
April 2004

State of New Jersey
James E. McGreevey, Governor

Department of Environmental Protection
Bradley M. Campbell, Commissioner

Land Use Management
Ernest P. Hahn, Assistant Commissioner

Division of Watershed Management
Larry Baier, Director

In cooperation with
New Jersey Department of Agriculture
New Jersey Department of Community Affairs
New Jersey Department of Transportation

New Jersey Department of Environmental Protection
Division of Watershed Management
PO Box 418
Trenton, NJ 08625-0418
Acknowledgements

Participating State Departments
This manual was developed in coordination with the New Jersey Department of Agriculture, New Jersey Department of Community Affairs, and New Jersey Department of Transportation.

The Department of Environmental Protection would like to thank the offices and individuals listed below for their assistance and contributions to the New Jersey Stormwater Best Management Practices Manual.

Project Manager
Elizabeth Semple, NJDEP – Division of Watershed Management

Principal Authors
Sandra A. Blick, NJDEP, Division of Watershed Management
Fred Kelly, Natural Resources Conservation Service
Joseph J. Skupien, P.P., P.E., Storm Water Management Consulting, P.A.

Co-authors
Bruce Friedman, NJDEP – Division of Water Quality
Steve Jacobus, NJDEP – Division of Watershed Management
Gene McColligan, NJDEP – Division of Watershed Management
Hunter Birckhead, P.E., PP, NJDA – State Soil Conservation Committee
Jim Morris, Rutgers University, Cook College Office of Continuing Professional Education
Christopher Obropta, P.E., PhD., Rutgers Cooperative Extension
Paul Schiariti, P.E., Mercer County Soil Conservation District
Kaveh Zomorodi, PhD., Dewberry
Chris Miller, Natural Resources Conservation Service

Updates and Future Versions of the Stormwater BMP Manual

Technical information regarding updates of the New Jersey Stormwater Best Management Practices Manual will be available at www.njstormwater.org
Future versions of the New Jersey Stormwater Best Management Practices Manual will reflect the technical updates found on the website.
Notices regarding future versions of the manual will be posted at this website.
Future versions of the manual are expected to occur at most once a year.

www.njstormwater.org
THE DEPARTMENT WOULD ALSO LIKE TO THANK the Best Management Practices Manual Technical Committee and the Mosquito Control Subcommittee for their assistance in the development of the technical standards in this manual:

**Best Management Practices Manual Technical Committee**

David Ahdout, NJDOT – Division of Design Services  
Michael Baier, NJDCA – Division of Codes and Standards  
Sandra A. Blick, NJDEP, Division of Watershed Management  
Hunter Birckhead, P.E., P.P, NJDA – State Soil Conservation Committee  
Kiong Chan, NJDOT – Division of Design Services  
Robert Colburn, Land Improvement Contractors of America, NJ Chapter  
Joseph D'Abundo, P.E., NJ State Association of County Engineers  
Anthony DiLodovico, Schoor DePalma, Inc.  
Nicole Einthoven, NJDOT – Division of Design Services  
Bruce Friedman, NJDEP – Division of Water Quality  
Madhu Guru, P.E., NJDEP – Land Use Regulation Program  
Steve Jacobus, NJDEP – Division of Watershed Management  
Michael Kaminski, NJDOT  
Fred Kelly, Natural Resources Conservation Service  
Vincent J. Mazzei, Jr., P.E., NJDEP – Land Use Regulation Program  
Gene McColligan, NJDEP – Division of Watershed Management  
Brian McLendon, NJDEP – Division of Water Quality  
Frank J. Minch, NJDA – State Soil Conservation Committee  
Manish Patel, P.E., NJDEP – Office of Innovative Technology  
Frank S. Scarantino, P.E., P.P, NJ State Association of County Engineers, Society of Municipal Engineers  
John Showler, NJDA – State Soil Conservation Committee  
Joseph J. Skupien, P.P., P.E., Storm Water Management Consulting, P.A.  
Lad Szalaj, NJDOT – Division of Design Services  
Victoria Thompson, Monmouth County Mosquito Extermination Commission  
Fritz Wise, NJDEP – Division of Water Quality

**Best Management Practices Manual Mosquito Control Subcommittee**

Hadley C. Foster, Morris County Mosquito Extermination Commission  
John Kranz, Middlesex County Mosquito Extermination Commission  
Daniel Rice, Morris County Mosquito Extermination Commission

THE DEPARTMENT WOULD ALSO LIKE TO THANK the Best Management Practices Manual Advisory Committee for their input and advice during the development of the manual:

**Best Management Practices Manual Advisory Committee**

Michael S. Bennett, P.E., Hatch Mott McDonald  
Tracy Carluccio, Delaware Riverkeeper Network  
Thomas H. Cahill, P.E., Cahill Associates  
Frank Doyle, RSIS – Site Improvement Advisory Board  
Valerie Hrabal, P.E., RSIS -Site Improvement Advisory Board, Keller Kirkpatrick  
Don Johnson, P.E., Montgomery Township Special Projects Engineer
Best Management Practices Manual Advisory Committee continued

David Lamm, P.E., Natural Resources Conservation Service
Paul Pogorzelski, P.E., Van Cleef Engineering Associates
Gene Santana, P.E., Michael Baker Jr. Engineers, formerly from Act Engineers
Ramesh Rajagopal, P.E., Gannett Fleming, Inc.
Maya van Rossum, Delaware Riverkeeper

THE DEPARTMENT WOULD ALSO LIKE TO THANK the following individuals for their technical input and assistance during the development of the manual:

Roger T. Bannerman, Wisconsin Department of Natural Resources
Stewart Comstock, P.E., Maryland Department of the Environment
James F. Cosgrove, Jr., P.E., TRC Omni Environmental Corporation
Karl Dauber, P.E., Michael Baker Jr. Engineers
Mark Gallagher, Princeton Hydro, LLC
Geoffrey M. Goll, P.E., Princeton Hydro, LLC
Jeffrey L. Hoffman, P.G., NJDEP – New Jersey Geological Survey
Richard R. Horner, Ph.D., University of Washington
Robert Limbeck, Delaware River Basin Commission
Eric H. Livingston, Florida Department of Environmental Protection
William C. Lucas, TRC Omni Environmental Corporation
Richard H. McCuen, Ph.D., University of Maryland
Robert E. Pitt, Ph.D., P.E., University of Alabama
Thomas R. Schueler, Center for Watershed Protection
H. Earl Shaver, Auckland Regional Council, New Zealand
Eric W. Strecker, P.E., GeoSyntec Consultants
Stephen J. Souza, Ph.D., Princeton Hydro, LLC
John A. Thonet, P.E., P.P., Thonet Associates
Paul I. Welle, P.E., Schnabel Engineering

THE DEPARTMENT WOULD ALSO LIKE TO THANK the staff at the Rutgers University, Cook College Office of Continuing Professional Education, as well as the following individuals for administrative and research assistance:

Robin Paulin, P.E., Somerset County Engineering Department
Benjamin B. Witherell, Water Resource Management

Finally, a special thanks to our copy and style editor Nadene Rehnby at Hands On Publications.

Manual References

The information presented in each chapter of the Best Management Practices Manual was developed both from published sources and through detailed technical discussions held at numerous BMP Manual Technical, Mosquito Control, and Advisory Committee meetings hosted by the NJDEP. The information and conclusions developed at these meetings reflect the technical knowledge of the committee members, which was derived from their own experience and both published and unpublished sources of stormwater management information. Therefore, the NJDEP would like to thank all of the private, public, and academic researchers, practitioners, and experts, including those not specifically noted in the chapters’ References sections, who have contributed to the current, extensive body of stormwater management knowledge upon which this manual has been based.
Contents

Acknowledgements ............................................................................................................................ iii
Chapter 1: Impacts of Development on Runoff ................................................................................ 1.1
Chapter 2: Low Impact Development Techniques ............................................................................ 2.1
Chapter 3: Regional and Municipal Stormwater Management Plans ................................................ 3.1
Chapter 4: Stormwater Pollutant Removal Criteria .......................................................................... 4.1
Chapter 5: Computing Stormwater Runoff Rates and Volumes ........................................................ 5.1
Chapter 6: Groundwater Recharge (April 2004) ............................................................................. 6.1
Chapter 7: Landscaping ................................................................................................................... 7.1
Chapter 8: Maintenance and Retrofit of Stormwater Management Measures .................................... 8.1
Chapter 9.0: Structural Stormwater Management Measures .......................................................... 9.0.1
  Chapter 9.1 Standard for Bioretention Systems ......................................................................... 9.1
  Chapter 9.2 Standard for Constructed Stormwater Wetlands .................................................... 9.2
  Chapter 9.3 Standard for Dry Wells ........................................................................................... 9.3
  Chapter 9.4 Standard for Extended Detention Basins .............................................................. 9.4
  Chapter 9.5 Standard for Infiltration Basins .............................................................................. 9.5
  Chapter 9.6 Standard for Manufactured Treatment Devices ................................................... 9.6
  Chapter 9.7 Standard for Pervious Paving Systems ................................................................. 9.7
  Chapter 9.8 Standard for Rooftop Vegetated Cover .................................................................... 9.8
  Chapter 9.9 Standard for Sand Filters ....................................................................................... 9.9
  Chapter 9.10 Standard for Vegetative Filters ........................................................................... 9.10
  Chapter 9.11 Standard for Wet Ponds ..................................................................................... 9.11
Appendix A: Low Impact Development Checklist ........................................................................... A-1
Appendix B: Municipal Regulations Checklist ................................................................................. B-1
Appendix C: Sample Municipal Stormwater Management Plan ....................................................... C-1
Appendix D: Model Stormwater Control Ordinance for Municipalities (April 2004) ....................... D-1