Wolf Creek Watershed Plan - Phase I

October 2011

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This report is submitted in fulfillment of Deliverable 5, from NEFCO's Scope of Work, Exhibit 1-A of NEFCO's water quality management contract with Ohio EPA. The scope calls for NEFCO to update the Upper Wolf Creek Watershed Plan in coordination with the Northeast Ohio Areawide Coordination Agency.

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Table of Contents

Page

I. Introduction 1
Purpose 1
Fundamental Water Quality Goals 1
Watershed Issues Overview 1
Updates and Revisions 3
Watershed Groups 3
Development of the Watershed Plan 3
Education, Marketing Strategies, and Outreach Goals 4

II. Watershed Inventory 5
Introduction 5
Watershed Information and Map 5
Physical Description 5
Administrative Boundaries 7
Districts and Educational Institutions 7
Parks 7
Schools 8
Colleges and Universities 9
Sewer 9
Soil and Water 9
Resource Conservation and Development (RC&D) Program 10
Muskingum Watershed Conservancy District (MWCD) 10
Geology 11
Topography, Land Form and Slope 11
Glacial History and Geology 12
Bedrock Geology 14
Mineral Resources 14
Soils 16
Rittman-Wadsworth Association 17
Canfield-Wooster-Ravenna Association 17
Fitchville-Chili-Bogart Association 17
Sebring-Canadice Association 19
Biological Features 19
Invasive, Non-Native Species 19
Wildlife 20
Water Resources 22
Climate and Precipitation 22
Surface Water 22
Home Sewage Treatment Systems (HSTSs) 23
Flow Regime, Bankfull Discharge, and Stream Power 24
Floodplain Areas 24

Table of Contents (continued)

Page

Water Quality Improvement Efforts..26
Ohio EPA Section 319 Grant..26
Medina SWCD..26
Storm Water..28
NPDES Storm Water Phase 2 Communities..28
Summit County - Countywide Storm Water Management Program (SWMP) .28
Wetlands..29
Ground Water..31
Water Supplies..33
SWAP Program..35
Barberton Drinking Water Source Assessment..35
Land Use..36
Land Cover..37
Impervious Surfaces..39
Zoning..42
Watershed Communities Zoning Summary..42
Low Impact Development..45
Physical Attribute..46
Gradient..46
Flood Plain Connectivity..47
Riparian Levees..47

III. Water Resources Quality..48
Designated Use for Ohio Surface Water Resources..48
Aquatic Life Use Designation..48
Non-aquatic Life Use Designation - Water Supply..49
Biological Criteria..50
Aquatic Life Use Attainment Status..50
Qualitative Habitat Evaluation Index (QHEI)..51
City of Barberton Watershed Monitoring..53
Overview..53
Results..55
Phosphorus..55
Ammonia..56
Total Suspended Solids..57
Iron..58
Nitrate + Nitrite..59
Fecal Coliform..60
Turbidity..61
Other Water Quality Studies..62

Table of Contents (continued)

Page

IV. Water Quality Issues 64
General Watershed Issues 64

V. Total Maximum Daily Load 65
Summary 65
TMDLs Developed for Upper Wolf Creek 66
TMDL Load Reductions 66
Pathogens (Bacteria) 66
Habitat 67
Sediment 68

VI. Open Space Preservation Plan 70
Introduction 70
Current Conditions 70
Open Space Preservation Strategy 71
Overview 71
Anchor Based Strategy 71
Upper Wolf Creek Anchor Sites 71
Upper Wolf Creek Connecting Sites 72
Additional Sites 73
Open Space Protection Priorities 74
Open Space Protection Options 74
Land Donation 74
Conservation Easement 74
Land Acquisition 74
Bargain Sale 74

VII. Subwatershed Issues 76
Upper Wolf Creek Headwaters Subwatershed Issues 76
Ridge Creek and Spruce Run Subwatershed Issues 76
Kootnz Creek Subwatershed Issues 76
Barberton Reservoir Subwatershed Issues 76

VIII. Next Steps 77

IX. References Cites 78

List of Tables

Table		Page
II-1	Parks in the Upper Wolf Creek Watershed	8
II-2	School Districts Serving the Upper Wolf Creek Watershed Communities	8
II-3	Area and Percentages of the Upper Wolf Creek Watershed with Slopes Great than Six Percent	12
II-4	Abandoned Underground Coal Mines in the Upper Wolf Creek Watershed	16
II-5	Upper Wolf Creek Tributaries	22
II-6	Public Drinking Water Systems in the Upper Wolf Creek Watershed	33
II-7	Summary of Impervious Areas in the Upper Wolf Creek Watershed	41
II-8	Lot Area Minimum, Riparian and Wetland Setback Zoning Summary for Government Jurisdictions in the Upper Wolf Creek Watershed	44
II-9	Floor Area Minimum, Open Space, Conservation, and Recreation Zoning Summary of Government Jurisdiction in the Upper Wolf Creek Watershed	44
II-10	Upper Wolf Creek Watershed Average Stream Gradient and Percent Slopes	47
III-1	Water Supply Use Designation for Upper Wolf Creek Watershed and Tributaries	49
III-2	Aquatic Life Use and Recreation Uses Attainment Status	51
III-3	Relationship between Ohio's Aquatic Life Uses and the QHEI	53
III-4	City of Barberton Water Quality Monitoring Sites in the Upper Wolf Creek Watershed	55
III-5	Summary of Barberton Water Quality Monitoring Phosphorus	56
III-6	Summary of Barberton Water Quality Monitoring Ammonia	57
III-7	Water Quality Based on Total Suspended Solids (TSS) Values	57
III-8	Summary of Barberton Water Quality Monitoring Total Suspended Solids	58
III-9	Summary of Barberton Water Quality Monitoring Iron	59
III-10	Summary of Barberton Water Quality Monitoring Nitrate + Nitrite	60
III-11	Summary of Barberton Water Quality Monitoring Fecal Coliform	61
III-12	Summary of Barberton Water Quality Monitoring Turbidity	62
V-1	Total Existing Land, TMDL, and Allocation of Fecal Coliform Loads	66
V-2	Point Source Fecal Coliform Loads	66
V-3	Non Point Source Fecal Coliform Loads	67
V-4	QHEI Modified Attributes	67
V-5	Upper Wolf Creek Habitat TMDL	68
V-6	Ridge Creek Sediment TMDL	69
VI-1	Proposed Anchor Sites for the Upper Wolf Creek Open Space Preservation Plan	72
VI-2	Proposed Initial Connecting Sites for the Upper Wolf Creek Open Space Preservation Plan	73
VI-3	Additional Sites for the Upper Wolf Creek Open Space Preservation Plan	73

List of Figures

Figure Page

I-1 Upper Wolf Creek Watershed ... 2

II-1 Upper Wolf Creek Watershed Subwatersheds ... 6
II-2 Abandoned Mines - Upper Wolf Creek Watershed ... 15
II-3 General Soil Map - Upper Wolf Creek Watershed ... 18
II-4 100-year Flood Plain - Upper Wolf Creek Watershed ... 25
II-5 Upper Wolf Creek Watershed Sharon Township Balanced Growth ... 27
II-6 Upper Wolf Creek Watershed Ohio Wetland Inventory ... 30
II-7 Groundwater Pollution Potential - Upper Wolf Creek Watershed ... 32
II-8 Public Water Systems and Source Water Protection Areas in the Upper Wolf Creek Watershed ... 34
II-9 Upper Wolf Creek Watershed Land Use/Land Cover ... 38
II-10 Impervious Surfaces in the Upper Wolf Creek Watershed ... 40

III-1 Upper Wolf Creek Watershed Ohio EPA TMDL Sample Sites ... 52
III-2 Upper Wolf Creek Watershed City of Barberton Monitoring Stations ... 54

I. Introduction

Purpose

The intent of the Upper Wolf Creek Watershed Plan is to:

1. Develop a plan to protect and/or restore the water quality of the Upper Wolf Creek and its tributaries to meet state water quality standards and ensure the health and safety of watershed residents.
2. Preserve the water quality of the Barberton Reservoir which serves as the primary drinking water source for the City of Barberton.
3. Raise public awareness, especially among the watershed's residents, of the pollution sources and solutions in the Upper Wolf Creek Watershed.
3. Consolidate existing watershed information from previous reports and studies into a single user-friendly report; as well as, create a reporting format that can easily be updated when new information becomes available.

Fundamental Water Quality Goals

1. Protect sections of Upper Wolf Creek that are currently meeting state water quality standards from degradation.
2. Restore sections of Upper Wolf Creek currently not meeting state water quality standards.
3. Protect and restore the riparian corridor.
4. Preserve high quality natural resource, recreation, and open areas.

Watershed Issues Overview

The Upper Wolf Creek is a small headwater tributary to the Tuscarawas River located in predominately rural and low density residential areas of western Summit and eastern Medina Counties (Figure I-1). The Creek originates in Medina County and flows east into Summit County before forming the Barberton Reservoir in the City of Norton and Copley Township. From the Barberton Reservoir dam, the Upper Wolf Creek drains approximately 18,062 acres. In addition, Barberton Reservoir serves as the primary drinking (source) water supply for the City of Barberton, serving a population of over 29,000 people.

The riparian corridor is currently in relatively good condition with forested, wetlands, shrubs, and/or old field lands adjacent to the majority of the creek. However, the watershed is facing development pressures due to its close proximity to Akron (east), Wadsworth (south), Medina (west), and Cleveland (north). Urban sprawl is resulting in the development of the watershed's open lands, especially forested and agricultural areas. The water quality issues facing the Upper Wolf Creek Watershed are similar to other rural areas in the path of urban sprawl. However, the watershed is unique because Barberton Reservoir is a drinking water source for the City of Barberton. It is the only community public water system in the Upper Tuscarawas River Watershed supplied by surface water. The primary issues to be addressed in the plan are:

- Promote Environment Education and Outreach
- Diminish the Impacts from Storm Water Runoff

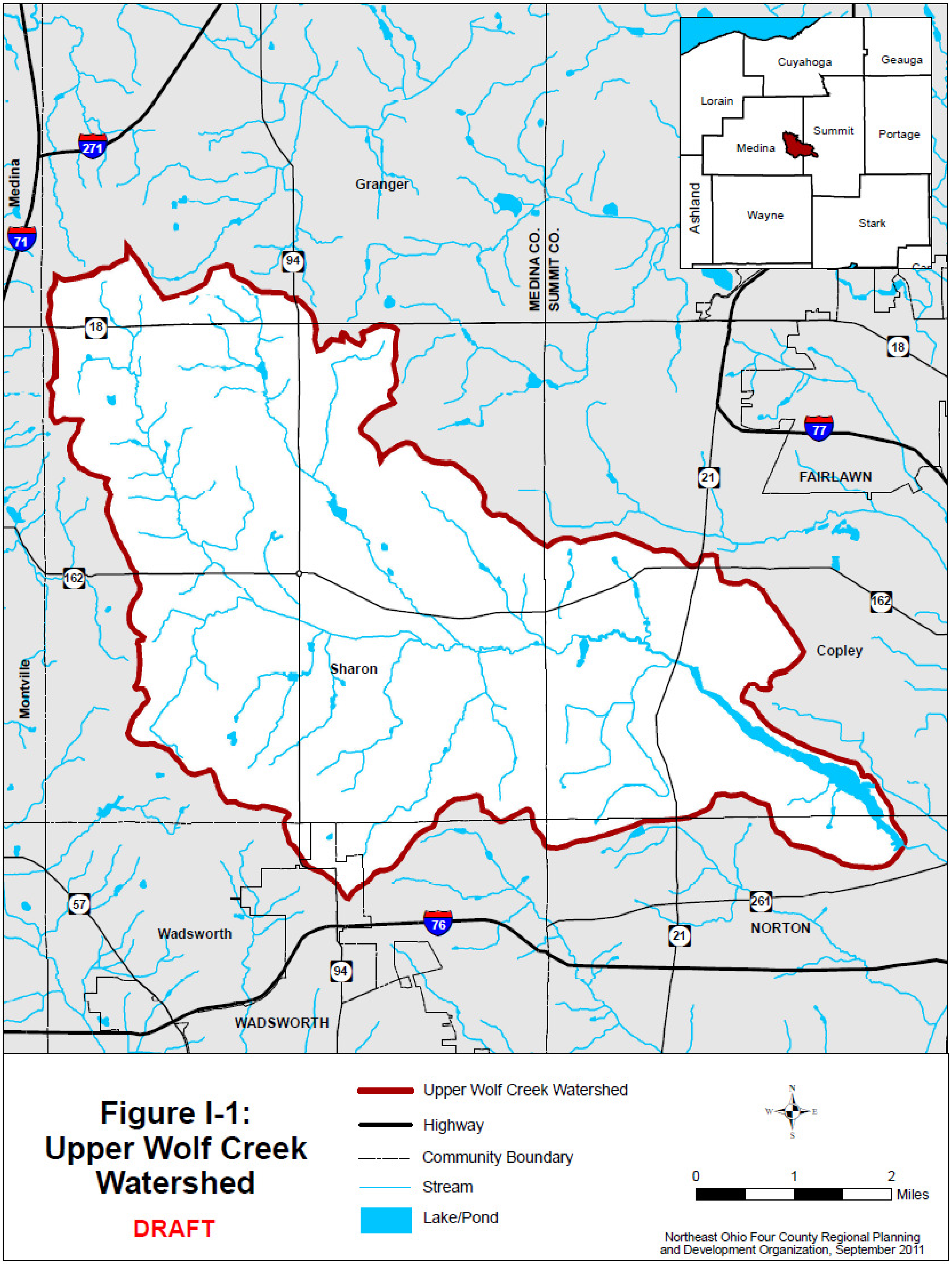

Figure I-1: Upper Wolf Creek Watershed

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- Maintain Barberton Reservoir's Water Quality
- Protect and Restore Riparian Corridors
- Reduce Pollution from Failing Wastewater Treatment Systems
- Identify and Protect High Quality Natural Resources and Open Space

Updates and Revisions

Maintenance and revisions of the Upper Wolf Creek Watershed Plan will be the primary responsibility of the Northeast Ohio Four County Regional Planning and Development Organization (NEFCO). NEFCO is the designated water quality planning agency for Summit County and conducts regional planning on various issues, including watershed management. The Northeast Ohio Areawide Coordinating Agency (NOACA) is the designated water quality planning agency for Medina County and provides watershed planning assistance. NEFCO will seek input from NOACA for all updates and revisions to the portions of the watershed plan pertaining to Medina County. Updates and revisions will be made as new or updated information becomes available, as projects are completed, and/or as the plan's goals are achieved.

Watershed Groups

There is currently not a formalized watershed group for the Upper Wolf Creek Watershed. However, NEFCO has formed a Technical Advisory Committee (TAC) to assist NEFCO's Upper Tuscarawas Watershed Coordinator with the development of this Watershed Plan. The TAC is comprised of local environmental professionals, elected official, and other stakeholders interested in the protection and restoration of the Upper Wolf Creek. A list of TAC members can be provided upon request. There are currently no plans to formalize the TAC as a group. However, this section will be updated if a formal watershed group is created.

Development of the Watershed Plan

The Upper Wolf Creek Watershed Plan is the continuation of efforts started by NEFCO in the 1990s to develop the *Upper Wolf Creek Comprehensive Watershed Management Plan* (CWMP). In 1997, the *Phase I Diagnostic Report* was completed which included information on the watershed's physical geology, potential pollution sources, riparian inventory, and recommended best management practices. Phase II was completed in 1999 and included the results of biological and chemical monitoring conducted in 1998 and 1999 at ten monitoring locations throughout the watershed. Both phases of the CWMP were developed with considerable input and guidance from local and statewide stakeholders.

The information provided in the CWMPs were utilized to secure from Ohio Environmental Protection Agency (Ohio EPA) a nonpoint source pollution (NPS) control grant established under Section 319 of the Clean Water Act. The three-year grant (1999-2001) goals were to reduce phosphorus loads by 1,000 lbs/year from failing home sewage treatment systems (HSTSs) and small farm operators, conduct water quality monitoring, and preserve 25 acres of the riparian and wetland habitats. The partners involved with the grant included NEFCO, the City of Barberton, Medina County

Soil and Water Conservation District (SWCD), Medina County Health Department, the Ohio Department of Natural Resources, and the Medina Summit Land Conservancy. The grant resulted in nine failing HSTSs being replaced and seventeen systems repaired. Also accomplished was increasing awareness among the watershed's residents of NPS pollution issues and a strengthening of the partnership among participating agencies to address watershed issues.

However, an updated Upper Wolf Creek CWMP was needed to reflect the current watershed planning standards, new water quality programs, and information that has become available since its completion. Specifically, the two phases of the CWMP were completed prior to the new watershed plan endorsement standards from Ohio Environmental Protection Agency (EPA) and the Ohio Department of Natural Resources. The previous NEFCO plan was also completed prior to new regulations such as the National Pollution Discharge Elimination System (NPDES) Storm Water Program Phase II, and Ohio EPA's Total Maximum Daily Load (TMDL) program.

This report is a stand alone plan that consolidates information from the previous phases of the Upper Wolf Creek CWMP, includes new programs and regulations, and provides the most up to date information about the watershed. This Watershed Plan was completed with continued input and review from Upper Wolf Creek stakeholders.

Education, Marketing Strategies, and Outreach Goals
In general, education will be targeted to people who can provide the greatest benefit for stream protection and restoration. That would include such stakeholders as riparian landowners, elected officials, and educators. A marketing strategy was not developed for inclusion in this plan. One will be developed in the future, if needed.

II. Watershed Inventory

Introduction

The intent of the Upper Wolf Creek Watershed Plan is to protect and/or restore the water quality of the Upper Wolf Creek, its associated tributaries, and Barberton Reservoir by developing a watershed plan that follows endorsement guidelines established by the State of Ohio. This watershed inventory provides information needed to address water quality issues and includes data on water resources, geology, socioeconomic factors, land usage, and cultural resources. Each section in the inventory was completed using the most up-to-date information available.

Watershed Information and Map

The Upper Wolf Creek Watershed is located in Medina and Summit Counties in Northeast Ohio (Figure II-1). For this report the Upper Wolf Creek Watershed is defined as all 18,286 acres of land that drains into Barberton Reservoir. In other words, it is the portion of the Wolf Creek Watershed from the Barberton Reservoir dam upstream to its headwaters.

The Wolf Creek Watershed is part of the Headwaters of the Tuscarawas River which has been assigned the unique Hydrologic Unit Code (HUC) number of 05040001 01. The entire Wolf Creek Watershed is divided into 12-digit HUC subwatershed of the Tuscarawas River Headwaters (05040001 01 04) covering 25,088 acres. The Upper Wolf Creek as defined in this report covers 73 percent of the Wolf Creek HUC (05040001 01 04), excluding the area downstream of the Barberton Reservoir dam. The remaining portions of the Wolf Creek Watershed not in this Watershed Plan will be included in future Tuscarawas River Watershed planning efforts.

NEFCO and Upper Wolf Creek Technical Advisory Committee (TAC) have further divided the watershed into four subwatersheds: Barberton Reservoir, Koontz Creek, Ridge Creek/Spruce Run, and Wolf Creek Headwaters. The Wolf Creek Headwaters is the largest subwatershed at 6,206 acres followed by Barberton Reservoir (5,049 acres), Ridge Creek/Spruce Run (4,230 acres), Koontz Creek (2,801 acres) subwatersheds. The benefits of developing and implementing a watershed plan using smaller subwatershed areas include improving the accuracy of determining impairments for specific stream segments, focusing the development and prioritization of needed actions, separating watershed areas for protection or restoration actions, and improved monitoring of the progress of implemented watershed efforts.

Physical Description

The Upper Wolf Creek (Figure II-1) is a headwater stream of the Tuscarawas River. The Tuscarawas River is located in the northeastern portion of the Muskingum River Watershed in the Ohio River drainage basin in which Tuscarawas River is a primary subwatershed. The headwaters of the Upper Wolf Creek originate in the northern part of the watershed near State Route 18 and Boneta Road. The creek flows south through Sharon Township in Medina County turning east near the Sharon Copley Road culvert.

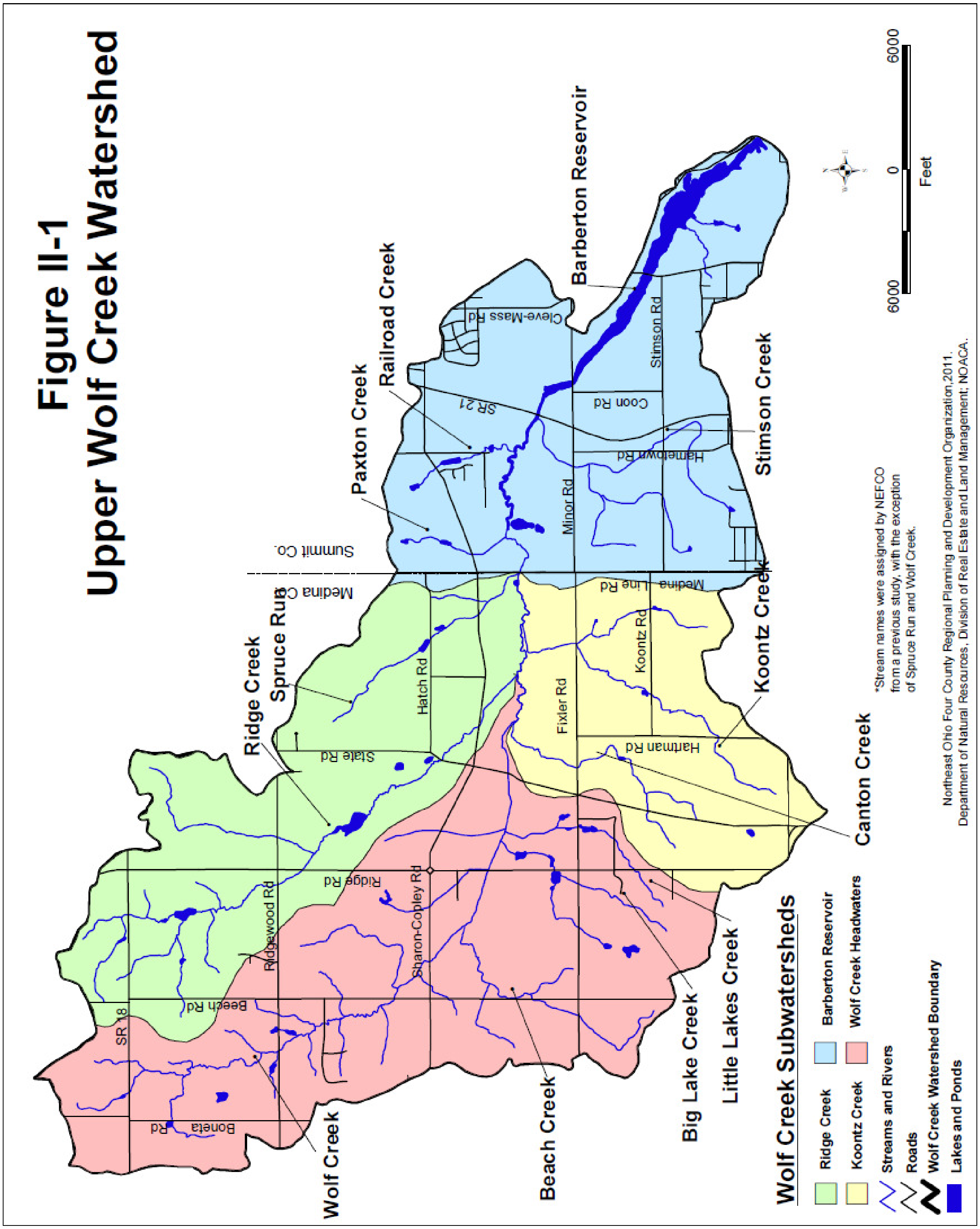


Figure II-1
Upper Wolf Creek Watershed
Barberton Reservoir
Railroad Creek
Paxton Creek
Stimson Creek
Spruce Run
Ridge Creek
Koontz Creek
Canton Creek
Wolf Creek
Beach Creek
Big Lake Creek
Little Lakes Creek
Summit Co.
Medina Co.
Cleve-Mass Rd
SR 21
Coon Rd
Stimson Rd
Hametown Rd
Minor Rd
Medina Line Rd
Koontz Rd
Fixler Rd
Hartman Rd
Hatch Rd
State Rd
Ridge Rd
Sharon-Copley Rd
Ridgewood Rd
Beech Rd
SR 18
Boneta Rd
6000
0
6000
Feet
*Stream names were assigned by NEFCO
from a previous study, with the exception
of Spruce Run and Wolf Creek.
Northeast Ohio Four County Regional Planning and Development Organization,2011.
Department of Natural Resources, Division of Real Estate and Land Management; NOACA.
Wolf Creek Subwatersheds
Ridge Creek
Koontz Creek
Barberton Reservoir
Wolf Creek Headwaters
Streams and Rivers
Roads
Wolf Creek Watershed Boundary
Lakes and Ponds

From this point the Upper Wolf Creek flows in an eastwardly direction through Sharon Township between Sharon Copley Road and Fixler Road. The creek flows into Copley Township in Summit County and continues to flow east until it forms the Barberton Reservoir after crossing under State Route 21.

The two longest tributaries to the Upper Wolf Creek are Ridge Creek and Koontz Creek. Ridge Creek also begins north of State Route 18 near the intersection of Beach Road. It flows in the east to southeasterly directing through Sharon Township until its confluence with Upper Wolf Creek just south of the Sharon Copley Road and Burdett Road intersection in eastern Sharon Township. Koontz Creek originates in the City of Wadsworth to south of Sharon Township. Kootnz Creek flows north to northeast through Wadsworth Township and Sharon Township, respectively. Koontz Creek joins Upper Wolf Creek just downstream of the Ridge Creek confluence.

Administrative Boundaries
Located within the watershed boundaries, in part or in whole, are the following government jurisdictions shown in Figure I-1:

Cities (County):
- Norton (Summit)
- Wadsworth (Medina)

Townships (County):
- Copley (Summit)
- Granger (Medina)
- Sharon (Medina)
- Wadsworth (Medina)

Districts & Educational Institutions

Parks

Parks provide several benefits to both environmental and recreational benefits to the watershed stakeholders. If properly managed, parks located along a creek can provide numerous water quality benefits like stream shading, runoff filtration, soil stabilization, floodplain protection, and wildlife habitat. Conversely, a poorly managed riparian park can have significant water quality impacts. The Upper Wolf Creek Watershed has three established parks and all are adjacent to the Upper Wolf Creek or a tributary (Table II-1). These creek-side parks not only can be the first areas considered for possible water quality protection or restoration project, but can also be used for educational programs.

Medina Park District's Wolf Creek Environmental Education Center was completed in 2000 on 103 acres of donated property. The District has since added an additional 145 acres bring it to its current size of 248 acres. The Education Center offers classrooms and a wide variety of habitats including wetlands, riparian areas, mature forests, and prairies to conduct the District's nature programs for school group and the general public. In addition, the land is also a wildlife sanctuary which minimizes the disturbances to the creek's and other natural communities within the park.

The Medina County Park District and Sharon Township both have goals of expanding existing parks and/or developing new park lands to further opportunities for recreation, environmental education, and natural resource protection.

Table II-1: Parks in the Upper Wolf Creek Watershed

District	Park Name	Size (Acres)	Subwatershed
Medina County Park	Green Leaf	62	Ridge Creek/Spruce Run
	Wolf Creek Environmental Education Center	248	Headwaters and Ridge Creek/Spruce Run
Sharon Township	Sharon Community Park	20	Headwaters

Schools

The Upper Wolf Creek Watershed is located in portions of five school districts in Medina and Summit Counties. Table II-2 summarizes all the districts including number of students and schools. Programs aimed at students and/or teachers are an important part of any education and awareness type program.

Table II-2: School Districts Serving the Upper Wolf Creek Watershed Communities

School District	Watershed Communities Served	Total Enrollment: 2010-2011	Number of Elementary Schools	Number of Middle Schools	Number of High Schools
Barberton City Schools	City of Barberton	3,676	5	2	1
Copley - Fairlawn City Schools	Copley Twp.	3,156	3	1	1
Highland Local Schools	Copley Twp., Granger Twp., and Sharon Twp.	3,221	2	1	1
Medina City Schools	Granger Twp. and Sharon Twp.	7,354	6	2	1
Norton City School District	City of Norton	2,543	4	1	1
Wadsworth City School District	City of Wadsworth and Wadsworth Twp.	4,742	5	2	1
	Totals	**24,692**	**25**	**9**	**6**

Source: Ohio Department of Education, 2011

Colleges and Universities

Although no colleges or universities are located in the Upper Wolf Creek Watershed, the basin's location in Northeast Ohio places it near several institutions of higher learning. Colleges or universities within 30 miles of the watershed are the University of Akron, Baldwin-Wallace College, Cuyahoga Community College, Kent State University, Stark State College, The Ohio State University Agricultural Technical Institute, and the College of Wooster. High education institutions can be utilized for various education, monitoring, research, and implementation programs. Involvement from these stakeholders will be explored and encouraged.

Sewer

Currently only a small portion of the basin is sewered including the City of Wadsworth; Sharon Township south of Sharon Copley Road between State Road and Ridge Road; and the State Route 18 corridor. The remaining portions of the watershed remain dependent on some type of home sewage treatment system (HSTS).

A facilities planning area (FPA) is a delineated area for sewer-related planning that clearly designates areas with sewers, areas where sewers can be extended, and areas that will not have sewer access. The four FPAs in the Watershed are: Akron, Barberton-Wolf Creek, Medina, and Wadsworth. In general, municipalities are the lead agencies for all sewer planning within their corporate limits, while the county is the lead agency for sewer projects in all unincorporated area. However, a portion of the Upper Wolf Creek Watershed in Copley Township is part of a Joint Economic Development District (JEDD) agreement with the City of Akron that makes the city the lead agency for wastewater planning in that area (NEFCO, 2005).

The extension of sewers is planned for small portions of the watershed over the next several years. In Medina County, the extension of sewers is planned for the remaining portion of the Wadsworth FPA, including the parcels west of Ridge Road (NOACA, 2000). The portion of the watershed in the Copley Township JEDD area is not currently sewered, but all new development and failing HSTSs will be required to connect to sewers. The last section of the watershed which could see the extension of sewers is the small area in Summit County that resides south of Hemphill Road in the Barberton-Wolf Creek FPA (NEFCO, 2005)

Soil and Water

The Summit Soil and Water Conservation District (SWCD) serves the Summit County portion of the Upper Wolf Creek Watershed located in Copley Township and the City of Norton. The agency conducts reviews on Storm Water Pollution Prevention Plans (SWP3) and inspects construction sites for erosion control.

The section of the watershed in Medina County is served by the Medina County SWCD. The Medina SWCD was organized in 1944 to aid farmers in applying soil and water conservation techniques on the land through technical assistance. This mission is still continued today, but development and urbanization over the last several years has brought new issues that the Medina SWCD helps county residence address. Through education, guidance, and technical assistance, the SWCD helps protect the Upper Wolf Creek. They promote stream corridor restoration, watershed planning, wetlands conservation, storm water management, and agricultural best management practices such as grassed waterways, conservation tillage, and animal waste management. Unlike the Summit SWCD, the Medina SWCD does not conduct reviews of SWP3 nor does it conduct construction site inspection for erosion control. The Medina County Highway Engineer manages these programs in the county. However, the Medina SWCD has been involved in Balanced Growth watershed planning in other watersheds in Medina County. This will be discussed later in this section.

Resource Conservation and Development (RC&D) Program

The Resource Conservation and Development (RC&D) program was established by Congress in 1962 to expand opportunities for conservation districts, county governments, and individuals in multi-county areas to improve their communities through the formation of regional non-profit organizations. Local people create and organize each RC&D and provide a way for residents to join together to address environmental, economic, and community issues. The United States Department of Agriculture provides technical and financial assistance to the program.

The Upper Wolf Creek Watershed is part of the Western Reserve RC&D. The RC&D covers nine counties in northeast Ohio including Summit and Medina. The Western Reserve RC&D has a history of supporting watershed improvement and education projects, however they currently do not have active projects in the Upper Wolf Creek Watershed. Inclusion of the RC&D will be sought, when appropriate.

Muskingum Watershed Conservancy District

The Muskingum Watershed Conservancy District (MWCD) was created in 1933 for flood control and conservation. It is the largest conservancy district in Ohio, covering all or part of eighteen counties. The District is controlled by the Conservation Court consisting of common pleas court judges from each of the 18 counties within the MWCD's administrative boundary. The Conservation Court appoints a five person Board of Directors which oversees the District's operations. The MWCD is based in New Philadelphia and is considered a local agency of government and not a state or federal entity.

The District has thirteen earthen and one concrete dams for flood control. The U.S. Army Corps of Engineers was given responsibility for the dams and flood control in 1939, an agreement that continues to this day. In addition to assisting the Corps of Engineers in flood protection, the MWCD is responsible for the conservation and recreation on its lands and reservoirs.

The MWCD had been a self-sustaining district funded through visitors' fees, land leases, contract services, and grants. The District had been the only one in Ohio not to assess a maintenance fee to property owners within its administrative boundary.

However, the MWCD established such an assessment for nearly all property owners within their administrative boundary in 2009. Money generated by the assessment is being used throughout the watershed to upgrade and repair the aging flood control system, sediment removal, shoreline protection, water quality improvements, and reservoir management. The MWCD established a grant program to assist stakeholders in addressing water quality problems in their district.

The Upper Wolf Creek Watershed is located in the headwaters of the Muskingum River basin. So flood control, sediment reduction, and watershed improvement projects for Upper Wolf Creek can be funded through the MWCD grant program. However, the MWCD administrative boundaries were drawn based on political boundaries and not watershed boundaries. As such, the Upper Wolf Creek Watershed falls outside of the current MWCD administrative boundary and is technically not in the MWCD. So property owners in the watershed are currently not assessed, but are still eligible for MWCD-funded projects and grants.

Geology

Topography, Land Form, and Slope

The topography of the Upper Wolf Creek Watershed is controlled primarily by the underlying bedrock which forms prominent ridges within the watershed. The ridges are divided by a steep sided valley whose sandstone-capped uplands have been cut into by Wolf Creek and its tributaries. Many slopes exceed six percent or six feet of rise over 100 feet of horizontal run. The steepest slopes occur along several tributaries to Wolf Creek where the slopes are close to vertical. The most level topography occurs in the valley of the Upper Wolf Creek itself. This wide flat bottomed valley has been partially filled with glacial deposits. Near State Route 21 the valley is approximately 7,000 feet wide. The highest elevation within the watershed is 1,200 feet above sea level near the intersection of Hatch and Burdett Roads in Medina County. The lowest elevation is 981 feet above sea level near the Barberton Reservoir in Summit County (NEFCO, 1997).

Areas that have a slope of greater than six percent were identified because often these areas are at risk of being highly erodible. Table II-3 gives the total area and percentage of areas with these slope conditions for each of the subwatersheds. The lands around Barberton Reservoir (1,154 acres) and Ridge Creek/Spruce Run (1,133 acres) have the largest percentage of steep sloping lands. If left barren, these high sloping areas would produce large amounts of sedimentation in the Upper Wolf Creek and its tributary from runoff erosion.

Table II-3: Area and Percentage of the Upper Wolf Creek Watershed with Slopes Greater than Six Percent		
Subwatershed	**Total Area (acres)**	**Slopes Greater Than 6 Percent (acres) (%)**
Barberton Reservoir	5,049	1,154 (23)
Koontz Creek	2,801	431 (15)
Ridge Creek/Spruce Run	4,230	1,133 (27)
Wolf Creek Headwaters	6,206	984 (16)
Total	**18,286**	**3,702 (20)**

Glacial History & Geology

During a period from two million to 10,000 years ago there has been a series of four glacial stages or ice advances that moved out of Canada and covered a significant portion of the United States. Each stage may have reached Ohio, but evidence of the earliest stages has been long erased by subsequent glacier advances and retreats. The most recent advance, known as the Wisconsin stage, entered Ohio approximately 80,000 years ago and remained until about 10,000 years ago. The entire Upper Wolf Creek Watershed was covered by ice from the Wisconsin stage bringing about great changes to the landscape and is responsible for the surface which is present today.

As the ice advanced from Canada it eroded and carried massive amounts of soil and rock into Ohio and the watershed. As the ice sheets melted this soil and rock load it was carrying was deposited upon the land. The debris called glacial drift or till consisted of an unconsolidated, unstratified mixture of clay, silt, sand, gravel, cobbles, and boulders which covered the landscape. The water runoff from melting ice developed new drainage patterns in Ohio and deeply entrenched many streams into the bedrock surface, including the Upper Wolf Creek. The flowing melt waters also sorted, transported, and deposited glacial material within the valleys (NEFCO, 1997).

In the Upper Wolf Creek basin, the glacial deposits range from very thin till layers on top of the bedrock ridges to 150 foot thick deposits underlying porting of the creek. The surface deposits in the upland are primarily classified as Haysville Till which consists of 18 percent sand, 43 percent silt, and 39 percent clay (Totten, 1988). The Rittman-Wadsworth soil associations developed in the Haysville Till and range from moderately well drained to somewhat poorly drained. Underlying the Haysville Till and responsible for the soils in the uplands of the eastern half of the watershed is the Navarre Till which ranges in thickness from less than three feet to six feet. The Navarre Till is relatively sandy and averages 25 percent sand, 44 percent silt, and 30 percent clay. The soils in the Canfield-Wooster-Ravenna association are developed in the Navarre Till and are considered moderately well drained (Totten, 1988).

The glacial deposits within the valleys of the Upper Wolf Creek and its tributaries are different in character than the uplands due to depositional environments. These environments include kames, kame terraces, and outwash valley trains resulting in considerable amounts of sorted and stratified sand and gravel deposits laid down in the creek's valleys by meltwater from the glaciers. Kames are conical hills that form when sand and gravel are washed from the ice into cracks and crevices along the front of a slowly melting or stationary glacier. Sand and gravel pile up into mounds as the ice melts. Kame terraces are also comprised of sand and gravel, but deposit along the side of a glacier and a valley wall. Both kames and kame terraces result in a hummock or rolling topography. A glacial valley train is outwash deposits consisting of silt, sand, and gravel laid down in the valley bottoms by meltwaters from retreating glaciers (NEFCO, 1997).

The impact of glacial forces in the Upper Wolf Creek Watershed resulted in the western portion of the basin consisting of outwash valley train deposits in the form of terraces along the valley sides. The silty, sand and gravel mixture is the parent material for the Jimtown-Bogart soils which range from somewhat poorly drained to well drained (NEFCO, 1997). Some areas may also be mapped as Chili soils where deposits are more sandy and gravelly in nature (Totten, 1988).

The eastern portion of the watershed, from approximately the Medina/Summit County line east, consist of a kame and kame terrace complex that continues east into Summit County to the southern end of Barberton Reservoir. Chili, Fitchville, and Bogart soils are derived from these sandy, gravelly parent materials. These soils range from somewhat poorly drained to well drained (Totten, 1988). Several sand and gravel mining operations have operated in this kame complex over the years (NEFCO, 1997).

Kame and kame terrace topography typically have kettle holes which are depressions in the land where blocks of ice were buried at one time. As the ice blocks melted the overlying sand and gravel material subsided and a depression was created. Depending on the local water table, these depressions usually became lakes or bogs. Many kettles that were originally lakes have been filled over the years with organic matter resulting in peat and muck soils. Kettle areas are present within the Upper Wolf Creek valley and are generally poorly drained.

The valley area located between State Road and Medina Line Road was once the site of a temporary glacial lake. The lake deposits in this area consist of sand, clay, silt, peat, and muck (Totten, 1988). The resulting soils from these deposits are generally more poorly drained than the surrounding areas (NEFCO, 1997). The valley bottoms near State Route 21 in Copley Township are part of the once extensive Copley Bog. The bog was form by silt and clay deposits from shallow temporary glacial lakes and/or slow moving streams interspersed with large areas of peat and muck kettle hole deposits (White, 1984). The soils that developed in the silt and clay deposits belong to the Sebring-Canadice association and are level and poorly drained soils. The muck soils or Carlisle association soils are very poorly drained organic soils. Some areas of muck soils have been drained for production of specialized agricultural crops. One of the largest areas of muck soils in Summit County, known as Copley Swamp, lies just east of State Route 21.

Bedrock Geology

The uplands and ridges within the Upper Wolf Creek Watershed are underlain by the Sharon member of the Pottsville Formation. The Sharon member can be divided into an upper shale unit, a thin coal unit, and a conglomerate unit which is most prominent. The conglomerate unit is a coarse to medium grained sandstone with zones of quartz pebbles. Underlying the Sharon member and making up the sides and floors of the creek valley are the interbedded sandstone and shale units rocks of the Cuyahoga Group. The bedrock underlying the uplands in some areas is covered by only a thin layer of glacial drift, while the bedrock valley underlying Wolf Creek is up to 150 feet below the present valley surface (NEFCO, 1997).

Mineral Resources

According to the ODNR Division of Mineral Resources Management there are no active mines within the Upper Wolf Creek Watershed. Historically, there have been small sand and gravel operations primarily in the Summit County portion of the watershed taking advantage of the resources deposited by glaciers. See the Glacial History and Geology section above for more details. Some degree of negative impacts to local water resources likely occurred during these operations, but there is no known historical documentation or studies attesting to any impacts.

ODNR does have records of four abandoned coal mines in the basin. Three of the mines are in the Koontz Creek Subwatershed in or adjacent to the City of Wadsworth, and the remaining mine is in the Headwaters Subwatershed just to the west of Wadsworth (Figure II-2). Table II-4 summarizes the four in the Upper Wolf Creek Watershed including the bedrock formation where they are found and the year of abandonment.

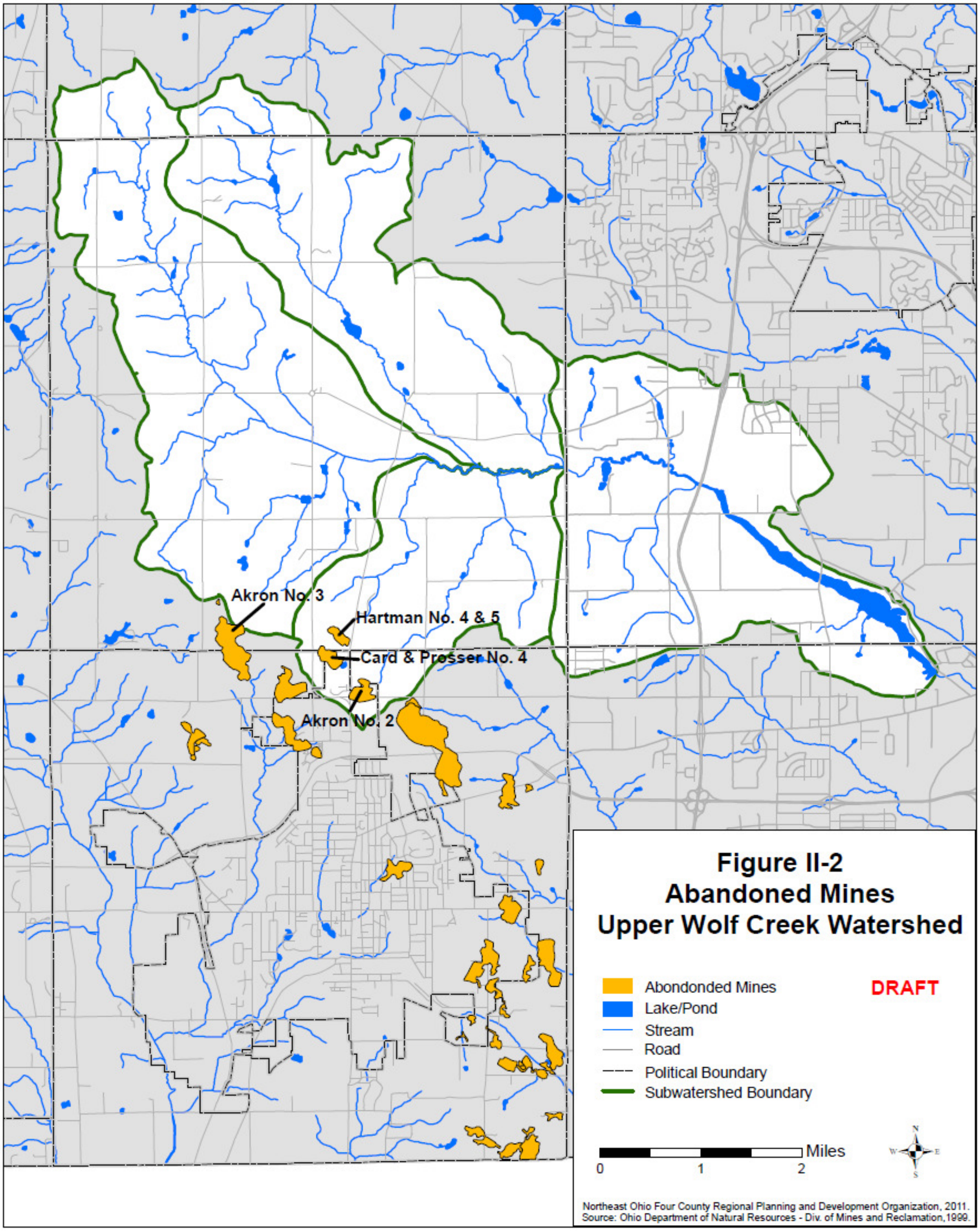


Figure II-2
Abandoned Mines
Upper Wolf Creek Watershed

Table II-4: Abandoned Underground Coal Mines in the Upper Wolf Creek Watershed

Mine Name	Identification Number	Bedrock Formation	Year Abandoned	Subwatershed
Akron No. 3	341038001802	Sharon No. 1	1902	Headwaters
Card & Prosser No. 4	341038001902	Sharon No. 1	1902	Koontz Creek
Akron No. 2	341038002602	Sharon No. 1	1896	Koontz Creek
Hartman No. 4 & 5	341038002002	Not Given	1904	Koontz Creek

Coal mining peaked in Northeast Ohio from the late 1880s to the 1930s to meet the region's growing industrial needs. However, most of these mines were abandoned as coal deposits became more difficult to mine and the more profitable surface mining technique became the standard in Ohio. Unfortunately standards for abandoning mining operations did not exist prior to 1972 which results in acid water polluted with heavy metals discharging directly into streams throughout the region. This problem is known as acid mine drainage (AMD). Fortunately, there is not a known AMD discharge problem from any of the four abandoned mines found in the watershed. Should an AMD problem be found, this section will be updated accordingly, remediation options investigated, and needed actions taken, if possible.

Soils

Soils play an integral role in the overall quality of Upper Wolf Creek. The type of soil determines, in part, the vegetation cover, farming practices, rainfall infiltration, pollution runoff rates, erosion, and sedimentation (Ohio EPA, 1997). Varying soil characteristics can also affect development by limiting areas suitable for building or for the installation of home sewage treatment systems.

The soils in the Upper Wolf Creek Watershed were derived from a combination the parent bedrock, glacial geology, and recent alluvium deposits. The western portion of the watershed in Medina County soils primarily consist of silty, sand and gravel from the outwash valley train deposits. Jimtown-Bogart soils are common in this area and range from somewhat poorly drained to well drained (NEFCO, 1997). Some areas in the Medina portion of the basin may also be mapped as Chili soils where deposits are more sandy and gravelly in nature (Totten, 1988). The eastern Summit County portion of the watershed has Chili, Fitchville, and Bogart soils derived from the sandy, gravelly parent materials left from glacier kame and kame terrace complex. These soils range from somewhat poorly drained to well drained (Totten, 1988). Lastly, alluvium consisting of fine sand, silt, and clay has been recently deposited along the creek's flood plains.

The soils of the Upper Wolf Creek Watershed fall into four soils associations each with unique characteristics and properties: Rittman-Wadsworth, Canfield-Wooster-Ravenna, Fitchville-Chili-Bogart, and Sebring-Canadice. Figure II-3 shows the distribution of these soil associations in the watershed, and below is a brief description of each of these soil types.

Rittman-Wadsworth Association:
In the Upper Wolf Creek Watershed, the Wadsworth-Rittman soils occur only in the upper portions of the Headwaters and Ridge Cree Subwatersheds in Sharon and Granger Townships. These soils were formed in clay loam or silty clay loam glacial till and have a compact layer in the subsoil that restricts the infiltration of water. The Wadsworth soils are mainly level and are somewhat poorly drained. The Rittman soils are sloping and moderately well drained. Both soil types naturally have a seasonally high water table with Wadsworth soils remaining wet for a longer duration. Farming and pasturing are the primary uses of this land, and artificial drainage is needed on the Wadsworth soils for good crop production. Erosion from farming or construction is a hazard for Rittman soils. Development of these soils is severely limited due to the seasonally-high water table. Home sewage treatment systems with filter beds will also not function properly even during dry periods.

Canfield-Wooster-Ravenna Association:
The Canfield-Wooster-Ravenna soils occur in upland areas along the lower portions of the Headwater and Ridge Creek Subwatershed, most of the Koontz Creek Subwatershed, and upland areas in the Barberton Reservoir Subwatershed. The soils were formed in deep glacial till and are moderately to well-drained soils. All the major soils in this association have dense, compact subsoil that limits the movement of water and plant roots. The compact subsoil soils can also limit the function of a HSTS leach field. The Canfield soils are moderately well drained in gently sloping areas. Wooster soils are in more sloping areas, resulting in better drainage. Ravenna soils are found in nearly level to gently sloping sections of the watershed and are somewhat poorly drained. The Canfield and Wooster soils have major limitations to use in sloping areas due to erosion. Ravenna soils primary use limitation is due to seasonal wetness. This association is used for both farming and development in the watershed. Proper management practices during development are needed to limit soil erosion.

Fitchville-Chili-Bogart Association:
The soils in this association are found along the creek valley and around Barberton Reservoir on low-lying steam terraces and former glacial lakebeds in Sharon and Copley Townships. The soils' slope ranges from nearly level to gently sloping lands. Fitchville soils were formed in mostly silty sediment deposited in former glacial lakes and are somewhat poorly drained. Fitchville soils major use limitations are seasonal wetness, poor stability, occasional

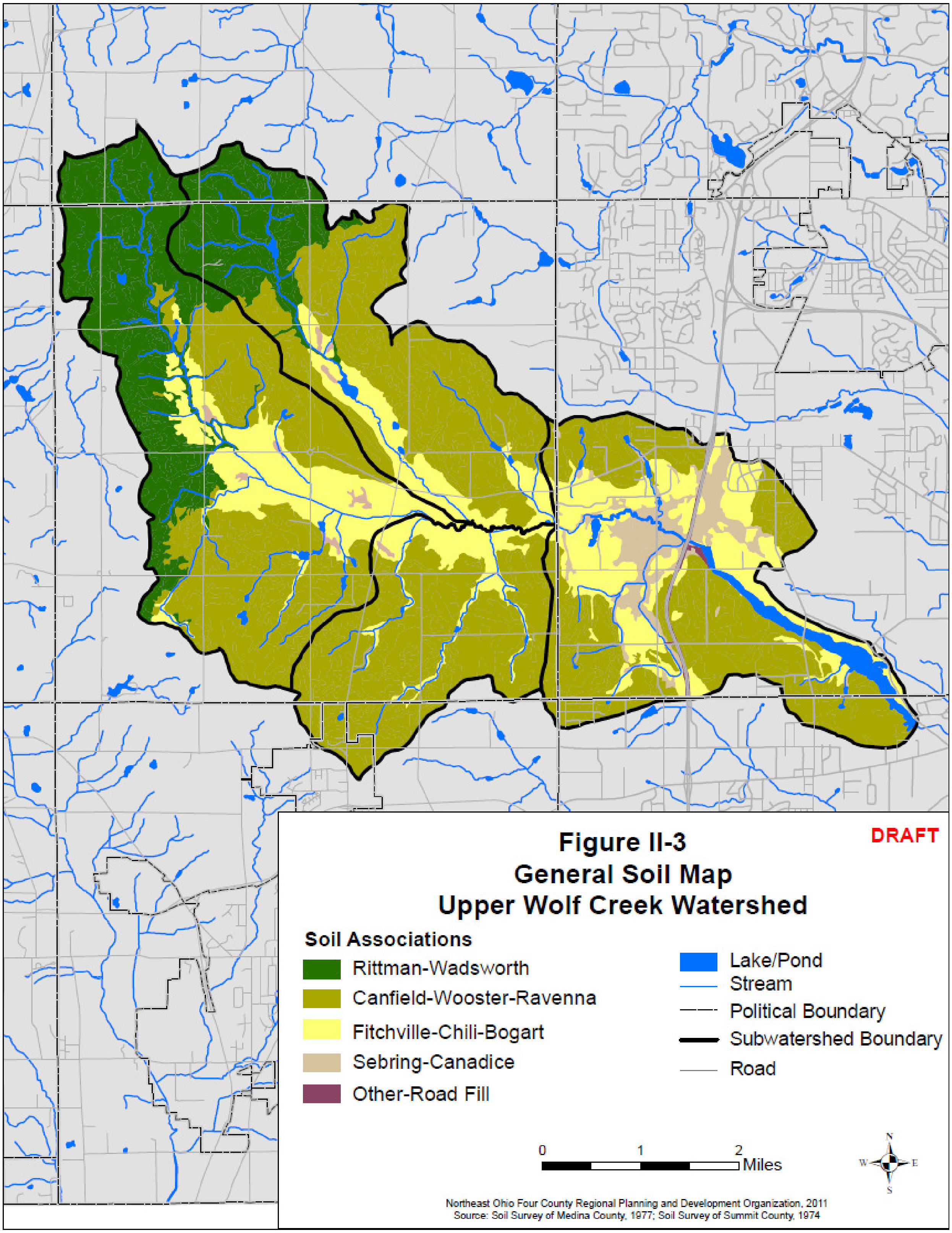


Figure II-3
General Soil Map
Upper Wolf Creek Watershed

flooding, and moderately slow permeability for many non farm uses. However, Chili and Bogart soils, due to generally good natural drainage and favorable topography, have few use limitations. Groundwater contamination from a high density of home sewage treatment systems in subdivisions is a concern in these soil types.

Sebring-Canadice Association:
The Sebring-Canadice Association soils are found only in the Summit County portion of the watershed along the Upper Wolf Creek valley before it enters the Barberton Reservoir and run south along an unnamed tributary near Stimson Road. These soils mark the site of glacial lakes where large amounts of silt and clay were deposited from higher adjacent lands. When the lakes were drained the silt and clay were exposed and form soil layers. These nearly level soils are poorly drained with and seasonal ponding common. A high water table is typical in these soils except when artificially lowered. Due to the above limitations, these soil associations are rarely used for crops. The soils are also limited for many other uses due to the instability and softness of the soils when they are saturated with water. Conversely, this association has good potential for the development of wetland habitat.

Biological Features

Invasive, Non-Native Species

An inventory of invasive, non-native exotic species has not been conducted for the Upper Wolf Creek Watershed. However, the types of invasive species and the ensuing problems created are equivalent to other areas in Northeast Ohio. Invasive species they have been documented in the region include Japanese knotweed (*Polygonum cuspidatum)*, garlic mustard (*Alliaria petiolata)*, multiflora rose (*Roda multiflora*), purple loosestrife (*Lythrum salicaria*), privet (*Ligustrum spp.)*, amur honeysuckles (*Lonicera maackii*), Canada thistle (*Cirsium arvense*), phragmites (*Phragmites austrails*), crown vetch (*Coronilla varia*), Queen Ann's lace (*Daucus carota*), and reed canary grass (*Phalaris arundinacea*).

Invasive plants can cause severe economic, recreational, or environmental harm if left uncontrolled. Nearly all invasive species are non-native to the watershed thereby lacking natural predators or controls which results in rapid reproduction and dispersion. Because of these traits, invasive plants force out native plants often creating monocultures of the invasive plant. Wildlife is often affected by plant invasions because many animals depend on a variety of native plants for food and cover. In Ohio, invasive plants are now considered the second largest threat to biodiversity and endangered species, only behind habitat loss (Windus, 2003).

Controlling invasive plant species is often a time, labor, and/or resource-intensive process. Attacking invasive plants during the early stages of establishment is generally the best strategy because once well established, multiple control strategies with follow-up treatment are often needed. Specific control measures will vary depending on the targeted plant, but will fall into one of three control categories:

biological (natural enemies), mechanical (cutting, digging, etc.), or chemical (herbicides).

Wildlife

An extensive survey of wildlife has not been completed for the Upper Wolf Creek Watershed. However, various organizations and agencies have conducted surveys of certain wildlife segments providing a general picture of animal diversity found in the watershed. Generally the wildlife is typical of similar areas in Northeast Ohio. The list below is a condensed list of the most common wildlife in the watershed as gathered from the surveys and general field observations:

Fish:
Largemouth Bass
Smallmouth Bass
Rock Bass
White and Black Crappie
Yellow, Brown, and Black Bullhead
Common Carp
Bluegill Sunfish
Green Sunfish
Pumpkinseed Sunfish
Yellow Perch
White Sucker
Northern Hog Sucker
Creek Chub
Blacknose Dace
Striped Shiner
Bluntnose Minnow
Central Stoneroller
Johnny Darter
Greenside Darter
Rainbow Darter
Mottled Sculpin

Amphibians:
American Toad
Bull Frog
Green Frog
Grey Tree Frog
Spring Peeper
W. Chorus Frog
Wood Frog
Eastern Red-Spotted Newt
Spotted Salamander
Jefferson Salamander
Northern Dusky
Redback Salamander
Northern Slimy Salamander
Northern Red Salamander
Two-Lined Salamander
Four-Toed Salamander

Waterfowl:
Canada Goose
Mallard Duck
Wood Duck

Mammals:
White-Tailed Deer
Beaver
Red Fox
Muskrats
Ground Hogs
Mink
Raccoons
Coyotes
Least Weasels
Long Tail Weasels
Eastern Chipmunk
Squirrels (Fox, Grey, Flying, Black)
Eastern Cottontail Rabbit
Striped Skunk
Voles
Deer Mice
Big Brown and Little Brown Bats

Raptors/Birds:
Bald Eagle
Broad-Winged Hawk
Coopers Hawk
Red-Tailed Hawk
Sharp-Shinned Hawk
Great Blue Heron
Osprey

Reptiles:
Eastern Garter Snake
Eastern Box Turtle
Spotted Turtle
Snapping Turtle
Northern Brown Snake
Water Snake

Water Resources

Climate and Precipitation

Weather conditions in Northeast Ohio throughout most of the year are generally mild, but can be extreme in the winter. The region in which the Upper Wolf Creek is located averages approximately 37 inches of precipitation each year. January and February are generally the driest months averaging 2.2 inches per month, and July at 4.1 inches per month is on average the wettest. However, extreme variations in precipitation can occur for any month, any given year (Oelker, 2006). Average monthly temperatures range from a low of 33^{o}F in January to 82^{o}F in July.

Surface Water

The Upper Wolf Creek Watershed cover 18,283 acres or approximately 28.5 square miles in eastern Medina County and western Stark County (Figure II-1). The creek has ten tributaries with a length of 0.9 miles or longer and several smaller tributaries. Table II-5 lists the length and basin size for the ten largest tributaries in the watershed.

Table II-5: Upper Wolf Creek Tributaries

Stream Name	Subwatershed	Basin Size (acres)	Length (miles)
Wolf Creek (Mainstem)	All Subwatersheds	18,283	12.7
Beach Creek	Headwaters	846	2.2
Little Lakes Creek	Headwaters	456	1.6
Big Lakes Creek	Headwaters	694	1.6
Ridge Creek	Ridge Creek/Spruce Run	3,057	3.6
Spruce Run	Ridge Creek/Spruce Run	846	1.9
Paxton Creek	Barberton Reservoir	325	0.9
Railroad Creek	Barberton Reservoir	546	0.9
Stimson Creek	Barberton Reservoir	1,285	2.6
Koontz Creek	Koontz Creek	1,741	2.7
Canton Creek	Koontz Creek	731	2.0
NEFCO assigned all creek names except for Wolf Creek			

All of the tributaries and the mainstem of the Upper Wolf Creek eventually flow into Barberton Reservoir located in the southeast corner of the basin. Constructed in 1927, Barberton Reservoir is a 196 acre man-made lake that serves as the primary drinking water source for the City of Barberton, serving a population of approximately 29,000. The City has the capacity to treat 8.0 million gallons per day from Barberton Reservoir, with the average production of about 4.2 million gallons per day (Ohio EPA, 2003). The reservoir and the most lands surrounding the water body are owned by the City of Barberton. Due to the importance of this resource, Barberton Reservoir is closed off to the public. More information on the Barberton Reservoir can be found in the “SWAP Program” and “Water Resource Quality” sections below.

In general, lakes may provide localized water quality, wildlife, and/or recreational benefits in their immediate vicinities. However, outside of Barberton Reservoir the Upper Wolf Creek Watersheds does not have any other lakes five acres or greater (ONDR, 1980). Therefore, the overall impact lakes have on surface water quality, wildlife, and recreational opportunities are minimal in watershed areas upstream of the Barberton Reservoir.

Home Sewage Treatment Systems (HSTSs)

Only a small portion of the watershed is sewered; therefore, homes and businesses rely on home sewage treatment systems (HSTSs) to treat wastewater. These systems range from the traditional system consisting of a septic tank(s) and leaching time lines, to new and innovative systems designed to perform in soils where traditional systems fail. HSTSs rely on soils that can receive wastewater and treat it properly before it reaches surface or ground water. The varying characteristics of soil types make some soils well suited to receive and treat wastewater, while other soil types are not as well suited. Systems installed in poor soils will most likely fail and pollute local water resources (NEFCO, 1997).

HSTSs play a critical role in the quality of the Upper Wolf Creek because most of the watershed is served by these systems. A failing home sewage system can release pathogens, nutrients, and sediments that can significantly reduce the water quality and biology of local waterways. Home sewage treatment systems that actually discharge into local streams after treatment should be inspected and monitored on a regular basis. Failing HSTS that do not discharge (on-site) should also be properly maintained and repaired/replaced when failing.

Currently in the watershed, HSTSs are typically inspected by the Medina County Health Department and Summit County Health District when there is a nuisance complaint or for an optional real estate evaluation during a home sale. The Ohio EPA now requires a National Pollution Discharge Elimination Systems (NPDES) general permit for any discharging home sewage treatment systems installed after 2007. Requirements of this permit include annual monitoring and reporting, for the life of the system.

Flow Regime, Bankfull Discharge, and Stream Power

There is not a gauging station located in the Upper Wolf Creek or its tributaries. Any needed flow calculations will either have to be attained through field measurements or computer modeling.

Floodplain Areas

Floodplains are land areas along Upper Wolf Creek that are subject to recurring water inundation during high water flows. Events that trigger flooding of these areas are typically heavy rain storms and/or snow melt. Flooding is a natural process and can be beneficial to both the creek and adjacent lands. Specifically, floodplains act as natural water retention basins slowing down and holding flood waters. Floodplains reduce the force and volume of water transported downstream resulting in less erosion and flooding. A floodplain is functioning properly when the deposition of soil and mineral particles occurs in flooded areas which results in less sediment, nutrients, and pollutants being transported downstream. An ancillary benefit from this deposition is that floodplains are often fertile agricultural lands.

Upper Wolf Creek's floodplain areas vary in both size and frequency of inundation. Like many streams in Ohio, the floodplain of Upper Wolf Creek has been altered over the years by human actions, agriculture, and suburban development. The reduction in floodplain land from encroachment in conjunction with wetlands filled and open land covered with buildings and pavement has resulted in more water reaching Upper Wolf Creek at a faster rate and in greater volumes. Over time the floodplain areas of the creek change in response to these and other actions.

Mapping of the floodplain areas is the responsibility of the Federal Emergency Management Agency (FEMA) and is primarily for insurance purposes. Figure II-4 shows the 100-year floodplain areas in Upper Wolf Creek as determined by FEMA. The term "100-year floodplain" is used to express the probability of a given area to flood any given year, and not the occurrence interval between major floods. A 100-year floodplain simply means that the area has a one percent chance of flooding in any given year, while a 50-year floodplain has a two percent chance of flooding. The extent of floodplain areas fluctuates to reflect changes within the basin. For example, if a floodplain is filled (developed) upstream, the footprint of downstream floodplains will likely become larger to hold the increased volume of water.

Figure II-4 was created using the current FEMA floodplain map; however, the map for Summit County and Medina County were created in 1978 and 1974, respectively. The 100-year floodplain has almost certainly changed since the 1970s to reflect increased flood volumes from development and changing land use within the watershed. Although the focus of this study is water quality, flooding should also be considered for projects or action when appropriate.

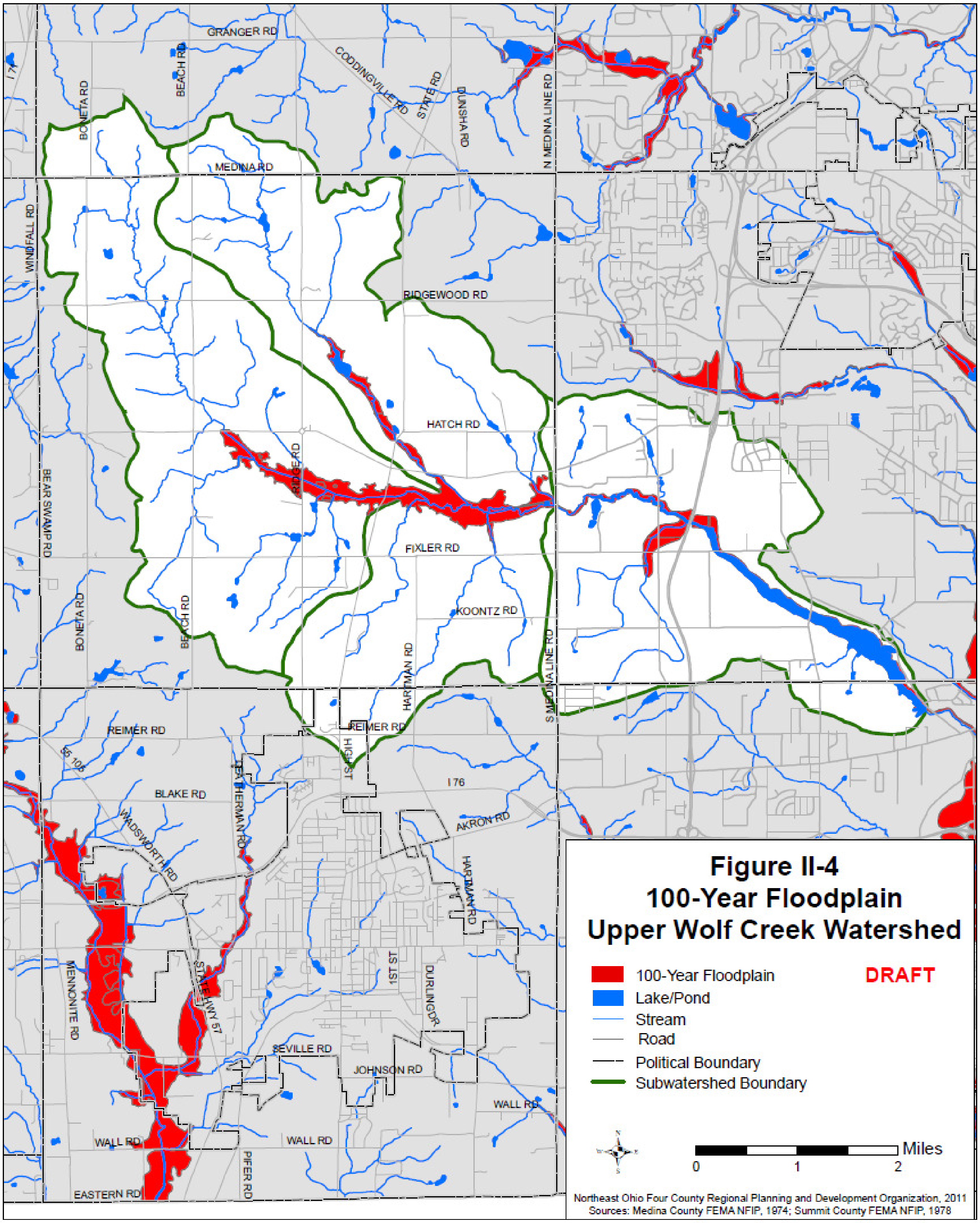


Figure II-4
100-Year Floodplain
Upper Wolf Creek Watershed
100-Year Floodplain
DRAFT
Lake/Pond
Stream
Road
Political Boundary
Subwatershed Boundary
Miles
0
1
2
Northeast Ohio Four County Regional Planning and Development Organization, 2011
Sources: Medina County FEMA NFIP, 1974; Summit County FEMA NFIP, 1978
GRANGER RD
BEACH RD
BONETA RD
CODDINGVILLE RD
STATE RD
DUNSHA RD
N MEDINA LINE RD
MEDINA RD
WINDFALL RD
RIDGEWOOD RD
HATCH RD
RIDGE RD
BEAR SWAMP RD
FIXLER RD
KOONTZ RD
HARTMAN RD
S MEDINA LINE RD
REIMER RD
BLAKE RD
WADSWORTH RD
SEIBERMAN RD
HIGH ST
I 76
AKRON RD
MENNONITE RD
STATE HWY 57
1ST ST
DURLING DR
SEVILLE RD
JOHNSON RD
WALL RD
PIFER RD
EASTERN RD

Water Quality Improvement Efforts

Ohio EPA Section 319 Grant - *Nutrient and Sediment Pollution Reduction Program in the Upper Wolf Creek Watershed: Project Number 98(h)E-11*

The goal of the Upper Wolf Creek grant was to improve and protect the water of Wolf Creek by reducing the phosphorus loads by 1,000 lbs/year from failed home sewage systems and small farm operators, as well as preserve 25 acres of the riparian corridor and wetlands in the watershed. The grant partners included NEFCO, Medina County Health Department, Medina SWCD, City of Barberton, and the Medina Summit Land Conservancy. The grant activities occurred between October 1, 1998 and December 31, 2001, from which 9 failing HSTSs were replaced, 17 failing HSTS were repaired, 869 water quality tests were completed, eight fact sheets distributed to watershed residents, and a HSTS maintenance guide was developed for homeowners. The grant partners were not able to establish manure management systems on small farms or preserve the riparian corridor or wetlands with conservation easements. The primary reason for not accomplishing these grant goals was that the projects were voluntary and incentives offered by the grant were not high enough to attract participants. For more information see the final report on file with the Ohio EPA or NEFCO.

Medina SWCD

The Medina County SWCD was awarded a grant by the Ohio Lake Erie Commission to complete a balanced growth plan for the Rocky River Upper West Branch Watershed. The Rocky River basin is the next watershed to the west of Upper Wolf Creek and both are located in Sharon and Granger Townships. The purpose of the plan is to identify priority conservation areas (PCAs) and priority development areas (PDAs) for jurisdictions in the Rocky River Upper West Branch Watershed. PCAs are critically important ecological, recreational, agricultural, heritage, public access, and other critical areas. Priority development areas (PDAs) are lands used to support growth and redevelopment. The goal is to locate development in areas that minimize the impact on local water resources.

The Medina SWCD as part of their efforts in the Rocky River Upper West Branch completed the mapping of the priority areas for Sharon Township which adopted the plan. Work was also completed for Granger Township; however, they did not adopt the Rocky River Upper West Branch Balanced Growth Plan. Therefore, the mapping of priority areas in the Granger Township portion of Wolf Creek will not be considered. Figure II-5 shows the various conservation areas for Sharon Township in the Wolf Creek Watershed. Areas of particular interest are the yellow parcels on the map that shows an overlap of PDAs and PCAs. These are the areas that will need attention in order to promote development while protection vital natural resources. Implementation of this balanced growth plan for Sharon Township is a priority action of this Watershed Plan.

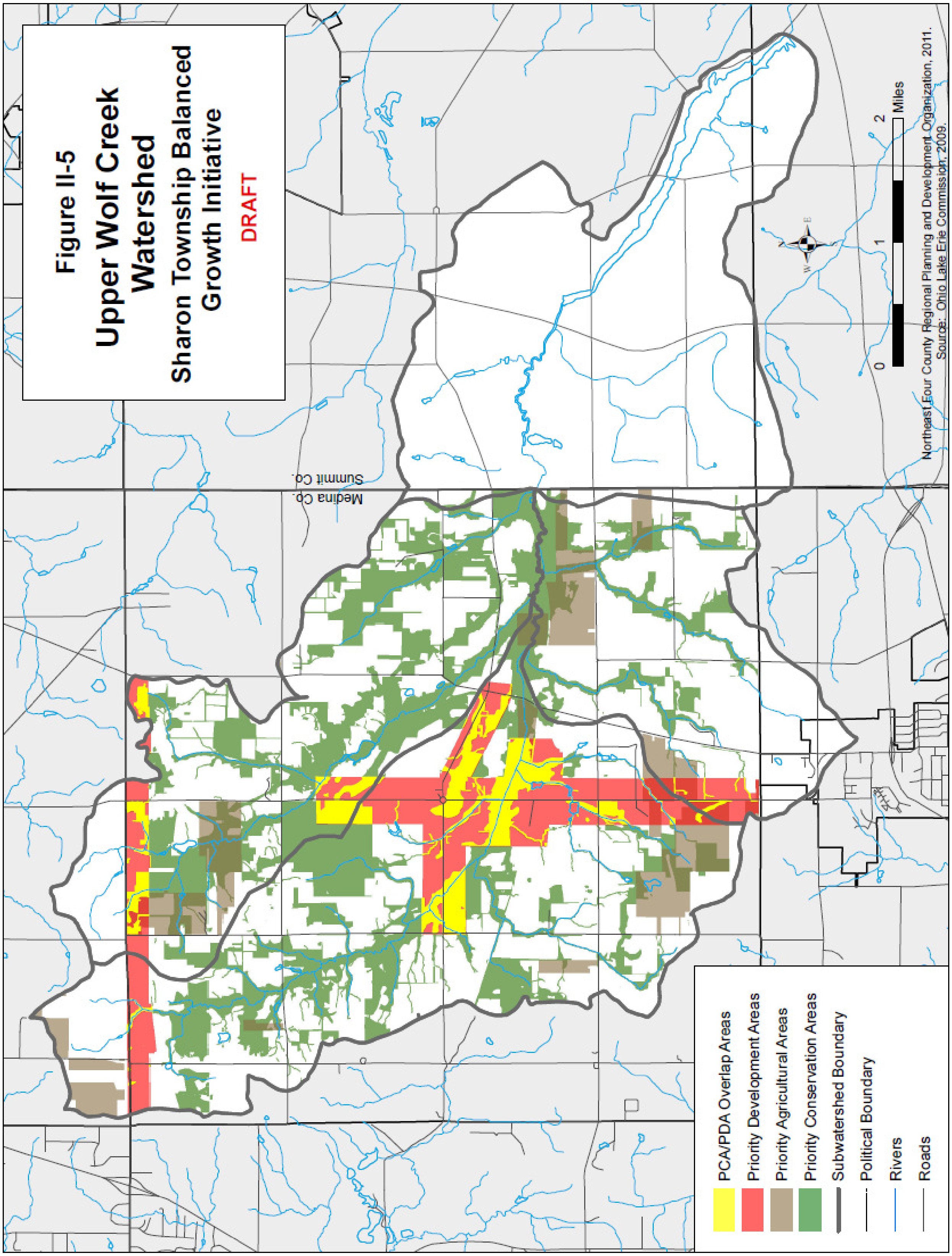


Figure II-5
Upper Wolf Creek Watershed
Sharon Township Balanced Growth Initiative
DRAFT
Summit Co.
Medina Co.
PCA/PDA Overlap Areas
Priority Development Areas
Priority Agricultural Areas
Priority Conservation Areas
Subwatershed Boundary
Political Boundary
Rivers
Roads
0 1 2 Miles
Northeast Four County Regional Planning and Development Organization, 2011.
Source: Ohio Lake Erie Commission, 2009.

Storm Water

Storm water runoff from land and impervious areas like streets, parking lots, and rooftops during rain or snow events can cause local water quality problems. Storm water runoff has primary adverse impacts on local water resources. First, storm water can carry pollutants like sediment, bacteria, pesticides, oils, fertilizers, and litter directly to local streams reducing water quality. Second, the quantity of storm water entering a stream can cause flooding, particularly in developed or urban areas with increased impervious surfaces.

NPDES Storm Water Phase 2 Communities

In an effort to preserve, protect, and improve water resources throughout the nation from polluted storm water runoff (drainage), the United States Environmental Protection Agency (USEPA) in 2003 mandated that most urban areas develop a program to manage their community's runoff. This regulatory mechanism is called the National Pollutant Discharge Elimination System (NPDES) Storm Water Program Phase 2 and was authorized by the 1987 Water Quality Act (WQA). All affected communities had to implement at least six minimum control measures to control polluted storm water runoff. Those control measures are:

1. Public Education and Outreach Program
2. Public Involvement and Participation
3. Elimination of Illicit (Illegal) Discharges
4. Construction Site Storm Water Ordinance
5. Post Construction Storm Water Ordinance
6. Pollution Prevention and Good Housekeeping

The following communities in the Upper Wolf Creek Watershed are designated as NPDES Phase II communities:

- **Counties**: Medina and Summit
- **Cities**: Norton and Wadsworth
- **Townships**: Copley and Wadsworth

Summit County and Copley Township were two of twenty-six co-permittees in the *Summit County Countywide Storm Water Management Program* Phase 2 permit application to the Ohio EPA. All of the rest of the communities submitted individual applications for their NPDES Phase 2 permits. For more information about NPDES Phase II in the Watershed, refer to the above plans available from the Ohio EPA's Division of Surface Water or any of the permitted communities.

Summit County - Countywide Storm Water Management Program (SWMP)

The SWMP was initiated to satisfy the requirements of the NPDES Storm Water Phase 2 program for twenty-six co-permittees in Summit County. The intent of the program was to reduce pollution from storm sewers to the maximum extent possible to protect local water quality. Best management practices (BMPs) selected to improve storm water quality are broad and programmatic in scope due to the large number of co-permittees participating in the program. The large number of communities involved in the program allowed for a watershed and multi-community approach to be used for storm water protection. In addition, co-permittees will be able to consolidate resources and share successful projects with other communities. Continuous evaluation by the participating communities is being conducted to improve the County SWMP's effectiveness (Summit, 2003). More information regarding the SWMP can be found at the Summit County Engineer's Office website (http://engineer.co.summit.oh.us).

Wetlands

Wetlands have been described as the kidneys of a watershed because of the functions that they perform in the hydrologic and chemical cycles. They function as the downstream receivers of wastes from both natural and human sources. Wetlands can cleanse polluted waters, prevent floods, protect shorelines, and recharge groundwater. They also provide unique and important habitat for plants and animals (Mitsch, 1993). Unfortunately, the benefits of wetlands have not always been appreciated by mankind. Over the years they have been drained, ditched, and filled for agriculture and development. Mass wetland destruction began in the mid-1800s and continued nearly unchecked until the mid-1970s when wetlands began receiving legal protection by the United States and state governments.

In Ohio, wetland areas have declined by an estimated 90 percent over the last 200 years. Wetlands currently cover 1.8 percent of the State or approximately 483,000 acres (Dahl, 1990). No study has been done for the Upper Wolf Creek to determine historic wetland loss, but it is believed to be equal to or greater than the percentage of wetland loss throughout the State. This observation is based on the extensive agricultural activity prior to the urban/suburban development in the watershed.

The Ohio Department of Natural Resources and Natural Resources Conservation Service maintains the Ohio National Wetlands Inventory (ONWI) database. This inventory was conducted using digital satellite data and other digital data to attain an estimate of wetland areas in Ohio. Figure II-6 shows the wetland areas in the watershed as determined by the Ohio National Wetland Inventory. The inventory provides a general picture of wetland areas in the watershed. For the Upper Wolf Creek Watershed, the ONWI shows 843.0 acres of freshwater forested/shrub wetlands, 45.7 acres of freshwater emergent wetlands, 227.4 acres of freshwater ponds, and 183.7 acres of lakes.

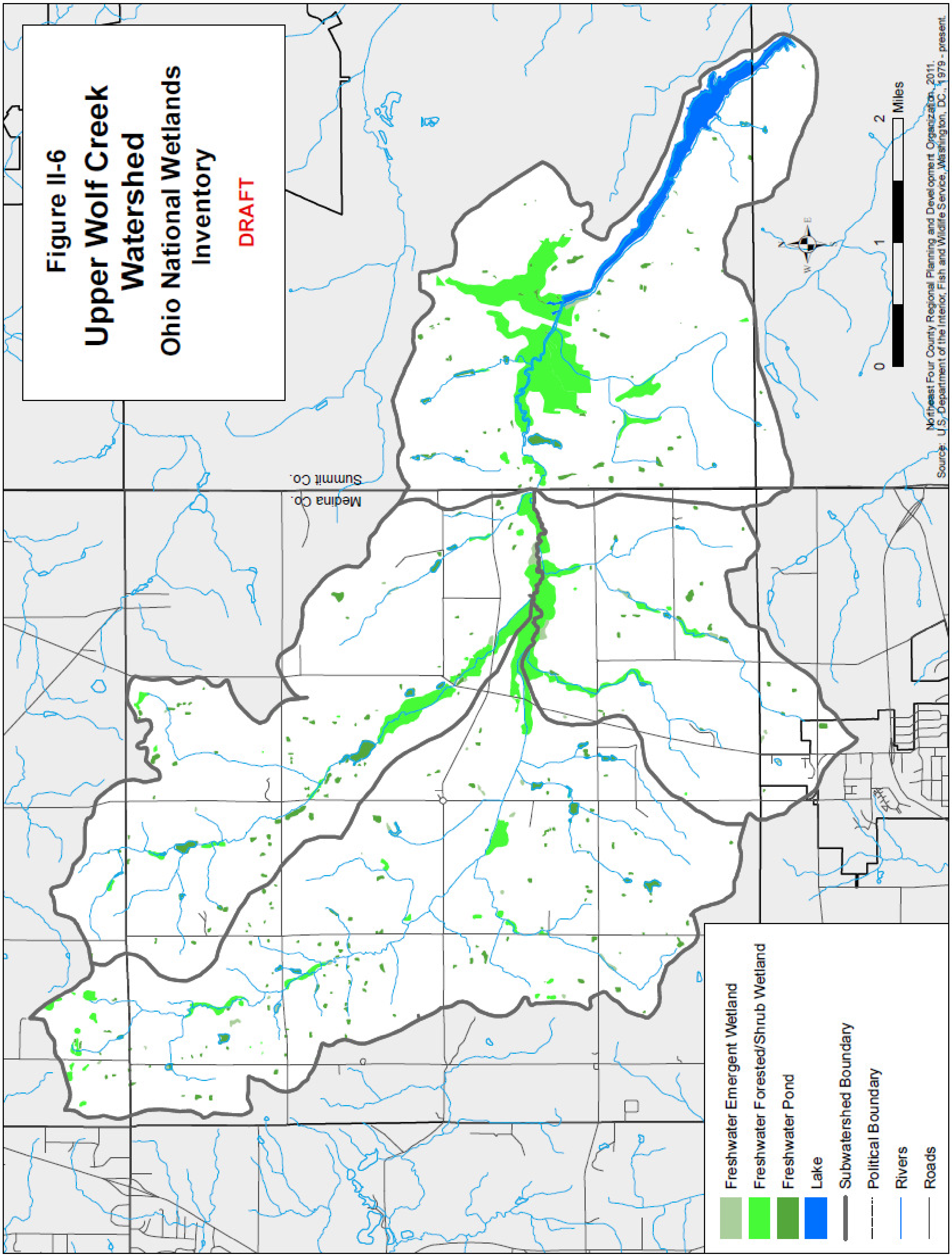


Figure II-6
Upper Wolf Creek Watershed
Ohio National Wetlands Inventory
DRAFT
Summit Co.
Medina Co.
0
1
2
Miles
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Subwatershed Boundary
Political Boundary
Rivers
Roads
Northeast Four County Regional Planning and Development Organization, 2011.
Source: U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC., 1979 - present.

However, information displayed on Figure II-6 should be viewed with caution since the data for the Ohio National Wetland Inventory was collected any between 1979 and the present. Changes have likely occurred to a number of these wetland areas that are not reflected in Figure II-6. In addition, the wetland areas were not field checked in the Upper Wolf Creek Watershed and areas represented as wetlands in the inventory may never have been wetlands. Conversely, there are likely wetland areas in the watershed that did not show up on the inventory due to the either the method of data collection used or wetland restoration efforts occurring after the survey was completed.

Ground Water

The Ohio Department of Natural Resources Division of Water completed the mapping of the pollution potential of ground water resources in Medina (Angle, 1994) and Summit (Angle, 2003) Counties. The mapping program used by ODNR is called the DRASTIC method and it identifies areas that are vulnerable to contamination. The program takes into account characteristics of an area including depth to water, net recharge of the ground water, aquifer media, soil types, and topography to determine a numeric value indicating the potential pollution risk to ground water resources. The higher the DRASTIC values, the greater the vulnerability to contamination. Figure II-7 shows the findings of this analysis.

In general, the ground water pollution potential is higher in the Summit County portion of the Upper Wolf Creek Watershed. This is generally due to reduced topography and the glacial kame deposits underlying much of this area. The highest values are located just upstream and to the north of Barberton Reservoir in Copley Township. In the Medina County portion of the basin, the highest pollution potential ratings are found along the stream valley in western Sharon Township. These include the downstream portions of the Headwaters, Ridge Creek, Spruce Creek, and Koontz Creek Subwatershed. The rest of the Watershed has moderate to low pollution potential ratings due to increase slopes, soils, and local geology. Generally the stream valleys have higher ratings than upland areas.

ODNR's ground water pollution potential studies are useful in developing protection strategies for a large area. They can be used to help prioritize ground water monitoring or clean-up efforts by stakeholders in the county. However, they are not designed to take the place of site investigations for specific projects. The results of the studies should not be applied to areas less that 100 acres (Angle, 1994).

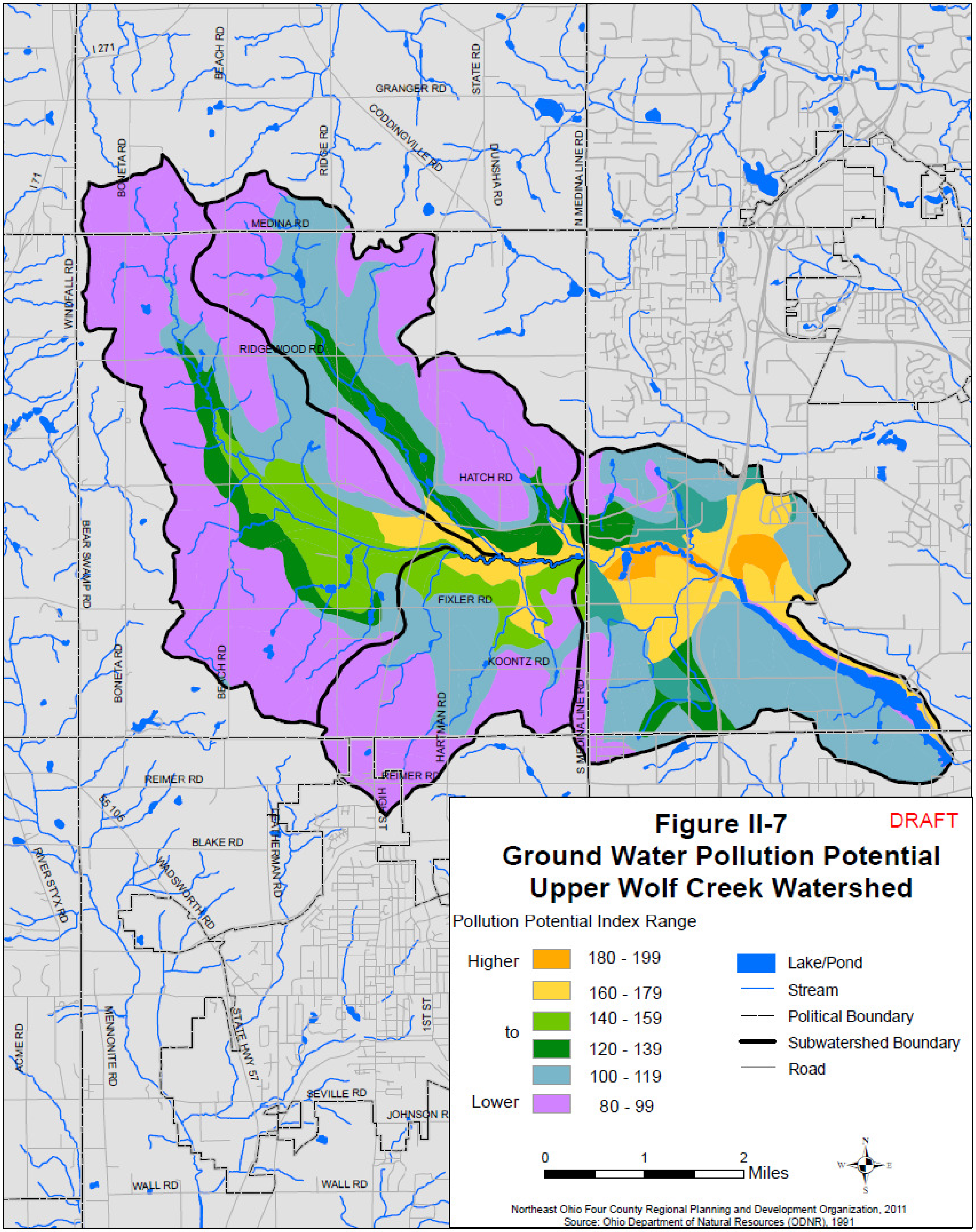


Figure II-7
DRAFT
Ground Water Pollution Potential
Upper Wolf Creek Watershed
Pollution Potential Index Range
Higher
180 - 199
160 - 179
to
140 - 159
120 - 139
100 - 119
Lower
80 - 99
Lake/Pond
Stream
Political Boundary
Subwatershed Boundary
Road
0
1
2
Miles
Northeast Ohio Four County Regional Planning and Development Organization, 2011
Source: Ohio Department of Natural Resources (ODNR), 1991
GRANGER RD
CODDINGVILLE RD
STATE RD
BEACH RD
RIDGE RD
BONETA RD
N MEDINA LINE RD
DUNSHA RD
MEDINA RD
WINDFALL RD
RIDGEWOOD RD
HATCH RD
BEAR SWAMP RD
FIXLER RD
KOONTZ RD
HARTMAN RD
S MEDINA LINE RD
REIMER RD
BLAKE RD
RIVER STYX RD
WADSWORTH RD
STATE HWY 57
1ST ST
SEVILLE RD
JOHNSON RD
WALL RD
MENNONITE RD
ACME RD
HIGH ST

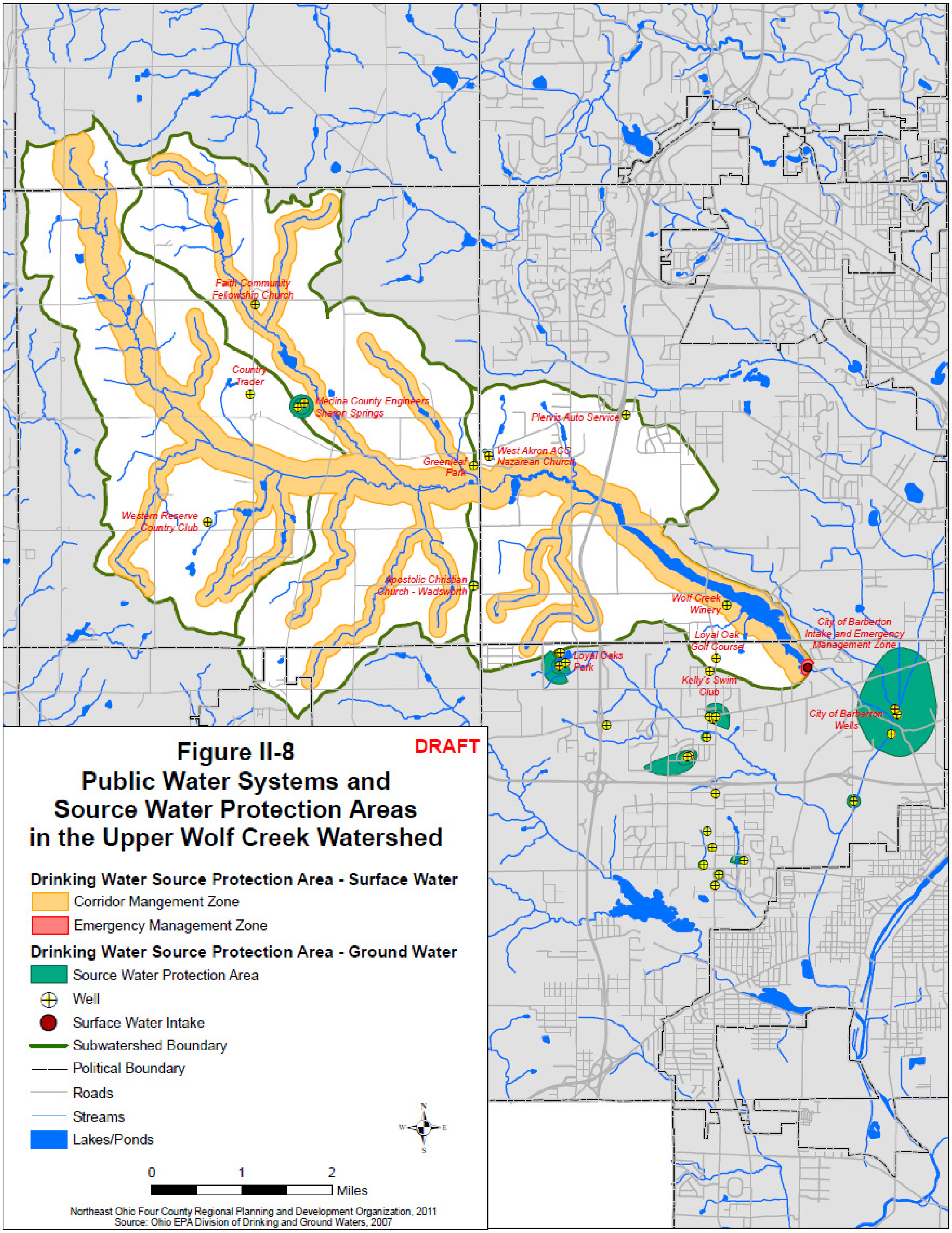
Water Suppliers

The Upper Wolf Creek surface and ground waters serve as a drinking water source for over 30,000 people in Medina and Summit Counties. The largest supplier is the City of Barberton who uses Barberton Reservoir as its primary drinking water source (Table II-6). There are several smaller public drinking water systems that utilize ground water wells. Overall there are eleven entities that utilize the Upper Wolf Creek Watershed for public drinking water sources. Figure II-8 shows the locations of all public drinking water wells and surface water intakes.

Table II-6 : Public Drinking Water Systems in the Upper Wolf Creek Watershed

System Name	Population Served	Avg. Production (Gallons/Day)	Subwatershed
Apostolic Christian Church - Wadsworth	220	1,000	Barberton Reservoir
City of Barberton	29,000	3,960,000	Barberton Reservoir
Faith Community Fellowship Church	25	150	Ridge Creek
Loyal Oak Golf Course	350	Not Given	Barberton Reservoir
Medina County Engineer - Sharon Springs	342	22,000	Ridge Creek
Greenleaf Park	100	500	Spruce Run
Plevris Auto Service	25	125	Barberton Reservoir
West Akron ACC Nazarene Church	180	Not Given	Barberton Reservoir
Wolf Creek Winery	96	Not Given	Barberton Reservoir
Country Trader	Not Given	Not Given	Headwaters
Western Reserve Country Club	Not Given	Not Given	Headwaters
Source: Ohio Environmental Protection Agency - Division of Drinking and Ground Waters, 2007.			

Six out of the eleven public systems are located in the Barberton Reservoir Subwatershed, three are in the Ridge Creek/Spruce Run Subwatershed, and the remaining two systems can be found in the Headwaters basin. On average over 4 million gallons per day from the watershed are used for public drinking water. These figures do not include individual homes and farms that utilize ground water wells to supply water.


Faith Community
Fellowship Church
Country
Trader
Medina County Engineers
Sharon Springs
Plervis Auto Service
West Akron ACC
Nazarean Church
Greenleaf
Park
Western Reserve
Country Club
Apostolic Christian
Church - Wadsworth
Wolf Creek
Winery
Loyal Oak
Golf Course
Loyal Oaks
Park
Kelly's Swim
Club
City of Barberton
Intake and Emergency
Management Zone
City of Barberton
Wells
Figure II-8
Public Water Systems and
Source Water Protection Areas
in the Upper Wolf Creek Watershed
DRAFT
Drinking Water Source Protection Area - Surface Water
Corridor Mangement Zone
Emergency Management Zone
Drinking Water Source Protection Area - Ground Water
Source Water Protection Area
Well
Surface Water Intake
Subwatershed Boundary
Political Boundary
Roads
Streams
Lakes/Ponds
N
W
E
S
0
1
2
Miles
Northeast Ohio Four County Regional Planning and Development Organization, 2011
Source: Ohio EPA Division of Drinking and Ground Waters, 2007

SWAP Program

Ohio's Source Water Assessment and Protection (SWAP) Program is designed to protect ground and surface water resources that are used for public drinking water from contamination. There are two phases in the SWAP Program: assessment and protection. The Ohio EPA has completed the assessment phase for all public drinking water systems in the State. The assessment includes a determination of the protection areas, an identification of potential contamination sources in the area, and a determination of the susceptibility of the drinking water to contamination. How long it takes, or the time-of-travel, for water to reach a well used for public drinking water is also determined in the assessment phase. The time-or-travel is typically delineated for up to 5 years. Land within these areas should be carefully managed to prevent contamination of a drinking water system.

To aid in protection, the Ohio EPA recommends that owners and operators of public water systems complete the second phase of the SWAP Program by developing and implementing a local drinking water source protection plan. The protection plan is locally designed and the content is dependent on the size and type of water system. All the drinking water systems in the Upper Wolf Creek Watershed besides Barberton Reservoir are from groundwater wells. Typical drinking water protection plans for groundwater sources include public education guidance, water system concerns, contingency plans, and strategies to reduce contamination risks. Completion and implementation of a protection plan is not required by the Ohio EPA, but is highly recommended to ensure an abundant supply of safe drinking water. All public water supply wells in the watershed have a completed assessment analysis, but none have completed a source water protection plan. However, the City of Barberton with assistance from NEFCO is working with the Ohio EPA to develop the source water protection plan.

Barberton Drinking Water Source Assessment

The Barberton Reservoir typically provides 100 percent of the drinking water to approximately 29,000 customers in the City of Barberton. The City produces about 4.2 million gallons per day of drinking water from the reservoir with the capacity of nearly 8.0 million gallons per day. In 2003, the Ohio EPA completed a *Drinking Water Source Assessment for the City of Barberton* in order to identify where and how the City's drinking waters are at risk of contamination. This was done by determining the appropriate protection area, examining the characteristics of the watershed and water quality, creating an inventory of potential contamination sources, and discussing the susceptibility of the drink water system to contamination. Lastly, the report suggests actions the City of Barberton and local communities can take to reduce the risk of their source of drinking water.

The assessment identifies the Drinking Water Source Protection Area which is simply all the drainage area upstream from where the water is withdrawn. The drinking water intake for the City is at the dam for the Barberton Reservoir.

Therefore the protection area is the entire Upper Wolf Creek Watershed. The protection area is subdivided into management zones: Corridor Management Zone (CMZ) and Emergency Management Zone (EMZ). The Barberton CMZ is the area within 1,000 feet of each bank of Wolf Creek starting at the reservoir dam and extending up into the headwaters, a distance of approximately 12 miles. This CMZ also includes a 500 foot management zone from each bank of all of Upper Wolf Creek's tributaries. The Barberton EMZ is the area in the immediate vicinity of the surface water intake. This area is vital because water plant operators have little or no time to respond to a spill. Figure II-8 shows both the CMZ and EMZ for the City of Barberton's water supply.

The Ohio EPA report identified seventeen potential contamination sources along the corridor management zone and no contamination sources in the emergency management zone. In addition, contamination through vehicular and railway accidents that release hazardous material was also considered a threat because there are approximately 66 miles of roads and 6.2 miles of rail lines within the Upper Wolf Creek Watershed. Lastly, oil and gas production and transportation is also considered a potential threat to Barberton's drinking water because approximately 3.1 miles of pipeline and 158 wells are located within the CMZ.

Because the drinking water source is surface water, the Barberton Reservoir is susceptible to contamination. Surface waters by nature are accessible and can readily be contaminated chemicals or pathogens with relatively short travel times from the source of pollution to the intake. The report indicates that the Barberton Reservoir is susceptible to elevated nutrients from agriculture, animal operations, and failing home sewage treatment systems; elevated agricultural chemicals from storm water runoff; and loss of riparian vegetation.

The Drinking Water Source Assessment report's protective strategies for Barberton Reservoir include:

- Working with local agencies and landowners to control contamination from agricultural runoff and home sewage treatment systems;
- Continuing watershed water quality monitoring to identify trends and potential contamination sources;
- Public education on water quality issues; and
- Encouraging open space preservation of riparian areas.

For more information regarding the City of Barberton's drinking water assessment, contact the Ohio EPA Division of Drinking and Ground Waters and request the Public Water System #7700411 report.

Land Use

The topography and soil types impose limits on the land use within the watershed that should be accounted for when evaluating proposed land use changes from the natural state. Some areas may be more favorable to development, while other should remain natural or restored to a more natural state to protect water quality.

Land Cover

Understanding land cover within the watershed can offer clues as to the types of nonpoint source (NPS) pollutants, subwatersheds at high risk of NPS pollution, and appropriate best management practices (BMPs) to address the problems. The land use/land cover for the Upper Wolf Creek Watershed is shown in Figure II-9. The information is from data collected by the United States Geological Survey (USGS) in 2006.

Most of the watershed's land use/land cover watershed is pasture, cultivated crops, and forest. Developed-open space and low density development also cover significant areas. Along Route 18, near the City of Wadsworth, and Sharon Center there are areas of development that are categorized as high or medium intensity development.

As residential (low and medium intensity) development continues, the demand for clean and safe water is on the rise. Residential areas have the potential to be sources of nutrients and bacteria, particularly if located in unsewered areas with poor soils for home sewage treatment systems (HSTSs). Nutrients and bacteria can originate from failed HSTSs, while other pollutants can arise as the result of lawn fertilizers, pesticides and general household wastes. As development proceeds, the level of imperviousness and storm water drainage increases. The impacts of storm water runoff from urbanized areas (medium and high intensity development) can destabilize streams and ditches. Streams respond to increased flows by eroding (usually along stream banks), transporting and depositing sediment downstream. Increased sediment and attached nutrients may well exacerbate other pollutant impacts, i.e. reducing a stream's ability to assimilate pollution.

Significant portions of wooded and open areas are located throughout the watershed (Figure II-9). The presence of these natural areas probably moderates the impact of runoff from many of the land uses throughout the watershed. These natural areas act as buffers and filters to moderate water flow and reduce erosion and the transport of pollutants downstream.

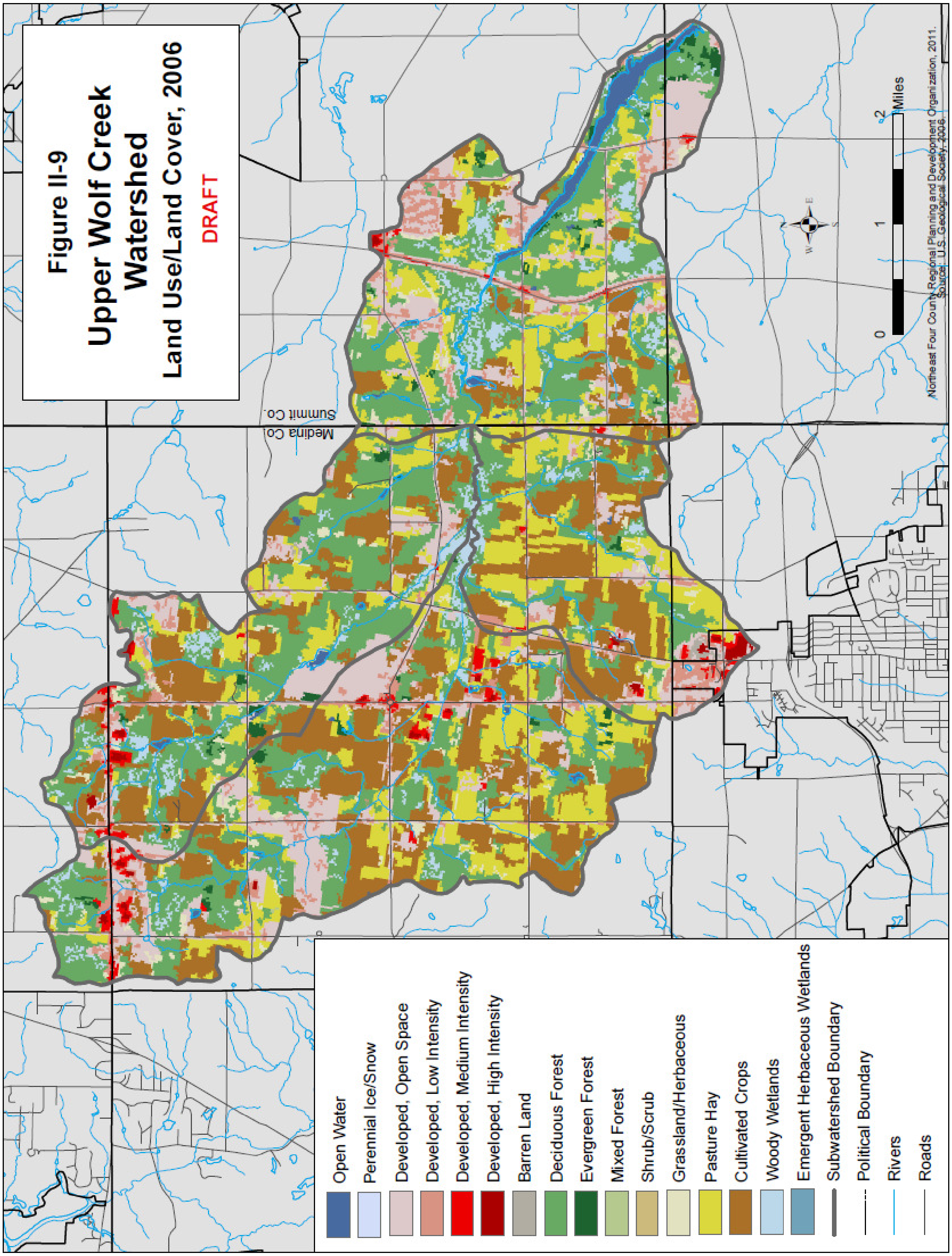


Figure II-9
Upper Wolf Creek Watershed
Land Use/Land Cover, 2006
DRAFT
Summit Co.
Medina Co.
0
1
2
Miles
Northeast Four County Regional Planning and Development Organization, 2011.
Source: U.S. Geological Society, 2006.
Open Water
Perennial Ice/Snow
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
Subwatershed Boundary
Political Boundary
Rivers
Roads

Impervious Surfaces

Impervious areas in the watershed are those areas where vegetation has been replaced by nearly impermeable surfaces such as roads, sidewalks, parking lots, and roof tops. As the level of impervious cover increases it prevents the infiltration of water into the soil. This can reduce ground water recharge, exacerbate runoff and streambank erosion, and impact the natural aquatic community. Research indicates that stream degradation occurs at levels of imperviousness as low as 10 percent (Ohio EPA, 1997). Impervious areas can also be the source of a magnitude of pollutants, since gasoline, oil, and chemical spills are likely to occur on impervious surfaces, such as: trucking docks and yards, gasoline stations, and roads. The location of urbanized areas, as well as roads, in the watershed indicate where a high degree of impervious surfaces are found.

An impervious surface analysis of the Upper Wolf Creek Watershed was completed using data gathered in 2001 by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a group of federal agencies who joined together to purchase satellite imagery to create a land cover information for the entire country called the National Land Cover Database. One of the land cover images created was for impervious areas.

Figure II-11 shows the impervious area for the Upper Wolf Creek Watershed according to the National Land Cover Database. The gray areas represent the least amount of impervious cover (0 - 10 percent) while the darker red areas have a greater concentration of impervious surfaces (90 - 100 percent). The greatest concentration of impervious area is along the Route 18/Medina Line Road corridor in the headwaters, Sharon Center, Ridge Road between Copley and Fixler Roads, and the Wadsworth area between Hemphill and Remer Roads.

The MRLC used 2001 satellite imagery to determine the percent of impervious area in 30 by 30 meter sections. For each section they determined what percentage of land area was covered by impervious area (Yang, 2006). Table II-7 summarizes this data for the Upper Wolf Creek. For example, 16,250 acres (88 percent) of the Upper Wolf Creek Watershed was determined by this analysis to have 9 percent or less impervious area, and 21 acres (0.12 percent) had over 90 percent impervious cover.

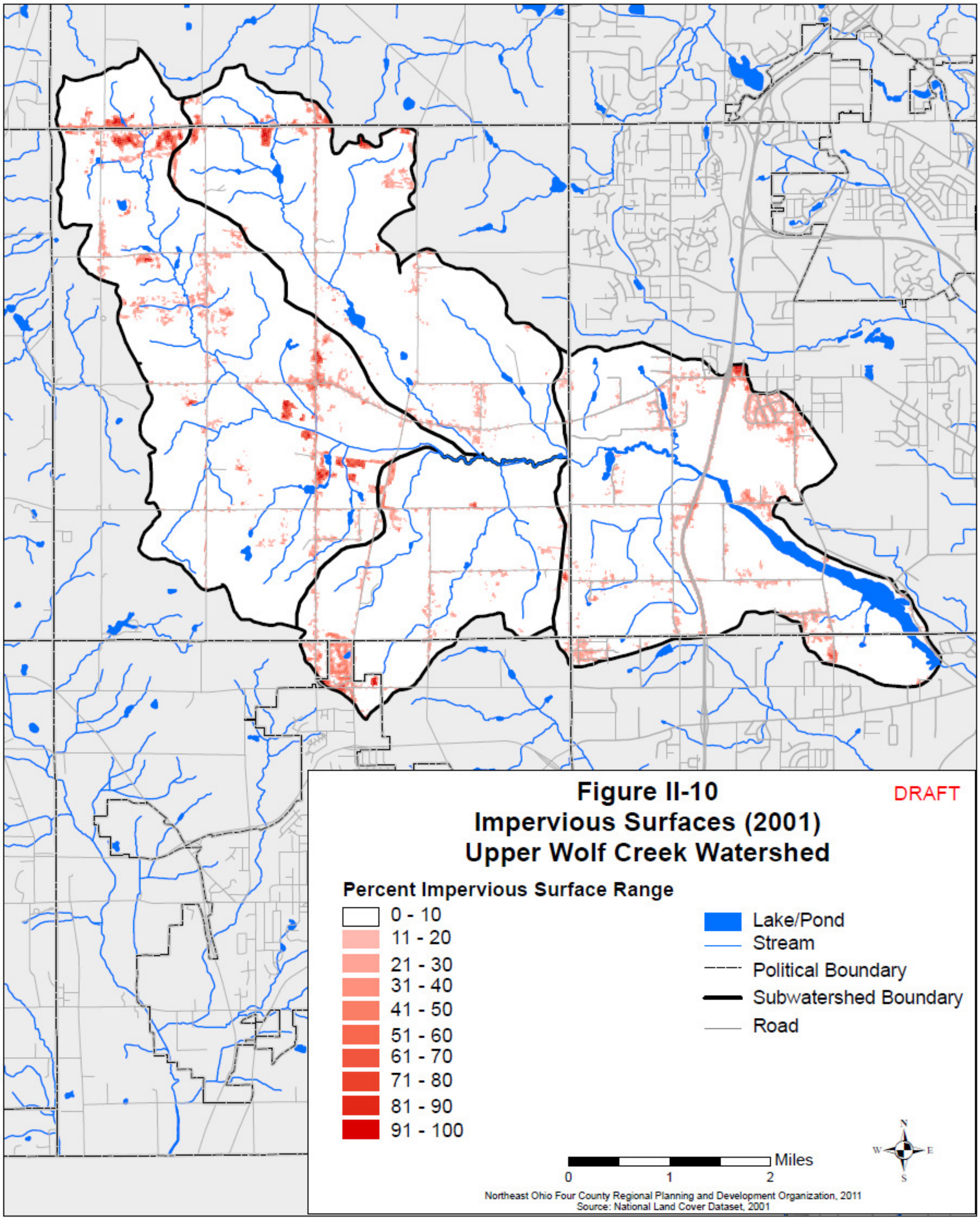


Figure II-10
Impervious Surfaces (2001)
Upper Wolf Creek Watershed
DRAFT
Percent Impervious Surface Range
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 - 100
Lake/Pond
Stream
Political Boundary
Subwatershed Boundary
Road
Miles
0
1
2
N
S
E
W
Northeast Ohio Four County Regional Planning and Development Organization, 2011
Source: National Land Cover Dataset, 2001

Table II-7: Summary of Impervious Areas in the Upper Wolf Creek Watershed		
Percentage of Impervious Area	**Total Acres**	**Percent of Upper Wolf Creek Watershed**
0% - 9%	16,250	88.8%
10% - 19%	834	4.6%
20% - 29%	491	2.7%
30% - 39%	302	1.6%
40% - 49%	168	0.9%
50% - 59%	102	0.6%
60% - 69%	56	0.3%
70% - 79%	41	0.2%
80% - 89%	27	0.15%
90% - 100%	21	0.12%
Total Impervious Area = 644.24 acres or 3.52% of the Watershed		
Source: National Land Cover Dataset, 2001.		

To determine the total impervious cover for the basin, each of the over 14,000 satellite parcels examined by the survey was converted to actual impervious area. For example an area of 900 meters square was determined to have 50 percent cover. That parcel's area was multiplied by 50 percent to come up with an impervious area of 450 square meters. After conducting these calculations for all the satellite parcels in the watershed, the total impervious area was determined to be approximately 644 acres or 3.52 percent of the entire basin.

As mentioned above, surface water quality starts to degrade when more than 10 percent of the watershed is impervious area. Fortunately, the Upper Wolf Creek Watershed was well below this threshold when this data was collected in 2001. Unfortunately, 2001 was the first year this data was collected by the MRLC Consortium so comparing impervious area to similar satellite data is not possible. In addition, the data is not exact due to the small scale used. Studies have found correlation coefficient between modeled and actual percent impervious surface ranging from 0.82 and 0.91 with an average error varying from 8.8 percent to 11.4 percent (Yang, 2006). Factoring in these average errors in the analysis, the Upper Wolf Creek Watershed is still under 4 percent impervious area.

However, development pressures from Medina, Akron, Cleveland and Wadsworth continue to threaten the conversion of open space to impervious area. Since the data used in this study was collected in 2001, it is likely some areas have already been converted to impervious surfaces.

Zoning

Zoning is a public regulation of land and building to control the character of a place. Zoning in Ohio is delegated from the State to local governments as a police power. It allows for laws to be enacted to protect, promote, and improve the public health, safety, morals, and general welfare of the people. Regulations specify what type of activities may take place in a specific location; generally, this identifies areas of residential, commercial, industrial or open spaces. Sometimes restrictions can be enforced on an area in relation to building height, lot area and land use. This is referred to as Euclidean Zoning. Other types of zoning regulations may include structural setbacks and required lot coverage as noted in the local municipalities included in this study. Because of zoning regulations, orderly growth and development occur allowing for the stability of present and future land use and community development. Local governments are not required to have zoning in Ohio, but all of the watershed communities in the Upper Wolf Creek employ zoning practices.

Zoning should be utilized to protect both man-made and natural resources. Therefore, using local zoning to help protect and restore water resources is an important tool in watershed planning. When utilizing zoning to protect natural resources in developable areas, water quality and quantity become safeguarded. Unregulated or poorly planned developments often degrade water quality and increase runoff to local streams and lakes. This can impact a community by limiting recreations opportunities, increasing costs of treating drinking water, limiting economic expansion, and creating public health and safety problems.

Watershed Communities Zoning Summary

Each administration in the Upper Wolf Creek Watershed has its own division of zoning districts to meet its individual governmental needs. The districts are generally broken down into residential (R), commercial (C), and industrial (I) zoning categories, often with multiple subcategorizes for differing development needs. Granger Township includes the Residential R-1 and R-2 districts; the Commercial Local C-1, Commercial General C-2, and Commercial Highway Interchange C-3 districts; an Industrial I-1 district; and the Planned Development district.

Sharon Township includes the Residential R-1 and R-2 districts; Commercial C-1 and General C-2 districts; Industrial I-1, I-2, and I-3 districts; and the Planned Residential Development District R-PDD. Wadsworth Township includes the Residential R-1, R-2 and R-3 districts; Commercial Local C-1 district and Highway Commercial Interchange C-2 district; and Industrial I-1 Light district and the Industrial I-2 Heavy district.

The City of Norton includes the residential districts Rural (RU-1), One Family Residences (R-1, R-2, and R-3), Multi-Family (R-4 and R-5), and Planned

Clustered Residence (R-RC). The Business Districts include Central (B-1), Neighborhood (B-2), and Highway (B-3). Industrial districts are divided into Light (I-1) and Heavy (I-2) categories. Norton also has a Public Recreation district. Copley Township has Residential R-1, R-2, R-3, R-3A, R-4, R-5 and R-6 districts; Commercial C-1, C-2, C-3, C-4 and C-5 districts; Industrial I-1 Light and I-2 Heavy zoning; an Open Space & Conservation O-C district; and a Planned Residential Development district .

Table 8 is an overview of lot area minimums in each of the specified zoning districts. These ordinances are the smallest area allowed in a particular subdivision. The minimums are put in place by the zoning ordinance for each municipality. Riparian setbacks are included for each of the municipalities if applicable. These setbacks act as a tool for local governments for the protection of the natural stream channel. The setbacks aid in stream bank erosion, filter pollutants and protect the ecosystem of the stream.

Please note that ranges for each of the localities vary. Minimum lot sizes are given, but are not intended to be used in place of the specific zoning regulation for each district. Setbacks for Riparian Corridors will vary according to the size of the drainage area.

Lot Area Minimums, Riparian and Wetland Setback Zoning Summary for Government Jurisdictions in the Upper Wolf Creek Watershed					
GOVERNMENT	Lot Area Zoning Minimums				RIPARIAN & WETLANDS SETBACKS
	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	PLANNED RESIDENTIAL DEVELOPMENT	
Granger Township*	Minimum 2 Ac	Minimum 2 Ac	Minimum 5 Ac	Minimum 2 Ac	None

Low Impact Development

An effective, comprehensive approach to provide protection to a watershed is Low Impact Developments (LIDs). The primary objective for this land use approach is to both protect and conserve local natural resources while still allowing for development in a community. This can be accomplished by using various land use planning design practices and technologies which minimizes the impact to local natural resources as well as reducing infrastructure costs.

A primary environmental benefit of LIDs for the purposes of this watershed plan is storm water management. Conventional storm water management systems act as a collection and conveyance system. That is when the gutter downspout is piped directly to the storm sewer which flow directly into the nearest pond, lake, or stream. The result of this typical conveyance system is little or no treatment of storm water runoff before it reaches local streams or lakes.

The LID system attempts to replicate the predevelopment hydrologic (drainage) system. This involves practices that detain, retain, percolate, and evaporate storm water from a home or commercial developments. Examples of these practices may include decreasing impervious surfaces and disconnecting flow paths (downspouts to storm sewers) and managing storm water at its source instead of at collection points like detention ponds. Examples include rain gardens and rain barrels on developed parcels. These practices help minimize the impact from storm water on the local water resources.

Environmental protection goals achieved by low impact development include the support of native plant species, the ability to maintain natural ecological processes, reduction in water runoff reaching waterways, and sustained water quality. Other benefits include preservation of open space, minimizing land disturbances, and the ability to incorporate natural features such as riparian corridors, wetlands and mature forests into site design. Also, environmental preservation and protection of these natural amenities can provide a unique marketing tool for homeowners, developers, and communities. Energy conservation is also a potential benefit to the homeowner because of shading and home orientation design techniques.

Municipalities also benefit from the LID approach because urban growth needs are balanced with environmental protection resulting in fewer impacts from storm water runoff. With this design, there is typically reduction of municipal infrastructure and utility cost. Furthermore, the LID is a proactive approach to land use management that promotes relationships between the private and public sectors.

The implementation of some low impact development principles is not suitable under certain circumstances. For example, LID often promotes smaller lot sizes in order to protect vital natural resource areas in a development. However, smaller lots may not be possible in some areas without a central sewer system.

Larger lots are often needed for placement of a home sewage treatment system in areas without sewers. Installation of rain gardens can also be limited if an area has well drained soils or other physical limitations on a property.

Physical Attributes

Gradient

Stream gradient can indirectly indicate how quickly a stream segment can recreate needed habitat features over time. With all things being equal, the steeper the gradient of a stream, the more power the stream possess allowing it to more quickly recover from perturbations such as flooding or sedimentation. Based upon observed relationships between stream gradient and fish sampling by the Ohio EPA, a gradient of 6 ft./mile of watershed less than 20 square miles, or 2 feet per mile for watersheds between 20-200 square miles is needed to achieve a normal Warm Water Habitat fish community.

Table II-10 shows the average stream gradients and percent of slope for Upper Wolf Creek Watershed, approximately 28 square miles. Typically, a stream with a steep gradient has more energy available for stream flow. This increases its capacity to headwardly erode and transport sediment loads and debris downstream. The stream gradient diminishes as it approaches the convergence with the mainstem or higher order stream. This is generally the case with the Upper Wolf Creek with the Mainstem having less of a gradient than its smaller headwater streams.

Table II-10: Upper Wolf Creek Watershed Average Stream Gradient and Percent Slope				
Stream Name	**Subwatershed(s)**	**Length (mile)**	**Average Stream Gradient (feet/mile)**	**Percent of Slope**
Wolf Creek (Mainstem)	Headwaters and Barberton Res.	7.8	18.22	0.35%
Beach Creek	Headwaters	2.2	69.70	1.32%
Little Lakes Creek	Headwaters	1.6	102.40	1.94%
Big Lakes Creek	Headwaters	1.6	107.10	2.03%
Ridge Creek	Ridge Creek/Spruce Run	3.6	29.50	0.56%
Spruce Run	Ridge Creek/Spruce Run	1.9	84.20	1.59%
Paxton Creek	Barberton Res.	0.9	146.70	2.78%
Railroad Creek	Barberton Res.	0.9	63.50	1.20%
Stimson Creek	Barberton Res.	2.6	41.64	0.79%
Koontz Creek	Koontz Creek	2.7	69.10	1.31%
Canton Creek	Koontz Creek	2.0	69.10	1.31%
NEFCO assigned all creek names except for Wolf Creek				

Floodplain Connectivity

A study of Upper Wolf Creek and its tributaries' connection with the floodplain has not been completed. There are no plans to complete such a study at this time since flooding is not a priority in this Watershed Plan. However, actions in this plan specifically with regards to riparian habitat and open space protection indirectly address the need for a connected and continuous stream corridor. In the future, a floodplain connectivity study will be pursued if it is determined to be needed for the continued protection of local water resources and/or local property.

Riparian Levees

An extensive levee system has not been constructed along Upper Wolf Creek. It is possible that localized levees have been placed over the years to prevent flood waters from inundating specific locations, but none have been documented. This section will be updated should such levees be discovered.

III. Water Resource Quality

Designated Uses for Ohio Surface Water Resources

The Ohio EPA is required by the Federal Clean Water Act to develop water quality standards in order to protect, maintain, and improve surface water in the state. Consequently, the agency created standards in two designated categories: Aquatic Life Uses and Non-Aquatic Life Uses. Aquatic Life Use designations vary depending upon where the segment is located in the state and the demonstrated potential of that section of a stream. Non-Aquatic Life Use designations are used to determine a stream's ability as a viable water supply, and for recreation.

Aquatic Life Use Designations

An aquatic life use designation is assigned to a stream or river based on the potential aquatic biological community that can realistically be sustained given the biological, physical, and chemical attributes of the waterway. Ohio's aquatic life use designations are:

Exceptional Warm Water Habitat (EWH): A designation given to waterbodies with the most productive environment. These streams support unusual and exceptional assemblages of aquatic organisms, which are characterized by a high diversity of species, particularly those that are highly intolerant and/or rare, threatened, or endangered. This use represents a protection goal for water resource management efforts dealing with Ohio's best water resources.

Warmwater Habitat (WWH): A designation given to streams and rivers with a typical warmwater assemblage of aquatic organisms. It is the principal restoration goal for the majority of water resource management efforts in Ohio. Criteria vary by ecoregion and site type.

Modified Warmwater Habitat (MWH): This designation applies to streams with extensive and irretrievable physical habitat modifications, and where the biological criteria for warmwater habitat is not attainable. The activities contributing to the modified warmwater habitat designation have been sanctioned and permitted by state or federal law. The representative aquatic assemblages are generally composed of species that are tolerant to low dissolved oxygen, silt, nutrient enrichment and poor habitat quality. The three primary types of modification are acid mine drainage runoff, heavily channelized streams, and extensively impounded rivers.

Limited Resource Water (LRW): Designation applies to small streams in watersheds of less than 3 square miles and other waterbodies which have been irretrievably altered to the extent that no appreciable assemblage of aquatic life can be supported. Limiting factors often include acid mine drainage, drainage way maintenance, or other specified conditions. No biological criteria has been established for LRW streams.

Coldwater Habitat (CWH): These are designated waters that support assemblages of coldwater organisms and/or those that are stocked with salmonids with the intent of providing a fishery on a year round basis. No specific biological criteria has been established for this use designation.

Seasonal Salmonid Habitat (SSH): A designation used for waters that are capable of supporting the passage of salmonids from October to May and large enough to support recreational fishing. This designation is only in effect from October to May each year.

As documented in Chapter 3745-1-24 in the Ohio Administrative Code, Upper Wolf Creek and its tributaries have the aquatic life habitat designation of warmwater habitat (WWH). No segment in the Upper Wolf Creek Watershed was designated as exceptional warmwater habitat, modified warmwater habitat, limited resource water, seasonal salmonid habitat, or coldwater habitat (CWH).

Non-Aquatic Life Use Designation - Water Supply

Ohio has three categories for surface water supply: public water supply (PWS), agricultural water supply (AWS), and industrial water supply (IWS). The water supply use designations for Upper Wolf Creek are summarized in Table III-1. Water from the Barberton Reservoir is used as a potable drinking water source. Agricultural water supply is defined as surface water that is used, or potentially used, for watering livestock or irrigation. All segments of the creek have this use designation. Lastly, IWS is surface water that can be used for industrial purposes. All stream segments in the Upper Wolf Creek Watershed are classified as being suitable for this use. For more information about Upper Wolf Creek's water supply use designations, refer to the Ohio Administrative Code, Chapter 3745-1-24.

Table III-1: Water Supply Use Designation for Upper Wolf Creek and Tributaries

Upper Wolf Creek Segment	PWS	AWS	IWS
Upper Wolf Creek at River Mile 5.12 (Barberton Reservoir)	X	X	X
Upper Wolf Creek - all other segments		X	X

RM = River Mile; PWS = Public Water Supply; AWS = Agricultural Water Supply; IWS = Industrial Waters Supply
Source: Ohio Administrative Code, Chapter 3745-1-24

Non-Aquatic Life Use Designation - Recreation

The Ohio EPA designates waterbodies based on recreational activities that can occur. The three designations used are bathing waters (BW), primary contact recreation (PCR), and secondary contact recreation (SCR). Bathing waters include swimming beaches with lifeguards and/or bath houses. No areas within the Upper Wolf Creek Watershed fall under this classification. One or more of the following characteristics must be met to receive the primary contact recreation designation: water depth allows for full body immersion; creek segment in close proximity to residential areas; or the water present and intermediate potential exposure to bacteria. Characteristics to qualify as a SCR designated creek segment are water depth precludes full body immersion, not near residential areas, and low potential to bacteria exposure. All of Upper Wolf Creek's segments are classified as primary contact water according to the Ohio Administrative Code, Chapter 3745-1-24.

Biological Criteria

The Ohio EPA adopted biological criteria into the Ohio Water Quality Standards in 1990. Specifically, two fish and one macroinvertebrate indices are used to determine if a specific stream segment is reaching its aquatic life use designation as described "Aquatic Life Use Designation" section above.

These indices are:

IBI - Index of Biological Integrity

The Index of Biological Integrity (IBI) is a measure of fish species diversity and species populations. The index is a number that reflects total native species composition, indicator species composition, pollutant tolerant and intolerant species composition, and fish condition. The higher the calculated score, the healthier the stream system with the highest score being 60 (Ohio EPA, 1997).

ICI - Invertebrate Community Index

The Invertebrate Community Index (ICI) is based on measurements of the macroinvertebrate communities living in a given stream or river. It is a useful evaluation tool of a stream health because: (1) there are a wide variety of pollution tolerant macroinvertebrate taxa; and (2) there are a number of macroinvertebrate types which are known to be intolerant to pollution. The ICI is also on a scale of 0 to 60 with higher scores reflecting healthier macroinvertebrate communities and therefore more diverse communities (Ohio EPA, 1997).

MIwb - Modified Index of Well Being

The Modified Index of Well Being (MIwb) filters out 13 pollutant tolerant fish species and includes fish mass in the final analysis. Using both the IBI and MIwb can give a clear picture of the health of the fish and biological community along a section of stream. Also, by comparing the fish mass versus fish abundance, the Ohio EPA may be able to determine which pollution source is impacting the biological community more than others (Ohio EPA, 1997).

To be in full attainment, all three of these indices must meet standards from regional reference sites reflecting natural or least impacted habitats in each ecoregion. If only one or two of the indices is met, then a stream segment is in partial attainment. If none of the standards are met then the waterbody is considered to be in non-attainment.

Attainment Status

The Upper Wolf Creek was assessed for water quality as part of the Upper Tuscarawas River TMDL (See Section V). The assessment determined the attainment status for aquatic life use (ALU) and recreational use (RU) for four sites in the Upper Wolf Creek Watershed (Table III-2). The Ohio EPA TMDL sampling sites are shown in Figure III-1.

Only one site, Wolf Creek at State Road, was not in attainment for aquatic life use. Poor stream habitat and siltation from channelization and development are the reasons cited for non-attainment. Two sites, Wolf Creek at Barberton Water Treatment Plant Intake and Ridge Creek at State Route 162, was not in attainment of recreational use due to high bacteria levels from failing home sewage treatment (septic) systems.

Table III-2: Aquatic Life Use (ALU) and Recreation Uses (RU) Attainment Status for the Upper Wolf Creek

Stream (Location)	Attainment Status		QHEI	Impairment Causes	Impairment Sources
	ALU	RU			
Wolf Creek (S.R. 162)	Full	Full	63.0	None	None
Wolf Creek (State Rd.)	Non	Full	53.0	Habitat Alteration, Siltation	Suburbanization, Channelization
Wolf Creek (Barberton WTP)	Full	Non	47.5	Pathogen	Septic Discharges
Ridge Creek (S.R. 162)	Full	Non	68.5	Pathogen	Septic Discharges

QHEI - Qualitative Habitat Evaluation Index

In addition to surveying the biology of a specific stream segment, the Ohio EPA also examines the in-stream and bank-side (riparian) habitat. This survey is called the Qualitative Habitat Evaluation Index (QHEI) and is designed to provide measures of habitat that normally correspond to physical features that affect biological communities in a stream. Physical features used in this index include composition of the substrate, type and magnitude of cover, condition of the riparian habitat, the quality of the pool and riffles areas, and channel dimensions (Rankin, 1989). Scores can range between 0 and 100 with higher scores equating to better habitat conditions. However, unlike the above indices the **QHEI is not used to determine aquatic life use attainment status for streams**. However, it has been shown that there is a strong relationship between QHEI scores and aquatic life use scores. Table III-3 shows the relationship between the QHEI and aquatic life use.

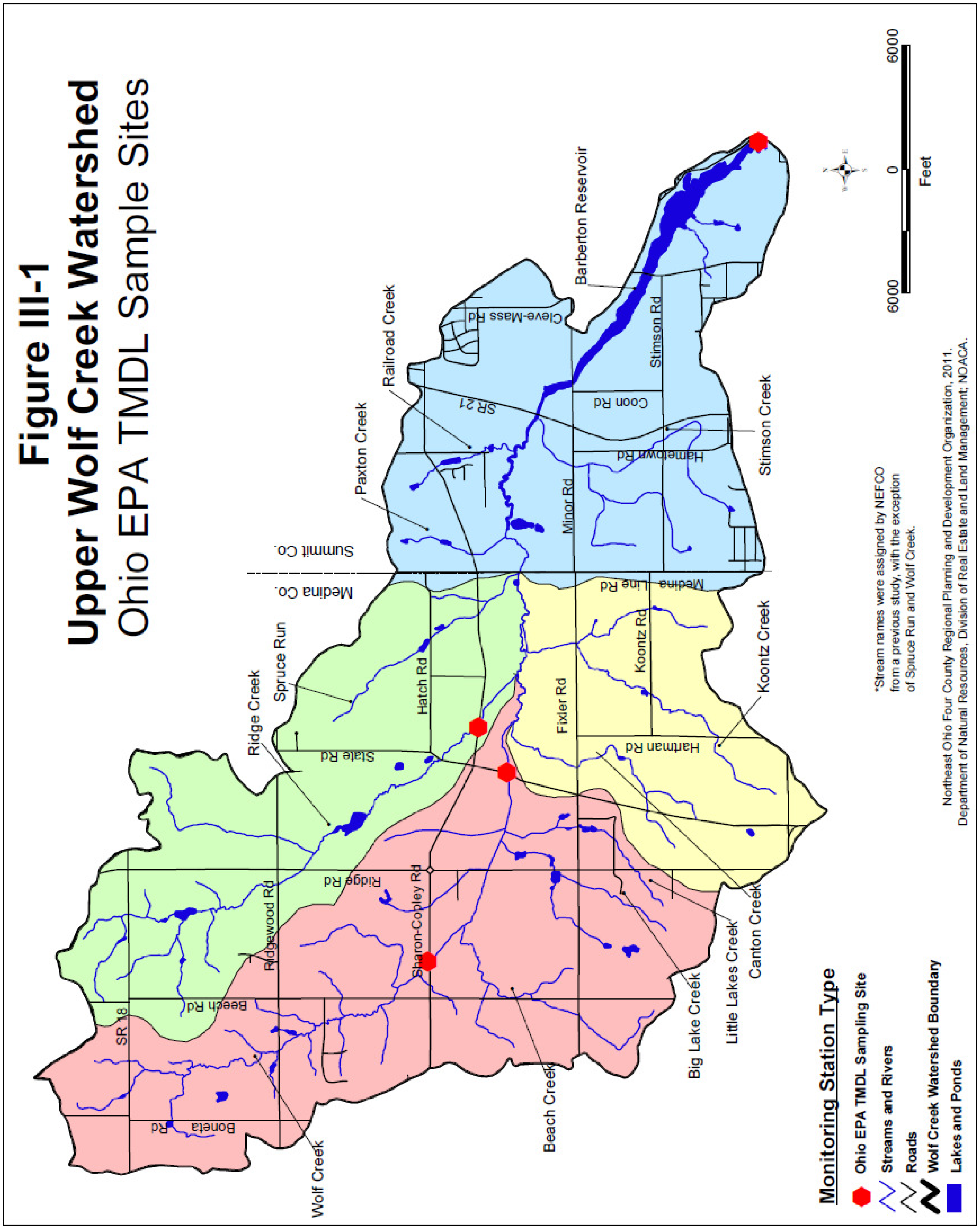


Figure III-1
Upper Wolf Creek Watershed
Ohio EPA TMDL Sample Sites
Monitoring Station Type
Ohio EPA TMDL Sampling Site
Streams and Rivers
Roads
Wolf Creek Watershed Boundary
Lakes and Ponds
Wolf Creek
Beach Creek
Big Lake Creek
Little Lakes Creek
Canton Creek
Ridge Creek
Spruce Run
Koontz Creek
Paxton Creek
Railroad Creek
Stimson Creek
Barberton Reservoir
Summit Co.
Medina Co.
SR 18
Boneta Rd
Beech Rd
Ridgewood Rd
Ridge Rd
Sharon-Copley Rd
State Rd
Hatch Rd
Fixler Rd
Hartman Rd
Koontz Rd
Medina Line Rd
Minor Rd
Hametown Rd
Coon Rd
SR 21
Stimson Rd
Cleve-Mass Rd
6000
0
6000
Feet
*Stream names were assigned by NEFCO from a previous study, with the exception of Spruce Run and Wolf Creek.
Northeast Ohio Four County Regional Planning and Development Organization, 2011.
Department of Natural Resources, Division of Real Estate and Land Management; NOACA.

Table III-3: Relationship between Ohio's Aquatic Life Uses and the QHEI	
Aquatic Life Use	**Habitat Characteristics**
Exceptional Warmwater Habitat (EWH)	QHEI Scores > 70-75 Excellent Habitat Heterogeneity
Warmwater Habitat (WWH)	QHEI Scores > 60 Good to Fair Habitat Heterogeneity
Modified Warmwater Habitat (MWH)	QHEI Scores < 45 Poor Habitat Heterogeneity
Limited Resource Water (LRW)	QHEI Scores < 20-30 Habitat Limited Sites, Usually < 3 mi^2 Drainage Area
Source: Ohio EPA, "The Use of the Qualitative Habitat Evaluation Index for Use Attainability Studies in Streams and River in Ohio" by Edward Rankin.	

Table III-2 shows the QHEI scores for the four Ohio EPA sampling locations in the Upper Wolf Creek Watershed. Upper Wolf Creek at the Barberton Water Treatment Plant (47.5) and at State Road (53.0) did not have QHEI scores above 60.

City of Barberton Watershed Monitoring

Overview

The City of Barberton started monitoring water chemistry of the Upper Wolf Creek and Barberton Reservoir as part of an Ohio EPA Section 319 grant in 2000. Since the Barberton Reservoir serves as the City's primary drinking water supply, the goal of monitoring is to establish baseline data, identify water quality trends, and detect potential sources of contaminants. Parameters monitored by the City of Barberton's Water Treatment Plant personnel are phosphorus, ammonia, total suspended solids, iron, nitrate + nitrite, biological oxygen demand (2000 - 2001), total organic carbon (2004 - present), fecal coliform, total coliform, pH, stream temperature, turbidity, dissolve oxygen, and chlorides. Figure III-2 shows the monitoring location throughout the watershed and Table III-4 has additional information about each monitoring location.

The Barberton Water Treatment Plant collects grab samples from these eleven monitoring locations on average of 21 times per year or once every two and one-half weeks. The goal is to collect water quality samples at least twice a month for the sites. The continued monitoring of these sites is a protective strategy outlined in the City's Source Water Assessment and Protection plan with Ohio EPA. Therefore, the Water Treatment Plant staff will continue to monitor these sites for the foreseeable future.

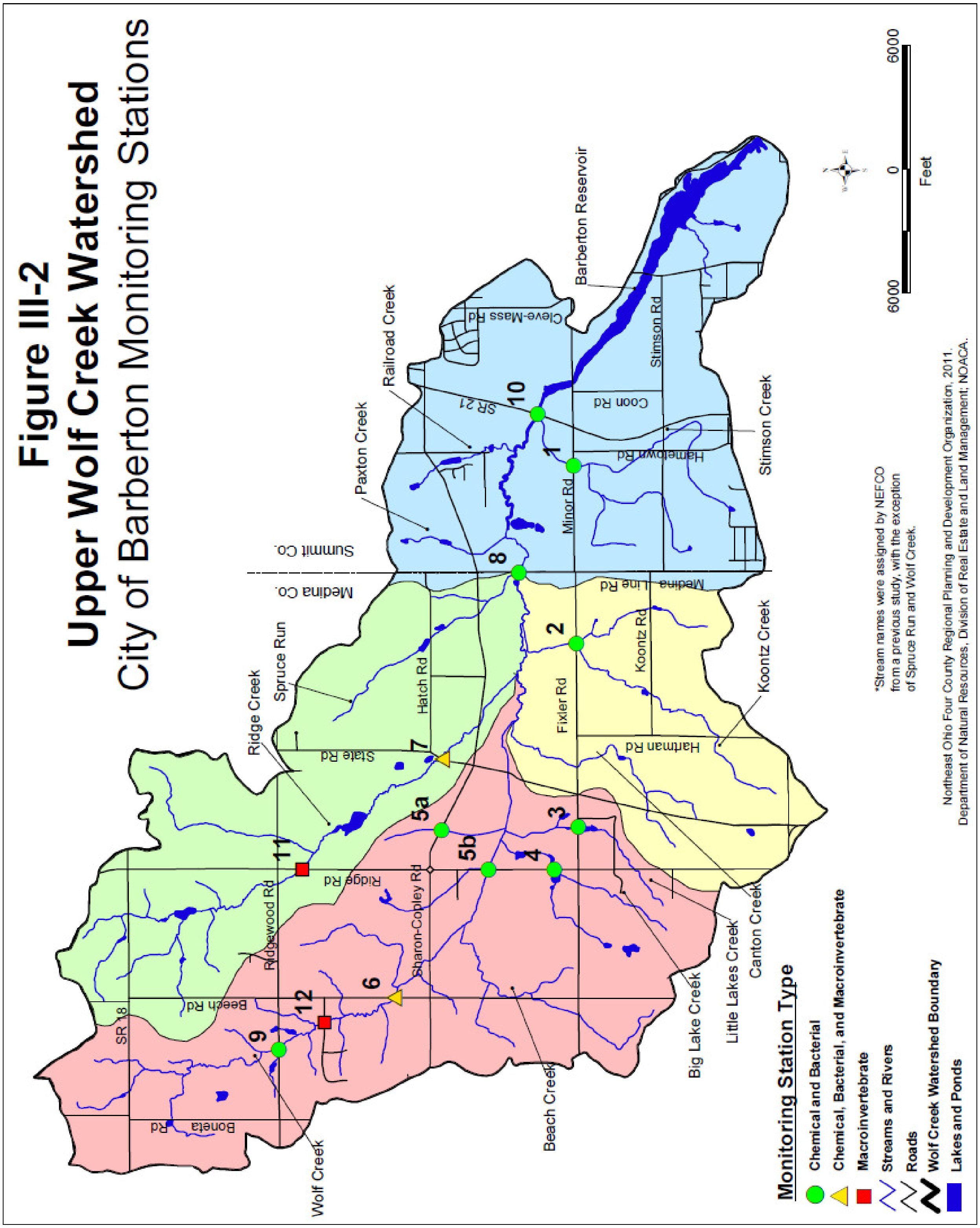


Figure III-2
Upper Wolf Creek Watershed
City of Barberton Monitoring Stations
Monitoring Station Type
Chemical and Bacterial
Chemical, Bacterial, and Macroinvertebrate
Macroinvertebrate
Streams and Rivers
Roads
Wolf Creek Watershed Boundary
Lakes and Ponds
*Stream names were assigned by NEFCO from a previous study, with the exception of Spruce Run and Wolf Creek.
Northeast Ohio Four County Regional Planning and Development Organization, 2011.
Department of Natural Resources, Division of Real Estate and Land Management; NOACA.
6000
0
6000
Feet
Summit Co.
Medina Co.
Wolf Creek
Beach Creek
Big Lake Creek
Little Lakes Creek
Canton Creek
Ridge Creek
Spruce Run
Koontz Creek
Paxton Creek
Railroad Creek
Stimson Creek
Barberton Reservoir
SR 18
Boneta Rd
Beech Rd
Ridgewood Rd
Ridge Rd
Sharon-Copley Rd
State Rd
Hatch Rd
Fixler Rd
Hartman Rd
Koontz Rd
Medina Line Rd
Minor Rd
Hametown Rd
Coon Rd
SR 21
Stimson Rd
Cleve-Mass Rd
1
2
3
4
5a
5b
6
7
8
9
10
11
12

Table III-4: City of Barberton Water Quality Monitoring Sites in the Upper Wolf Creek Watershed			
Map Number	**Stream Name**	**Sample Location**	**Subwatershed**
1	Stimson Creek	Minor Road Bridge	Headwaters
2	Koontz Creek	Fixler Road Bridge	Koontz
3	Beach Creek	Beach Road Bridge	Headwaters
4	Big Lake Creek	Ridge Road Bridge	Headwaters
5	Wolf Creek	Ridge Road Bridge	Headwaters
6	Wolf Creek	Beach Road Bridge	Headwaters
7	Ridge Creek	State Road Bridge	Ridge Creek / Spruce Run
8	Wolf Creek	Medina-Line Road Bridge	Ridge Creek / Spruce Run
9	Wolf Creek	Ridgewood Road Bridge	Headwaters
10	Wolf Creek	State Route 21 Bridge	Barberton Reservoir
11	Barberton Reservoir	Water Treatment Plant Intake	Barberton Reservoir
Source: City of Barberton Water Treatment Plant, 2011			

Results

Below is a summary of the Upper Wolf Creek's chemical monitoring results for selected parameters. A brief summary of the each selected parameter is followed by a table containing the concentration averages and the maximum concentration for each sampling year. The site and date of the maximum values is also included in each table. For additional results contact the City of Barberton Wastewater Treatment Plant.

Phosphorus

Chemical analysis to determine phosphorus concentration is important to assess stream health. Phosphorous can enter the water from human and animal waste, decomposing organic matter and fertilizer runoff. Industrial effluent and detergent wastewater also contribute phosphates, in addition to leaching from natural deposits. Yearly average and maximum phosphorus concentrations for the Upper Wolf Creek monitoring sites are found in Table III-5.

Total phosphorus levels higher than 0.03 mg/l contribute to increased eutrophication in water bodies and levels above 0.1 mg/l may stimulate plant growth sufficiently to surpass normal eutrophication rates (Campbell and Wildberger, 1992). Elevated levels of phosphorus may stimulate plant growth beyond natural limits causing excessive algal production, fish kills, and taste and odor problems. The Ohio EPA's water quality standards limits phosphorous to the extent necessary to prevent nuisance growths of algae, weeds and slimes that result in violation of water quality criteria or, for public water supplies, results in taste or odor problems (Ohio EPA, 2002).

Two of the yearly averages were at 0.1 mg/l, and all were higher than the 0.03 mg/l. The maximum value recorded from 2000 to 2010 was 0.7 mg/l at station 6 on June 26, 2002.

Table III-5: Summary of Barberton Water Quality Monitoring - Phosphorus

Year	Yearly Average (mg/l)	Yearly Maximum (mg/l)	Site of Maximum Location	Maximum Sample Date
2000	0.07	0.53	7	September 6
2001	0.08	0.24	1	September 1
2002	0.07	0.70	6	June 26
2003	0.07	0.50	5	January 22
2004	0.07	0.54	2	February 11
2005	0.06	0.17	1	February 16
2006	0.05	0.11	5	January 3
2007	0.05	0.14	2	December 11
2008	0.05	0.17	2	June 3
2009	0.10	0.62	3	May 12
2010	0.10	0.16	10	March 18

Source: City of Barberton Water Treatment Plant, 2011

Ammonia

Ammonia is a naturally occurring compound of nitrogen and hydrogen highly soluble in water. It can reach waterways through discharge of industrial wastes containing ammonia as a byproduct or wastes from industrial processes using "ammonia water". It is a normal product of biological degradation of nitrogenous organic material. Sources of nitrogen can enter water from human and animal waste, decomposing organic matter and fertilizer runoff. The toxicity of aqueous solutions of ammonia is attributed to the NH_3 species. Factors which affect the concentration of NH_3 in water solutions include pH and water temperature.

The average yearly and maximum ammonia concentrations for the monitoring sites are shown in Table III-6. Stream temperature and pH affect the acceptable maximum and 30-day average levels of ammonia. Despite these variances, all of the yearly averages are well below 30-day average total ammonia-nitrogen criteria.

Many laboratory experiments of relatively short duration have demonstrated that the lethal concentrations for a variety of fish species are in the range of 0.2 to 2.0 mg/l NH_3, with trout being the most sensitive and carp the most resistant (U.S. EPA, 1976). Four yearly maximum values were above 2.0 mg/l with the highest being 160 mg/l recorded at site 11 on October 5, 2009. The yearly average and maximum values from 2006 to 2009 greatly increased from the previous six years of monitor. In 2010 the average and maximum values returned to pre-2006 ranges.

Table III-6: Summary of Barberton Water Quality Monitoring - Ammonia				
Year	**Yearly Average (mg/l)**	**Yearly Maximum (mg/l)**	**Site of Maximum Location**	**Maximum Sample Date**
2000	0.03	0.18	4	October 11
2001	0.05	1.40	9	August 22
2002	0.03	0.80	4	February 13
2003	0.02	0.22	7	May 14
2004	0.02	0.21	1	February 11
2005	0.03	0.69	3	August 23
2006	0.07	4.08	7	April 18
2007	0.09	4.02	6	June 13
2008	2.00	120	3	May 29
2009	0.17	160	11	October 5
2010	0.05	0.22	10	March 24
Source: City of Barberton Water Treatment Plant, 2011				

Total Suspended Solids
Sources of elevated levels of suspended solids and low water clarity include sedimentation from agricultural and construction site runoff, mining, forestry, natural erosion processes and increased growth of microscopic plankton.

There are no formal water quality criteria for suspended solids relating to either human health or aquatic life. Moderately low levels of turbidity may indicate a healthy, well functioning ecosystem without excessive plankton growth. High levels of turbidity may be an indication of runoff or blooms of microscopic organisms as a result of high nutrient inputs (Campbell and Wildberger, 1992). A document referred to as the Ohio Reference site data has developed a water quality scale based on total suspended solids values and can be viewed in Table III-7.

Table III-7 Water Quality Based on Total Suspended Solids Values	
Total Suspended Solids (mg/l)	**Water Quality**
Less than 10	Excellent water quality
10 to 30	Normal
31 to 133	Impaired stream
More than 133	Severely impaired stream
Source: Ohio Department of Natural Resources (ODNR), Division of Soil and Water Conservation 1999, Fieldsheet for the Ohio Sediment Stick	

Table III-8 shows the yearly average and maximum TSS values the Upper Wolf Creek monitoring sites. Yearly averages ranged from 4.71 mg/l to 16.23 mg/l, within the "normal" water quality range in the table above. However, five yearly maximum values were above 133 mg/l or "severely impaired stream" standard. Sites 3, 5, 6, and 9 all had values above 133 mg/l. Cumulative impacts from upstream land uses and/or re-suspension of sediment by carp or other fish could be an explanation for these slightly higher levels of suspended solids. Additions of particulates and mixing of bottom sediments from storm water runoff is also a probable reason for higher levels.

Table III-8: Summary of Barberton Water Quality Monitoring - Total Suspended Solids (TSS)

Year	Yearly Average (mg/l)	Yearly Maximum (mg/l)	Site of Maximum Location	Maximum Sample Date
2000	9.31	168.80	6	April 4
2001	8.93	127.60	10	January 24
2002	16.23	463.00	6	April 3
2003	8.97	63.60	6	December 23
2004	10.90	133.60	5	April 14
2005	13.34	207.20	9	January 12
2006	4.71	38.40	10	August 15
2007	7.14	27.2	2	June 13
2008	6.83	65.2	6	June 3
2009	11.97	258.0	3	June 6
2010	7.15	23.6	7	March 24

Source: City of Barberton Water Treatment Plant, 2011

Suspended materials reduce light penetration, therefore limiting the amount of photosynthetic organisms which decompose organic matter and are an important link in the food chain (Miller, 1998). Some examples of how fish populations are adversely affected by suspended solids include: preventing successful development of eggs and larvae, modifying natural movements and migration, and reducing food sources. Soil particles can also bind to contaminants such as heavy metals and nutrients, thus transporting them into the waterway (Mayer et. al. 1995).

Iron

Table III-9 provides the yearly average and maximum iron concentrations for the Upper Wolf Creek monitoring sites. Iron is common in many rocks and soils, especially clay soils where it is often a major component. Iron may be present in water in varying quantities, dependent upon the geology of the area and the remaining chemical composition of the waterway. Both plants and animals require iron, making it an essential trace element.

Prime iron pollution sources include industrial wastes, acid mine drainage and iron-bearing groundwater. In the presence of dissolved oxygen, iron in water from mine drainage is precipitated as a hydroxide, $Fe(OH)_3$. These yellowish precipitates produce "yellow boy" deposits. However, no such deposits have been documented in the Upper Wolf Creek Watershed.

Levels of iron above 1.0 mg/l can be toxic to aquatic life. Iron at exceedingly high concentrations has been reported to be toxic to livestock and to interfere with the metabolism of phosphorus (U.S. EPA, 1976). Ohio EPA water quality criteria for the protection of agricultural uses is 5.0 mg/l or below (Ohio EPA, 2002).

All samples collected measured below 5.0 mg/l except for one reading in 2009 which was 9.6 mg/l. All yearly averages ranged between 0.32 mg/l and 0.42 mg/l. The maximum concentration recorded from 2000 to 2006 was 9.6mg/l occurring at site 4 on May 26, 2009.

Table III-9: Summary of Barberton Water Quality Monitoring - Iron

Year	Yearly Average (mg/l)	Yearly Maximum (mg/l)	Site of Maximum Location	Maximum Sample Date
2000	0.34	1.28	5	October 4
2001	0.34	1.32	3	October 26
2002	0.32	1.81	5	April 3
2003	0.36	4.41	10	December 23
2004	0.39	1.65	6	June 10
2005	0.40	1.47	3	January 12
2006	0.34	1.04	2	January 3
2007	0.30	0.97	5b	June 13
2008	0.30	0.92	7	February 19
2009	0.38	9.6	4	May 26
2010	0.42	0.85	10	March 18

Source: City of Barberton Water Treatment Plant, 2011

Nitrate + Nitrite

Nitrate + Nitrite yearly averages and yearly maximum values are shown in Table III-10 for the entire watershed. Nitrate is a natural form of nitrogen found in water. Nitrite occurs as an intermediate stage in the biological decomposition of compounds containing nitrogen. Since nitrites readily oxidize to nitrates, they are not often found in surface water (HACH Co.).

State water quality criteria for the protection of agricultural uses limits total nitrates + nitrites to levels of 100 mg/l or less. The limit of nitrates for drinking water is 10 mg/l or less (Ohio EPA, 2002). The yearly averages for the Upper Wolf Creek ranged from 0.47 mg/l to 2.31 mg/l. The highest level recorded was 150 mg/l, which was a sample taken at site 3 on May 29, 2008.

Nitrogen is an essential nutrient for plant growth. It can also enter water from human and animal waste, decomposing organic matter and fertilizer runoff. Excessive amounts of nitrates and nitrites may result in plant growth past normal eutrophication rates, leading to high levels of algae, oxygen depletion, and fish kills (Campbell and Wildberger, 1992).

Table III-10: Summary of Barberton Water Quality Monitoring - Nitrate + Nitrite

Year	Yearly Average (mg/l)	Yearly Maximum (mg/l)	Site of Maximum Location	Maximum Sample Date
2000	1.17	4.50	11	February 16
2001	1.09	3.00	2	December 20
2002	0.64	2.50	3	March 27
2003	0.61	1.90	2	May 22
2004	0.60	2.10	2	March 2
2005	0.47	1.20	2	June 1
2006	0.56	3.00	7	April 18
2007	0.62	4.9	8	July 10
2008	2.31	150	3	May 29
2009	0.69	3.50	3	June 6
2010	0.79	1.70	2	March 18

Source: City of Barberton Water Treatment Plant, 2011

Fecal Coliform

Fecal coliform are a type of bacteria naturally abundant in the lower intestine of humans and other warm blooded animals but are rare or absent in unpolluted waters. Because of this, its presence is a reliable indication of sewage or fecal (animal waste) contamination in water. Other coliform bacteria are also present in human and animal feces, but the fecal coliform measurement is more specific, by indicating coliform strains of which 95 percent have a fecal origin (Campbell and Wildberger, 1992). Table III-11 has the fecal coliform data for the yearly average and maximum counts at each site.

Fecal coliform counts of less than 200 per 100 ml of water is desirable for bathing (swimming) waters, less than 1,000 per 100 ml for primary contact (wading) waters, and less than 5,000 per 100ml for secondary contact (boating and fishing) waters (Ohio EPA, 2002).

The yearly average for all the sites monitored ranged between 195 and 327 colonies per 100 ml. All yearly maximum counts were above 1,000 per 100ml. The maximum value of 6,224 colonies per 100/ml occurred at site 2 on December 23, 2003. Site 1 at the Minor Road bridge along Stimson Creek recorded the highest yearly maximum value for four of the ten years of monitoring by the City of Barberton.

Fecal coliform counts are typically higher during the summer months and during or immediately after storm events. However, three of the yearly maximum values occurred during the fall in the month of October.

Table III-11: Summary of Barberton Water Quality Monitoring - Fecal Coliform

Year	Yearly Average (#/100ml)	Yearly Maximum (#/100ml)	Site of Maximum Location	Maximum Sample Date
2000	260	2,140	6	October 4
2001	223	1,820	3	October 26
2002	195	1,640	1	June 26
2003	234	6,224	2	December 23
2004	219	1,748	1	October 6
2005	242	2,144	1	July 6
2006	200	2,174	2	May 23
2007	258	1,932	1	July 10
2008	170	1,490	3	June 11
2009	231	1,996	3	July 21
2010	327	2,748	6	March 24

Source: City of Barberton Water Treatment Plant, 2011

Turbidity

Turbidity is a measure of how quickly transparency is lost in the water column due to the presence of suspended particles. Material that causes turbidity includes clay, silt, fine organic matter, plankton, microscopic organisms, organic acids, and dyes. The more particles that are suspended the less transparent the water, resulting in a cloudy, murky, or opaque appearance. Because this is a measure of suspended solids, there is typically a correlation with total suspended solids measurements.

Turbidity is measured by shining a light through a sample of water and measuring the intensity of light scattered at a 90 degree angle, which is measured with Nephelometric Turbidity Units (NTU). The smaller the NTU number the clearer the water. Turbidity values will generally be higher after rain storms due the water runoff collecting particles before entering the stream or lake. Areas with soil erosion problems will also likely have elevated turbidity scores.

In Ohio there are no turbidity standards for streams and lakes; however, it can be a good indicator of water quality. High turbidity values represent higher concentration of suspended particles in the water. Excess particles can settle and cover stream and lake bed habitat for fish and macroinvertebrates. Suspended particles can also absorb heat make the water warmer which decreases the water's dissolved oxygen. The warmer temperatures and/or lower dissolved oxygen concentrations could impact the fish and macroinvertebrates communities. Also in larger rivers and lakes, high levels of suspended solids limit light penetration reducing the photosynthetic activities of plants and algae. Reduced photosynthetic activity could lead to a reduction of dissolved oxygen in the water. Lastly, streams or lakes with high turbidity values are generally less aesthetically appealing than water bodies with clearer water.

The City of Barberton measures turbidity in the Upper Wolf and Barberton Reservoir because there are turbidity standards for drinking water. From the Ohio Revised Code (Chapter 3745-81), public drinking water has to be between 0.3 and 1.0 NTU, depending on the type of filtration system and the size of the community serviced. Therefore, the City of Barberton has to remove enough suspended particles from the water drawn in from Barberton Reservoir in order to reach drinking water standards. The more sediment the City has to remove from its raw water sources, the higher the cost producing potable water.

Table III-12 has the yearly average and maximum turbidity values for the Upper Wolf Creek. The average values range between 5.8 NTU and 20.0 NTU. The highest turbidity value recorded since 2000 was 166.0 NTU at site 5 on April 3, 2002.

Table III-12: Summary of Barberton Water Quality Monitoring - Turbidity

Year	Yearly Average (NTU)	Yearly Maximum (NTU)	Site of Maximum Location	Maximum Date
2000	8.9	87.2	5	October 25
2001	7.5	86.1	3	October 26
2002	9.8	166.0	5	April 3
2003	8.4	95.7	11	July 23
2004	10.0	86.5	6	June 10
2005	12.8	108.0	3	January 12
2006	5.8	39.2	2	January 3
2007	6.56	33.3	11	March 20
2008	7.01	62.0	7	January 29
2009	8.25	77.5	5	June 2
2010	20.0	108.7	6	March 24

Source: City of Barberton Water Treatment Plant, 2011

Other Water Quality Studies

Over the years there have been numerous studies and documents from various agencies and organizations that directly or indirectly deal with watershed and water quality management for Upper Wolf Creek. Information from several of these reports and documents have been incorporated into this Plan. Some of these include:

- *Upper Wolf Creek Comprehensive Watershed Management Plan - Phase I Diagnostic Report*, April 1997, by NEFCO. This report serves as a starting point to restore and protect water quality in the Upper Wolf Creek by providing the direction to initiate need projects. The report characterizes the watershed, identifies water quality problems, sources of pollution, and management alternatives to address the problems. The impetus of this watershed plan was to protect the water quality of Barberton Reservoir and the City of Barberton's primary drinking water supply.

- *Upper Wolf Creek Comprehensive Watershed Management Plan - Phase II Watershed Monitoring*, July 1999, by NEFCO. The purpose of this watershed monitoring study was to assess stream health and characterize nutrient and sediment concentrations originating in the watershed. Chemical, bacterial, and macroinvertebrates were sampled monthly at twelve sites over an entire year to assess the stream's health. This study also began the process of forming baseline data useful for comparison during subsequent water quality testing. Information gathered is utilized to assist in identifying critical areas, offer guidance for implementation, and provide a basis for evaluation of efforts to reduce pollution in the watershed.

- Nutrient and Sediment Pollution Reduction Program in the Upper Wolf Creek Watershed, Section 319 Grant Project Number 98(h)E-11, February, 2002. The program was funded by the Ohio EPA Section 319 nonpoint source pollution reduction grant from 1999 to 2001. The project goal was to reduce and protect local water resources by reducing the phosphorus loads by 1,000 lbs/year from failed home sewage treatment systems (HSTSs) and small farm operators. Nine HSTSs were replaced and sixteen repaired. The total project cost was $294,774.29.

IV. Water Quality Issues

General Watershed Issues

Upper Wolf Creek has relatively good water quality with some sections not meeting State of Ohio water quality standards as a result of various natural processes and human activities. For sections that are in attainment, the primary goal is to preserve the water quality and reduce the risk of future degradation. The sections not in attainment are the result of natural processes and human activity. Some of these human activities directly lead to pollution being dumped into the Creek. Other activities lead to the indirect introduction of pollutants to the stream. Still other activities may not lead to pollutants being introduced to the Creek, but ultimately reduce the ability of Wolf Creek to process or assimilate increase pollution or water loads. It is a combination of all of these actions and pollution sources that have lead to degraded water quality in the basin.

Below are general watershed issues that affect the water quality in the entire Upper Wolf Creek Watershed. These issues represent, in the view of local stakeholders, either a primary reason why the water quality is not meeting standards and/or a prominent local water issue. The next priority is to determine if there is sufficient local interest and funding is to develop and implement successful actions to address these Wolf Creek issues in each of the subwatershed of Wolf Creek.

General Water Quality Issues in the Wolf Creek Watershed

- Open Space and Riparian Corridor Preservation and Restoration
- Improperly Treated Waste Water
- Erosion and Sedimentation
- Environmental Education
- Suburbanization

V. Total Maximum Daily Load

Summary

The Ohio EPA completed the Tuscarawas River total maximum daily load (TMDL) report in 2009. A TMDL is a study to find out how to improve the quality of rivers, streams, and lakes that do not meet water quality goals. This study focused on the mainstem of the Tuscarawas River and the smaller tributary stream systems, including Wolf Creek.

The upper portion of Wolf Creek flows predominantly through glacial outwash deposits and is a low gradient stream associated with wetland areas. Much of the Wolf Creek drainage has been highly channel modified to facilitate drainage associated with the urbanization of the Akron area and suburbs. Wolf Creek has also been impounded to form Barberton Reservoir.

In the Upper Wolf Creek, the Ohio EPA sampled three sites along the Wolf Creek and one site along Ridge Creek (Figure III-1). The sites are located at:

- Wolf Creek @ Barberton Water Treatment Plant Intake (River Mile 3.9)
- Wolf Creek @ State Road (River Mile 12.0)
- Wolf Creek @ State Route 162 (River Mile 13.7 to 14.3)
- Ridge Creek @ State Route 162 (River Mile 0.6)

Only one site, Wolf Creek at State Road, did not meet the water quality goals for aquatic life (fish and macroinvertebrates). The cause of the impairment is cited as being habitat alterations and siltation from suburbanization and channelization. Two sites, Wolf Creek at the Barberton Water Treatment Plant and Ridge Creek, did not meet recreation use standards due to high bacteria levels from failing home sewage treatment (septic) systems.

The Upper Wolf Creek is impaired by both habitat and sediment. Two sites assessed on Upper Wolf Creek (State Route 162 and State Road) and one site on Ridge Creek (Stare Route 162) failed to meet the habitat TMDL. While the qualitative habitat evaluation index (QHEI) scores for both Wolf Creek totaled 60 or higher by Ohio EPA, there are many modified attributes which indicates channel and riparian disturbances. The portion of Wolf Creek that is just upstream of the Barberton Reservoir undergoes ditch maintenance by Summit County. That stream segment and the reservoir itself are sections that have not been assessed with the QHEI, but very much appears to have poor habitat quality.

The sediment TMDL for Upper Wolf Creek meets expectations for a WWH stream and is therefore not impaired by sediment. Ridge Creek is however impaired by sediment and is lacking about a third of the points needed to meet the target. Poor substrate is the primary reason for the deviation. Ridge Creek also did not meet recreational water quality standards due to high concentrations of bacteria in the water from failing home sewage treatment systems (Ohio EPA, 2009).

TMDLs Developed for Upper Wolf Creek

Pathogen - Bacteria TMDL (sampling location)

- Ridge Creek (S.R. 162)

Habitat TMDL (sampling location)

- Ridge Creek (S.R. 162)
- Wolf Creek (S.R. 162)
- Wolf Creek (State Rd.)

Sediment TMDL (sampling location)

- Ridge Creek (S.R. 162)

TMDL Load Reductions

Pathogens (Bacteria)

The TMDL states that recreation use impairments from pathogens in the Ridge Creek Subwatershed is nearly entirely from failing home sewage treatment systems (HSTS). Small contributions to the Upper Wolf Creek bacteria load from cropland, pastures, and urban areas are also documented. Table V-1 show the existing load, TMDL, waste load allocations, and the percent reduction needed to attain water quality standards (Ohio EPA, 2009). Ninety-five percent of the existing bacteria load in Ridge Creek is from failing HSTS. The TMDL calls for a 100 percent reduction in bacteria from these failing systems (Table V-2). Percent reduction from nonpoint sources of pollution are shown in Table V-3.

Table V-1: Total Existing Load, TMDL, and Allocations of Fecal Coliform Loads (for the recreation season)

Subwatershed	River Miles Covered	Existing Loads			TMDL[1]	% Reduction	Allocations	
		PS	NPS	Total			WLA	LA
Ridge Creek	Headwaters to RM 3.95	42.0	1.8	43.9	1.71	96.1	0.00	1.7

[1] cfu * 10^3 * $season^{-1}$ (for cfu * 10^3 * day^{-1} divided each value by 138)
Source: Tuscarawas River TMDL, 2009

Table V-2: Point Source Fecal Coliform Loads. These Include Existing, Percent Reduction Required, and Wasteload Allocation (WLA) by Source

Subwatershed	River Miles Covered	Point Source Loads[1]				
			NPDES Discharger	MS4	HSTS	Total WLA
Ridge Creek	Headwaters to RM 3.95	Existing	0	0	42.04	42.04
		% Reduction	--	--	100	
		Allocation	0	0	0	0

[1] cfu * 10^3 * $season^{-1}$ (for cfu * 10^3 * day^{-1} divided each value by 138)
Source: Tuscarawas River TMDL, 2009

Table V-3: Nonpoint Source Fecal Coliform Loads. These Include Existing, Percent Reduction Required, and Load Allocation (LA) by Source								
Sub-watershed	River Miles Covered	Non-Point Source Loads[1]						
			Cropland	Pasture	Forest	Urban[2]	Cattle in Stream	Total LA
Ridge Creek	Headwaters to RM 3.95	Existing	0.13	1.67	0.01	0.03	--	1.84
		% Reduction	7.1	7.1	0	67.1	--	
		Allocation	0.12	1.55	0.01	0.02	0	1.71

[1] cfu * 10^3 * $season^{-1}$ (for cfu * 10^3 * day^{-1} divided each value by 138)
[2] This is non-MS4 Urban
Source: Tuscarawas River TMDL, 2009

Habitat

Habitat alteration is a cause of impairments for portions of Upper Wolf Creek and Ridge Creek. Poor habitat quality is an environmental condition, rather than a pollutant load, so development of a load-based TMDL to address this cause of impairment is not possible. However, the Qualitative Habitat Evaluation Index (QHEI) is a tool that provides a numeric value, which is assigned to a particular stream segment based on the quality of its habitat. The QHEI evaluates six general aspects of physical habitat that include channel substrate, instream cover, riparian characteristics, channel condition, pool/riffle quality, a gradient, and drainage area (Ohio EPA, 2009).

The analysis of the QHEI components as they relate to fish community scores by the Ohio EPA led to the development of a list of attributes that are associated with degraded communities. These attributes are modifications of natural habitat and are listed in Table V-4. The Ohio EPA further divided modified attributes into high influence and moderate influence attributes based on the statistical strength of the relationships. The presence of these attributes can strongly influence the characteristics of the fish communities, and the QHEI score itself may not reflect this effect. High influence modified attributes are particularly detrimental. The presence of one is likely to result in impairment, and two will likely preclude a site from achieving aquatic biology standards (Ohio EPA, 2009).

Table V-4: QHEI Modified Attributes		
QHEI Category	Modified Attributes	
	High Influence	Moderate Influence
QHEI Score	- Channelized or No Recovery - Silt/Muck Substrate - Low Sinuosity - Sparse/No Cover - Max Pool Depth < 40 cm (Wadable streams only)	- Recovering Channel - Sand Substrate (boat sites) - Hardpan Substrate Origin - Fair/Poor Development - Only 1-2 Cover Types - No Fast Current - High/Moderate Embeddedness - Ext/Mod Riffle Embeddedness - No Riffle

Source: Tuscarawas River TMDL, 2009.

The habitat TMDL equation presented in Table V-4 reflects the relationship between the QHEI score, modified attributes and fish community performance. The TMDL is based upon a total score of three (3), and is the sum of three component scores each worth one point (Ohio EPA, 2009). Sites with a Habitat TMDL score below three are considered impaired. Two sites along upper Wolf Creek and one Ridge Creek site scored below three (3) points in the Habitat TMDL (Table V-5).

Table V-5: Upper Wolf Creek Habitat TMDL								
		Allocations						TMDL
		QHEI Score	# of High Influence Attributes		Total # of Modified Attributes			
TMDL Targets		≥ 60 = 1 point	< 2 = 1 point		< 5 = 1 point			3 points
Stream (Location)	River Mile	QHEI Score	# of High Influence Attributes	Total # of Modified Attributes	Sub-Score			Total Habitat Score
					QHEI Score	High Influence	Total # Modified	
Wolf Creek (S.R. 162)	13.7	61	1	5	1	1	0	2
Wolf Creek (State Road)	11.9	60	1	5	1	1	0	2
Ridge Creek (S.R. 162)	0.8	48	0	6	0	1	0	1
Source: Tuscarawas River TMDL, 2009.								

Sediment

In the Ridge Creek subwatershed, the Ohio EPA's TMDL assessment areas has sedimentation listed as a cause of impairment in addition to habitat alteration. In order to address this, Ohio EPA developed numeric targets for sediment based upon the QHEI metrics. The QHEI substrate, riparian characteristic, and channel metrics all evaluate stream attributes related to sediment. Each of these factors influences the degree to which sediment affects a stream, and cumulatively serves as its numeric target (Ohio EPA, 2009).

The individual components of the sediment TMDL are QHEI metric scores for substrate, channel, and riparian areas. These metric target scores are based on the same associations made between QHEI and aquatic biology results as explained in the habitat TMDL above. Table V-6 show the minimum scores expected for the sediment TMDL (Ohio EPA, 2009). The site at Ridge Creek scored 31.25 percent below the needed TMDL score due to siltation from the effects of suburbanization and channelization along the creek.

Table V-6: Ridge Creek Sediment TMDL

TMDL Target for Warm Water Habitat (WWH)	QHEI Categories			Total TMDL Score
	Substrate	Channel	Riparian	
	Allocations			
	≥ 13	≥ 14	≥ 5	32

Existing Scores

Stream (Location)	River Mile	QHEI Scores			Total Sediment Score	Percent Deviation from Target	Main Impairment Category
		Substrate	Channel	Riparian			
Ridge Creek (S.R. 162)	0.8	1	15	6	22	31.25	Substrate

Source: Tuscarawas River TMDL, 2009.

VI. Open Space Preservation Plan

Introduction

Open space broadly refers to undeveloped areas that provides numerous environmental, recreational, and economic benefits to communities. Examples of open space include parks, wetlands, farmland, fields, and wooded areas. Although benefits will vary depending on the land use, generally open space increases local property values, provides wildlife habitat, increases recreational opportunities, and improves aesthetics for communities. Open areas also help protect local water resources by filtering the water of trash, debris, and chemicals before reaching the stream or groundwater table. Nationwide there has been a push to protect remaining open spaces to preserve their benefits to a community.

The preservation of open space and associated benefits is a priority in the Upper Wolf Creek Watershed. The Watershed's location makes the area susceptible to the pressures of urban sprawl. Specifically, the majority of the Upper Wolf Creek basin is situated in Medina County which has seen a 14.1 percent increase in its population since from 2000 to 2010, making it the fastest growing county in Northeast Ohio (Census, 2010). The Akron metropolitan area lies directly to the east with the Cities of Barberton and Wadsworth to the south. Two major interstates, I-71 and I-77, are located just outside the watershed to the west and east, respectively. State Route 18, located in the Upper Wolf Creek headwaters, connects these two interstate and serves as the primary corridor between the Akron metro area and Medina County. Lastly, the southern suburbs of the Cleveland metro area are less than a half hour drive from the watershed. As a result of the watershed's unique location the area has increasing pressures to develop open space into commercial and residential properties as the population in Northeast Ohio continues to spread out from traditional urban areas.

Current Conditions

The Upper Wolf Creek Watershed land uses are primarily agriculture, large lot residential and open space. There are currently large areas and parcels of undeveloped land and open spaces in the watershed. Most of these areas are located around Barberton Reservoir and in central Sharon Township. However, due to development from urban sprawl, large parcels containing open spaces are being sectioned off and converted into housing subdivisions in the last 15 years. Sharon Township in Medina County has seen a significant increase in low-density subdivisions being constructed within the watershed primarily due to its convenient access to Route 18. The southern portion of the watershed in and around the City of Wadsworth has also seen an increase in both residential and commercial development. Specifically, Sharon Township south of Koontz Road and between Hartman and Beach Roads has been designated for residential development. If development continues at the current rate, the watershed will rapidly run out of large open space areas.

Open Space Preservation Strategy - Overview

The preservation and protection of open space is a critical component to protecting water quality in the Upper Wolf Creek Watershed and Barberton Reservoir. Although some open space areas have already been converted to residential and commercial uses, they remain significant and intact open areas that could still be protected. In general open spaces that will receive higher priority for preservation include:

- Sites Adjacent to Protected Open Spaces
- Riparian Habitat and Stream Corridors
- Environmentally-Sensitive and Unique Features

To help identify the parcels that fit one or all of the criteria above, the Western Reserve Land Conservancy's anchor-based strategy will be utilized. The intent is to help stakeholders direct their limited resources to protect the most beneficial parcels in the watershed.

Anchor-Based Strategy

This open space identification process used in this plan was developed with assistance from the Medina-Summit Chapter of the Western Reserve Land Conservancy (WRLC) in 2006. They utilized a computerized geographic information system (GIS) mapping program to prioritized parcels for protection. The data used to determine priority parcels include parcel size, natural features (wetland, forested, water resources, etc.), and threat of development. They use this information to determine "anchor" parcels. Once anchor parcels are identified, the goal is to protect them either by purchasing the parcels or establishing a conservation easement. After protecting anchor parcels the next step is to connect these anchors by identifying and protecting parcels or corridors between the anchor sites. If successful, the area will have a protected open spaces featuring several large anchor sites connected by smaller corridors.

Upper Wolf Creek Anchor Sites

In the Upper Wolf Creek Watershed, four anchor sites or parcels have been identified as the focal point of open space preservation. Three of the sites are existing parks and one consists of a number of parcels around Barberton Reservoir owned by the City of Barberton. Table VI-1 has information regarding these possible anchor sites.

There is an existing or proposed anchor site in each of the four Upper Wolf Creek subwatersheds except Koontz Creek. Finding an anchor site in this subwatershed will be a high priority. The Western Reserve Land Conservancy has contacted landowners of potential anchor sites, but no agreement is imminent. Lastly, the Wolf Creek Winery on Barberton Reservoir is also a potential anchor. The owners and operators of the winery are interested in the long-term protection of the land and developing tourist and recreational opportunities on and around the property.

Table VI-1: Proposed Anchor Sites for the Upper Wolf Creek Open Space Preservation Plan				
Owner	**Property Description**	**Size (acres)**	**Subwatershed**	**Acres Currently Protected - Type of Protection**
City of Barberton	Wooded Buffer Land Around Barberton Reservoir	988*	Barberton Reservoir	988 - Land Acquired
Medina County Park District	Green Leaf Park	62	Ridge Creek / Spruce Run	62 - Land Acquired
Sharon Township Board of Trustees	Sharon Community Park	20	Headwaters	20 - Land Acquired
Medina County Park District	Wolf Creek Environmental Education Center	248	Headwater and Ridge Creek / Spruce Run	248 - Land Acquired
Sources: Medina County Auditor, 2007; Summit County Fiscal Officer, 2007 * More than one parcel				

Upper Wolf Creek Connecting Sites

Connecting sites in the Upper Wolf Creek open space protection plan are parcels adjacent to or near current anchor sites and/or riparian habitat. Several other factors besides location contributed to the initial selection of connecting sites including size, natural features, and familiarity with existing landowners. Table VI-2 has a list of six properties that fit the criteria outlined above.

The intent of the of the Table VI-2 is to provide a starting point for stakeholders, including the Western Reserve Land Conservancy, Medina County Park District, and the City of Barberton, for exploring means to protect the remaining open space sites. The sites listed above are perceived to be the best open space areas remaining in the watershed near or adjacent to anchor sites and/or the Upper Wolf Creek. Contacting and working with the land owners to protect all or portions of the above open spaces from future development is of high priority.

Table VI-2: Proposed Initial Connecting Sites for the Upper Wolf Creek Open Space Preservation Plan			
Property Description	**Size (acres)**	**Subwatershed**	**Acres Currently Protected - Type of Protection**
Farm Land; Wooded Riparian Habitat	109	Headwaters	0 - None
Farm Land; Wooded Riparian Habitat; Wooded Upland	272*	Headwaters	0 - None
Farm Land; Wooded Upland	79	Headwaters	0 - None
Wooded Riparian Habitat; Wooded Upland	60	Barberton Reservoir	0 - None
Farm Land; Wooded Riparian Habitat; Wooded Upland	155.6*	Koontz Creek & Ridge Cree / Spruce Run	0 - None
Farm Land; Wooded Riparian Habitat	98*	Koontz Creek & Headwaters	0 - None
Farm Land; Wooded Riparian Habitat	70	Headwaters	0 - None

Sources: Medina County Auditor, 2007; Summit County Fiscal Officer, 2007

* More than one parcel

Additional Sites

These open space areas in need of protection that do not fit the above criteria for either anchor or connecting sites will not be ignored. These will typically include smaller parcels, land with environmental sensitive or unique features, or cooperative landowners. These lands can include high quality wetlands, endangered species habitat, and unique geologic features. Table VI-3 contains an initial list of these additional open space sites that will be pursued as part of the open space preservation strategy. Additional open space sites will be added to this table when they are identified.

Table VI-3: Additional Sites for the Upper Wolf Creek Open Space Preservation Plan			
Property Description	**Size (acres)**	**Subwatershed**	**Acres Currently Protected - Type of Protection**
Wooded Riparian Habitat; Wooded Upland	37	Ridge Creek / Spruce Run	0 - None
Farm Land; Wooded Riparian Habitat	70	Ridge Creek / Spruce Run	0 - None

Sources: Medina County Auditor, 2007

Open Space Protection Priorities

The open space areas that fit the criteria and locations outlined above will be the first priority for protection in the Upper Wolf Creek Watershed. Securing an anchor site in the Koontz Creek Subwatershed will receive the greatest attention in the near future. The protection priority will be updated as sites are protected or developed and new sites are identified. Once all the anchor sites have been protected, connecting sites, riparian habitat, and parcels with unique features will receive the highest priority for protection.

Open Space Protection Options

Once open space areas have been identified and the landowners are interested in protecting their property from future development, there are several options available to stakeholders to preserve these lands. These include donation of land, conservation easements, land acquisition, and bargain sale.

Land Donation:

Donation of land is simply the landowner donating all or a portion of the parcel to an organization for protection. The land value is recorded as a charitable gift and the landowner receives tax benefits from this donation.

Conservation Easement:

A conservation easement is a land protection tool that allows the landowner to maintain ownership of the land while placing restrictions on land to protect it from development. An easement is a legal document that guides future use of the property by limiting certain types of uses, like development, regardless of the landowner or zoning. The land remains private property and does not require the public to have access to the land. For the landowner, an easement can provide significant income, estate and property tax benefits, and can prevent the forced sale of inherited property. The holder of the easement (not the landowner) is responsible for making sure the terms of the easement are being met by the current and any future landowners.

Land Acquisition:

This is the simplest yet the most expensive way of protecting open space. Property is purchased at market value by an interested conservation organization or government entity. The landowner receives full value for the property and the conservation organization or government entity owns the land outright. Unfortunately this is becoming a less viable option for many conservation organizations due to the high price of land in Medina and Summit Counties.

Bargain Sale:

A bargain sale is similar to land acquisition but instead of the seller receiving full market value for the property, they sell the land to a charitable organization below market value. The seller gets some money up front from the sale, but also receives a tax benefit for selling the land to a charity at below market value. The difference between the fair market value and the sale price is viewed as a charitable donation by the Internal Revenue Service, making it tax deductible. The charitable organization receives the desired land at below market value.

VII. Subwatershed Issues

Upper Wolf Creek Headwaters Subwatershed Issues

1. Route 18 Corridor
2. Open Space and Riparian Corridor Protection and Restoration
3. Failing Home Sewage Treatment Systems (HSTS)
4. Environmental Education and Watershed Monitoring

Ridge Creek and Spruce Run Subwatershed Issues

1. Failing Home Sewage Treatment Systems (HSTSs)
2. Erosion and Sedimentation
3. Route 18 Corridor
4. Environmental Education and Watershed Monitoring
5. Open Space and Riparian Corridor Restoration and Protection

Koontz Creek Subwatershed Issues

1. Open Space and Riparian Corridor Protection and Restoration
2. Environmental Education and Watershed Monitoring
3. Suburbanization
4. Failing Home Sewage Treatment Systems (HSTSs)

Barberton Reservoir Subwatershed Issues

1. Open Space and Riparian Corridor Protection and Restoration
2. Failing Home Sewage Treatment Systems
3. Erosion, Nutrients, and Sedimentation
4. Environmental Education and Watershed Monitoring

VIII. Next Steps

The information presented in this report is a significant first step in developing both a watershed plan and watershed stakeholder group specific for the Upper Wolf Creek Watershed and Barberton Reservoir. The information presented in this report provides general watershed information, watershed mapping, water quality monitoring results, load reduction needs, open space preservation plan, and general subwatershed issues for the basin. Although all of this is useful information for various projects, the next watershed planning step would be to utilize this information to develop and implement specific actions to address water quality impairments. This development and implementation of actions needs to be a collaborative watershed effort among government entities, private landowners, park districts, nonprofit organizations and other key stakeholders. The formation of a watershed stakeholder group is needed for this coordination to occur in the Wolf Creek Watershed.

If there is sufficient stakeholder interest and support, then specific implementation actions should be created for the watershed to address the water quality issues. These efforts should include prioritization of actions, funding options, responsible parties, monitoring/tracking plans, and a timeline of implementation for the prescribed watershed actions. This step is a significant investment of time and resources by the stakeholders. Success of these types of efforts in other watersheds is consistently linked to strong local support by stakeholders.

At the September 29, 2011, Upper Wolf Creek Technical Advisory Committee (TAC) meeting, it was determined that the committee would begin the process of developing problem statements and specific actions for the Ridge Creek subwatershed portion of the Upper Wolf Creek. Two factors went into making this decision. First, the TAC wanted to commit to a smaller area to see if the various organizations and agencies that will be involved can handle the workload associated with the development of an action plan. Second, Ridge Creek Subwatershed was selected because water quality sampling conducted by the Ohio EPA, the City of Barberton, and NEFCO have consistently shown this to be the tributary with the poorest water quality and habitat in the basin. The TAC believes that the most benefits from its efforts would result from working in this subwatershed.

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