# BRODHEAD CREEK AND MCMICHAEL CREEK WATERSHED

# ACT 167 STORMWATER MANAGEMENT PLAN RENEWAL

## MONROE COUNTY, PENNSYLVANIA

***FINAL PLAN – April 19, 2022***

**PREPARED FOR**
MONROE COUNTY COMMISSIONERS
1 Quaker Plaza
Stroudsburg, PA 18360

PIKE COUNTY COMMISSIONERS
506 Broad Street
Milford, PA 18337

**PREPARED BY:**
MONROE COUNTY CONSERVATION DISTRICT
8050 Running Valley Road
Stroudsburg, PA 18360

MONROE COUNTY PLANNING COMMISSION
1 Quaker Plaza, Room 106
Stroudsburg, PA 18360

# Insert Resolutions Here

## Monroe County Commissioners

| | |
|---|---|
| Sharon S. Laverdure | *Chairman* |
| John R. Moyer | *Vice Chairman* |
| John D. Christy | *Commissioner* |

## Pike County Commissioners

| | |
|---|---|
| Matthew M. Osterberg | *Chairman* |
| Ronald R. Schmalzle | *Vice Chairman* |
| Tony Waldron | *Commissioner* |

## Monroe County Planning Commission

| | |
|---|---|
| Christine Meinhart-Fritz | *Director* |
| Eric Koopman | *Lead Senior Planner* |

## Monroe County Conservation District

| | |
|---|---|
| Kristina Heaney | *District Manager* |
| Lori Kerrigan | *Head Resource Conservationist* |
| Drew Wagner | *Hydraulic Engineer* |
| Michael Wilk | *Hydraulic Engineer* |
| David Hooker | *Resource Conservation Specialist* |

# Watershed Plan Advisory Committee

| Name(s) | Affiliation |
|---|---|
| Sharon S. Laverdure | *Monroe County Commissioners* |
| Greg Christine | *Monroe County Commissioners* |
| Christine Meinhart-Fritz | *Monroe County Planning Commission* |
| Eric Koopman | *Monroe County Planning Commission* |
| Kristina Heaney | *Monroe County Conservation District* |
| Lori Kerrigan | *Monroe County Conservation District* |
| Drew Wagner | *Monroe County Conservation District* |
| Michael Wilk | *Monroe County Conservation District* |
| David Hooker | *Monroe County Conservation District* |
| Maryellen J. Keegan | *Monroe County Safety Center* |
| Michael Mrozinski | *Pike County Planning Commission* |
| Michelle Long | *Pike County Conservation District* |
| Ellen Enslin | *Pike County Conservation District* |
| Craig Rickard | *Wayne County Planning Commission* |
| Jamie Knecht | *Wayne County Conservation District* |
| David Bodnar | *Carbon County Planning Commission* |
| Chris Storm | *Carbon County Conservation District* |
| Shane Kleiner | *PA Department of Environmental Protection* |
| Robert Jevin | *PA Department of Environmental Protection* |
| Ted Ritsick | *PA Department of Community & Economic Development* |
| John Bohman | *PA Department of Transportation* |
| David Padfield | *PA Emergency Management Agency* |
| Steve Tambini | *Delaware River Basin Commission* |
| David Horton | *Brodhead Creek Regional Authority* |
| Pamela Gardsy | *Barrett Township (Monroe)* |
| Cathy Martinelli, David Albright | *Chestnuthill Township (Monroe)* |
| Meredith Thompson, Erin Masker | *Coolbaugh Township (Monroe)* |
| Shaina Serrano, Larry Freshcorn | *Delaware Water Gap Borough (Monroe)* |
| Becky Smith | *East Stroudsburg Borough (Monroe)* |
| E. Ann Velopolcek | *Eldred Township (Monroe)* |
| Terry Keesler, Lawrence Buzzard | *Hamilton Township (Monroe)* |
| Jacqueline Elliott | *Jackson Township (Monroe)* |
| Michele Clewell | *Middle Smithfield Township (Monroe)* |
| Joshua Walker, Michael Penn | *Mt. Pocono Borough (Monroe)* |
| Reda Briglia | *Paradise Township (Monroe)* |
| Beverly Christman, Tracy Herman | *Polk Township (Monroe)* |
| Richard Wielebinski | *Pocono Township (Monroe)* |
| Samantha Borushak | *Price Township (Monroe)* |

## Watershed Plan Advisory Committee, Continued

| | |
|---|---|
| Danielle Romano | *Ross Township (Monroe)* |
| Brian Barrett, Julia Heilakka | *Smithfield Township (Monroe)* |
| Donna Alker, Jennifer Shukaitis | *Stroud Township (Monroe)* |
| Mary Pat Quinn | *Stroudsburg Borough (Monroe)* |
| Robert McHale, Autumn Canfield | *Tobyhanna Township (Monroe)* |
| Tina Kernan | *Tunkhannock Township (Monroe)* |
| Linda Kramer | *Greene Township (Pike)* |
| Alice Rehrig | *Lehigh Township (Wayne)* |
| Suzanne Brooks | *Kidder Township (Carbon)* |
| Robert Dobosh | *Kidder Township (Carbon)* |
| Alexander Jackson | *Brodhead Watershed Association* |
| Craig Todd | *Brodhead Watershed Association* |
| Andrea Higgins | *Brodhead Watershed Association* |
| James Vogt | *Aquashicola Pohopoco Watershed Conservancy* |
| Geoff Rogalsky | *Tobyhanna Tunkhannock Creek Watershed Association* |
| Bonnie Smith | *North Pocono CARE* |
| Abby Jones | *Our Pocono Waters - Penn Future* |
| Eric Baird | *Brodhead Chapter of Trout Unlimited* |
| Louise Troutman | *Pohoqualine Fish Association* |

# Table of Contents


**Section I. Introduction** ..... **1**

**Section II. Brodhead Creek and McMichael Creek Watershed Characteristics** ..... **2**

A. Watershed Characteristics ..... 2

B. Topography ..... 3

C. Geology ..... 4

D. Soils (Hydrologic Soil Groups) ..... 6

**Section III. Previous and Current Plan Efforts** ..... **7**

A. Pocono Creek Pilot Project ..... 7

B. Watershed Plan Advisory Committee (WPAC) ..... 9

**Section IV. Drainage Problems and Proposed Solutions** ..... **11**

**Section V. Comprehensive Watershed-Wide Water Resources Management** ..... **14**

A. Impact of Runoff on Watersheds ..... 14

B. Five-Phased Approach ..... 14

C. Management District Concept (Overbank and Extreme Events) ..... 22

D. Alternative Runoff Control Techniques ..... 29

E. Sub-Regional (Combined Site) Storage ..... 31

F. Regional Detention Facilities ..... 31

G. "No Harm Option" ..... 32

H. "Hardship Option" ..... 32

I. Exemptions ..... 33

**Section VI. Priorities for Implementation of the Plan** ..... **35**

A. DEP Approval of the Plan ..... 35

B. Publishing the Plan ..... 35

C. Development of a Local Program to Coordinate with DEP Regarding Chapter 105 and Chapter 106 Permit Application Reviews ..... 35

D. Municipal Adoption and Enforcement of Ordinance Provisions to Implement the Plan ..... 36

E. Level of Government Involvement in Stormwater Management ..... 36

F. Development of a Systematic Approach for Correction of Existing Storm Drainage Problem Areas ..... 36

G. Culvert Replacement ..... 38

H. PennVEST Funding ..... 38

I. Landowner's/Developer's Responsibilities ..... 39

**Section VII. Plan Review Adoption and Updating Procedures** ..... **40**

A. Plan Review and Adoption ..... 40

B. Procedure for Updating the Plan ..... 40

**Section VIII. References** ..... **41**

## Figures

Page

II-2. Base Map ..... Appendix D
II-2. Digital Elevation Model ..... Appendix D
II-3. Geology ..... Appendix D
III-1. WPAC Formation ..... 10
IV-1. Stormwater Problem Areas ..... Appendix D
V-1. Act 167 Technical Objectives ..... 15
V-2. Infiltration Requirements based upon NRCS Curve Numbers ..... 17
V-3. Hypothetical Undeveloped Site ..... 18
V-4. Relative Timing of Subwatershed Hydrographs ..... 22
V-5. Management District Map ..... Appendix D

## Tables

IV-1. Stormwater Problems by Municipality ..... 12
V-1. Twenty Benefits of Buffers ..... 19
V-2. Management District Peak Rate Requirements ..... 23
V-3. Process to Achieve the Standards and Criteria in Order of Required Consideration ..... 25
V-4. Required Criteria and Standards ..... 26
V-5. Recommended Criteria and Standards ..... 28
V-6. Temperature Sensitive BMP's ..... 31

## Appendices

Appendix A. Stormwater Problem Area Survey Sample and Results
Appendix B. Public and Watershed Plan Advisory Committee Participation and Comments
Appendix C. Municipal Ordinance Matrix
Appendix D. Maps
Appendix E. DEP Levee Data
Appendix F. Model Stormwater Ordinance for Municipalities with No MS4's
Appendix G. Model Stormwater Ordinance for Municipalities with MS4's