

## ACKNOWLEDGEMENTS

Wildlands Conservancy would like to acknowledge the following participants and many other volunteers and supporters of this project whose hard work and passion for Monocacy Creek helped make this Management Plan possible.

Lehigh Valley Planning Commission was a key partner in completion of the project. We thank them for providing GIS coverages, numerous reports, maps, and other files for background information, and for their technical support.

We would like to offer special thanks to the following academic institutions for their support in the project. Moravian College's gesture to allow the Conservancy to host public meetings on their campus was greatly appreciated. We would also like to thank Lehigh University, Denise Palleiko in particular, for assisting in production of GIS maps. We also offer thanks to Dr. Patricia Bradt and Kelly McCormick from Muhlenberg College for their technical support, guidance, and hard work to complete a macro-invertebrate study of the creek for use in this report.

Wildlands Conservancy would also like to thank Monocacy Creek Watershed Association (MCWA), Monocacy Creek Corridor Citizen's Action Committee (CAC), and Monocacy Creek Chapter of Trout Unlimited for their technical support and for providing detailed local knowledge and history of the watershed. The PA Historical and Museum Commission also provided significant cultural information for which they are thanked.

We would also like to thank all of the municipalities of the watershed including Chapman and Bath Boroughs, Bushkill, Moore, East Allen, Upper and Lower Nazareth, Hanover, and Bethlehem Townships, and the City of Bethlehem. We thank you for your cooperation in meeting with Conservancy staff to identify valuable resources and potential problems within the watershed, discussing management options, and for providing recommendations to be included in the management plan.

Wildlands Conservancy would like to express their appreciation to Tom Gettings from Rodale Press Inc., for providing professional photographing of the watershed for use in the management plan as well as public meetings.

The Conservancy would also like to thank Karen Dolan for her hard work and many hours invested in compiling available information to create "Biological Diversity in the Monocacy Creek Watershed", a document prepared for use in the management plan.

We also thank Gordon Heller from Northampton County Parks and Recreation Department for his input on recreational facilities and possible trail constructions within the watershed.

# EXECUTIVE SUMMARY

## I. INTRODUCTION

The Monocacy Creek watershed occupies approximately 48.8 square miles, mostly within Northampton County but also partly within Lehigh County, Pennsylvania. The mouth of this limestone stream is located in the City of Bethlehem where it converges with the Lehigh River. Monocacy Creek is a well-reknoned stream for its ability to sustain a naturally reproducing trout population, a rarity in city environments.

Wildlands Conservancy has received a Pennsylvania Rivers Conservation Program Planning Grant for Monocacy Creek. A study of the Monocacy Creek, and the preparation and publication of a comprehensive Monocacy Creek Watershed Management Plan were the intended outcomes of the grant. The Pennsylvania Rivers Conservation Program was recently created by the Pennsylvania Department of Conservation and Natural Resources (DCNR). The objective of the program is to conserve, restore, and enhance Pennsylvania's rivers through partnership, education, awareness, and stewardship.

The primary goals of the Monocacy Project are to restore the physical and biological health of the stream; establish management practices to prevent additional degradation of the stream; preserve critical cultural and natural resource areas within the watershed; and ultimately have the Monocacy Creek listed on the Pennsylvania Rivers Registry. Inclusion on the Registry will qualify the Monocacy Creek corridor for technical and financial assistance from the state for restoration and improvement projects.

In order for Monocacy Creek to be included on the Registry, the management plan must identify the historical, cultural, natural, and physical resources along the creek. The plan must also characterize the water quality and aquatic life of the stream, as well as identify any problem areas along the stream. In addition, the plan must contain recommendations for conservation and preservation of the Monocacy Creek based partly on input from public hearings and informational meetings with municipalities.

The Monocacy Creek was chosen for this project because of its importance to the Lehigh Valley as a natural resource. The Monocacy Creek is classified, in Chapter 93 of the PA Water Quality Standards, as a "High Quality-Cold Water Fishery" (HQ-CWF). The excellent water quality of the creek provides many uses to the residents and visitors of Lehigh and Northampton Counties. Recreational and aesthetic uses of the Monocacy are especially important to the region. These factors combined with the easy accessibility of the creek's resources make it imperative to restore and conserve the Monocacy Creek watershed for today and future generations.

## II. RESOURCE INVENTORY

### A. Physical Resources

1. **Geology**- Monocacy Creek watershed is dominated by two types of bedrock. The shift from shale formations in the northern part of the watershed to limestone formations in the lower 2/3 of the watershed causes noticeable changes in water quality that promotes the sustainability of the trout population. Some stretches of the creek are susceptible to very low water levels as a result of losing water to the limestone aquifers.
2. **Soils**- The watershed is blessed with some of the most fertile farmlands in Northampton County. Highly erodible lands are a main concern where the stream is not adequately buffered along agricultural and open space lands.
3. **Topography**- Monocacy Creek is located in the Great Valley Section of the Valley and Ridge Physiographic Province of Eastern Pennsylvania. The major topographic feature of the watershed is known as Camel's Hump. The bedrock composing the formation is not easily eroded and therefore a prominent hill has formed with a vantage point overlooking the surrounding landscape.

### B. Aquatic Resources

1. **Surface water**- Monocacy Creek is a 4<sup>th</sup> order, low gradient stream, flowing 20.3 miles from the headwaters to the confluence with the Lehigh River. The flow of the creek is sustained by cold springs in the area of Camel's Hump, where groundwater is forced to the surface. Preserving the very few wetlands still existent within the watershed is essential to protecting the water quality in the creek.
2. **Groundwater**- Limestone aquifers within the watershed have higher water yielding capacities than non-carbonate aquifers. However, there is concern that the limestone aquifers may be easily contaminated through solution cavities in the bedrock. The need for stricter wellhead protection regulations is an issue that should be addressed within the watershed.

### C. Biological Resources

1. **Flora and fauna**- Recent studies have found that the Monocacy corridor plays an important role in the life of migratory birds. Valuable habitat areas include the Monocacy Nature Center and most of the stream corridor from Lower Nazareth Township to the Lehigh River. Invasive species of wildlife and vegetation are a growing concern within the watershed. Overall, very little data exists on the biological resources of the watershed, pointing to a need for further research in this area.
2. **Fishery**- The Monocacy is a well-known trout fishery due to cold spring water entering the creek around Camel's Hump. A 1.9-mile

stretch of the creek is designated as a “Trophy Trout “stream by the PA Fish and Boat Commission. Another three sections of the creek are also annually stocked with various trout species. Protecting the creek from degradation of valuable trout habitats is a priority for remediation efforts.

- 3. Macroinvertebrate community-** Results of fieldwork show that there has been a change in dominant species found at various sites throughout the watershed since studies performed in the 1970's. Signs of a shift to less pollutant tolerant species is a main concern.

#### **D. Cultural Resources**

- 1. Historical sites and significance-** Many historic sites and structures within the watershed are reminders of the Moravians, German Immigrants who arrived in the 17<sup>th</sup> and 18<sup>th</sup> Centuries. Aside from Bethlehem's Historic District, notable historic sites within the watershed include Burnside Plantation, Daniel-Steckel House, and the George Wolf Academy.
- 2. Socio-economic background-** Census data predicts that Bethlehem and Moore Townships will experience the most dramatic population growth during the 1990's, accompanied by an equally dramatic increase in the amount of land used for residential purposes. A major socio-economic issue within the watershed is the trend of growth and development that may result in more stormwater runoff influencing water quality and the frequency and severity of flooding.

- E. Recreational Resources-** Conservation parks within the watershed provide strong aesthetic values for predominantly passive recreation, while several facilities provide outlets for active recreational pursuits. Opportunities exist to convert abandoned railways throughout the watershed into various types of recreational trails.

- F. Institutional Resources-** The Monocacy watershed is fortunate in that it is supported by two local organizations, Monocacy Creek Watershed Association (MCWA) and Monocacy Creek Citizens' Action Committee (CAC). The key to utilizing the full potential of local organizations is to form partnerships and improve communication with municipalities, county, state, and federal organizations.

### **III. WATERSHED ISSUES**

- A. Land Use-** There are two predominant land uses in the watershed. Agriculture, occupying approximately 45% of the land surface, dominates the northern 2/3 of the watershed, and residential use dominates the southern portion of the watershed at 25% of the land area. The challenge for future growth and development of the

watershed will be to minimize non-porous surfaces and to conserve vegetated buffers along the stream.

- B. Protecting Critical Areas-** Floodplains, alluvial soils, steep slopes, special conservation areas, wetlands, woodlands, and wellhead areas are all resources that should be protected. Preservation of these areas is critical as they provide numerous benefits for both society and the natural environment.
- C. Flooding and Storm Water Management-**Development on floodplains is a major concern for storm water management, particularly in the City of Bethlehem and other urban centers within the watershed where riparian buffers have been removed and stormwater runoff contributes significantly to stream flow. Future efforts should focus on managing storm water for both quantity and quality entering the creek.
- D. Invasive/Exotic Vegetation-** Several invasive and exotic species have been introduced to the watershed that are threatening to take over the native natural vegetation. Wildlife and aquatic life that have not evolved on these species will not feed off them. Thus, introduction of these vegetative species to the watershed may cause major alterations to the ecosystem, possibly eliminating sensitive species of flora and fauna from the watershed.
- E. Water Quality and Land Use-** Results of studies by Wildlands Conservancy confirmed the findings of previous studies, citing that nutrient loading, sedimentation, and thermal pollution are the major threats to water quality of the Monocacy Creek. Future efforts to preserve water quality, as identified by Lehigh Valley Planning Commission (LVPC), should focus on mitigating potential adverse impacts from residential and industrial development.
- F. Water Usage-** Water usage is in accordance with safe yields for most wells within the watershed. Withdrawal rates from one well are excessive and may lead to a dry well, in which case a new water source will need to be identified.

#### **IV. MUNICIPALITY ISSUES**

- A. Vision and Management-** The general consensus among municipalities was that the watershed should be managed to preserve natural resources and maximize recreational opportunities.

- B. Common Concerns-** The top priority for most municipalities is to minimize damage and other adverse impacts caused by flooding within the watershed. Other major concerns include the increasing sediment loads in the stream and a lack of recreational trails within the watershed.
- C. Development-** Residential developments will form the core of future growth within the watershed. Incorporating green space into development plans and preserving riparian buffers and floodplains will be a key to healthy management of the watershed as development continues.
- D. Municipal Ordinances-** Currently, municipal ordinances do not adequately protect critical areas within the watershed as discussed above. Formulation of a “Riparian Buffer Ordinance” would address many issues and concerns highlighted throughout this study.

## **V. MANAGEMENT OPTIONS**

### **A. Preserve Significant Features and Valuable Resources**

1. Continue restoration and preservation of known historical sites and survey the watershed to identify potential sites for listing on the National Historic Registry.
2. Preserve farmland and open space through utilization of financial assistance programs such as Environmental Quality Incentives Program and Conservation Buffer Initiative.
3. Preserve wetlands through public education and use of state and federal programs such as Wetlands Reserve Program and Partners for Wildlife.
4. Revise ordinances to protect and encourage stewardship of creek resources. Particular emphasis should focus on enhancing riparian buffers, protecting ground water supplies, and improving quality of stormwater runoff.

### **B. Water Quality and Biological Documentation**

1. Develop an ongoing water monitoring routine, including an annual streamwalk, with the help of volunteers and local organizations.
2. Acquire financial and technical assistance to perform specialized studies on critical issues such as loading of metals, pesticides, herbicides, or fertilizers in the stream, in order to properly manage these substances.
3. Perform periodic inventories of vegetative and macroinvertebrate communities.
4. Thoroughly investigate presence of threatened or endangered species of flora and fauna.

5. Provide efficient data management and distribution through a central database such as an internet website.

**C. Conservation and Enhancement of Water Quality and Corridor Habitat**

1. Stream improvement projects including streambank stabilization, habitat improvement, and stream clean-ups should be initiated.
2. Removal of dams would reduce sedimentation as well as backwater conditions that contribute to flooding.
3. Improve point source discharges through tertiary treatment of sewage plant discharges and/or through compensatory work for water quality or habitat improvement, such as enhancing riparian buffers.
4. Improve compliance with erosion and sedimentation regulations through citizen watchdog efforts and more funding directed to Lehigh and Northampton County Conservation Districts.

**D. Increase Environmental Awareness**

1. Provide more educational opportunities for the general public through efforts such as signing at parks and on trails, incorporating environmental programming with local festivals and school curriculums, and producing a management guide specifically for streamside property owners.
2. Establish easy-use oil recycling facilities, as current facilities are sparse and primitive and use is not widespread due to a lack of education.

**E. Improve Quality of Life and Property Value**

1. Improve and expand recreational facilities, placing emphasis on acquiring streamside property and abandoned railways for the development of nature trails.
2. Voluntary roadway clean-ups by businesses within the watershed are encouraged through use of a program such as "Adopt-A-Highway."
3. Restrict herbicide spraying along roadways as spraying yields unsightly views and incurs a high environmental cost despite its apparent cost efficiency.
4. Municipal management projects such as preventing waste dumping should be implemented to address localized problems.

**F. Reduce Nonpoint Source Pollution**

1. Reduce pollution at the source by using best management practices and available technology whenever possible.
2. Treat pollution before it reaches the stream corridor by using devices such as oil separators to control runoff of deleterious substances from roads and parking areas.

3. Preservation of floodplains could be approached by reassessing the 100-year floodplain, seeking better compliance with current regulations, and incorporating floodplains in a riparian buffer zone to ensure their protection.
4. Public sewer systems should be linked to recently developed areas in order to eliminate potential nonpoint sources of pollution. Proper maintenance and management plans and practices should be followed for on-lot septic systems that can not be linked to the public sewer system.
5. Riparian Buffers should be established as they provide many functions that protect water quality and enhance the value of the Monocacy corridor. Devising or adopting an ordinance such as the "Riparian Corridor Conservation District," created by Montgomery County Planning Commission, could be a key tool in this effort.

## **VI. CONCLUSION**

Monocacy Creek watershed plays host to numerous valuable and unique resources. Among them are the high quality- cold water fishery that supports a reproducing brown trout population, several historic sites and structures that tell the story of our forefathers, many acres of rich farmlands, and habitats that may serve wildlife species unobserved throughout other parts of the Lehigh Valley. The management options have been developed in an attempt to restore, preserve, and enhance the value of these resources.

Utilizing best management practices and establishing riparian buffers is a simple yet powerful combination of remediation efforts identified in the plan. Combining these techniques may provide benefits for numerous resources including improvement of water quality and aquatic life, expansion of wildlife habitat, enhanced scenic and recreational value, and land and soil preservation. These important actions and many others mentioned throughout the plan cannot be effectively implemented without proper education for the public. Education holds the key to an improved and healthier watershed.

Knowledgeable and concerned citizens and institutions must share this information with their neighbors and other contacts in order to strengthen the conservation effort on a watershed-wide basis. By establishing partnerships, resources can be shared and utilized more effectively. Partnerships and open lines of communication among concerned institutions and individuals are essential to successful restoration and preservation of Monocacy Creek watershed.