Bob Moore, Rhonda Sandquist, and Andy Fang.

I cannot conclude without thanking my co-workers at the Washington Suburban Sanitary Commission, whose support has been invaluable to me. Finally, and most importantly, thank you Carol and Matt. I couldn't have done it without you.

Cy Jones

# About the Authors

## Cy Jones

Cy Jones is the Regulatory Planning and Compliance Manager for the Washington Suburban Sanitary Commission in Laurel, Maryland, where his responsibilities include regulatory compliance, permitting, enforcement issues, and policy development on a broad range of environmental and regulatory issues. He has a B.S. in zoology and an M.S. in environmental engineering from the University of Iowa. He served as Chair of the Water Environment Research Foundation's Project Subcommittee for five water-quality-trading demonstration projects funded by the Water Environment Research Foundation. As Chair of the Nutrient Committee of the Maryland Association of Municipal Wastewater Agencies, he represented Maryland point sources on the Chesapeake Bay Program Nutrient Trading Task Force that developed the Nutrient Trading Fundamental Principles and Guidelines published by the U.S. Environmental Protection Agency and is currently assisting the Maryland Department of the Environment in determining the best role and structure for a nutrient trading program to help achieve the state's Chesapeake Bay Tributary Strategies. He is a Past President of the Chesapeake Water Environment Association and past member of the Water Environment Federation's Board of Directors.

## **Lisa Bacon**

Lisa Bacon is a Principal Technologist with CH2M Hill in Herndon, Virginia. She has 16 years of experience providing strategic and technical support to utilities, watershed communities, and state and federal agencies, helping them identify and implement ways to increase the cost-effectiveness of watershed management programs. She wrote several early U.S. Environmental Protection Agency (U.S. EPA) trading studies and was the lead contract author for U.S. EPA's 1996 *Draft Framework for Watershed-Based Trading*. She was the Principal Investigator for the Water Environment Research Foundation's (WERF's) "Nitrogen Credit Trading in Maryland: A Market Analysis for Establishing a Statewide Framework" project and is currently the Principal Investigator for the WERF project featured in the workshop, "Water Quality Credit Trading: Tools for Assessment and Implementation." Lisa has supported trading pilot studies for watersheds in Alabama, Colorado, Florida, Michigan, Mississippi, Pennsylvania, and Washington, and is currently supporting trading and watershed permitting initiatives in California, Maryland, Oregon, Texas, and Virginia.

## **Mark S. Kieser**

Mark S. Kieser is principal of Kieser & Associates, an environmental science and engineering firm in Kalamazoo, Michigan, that specializes in water resources research, watershed management, water-quality modeling, and new program development. Mr. Kieser has a bachelor's degree in biological sciences from Wittenberg University in Springfield, Ohio, and master's degree in biological sciences from Michigan Technological University in Houghton, Michigan. Mr. Kieser led one of the five U.S. EPA supported water-quality trading projects in the United States in the late 1990s. He served on the State of Michigan Water Quality Trading Workgroup that developed the framework for Michigan's 2002 water-quality trading program. Mr. Kieser has also served as Acting Chair of the Environmental Trading Network since 2001, an internationally recognized clearinghouse for market-based environmental programs. He is currently directing other regionally and nationally recognized projects in watershed management and urban stormwater research.

## **David Sheridan**

David Sheridan is a principal in Aqua Cura, a consulting engineering firm in Camp Hill, Pennsylvania, specializing in water management. He is trained in civil engineering, with a B.S. from the University of Pittsburgh, Pennsylvania, and M.S. and Ph.D. from Penn State University, University Park, Pennsylvania, and is a registered professional engineer in ten states and the District of Columbia.

# About the Reviewers

## **Rob Greenwood**

Rob Greenwood, Vice President and Partner at Ross & Associates Environmental Consulting, Ltd., has 21 years of experience designing and managing complex environmental and public health programmatic and policy projects. He has substantial responsibility for conducting analysis and facilitating collaborative stakeholder processes geared to consensus building for durable program and policy change. Since 1995, Mr. Greenwood has used his business finance background to develop a highly successful “market-based instruments” practice at Ross & Associates. This practice focuses on assisting public sector environmental management agencies in using such tools as water-quality trading, voluntary environmental improvement initiatives, and flexible permitting to lower environmental protection costs and encourage “beyond compliance” environmental performance. He has direct experience supporting water-quality trading market analysis, design, development, and/or implementation for several watersheds, including the Puyallup–White River in Washington and the Lower Boise, Middle Snake, Snake River–Hells Canyon, and Portneuf Rivers in Idaho. Mr. Greenwood is the primary author of U.S. EPA Region 10's “Water Quality Trading Assessment Handbook” and U.S. EPA “National Water Quality Trading Assessment Handbook.”

## **Lynda Hall**

Lynda Hall is a senior policy analyst with U.S. EPA Office of Wetlands, Oceans, and Watersheds, where she is U.S. EPA's subject matter expert in water-quality trading. Ms. Hall is the coauthor of U.S. EPA's 2003 Water Quality Trading Policy and Chair of U.S. EPA's internal workgroup, the Water Quality Trading Network.

## **Leon Holt**

Leon Holt is the Utilities Pretreatment Manager for the Town of Cary, North Carolina. He is active with the Lower Neuse Basin Association and the newly formed Neuse River Compliance Association. Mr. Holt developed and coordinated a research proposal with North Carolina State University to the Water Environment Research Foundation and U.S. EPA for better understanding fats, oils, and grease (FOG) induced sanitary sewer overflows, the ultimate goal of which is to establish technically based local limits rationale for discharges from food service facilities and as a supplement to nutrient and pathogen total maximum daily load modeling. Mr. Holt is an instructor for the Water Environment Federation for its FOG workshops held around the country. He attended Barton College in Wilson, North Carolina, and graduated with a B.S. in biology. He later attended Fayetteville Technical Institute and received an associate of applied science degree in environmental engineering technology.

## **Norman E. LeBlanc**

Norman E. LeBlanc has more than 30 years experience in the field of water-quality management. As Chief of Technical Services for the Hampton Roads Sanitation District, Virginia Beach, Virginia, his primary responsibilities include National Pollutant Discharge Elimination System, biosolids- and air-permitting activities for nine major and four minor publicly owned treatment works. He has been an active participant in the Chesapeake Bay Program in the development and implementation of water-quality criteria for the control of nutrient and suspended solids effects on living resources of the Bay. He serves as Chair of the Water Quality Committee for the Association of Metro-

politan Sewerage Agencies and for the Virginia Association of Municipal Wastewater Agencies and has served on numerous other committees and boards. His interests include total maximum daily loads, nutrients, whole effluent toxicity, and toxicity of metals to aquatic organisms. His education is in physical oceanography.

### **Paul E. Stacey**

Paul E. Stacey is a supervising environmental analyst with the Connecticut Department of Environmental Protection's (CTDEP's) Bureau of Water Management, Planning, and Standards Division. Mr. Stacey has served as state coordinator for the Long Island Sound Study since he was hired in 1985 and also supervises CTDEP's nonpoint-source pollution control program. Mr. Stacey was previously employed by the Academy of Natural Sciences in Philadelphia, Pennsylvania, for eight years.

### **Julie Vlier**

Julie Vlier, P.E., is Manager of Water Quality Services at URS Corporation. She has more than 20 years of experience in water resources engineering, water-quality engineering, and management. Ms. Vlier has worked with numerous clients in the areas of water resources planning, water supply development, water reuse, utility planning, source water protection, total maximum daily load development and implementation, watershed-based trading, watershed-management planning, and water-quality monitoring. Ms. Vlier has provided clients with National Pollutant Discharge Elimination System permitting assistance, including the evaluation of regulatory requirements and development and negotiation of permit conditions with various state agencies. Ms. Vlier has also led watershed-based-trading projects in U.S. EPA Region 8, specifically for phosphorus trading in the Cherry Creek watershed (Colorado), and selenium trading in the Colorado River. On behalf of her clients, she has also provided project management and technical oversight in the areas of wastewater utility planning, Clean Water Act compliance, site application approval, and wastewater design. Ms. Vlier recently completed her second term on the Colorado Water Quality Control Commission, serving as Chair of the nine-member board that promulgates water-quality standards and classifications to protect beneficial uses of state waters.

## **Allison Wiedeman**

Allison Wiedeman received her environmental engineering degree from Vanderbilt University in Nashville, Tennessee, in 1980 and has been working since then with the U.S. EPA. At their headquarters office, she was project manager for the development of national water pollution regulations for energy-related industries. She worked at the U.S. EPA Chesapeake Bay Program for the past 9 years, where she was in charge of directing activities to accelerate the restoration of the Bay through technological innovation and implementation. Her efforts have included development of an accurate tracking program for point-source discharges throughout the Bay watershed; development of nutrient-trading guidelines for the Bay watershed; working with municipalities, industries, and state and local governments to develop programs to reduce their point-source pollutant loading; and an extensive study to determine the costs and economic effects of point- and nonpoint-source nutrient-reduction efforts for the Bay watershed as a whole. She has just returned to U.S. EPA headquarters as the Chief of the Rural Branch in the Office of Water's Water Permits Division. There, she is in charge of the national implementation of the new regulations for concentrated animal feeding operations and policy on permitting of other rural discharges.