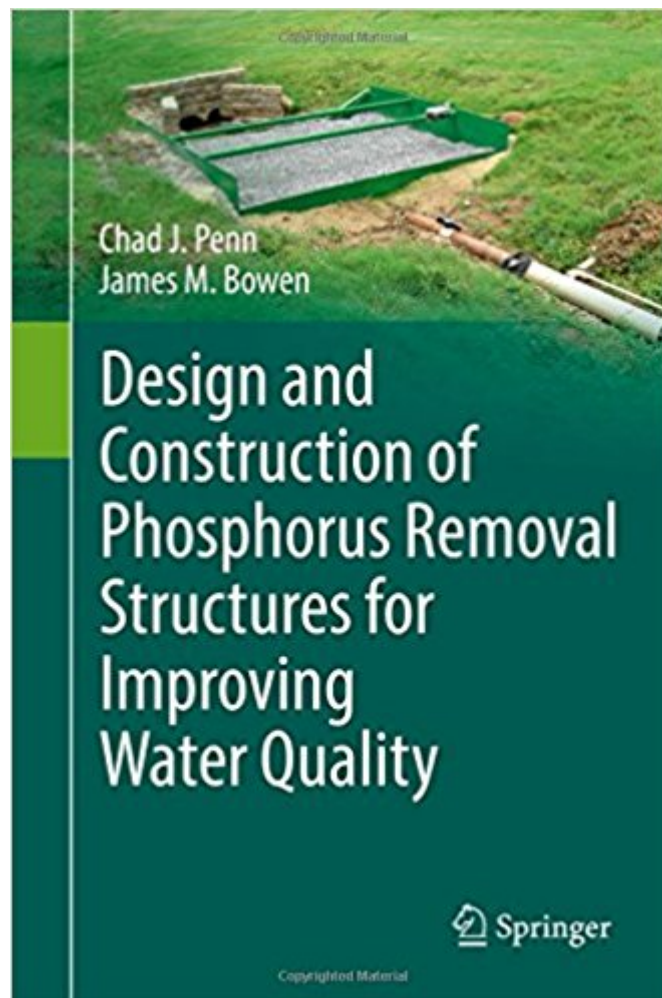




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# Design And Construction Of Phosphorus Removal Structures For Improving Water Quality



## Synopsis

The purpose of this book is to introduce the phosphorus (P) removal structure as a new BMP for reducing dissolved P loading to surface waters from non-point source pollution, provide guidance on designing site-specific P removal structures, and provide instruction on use of the design software, Phrog (Phosphorus Removal Online Guidance). The book initially provides a review of the nature and sources of non-point source P pollution, examines short and long term solutions to the problem, and provides detailed theory on design and operation of the P removal structure. As with many areas of study, one of the best methods of communicating concepts is through illustrations and examples. This book is no exception; several years of experience in studying P sorption and constructing P removal structures at multiple scales and settings is utilized for providing real examples and applications. With an understanding of the P removal structure established, the reader is instructed on how to obtain all of the necessary inputs for properly designing a site-specific P removal structure for meeting a desired lifetime and performance, or predict the performance and lifetime of a previously constructed P removal structure. For the readers who already possess the Phrog design software or are interested in obtaining it, one chapter is dedicated to detailed use of the software as demonstrated with various examples of structure design and also prediction.

## Book Information

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The purpose of this book is to introduce the phosphorus (P) removal structure as a new BMP for reducing dissolved P loading to surface waters from non-point source pollution, provide guidance on designing site-specific P removal structures, and provide instruction on use of the design software, *Phrog* (Phosphorus Removal Online Guidance). The book initially provides a review of the nature and sources of non-point source P pollution, examines short and long term solutions to the problem, and provides detailed theory on design and operation of the P removal structure. As with many areas of study, one of the best methods of communicating concepts is through illustrations and examples. This book is no exception; several years of experience in studying P sorption and constructing P removal structures at multiple scales and settings is utilized for providing real examples and applications. With an understanding of the P removal structure established, the reader is instructed on how to obtain all of the necessary inputs for properly designing a site-specific P removal structure for meeting a desired lifetime and performance, or predict the performance and lifetime of a previously constructed P removal structure. For the readers who already possess the *Phrog* design software or are interested in obtaining it, one chapter is dedicated to detailed use of the software as demonstrated with various examples of structure design and also prediction.

Dr. Chad Penn is a soil, agricultural, and environmental chemist at the USDA Agricultural Research Service (ARS). Before joining the ARS, he served as a professor of soil and environmental chemistry at Oklahoma State University for eleven years. He received his B.S. in soil science at Penn State University (1998) and M.S. in environmental soil science (2001). He earned his Ph.D. in environmental soil chemistry at Virginia Tech (2004). Dr. Penn has constructed over twenty phosphorus removal structures throughout the U.S., and helped to design many more in the U.S. and internationally. With his thirteen years of experience in conducting research on removing dissolved phosphorus from runoff, Dr. Penn created the software, *Phrog* (Phosphorus Removal Online Guidance) (Phrog), in an effort to disseminate the technology and enable the lay-person to more easily design and construct phosphorus removal structures. He has been a member of the National Academy of Inventors since 2015 and the American Society of Agronomy since 1997. Dr. Penn continues to help people around the world design phosphorus removal structures. Mr. James Bowen is pursuing a Ph.D. in the plant and soil sciences department with a concentration in soil fertility at the University of Kentucky. His research focuses on the spatial variability of soil phosphorus critical thresholds in agricultural systems. He has a BS in environmental science and an MS in soil science from Oklahoma State University. Mr. Bowen

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