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ACKNOWLEDGMENTS

This master plan was prepared under the direction of the Mill Creek Watershed Council Greenway Committee, the Mill Creek Restoration Project, the Hamilton County Department of Environmental Services and the Cincinnati-Hamilton County Metropolitan Sewer District. The study area encompasses the Mill Creek watershed, portions of which are located in Hamilton and Butler Counties in southwest Ohio.

The creation of this master plan would not have been possible without the contributions of many individuals, organizations, businesses, foundations, local political jurisdictions, the State of Ohio, and several federal agencies. More than one hundred stakeholder groups have had a hand in crafting this action strategy.

Funding to hire the professional consultants who worked with these stakeholders to produce this plan came from the State of Ohio Capital Improvement Program, administered by the Ohio Department of Natural Resources NatureWorks Program. Locally, the Mill Creek Watershed Council (MCWC) raised funds to cover printing and other direct greenway planning expenses from the City of Cincinnati, Hamilton County, Butler County, Metropolitan Sewer District, Hamilton County Park District, Millcreek Valley Conservancy District, and Waste Management, Inc.

Mill Creek Restoration Project's leadership and professional staff support for the entire community-based planning process have been made possible through generous grants from the Greater Cincinnati Foundation; the Threshold Foundation; U. S. EPA; Ohio EPA; The Conservation Fund's American Greenways DuPont Award Program; and Recreational Equipment, Inc., through the National Rivers Coalition.

While it is not possible to recognize all of the individuals who had a hand in preparing this plan, it is appropriate to acknowledge those who attended the regularly scheduled meetings of the Greenway Committee, and who worked diligently with the consultant team to prepare this plan.

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Mr. George Hardebeck	Cincinnati Park Board
Ms. Lorna Harrell	Butler Soil & Water Conservation District
Ms. Helen Heekin	Cincinnati Town and Country Garden Club
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Mr. Bill Hughes	Liberty Township Parks
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Mr. Bruce Koehler	Ohio-Kentucky-Indiana Regional Council of Governments
Mr. Paul Labovitz	National Park Service
Mr. Douglas Lane	Cincinnati Recreation Commission
Ms. Lisa Lange	Port Authority for Brownfields Redevelopment in Cincinnati and Hamilton County
Mr. Gene Langschwager	Greater Cincinnati Chamber of Commerce
Ms. Vanessa Lenear	City of Wyoming
Ms. Sue Magness	Keep Cincinnati Beautiful
Mr. Bob Temple	Sierra Club, Miami Group
Mr. Terry Meadows	Village of Woodlawn
Prof. Michael C. Miller	University of Cincinnati
Ms. Christine Moran	League of Women Voters of the Cincinnati Area
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Ms. Sharma Young	Butler County Department of Environmental Services
Mr. Tim Zelek	Hamilton County Park District
Mr. John Zimmerman	U.S. Army Corps of Engineers - Louisville District

Other Valuable Contributors

Mr. Cory Chadwick	Hamilton County Department of Environmental Services
Dr. Stanley Hedeem	volunteer researcher - biotic refugia and existing trails
Mr. Don Begosian	volunteer researcher - historic and cultural resources and native species
Ms. Pat Fagan	Ohio Department of Natural Resources



ADDITIONAL ACKNOWLEDGMENTS AND THANKS

In addition to the outstanding contributions of the dedicated Mill Creek Watershed Council Greenway Committee, thousands of people involved in over one hundred schools, businesses, and neighborhood, community, civic, and environmental groups contributed to the development of the Mill Creek Watershed Greenway Master Plan and Implementation Strategy. Mill Creek Restoration Project's community-based planning efforts started in 1995, when we first explored whether greenways could have application in our watershed, and continued through January 1999, when our greenway consultants submitted the final plan.

A very special thanks goes to Barry Cholak, an amazing volunteer; to Paul Labovitz, our senior advisor for our community-based approach, with the Rivers, Trails, and Conservation Assistance Division of the National Park Service; and to the citizens from the following communities, groups and businesses who provided invaluable support and input by participating with Mill Creek Restoration Project in riparian corridor projects, briefings, greenway programs, training sessions and planning workshops

- Robin Corathers, Executive Director
Mill Creek Restoration Project

Aiken High School
Mike Albert Leasing
All American Rental Center
Village of Arlington Heights
AT&T Pioneers
Beautiful Woodlawn Business Association
Bloom Middle School
Butler County: four public meetings for citizens, government officials, business representatives and developers and homebuilders
Butler County Canal Coalition (Metro Parks of Butler County, Liberty Township Parks, Union Township Historical Society and Pathway Committee, Ohio Canal Society, and Izaak Walton League)
Butler County Department of Environmental Services
Butler Soil and Water Conservation District and its Mill Creek Public Advisory Group
Camp Washington Community Council
Carthage Civic League
Cas-Ker Company
Catholic Archdiocese TACKLE youth program
Catholic Archdiocese World Youth Day Volunteers
L. P. Cavett Company
Cincinnati Air Conditioning Company
Cincinnati Bell Telephone
Cincinnati Bengals
Cincinnati City Council
Cincinnati Bar Association's Environmental Law Workshop
Cincinnati Economic Development Department
Cincinnati Environmental Advisory Council and its Water Committee
Cincinnati Health Department
Cincinnati Office of Environmental Management
Cincinnati Park Board



Cincinnati Recreation Commission
Cincinnati Sub-Zero
Cincinnati Town & Country Garden Club
Cincinnati Water Works
Cinergy
Citizens for Civic Renewal and its Sustainable Land Use Committee
Coleman Instrument Company
Communities United for Action
Consolidated Grain and Barge Company
CSX Transportation
Village of Elmwood Place
Epcor Foundries
Village of Evendale
Fifth Third Bank
Frito-Lay, Inc.
Garden Club of Cincinnati
General Electric Aircraft Engines
Habitats
Hamilton County Department of Environmental Services
Hamilton County Environmental Action Commission
Hamilton County Environmental Priorities Project
Hamilton County Park District
Hamilton County Soil and Water Conservation District
Heinold Foreign Language Academy
Hillshire Farm and Kahn's
Hughes Center
Henkel Corporation and its Community Advisory Committee
Institute for Advanced Manufacturing Sciences: two greenway meetings for business
and development representatives
Institute of Environmental Science, Miami University
Isaac Wise Temple eighth grade class
Jacobs Center
Keep Cincinnati Beautiful
The Kroger Company
Leadership Cincinnati 1997 Class
League of Women Voters
Village of Lincoln Heights
Lockland High School
Village of Lockland
Lower Price Hill Community Council
McDonald's
Metropolitan Sewer District
Mill Creek Restoration Project Board of Trustees
Millcreek Valley Conservancy District
Mill Creek Watershed Council and its New Realities Symposiums
Millvale Community Council
Millvale Landscaping/Lawn Care Inc.
Morton International, Inc.
National Tree Trust
Nativity
New Jerusalem Community



North College Hill High School and Middle School
North Fairmount Community Center
North Fairmount Community Council
Northside Community Council
Norwood Middle School
Ohio Citizen Action
Ohio Department of Natural Resources
Ohio Environmental Education Fund
Ohio-Kentucky-Indiana Regional Council of Governments
Ohio EPA
The Ohio River Company
Old St. George Community Center
ORSANCO
PCL Group, Inc.
Port Authority for Brownfield Redevelopment
Porter Middle School
Preserving Affordable Housing
Princeton High School
Ralston Purina
City of Reading
Reece Campbell
Regional Sustainability Workshop Participants and Steering Committee Members
Riverwood International
City of St. Bernard
St. Bernard/Elmwood Place High School
St. Mary's
St. Xavier High School
Sierra Club, Miami Chapter
Sign Effects
City of Sharonville and the citizens, business people and government officials who
attended the "Greenway and Flooding" presentation and discussion hosted by
Sharonville
South Cumminsville Community Council
South Fairmount Community Council
Southside River Rail
Stream Assessment Volunteers
Sun Chemical Corporation
Union Township Trustees, Butler County
University of Cincinnati Law School
University of Cincinnati School of Planning students
U. S. EPA
West End Community Council
Winton Hill Neighborhoods/Winton Place Environmental Justice Project Committee
Winton Place Civic Club
Village of Woodlawn
Walnut Hills High School
Withrow High School
Woodward High School
Woolpert
City of Wyoming
XCG Consultants, Ltd.



EXECUTIVE SUMMARY

Introduction/Overview

Greenways are linear corridors of open space with trees and other vegetation that connect people and places together. These green corridors are often created along streams and rivers, abandoned rail corridors, utility corridors and roadways. When properly planned and designed, greenways can provide multiple environmental, economic and social benefits to communities.

The Mill Creek Watershed Greenway Master Plan defines a course of action for making improvements to property located along the primary channel and tributary streams of the Mill Creek. These improvements would yield a number of important benefits to residents, businesses and numerous local governments within the watershed. Some of these future benefits would include cleaner water; a comprehensive strategy for floodplain management; improved access to lands adjacent to the primary channel and tributary streams in the form of multipurpose trails; a choice in transportation via bicycle and pedestrian travel for short distance trips; diversified passive recreation opportunities; increased economic values for properties adjacent to the stream system; reduced erosion of stream banks and siltation in the stream system; and improved wildlife habitat within riparian areas.

In order to realize these benefits, this Master Plan describes a set of specific programs, policies and actions that should be accomplished. These are described first as a set of "initiatives" that are divided into six focus areas. Next, sixteen specific early action projects are defined for immediate implementation. Through the development of these projects, the benefits described earlier will be realized.

In order to execute the myriad recommendations featured in this plan it is necessary that a "champion" and lead facilitator for the plan be designated. The Mill Creek Restoration Project (MCRP) has agreed to accept this responsibility, and has also agreed to work with a variety of partners, including the Mill Creek Watershed Council, Hamilton County, Butler County, City of Cincinnati and other local governments, businesses and industries, civic organizations, institutions and watershed residents, to implement the programs, policies and actions defined within this plan.

How This Plan Was Developed

In November 1997, the Mill Creek Watershed Council began work on the preparation of this master plan. The Council employed a team of consultants to assist the Council's Greenways Committee with the preparation of the plan. Funding for the plan came from a State of Ohio Capital Improvements Program Grant administered by the Ohio Department of Natural Resources NatureWorks Program. A local match for the grant was provided by the Mill Creek Watershed Council and its partners. Over a period of 15 months, the consultant and committee met monthly to define, discuss, revise and finalize all aspects of this plan. More than 90 individuals participated in this monthly meeting and review process. Additionally, numerous public meetings were

Figure 1: Chuck Flink, of Greenways Incorporated, presents draft recommendations of the Greenway Plan at a public meeting in the Woodlawn community.



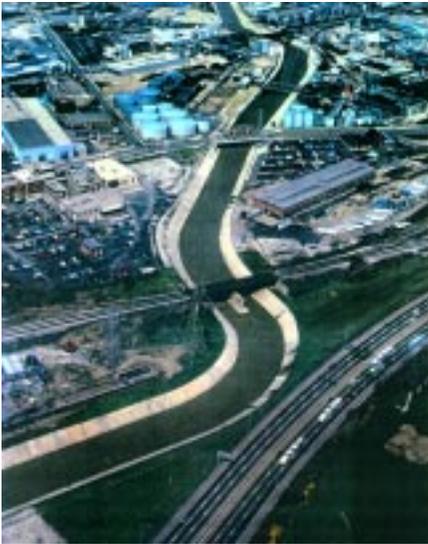


Figure 2: The Mill Creek possesses different characteristics, from its urban and industrial character in the lower reaches of the primary channel in Cincinnati

Figure 3: to a rural and suburban residential character in northern Hamilton and southern Butler counties.



held throughout the watershed to gather input from the general public. Finally, a lengthy review period of the initial draft master plan occurred from July to November 1998, in which approximately 100 different individuals, representing organizations, institutions, businesses and agencies, reviewed and critiqued the draft plan. This thorough participatory planning process has resulted in the preparation of a master plan that is tailored to address and resolve issues that are important to the future vitality of the Mill Creek watershed.

The consultant team, consisting of **Fuller, Mossbarger, Scott and May** of Cincinnati, **Greenways Incorporated** of North Carolina, **Biohabitats, Inc.** of Maryland, and **Rhinoworks** of Cincinnati, served as principal authors for this Plan. They prepared much of the text in this report, developed a Geographic Information System (GIS)-based greenways layer that is compatible with the Cincinnati Area Geographic Information System (CAGIS), conducted an in-field training session on stream classification, designed a greenway logo, facilitated approximately 45 meetings with local stakeholders, and prepared an executive summary brochure. The consultant also produced newsletters which were used to convey information to watershed residents during the planning process.

Summary of Key Recommendations

This master plan proposes the restoration, preservation and enhancement of natural corridors along the Mill Creek and its tributaries. A greenway system is defined and is comprised of primary and secondary stream corridors -- supplemented by parks, utility corridors and open spaces to form an interconnected system of "multi-objective corridors" throughout the watershed. A total of 14 stream corridors comprise the multi-objective greenway system.

A set of greenway initiatives are recommended for implementation throughout the Mill Creek watershed. The use of recycled and reusable waste by-products is encouraged during the development of all future greenway projects. The greenway initiatives include:

Mill Creek Flood Damage Reduction Program

To reduce the economic losses, and impacts on private properties and the lives of residents associated with flooding, through a comprehensive floodplain management program for the Mill Creek riverine system.

Mill Creek Clean Water and Healthy Habitat Program

To improve the water quality within the Mill Creek riverine system so that portions can support water contact recreation and aquatic life and to restore habitat for plants and animals.

Mill Creek Fingers of Green Program

To establish a network of greenway trails for recreation and transportation throughout the watershed.

Greenbacks from Greenways

To create new jobs and business opportunities through collaborative efforts between public and private sectors working to restore and enhance the Mill Creek watershed.



Mill Creek Greenways Trust

To establish a dedicated source of funding that supports development and maintenance activities defined within this Plan.

Brownfields to Greenways

To remediate and recycle brownfield sites into economically viable greenways and/or redevelop the sites to compliment the greenway system.

Early Actions

Early action projects for the Mill Creek Watershed Greenway system seek to resolve issues and problems that are representative throughout the watershed. These projects offer feasible and tangible steps that can be taken to begin improving resources throughout the Mill Creek Watershed. Possible funding sources for these projects include the City of Cincinnati Capital Budget, the State of Ohio Capital Improvement Program Fund, Ohio EPA, Ohio Department of Natural Resources, U.S. EPA, and numerous other local governments, businesses and private-sector foundations. Each of these pilot projects is recommended to be completed by the close of calendar year 2003.

City of Cincinnati Capital Budget Projects

- Caldwell and Seymour Parks Greenway
- Silver Oak Estates Park, Winton Hills
- Salway Park/Mitchell Avenue Greenway Trail & Queen City Centre Park
- Salway Park to Queen City Avenue/Western Hills Viaduct: Greenway Walking Trail
- North Fairmount Community Center (NFCC) Research and Training Greenway
- Mill Creek/Ohio River Confluence Park and Greenway Trail to Downtown

Other Early Action Projects Located Within Hamilton County

- West Fork Mill Creek Greenway
- Mill Creek Walking Trail
- Reading Greenway
- Greenway/Quiet Park, Reading

Greenway Projects Proposed in Butler County

- Union Centre East Greenway
- Mill Creek Headwaters Preserve Park
- Reserves Park, Liberty Township
- Butler County Regional Highway Trails Network
- Connection of Butler County Regional Highway Trail to Union Centre Boulevard
- East Fork Mill Creek Stream Restoration Greenway

What are the Next Steps for the Plan?

In order to begin implementing the master plan, it is recommended that during the next six months (January to June 1999) the Mill Creek Restoration Project (MCRP) and Mill Creek Watershed Council (MCWC) publish and distribute this report, associated maps and executive summary brochure to interested organizations, businesses and individuals. MCRP will make presentations of the completed plan to any organization, group, business or agency that makes a request. MCRP will also develop a greenway web page to post up-to-date information regarding implementation progress.



Figure 4: Greenway trails are already in existence in selected areas of the watershed. This trail system extends throughout much of the Sharon Woods Park in northeastern Hamilton County.

MCRP will continue to identify public and private sector partners who can assist in the implementation of the Plan. Pilot projects identified in the Plan will be implemented as development strategies are completed, funding secured and partnerships defined. First year projects include the North Fairmount Greenway Project, the Caldwell/Seymour Parks Greenway, Reading's Voorheestown Greenway and Greenway Quiet Park, the East For and West Fork Mill Creek Greenways, the proposed Union Centre East Greenway, the Mill Creek Walking Trail, and the Liberty Township Reserve Park in Butler County. Finally, the former Mill Creek Watershed Council Greenway Committee should reconstitute as an advisory committee to MCRP, and assist with the implementation of the plan.

By the close of calendar year 1999, MCRP and the Watershed Council should begin to solicit specific endorsements and adoptions of the Plan from local governments throughout the watershed. As an official element of a local government plan, the recommended policies, programs and actions will be easier to implement. Adoption of the plan will also enable local governments to obtain funding from state and federal agencies in support of implementing plan recommendations.

During calendar year 2000, it is hoped that at least fifty (50) percent of the jurisdictions throughout the watershed would have adopted or endorsed the Plan. MCRP will also have established the Greenway Trust Fund. Finally, all other identified pilot greenway projects will be well underway, with some completed projects.

This is a rather ambitious program of action, and it will take the concerted efforts of many organizations, agencies and businesses to complete. MCRP and its partners invite you and your organization to support the Greenway Program.

How Can I Get Involved?

You and your organization can be a part of the implementation of this master plan. First, we encourage you to contact the Mill Creek Restoration Project (MCRP) at 861-7666 to register your support for the Greenway project. Second, volunteer opportunities abound for local residents, businesses, community groups, and organizations who want to make the Greenway project a reality. Contact MCRP to determine the most appropriate volunteer activity for your organization. These activities can range from stream cleanups, to planting trees and shrubs, to building trails. Third, if you are a landowner along the Mill Creek or one of its tributaries, there are several things you can do in support of the Greenway project, including sponsoring private initiatives to "green-up" your property adjacent to the stream channel, coordinating cleanup of the stream channel with MCRP or other local agencies, or supporting one of the other specific initiatives defined in the plan. MCRP and its partners can help you achieve any of these actions. Fourth, any resident, organization, business, or agency is encouraged to contribute financially to the implementation of the plan. The Greenways Trust Fund is one financial account that will be created to support maintenance and operation of greenway lands. Additionally, each of the Early Action projects defined in the plan will require financial support from public and private funding sources.

Figure 5: Volunteers have been a primary source of labor for early greenway initiatives. In this photo, local school children plant trees along a section of the Mill Creek.



How This Report is Organized

This report is divided into six (6) chapters with a accompanying appendices:

Chapter One: Defines the need for the greenway plan citing the conclusions of other completed studies, and the work of other organizations throughout the watershed.

Chapter Two: Describes the vision, goals and objectives that were developed by the Mill Creek Watershed Council's Greenway Committee.

Chapter Three: Defines the Watershed Greenway system and its component parts. This chapter includes a GIS map of the entire watershed greenway system.

Chapter Four: Describes the programs, policies and actions that comprise the key recommendations of the Master Plan. This chapter also contains a listing of the Early Action Projects, along with a budget for each project and a listing of potential project partners.

Chapter Five: Provides the specifications for signage that will help create a unique identity for the Mill Creek Greenway System.

Chapter Six: Provides a glimpse of the future greenway system through the eyes of an imaginary family living in the Mill Creek Watershed.

Appendices: The appendices contain a significant amount of data that supports the findings and recommendations in the first four chapters. Appendix A provides a more detailed description of the existing conditions found throughout the watershed. Appendix B defines the benefits typically associated with the development of community-based greenway programs. Appendix C offers a comprehensive set of design guidelines for implementing the recommended actions within Chapter 4. Appendix D describes typical costs for greenway facility development and management. Appendix E provides a listing of potential sources of funding that have been used to support greenway facility development. Appendix F describes maintenance and management criteria for a multi-objective greenway system. Appendix G offers a glossary of terms that have been frequently used throughout this report.



1. NEED FOR A GREENWAY PLAN

The Mill Creek Watershed, 166 square miles in size, has for two hundred years been at the center of industry in the Greater Cincinnati metropolitan area. Water dependent industries have historically located on the banks of the river and have prospered from their relationship with the Mill Creek. Transportation systems including railroads and interstate highways wind their way north and south through the flat and broad landscapes of the Mill Creek valley. Towns and communities have grown along the banks of Mill Creek, in response to industrial development. Today, the Mill Creek watershed is home to thirty-seven political jurisdictions (see Map in Chapter 3). Two hundred years of human development and encroachment have taken their toll on the resources of the Mill Creek. Historically, many factors have contributed to Mill Creek's decline as a water resource, including: sanitary sewage from combined sewer overflows, polluted stormwater runoff, urban and suburban encroachments in the floodplain, paving of stream channels, removal of vegetation along streambanks, abandoned landfills and industrial sites, and contaminated sediments from industrial discharges prior to the Clean Water Act of 1972. Because of these historic problems, as well as some present day threats, the national group American Rivers designated Mill Creek in 1997 as the "most endangered urban river in North America." (Appendix A contains a more thorough description of existing watershed conditions.)

Short-term, short-sighted solutions to Mill Creek have already proven to cause more harm than good, serving to further debilitate the resource and alienate residents to its possibilities. Today what is needed is a comprehensive solution to the problems of the Mill Creek watershed. In the past five years there has been growing public recognition locally, and nationally, that urban rivers are valuable natural resources, and that reclaiming them can and should be part of regional efforts to develop a sustainable economy and improve the quality of life. This Greenway Master Plan and implementation strategy will be a key component in a comprehensive, watershed approach to solving the problems and seizing the opportunities the Mill Creek watershed presents.

For several years, a consortium of groups has been promoting greenways as a way of conserving natural resources, promoting economic development, and improving the quality of life in communities across the state. This greenway partnership has included the nonprofit river conservation group Rivers Unlimited, The Conservation Fund, the George Gund Foundation, the National Park Service, Ohio Parks and Recreation Association, Ohio Department of Natural Resources, and a number of other recreation and conservation groups and state agencies. This greenway partnership sponsored a statewide conference on greenways in 1998.

Several Ohio communities have been successful in developing greenway programs. The oldest such program is **Cleveland's** "Emerald Necklace" which has been in place since the early 1900's, encompassing approximately 19,000 acres of land, and offering 256 miles of multi-purpose greenway trails. Among the credits attributed to the Emerald Necklace has been the cleanup and restora-



Figure 6: An editorial cartoon depicts a common misperception about the Mill Creek (reprinted with permission).



tion of the Cuyahoga River in the city's industrial developed area. **Toledo** has also begun a community wide greenway initiative, with a focus on the Maumee River and its lakefront property. Two segments of completed greenway exist, the University/Parks Trail and the Wabash Cannonball Trail, both of which have come about through multi-agency partnerships. Other Ohio communities including Dayton, Columbus, Xena and Bowling Green have also undertaken greenway development.

Large metropolitan communities within a day's drive of Cincinnati have embraced the idea of greenways and launched major initiatives to develop segments of a community-wide system. Under the leadership of the Metropolitan Sewer District, **Louisville**, KY, has begun greenway development along both the Ohio River and major tributaries throughout the metro area. The primary focus of this development has been improved floodplain management, water quality protection and public access to outdoor resources. MSD has been assisted in its efforts by the City of Louisville, Jefferson County, the Louisville Chamber of Commerce and local industries. Louisville's Riverfront Park and Greenway system is one of the early successes of this community-wide initiative.

Pittsburgh, PA, began a community-wide greenway initiative as part of an overall revitalization of its downtown. The *Three Rivers Heritage Trail Greenway* extends along the Allegheny, Monongahela and Ohio rivers, and links together Three Rivers Stadium, Roberto Clemente Park and numerous other attractions. Greenway development has been successfully tied to economic development, and an overall improvement in the quality of life. Under the leadership of Governor Tom Ridge, and his state-wide greenway initiative, Pittsburgh will host the *2nd International Greenways Conference* in 1999, which is expected to attract more than 1,000 participants from throughout the world. **Indianapolis**, IN has also launched a community-wide greenway program as part of an economic revitalization of the urban center city. The White River State Park Greenway, known as "Indiana's First Urban Park" is part of a \$750 million economic development and natural resource conservation initiative by Mayor Goldsmith's office. Project partners include the US Army Corps of Engineers, which is assisting the City with the development of the Central Waterfront Park. White River contains some of the city's best cultural and economic attractions, including Victory Field, IMax 3D Theatre, Celebration Plaza, Indianapolis Zoo, the National Institute for Fitness and Sports, and the yet to be completed National Headquarters for the NCAA.

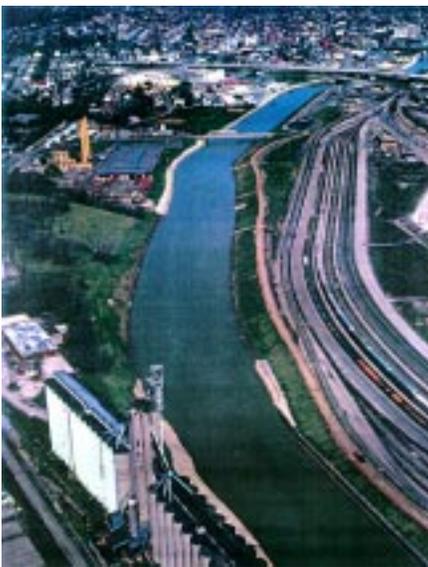


Figure 7: This aerial view shows the part of the lower section of Mill Creek, south of the Northside community. (Photo courtesy of the Mill Creek Watershed Council)

The Anacostia River in metropolitan **Washington, DC**, shares some common characteristics and a similar history with the Mill Creek and provides a useful model for how a degraded urban river can be restored to a community asset. The Anacostia watershed is approximately the same size as Mill Creek's and the river has been impacted in similar ways. A 1990 study by the US Army Corps of Engineers (ACOE) defined the primary causes of ecological degradation of the Anacostia River as: "1) lack of environmental controls during extensive urbanization of the watershed in the twentieth century, and 2) past activities of the Corps of Engineers in flood control, channelization, navigation implementation, debris removal, and aquatic-vegetation control." The Anacostia Watershed Restoration Committee, established in 1987 through an intergovernmental agreement, developed a "Six Point Action Plan to Restore the Anacostia River." The six point plan includes:

- Dramatically reduce pollutant loads from urban areas.
- Protect and restore the ecological integrity of the river.
- Restore the spawning range of anadromous fish to historical limits.
- Increase the natural filtering capacity of the watershed.
- Expand the forest cover throughout the watershed.
- Make the public aware of its role in river cleanup, and increase volunteer participation in restoration activities.

This plan of action for the Anacostia is working. Key partnerships have been established to reduce combined sewer overflows to the river, restore important ecological systems and expand the role of local residents in restoration efforts. Most importantly, a plan has been implemented to respond to issues that impact the quality of life and economic health of the communities in the watershed.

This Greenway Master Plan proposes a seven point plan of action that will improve the ecological balance, better manage stormwater flow and restore water quality. This system of greenway facilities is intended to link suburban areas to the inner-city and residential neighborhoods to schools, parks and places of employment in the watershed through the development of trails for recreation and transportation. The implementation of this plan will eventually lead to an improved quality of life for residents of the watershed, increased property values, and opportunities for new jobs in emerging markets. This plan stresses voluntary participation in these activities and does not infringe on personal rights.

The Mill Creek Watershed Greenway Master Plan will be implemented through a partnership effort among residents of the watershed, local communities, local, state and federal agencies, businesses and industry. The mission of this partnership will be to stop the decline of the resource and transform it into a community asset. This will be accomplished, over time, by implementing long-term, comprehensive strategies for restoration and improvement of the Mill Creek resources.



Figure 8: In Butler County, the Mill Creek is a meandering, cobbled-bed stream. (Photo by Greenways Incorporated)

PREVIOUS EFFORTS

Recent increased awareness of Mill Creek and its problems has spurred the formation of new organizations and planning efforts undertaken to help improve the quality of the Mill Creek Watershed resources. More than 23 independent studies have been conducted for the Mill Creek channel, its tributaries and the watershed. These studies have ranged from water quality surveys to flood damage reduction projects to reports on the biotic integrity of the main channel. All of these reports define the overwhelming problems of the Mill Creek. The need for improvements to this natural resource has in fact been overstated. What has been missing is a plan of action to resolve the problems associated with the Mill Creek. Some of the key studies are summarized below and on the following pages.



Creating a New Vision for the Mill Creek

This 1993 report by the Hamilton County Environmental Action Commission is a result of the Commission's study of the Mill Creek watershed, and recommends an organizational strategy for restoring Mill Creek and its riparian corridor to "reclaim what can be again a valuable natural resource for present and future generations." The strategy consists of three primary recommendations:

- the establishment of an intergovernmental agreement among political jurisdictions in the Mill Creek watershed to commit to restoration of Mill Creek;
- the formation of a "Mill Creek Restoration Committee," composed of local, state and federal agency representatives; and
- the development of a computerized data base or GIS (Geographic Information Systems) and other information and studies that could assist this Committee.

As a result of this strategy, the Mill Creek Watershed Steering Committee was first organized as a forum for sharing ideas and resources. This Steering Committee worked to get 17 jurisdictions to sign an intergovernmental agreement to commit to cleaning up Mill Creek and establishing the permanent Mill Creek Watershed Council (see Mill Creek Organizations). The primary recommendations contained within Creating a New Vision for the Mill Creek have been and continue to be implemented, making it a successful early organizational strategy.



Figure 9: The Mill Creek channel landscape differs significantly from the lower reaches in the City of Cincinnati . . . (Photo by Greenways Incorporated)

Figure 10: . . . to the upper reaches in northern Hamilton and southern Butler Counties. (Photo by Greenways Incorporated)



Mill Creek Watershed Management Plan

This Management Plan was developed by the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) in 1995 to help transform the vision, outlined by the Hamilton County Environmental Action Commission, into reality by providing a comprehensive description of the Mill Creek watershed, an achievable set of goals and a broadly-defined action plan to improve the watershed. However, this plan does not have a detailed implementation strategy, spelling out how goals will be specifically achieved.

The "Mill Creek Watershed Management Plan" does include a section titled "Mill Creek Framework for Action." It consists of six major goals. Each of these goals can be partially met through the implementation of the Mill Creek Watershed Greenway Master Plan:

1. Ensure collaboration among all affected parties, public and private, to effectively combine resources for the improvement of the Mill Creek watershed.
2. Reduce harmful pollutant loads delivered to Mill Creek and its tributaries to measurably improve water quality by 2005.
3. Reduce the impacts of flooding throughout the watershed.
4. Improve and protect the ecological integrity of the Mill Creek and its tributaries to increase the diversity of plants and animals.
5. Make the public aware of the problems of Mill Creek and its potential importance as a natural asset and increase participation in improvement efforts.
6. Make the Mill Creek aesthetically pleasing to residents and visitors alike.

U. S. Army Corps of Engineers (ACOE) Flood Damage Reduction and Public Use Plans

Beginning in the 1970s, the ACOE generated a number of plans for the design and construction of its Mill Creek flood damage reduction project. The ACOE plans called for the use of various channelization methods in different sections of the Mill Creek in Hamilton County to “provide a 100-year level of flood protection” along the Creek, from the Barrier Dam near the Ohio River north to Interstate 275.

In August 1991, the ACOE also completed a “Master Plan for Public Use” that proposed the construction of a paved recreational trail parallel to Mill Creek through most of its seventeen mile length in Hamilton County. This recreational plan was completed just prior to the ACOE’s suspension of its Mill Creek project, due in part to rising project costs and concerns about potential hazardous waste contamination in and along portions of the Creek that ACOE had not channelized. When local stakeholders convinced the ACOE to conduct a comprehensive reevaluation of the entire flood protection project and helped to secure federal funding, the ACOE developed the following plan.

Mill Creek, Ohio Flood Damage Reduction Project—General Reevaluation Report Project Study Plan

The scope of work for the General Reevaluation Report was completed in 1997 by ACOE to identify the tasks, schedule and costs required to perform a General Reevaluation of the Mill Creek, Ohio, Flood Damage Reduction Project. The ACOE was authorized in 1970 to solve the flooding problems along Mill Creek through channelization, culvertization (installing concrete sides and bottom) and other engineering measures. The project was executed in 1975, construction began in 1981 and the project was suspended in 1991 with 43 percent of the project completed. The ACOE is proposing a reevaluation because “although completion of the previously authorized plan is economically feasible, it is believed that a plan that is more feasible and environmentally acceptable can be formulated.”

A listing of alternatives that will be considered for each section of the project is included. These alternatives vary significantly and include constructed wetlands, detention/retention basins, installing levees and pump stations, bioengineering, and landscaping with native vegetation. Work on the General Reevaluation Study was authorized in August 1998 and is scheduled to conclude in April 2000.



Several organizations are currently concerned about resources in the Mill Creek watershed. They serve to represent a diversity of local government, citizen and business interests in the drainage basin. They are cooperatively working towards a management strategy for the Mill Creek that will transform the degraded resource into a community asset. Descriptions of each of these organizations follow:

Millcreek Valley Conservancy District (MVCD)

The Millcreek Valley Conservancy District (MVCD) was created in 1962 by petition of eight floodplain communities, under the authority of the Ohio Conservancy District Act, following the 1959 Mill Creek flood event. MVCD is a political subdivision of the State, established under Ohio Revised Code, Chapter 6101. The purpose of the District is to reduce flood damage in the Mill Creek Valley. The District can provide recreation opportunities in conjunction with water management projects and facilities. The District is the local sponsor for the seven-mile federally funded flood damage reduction project, extending from the Barrier Dam in Lower Price Hill to Interstate 275 in Sharonville. To date, 43 percent of this project has been completed. The remaining portions of the project are under reevaluation by the Army Corps of Engineers (ACOE).

MVCD recently entered into an agreement with ACOE to maintain completed sections of the Mill Creek Project from the Western Hills Viaduct to Center Hill Avenue. The District will assume maintenance responsibility for other sections of the project as they are completed.

Mill Creek Watershed Council (MCWC)

The Mill Creek Watershed Council (MCWC) was formed on June 21, 1995, as representatives from 17 jurisdictions met on the banks of Mill Creek to enter into a partnership to "save the creek and its drainage area." The mission of the Council is "the improvement of the Mill Creek Watershed."

Current members of the Council include the following political jurisdictions:

- Arlington Heights
- Cincinnati
- Elmwood Place
- Forest Park
- Golf Manor
- Liberty Township
- Lockland
- St. Bernard
- Wyoming
- Springfield Township
- Butler County
- Deer Park
- Evendale
- Glendale
- Hamilton County
- Lincoln Heights
- Reading
- Springdale
- Woodlawn
- Union Township

- Fairfield Township
- Sharonville
- Millcreek Valley Conservancy District

The Watershed Council includes some representatives from local, state and federal agencies, businesses and civic groups. MCWC has formed a number of committees that have focused efforts toward flood damage reduction, recreation, water quality, economic development, public awareness and greenways. The Council also has an Executive Committee that oversees its operations.

Mill Creek Restoration Project

The Mill Creek Restoration Project (MCRP) is a private non-profit 501(c)3 charitable organization created in January 1994. The mission of MCRP is to “serve as a catalyst for developing sustainability in the Mill Creek Watershed through community-based planning and empowerment, environmental education, and economically sound ecological restoration.”

MCRP has launched a number of major initiatives aimed at revitalizing the Mill Creek ecosystem and engaging the people who live and work in the watershed, including:

- Creating an interdisciplinary Mill Creek environmental education program for more than 4,000 students and 100 teachers and community volunteers;
- Launching a new pollution prevention initiative, in partnership with the Institute for Advanced Manufacturing Sciences, that includes technical assistance and training and educational services for businesses, civic groups and schools;
- Sponsoring annual community river events, including the first Mill Creek Clean-Up/Green-Up Day in 1996 that involved more than 700 students and community volunteers, and planting 5,000 trees along the creek in April 1998;
- Publishing the book: *The Mill Creek: An Unnatural History of an Urban Stream*, written by MCRP Vice President Stan Hedeem;
- Developing a nonpoint source pollution prevention program, in partnership with the Butler County Soil and Water Conservation District, for training, education and demonstration projects in Hamilton and Butler Counties;
- Serving as a strong advocate for a comprehensive reevaluation of the entire Mill Creek flood damage reduction project and for more environmentally sound maintenance practices in and along Mill Creek;
- Spearheading the greenway planning effort in the Mill Creek watershed.



2. VISION AND GOALS OF THE PLAN

Benefits of a Greenway System

A Greenway System within the Mill Creek Watershed would provide a variety of benefits for the residents of Hamilton and Butler Counties. By establishing riparian buffers a greenway system would improve water quality, protect wetlands and other valuable habitat, help reduce flooding downstream, and buffer adjacent land uses. In addition, greenways typically incorporate trails for recreation and alternative transportation, on-road bicycle and pedestrian facilities, passive and active park facilities, and other types of open space. As recreational amenities, greenways increase the value of adjacent private properties, attract businesses to the area, and promote tourism in the region. Further information about the benefits of greenways can be found in Appendix B.

VISION STATEMENT

Keeping the potential benefits of greenways in mind, the Greenway Committee of the Mill Creek Watershed Council developed the following vision statement for the Mill Creek Watershed:

The vision of the Mill Creek Watershed is a healthy ecological system of hills, valleys, and stream corridors that serve to enrich the lives of residents in both Hamilton and Butler Counties. The Mill Creek Watershed Greenway System will improve floodplain management and water quality within the primary and tributary channels of Mill Creek and will contribute to the economic well-being of the Greater Cincinnati metropolitan region.

This vision will be realized through the adoption and implementation of the following project goals. Some of these goals are repetitive and may appear under several categories. Many initiatives are already underway and offer opportunities for volunteers to become involved immediately in working toward the long-term greenway vision.

Environmental Goal

- Restore riparian corridor habitat throughout the watershed to improve flora and fauna species diversity and number;
- Clean up toxic areas and hazardous waste to prevent adverse health effects on people and wildlife;
- Encourage biodiversity through removal of invasive exotic species and reintroduction of native species and natural communities;
- Maximize wildlife habitat in a manner that is consistent with community infrastructure and development needs;
- Promote pollution prevention strategies to be adopted by businesses, institutions and individuals within the watershed;
- Encourage environmental responsibility and stewardship of natural resources

Figure 11: A scenic view of the headwaters section of Mill Creek. (Photo courtesy of Butler Soil & Water Conservation District)



among all sectors of the watershed;

- Promote air quality improvements in the region by providing facilities for alternative forms of transportation;
- Develop environmentally friendly greenways through the use of recycled materials, native vegetation and soil bioengineering techniques.



Figure 12: Eroding stream banks diminish water quality and the carrying capacity of the stream channel. (Photo by FMSM)

Water Quality Goal

- Ensure/encourage compliance with, and enforcement of existing local, state and federal water quality regulations;
- Provide vegetated buffers and wetlands to treat and prevent nonpoint source pollution;
- Utilize best management practices to slow runoff and pollutant loading on streams;
- Expand local volunteer water quality monitoring and educational programs;
- Educate local residents as to the importance of streamside vegetated buffers and other best management practices;
- Improve water quality in surface and groundwater supplies within the watershed to enhance human recreational use and fish and wildlife habitat;
- Work with agencies to reduce contamination from combined sewer overflows (CSOs) as quickly as possible.

Economic Goal

- Implement a watershed-wide greenway strategy that encourages sustainable economic development and does not serve as a barrier to growth;
- Contribute to the economic well-being of the community by providing employment opportunities for watershed residents;
- Increase residential, commercial and industrial property values, and the local tax base, through the development of the greenway system; and define, quantify and promote these economic benefits;
- Work to coordinate greenway development with efforts to redevelop abandoned industrial sites (brownfields);
- Promote tourism by connecting historic/cultural sites along the greenway;
- Help to reestablish the Mill Creek Valley as a center for economic and community activity.

Recreation Goal

- Return Mill Creek to an attractive destination for local residents and visitors.
- Develop passive recreation facilities along greenway lands close to where residents live, work and play.
- Construct a comprehensive system of trails on publicly owned or leased properties.
- Promote improved water quality to provide for the recreational use of waterways within the watershed, including fishing, canoeing and swimming;
- Link historic and significant natural sites throughout the watershed with the greenway system;
- Improve water and air quality within the watershed to benefit public health;
- Regularly inform and educate watershed businesses, municipalities and residents as to the level of contamination and efforts to reduce pollution in Mill Creek and its tributaries;
- Work with agencies to improve water quality so Mill Creek is designated as safe for human contact.
- Promote safety and security as key elements of the new recreational greenway system.

Public Participation Goal

- Include all watershed communities (upper and lower reaches) and all sectors in the planning and creation of the greenway system;
- Implement a community-based planning strategy that enables local residents and the business community to be involved with the decision making process;
- Involve the youth of the community in the planning process;
- Promote the long-term involvement of local residents, property owners and businesses in the implementation of the Greenway Master Plan.
- Involve low income and minority populations in Master Plan implementation to help promote environmental justice.

Maintenance/Stewardship Goal

- Develop greenways in a way that will minimize maintenance requirements;
- Provide assistance to individual communities (through the MCWC);
- Develop a plan to ensure short and long-term maintenance of the system, recruiting individuals and groups throughout the watershed to adopt portions of the greenway system;
- Implement strategies for public/private partnerships to ensure the long-term maintenance and management of the stream corridor greenway system.
- Develop and maintain long-term relationships with residents, property owners and businesses within the watershed;
- Implement strategies to minimize future encroachments in the greenway system.
- Work to secure dependable long-term funding and endowments to provide for responsible maintenance and management of the future greenway system.

Quality of Life Goal

- Improve the quality of life for all who live, work or play in the watershed by reforesting portions of the watershed;
- Improve the physical character of the stream corridors, making them assets for local neighborhoods and businesses;
- Provide physical improvements that link neighborhoods and businesses to stream corridors;
- Integrate the greenways system concept with other unique assets of the region, including existing park and recreation facilities, cultural and historic sites, and ongoing civic and educational activities;
- Return Mill Creek to a more beneficial and positive aspect of the community.
- Promote the development of vegetated buffers for community beautification and community gardening projects;
- Promote volunteerism and community involvement throughout Master Plan implementation.

Transportation Goals

- Provide a trails system connecting community resources within the watershed system;
- Encourage local employers to make the greenway accessible to adjacent businesses.
- Develop an efficient alternative transportation system within the watershed by including bicycle and pedestrian facilities in the greenway system;
- Take advantage of opportunities to incorporate bicycle and pedestrian transportation enhancements;
- Promote safety and security as elements of an alternative transportation system



Figure 13: On the West Fork of the Mill Creek, this covered bridge is a reminder of the history that is an important part of the legacy of the Mill Creek. (Photo by Greenways Incorporated)

within the watershed;

- Develop an efficient intermodal transportation system through linking bicycle and pedestrian facilities with other modes of transportation (bus, light rail, airplane, ferry) in the region;
- Convert human-made corridors, including abandoned railroads, utility rights-of-way and canals, into multi-use trails;
- Promote the development of a continuous trail system through linking existing trails and building new ones;
- Promote the connection of Mill Creek greenways to the Buckeye Trail, American Discovery Trail, Ohio River Heritage Trail, Ohio to Erie Trail (Cincinnati to Cleveland) and the Toledo-Cincinnati Trail.



Figure 14: Flooding is a problem throughout the Greater Cincinnati metro area. This photo is of the March 1997 flood along the Ohio River. The mouth of the Mill Creek is in the lower left corner . (Photo by FMSM)

Safety/Public Health Goals

- Protect the public health, welfare and safety of greenway users;
- Respect the privacy of adjacent landowners;
- Reduce the liability of landowners who voluntarily participate in the greenways program;
- Promote safety and security through comprehensive education;
- Improve water and air quality within the watershed to benefit public health;
- Regularly educate watershed businesses, municipalities and residents as to the level of contamination in Mill Creek and its tributaries;
- Work with agencies to improve water quality so Mill Creek is designated as safe for human contact.

Environmental Education Goals

- Create and enhance opportunities for environmental education to occur throughout the watershed;
- Encourage education-based projects, experiments, monitoring programs and other activities;
- Work with local school systems to provide and utilize outdoor classroom settings for biology, zoology and geology classes;
- Develop curricula that teach students about the Mill Creek watershed and encourage them to become involved in its improvement;
- Educate local residents, governments and industries as to the importance of streamside vegetated buffers;
- Increase public awareness of the watershed and educate communities on what they can do to improve current conditions;
- Provide the public and the media with updates on the implementation of the Master Plan;
- Provide opportunities for interpretation of historic, natural and cultural resources along the greenway system.
- Provide areas where environmental education can occur throughout the Watershed.

Creation of the multi-objective greenway system will contribute to the achievement of the following longer-term but integrally related goals. Likewise, successful pursuit of the next two goals will enhance and support greenway implementation.

Stormwater/Flood Damage Reduction Goal

- Develop, in coordination with the Army Corps of Engineers and multiple jurisdictions, a long-term solution to large water flows through Mill Creek;
- Increase soil perviousness (allowing rainfall to percolate through the soil) and reforestation throughout the watershed;
- Reduce the volume and velocity of stormwater impacting Mill Creek watershed streams, and thus reduce flood damage, through greenway implementation;
- Promote watershed-wide, environmentally friendly flood damage reduction alternatives in the Corps of Engineers' Reevaluation study;
- Promote the greenways system as part of the solution to a comprehensive stormwater/flood damage reduction strategy;
- Implement a stormwater/flood damage reduction strategy that will serve as a national model for urban watershed planning.

Land Use Planning/Floodplain Management Goal

- Provide for reuse of floodplain lands through clean up and ecological improvement of waterways and adjacent lands, greenway development, and a reduction in point and nonpoint source pollution;
- Encourage the voluntary removal of repetitive flood loss properties and reuse of these lands as open, park and recreational landscapes;
- Promote land use, zoning and floodplain management practices that support creation and long-term maintenance of the greenway system and help to protect sensitive natural resources;
- Support development that incorporates on-site stormwater management;
- Update FEMA floodplain maps for Mill Creek and its tributaries;
- Encourage land use and zoning regulations that protect natural resources and promote the development of an integrated greenway system.
- Promote the connection of the Mill Creek greenway system to the Buckeye Trail, American Discovery Trail, Ohio River Heritage Trail, Ohio to Erie Trail (Cincinnati to Cleveland) and the Toledo-Cincinnati Trail.



3. WATERSHED GREENWAY SYSTEM

The Mill Creek Watershed Greenway System represents the joining of ideas and philosophies with on-the-ground realities and actions. The primary goal of the Greenway System is to improve the environment of Mill Creek and its tributaries, and transform what has heretofore been thought of as a liability into a community asset. In years to come, Mill Creek, its tributaries and the entire watershed will become a more valuable resource for the citizens of Greater Cincinnati through the implementation of this Master Plan.

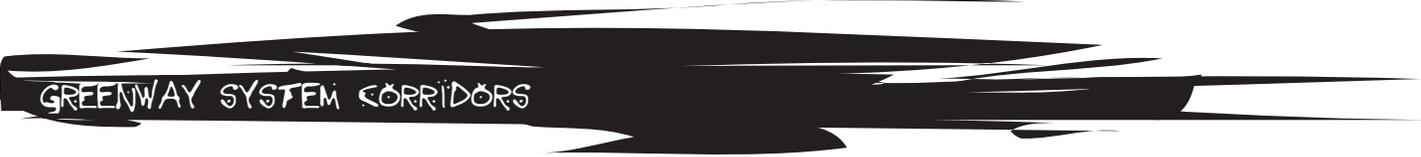
To accomplish this a number of challenges must be overcome and a number of exciting opportunities must be seized. One of the first steps that must be undertaken is a completely new understanding of the way that this urban river system functions, and a program of restoring natural ecosystems that in the long run lessen negative impacts on the community. Restoration of the riverine system must begin with the watershed, not the stream channels. Understanding the functions and activities (both natural and human) occurring within the watershed will be an integral part of the restoration of Mill Creek. A number of factors within this watershed, occurring in tandem, influence the behavior of Mill Creek, including the size of the drainage area, local climate, land use, stormwater management, soils, topography, encroachment on the stream channel and amount of impervious surfaces in the watershed. Restoration must occur not only immediately adjacent to Mill Creek, but throughout the entire watershed.

Implementing the proposed Greenway System will require the establishment of unique partnerships between the public and private sectors in Hamilton and Butler Counties. These partnerships must be capable of resolving complex problems within the watershed. As a matter of policy, participation in the greenway program shall be **voluntary**. No individual, business or organization is required to participate in the recommended actions of this Plan. However, the key to success of this plan will be a broad participation by many people throughout the metropolitan community.

The recommendations in this plan cannot be achieved by a single agency or organization. It will require multiple agencies, organizations and businesses working together to first reduce and prevent any further adverse impacts to the Mill Creek riverine system, and then to begin a process of restoration, mitigation and remediation. It may be necessary longer-term to implement new land use, stormwater and floodplain management programs that establish a "new way of doing business" in the watershed. These future programs should be developed with the active participation of all sectors in the watershed so that they will be broadly supported by watershed residents and businesses. It would be useful to pool resources and funds throughout the watershed, through partnerships, in such a manner as to produce cost-efficient changes to the physical character of the riverine system.

Under this multi-jurisdictional and multi-objective program, the Greenway System cannot be represented by a singular image or focus. The system is not

just a trail, nor a restored stream channel, nor a vegetated buffer. Instead, it should be defined by a series of images, programs and pursuits. The Greenway System will be defined by different people in different ways. This, in time, will become the strength of the system. This multi-faceted approach offers the future potential for the Mill Creek Watershed to become a landscape capable of supporting a strong economy and a healthy environment well into the 21st Century.



GREENWAY SYSTEM CORRIDORS

Historically, greenway implementation has been tied to the management of floodplain landscapes and stream corridors. Greenway programs throughout the United States share this common legacy. The Mill Creek Watershed Greenway System will include the primary and secondary stream corridors, supplemented by parks, open spaces, utility corridors and roadway corridors to form an interconnected system of “multi-objective corridors” throughout the watershed (Please refer to Maps 1 and 3 in this section). The focus of these multi-objective corridors will be to reduce economic losses associated with flooding of public and private properties, clean up the water in the main channel and tributaries, implement a system of trails for transportation and recreation, and promote a program of environmental and cultural education. A total of 14 stream corridors are proposed to be part of the multi-objective greenway system. *Please note that all or parts of Lick Run, Clearwater Creek, Ross Run, and Bloody Run are no longer visible, since they were piped underground many years ago.*

Primary Stream Corridors

Primary stream corridors are defined as second and third order streams with watersheds of at least 9 square miles. The primary stream corridors include:

Mill Creek	East Fork Mill Creek
West Fork Mill Creek	Sharon Creek
West Fork Creek	

Secondary Stream Corridors

Secondary stream corridors are defined as:

Town Run	Cooper Creek
Bloody Run	Ross Run
Lick Run	Clearwater Creek
Amberley Creek	Congress Run
Beaver Run	

Other Corridors

Aside from stream corridors, other human-made corridors could be developed as greenways in order to provide transportation, recreation, economic and environmental benefits. These include abandoned (or, in some cases, active) railroad corridors and utility corridors within the Mill Creek watershed. Such corridors should connect to the primary and secondary greenway corridors listed above. These

corridors (as well as stream corridors) could serve as passageways for wildlife by linking essential habitat located within parks, nature preserves, undeveloped land, and pockets of urban wilderness. A significant example of a potential greenway corridor along a utility easement is the land linked by the CG&E power lines entering the watershed from the west and connecting city wilderness to the Mill Creek near Caldwell Nature Center. The easement along the power lines unnaturally creates a natural passageway of periodically cleared land surrounded by wooded hillsides. Coincidentally, this provides habitat similar to the historically specific habitat of woodland spotted with pocket prairies, supporting an uncommon diversity of wildlife.

GREENWAY FACILITY DEVELOPMENT

A greenway trails system is proposed throughout the watershed to link neighborhoods and businesses to nearby community assets. It is recommended that facility development and use of greenway corridors be defined to reflect goals for floodplain management, water quality, transportation, recreation and education. Under this philosophy, the level of facility development and use for a greenway corridor will vary significantly. Some greenway corridors will contain paved trails, while others will contain unpaved trails, or no trails. Some greenway facilities will need to be developed on existing roadways in order to avoid conflicts with private businesses or residential properties, and to provide for continuous bicycling and walking routes. Differing levels of facility development and use, as categorized below, should be assigned to specific corridors based on more detailed studies of each corridor and further community involvement.

This master plan defines design guidelines that should be used in the future development of each greenway corridor throughout the watershed. They can be found in Appendix C.

Type 1: No facility development

This designation would apply to corridors containing: environmentally sensitive areas, steep slopes, wetlands or other constraints that make a greenway facility undesirable or impossible. The corridor would remain primarily in a natural state as human access would be extremely limited. Other functions for these corridors would include floodplain management, water quality protection and conservation of important habitat for wildlife and plants.

Type 2: Limited development, low impact uses

This designation would apply to greenway corridors containing environmentally sensitive features that limit the extent of greenway facility development. The corridor would remain primarily in a natural state, with boardwalk, gravel or dirt/woodchip trails (4 to 6 feet wide) for use by low-impact user groups, such as hikers. Trail head facilities and other amenities (such as signage and picnic tables) would be limited.

Type 3: Multi-use unpaved trail development

This designation would apply to greenway corridors where the adjacent natural areas, rural landscapes or historic sites dictate a more natural facility



Figure 11: A natural stream that contains no facility development.



Figure 12: A typical boardwalk through an environmentally sensitive landscape.



Figure 13: An unpaved trail through a wooded landscape.



Figure 14: A concrete trail that has been developed within a stream channel.



Figure 15: An on-road bike lane through an urban area.



Figure 16: A water-based trail.

development objective, corridors located outside of areas that experience frequent flooding, or greenways where use is anticipated to be lower than in other areas and primarily recreational. The unpaved trails could be surfaced with pit gravel or crushed stone (10 to 12 feet wide) for use by several user groups, such as bicyclists, walkers and joggers. Wheelchair users and persons with strollers can use unpaved trails if they are designed to ADA standards and surfaced with compacted crushed stone. Trail head facilities and other amenities (such as benches, signage and picnic tables) would be developed as needed where appropriate.

Type 4: Multi-use paved trail development

This designation would apply to corridors where high use is anticipated; greenways that do not contain environmentally sensitive areas; corridors that will most likely be used as transportation routes; greenways located within frequently flooded areas; or those located in urban settings. The paved trails could be surfaced with asphalt or concrete (10 to 12 feet wide) for use by several user groups, including bicyclists, joggers, wheelchair users and rollerbladers. Although asphalt is the most common paved surface used for greenway trails, concrete is best for areas experiencing frequent flooding. Trail head facilities and other amenities (such as lights, benches, and signage) would be developed as needed and where appropriate.

Type 5: On-road (sidewalks and bikeways)

This designation would apply to corridors in urban areas where an off-road option is not possible, or corridors that function as connections between off-road trails and major origins and destinations. On-road greenways would consist of sidewalks for pedestrian use and bikeways for cyclists. Bikeways can vary from 6-foot wide bicycle lanes (complete with pavement striping and signage) to 4-foot wide paved roadway shoulders to a 14-foot wide curb lane (to be shared by cyclists and motorists). Pedestrian-scale lighting, street trees, benches and other amenities could be developed to encourage sidewalk use.

Type 6: Water Based Trails

This designation applies to those rivers and streams that can successfully accommodate and/or which are designated to support canoeing, kayaking and boating. Water based trails can be designed with features and facilities that make this activity more enjoyable for residents, including signage systems, improved rapids and safety systems.

Greenway System Map

The extent of the greenway system is depicted on the Greenway System Map (see Map 3). The map illustrates the primary and secondary corridors proposed for the greenway system. The location of specific greenway facilities is not depicted on the map due to the specific nature of facility development. The designation of trail corridors will be accomplished on a case-by-case basis during the implementation of this master plan. Further, Appendix C offers design guidelines for the restoration and mitigation of streams, as well as the development of off-road and on-road trail facilities.

4. ACTION PLAN

The Mill Creek Watershed Greenway Master Plan is an ambitious and progressive initiative that will require the concerted efforts of local government agencies, private sector organizations, park boards and political jurisdictions, business and industry, civic groups, and community residents. These groups, organizations and agencies ultimately must take action if the Mill Creek is to become the valuable community asset that this Plan envisions. State and federal agencies should provide funding and programs to support local efforts to improve the short-term and long-term environmental and economic health of the watershed.

This chapter of the Plan defines some of the most important actions that will need to be undertaken to achieve a watershed-wide, multi-objective greenway system. The chapter is divided into several sections. The first section offers broad, interrelated recommendations and actions that should be implemented by an array of public and private sector partners. The second section defines an implementation strategy for the master plan and suggests the establishment of a lead organization, the Mill Creek Restoration Project, that can champion and facilitate the recommendations of this Plan. The third section delineates “early action projects” that will demonstrate how to establish multi-objective greenway projects throughout the watershed. The fourth section describes costs that would be associated with some of the early action projects. The final section outlines some practical “next steps” for implementing this plan.

If the recommendations of this chapter are followed, positive changes will occur throughout the Mill Creek watershed. Localized and watershed-wide flooding will be mitigated; erosion and sediment that clogs the riverine system will be minimized; access to outdoor resources will be improved; greater transportation choice will be offered; green landscapes will emerge from brownfields; wildlife will flourish along the banks of the creeks and streams; cleaner water will flow within the banks of the Mill Creek from Butler County to the Ohio River; and the Mill Creek will become an emerald ribbon weaving its way through the heart of Cincinnati’s prosperous Mill Creek valley.

MILL CREEK GREENWAY INITIATIVES

This section outlines a broad set of interrelated programs that will support implementation of the greenway system throughout the watershed. Likewise, successful greenway development will contribute to the achievement of the following recommended programs that embody the vision, goals and objectives defined within this Plan.

Mill Creek Flood Damage Reduction Program

Objective: To reduce the economic losses, and impacts on private properties and the lives of residents associated with flooding, and to support greenway creation, through a comprehensive flood management program for the Mill Creek riverine system.

Short-Term Recommendations:

1. Work with the US Army Corps of Engineers (ACOE), Louisville District, to complete the General Reevaluation Report for Mill Creek. The focus of the study should be on progressive and comprehensive floodplain management strategies. The study should examine alternatives outside of main channel modification, such as upstream retention, relocating repetitive flood loss properties, developing greenways, and restoring natural ecosystems to reduce the magnitude of flooding. The ACOE and its partners should utilize the recommendations and results of other ACOE projects in Napa, California; Grand Forks, North Dakota; Sacramento, California; St. Louis, Missouri; and other communities which incorporate these and other state-of-the-art floodplain management strategies.

2. Beginning in 1999, MCWC, MCRP, local governments, and other stakeholders should explore the benefits of becoming part of Project Impact. The Federal Emergency Management Agency (FEMA) has defined Project Impact as a disaster preparedness program that seeks to involve public and private sector groups in efforts aimed at reducing the impact that natural disasters have on local communities. MCWC and local governments should work with ACOE and FEMA to define strategies necessary to become a qualified community. Specifically this would include developing a progressive public-private partnership to address lands that are subject to flooding and establishing a flood preparedness program. As a Project Impact community, the Mill Creek watershed may become eligible for additional federal assistance to alleviate some of the problems associated with frequent flooding.

3. The MCWC should work with MVCD and local governments to develop an ongoing program to remove large woody debris dams and trash from the channel of Mill Creek and its major tributaries that can cause or increase localized flooding. The Village of Evendale and City of Sharonville have already taken such steps and may serve as a resource for advising other communities.

4. Local governments, MCWC, MCRP and other stakeholders should work with ACOE, Ohio Department of Natural Resources, and FEMA to update all FEMA Flood Insurance Rate Maps. The updated maps should project fully developed conditions in the watershed in order to better understand and reduce flooding problems today and in future years.

Floodplain and Stormwater/Wet Weather Management Program

Objective: To develop the greenway system as an integral component of a future watershed-based floodplain and wet weather management program that reduces flood damages and effectively addresses both water quantity and water quality problems.

Short-Term Recommendation:

Beginning in 1999, MCRP and MCWC should work cooperatively with political jurisdictions, businesses, property owners, Ohio EPA, and other key stakeholder

groups to develop a model comprehensive floodplain and stormwater management program for the watershed and to achieve consensus on it and commitment to implement it. This approach should include both point and nonpoint sources and significant incentives (including regulatory flexibility for stormwater permittees) to encourage participation. This effort should be coordinated with the ACOE, MVCD, Ohio EPA, Butler County Stormwater Committee, and the Wet Weather Initiative for all of Hamilton County. The Hamilton County Environmental Priorities Project recommended the wet weather program in fall 1998 and the county-wide initiative is being spearheaded by the Hamilton County Soil and Water Conservation District.

Longer-Term Recommendation:

This watershed approach to floodplain and wet weather/stormwater management should result in the development and implementation of an action strategy that may include, but not be limited to:

- Assessment of major sources of wet weather impacts and their relative impact on water quantity and quality.
- Reduction of impervious surfaces (e.g., use of cluster development, greenways, porous pavement materials and potential watershed-based zoning, described in the next program description).
- Utilization of Best Management Practices (BMPs) to reduce erosion, sediment and stormwater impacts from new public and private construction sites and to retrofit already developed areas to improve stream hydrology and water quality.
- Development of regional, watershed-wide BMPs including stormwater pollutant reduction trading and regional reserved open space and stormwater retention and detention facilities.
- Creation of greenways and forested buffers in riparian corridors of watershed streams to slow down and absorb stormwater and filter contaminants carried by stormwater.

Mill Creek Clean Water/Healthy Habitat Program

Objective: To improve the water quality within the Mill Creek riverine system so that portions can support water contact recreation and aquatic life and to restore and improve riverine-riparian habitat for plants and animals.

Short-Term Recommendations:

1. MCRP, MCWC, health departments, and other stakeholders should work cooperatively with the Cincinnati-Hamilton County Metropolitan Sewer District (MSD), the Hamilton County Commission, and MSD's Policy Advisory Committee to develop and implement a more aggressive and accelerated program to eliminate and reduce combined sewer overflows (CSOs). The CSOs release untreated or undertreated sewage to Mill Creek and its tributaries and are an ongoing source of pathogens and other pollutants. Funding for a more accelerated remediation program and for specific demonstration projects should be pursued, including U. S. EPA and Ohio EPA grant and loan programs and potential sewer rate increases. Stakeholder groups should assist MSD in these endeavors.

2. MCRP, MCWC, and other stakeholders should coordinate local water quality and habitat improvement programs with Ohio EPA's Total Maximum Daily Load (TMDL) study that will commence in early 1999. The TMDL will identify all sources of pollution (point and nonpoint), the maximum amount of pollutants of concern that may be allowed to enter Mill Creek and still allow it to meet water quality standards, and the strategies needed for Mill Creek to achieve water quality standards in the future.

Longer-Term Recommendations:

3. Encourage communities within the watershed to adopt a vegetated buffer program to protect publicly-owned stream channels and streamside vegetation and to provide incentives for private property owners to establish these buffers or greenways. The program should include conservation and restoration strategies. Soil bioengineering should be promoted to restore buffers removed or destroyed by urbanization. A three-tiered approach may be recommended for all stream buffers that would include the designation and protection of a streamside zone, a greenway facility zone, and a buffer zone.

4. In developing greenway projects, sponsors should address, or request assistance in addressing, a number of ecological issues, including monitoring and repairing streambank erosion using soil bioengineering techniques; reintroducing native species, removing invasive exotic species, and monitoring riparian vegetation; monitoring stream bed scour and sediment deposition; monitoring stream flows; conducting pre- and post-greenway development water chemistry and biological monitoring; and evaluating the ecological condition of the greenway development site.

5. As part of the Floodplain and Wet Weather Management Program described above, local governments should explore, with key stakeholders, whether watershed-based zoning in Hamilton and Butler Counties that utilizes impervious cover, rather than population density, could provide a more appropriate measure of growth impact to streams. Watershed-based zoning may provide more effective stream protection strategies than conventional zoning techniques by classifying headwater urban streams as sensitive, degrading, or non-supporting and assigning various stream protection strategies to each specific classification.

6. Local government agencies, park boards, universities, and others should complete the Rosgen stream assessment of all perennial streams within the Mill Creek watershed, and complete aquatic, semi-aquatic and riparian plant and wildlife inventories. Information collected during field investigations should be placed into the CAGIS computer data base, as discussed earlier in this plan, to be used to assist in future ecological restoration work.

7. The Mill Creek Watershed Council should work with MSD, Cincinnati Health Department and Hamilton County General Health District, to provide timely testing for fecal coliforms and other indicators of pathogens. Public advisories should be issued to identify when and where secondary recreational contact with Mill Creek waters is safe for the general public.

Mill Creek Fingers of Green Program

Objective: Establish a network of greenway parks and trails for recreation and transportation throughout the watershed.

Short-Term Recommendations:

1. Local governments and organizations throughout the watershed who have an interest in building greenway facilities should adopt the guidelines and standards presented in this Master Plan for all future development.

2. Project sponsors should develop the pilot projects defined in this Master Plan to demonstrate the effectiveness of a multi-objective greenway strategy.



3. MCRP and the Mill Creek Watershed Council should develop public/private partnerships to sponsor more Mill Creek cleanups.

Longer-Term Recommendations:

4. Project sponsors and local governments should develop an on-road and off-road trails network based on the guidelines of this Plan to connect citizens to watershed resources.

5. MCRP, MCWC and local governments should develop reforestation programs for publicly-owned properties and develop incentives for land owners and land developers to retain existing trees and reforest open spaces.

6. Project sponsors and local governments should link the Mill Creek Greenway with a Green Alleys program. Green Alleys are corridors within existing or proposed urban areas that incorporate native tree plantings, water quality best management practices, and environmentally sustainable building products, which are connected to the Mill Creek Greenway.

7. When water quality becomes safe for secondary recreational contact in different places in the watershed, the Mill Creek Watershed Council, the Mill Creek Restoration Project, and other greenway partners should identify sites for canoe and kayak landings on public property and develop designs for landings where they are most needed.

Greenbacks from Greenways

Objective: Create new jobs and business opportunities through collaborative efforts between public and private sectors working to create greenways and restore and enhance the Mill Creek watershed.

Short- and Longer-Term Recommendation:

1. Local governments, MCRP, and other organizations that will implement greenway development strategies contained in this Plan should work cooperatively to develop job training and employment programs for watershed residents within public sector agencies such as the Cincinnati Park Department, Recreation Commission and Public Works Department; MSD; Millcreek Valley Conservancy District, and the Hamilton County Park District. Training and employment opportunities could include site preparation, stream restoration projects, trail construction, and greenway facility maintenance. Neighborhoods and communities located closest to greenway projects should be especially targeted for these training and employment opportunities.

Longer-Term Recommendations:

2. Local Chambers of Commerce and economic development agencies should support a "start-up" business program for new companies or for existing businesses that want to expand to focus on clean up and restoration of Mill Creek. A venture capital program could be established to provide seed money for these new companies that would enable them to begin and sustain operations. For example, a local company already reusing and recycling materials in its production process could expand its operations to include fabrication of greenway furnishings (fences, sign posts, benches) from materials collected in and around the watershed.

3. Local governments within the watershed should develop an incentive program for businesses that choose to develop greenways on their property. These

incentive programs could include local tax abatements, tax credits or waiver of local government fees. The purpose is to encourage businesses to remain in the Mill Creek watershed and to participate in greenway-based programs that protect watershed resources.

4. MCRP and other greenway sponsors should work with business representatives to develop incentives to promote business participation in greenway implementation and stewardship, including, but not limited to:

- Providing education and information materials on how greenways can assist businesses with pollution prevention, stormwater management and flood damage reduction efforts, enhance the aesthetic appearance of property and increase its value, and provide health and fitness benefits for employers and their employees.
- Creating a prospectus for each greenway project that gives businesses a menu of specific partnership options, from cash donations to company adoption of portions of the greenway nearest their location.
- Recognizing business and corporate partners and enhancing their public and consumer image through public acknowledgment of their contributions.

Mill Creek Greenways Trust

Objective: Establish a dedicated source of funding that supports development and maintenance activities defined within this Plan.

Short-Term Recommendation:

1. The Mill Creek Restoration Project should establish a greenway investment portfolio and account with a local bank and potentially, an endowment fund with a local foundation. Initial contributions should be solicited from local public sector agencies, businesses, foundations and individuals. The goal is to place \$1 million into the account of new capital reserve each year.

Longer-Term Recommendations:

2. MCRP should utilize the interest from the account to offset maintenance and project management activities.

3. MCRP should sponsor fundraising events with local businesses and community organizations to raise money for the Greenways Trust.

Brownfields to Greenways

Objective: Remediate and recycle brownfield sites into economically viable greenways and/or redevelopment that compliments the greenway system.

Short-Term Recommendations:

1. Local governments and private sector organizations in Hamilton County should build a partnership with the Port Authority for Brownfields Redevelopment to identify brownfield sites in the watershed and to implement strategies for the clean up and restoration of brownfield sites throughout the watershed. Partner with the Port Authority to incorporate multi-objective greenways and protected open space in brownfield redevelopment projects where it is appropriate. Specifically, look for ways to link brownfield redevelopment with greenway development to encourage private sector stewardship of the system and broaden the appeal of projects for funding and subsidy opportunities.

2. Local governments and private sector partners should work with the Port Authority for Brownfields Redevelopment to identify and secure funding for brownfield redevelopment feasibility studies and environmental assessment work to be conducted in the watershed. Funding and subsidies for environmental clean up and greenway development should be pursued. Engage the Port Authority to manage and/or provide technical assistance to brownfield redevelopment projects and administer any related financial assistance program.

Longer-Term Recommendations:

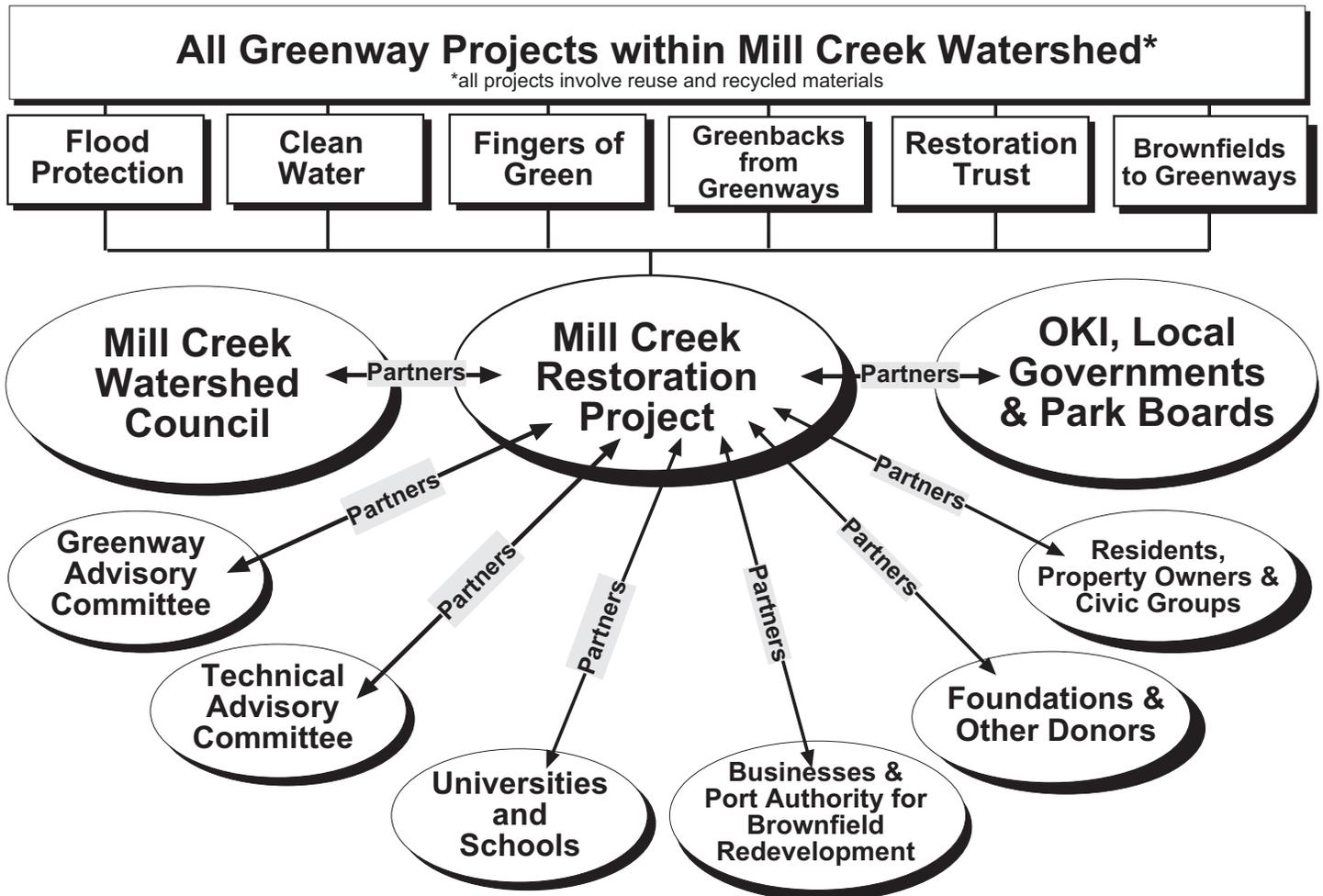
3. Often brownfield areas no longer appeal to modern market demand. Work with the Port Authority for Brownfields Redevelopment to create more marketable and economically sustainable brownfield redevelopment opportunities, which will complement the greenway system, by using parcel assembly, innovative development approaches and/or area planning strategies.

4. Local governments and private sector organizations should assist the Port Authority for Brownfields Redevelopment in facilitating consensus about and communicating the necessity for risk-based clean up standards which protect human health and safety and the watershed and environment, while also enabling economically feasible brownfield redevelopment projects.

IMPLEMENTATION STRATEGY

Nationally, successful greenway programs typically have a lead group or organization. This group will generally become the champion of the completed master plan, lead a community-wide effort toward successful implementation of plan recommendations, and facilitate the involvement of other partners and the general public in implementation. After carefully considering the various missions and operating objectives of several organizations involved in caring for resources in the Mill Creek watershed, the consultant team recommends that the Mill Creek Restoration Project (MCRP) be targeted as the champion and facilitator of the Mill Creek Watershed Greenway Master Plan.

MCRP cannot accomplish the complex objectives of this master plan alone. MCRP has a specific role to play in master plan implementation. The following text defines this role and the role of other key agencies, organizations, businesses, and citizens in the implementation of this Master Plan.



The Role of the Mill Creek Restoration Project

The primary role of the Mill Creek Restoration Project (MCRP) will be to serve as the champion, facilitator and coordinator for implementing the Mill Creek Watershed Greenway Action Plan. In some cases, MCRP may choose to become more directly involved in implementation projects, as illustrated by the group's proposed capital projects within the City of Cincinnati. In most cases, however, MCRP will serve as a resource (providing advice, helping to raise funds and developing partnerships as needed) for local governments, park boards, and other organizations and property owners that will create their own projects consistent with the greenway plan.

As a 501 (c)(3) non-profit organization, MCRP has the organizational structure necessary to become the facilitator of greenway projects throughout the watershed. MCRP currently employs full-time staff to manage its operations and programs and has already established an excellent working relationship with numerous public and private partners inside and outside the watershed. MCRP has been successful in raising funds from both public and private sources and has proven that it can quickly and efficiently implement high quality projects.

MCRP will need to expand its board of directors to include a more representative cross section of the watershed. Additional staff and financial resources will also be needed to address the responsibilities outlined in this action plan.

The Role of the Mill Creek Watershed Council

The Mill Creek Watershed Council (MCWC) will be a key partner, taking a leadership role in championing local government adoption of plan recommendations that will support greenway implementation. One of the most important recommendations concerns development of a coordinated floodplain management program throughout the watershed. MCWC should continue its coordination and communication activities across and among political jurisdictions throughout the watershed.

The Role of the Millcreek Valley Conservancy District

The work of the Millcreek Valley Conservancy District (MVCD) is principally linked to the US Army Corps of Engineers activities along the main channel of Mill Creek in Hamilton County. This is a substantial responsibility, and MVCD should work with the Corps, MCRP, MCWC and other partners to develop a progressive array of environmentally sound remedies, including floodplain management, water quality improvements, and ecological restoration. MVCD staff have an expressed interest in facilitating/implementing greenway projects in the longer term. The Conservancy District's capability to take on this new role should be assessed and discussed with other partners during next two years.

The Role of OKI, Local Governments and Park Boards

Local governments and park boards will have a critical role to play in fostering implementation of the greenway system. Their future work may include, but not be limited to: direct implementation of greenway projects within their jurisdictional boundaries; funding, technical assistance, land acquisition and other in-kind services for joint-venture or multiple-sponsor projects; maintenance of greenway projects; adoption and implementation of sound floodplain management practices and other greenway plan recommendations; environmental assessments and property clean-ups; development and implementation of safety and security programs with local law

enforcement agencies; and assistance with building greenway facilities from products that come from recycled waste streams.

In addition to the 37 political jurisdictions in the watershed, there are many other government agencies that are or could be involved in this initiative, including: the Ohio-Kentucky-Indiana Regional Council of Governments (OKI), Hamilton County Department of Environmental Services, Cincinnati Office of Environmental Management, Butler County Department of Environmental Services, health departments within the watershed, Hamilton County Soil and Water Conservation District, Butler Soil and Water Conservation District, Cincinnati-Hamilton County Metropolitan Sewer District, Butler MetroParks, Hamilton County Park District, Cincinnati Park Board, and other local government park and recreation departments. As an example of the variety of roles government organizations may take, OKI can help facilitate funding applications for greenway projects to the Ohio Department of Transportation, track Mill Creek watershed greenway development and its replication in other places in the Greater Cincinnati region, and share information with regional governments.

Role of Local Businesses and Corporations

The Metropolitan Growth Alliance, Greater Cincinnati Chamber of Commerce, economic development agencies, and businesses and corporations throughout the watershed and region have an important role to play in the implementation of this plan. Currently, some businesses in the watershed are considering cosponsoring segments of the greenway network along Mill Creek and tributary streams. Businesses and corporations can work with MCRP and other partners to gift money, materials, products and labor (e.g. the AT&T Pioneers and the Beautiful Woodlawn Business Association) toward development of a greenway project. Businesses can also consider donating conservation easements and installing facilities, such as bike racks or lockers, benches and signage that link their operations to the greenway system. In addition to supporting capital projects, the private sector may also support the development of the Mill Creek Greenways Trust, an endowment fund that will support long-term stewardship of the new resources.

Role of Civic, Environmental and Religious Organizations and Citizens

Local neighborhood community councils, and civic, environmental, and religious groups can play a vital role in detailed planning, creation, and maintenance of greenway parks and trails, and co-hosting events that raise money for and celebrate the greenway system. These groups may include, but are not limited to; The Izaak Walton League, Sierra Club, New Jerusalem Community, Issac Wise Temple, Catholic Archdiocese, Citizens for Civic Renewal, Cincinnati Environmental Advisory Council, Hamilton County Environmental Action Commission, Junior League, Boy and Girl Scouts, garden clubs, YMCA and YWCA, Kiwanis and Rotarians, and other organizations.

Local residents that are interested in developing the Mill Creek Watershed Greenway can participate by donating their time, labor and expertise and dollars. Residents might choose to volunteer alone or with a local group that adopts a section of greenway for maintenance and management purposes. Individuals can volunteer to plant trees, shrubs and flowers along segments of greenways. MCRP can help recruit, train and recognize volunteers through a community-wide program.

The Role of Geographic Information Systems (GIS)

The maps presented in this Master Plan were developed in a Geographic Information System (GIS). GIS software combines the ability to produce maps of a given area with databases which contain attribute data about the features shown on the maps. GIS technology is used to collect, store, retrieve, analyze and display data such as land use, physical infrastructure, pollution sources, open spaces and flood plains. Typically, a series of "thematic" maps are produced of the same area. The maps are stored as individual map "layers" with the same boundaries and scale so that they can be overlaid and displayed simultaneously. These layers may be combined in a variety of ways to produce other maps. The graphics or maps are also linked to a database or computer information that can be displayed on the map. In terms of greenway planning efforts for example, it may be useful to display features which might be considered as opportunities for greenway development, such as existing parks, trails, nature preserves and historic sites. By viewing all of these areas at once, it is easier to visualize the development of new greenway systems. Likewise, constraints to greenway development such as existing buildings, landfills, hazardous waste sites and combined sewer overflows (CSO's) can be overlaid with planned greenway systems to help determine priorities.

The GIS software packages used in this project are ArcInfo and ArcView, both products of Environmental Systems Research Institute (ESRI). The data base was developed and analysis performed using ArcInfo running on a Sun workstation. These operations produced series of thematic map layers showing various conditions in the watershed. The map layers were exported to ArcView, which runs on personal computers. ArcView permits a novice user, with a minimal amount of training, to display and query the GIS database developed by GIS professionals. ArcView permits the user to select the map layers to be displayed and query the database tables associated with the map features. The user can also change map colors and symbols, add or modify annotation associated with map features, and print maps. On this project, ArcView has been used in many meetings to present the various options and information available.

Various sources of data were used in building the GIS for this project. The "base" data for the Hamilton County portion of the project was provided by the Cincinnati Area Geographic Information System (CAGIS). CAGIS is a consortium of the land and infrastructure agencies in the City of Cincinnati, Hamilton County, Cincinnati Bell Telephone and Cincinnati Gas and Electric. The mission of CAGIS is to create innovative systems support for the processes of creating, managing, and improving the region's infrastructure which also results in improvements in the way business is done in the agencies involved. Basic data obtained from CAGIS included such information as topography, roads, buildings, political boundaries, zoning, parcels, and floodplains.

Unfortunately, Butler County does not yet have a well developed GIS. For the Butler County portion of the watershed, base data was obtained from the United States Geological Survey (USGS) in the form of "Tiger" files. This data includes very basic information such as roads, streams and topography. It should be noted that the topographic information is much less accurate than that in Hamilton County, using 10-foot contour intervals as opposed to 2-foot intervals.

In addition to basic infrastructure data, information was also obtained from many other sources as well. Primary data sources included:

- EPA Basins, a multi-purpose, environmental analysis system with a digital inventory of items such as NPDES sites, CERCLA sites and underground storage tanks
- "Applying Watershed Strategies to Address Complex Problems in the Mill Creek", Metropolitan Sewer District of Greater Cincinnati, 1997
- Union Township GIS Study, Joint Center for Geographic Information Systems and Spatial Analysis, University of Cincinnati, 1997
- "Vegetation of the Mill Creek Valley, an Urban Flora", Don Bogosian, 1996
- "Biotic Refuges in the Mill Creek Region", Stanley Hedeem
- Biological and Water Quality Study of Mill Creek and Tributaries, Butler and Hamilton Counties, Ohio, Volume 1, Technical Report SWS/1993-2-9, Ohio EPA, 1994
- Existing and Proposed Green Spaces Map, Cincinnati Park Board
- Existing and Proposed Hike/Bike Trails, OKI, Liberty Township Park Board, Union Township and Stan Hedeem

Some of the data (primarily the first three bullets) was provided in digital format which was easily added to the Mill Creek Greenway GIS. Other data such as historic sites, vegetation sites, proposed green spaces, and existing and proposed trail systems, were digitized from hard copy maps provided by others.

It should be noted that since the data was collected from many different sources, the accuracy of the data cannot be verified in all cases. This should not be a deterrent to the use of the GIS for planning and educational purposes. Where detailed design is to be performed for specific projects, the data should be verified by the user.

In order for the maximum benefit of the Mill Creek Watershed Greenway Master Plan to be realized, it is recommended that the following steps be implemented:

1. One agency should be designated as the "lead agency" for the maintenance and expansion of the Greenway GIS. In addition to CAGIS, It is recommended that the Metropolitan Sewer District of Greater Cincinnati be the lead agency since the agency already possesses the technical expertise and facilities to perform this function and they are involved with many other water quality and quantity data collection efforts throughout the watershed.
2. Copies of the GIS data should be distributed to as many interested groups as possible in order to encourage implementation of the Greenway Master Plan.
3. Parties interested in the development of the Mill Creek Watershed Greenway system should actively support the development of a GIS for Butler County comparable in quality and scope to CAGIS.



FY 1999 to FY 2003

The following text defines the early action projects for the Mill Creek Watershed Greenway system. These early action projects include important projects that have been proposed for development by the Mill Creek Restoration Project, the MCWC Recreation Committee, the Village of Woodlawn, the City of Reading, the City of Wyoming, the Butler County Department of Environmental Services, and Liberty and Union Townships in Butler County. These projects are representative of issues and problems addressed in this master plan. These projects also embody the seven primary goals of the greenway initiative: flood protection, clean water, fingers of green, greenbacks from greenways, brownfields to greenways, the reuse of waste land and waste materials and the establishment of economically sustainable projects.

The following pilot projects are divided into three broad geographic categories, with lead sponsors indicated and, where appropriate, anticipated major funding sources identified:

- Projects proposed by MCRP and located within the City of Cincinnati that could be funded in part with city capital budget funds.
- Projects proposed by communities and the MCWC, located within Hamilton County, that will receive funding from the State of Ohio Capital Improvement Program and/or other sources.
- Projects proposed by local governments and Friends of Liberty Township Parks, located in Butler County, that will receive funding, land donations and other inkind services from a variety of sources.

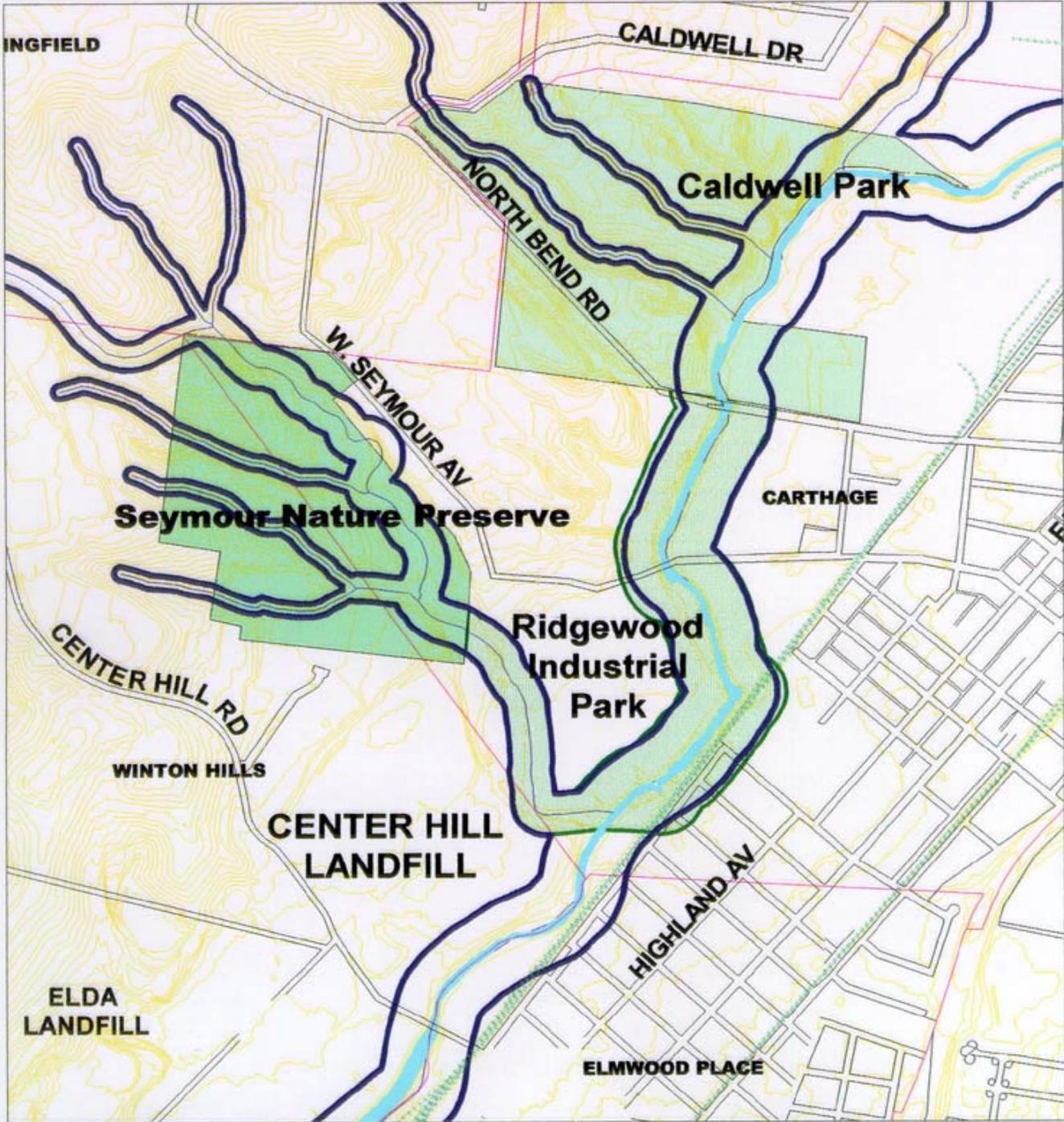
It should be noted that none of the projects at this point in time has guaranteed funding for all project costs. The following text describes each proposed pilot project and lists known and potential partners.

City of Cincinnati: MCRP Proposed Capital Budget Projects

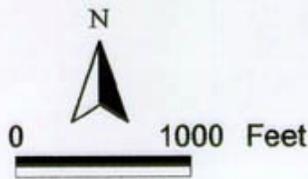
The following text is taken from a grant application authored by MCRP with technical assistance from the consultant team, filed in September 1998 with the City of Cincinnati's Capital Budget Committee. It is recommended that the City commit to making a major capital investment in these projects and that MCRP continue to recruit other public and private partners to contribute additional funding and inkind services.

Caldwell and Seymour Parks Greenway

Mill Creek historian and ecologist Dr. Stanley Hedeon identified Caldwell and Seymour Parks as two important but isolated biotic refuges in a heavily urbanized portion of the watershed. This project will physically connect these parks through a greenway system, providing opportunity for future migration corridors for wildlife (refer to Map 4).



Map 4:
Caldwell and Seymour Parks Greenway



4/99

The Port Authority for Brownfields Redevelopment is working to cleanup and redevelop the old Vine Street dump in Carthage. The dump is located a short distance upstream of Caldwell Park. The Port Authority's work will help improve water quality and create a greenway buffer between Mill Creek and the future commercial uses of the property, further extending the Caldwell/Seymour greenway corridor.

The two parks are located in an economically "Distressed Enterprise Zone" and close to environmental justice and underserved communities including Carthage and Silver Oak Estates, Findlater Gardens, and Winton Terrace neighborhoods. According to the 1990 Census, the Winton Hills/Winton Place neighborhoods include a 71% minority population and have a 17.5% unemployment rate. This project will provide training and employment opportunities for local residents as the greenway, hike and bike trail and other amenities are created for use by them and other visitors. To improve access to the new facilities for local neighborhoods, the project will develop pedestrian- and bicycle-friendly crosswalks at one or more street intersections. In addition, MCRP will provide outdoor learning experiences and community service opportunities for middle and senior high school students participating in MCRP's Mill Creek School Program.

The City, Elmwood Place, Millcreek Valley Conservancy District, a railroad company and private property owners own land in the riparian corridors of Mill Creek between Caldwell Park (at North Bend Road) and Center Hill Road. The project will encourage voluntary donations or bargain sales of conservation easements or fee simple title to privately owned parcels to create a greenway along both sides of the river. Soil bioengineering or biotechnical techniques will be used as needed to prevent and reduce streambank erosion along Mill Creek. This effort will help to protect the City's investment in the major streambank stabilization project along the southeastern edge of Center Hill landfill that the Office of Environmental Management is overseeing.

Downstream from Caldwell Park and adjacent to Mill Creek, the City's Economic Development Department is actively marketing brownfields property, the previous Army Corps of Engineers' Ridgewood Arsenal. The City has completed site preparation and environmental remediation of the Ridgewood Industrial Park, but the property lacks visual attractiveness and the local neighborhood has requested buffers between future economic uses and the neighborhood and Seymour Avenue. Plans now call for produce companies and other businesses to relocate at the industrial park in 1999. This project will help improve the marketability and appearance of the industrial park and provide amenities for the new businesses.

A small tributary (named Dan's Creek) flows through Seymour Park to Mill Creek, skirting the boundary of the old municipal Center Hill landfill and Ridgewood Industrial Park. The Cincinnati Park Board is working cooperatively with the City's Economic Development Department to obtain ownership of land along Dan Creek to protect it during future development of the industrial property, repair environmental damages caused by relocation of a portion of the creek over ten years ago, and create greenways in its riparian zones. This will provide a wildlife migration corridor between Seymour Preserve, Mill Creek and Caldwell Park.

The City of Cincinnati's Office of Environmental Management is developing a strategy to clean up the Center Hill landfill using a process called phytoremediation. This ecological solution involves planting certain tree species whose roots will absorb



the landfill leachate and break down contaminants over time. The City will work with the Ohio EPA and a U. S. EPA phytoremediation researcher who will oversee plantings and conduct environmental monitoring to determine the project's effectiveness at improving environmental conditions. The City is maintaining leachate and methane gas collection systems for the landfill. MCRP will contribute \$30,000 cash to the project from a U.S. Department of Agriculture Natural Resources Conservation Service grant. MCRP will work to ensure neighborhood involvement in all aspects of this project and to provide job training opportunities for local residents.

Committed and Potential Partners

Cincinnati Park Board, Office of Environmental Management (OEM), Economic Development Department, Cincinnati Police Department, Neighborhood Services and CNAS teams. U. S. EPA, Millcreek Valley Conservancy District (MVCD), Metropolitan Sewer District, Ohio EPA, Carthage Civic League, Winton Hills neighborhoods, E Check, MIRG, relocating produce companies, Henkel, Sun Chemical, private property owners, MCRP and its corps of school and community volunteers, Port Authority for Brownfields Redevelopment, and the Natural Resource Conservation Service of the Department of Agriculture

Silver Oak Estates Park, Winton Hills

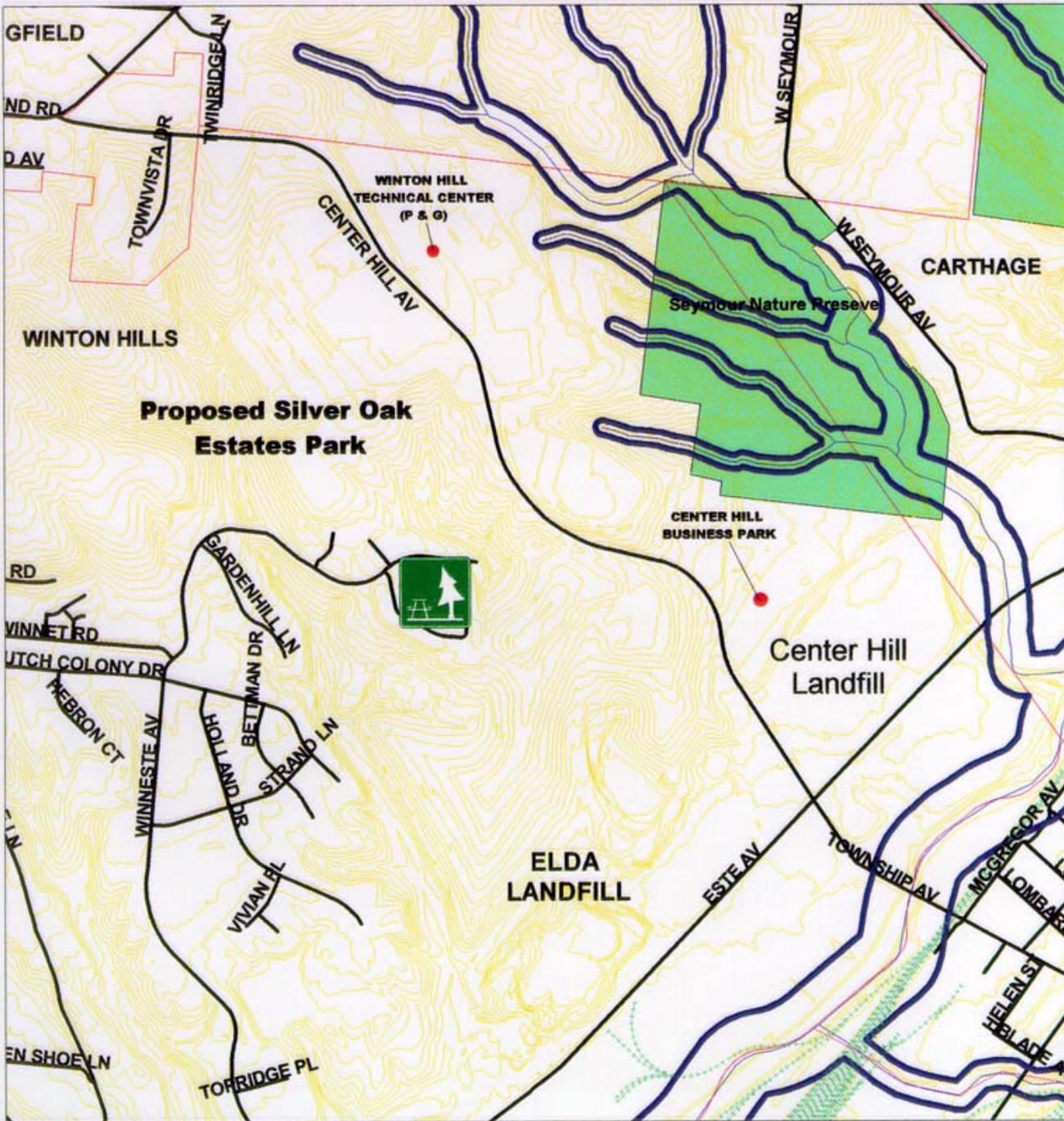
The non-profit Preserving Affordable Housing, Inc. (PAH) is renovating a total of 276 apartments in a “new” neighborhood called Silver Oaks Estates in the Winton Hills region of the City. PAH owns the proposed park site, a 27 acre property bordered by a forested hillside to the north, the residential neighborhoods to the west, and the ELDA Landfill to the south and east (refer to Map 5). The property is the former site of the Ridgewood Apartments. The U. S. Department of Housing and Urban Development (HUD) razed the old apartment buildings due in part to problems with asbestos and lead paint. In addition to building demolition, HUD removed all utilities and other infrastructure to prevent methane gas from migrating from ELDA onto the site. The landfill has a methane gas collection and extraction system in place and is currently undergoing closure activity.

The proposed park property is located at the highest point of this hillside, between Winton Road and Center Hill Road and affords a 270 degree view of the watershed. PAH wants to create a passive park for local residents and is willing to consider using part of the site for commercial or light industrial development that will provide services and jobs for local residents. PAH is applying to the National Campaign for Human Development (NCHD) for a \$10,000 grant to conduct a feasibility study for any potential commercial/industrial uses. To prevent truck and other heavy traffic from traveling through the residential neighborhoods, PAH believes it will be necessary to create a new road connecting the site to North Bend Road or Center Hill Road.

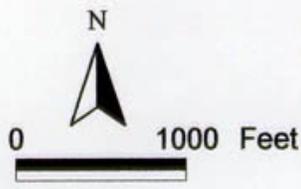
Public safety is a concern with any development of the current site. It will be critical to work with environmental regulatory agencies and with the Cincinnati Police Department to design safety features into the project. The District Five Police Station will locate a substation in the soon-to-be-completed Silver Oaks Estates Community Center. The Port Authority for Brownfields Redevelopment has expressed willingness to advise MCRP and other partners on the future development of this site. Procter and Gamble and the U. S. EPA are located downhill from the site, with frontage on Center Hill Avenue, close to Seymour Park. They will be asked to participate in the development of this project. MCRP will work with PAH to conduct planning workshops with local residents and to provide training stipends so that they can help to physically create the park and develop a sense of ownership.

Committed and Potential Partners

Preserving Affordable Housing, Inc. (PAH), residents of Silver Oaks Estates, Findlater Gardens and Winton Terrace neighborhoods, Cincinnati Park Board, Cincinnati Police Department, CNAS Team, area businesses, MCRP and its corps of volunteers, National Campaign for Human Development, U. S. Department of Housing and Urban Development (HUD), State of Ohio Economic Development Department, Brownfields Redevelopment Authority.



Map 5:
Silver Oak Estates Park



Salway Park/Mitchell Avenue Greenway Trail & Queen City Centre Park

The proposed greenway trail in the riparian corridor of Mill Creek, from Salway Park to Mitchell Avenue, is one segment of a temporary walking trail proposal by the Mill Creek Watershed Council's Recreation Committee (refer to Map 6). State and local funds are expected to pay for signage, bollards, fencing, and other items that will be designed for reuse in the capital greenway trail project.

A new park is also proposed along Mill Creek, between Clifton and Mitchell Avenues. These capital improvements will be highly visible from Interstate-75, Mitchell, Clifton, and Spring Grove Avenues, and to those who shop at the new Queen City Centre Kroger or other businesses in this commercial center. The Army Corps of Engineers (ACOE) channelized Mill Creek along the Queen City Centre area, lining the bottom and streambanks with concrete or cribwall. The landscape west of Mill Creek is visually and ecologically degraded in riparian zones and currently constitutes Kroger's "front door." Kroger has indicated preliminary interest in participating in the project as a lead corporate sponsor.

On the east side of Mill Creek, across the stream from the Queen City Centre, the Cincinnati Park Board and MCRP volunteers planted 5,000 native tree seedlings in April 1998 and removed significant groves of aggressive, non-native Amur honeysuckle. The Park Board has also landscaped several traffic islands near the intersection of I-75 and Mitchell Avenue and there is an active "Adopt-A-Highway" program in the area to remove litter and debris from along the major thoroughfares. Through Keep Cincinnati Beautiful's "Adopt-A-Block" program, staff members of the City's Office of Environmental Management remove litter on Mitchell Avenue, from Spring Grove Avenue to Vine Street.



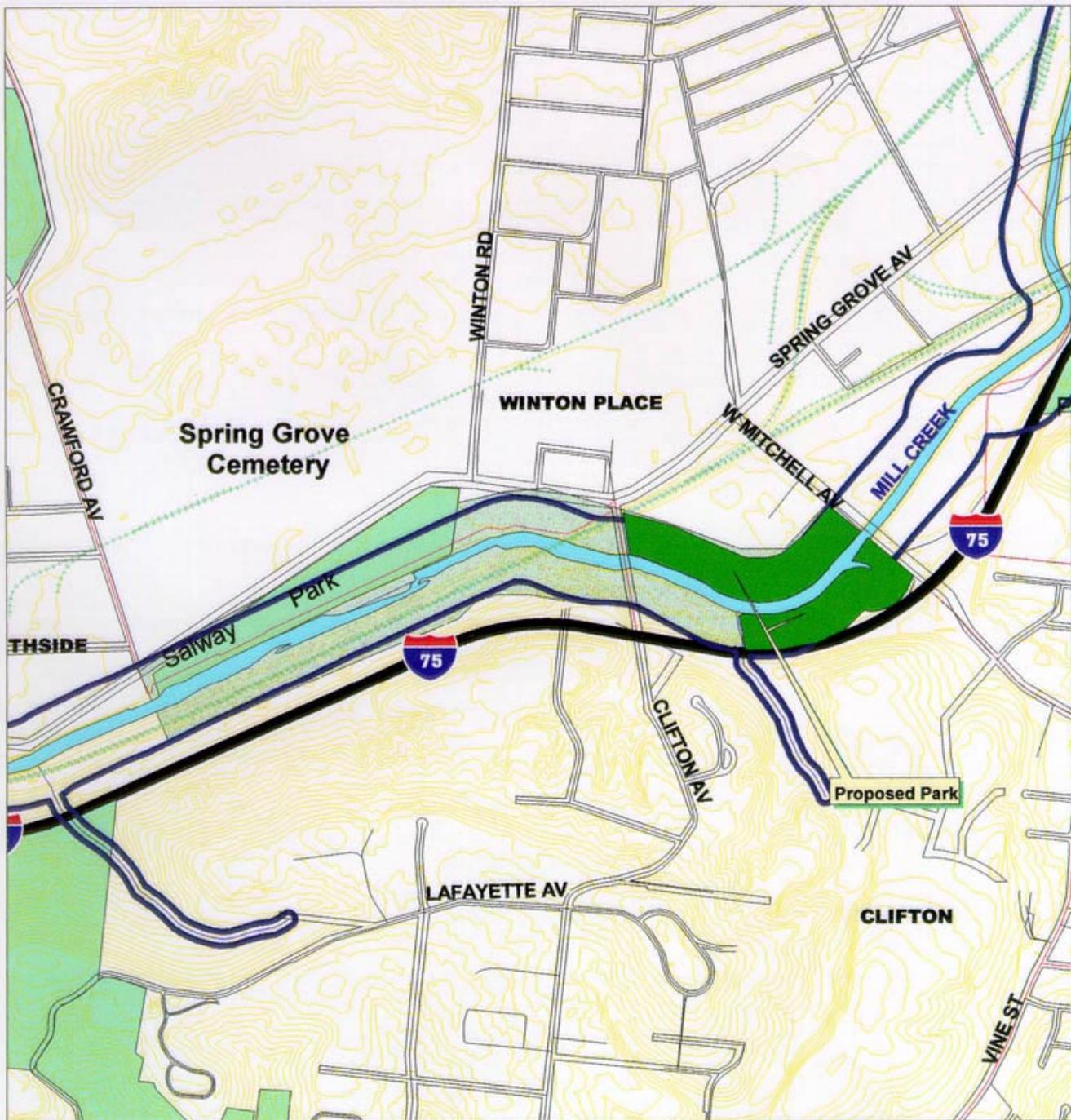
Figures 17 and 18: The above photos show the proposed location for a future public park that would be across the street from the Queen City Centre Kroger on Clifton Avenue. In the background of the lower photo you can see Interstate 75. (Photos by MCRP)

Salway Park is located at the southern end of the proposed project. In the past two years, MCRP and its volunteers have planted butterfly gardens and over two hundred trees of various sizes in this recreational park. This portion of Mill Creek was relocated and straightened many years ago, but there is no concrete or crushed rock armoring of the stream banks and channel bottom. It is an area that is biologically recoverable and contains a small functioning wetland system. MCRP is working to ensure that the ACOE uses soil bioengineering or biotechnical solutions to address streambank erosion problems in this important part of the river system.

Metropolitan Sewer District (MSD) hired a botanist who completed a spring 1998 inventory of vegetation in this stretch of Mill Creek and in other channelized sections of the stream where the City's Stormwater Management Utility (SMU) is responsible for maintenance, under an agreement with the Millcreek Valley Conservancy District. This report documented that this section of Mill Creek has the second highest number of native wetland plant species within the City. The initial establishment of non-native invasive wetland plants were also documented, notably purple loosestrife and reed canary grass. Much of the riparian corridor on both sides of Mill Creek is owned by the Millcreek Valley Conservancy District.

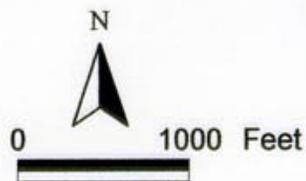
Committed and Potential Partners:

Cincinnati Park Board, City Recreation Commission, CNAS Team, Mill Creek Watershed Council's Recreation Committee, Kroger, Woody Sander Ford, McDonald's, Spring Grove Cemetery, Zero Breeze, Winton Place Civic League, Clifton Town Meeting, Northside Community Council, Winton Hills neighborhoods, Millcreek Valley Conservancy District, Cincinnati Water Works, Metropolitan Sewer District and



MILL CREEK GREENWAY

Map 6:
Queen City Centre Park and
Salway/Mitchell Greenway Trail



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the Stormwater Management Utility, Ohio Department of Transportation (TEA funding), MCRP and its corps of school and community volunteers (including the New Jerusalem Community, Isaac Wise Temple, Sierra Club, and the AT&T Pioneers).

Salway Park to Queen City Avenue/Western Hills Viaduct: Greenway Walking Trail

The proposed riparian corridor greenway in this section of Mill Creek will include a multi-purpose hike and bike trail. The trail will follow part of a nine-mile walking trail alignment, from Lower Price Hill to Caldwell Park, originally proposed by the Mill Creek Watershed Council's Recreation Committee. The greenway will border the neighborhoods of Northside, South Cumminsville, Millvale, English Woods, North Fairmount and South Fairmount (refer to Map 7).

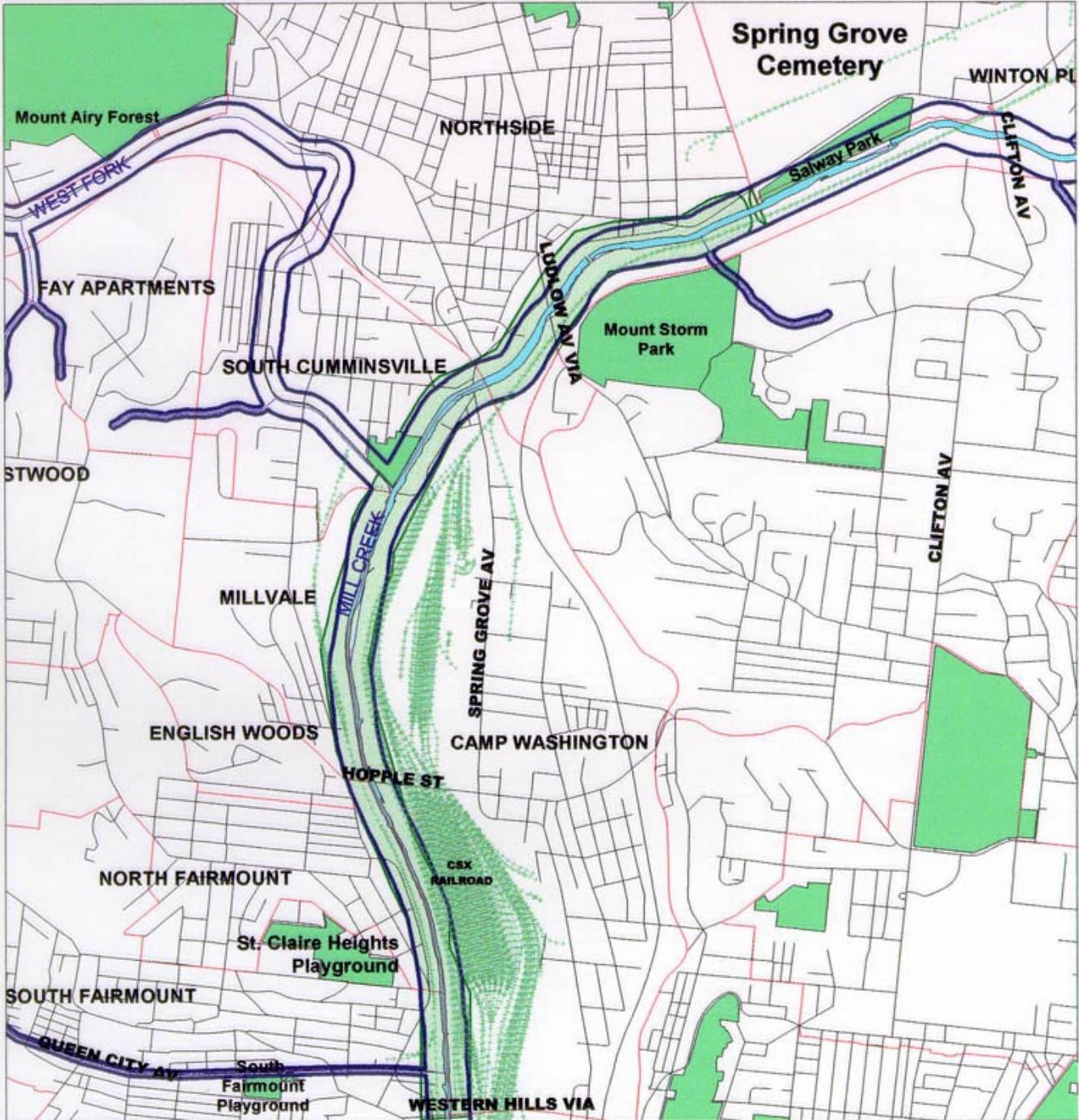
Much of the land is in public ownership. The project will secure property or easements as necessary. From Northside, traveling downstream, the greenway will incorporate City-owned land, including an area currently used by Highway Maintenance for storing highway materials, the Cincinnati Recreation Commission's Hille Playfield, and the City's Sanitation Division property. This is another area where there are functioning wetlands in and along the Mill Creek channel. In coordination with the Army Corps of Engineers, these wetland areas should be protected and enhanced. South of the Sanitation building, the project will seek an easement from the CSX Railroad Company to use a gravel road that runs parallel to Mill Creek, south to its intersection with Queen City Avenue, near the Western Hills viaduct.

The riparian corridors of Mill Creek in this stretch of the river are seriously degraded and will need extensive landscaping, with particular attention to removal of aggressive alien species and reintroduction of low maintenance native species. There is great potential for wildlife habitat restoration and other environmental improvements. Where Phase I environmental assessments note potential contamination problems, Phase II assessments will be needed. Based on this environmental information, it may be possible to remediate minor problems or realign the greenway trail away from problem areas. In some constricted trail areas, it will be necessary to install guard rails and fencing for safety. The development of this greenway and trail system will afford ample opportunities for job training, employment, recreation, and environmental education.

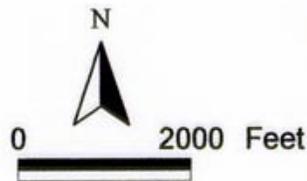
Committed and Potential Partners:

Cincinnati Park Board, Public Works and its Sanitation and Highway Maintenance Divisions, MCWC Recreation Committee, Cincinnati Police Department, CNAS Team, MSD/SMU, Millcreek Valley Conservancy District, Office of Environmental Management, CSX Railroad, Conrail, Reece Campbell, Truckway Leasing, North Fairmount Community Center, North Fairmount Community Council, Millvale Residents Council, South Cumminsville Community Council, South Fairmount Community Council, Northside Community Council, Winton Place Civic Club, Millvale Landscaping Company, Ohio Department of Transportation (TEA funding), and MCRP and its corps of volunteers.





MILL CREEK GREENWAY
 Map 7: Salway Park to Queen City Avenue/Western Hills Viaduct: Greenway Trail



Greenways
INCORPORATED

JSM
ENGINEERS

Biohabitats, Inc.
 25 W. Archibald Road
 Frederick, Maryland 21705
 Phone: 410-371-3639
 Fax: 410-383-5678

North Fairmount Community Center (NFCC) Research and Training Greenway

The North Fairmount Community Center (NFCC) owns seven acres of land bordered by Mill Creek on the east, Beekman Street on the west, and Hopple Street on the north. This capital project will become part of the greenway trail between Salway Park and Queen City Avenue and it provides a large parking lot and access to the greenway trail system (refer to Map 8).

In addition to creating a greenway corridor on this property, NFCC has agreed to use it for needed scientific research and as a training center for ecological restoration and greenway creation for other parts of the Mill Creek watershed. There is a need to improve access to the site from North Fairmount and surrounding neighborhoods.

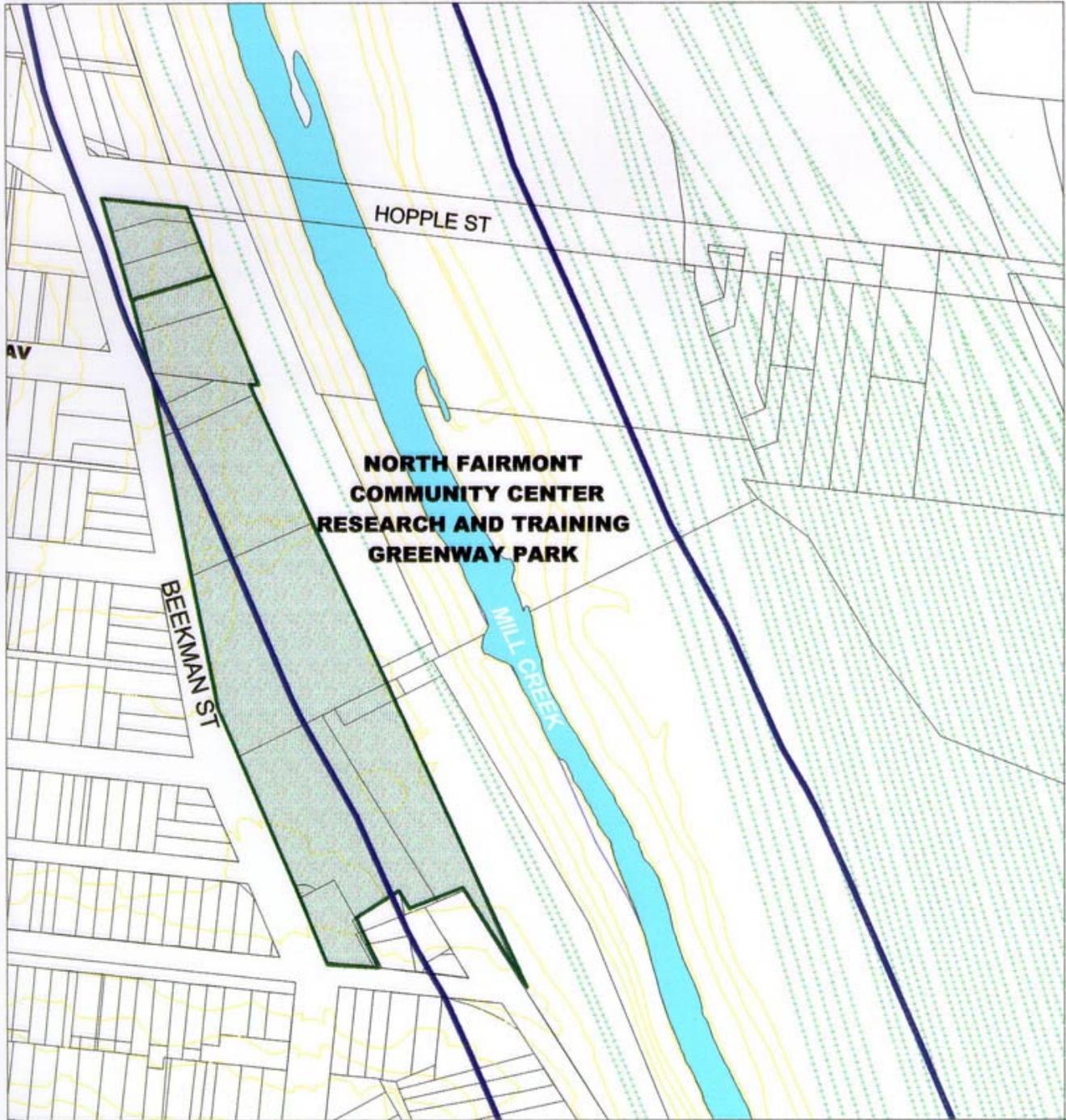
This is a brownfields site, the former location of the Buckeye Foundry. The E-Check auto emissions testing facility and a medical clinic run by University Hospital, the Baby's Milk Fund, and Children's Hospital are located on part of the property. NFCC has recently attracted a small, family-run business to the site and an automated banking facility.

This greenway project has progressed in phases, as financial resources and volunteers have been available. NFCC completed a "gateway" to the neighborhood at the northwest corner of the lot, with assistance from the Neyer Foundation, MCRP, and volunteers. The medical clinic has been landscaped, but the rest of the property needs significant ecological improvements. In the past year, NFCC, MCRP and its consultant Habitats, and community volunteers have worked to prepare the site for future plantings. Site preparation has been difficult due to the need to remove subsurface construction debris including large pieces of broken concrete, railroad ties, tires, and metal rebar. In addition, site preparation has included removal of aggressive Amur honeysuckle and other non-native shrubs and "junk" trees from the back property line.

Capital funds will be utilized in FY 1999 to complete site preparation, including loosening heavily compacted soils and amending them with top soil. Native vegetation will be planted and research plots will be created to investigate a variety of critical urban ecosystem restoration questions. During all phases of this capital project, MCRP will ensure that there are educational and training opportunities for students and local residents.

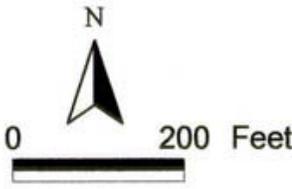
Committed and Potential Partners:

North Fairmount Community Center, North Fairmount Community Council, the Neyer Foundation, E Check, Ohio EPA and U.S. EPA (\$15,000 grants to MCRP for this project), Habitats, MCRP and its school and community volunteers, including students, Sierra Club and AT&T Pioneers.



MILL CREEK GREENWAY

Map 8:
 North Fairmont Community Center (NFCC)
 Research and Training Greenway



4/99

Mill Creek/Ohio River Confluence Park and Greenway Trail to Downtown:

The confluence of Mill Creek and the Ohio River is located west of downtown Cincinnati and just east of Lower Price Hill (refer to Map 9). The landscape at the mouth of Mill Creek is significantly degraded and in need of ecological restoration and aesthetic improvements. There is a coal barge loading operation on the west and industrial use on the east. There are one or two abandoned rail lines with rights-of-way that provide a connecting corridor between this site and downtown.

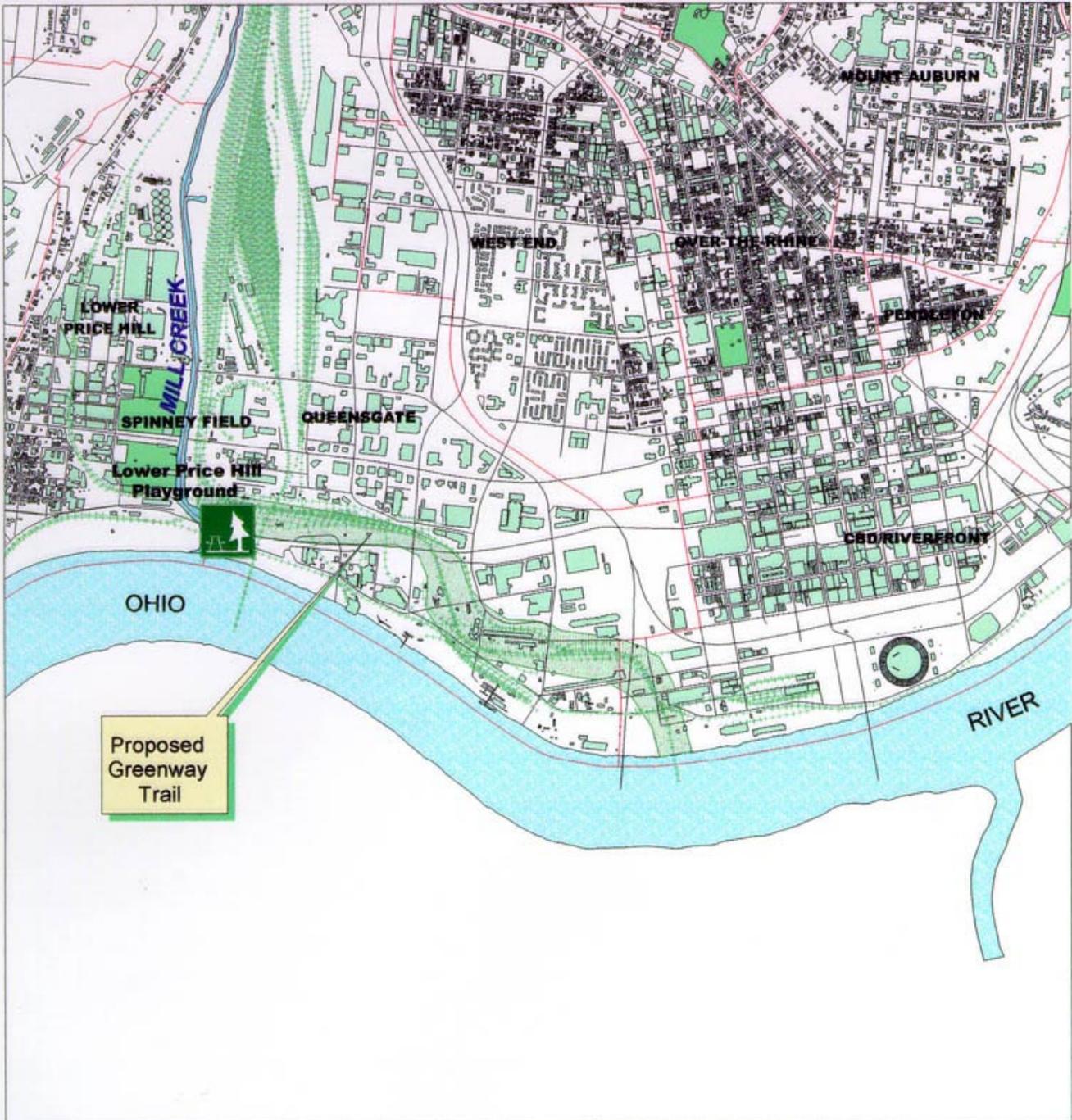
The Metropolitan Sewer District is responsible for maintaining the Barrier Dam, built in the 1950's to prevent Ohio River floods from backing up into the Mill Creek Valley. There is considerable open space around this property. The Cincinnati Bengals Spinney Field practice facility is located upstream from the Barrier Dam.

Approximately the last linear mile of Mill Creek upstream of the dam has been fenced off by order of the Cincinnati Health Department due to contamination concerns raised years ago by the Army Corps of Engineers. More recently, the City and CSX Railroad commissioned an additional environmental investigation that concluded that there were no specific conditions that required immediate further investigation. This forested segment of Mill Creek supports an amazing number and variety of wildlife species, including Great Blue Herons, Green Herons, hawks, Egrets, Black-crowned Night Herons, beaver, muskrats, turtles, and fish. Most significant is the occurrence of a Black-crown night heron rookery, one of three known sites in the State of Ohio.

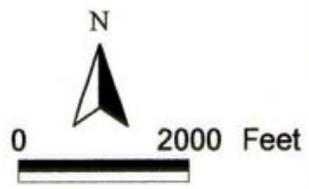
Committed and Potential Partners:

Cincinnati Park Board, Cincinnati Economic Development Department, Cincinnati Recreation Commission, Lower Price Hill Community Council, Urban Appalachian Council, Santa Maria, West C, Metropolitan Sewer District, Queensgate businesses, West End Community Council, Cincinnati Bengals, Railroad Companies, Downtown City Inc. (DCI), MCRP and its youth and community volunteers.





Map 9:
 Lower Price Hill: New Park at Mouth of Mill
 Creek and Greenway Connector to Downtown



4/99

Other Early Action Projects Located Within Hamilton County

The following projects will receive State of Ohio Capital Improvement Program grants, funds provided by local governments, and/or funds from other public and private partners.

West Fork Mill Creek Greenway: Winton Woods/Woodlawn/Wyoming Trail

The West Fork Mill Creek Greenway is a collaborative effort among public sector agencies and private citizens who are committed to “protecting corridors of open space” and enhancing the quality of life in the communities of Woodlawn and Wyoming. The sponsors and partners of this project envision that the greenway will contribute significantly to “safe and healthy outdoor recreation,” alternative transportation and economic development. The greenway project brings together two major pursuits that are mutually supportive: one involves the development of a 6-mile scenic “hike-bike” trail that will link together resources in Winton Woods, Woodlawn and Wyoming; the second is the development of a 4-acre retail service shopping center that will be located adjacent to the West Fork, in the center of the Woodlawn community (refer to Map 10).

One of the most important features of the project is its protection of the floodplain through both Woodlawn and Wyoming. By virtue of its designation as a community greenway, future private residential and commercial development along the West Fork will be very limited, the riparian forest buffer along the stream will be preserved, and floodwater absorption will be protected. This in turn has a positive impact on downstream communities who will not have to deal with an increase in runoff from inappropriately developed floodprone areas.

The hike-bike trail is envisioned as a 12-foot wide, asphalt paved facility that extends from the Winton Woods Lake through Woodlawn and to the City of Wyoming. The trail will feature, where feasible, trash cans, educational signage, landscaping, water fountains, information kiosks, and emergency telephones. It is hoped that much of the trail and amenities can be constructed from recycled waste materials. At least two bridges are needed to span the West Fork in the Village of Woodlawn.

The 4 acre retail service shopping area is part of a larger economic development plan for the Village of Woodlawn’s business district, which currently extends the length of Springfield Pike from the Village’s southern boundary with the City of Wyoming, to its northern boundary with the Village of Glendale.

Committed and Potential Partners

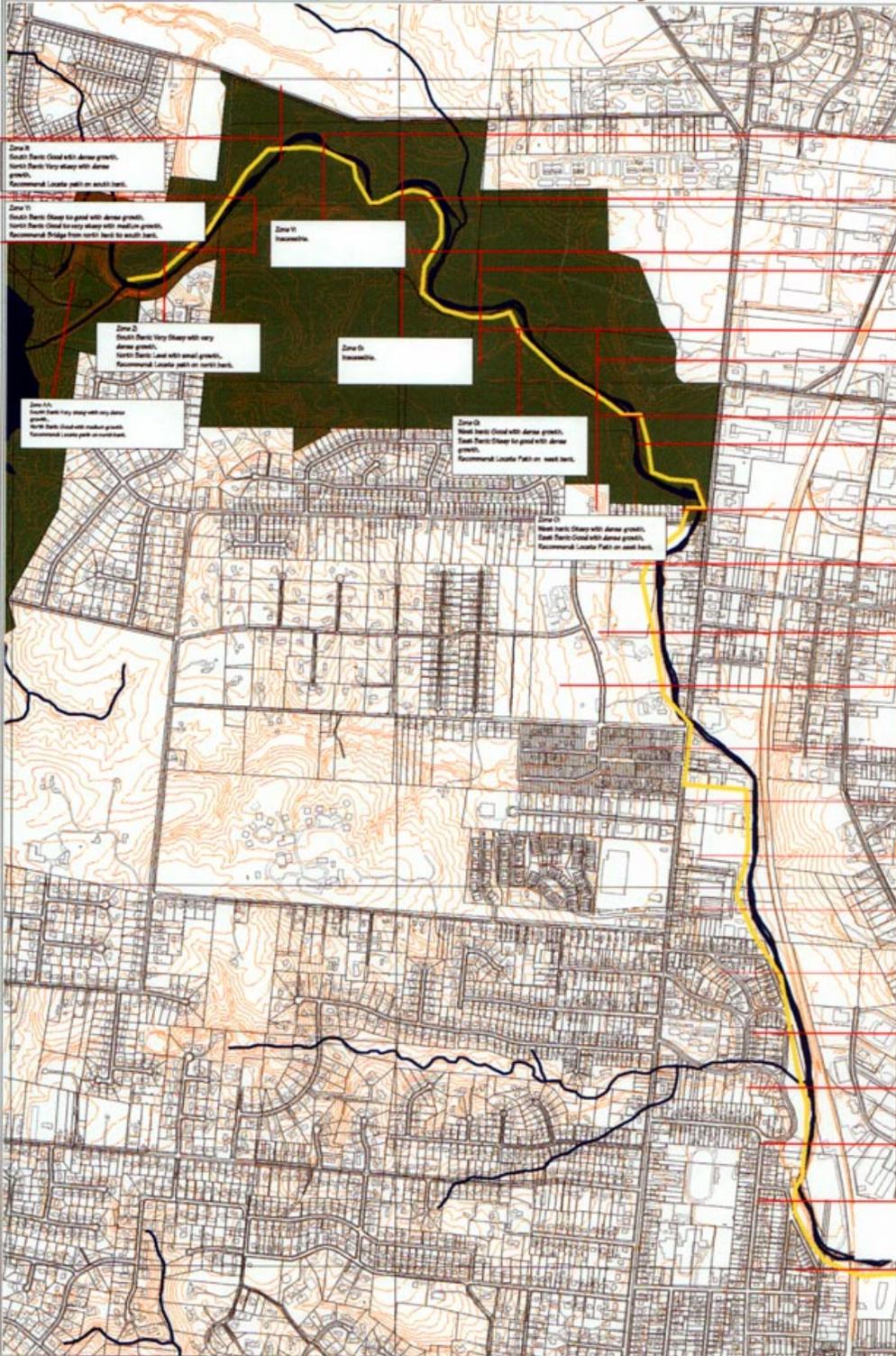
The Village of Woodlawn, The City of Wyoming, Hamilton County Park District, Princeton School District, Community of Hollydale, Mill Creek Restoration Project, Metropolitan Sewer District, Beautiful Woodlawn Business Association, Woodlawn Kiwanis Club, Wyoming School District, Buckingham Companies, Hamilton County Environmental Services Solid Waste Management District, Goodwill Industries, Anchor Brothers, Star Bank, Plant Equipment Company, Clancy Associates, Astro Met, Kroger Company, The Printing Place, Party Tyme Inn.



Figures 19 and 20: The above photos are of a portion of the Woodlawn-Wyoming Greenway along the West Fork of the Mill Creek. The top photo shows the existing Woodlawn Elementary School which will be linked to the greenway for environmental education purposes. The lower photo illustrates part of the existing Greenway trail within the Woodlawn community park.

Woodlawn to Wyoming Greenway

Map 10



Explanation

- Streams
- Proposed Greenway Trail
- 2' Contour lines
- Property parcels
- Streams & Winton Lake
- Hamilton County Park Districts



MILL CORP GREENWAY

- Zone U:
Inaccessible.
- Zone T:
Inaccessible
- Zone R:
Inaccessible.
- Zone F:
West Bank: Good with dense growth.
East Bank: Good to steep with dense growth.
Recommend: Move path to west bank.
- Zone H:
West Bank: Good to steep with dense growth.
East Bank: Steep to good with dense growth.
Recommend: Bridge over at bend.
- Zone M:
West Bank: Level with dense growth.
East Bank: Steep with dense growth.
Recommend: Locate path on west bank.
- Zone L:
West Bank: Steep to good with dense growth.
East Bank: Steep to good with dense growth.
Recommend: Locate path on west bank.
- Zone K:
West Bank: Steep with dense growth.
East Bank: Steep with dense growth.
Recommend: Locate path in open space above west bank.
- Zone J:
West Bank: Steep with dense growth.
East Bank: Steep with dense growth.
Recommend: Locate path in open space above west bank.
- Zone I:
West Bank: Good to very steep with dense growth.
East Bank: Steep to good with dense growth.
Recommend: Locate path off Springfield Pike.
- Zone N:
West Bank: Good with dense growth.
East Bank: Good to steep with dense growth.
Recommend: Locate path on west bank.
- Zone G:
West Bank: Steep with dense growth.
East Bank: Good to steep with dense growth.
Recommend: Locate path on west bank.
- Zone P:
West Bank: Good with small growth.
East Bank: Good to steep with dense growth.
Recommend: Locate path on west bank.
- Zone E:
West Bank: Good with medium to dense growth.
East Bank: Steep with dense growth.
Recommend: Locate path on west bank.
- Zone D:
West Bank: Level with dense growth.
East Bank: Steep with dense growth.
Recommend: Locate path in park above west bank.
- Zone C:
West Bank: Level with dense growth.
East Bank: Steep with dense growth.
Recommend: Locate path in open space above west bank.
- Zone B:
West Bank: Steep with dense growth.
East Bank: Good to steep with dense growth.
Recommend: Locate Path in open space above west bank.
- Zone A:
West Bank: Steep to good with dense growth.
East Bank: Steep with dense growth.
Recommend: Locate Path in open space above west bank.

Reading Greenway

The Voorheestown Bicentennial Trail is a multi-purpose trail that is envisioned to travel along the banks of the Mill Creek throughout the City of Reading. The existing trail, phase one, extends along the east bank of the Mill Creek through the northern portion of the City. Phase one is just under one mile in length traveling from the Veterans Memorial Stadium, north towards Evendale, then loops back south along the creek bank where it terminates after passing through Koenig Park. Phase one passes through the majority of the recreation facilities located in the valley of the City.

The second phase of this trail extension is planned to extend the trail south from Koenig Park to Voorhees Park, near the southern end of the City. The overall length would be extended by 9/10 of a mile and would link all the parks and recreation facilities in the valley of this Mill Creek community. Furthermore, this extension would continue to broaden the interest and future development of the long envisioned recreation trail that will become an instrumental part of the Mill Creek Greenway project.

The multi-use trail is envisioned as a 12-foot wide, asphalt paved trail featuring where appropriate, trail head signage, stop signs, crosswalks, trash cans, bike racks, rest stations, educational signage, landscaping, informational kiosks, restroom facilities and emergency telephones. The possibility exists in one area of the trail for development of a boardwalk trail tread allowing users a better view of the Mill Creek.

Committed and Potential Partners

American Discovery Trail, Archdiocese of Cincinnati, Army Corps of Engineers, Bike Pac, City of Reading, Hoechst Marion Roussel, Local businesses, Millcreek Valley Conservancy District, Mill Creek Watershed Council, Metropolitan Sewer District, Municipal Road Fund, National Association of Service and Conservation Corp., National Tree Trust, Ohio Department of Natural Resources, Ohio EPA, Ohio Historical Society, Ohio-Kentucky Regional Council of Governments, Property owners, Reading Board of Education, Reading Boy Scouts, Reading Chamber of Commerce, Reading Flower and Garden Club, Reading Girl Scouts, Reading Historical Society, Reading IGA, Reading Kiwanis Club, Reading Seniors, Rumpke, Sierra Club, Southern Ohio Chamber Alliance, South Western Ohio Trails Association, State Capital Improvement Project, Village of Evendale, and Village of Lockland

Greenway/Quiet Park, Reading

The "Greenway/Quiet Park" project is located on the site of the demolished water plant in Reading. The north border of this site is Halker, the south border is Walnut, the west border is Fenton and the east border is Jefferson. The project is .9 miles southwest of the Pristine Superfund site also located in Reading. The proposed project will be restoring to its natural state, the same amount of "green earth" that Pristine destroyed. Plans include a nature trail throughout the greenway. Future plans call for connecting this nature trail to the Voorheestown Bicentennial Trail and a future greenway being planned along the entire length of the Mill Creek.

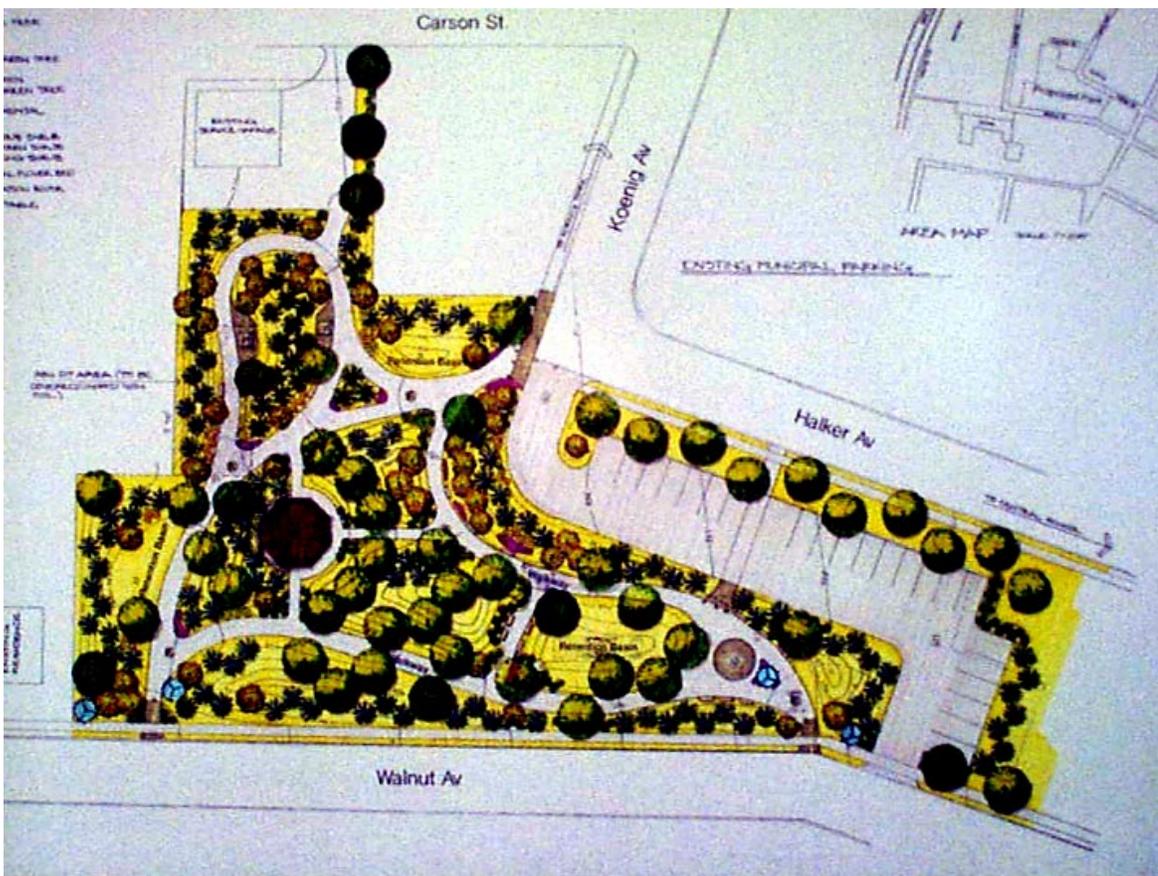
The close proximity to the Pristine site adds to the impact felt as the public will be kept aware of the devastation that took place and the site will provide a real life laboratory to show how long it takes and how difficult it is to reclaim what has

been destroyed. The effort to restore the site, which is only 1000' from the Mill Creek, culminated in a project to create a Greenway/Quiet Park. The park will be landscaped to provide many trees, flowers, shrubs, walkways, benches, an environmental gazebo, a water feature, and will be dedicated to the preservation of the environment, especially our ground and surface water.

Committed and Potential Partners

Committed: Reading IGA, Reading Community Schools, Reading Senior Citizens Club, Reading Historical Society, Reading Boy Scouts, The Garden Club of Reading, OKI Regional Council of Governments, Reading Bridal Council, The Mill Creek Watershed Council, Mill Creek Restoration Project, Rivers Unlimited, Hamilton County Environmental Action Commission, Reading Chamber of Commerce, Hoechst Marion Roussel. Potential: Archdiocese of Cincinnati, local businesses, Cincinnati Park Board, Cincinnati Recreation Commission, Cincinnati Water Works, Cinergy, Metropolitan Sewer District, National Tree Trust, Ohio Department of Natural Resources, Ohio EPA, Ohio Historical Society, property owners, Reading Kiwanis, Rumpke, Sierra Club, Southern Ohio Chamber Alliance, Southwestern Ohio Trails Association, State Capital Improvement Project.

*Figure 21: An illustration of the proposed Greenway/Quiet Park in Reading.
(Drawing provided by City of Reading)*



MCWC: Mill Creek Walking Trail

Residents of the Mill Creek Watershed have long been told what is wrong with the waterway. What they have lacked in the past is a firsthand evidence of the Mill Creek's assets and future possibilities. The Recreation Committee of the Mill Creek Watershed Council (MCWC) proposes to develop a "Mill Creek Walking Trail" to provide people with easy access to and through the nine miles of riparian corridor that makes up the lower portion of the primary river corridor, so they can see for themselves what is at stake.

The Walking Trail will consist of installing a series of identification signs on utility poles, fences, sign posts throughout the corridor to define the route of the "trail." The Trail will also be defined on maps placed at trail heads, or public entry points. Mile markers will be installed along the route to define the location of the user in relation to the overall project.

This project will help people realize the Mill Creek's recreational and community value, while also defining the need for creek cleanup, improved water quality and need for habitat restoration. The trail will also help to boost the MCWC's continuing efforts to broaden the constituency for protecting and improving the long abused waterway. To put it simply, presence leads to vigilance. An inexpensive walking trail is a low cost way to increase local resident awareness of the issues surrounding Mill Creek.

While the overall trail alignment begins at the Barrier Dam, in Lower Price Hill, and extends up to the Nature Preserve at North Bend Road, the first phase of this project is designed to begin at Salway Park and continue north to Caldwell Park. Along the way, there are opportunities to walk right along the creek banks and, in other areas, veer from the creek by walking along the roadways and sidewalks. Traveling through Cincinnati, St. Bernard and Elmwood Place, the project will need to have the cooperation of these three jurisdictions in order to be successful.

Committed and Potential Partners

Mill Creek Watershed Council, City of Cincinnati, St. Bernard, Elmwood Place, Millcreek Valley Conservancy District, Sierra Club, Cinergy, Southwestern Ohio Trails Association.

Mill Creek Water Trail

The purpose of this project would be to identify, design and create water-based trails, section-by-section along the main channel of Mill Creek and navigable tributaries, as the water quality (particularly bacteria and virus levels) is improved. This can only happen after designated sections become eligible for secondary recreational contact. From a public health point of view, the feasibility of water-based trails is largely dependent on the elimination or mitigation of combined sewer overflows.



Greenway Projects Proposed in Butler County

East Fork Mill Creek Stream Restoration and Habitat Enhancement Project

The Butler County Department of Environmental Services (BCDES) plans to implement a stream restoration and habitat enhancement project on the East Fork Mill Creek that will improve habitat and biological diversity within a new riverine-riparian greenway. BCDES will focus on approximately one mile of the stream between the Upper Mill Creek Water Reclamation Facility's outfall and the confluence of East Fork and Mill Creek. BCDES anticipates using a variety of restoration techniques, including using conservation easements, reintroducing native plants to provide better habitat, installing bio-engineering techniques to reduce erosion and sedimentation and improving substrate, increasing pool and riffle formations, and other cost effective and viable methods that will contribute to biological attainment and improved fish and macroinvertebrate diversity along the East Fork. Ohio EPA plans to reassess the stream during the Summer of 2002 for biological attainment.

This is an innovative demonstration project geared to enhance biological diversity and determine the impact that habitat enhancements have on in-stream biological performance that can be used to improve biological attainment. This initiative is a result of efforts by BCDES, Ohio EPA, MCRP, and others to improve and attain biological indices of the warm water habitat in the East Fork. Other projects will also be initiated that incorporate more of a holistic perspective that will enhance the in-stream improvement efforts.

Committed and Potential Partners

Butler County Department of Environmental Services, Butler County Board of Commissioners, Mill Creek Restoration Project, Butler Soil and Water Conservation District, Ohio EPA, and the Water Quality Committee of the Mill Creek Watershed Council.

Proposed Union Centre East Greenway, Union Township, Butler County

In 1998, the Union Township Trustees approved a conceptual design plan for Union Centre East that includes greenspace within the floodplain of East Fork Mill Creek, upstream of the Upper Mill Creek Water Reclamation Facility. Union Township is currently exploring an opportunity with MCRP and consultants to develop a site-specific greenway plan and engineering documents to create the future greenway through the Union Centre East "new town." This combined development and conservation approach will protect East Fork Mill Creek during and after construction, provide a recreational and alternative transportation trail system, improve the aesthetic appearance and economic value of the development site, and provide critically-needed stormwater management that will protect public/private investments locally and in downstream areas.

Committed and Potential Partners

This proposed project would be partially funded by an Ohio EPA 319 Nonpoint Source Pollution grant to MCRP and potentially by the Union Township government. The work will be assisted by and coordinated with other partners, including the Butler County Department of Environmental Services (conducting stream restoration projects downstream of Union Centre), the County Stormwater Committee, and the Butler Soil and Water Conservation District.

Reserves Park, Liberty Township

The Reserves Park is a 16 acre park is being developed by Liberty Township with financial assistance from Ohio Department of Natural Resources Nature Works grant. The park is located in the headwaters of the Mill Creek watershed and provides preservation of open space between the Reserves of Liberty Subdivision and the Butler County Regional Highway (BCRH). The park will include paved trails connecting Princeton Glendale Road to Van Gorden Road, playground equipment, tennis courts, basketball courts and soccer fields.

Committed and Potential Partners

Liberty Township Park Committee, Liberty Township Trustees, Tri-State Land Development, Ohio Department of Natural Resources, Butler County Transportation Improvement District

Mill Creek Headwaters Preserve Park

The Mill Creek Preserve is an approximately 23 acre parcel of land proposed for donation to Liberty Township by the Butler County Transportation Improvement District (TID). The parcel is located on the south side of the Butler County Regional Highway and serves as a buffer between the highway and homes in the Logsdons Ridge and Woods of Logsdons Ridge subdivisions. A main line sanitary sewer and petroleum pipeline cross the property. The parcel of land contains a portion of the main stem of Mill Creek in the upper reaches of the watershed. Establishing the park in this property will assure the preservation of the riparian forest buffer. Preventing development of the property will preserve the water absorption qualities of the landscape in an area of rapid development. It is also adjacent to the historic Ayers cemetery situated on a terrace above Mill Creek. Liberty Township intends to maintain the park as a nature preserve, limiting development to occasional mowing of foot paths through the woodland.

Committed and Potential Partners

Liberty Township Park Committee, Liberty Township Trustees, Butler County Transportation Improvement District, Logsdons Ridge Homeowners Association

Butler County Regional Highway Trails Network

The Liberty Township Park Committee is working with the Transportation Improvement District (TID) to explore the possibility of a trail system along the right-of-way of the BCRH. The proposed trail would provide a recreation corridor connecting the Reserves Park and the upper reaches of the tributaries to the main stem of the Mill Creek to parks and greenways in the adjacent Gregory Creek drainage basin.

Committed and Potential Partners

Liberty Township Park Committee, Liberty Township Trustees, Butler County Transportation Improvement District, Logsdons Ridge Homeowners Association, City of Hamilton, Fairfield Township Trustees

Connection of Butler County Regional Highway Trail to Union Centre Boulevard

In order to achieve the vision of establishing a greenway with recreational opportunities from the Ohio River to the headwaters of Mill Creek a connection must be made between the proposed Union Centre Greenway and the proposed BCRH trail.

The section of Mill Creek that connects these areas is currently agricultural with spotty commercial development. Mill Creek flows near the remnants of the Ohio and Erie canal which is proposed for future recreational development. A coordinated effort between the potential partners will assure the preservation of the corridor for environmental, recreational and aesthetic benefits.

Committed and Potential Partners

Butler County Transportation Improvement District, Ohio Canal Society, City of Fairfield Parks Department, Fairfield Township Trustees, Union Township Parks Department, Union Township Trustees and MCRP.

ESTIMATED EXPENSE AND RESOURCE BUDGETS (FY1999-2000)

The following text defines possible funding scenarios for Early Action projects defined herein. These are draft cost estimates that may change as more detailed planning takes place. These projected expense budgets are followed by resource budgets that identify secured and potential sources of funding and a variety of in-kind contributions. Where funding sources have been identified but not secured or committed the status is indicated as "to be raised" or "application to be submitted."

I. City of Cincinnati Projects Proposed By MCRP

Caldwell-Seymour

Environmental Assessments	\$25,000
Acquisition	\$35,000
Planning/Design	\$20,000
Construction/Engineering Documents	\$17,500
Construction	\$30,000
Project Management	<u>\$31,625</u>
Subtotal	\$159,125

Silver Oaks

Environmental Assessments	\$25,000
Economic Feasibility Study	\$10,000
Planning/Design	\$50,000
Project Management	<u>\$25,250</u>
Subtotal	\$110,250

Queen City Centre/Salway/Mitchell

Environmental Assessments	\$25,000
Acquisition	\$55,000
Planning/Design	\$20,000
Construction/Engineering Documents	\$40,000
Project Management	<u>\$33,500</u>
Subtotal	\$173,500

Salway/Western Hills Viaduct

Environmental Assessments	\$100,000
Planning/Design	\$50,000
Project Management	<u>\$35,000</u>
Subtotal	\$185,000

North Fairmount

Construction/Restoration	\$60,000
Project Management	<u>\$21,500</u>
Subtotal	\$81,500

Mill Creek/Ohio River

Environmental Assessments	\$75,000
Planning/Design	\$75,000
Project Management	<u>\$35,000</u>
Subtotal	\$185,000

Total Estimated Costs for Phase One Cincinnati Projects: \$894,375

Secured and Potential Resources:

City Capital Budget	\$150,000	City Council approved 1/99
Ohio EPA 319	\$ 15,000	secured
Ohio EPA 319	\$100,000	application to be submitted
US EPA	\$ 75,000	applications pending
Community Investment Partners	\$150,000	to be raised
City of Cincinnati	\$ 30,000	in-kind services to be committed
NRCS Dept. of Agriculture	\$ 30,000	secured
Kroger Co.	\$ 3,000	secured
Other Businesses	\$ 25,000	to be raised
Foundations	\$ 72,000	to be raised
Volunteers	\$ 16,800	committed
Other Needed Funds/Partners	<u>\$227,575</u>	to be raised
Total	\$894,375	

II. Other Early Action Project Located Within Hamilton County

West Fork Mill Creek Greenway (Woodlawn-Wyoming)

Environmental Assessments	\$25,000
Construction/Engineering Documents	\$75,000
Construction	\$297,800
Project Management	<u>\$18,000</u>
Subtotal	\$415,800

Secured and Potential Resources:

ODNR NatureWorks	\$137,214	application submitted 2/99
Ohio CIP	\$30,000	secured
Woodlawn	\$18,000	committed: project manager
Anchor Brothers Properties, Ltd.		Conservation easement committed
Other Local Businesses	\$75,000	to be raised
Hamilton Co. Park District	\$5,000	in-kind technical services
Volunteers	\$720	committed
Community Investment Partners	\$50,000	submit application Spring '99
Foundations & other sources	<u>\$99,866</u>	to be raised spring '99
Total	\$415,800	

Reading Greenway

Engineering and Design	\$4,450
Bid Advertising	\$500
Equipment Rental	\$1,850
Trail Paving	\$38,500
Turf Restoration	\$1,600
Trail Markers with Decals	\$1,550
Crosswalk Signage	\$1,900
Trail Heads	<u>\$4,650</u>
Total	\$55,000

Secured and Potential Resources:

Ohio Capital Improvement Program Grant	\$50,000	secured
City of Reading	<u>\$5,000</u>	committed inkind
Total	\$55,000	

Greenway/Quiet Park

Landscaping	\$49,500
Gazebo/outdoor classroom	\$60,000
Storm sewers	\$7,000
Signage	\$3,000
Excavation/Grading	\$10,000
Soil	\$10,000
Asphalt Walkways	\$18,500
Decorative Paving	\$10,000
Lighting	\$3,000
Irrigation System	\$9,500
Sound	\$3,000
Fountain	\$4,000
Bollards	\$2,500
Design/Engineering	<u>\$15,000</u>
Total	\$205,000

Secured and Potential Resources:

Ohio EPA Pristine Fund	\$125,000	secured
City of Reading	<u>\$80,000</u>	committed inkind
Total	\$205,000	

MCWC: Mill Creek Walking Trail

Greenway Trail Markers	\$3,000
Trail Identification Signs	\$750
Security Fencing	\$5,000
Trail Heads	\$14,000
Trail Information Signs	\$1,500
Trail Improvements	\$5,000
Total	\$29,250

Secured and Potential Resources:

State and Local Government Funds	\$29,250	Secured
through MCWC		



III. Greenway Projects Proposed in Butler County

BCDES/East Fork Mill Creek Stream Restoration Project

Field Surveys	\$ 10,000
Planning/Design	\$ 25,000
Restoration/Engineering Documents	\$ 70,000
Construction/Restoration	\$204,920
Project Management	<u>\$ 30,000</u>
Total	\$339,920

Secured and Potential Resources:

BCDES	\$230,000	committed: cash & inkind
Ohio EPA 319	\$100,000	application to be submitted
MCRP	<u>\$ 9,920</u>	committed: inkind services
Total	\$339,920	

Proposed Union Centre East Greenway, Union Township, Butler County

Digital Mapping	\$ 5,000
Detailed Site Plan and Design Specifications	\$16,500
Engineering Documents	\$16,500
Community and Agency Review and Project Mgt.	<u>\$ 8,000</u>
Total	\$46,000

Potential Resources:

Union Township	\$23,000
MCRP	<u>\$23,000</u>
Total	\$46,000

Liberty Township Reserves Park

Phase One Total Estimated Cost: \$438,700

(Detailed budget unavailable at the time this plan went to press.)

Secured and Potential Resources:

Tri State Development Co.	16 acres	secured: land donation (G. Amend & C. Todd)
BC Transp. Improvement District	\$63,000	secured: land purchase/swap
ODNR NatureWorks	\$68,950	secured
Liberty Township	\$35,750	secured
HUD CDBG	\$ 8,000	secured
Hamilton Community Foundation	\$ 7,500	secured: matching grant
Friends of Liberty Twnshp Parks	\$63,000	committed: volunteer inkind
D. Russell Lee Vocational School	\$ 2,000	committed: inkind
Businesses	\$ 5,000	committed: inkind
Other Sources	<u>\$185,500</u>	to be raised
Total	\$438,700	

Phase One (FY 1999-2000) Pilot Projects Budget Summary

MCRP/City of Cincinnati Projects	\$894,375
West Fork MC/Woodlawn-Wyoming	\$415,800
Reading Greenway & Quiet Park	\$260,000
Liberty Township Reserves Park	\$438,700
East Fork MC/BCDES	\$339,920
Union Township Greenway	\$46,000
MCWC/Walking Trail	<u>\$29,250</u>
Total	\$2,424,045

Secured and Potential Funding Sources (FY 1999-2000)

<u>Source</u>	<u>Amount</u>	<u>Status</u>
Ohio Capital Improvement Program	\$ 85,378	secured: Woodlawn, Reading, & MCWC Walking Trail projects
ODNR NatureWorks	\$137,214	application submitted by Woodlawn
ODNR NatureWorks	\$ 68,950	secured: Liberty Township Reserves Park
Ohio EPA Pristine Fund	\$125,000	secured by Reading
Ohio EPA 319 Program	\$ 43,000	secured by MCRP: N.Fairmount and U. Twnshp, projects
Ohio EPA 319 Program	\$249,866	applications submitted in '99 by BCDES, Woodlawn, MCRP
NRCS, Dept. of Agriculture	\$ 30,000	secured by MCRP
U.S. EPA	\$ 75,000	applications submitted by MCRP
HUD Comm. Dev. Block Grant	\$ 8,000	secured by Liberty Township
City of Cincinnati Capital Budget	\$150,000	approved 1/99 by City Council for MCRP projects
MCWC local government grants	\$ 19,000	secured or committed
City of Reading	\$ 85,000	committed inkind
Village of Woodlawn	\$ 18,000	committed inkind
Liberty Township	\$ 35,750	secured
BCDES	\$230,000	cash & inkind committed
BC Transp. Improvement District	\$ 63,000	secured (land purchase/swap in Liberty Township)



Other Local Govmts/Park Boards	\$ 62,872	commitments to be secured (MCWC, UT, CPB, HCPD)
Community Investment Partners	\$200,000	to be raised
Tri State Development Co.	16 acre land	donation (by G. Amend & C. Todd: Liberty Twnshp Reserves Park)
Kroger Company	\$ 3,000	secured by MCRP
Other Businesses	\$127,000	cash & inkind services to be raised
D. Russell Lee Vocational Center	\$ 2,000	estimated inkind services committed
Hamilton Community Foundation	\$ 7,500	matching grant secured by Liberty Township
Other Foundations	\$100,000	to be raised
Volunteer Inkind Services	\$ 85,440	committed: thru MCRP, Woodlawn, Liberty Twnshp, MCWC
Other Needed Funds/Partners	<u>\$413,075</u>	(MCRP: 227,575; Liberty Township: 185,500)
Total	\$2,424,045	

Funding Status Summary As of 1/31/99:

Total Secured and Committed:	\$1,059,018
Total Applications Submitted:	\$ 462,214
Other Funds to be Raised:	<u>\$ 902,813</u>
Total	\$2,424,045

ESTIMATED EXPENSE AND RESOURCE BUDGETS (FY2000-01)

I. City of Cincinnati Projects Proposed By MCRP

Caldwell-Seymour

Streambank Stabilization	\$150,000
Construction	\$157,000
Project Management	\$ 58,625
Subtotal	\$366,125

Silver Oaks

Acquisition	\$110,000
Construction/Engineering Documents	\$150,000
Project Management	\$ 51,500
Subtotal	\$311,500

Queen City Centre/Salway/Mitchell

Construction	\$456,000
Management	\$ 80,900
Subtotal	\$536,900

Salway/Western Hills Viaduct

Acquisition	\$100,000
Construction/Engineering Documents	\$225,000
Project Management	\$ 61,250
Subtotal	\$386,250

Mill Creek/Ohio River

Environmental Assessments	\$ 75,000
Acquisition	\$250,000
Project Management	\$ 61,250
Subtotal	\$386,250

Total Estimated Costs for Phase Two

City of Cincinnati Projects: **\$1,987,025**

Secured and Potential Resources:

City Capital Budget	\$1,068,564	requested; City Council approval 1/99 for \$150,000
ODNR Nature Works	\$ 100,000	to be raised
TEA-21	\$ 250,000	to be raised
HUD CDBG	\$ 200,000	to be raised
Community Investment Partners	\$ 150,000	to be raised
City of Cincinnati	\$ 30,000	in-kind services to be committed
Businesses	\$ 80,000	to be raised
Foundations	\$ 79,013	to be raised
Volunteers	\$ 29,448	committed
Other Needed Funds/Partners	<u>\$0 to 918,564</u>	amount dependent on final City allocation in 2000
Total	\$1,987,025	



II. Other Projects Located Within Hamilton County

West Fork Mill Creek Greenway: Winton Woods/Woodlawn/Wyoming Trail

Construction/Engineering Documents	\$150,000
Construction/landscaping	\$419,800
Project Management	\$ <u>18,000</u>
Total	\$587,800

Secured and Potential Resources:

Buckingham Properties	\$250,000	committed
Hamilton Co. Park District	\$190,000	committed
Woodlawn	\$ 18,000	committed: project manager
Wyoming	\$120,000	cash & inkind committed
		to be raised
Volunteers	\$ 4,800	committed
Other Businesses	\$ <u>5,000</u>	inkind services
Total:	\$587,800	

Reading Greenway (Section 3):

Estimated Cost	\$55,000
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Secured and Potential Resources:

ODNR NatureWorks	\$41,250	to be raised
City of Reading	\$13,750	committed inkind
Total	\$55,000	

III. Greenway Projects Proposed in Butler County

Liberty Township: Butler Cty Regional Highway Trails Network

Estimated Cost	\$221,613*
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Secured and Potential Resources:

Liberty Township	\$200,000	committed: cash and inkind
		to be raised
Volunteers	\$ <u>21,613</u>	to be recruited
Total	\$221,613	

Phase Two (FY 2000-2001) Pilot Projects Budget Summary

MCRP/City of Cincinnati Projects	\$1,987,025
West Fork MC/Woodlawn, Wyoming, HCPD	\$ 587,800
Reading Greenway (Section 3)	\$ 55,000
Liberty Township BC Hwy Trails	\$ <u>221,613*</u>
Total	\$2,851,438

* At the time this plan went to press, estimated budgets were not available for two greenway projects, to be developed in Liberty Township in the year 2000. It's expected that the Butler County Transportation Improvement District will donate 42 acres of land for the Wetlands Park and 23 acres for the Mill Creek Headwaters Preserve Park, after construction is completed for the Butler County Regional Highway. In addition, the Butler County Regional Highway Trails Network will be developed in the highway right-of-way. The Friends of Liberty Township Parks and the Township government have budgeted \$200,000 for this trail system, with anticipated volunteer contributions of at least \$21,613.

Secured and Potential Funding Sources

<u>Source</u>	<u>Amount</u>	<u>Status</u>
ODNR NatureWorks	\$ 241,250	to be raised
TEA-21	\$ 250,000	to be raised
HUD CDBG	\$ 200,000	to be raised
City of Cincinnati	\$1,068,564	requested: \$150,000 approved by City Council 1/99
City of Reading	\$ 13,750	committed inkind
Villages of Woodlawn & Wyoming	\$ 38,000	committed inkind
City of Cincinnati	\$ 30,000	inkind to be committed
Buckingham Properties/Duke	\$ 250,000	committed
Hamilton County Park District	\$ 190,000	committed
Liberty Township	\$ 200,000	committed: cash & inkind to be raised
BC Transp. Improvement Distct	land donations	committed
Community Investment Partners	\$ 150,000	to be raised
Businesses: cash & inkind	\$ 85,000	to be raised
Foundations	\$ 79,013	to be raised
Volunteer Inkind Services	\$ 55,861	committed thru MCRP, Liberty Twnshp, West Fork MC partners
Other Needed Funds/Partners	<u>\$0 to 918,564</u>	amount dependent on Cincinnati final capital allocation in 2000.
Total	\$2,851,438	

Phase Two Funding Status Summary As of 1/31/99:

Total Secured and Committed:	\$ 897,611
Other Funds to be Raised:	<u>\$1,953,827</u>
Total	\$2,851,438



ESTIMATED EXPENSE AND RESOURCE BUDGETS (FY2001-03)

Silver Oaks

Construction/Landscaping	\$1,188,000
Project Management	\$178,200
Subtotal	\$1,366,200

Salway/Western Hills Viaduct

Construction/Landscaping	\$1,560,000
Project Management	\$234,000
Subtotal	\$1,794,000

Mill Creek/Ohio River

Acquisition/Easements	\$750,000
Construction/Engineering Documents	\$198,000
Construction/Landscaping	\$1,320,000
Project Management	\$340,200
Subtotal	\$2,068,200

Total Budget for Cincinnati Greenway Projects \$5,288,400

West Fork Mill Creek Greenway: Winton Woods/Woodlawn/Wyoming Trail

Estimated Cost \$3,700,000

Secured and Potential Resources:

Woodlawn	36,000
Wyoming	40,000
Ohio CIP	500,000
TEA-21	1,000,000
HUD CDBG	104,800
Volunteers	19,200
Other Funds to be Raised	<u>2,000,000</u>
Total	3,700,000

Reading Greenway (Section 4)

Estimated Cost \$55,000

Secured and Potential Resources:

ODNR NatureWorks	41,250	to be raised
City of Reading	<u>13,750</u>	committed inkind
Total	55,000	

Phase Three (FY 2001-2003) Pilot Projects Budget Summary

MCRP City of Cincinnati Projects	5,288,400
West Fork MC/Woodlawn, Wyoming, HCPD	3,700,000
Reading Greenway (Section 4)	<u>55,000</u>
Total*	8,983,400

* Estimated budget for the Regional Highway Connector Trail in Liberty Township to the Union Centre Boulevard greenway system in Union Township unavailable at the time this plan was printed.

Summary of Potential Funding Sources

<u>Source</u>	<u>Estimated Amount</u>
Ohio Capital Improvement Program (2001-2002 & 2003-2004 Biennial Budgets)	\$1,500,000
ODNR NatureWorks	\$ 537,650
Ohio EPA 319	\$ 300,000
TEA-21	\$1,500,000
HUD CDBG	\$ 610,000
City of Cincinnati Capital Budget (2001-2002 & 2003-2004 Biennial Budgets)	\$1,500,000
City of Reading	\$ 13,750
Villages of Woodlawn & Wyoming	\$ 76,000
Other Local Governments/Park Boards	\$2,000,000
Community Investment Partners	\$ 450,000
Businesses: cash & inkind	\$ 200,000
Foundations	\$ 200,000
Volunteer Inkind Services	<u>\$ 96,000</u>
Total	\$8,983,400



NEXT STEPS

The following text outlines some of the important next steps that are needed to implement the Mill Creek Watershed Greenway Master Plan. These steps should commence immediately upon the adoption of the Master Plan by the Mill Creek Watershed Council. The actions outlined below are not in order of importance. The anticipated "responsible party" to implement each action step is indicated in bold type.

Year 1: January through December 1999

I. Organizational Strategy and Public Information

- 1) The **Mill Creek Watershed Council** (MCWC) should endorse and adopt the completed master plan at its January 1999 meeting, including designation of MCRP as the facilitator for greenway implementation (Editors Note: This was accomplished at the MCWC's 1/29/99 meeting). MCWC should communicate its support for the plan with its membership and urge its members and others to support/endorse/approve/adopt the plan as appropriate.
- 2) The **MCWC** and **Mill Creek Restoration Project** (MCRP) should work together to publish and make available the final Mill Creek Watershed Master Plan, Executive Summary Brochure and CAGIS files to watershed communities, interested government agencies, civic organizations, businesses, property owners, and other interested parties.
- 3) **MCRP** and **MCWC** should begin to make presentations of the completed master plan to key partners, including Cincinnati City Council, Cincinnati Park Board, Cincinnati Recreation Commission, Hamilton County Commission, Hamilton County Park District, OKI Regional Council of Governments, Butler County Commission, Butler MetroParks, Union Township Trustees, Greater Cincinnati Chamber of Commerce, Port Authority for Brownfield Redevelopment, Ohio Department of Natural Resources, civic and environmental associations, and volunteer groups. The objective of these presentations is to gain support for the plan, recruit project partners, develop optimal implementation strategies.
- 4) **MCRP** should create a public exhibit about greenways and develop a web site and publish a newsletter documenting the implementation of pilot projects and informing people how they can help. The MCWC and other partners should include the web site address in their ongoing publications. The exhibit should be displayed at public places throughout the watershed. The newsletter should be published on at least a semiannual basis.
- 5) The former **Mill Creek Watershed Greenway Committee** should be asked to serve as valuable advisors to MCRP, participating on a speakers bureau for community greenway presentations, and assisting with a variety of technical and community outreach and education activities.

- 6) **MCRP** and **MCWC**, in coordination with Hamilton County government, should prepare a progress report to ODNR concerning completion of the greenway plan and status of proposed pilot projects that will be developed with State of Ohio Capital Improvement Program funds through ODNR's NatureWorks.
- 7) **MCRP** and other greenway project sponsors should coordinate their work with the new "Regional Greenspace Office" at OKI.

II. Fingers of Green: Pilot Projects

The following projects should be completed by December 1999:

- 1) North Fairmount Research and Training Greenway Park within the City of Cincinnati, by **MCRP**, North Fairmount Community Center and other partners.
- 2) Phase II Vorheestown Bicentennial Greenway Trail and the Greenway Quiet Park, by the **City of Reading**.
- 3) Liberty Township Reserve Park, by **Liberty Township** government in Butler County.
- 4) Potential greenway system strategy for Union Centre East, by **Union Township**, Butler County and **MCRP**.
- 5) Phase I Mill Creek Temporary Walking Trail, by **MCWC Recreation Committee**.

Other Pilot Projects to be Launched in 1999:

- 1) Within the City of Cincinnati (by **MCRP** and **partners**): Caldwell and Seymour Parks Greenway, Silver Oak Estates Park, Salway Park/Mitchell Avenue Greenway Trail and Queen City Center Park, Salway Park to Western Hills Viaduct Greenway Trail, and Mill Creek/Ohio River Confluence Park and Greenway Trail to the downtown riverfront.
- 2) **Liberty Township**: Mill Creek Headwaters Preserve Park
- 3) Villages of **Woodlawn** and **Wyoming** and **Hamilton County Park District**: Winton Woods Lake Greenway Trail connecting to and through Woodlawn and Wyoming.
- 4) **Butler County Department of Environmental Services**: East Fork Mill Creek Improvements.

III. Fundraising and Partnership Development

- 1) The **City of Cincinnati** should provide requested capital budget funding to launch pilot projects within the city's portion of the watershed.
- 2) **MCRP** should work with **OKI**, the **Port Authority for Brownfields Redevelopment**, and other greenway pilot project sponsors and cosponsors (e.g., Reading, Woodlawn, Union Township, Liberty Township, City of Cincinnati) to develop grant applications for FY 2000 TEA-21 transportation funds.
- 3) **MCRP** should meet with Ohio Department of Natural Resources staff to coordinate applications for NatureWorks funding for greenway pilot projects in the watershed.



- 4) **MCRP** should research potential institutions for “housing” the Greenways Trust fund, including The Greater Cincinnati Foundation and local banks.
- 5) **MCRP** and other greenway project sponsors should develop a prospectus for each proposed pilot project, with special attention to specific ways businesses can get involved. Key businesses, corporations, foundations, and volunteers groups should be identified and asked to participate. To the extent practicable, **MCRP** will assist other sponsors with fundraising and partnership development for their pilot projects.
- 6) The **Greater Cincinnati Chamber of Commerce** should work cooperatively with MCRP, MCWC, local governments, and greenway project sponsors to develop viable incentives to encourage business participation in the development of the greenway system.

IV. Integrated and Collateral Programs and Activities

Floodplain/Stormwater Management

- 1) **MCRP** should begin work with key stakeholders on the “Watershed Alternative to Urban Wet Weather Impacts” project that will focus on water quality and quantity and ecosystem health in the Mill Creek watershed. MCRP should coordinate this work with the Hamilton County Soil and Water Conservation District that is spearheading a “Wet Weather Initiative” for all of Hamilton County. Other key partners include the Butler County Stormwater Committee, existing stormwater permittees and municipalities that are expected to be regulated under future Phase II stormwater regulations, Army Corps of Engineers, Millcreek Valley Conservancy District, and existing stormwater utilities in Forest Park and Cincinnati.
- 2) The **Wet Weather Initiative, MCRP, MCWC, and Butler County** Stormwater Committee should cosponsor an educational workshop in spring 1999 for local government officials and other interested parties about the upcoming U.S. EPA Phase II Stormwater program requirements. This workshop should include a special focus on integration of greenway and stormwater objectives and strategies.
- 3) **MCWC** should contact FEMA and arrange for a knowledgeable “Project Impact” speaker to brief MCWC members about this disaster preparedness program. MCWC, MCRP, and watershed political jurisdictions should explore whether the entire watershed may want to participate in the Project Impact program. MCWC should mail FEMA information to its members.
- 4) **MCRP** should communicate and coordinate floodplain management and greenway development work with Colerain Township, that recently become a Project Impact community.
- 5) **MCWC and Millcreek Valley Conservancy District** should develop an ongoing program with local governments to identify and remove large woody debris dams and trash from Mill Creek.
- 6) **MCWC, MCRP**, and all local and state stakeholders should work cooperatively with the ACOE to develop environmentally sound methods for reducing flood damages in the future and for repairing damages to the Mill Creek ecosystem that

may have occurred during the channelization of the stream.

Water Quality and Ecosystem Health

- 1) **MCRP, MCWC**, health districts and other concerned parties should work with the Hamilton County Commission, Metropolitan Sewer District, and the MSD Policy Committee to facilitate acceleration of the current 25 year plan to correct combined sewer overflows in the watershed.
- 2) **Park boards and university faculty and students** should begin to target riverine-riparian zones of Mill Creek and its tributaries to conduct stream assessments, plant and wildlife inventories, streambank erosion surveys. Opportunities for applying Best Management Practices should be identified.
- 3) **Ohio EPA** should begin its "Total Maximum Daily Load" study of the Mill Creek watershed and work cooperatively with all local stakeholders.

Year 2: January through December 2000

- A new specific plan of action for the year should be developed that builds on the accomplishments of the first year and continues education and marketing efforts and creation of greenway projects. By the Millennium, the following objectives should be accomplished:
- At least fifty percent of the political jurisdictions throughout the watershed support and endorse the greenway master plan and are beginning to implement its recommendations.
- The Greenway Trust Fund has at least \$500,000 in donations and grants and is established at a local bank or foundation.
- A greenway video program has been created and is used for public education.
- The Caldwell and Seymour Parks Greenway, and Salway Park/Mitchell Avenue Greenway Trail and Queen City Center Park are completed within the City of Cincinnati, and Phase III of the Voorhees Bicentennial Trail in Reading is complete.
- Several greenway pilot projects are well underway, including the Woodlawn-Wyoming Greenway; the Mill Creek Headwaters Preserve Park in Liberty Township; and within the City of Cincinnati, the Silver Oak Estates Park, Salway Park to Western Hills Viaduct Greenway Trail, and Mill Creek/Ohio River Confluence Park and Greenway Trail to the downtown riverfront.
- The "Watershed Alternative to Urban Wet Weather Impacts" project has resulted in an action plan that has the consensus among all of the major stakeholders who are beginning to implement it.

Years 3-5: 2001 through 2004

By the end of 2004, the following objectives should be accomplished:

- The remaining fifty percent of watershed jurisdictions have endorsed the greenway plan and are implementing its recommendations.



- There will be at least \$1 million in the Greenway Trust Fund.
- The Woodlawn-Wyoming Greenway, Phase IV Vorheestown Bicentennial Greenway Trail, Silver Oak Estates Park, Salway Park to Western Hills Viaduct Greenway Trail, and Mill Creek/Ohio River Confluence Park will be completed.
- The Action Plan developed in the “Watershed Alternative for Urban Wet Weather Impacts” is implemented.
- The Mill Creek watershed greenway partners have conducted a full review of master plan implementation activities and developed a new greenway action strategy for the next five years.

1999-2004 Ongoing Implementation Strategies

- MCRP should identify the private sector partners who will endorse and support the plan and are interested in becoming project partners.
- MCRP should conduct educational workshops for local residents to brief them on the vision and goals of the plan, as well as the specific development objectives.
- MCRP should develop an agreement that can be executed with organizations and agencies that support and endorse the master plan and an agreement for project partners.
- MCRP and MCWC, along with project partners, should sponsor events and programs throughout the Greenway system.

5. MILL CREEK SIGNAGE PROGRAM

The Mill Creek Greenway Signage Program has been developed to convey a unique identity and wayfinding system for the Mill Creek watershed's future network of greenways. Rhinoworks, a Cincinnati-based graphic design firm, created the logo in a hand-drawn style to remind people of Mill Creek's rich Native American history. Within the logo, individual symbols depict key elements of the greenway initiative: water, habitat, people, wildlife, and a greenway trail. The Mill Creek Watershed Council Greenway Committee unanimously approved this logo for use in the greenway system.

Rhinoworks then worked closely with Greenways Incorporated, the Mill Creek Restoration Project and Cincinnati-based sign manufacturer, Holthaus, to develop a durable and unique signage program that reuses and recycles aluminum for all signs. Greenway sponsors are also strongly encouraged to use other recycled materials for greenway furnishings like benches, sign posts, and fences. The signage program consists of entry, trailhead, informational, directional, bollard and kiosk signs that will be installed along the greenway trail system. The materials and design styling was approved by the Greenway Committee of the Mill Creek Watershed Council. The specifications for each sign are defined on the following pages of this chapter.

Please note that some funding sources, such as the Ohio Department of Natural Resources NatureWorks Program, stipulate additional logo and signage requirements.

Mill Creek Logo as designed by Rhinoworks





MILL CREEK SIGNAGE PROGRAM



Mill Creek Greenway Signage System

Entry

PMS 286 Blue - Background

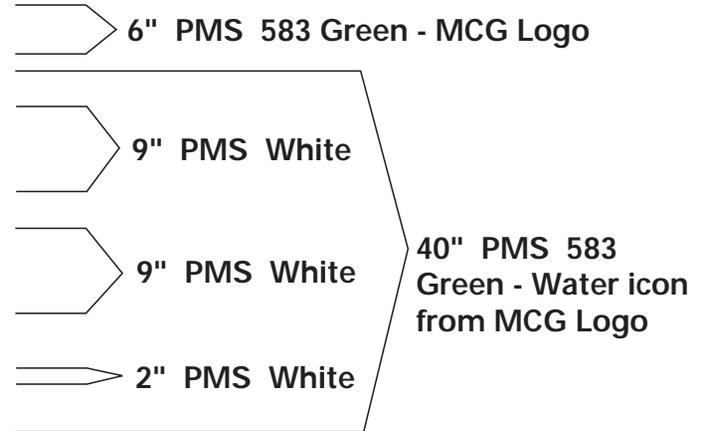


The Mill Creek Greenway Signage shall be designed by Rhinoworks or approved equal.

Rhinoworks
42 Calhoun Street
Cincinnati, Ohio 45219
513.861.7966
fax - 513.861.7900
email - rwarner@rhinoworks.com

The Mill Creek Greenway Signage shall be fabricated by Holthaus or approved equal.

Holthaus
817 Ridgeway Ave.
Cincinnati, Ohio 45229
513.861.0060
fax - 513.559.0975



- Font usage - Myriad Bold by Adobe (Title, Headline, and body copy)
 Title and Headline (Initial Caps with upper case at 75% vertical scale)
 Body copy (upper and lower case)
- Utopia Regular by Adobe (Mill Creek Greenway logo type and support text)
 MCG logo type (upper case)
 Support type (upper and lower case)

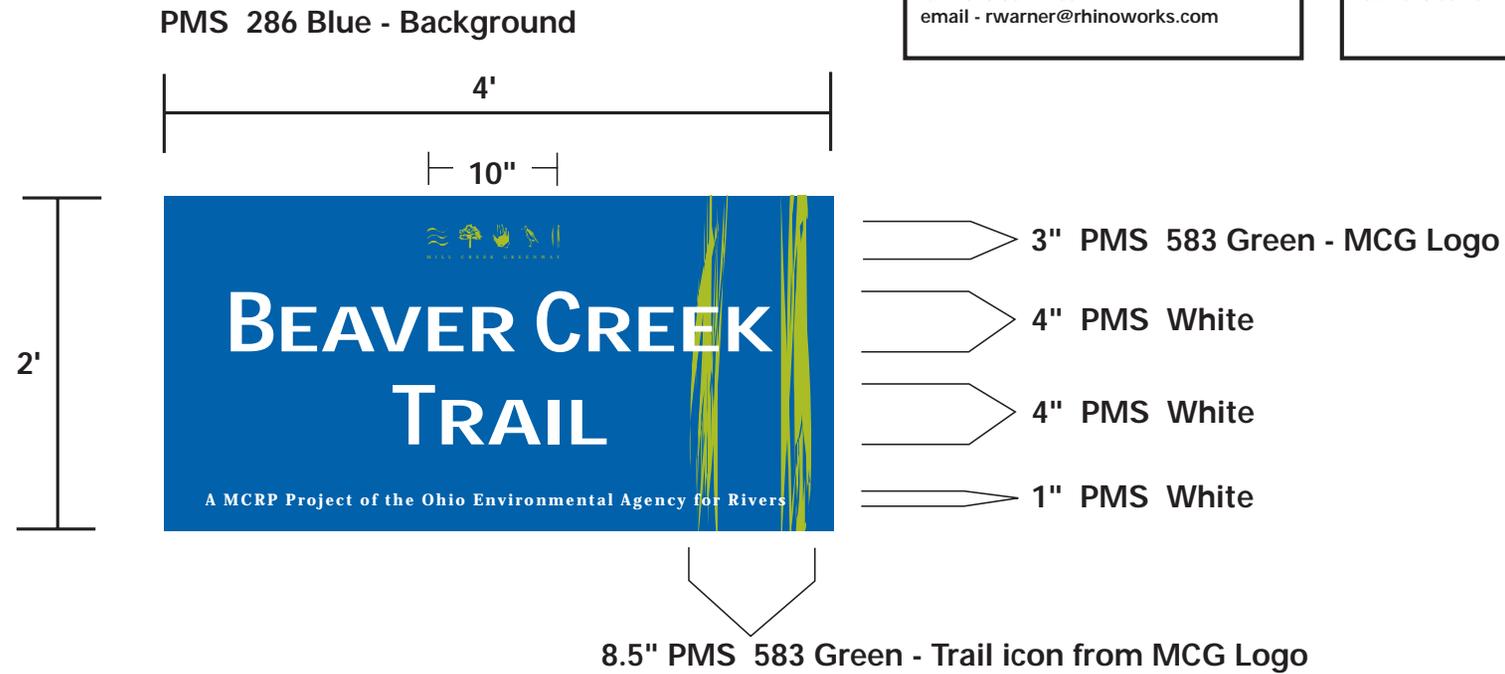
Graphic Elements - Mill Creek Greenway logo (varying scale)

Colors - Pantone Matching System (PMS 286-Blue, PMS 583-Green, PMS White)

Notes: The name of the Greenway on the entry sign will change from community to community.
 The smaller copy under the title is for special funding text.

Mill Creek Greenway Signage System

Trailhead



The Mill Creek Greenway Signage shall be designed by Rhinoworks or approved equal.

Rhinoworks
 42 Calhoun Street
 Cincinnati, Ohio 45219
 513.861.7966
 fax - 513.861.7900
 email - rwarner@rhinoworks.com

The Mill Creek Greenway Signage shall be fabricated by Holthaus or approved equal.

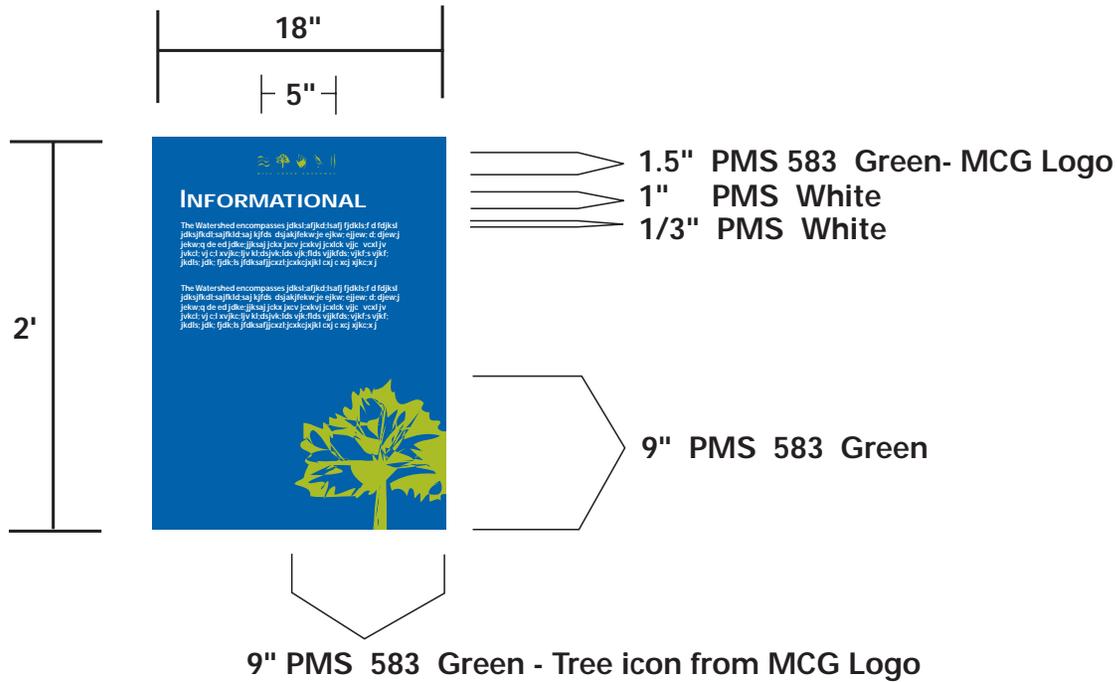
Holthaus
 817 Ridgeway Ave.
 Cincinnati, Ohio 45229
 513.861.0060
 fax - 513.559.0975



Mill Creek Greenway Signage System

Informational (natural, cultural info or sponsors*)

PMS 286 Blue - Background



The Mill Creek Greenway Signage shall be designed by Rhinoworks or approved equal.

Rhinoworks
 42 Calhoun Street
 Cincinnati, Ohio 45219
 513.861.7966
 fax - 513.861.7900
 email - rwarner@rhinoworks.com

The Mill Creek Greenway Signage shall be fabricated by Holthaus or approved equal.

Holthaus
 817 Ridgeway Ave.
 Cincinnati, Ohio 45229
 513.861.0060
 fax - 513.559.0975

*Note: Use .5" white letters if sign is to be used for sponsorship. Change icon in lower left to the hand.

Mill Creek Greenway Signage System

Directional

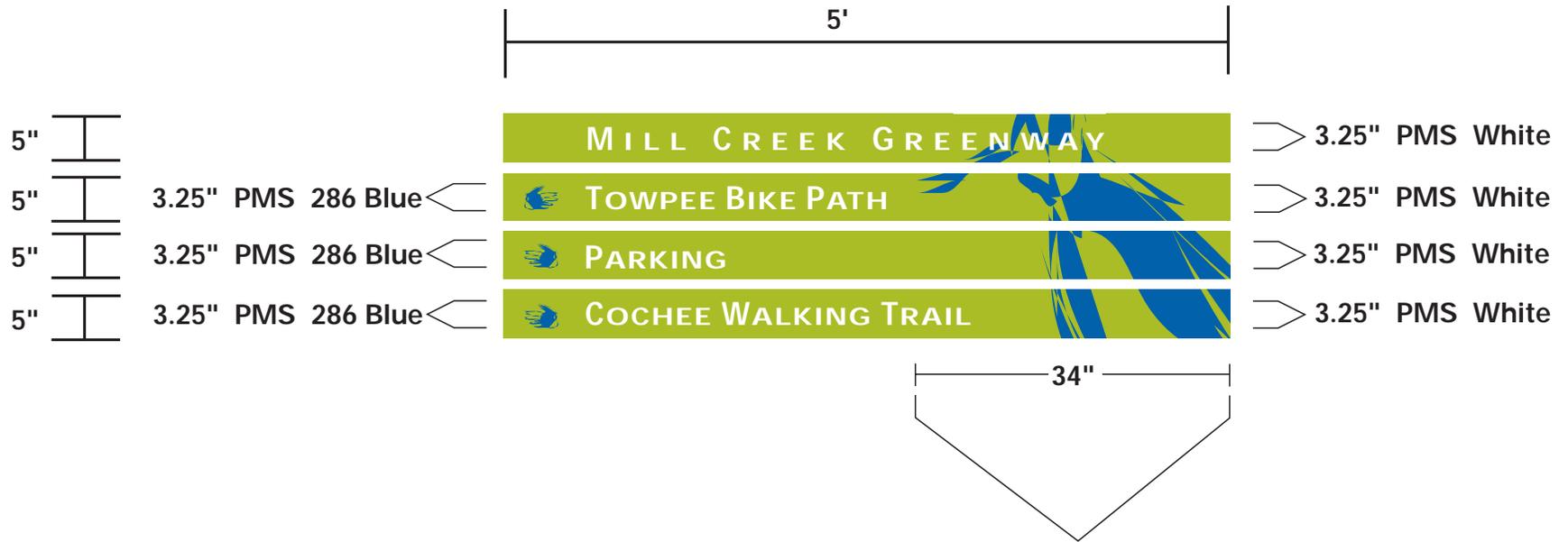
PMS 583 Green - Background

The Mill Creek Greenway Signage shall be designed by Rhinoworks or approved equal.

Rhinoworks
 42 Calhoun Street
 Cincinnati, Ohio 45219
 513.861.7966
 fax - 513.861.7900
 email - rwarner@rhinoworks.com

The Mill Creek Greenway Signage shall be fabricated by Holthaus or approved equal.

Holthaus
 817 Ridgeway Ave.
 Cincinnati, Ohio 45229
 513.861.0060
 fax - 513.559.0975



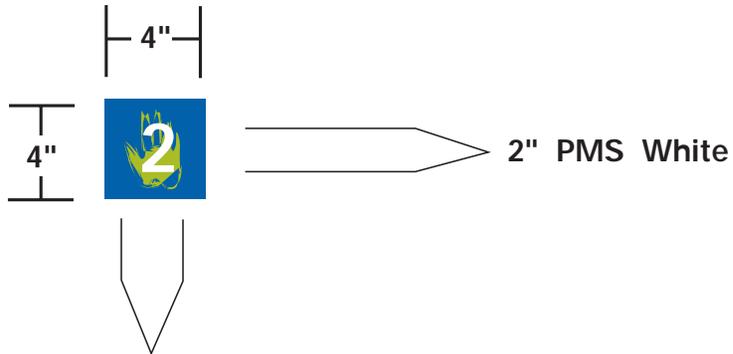
PMS 286 Blue - Bird icon from MCG Logo



Mill Creek Greenway Signage System

Bollard

PMS 286 Blue - Background



3" PMS 583 Green - Hand icon from MCG Logo

The Mill Creek Greenway Signage shall be designed by Rhinoworks or approved equal.

Rhinoworks
42 Calhoun Street
Cincinnati, Ohio 45219
513.861.7966
fax - 513.861.7900
email - rwarner@rhinoworks.com

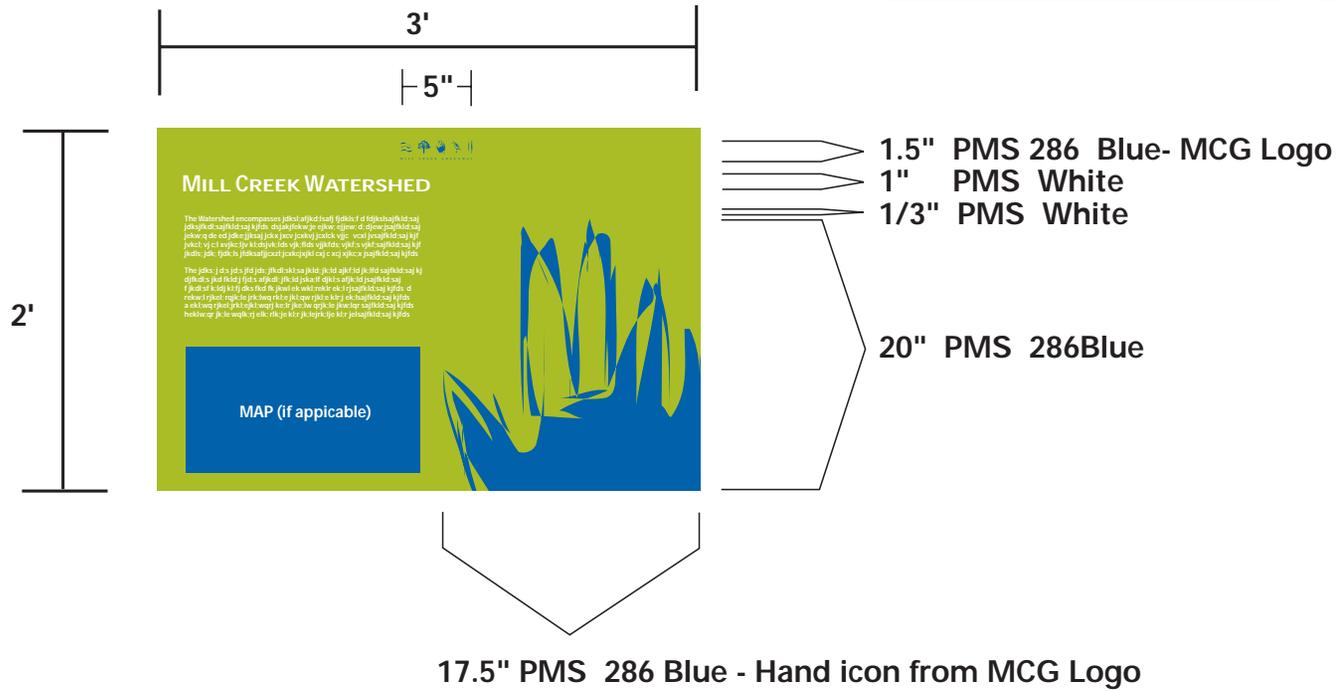
The Mill Creek Greenway Signage shall be fabricated by Holthaus or approved equal.

Holthaus
817 Ridgeway Ave.
Cincinnati, Ohio 45229
513.861.0060
fax - 513.559.0975

Mill Creek Greenway Signage System

Kiosk

PMS 583 Green - Background



The Mill Creek Greenway Signage shall be designed by Rhinoworks or approved equal.

Rhinoworks
 42 Calhoun Street
 Cincinnati, Ohio 45219
 513.861.7966
 fax - 513.861.7900
 email - rwarner@rhinoworks.com

The Mill Creek Greenway Signage shall be fabricated by Holthaus or approved equal.

Holthaus
 817 Ridgeway Ave.
 Cincinnati, Ohio 45229
 513.861.0060
 fax - 513.559.0975

6. A FUTURE FOR MILL CREEK

Upon implementation of the recommendations of this Master Plan, the Mill Creek and its watershed will be transformed into valuable resources for communities within Butler and Hamilton Counties. The focus of a common vision is needed to complete the tasks outlined in the action plan. The following narrative was developed in order to assist in providing such a vision for the future of Mill Creek.

DATE: April 8, 2015

PLACE: Cincinnati, Ohio

I awoke this morning to one of those rare cool, sunny, Spring days in Cincinnati, and decided to go to work late so I can walk my son, Sam, to school. After calling my boss, Sam and I walk with my wife, Susan, to the local Metro transit stop, where she catches a bus to work. Sam's riding his bike and so I sling my skates over my shoulder. As we leave our Northside neighborhood, we walk along a new sidewalk on Spring Grove Avenue that is bordered by freshly planted street trees and head down to the Mill Creek Greenway.

We enter the Greenway at a beautifully landscaped area with signs, benches and a drinking fountain. Sam has trouble pronouncing the name of the trail, an old Indian word "Maketewa." He asks me what it means, but I'm not really certain. I tell him it has something to do with a beautiful stream and forest that once spanned the Mill Creek valley.

It's a little more than a mile to Sam's elementary school, and we'll need to make good time along the Greenway in order to arrive before the morning school bell. Sam fills his water bottle at the fountain, as I strap on my skates, and away we go. Sam knows the route pretty well, since he bikes to school almost every day. It's not long into our journey before we're joined by a couple of Sam's classmates, regular commuters on the Greenway.

As I skate along its west bank, I'm struck by the tranquility and beauty of the Mill Creek. When Susan and I were growing up in Cincinnati, we were warned to never go down to the creek. At that time, the pollution was so bad that everyone thought the creek was "dead." It is incredible to see how much things have changed in such a short amount of time. I remember when much of the Mill Creek used to be lined with concrete and was barren of trees. Now trees and shrubs have been planted along the upper portions of the bank and some of the concrete has been replaced with rock, small shrubs and vines. It isn't natural-the way it used to be 100 years ago-but it certainly looks better than when we were kids. The best part of the Greenway is this new trail that was installed several years ago. I understand that it goes all the way to Butler County. Susan keeps telling me that we should bike the whole thing one day. She says that there is this nice Environmental Park at Union Centre that contains wetlands, an aviary sanctuary and a system of boardwalk trails. Apparently, the Park also helps to absorb excess rainwater and minimizes downstream flooding.

As we make our way down the creekside trail, we pass other people headed



north. The trail is crowded with people headed north and south. I see businessmen walking to work, couples pushing baby strollers, cyclists and joggers. Everyone we pass smiles and says a quick hello. It seems that people are a little friendlier on the Greenway. Maybe its just my imagination, but who wouldn't be in a better mood? The sun is shining, flowers, shrubs and trees are in bloom, the birds are singing and the air smells fresh and clean. I take a quick look at the creek, where I hear something moving, and catch a glimpse of a graceful blue heron catching some sort of fish. You sure wouldn't have seen that here twenty years ago. Sam and his friends have managed to get out ahead of me and so I pick up the pace to catch up.

In the distance I can see a small flotilla of canoes making their way down Mill Creek. As we approach them, I recognize the lead canoeist because his picture has been in the paper from time to time. He is affectionately known as the "Admiral of the Mill Creek Yacht Club." He used to be with our regional planning organization until his recent retirement. Now he runs a canoe livery on the Mill Creek and conducts daily tours. Years ago, I never would have imagined anyone wanting to canoe the Mill Creek. But the "Admiral" has a waiting list and now takes reservations.

We're getting very close to Sam's school, Millvale Elementary. I catch up with him right as we arrive at the school's Greenway entry area. As I'm unlacing my skates, Sam says that he gets to go and plant trees along the Greenway today. He says that a lady from the Greenway project comes over to the school and works with the kids to plant trees. As I understand, the Greenway project coordinates a lot of the efforts along the Greenway. They approached our neighborhood association years ago and asked if we would adopt the completed section of Greenway in the Northside neighborhood. We decided to partner with some of the restaurants and retail shops in our area to take care of the Greenway. We help pick up trash and take part in a community-wide stream clean up every year. I give Sam a kiss on the forehead and tell him to plant those trees just the way Greenway lady asks him to.

After leaving Sam's school, I decide to walk a little further south along the Greenway. As I come around the corner I can see a bunch of workmen down in the creek. The trucks on the top of the creek bank have the MSD logo on the side, which stands for the Metropolitan Sewer District. As I get closer, I can see other trucks bearing the logos of the Ohio EPA and Hamilton County Environmental Services. I stop to chat with one of the workmen, who informs me that they are examining one of the combined sewer overflow pipes. Apparently, they're going to do some reconstruction work on the pipe. He says that this is part of a larger program that's been going on for more than a decade, to repair or eliminate the sanitary sewer overflows in the creek. He says that this section is one of the last to be rebuilt. I ask him where they get the money to do this work, and he responds that it comes from the "Clean Water 21" program that Hamilton County implemented at the start of the century. I remember talking with Mom and Dad about this program years ago. Dad was very upset about the program, and said he voted against the referendum. Mom said that she was for clean water, no matter what it cost, and voted for the program. I thanked the workman for the information. I'm glad that some of our tax money has been used to clean up the Mill Creek. It's now a real asset to Cincinnati, instead of the smelly, polluted eyesore that it was when I was a kid.

I turn for home and decide to walk along an older section of trail that has been



in place for years. I am impressed with the amount of new economic development that has occurred adjacent to the trail. This section of the Mill Creek Valley is certainly undergoing a change from its industrial past, to a future that includes mixed use development. Housing occupies old warehouses, and new businesses are emerging along the edge of abandoned railroad tracks. Not far away from the trail is a McDonalds, so I duck in for a cup of coffee and a biscuit to go. Back on the trail, I come to a small park with some picnic tables. It looks like several other people have the same idea. As I eat my breakfast, I can see a plaque at the far entrance to the park. I'm surprised to learn that this Greenway park was constructed from funds donated by my employe back in 1999. The plaque shows a picture of what the site used to look like before construction began-what a mess. It is hard to believe that I'm standing on the same ground. It's nice to know that my company supports the Greenway.

What a great morning. I feel refreshed and ready to take on the challenges at work. When you work in a chemical laboratory everyday, you need to get some relief every once in a while. I have just enough time to make it home, grab a change of clothes and head to work. Today, I think I'll ride my bike to work. The company recently installed bike lockers and employee shower facilities on the campus. I can use the Greenway to avoid the traffic and make it almost the entire way to work without having to use local streets. The Greenway certainly makes Cincinnati a better place to live and raise a family.



APPENDIX A: WATERSHED CONDITIONS

Since the Mill Creek watershed has been studied in detail by numerous professionals in the past, this Master Plan will not attempt to “reinvent the wheel” by duplicating these studies. However, a summary of the watershed’s natural and man-made systems is provided below in order to provide needed perspective for the goals of this greenway planning effort.

MILL CREEK: AN HISTORICAL PERSPECTIVE

The Mill Creek Valley was formed during the last Ice Age in North America. Mill Creek is sandwiched between two larger riverine systems; to the west is the Great Miami River and to the east is the Little Miami River. These river systems and their watersheds dwarf Mill Creek, and almost encircle it at the northern boundary of the watershed.

Originally called “Maketewa” by Native American Indians, Mill Creek has been the source of life, activity and commerce for more than 1,000 years. The forest canopy was so thick once that it was claimed a squirrel could travel the entire watershed simply by jumping from tree to tree. Degradation and abuse of Mill Creek and her watershed began 200 years ago, when settlers from the East cleared over 80 percent of the land for lumber, firewood and farmland. This had a devastating impact on the natural systems of the watershed and eventually led to higher floods, longer droughts and an outbreak of malaria in 1874. After the turn of the century, corn and pig based industries contributed early industrial pollution to Mill Creek. In 1913, one quart of every gallon flowing from Mill Creek consisted of industrial waste and sewage from the area’s ever-growing population. Despite the completion of a 12-mile interceptor sewer, Mill Creek was listed in 1940 by the City Manager of Cincinnati as one of the major sources of Ohio River pollution. Today, the Mill Creek continues to suffer from various sources of pollution and was designated in 1997, by American Rivers, a national non-profit organization, as the most endangered urban waterway in the country.

The continued degradation of the watershed led to extensive flooding which occurred about every other year during the nineteenth and first half of the twentieth century. As a result of the 1937 flood, where 12 lives and about \$9 million in property was lost, the Army Corps of Engineers constructed the Barrier Dam, floodwalls, and pump station across the Mill Creek and along the Ohio River, thereby protecting the Mill Creek Valley from Ohio River backwater flooding. In 1959, after more flooding in the valley occurred, a flood reduction project was initiated, including channelization of parts of Mill Creek in Hamilton County by the Army Corps of Engineers, beginning in 1981. (Source: *The Mill Creek: An Unnatural History of an Urban Stream* by Stanley Heeden)



Perhaps the best way to describe the interrelationship of a stream to its watershed is to define the importance of the circulatory system to the human body. Through poor nutrition and careless health maintenance we can severely degrade the system of arteries and veins within our body. As a result, our health will decline, in many cases leading to death. Our blood stream not only provides the elements necessary to sustain our life, it also removes the harmful waste that can lead to poor health. A riverine system performs a similar function for its watershed. Small tributaries, the capillaries of the land, feed into larger primary channels, the veins. This system of creeks, streams and rivers nourishes the land, well beyond the boundaries of the channel. It also removes, redistributes and dilutes waste. Streams are a living ecological system, directly affecting the economic and physical well-being of those living within their watersheds. Unfortunately, Mill Creek has not been viewed as such a system for many years, and its health is in critical condition.

Background

The Mill Creek, named to reflect the past existence of water-driven mills along its course, is an important waterway to the City of Cincinnati, second only to the Ohio River. As the city began development in the 1700s, the stream suffered the brunt associated with urbanization and industrialization, being used as a “dump” site for municipal and industrial wastes.

Climate

The climate of Mill Creek is nearly identical for the two counties it flows through. Both Butler and Hamilton Counties experience cold winters and hot summers. The average winter temperature in the watershed is 33°F and the daily minimum temperature is 24°F. The average summer temperature is 74°F and the average daily maximum temperature is 85°F. Total annual precipitation within the watershed is 40 inches, nearly 60 percent of which falls between April and September. The average seasonal snowfall is 15 inches and accumulation during the winter allows for good soil moisture for the spring, and minimizes drought during the summer months. Source: USDA, 1980 and 1992.

Geology and Topography

In Butler County, the Mill Creek watershed lies in the interior of the Low Plateau physiographic province of the eastern portion of the United States. Bedrock in this area consists of shale and limestone of Ordovician-age, which outcrops on steep valley walls but is typically overlain by Wisconsin-age glacial deposits. Soils within the watershed were mostly formed in the glacial materials overlying the bedrock, consisting mainly of limestone fragments. Soil associations found within the watershed boundaries are: Russell-Miamian-Wynn, Fincastle-Ragsdale-Xenia, and Xenia-Wynn-Russell. These associations consist of soils that are typically deep and moderately deep, moderately well to well drained, moderately fine or fine textured, and were formed in loess, glacial till, and residuum from shale and limestone.

The reach of Mill Creek that flows through Hamilton County is located in the Central Lowland physiographic province. Geology of this area consists of shale and fossiliferous limestone of middle and late Ordovician age overlain by glacial deposits except in areas of steep slopes. Soils within this county were also formed in the glacial materials overlying the bedrock and consist mainly of limestone fragments. Soil associations found within the watershed in Hamilton County are: Markland-Urban Land-Patton, Russell-Urban Land-Xenia, Eden-Pate, Urban Land-Martinsville-Fox, Bonnell-Rossmoyne-Cincinnati, and Genesee-Stonelick-Urban Land. These soils are typically deep, moderately well to well drained, medium to moderately fine textured soils, and have poor natural drainage and some erosion concern.

The Mill Creek's topography consists of a stream flowing within a pre-glacial valley with a wide terrace and floodplain and steep hillsides containing tributaries that intersect the main stem. The valley floor is flat and the stream falls an average of 11.9 feet per mile. Source: USDA, 1980 and 1992.

Vegetation

A large amount of both native and ornamental species can be found in the Mill Creek Valley. Since part of the watershed lies within the urban area of Cincinnati, an extensive amount of ornamental plants are present within the watershed as these are used for aesthetics. A 1996 paper written by Don Bogosian provided a summary of the vegetation existing in the Mill Creek Valley as determined from 14 sampling sites. These sampling sites were: Glenway Woods, Mt. Airy Forest, Spring Grove Cemetery, Caldwell Park, Avon Woods, French Park, Winton Woods, Trillium Trails, Gorman Farm, Sharon Woods, and Gilmore Ponds.

Within the Mill Creek Valley, 733 native plants can be found. These 733 native plants are comprised of: 21 species of ferns and allies, 86 species of grasses and sedges, 153 species of trees and shrubs, and 473 species of wildflowers. However, more than 800 ornamental species and nearly 900 varieties of ornamentals have been cited in literature from Spring Grove Cemetery and the Cincinnati Zoo and Botanical Garden.

Dominant plant families existing in the valley include:

- Polypodiaceae (Polypody Fern Family)
- Cyperaceae (Sedge Family)
- Graminae (Grass Family)
- Caprifoliaceae (Honeysuckle Family)
- Fagaceae (Beech Family)
- Rosaceae (Rose Family)
- Caryophyllaceae (Pink Family)
- Compositae (Composite Family)
- Cruciferae (Mustard Family)
- Labiatae (Mint Family)
- Leguminosae (Bean Family)
- Liliaceae (Lily Family)
- Polygonaceae (Smartweed Family)
- Ranunculaceae (Crowfoot Family)

Source: Don Bogosian, 1996



Biotic Refuges and Ecologically Important Areas

An investigation of biotic refuges within the Mill Creek region was conducted by Stanley Hedeem to provide a list of areas that could be utilized as “sources of organisms for adjacent areas recovering from pollution and habitat disturbance.” At the conclusion of Hedeem's investigation, 16 biotic refuges along Mill Creek and its tributaries were identified as well as 6 ecologically important areas along the Mill Creek main stem that should be protected. The following is a list of the areas identified, along with a short description, as provided by Stanley Hedeem:

Biotic Refuges

1. *Mt. Airy Forest, Cincinnati and Green Township* - Cincinnati Park in the West Fork watershed containing a good biological community.
2. *Warder Nursery, Springfield Township* - includes a biologically rich tributary with good water quality.
3. *Caldwell Park, Cincinnati* - City park at the Congress Run/Mill Creek confluence with the least undisturbed stand of vegetation throughout the entire main stem of Mill Creek.
4. *Garner Park, Lockland* - City park with a good riparian corridor along the West Fork Mill Creek.
5. *North Park, Wyoming* - Municipal park containing a fair biological community adjacent to a segment of the West Fork Mill Creek.
6. *Trillium Trails, Woodlawn* - Hamilton County Park with an intact riparian corridor possessing a good biological community along a segment of West Fork Mill Creek.
7. *Winton Woods, Springfield Township* - Hamilton County Park along West Fork Mill Creek containing clear waters at the outlet of Winton Lake.
8. *Hilma-Ross Memorial Park, Springdale* - City park on the Beaver Creek tributary.
9. *Chamberlain Park, Springdale* - City park on Beaver Creek tributary.
10. *Gilmore Ponds Reserve, Hamilton* - Butler County Metropark along drainage way connecting Mill Creek with Pleasant Run, allowing migration of stream fauna from Great Miami watershed.
11. *Keehner Park, Union Township* - Township park with excellent riparian habitat adjacent to upper portion of East Fork which has good water quality.
12. *Sharon Woods, Sharonville* - Hamilton County park with excellent biological community downstream of Sharon Lake.
13. *Gorman Farm, Evendale* - Portion of Cincinnati Nature Center with a permanent spring at the headwaters of a short brook.
14. *Blue Ash Nature Park, Blue Ash* - Municipal woodland supplying nutrients and woody debris to the north branch of Cooper Creek.



15. *Cherryfield Park, Reading* - City park and surrounding public areas support a riparian corridor along the middle and south tributaries to Cooper Creek.
16. *French Memorial Park, Amberley* - Cincinnati Park adjacent to the headwaters of Amberley Creek that is densely wooded.

Ecologically Important Areas

1. Wooded corridor between Gest Street and the Western Hills viaduct. This area is the only wooded corridor left along the lower Mill Creek.
2. Broad flood channel near Mill Creek Road is an excellent feeding area for many birds.
3. Tree-fringed creek between Center Hill Avenue and North Bend Road provides nesting, food, and shade for stream animals and birds.
4. Mill Creek between Cooper Road and Glendale-Milford Roads in Evendale provides a good floodplain habitat along the stream.
5. Riparian area north and south of East Kemper Road supplies good habitat for shoreline and aquatic animals.
6. Headwaters east and west of Liberty-Fairfield Road provides the best aquatic community on the main stem.

Mill Creek and its Tributaries

Mill Creek has a drainage area of 166 square miles in Butler and Hamilton Counties in southwestern Ohio. Thirty-five square miles of the drainage area lie in Butler County and the remaining 131 lie in Hamilton County. The creek's 28.1 mile course begins at its headwaters in southeastern Butler County and ends at its mouth at the Ohio River in Hamilton County. The creek is a fifth order stream (see definition of stream order in glossary) at its mouth after several major tributaries intersect the mainstem along its course. These tributaries include West Fork, West Fork Mill Creek, Cooper Creek, Sharon Creek, Beaver Run, and East Fork Mill Creek. The average gradient of these tributaries is 51.8 ft./mi.

According to U.S.G.S. 15 minute quadrangle topographic maps (photorevised in 1987), West Fork's headwaters are at the intersection of Shepherd Road and West Fork Road in Mt. Airy Forest and it intersects Mill Creek near Mill Creek Road. West Fork Mill Creek begins in the Groesbeck area and intersects Mill Creek south of Galbraith Road. Cooper Creek begins at the Blue Ash/Reading city line between Cooper Road and Hunt Road and meets Mill Creek west of Reading Road. Sharon Creek, which begins at the outfall of Sharon Lake in Sharon Woods, intersects Mill Creek in Evendale. Beaver Run begins its course towards Mill Creek at the intersection of I-275 and Route 747 and meets Mill Creek near the intersection of I-75 and I-275. Finally, East Fork Mill Creek begins in the West Chester area and also intersects Mill Creek near the intersection of I-75 and I-275.

Mill Creek's main stem is currently designated as Warmwater Habitat upstream of I-275 and Limited Warmwater Habitat downstream of I-275. As a result of modifications, West Fork is designated as Limited Warmwater Habitat. The other major

tributaries are designated as Warmwater Habitat. West Fork Mill Creek is also listed as State Resource Water due to Winton Lake/West Fork Mill Creek Reservoir.

Chemical Water Quality

In 1994, Ohio EPA published its *Biological and Water Quality Study of Mill Creek and Tributaries* which focused on the Mill Creek, East Fork Mill Creek, Sharon Creek, and West Fork Mill Creek. The report notes that over 100 years of industrial usage have degraded the Mill Creek with contaminated sediments, leaking landfills, and Superfund sites. Furthermore, Ohio EPA's Division of Emergency and Remedial Response has identified 31 sites along Mill Creek and its tributaries that "have potential to adversely affect water quality due to possible hazardous waste."

The Mill Creek has suffered from past discharges of chemical contaminants, as evidenced by analysis of sediments in the stream channel. It should be noted, however, that subsequent investigations by the City of Cincinnati, in Section 8 and adjacent to various City-owned property in the Mill Creek corridor, have confirmed reduced point source discharges and marked improvement in the chemical water quality of the stream over the past decade. In addition to combined sewer overflows, nonpoint sources of contamination, such as urban runoff, appear to be a current, primary cause of impaired water quality in the Mill Creek.

The following provides additional summary of the 1994 Ohio EPA study for Mill Creek and the selected tributaries.

Mill Creek

Nearly all the sites sampled for fecal coliform and *E. coli* yielded several exceedences of the recreation criteria for the two parameters. The high levels are attributable to discharges of raw or partially treated sewage into the stream via combined sewer overflows and sanitary sewer overflows. Dissolved oxygen (D. O.) levels in the mainstem were regularly recorded above the water quality criteria in the headwaters, however the Ohio EPA reported that "open channels created conditions to algal growth and account for the generally high D.O. readings at these locations." In addition to fecal coliform and *E. coli*, increased levels of ammonia, phosphorus, nitrate-nitrite nitrogen levels were also recorded. Also, lead, organic compounds, selenium, cyanide, and copper were all recorded to exceed water quality criteria.

East Fork Mill Creek

Exceedences of the primary contact recreation criteria for fecal coliform and *E. coli* were recorded during the study. In addition, exceedences of criteria for dissolved oxygen, ammonia, selenium, and various pesticides were all recorded during the study.

Sharon Creek

One chemical water quality sampling site was located on Sharon Creek at river mile (RM) 0.01. Recordings at this location revealed that 58% of fecal coliform and 83% of *E. coli* concentrations exceeded the recreation criteria. In addition, suspended solids were slightly elevated and one cyanide value surpassed the Warmwater Habitat criterion for prevention of chronic toxicity.

West Fork Mill Creek



RM 2.00 experienced two exceedences of the criterion for lead, possibly due to historical uses of what is now Chemical Incorporated located about 500 feet west of the stream and to stormwater runoff and CSO's in the area. In addition, RM 0.19 was noted to surpass the water quality criteria for dissolved oxygen, ammonia, fecal coliform E. coli, lead, and various organochlorine pesticides, including DDT. Also, the Ohio EPA reported that the highest ammonia concentrations throughout the entire Mill Creek watershed study were recorded at RM 0.19.

Physical Habitat for Aquatic Life

The Ohio EPA uses the Qualitative Habitat Evaluation Index (QHEI) to score features important to fish communities. Point values are assigned to six indicators: substrate, instream cover, channel morphology, riparian zone and bank erosion, pool/glide and riffle/run quality, and map gradient. The highest possible score is 100. Although the Ohio EPA has not set score ranges for excellent, good, fair, and poor, streams that score above 60 are usually designated as warmwater habitat.

Mill Creek

With the exception of the extreme upper limits of the headwaters, the entire Mill Creek has been modified as it has been channelized, stripped of its riparian buffer, and lined with concrete in various sections throughout the lower reaches. RM 24 to 27 was reported by the Ohio EPA to be unmodified except where bridges and sewer lines cross. In areas where the substrates were predominantly cobble, the instream cover was moderate and the channel development was fair to good.

Between RM 24.0 and 8.0, the channel has been extensively modified as it has been channelized for agricultural purposes, mainly to maximize farmland and minimize flooding, and there is a 0.6 mile reach near Cross County Highway where the channel has been lined with concrete. Within this reach, the Ohio EPA reports that the channel exhibits some recovery towards natural conditions. Throughout this reach, the Ohio EPA classified the QHEI scores as ranging from poor to good as the substrate is predominantly sand and gravel and the riparian canopy consists of a narrow row of trees.

From RM 8.0 to 0.0 at its mouth on the Ohio River, the channel possesses fair to poor aquatic habitats as a result of channel modifications, including 3.3 miles of concrete lining, and backwater from the Ohio River extending 2 miles upstream. QHEI scores ranged from 22 to 64 (mean = 38.3) and were low due to the concrete lining, removal of the riparian canopy, fair to poor channel development, and a predominantly sandy substrate.

Sharon Creek

Sharon Creek was noted to have fair to good channel development with poorly defined riffles as the stream is recovering to natural conditions where there have been past modifications. Its QHEI score at the one location surveyed was 62.

East Fork Mill Creek

Good habitat conditions were observed at the upstream sites on the East Fork Mill Creek, where the stream is unmodified, with QHEI scores being 72 and 74 at RM 3.8 and 4.7 respectively. Substrates through this reach were reported to be slab boulders and cobble.

On the contrary, the physical habitat for the lower 2 miles of the East Fork Mill



Creek was observed to be degraded as compared to the upstream habitat. This reach has been modified in the past and QHEI scores ranged from 61 to 66 with the dominant substrates being sand and gravel. Particularly, there is considerable embeddedness at RM 0.8 which Ohio EPA believes is a direct result of effluent discharged from the Upper Mill Creek Wastewater Treatment Plant, located immediately upstream.

West Fork Mill Creek

The 1994 study only assessed the lower 5 miles of stream (downstream of Winton Lake) during the investigations. The Ohio EPA reported that natural stream habitat conditions were present between RM 4.5 and 2.0 where the substrate was predominantly cobble and gravel and QHEI scores of 71 and 76 were yielded at RM 4.5 and 2.0 respectively.

The lower mile was noted to have physical habitat of good quality where QHEI scores were 60 and 70 and the dominant substrate was boulders and cobble. However, there was a large amount of trash and debris along the streambanks through this reach.

Biological Assessment

Macroinvertebrate Community

Mill Creek

After the Ohio EPA's study was completed, the agency determined that the total number of taxa decreases in a downstream direction, which is to be expected as the amount of human influences upon the creek increases in a downstream direction. Furthermore, RM 26.4, (the most upstream site) where the creek is unmodified, had the highest number of taxa with 45 different taxa, which classified the area as marginally good.

A poor macroinvertebrate community was observed between RM 24.0 and 8.0 which included the most severely impacted site along Mill Creek at RM 13.3, downstream of raw sewage discharge and the Pristine Superfund site.

Additionally, the lower 8 miles possessed severely impacted and poor communities due to toxic stresses and oxygen demanding wastes associated with combined sewer overflows and slow flow velocities at backwater conditions.

Sharon Creek, East Fork Mill Creek, West Fork Mill Creek

The 1994 study only briefly studied the macroinvertebrate communities of Sharon Creek, East Fork Mill Creek, and West Fork Mill Creek. To summarize, the study found that Sharon Creek had a marginally good community; East Fork Mill Creek had a marginally good community upstream of the wastewater treatment plant and a degraded (fair) community consisting of pollution tolerant species downstream of the wastewater treatment plant; and, West Fork Mill Creek was evaluated to have a fair community with the exception of RM 2.0 where it transitioned into a poor community consisting of pollution tolerant species.

Fish Community

Fish communities sampled throughout the Ohio EPA's 1994 study were analyzed using the Index of Biotic Integrity (IBI). The IBI incorporates twelve metrics that evaluate the diversity and functional stability of a population. These metrics include



the total number of species, number of darter, sunfish, sucker and intolerant species, percent omnivores, insectivores, and top level carnivores, as well as percent of individuals with DELT (deformities, eroded fins, lesions, and tumors) anomalies.

Mill Creek

The fish population along the entire mainstem consisted solely of pollution tolerant species. Not surprisingly, the Ohio EPA stated that of the 13 species listed as highly tolerant to pollution in Ohio, 9 were present in Mill Creek.

Similar to the macroinvertebrate community in the mainstem, the best fish community was also found at RM 26.4 where the community was described as marginally good with an IBI score of 38. Likewise, the fish community was considerably degraded between RM 24.0 and 8.0 where the IBI scores ranged between 20 and 25.

Sharon Creek

The fish community of Sharon Creek was comprised of pollution tolerant species and was classified in the poor range with an IBI score of 26.

East Fork Mill Creek

Not surprisingly, the fish community was determined to be better upstream of the wastewater treatment plant (similar to the conditions observed in the macroinvertebrate community). Sites upstream of the wastewater treatment plant had fish communities classified in the good range, yielded IBI scores of 40, and had low numbers of highly tolerant species.

Downstream of the wastewater treatment plant, the fish community transitioned into one of poor quality and there was a significant reduction in the total number of fish collected. In addition, the Ohio EPA noted that sampling results from a site 0.2 mile downstream of the wastewater treatment plant suggest a toxic impact.

West Fork Mill Creek

All the fish sampling sites were located downstream of Winton Lake. IBI scores in the poor to very poor range were determined and 8 highly tolerant species were collected.

Fish Tissue Summary

PCBs

The presence of polychlorinated biphenyls (PCBs) was investigated in eight samples that represented four species. PCBs are a group of manufactured organic compounds containing chlorinated chemicals. They served as coolants and lubricants in transformers, capacitors, and other electrical equipment. Manufactured products commonly containing PCBs were old fluorescent lighting fixtures, hydraulic fluids, capacitors, and electrical appliances. Although the manufacture of PCBs stopped in 1977, they continue to enter the environment from old electrical appliances and hazardous waste sites.

Six of the eight samples contained at least one type of PCB and the edible portions of three whole body samples surpassed the Food and Drug Administration's (FDA's) PCB level of concern. Four of the eight samples contained PCB levels in violation of Ohio's Water Quality Standards .



Pesticides

Nineteen pesticide compounds were tested for in 8 fish tissue samples. Of the 19 compounds in question, all were below lab detection limits .

Semivolatile Organic Compounds

Of the 56 semivolatile organic compounds analyzed for in 8 fish samples representing four species, only 2 were detected .

Metals

Barium, lead, mercury, and zinc were detected in 6 whole body fish samples during the study . However, arsenic, cadmium, chromium, selenium, and silver were not detected in any of the 6 samples . With regards to mercury, 2 of the 6 fish samples contained detectable levels, but these levels were below the FDA level of concern in edible portions .

As a result of the Ohio EPA's findings regarding PCBs, pesticides, semivolatile organic compounds and metals during the 1994 study, the Ohio Department of Health issued a fish consumption advisory to the public for fish from the Mill Creek.

Sediment

Metals

Mill Creek

Thirteen sediment sampling sites were established on Mill Creek. Nearly half of the sites were observed to have extremely elevated metal concentrations, particularly lead which first appeared at West Columbia Avenue (RM 13.13) and steadily increased downstream to Gest Street (RM 0.5). Additionally, zinc concentrations were noted to peak at Salway Park (RM 5.2) and Center Hill Road .

West Fork Mill Creek

West Fork Mill Creek exhibited high levels of lead along its lower 5 mile course . RM 4.45 (near Riddle Road) had the highest lead concentration recorded for the entire watershed survey, attributable to the large amount of industries in the vicinity . Elevated levels in the lower reach have been attributed to the large amount of industries in the area, landfills, and combined sewer overflows.

East Fork Mill Creek

Elevated levels of chromium, zinc, and iron were revealed at RM 1.85 near Allen Road, however chromium and iron were not detected at the downstream site, RM 0.1, and zinc concentrations were reduced . Additionally, slightly elevated levels of lead were discovered at RM 1.85 and at the mouth.

PCBs

Analysis of PCBs in sediments was only completed on the Mill Creek mainstem. PCBs became extremely elevated at RM 13.3 (W. Columbia Avenue) and remained highly elevated to Gest Street . The Ohio EPA noted that the high levels occurred at RM 13.3 because the site is downstream of a combined sewer overflow, the Pristine Superfund site, Carstab and Cincinnati Drum, and other industrial sites. Although elevated levels of PCBs have been recorded along the main stem through the industrialized area, General Electric has completed a PCB remediation project, costing more than \$12 million, to combat the problem.



Organic Compounds

Mill Creek

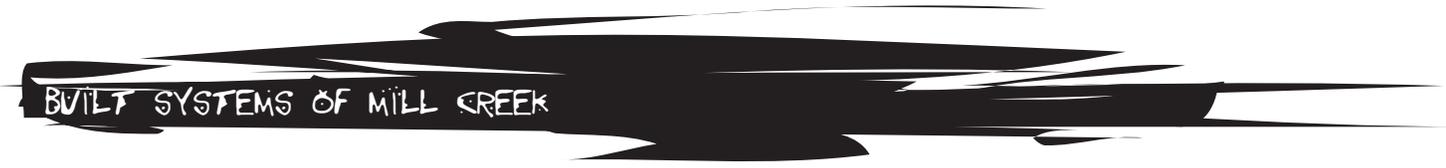
Eighty-nine percent of the sediment sampling sites exhibited detectable levels of either volatile organic compounds or semi-volatile compounds or both.

West Fork Mill Creek

Again, only the lower 5 miles of stream were studied in the 1994 study. After completing the study it was determined that organic compounds increased in number in a downstream direction to the magnitude that RM 0.1 had nearly a 60% increase in the number of detectable organic compounds as compared to RM 4.45.

East Fork Mill Creek

There were no organic compounds detected at RM 1.85, however RM 0.1 and the mouth displayed the presence of non-priority volatile organic compounds.



BUILT SYSTEMS OF MILL CREEK

Land Uses

The Mill Creek watershed is 166-square miles, and includes 37 political subdivisions and 2 counties. In the City of Cincinnati alone, an estimated 41 neighborhoods are located within the watershed. More than half a million people live in the watershed, and it is generally accepted that an estimated half a million more work in or travel through the watershed each day.

The Hamilton County portion of the Mill Creek Valley is one of the most industrialized areas in the United States. More than half of the land uses have been modified from agricultural and forestry to urban, predominantly residential (see Map 12). The primary industries in this county are machine tools, jet engines, automobiles, and soap and detergents (USDA, 1992). Mill Creek is one of the primary reasons for this industrialized land use pattern. The Creek attracted a variety of industries that were dependent on a steady supply of water and a convenient waste disposal system. The flat floodplain land was inexpensive and easy to build on, especially for the types of industries that located in the Valley. Transportation systems (including the Miami & Erie Canal) naturally followed rivers, creeks and streams, and the Mill Creek has always served a role as an important element of transportation. Dominant transportation land uses include I-75 and a large railroad switching yard, both of which follow Mill Creek (see Map 13).

The industrial development of the Mill Creek Valley has been the economic engine of the Cincinnati metropolitan area for more than 200 years. It has created prosperity throughout the valley. It has also left the valley vulnerable to economic loss. By-products of this industrialization are severe and further threaten the economic well-being of the valley:

- 31 toxic waste sites known to exist in the valley
- Five designated Superfund sites have undergone, or are currently undergoing remediation:
 - Skinner Landfill in Union Township
 - Pristine in Reading
 - City Bumper in Lower Price Hill

- York Street building in West End
- Green Industries in Sharonville
- Landfills and garbage dumps can be found along the banks of Mill Creek.
- Brownfields, or abandoned industrial sites, are also designated within the valley. In the Summer of 1997, the City of Cincinnati, Hamilton County and the Greater Cincinnati Chamber of Commerce established a partnership with the US EPA to establish the Port Authority for Brownfields Redevelopment in Cincinnati and Hamilton County. The partnership has identified more than 500 acres of abandoned industrial sites in the valley that may require remediation and has designated two Distressed Economic Enterprise Zones. The purpose of the partnership is to establish a model strategy for identifying, assessing, cleaning up and redeveloping brownfield sites in the valley and throughout the watershed, and for engaging citizens in the process.
- Despite the fact that Mill Creek was essentially being used as an open sewer in the 1800s, serious attempts to manage the waste did not arise until 1913 when construction of the first Mill Creek interceptor sewer began. Mill Creek waste handling methods have not kept pace with technological advances. In fact, the sewer constructed in 1913 is still in use today, along with a second interceptor sewer constructed in the early 1960s. They are not capable of handling all of the sewage and stormwater flows that have been added through the years, thus raw sewage continues to enter Mill Creek today through sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs). The sewers present today were designed to accommodate combinations of domestic sewage, stormwater, and industrial wastes. However, since this system cannot handle all of these inputs in tandem during rain events, there are CSOs and SSOs along streams within the valley where overflow from the sewers discharges directly into the streams untreated. Currently, there are 164 locations where combined sewer overflows (CSOs) contribute fecal bacteria viruses, excessive nutrients, industrial wastes, and other pollutants to the Mill Creek and its tributaries .

Increased erosion and sedimentation is another problem because “development has occurred without sufficient provisions for stormwater control or control of erosion from the construction sites” . Consequently, all streams within the Mill Creek watershed have suffered from significant increases of sediment. For example, Winton Lake in Greenhills lost half of its volume and a third of its surface area to sedimentation caused by uncontrolled development, accelerated streambank erosion, and combined sewer overflows. Similarly, Sharon Lake experienced the same problems and was dredged clean between 1987 and 1989 . The dredging process for these two lakes will have to be repeated periodically if their contributing streams are not stabilized.

Communities and residential neighborhoods surround the heavily industrialized Mill Creek valley. Most developed because of their proximity to the industries and businesses located along Mill Creek. Neighborhoods and communities in the watershed are diverse, ranging from the affluent to the economically distressed. Many of the distressed neighborhoods are near the most polluted areas of Mill Creek. In its nomination for the American Heritage Rivers designation, the Mill Creek Restoration Project (MCRP) states “Thousands of people living near Mill Creek bear a disproportionate burden from the polluted and degraded environment and its associated health risks. According to the 1990 census, some inner-city neighborhoods have unemployment rates as high as 29 percent, the poverty rate is 67 percent, and the minority population is 99 percent.” MCRP applied for and received an “Environmental Justice Through Pollution Prevention” grant from US EPA to encourage business participation



in environmental education and greenway planning, pollution prevention training and opportunities for small and medium-sized companies to reduce wastes.

The Butler County portion of the Mill Creek Watershed is experiencing rapid change through population growth and development. Butler is the second fastest growing county in Ohio, and the 35 square mile Upper Mill Creek Subbasin is being transformed from a rural, agricultural landscape to one that is sprouting residential homes, commercial and retail developments and industrial land uses. The downstream impact of this development will be significant, and the communities, businesses and industries located to the south in Hamilton and Butler Counties have cause to be concerned about the pattern of development. One example of such development is the proposed Union Centre, where an estimated 2,300 acres of farmland, wetlands and open space is scheduled to be transformed into mixed use development that will forever alter the appearance and quality of life in Butler County. Fortunately, the Union Township government, private property owners, citizens and business leaders are interested in developing Union Centre in a manner that will include conservation of natural resources and features of the Mill Creek floodplain, through a greenway strategy. The Union Township government is working cooperatively with Mill Creek Restoration Project and the Butler Soil and Water Conservation District to develop a site-specific greenway plan for Union Centre East.

Water Quality/Stormwater/Sewers

Degraded water quality is a fact of life in the main stem of the Mill Creek and in her tributaries (see Map 14). The problem is complex and not easily resolved. In other urban communities throughout the nation, one of the biggest problems with degraded water quality is the lack of awareness of the problem and constituency to correct it. As long as Americans continue to run clean water from their faucets, the problem of clean water remains unnoticed by many. Many do not realize that even though most of the watershed relies upon the Ohio River for drinking water, Mill Creek dumps into the Ohio River, affecting drinking water for downstream communities. This lack of awareness is beginning to change. The perception in America is that tap water and other potable water supplies are no longer healthy enough to consume, which has given rise to the bottled water industry. The American Water Works Association has quietly begun to identify serious problems in the delivery of potable water nationwide. Communities like Milwaukee, Wisconsin, have sounded the alarm that water delivery systems in the United States are vulnerable.

How does all of this affect the Mill Creek? Without question, the creek system has serious water quality problems that at times can threaten human health. In fact, the Ohio EPA has recommended that no human contact occur with the waters in Mill Creek in most of Hamilton County. This warning extends not only to the main stem, but to some or parts of some of the tributaries as well. Some of this problem is attributed to the combined sewer system that is very old and in great need of repair. In July 1995, the Metropolitan Sewer District (MSD) launched a twenty-year, \$187 million long-term control plan for combined sewer overflows (CSOs) that addresses 360 capital projects. MSD identified 164 CSOs throughout the watershed. In August 1997, MSD completed an "Urban Wet Weather Phase I" project with US EPA to define factors other than CSOs that impact the water quality in the Mill Creek. MSD has also proposed to launch a county-wide stormwater study to determine how best to manage water quality and quantity problems in the future.



CSOs are, however, not the only problems in the main channel, or its tributaries. Landfills, garbage dumps, and toxic sites contribute to the problem. Stormwater runoff (also called nonpoint source pollution) from major highways, streets, parking lots and other urban and suburban properties carries a variety of heavy metals, petroleum products, and other pollutants that impair water quality. Accidental releases and spills and permit violations from industries and businesses contribute as well. Runoff from agricultural fields in the upper portions of Hamilton County and from Butler County add more nutrient loading to a stream system that is above capacity. Surrounding communities and residential neighborhoods contribute their share to the problem through the improper disposal of household hazardous waste, reliance on polluting forms of transportation, the removal of vegetation which leads to erosion, and the use of chemical fertilizers and pesticides. Water quality is a concern throughout the watershed. While historically regulatory agencies required “end-of-the-pipe” treatments of point source pollution, today there is growing recognition that a comprehensive watershed approach is needed to ensure watershed and ecosystem health.

Historic and Cultural Resources

The Mill Creek Valley and watershed are a haven for cultural resources. An estimated 50 National Register Historic Sites can be found throughout the valley (see Map 15 and its accompanying tables). There are hundreds of Ohio Historic Inventory sites that date from the nineteenth and early twentieth century. MCRP volunteer Don Begosian reports that there are 34 significant historic sites within the watershed, including:

- 733-acre Spring Grove Cemetery, established in 1845, where prominent Cincinnati families are buried, is the largest private, rural-style cemetery in the country.
- Residence of Samuel Hannaford, a former Cincinnati mayor and famous architect, with fifty-eight of his buildings listed on the National Register.
- Procter & Gamble's 243 acre Ivorydale manufacturing site, where Mill Creek flows through the corporate campus and the original 1884 buildings are still in use.
- Union Terminal, built in 1931-33, famous for its Art-Deco rotunda and Weinholt Reiss murals depicting Cincinnati history.
- Sharon Woods Village, a recreated eighteenth century village located in Sharon Woods Park.
- Miami and Erie Canal Historic District, located in Butler County, including remnants of the Miami and Erie Canal, built in 1826 and operated in the area until 1929.

Preserving the cultural identity of the valley is important to the future growth and development strategies for Mill Creek. Tourism is rapidly becoming the number one economic force in the United States and throughout the world. Communities that preserve their past have an opportunity to reap economic rewards in the future.

Parks, Greenways and Cemeteries

Existing parks, recreation facilities and other types of open space throughout the Mill Creek Watershed are tremendous assets to the goals of this Greenway Action Plan (see Map 13 and 15). Hamilton County boasts Ohio's third largest park system, with more than 12,500 acres of land. The City of Cincinnati manages more than 5,000 acres of parkland, approximately half of which lies within the watershed. Many of these facilities are located in close proximity to Mill Creek and its tributaries. Significant parkland acreage is located on the West Fork Creek, Sharon Creek, and West Fork Mill Creek, and these parks perform significant water quality and floodplain management functions within the watershed. These parks serve as a valuable



resource helping to absorb rainfall, trapping pollutants from overland runoff and providing green space within urban and suburban areas.

Hamilton County Parks

Sharon Woods is the oldest park in Hamilton County, opened for public use in 1932. This 755-acre park features the 35-acre Sharon Woods Lake, which provides valuable stormwater retention and water quality filtration for Sharon Creek. The park also has a 2.6 mile hike/bike trail that encircles the lake, and the Richard H. Durrell Gorge Trail that traverses the banks of Sharon Creek. Other facilities in the park include an 18-hole golf course, a visitors center, a campground, and the Sharon Woods Historic Village depicting life in the early 19th century.

Hamilton County's second oldest park is Winton Woods, a 2,629 acre park that was opened in 1939. As with Sharon Woods Lake, Winton Lake is the central feature of the park. This flood damage reduction structure provides valuable protection for downstream properties on the West Fork Mill Creek. The Park provides a 1.7 mile hike/bike trail that encircles Winton Harbor, and nature paths and horse trails that traverse other portions of the park. Three golf courses are located inside the park, Meadow Links and Golf Academy and The Mill Course. A campground, Parky's Farm and a riding center also add to the diverse range of recreation activities at the park.

Embshoff Woods and Nature Preserve, located along River Road in the lowest portion of the Mill Creek watershed, opened for public use in 1982. This 316-acre Hamilton County park is maintained in a natural state. The benefits of this management philosophy are important to the Mill Creek watershed, despite its location. Embshoff Woods protects valuable natural ecosystems, provides habitat for wildlife and offers a small wilderness in the midst of an urbanized watershed.

Butler County Parks

Keehner Park in Union Township, Butler County is located off Barrett Road and encompasses 123 acres along the East Fork Mill Creek tributary. Here the East Fork has good water quality and is capable of supporting an abundance of aquatic, semi-aquatic and terrestrial wildlife. Visitors can find many prehistoric fossils in the stream bed and the park includes the Union Cabin, a restored 1840s era log house that is an example of the living arrangements of early Butler County residents. The park's winding trails were originally created by the cattle and horses on the original Keehner farm.

Gilmore Ponds Interpretive Preserve is a 195 acre seasonal wetland located along Gilmore and Symmes Roads in Fairfield Township, Butler County. This wetland is an important biological bridge between the Great Miami and Mill Creek watersheds, allowing migration of plants and wildlife between the two drainage basins. In Ohio, one-third of wildlife species depend on wetlands for survival. Gilmore Ponds is home to many wildlife, including some rare and endangered species

Reserves Park in Liberty Township is a 16 acre park being developed by Liberty Township with financial assistance from Ohio Department of Natural Resources Nature Works grants. The park is located in the headwaters of the Mill Creek watershed and provides preservation of open space between the Reserves of Liberty Subdivision and the Butler County Regional Highway. The park will include paved trails, playground equipment, tennis courts, basketball courts and soccer fields.

Cincinnati Parks and Greenways

The mission of Cincinnati's Parks and Greenways System is "To conserve, manage, sustain and enhance parks' natural and cultural resources and public greenspace - for the enjoyment, enlightenment and enrichment of the Cincinnati community." Several parks in the Cincinnati system provide important open space/greenspace functions within the watershed. The Cincinnati Parks and Greenways System Plan proposes to conserve these natural areas and to link existing reserves together through a greenway system. As stated earlier, the Caldwell Nature Center and Seymour Outdoor Recreation Area are valuable assets due to their location on and near the Mill Creek channel. The steep hillsides and lush vegetation in these parks are critical to a healthy ecosystem in this section of the watershed. Salway Park adjacent to Mill Creek and, is one of the few floodplain parks in the system. Mt. Airy Forest is located along the southwestern side of the watershed. This massive park is largely wooded and protected as a natural systems park. Trails meander throughout the forest. Future plans for the park call for a new system of hike/bike trails, new lake impoundments and an arboretum. Burnet Woods is an existing urban park located along Clifton Avenue. Planned improvements include a new lake impoundment and building new pedestrian trails. Other important parks in the system include:

- Mt. Echo Park
- Miles Edwards Park
- Dempsey Park
- Wilson Commons
- Fairview Park
- Bellevue Hill Park
- Inwood Park
- Mt. Storm Park
- St. Clair Heights Park
- Edgewood Grove Park
- Valley Park
- Parkers Woods
- Buttercup Valley
- Ross Avenue Park
- Lytle Park
- Rawson Woods

The City also has identified potential new parks and greenways that will be of great benefit to Mill Creek. The Western Wildlife Corridor Greenway is part of the Ohio River bluffs, extending from Mt. Echo Park to Shawnee Lookout Park. This corridor falls outside of the City limits, but partnership efforts are underway to protect this resource area from encroachment and development. The Queen City Avenue/Lick Run Valley Greenway is another wooded hillside located north of the Ohio River and west of Mill Creek. The City is interested in an acquisition program that would protect much of the remaining forested land from urban development. The Uptown Chain of Parks Greenbelt is a wooded hillside in the center of the City that could link together Mt. Storm, Edgewood Grove and Rawson Woods. New greenway linkages are envisioned to Coy Field, Fairview Park, Bellevue Park, Inwood Park, and Jackson Hills Park. Finally, the City is interested in acquiring land and developing the proposed Mill Creek Park at the confluence of the Ohio River and Mill Creek.



Other Important Parks and Preserves

Other important parks and natural reserves are located along Mill Creek and some of its major tributaries. These include three Butler County parks in Fairfield, Liberty and Union Townships along East Fork Mill Creek; two City of Reading parks along Mill Creek; two Springdale Township parks on Beaver Run; and parks along West Fork Mill Creek in Lockland, Wyoming, Woodlawn, and Greenhills.

City of Reading Parks

Koenig Park features many recreational opportunities and is adjacent to the river on Kownig and Columbia Avenues. The Mill Creek Watershed Intergovernmental Agreement was signed at Koenig Park in June 1995. That same day, the Miami Chapter of the Sierra Club planted fifty new trees along Mill Creek. Voorhees Park is located along Mill Creek at Kowhler Avenue in Reading and is used as one of the water quality monitoring sites for the Mill Creek Restoration Project's school program. The park is named after Abraham Voorhees, the founder of Reading. The park opened in 1931, the same year that Reading officially upgraded its status from a village to a city.

City of Springdale Parks

Chamberlain Park encompasses eighteen acres with Beaver Run going through the park. Entrances to the park are off Chesterdale Road and Marwood Lane. The park was developed in 1975 and includes a soccer field, playground, basketball court, and foot bridge crossing the creek. Ross Park is an eight acre park developed in 1959 with ball fields, playground, picnic and parking areas. Entrance to the park is off Lawnview Avenue. A vehicular bridge crosses Beaver Run.

Village of Lockland

Garner Park is located on the corner of Westview Ave. and Bacon St., the West Fork Mill Creek tributary flows along the length of this park. This seventeen acre facility is the largest park in Lockland and is the focus of many sporting and family events throughout the year. Garner Park features three full-sized base ball diamonds, a basketball court, two soccer fields, a one-mile paved walking trail, two pavilions with picnic facilities, a sand volleyball court, three horseshoe pits, a complete playground, restroom facilities, and off-street parking.

City of Wyoming Parks

Oak Park encompasses 7.5 acres of a former landfill site along West Fork Mill Creek. The park can be reached by a pedestrian bridge and a vehicular bridge from Oak Avenue. Oak Park includes two ball fields, playground equipment, and a 0.35 mile walking trail. North Park is a 1.1 acre mini-park located between residential areas and the lower reaches of the West Fork Mill Creek tributary across the creek from Oak Park. The park is used for public recreation, sports, and community events.

Village of Woodlawn

The Woodlawn Park and ball fields along West Fork Mill Creek are located in the heart of Woodlawn adjacent to the elementary school and municipal building along Woodlawn Blvd. This area is included in the proposed Greenway project for the Village of Woodlawn connecting to the City of Wyoming.

Village of Greenhills

The greenbelt surrounding Greenhills is a mixture of old farm pastures, rows of white pines that were planted in the 1930s to stop soil erosion, and a very old forest of large beech and maple trees. The greenbelt is approximately one third the size of the village. Greenbelt lands are owned by the Village of Greenhills, the local school district, local churches, homeowners, and Hamilton County Park District. The greenbelt property was sold to the Hamilton County Park District in the 1970s to assure its preservation. The park district dedicated this forest to Ohio as a state nature preserve in 1977. A portion of the greenbelt runs along West Fork Mill Creek. Property owners have agreed to follow certain guidelines to protect the greenbelt such as prohibiting structures and fencing.

Cemeteries

Most people do not normally think of a cemetery as an important open space feature. In watershed planning, cemeteries can have a valuable role in terms of water quality, wildlife habitat and greenspace. Several cemeteries exist throughout the watershed, and some of the more important ones include:

- Old St. Joseph's
- New St. Joseph's
- Vine Street Hill
- Spring Grove
- St. Mary's
- Baltimore Pike
- Potter's Field
- Judah Touro
- Arlington Memorial Gardens
- Oak Hill
- Ayers Cemetery in Liberty Township

Of these, Spring Grove Cemetery is the most important due to its historical significance, the amount of land and its location in the watershed.

Golf Courses

Golf courses also provide an important resource for watershed planning. Research at Penn State University, North Carolina State University and Clemson University suggests that golf courses can serve as important water quality, floodplain management and wildlife habitat resources, especially in urban areas. Several golf courses exist within the watershed that offer the potential to serve these purposes, including:

- Arrowhead Golf Course
- G.E. Park Golf Course
- Golden Tee Golf Center
- Glenview Golf Course
- Clovernook Country Club
- Wyoming Golf Course
- Blue Ash Golf Course
- Dunham Recreation Complex
- Avon Fields Golf Course



Bicycle Facilities

In June 1993, the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) produced a Regional Bicycle Plan for seven counties in Ohio and Kentucky. Hamilton and Butler Counties were included in this planning effort. In the Plan, OKI states *"The existing roadway network is the primary transportation system that bicyclists use for travel. In addition, separate bike paths offer unique opportunities for recreation, exercise, and travel."* The OKI Bike Route Guides (a part of the OKI Regional Bicycle Plan) represent the current conditions of the existing system of on-road routes throughout the Mill Creek Watershed that are used by cyclists (see Map 16).

The Bike Plan recommends a separate trail along Mill Creek, however, an exact alignment is not identified.

Many of the roads within Hamilton and Butler Counties are "recommended bike routes" by virtue of this Plan. That is not to conclude that all cyclists would feel comfortable riding on these roads. The Plan defines "Recommended Routes", "Alternate Routes", "Bike Paths", "Not Recommended Routes", "Difficult Locations", and "Memorable Hills". Only certain types of cyclists may feel comfortable on a given road, depending on the amount and speed of traffic, lane width and other factors.

In Looking Ahead: 2020 Metropolitan Transportation Plan, adopted by OKI in 1998, the following three recommendations are designed to improve and expand the existing roadway network for bicycling:

- It is recommended that local governments and transportation agencies identify and pursue opportunities in their planning processes for enhancing bicycle and pedestrian travel.
- It is recommended that the sponsors of roadway construction or expansion projects include facilities to accommodate bicycle and pedestrian travel where appropriate.
- It is recommended that the sponsors of roadway resurfacing projects facilitate bicycling where there is an opportunity for re-striping to provide a wide outside lane or for paving the shoulders.

The Millcreek Valley Conservancy District and Army Corps of Engineers developed a Master Plan for Public Use which included a "bike path" along 17.4 miles of the Mill Creek channel. This would be accomplished in conjunction with the Army Corps of Engineers flood damage reduction project, which is currently being reevaluated. This bike path would offer links to the proposed Mill Creek Park, Salway Park, Mt. Storm Park, and Caldwell Park, as well as to other areas and trails in the valley.

Some well known trails in the Mill Creek Watershed Greenway system, compiled by Dr. Stanley Heeden, run along named and unnamed tributaries as well as along Mill Creek. These trails are easily accessed and range from 0.2 to 2.0 miles in length. The trails are maintained by the entities listed in parentheses. Refer to Map 16 for trail locations.

0. Nature Trail: 0.3 mile loop trail in Rapid Run Park along a tributary of Lick Run (Cincinnati Parks)
1. Valley Trail: 0.3 mile trail along a tributary of Mill Creek runs from Trailside Museum to the northwest corner of Burnet Woods (Cincinnati Parks)
2. Red Oak Trail: 0.9 mile trail along a tributary of West Fork runs from the oval in Mt. Airy Forest to West Fork Road (Cincinnati Parks)
3. Ravine Creek Trail: 0.6 mile trail along both a tributary and Mill Creek in Caldwell Nature Preserve

(Cincinnati Parks)

4. Creek Trail: 0.6 mile trail adjacent to Amberley Creek in French Park (Cincinnati Parks)
5. Gardner Park Trail: 0.4 mile trail adjacent to West Fork Mill Creek (Village of Lockland)
6. Vorheestown Bicentennial Trail: 0.5 mile trail paralleling Mill Creek (City of Reading)
7. GE ELFUN Society Upper Meadow Trail: 1.2 mile hillside trail encircling a tributary of Mill Creek on Gorman Heritage Farm (Cincinnati Nature Center)
8. Pin Oak Trail: 0.7 mile loop trail along a tributary of West Fork Mill Creek and past adjacent ponds and meadows in Fahrback-Werner Nature Preserve (Hamilton County Park District)
9. Kingfisher Trail: 0.6 mile trail adjacent to a tributary of West Fork Mill Creek in Winton Woods (Hamilton County Park District)
10. Creekside Trail: 0.7 mile trail along both a tributary and West Fork Mill Creek in Trillium Trails (Hamilton County Park District)
11. Richard J. Durrell Gorge Trail: 0.6 mile trail along Sharon Creek in Sharon Woods (Hamilton County Park District)
12. Streamside Trail: 0.6 mile trail along East Fork Mill Creek in Keehner Park (Union Township Park Department)
13. Gilmore Wetlands Loop Trail: 2.0 mile loop trail along a tributary of Mill Creek and adjacent wetlands on the Gilmore Ponds Interpretive Preserve (Metroparks of Butler County)

Pedestrian Facilities

Pedestrian travel throughout the Mill Creek Watershed is possible in some places, and not possible in others. The primary ingredient needed for effective pedestrian travel is either an extensive sidewalk system, or an off-road trail network. The Mill Creek Watershed Council's Recreation Committee has proposed a "Walking Trail" that would begin at Evans Field near River Road and Evans Street, and extend north, parallel to the Mill Creek channel to Caldwell Park, for a total distance of approximately 9 miles. Along much of this route, the Committee proposes to use the existing sidewalk network to facilitate travel. Aerial photographs of the route reveal that an extensive sidewalk network does exist, especially in the middle section of the proposed Walking Trail.

Stream Geomorphology

The geomorphology of a stream is its physical structure or shape. Additional goals of the Greenway Master Plan are the identification of potential strategies for the protection and restoration of water quality and wildlife habitat, including erosion and sediment control, stream restoration, soil bioengineering, water quality best management practices (BMPs), water quantity management, reforestation, and urban forestry. These strategies will be determined through field investigations throughout the watershed, including the Rosgen Stream Classification System, Pfanckuch streambank stability assessment, and identification of possible water quality BMP sites. These methodologies were taught during a stream classification and assessment workshop during the first week of May 1998 to citizens willing to apply the techniques to the Mill Creek watershed. Once the data is collected, the results will be used to identify and select potential demonstration project sites based on the work efforts.

Stream Morphology Assessment

Overview

As part of the Greenway Master Plan, Biohabitats, Inc. was contracted to conduct a Level I Rosgen stream classification for Mill Creek and all perennial streams (perennial streams are those that flow on a year-round basis from ground water



storage) within the Mill Creek Watershed. Information from the Level I characterization will then be overlaid with information collected on land use, land ownership, zoning, sanitary sewers, stormwater management, and point/non-point source discharges to identify and prioritize stream reaches in need of corrective action.

Introduction to the Rosgen Stream Classification System

In 1994 Dave Rosgen, Ph. D. published a stream classification system which he derived from 27 years of field investigations. As stated by Rosgen, the "specific objectives of the stream classification system include the following:

1. Predict a river's behavior from its appearance.
2. Develop specific hydraulic and sediment relationships for a given stream type and its state.
3. Provide a mechanism to extrapolate site-specific data to stream reaches having similar characteristics.
4. Provide a consistent frame of reference for communicating stream morphology and condition among a variety of disciplines and interested parties".

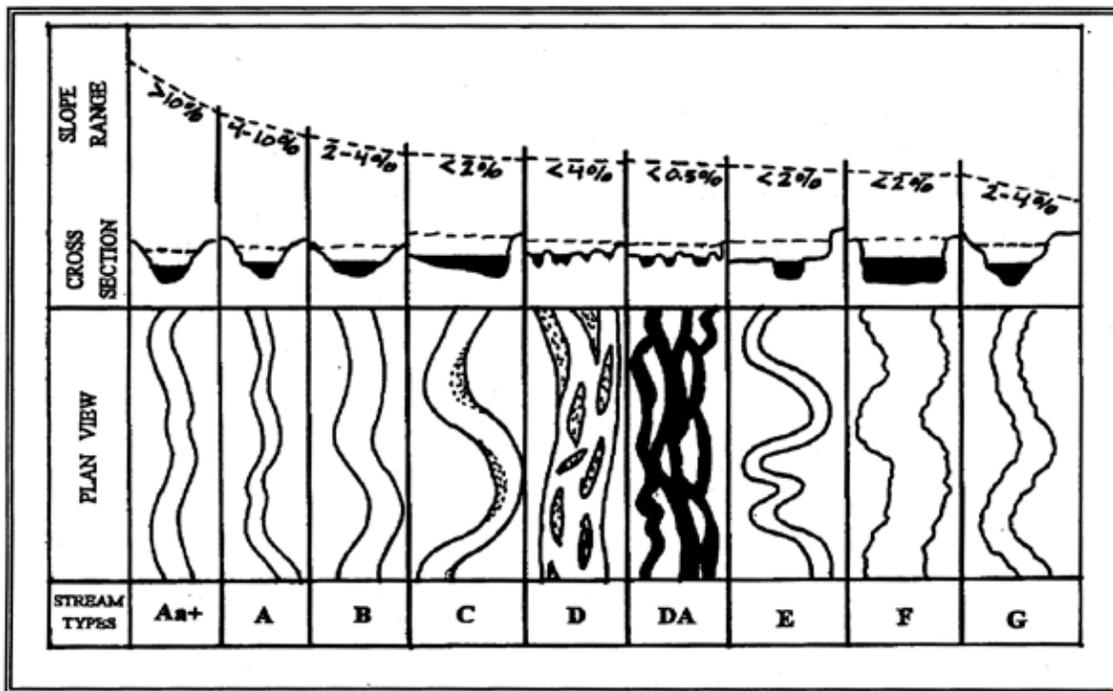


Figure A1. Broad level stream classification delineation showing cross-sectional and plan views of major stream types.

Included in Rosgen's stream classification system is a hierarchical inventory of four different levels (Level I through Level IV) which classify streams by different levels of detail. Level I provides a broad geomorphic characterization whereas Level IV provides a detailed-specific description and assessment. Due to the large drainage area and time constraints, Level I and II studies of all perennial streams within the Mill Creek Watershed were chosen for the purposes of this planning effort.

Level I

As stated by Rosgen, "Level I stream classifications serve four primary inventory functions:

1. Provide for the initial integration of basin characteristics, valley types, and landforms with stream system morphology.
2. Provide a consistent, initial framework for organizing river information and communicating the aspects of river morphology. Mapping of physiographic attributes at Level I can quickly determine location and approximate percentage of river types within a watershed sub-basin, and/or valley type.
3. Assist in the setting of priorities for conducting more detailed assessments and/or companion inventories.
4. Correlate similar general level inventories such as fisheries habitat, river boating categories, and riparian habitat with companion river inventories” .

The Level I characterization includes analysis of basin relief, valley morphology, channel shape, and channel morphology. As part of this level of characterization, Rosgen recognized 11 different valley types. In addition, Rosgen identified the characteristics of each type along with the stream types typically occurring in each valley type. Figure 1 shows the cross-sectional and plan-views of major stream types developed by Rosgen.

Aa+ Stream Type

These streams are very steep, entrenched channels with a low width to depth ratio that are confined within their valley. Streamflow within these channels is torrent due to steep gradients and step/pool and/or waterfall bed morphology. This stream type is typically located in “debris avalanche terrain, zones of deep deposition such as glacial tills and outwash terraces, landforms that are structurally controlled or influenced by faults, joints, or other structural contact zones”.

A Stream Type

This type possesses similar landforms and channel characteristic to the Aa+ stream type. However, these streams have a slope range of 4-10%. Streamflow of the A stream type is also described as step/pool.

B Stream Type

B stream types are moderately entrenched, have a width to depth ratio of greater than 12, and have a low sinuosity. Streamflow within these channels is described as “rapids” and erosion rates and channel degradation/aggradation are typically low. This stream type typically occurs in “moderately steep to gently sloped terrain, with the predominant landform seen as a narrow and moderately sloping basin”.

C Stream Type

C stream types have well-developed floodplains, point bars within the active channel, moderate sinuosity, width to depth ratio of greater than 12, and slopes less than or equal to 2%. Bed morphology of these streams consist of riffle/pool configurations. These stream types typically occur in “narrow to wide valleys, constructed from alluvial deposition”.

D Stream Type

This stream type is most often located in “landforms and related valley types consisting of steep depositional fans, steep glacial trough valleys, glacial outwash valleys, broad alluvial mountain valleys, and deltas”. The D stream type consists of a multiple channel system with a braided or bar-braided pattern having a very high width to depth ratio and high bank erosion rates. These systems have an excessive sediment supply and exist in areas where runoff is characteristically “flashy”.



Table 1. Stream Valley Types and Their Characteristics and Associated Stream Types		
<i>Valley Types</i>	<i>Characteristics</i>	<i>Associated Stream Types</i>
Valley Type I	V-shaped, confined, high elevational relief, often structurally controlled, floor slopes >2%, landforms may be steep, glacial scoured lands, and/or highly dissected fluvial slopes.	A, G
Valley Type II	Moderate relief and side slope gradients, relatively stable, floor slopes that are often <4% with soils developed from parent material of alluvium and colluvium. Bed features typically described as “rapids”.	B, G
Valley Type III	Depositional in nature with characteristic debris-colluvial or alluvial fan landforms, floor slopes are moderately steep or >2%.	A, B, G, D
Valley Type IV	Classic meandering, entrenched or deeply incised, and confined landforms such as canyons or gorges with gentle elevation relief and floor gradients often <2%. Structurally controlled and incised in weathered material.	C, F
Valley Type V	Resulting from glacial scouring where the resultant trough is now a wide, U-shaped valley with floor slopes generally <4%.	C, D, G
Valley Type VI	“Fault-line valley”. Structurally controlled and dominated by colluvial slope building processes. Floor gradients are moderate, often <4%. Stream patterns controlled by the confined, laterally controlled valley.	B, C, F
Valley Type VII	Steep to moderate steep landform, with highly dissected fluvial slopes, high drainage density, and a very high sediment supply. Streams are characteristically deeply incised in either colluvium and alluvium.	A, G
Valley Type VIII	Multiple river terraces positioned laterally along broad valleys with gentle, down-valley elevation relief. Alluvial terraces and floodplains are the predominant depositional landforms.	C, D, E, F, G
Valley Type IX	Glacial outwash plains and/or dunes, where soils are derived from glacial, alluvial, and/or eolian deposits.	C, D
Valley Type X	Very wide, with very gentle elevation relief and is mostly constructed with alluvial materials originating from both riverine and lacustrine deposition processes. Landforms are commonly coastal plains, broad lacustrine and/or alluvial flats.	C, E, DA
Valley Type XI	River deltas and tidal flats constructed on fine alluvial materials originating from riverine and estuarine depositional processes.	D, DA, occasionally C, E

DA Stream Type

The DA stream type is also a multiple thread system. This type has a low gradient and the bankfull width of each individual channel varies. Unlike the D stream type, the DA stream type has very stable channels and lateral migration rates are low.

E Stream Type

The E stream type is the most stable of all the stream types. These streams are slightly entrenched, have very high sinuosities, and have very low width to depth ratios. This stream type is usually located in alluvial valleys and have been classified as the development “endpoint” of stream evolution and channel stability.

F Stream Type

This stream type is typically “deeply incised in valleys of relatively low elevational relief, containing highly weathered rock and/or erodible materials”. These

streams have very high width to depth ratios, very high bank erosion rates, and have "significant bar deposition and accelerated channel aggradation and/or degradation while providing for very high sediment supply and storage capacities".

G Stream Type

These stream channels are highly entrenched systems which have a low to moderate gradient, moderate sinuosity, and low width to depth ratio. These streams are entrenched to such a degree that even low-frequency flood flows (rare, large discharge events) are contained within the channel and therefore, do not have access to a wide floodplain for volume storage, energy dissipation, and sediment deposition.

The various valley types identified by Rosgen are simply named Valley Type I - Valley Type XI. Table 1 shows the characteristics of each valley type and the associated stream types typically occurring in each valley type as determined by Rosgen.

Methodology

Level I

The Level I characterization of all the perennial streams within the Mill Creek watershed was completed through two phases of analyses: in-house documentation review and field investigations. Phase I - in-house documentation review, completed first, includes the analysis of U.S.G.S. topographic maps (1" = 2000') and existing aerial photography. Following the completion of Phase I, Phase II - field investigations, were completed via site visits to the streams to verify classifications established during Phase I as correct or incorrect. At locations where the in-house classification was determined to be incorrect, the correct classification was determined by best judgement through professional experience after the stream's morphology was visually assessed.

As previously stated, Phase I includes the analysis of topographic maps and existing aerial photography. The first task to be completed under this phase was the identification of all the perennial streams within the Mill Creek watershed. Perennial streams were identified as those indicated on the topographic maps with continuous, solid blue lines (blue dash-dot lines indicate intermittent streams). Once all the perennial streams were identified, the streams were separated into segments delineated by roads to provide a more accurate characterization and allow for easier field verification. Next, the valley morphology and the plan-view channel shape for each stream was studied by use of topographic maps and existing aerial photography. The valley type for each segment was determined through analysis of contours on the topographic maps for both cross-section and profile representations. Then, the slope and sinuosity for each stream segment was determined via the topographic maps. Slope was determined by calculating the drop in elevation along the stream's course through each segment divided by the length of stream scaled off of the map. Sinuosity was determined by scaling off the reach's stream length and valley length (along the fall line of the valley) from the topographic map, then dividing the stream length by the valley length. Once all the above data was collected, the stream classification of each stream segment was determined by comparing the data collected to a delineation figure of the cross-sectional and plan-views of major stream types developed by Rosgen (see Figure 1).

It should be noted, however, that the stream classifications made through the use of aerial photographs and the U.S.G.S. topographic maps should be verified with a field visit. This is necessary because the small scale of the topographic maps and



aerial photographs does not allow enough detail to accurately conduct a Level II survey, particularly concerning the entrenchment and width/depth ratio of a stream.

REACH:
DATE:
Channel Dimensions:
<i>Entrenchment Ratio:</i>
<i>Width/Depth Ratio:</i>
<i>Water Surface Slope:</i>
<i>Sinuosity:</i>
Bed Material:
ROSGEN STREAM TYPE:
Pfankuch Score:
Comments:

Figure 2. GIS dialog box of stream classification and assessment results for each stream reach.

Results of the Level I characterization completed as of March 18, 1998 are shown on map 17.

Level II

Due to time and money constraints, a Level II survey of all the perennial streams within the watershed can not be conducted through a continuous surveying effort. As a result, a prioritization system was developed to identify which stream reaches should be surveyed first. This system ranked streams from 1 to 3. A ranking of 1 means that the reach should be surveyed by September 1999; a ranking of 2 means that the reach should be surveyed by September 2000; and a ranking of 3 means that the reach should be surveyed by September 2001. Generally, headwater streams in undeveloped areas or areas undergoing development in the near future were ranked 1. Since these streams are in the headwaters, where streams rapidly adjust to changes in their environment and/or are in areas that will be developed in the near-future, they should be surveyed immediately so baseline conditions of these reaches can be established. Conversely, reaches that have been channelized with concrete were assigned a ranking of 3. These reaches receive the least urgent ranking because of the high cost associated with restoration and their stability from the concrete. The remaining reaches of streams (the majority of the watershed) were ranked 2. Rankings for various stream reaches are shown on map 18.

The Level II stream survey will be conducted by park boards, other government agencies, university faculty and students, community volunteers. The stream classification and assessment methodologies were taught by Biohabitats, Inc. during a stream classification and assessment workshop May 1-2, 1998.

Once the field data is collected at each reach being investigated, the entrenchment, width/depth ratio, water surface slope, sinuosity, and dominant bed material will all be calculated to determine the reach's Rosgen stream type. In addition, the total Pfankuch score will be calculated to characterize the stability of the reach being investigated. After the Rosgen parameters, the Rosgen stream type, and the Pfankuch score have been determined, they will be entered into a database that will be included as part of the GIS maps, providing dialog boxes of the stream classification and assessment results of the reaches (see Figure 2).

DISCUSSION

Nearly 85% of the stream segments delineated contain "F" stream types. The only other natural stream type occurring within the watershed is a "B" stream type, all of which are short segments located at the headwaters of each perennial stream. Concrete channels were observed in stream segments within the urbanized area of Cincinnati. These concrete channels were constructed to provide a reduction in flood damage.

Mill Creek and its tributaries have been heavily manipulated by man over the past 100+ years. Manipulation to Mill Creek and its tributaries has occurred as a result of two acting forces: urbanization and agriculture. Urbanization has degraded the streams through channelization (straightening and entrenching stream channels) and increasing impervious areas (areas that do not allow water infiltration; such as pavement, roof tops, etc.) throughout the watershed. These urban influences on streams can negatively affect streams by themselves, but when they occur in tandem, as they do in the Mill Creek Watershed, the cumulative impacts are severe. Impacts upon stream systems as a result of an increase in impervious areas are:

- Increase in peak discharges
- Increase in volume of stormwater runoff
- Increase in frequency and severity of flooding
- Increase in runoff velocity
- Decrease of time of concentration
- Decrease in base flow during dry periods.

Channelization of and by itself can impact streams by accelerating stream bank erosion and destroying in-stream and riparian habitat. When a stream is channelized (straightened) the sinuosity is decreased, steepening the stream gradient as the stream follows a shorter course from point A to point B. Because of a steeper grade, flows with higher velocities occur. In addition, when a stream is channelized it is typically entrenched as part of the process, thus both the bankfull flows and flood prone flows are contained inside of the same channel. Since these flows are contained inside of the same channel and occur at higher velocities, bank erosion is drastically increased. Furthermore, in-stream and riparian habitat are destroyed as the channel is disturbed during channelization, the riparian buffer is decreased, and in-stream habitat is decreased as riffles and pools are diminished and in-stream cover decreases.



Attribute	1-3	4-6	7-9	10
Ratio of Site Size to Drainage Area Size	<2%	3-4%	5-7%	>8%
Topography	Steep	Rolling	Gently Rolling	Flat
Land Ownership	Private, Developed	Private, Open Space	Public, Developed	Public, Open Space
Nearby Streams/Storm Drains	>500' Off-Site	100-500' Off-Site	<100' Off-Site	Directly On-Site
Access	Difficult, Private Road	Easy, Private Road	Difficult, Public Road	Easy, Public Road
Nearby Utilities	Overhead & Buried Utilities On-Site	Overhead or Buried Utilities On-Site	Utility Access On-Site	No Utility Conflicts
Hydrologic Soil Group	D	C	B	A

Figure 3. Attribute scoring matrix for BMP sites.

Stormwater Management / BMP Assessment

As part of the Mill Creek watershed restoration project, the negative impacts of urbanization within the watershed need to be addressed. To reduce these negative impacts, best management practices (BMPs) to enhance water quality and reduce storm peak flows and discharge velocities should be considered throughout the watershed.

The first step involved in this process is to identify possible BMP facility locations on topographic maps and aerial photographs. Possible locations can be identified by choosing areas that are depressions, open and accessible, and appear to be publicly owned. When selecting a water quality BMP site, there are 8 basic attributes to evaluate and score in order to select the best sites. These attributes are: ratio of proposed BMP site size (ft²) to the drainage area to the site (ft²), topography, land ownership, nearby streams/storm drains, access, nearby utilities, and USDA hydrologic soil group. During field investigations at each site, each attribute is scored from 1 to 10, with 10 being the highest score. The matrix in Figure 3 provides characteristics to look for in each attribute and how to score them.

Once each attribute is scored, all the scores are totaled to give the site an overall score. Those sites with the highest scores are those best suited for BMPs. If two locations have equal scores, the attributes can be prioritized. The following is a list of the attributes in order of importance:

1. Ratio of site size to drainage area size
2. Topography
3. Land Ownership
4. Nearby streams/storm drains
5. Access
6. Nearby utilities
7. Hydrologic soil group.

Thus, if two sites had equal overall scores, the site with the highest score for #1 above would be better. However, if both sites were equal for #1, then the site with the highest score for #2 above would be better, etc.

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Map 15 Key: Mill Creek Watershed Historic Areas

Downtown Cincinnati Historic Areas

TYPE	Name	Ordinance#
A	Betts-Longworth	138-82
A	Cincinnati Athletic Club	248-85
A	Cincinnati Bell	452-85
A	Cincinnati City Hall	199-74
A	Citadel	452-85
A	Court Street	538-84
A	Court Street Fire Station	452-85
A	Covenant-First Presby Church	249-75
A	Cuvier Press Club	216-73
A	Doctor's Building	452-85
A	Krippendork-Dittman Bldg	452-85
A	Lytle Park	284-64
A	Main Street	539-84
A	Ninth Street	296-85
A	Plum Street Temple	250-75
A	Provident Bank Building	452-85
A	St. Louis Church	452-85
A	St. Frances Xavier Church	249-85
A	St. Peter-in-Chains Cathed	251-75
A	Third-Main Street	462-85
A	Tyler-Davidson Foundtain	452-85
A	Underwriter's Salvage Cor	452-85
A	West Fourth Street	119-86
A	WLWT	452-85

Other Historic Areas

B	Laurel Court	199-79
C	Carthage Flagpole	220-83
D	Bond Hill	287-82
E	Northside NBD	189-82
F	Sacred Heart A./Mt. Storm	422-80
G	Hyde Park Observatory	147-93
H	East Walnut Hills	193-88
I	Lincoln-Melrose	88-82
J	Harriet Beecher Stowe House	219-83
K	Sayler Park Indian Status	222-83
L	St. Francis Desales Church	221-83
M	Cleinvew-Hackberry	237-89
N	Auburn Avenue	1-88
O	Benn Pitman House	202-74
P	Dayton Street	243-65
Q	Columbia Tusculum	424-90
R	Over-the-Thine	408-93
S	Prospect Hill	140-81
T	Laurel Homes	200-89
U	Cincinnati Union Terminal	79-74
V	Holy Cross Monastery	443-81
W	Riverview Playground Entrance	452-85

Map 15 Key: Mill Creek Watershed Historic Sites

Number	Name	Address
1	Sharon Woods Village	11450 Lebanon Road
2	Louis Hauck Home	12171 Moteller Road
3	Spring Grove Cemetery	4521 Spring Grove Av
4	Samuel Hannaford Home	741 Derby Av
5	Chester Park Car barn	4815 Spring Grove Av
6	St. John's Cemetery	4423 Vine St
7	Procter & Gamble	5201 Spring Grove Av
8	Carthage Firehouse	7017 Vine St
9	Hartwell School	8320 Vine St
10	Village Green Rest	400 Wyoming Av
11	Lockland Mem Park	113 Williams St
12	Gorman Heritage Farm	9980 Reading Rd
13	St. Michael's Church	2110 St Michael St
14	Union Terminal	1301 Western Av
15	Price Hill Incline	810 Matson Pl
16	Kahn's Meat Factory	3241 Spring Grove Ave
17	Crosley Factory	1329 Arlington St
18	Mt. Storm Park	725 Lafayette Av
19	Wesleyan Cemetery	4003 Colerain Av
20	Benson Street Bridge	Benson St
21	Koehler Avenue Bridge	Koehler Ave
22	Tucker's Station	Glendale Rd
23	Winton Lake Dam	McKelvey Rd
24	Jediah Covered Bridge	Covered Bridge Rd
25	Hamilton Co Fairgrounds	Vine & 77th
26	Union Cabin	Barrett Rd
27	Union Cemetery	Beckett Rd
28	Miami & Erie Canal	Rialto Rd
29	Western Hills Viaduct	Western Hills
30	Central Parkway	Central Parkway
31	Ludlow Station	Knowlton & Mad Anthony
32	Crescentville School	12153 Crescentville
33	Twelve Mile House	11006 Reading Rd
34	Reading Historical Society	22 W Benson St





APPENDIX B: BENEFITS OF GREENWAYS

Greenways typically incorporate varying types and intensities of human use, including trails for recreation and alternative transportation, riparian buffers, on-road bicycle and pedestrian facilities, passive and active park facilities, and other types of open space. Other communities have implemented greenways to provide for recreation and alternative transportation, control flooding, improve water quality, protect wetlands, conserve habitat for wildlife, and buffer adjacent land uses. Greenways have also been shown to increase the value of adjacent private properties as an amenity to residential and commercial developments. These, and other, benefits of a Mill Creek watershed greenway network are described in the following pages.

WATER QUALITY AND WATER QUANTITY BENEFITS

Historically, flooding has been a significant problem in many parts of the Mill Creek watershed. One cause of significant flood damage in the region is the continuing conversion of natural, open spaces to developed landscapes. This activity increases the amount of impervious surface in the watershed, creating fewer areas for stormwater to be stored and stormwater flow decreased. Another cause of increasing property damage due to flooding is the encroachment of buildings and other land uses into flood prone areas.

Traditional “hard” engineering solutions have been employed in the past to solve these flooding problems, resulting in the widening, straightening and culverting of streams and creeks. These expensive flood control measures have served to increase the velocity of floodwaters, which causes increased damage downstream, and have seriously damaged the biological integrity and natural function of stream corridors. Greenways are a less expensive, “soft” engineering approach to the prevention of flood damage. By preserving valuable open spaces and floodplain lands, greenway corridors slow the velocity of stormwater, absorb excess rainwater, and serve as primary storage zones during periods of heavy rainfall or snowmelt. The protected floodplain can be used during non-flood periods for other activities, including recreation and alternative transportation. Greenway development also includes the stabilization of streambanks with natural materials, which restores a waterway’s inherent stormwater management and filtration functions.

The expense associated with the establishment of the greenway system can be offset by the savings realized in reduced flood damage claims. Additionally, for those residents who are required to purchase flood insurance, implementation of a community-wide greenway system in the Mill Creek watershed is likely to result in reduced flood insurance rates.



ECONOMIC BENEFITS

One of the most important benefits of a greenway system would be the improvement of water quality in Mill Creek and its tributaries. The floodplain vegetation and open space contained within greenway corridors help filter pollutants from stormwater (including sediment, oil and other substances carried by stormwater). These pollutants are not removed if stormwater is collected in pipes and discharged directly into local streams and rivers.



Greenways offer numerous economic benefits to Butler and Hamilton Counties, including higher property values, increased tourism and recreation related revenues. Benefits in the form of taxpayer savings can also be realized through greenway development, as these facilities can help communities avoid paying the costs of rebuilding and mitigating flood-damaged areas, and avoid expensive federally mandated programs to clean the region's air and water supplies. One example of how this has worked in other communities is New York City. Over the next decade, the City plans to spend \$250 million on watershed protection, including the acquisition of greenway lands along riparian corridors, in order to avoid spending \$5 billion on a federally mandated water filtration system for New York's water supply.

Greenways have been shown to raise the value of immediately adjacent properties by as much as 5 to 20 percent. For example, in a new development in Raleigh, North Carolina, lots situated on greenways were priced \$5,000 higher than comparable lots off the greenway. Many home buyers and corporations are looking for real estate that provides direct access to public and private greenway systems. Greenways are viewed as amenities by residential, commercial and office park developers who, in turn, are realizing higher rental values and profits.

Greenways can work to enhance the tourism industry in Butler and Hamilton Counties. Tourism is currently ranked as the number one economic force in the world. In several states, regional areas, and localities throughout the nation, greenways have been specifically created to capture the tourism potential of a regional landscape or cultural destination. The State of Missouri, for example, spent \$6 million to create the 200-mile KATY Trail, which, in its first full year of operation, generated travel and tourism expenditures of more than \$6 million.

AIR QUALITY BENEFITS

Large portions of the Mill Creek watershed are located in Cincinnati, historically one of the most industrialized places in America. This industry, combined with population growth and suburban sprawl and the resulting heavy reliance on automo-



biles, has resulted in air quality problems in the region. Greenways as alternative transportation corridors could serve to reduce traffic congestion, helping to improve local air quality. Offering viable, alternative transportation choices through greenways would encourage people to bicycle and walk more often, especially on short trips, thereby reducing traffic congestion and automobile emissions.

TRANSPORTATION BENEFITS

In past years, most American communities have grown in a sprawling, suburban form as a result of dependence upon the automobile as the sole means of transportation. This sprawl, as an economically unsustainable pattern of development, has destroyed many of our once-lively downtowns. Americans have abandoned some traditional forms of transportation (such as passenger train service), and have been slow to improve other forms of transportation (bicycle and pedestrian networks, bus systems, local train service). In order to help provide relief from congested streets and highways in Butler and Hamilton Counties, future transportation planning and development should be concentrated on providing a choice in mode of travel to local residents. These mode choices should offer the same benefits and appeal currently offered by the automobile: efficiency, safety, comfort, reliability and flexibility.

Greenway corridors throughout the Mill Creek watershed can serve as extensions of the road network, offering realistic and viable connections between origins and destinations such as work, schools, libraries, parks, shopping areas, and tourist attractions. Greenway-based bikeways and walkways are most effective for certain travel distances. National surveys by the Federal Highway Administration have shown that Americans are willing to walk as far as two miles to a destination, and bike as far as five miles. It is easily conceivable that destinations can be linked to multiple origins throughout the watershed region with a combination of off-road trails and on-road bicycle and pedestrian facilities.



PLANT AND ANIMAL HABITAT BENEFITS

The degradation and channelization of Mill Creek has resulted in an environment that falls far short of its potential. However, many of Mill Creek's tributaries are in a more natural state and could be protected and improved through the development of greenways. Greenway corridors along these streams would protect streambanks and other natural areas, which serve as viable habitat for many species, by providing migratory routes, essential food sources, and access to clean water. Programs can be established to not only protect the valuable existing forested and wetland areas of the watershed, but also to reclaim and restore Mill Creek and other streams to once again support terrestrial and aquatic habitat.



HEALTH AND RECREATION BENEFITS

Greenways encourage more people to walk or bike to short-distance destinations, which improves the health of residents. Studies have shown that as little as 30 minutes a day of moderate-intensity exercise (such as bicycling, walking, in-line skating or cross-country skiing) can significantly improve a person's mental and physical health and prevent certain diseases. Providing opportunities for participation in these outdoor activities, close to where people live and work, is an important component of promoting healthy lifestyles for Mill Creek watershed residents.



In 1987, the President's Commission on Americans Outdoors Report profiled the modern pursuit of leisure and defined the current quality of life for many Americans. Limited access to outdoor resources was cited as a growing problem throughout the nation. The Commission recommended that a national system of greenways could provide all Americans with access to linear open space resources.

The proposed greenway system for the Mill Creek watershed would be developed to complement existing parks and open space systems. Trail systems could be developed not only for alternative transportation, but also to serve as primary recreation and fitness resources.

CULTURAL/EDUCATIONAL BENEFITS

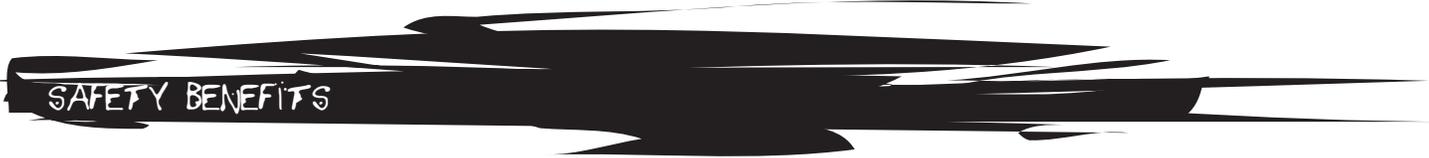
Greenways can enhance the culture and protect many of the historic resources in the Mill Creek watershed. Successful greenway projects across the United States have served as new "main streets," where neighbors meet, children play, and community groups gather to celebrate. For cities and towns large and small, greenways have become a cultural asset and focal point for community activities. Some communities sponsor "greenway days" to celebrate the outdoors and local traditions. Various walking and running events are also held on greenways to support charity or extend traditional sporting events. Many civic groups adopt segments of greenways for cleanup, litter removal and environmental awareness programs. Some greenways, like San Antonio's Riverwalk, are the focal point not only for community activities, but also for economic development.



The richness and diversity of the Mill Creek watershed's historic resources are represented by numerous National Register of Historic Places and locally significant sites and historic districts. The interpretation of historic and archeological sites along greenways can serve to increase the awareness and appreciation of the region's rich history. Greenways can also be a vehicle to provide controlled public access to important cultural sites in a manner that promotes preservation and enhances interpretive opportunities.

Greenway trails could also provide opportunities for learning about the natural

resources within the Mill Creek watershed. Displays and outdoor classrooms could provide information to schoolchildren, as well as adults, on such topics as hydrology, biology, ecology, the watershed concept, non-point source pollution, and stormwater management. Greenways within the Mill Creek watershed, by their very existence, will also increase local citizen awareness of the watershed and help to spur local initiatives, such as stream cleanups, to improve the quality of Mill Creek and other streams.



SAFETY BENEFITS

Many Americans are concerned with crime. Some of the most successful deterrents to criminal activity have involved increased neighborhood awareness by citizens and participation in community watch programs. Greenways have proven to be an effective tool to encourage local residents to participate in neighborhood watch programs. Some greenways have even been developed as part of efforts to deter criminal activity in a neighborhood. Crime statistics and reports from law enforcement officials have shown that parks and greenways are typically land uses with the lowest incident of reported criminal activity.

As a recreation resource, alternative transportation corridor, or area where fitness activities can take place, most greenways provide a much safer and more user-friendly resource than other linear corridors, such as local roads. Greenways typically attract local residents, who use the facility frequently, creating an environment that is virtually self-policing. Additionally, greenways-whether publicly or privately owned-are dedicated for multiple use and are normally designed to meet federal, state and local standards for public safety and use.

APPENDIX C: DESIGN GUIDELINES

Introduction

This chapter provides guidelines to both public and private entities for the development of greenway facilities throughout the Mill Creek watershed. The regional guidelines herein are based on the best practices in use throughout the United States, as well as accepted national standards for greenway facilities. Local governments can use them at their own discretion.

The guidelines should be used with the understanding that each greenway project is unique, and that design adjustments may be necessary in certain situations in order to achieve the best results. Such projects should be evaluated on a case-by-case basis, in consultation with local or state bicycle and pedestrian coordinators, a qualified engineer, and/or a landscape architect.

Facility design is a broad topic that covers many issues. This chapter provides guidelines for design development, and is not a substitute for standards. For more in-depth information and design development standards, the following publications should be consulted:

Greenways: A Guide to planning, Design and Development

Published by Island Press, 1993

Authors: Charles A. Flink and Robert Searns

Trails for the Twenty-First Century

Published by Island Press, 1993

Edited by Karen-Lee Ryan, Rails-to-Trails Conservancy

Guide to the Development of Bicycle Facilities

Updated in 1991 by the American Association of State Highway Transportation Officials (AASHTO). Available from FHWA or AASHTO.

Manual on Uniform Traffic Control Devices (MUTCD)

Published by the U. S. Department of Transportation, Washington, DC

Mountain Bike Trails: Techniques for Design, Construction and Maintenance

Published by Bike-Centennial, Missoula, MT

Construction and Maintenance of Horse Trails

Published by Arkansas State Parks

Universal Access to Outdoor Recreation: A Design Guide

Published by PLAE, Inc., Berkeley, CA, 1993

Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Schueler, Thomas R., 1987. Published by Metropoli-



tan Washington Council of Governments, Water Resources Planning Board,
Department of Environmental Programs, Washington, D.C.

Policy and Design Guidelines for Accessible Parks and Facilities
Published by Hamilton County, Ohio, Park District



STREAM RESTORATION DESIGN

In all cases, the recommended guidelines in this report meet or exceed national standards. Should these national standards be revised in the future and result in discrepancies with this chapter, the national standards should prevail for all design decisions.

Stream Restoration Design

Stream restoration projects begin with the watershed, not the stream. Understanding of the functions and activities (both natural and human) occurring within a watershed are an integral part of restoration projects. Many factors within a watershed, all occurring in tandem, influence the behavior of streams; such as drainage area, climate, land uses, stormwater management, soils, topography, etc. When embarking upon stream restoration projects, it is extremely important to realize that the area being restored is not only being impacted by the area immediately adjacent to that reach of stream, but is impacted by the entire watershed draining to that area. The most successful stream restoration designs are those that incorporate stormwater management and soil bioengineering into the projects.

The main goal behind stream restoration design is to create a stable channel, meaning a stream that will “maintain a stable dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades” (Rosgen, 1996). Ancillary goals include improving habitat and water quality.

Questions that need to be answered before beginning a stream restoration design include those listed as follows.

What is the current problem with the stream?

The stream's current problem is what identifies the need for restoration. Typically, the problems most often encountered which warrant the need for restoration are degradation (erosion) and aggradation (sediment deposition).

Stream degradation occurs in the form of bed erosion (downcutting) and/or lateral erosion (widening). Stream degradation can be a result of two scenarios: (1) the stream is undersized and cannot accommodate the amount of water moving through the system, or (2) the stream is transport-



ing more sediment than is being supplied to the system. Undersized streams can be restored by increasing the cross sectional area and width/depth ratio of a stream to accommodate the desired amount of flow. Streams that are transporting more sediment than is being supplied to the system have “sediment starved” water. Generally, water that is “sediment starved” is capable of transporting more sediment than is being supplied; as a result, the water erodes the banks and/or bed to get the amount of sediment desired. This scenario can be remediated by increasing the width/depth ratio of the stream to decrease stream power.

Stream aggradation occurs when a stream’s flow is not capable of effectively transporting the sediment being supplied to the system. As a result, excessive sediment is deposited along the stream bed as depositional bars. Consequently, these depositional bars direct flows into the streambanks and accelerate lateral erosion. Most often, aggradation occurs within streams because of human activities within a watershed. Such activities include: development without proper erosion and sediment controls (increasing the influx of sediment to the stream), upstream streambank and/or bed erosion because of channelization or poor stormwater management, deforestation, mining, etc. To alleviate the problem, the amount of sediment being supplied to the system can be decreased by stabilizing upstream banks with vegetation, effective stormwater management, and proper erosion and sediment controls. If the previous options are not feasible, then the problem can be fixed by lowering the stream’s width/depth ratio so the stream has more depth and a higher velocity that can transport the sediment.

What caused the stream to reach this state?

Although the answer to this question is important for understanding the cause and effect relationship that produced the problem; the cause does not always have to be rectified as part of the restoration project (the design can take this into consideration so the new channel can effectively handle the conditions created by the cause).

What discharge should the stream be designed to accommodate?

Typically, stream channels are designed to accommodate bankfull flows. A bankfull flow is the dominant channel forming discharge that has a recurrence interval between 1.1 and 1.8 years. Thus, if a bankfull discharge was calculated to have a recurrence interval of 1.5, this means that the storm which creates this discharge occurs, on average, approximately every 1.5 years.

What are the site constraints?

Stream restoration designs in urban and dense residential environments can be a very difficult task. Many obstacles exist in these environments that have to be either overcome or avoided, therefore the ideal design is not always possible. Many times the easement width surrounding a stream is narrow and does not provide adequate room for realigning a stream’s geometry or for construction equipment and access. Furthermore, utilities such as sanitary sewer lines, underground cables, gas lines, and overhead wires may be present and are typically avoided rather than relocated. Occasionally the topography of the site may limit what type of restoration

can be constructed because the topography is too severe for the required construction equipment to access the site.

How much money is available for the project?

Although some sites may have all or none of the above constraints, one constraint that exists at many sites is money. Rarely can the best design be applied to a stream restoration project because of monetary constraints. Stream restoration projects can be a very expensive investment, typically costing around \$100 per linear foot. However, additional funding can often be obtained from federal agencies, organizations, and local and federal governments.

Design

Stream restoration designs use fluvial geomorphic principles of river form and process. The design is based on the natural combination of bankfull dimension and form characteristics of a reference reach. These characteristics include width, depth, slope, entrenchment, meander radius and wavelength, and hydraulic roughness.

Before beginning a stream restoration design, the problem, and its cause, need to be identified to determine restoration techniques. Next, the bankfull discharge (design discharge) needs to be determined via cross section and profile measurements taken on the stream. Once these tasks are completed, the stream type is determined based on valley characteristics and site constraints. After the stream type is determined, a reference reach is selected as a basis for the design.

A reference reach is a stable stream section that is of the same stream type as the stream section to be restored. Ideally, the reference reach stream should be located within the same watershed and have a similar drainage area size. However, this is not always possible so a reference reach should be found as close as possible (in the same physiographic province) to the project site. Ratios calculated from measurements taken on the reference reach are used as the basis for design. These ratios are:

- width/depth ratio;
- entrenchment;
- percentage of pools to percentage of riffles;
- where the deepest portion of the pool is typically located;
- radius of curvature;
- and in step/pool systems- height of step compared to depth of pool, width of step compared to width of pool, where the deepest portion of the pool is located, and total length of each pool.

After the reference reach data is collected and the ratios are calculated, the design begins. The design discharge, determined earlier in the process, is used in the tangent cross section designs (the hydraulic control areas) to determine the narrowest width of the stream. Next, the meander width is based on ratios determined from the reference reach. Once the widths of the new stream are calculated, the site constraints are identified and the new stream alignment is determined.



Following the plan view design, the profile of the stream is designed based on the slope of the valley and the type of stream being designed. During this process, the slope and bed features are designed based on data collected from the reference reach.

Soil Bioengineering

After the plan and profile designs are completed, stabilization measures to impede bank/bed erosion and protect the disturbed soil are determined. Soil bioengineering provides natural means for stabilizing streambeds and enhancing habitat. It combines living and non-living materials to reinforce streambanks and prevent erosion. Streambanks can be stabilized with live branch layering, root wads, tree plantings, rock, live fascines, and coir fiber rolls among others. Stream beds can be stabilized with vortex rock weirs, cross vanes, and boulder drop structures among others.

Living Materials

Living materials used in soil bioengineering include grasses, forbs, shrubs, trees, and vines. Installation techniques include: plugging/transplanting, branch layering, live fascines, and brush mattresses. Applications using hardwood cuttings (branch layering, transplanting, live fascines, brush mattresses, etc.) should use longer and thicker cuttings that are relatively young. Species to consider are: *Salix* spp., *Cornus amomum*, *Cornus sericea*, *Sambucus canadensis*, and *Viburnum dentatum*.

Ecological considerations associated with living materials are soil moisture, soil fertility, temperature, and sunlight. Propagation/procurement includes: propagating from seed, harvesting hardwood cuttings, and seasoning to ensure the highest success rate. Construction details for each application previously mentioned are included in the following pages.

Non-Living Materials

Non-living materials used in soil bioengineering are: woven and non-woven geotextiles, impermeable liners (clay, geomembranes, elsatic and rubber), geonets, geocells, root wads, coir fiber rolls, cribwalls, rock, and stone. These materials may be installed anytime throughout the year. Construction details for applications mentioned above are included in the following pages.

Best Management Practices (BMPs)

BMPs were developed to mitigate some of the negative impacts from development and are designed to:

- "Reproduce, as nearly as possible, the hydrological conditions in the stream prior to development;
- Provide a moderate level of removal for most urban pollutants;
- Be appropriate for the site, given physical constraints;
- Have an acceptable future maintenance burden; and
- Have a neutral impact on the natural and human environment."

Generally, there are three types of BMPs that are used: infiltration, vegetative, and ponds. Considerations to take into account when selecting which

type of BMP to use are:

- Total contributing area watershed;
- Infiltration rate of soils at the site;
- Site topography;
- Seasonally high water table elevation;
- Depth to bedrock; and
- Land Uses.

Various types of BMPs that are commonly used include: extended detention ponds, wet ponds, infiltration trenches, and infiltration basins.

Extended Detention Ponds

Extended detention ponds can be an effective measure to remove pollutants and minimize downstream bank erosion commonly associated with development. Detaining stormwater for more than 24 hours can provide as much as 90% removal of particular pollutants. Furthermore, extended detention basins can control post development peak discharge rates to match pre-development rates and manage smaller floods that occur more frequently than annual and two-year floods to reduce streambank erosion rates. Other positive attributes of this BMP are wetland and wildlife habitat creation and protection of downstream habitat. On the contrary, negative impacts of extended detention ponds are: nuisance and aesthetic problems in inundated portions such as algae and foul odor, moderate to high routine maintenance requirements, and sediment removal.

Site Attributes

Dry extended detention ponds can be used on sites less than 10 acres, whereas wet extended detention ponds need larger drainage areas to maintain permanent pool levels. Impermeable soils ("D" soils) are not favorable for dry detention basins because the basin will retain too much water and highly permeable soils ("A" soils) are not desirable for wet detention ponds because of excessive infiltration and the inability of wetlands to be created. There are products available to address or change these problems. Furthermore, the depth to bedrock should not be shallow because of the necessary excavation.

Maintenance

As stated earlier, extended detention basins have moderate to high maintenance requirements. The basin's upper stage, side-slopes, embankment, and emergency spillway should be mowed twice a year to prevent woody growth or more frequently in residential areas. Additional routine maintenance measures include annual inspections during wet weather, whenever possible, and debris and litter removal during mowing visitations. Non-routine maintenance includes structural repairs and replacement and sediment removal.

Wet Ponds

Wet ponds are the most cost-effective BMP in highly developed areas. These BMPs can be a very effective water quality BMP and, if properly sized and maintained, they can remove sediments, BOD, organic nutrients and trace metals. In



addition to water quality enhancement, wet ponds can improve landscape, habitat, stormwater management, and recreation. However, negative characteristics of wet ponds are possible upstream and downstream habitat degradation, nuisance problems (odor, algae, debris), sediment removal, and potential safety hazards. Also, wet ponds require more planning, design, and maintenance than any other BMP.

Site Attributes

Wet ponds are most effective in residential or commercial developments that are greater than 20 acres in size. The minimum drainage area should be 10 acres and the soils should not be permeable. This BMP should not be applied in watersheds having land costs or space at a premium. In addition, the sites need adequate space because the pond and buffer can occupy up to 10% of the watershed area, however, they typically occupy less than 5%.

Infiltration Trenches

Infiltration trenches are BMPs that can effectively remove both soluble and particulate pollutants. Positive impacts of infiltration trenches include: groundwater recharge, localized streambank erosion control, minimal space requirements, pollutant removal on small sites, and limited routine maintenance requirements. Negative impacts include excessive sedimentation promoting clogging, careful construction and regular maintenance requirements, and possible groundwater contamination. Trenches should be sized according to the volume of runoff controlled and the degree to which exfiltration is used to dispose of runoff. These BMPs should be designed to completely drain within 3 days after the maximum design storm event to maintain aerobic conditions conducive to bacteria growth.

Site Attributes

Infiltration trenches are not feasible for sites with "D" soils, infiltration rates of less than 0.27 inches per hour, or clay contents of more than 30%. Underground trenches cannot be installed on sites having slopes greater than 20% and surface trenches are not recommended when contributing slopes are greater than 5%. A minimum of 4 feet clearance between the bottom of the stone reservoir and bedrock is needed in addition to a minimum of 2 to 4 feet clearance between the bottom of the stone reservoir and the seasonably high water table. Trenches should be located at least 100 feet from drinking water wells in commercial and industrial areas and should be a minimum of 10 feet down gradient and 100 feet up gradient from building foundations. Finally, this BMP should not serve drainage areas greater than 5 acres.

Maintenance

Infiltration trenches should be inspected several times during the first few months and annually thereafter. Routine maintenance costs for surface trenches are typically higher than underground trenches because of mowing. Rehabilitation costs for underground trenches can be as much as the initial construction cost, whereas rehabilitation costs for surface trenches are generally 20 percent of the initial construction cost. Typically, under-



ground and surface trenches need rehabilitation every 5 to 15 years. Grass filter strips should be mowed twice per year or 10 to 14 times per year if located in residential areas. Inlets of underground trenches should be periodically checked and cleaned, with cleaning occurring when sediment depletes more than 10 percent of available capacity. Generally, 5 to 10 percent of initial construction costs are set aside for annual maintenance for surface trenches and 10 to 15 percent of initial construction costs are set aside for underground trenches.

Infiltration Basins

Infiltration basins are an effective means of removing both soluble and fine particulate pollutants from runoff. When designing this BMP, it is important to remember that large, shallow basins are more effective than those that are small and deep, and inlet channels should be stabilized to prevent runoff entering the BMP becoming erosive. Infiltration basins should be designed to completely drain within 2 to 3 days after the maximum design storm event to maintain aerobic soil conditions conducive to bacteria growth. Basin floors should be designed to have a slope approximately equal to 0% and the side slopes should be no steeper than 3:1.

Site Attributes

The best nutrient and metal sorption for infiltration basins has been observed for those constructed in soils that typically have the least capacity to infiltrate runoff. Furthermore, soils possessing a high organic matter content provide excellent pollutant removal. This BMP is not feasible on sites having impermeable soils, infiltration rates of less than 0.27 inches per hour, or clay content greater than 30 percent. Infiltration basins should not be used if: the slope of the contributing watershed is greater than 20 percent, depth to bedrock is less than 4 feet from the basin bottom, seasonally high water table is less than 2 to 4 feet from the basin bottom, or the watershed is less than 5 acres or greater than 50 acres. In addition, an infiltration basin should be located a minimum of 100 feet away from drinking water wells and 10 feet down gradient and 100 feet up gradient from building foundations.

Maintenance

Maintenance requirements associated with infiltration basins are slight, however, more maintenance is required with this BMP as compared to dry extended detention basins. These basins should have their performance checked after every major storm during the first few months and then inspected annually thereafter. Mowing should be completed twice per year to prevent woody growth, or more frequently if located in a residential area. In addition, debris and litter should be removed during the mowing visitations. Similar to the other BMPs previously mentioned, 3 to 5 percent of the initial construction cost is set aside for annual monitoring.

Reference: Schueler, Thomas R., 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Metropolitan Washington Council of Governments, Water Resources Planning Board, Department of Environmental Programs, Washington, DC.



APPENDIX D: ESTIMATES OF COST AND RETURN

The Mill Creek Greenway program will be a new initiative that requires a fresh look at how local dollars are spent to fulfill watershed and community-wide land use objectives. The costs of developing greenways must be weighed against the costs and impacts of inappropriate land use development. For example, the best use of the floodplain is for the storage of flood water. Greenways provide an economically viable use of the same land, expanding the functional use of the property. Greenways as a functional land use can lower short and long term community costs and provide financial return on money the community invests in infrastructure, transportation, recreation and education.

The following text defines typical costs (in 1998) for on and off-road greenway facility development and management. These are represented by general unit costs for facility development (not including land acquisition costs) which are categorized by greenway type, as well as management/maintenance/operations costs. Cost estimates are followed by examples of how other communities are receiving a return on their investment in greenways in terms of reduced flooding costs, reduced costs of water quality improvement, increased tourism revenue and increased business attraction.

GREENWAY FACILITY DEVELOPMENT COSTS

Costs do not include land acquisition costs. Labor costs are included in facility estimates. Costs for engineering and design development are estimated at 10-15% of construction costs.

Greenways with No Facility Development:

Extended Detention Basin

In 1985 dollars, the construction cost for an extended detention basin is:

$$C=(10.71V_s^{0.69})1.25$$

V_s=Volume of storage of pond to emergency spillway crest

(For example, if V_s = 50,000 cubic feet, cost = \$18,700. Then, cost is multiplied by 1.25 for a contingency factor, bringing the final cost to \$23,400.)

Annual maintenance costs average \$300 - \$500 per acre and non-routine maintenance costs average 1-2% of the base construction cost. Typically,

3-5% of the base construction costs are set aside to cover routine and non-routine maintenance costs.

Wet Pond

In 1985 dollars, the construction cost for a wet pond is:

$$C=6.1Vs^{0.75} \text{ for basins } <100,000 \text{ ft}^3, \text{ or}$$

$$C=34Vs^{0.64} \text{ for basins } >100,000 \text{ ft}^3$$

Vs = Volume of storage of pond to emergency spillway crest

Cost is multiplied by 1.2, for contingency factor, to arrive at final cost.

Routine and non-routine maintenance required for wet ponds is similar to extended detention basins. Like extended detention basins, the construction cost is based upon volume of storage (indicated below) and 3-5% of the initial construction costs are set aside for annual maintenance.

Infiltration Trench

In 1985 dollars, the construction cost for an infiltration trench is:

$$C=26.6(Vs \times 0.63)$$

Vs = Volume of storage

Multiply by 1.25, for contingency factor, for final cost

Excavation Cost = 20-25% of total cost

Stone Fill = 45-55% of total cost

Filter Fabric (a nonwoven geotextile) = 10-15%

Inlet and Outlet Pipes = 10-30% of total cost

Infiltration Basin

In 1985 dollars, the construction cost for an infiltration basin is:

$$C=10.7(Vs \times 0.69)$$

Vs = Volume of storage

Multiply by 1.25, for contingency factor, for final cost.

Soil Bioengineering

<u>Application</u>	<u>Unit of Measure</u>	<u>Unit Cost</u>
Stone		
24" diameter	Ton	\$45.00
30-36" diameter	Ton	\$50.00
Root Wad	Linear Foot	\$120.00
Live Branch Layering	Linear Foot	\$20.00
Tree Plantings		
1" caliper	Each	\$95.00
2-3' container	Each	\$18.00-\$20.00
1-2' container	Each	\$15.00-\$20.00
Live Stakes	Each	\$3.00
Live Fascines	Linear Foot	\$20.00
Coir Fiber Roll	Linear Foot	\$25.00



Herbaceous Seeding	Square Yard	\$0.50
GCL	Square Foot	\$0.70
Woven Geotextile	Square Yard	\$1.00
Nonwoven Geotextile	Square Yard	\$0.65
Geonet	Square Foot	\$0.55

Greenways with Limited Facility Development:

Trail Treads

6-foot Bare Earth Hiking/Mtn. Bike Trail	\$40,000 per mile
8-foot Bare Earth Equestrian Trail	\$50,000 per mile
8-foot Woodchip Pedestrian Trail	\$65,000 per mile
12-foot Wood Deck/Boardwalk Trail	\$1,800,000 per mile

Signage

Information Signs	\$1,000.00 each
Direction Signs	\$200.00 each
Warning Signs	\$200.00 each
Mile Markers	\$250.00 each

Furniture/Furnishings

Benches	\$600.00 each
Trash Receptacles	\$400.00 each
Security Bollards	\$250.00 each
Bicycle Racks	\$500.00 each
Fencing (Board-on-Board)	\$20.00 per linear foot
Gates	\$750.00 each
911 Emergency Phones	\$800.00 each
Restrooms	\$40,000.00 each
Landscaping	\$25,000.00/mile

Parking Lots

	<u>Gravel Lot</u>	<u>Asphalt Lot</u>
10 cars	\$7,500.00	\$14,000.00 each lot
20 cars	\$15,000.00	\$28,000.00 each lot
40 cars	\$30,000.00	\$56,000.00 each lot

Greenways with Multi-use Unpaved Trail Facility

Development:

Trail Treads

12-foot Soil-Cement Multi-Purpose Trail	\$80,000 per mile
12-foot Aggregate/Stone Trail	\$100,000 per mile
12-foot Wood Deck/Boardwalk Trail	\$1,800,000 per mile

Signage

Information Signs	\$1,000.00 each
Direction Signs	\$200.00 each
Warning Signs	\$200.00 each
Mile Markers	\$250.00 each

Furniture/Furnishings

Benches	\$600.00 each
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Trash Receptacles	\$400.00 each
Security Bollards	\$250.00 each
Bicycle Racks	\$500.00 each
Fencing (Board-on-Board)	\$20.00 per linear foot
Gates	\$750.00 each
911 Emergency Phones	\$800.00 each
Restrooms	\$40,000.00 each
Landscaping	\$25,000.00/mile

Parking Lots

10 cars
20 cars
40 cars

Gravel Lot

\$7,500.00
\$15,000.00
\$30,000.00

Asphalt Lot

\$14,000.00 each lot
\$28,000.00 each lot
\$56,000.00 each lot

**Greenways with Multi-use Paved Trail Facility
Development:**

12-foot Asphalt Multi-Purpose Trail	\$200,000 per mile
12-foot Concrete Multi-Purpose Trail	\$500,000 per mile
12-foot Wood Deck/Boardwalk Trail	\$1,800,000 per mile

Signage

Information Signs	\$1,000.00 each
Direction Signs	\$200.00 each
Warning Signs	\$200.00 each
Mile Markers	\$250.00 each

Furniture/Furnishings

Benches	\$600.00 each
Trash Receptacles	\$400.00 each
Security Bollards	\$250.00 each
Bicycle Racks	\$500.00 each
Fencing (Board-on-Board)	\$20.00 per linear foot
Gates	\$750.00 each
911 Emergency Phones	\$800.00 each
Restrooms	\$40,000.00 each
Landscaping	\$25,000.00/mile

Parking Lots

10 cars
20 cars
40 cars

Gravel Lot

\$7,500.00
\$15,000.00
\$30,000.00

Asphalt Lot

\$14,000.00 each lot
\$28,000.00 each lot
\$56,000.00 each lot

On-Road Greenway Facilities:

Restriping

Conducted as part of a regularly scheduled roadway resurfacing project and does not include right-of-way acquisition and changes to signal actuation.

Bicycle Lanes	\$7,200/mi
Wide Outside Lanes	\$6,450/mi



Independent Projects

Listing is for development of facility type. Right-of-way cost estimates are provided as a general guide. Not all projects will require the acquisition of right-of-way. Real estate values fluctuate dramatically and will need to be adjusted on a parcel-by-parcel basis.

Urban Bike Lanes (4' wide, both sides)	\$200,000/mi
Rural Bike Lanes (4' wide, both sides)	\$110,000/mi
Paved Shoulders (4' wide, both sides)	\$110,000/mi
Wide Curb Lane (14' wide, both sides)	\$130,000/mi

Other Bicycle Facilities

Class I Bicycle Parking (Bicycle Lockers - per 2 bicycles)	\$500-\$1500
Class II Bicycle Parking (Secure wheels and frame)	\$65-\$150/bike
Class III Bicycle Parking (Inverted U's or rail racks)	\$65-\$80/bike
Bike Route/ "Share the Road" sign	\$250/sign

Typical Costs for Pedestrian Facilities

Sidewalks (6' wide, 2 sides)	\$54,000/mi
Pedestrian Signal Heads (For 2 corners)	\$1,800
(For 4 corners)	\$3,700
Pedestrian Overpass	\$300/sq ft
Crosswalk Striping	\$250 each
Curb Extensions	\$4,500 each

RETURNS ON GREENWAY INVESTMENT

Although some of the costs of greenway development in the Mill Creek watershed will be borne by municipalities, local businesses, and community organizations, investing dollars in greenways will yield a substantial return on a community-wide investment. This return will be in the form of reduced flooding costs, reduced costs of water quality improvement, increased property values, increased recreational opportunities, longer term generation of tourism revenue and increased business attraction, among other factors. Although the amount of return cannot be accurately predicted for the watershed-wide greenway

system, examples of how much other communities have realized from greenway development demonstrate such potential.

Increased Business Revenue

One way that greenways can improve the local economy is by increasing tourism revenues. Tourism is currently the third largest industry in the country and natural areas are destinations for much of the traveling public. Local communities not only benefit when tourists spend money on food, lodging, and souvenirs, but also recreational supplies for boating, fishing, birdwatching and bicycling.

- The Northern Central Rail Trail attracts 457,000 visitors every year and has led to the creation and support of 262 jobs in Baltimore County, Maryland. These positions range from trail construction and maintenance work, to jobs in local restaurants and hotels serving trail users, to added positions in regional sporting goods companies and supermarket chains due to increased business. A study found that the trail's cost to the public in 1993 was \$191,893, but it generated \$303,750 that same year in sales, property and income taxes.
- While tourists will travel far to see unique natural features, they are also attracted by the character of an area. This unique character can be urban or rural. One example is in Lancaster County, Pennsylvania, where the main attraction is the picturesque small family farm landscape. The tourists who come to enjoy this scenery bring in nearly \$250 million a year in to the County.
- Protecting open space such as wetlands and streamside buffers can decrease the amount of sediment reaching a body of water. The improvement in water quality can result in tourism benefits. A survey of anglers in Illinois estimated that if water visibility in a currently erosion-muddied lake could be increased to a 2-foot visibility, the number of trips per year to the lake would increase by 50%. In addition, 56% of the surveyed anglers would be willing to pay additional fees if such funds would help improve water clarity.

Increased Property Values

The existence of parks, greenways and natural areas also factors into the decisions of potential homebuyers. People are seeking residential areas that include these amenities. Due to this demand, the preservation of natural areas and development of trails adjacent to properties increases their value.

- The Burke-Gilman Trail in Seattle is used as a selling point for nearby properties and has increased the value of adjacent properties. A study by the Seattle Engineering Department concluded that "property near but not immediately adjacent to the trail is significantly easier to sell and, according to real estate agents, sells for an average of six percent more as a result of its proximity to the trail."
- According to a recent study conducted for the real estate industry, out of 39 features identified by potential homebuyers as crucial factors in their home purchasing decision, "lots of natural open space" ranked second,



just behind “quiet streets and low traffic”. “Walking and biking paths” ranked third. This study revealed that the most attractive neighborhoods to live in are no longer to golf course communities, but rather open space and trails communities.

- In the neighborhood of Cox Arboretum, in Dayton, Ohio, the proximity of the park and arboretum accounted for an estimated 5% of the average residential selling price. In the Whetstone Park area of Columbus, Ohio, the nearby park and river were estimated to account for 7.35% of selling prices.
- The developer of the Shepherd’s Vineyard subdivision in Apex, North Carolina, incorporated greenways into the design of the development and advertised the greenways as a selling point in marketing brochures. As a result, the lots adjacent to the greenways sold the fastest and sold for an average of \$5,000 more than similar lots in the subdivision that were not located next to a greenway.

Business Attraction

Tourists and potential homebuyers are not the only people attracted to communities with greenways. Business leaders are selecting sites for the relocation and expansion of industries and corporations where the quality of life is high and recreation opportunities are available. More and more, corporations are recognizing the benefits to their employees of convenient fitness and recreation facilities and are seeking these greenway amenities in potential business sites.

- “Quality of life for employees” was rated the third most important factor in locating a business, according to an annual survey of chief executive officers conducted in 1989. The top city for business was Atlanta, which also ranked first for highest quality of life.
- Research Triangle Park, in the Raleigh-Durham-Chapel Hill region of North Carolina, is a major corporate park that contains a 12-mile greenway trail system. After a five-state search, Reichold Chemical chose to relocate to this area because, as a company spokesman told the News and Observer, they wanted a corporate site near “the jogging trails”.
- Prior to the development of the Pinellas Trail through the small town of Dunedin, Florida, businesses were suffering and the downtown storefront occupancy rate was at 30%. Today, revenue from trail users has spurred economic activity. Business is booming and there is now a waiting list for businesses who wish to locate to the downtown.

Decreased Costs of Water Treatment

Greenways, especially when they protect wetlands and buffers located adjacent to waterways, clean the water by acting as a filter, trapping non-point source pollutants. These pollutants, including sediment, pesticides, fertilizers, oil, gas and other chemicals, are transported into streams, rivers and lakes by stormwater when it rains or snows. Greenways and other natural lands also help reduce erosion and recharge the groundwater. All of these natural functions of protected lands reduce the need for expensive water-treatment facilities.



- The City of New York plans to spend \$1.5 billion over the next decade to safeguard its vast upstate reservoir system through watershed protection and the purchase of 80,000 acres of open space. In doing so, the City is avoiding the expense of constructing federally-mandated filtration facilities estimated to cost between \$6-8 billion.
- Controlling nonpoint source pollution can result in significant economic benefits to farmers. Reduced soil loss from erosion, accompanied by increased moisture retention and decreased fertilization requirements, all lead to increased crop productivity and reduced costs. A 1996 study of the economic benefits of such watershed management solutions applied to 10,570 acres of the Highland Silver Lake watershed in Illinois revealed total estimated project benefits of \$2.3 million. The costs incurred by the practices were estimated to total \$1.8 million, resulting in net benefits of approximately \$500,000.
- The wetlands of Congaree Bottomland Hardwood Swamp in South Carolina provide valuable water quality functions such as sediment, toxicant and excess nutrient removal. The least cost substitute for the water quality services provided would be a water treatment plant costing \$5 million.

Flood Damage Prevention

In the 1990s, the economic losses attributed to flooding are greater than that from all other disasters combined. Traditionally, managers have taken a “hard” engineering approach to flood damage reduction--building dams, straightening rivers and lining streams with concrete. Today, managers are beginning to realize that these expensive options are not providing the amount of flood protection needed and that a “softer” approach needs to be considered. This approach includes the protection of wetlands, flood-plain storage capacity, watershed recharge areas and streamside buffers.

Greenways as streamside buffers can lessen the impacts of flooding by reducing the amount and velocity of water during storm events. Natural areas act as sponges, soaking in rain and snow and slowing the overland flow of water. This is in contrast to impervious surfaces, such as parking lots, rooftops and roadways, which serve to speed up stormwater flow. The more pervious, or natural, surfaces that are present within a watershed, the less severe flooding will be in downstream areas.

Flooding is costly, not only in terms of the value of property lost, but also lives lost. Along the mainstem of Mill Creek alone, the Army Corps of Engineers estimates expected annual flood damages (what might be expected to occur in the present or any future year) to be \$31 million. If a storm were to produce six or more inches of rain in one day, the Corps estimates damage could be as high as \$500 million for the Mill Creek Valley in Hamilton County.

One reason for this loss is the fact that many floodprone areas have been inappropriately developed. There are currently over 3,000 structures located in floodplains within Hamilton County alone, 90 percent of which were built prior to floodplain regulation implementation. Development continues to occur in the floodplain storage lands, where the majority of



damage occurs. More than half of the damages associated with flooding are actually outside any officially mapped floodplain (Source: Scott Faber, *On Borrowed Land*).

Setting aside open space within river and stream corridors as floodwater storage areas helps lessen the impacts of flooding by ensuring an alternative use of the floodplain. If natural areas within floodplains are protected, open space will be flooded frequently instead of commercial and residential structures located within the floodplain. This minimizes economic losses attributed to flooding.

- Leaders in Johnson County, Kansas, expected to spend \$120 million on stormwater control projects. Instead, voters passed a \$600,000 levy to develop a county-wide open space streamside park system to address the County's flooding problems.
- The City of Napa, California, and the Army Corps of Engineers are spending \$155 million on the Napa Flood Protection Project, a project which incorporates pump stations, floodwalls and roadway bridge reconstruction with floodplain terraces, bank revegetation and restored wetland habitats. It is estimated that the completed project will save \$20 million in average annual reductions of property damage, emergency response and cleanup avoided, and flood insurance no longer needed.
- An article in the New Yorker noted that the streams of southern Staten Island save taxpayers hundreds of millions of dollars because they handle rainwater so efficiently that there is no need to build more storm sewers.
- Baltimore County, Maryland, acquired 100 homes in several 100-year floodplains and resold them to people willing to relocate the structures to higher ground. At a cost of \$27 million, the County will have protected the floodplain in eight of its most critical watersheds, with a savings of \$85 million in storm damage assistance costs over five years.

Decreased Health Costs

Greenways as recreation facilities help promote fitness by providing convenient opportunities for exercise. Studies have shown that as little as 30 minutes a day of moderate-intensity exercise (such as bicycling, walking, in-line skating or cross-country skiing) can significantly improve a person's mental and physical health and prevent certain diseases. Providing opportunities for participation in these outdoor activities, close to where people live and work, is an important component of promoting healthy lifestyles. Businesses are also realizing the benefits of healthy employees, both in increased efficiency and decreased health insurance claims.

- The American Heart Association conducted a study of men and women employed at 35 corporations across the country and found that those who were the most physically fit had a 37% lower absenteeism rate than those who were unfit.
- People who exercise regularly, including bicyclists and pedestrians, have 14 percent lower claims against their medical insurance and spend 30 percent fewer days in the hospital.



- The President's Council on Physical Fitness recommends that one of the best things local communities can do to promote healthy lifestyles is to provide more open space and trails.

Decreased Transportation Costs:

- According to the Federal Highway Administration, the public saves from 5 to 22 cents for every automobile mile displaced by bicycling or walking. This savings comes from the reduced costs of air pollution (health costs), oil importation, and traffic congestion (such as lost wages and lost time on the job).
- A household can save \$3000 a year by giving up one automobile and taking advantage of bicycling, walking and transit.

Decreased Criminal Activity:

- Evidence suggests that crime rates frequently drop dramatically when recreation opportunities are improved. To avoid spending \$30,000 to keep one teenager in detention for a year, communities are investing money in greenways and other recreation facilities as crime prevention tools. In Philadelphia, burglaries and thefts in an area dropped by 90 percent after police helped neighborhood volunteers clean up vacant lots and plant gardens.



APPENDIX E: FUNDING SOURCES

The most successful method of funding greenways is to combine private sector funds with funds from local, state, and federal sources. Many communities involved with greenway implementation will seek to leverage local money with outside funding sources, to increase resources available for greenway acquisition and development.

To implement greenways in the Mill Creek watershed, local organizations and municipalities should pursue a variety of funding sources. The funding sources listed in this chapter represent some of the greenway funding opportunities that have typically been pursued by other communities.

PUBLIC FUNDING SOURCES

Federal

Several federal programs offer financial aid for projects that aim to improve community infrastructure, transportation, housing, and recreation programs. Some of the federal programs that can be used to fund greenways include:

Transportation Equity Act for the 21st Century (TEA21)

The primary source of federal funding for greenways is through the Transportation Equity Act of 1998 (TEA21), formerly the Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA provided millions of dollars in funding for bicycle and pedestrian transportation projects across the country and will provide millions more as TEA21.

There are many sections of TEA21 that support the development of bicycle and pedestrian transportation corridors. ODOT can utilize funding from any of these subsets of TEA21. Those sections that apply to the creation of greenways, sidewalks and bikeways include:

- Surface Transportation Program (STP) funds

These funds can be used for bicycle and pedestrian facility construction or non-construction projects such as brochures, public service announcements, and route maps. The projects must be related to bicycle and pedestrian transportation and must be part of the Long Range Transportation Plan. These funds are programmed by the Metropolitan Planning Organization (MPO) in the Transportation Improvement Program.

- Transportation Enhancements Program

Ten percent of Ohio's annual STP funds are available for Transportation Enhancements, which include projects such as trails, greenways, sidewalks, signage, bikeways, safety education and wildlife undercrossings. There is usually a 20 percent match of local funds required (some states will accept donations of services, materi-



als or land in lieu of cash) and there are several key requirements that projects must meet in order to receive these funds. The Ohio-Kentucky-Indiana Regional Council of Governments administers the urban area portion of the TEA-21 funding for Butler, Clermont, Hamilton, and Warren Counties in Ohio. In addition, the Ohio DOT administers the statewide Bicycle and Pedestrian Program.

- Transit Enhancements Program

Transit Enhancement Activities. This will generate approximately \$30 million annually for these activities, which will then be divided among the 125 largest urban areas in the U. S. Activities eligible for funding include pedestrian access and walkways, bicycle access, bike storage facilities, bike-on-bus racks, and transit connections to parks within the transit service area.

- National Recreational Trails Fund Act (NRTFA)

A component of TEA21, the NRTFA is a funding source to assist with the development of non-motorized and motorized trails. The Act uses funds paid into the Highway Trust Fund from fees on non-highway recreation fuel used by off-road vehicles and camping equipment. This money can be spent on the acquisition of easements and fee simple title to property, trail development, construction and maintenance.

Through state agencies, "Symms Act" grants are available to private and public sector organizations. NRTFA projects are 80 percent federally funded, and grant recipients must provide a 20 percent match. Federal agency project sponsors or other federal programs may provide additional federal share up to 95 percent. Local matches can be in the form of donations of services, materials or land. Projects funded must be consistent with the Statewide Comprehensive Outdoor Recreation Plan. This program is administered by the Ohio Department of Natural Resources.

- Congestion Mitigation and Air Quality Improvement Program (CMAQ)

The CMAQ program was created to reduce congestion on local streets and improve air quality. Funds are available to communities designated as "non-attainment" areas for air quality, meaning the air is more polluted than federal standards allow. Funds are also available to "maintenance" areas, former non-attainment areas that are now in compliance. Funds are distributed to states based on population by county and the severity of air quality problems. A 20 percent local match is required.

Transportation and Community and System Preservation Pilot Program (TCSP)

The TCSP provides funding for a comprehensive initiative including planning grants, implementation grants, and research to investigate and address the relationships between transportation and community and system preservation and to identify private sector-based initiatives. The TCSP is a Federal Highway Administration program being jointly developed with the Federal Transit Administration, the Federal Rail Administration, the Office of the Secretary, the U. S. Department of Transportation, and the U. S. EPA. This program has been authorized \$20 million for 1999, and \$25 million is authorized for each of the years 2000-2003. States, MPOs, and local governments are eligible to receive planning and implementation grants for projects that: reduce impacts of transportation on the environment, reduce the need for costly future infrastructure investments, and improve the efficiency of the transportation system. Projects involving partnerships among public and private sectors are



given priority. The Region 5 EPA contact for the program is Sherry Kamke (312-353-5794).

Community Development Block Grant Program

The U.S. Department of Housing and Urban Development (HUD) offers financial grants to communities for neighborhood revitalization, economic development, and improvements to community facilities and services, especially in low and moderate-income areas. Several communities have used HUD funds to develop greenways, including the Boulding Branch Greenway in High Point, North Carolina.

Land and Water Conservation Fund (LWCF) Grants

This federal funding source was established in 1965 to provide park and recreation opportunities to residents throughout the United States. Money for the fund comes from the sale or lease of nonrenewable resources, primarily federal offshore oil and gas leases and surplus federal land sales. LWCF funds are used by federal agencies to acquire additions to National Parks, Forests, and Wildlife Refuges. In the past, Congress has also appropriated LWCF monies for so-called "state-side" projects. These "state-side" LWCF grants can be used by communities to acquire and build a variety of park and recreation facilities, including trails and greenways.

"State-side" LWCF funds are annually distributed by the National Park Service through the Ohio Department of Natural Resources (ODNR). Communities must match LWCF grants with 50 percent of the local project costs through in-kind services or cash. All projects funded by LWCF grants must be used exclusively for recreation purposes, in perpetuity.

Conservation Reserve Program

The U. S. Department of Agriculture, through its Agricultural Stabilization and Conservation Service, provides payments to farm owners and operators to place highly erodible or environmentally sensitive landscapes into a 10-15 year conservation contract. The participant, in return for annual payments during this period, agrees to implement a conservation plan approved by the local conservation district for converting these sensitive lands to a less intensive use. Individuals, associations, corporations, estates, trusts, cities, counties and other entities are eligible for this program. This program can be used to fund the maintenance of open space and non-public use greenways along water bodies and ridge lines.

Wetlands Reserve Program

The Department of Agriculture also provides direct payments to private landowners who agree to place sensitive wetlands under permanent easements. This program can be used to fund the protection of open space and greenways within riparian corridors. It is administered by the NRCS in Ohio.

Watershed Protection and Flood Prevention (Small Watersheds) Grants

The USDA Natural Resources Conservation Service (NRCS) provides funding to state and local agencies or nonprofit organizations authorized to carry out, maintain and operate watershed improvements involving less than 250,000 acres. The NRCS provides financial and technical assistance to eligible projects to improve watershed protection, flood prevention, sedimentation control, public water-based fish and wildlife enhancements, and recreation planning. The NRCS requires a 50 percent local match for public recreation, and fish and wildlife projects.



State

Natureworks Grants

The Ohio Department of Natural Resources provides grants from state bond moneys. Contact Mike Cook at (614) 265-6405 for more details.

Local Capital Improvement Program Funds

Taxes

Greenways can be funded through sales tax revenues. One example of a community that is using sales tax dollars to fund bicycle and pedestrian facilities is Cobb County, Georgia, where citizens voted to implement a one percent local sales tax to provide funding for transportation projects. Over four years, Cobb County Department of Transportation will receive \$3.8 million of this sales tax revenue for bicycle improvements alone, to be used as a match for federal dollars. Another example is Oklahoma City, where voters approved a temporary \$0.01 sales tax, which generated millions of dollars for greenway acquisition and development.

Impact Fees

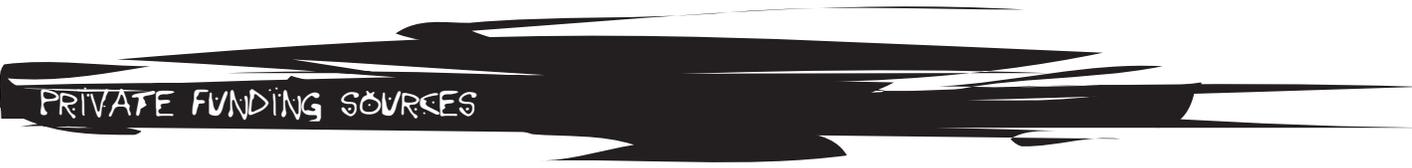
Impact fees are monetary one-time charges levied by a local government on new development. Unlike required dedications, impact fees can be applied to finance greenway facilities located outside the boundary of development. These fees can be levied through the subdivision or building permit process to finance greenways in Butler and Hamilton Counties.

Bond Referendums

Communities across the nation have successfully placed propositions on local ballots to support greenway development. The Charlotte-Mecklenburg County, North Carolina, area passed four consecutive referendums that generated more than \$3 million for greenways. Guilford County, North Carolina also passed a referendum that appropriated \$1.6 million for development of the Bicentennial Trail. Since bonds rely on the support of the voting population, an aggressive education and awareness program will need to be implemented prior to any referendum vote.

Local Capital Improvements Program

Some local governments have initiated a yearly appropriation for greenway and trail development in the capital improvements program. In Raleigh, North Carolina, greenways continue to be built and maintained, year after year, due to a dedicated source of annual funding, that has ranged from \$100,000 to \$500,000, administered through the Parks and Recreation Department.



PRIVATE FUNDING SOURCES

Many communities have solicited greenway funding from a variety of private foundations, corporations, and other conservation-minded benefactors. As a general rule, local foundations and businesses will have a greater interest in and be more likely to fund local projects. These local sources should be approached first, before seeking funds outside the community.



Local Businesses

Local industries and private businesses may agree to provide support for development of greenways through:

- donations of cash to a specific greenway segment;
- donations of services by corporations to reduce the cost of greenway implementation, including equipment and labor to construct and install elements of a trail;
- reductions in the cost of materials purchased from local businesses which support greenway implementation and can supply essential products for facility development.

This method of raising funds requires a great deal of staff coordination. One example of a successful endeavor of this type is the Swift Creek Recycled Greenway in Cary, North Carolina. A total of \$40,000 in donated construction materials and labor made this trail an award-winning demonstration project. (Some materials used in the "recycled trail" were considered waste materials by local industries!)

Trail Sponsors

A sponsorship program for trail amenities allows for smaller donations to be received both from individuals and businesses. The program must be well planned and organized, with design standards and associated costs established for each amenity. Project elements which may be funded can include wayside exhibits, benches, trash receptacles, entry signage, and picnic areas. Usually, plaques recognizing the individual contributors are placed on the constructed amenities or at a prominent entry point to the trail.

Volunteer Work

Community volunteers may help with trail construction, as well as fund raising. Potential sources of volunteer labor in Butler and Hamilton Counties could include local bicyclists, local historical groups, neighborhood associations, local churches, conservation groups, school groups, and local civic clubs such as Kiwanis, Rotary and Lions Clubs.

A good example of a volunteer greenway program is Cheyenne, Wyoming, which generated an impressive amount of community support and volunteer work. The program has the unusual problem of having to insist that volunteers wait to begin landscaping trails until construction is completed. A manual for greenway volunteers was developed in 1994 to guide and regulate volunteer work. The manual includes a description of appropriate volunteer efforts, request forms, waiver and release forms, and a completion form (volunteers are asked to summarize their accomplishments). Written guidelines are also provided for volunteer work in 100-year floodplains.

To better organize volunteer activity, Cheyenne developed an "Adopt-a-Spot" program. Participants who adopt a segment of trail are responsible for periodic trash pick-up, but can also install landscaping, prune trail-side vegetation, develop wildlife enhancement projects, and install site amenities. All improvements must be consistent with the Greenway Development Plan and must be approved by the local Greenway Coordinator. Adopt-a-Spot volunteers are allowed to display their names on a small sign along the adopted section of greenway.



“Buy-a-Foot” Programs

“Buy-a-Foot” programs have been successful in raising funds and awareness for trail and greenway projects across the country. Under local initiatives, citizens are encouraged to purchase one linear foot of the greenway by donating the cost of construction. An excellent example of a successful endeavor is the High Point (North Carolina) Greenway “Buy-a-Foot” campaign, in which linear greenway “feet” were sold at a cost of \$25 per foot. Those who donated were given a greenway T-shirt and a certificate. This project provided an estimated \$5,000 in funds.

Developer Dedications

Cary, North Carolina, has used a dedication program to acquire land for its greenway program. Other communities have used such programs to build facilities, such as sidewalks, trails and other amenities, as part of new development. The developer typically fronts the cost of these improvements and passes the costs along to homebuyers.

American Greenways DuPont Awards

The Conservation Fund’s American Greenways Program has teamed with the DuPont Corporation and the National Geographic Society to award small grants (\$250 to \$2,000) to stimulate the planning, design and development of greenways. These grants can be used for activities such as mapping, conducting ecological assessments, surveying land, holding conferences, developing brochures, producing interpretive displays, incorporating land trusts, building trails, and other creative projects. Grants cannot be used for academic research, institutional support, lobbying or political activities.



APPENDIX F: MANAGEMENT AND MAINTENANCE

Managing and maintaining a system of greenways in the Mill Creek watershed will require a coordinated effort among several local municipalities and other public and private sector organizations and individuals. The following text defines the key aspects of greenway system management, beginning with operational policies, followed by facility management, land management, safety and security, trail user rules and regulations, an emergency response plan, and a risk management plan.

MANAGEMENT

Over the course of time, an implementing agent will encounter a variety of issues that are important to the successful management and operation of the greenway system. The following operational policies are defined to assist an implementing agent in responding to typical greenway implementation issues. More specific problems and issues may arise during the long-term development of the system that result in additional policies being considered and adopted.

Land Acquisition Policy

Much of the land that is included within the Mill Creek Watershed Greenway System is currently in private ownership. For these lands, an implementing agent and local municipalities will cooperatively work to negotiate with individual property owners for the use of their land for greenway purposes. They will accept donation of property or easements for the greenway system that is contained within the corridors defined in this Master Plan in accordance with existing policies and codes pertaining to the acquisition of parkland, transportation corridors and land for water and wastewater facilities.

Right of Public Access and Use of Trail Lands Policy

The general public should have access to and use of specific greenway lands that are owned by local municipalities, or on land that the municipalities have secured the right of public access and use. All access and use is governed by existing local government policies and should also be governed by a new Trail Ordinance (found in this chapter). The use of all trails is limited to non-motorized uses, including hiking, bicycling, running, jogging, wheelchair use, skateboarding, rollerblading, equestrian use, mountain biking, and other uses that are determined to be compatible with trails by local municipalities and an implementing agent.



Naming of Greenways Policy

Greenway segments can be named for the significant natural features that are found within a corridor. Greenways can also be named after an individual or individuals if these persons are truly distinguished within the community, or if these persons have contributed a gift equal to more than 50% of the value of greenway development within that corridor segment.

Fencing and Vegetative Screening Policy

The appropriate local government(s) and an implementing agent will work with each landowner on an individual basis to determine if fencing and screening is required and appropriate. The local municipality(ies) and an implementing agent may agree to fund the installation of a fence or vegetative screen, however, it should be the responsibility of the adjacent property owner to maintain the fence or vegetative screen in perpetuity, including the full replacement of such fence or screen in the event of failure or deterioration due to any circumstances.

Adopt-a-Greenway Program Policy

An Adopt-a-Greenway Program should be established by an implementing agent to encourage community groups, families, businesses, school groups, civic clubs and other organizations to join in managing the greenway system. An implementing agent will need to work closely with the appropriate Parks and Recreation Departments and utility companies to ensure that all Adopt-a-Greenway Program groups manage and maintain greenways in a manner that is consistent with other land use objectives. An implementing agent should develop written agreements for each Adopt-a-Greenway entity and keep a current record of this agreement on file (see example provided in Appendix). Adopt-a-Greenway entities will be assigned a specific section of the greenway system, defined by location or milepost. The activities of each organization should be monitored by an implementing agent or its designee. Agreements for management can be amended or terminated at any time by either party, giving 30 days written notice.

Management Agreements Policy

Management Agreements will be established between local governments, an implementing agent, and specific public or private organizations wishing to assist with the management of designated segments of the greenway system. The objective of these agreements is to define areas of maintenance and management that are compatible with existing land management activities, especially where greenways intersect with public or private properties and/or rights-of-way. Management agreements spell out specific duties, responsibilities and activities of the appropriate municipality, an implementing agent, and public or private organization that wishes to assist with management activities. They can be amended or terminated at any time by either party, giving 30 days written notice.

Cross Access Agreements Policy

Local governments can use cross access agreements to permit private landowners that have property on both sides of a greenway corridor access to and use of a greenway corridor to facilitate operation and land use activities. An example cross access agreement is provided within this Plan (See Appendix) which can serve as a model for how cross access can be obtained and maintained by a local government, an implementing agent, and adjacent property owners.



This cross access agreement is based on case law of the United States and specific experiences from other greenway trail systems throughout the United States. Adjacent landowners generally have the right to use the access at any time. However, access cannot block the right-of-way for trail users, other than for temporary measures such as permitting livestock to cross, or transporting equipment. Adjacent landowners are responsible for acts or omissions which would cause injury to a third party using the trail. If a landowner must move products, materials, livestock or equipment across the trail on a regular basis, appropriate signage should be installed to warn users of the trail to yield for such activities.

Crossing of abandoned or active rail lines, utility corridors and/or roads and highways will require the execution of agreements with companies, local, state or federal agencies and organizations that own the rights-of-way. These crossings must provide clearly controlled, recognized, and defined intersections in which the user will be warned of the location. In accordance with the American Association of State Highway Transportation Officials (AASHTO) and the Manual on Uniform Traffic Control Devices (MUTCD), the crossing will be signed with appropriate regulatory, warning and information signs.

Safety and Security

Safety is a duty and obligation of all public facilities. In order to provide a standard of care that offers reasonable and ordinary safety measures, an implementing agent and local governments should cooperatively develop and implement a Safety and Security Program for the greenway system. This program should consist of well-defined safety and security policies; the identification of greenway management, law enforcement, emergency and fire protection agencies; the proper posting, notification and education of the trail user policies; and a system that offers timely response to the public for issue or problems that are related to safety and security. The safety and security of the greenway system will need to be coordinated with local law enforcement officials, local neighborhood watch associations, and Adopt-a-Greenway organizations.

Important components of the safety and security program include the following. The local government and an implementing agent should:

- 1) work with local Police to establish a Greenway Safety and Security Committee that can meet monthly to discuss management of the greenway system.
- 2) prepare a Greenway Safety Manual and distribute this to management agencies and post it at all major trail heads.
- 3) post User Rules and Regulations at all public access points to greenway trails.
- 4) work with the management agencies to develop Trail Emergency Procedures.
- 5) prepare a Safety Checklist for the greenway system, and utilize it monthly during field inspection of greenway facilities.
- 6) prepare a Greenway User Response Form for complaints and complaints and provide copies at all trail heads.
- 7) work with management agencies to develop a system for accident reporting analysis.



- 8) conduct a regular Maintenance and Inspection Program, and share the results of these investigations with all management agencies.
- 9) coordinate other Public Information Programs that provide information about greenway events and activities that residents can participate in.
- 10) have an ongoing evaluation of greenway program objectives. It would be best to have this evaluation conducted by an implementing agent and local greenway user groups.

User Rules and Regulations

Trails within greenway corridors should be operated like all other parks within Hamilton and Butler Counties, open for public use from sunrise to sunset, 365 days a year, except as specifically designated. Individuals who are found to be using unlighted facilities after dusk and before dawn should be deemed in violation of these hours of operation and treated as trespassers. Where trails are lighted for nighttime use, the rules established within the Trail Ordinance (below) should govern permitted uses and activities.

The appropriate local government should enforce three types of trespass violations. A Level One violation is a first occurrence in which the violator is provided a written warning. Level Two violation is a second occurrence in which the violator is suspended for 30 days from using the greenway system. Level Three violation is a multiple occurrence in which the violator is suspended for life from using the greenway system.

The local government and an implementing agent should always discourage the general public from using any segment of a greenway trail that is under construction. Greenway segments should not be considered officially opened for public use until such time as a formal dedication ceremony and official opening has been completed. Individuals who use greenway segments that are under construction, without written permission from the local government should be deemed in violation of this access and use policy and treated as a trespasser.

Trail Ordinance

Multiuse conflict is a national problem for community and regional greenway systems. Typically, conflicts are caused by overuse of a greenway trail, however, other factors may be problematic including poorly designed and engineered trail alignments, inappropriate user behavior, or inadequate facility capacity. The most effective conflict resolution plan is a well conceived safety program that provides the individual user with a Code of Conduct for the greenway trail, sometimes called a Trail Ordinance. Several communities across the United States have adopted progressive trail ordinances to govern public use and keep trails safe for all users. The following Rules and Regulations are recommended for the Mill Creek Greenway System. These rules should be displayed as part of brochures and information signs throughout the greenway system.

- 1) Be Courteous: All Trail users, including bicyclist, joggers, walkers, wheelchairs, skateboarders and skaters, should be respectful of other users regardless of their mode of travel, speed, or level of skill. Never spook animals; this can be dangerous for you and other users. Respect the privacy of adjacent landowners!
- 2) Keep Right: Always stay to the right as you use the Trail, or stay in the lane that



has been designated for your user group. The exception to this rule occurs when you need to pass another user.

- 3) Pass on the Left: Pass others going in your direction on their left. Look ahead and behind to make sure that your lane is clear before you pull out and around the other user. Pass with ample separation. Do not move back to the right until you have safely gained distance and speed on the other user. Faster traffic should always yield to slower on-coming traffic.
- 4) Give Audible Signal When Passing: All users should give a clear warning signal before passing. This signal may be produced by voice, bell or soft horn. Voice signals might include "Passing on your left!" or "Cyclist on your left!" Always be courteous when providing the audible signal - profanity is unwarranted and unappreciated.
- 5) Be Predictable: Travel in a consistent and predictable manner. Always look behind before changing position on the Trail, regardless of your mode of travel.
- 6) Control Your Bicycle: Lack of attention, even for a second, can cause disaster - Always stay alert! Maintain a safe and legal speed at all times.
- 7) Do not Block the Trail: When in a group, including your pets, use no more than half the trail, so as not to block the flow of other users. If your group is approached by users from both directions, form a single line or stop and move to the far right edge of the Trail to allow safe passage by these users.
- 8) Yield when Entering or Crossing Trails: When entering or crossing the Trail at uncontrolled intersection, yield to traffic already using the other trail.
- 9) The Use of Lights: (where permitted) When using the Trail after dawn or before dusk be equipped with proper light. Cyclists should have a white light that is visible from five hundred feet to the front, and a red light that is visible from five hundred feet to the rear. Bicycles also need to be equipped with reflectors. Other Trail users should use white lights (bright flashlights) visible two hundred fifty feet to the front, and wear light or reflective clothing.
- 10) Do not Use this Trail Under the Influence of Alcohol or Drugs: It is illegal to use this Trail if you have consumed alcohol in excess of the statutory limits, or if you have consumed illegal drugs. Persons who use a prescribed medication should check with their doctor or pharmacist to ensure that it will not impair their ability to safely operate a bicycle or other wheeled vehicle.
- 11) Clean-up Your Litter: Please keep this Trail clean and neat for other users to enjoy. Do not leave glass, paper, cans or any other debris on or near the Trail. Please clean up after your pets. Pack out what you bring in - and remember to always recycle your trash.
- 12) Keep Pets on Leashes: All pets must be kept on secure and tethered leashes. Keep pets off of adjacent private property. Failure to do so will result in a fine.
- 13) Prohibition on Camp Fires: Fires, for any purpose, are prohibited within the Trails System. Any person caught lighting a fire for any purpose will be prosecuted to the fullest extent of the law.



Emergency Response Plan

In order to effectively patrol the greenway system and respond to the potential for fire, floods and other natural or human-caused disasters, local governments and an implementing agent should adopt a greenway emergency response plan. This plan defines a cooperative law enforcement strategy for greenways based on services required and those that are typically provided by police, sheriff, fire and EMS agencies. Specifically, all trails should be provided with an address system that denotes specific locations along the length of a trail corridor. A site plan that illustrates points of access to each trail corridor should be produced and kept on file at the appropriate Planning Department and provided to each agency. Each trail should be designed to permit access for law enforcement, fire and EMS agencies. Typically, inter-governmental agreements are executed for this. A system of cellular-type emergency phones should be located in remote sections of the system, providing users with access to the area 911 Emergency System.

The emergency response plan should also define the agencies that should respond to 911 calls, and provide easy-to-understand routing plans and access points for emergency vehicles. Local hospitals should be notified of these routes so that they may also be familiar with the size and scope of the project. The entire greenway system should be designed and developed to support a minimum gross vehicle weight of 6.5 tons.

Risk Management Plan

The purpose of a Risk Management Plan is to increase safety for the users of the Mill Creek Watershed Greenway System and reduce the potential for accidents to occur within the system or on lands adjacent to the system. While it is impossible to guarantee that all risk will be eliminated by a Risk Management Plan, implementation of a plan is in fact a critical step to reduce liability and improve safety. A Risk Management Plan establishes a methodology for greenway management that is based on current tort liability and case law in the United States related to the development, operation and management of public use greenway lands and facilities.

The ultimate responsibility for managing the greenway system, as defined within this Plan, rests with local governments and an implementing agent. The Risk Management Plan has as its major goals:

- 1) Risk Identification: determining where risk (threat to safety or potential loss) exists within the corridor.
- 2) Risk Evaluation: conducting appropriate examination of areas defined as a risk and determining the factors that contribute to risk.
- 3) Risk Treatment: defining and implementing an appropriate solution to the area of risk in accordance with one of the four options:
 - a) risk avoidance: prohibiting use of a risk area.
 - b) risk reduction: limit use of area and repair risk area immediately.
 - c) risk retention: obtain waivers from all potential users of the risk area.
 - d) risk transfer: transfer risk area (property) to an agency better suited to manage the area.



The following sixteen step plan should be implemented by local governments and an implementing agent to establish a Risk Management Plan for the Mill Creek Watershed Greenway System.

- 1) Develop a policy statement about risk management.
- 2) Conduct a needs assessment for the greenway program.
- 3) Determine goals and objectives for risk management - what are acceptable and not acceptable management levels.
- 4) Develop specifications for site and facility development.
- 5) Establish a clear and concise program for risk management.
- 6) Define supervision and responsibility for risk management.
- 7) Define appropriate rules and regulations that govern the use of the greenway system.
- 8) Conduct routine/systematic inspections and investigations of the greenway system.
- 9) Develop an accident reporting and analysis system.
- 10) Establish procedures for handling emergencies.
- 11) Develop appropriate releases, waivers and agreements for use and management.
- 12) Identify best methods for insuring against risk.
- 13) Develop a comprehensive in-service training program for employees of the Counties.
- 14) Implement a public relations program that can effectively describe the risk management program and activities.
- 15) Conduct periodic reviews of the Risk Management Plan by outside agents to ensure that the Plan is up to date.
- 16) Maintain good legal and insurance representation.

Liability

The design, development, management, and operation of the Mill Creek Watershed Greenway System must be carefully and accurately executed in order to provide a resource that protects the health and welfare of the public. Exposure to liability may occur when a facility has been under-designed to handle its intended volume of use; when management of the facility is poor; or when unexpected accidents occur because the trail manager failed to recognize the possibilities of a potentially hazardous situation. To reduce the possibility and exposure to liability, local municipalities and an implementing agent should have in operation the following measures prior to opening the first segment of greenway:

- 1) a thorough Maintenance Program that provides the appropriate duty or level of care to greenway users;
- 2) a Risk Management Plan that appropriately covers all aspects of the greenway system, and as necessary adjacent landowners;
- 3) a comprehensive working knowledge of public use laws and recent case history applicable in Ohio.

Existing government insurance programs should be adequate to protect the community from financial loss that might occur through the development and operation of a public use greenway system. Trails are no greater liability to the community than park and recreation resources. Local municipalities should review their current policies and check coverages to be certain that all aspects of these policies are up to date.



Local governments should exercise reasonable care in the design and construction of all greenway facilities to reduce hazardous, public nuisance and life threatening situations. Recreational Use Statutes in Ohio serve to reduce the exposure that adjacent landowners might expect to realize from the proximity of trails to private property. In fact, it is very difficult to find any case law in the United States where an adjacent property owner has been sued because a trail user strayed onto the adjacent private property and fell victim to an accident that was caused by the adjacent landowner. Some landowners have claimed that their insurance rates will go up because of the presence of a trail abutting their property. Once again, there is no case history among insurance companies to support this claim — provided the landowner has not gone out of his/her way to create an attractive nuisance and lure trail users onto their property.

It is also important that a fee not be charged to use any portion of the greenway system, because typically this may impact the way in which the recreational use statutes in Ohio apply to the use of the system. A voluntary donation applied to the greenway system will generally not affect the recreational use statute.



MAINTENANCE

Greenway facilities should be maintained in a manner that promotes safe use. All greenway facilities should be managed by the local municipality, an implementing agent, or their designee. Greenway maintenance should include the removal of debris, trash, litter, obnoxious and unsafe man-made structures, and other foreign matter so as to be safe for public use. Trail heads, points of public access, rest areas and other activity areas should be maintained in a clean and usable condition at all times. The primary concern regarding maintenance should always be public safety.

All trail surfaces should be maintained in a safe and usable manner at all times. Rough edges, severe bumps or depression, cracked or uneven pavement, gullies, rills and washed out treads should be repaired immediately. Volunteer vegetation occurring in the tread of the trail should be removed in such a manner so that the trail surface is maintained as a continuous, even and clean surface.

Property owned or used by a local government for the greenway system should be maintained in a condition that promotes safety and security for greenway users and adjacent property owners. To the extent possible, the property should also be maintained in a manner that enables the corridor to fulfill multiple functions (i.e. passive recreation, alternative transportation, stormwater management and habitat for wildlife). Property that is owned or managed by other entities should be managed and maintained in accordance with the policies of that public body responsible for the affected parcel.



Vegetation within each greenway corridor should be managed to promote safety, serve as wildlife habitat, buffer public trail use from adjacent private property (where applicable), protect water quality, and preserve the unique aesthetic values of the natural landscape. Removal of native vegetation should be done with discretion, removal of exotic species should be accomplished in a systematic and thorough manner. The objective in controlling the growth of vegetation should be to maintain clear and open lines of sight along the edge of the trail, and eliminate potential hazards that could occur due to natural growth, severe weather or other unacceptable conditions. Further information on stream channel maintenance is provided in the Design Guidelines chapter.

To promote safe use of any greenway trail, all vegetation should be clear cut to a minimum distance of three (3) feet from each edge of a trail. Selective clearing of vegetation should be conducted within a zone that is defined as being between three (3) to ten (10) feet from each edge of a trail. At any point along a trail, a user should have a clear, unobstructed view, along the centerline of a trail, 300 feet ahead and behind his/her position. The only exception to this policy should be where terrain or curves in a trail serve as the limiting factor.

The local government, an implementing agent, or their designated agent should be responsible for the cutting and removal of vegetation. Removal of vegetation by an individual or entity other than the appropriate local municipality or their designee should be deemed unlawful and subject to fines and/or prosecution.



APPENDIX G: GLOSSARY

AASHTO: American Association of State Highway Transportation Officials.

ADA: Americans with Disabilities Act

At-Grade Crossing: refers to a trail/roadway intersection where trail users are routed onto the road, rather than above (pedestrian bridge) or below (tunnel) it.

BOD (Biological Oxygen Demand): Amount of oxygen used up in the respiration of organic matter by decomposers.

Bollards: metal, wooden or concrete posts designed to restrict vehicle access to a trail.

Channelization: Straightening of a channel via construction methods utilizing heavy machinery.

COD (Chemical Oxygen Demand): Amount of oxygen used up in the chemical oxidation of organic matter by decomposers.

Combined Sewer Overflow (CSO): Sanitary sewer system which also functions as the storm drain system. During storm events, stormwater runoff and sewage combine in the same system. When the system becomes overloaded and is incapable of handling the combined amount of stormwater and sewage during a high runoff event, the combined sewer overflows and discharges directly into the nearby stream.

Embeddedness: The degree or amount that larger stream bed material is surrounded or covered by fine sediment.

Entrenchment: A computed index value which is used to describe the degree of vertical containment of a river channel (width of the flood prone area at an elevation twice the maximum bankfull depth/bankfull width).

Fossiliferous: Containing a high amount of fossil material.

Floodplain: the lowland that borders a stream, creek, river, or water conveyance and is subject to flooding when the stream overflows its banks.

Geomorphology: Study of the appearance of the landscape and the processes which shape the landscape.

Glacial Till: Unstratified glacial drift deposited by ice and consisting of clay, silt, sand, gravel, and boulders, intermingled in any proportion.

Gabions: rectangular, rock-filled, wire baskets which are building blocks that are used to stabilize stream banks.

Geotextile: If nonwoven, is a felt-like plastic material used as a filter or separation fabric. If woven, is a yarn-like plastic, weaved together, and is used as a stabilization or separation fabric.

Geonet: Net-like plastic material used as a drainage layer.

Geogrid: Grid-like plastic material used for erosion control or structural foundation.

Greenway: a linear corridor of natural land, usually following features such as rivers and creeks, which can contain trails for recreation and transportation and can also protect flood prone areas.

Hydrologic Soil Group: A classification system developed by the United States Department of Agriculture based upon soil texture and infiltration rates. The soils are classified as either A, B, C or D where A soils are very porous (gravelly, sandy) with high infiltration rates and D soils are non-porous soils (clayey) with very low infiltration rates.

Impermeable Liner/Hydraulic Barrier: 2 to 3 feet of clay (natural or sodium bentonite enhanced). GCL's (Geotextile Clay Liner) are 1/2" to 1" thick layer geotextiles and sodium bentonite bonded together ("rug & mud"). Plastic or rubber geomembranes.

Loess: Material transported and deposited by wind and consisting of predominantly silt-sized particles.

MUTCD: Manual on Uniform Traffic Control Devices

Macroinvertebrate: An organism without a backbone large enough to be seen without magnification.

Ordovician-age: Geologic time period occurring 438-510 million years ago.

Perennial Streams: Streams possessing baseflow throughout the entire year.

Physiographic Province: Region of the conterminous United States delineated based upon geomorphic characteristics. There are 24 physiographic provinces/regions in the conterminous United States.

Riparian: associated with a river or creek.

Rip Rap: large angular rocks that are traditionally used to armor eroding banks of small streams.

Sanitary Sewer Overflow (SSO): Sanitary sewer system which overflows and discharges directly into a nearby stream when the system is incapable of handling large amounts of sewage.

Sinuosity: Stream length divided by valley length.



Soil Bioengineering: Combination of biological and ecological concepts to arrest and prevent shallow slope failures and erosion.

Stormwater: Rainfall or snowmelt which travels into streams and rivers during and after storm events.

Stream Order: A measure of the position of a stream in the hierarchy of tributaries. Stream ordering is a means of classifying the segments of streams within a drainage basin. The "order" of a stream increases as the size and number of tributaries increase. Within a drainage basin, the small, headwater streams with no tributaries are classified as 1 (first order). A stream becomes a second order stream where two first order streams intersect. Thus, a third order stream segment begins where two second order streams intersect, and so on.

Taxa: Groups in a formal system of nomenclature for classifying plants and animals.

Trail Head: a designated public access point along a greenway which can include bicycle and paved or gravel automobile parking, restroom facilities, drinking fountains, signage, benches and picnic tables.

Trail Tread: the surface of a trail.

Warmwater Habitat: Waters capable of supporting and maintaining a balanced, integrated, adaptive community of warmwater aquatic organisms having a species composition, diversity, and functional organization comparable to the twenty-fifth percentile of the identified reference sites within each of the following ecoregions: the interior plateau ecoregion, the Erie/Ontario lake plains ecoregion, the western Allegheny plateau ecoregion and eastern corn belt plains ecoregion.

Width/Depth Ratio: An index value which indicates the shape of the channel cross-section (ratio of bankfull width/mean bankfull depth).

Wisconsin-age: Geologic time period occurring 10,000 - 20,000 years ago.