

**An Interim Watershed Management Plan for  
the Lower, Non-Tidal Portion of the Rondout Creek,  
Ulster County, New York**



**November 2010**

**Prepared by the Rondout Creek Watershed Council**

Financial support for this document was provided by:  
Hudson River Estuary Program of the New York State Department of Environmental Conservation  
and the New England Interstate Water Pollution Control Commission

# **An Interim Watershed Management Plan for the Lower Non-Tidal Portion of the Rondout Creek, Ulster County, New York**

November 2010

Prepared by the Rondout Creek Watershed Council

## **Primary Authors:**

Victor-Pierre Melendez, Rondout Creek Watershed Council Coordinator, Hudson River Sloop Clearwater  
Jen Rubbo, Environmental Action Educator, Hudson River Sloop Clearwater  
Manna Jo Greene, Environmental Director, Hudson River Sloop Clearwater.

## **Section Authors:** *(Order?)*

Katherine Beinkafner, PhD, CPG, Mid-Hudson Geosciences (Soil and Geology)  
Martha Cheo, Hudson Basin River Watch (Water Quality)  
Laura Finestone, Town of Rochester Environmental Conservation Committee (RCWC Mission and Vision)  
Jennifer Grieser, Department of Environmental Protection (Riparian Buffers)  
Kevin Grieser, Department of Environmental Conservation (Riparian Buffers)  
Simon Gruber, Hudson Valley Regional Council (Stormwater and Wastewater)  
Laura Heady, Hudson River Estuary Program and Cornell University (Biodiversity)  
Ryan Trapani, Catskill Forestry Association (Forestry and Agriculture)  
Mary McNamara, Lower Esopus Watershed Partnership (Esopus Watershed Appendix)

## **Intern Research Assistants:**

Jessica Gray, Marist College  
Brenden Tacon, SUNY Purchase  
Franklin Tavarez, SUNY Dutchess

## **Maps and Charts:**

Amanda LaValle and Amanda Wolfson, Ulster County Department of the Environment  
Jake Wedemeyer, Ulster County Soil and Water Conservation District

## **Project Advisors, Contributors and Editorial Assistance:**

William Flank, PhD., Chemical Engineering, Pace University; Clearwater Board Member  
Jorge Gomez, *TITLE*  
Michelle Leggett, Ulster County Resource Recovery  
Terry Laibach, NYS Department of Environmental Conservation Region 3 (Solid Waste and Recycling)  
Lance Matteson, Ulster County Development Corporation (Economic Development)  
Kristen Marcell, NYS Department of Environmental Conservation (Climate and Precipitation)  
Rick Oestrike, Fishkill Creek Watershed Committee  
Leanna O'Grady, Kinderhook Creek  
Jennifer Schwartz, Ulster County Planning Department (Land Use and Economic Development)  
Karen Schneller-McDonald, Hickory Creek Consulting/Shawangunk Ridge Biodiversity Partnership/Green Assets  
Ira Stern, New York City Department of Environment Protection (Reservoir Management)

**Rondout Creek Watershed Council Members:**

**Municipal Appointees:**

Town of Marbletown: Brooke Pickering Cole, Supervisor

Julia Bronson, *Marbletown Town Board*

Pete Robbins, *Marbletown Environmental Conservation Commission*

Town of Rosendale: Patrick McDonough, Supervisor

Jen Metzger, *Deputy Supervisor, Chair of Rosendale Environmental Commission*

Anne Diaz-Matos, *Rosendale representative*

Miriam Patton, *Alternate Rosendale representative*

Town of Rochester: Carl Chipman, Supervisor

Laura Finestone, *Rochester Environmental Conservation Commission, Chairperson RCWC*

Judith Karpova, *Rochester Environmental Conservation Commission*

Town of Wawarsing: Leonard Distel, Supervisor

John Adams, *Wawarsing Environmental Conservation Commission*

Henry Alicandri, *Wawarsing Environmental Conservation Commission*

**RCWC Members:**

Pat Barnes, *High Falls Water District*

Henry Bartosik, *Wawarsing member to Ulster County Environmental Management Council*

Joyce Bialik, *Creekside Lane resident, Rosendale*

Lisa Cavanaugh, *Warwarsing resident*

Martha Cheo, *Hudson Basin River Watch*

Dan Davis, *Rochester ECC*

Glenn Debrosky, *Trout Unlimited*

Diane Dianruff, *Watershed resident and kayaker*

Astrid Fitzgerald, *Kerhonkson resident, Town of Rochester*

Richard Geldard, *Friends of Shawangunks Board*

Manna Jo Greene, *Rosendale Town Council, Env't. Dir., Hudson River Sloop Clearwater*

Jennifer Grieser, *NYS DEC, Rochester ECC*

Kevin Grieser, *NYS DEC, Rochester ECC*

Walter Levy, *Rondout-Esopus Land Conservancy*

Ed Maestro, *Rosendale RCCE*

Fran Martino, *Hudson Basin River Watch/Kinderhook Creek;*

John Maylie, *Town of Rosendale MS4 program, liaison Ulster County EMC*

Adam Mierzwa, *Rosendale resident*

Laura Murawski, *Rosendale Environmental Commission*

Victor-Pierre Melendez, *RCWC Coordinator, Hudson River Sloop Clearwater*

Rocco Rizzo, *Rosendale resident*

Ron Schade, *Rondout Creek property owner, Rosendale*

Ira Stern, *NYC DEP Operations/Rondout*

Thomas P. Sullivan, *Marbletown Resident*

Catherine Taylor-Rosenbaum, *Creekside Lane Project*

Debra Tierney, *Creek Locks Rd., Rosendale*

Paul Tobin, *Caretakers Society*  
Ryan Trapani, *Catskill Forestry Association, Denning resident*  
Dave & Debbie Werner, *Resident, Creek Locks Rd., Rosendale*  
Kristen Wilson, *4-H Resource Educator*  
Natasha Williams, *Marbletown ECC*

*Add in people from original and recent workshops and all meetings – this list is not complete*

*Our partners Doug Reed, Liz LoGuidice, Marilyn Wyman and Fran Martino and Scott Cuppett will also be acknowledged.*

DRAFT

*Printed on Boise Aspen 50 (50% Post-consumer recycled content)*

**TABLE OF CONTENTS**

**EXECUTIVE SUMMARY** .....

**SECTION 1 – INTRODUCTION**.....

- **1.1 Watersheds and their importance.** .....
- **1.2 Vision Statement.**.....
- **1.3 History of the RCWC.**.....
- **1.4 Rondout Creek Interim Watershed Management Plan (RCIWMP).**.....
- **1.5 RCWC Watershed assessment process.**.....
  - Municipal Watershed Questionnaire (MWQ) Summary
  - Assets Identified in the MWQ
  - Challenges identified in the MWQ
- **1.6 Goals of the RCIWMP.**.....

**SECTION 2 - RONDOUT CREEK AND ADJACENT WATERSHEDS.**.....

- **2.1 The Rondout-Walkkill Watershed.**.....
  - Delineation
  - Impervious surface in the Rondout-Walkkill Watershed
  - Land cover of the Rondout Watershed and Creek
  - Protection efforts in the Walkkill Watershed
- **2.2 Lower Non-Tidal (LNT) Rondout Creek Watershed.**.....
  - Watershed General Description
  - Delineation of the LNT Rondout Creek
  - Land Use in the LNT Rondout Creek
- **2.3 Adjacent Watershed.**.....

**SECTION 3 - LOWER NON-TIDAL RONDOUT CREEK WATERSHED CHARACTERISTICS.**.....

- **3.1 Watershed Soils and Geology** .....

  - Historical Geology
  - Course of the Rondout Creek From Reservoir to Eddyville Dam
  - Sub-Basins of the Rondout Creek and Drainage Patterns
  - Surficial Geology and Soils
  - Relation of impoundments and Wetlands to Groundwater Flow
  - Recommendations

- **3.2 Climate and Precipitation** .....

  - Municipal Climate Data
  - Climate Change and Sea Level Rise
  - Recommendations

- **3.3 Biodiversity**.....
  - Significance of Biodiversity to Watershed Planning
  - Threats to Biodiversity and Associated Impacts to Watershed Health
  - Biodiversity of the Lower Non-Tidal Rondout Creek Watershed

- Priority Habitats of the Watershed
- How to Use This Information
- Stream Corridors and Wetlands
- Lakes, Ponds, and Pools
- Forests
- Grasslands, Shrublands, and Farms
- Cliffs and Caves
- Cores, Connections, and Landscape Perspective
- Threats and Conservation Recommendations
- Conclusions
- Literature Cited
  
- **3.4 Riparian Vegetation Ecology and Management**.....
  - Role of vegetation in maintaining a healthy stream
  - Erosion and Pollution Prevention Capabilities
  - Hydrologic Influences
  - Ecological importance of vegetation in the Riparian Zone
  - Characteristics of a Healthy Riparian Plant Community
  - Riparian Vegetation in the Lower Non-Tidal Rondout Watershed
  - Recommendations for Healthy Riparian Buffers
  - Implementation Strategies for Riparian Buffers
  
- **3.5 Agriculture and Forestry**.....
  - Recommendations
  - Existing Laws and Programs
  - Opportunities for Local Leadership
  - Public participation and education
  - Coordination and partnerships
  - Updating the comprehensive plan
  - Evaluating Existing Land Use Regulations
  - Forest Regulations in Use
  - Updating Land Use Regulations
  - Timber Harvest Plans
  - Land Clearing of Trees

**SECTION 4 - WATER QUALITY - MONITORING AND BIOMONITORING**.....

- **4.1 Waters Quality**.....
  - Recommendations
- **4.2 Stormwater and Wastewater**.....
  - Recommendations

**SECTION 5 – ECONOMIC DEVELOPMENT IN THE WATERSHED**.....

- **5.1 Ulster County Economics and demographics**.....
- **5.2 Local and County Economic Development Clusters**.....

- Agriculture
- Creative Arts
- Green Industry
- Innovative technology
- Workforce
- Tourism
- **5.3 Local Development Projects and Initiatives**.....
- **5.4 Recommendations**.....

**SECTION 6 - EDUCATIONAL AND RECREATIONAL ASSETS**.....

- **6.1 Watershed Educational**.....
  - Recommendations
- **6.2 Recreational Assets**.....
  - Recommendations

**SECTION 7 - MANAGEMENT STRATEGIES FOR KEY ISSUES IN THE WATERSHED**.....

- 7.1 Introduction**.....
- 7.2 Stormwater Management**.....
- 7.3 Floodplain Management** .....
  - Climate Change
  - Biodiversity
- 7.4 Riparian Vegetation and Forestry**.....
  - Riparian Buffers
  - Forestry
- 7.5 Outreach and Education** .....

**SECTION 8 – GUIDE TO IMPLEMENTATION**

- **8.1 Role of RCWC in Implementation**.....
- **8.2 Trends in Recommendation**.....
- **8.3 Promoting Watershed Economy**.....
- **8.4 Concerns of the Rondout-Esopus Watershed Relationship**.....
- **8.5 Comparison of Municipal Natural Resources and Land Use Objectives**.....
  - Stormwater Management Recommendations
  - Floodplain Management recommendations
  - RCIWMP Recommendations
- **8.6 Conclusion** .....

**SECTION 9 - LITERATURE CITED AND ADDITIONAL WATERSHED REFERENCES**.....

**SECTION 10 – APPENDICES**.....

- **Glossary**
  
- **Section 1**
  - Appendix A. Municipal Watershed Questionnaire (MWQ)
  - Appendix B. Wawarsing, Rochester, Marbletown, and Rosendale completed the questionnaire(s)
  - Appendix C. State Pollution Discharge Elimination System (SPDES) permits
  - Appendix D. Toxic Release Inventory (TRI)
  
- **Section 2.1**
  - Appendix E. Using a Shoreline Inventory for Conservation and Planning: the Rondout Creek Case Study, original research by Chris Bowser
  
- **Section 2.2**
  - Appendix F. Tributaries to Rondout Creek Table 3.1
  - Appendix G. Upper Rondout Watershed Management Plan.
  
- **Section 2.3**
  - Appendix H. Upper and Lower Esopus Watershed Description
  
- **Section 3.2 and 7.3**
  - Appendix I. Climate Smart Communities Pledge.
  - Appendix J. NYS Sea Level Rise Projections.
  
- **Section 4.1**
  - The water quality assessments at each site sampled by HBRW.
  - Appendix K. List of sites and assessment results.
  - Appendix L. Map of sites and assessment results.
  
- **Section 4.2**
  - Appendix M. Information about specific GI practices and related technical guidance.
  
- **Section 6**
  - Appendix N. Education and Outreach program inventory.
  
- **Section 8.5**
  - Appendix O. Municipal Resource and Land Use Existing Objectives and RCIWMP Recommendations.
  - Appendix P. All cross-referenced municipal management plans
  - Appendix Q. Additional Management Plan Resources



## List of Tables, Figures and Maps:

Table 1.1 Consolidated watershed resource management  
Table ?

Map 2.1.1 Rondout-Walkill Combined Watershed

Map 2.1.2

Map 2.1.3 Ulster County Watershed

Map 2.1.4 Land use in the Rondout-Walkill watershed

Map 2.1.5 Land use along the tidal Rondout Creek

Map 2.2.1 Esopus Watershed-Upstream and Downstream of the Ashokan Reservoir

Map 2.2.2

Map 2.2.3 Lower Esopus Watershed: Valley and River Segments

Map 2.3.1 Delineation of a watershed boundary.

Map 2.3.1 Rondout Watershed Three Main Sections

Map 2.3.2 Rondout Lower Non-Tidal Sub-Basins

Map 2.3.3 Land Protection in the Lower Rondout Watershed

Map 3.1.1 Bedrock Geology

Map 3.1.2 Surficial Geology

Map 3.1.3 Prime and Important Soils

Map X State and Federal Wetlands

Map X Protected Forest and Agricultural Districts

Figure 2.3.1

Figure 3.4.1 Ecological functions of various plant parts

Figure 3.4.2 Comparison of Runoff on a Forested Watershed Versus a Deforested Watershed

Figure 3.4.2 Healthy riparian community

Figure 3.4.3 (a), (b), and (c) Stages of Japanese knotweed's growth throughout the growing season

Figure 4.2.1 Changes in Hydrology Due to Development

Figure X Change in Hydrograph Following Development

Figure 5.1

Photo 3.4.1. Riparian understory along Rondout Creek.

Photo 3.4.2

Photo 3.4.3

Photo 3.4.4 Healthy riparian buffer of lower Rondout Creek

Photo 3.4.5 Lower Rondout Creek

Photo 3.4.6 Skunk cabbage

Photo 3.4.6 Hemlock branch

Photo 3.4.7 Lower Rondout Creek entering Kingston

Photo X

Photo X

## EXECUTIVE SUMMARY

The Rondout Creek Watershed Council (RCWC), a coalition of multiple stakeholders, was formed in 2007 to promote watershed awareness, planning and protection for the central portion of the Rondout Creek. The incubation of the RCWC, with the stream monitoring, education and outreach and subsequent watershed planning efforts were made possible by grant funding from the NYS DEC Hudson River Estuary program. The project was initially administered by Open Space Institute/Hudson Basin River Watch and Hudson River Sloop Clearwater and later in partnership with Cornell Cooperative Extension of Greene County/Agroforestry Center. After experiencing a series of heavy rain events and subsequent severe flooding that occurred throughout the Hudson Valley between 2004-2007, there was an enthusiastic response to the proposed coalition by local property owners, businesses, municipalities and government agencies who sought to increase the number of consensus-building watershed partnerships that would help to identify, educate and implement solutions to these and related water resource issues. In 2010, the New England Interstate Water Pollution Control Commission graciously provided additional funding for completion of this project.

The Rondout Creek is one of the largest tidal tributaries to the Hudson River. For management purposes the watershed has been delineated into three sections: the Upper portion which extends from the headwaters flowing southernly down the slopes of Rocky into a narrow valley, receiving tributary Picket Brook on the left and three unnamed streams from the slopes of Peekamoose Mountain to the right to the outlet of the Rondout Reservoir, the Lower, Non-Tidal portion which includes the area below the Rondout Reservoir to the Eddyville Dam, and the Tidal portion which extends from the Eddyville Dam to the Hudson River. The New York City Department of Environmental Protection, in collaboration with local stakeholders, has developed a management plan for the upper portion of the Rondout Creek and a plan for the tidal Rondout is currently underway. The formation of the RCWC resulted in the adoption of an intermunicipal agreement (IMA) among the four major municipalities in the lower non-tidal portion of the watershed -- Wawarsing, Rochester, Marbletown and Rosendale -- to produce an interim watershed management plan for this section of the watershed. The RCWC envisions that the management plans for the three sections of the Rondout will eventually be combined into one complete document addressing the needs and providing information about the entire Rondout Creek Watershed

The purpose of this document, created by the RCWC for the lower, non-tidal portion of the Rondout Creek, is to provide civic leaders, policy makers, community groups and individual citizens with comprehensive information about the state of the Rondout Creek and actions that are needed to enhance water quality and quality of life within the watershed boundaries. The plan acts to identify current information that will help inform interested parties about what is known about the watershed, as well as pointing out the unknowns, thus suggesting what research is needed and what future actions should be taken. The basis for the information presented in the plan and the recommendations that it proposed come from a Municipal Watershed Questionnaire, water quality data specific to the region, and pertinent information gathered from RCWC stakeholders and advisors. Based on information provided through multiple workshops and meetings, watershed protection goals were defined in the following four categories:

- 1) Stormwater Management,

- 2) Floodplain management,
- 3) Agriculture and Forestry, and
- 4) Outreach and Education.

Findings: Utilizing an iterative process that included frequent meetings with RCWC members, municipal officials, and a variety of key stakeholders, along with input from area experts, the following observations have been documented in the Rondout Creek Interim Watershed Management Plan (RCIWMP):

- Topography: The topography of the watershed has developed over millions of years with four main periods of Bedrock deposition: 1) Late Ordovician Flysch marine trough, 2) Silurian Shawangunk Conglomerate beach, 3) Late Silurian and Early Devonian Carbonates in warm shallow seas, and 4) Devonian Catskill delta.
- Climate: The average temperatures for Wawarsing, Rosendale, Marbletown and Rochester are all similar to each other and the US average. Precipitation within each town is greater than the US average with no town receiving more than 5 inches of precipitation.
- Impacts of Climate Change: Shoreline communities along the Rondout are very likely to see an increase in the frequency of flooding and erosion events due to climate change. This may result in:
  - The regular resuspension of waterborne pollutants that may put public health at risk
  - Inundation of critical infrastructure and facilities, especially those in flood-prone areas, leading to a loss of services
  - Further stress to already degraded stormwater and sewage systems, as well as municipal infrastructure
  - The impairment of water quality and an increase in water quantity
  - Impacts on populations of local fish and a possible increase in pest and insect epidemics.
- Biodiversity: The biodiversity of the watershed supplies services such as the purification of drinking water, control of floodwaters, replenishment of aquifers, pollination of crops, creation of fertile soil, control of insect pests, and adaptation to a changing climate. Healthy natural systems also provide opportunities for hunting and fishing, outdoor recreation, and environmental education and research. All of these services and benefits to the community cost less than the artificial or built alternatives, contribute to local economies, and are widely recognized as important assets by a variety of stakeholders.

Riparian buffers play a particularly important role in the watershed by:

- Slowing the rate of runoff
  - Capturing excess nutrients carried from the land
  - Protecting stream banks and floodplains from erosion
  - Regulating water temperature changes
  - Providing food and cover to terrestrial and aquatic fauna
  - Acting as natural filtration systems.
- Water Quality: With only 9.4% average impervious cover, the lower non-tidal Rondout Creek is designated as only “slightly impacted,” which means that it has maintained fairly

good water quality. However, numerous point and non-point sources of pollution in the watershed may threaten the health of the creek and its watershed, with some areas identified through monitoring to show early signs of variable human impact; overall the Creek is only slightly impacted.

- Stormwater Regulations: The towns of Marbletown and Rosendale have been designated as Municipal Separate Stormwater Sewer System (MS4) communities in the lower non-tidal portion of the watershed and are successfully implementing various stormwater management practices. Wawarsing and Rochester have not yet been required to implement MS4 programs.
- Effects of Impervious Surface: Impervious surfaces can greatly alter the hydrology of a watershed and have major impacts on the amount of and quality of the water entering streams and other waterbodies and aquifers. Green Infrastructure practices, such as rain gardens, bioswales, pervious paving, and green roofs, are viable solutions to mitigating the problems caused by impervious surfaces and assuring groundwater recharge
- Economic Development: Economic initiatives, if designed with conservation and environmental considerations, can potentially enhance watershed protection, minimize negative impacts, and create green jobs.

## Recommendations

This plan suggests recommendations for each of the four watershed protection categories identified. However as the plan was being developed it became apparent that there were recommendations that would serve to address multiple issues. These trends in recommendations are summarized below:

1. Continue to facilitate the functioning of the RCWC and form an ongoing intermunicipal council to oversee and coordinate the work that is already being done by the committee.
2. Promote ordinances designed to protect the natural resources of the watershed.
3. MS4 communities should continue to work toward meeting all MS4 requirements. Where feasible, towns that are currently not MS4 communities (Wawarsing and Rochester) should voluntarily adopt practices and ordinances that parallel the MS4 program. Specifically, this means implementing Best Management Practices that satisfy the six minimum control measures: 1) Public education and outreach, 2) Public Participation and Involvement, 3) Illicit discharge detection and elimination, 4) Construction Site Runoff Control, 5) Post-Construction Runoff Control, 6) Pollution prevention (see Section 4).
4. Create a comprehensive Rondout Creek Watershed Atlas representing uniformed maps that not only inventory the natural resources in the watershed but also identify areas at risk due to climate change and development, identify access points to the creek and other existing recreational opportunities, and further delineates local watershed boundaries.
5. Use zoning and planning tools to manage for open spaces, biodiversity, forestry, agriculture, and the protection of riparian and other sensitive areas. Promote education and outreach specifically to town Planning Boards and other municipal departments, advisory groups and agencies.

6. Adopt Better Site Design principles (also known as Low Impact Development or Green Infrastructure practices) to manage stormwater runoff and reduce impervious surfaces in the watershed.
7. Increase the focus on riparian zones and coordinate efforts to protect these areas throughout the watershed. This includes: mapping and identifying potential sites for restoration, creating zoning that will stop development in the floodplain, reducing impervious surfaces in these areas, increasing education about the importance of these areas.
8. Assure local food security and the rural character that graces much of the landscape in this portion of the watershed by promoting local agriculture and preserving farmland, as well as forestry and other open space, that serve to protect water quality.
9. Promote public education and outreach programs by collaborating with organizations that currently exist to raise awareness and garner support for watershed issues and best management practices. Issues to focus on include: invasive species, non-point source pollution, biodiversity, climate change
10. Intermunicipal collaborations should be explored to identify funding and cost-sharing opportunities that can further this Plan's objectives throughout all four municipalities.