East Fork Little Miami River

Watershed Action Plan

Lower East Fork
Watershed Management Plan 2003

December 2003

Picture of Hall Run in Lower East Fork watershed.

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CHAPTER 1: INTRODUCTION

Historically, environmental regulatory agencies have addressed water quality concerns by focusing on the discharges from "point sources" - the direct discharges from industrial facilities and municipal wastewater treatment plants. While controlling these discharges has significantly improved water quality in many streams, many others remain impaired despite these controls, including several streams in the East Fork Little Miami River watershed. Many other possible sources of impairment remain, including urban stormwater runoff, the discharge from failing septic systems, and runoff from agricultural fields. To successfully manage pollutant loadings so that streams are "fishable, swimmable and drinkable" (the goals of the Clean Water Act), the watershed system must be addressed as a whole, and all potential sources of pollution must be taken into account.

As a result of this thinking, Clermont County initiated a comprehensive monitoring program to assess the condition of the East Fork of the Little Miami River (EFLMR) and its tributaries. The information compiled from this study has enabled an in-depth look into the existing stream conditions within the East Fork watershed, and the potential factors that result in impairment of water quality. Also, Clermont County began to build an active stakeholders group to help initiate the watershed management process. The first stakeholder meetings held in 1998 focused on the basics of water quality and the problems that exist in the East Fork watershed. These stakeholder meetings became the basis for establishing the East Fork Watershed Collaborative.

Lower East Fork Watershed

For purposes of this action plan, the Lower East Fork watershed is defined as the land area that drains to the East Fork Little Miami River from a point downstream of Stonelick Creek to the confluence with the Little Miami River (see Figure 1). It is 42.4 square miles in size, and consists of two 14-digit Hydrologic Unit Codes (HUCs), as defined by the U.S. Geological Survey - the Lower East Fork HUC (No. 05090202-130-060) and the Shayler Run HUC (No. 05090202-130-050) (see Figure 1). The watershed is located entirely within Clermont County, and primarily within the City of Milford, and Union and Miami Townships, with smaller portions falling within Batavia and Pierce Townships. Each has been designated as a Phase II stormwater community.

Within this watershed, the main stem of the East Fork (Ohio Waterbody ID OH53-1; River Code 11-100) extends 8.8 miles from Stonelick Creek to where it joins the Little Miami River south of Milford. Ohio EPA has classified this stretch of river as "Exceptional Warmwater Habitat." It is also designated for "Primary Contact Recreation" by the State.

The major tributary in this stretch is Shayler Run (OH53-6; 11-105). The Shayler Run watershed is 12.8 square miles and located primarily within Union Township. Other significant tributaries in the Lower East Fork watershed include:

- Hall Run (OH53-2, 11-101),
- Salt Run (OH53-4, 11-103),
- Sugarcamp Run (OH53-5, 11-104), and
- Wolfpen Run (OH 53-3, 11-102).

Each of these, along with Shayler Run, has received a "warmwater habitat" use designation. All other streams in the Lower East Fork watershed have not been designated by Ohio EPA.

Lower East Fork Demographics

The population characteristics of the Lower East Fork watershed were obtained using GIS census data from the years 1990 and 2000. This is by far the most populous watershed within the larger East Fork basin. Data from the 2000 census indicates that 67,418 residents live within the watershed. Of the two 14-digit HUC watersheds, 44 percent of the population lives within the Shayler Creek watershed, mostly along the western edge in the communities of Willowville and Withamsville in Union Township. The average population density in Shayler Creek is 5.24 persons per acre (Figure 2).

The remainder of the population resides within the Lower East Fork subwatershed. Miami Township, located in the northern part of the watershed, is the most densely populated, with an average of 6.85 people per

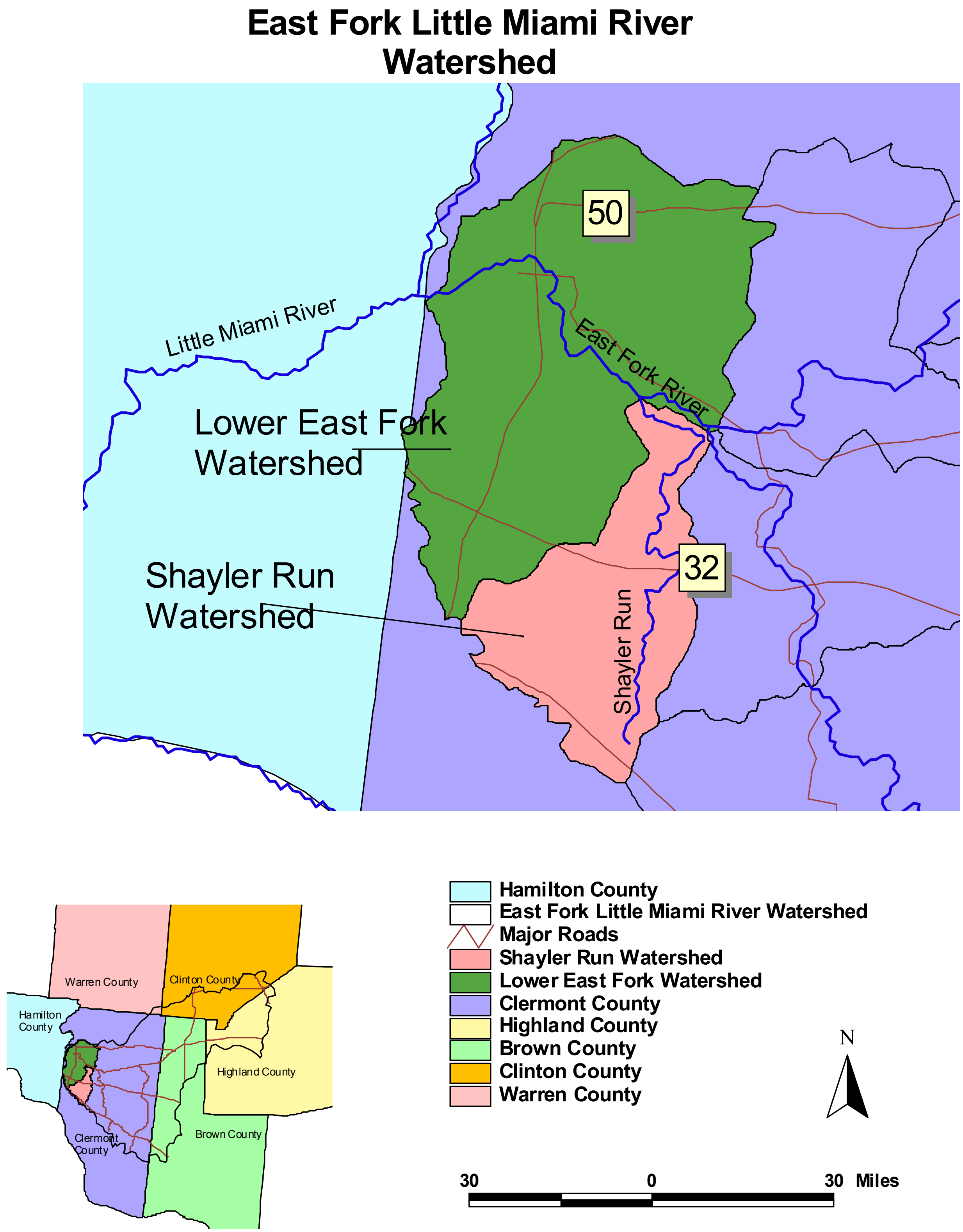


Figure 1: Location of Lower East Fork and Shayler Run watersheds in relation to Little Miami River. Inset shows location of watersheds within East Fork basin.

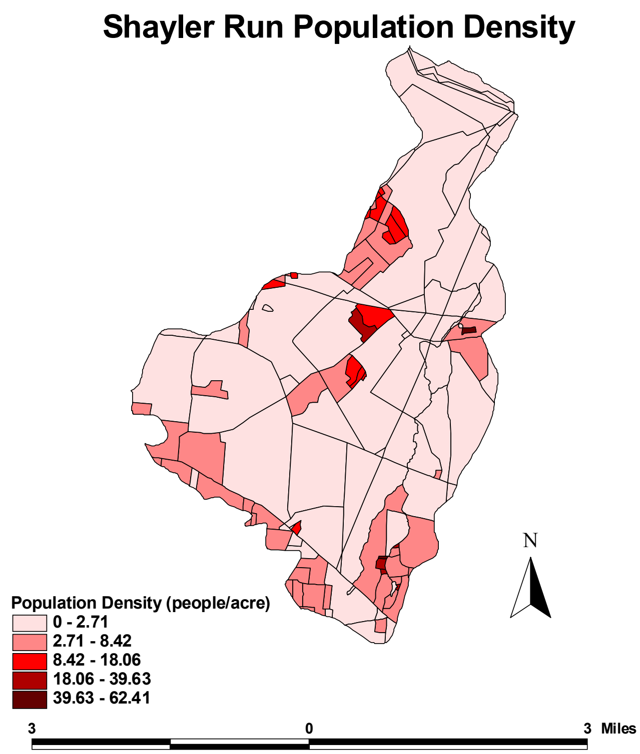


Figure 2: Population density within Shayler Run watershed for the year 2000.

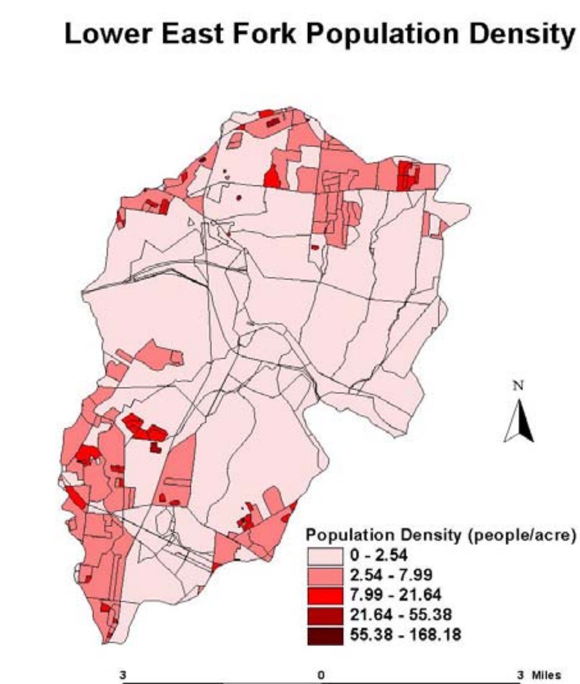


Figure 3: Population density within Lower East Fork watershed for the year 2000.

acre. The Eastgate area in Union Township, located at the western edge of the watershed, is also heavily populated, with an average of 5.88 people per acre. The average population density for the Lower East Fork sub-watershed is 5.26 people per acre (Figure 3).

Comparisons of the 1990 and 2000 census indicate a ten percent increase in population. This increase in population is expected to continue. For example, a recent extension of Bach-Buxton Road from Clough Pike to State Route 32 has provided access to an undeveloped section near the center of the watershed, as has the construction of a new interchange at State Route 32 and Olive Branch-Stonelick Road.

Clermont County Watershed Management Program

In 1995, Clermont County completed a Wastewater Master Plan that proposed a strategy to effectively treat wastewater throughout the County. As the County developed the plan, it quickly became evident that this alone would not protect the water quality of Clermont's streams and lakes. A number of other potential pollutant sources needed to be addressed if stream quality was to be protected. A comprehensive water resources management approach was needed. Soon after the development of the Wastewater Master Plan, the County initiated a watershed management process to better characterize water quality conditions, implement control measures to protect and improve water quality, and plan for future growth while preserving Clermont's natural character and environment.

In 1996, the Clermont County Office of Environmental Quality initiated a comprehensive monitoring program to characterize stream conditions throughout the East Fork watershed. Since the inception of the program, OEQ has:

- assessed the physical conditions of stream channels,
- conducted annual biological surveys to evaluate the fish and macroinvertebrate communities and their habitat,
- conducted annual water quality sampling to monitor concentrations of various pollutants,

- established five autosampling stations to continuously monitor conditions and collect samples during and after periods of rain.

In 2000, Clermont Count partnered with the Clermont Soil and Water Conservation District (SWCD), as well as the SWCDs in Brown, Clinton and Highland Counties, to participate in the Ohio Department of Natural Resources Watershed Planning Program. A grant was received to fund a Watershed Coordinator for the East Fork Little Miami River Watershed. The primary responsibilities of the coordinator are to assist in establishing a stakeholders group to be involved in the watershed planning process (see East Fork Watershed Collaborative, Chapter 2), and to guide the development of watershed action plans for the East Fork.

CHAPTER 2: WATERSHED PLAN DEVELOPMENT

East Fork Watershed Coordinator

Through a grant received from the Ohio Department of Natural Resources, the Clermont County Soil and Water Conservation District was able to hire a Watershed Coordinator for the East Fork Little Miami River in December 2000. The Watershed Coordinator's position is supplemented with funding from the Clermont County Commissioners, as well as the Soil and Water Conservation Districts from Brown, Clinton and Highland Counties. Jay Dorsey currently serves as the East Fork Watershed Coordinator. Anyone wishing to receive more information about this plan or the East Fork watershed in general can contact Jay at (513) 732-7075, or by e-mail at jay-dorsey@oh.nacdnet.org.

East Fork Watershed Collaborative

One of the Watershed Coordinator's first duties was to establish an organization that would allow local agencies, groups and individuals the opportunity to plan and implement stream improvement projects throughout the watershed, especially those in the upper portions of the watershed outside of Clermont County. The result of this effort was the formation of the East Fork Watershed Collaborative, an organization consisting of representatives from the four counties (Brown, Clermont, Clinton and Highland Counties) within the East Fork Little Miami River watershed. The Collaborative's mission is to protect and enhance the biological, chemical and physical integrity of the East Fork Little Miami River and its tributaries. Through this organization, local agencies, groups and individuals will help plan and implement stream improvement projects throughout the watershed.

Currently, the Collaborative is still an informal organization. No application has been made for legal non-profit status, and operational procedures or bylaws have not been developed. The structure of the EFWC consists of four County Teams and an Executive Board. The EFWC Executive Board has nine members. Four of the members are directly appointed by the Board of Commissioners for Brown, Clermont, Clinton and Highland Counties. Four additional members (one per county) are selected by the County Teams. The ninth member of the Executive Board is the Administrator of the Clermont SWCD, the direct supervisor of the Watershed Coordinator. The Executive Board is responsible for providing direction to both the Watershed Coordinator and the County Teams, making decisions that affect the scope and direction of the Watershed Action Plan, and presenting the management plans to State and local leadership for formal adoption. The Board formally meets at least twice a year. Additional meetings and/or conference calls will be held as needed (e.g., to discuss/review grant applications).

County Team members include representatives from key organizations and interests in each county, including county offices, townships and municipalities, Health Districts, Soil and Water Conservation Districts, point source dischargers, and the development and agricultural communities. The County Teams are responsible for guiding the development and the implementation of the Watershed Action Plan in their respective subwatersheds, and working to inform and involve the public in the management process. The County Teams meet at least once annually to review the progress of Watershed Action Plan implementation, and to provide direction to the Watershed Coordinator.

The Clermont County Team met on several occasions throughout 2002. Members on the Clermont County team include representatives from the following agencies and organizations:

- Clermont Soil & Water Conservation District,
- the General Health District,
- the County Engineer's Office,
- several county-level departments under the County Board of Commissioners, including the Office of Environmental Quality, the Water and Sewer District, the Planning Department and the Building Inspections Department,
- Clermont County Park District,
- Batavia, Miami and Union Townships, and
- Ohio State University Extension, Clermont County Office

In addition, numerous comments and suggestions were received from the public during two public meetings hosted by the Collaborative in the Shayler Run and Lower East Fork watersheds. The County Team and public stakeholder team meetings focused on building the resource inventory for the two watersheds, reviewing water quality information and sources of impairment, and discussing potential management strategies. Information about these meetings is provided in Appendix 1. The end result of these meetings was the development of this Watershed Action Plan.

The watershed planning process and the County Team meetings have led to an improvement in communications and cooperation across county offices and among the County, municipalities and townships. An example of this cooperation can be seen in the partnership formed among the County's Office of Environmental Quality (OEQ), Water and Sewer District and Health Department to draft and submit a Section 319 grant proposal in April 2003. The proposed project would utilize grant funds and the expertise of the various departments to restore segments of Hall Run, and to improve the performance of on-site wastewater treatment systems in the watershed. Another example can be seen with OEQ and the County's Department of Planning and Economic Development, which are working together to plan a low impact development workshop in early 2004. Additionally, years of effort by Clermont County to involve stakeholders in the planning process has resulted in a close relationship with the cities, villages and townships within the County. By establishing this relationship, the County was able to work with local municipalities and townships to develop a Stormwater Management Plan and jointly apply for a Phase II stormwater permit. It is fully expected that cooperation and communication among these groups will continue to improve through regular meetings of public stakeholders and East Fork Watershed Collaborative advisory groups.

East Fork Watershed Planning Process

The East Fork Watershed Collaborative (EFWC) has accepted the responsibility for developing a watershed action plan (WAP) for the entire East Fork Little Miami River watershed. Due to the size of the East Fork watershed (500 mi^2 or almost 320,000 acres), and the variability in land use and stream conditions in various parts of the East Fork watershed, the EFWC made a decision to divide the overall watershed into smaller (i.e., more manageable) subwatersheds for the purpose of planning. The subwatersheds selected as planning units are the Lower East Fork watershed, the Middle East Fork watershed, the Stonelick Creek watershed, the East Fork Lake Tributaries, and the East Fork Headwaters (see Figure 4).

Subwatershed plans will focus on concerns unique to each subwatershed, providing a detailed description of subwatershed characteristics and stream conditions (including causes and sources of impairments), and specific recommendations on how those impairments might be addressed. The Lower East Fork is addressed in this watershed plan. The EFWC is currently developing, and expecting to complete by summer 2004, watershed plans for the East Fork Headwaters and Lake Tributaries subwatersheds. Upon completion of those plans, the EFWC will focus on developing watershed plans for the Stonelick Creek and Middle East Fork subwatersheds. We expect to complete the last two subwatershed plans in early 2005. Our final Watershed Action Plan for the East Fork Little Miami River will integrate the five subwatershed plans into a coherent whole, highlighting the connections and differences among the subwatersheds.

Lower East Fork Watershed Action Plan

This document represents the action plan for the Lower East Fork watershed, which consists of the entire East Fork drainage area downstream of Stonelick Creek. This plan contains the following sections:

1. a watershed inventory, focusing on geology, biological features, water resources, land use, demographics, wastewater treatment and alterations to natural habitat;
2. a summary of existing water resource quality in the Lower East Fork and its tributaries;
3. a discussion of watershed impairments, including an identification and quantification of potential pollutant sources, and recommended watershed restoration and protection goals.

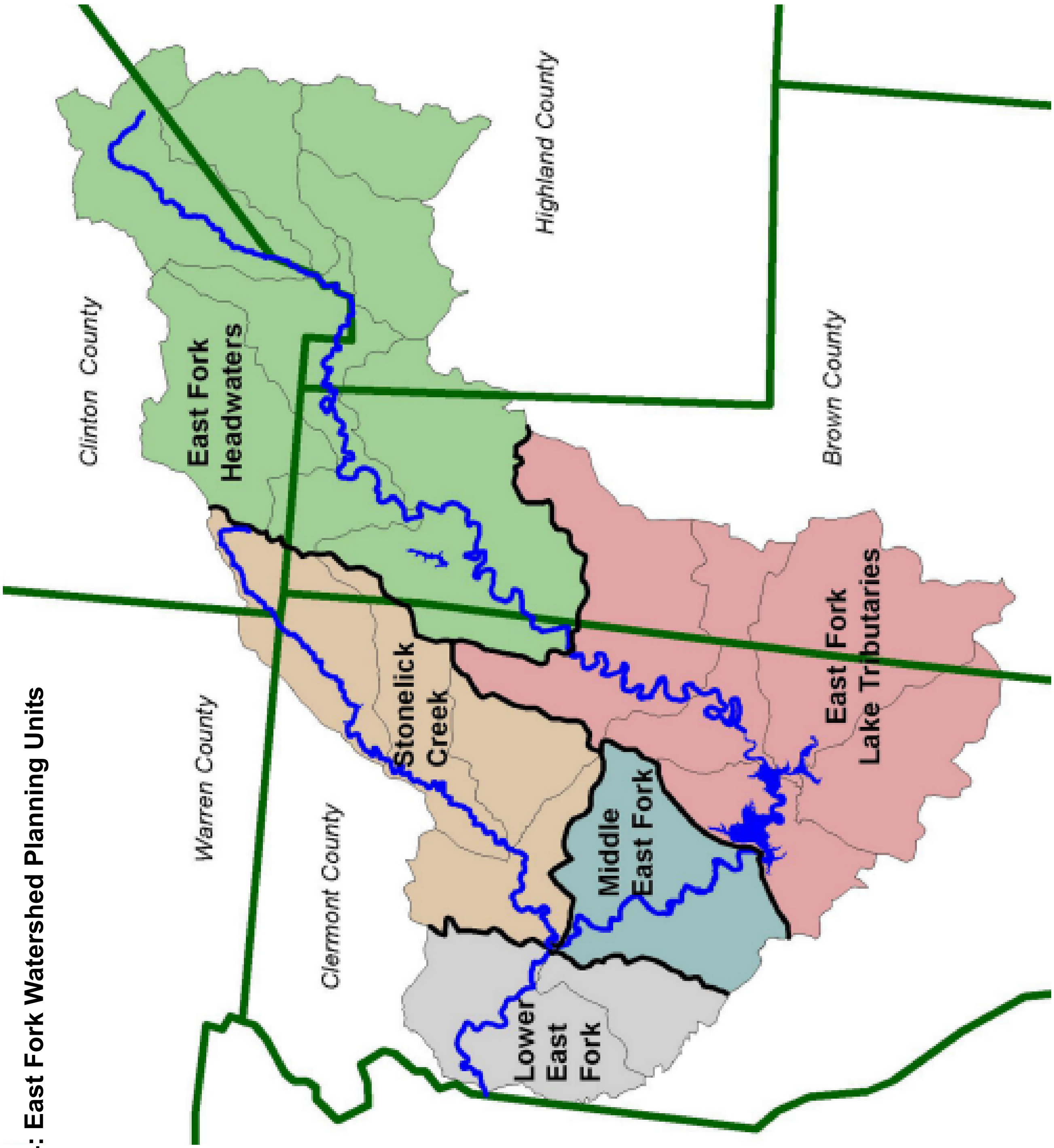


Figure 4: East Fork Watershed Planning Units

Public Involvement

Clermont County has long placed an emphasis on involving the public in the watershed planning process. In 1998, the Office of Environmental Quality began hosting public stakeholder meetings at various locations in the East Fork watershed. Early meetings focused on the basics of stream quality and watershed protection. Information on why water quality is important, both in terms of economics and quality of life, were presented at these meetings. As participants at these meetings began to build an understanding of water quality and watershed management issues, the issues presented became more specific and complex. Eventually, the regular public stakeholder meetings held by OEQ became the basis for establishing the East Fork Watershed Collaborative.

As described above, the structure of the EFWC consists of four County Teams, in addition to the Executive Board. The Clermont County Team was responsible for developing the initial set of management strategies for the Lower East Fork watershed. At the County Team meetings, a draft report summarizing the water quality conditions and potential sources of impairment in the watershed were presented by the Watershed Coordinator and Clermont County OEQ to representatives of various county, municipal and township departments and organizations (see Appendix 1 for details). After reviewing this information, County Team members worked together to develop different management strategies for a range of pollutant source categories, including point source discharges, urban stormwater runoff, on-site wastewater treatment systems, agricultural runoff, habitat/hydromodification and others.

The draft recommendations developed by the County Team were then presented to the public at separate stakeholder meetings in the Shayler Run and Lower East Fork subwatersheds. A significant effort was made to involve those individuals that had been active participants in past stakeholder meetings, as well as landowners with property along streams in the Lower East Fork watershed (identified through Clermont County's GIS database). Those attending the two stakeholder meetings were asked to rank the importance of proposed management strategies on a scale of 1 to 5, as well as to voice or submit additional ideas. Members of the County Team used information compiled at these meetings to draft the final list of management strategies.

The County Team will continue to be directly involved in implementing and revising the plan, and public meetings will continue to be held to update community members on plan implementation and to receive feedback from watershed residents. The action plan, as well as a wide range of educational materials, will be made available on both the Office of Environmental Quality's web site (www.oeq.net), and the East Fork watershed page on the Little Miami River Partnership's web site (http://www.littlemiamiriver.org/eastfork.html).

Copies of the plan have been made available to local elected officials; however, no formal action has been taken. Once the Watershed Action Plan has been fully endorsed by Ohio EPA and Ohio DNR, the Collaborative will present the action plan to the County Board of Commissioners, Milford's City Council, and the Miami, Union and Batavia Township trustees during open public sessions. After each presentation, the appropriate Board or Council will either formally endorse the plan or make recommendations for change.

Implementation and Evaluation

The implementation of any watershed plan requires the cooperation of landowners, local governments, local businesses and other stakeholders. The East Fork Watershed Collaborative continues to seek partners in implementing practices and programs that will improve water quality in the Lower East Fork and its tributaries. Many such activities are described in this document; however, the Collaborative will revisit this document with our project partners on an annual basis to measure progress toward our goals, to review whether our goals and priorities are still appropriate, to solicit additional resources, and to direct available resources where they are most needed.

CHAPTER 3: WATERSHED INVENTORY

Geology

Watershed geology is an extremely important factor when considering water quality concerns. The erodability of bedrock material and overlying soils are primary natural factors governing the shape and slope of the stream bed, and ultimately the volume and velocity of water running through the channel. Alterations to upstream areas can lead to increased runoff, which ultimately causes increased water velocity and streambank erosion, as well as property loss or damage. Understanding the geology of the watershed can lead to insight into current or potential water quality concerns.

The geology of this section of the watershed is primarily interbedded shale and limestone of Ordovician age (450 million years) overlain by glacial cover, consisting mainly of clay. The clay layer is situated above the bedrock but below the soil often creating an impermeable cap preventing infiltration. Furthermore, clay is more erodible and less stable than limestone, and areas where the clay to limestone ratio is high will experience greater streambank erosion.

Along the East Fork, the valley floors range from one-half to three-fourths of a mile in width, except at the confluence with the Little Miami River south of Milford, where the valley is two miles wide. The tributary valleys, little more than wide enough to accommodate the streambed and having steep slopes on both sides.

In addition to the composition of the bedrock and glacial cover, elevation also has an impact on runoff and erosion rates. Intuitively, steeper topography yields faster streams and increased erosion. The steepness of the surrounding terrain can increase the potential for surface runoff to carry more eroded soils to water bodies. Maps depicting soil slope for both the Shayler Run and Lower East Fork subwatersheds are shown in Figures 5 and 6, respectively. Additionally, increased stream velocity caused by steep stream channels can increase streambank erosion. This section of the watershed reaches a maximum elevation of 935 feet in the headwaters and drops to 492 feet at the confluence of the East Fork River with the Little Miami River. Furthermore, the main stem of the East Fork drops 49 feet from Shayler Run to the mouth.

Soils

Soil plays an extremely important role in watershed management as certain soil types are prone to more frequent flooding and erosion, affecting pollution runoff rates and sedimentation. An understanding of soil types will lead to more effective land use management. The following paragraphs will provide a summary of soil characteristics in both the Shayler Run and the Lower East Fork subwatersheds.

The United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) identifies 45 different soil types in the Shayler Run watershed, which have been grouped into 21 soil series. In the Lower East Fork, 23 separate soil series are present. Maps illustrating the distribution of soil series types within the Shayler Run and Lower East Fork watersheds can be seen in Figures 7 and 8, respectively.

Tables 1 and 2 describe the most common soil series in each subwatershed, and provide information on the permeability, drainage and runoff characteristics of each. In both subwatersheds, Rossmoyne and Cincinnati soils are common, together comprising nearly half the soils in each. The 2002 Clermont County Soil Survey characterizes the Rossmoyne-Cincinnati Association as “mostly gently sloping to sloping soils on rather broad ridgetops and hillsides of uplands.” These soils are typically found in areas adjacent to major streams and on the wider ridgetops between streams. Rossmoyne and Cincinnati soils formed in as much as 40 inches of windblown silty material (loess) that overlies limy clay loam glacial till. Rossmoyne soils are moderately well drained, and Cincinnati soils are well drained. Both soils have a compact, brittle layer (fragipan) in the subsoil that impedes root penetration and percolation of water. A moderate to severe erosion hazard in sloping areas is the dominant limitation to use of Rossmoyne and Cincinnati soils (see Figures 5 and 6). In addition, ponding water resulting from the slow permeability of Rossmoyne soils can create a need for artificial drainage in places. Because Rossmoyne

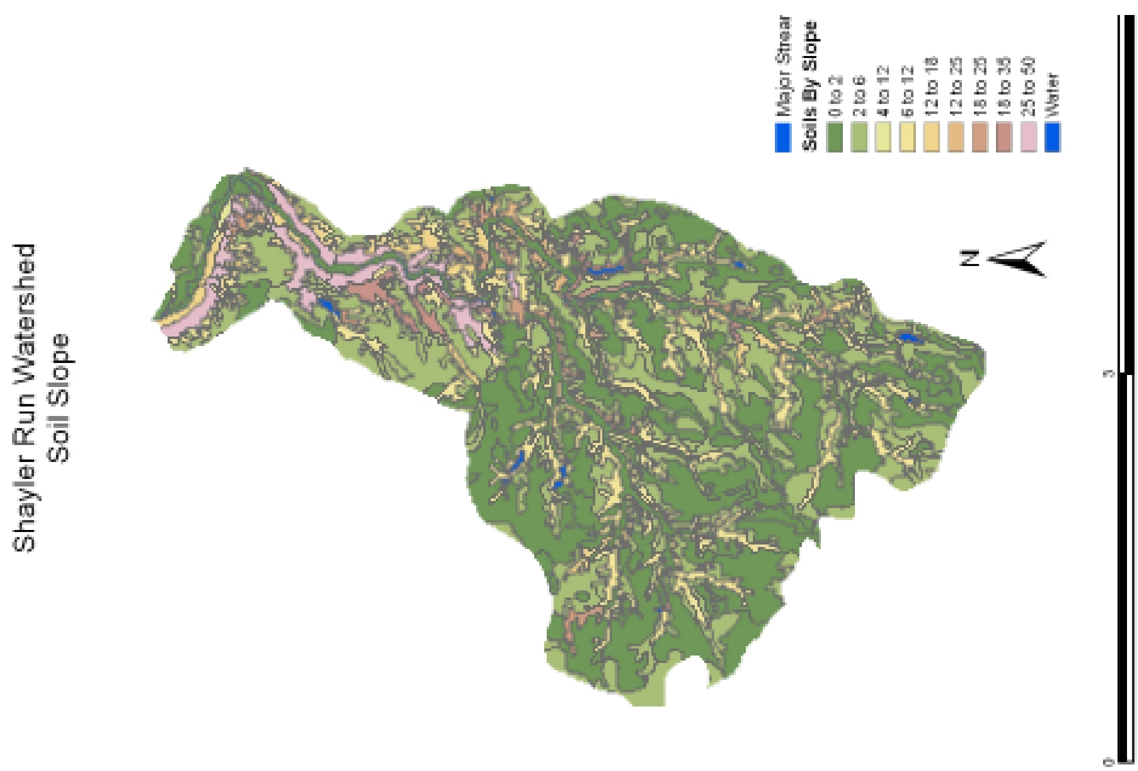


Figure 5: Soil slopes within the Shayler Run subwatershed.

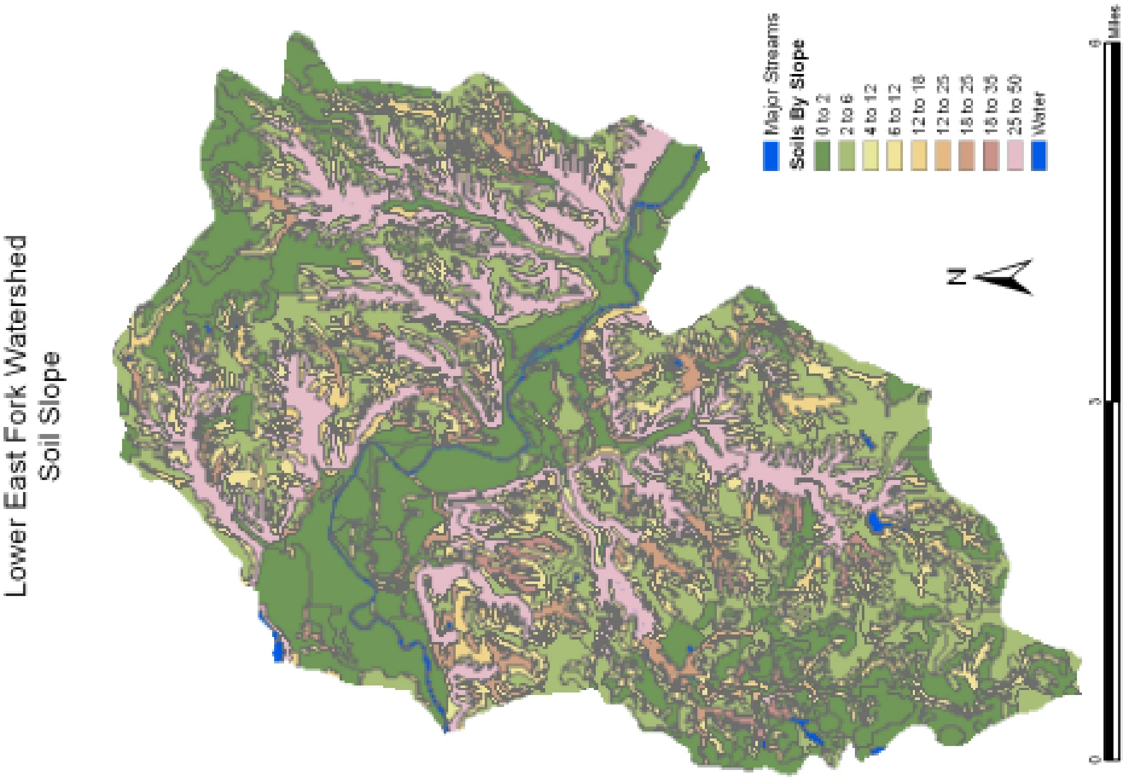


Figure 6: Soil slopes within the Lower East Fork subwatershed.

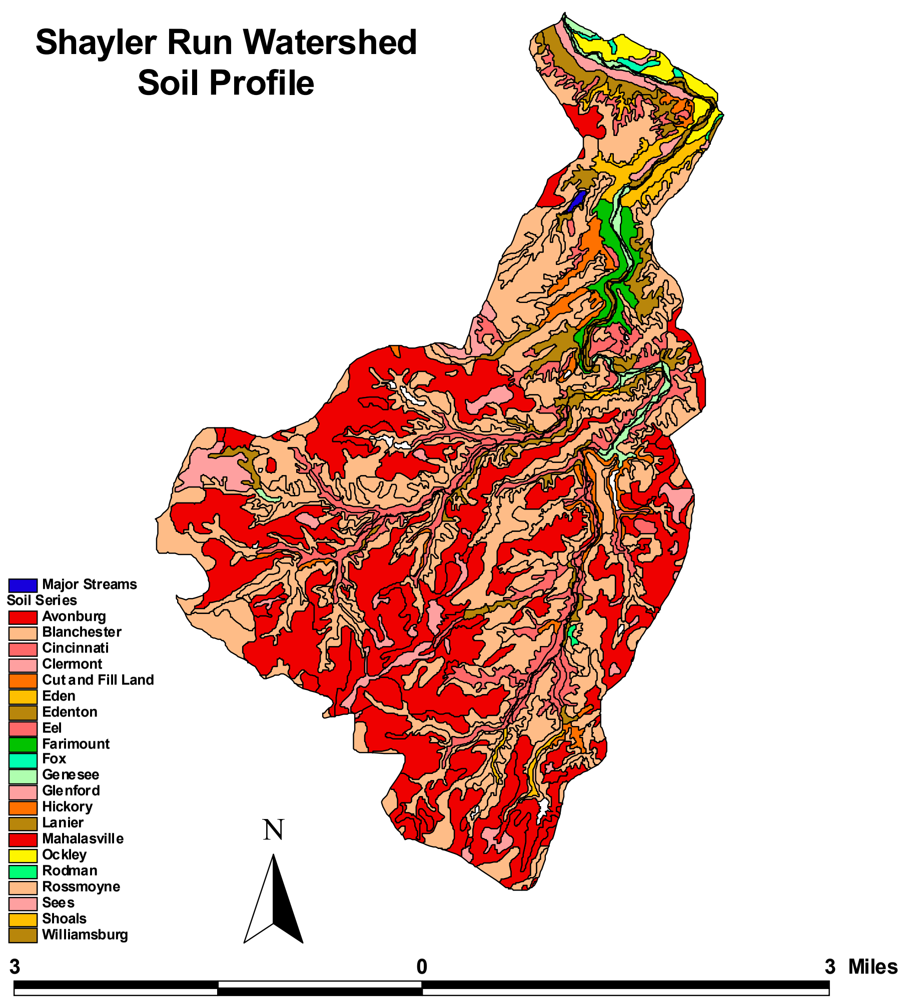


Figure 7: Distribution of soil types within the Shayler Run subwatershed.

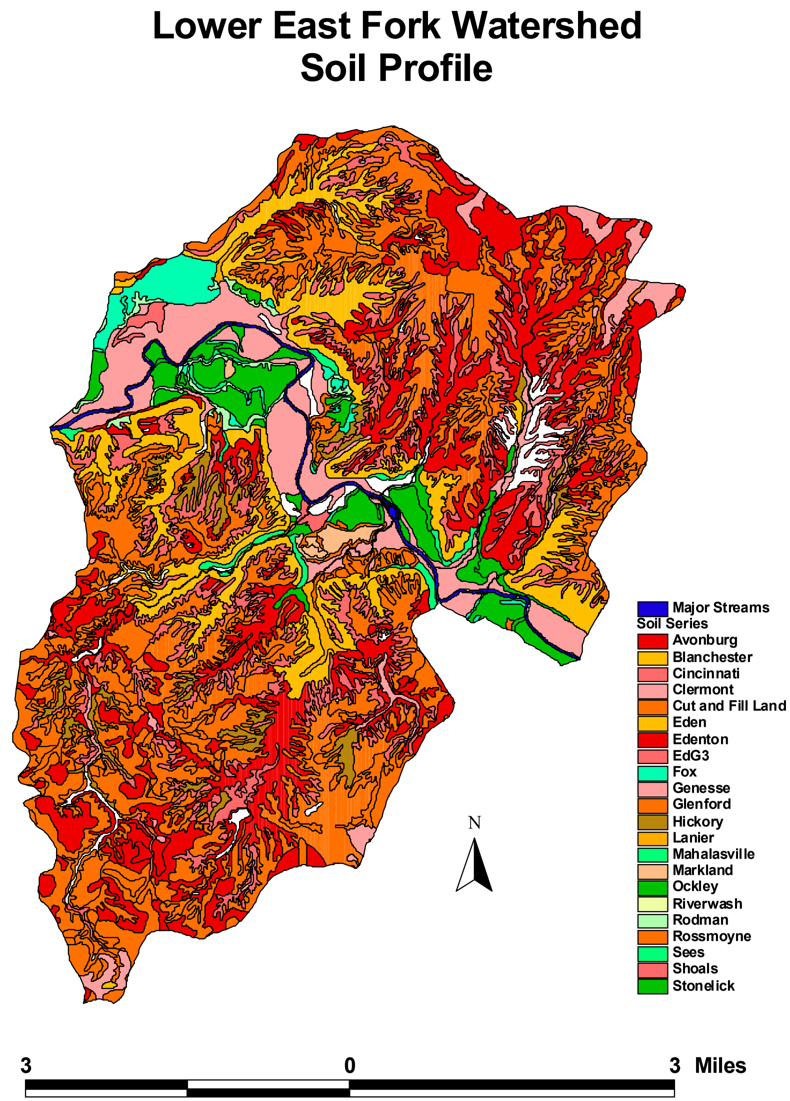


Figure 8: Distribution of soils within the Lower East Fork subwatershed.

and Cincinnati soils are silty, these soils are particularly susceptible to erosion where cultivated. If adequate erosion control and improved soil fertility and management practices are used, these soils have a moderate productivity potential for farming. Slow permeability because of the fragipan layer, however, severely limits their use for septic system leach fields.

Other common soil types in the two subwatersheds include those belonging to the Avonburg and Clermont soil series. The Avonburg-Clermont Association consists of nearly level soils on broad flats and gently sloping soils on uplands. Avonburg soils are much more common in the Shayler Run sub-watershed, which has broader flats than the Lower East Fork subwatershed.

To find out more about soils in this watershed and throughout Clermont County, check out the *Soil Survey of Clermont County, Ohio*, which can be downloaded from the Clermont County Soil and Water Conservation District's web site (http://home.fuse.net/soil_water/).

Avonburg are somewhat poorly drained, and Clermont soils are poorly drained. Poor soil drainage as a result of very slow or slow permeability, ponding, surface water, and slow runoff are the main limitations to use of Avonburg and Clermont soils. Similar to Rossmoyne and Cincinnati soils, these soils are silty, and despite the relatively level topography, are highly susceptible to sheet erosion and gullying where cultivated. If improved soil fertility and management practices that include artificial drainage and erosion control measures are used where needed, Avonburg and Clermont soils can be moderately productive for farming. Because of very slow permeability and other soil characteristics, subsurface drains generally do not function effectively on Avonburg and Clermont soils. Surface drains are, therefore, more commonly used to remove excess water from these soils. Even when drained, these soils are slow to dry out and warm up in the spring.

Edenton soils are much more common in the Lower East Fork subwatershed than in the Shayler Run watershed. Edenton and Eden soils are found in areas with steep slopes, usually along valley walls. Both have bedrock at a depth of two or three feet. Because of the steep slopes, runoff from Edenton soils tends to be very rapid, and the soils are usually well drained. Even so, the permeability can be moderately low. The erosion hazard is moderate to severe where these soils are not protected by a vegetative cover. The above characteristics pose significant limitations for farming and septic system leach fields.

Table 1: Characteristics of soil series within the Lower East Fork subwatershed.

Soil Series	Permeability	Drainage	Runoff	Seasonal High Watertable (Feet)	Topography	% Soil Type in Watershed
Avonburg Silt loam (AvA, AvB, AvB2, AwA)	Very slow	Somewhat poorly drained	Slow to medium	1/2 - 1 1/2	Nearly level to gently sloping	18%
Cincinnati Silt loam (CcB, CcB2, CcC2, CcD2, CkD3)	Moderately slow	Well drained	Medium to rapid	>3	Gently sloping	7%
Eden **Clay Loam (EaD2, EaE3, EaF2)**	Slow	Well drained	Rapid	>3	Moderately steep to very steep	10.6%
Edenton Loam (EbC2, EbD2, EbE2, EbG2, EcE3, EbG3),	Moderately slow	Well drained	Rapid to very rapid	>3	Sloping to very steep	11%
Genesee **Silt Loam (Gn)**	Moderately slow to moderate	Well drained	Slow	>3	Nearly Level	7.4%
Rossmoyne Silt loam (RpB, RpB2, RpC2, RpA, RsC3, RtB), RtC	Slow	Moderately well drained	Medium to rapid	1 1/2 - 2 1/2	Nearly level to sloping	26%

** Note: The remaining 15.7% consists of soil series representing less than five percent of all soils.*

Table 2: Characteristics of soil series within the Shayler Run subwatershed.

Soil Series	Permeability	Drainage	Runoff	Seasonal High Watertable (Feet)	Topography	% Soil Type in Watershed
Avonburg Silt loam (AvA, AvB, AvB2, AwA)	Very slow	Somewhat poorly drained	Slow to medium	1/2 - 1 1/2	Nearly level to gently sloping	39.6%
Cincinnati Silt loam (CcB, CcB2, CcC2, CcD2, CkD3)	Moderately slow	Well drained	Medium to rapid	>3	Gently sloping	2.2%
Clermont Silt loam (Ct)	Very slow	Poorly drained	Slow	0 - 1/2	Nearly level	2.5%
Edenton Loam (EbC2, EbD2, EbE2, EbG2, EcE3, EbG3),	Moderately slow	Well drained	Rapid to very rapid	>3	Sloping to very steep	1.8%
Rossmoyne Silt loam (RpB, RpB2, RpC2, RpA, RtB)	Slow	Moderately well drained	Medium to rapid	1 1/2 - 2 1/2	Nearly level to sloping	47.4%

**note: The remaining 6.5% of the soil types are reduced to soils of less than or equal to 1.5% each.*

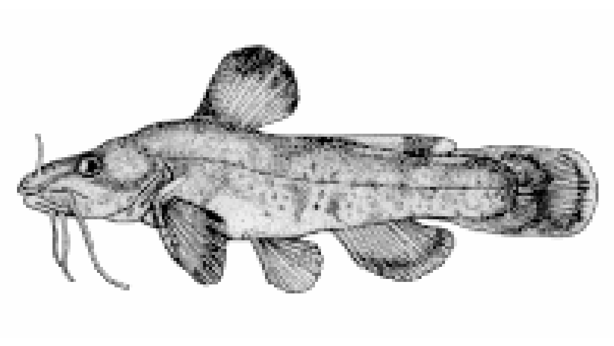
Biological Features

The Ohio Department of Natural Resources, Division of Natural Areas and Preserves maintains a list of endangered species in the State of Ohio, including endangered species of fish and macroinvertebrates.

Within the Lower East Fork watershed, both Ohio EPA and Clermont County fish surveys show the presence of the endangered mountain madtom (*Noturus eleutherus*) in the East Fork as recently as 1999, mostly around the Perintown area (river mile 6.6). In 1998, Ohio EPA surveys also found the northern madtom (*Noturus stigmosus*) present at Perintown and at sites downstream.

Ohio EPA and Clermont surveys have not shown any endangered macroinvertebrates; however, a 1992 study of mollusks in the Little Miami River basin (Hoggarth, 1992) revealed the presence of two endangered mollusk species in the East Fork watershed – the "rayed bean" (*Villosa fabalis*) and the "little spectaclecase" (*Villosa lienosa*); and one threatened mollusk – the "fawnfoot" (*Truncilla donaciformis*).

According to Dr. David Russell, a Miami University ornithologist who has conducted numerous bird surveys in Clermont County, several endangered birds have been identified in the Lower East Fork watershed (primarily at the Cincinnati Nature Center); however, these individuals typically just over-winter in the area or are passing through as part of their migratory journey. No nesting pairs have been identified. These species include the Northern harrier (*Circus cyaneus*), sandhill crane (*Grus canadensis*), common tern



Northern Madtom (*N. stigmosus*)

Rayed Bean (*V. fabalis*)

(*Sterna hirundo*), black tern (*Chlidonias niger*), yellow-bellied sapsucker (Sphyrapicus varius), and golden-winged warbler (Vermivora chrysoptera).

At this time, the Collaborative has not been able to compile information on endangered mammals, reptiles, amphibians or plants within the Lower East Fork watershed. The Collaborative will continue to work toward obtaining this information, and hopes to have some data by the end of 2003.

Climate and Precipitation

The entire East Fork watershed has a temperate climate characterized by well-defined winter and summer seasons. In winter, the average temperature is 31.6 degrees F and the average daily minimum temperature is 21.9 degrees (data taken from climate station at Meldahl Lock & Dam in southeastern Clermont County). Historically, the coldest month is January, which has an average daily temperature of 28.8 degrees F. The lowest temperature on record – minus 22 degrees F - occurred on January 19, 1994. The average seasonal snowfall is around 18 inches. Around 20 days per year have at least one inch of snow on the ground. In summer, the average temperature is 73.3 degrees F and the average daily maximum temperature is 85.0 degrees. The warmest month is July, with an average daily temperature of 75 degrees. The highest temperature recorded (August 22, 1983) was 107 degrees.

The average annual total precipitation ranges from 40-43 inches, generally increasing from north to south. Of this, about 60 percent usually falls in April through October. The heaviest 1-day rainfall during the period of record was 7.20 inches at Meldahl Lock & Dam on March 2, 1997. Thunderstorms occur about 42 days each year on average, and most occur between May and August. The months with the least amount of precipitation are January, February and October, all with average monthly totals of less than 3.0 inches. The wettest months, on average, are March, May and July, each with average monthly precipitation amounts greater than 4.0 inches. Before June, rainfall events are typically more widespread, caused by frontal systems moving through the area. In the hotter months of July, August and the beginning of September, rainfall is more spotty in coverage, as convective, "pop-up" thunderstorms in the afternoon are common.

Surface Water

As mentioned in the Introduction, the Lower East Fork watershed is defined as the land area that drains to the East Fork Little Miami River from a point downstream of Stonelick Creek to the confluence with the Little Miami River (see Figure 1). It consists of two 14-digit Hydrologic Unit Codes (HUCs), as defined by the U.S. Geological Survey - the Lower East Fork HUC (No. 05090202130060) and the Shayler Run HUC (No. 05090202130050). The drainage area of the two HUCs is 42.4 square miles; however, the drainage area of the East Fork at its confluence with the Little Miami River is approximately 500 square miles.

The main stem of the East Fork extends 8.8 miles from Stonelick Creek to where it joins the Little Miami River south of Milford. Ohio EPA has classified this stretch of river as "Exceptional Warmwater Habitat." It is also designated for "Primary Contact Recreation" by the State. Major tributaries include Shayler Run, Hall Run, Salt Run, Sugarcamp Run and Wolfpen Run.

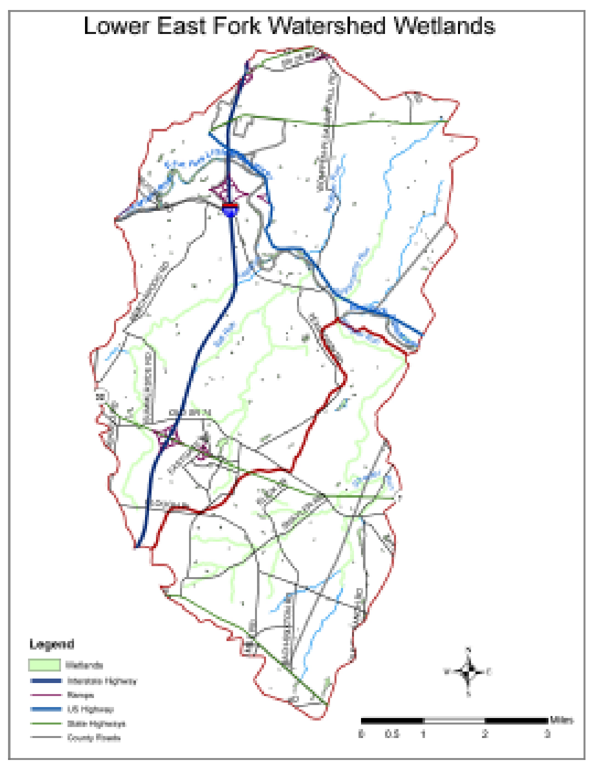


Figure 9: Location of wetlands in Lower East Fork watershed.

Each of these has received "Warmwater Habitat" and "Primary Contact Recreation" use designations.

The U.S. Geological Survey maintains a stream gauge on the East Fork at Perintown (river mile 6.4). The drainage area at this point is 476 square miles. The mean flow at Perintown, based on 78 years of data, is 1073 cubic feet per second (cfs). The lowest flow ever recorded at this site is 36 cfs, while the greatest flow recorded was 7,460 cfs. Both occurred before the construction of the Lake Harsha Dam, which has regulated flow in the East Fork since 1977.

There are no major lakes in the Lower East Fork watershed, though flow in the East Fork main stem is strongly affected by the regulated discharge from Lake Harsha upstream. There are a number of smaller man-made lakes/ponds, most significant of which are Lake Allyn and Arrowhead Lake, both in the Shayler Run subwatershed. Most of the identified wetlands within the Lower East Fork watershed are small and isolated. A map based on National Wetlands Inventory data is shown in Figure 9.

Ground Water

The majority of aquifers in the Lower East Fork and throughout Clermont County are poor sources of ground water. The bedrock consists of interbedded plastic shales and thin limestone layers and seldom yields more than three gallons per minute. The glacial cover ranges from 20 to 50 feet thick and is mainly clay. The valley fill aquifer along the lower East Fork contains sand and gravel deposits of limited thickness and extent. Yields in this aquifer can range between 10 to 20 gallons per minute.

There are no public ground water supplies in the Lower East Fork subwatershed. Rather, drinking water comes from Lake Harsha, from well fields adjacent to the Ohio River, or from well fields adjacent to the Little Miami River near Milford. The protection area for the City of Milford water supply wells may extend into the Lower East Fork subwatershed. We are awaiting definitive Source Water Assessment and Protection (see sidebar) information from Ohio EPA.

Land Use

Land use is a dominant factor in determining the overall condition of a watershed. The following sections present a summary of land use in the Lower East Watershed based on 1992 statistics from the National Land Use database (see following page for explanantion). The Lower East Fork is the most heavily populated of all the East Fork watersheds, with associated commercial and urban development. Much of this development is expanding eastward from the Cincinnati area.

Source Water Assessment and Protection Program

The Source Water Assessment and Protection (SWAP) Program aims to protect Ohio's streams, rivers, lakes, reservoirs, and ground waters used for public drinking water from future contamination. The 1996 amendments to the Safe Drinking Water Act require every state to develop and submit a SWAP Program to the U.S. EPA and to complete a drinking water source assessment of every public water system. Specifically, the amendments require three steps to be taken for each public water system:

- Delineate the area to be protected, based on the area that supplies water to the well or surface water intake;
- Inventory potential significant contaminant sources within the protection area; and
- Determine the susceptibility of each public water supply to contamination, based on information developed in the first two steps.

Source: http://www.epa.state.oh.us/ddagw/pdu/swap.html

Land Use Data Source

Accurate land use data are necessary to understand the location and distribution of non-point source pollutants and to assess the impacts of impervious surface in the East Fork Watershed. Therefore, we wanted to have information that was recent, detailed, and accurate, and was available for the entire watershed. We assessed three available land cover data sets (described below). We selected the 1992 National Land Cover Data due to significant limitations of the more recent databases.

1997 Land Use and Chemical Application Analysis – OSU Extension and Clermont Soil and Water Conservation District - Although this 1997 Analysis provided high quality information regarding agricultural and forest lands, it provided no information regarding the composition of the non-agricultural lands, a very important part of the landscape in the more rapidly urbanizing portions of the watershed.

Ohio 1994 Land Cover Data – Ohio Department of Natural Resources - The Ohio 1994 Land Cover Data was developed using technology that categorizes land into seven different land cover classifications: Urban, Agriculture, Shrub, Wooded, Water, Non-forested Wetlands, and Barren Land. Because there are so few classifications, a wide array of substantially different land uses are lumped together through this process. As a result, this data set does not differentiate between row crops, pasture, golf courses or grassy parks (all classified as “Agriculture”). Likewise, heavily wooded subdivisions and neighborhoods are categorized as “Wooded” areas rather than “Urban”. There is also no differentiation between highly developed commercial areas and low-density residential areas; both are considered to be “Urban” even though the former is significantly less pervious than the latter.

1992 National Land Cover Data – U.S. Environmental Protection Agency - The 1992 National Land Cover Data is a nationwide data set that utilizes the same LANDSAT Thematic Mapper satellite used to develop the Ohio 1994 Land Cover Data. The 1992 Land Cover Data, however, used a technology capable of classifying land cover into one of fourteen different types: Open Water, Light Urban, Dense Urban, Commercial, Quarry, Transitional, Deciduous Forest, Coniferous Forest, Mixed Forest, Pasture, Row Crops, Urban Grass, Woody Wetland, Herbaceous Wetland.

The 1992 National Land Cover Data provides a better assessment of non-agricultural areas than the 1997 Land Use and Chemical Application Analysis, and a better representation of both agricultural and non-agricultural areas than the Ohio 1994 Land Cover Data. Although the classifications generated by the 1992 National Land Cover Data do contain some of the same errors as the Ohio 1994 Land Cover Data (e.g., the misclassification of highly wooded urban areas, and discerning urban grasslands from pastures), the picture of land use provided by this satellite data is generally the most accurate watershed-wide data set currently available.

Higher amounts of impervious area are associated with commercial, industrial and even residential land uses. Impervious area is that which does not allow the infiltration of rainwater. Typical examples include roofs, road surfaces, parking lots, driveways and sidewalks. Studies have shown that as little as ten percent impervious cover in a watershed can be linked to stream degradation, with degradation becoming more severe as the impervious area increases in size. Watersheds are often classified based on their percent of impervious surfaces. Those with the least amount of impervious area tend to have the highest quality streams; and those with the most amount of impervious area typically have degraded conditions. The Center for Watershed Protection has classified watersheds with impervious cover of less than 10% as sensitive; 10-25% as degraded or impacted; greater than 25% non-supporting of aquatic life.

For purposes of this Watershed Action plan, land use and impervious area information is provided separately for the Lower East Fork and Shayler Run subwatersheds.

Shayler Creek Land Use

Based on 1992 land use statistics from the National Land Use Database, the Shayler Run watershed supports a variety of land uses. The majority of the land (43.1%) is forested (Figure 10). This forestation, however, is primarily segmented with patches of forest limited to areas with higher slopes and/or areas that border streams. Light and dense urban development accounts for 19.7%, while pasture and row crops account for 16.4% and 13.1%, respectively. The remaining portions of the watershed are classified as commercial, urban grass, water, wetlands, and transitional areas, totaling 8.7% . Within the watershed, single-family homes comprise the majority of urban development in Batavia and Union Townships; businesses are the majority of light urban development in Pierce Township. A map illustrating land use within the Shayler Run watershed is shown in Figure 11.

Dense/Light Urban-Residential

Urban and suburban growth is important to the vitality of neighborhoods and towns. It can have beneficial impacts for communities in terms of economics

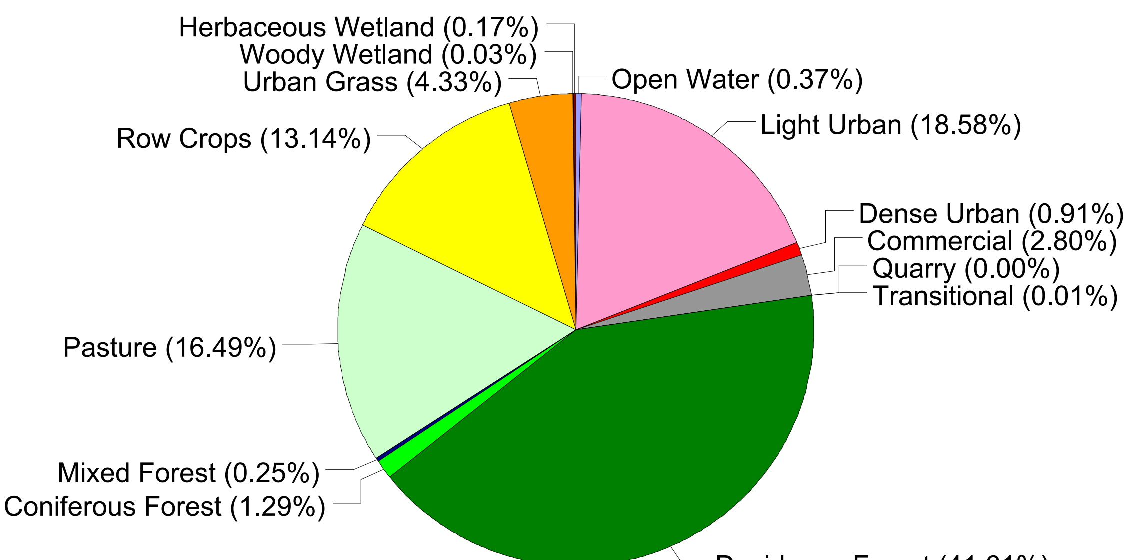


Figure 10: Percent distribution of land use within the Shayler Run subwatershed.

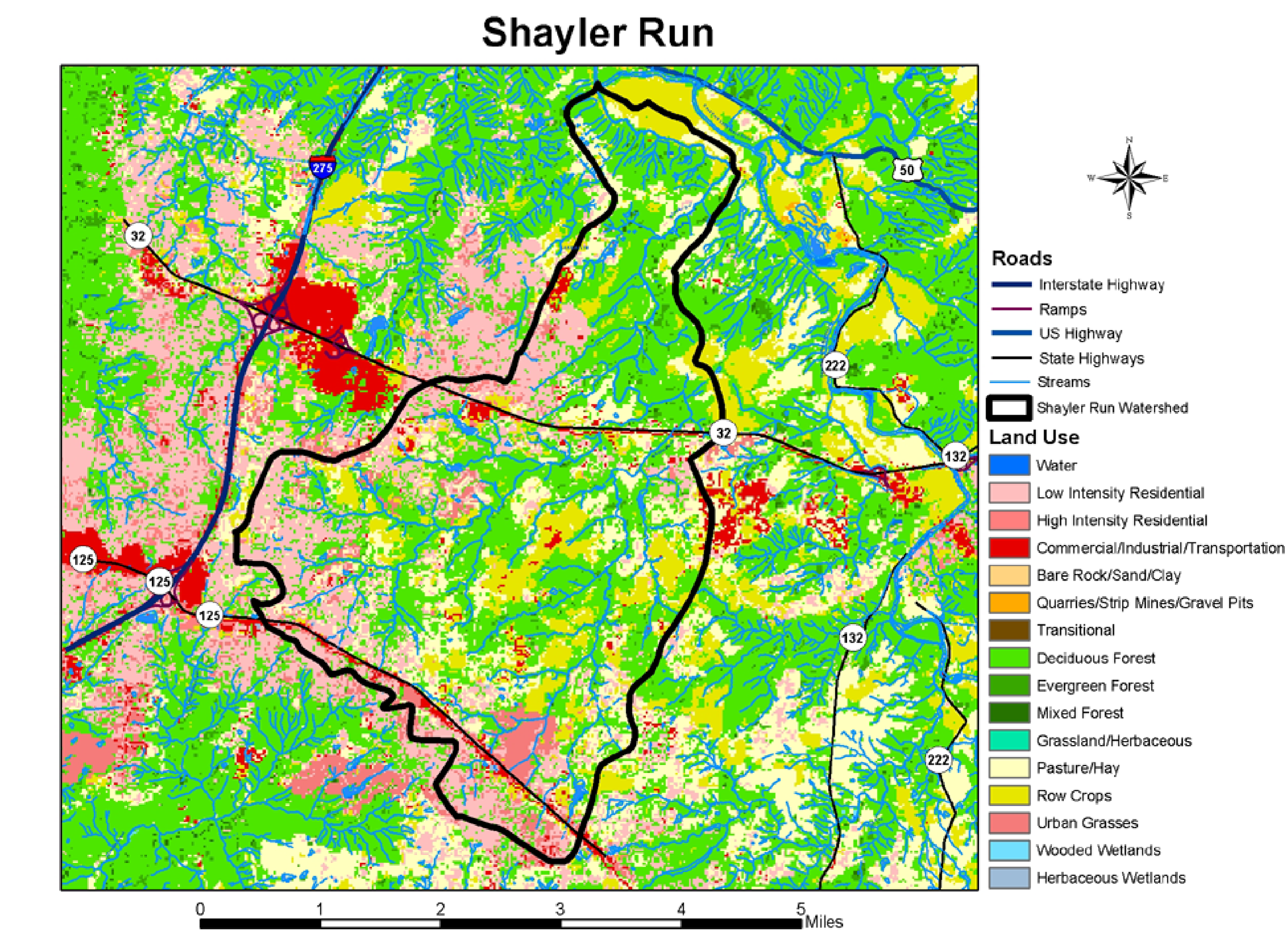


Figure 11: Distribution of land use within the Shayler Run subwatershed. (Data from National Land Use Database, 1992)

and community structure. However, growth and development that occur without environmental planning can be detrimental to stream quality. Urbanization increases the amount of impervious surfaces in the watershed, increases the runoff and pollutant loads, and potentially results in the impairment of streams. In order for a balance to exist between growth and the environment, water quality concerns should be taken into consideration during the planning stages of development.

Based on 2000 census data, residential land use within Shayler Run watershed comprises 1611 acres (19.7%). Recent trends, however, indicate increased development near the headwaters of Shayler Run, located to the south and west within the watershed. Currently, the majority of residential land use within Shayler Run watershed is classified as low density urban, about 1537 acres (95%). Low density implies single-family homes surrounded by some amount of greenspace (lawn). Only 74.7 acres (0.9%) of the watershed are considered dense urban. This type of environment is typically tightly packed apartment buildings and other multifamily dwellings.

Commercial

Located primarily along State Routes 32 and 125, strip construction and restaurants comprise the majority of commerce. Totaling nearly 230 acres (2.8%), the commercial land use is very linear, and does not deviate far from main roads.

Agriculture

Agriculture can also add to the economic health of communities. With the production of crops comes the production of capital and finances. Oftentimes considered to be more environmentally friendly than urban growth, agriculture can also have significant impacts on stream quality. Fertilizers applied by farmers in the early spring before planting may enrich surface waters with nitrogen and phosphorus through runoff and erosion. Certain tillage practices cause erosion of topsoil. Increased sediments can ultimately change the flow and shape of a stream, and alter the habitat of stream biota. Also, phosphorus attaches itself to sediment particles and enters the water body through sedimentation.

Additionally, residues from pesticides applied to crops to control weeds, insects and fungi can enter streams through runoff and soil erosion.

Based on 1992 land use data, more than 1069 acres (13%) are used for agriculture, not including pasture. Of this, forages account for the majority (41%) of production and utilize 438 acres, followed by soybean production (40%) utilizing 430 acres. Corn (17%) and wheat (1%) comprise the remaining agricultural land use of 179 acres and 12 acres respectively.

Pasture

As with any other land use, pasture land has the potential to contribute excess pollutant loadings to rivers, streams and lakes in the absence of adequate management practices. Typical pollutants of concern from pasture areas include suspended sediments, excess nutrients and the organic enrichment of surface waters. The decomposition of animal matter and excreta depletes oxygen supplies in water bodies, which in extreme cases can be depleted to a point at which aquatic life can no longer be sustained. Furthermore, the flushing of animal excreta into the water body can potentially introduce pathogens (bacteria and viruses) into the water supply.

Pasture land accounts for 1347 acres (17%) within the Shayler Run watershed.

Forested

According to the 1992 land use data, deciduous forest comprises 3404 acres (41.5%), the largest land use within Shayler Run watershed. The forested areas, however, are located primarily on steeply sloped areas bordering streams. In addition to deciduous forest, evergreen forest totals 107 acres, (0.3%) and mixed forest totals 21 acres (0.25%).

Forested areas often increase the health of the watershed. Deep root systems help to prevent soil erosion, aiding water infiltration into the soil while preventing excess sediments from entering water bodies. Forested areas along streambanks help to increase the stability of the stream channel by preventing erosion. Riparian forestation also provides shade to streams, which helps maintain desirable water temperatures and dissolved oxygen levels.

Lower East Fork Land Use

Based on 1992 land use data, the Lower East Fork subwatershed is the most heavily populated within the East Fork basin. This is reflected by the most commercial (4.5%) and urban (20%) development (Figure 12). There is a significant portion of land still considered agricultural, of which 10.4 percent is row crops and 12.6 percent is pasture, though this is based on 1992 data, and has decreased over the past 11 years. Most striking is the significant amount of forested area within the watershed. Nearly 50 percent of the watershed is considered forested. However, due to steep terrain, much of this land type is restricted to lands not suited for development or farming (Figure 13).

Residential- Dense/Light Urban

As the most heavily populated subwatershed, the Lower East Fork region has the highest percentage of dense and light urban development, totaling 20.1 percent (3800 acres). The majority of this development is located in the northern portion of the watershed in and around Miami Township, and in the southern portion of the watershed in and around the Eastgate area. Continued development in these areas is expected to occur over the next several years.

Commercial

This subwatershed also has the greatest percentage of commercial areas totaling 4.5 percent (845 acres). The commercial areas are located primarily in Eastgate near the S.R. 32 and I-275 interchange, and in and around Miami Township.

Agriculture-Row Crops and Pasture

The Lower East Fork subwatershed has the smallest percentage of agricultural land in the East Fork basin. With only 10.4 percent (245 acres) of the watershed as row crops and 12.6 percent (1919 acres) as pasture, the majority of agricultural lands have been or are currently being developed. Much of the land used for row crops is along the US 50 corridor, while pasturelands are evenly distributed throughout the watershed. Of the agricultural land within this subwatershed, 72 percent is used for soybeans, 11 percent for forages, 15 percent for corn and 2 percent for wheat.

Forested

Nearly 51 percent (9569 acres) of the watershed is considered forested. However, it is important to note that the majority of the forested areas are located along stream valley walls and are patchy in other areas. Also important to note is that these figures are based on 1992 land use data and, similar to agricultural land areas, have undoubtedly declined since that time.

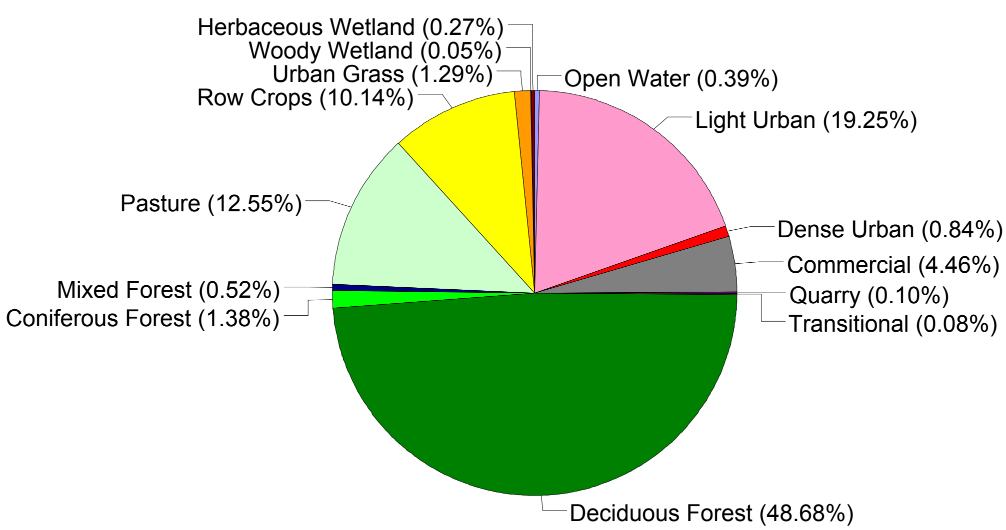


Figure 12: Percent distribution of land uses within the Lower East Fork subwatershed.

Lower East Fork

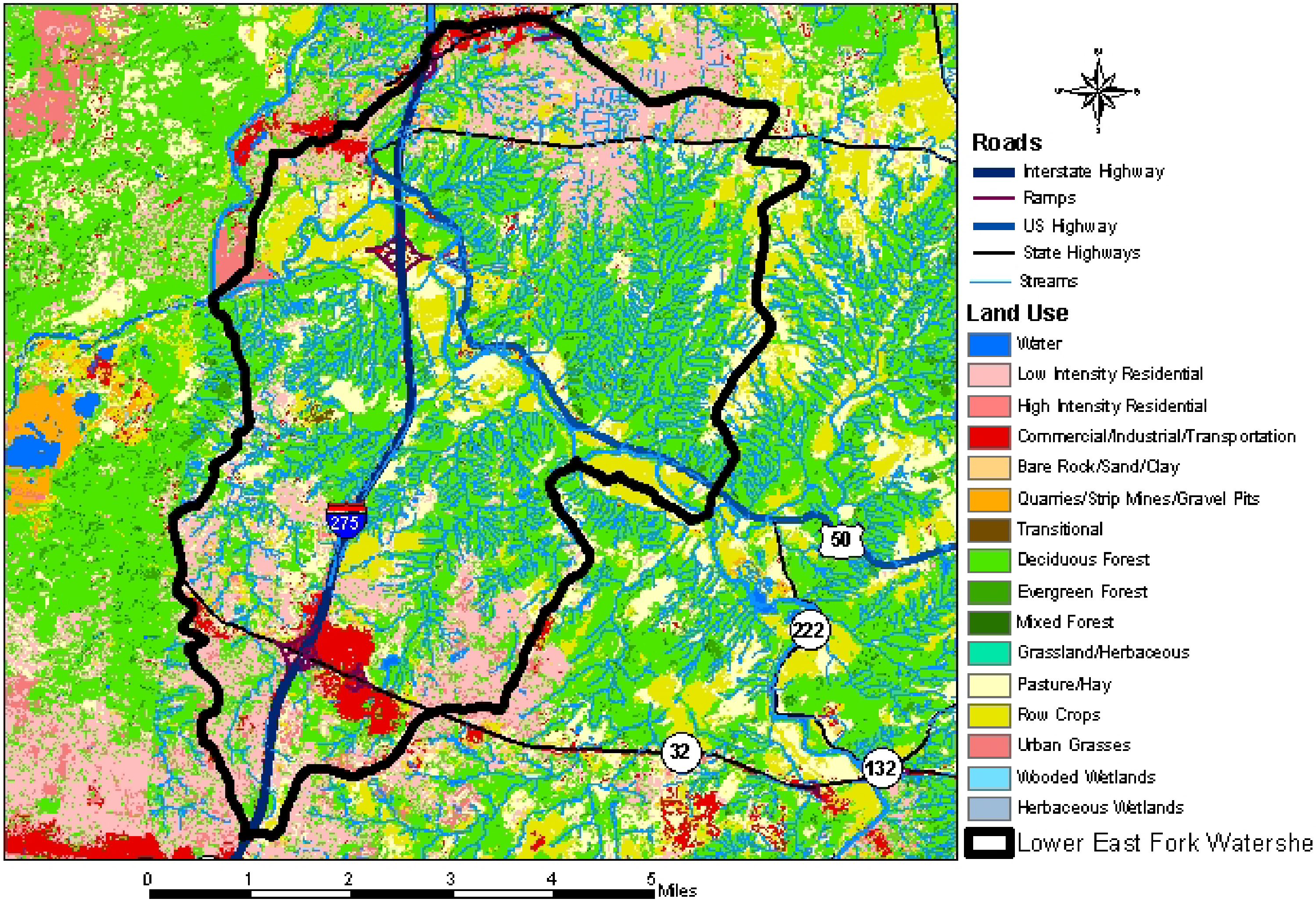


Figure 13: Distribution of land uses within the Lower East Fork subwatershed, based on the 1992 land use data.

Physical Stream Characteristics

While Clermont County and the representatives of the East Fork Watershed Collaborative have compiled a significant amount of information and data on water quality, stream biology, land use and other factors, more work needs to be done to compile a comprehensive inventory of physical stream and flood plain attributes. In the coming year, the Collaborative will focus on conducting an assessment of the riparian corridor.

Some information has been compiled on the physical characteristics of the stream channels within the Lower East Fork watershed. In 2001, Clermont County conducted a preliminary evaluation of stream channel conditions within the county using the Rosgen Level 1 and Level 2 stream classification system. The Rosgen system categorizes streams based on channel morphology. It uses a hierarchy of four assessment levels ranging from a broad characterization (Level 1) to a detailed reach-specific characterization of hydraulic and sediment relationships (Level 4).

A Level 1 assessment was conducted on all County streams to ascertain the degree of stream stability based on geomorphic characteristics. Within a Level 1 assessment, stream channel characteristics such as slope, shape and floodplain access are investigated to determine a channel's (Rosgen) stream type. Classifying streams in this manner allows us to communicate in a general sense about management strategies. For example, Rosgen stream types B and C are relatively stable,suggesting we should continue to protect watershed and riparian functions that maintain the streams in this condition. Conversely, where a predominance of unstable stream types F and G are found, we should look for opportunities to restore watershed and riparian function (e.g., restoring an F-channel's access to its floodplain), or taking corrective measures (e.g., installing grade control on a G-channel). The stability of streams, or lack thereof, can have extreme consequences to the surrounding environment. For example, unstable streams can lead to severe stream bank erosion, habitat loss, excess suspended sediment, property loss, and damage to utility lines and roadways.

Stream Channel Stability and Water Quality

Stream channel stability refers to the stream's ability to carry its sediment and water load without altering channel dimensions through erosion or deposition. Understanding a streams natural stability can greatly influence water quality management as streambank instability causes sedimentation, habitat loss, flooding and stream embeddedness.

Physical Stream Characteristics - Shayler Run Subwatershed

Results of the Level 1 assessment show a sharp differentiation in stream types in the upper and lower Shayler Run watershed. In the headwater tributaries and upper reaches of Shayler Run, F-type streams are

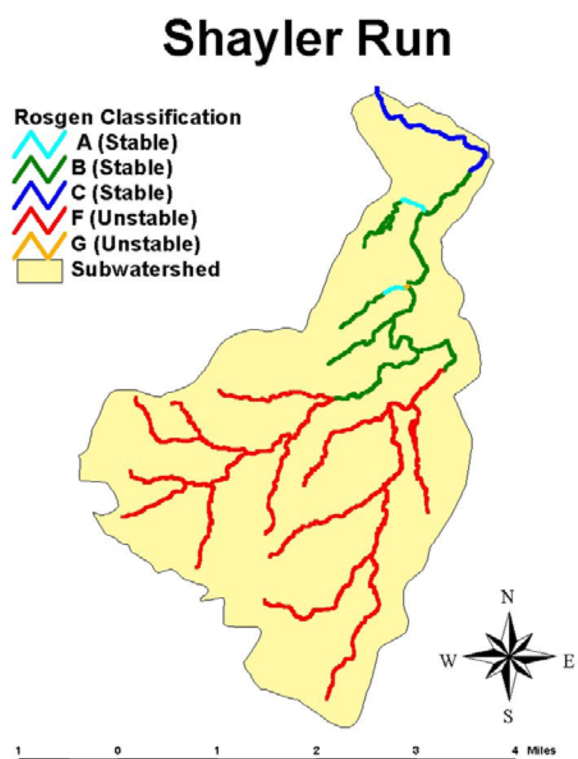


Figure 14: Map depicting stream type in Shayler Run subwatershed based on the Rosgen Level 1 classification scheme.

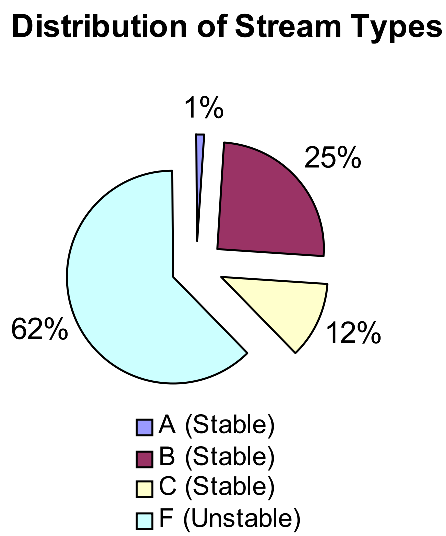


Figure 15: Percent distribution of stream type based on the Rosgen analysis, Shayler Run subwatershed.

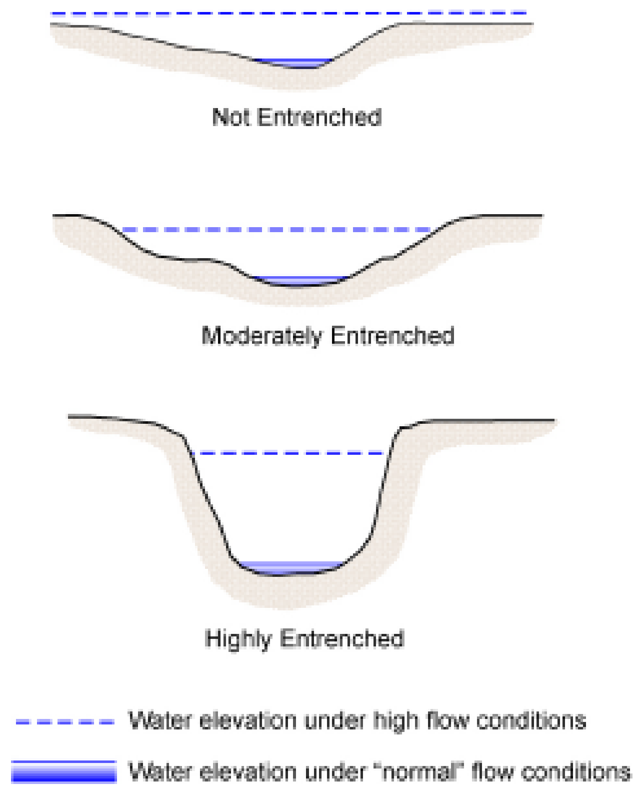


Figure 16: Examples of stream cross-sections depicting various degrees of channel entrenchment.

predominant. These streams are characterized as having an entrenched channel with high bank erosion rates and are typically unstable (see sidebar and Figure 16 for more information on entrenched streams). In the lower portions of the watershed, B-type streams are more common. These streams are only moderately entrenched and are more stable than F-type streams. The results of the Rosgen Level I stream analysis in the Shayler Run watershed are illustrated in Figure 14. The percent distribution of stream types is shown in Figure 15.

Entrenchment describes a stream's ability to access its floodplain under high flow conditions (see Figure 16). Streams that are not entrenched have the ability to rapidly overflow their banks during high flows, thereby dissipating much of the erosive energy of those high flows. Highly entrenched streams cannot access a floodplain during most high flows, thereby containing and concentrating the erosive energy of the high flows within the stream channel.

Physical Stream Characteristics - Lower East Fork Subwatershed

Results from the Rosgen stream assessment in the Lower East Fork subwatershed indicate that the majority (50.1%) of the streams are considered B-type streams (Figure 17 and 18). These stable stream types in the lower reaches of the tributaries, are typical of narrow valleys with low streambank erosion rates.

A significant amount of F-type (unstable) streams (23.9%) were found in the Eastgate area, including the upper reaches of Hall Run and an unnamed tributary to Salt Run. These stream types characteristically have high bank erosion rates, high sediment supply and are very entrenched (Figure 16).

The main stem of the East Fork River was rated as a C-type (stable) stream. These stream types are characterized by well developed floodplains and are generally stable. However, alterations to the watershed upstream can drastically influence streambank instability.

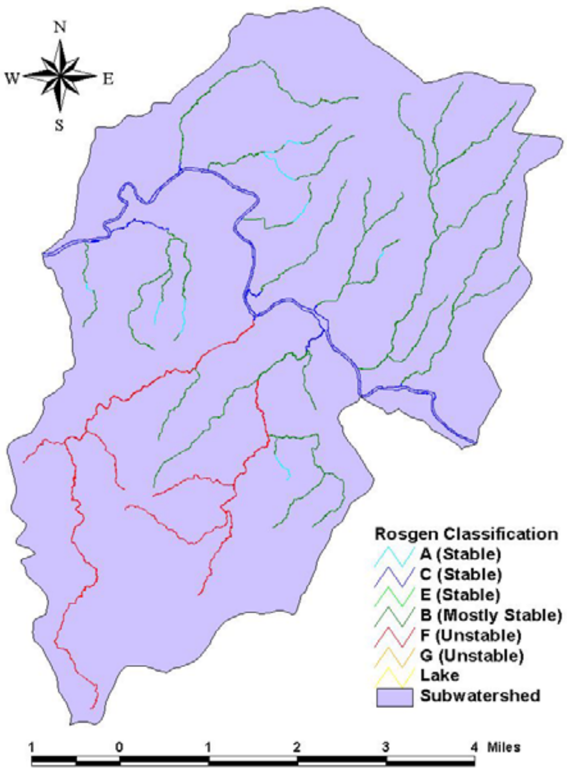


Figure 17: Map depicting stream type in Lower East Fork subwatershed based on the Rosgen Level 1 classification scheme.

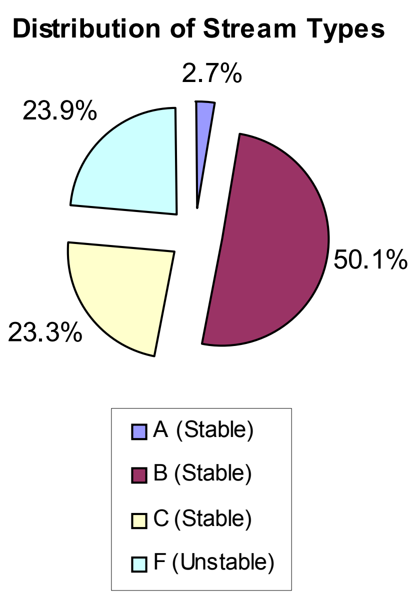


Figure 18: Percent distribution of stream type based on the Rosgen analysis, Lower East Fork subwatershed.

Stream Habitat

Both Ohio EPA and Clermont County have conducted assessments of habitat conditions at several stream sites using Ohio EPA's Qualitative Habitat Evaluation Index, or QHEI, protocol. The QHEI is calculated as the sum of the numeric scores given to various aspects of stream habitat, including substrate material, the availability of instream cover, channel morphology, riparian width and bank erosion, pool and riffle quality, and stream gradient. Ohio EPA has not established numeric attainment criteria for habitat.

East Fork Main Stem (Miles 8.8 to 0.0)

In general, QHEI scores for the lower 2.2 miles of the East Fork were less than scores at upstream sites. At the four most downstream sites, scores ranged from 62.5 to 70.5. These are considered moderately good to good. From mile point 2.2 upstream to mile 6.7, QHEI scores ranged from 68.5 (upstream of Lower East Fork WWTP) to 88.5 (Perintown), averaging 80 over seven locations. Scores over 80 are considered excellent. Primary reasons for lower scores in the downstream sections include poor substrate, poor riffle development, and less instream cover for aquatic life.

Shayler Run

Both Shayler Run and an unnamed tributary to Shayler Run (entering downstream of Old SR 74) have received a "Warmwater Habitat" (WWH) aquatic life use designation from Ohio EPA. While no habitat criteria exist, QHEI scores of 60 or greater are typically needed to achieve full support of the WWH use.

Ohio EPA has conducted 14 habitat surveys on Shayler Run and the unnamed tributary to Shayler Run between 1991 and 1998. In general, excessive disturbance and low QHEI scores between Shayler miles 5.2 and 2.3 were noted, with QHEI scores ranging from 38 to 56.5, while reaches upstream and downstream of this scored much better (QHEI scores between 56.5 and 73). There was not one particular reason for the lower scores in the disturbed area, as each QHEI metric typically scored lower than for the most upstream and downstream reaches.

Two sites were surveyed on the unnamed tributary to Shayler Run – one just 0.1 miles upstream from the mouth, and a second 0.7 miles upstream. The downstream site was surveyed in 1991 and received a QHEI score of 67. The upstream site was surveyed first in 1991 and received an excellent rating of 79.5. A follow-up survey at this same site in 1998 resulted in a QHEI of 64, indicating that significant habitat modifications had recently taken place. In particular, the substrate and available instream cover at this site scored much lower in 1998.

Lower East Fork Tributaries

Ohio EPA has conducted habitat surveys on Hall Run at Roundbottom Road, both upstream and downstream of Bzak Landscaping, and upstream of the Summerside Road bridge. Clermont County also conducted a habitat survey downstream of Bzak Landscaping on Roundbottom Road in 2000. Habitat values were fair at each site, ranging from 56 to 64.5. The substrate at each site was graded as excellent, while instream cover typically received the lowest scores. Ohio EPA and Clermont County scores were similar at the site surveyed by both (63.5 and 60.75, respectively).

One survey has been conducted on Salt Run, near Roundbottom Road, by Ohio EPA in 1997. The habitat at this location was fair (QHEI = 56), with below average substrate, poor riffle development, but good cover available for stream biota.

As with Salt Run, only one survey was conducted by Ohio EPA on Wolfpen Run in 1997. Stream habitat was fair (QHEI = 52), with excellent substrate, but poor instream cover and riparian zone protection, and below average pool and riffle quality.

In 1994, Ohio EPA conducted three surveys along Sugarcamp Run at stream miles 0.3, 2.0 and 2.6. The habitat at all sites was similar, with QHEI scores ranging from 63.5 to 69.5. All sites had good substrate, with a normal amount of silt and low embeddedness, but below average riparian zone and poor riffle development.

CHAPTER 4: WATER RESOURCE QUALITY

Use Attainment Status

In 2000, Ohio EPA completed its biennial *Ohio Water Resources Inventory* 305(b). This report summarizes the status of Ohio streams in terms of meeting their use designations (e.g., aquatic life use support, contact recreation use support) based on water quality and biological data collected by the state. In the 2000 report, Ohio EPA assessed the East Fork River from Stonelick Creek to the Little Miami River, as well as the five major tributaries to this section of the river (Shayler Run, Hall Run, Wolfpen Run, Salt Run and Sugarcamp Run). A summary of the causes of impairment in each stream is shown in Table 3.

In the 8.8 miles of the East Fork River assessed, 1.9 miles were found to be in full, but threatened, attainment, while 6.9 miles were listed in "partial" attainment. Specifically, the macroinvertebrate communities were very good to exceptional at all sites along the river; however, fish communities failed to meet their EWH expectations. Nutrients were mentioned as the primary factor causing the partial attainment status. In particular, nitrates and phosphorus concentrations were elevated downstream of the Lower East Fork WWTP and the Milford WWTP.

Two streams in the Shayler Run watershed were assessed - Shayler Run and an unnamed tributary that enters Shayler Run at mile 4.3, downstream of Old State Route 74. In the 7.8 miles of Shayler Run assessed, Ohio EPA found 3.5 miles to be in full attainment of its use designations, while 1.5 miles were in full, but threatened, attainment and 2.8 miles were classified as not in attainment. All 1.7 miles of the unnamed tributary did not support the warmwater aquatic life use designation. Nutrients and habitat alterations were among the most significant causes of impairment, while sewer line construction, sanitary sewer overflows and "other urban runoff" were listed as contributing sources of pollution.

In Hall Run, 5.7 stream miles were assessed. Of these, 1.5 miles were in partial attainment with fair biological communities. Additionally, OEPA states that this stream may experience "flashy hydrology." A stream that is flashy refers to conditions when flood waters rise and fall quickly, often disturbing instream habitat and causing excess streambank erosion. Ohio EPA lists organic enrichment, habitat alterations, organics and metals as the main causes of impairment in this stream.

Table 3: Causes of impairment in Lower East Fork watershed streams, Ohio EPA 2000 305(b) Report.

Causes of Stream Impairment - Ohio EPA 305(b) Report							
Impairment:	Nutrients	Habitat Alteration	O.E./Low DO	Siltation	Flow Alteration	Organics	Pathogens
East Fork River (Stonelick Creek to Little Miami River)	X						
Hall Run		X	X			X	
Salt Run	X			X			
Shayler Run	X	X			X		
Shayler Run Tributary	X	X			X		
Sugarcamp Run	X						
Wolfpen Run			X				X

**O.E.=Organic Enrichment DO = Dissolved Oxygen*

Only one mile was assessed on Wolfpen Run, and was listed as achieving partial attainment with fair biological communities. The report listed concerns with bacteria, nutrient and total suspended solids levels. Ohio EPA listed organic enrichment, pathogens and habitat alterations as causes of impairment.

On Salt Run, only three miles were assessed, two of which were listed as achieving partial attainment with fair biological communities. Ohio EPA stated that the stream is experiencing moderate to heavy streambank erosion, and that unstable streambanks are likely due to stormwater flows. Nutrients and siltation were listed as likely causes of impairments.

In 2002, Ohio EPA published a report that integrated the stream assessment information presented in past Water Resources Inventory reports and the 303(d) listing report. Rather than providing information on a stream segment basis, the integrated report provides use attainment assessment by watershed. For the Lower East Fork Watershed, which in this case includes Stonelick Creek, multiple high magnitude causes are listed, including nutrients, siltation, organic enrichment/DO, flow alteration, other habitat alterations and pathogens. High magnitude sources include:

- Major municipal point sources
- Combined sewer overflows (of which there are none in this watershed)
- Sanitary sewer overflows
- Non-irrigated crop production
- Sewer line construction
- Urban runoff/storm sewers
- Dredging – development
- Dam construction
- Streambank destabilization

Ohio EPA reports the status of Primary Contact Recreation use support in this watershed as unknown. Clermont County data collected during both dry and wet weather conditions indicate that in general, the primary contact recreation use is met during dry weather; however, during and after periods of rain, *E. coli* concentrations usually exceed instream criteria.

Sample Site Identification

River Miles are an easy and accurate way to identify sampling locations. River miles are measured in terms of distance (in tenths of a mile) from the stream "mouth".

In Shayler Run, river mile 0.0 (RM 0.0) would be the point where the creek enters the East Fork Little Miami River. River miles increase as you move upstream.

There is a fish consumption advisory in effect for the East Fork. The advisory recommends that fish consumption be limited to one meal per month for the following species: channel catfish, flathead catfish, rockbass, smallmouth bass and spotted bass.

Summary of Stream Conditions

In 1996, Clermont County OEQ established an intensive monitoring program to characterize the conditions of the East Fork Little Miami River watershed. This program, conducted annually, has included both biological and chemical monitoring. A summary of the County's annual monitoring and sampling program in the Lower East Fork watershed is provided in Appendix 2. In addition, Ohio EPA has also conducted several surveys within the watershed, most recently in 1998. The following paragraphs summarize the findings from these surveys in the Lower East Fork main stem, the Shayler Run subwatershed, and the Lower East Fork tributaries.

Stream Biology - East Fork Main Stem

The Ohio Environmental Protection Agency (OEPA) and Clermont County have conducted numerous biological surveys along the main stem of the East Fork and along several tributaries.

Ohio EPA has done extensive surveys on the lower East Fork during four separate summers since 1982 - most of these downstream of the Clermont County Lower East Fork WWTP, including one survey within the mixing zone of the plant's discharge. A list of the Ohio EPA sampling stations, types of biological surveys conducted, and years conducted, is presented in Table 4.

Clermont County has conducted biological surveys at two sites on the East Fork downstream of Stonelick Creek. There is a long-term monitoring station upstream of the Perintown/Roundbottom Road bridge (RM 6.6), where annual fish and macroinvertebrate surveys were conducted between 1997 and 2001. Ad-

Biotic Index

Ohio EPA has established biotic indices for both fish and macroinvertebrates as a means to directly assess any impacts on these populations. The Index of Biotic Integrity, or IBI, is a numerical index that characterizes the condition of the fish community and is based on a set of "metrics" that measure different components of the fish population. Examples of different metrics would be the total number of species or percent sunfish found during a particular survey. Likewise, the Invertebrate Community Index, or ICI, is based on a separate set of metrics that characterizes the stream's macroinvertebrate community. After the "catch" for each survey is assessed, each metric is given a score (1, 3 or 5 for fish; 2, 4 or 6 for macroinvertebrates). The metric scores are then added together to give the resulting index.

Sampling Station	Location	Type of Survey	Year of Survey
RM 0.5	475 Roundbottom Rd	Fish	1983
RM 0.8/0.9	South Milford Rd	Macroinvertebrates Macroinvertebrates/Fish	1983,1993 1982,1998
RM 1.4	Downstream Milford WWTP	Fish	1993
RM 1.7/1.9	Downstream I-275 Upstream Milford WWTP	Macroinvertebrates Macroinvertebrates/Fish	1982 1993
RM 2.2	Near Milford Parkway	Macroinvertebrates/Fish	1998
RM 2.4	I-275 crossing	Fish	1982
RM 3.7	US 50, upstream I-275 crossing	Fish	1998
RM 4.1/4.2	Near US 50 entrance to I-275	Macroinvertebrates	1982, 1998
RM 4.6	Downstream Lower East Fork WWTP	Fish	1982
RM 4.7/4.8	Downstream Lower East Fork WWTP	Macroinvertebrates/Fish	1993, 1998
RM 4.84	Lower East Fork WWTP Mixing Zone	Macroinvertebrates/Fish	1998
RM 5.1	Upstream Lower East Fork WWTP	Macroinvertebrates/Fish	1998
RM 5.4/5.5	P&G Stream Facility Intake	Macroinvertebrates/Fish	1998
RM 6.6/6.7	Roundbottom Road Bridge	Macroinvertebrates/Fish	1982, 1993, 1998

Table 4: Ohio EPA biological sampling locations in the Lower East Fork subwatershed.

ditional surveys were conducted upstream of the Lower East Fork Wastewater Treatment Plant (WWTP) on U.S. 50 (RM 4.8) in 1999 and 2000.

Biological Criteria

Ohio EPA has designated the East Fork Little Miami River as having "exceptional warmwater habitat" (EWH), which means that fish and macroinvertebrate communities are expected to be more healthy and diverse in the East Fork than in a typical Ohio stream. As a result, the biological criteria established by the Ohio EPA for the East Fork are more stringent. To meet the EWH criteria, the Index of Biotic Integrity (IBI) scores used to rate the fish communities must be equal to or greater than 48, and the Invertebrate Community Index (ICI) must be equal to or greater than 46. Scores within four index points are said to be in "non-significant departure" (ns) of the criteria, meaning that streams with IBI scores as low as 44 and ICI scores as low as 42 would still be in compliance with state standards.

While chemical criteria have been established to protect aquatic life, these do not provide a direct measurement of the well-being of the biological community. In many cases, chemical criteria can be exceeded and the stream biology may be quite healthy. Likewise, the stream can be meeting all chemical criteria, but still show biological impairment.

Fish Survey Results

Surveys conducted by Ohio EPA show that while the biological communities in the main stem of the East Fork are healthy, they do not always meet the exceptional criteria established for the river. Figure 19 illustrates the IBI scores from the fish surveys conducted between 1982 and 1998.

Only 12.5 percent of the surveys resulted in index scores that meet the exceptional warmwater habitat criterion of 48. A total of 42.5 percent of surveys had IBI scores equal to or greater than 44, which is within the range of "non-significant departure" from the established criterion. Although few surveys met the EWH

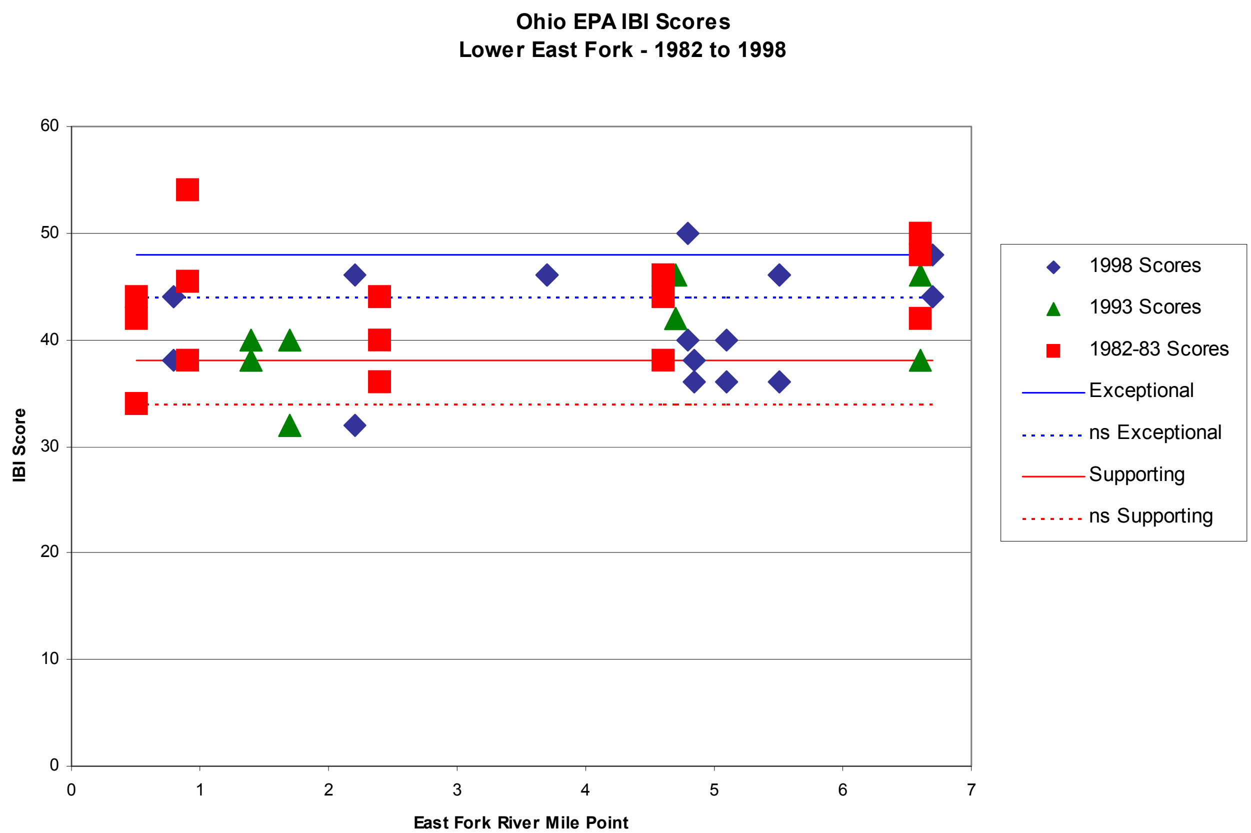


Figure 19: Results from Ohio EPA biological surveys on the Lower East Fork from 1982 to 1998.

criterion, all but two survey scores fell within the non-significant departure range for "warm water habitat" (WWH) criterion (IBI scores of 36 or greater). Streams designated as WWH have a less stringent criterion than those designated as EWH.

In more recent surveys conducted by Clermont County, IBI scores have been higher. The County has conducted annual fish surveys since 1997 at the site of the Roundbottom Road bridge in Perintown (RM 6.6). In all years, with the exception of 1998, average IBI scores have met the exceptional IBI criterion (or were within the range of "nonsignificant departure" as established by Ohio EPA). Currently, there is no explanation for the lower 1998 score (IBI = 41). Over the five years of surveys, there is no apparent trend, either increasing or decreasing, in IBI scores (Figure 20).

DELT Anomalies

One of the metrics used in calculating the IBI is a rating based on the percentage of Deformities, Eroded fins, Lesions and Tumors – also known as DELT anomalies – found on fish. Metric scores of 1, 3 or 5 are given based on the percent DELT anomalies seen in a sample collection, with a score of 1 indicating more anomalies, and a score of 5 indicating few to none. From 1982 to 1983, the average DELT score over 15 surveys was 3.0. In 1993, DELTs occurred in a much higher percentage of fish, with an average metric score of 1.75 over eight sites. A marked improvement was noted in 1998, where the average score increased to 3.7. A total of 11 of the 18 survey sites received a perfect score of 5, and no sites received the lowest possible score of 1.

Macroinvertebrate Survey Results

The macroinvertebrae community in the Lower East Fork appears to be in excellent condition, according to Ohio EPA and Clermont County survey results. Of the seventeen separate surveys conducted by Ohio EPA, only four had ICI scores lower than the EWH criterion of 46, with a low score of 42 at RM 5.1 in 1998, and at RM 0.8 in 1982. A follow-up survey in 1998 at RM 0.8 resulted in an ICI score of 50.

As with fish, Clermont County has a long-term record of the macroinvertebrate community in the East Fork at Perintown. Results from the macroinvertebrate surveys were almost identical to those for fish, as ICI scores for four of five years meet EWH criteria (or fall within the range of "non-significant departure"). The only low macroinvertebrate score occurred in 1997 (ICI = 34). There is no apparent trend in macroinvertebrate scores over the years (Figure 21).

Impacts of Wastewater Treatment Plants

When looking at results from all surveys, there is no apparent trend in biological index scores from upstream to downstream, or from year to year. Additionally, no impairments resulting from the two wastewater treatment plants (WWTPs) discharging in this stretch of river are apparent.

At the closest site downstream of the Milford WWTP (discharge at RM 1.3), IBI scores were good, averaging 46 over three surveys, though these were conducted twenty years ago in 1982. A little further downstream, IBI scores averaged 40 at RM 0.5 in 1983, and 41 at RM 0.8 in 1988. In 1993, surveys upstream of the plant resulted in an average score of 39.

Results were better for Ohio EPA macroinvertebrate surveys conducted in the area of the Milford WWTP. Three separate surveys have been conducted downstream of the plant at RM 0.8. In 1982, results did not meet the EWH criterion, but were in "nonsignificant departure." Scores in 1993 and 1998 showed improvement over the 1982 survey – both surveys exceeded the ICI criterion. Upstream of the plant, Ohio EPA conducted surveys in 1982 and 1993 at two separate locations. Both met the EWH criterion.

The Lower East Fork WWTP, owned and operated by Clermont County, discharges to the East Fork at river mile 4.84. In 1998, Ohio EPA conducted biological surveys within the mixing zone of the plant's effluent. It should be noted that the County (as well as all other dischargers) is not required to meet instream criteria within the mixing zone of the WWTP. Results from the fish surveys yielded an IBI score of 37, which would not meet the EWH criterion, but would be in the range of nonsignificant departure of the WWH criterion discharge. No DELT anomalies were noted. Two qualitative macroinvertebrate surveys were rated as "fair" and "moderately good."

Ohio EPA conducted fish surveys immediately downstream of the plant outfall in 1998. Scores (IBI = 46) from each of the two surveys were good - within

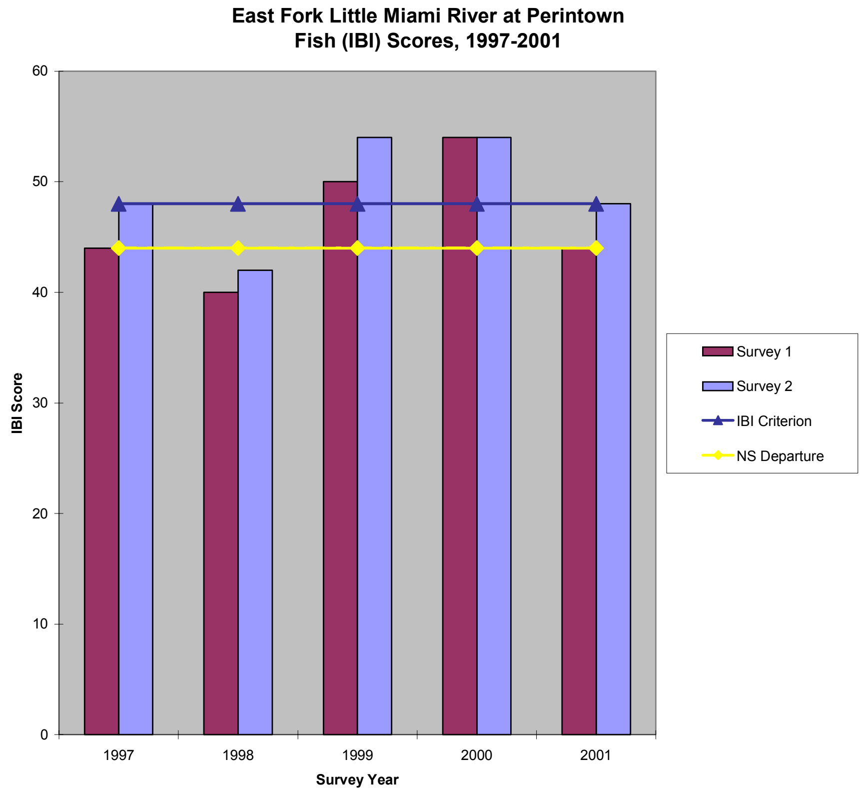


Figure 20: Clermont County fish results from East Fork surveys from 1997 to 2001.

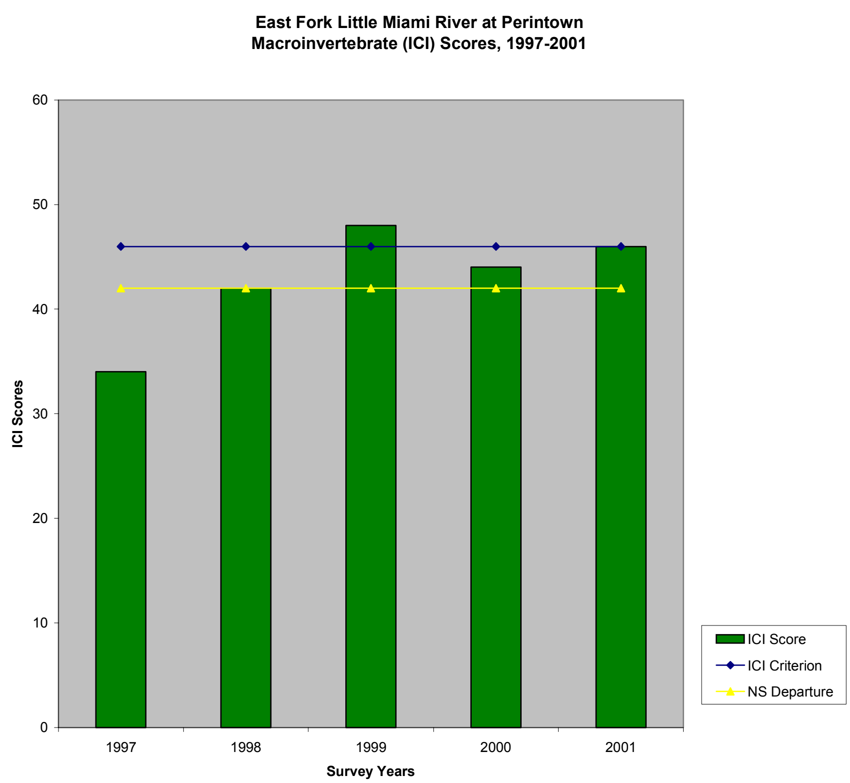


Figure 21: Clermont County macroinvertebrate results from East Fork surveys from 1997 to 2001.

the range of nonsignificant departure from the EWH criterion. Both times, the DELT metric received the highest score, meaning that very few anomalies were found. This is a slight improvement over surveys conducted in 1993, where the average IBI score was 44, and DELT anomalies were more frequently found (metric scores of 1 and 3 for two surveys). Fish surveys conducted upstream of the plant in 1998 had lower scores than those conducted downstream that same year (Average IBI = 37 at RM 5.1).

Clermont County also conducted surveys upstream of its Lower East Fork WWTP in 1999 and 2000. Scores from both 1999 fish surveys (48 and 52, respectively) meet exceptional criteria. The average 2000 IBI score (48) also meets the exceptional criterion. Macroinvertebrate scores (1999 ICI = 44, 2000 ICI = 48) were also in compliance with state standards.

Water Chemistry - East Fork Main Stem

Since 1996, Clermont County has conducted intensive water chemistry sampling throughout the Lower East Fork watershed. Under this monitoring program, water chemistry samples have been collected at four sites along the main stem, including East Fork river miles 0.5, 4.0, 5.4 and 6.6 (Figure 23, following page). In May 2003, two additional sites were added at river miles 0.8 and 2.1 In general, river samples have been collected annually between May and October and analyzed for solids, nutrients, metals, bacteria, CBOD5, dissolved oxygen, and more. Details about sampling sites, as well as the sampling parameters and frequency, can be found in Appendix 2.

Solids

Clermont County monitored for Total Suspended Solids (TSS) and Total Volatile Solids (TVSS) at the four main stem sites between 1996 to 2001, and began monitoring for turbidity in 1998. Ohio EPA has not established criteria for any of these parameters.

Results indicate that average solids concentrations significantly increase downstream. In particular, average concentrations are very similar for RM 4.0, RM 5.4 and RM 6.6, however, they significantly increase at RM 0.5 (Figure 22).

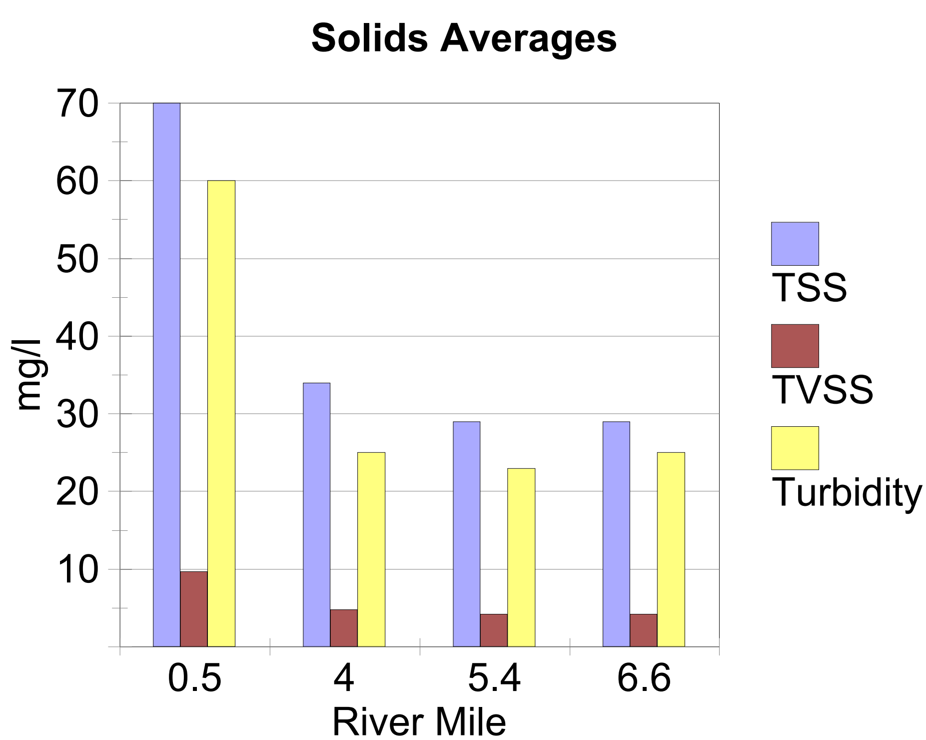


Figure 22: Solids averages at the Lower East Fork sampling locations.

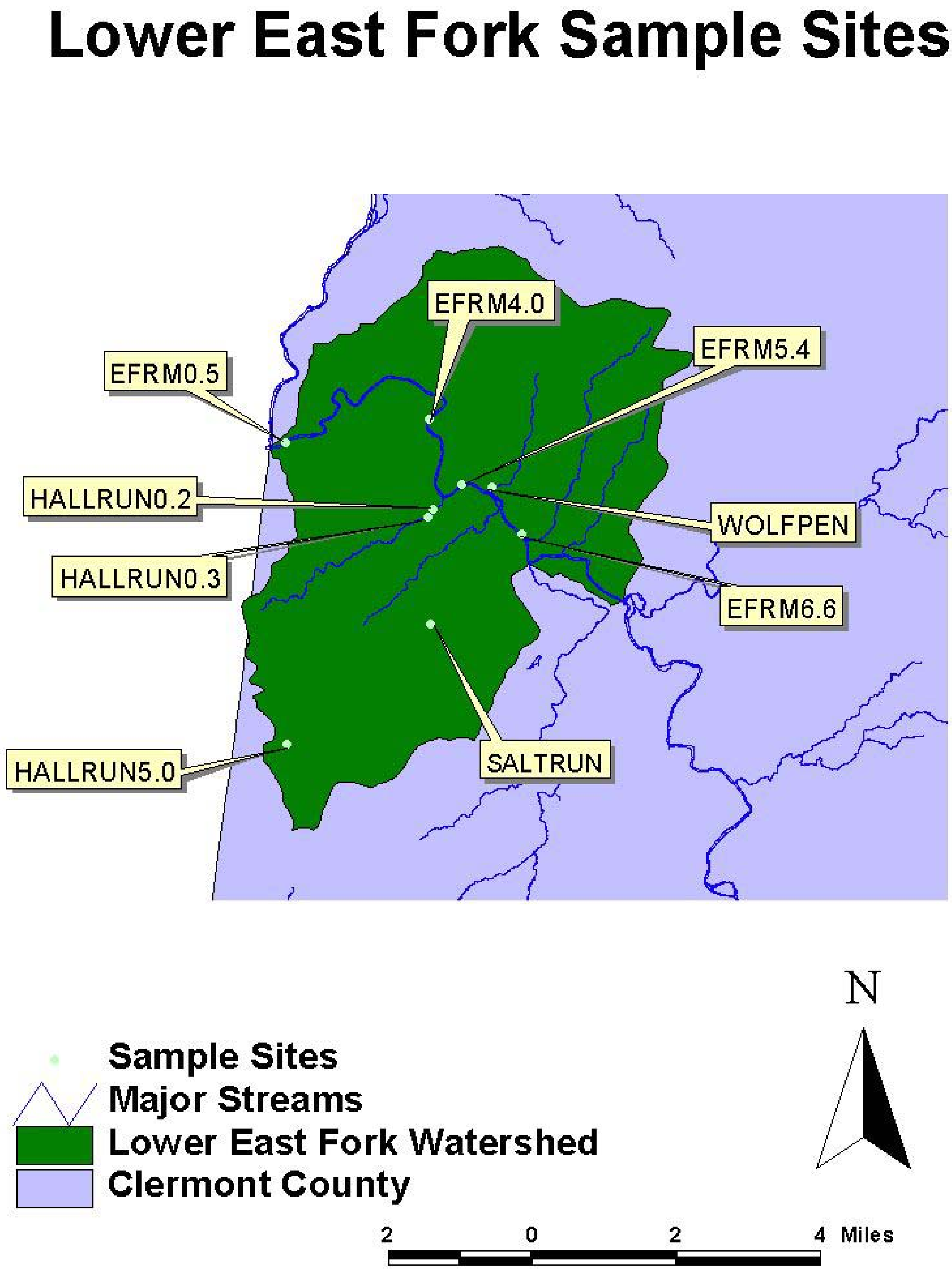


Figure 19: Location of sampling sites within Lower East Fork subwatershed.

Additionally, TSS values were at their highest in 2000. The increase in solids concentrations at RM 0.5 is most likely due to interchange construction to I-275 and nearby construction of a cinema complex, restaurants and a car dealership.

Annual average TSS concentrations were low in 1997 and higher in 1999. This could also be related to an increase in construction activity, although the higher 1999 levels are somewhat perplexing, as the Lower East Fork, as well as most of the Midwest, experienced a severe drought that year.

Average values for TVSS and turbidity are very similar to those of TSS. The greatest values were seen during the drought year, 1999. Additionally, the values appear to remain steady above RM 4.0 and increase significantly below this location.

Nutrients

Clermont County has collected and analyzed samples for several nutrient parameters including ammonia, nitrate+nitrite (NO3-NO2), total Kjeldahl nitrogen (TKN), total phosphorus (TP) and orthophosphate. Ohio EPA has only established water quality criteria for ammonia based on its toxicity to fish. Although the other parameters do not have established criteria, a bulletin published by Ohio EPA entitled "Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams" provides a possible benchmark against which instream total phosphorus and nitrate concentrations may be compared. Based on the size of the drainage basin and the stream's aquatic life use designation, potential limits are given for both total phosphorus and nitrate. Because the drainage area for the sampling sites on this section of the East Fork River is nearly 500 square miles, the bulletin classified the river as a "small river." Furthermore, the East Fork is designated as an Exceptional Warm Water Habitat (EWH) stream and as such, limits of 1.0 mg/L for nitrate and 0.1 mg/L for total phosphorus are suggested.

In general, nutrient averages for all sampling years seem to increase towards the mouth, but average concentrations jump significantly downstream of river mile (RM) 5.4 (Figure 24). The Lower East Fork and Milford WWTPs are located at river miles 4.84 and 1.3 respectively, likely adding nutrients to the water.

Total Phosphorus

The primary pollutant of concern in the lower East Fork main stem is total phosphorus, as 98 percent or greater of the samples collected exceeded the 0.1 mg/L benchmark at all four sampling sites (Figure 25).

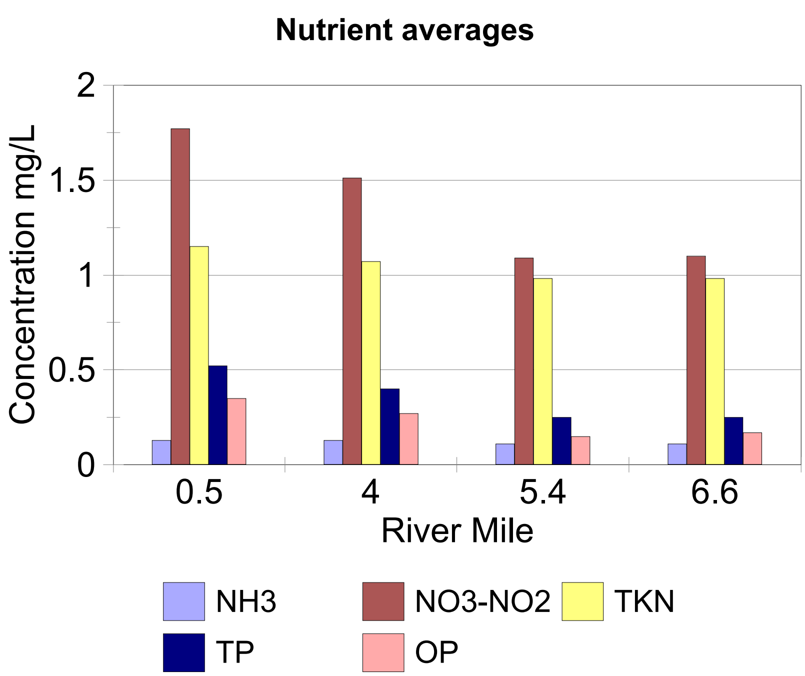


Figure 24: Nutrient averages at the sampling locations along the East Fork River.

Of all four sites, however, TP averages were greatest at river mile 0.5 with an average of 0.52 mg/L. At RM 0.5, 100 percent of the samples taken from 1996-2001 exceeded the benchmark; 99 percent exceeded from RM 4.0, 98 percent exceeded from RM 5.4; and 98 percent exceeded from RM 6.6 (Figure 25). At all sites, the greatest TP concentrations were seen in 1999, a drought year in which concentrations were higher due to low stream flow.

Nitrate+Nitrite

Nitrate-nitrite is also a concern on the main stem, primarily downstream of RM 5.4 (Figure 25). At both RM 0.5 and RM 4.0, 80 percent of the samples collected between 1996 and 2001 exceed OEPA's benchmark of 1.0 mg/L. Further upstream, only 49 percent of samples from RM 5.4 and 48 percent of samples from RM 6.6 exceeded this level. It is likely that inputs from the two wastewater treatment plants contribute to this increase.

Ammonia

As previously stated, Ohio EPA has established a baseline criteria limiting ammonia concentrations to no greater than 2.1 mg/L for EWH and 2.2 for WWH. On the main stem, ammonia concentrations increased over the sampling years at RM 0.5 and RM 4.0. Additionally, ammonia averages at the two downstream sites, RM 0.5 and RM 4.0, were significantly greater than averages at the two upstream sites, RM 5.4 and RM 6.6 (Figure 24). However, none of the samples exceeded criteria despite the slight increases at RM 0.5 and RM 4.0.

Orthophosphate/Total Kjeldahl Nitrogen

Criteria have not yet been established for either orthophosphate or TKN. Average values for TKN on the main stem appear to be relatively steady for all of the sampling years, however, values appear to increase slightly downstream (Figure 24).

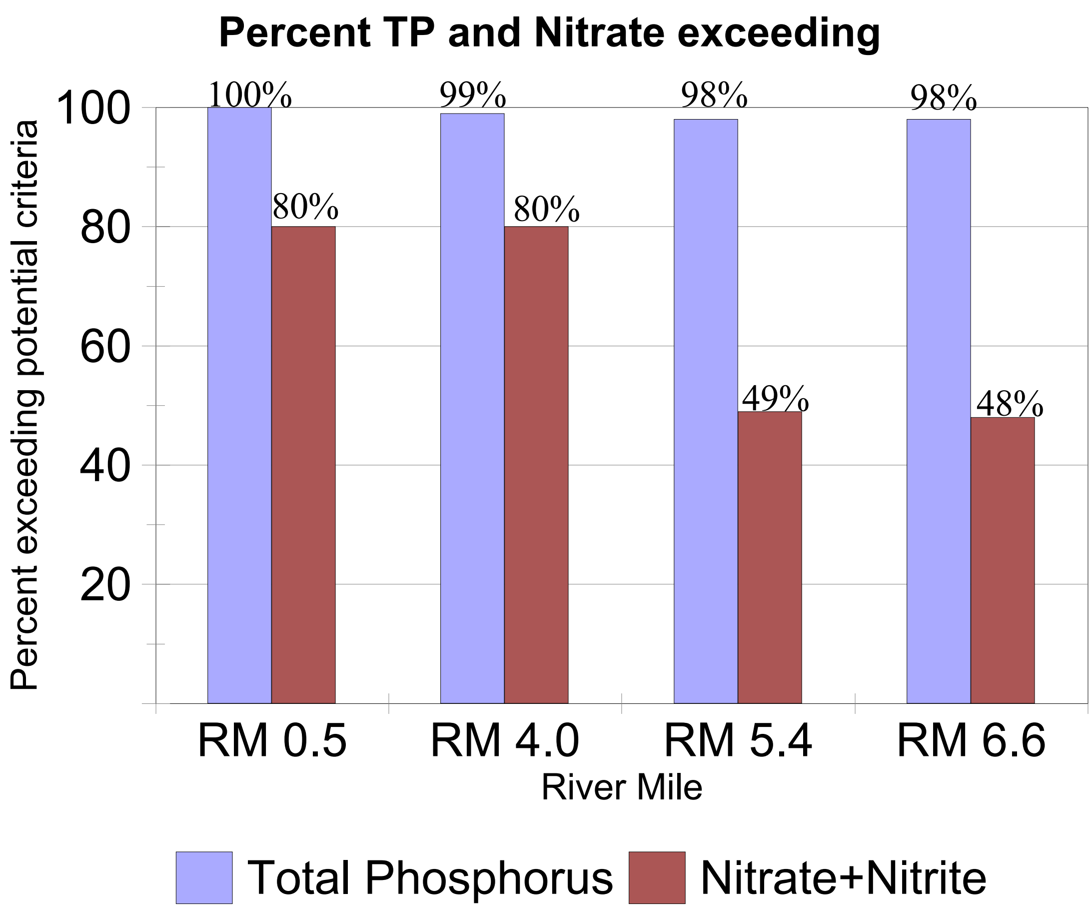


Figure 25: Percent Total Phosphorus and NO3-NO2 exceeding Ohio EPA benchmarks at the Lower East Fork sample sites.

Average orthophosphate values along the main stem also appear to increase downstream, as shown in Figure 20. However, annual orthophoshate average concentrations have decreased from 1996 to 2001 at RM 0.5 and 4.0.

Metals

Total recoverable copper, lead and zinc were measured at the four main stem sampling sites from 1996 to 2001. Copper and lead were measured at all four sites, while zinc was measured at all sites except RM 6.6.

Ohio EPA criteria states that concentrations must not exceed 9.3 ug/L for copper, 6.4 ug/L for lead, and 120 ug/L for zinc (assuming a hardness concentration of 100 mg/L). Results indicate that concentrations significantly increase downstream (Figure 26). In particular, the percent of copper samples that exceed OEPA's criteria is 25 percent at RM 0.5 and zero percent at RM 6.6. Likewise, the percent of lead samples exceeding criteria also increases downstream, as 14 percent of samples at RM 0.5 exceeded criteria while zero percent exceeded criteria at RM 5.4.

Bacteria

Clermont County began monitoring for fecal coliform in 1996. In 1998, however, the County changed its monitoring program to accommodate E. coli. Ohio EPA has established both fecal coliform and E. coli criteria for all streams designated for "primary contact recreation use," including the streams in this section of the East Fork watershed. The current E. coli criteria are:

- Geometric mean based on not less than five samples in a 30-day period shall not exceed 126 colony forming units (cfu) per 100 mL
- Geometric mean shall not exceed 298 cfu/100 mL in more than 10 percent of the samples collected in a 30-day period.

While the data collected by Clermont County cannot be directly compared to the criteria due to the frequency of sampling, the data does show concerns with E. coli concentrations at all four sampling sites along the main stem. At RM 0.5, 58 percent of samples exceeded 298 cfu/100 mL with concentrations reaching 18,000 cfu/100 mL. The percentage of samples ex-

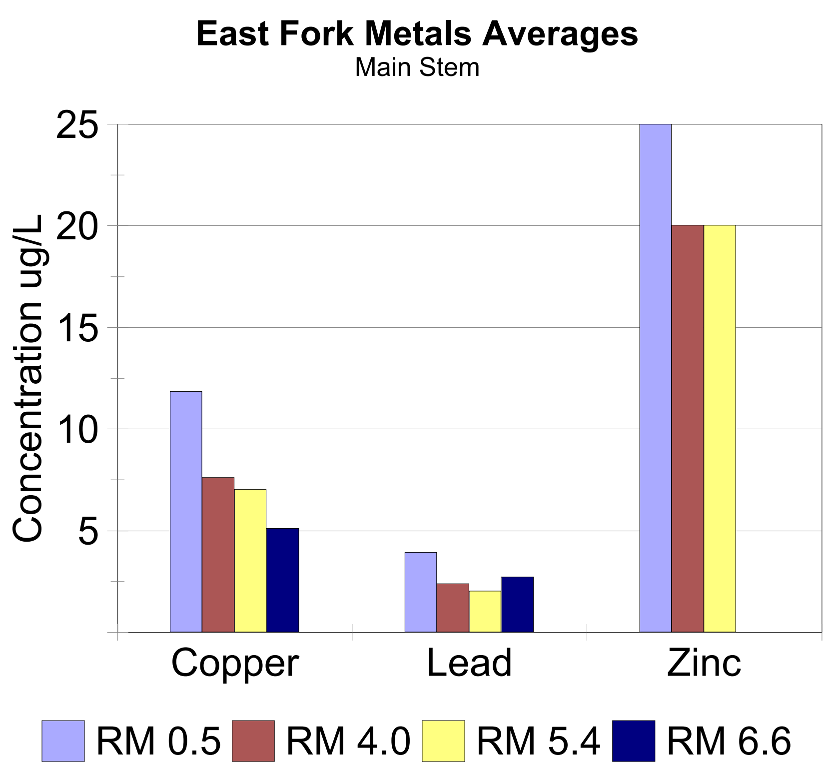


Figure 26. Metals (copper, lead and zinc) averages from the sampling locations along the East Fork River.

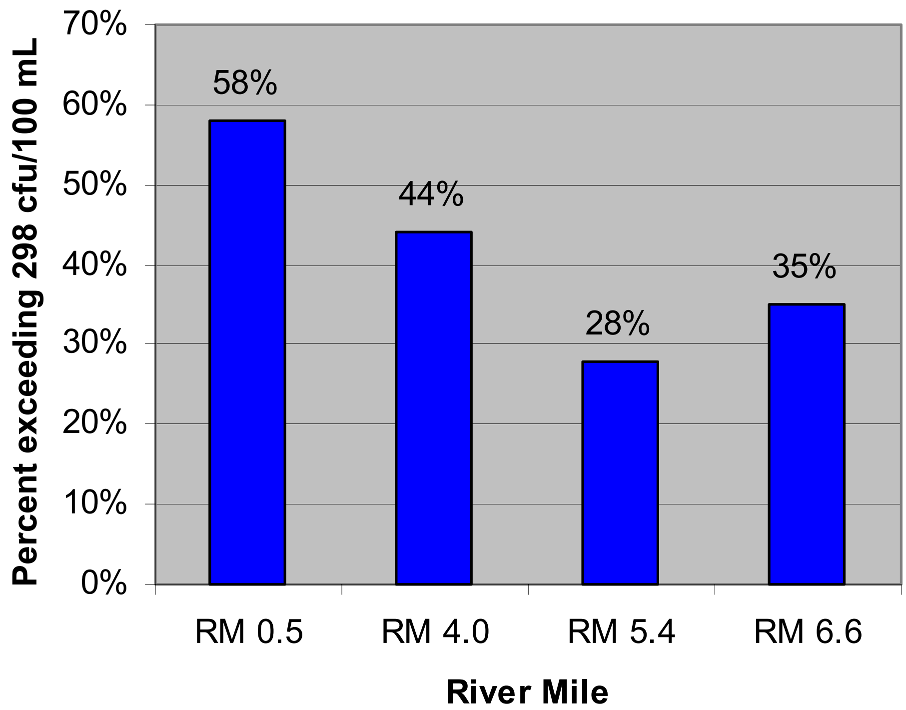


Figure 27: Percent of E. coli samples at lower East Fork sample sites exceeding 298 cfu/100 mL.

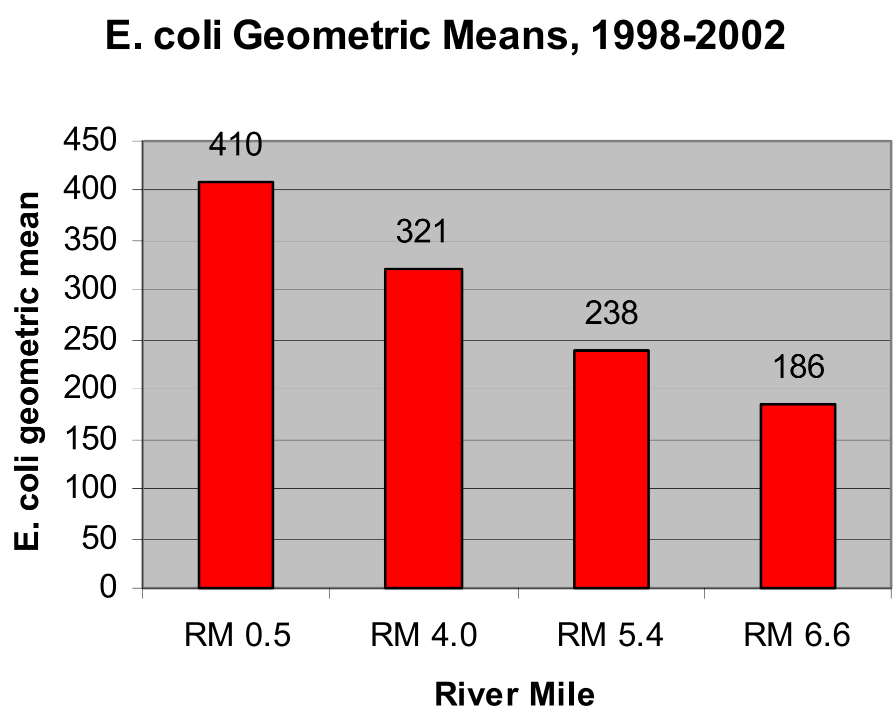


Figure 28: E. coli geometric means for sampling locations along the East Fork River.

ceeding this level is slightly less upstream, 44 percent, 28 percent and 35 percent of the samples exceeding 298 cfu/100 mL at river miles 4.0, 5.4 and 6.6, respectively (Figure 27).

The data also indicate a noticeable increase in the geometric means of E. coli concentrations in a downstream direction, increasing from 186 cfu/100 mL at RM 6.6 to 410 cfu/100 mL at RM 0.5. (Figure 28).

Annual geometric means at each station vary widely, and are very much dependent upon the amount of rainfall received during the contact recreation season. At each sampling location, the annual E. coli geometric mean was less than 298 cfu/100 mL during the drought year of 1999. At RM 5.4 and 6.6, annual geometric means were generally less than 298 cfu/100 mL, while at RM 0.5 and 4.0, the gometric means were usually greater than this level.

Organic Enrichment/Dissolved Oxygen

The level of dissolved oxygen (DO) and the five day carbonaceous biocehmical oxygen demand (CBOD5) were also measured from samples taken in the lower portion of the East Fork River. The CBOD5 represents a measure of the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter. The results indicate that the average CBOD5 concentrations are steady throughout all sampling sites; however, the maximum value increases downstream. Ohio EPA has not established criteria for CBOD5.

Ohio EPA's criteria for DO concentrations in EWH waters state that, for chronic conditions, average values must not fall below 6.0 mg/L, and minimum values must not be less than 5.0 mg/L. For all of the sampling locations, average DO concentrations were well above this criterion. The lowest minimum value was recorded at RM 4.0, with a value of 2.9 mg/L.

From 1996 to 2001, there were no dissolved oxygen concerns at either RM 6.6 or RM 5.4. At RM 4.0, a minimum concentration of 2.9 mg/L was recorded in 1996; however, DO levels have steadily increased at this site, and no readings have been less than 5.0 mg/L since this time. Low DO concentrations have been more of an issue at RM 0.5, where values have occasionally been less than the EWH minimum criterion of 5.0 mg/L, particularly in 1996 and 2000.

Stream Biology - Shayler Run Subwatershed

Both Clermont County and Ohio EPA have conducted biological surveys in the Shayler Run watershed to monitor the well-being of the fish and macroinvertebrate communities. Clermont County OEQ conducted a single survey in 1998 at the Baldwin Road site, while Ohio EPA surveyed several sites along Shayler Run and an unnamed tributary in 1991 and 1998 (Figure 29).

Biological Communities

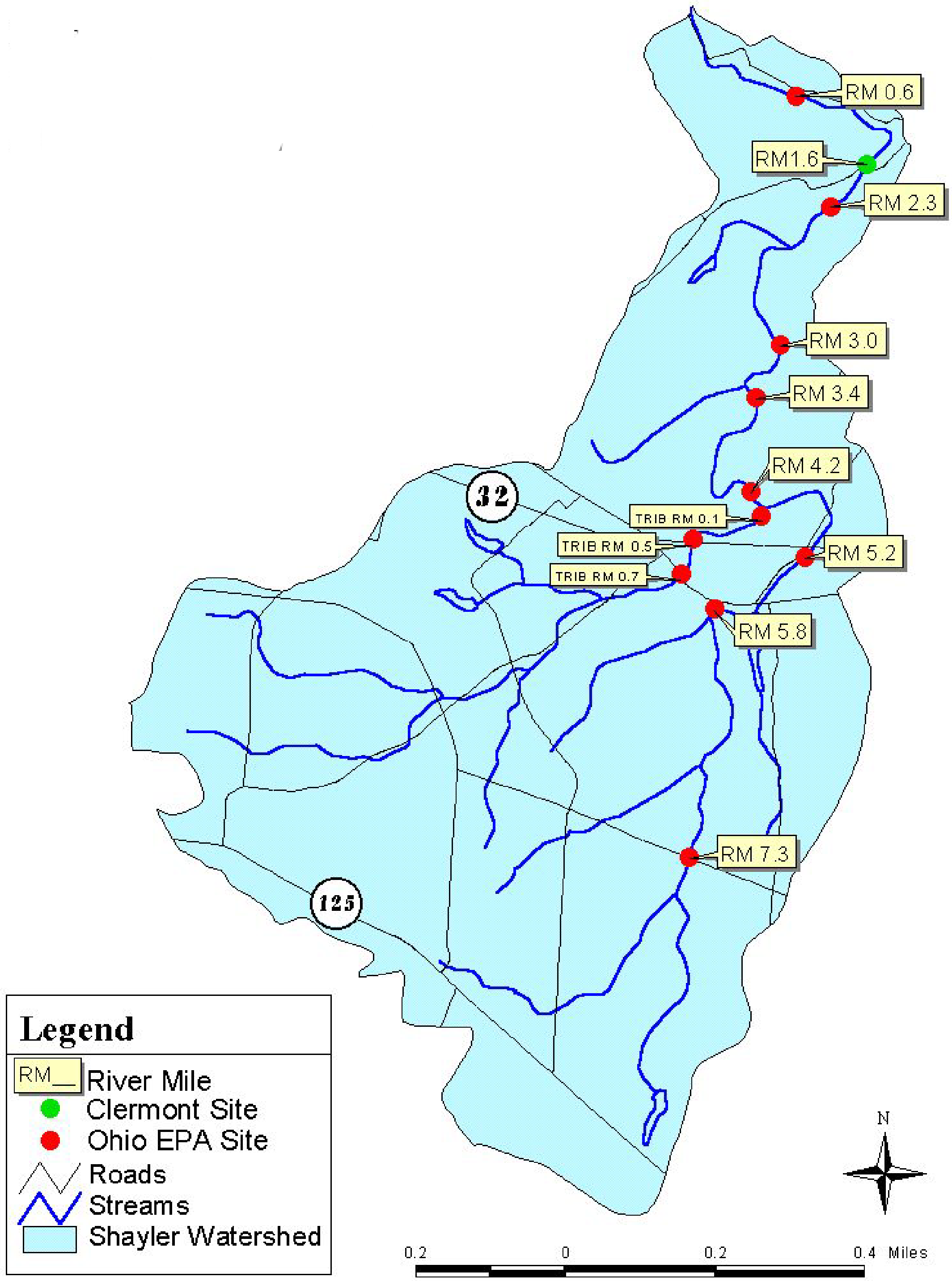
The fish and macroinvertebrate surveys conducted by the County and Ohio EPA have shown similar results. In general, the biological communities seem to be healthy in the upper and lower segments of Shayler Run, and somewhat impaired in between these stream reaches. While there is not sufficient information available to discern a trend, Ohio EPA data show that, at sites sampled in both 1991 and 1998, biological scores in 1998 were lower.

Clermont County OEQ conducted two biological surveys in July and September 1998 at the Baldwin Road site (RM 1.6). Results from both the fish and macroinvertebrate surveys showed a healthy biological community. Fish scores were slightly higher than the Ohio EPA Index of Biotic Integrity (IBI) criterion, and the qualitative macroinvertebrate samples were rated as "good" and "marginally good," respectively. While a detailed habitat assessment was not conducted, the overall habitat was rated as fair to good.

Ohio EPA conducted two intensive biological surveys in the Shayler Run watershed in 1991 and 1998 (OEPA biological database). In 1991, fish, macroinvertebrates and habitat were surveyed at eight different sites over 6½ miles of Shayler Run from near the headwaters to the confluence with the East Fork (mile points 7.3 to 0.6), and at two locations on the unnamed tributary entering Shayler Run downstream of Old State Route 74 (at about RM 4.3). Results from the 1991 survey showed:

- Healthy fish and macroinvertebrate communities at the most upstream site and over the lower three miles of Shayler Run
- Low fish scores between stream miles 5.8 and 4.2

Figure 29: Biological sampling locations in the Shayler Run subwatershed



- Excessive disturbance and low Qualitative Habitat Evaluation Index (QHEI) scores between miles 5.2 and 2.3.
- Stream substrate, cover, channel morphology, pool quality and stream gradient scores were generally lower in the middle portion of Shayler Run than they were in upstream and downstream reaches. The riparian zone rated above average, and riffle development was poor throughout the creek.
- The level of stream embeddedness (i.e., the extent to which the substrate is covered in silt) was moderately extensive or worse at five of the eight Ohio EPA sites.
- Relatively healthy biological communities in the unnamed tributary.

In 1998, Ohio EPA surveyed three sites on Shayler Run and two sites on the same unnamed tributary. Findings of this survey include:

- The one site sampled in the lower three miles of Shayler Run met Ohio EPA criteria, while the two upstream sites did not.
- Lower fish, macroinvertebrate and habitat scores were seen at the two upstream Shayler Run sites compared to results seen in 1991.
- A sharp decline in the fish and QHEI scores for the upstream site on the unnamed tributary, when compared to 1991 data.
- Stream substrate, cover and channel morphogy, decreased in quality at the two upstream sites from 1991 levels. The amount of silt and embeddedness increased.

Water Chemistry - Shayler Run Subwatershed

Each year since 1997, Clermont County has collected water chemistry samples from Shayler Run downstream of the Baldwin Road bridge (river mile 1.6) (Figure 29). From 1997 through 2001, ambient stream samples were collected once every two weeks from May through October. Samples were analyzed for a variety of pollutants, including bacteria, nutrients, metals, solids, dissolved oxygen (DO), biochemical oxygen demand (BOD) and pH. Additionally, wet weather samples have been collected since 1999 following periods of rainfall through the use of automatic sampling equipment installed at the site (see Appendix 2 for more detail on the sampling program).

Figure 30: Shayler Run autosampling station, Baldwin Rd.

Clermont OEQ installed the autosampler station at Baldwin Road in 1999 (Figure 30). At this site, stream level, temperature, pH, conductivity and DO concentrations are measured and recorded at 15-minute intervals throughout the year. The site also includes a sampling unit that is programmed to collect water quality samples from May through October when the stream exceeds a certain level.

The County has assembled a large database of water quality information on Shayler Run since sampling began in 1997. A summary of the findings to date is presented below. When considering these findings, it is important to keep in mind that the ambient data reflect samples collected in all types of weather, and do not necessarily reflect dry weather conditions.

Silt / Solids

As part of its monitoring program, Clermont County measures concentrations of total suspended solids (TSS), total volatile suspended solids (TVSS) and turbidity levels at its Shayler Run site. Additionally, Clermont began monitoring total dissolved solids (TDS) in 2001. No solids criteria have been established at either the national or state level, so there is not a benchmark against which to measure impairment; however,

Table 5: Concentrations of solids and turbidity levels in Shayler Run at Baldwin Road, 1997-2001.

Parameter	Ambient Average	Ambient Maximum	Storm Event Average	Storm Event Maximum
TSS	10.5 mg/L	110 mg/L	347 mg/L	2800 mg/L
TVSS	1.8 mg/L	8.2 mg/L	26.4 mg/L	216 mg/L
Turbidity	8.8 NTU	69.7 NTU	140 NTU	897 NTU

it is evident that levels of each of these parameters increase dramatically during wet weather. Table 5 presents a comparison of average and maximum concentrations seen in ambient and wet weather samples.

Samples collected between 1997 and 2001 show that average wet weather TSS concentrations are 33 times greater than those seen in ambient samples, while average TVSS concentrations are 15 times greater. Average turbidity levels in wet weather samples are 16 times higher in than levels seen in ambient samples.

When looking at ambient average values for all three parameters from 1997 to 2001, no discernible trend can be identified (Figure 31). Though TSS and TVSS concentrations have increased from 1999 to 2001, this is more likely the result of annual precipitation levels than other changes in the watershed. The lowest values for all three pollutants are seen in 1999, when Clermont County, like most of the Midwest, experienced a severe drought.

It is evident from the data that higher concentrations of solids and turbidity are seen during periods of wet weather, as is expected. Based on the Rosgen assessment, it is likely that a significant source of the sediment loadings are the headwater stream channels, as most were characterized as entrenched and unstable.

Nutrients

Clermont County has collected and analyzed samples for several nutrients at its Shayler Run site since 1997, including ammonia, nitrate+nitrite (NO3-NO2), total Kjeldahl nitrogen (TKN), total phospho-

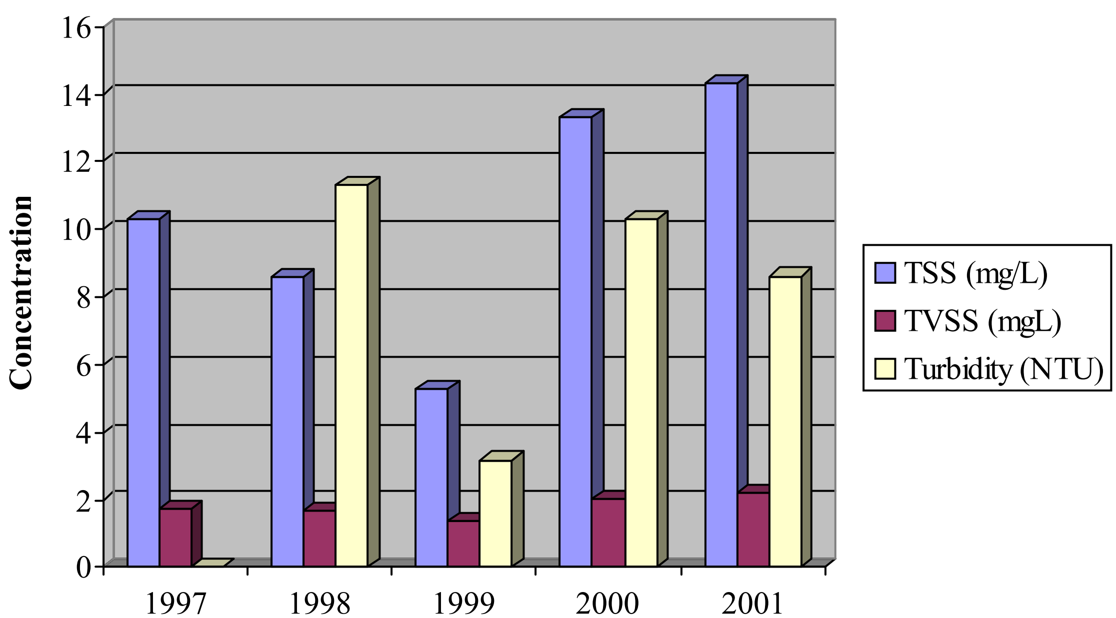


Figure 31: Annual average ambient concentrations of solids and turbidity in Shayler Creek, 1997-2001.

rus and orthophosphate. Ohio EPA has established water quality criteria for some nutrients, while criteria for others have not yet been developed. Acute and chronic criteria have been established for ammonia based on its toxicity to aquatic life. Criteria for nitrates and total phosphorus have not been established; however, criteria development for these parameters is in progress. One possible source for numeric nutrient criteria is a technical bulletin published by Ohio EPA entitled "Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams (Ohio EPA, 1999). For wadable streams, such as Shayler Run, the document proposes a nitrate+nitrite criterion of 1.0 mg/L and a total phosphorus criterion of 0.1 mg/L. However, there is some dispute regarding direct causal relationships between nutrient concentrations and biotic measurements (such as the IBI and ICI). In the absence of established and accepted criteria, these limits can be used as benchmarks to review the existing data.

Between 1997 and 2001, over 70 stream samples were collected and analyzed for each nutrient as part of the ambient sampling program and nearly 80 additional samples per parameter were collected during periods of wet weather. Average and maximum nutrient concentrations for both sampling programs can be seen in Table 6. The results of the sampling program show that:

- Total phosphorus concentrations present the greatest concern, especially following periods of rain. Only 21 percent of the ambient samples exceed 0.1 mg/L, while 83 percent of the samples exceeded this level after storm events.
- Ambient data show a slight upward trend in both orthophosphate and total phosphorus concentrations from 1997 to 2000.
- Levels of orthophosphate were relatively low and did not increase greatly during wet weather.
- Nitrate concentrations, while higher following periods of wet weather (avg. 0.49 mg/L) than in ambient samples (avg. 0.24 mg/L), do not seem to be a major concern, as levels rarely climb above 1.0 mg/L.
- Ammonia concentrations in both ambient samples and wet weather samples are rarely much higher than the detection level, and an order of magnitude below established criteria.
- Total Kjeldahl nitrogen (TKN) - a measure of the ammonia and organic nitrogen present in a water sample - increased significantly following periods of wet weather (ambient avg. of 0.59 mg/L; wet weather avg. of 1.38 mg/L).

Clermont County conducted a preliminary trend analysis on data collected from 1996 to 2000 at several sampling locations, including Shayler Run. Because of the relatively short time period, it is not possible to completely account for the influences of precipitation and flow. Any trends detected may be related more to these factors and natural variability than to specific changes within the watershed. Even so, the preliminary trend analysis can provide some useful information. The analysis showed that both total phosphorus and orthophosphate concentrations increased over this time period, while no discernible trends were seen for TKN, nitrate-nitrite or ammonia.

Table 6: Nutrient concentrations in Shayler Run at Baldwin Road, 1997-2001

Parameter	Criteria (mg/L)	Ambient Ave (mg/L)	Ambient Max (mg/L)	Wet Weather Ave (mg/L)	Wet Weather Max (mg/L)
Total Phosphorus	0.1 (proposed)	0.08	0.29	0.61	3.88
Orthophosphate	None	0.03	0.13	0.07	0.22
Nitrate	1.0 (proposed)	0.24	1.26	0.49	1.80
Ammonia[1]	2.2 chronic[2] 13.0 acute[2]	0.10	0.12	0.10	0.19
TKN	None	0.59	1.23	1.38	4.93

[1] – Ammonia samples below detection limit are assumed to equal the detection limit of 0.10 mg/L.
[2] – Represents nutrient criteria at pH of 7.5 and stream temperature of 20°C from March to November. Criteria become more stringent at higher temperatures and pH levels.

Metals

Clermont County OEQ began monitoring ambient concentrations of total recoverable copper, lead and zinc at Shayler Run in 1997, and initiated wet weather sampling in 1999. Results have shown some problems in wet weather, particularly with copper and lead. Copper concentrations have rarely exceeded instream criterion in ambient samples, but have been greater than the chronic criterion in approximately 74 percent of the samples collected after periods of rain, and greater than the acute criterion in 53 percent of these samples (Figure 32)(Hardness concentrations, on which criteria for copper, lead and zinc are based, were not available for all samples collected. A hardness level of 100 mg/L has been assumed for purposes of comparison). The findings were similar for lead. Ambient samples rarely exceeded lead standards. Wet weather concentrations were significantly greater, and 37 percent of the samples exceeded the chronic criterion of 6.4 mg/L (Figure 32). All samples were well below the acute criterion concentration.

Like copper and lead, instream zinc concentrations also increased significantly during wet weather; however, only two samples were greater than the Ohio EPA standard.

Since only three years of wet weather sampling data are available, there is not enough available information to determine the presence of any increasing or decreasing trends in instream metals concentrations. The trend analysis conducted on the ambient data did not reveal any distinct trends for any of the metals.

Bacteria

In 1997, Clermont County began monitoring fecal coliform concentrations in Shayler Run at Baldwin Road. Starting in 1998, the focus of the monitoring program shifted to E. coli. Ohio EPA has established both fecal coliform and E. coli criteria for all streams designated for "primary contact recreation use," in-

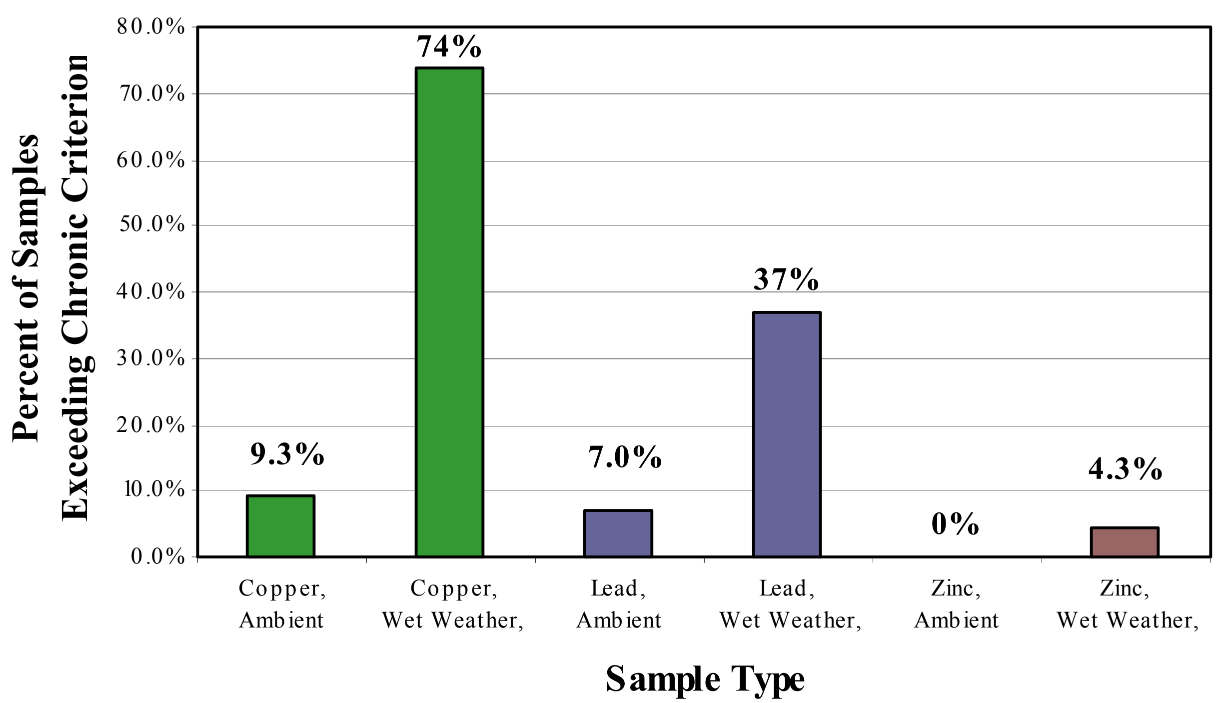


Figure 32: Percent of ambient and wet weather samples that exceed chronic aquatic life criteria established by Ohio EPA for copper, lead and zinc.

** Assuming a total hardness concentration of 100mg/L for all samples* cluding those in the Shayler Run watershed. The current E. coli criteria are:

- Geometric mean based on not less than five samples in a 30-day period shall not exceed 126 colony forming units (cfu) per 100 mL
- Geometric mean shall not exceed 298 cfu/100 mL in more than 10 percent of the samples collected in a 30-day period.

While the data collected by Clermont County cannot be directly compared to the criteria due to the frequency of sampling, instream concentrations seen following storm events illustrate an obvious problem. A total of 89 percent of the wet weather samples collected had *E. coli* concentrations greater than 298 cfu/100 mL, with counts as high as 26,000 cfu/100 mL.

The ambient sampling program also shows problems with elevated bacteria levels, though not to the extent that the wet weather samples do. Approximately 33 percent of the samples had *E. coli* counts greater than 298 cfu/100 mL. However, concentrations in these samples range from non-detectable to 36,000 cfu/100 mL. As stated above, ambient samples are collected once every two weeks during the contact recreation season, regardless of weather conditions. Undoubtedly, some of these samples were collected following storms while others were collected during dry periods. As such, it is difficult to determine if problems exist during dry weather. To make this determination, the existing ambient data should be tied to available rainfall data, or a bacteria sampling program that is tied to weather conditions should be established.

Organic Enrichment / Dissolved Oxygen

In all samples collected from Shayler Run, Clermont County measured the 5-day carbonaceous biochemical oxygen demand (CBOD5) concentration. Results show a slight increase in average CBOD5 concentrations during periods of wet weather samples (Figure 33).

Dissolved oxygen criteria for warmwater habitat streams (including those in the Shayler Run watershed) have been established by Ohio EPA. Criteria include:

- Minimum instream concentration of 4.0 mg/L
- Minimum 24-hour average concentration of 5.0 mg/L.

The DO data presented in this report represents readings taken at a single point in time, and therefore should be compared against the 4.0 mg/L criterion. Over a five-year period (1997-2001), DO concentrations as measured in Shayler Run during the collection of ambient water quality samples have averaged 8.2

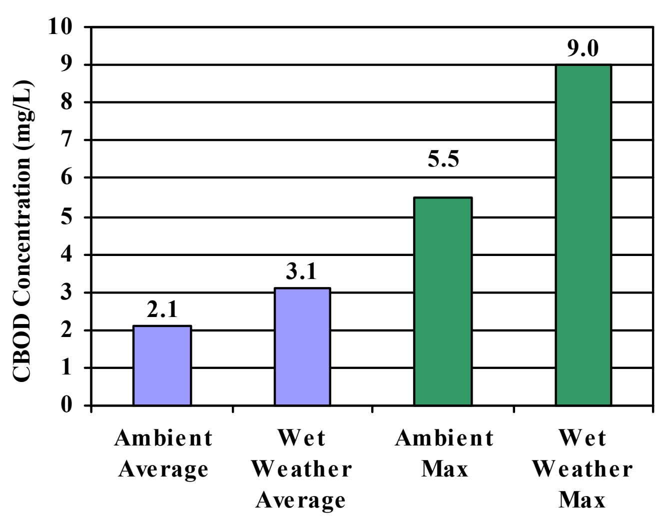


Figure 33: Comparison of ambient and wet weather $CBOD_5$ concentrations, Shayler Creek at Baldwin Road, 1997-2001

mg/L. In six of the 70 readings (8.6 %) recorded, DO concentrations have been below 5.0 mg/L, while five of the readings (7.1 %) have been less than 4.0 mg/L.

While the DO data collected represent single samples, the results show that most samples meet both the absolute minimum and minimum daily average criteria established by Ohio EPA.

At the time of this report, continuous dissolved oxygen data collected at the autosampler station were still being checked for accuracy. However, with only slight increases in wet weather CBOD concentrations and the increased aeration that occurs during higher flows, it is unlikely that instream DO concentrations during and immediately after storm events are significantly lower than those seen in ambient samples.

Additional Water Quality Information

In addition to the water quality data discussed above, OEQ has also monitored pH levels in Shayler Run since 1997. No readings have been less than 6.0 or greater than 9.0, the criteria established by Ohio EPA for warmwater habitat streams. The minimum pH value seen was 6.9, while the maximum reading was 8.5. The average pH of Shayler Run at Baldwin Road is 8.0 (+/- 0.3).

Samples have also been collected and analyzed for total chlorides. Ohio EPA has set a criterion of 250 mg/L for the protection of public water supplies. While Shayler Run is not designated for this use, this still provides a standard against which to compare the County's results. Chloride concentrations seen at this site have been well below the standard, averaging 32 mg/L in 35 samples collected between 1997 and 2000. The maximum concentration seen was 88 mg/L.

Stream Biology - Lower East Fork Tributaries

Biological Communities

Ohio EPA has also investigated the biological communities on four tributary streams to the Lower East Fork, though not as extensively as the East Fork itself. These streams include:

- three sites on Hall Run,
- Salt Run at Roundbottom Road,
- Wolfpen Run at Wolfpen-Pleasant Hill Road, and
- four sites on Sugarcamp Run along Sugar Camp Road.

Clermont County has also conducted biological surveys on Hall Run, upstream and downstream of Bzak Landscaping on Roundbottom Road.

Ohio EPA has designated all tributaries to the lower East Fork as "warmwater habitat" (WWH) streams. Each of the streams surveyed by Ohio EPA and Clermont County are considered to be "headwater streams" by the state. The fish (IBI) criterion for WWH headwater streams in this ecoregion is 40, while the macroinvertebrate (ICI) criterion is 36.

Hall Run

Biological surveys conducted by both Ohio EPA and Clermont County show that there is some degree of impairment on Hall Run. Ohio EPA has conducted surveys at Roundbottom Road, both upstream and downstream of Bzak Landscaping, and upstream of the Summerside Road bridge. Excluding 1998 scores which were influenced by a sewage spill (discussed below), only a 1991 survey upstream of Bzak met the IBI criterion. This same survey rated the macroinvertebrate community as "good." A follow-up survey at the same site resulted in a much lower score (IBI = 32) and a "moderately good" assemblage of macroinvertebrates. Qualitative macroinvertebrate surveys downstream of Bzak ranged from "fair" to "moderately good."

Clermont County also conducted fish and macroinvertebrate surveys downstream of Bzak Landscaping on Roundbottom Road in 1999 and 2000. The surveys were designed to see if there was any impact from the large mulch pile which borders the stream. The two surveys yielded varying results, with IBI scores meeting State standards in 1999, but falling below standards in 2000. The macroinvertebrate communities downstream of Bzak were rated as marginally good in 1999 and good in 2000. Based on the information from both Ohio EPA and Clermont County, runoff from the Bzak facility does not seem to noticeably impact Hall Run.

Both Ohio EPA and Clermont County conducted fish and macroinvertebrate surveys upstream and downstream of Bzak Landscaping in 1998. These surveys were drastically impacted by a sewage spill that occurred upstream of the sampling sites on July 17 and lasted for approximately four days. The impacts of the spill were dramatically evident on the fish community; however, the macroinvertebrates did not show the same type of response as the fish did. Both fish surveys conducted by Ohio EPA before the spill in June 1998 resulted in IBI scores of 32. While these are below the standards set by the State, it still represented a fair fish community. Follow-up surveys conducted about three weeks after the spill by Ohio EPA showed that the fish had almost completely disappeared from the stream. Both sites received the lowest possible IBI score of 12. Clermont County surveys conducted after the spill gave identical results. However, the stream did begin to show signs of recovery as early as September. Clermont surveys showed that the IBI score had climbed back to 32 upstream of Bzak, although the downstream site still received a very poor score of 14.

In contrast to the fish, macroinvertebrate scores of surveys conducted by Clermont County in August were moderately good to good at the upstream and downstream sites, respectively. This showed no difference (or even a slight improvement) when compared to the moderately good ratings given by Ohio EPA for surveys conducted two days before the spill.

Salt Run

Only one biological survey has been conducted on Salt Run, that by Ohio EPA near Roundbottom Road in 1997. The fish survey score was in compliance with State standards (in the "non-significant departure" range). The macroinvertebrate survey conducted using dip-net sampling produced a "fair" collection of the aquatic insects. The habitat at this location was fair (QHEI = 56), with below average substrate, poor riffle development, but good cover available for stream biota.

Wolfpen Run

As with Salt Run, only one survey was conducted by Ohio EPA on Wolfpen Run in 1997. Stream habitat was fair (QHEI = 52), with excellent substrate, but poor instream cover and riparian zone protection, and below average pool and riffle quality. Even with the less than ideal habitat, the fish community scored rather well (IBI = 42), though the macroinvertebrate community was only rated as "fair."

Sugarcamp Run

In 1994, Ohio EPA conducted three surveys along Sugarcamp Run at stream miles 0.3, 2.0 and 2.6. The fish community showed some impairment at the two most upstream sites, (IBI scores of 30 and 28); however, an excellent assemblage of fish was found at mile 0.3 (IBI = 48). One possible explanation for the difference in scores is that fish from the larger East Fork River have worked their way a short distance upstream into Sugarcamp Run. Macroinvertebrate ratings were fair at stream mile 2.6, and moderately good at miles 2.0 and 0.3. The habitat at all sites was similar, with QHEI scores ranging from 63.5 to 69.5. All sites had good substrate, with a normal amount of silt and low embeddedness, but a below average riparian zone and poor riffle development.

Water Chemistry - Lower East Fork Tributaries

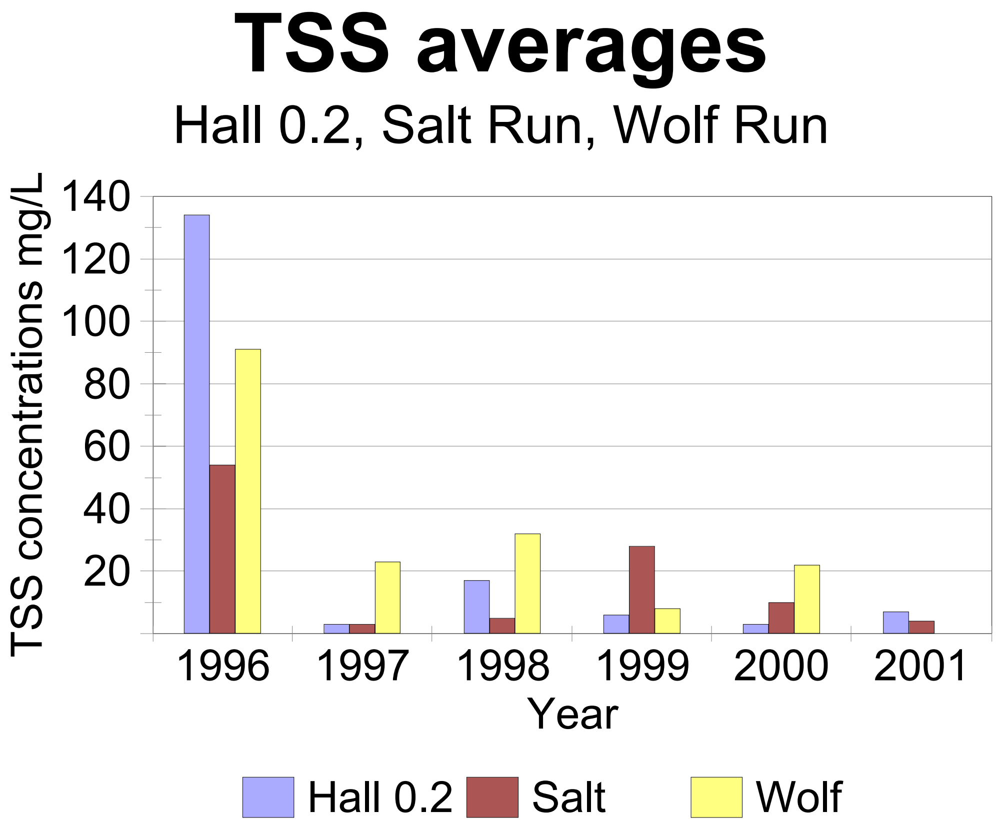
Solids

Clermont County began monitoring for Total Suspended Solids (TSS) and Total Volatile Suspended Solids (TVSS) at sites on Hall Run, Salt Run and Wolfpen Run in 1997, and began monitoring for turbidity in 1998. In addition, the County conducted one year of monitoring on Wolfpen Run at sites upstream and downstream of a mobile home park located at stream mile 1.55.

Solids concentrations measured at the three tributary sites were very different from those measured in the main stem. Total suspended solids were generally greatest in 1996 and significantly declined in the following years. This was also true for TVSS; the greatest concentrations were seen in 1996 samples, and the lowest concentrations were seen in 2001 samples. The declining trend in both TSS and TVSS concentrations is illustrated in Figures 34 a & b.

The TSS results from Wolfpen RM 1.5 and RM 1.6 indicated that concentrations slightly increased downstream of the mobile home park from a value of 2.8 mg/L at RM 1.6 to a value of 3 mg/L at RM 1.5.

a.



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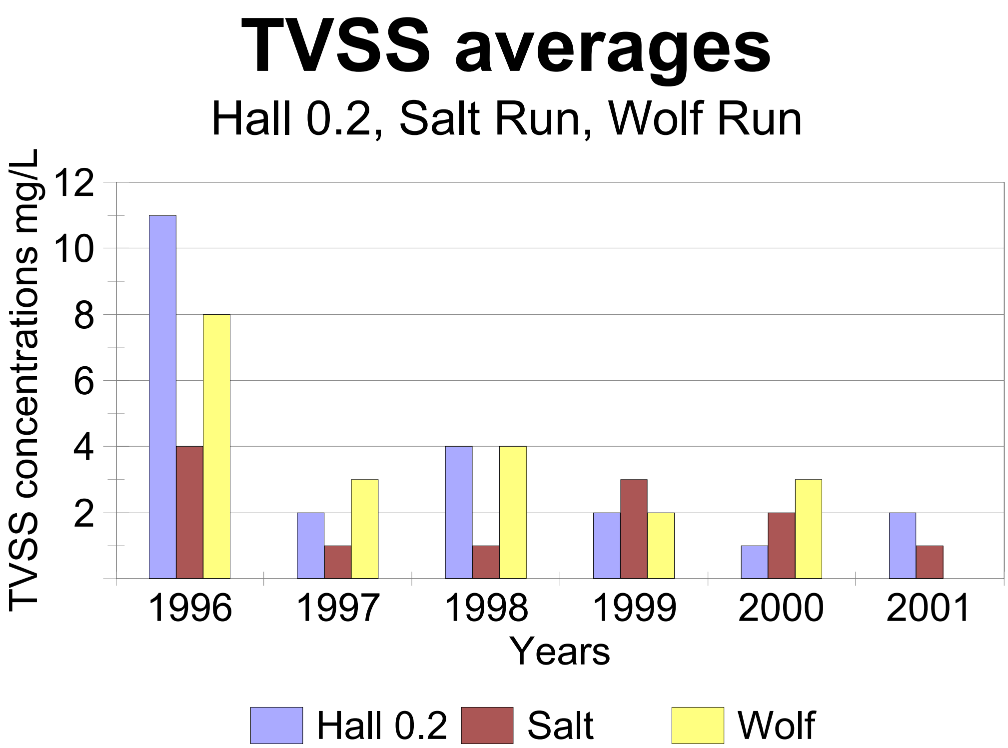


Figure 34: Annual average TSS concentrations (a) and TVSS concentrations (b) at Hall Run RM 0.2, Salt Run and Wolfpen Run.

Nutrients

Total phosphorus is a concern at several tributary sites as well as on the East Fork main stem. Hall Run RM 5.0 is a particular concern, where the average of 0.23 mg/L exceeds the benchmark concentration. Furthermore, the sample site on Wolfpen had an average concentration of 0.3 mg/L, with 95 percent of the samples exceeding 0.1 mg/L.

Nitrate+nitrite concentrations were only of concern on Wolfpen Run as 29 percent of the samples exceeded the potential criterion value with an average concentration of 0.79 mg/L. The averages for all other tributary sampling stations were well below this benchmark.

Results from the samples collected near the mobile home park at Wolfpen RM 1.5 and RM 1.6 indicate that nitrate concentrations upstream and downstream of the park's treatment plant outfall are essentially identical and very high. The nitrate concentrations for samples collected at both sites were 4.8 mg/L.

Ammonia concentrations on the tributaries do not seem to be of concern as only two percent of samples from both Hall RM 0.3 and RM 0.2 exceeded criteria. Criteria were not exceeded at any other tributary sampling station. The ammonia concentrations at Wolfpen RM 1.5 and RM 1.6 appear to slightly decrease downstream, but are below Ohio EPA's criteria. The sample collected at RM 1.6 had a concentration of 0.13 mg/L and the concentration at RM 1.5 was 0.1 mg/L.

The TKN concentrations on the tributaries indicate a slight decrease in the average concentrations from 1996 to 2001 at Hall Run RM 0.2, Salt Run and Wolfpen Run (Figure 35). The average concentration at Hall RM 0.2 decreased from 1.08 mg/L in 1996 to 0.72 mg/L in 2001. Likewise, the average concentration at Salt Run decreased from 0.83 mg/L in 1996 to 0.61 mg/L in 2001. The concentrations taken at Wolfpen Run RM 1.5 and RM 1.6 also appear to decrease downstream, with values of 1.29 mg/L at RM 1.6 and 0.9 mg/L at RM 1.5.

In contrast to TKN, the data indicate that orthophosphate has increased from 1996 to 2001 at Wolfpen RM 0.1. Average concentrations in Salt Run and Hall Run RM 0.2 were the lowest in 1997.

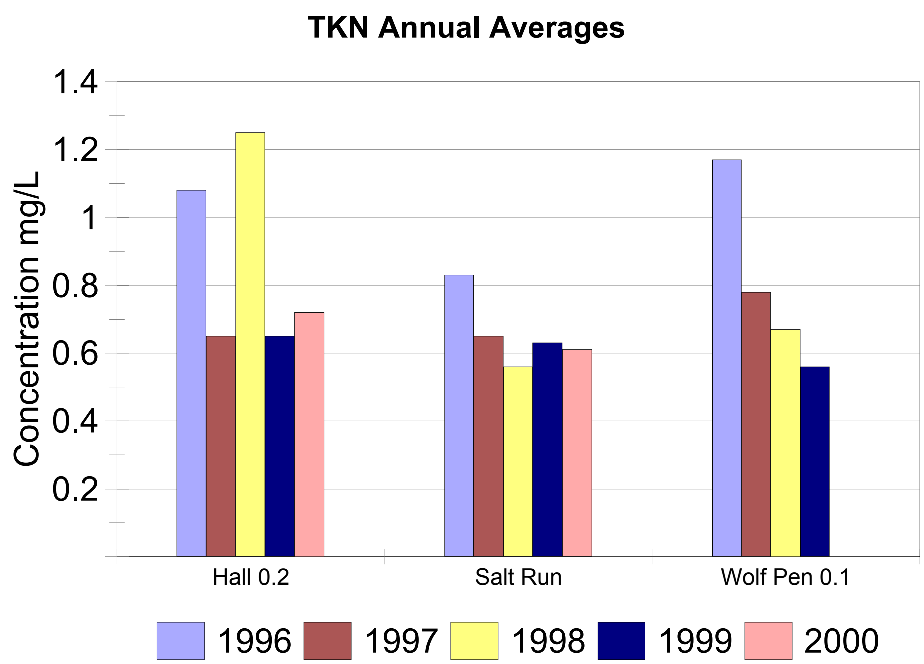


Figure 35: Annual TKN averages for tributaries to the Lower East Fork River.

Metals

Metals were sampled at several of the tributary sites, including Hall Run RM 0.2, Salt Run and Wolfpen RM 0.1. Copper and lead were sampled at all of these sites, while zinc was only sampled at Hall RM 0.2. Six lead samples were collected at Hall RM 0.2, half of which exceeded OEPA's criteria. Likewise, single copper samples taken at both Salt Run and Wolfpen Run yielded values of 13.2 ug/L and 21.7 mg/L, respectively, both of which exceed criteria.

Lead samples taken at Hall Run RM 0.2 had an average value of 9 ug/L, with two samples exceeding the chronic criterion. Single lead samples taken at Salt Run and Wolfpen Run both exceeded Ohio EPA's criterion. The sample from Salt Run was 13.9 ug/L and the sample from Wolfpen was 10.8 ug/L. Metals were not sampled at Wolfpen RM 1.5 and RM 1.6.

Bacteria

Bacteria levels were found to be elevated on the three tributaries sampled in the Lower East Fork subwatershed. Levels at Wolfpen Run were particularly high, as 69 percent of the bacteria samples exceeded OEPA's criteria, with a maximum concentration of 3500 cfu/100 mL. Furthermore, all three sampling sites on Hall Run are of concern. A total of 33 percent of samples exceeded criteria at RM 0.2, with a maximum concentration of 2.1 million cfu/100 mL. At RM 0.3, 39 percent of samples exceeded criteria with a maximum concentration of 2.3 million cfu/100 mL. At the most upstream sampling location (Hall RM 5.0), 89 percent of samples exceeded criteria with a maximum concentration of 18,000 cfu/100 mL. Additionally, the geometric means for all sampling years for all five of the tributary sites significantly exceeded OEPA's criteria.

Organic Enrichment/Dissolved Oxygen

The tributary values for CBOD5 were relatively steady. The yearly averages for Wolfpen Run were around 2.25 mg/L for all sampling years except for 1999 (drought year), when the average fell to 1.27 mg/L. The CBOD5 yearly averages for Hall Run RM 0.2 were also around this level, except for 1998, where tha annual average was 4.64 mg/L. The CBOD5 samples collected from Wolfpen RM 1.5 and RM 1.6 both had a concentration of 2.0 mg/L.

Dissolved oxygen averages on the tributaries have been a concern during periods of low flow and warmer stream temperatures. At some point in time, all of the tributary DO minimums have been below OEPA's minimum criteria of 4.0 mg/L, except for Wolfpen Run, which had a minimum value of 6.28 mg/L. Yearly DO averages do not show a trend at any of the tributary sampling sites.

Point Source Inventory

There are four permitted point source discharges in the Lower East Fork Watershed. The two most significant discharges are those from the City of Milford and Clermont County's Lower East Fork Wastewater Treatment Plants. The two others are discharges from the Orchard Lake and Royal Hills mobile home parks.

The wastewater statistics for the Lower East Fork watershed were obtained using GIS data from 1999. As the most heavily populated watershed in the East Fork region, the Lower East Fork watershed has the largest centralized sewer network. Central sewer service is provided to approximately 88 percent of this watershed, servicing 13,523 out of 15,337 parcels. The remaining 1814 parcels are left to rely on onsite septic systems. Currently there are 242.7 miles of sewer lines within this section of the East Fork watershed, serviced by 4658 manholes. Most of the sewer lines are gravity driven, meaning they follow the natural gradient of the stream bed to the wastewater treatment plant; however, there are 26 lift stations which serve to pump wastewater uphill toward the treatment facilities. Within this watershed, sewer lines run through the main stem of the East Fork River, Sugarcamp Run and Hall Run, with 466 stream crossings. In addition, there are approximately 17.6 miles of instream sewer line in the Shayler Run subwatershed. Flow is directed either to Clermont County Lower East Fork Wastewater Treatment Plant at RM 5.4 or the Milford Wastewater Treatment Plant at RM 1.3 (Table 7). Once the sewage has been treated, its effluent is then discharged directly to the East Fork River.

Annual average effluent concentrations for several parameters at the County's Lower East Fork treatment plant, including $CBOD_5$, TSS, ammonia and copper, started to increase significantly in 2000, when Earth Tech assumed operation of the plant (Figure 36). Part

Table 7: Summary of sewer system statistics for Lower East Fork and Shayler Run watersheds.

Sewer System Statistics		
	Lower East Fork Watershed	**Shayler Run Watershed**
Total land parcels	10117	5220
Parcels on sewer system	8600	4923
Parcels believed to be on septic system	1517	297
Parcels known on septic sytem	800	65
Total miles of sewer line	148.5	94.2
Total number of manholes	2860	1798
Total number of lift stations	19	8
Total number of stream crossings	466	245

of the reason for this is that the plant underwent an expansion from 7 to 9 MGD, although this does not entirely explain the increase. In 2002, the Lower East Fork WWTP continued to experience problems particularly with ammonia concentrations. From January through August 2002, there were 37 violations of the ammonia discharge limit contained in the plant's National Pollutant Discharge Elimination System (NPDES) permit. As of September 1, 2003, Clermont County terminated its contract with Earth Tech, and the Sewer District again assumed the responsibility of operating and maintaining the County's wastewater treatment plants and sanitary sewer collection systems. Sewer District staff are currently working to improve operations at the treatment plants. This should be evident in the near future.

At the time of this report, the East Fork Watershed Collaborative had not obtained discharge data from the City of Milford's 0.75 MGD wastewater treatment plant. The City of Milford has agreed to work with the Collaborative in compiling this information. This should be available by the end of 2003.

Spills, Bypasses and Overflows

A summary of spills, bypasses and overflows from the County's treatment plant and collection system between January 2000 and March 2003 is presented in Appendix 3. As can be seen from this table, the Lower East Fork WWTP experienced numerous bypass events from October 2001 through May 2002; however, no bypasses have been reported to Ohio EPA since that time. The recent plant expansion should help to eliminate that problem. Within the Hall Run watershed, there are chronic problems at a constructed overflow on Beechmont Drive, and a manhole at Todd Rose Lane. The Sewer District plans to correct both of these problems during 2003 as part of its capital improvements program. In the headwaters of the Sugarcamp Run watershed, the lift station at State Route 131 tends to overflow each time there is a significant rain. In 2000, a new lift station was constructed at this site; however, it was undersized. An upgrade to this lift station is also planned for 2003.

In November 2000, the Clermont Sewer District completed development of a computer model for the Shayler Run collection system in an effort to determine if the existing sewer system experiences capacity problems, or if the system can convey the projected

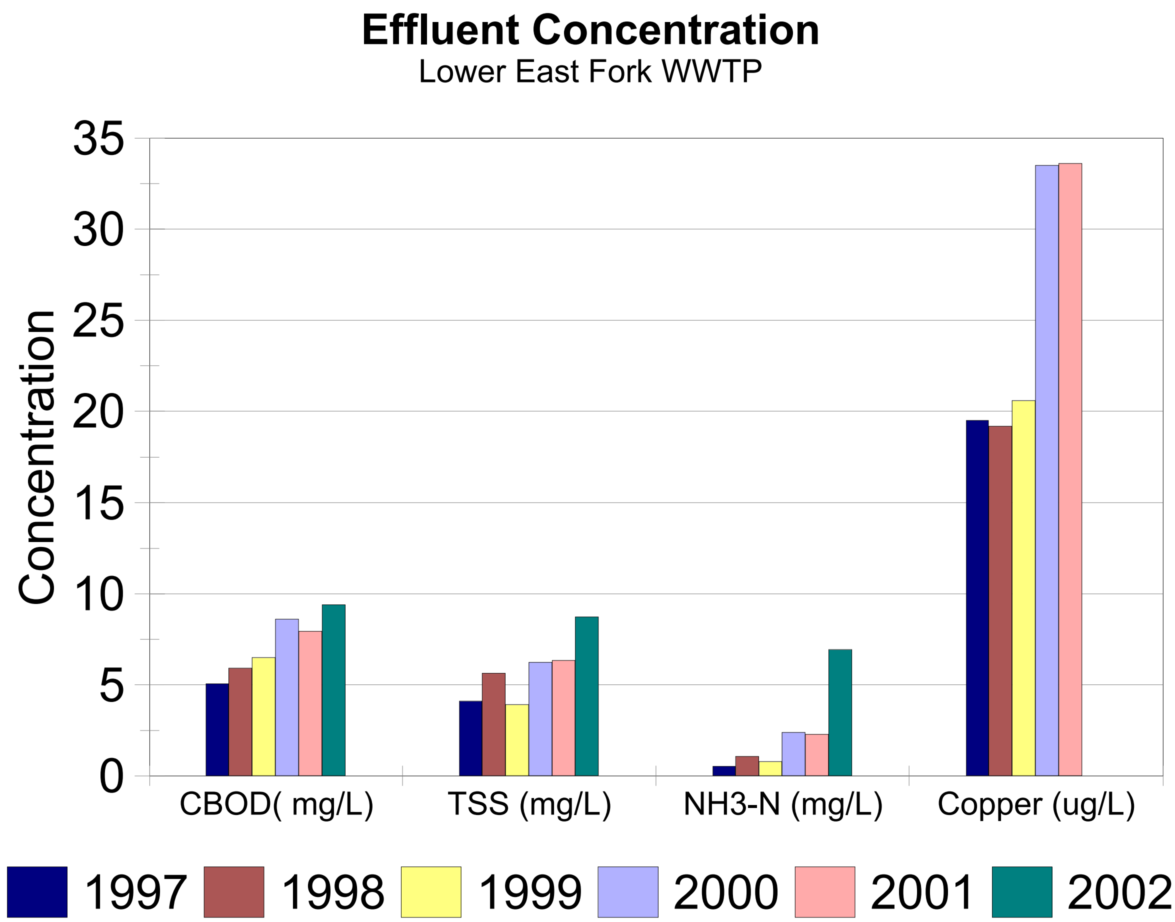


Figure 36: Summary of Lower East Fork WWTP effluent concentrations from 1997 to 2002

buildout flows. The study showed that the collection system does have adequate capacity, although seven specific areas experience problems with inflow and infiltration during periods of wet weather. The study also showed that the existing system can convey the projected buildout flows; however, the same seven areas will continue to experience capacity problems if no corrective actions are taken. Sewer system evaluation surveys and system rehabilitation in these areas were recommended.

The other permitted dischargers in the watershed include the treatment plants at the Orchard Lake and Royal Hills mobile home parks. Flow from the Orchard Lake plant (Ohio EPA Permit No. 1PV00009*CD) is approximately 42,900 gallons per day. Flow from the Royal Hills plant (Ohio EPA Permit No. 1PV00074*BD) is 37,300 gallons per day.

Nonpoint Source Inventory

Home Sewage Treatment Systems

An inventory of home sewage treatment systems has been completed for both the Lower East Fork and the Shayler Run subwatersheds. In the Lower East Fork, an estimated 1517 parcels rely on septic systems, although only 800 systems have been recorded by the County Health Department (Figure 37). It is assumed that the remaining 717 parcels are also served by septic systems, since it is known that these parcels are not served by central sewer.

Of the 800 parcels recorded by the Health District, 690 are discharging systems and 110 are soil absorption systems. Of the 690 discharging systems, 528 are aerobic systems, 155 utilize sand filters and 7 are extended aerobic package plants (Table 8). Furthermore, the Health District estimates that 570 soil ab-

Table 8: Summary of septic system statistics for the Lower East Fork subwatershed.

Septic Sytem Statistics: Lower East Fork	
Total number of known septic systems	800
Number with non-discharging technology	110
Number that discharge to subsurface sand filter systems	155
Number that discharge to aerobic digester systems	528
Total number of semi-public systems	17

sorption systems were placed in soils not suitable for onsite effluent disposal. The Health District also has 17 recorded semi-public systems.

The Health District estimates that 1064 systems are over 25 years old. Many of these systems were not designed to handle today's flows, fail to meet current codes, and may result in system failures. Most onsite sewage systems designed for homes that used a cistern for their water source have since been connected to a public water supply. In many of these cases, the homes' septic system were never upgraded to accommodate the higher flows associated with an "unlimited" public water supply. Failures are likely in such situations. Water quality issues that typically result from failing on-site systems include high biological oxygen demand (BOD), chemical oxygen demand (COD), biological pathogens, and ammonia, among others. Not only do low concentrations of DO reduce a stream's ability to support biota, high concentrations of ammonia can be extremely toxic to fish.

Other factors which severely limit the performance of any absorption-based onsite sewage system include soil, shallow water table and landscape position. A majority of the soils located in the East Fork watershed are not suitable for wastewater treatment and disposal. Many of these soils are hindered by a seasonally shallow water table which extends to within inches of the ground surface. During the wet months of the year, conventional soil absorption-based septic systems will discharge untreated wastewater directly into saturated soil layers. A seasonal water table will also cause wastewater to surface downslope and be carried in runoff to nearby drainage ways.

Septic systems in areas of Avonburg, Clermont and Blanchester soils are most likely to be failing. These soils are more common in the Shayler Run subwatershed, especially in the southernmost third of the watershed. Additionally, septic systems on soils with greater than six percent slope (and especially greater than 12 percent slope) may be allowing untreated waste to surface downslope. Sloping soils are more common in the Lower East Fork subwatershed.

In the past, residential development occurred without planning for proper onsite wastewater treatment. Septic systems were often the last priority in land and building development. As a result, systems were installed where they would fit rather than where they would work. On small crowded lots or other poorly planned properties, improper landscape positioning of sewage systems has resulted in many soil absorption systems being installed off contour, in places with disturbed soil, or placed in poorly drained areas. Small properties also do not account for an adequate septic system replacement areas. The Lower East Fork wa-

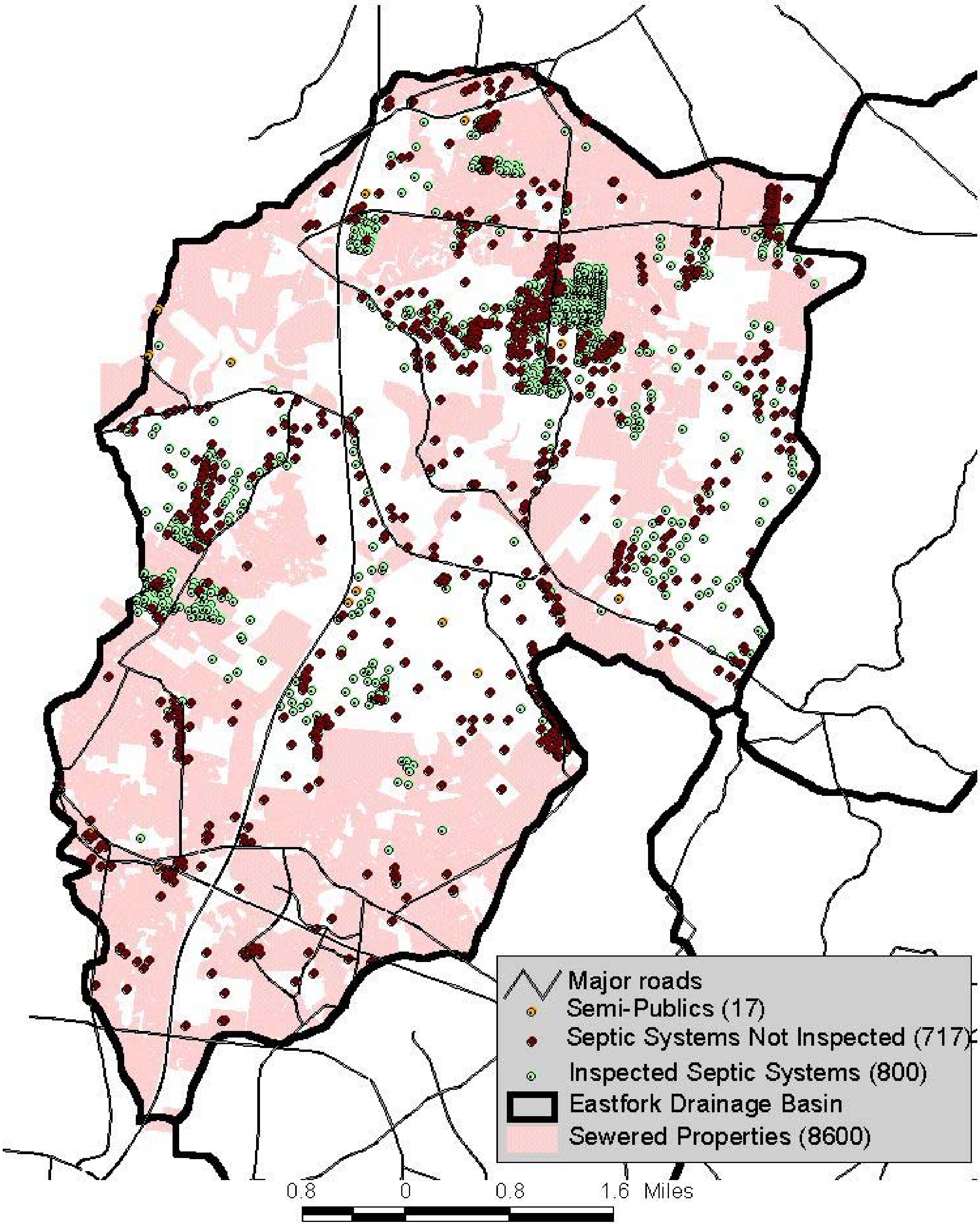


Figure 37: Distribution of residential and semi-public onsite systems within the Lower East Fork subwatershed.

How Septic Systems Affect Surface Water

Conventional septic systems typically release wastewater effluent into subsurface drainage tiles to absorb into the surrounding soil. In suitable soils, this effluent will infiltrate into the ground where it causes minimal risk to surface waters.

Having the septic tank pumped out at intervals determined by the scum/sludge accumulation rates in the tank will prolong the life of the secondary treatment component of the septic system.

Additionally, minimizing water usage in the home will reduce the likelihood of a septic system overflow.

The medium in which a system is placed is very important. Conventional soil absorption systems installed in unsuitable areas will result in high system failure rates. If the effluent is prohibited from infiltrating it will runoff, carrying harmful bacteria, nutrients (ammonia) and metals to surface water bodies.

tershed contains 757 unsewered residential properties with less than one acre of land.

Within the Shayler Run subwatershed, there are an estimated 297 parcels that rely on septic systems for wastewater treatment. Of these, only 65 are recorded by the County Health Department (Figure 38). Furthermore, 218 of 297 septic systems were estimated to be older than 25 years. Of the 65 recorded systems, 29 utilize non-discharging technologies, 36 discharge effluent directly from either subsurface sand filter sys-

Table 9: Summary of septic system statistics for the Shayler Run subwatershed.

Septic Sytem Statistics: Shayler Run	
Total number of known septic systems	65
Number with non-discharging technology	29
Number that discharge to subsurface sand filter systems	27
Number that discharge to aerobic digester systems	9
Total number of semi-public systems	9

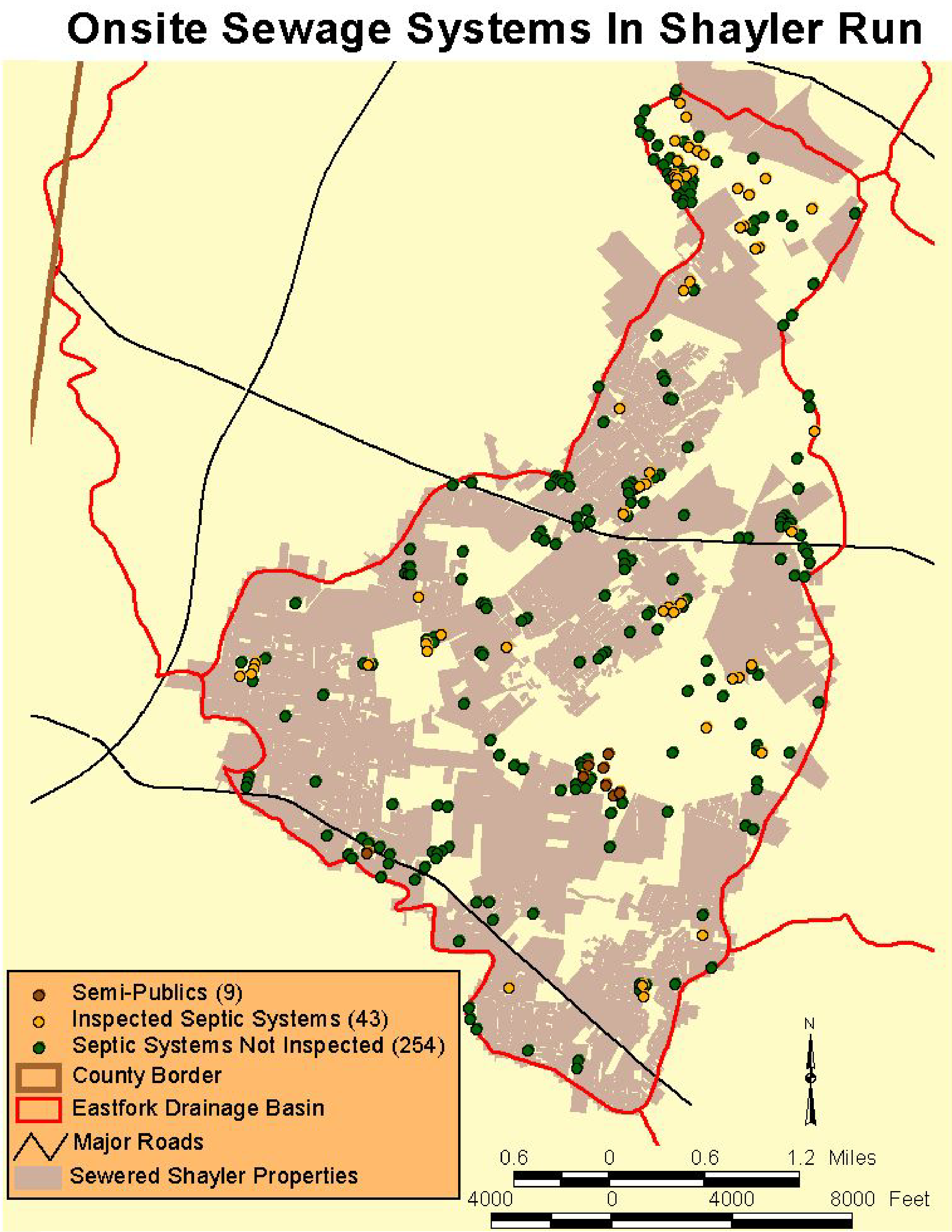


Figure 38: Distribution of residential and semi-public onsite systems within the Shayler Run subwatershed.

tems (27) or aerobic treatment systems (9). Nine are semi-public systems located primarily near Clough Pike and SR 125. Of the nine semi-public systems, seven were considered passing; one was vacant; and one was failing during recent inspections. Table 9 outlines the summary statistics of septic system usage within the Shayler Run watershed.

As stated above, the type of soil is a primary factor in determining the success or failure of home sewage treatment systems. Table 18 in the *2002 Clermont County Soil Survey* supplement indicates that almost all soils in the watershed have severe limitations for septic systems because of slow percolation and wetness factors. Figures 5 through 8 in this report show where the worst soil conditions for septic systems exist because of shallow water table (based on soil series) and landscape position (based on slope).

Also, Shayler Run contains 136 unsewered residential properties with less than one acre of land. As mentioned above, improper positioning on small crowded lots or other poorly planned properties may result in poorly performing septic systems.

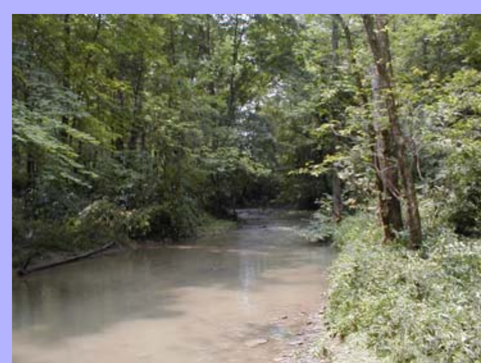
Stormwater Runoff

The Lower East Fork watershed is the most populous watershed within the East Fork Little Miami River basin. This area continues to see expanding growth from the east side of Cincinnati. As stated in the Introduction, data from the 2000 census indicate that 67,418 residents live within the watershed. Comparisons of the 1990 and 2000 census indicate a ten percent increase in population over this time. This increase in population is expected to continue. Clermont County has developed the Vision 32 Plan as a guide for future planning efforts. Focusing on the development along the State Route 32 corridor running through Clermont County, this land use plan "seeks to balance the preservation of the unique character of Clermont County...while allowing appropriate growth and development." Under this plan, the area surrounding SR 32 in the Lower East Fork and Shayler Run watersheds calls for preserving residential neighborhoods while strengthening their economic base.

Watersheds are often classified based on their percent of impervious surfaces. Those with the least amount of impervious area tend to have the healthiest water systems; and those with the most amount of impervious area typically have degraded conditions. The

Importance of Riparian Habitats

Preserving stream and watershed habitats is critical to the overall health of the watershed. **Riparian vegetation -** that which directly borders either side of a stream - is exceptionally important in maintaining stream quality. This vegetation acts as buffer to environmental stressors. When trees and shrubs are allowed to flourish, they can act as filters by trapping excess sediments, absorbing nutrients in runoff and providing shade. Furthermore, roots help to stabilize stream banks, preventing erosion and flooding, and provide for fish and other stream biota.



The removal of riparian vegetation can ultimately increase the temperature of the stream, causing the dissolved oxygen content of the water to decrease. If dissolved oxygen drops too low, the stream may not be able to sustain a healthy biotic community. Also, streambank erosion can threaten utility lines and transportation infrastructure, and **cause property loss or damage**.

Center for Watershed Protection has classified watersheds with impervious cover of less than 10% as sensitive; 10-25% as degraded or impacted; greater than 25% non-supporting of aquatic life. Based on 1992 land use data, the Shayler Run subwatershed has 10.4% imperviousness, and the Lower East Fork subwatershed has 11.6 percent imperviousness. With the growth experienced in both subwatersheds over the last decade, these numbers have undoubtedly increased from their 1992 levels, and based on a trend of continued growth, will likely continue to increase in the coming years.

However, there is one significant area of green space within the Lower East Fork watershed. The Cincinnati Nature Center's Rowe Woods, a 790-acre plot of land dedicated to natural preservation and environmental education, is located east of Milford along Tealtown Road. The lower reaches of Salt Run travel through the Nature Center.

Agriculture

The primary land uses of the Lower East Fork watershed are residential and commercial. Though the 1992 land use data may indicate otherwise, there is very little agriculture left in this watershed and, therefore, runoff from agricultural fields or animal feedlot operations does not pose a significant threat to water quality. Clermont County is currently working with the U.S. EPA research office in Cincinnati to update land use data for the entire Little Miami River basin.

Other Nonpoint Sources

The Lower East Fork watershed is segmented by 373.8 miles of roads with 29 Ohio Department of Transportation (ODOT) bridges, 44 county/township bridges, 621 culverts, 2.1 miles of railroad and 1 railroad trestle. Six bridges within Lower East Fork and Shayler Creek subwatersheds are scheduled to be replaced by the County Engineer's office (Figures 39 and 40, respectively).

This type of infrastructure often places stress on the watershed and consequently the receiving water bodies, resulting in: loss of vegetation/habitat in the riparian zone; instream habitat loss; impedance to fish passage; streambank instability; and increased erosion. Culverts, for example, often cause localized constriction of the stream channel, forcing water to flow faster while causing streambank erosion. Additionally, these types of infrastructure promote the removal of riparian vegetation, which is vital to the overall health of the watershed and receiving water bodies.

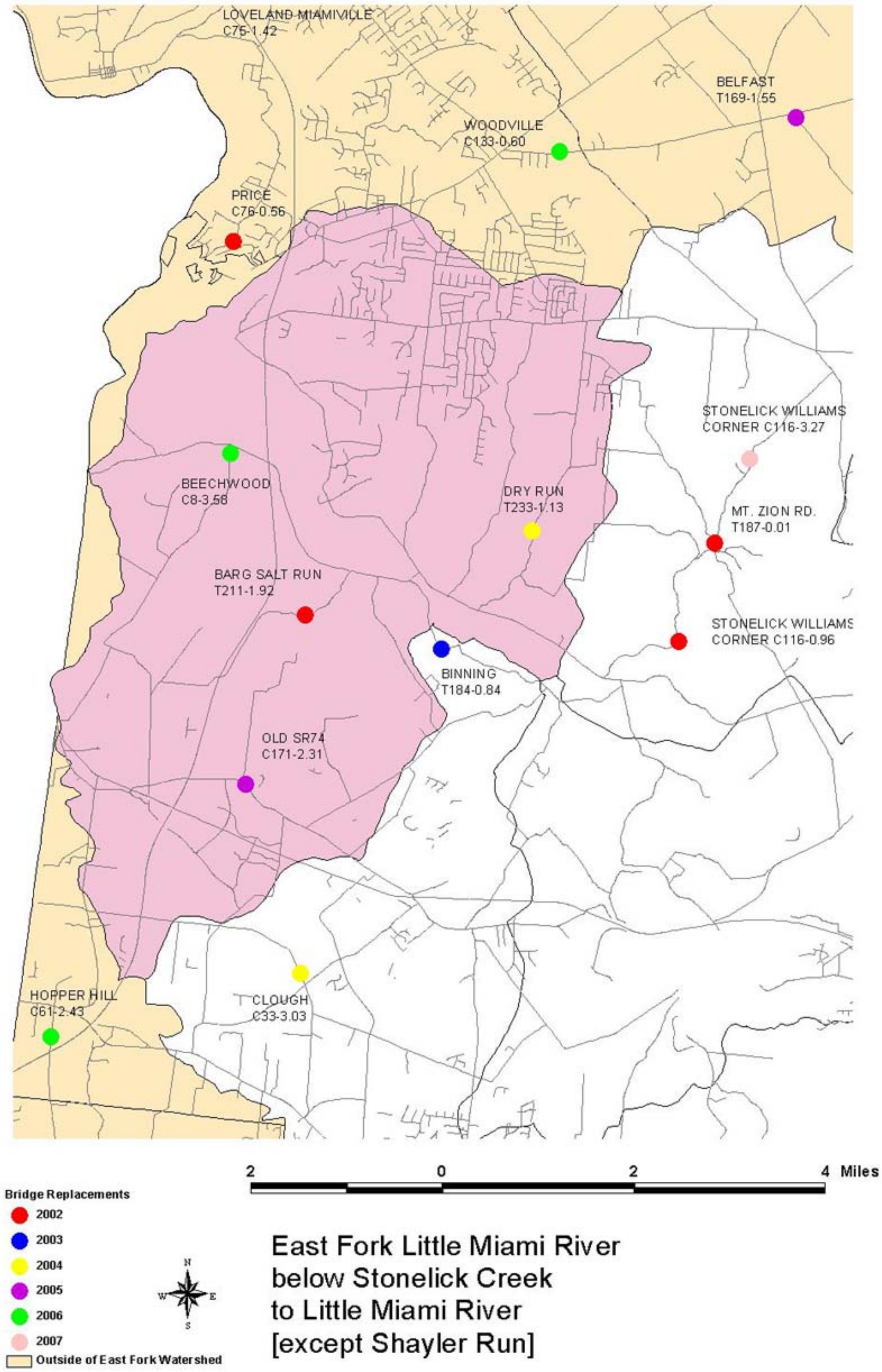


Figure 39: Location of bridges to be replaced in Lower East Fork subwatershed by 2007.

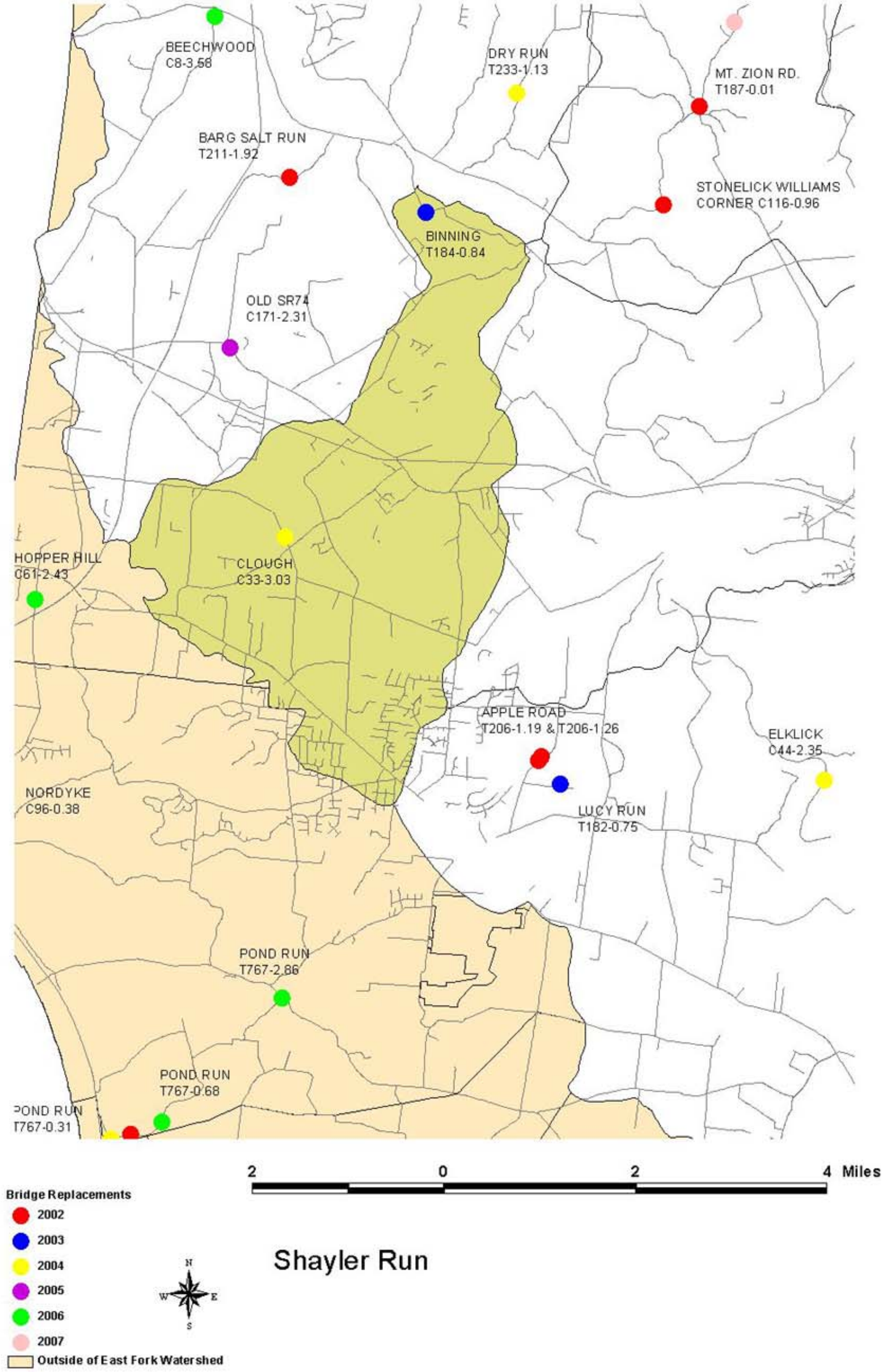


Figure 40: Location of bridges to be replaced in the Shayler Run subwatershed by 2007.

CHAPTER 5: WATERSHED IMPAIRMENTS

In the previous chapter, a detailed summary of existing water quality conditions in the Lower East Fork watershed was presented, as was a detailed description of the potential sources, or contributors, of water quality impairment. In this chapter, a link between the causes (i.e., pollutants) and pollutant sources will be presented, and recommended strategies for protecting and restoring streams in this watershed.

It is important to note that the quality of the lower 8.8 miles of the East Fork Little Miami River is highly dependent upon contributions from the upper and middle sections of the East Fork basin, in addition to the pollutant loadings and habitat alterations that occur in the Lower East Fork watershed (defined as the area draining to the East Fork downstream of Stonelick Creek). The East Fork Watershed Collaborative is currently working to develop separate Watershed Action Plans for the Stonelick Creek, Middle East Fork and and Upper East Fork watersheds. These documents will provide information on existing water quality conditions, pollutant sources and management strategies for those areas.

Table 10 summarizes the relationship between the causes and sources of stream impairment in the Lower East Fork watershed. For each cause of impairment, several contributing sources are listed for the River and its major tributaries. For example, high instream nutrient concentrations are listed as a cause of impairment. Along the East Fork main stem, the contributing sources are primarily the two wastewater treatment plants. In the tributary watersheds, contributing sources include sanitary sewer overflows, on-site sewage treatment systems, and urban runoff.

Management strategies for the Lower East Fork watershed were developed through a number of public stakeholder and East Fork Watershed Collaborative advisory group (i.e., County Team) meetings. At the County Team meetings, a draft report summarizing the water quality conditions and potential sources of im-

Table 10: Target area summary for the Lower East Fork watershed.

Lower East Fork Watershed - Target Area Summary			
Watershed	**Causes of Impairment**	**Sources of Impairment**	**Target Areas**
Lower East Fork	Nutrients	WWTPs	Lower East Fork Mainstem
		Sanitary Sewer Overflows	Hall Run Wolfpen Run Shayler Run
		On-Site Sewage Treatment Systems	Hall Run Wolfpen Run
		Urban Runoff	All Subwatersheds
	Organic Enrichment/ Low DO	Sanitary Sewer Overflows	Hall Run
		On-Site Sewage Treatment Systems	Hall Run Wolfpen Run
	Pathogens	Sanitary Sewer Overflows On-Site Sewage Treatment Systems	Wolfpen Run, Hall Run
	Hydromodification Siltation and Habitat Degradation	Urbanization (Channelization/ Development/ Urban Runoff)	Hall Run Wolfpen Run Salt Run Sugarcamp Run Shayler Run
		Sewer Line Construction	Shayler Run

pairment in the watershed were presented by the Watershed Coordinator and Clermont County OEQ to representatives of various county, municipal and township departments and organizations (see Appendix 1 for details). After reviewing this information, County Team members worked together to develop different management strategies for a range of pollutant source categories, including point source discharges, urban stormwater runoff, on-site wastewater treatment systems, agricultural runoff, habitat/hydromodification and others. These draft recommendations were then presented to the public at separate stakeholder meetings in the Shayler Run and Lower East Fork subwatersheds. Those attending the stakeholder meetings were asked to rank the importance of proposed management strategies on a scale of 1 to 5, as well as to voice or submit additional ideas. Members of the County Team used information compiled at these meetings to draft the final list of management strategies.

Problem statements and recommended management strategies for the Lower East Fork and its direct tributaries are included in the following pages. Each problem statement provides a summary of use attainment status, and a description of the causes and sources of nonattainment. Estimated pollutant loadings from the different sources are also included. It is important to note that these are estimates only. Clermont County has long expressed interest in taking the lead in developing Total Maximum Daily Loads for the East Fork Little Miami River basin, and is currently seeking funds to complete this through U.S. EPA and Ohio EPA. The development of TMDLs will result in significantly more accurate estimates of pollutant loads throughout the watershed.

Following each problem statement is a listing of recommended management strategies and projects designed to maintain full support of the streams' designated uses. Each task includes a description of the funds needed to complete it, potential sources of funding, a time frame for implementation, and measurable performance goals.

As shown in the tables below, some of the management strategies are relatively inexpensive and easier to accomplish, while others are much more expensive and complex. This should be expected in a rapidly developing watershed. Many of the more costly items are capital improvement projects identified by the Clermont County Sewer District, and funding has been set aside for these projects. However, funds for some of the other more costly tasks, such as riparian zone protection/preservation and stream restoration projects, are not available at this time. The Collaborative and its partners will continue to search for potential funding sources for these projects, and investigate alternative management strategies if funds are not available. Updates to this action plan will be made as new funding sources and management strategies are identified.

Lower East Fork

Background
As determined by Ohio EPA, The Lower East Fork of the Little Miami River [HUC 11: 05090202-130; WBID#OH53-1; 11-100], from the confluence with the Little Miami River to the entrance of Stonelick Creek at river mile 8.8, is not meeting its EWH water quality use designation due to excessive nutrients and habitat loss. Of this river segment, 1.9 miles are classified as non-supporting, and the remaining 6.9 miles only partially support the aquatic life use designation, primarily due to low fish index (IBI or mIWB) scores. Clermont County and Ohio EPA habitat surveys show lower QHEI scores in the lower two miles of the river. Additional loss of habitat/function can be expected for the entire Lower EFLMR (EWH use designation) unless the riparian corridor and floodplain are placed under permanent conservation management.

Problem Statement
In its 2002 Integrated Report, Ohio EPA reports that high nutrient levels are resulting in impaired use attainment. Significant sources of nutrients include discharges from Clermont County and City of Milford wastewater treatment plants, sanitary sewer overflows in selected tributaries, failing septic systems in selected tributaries, and stormwater runoff from urbanized areas. Using the HSPF model developed for the Lower East Fork watershed and information from the County and City Sewer departments, the total nitrogen loads from the two treatment plants are roughly estimated at 157 tons/year, and total phosphorus loads are roughly 27 tons per year. In addition, over the past three years, bypasses at the County's Lower East Fork treatment plant have resulted in an average of 11 and 0.9 tons per year of total nitrogen and phosphorus, respectively.

Nutrient loadings also result from sanitary sewer overflows that result from excess inflow and infiltration (I/I) that occurs during wet weather. Information related to these are discussed below in separate problem statements for specific subwatersheds, including Hall Run, Salt Run, Shayler Run, Sugarcamp Run and Wolfpen Run.

It is estimated that there are approximately 1100 failing or poorly performing home sewage treatment systems throughout the Lower East Fork watershed, mostly in the Hall Run, Sugarcamp Run and Wolfpen Run subwatersheds. Using the HSPF model and information received from the Clermont Health District, the total nitrogen and phosphorus loads from these systems are estimated at 13.3 and 1.65 tons per year, respectively.

Stormwater runoff also results in significant nutrient loads throughout the watershed. Based on 1992 land use data, approximately 12 percent of the watershed is covered with impervious surfaces. Urban residential development comprises approximately 20 percent of the watershed, while commercial development is present in approximately five percent. The HSPF model predicts respective nitrogen and phosphorus loads from urban stormwater runoff of 29.5 and 4.8 tons annually.

Goals
Note that, unless otherwise stated, these goals apply to the entire Lower East Fork watershed. Additional goals specific to smaller subwatersheds are presented in the following pages.

1. Reduce mean nutrient loadings from the two wastewater treatment plants by 20 percent.
2. Reduce nutrient loadings from on-site septic systems by 40 percent.
3. Reduce nutrient loadings from sanitary overflows by 100 percent.
4. Reduce nutrient loadings from urban stormwater sources by 20 percent.

5. Raise the QHEI for EFLMR RM0 to RM2.2 from current values in 60s to greater than 70.
6. Permanently protect 25% of the riparian corridor between RM 0 and RM 8.8 through land purchase or conservation easement.
7. Meet EWH use support in main stem of the East Fork and WWH use support in direct tributaries.

Task Description (Objective)	**Resources**	**How**	**Time frame**	**Performance Indicators**
Complete renovations at Lower East Fork, and upgrade portions of the collection system in lower East Fork subwatershed	$625,000 for WWTP and collection system upgrades	Clermont County Sewer District funds, Ohio EPA WPCLF funds	2003-2007	Meet NPDES NH3 limits Reduce nutrient loads by 20 percent Eliminate SSOs
Remove failing septic systems	$2,000,000 for central sewer extension into unsewered areas; $500,000 for septic replacement and homeowner education workshops	Sewer District/WPCLF funds to extend sanitary sewers described in Appendix A; EFWC and Clermont Health District will apply for 319 funds for septic education and replacement	2003-2007	Goal – Reduce the number of failing septic systems by 100 percent. Total nutrient loadings from on-site septic systems will be reduced by 40 percent.
Revise and enforce Clermont County Water Management and Sediment Control regulations	$150,000 in County staff time	Clermont County General Fund	Revisions complete by 2003; continual enforcement	Completed WMSC Regulations by 2003 Continued trend of increased compliance with regulations 20 percent decrease in TSS concentrations during wet weather at County autosampler stations.
Conduct Better Site Design/Low Impact Development workshop for developers and local zoning commissions	$15,000	Ohio EPA 319 Grant or OEEF Grant	2003 or 2004	Increased use of Low Impact Development designs in new developments.
Riparian corridor protection	$3,300,000 for land purchase or permanent conservation easement	EFWC/designated authority will apply for 319 grant, OEPA WRRSP funds, and/or Clean Ohio Fund Grant	June 2003 to Dec 2006	25% of the riparian corridor between RM 0 and RM 8.8 permanently protected through land purchase or conservation easement

Stream habitat enhancement	$500,000 for habitat improvement projects	EFWC will apply for 319 or USDA grant	June 2003 to Dec 2005	Increase QHEI scores in lower two miles to 70 or above

Hall Run

Background
Hall Run, a tributary to the East Fork of the Little Miami River (EFLMR) [HUC 11: 05090202-130; WBID#OH53-2; 11-101], is only partially meeting its warmwater habitat (WWH) aquatic life use designation due to organic enrichment and habitat alteration.

Problem Statement
Excessive levels of organic enrichment (with associated depression in DO levels) and habitat loss have resulted in partial attainment of the WWH designated use. Ohio EPA-listed sources of the organic enrichment include failing septic systems and excessive sewer inflow and infiltration (I/I), which results in sanitary sewer overflows during periods of wet weather. Stormwater runoff and nonpoint source pollution associated with urban development also contribute to the impairment.

Using the HSPF model developed by Clermont County and Tetra Tech for the lower East Fork watershed, we have estimated the average annual total BOD and suspended solids loading from sewer overflows in the Hall Run subwatershed to be 0.25 tons/year BOD and 0.15 tons/year TSS. The potential for major line failures, which have occurred in the past, could increase these loads significantly. A large number of failing onsite wastewater treatment systems (estimated 150) are located in the Hall Run subwatershed. Using the model and input received from the Clermont County Health District, we have estimated the total BOD and TSS loadings from failing septic systems in the Hall Run subwatershed to be 2.3 and 1.4 tons/year, respectively.

Significant suspended solids loadings also result from streambank erosion. Based on a 2001 study of the physical characteristics of streams in the East Fork watershed, it was determined the Hall Run headwaters were dominated by the unstable, habitat-poor Rosgen F stream type. Hydromodification associated with locating and installing the sanitary sewer infrastructure has contributed to stream instability. It is estimated that streambank erosion contributes 85 tons of TSS each year.

Goals
1. Reduce BOD & TSS loadings from sanitary overflows by 100 percent.
2. Reduce BOD & TSS loadings from on-site septic systems by 50 percent.
3. Stabilize and restore all segments of Hall Run associated with sewer infrastructure upgrades.
4. Restore 5000 ft of previously channelized Hall Run headwaters.
5. Reduce sediment loadings from streambank erosion by 25 percent.
6. Meet WWH aquatic life use designation in Hall Run
7. Inventory 100 percent of riparian corridor along Hall Run; provide recommendations for re-establishing riparian corridor.

Task Description (Objective)	Resources	How	Time frame	Performance Indicators
Update sewer infrastructure to address I/I and sanitary sewer overflows	$5,930,000 infrastructure upgrades	Clermont County Sewer District funds to accomplish projects listed in Attachment A	2003-2007	Sanitary sewer overflows from Hall Run collection system resulting from excess I/I will be eliminated.
Conduct home sewage treatment system operation and maintenance workshop for homeowners in Hall Run watershed.	$10,000 for septic education workshops	EFWC and Clermont Health District will apply for 319 for septic education	2004-2005	Improved operations of 50 septic systems, based on Health District inspections
Stream stabilization and restoration	$500,000 for restoration / stabilization of 5000 feet of stream bank and habitat. Restore appropriate morphology and reconnect to floodplain.	EFWC or authorized member of the Collaborative will apply for 319, USDA grant, or Ohio EPA WRRSP funds	June 2003 to Dec 2005	Conduct fish and macroinvertebrate surveys to determine compliance with WWH criteria. Improve QHEI scores in section of restored stream to average of 65. Use HSPF model to document sediment load reduction.
Riparian zone assessment	$25,000 for assessment of riparian zone conditions / need for improvement	Clermont Office of Environmental Quality/Soil and Water Conservation District will fund/conduct	June 2003 to Dec 2005	Document condition of riparian zone in Hall Run watershed / prioritize areas for restoration. This will lead to additional implementation projects

Salt Run

Background
Two miles of Salt Run, a tributary to the East Fork of the Little Miami River [HUC 11: 05090202-130; WBID#OH53-4; 11-103], are only partially meeting its warmwater habitat (WWH) aquatic life use designation due to excessive siltation, and to a lesser degree, excess nutrient loadings.

Problem Statement
Heavy commercial development in the headwaters (Eastgate shopping center) significantly increased the amount of impervious area in this watershed, resulting in increased stormwater runoff peaks and volume, and nutrient loads. Silt loadings resulting from urban runoff are estimated at 90 tons per year, while nitrogen and phosphorus loadings are estimated at 3.4 and 0.6 tons/year, respectively.

Stormwater flows have contributed to streambank erosion and channel entrenchment. An assessment of the physical characteristics of streams in the Salt Run watershed show that all of Salt Run, except the very lowest reaches, is characterized as a Rosgen F stream type. These streams are typically unstable and have poor habitat. It is estimated that streambank erosion contributes 25 tons of sediment per year.

Goals
1. Reduce sediment loadings by 20 percent.
2. Reduce nutrient loadings by 20 percent.

Task Description (Objective)	**Resources**	**How**	**Time frame**	**Performance Indicators**
Restore and stabilize one mile of Salt Run	$525,000 for stream restoration projects	EFWC or Clermont County will apply for 319 and USDA grants, or Ohio EPA WRRSP funds.	2005-2007	Restore appropriate morphology of one mile of Salt Run, and reconnect to flood plain. 20 percent load reductions in nutrients and phosphorus

Shayler Run

Background
Shayler Run, a tributary to the East Fork of the Little Miami River (EFLMR) [HUC 11: 05090202-130; WBID#OH53-6; 11-105], is not meeting its WWH water quality use designation from RM 3.5 to RM 7.8 due to excessive nutrient loadings, flow alteration and habitat alteration. A total of 2.8 miles of Shayler Run do not support the WWH use, while 1.2 miles only partially support this use. An additional 3.5 miles are in full support, but threatened.

Problem Statement
Excessive levels of nutrients, flow alteration and habitat loss have resulted in partial attainment of the WWH designated use. Construction of sewer lines in the stream channel has contributed significantly to these problems. Stormwater runoff and NPS pollution associated with urban development also contribute to the impairment. Sources of nutrients include sanitary sewer overflows resulting from excessive inflow and infiltration during wet weather, and failing septic systems. Based on an inventory of overflows in the Shayler Run watershed between January 2000 and March 2003 (Table 8, page 52), and an assessment of bacteria data that indicates E. coli levels during dry weather are consistently less than 200 cfu/100 mL, it was determined that sewer overflows contribute little in terms of nutrient loadings to Shayler Run. Using the overflow inventory and the HSPF model developed for the Lower East Fork watershed by Clermont County and Tetra Tech, Inc., we have estimated the total nitrogen and phosphorus loadings from sewer overflows in the Shayler Run subwatershed to be 19 and 1.8 lbs/year.

Habitat and flow alteration have also contributed to non-support. Based on the 2001 study of the physical characteristics of streams in the lower East Fork watershed, it was determined the Shayler Run headwaters were dominated by the unstable, habitat poor Rosgen F stream type. Hydromodification associated with locating and installing the sanitary sewer infrastructure has contributed significantly to stream instability, as has increased stormwater peak flows and volume resulting from increased development. It is estimated that streambank erosion contributes 53 tons per year of TSS.

Goals
1. Reduce nutrient loadings from I/I and sanitary overflows by 100%.
2. Eliminate failing septic systems.
3. Remove sewer infrastructure from Shayler Run and its tributaries
4. Restore four miles of Shayler Run / tributary channels in conjunction with sewer infrastructure improvements

Task Description (Objective)	Resources	How	Time frame	Performance Indicators
Update sewer infrastructure to address I/I and sanitary sewer overflow, and to remove sewer from stream channel	$20,713,931 for infrastructure upgrades	Sewer District funds; Ohio EPA WPCLF funds to accomplish projects detailed in Appendix A	2003-2007	Elimination of SSOs Removal of sewer infrastructure from stream channel.
Remove failing septic systems	$120,000 for central sewer extension into unsewered areas	Sewer District funds	2003	Elimination of 10 failing septic systems
Stream stabilization and restoration	$2,100,000 for restoration of Shayler Creek, to be conducted in conjunction with removal of sewer infrastructure	EFWC or Clermont County will apply for 319 and USDA grants, or Ohio EPA WRRSP funds.	2003-2007	Restore appropriate morphology of 4 miles of Shayler Creek and tributaries, and reconnect to flood plain. Increase QHEI scores in restored areas to average of 65 Meet WWH aquatic life criteria

Sugarcamp Run

Background
A 1.2-mile portion of Sugarcamp Run, a tributary to the lower East Fork of the Little Miami River [HUC 11: 05090202-130; WBID#OH53-5; 11-104], only partially supports its WWH water quality use designation due to high nutrient levels. An additional 1.1 miles fully supports the WWH use, but is considered threatened. Chronic overflows at an upstream lift station are the primary reasons for the problem. While no bacteria data are available, these overflows likely result in exceedences of primary contact recreation criteria during periods of wet weather.

Problem Statement
Excessive levels of nutrients have resulted in partial attainment of the WWH designated use. It is estimated that chronic overflows from a sewer lift station on State Route 131 contribute an average of 0.27 tons/year of total nitrogen and 0.025 tons/year of total phosphorus. Raw sewage discharges have estimated E. coli counts of 250,000 cfu/100mL and greater.

As with Wolfpen Run, there are a significant number (estimated 150) older and/or failing on-site wastewater treatment systems in the Sugarcamp Run headwater area. These contribute an estimated 1.8 tons/year of total nitrogen and 0.23 tons/year of total phosphorus.

Goal
1. Eliminate 100 percent of sanitary sewer overflows and subsequent nutrient loadings.
2. Eliminate discharges and subsequent loadings from 150 onsite wastewater treatment systems.

Task Description (Objective)	**Resources**	**How**	**Time frame**	**Performance Indicators**
Upgrade State Route 131 Lift Station / eliminate sanitary sewer overflows	$90,000	Clermont County Sewer District funds	2003	Eliminate 100 percent of SSOs
Eliminate Candy Lane Lift Station and potential for sanitary sewer overflows	$224,420	Clermont County Sewer District funds	2003	Eliminate 100 percent of SSOs
Provide sewer service to areas of older/failing on-site sewer systems	$1,240,000	Clermont County Sewer District funds	2003	Eliminate 150 on-site treatment systems

Wolfpen Run

Background
One mile of Wolfpen Run, a tributary to the East Fork of the Little Miami River (EFLMR) [HUC 11: 05090202-130; WBID#OH53-6; 11-105], is not meeting its WWH water quality use designation due to organic enrichment. Habitat alterations also contribute to the problem. The stream's primary contact recreation use is not met due to high bacteria concentrations.

Problem Statement
According to Ohio EPA's 2000 Water resources Inventory Report, streamside interceptors may be the primary cause of organic enrichment and pathogen loadings. However, a review of Clermont Sewer District spill reports does not indicate any overflows or bypasses in this watershed from January 2000 to March 2003. It is more likely that these problems are the result of failing on-site wastewater treatment systems. The Wolfpen Run subwatershed has the greatest concentration of failing systems in the Lower East Fork watershed. Using the HSPF model, Clermont County and Tetra Tech have estimated the BOD loads from approximately 300 systems at 4.5 tons/year. These systems are also responsible for high bacteria concentrations in the creek.

Goals:
1. Reduce BOD & pathogen loadings from on-site septic systems by 60 percent.

Task Description (Objective)	**Resources**	**How**	**Time frame**	**Performance Indicators**
Provide sanitary sewers to previously unsewered areas.	$7,120,000 for sewer extensions	Clermont County Sewer District funds; Ohio EPA WPCLF funds	2005-2007	Eliminate 150 on-site treatment systems; Monitor to confirm BOD and pathogen load reduction goals.
Conduct home sewage treatment system operation and maintenance workshop for homeowners in Wolfpen Run watershed.	$10,000 for septic education workshops	EFWC and Clermont Health District will apply for 319 for septic education	2004-2005	Improved operations of 50 septic systems.
Stream stabilization and restoration	$525,000	EFWC will apply for 319, USDA grant, or WRRSP grant	2005-2007	Restore appropriate morphology of one mile of Wolfpen Run Increase QHEI scores in restored section of stream to 65. Meet WWH aquatic life criteria.

Appendix 1: Summary of Lower East Fork Public Outreach Effort

Organizations and individuals represented on the Clermont County Team for the East Fork Watershed Collaborative.

Organization	Contact Person	Phone Number
East Fork Watershed Collaborative	Jay Dorsey, Watershed Coordinator	(513) 732-7075
Clermont General Health District	Robert Wildey, Director Water & Waste Division	(513) 732-7499
Clermont County Water and Sewer District	Tom Yeager, Director of Utilities	(513) 732-7040
Clermont County Office of Environmental Quality	Paul Braasch, Coordinator	(513) 732-7745
Clermont County Planning Department	Dean Niemeyer, Planner	(513) 732-7772
Clermont County Department of Building Inspection	Ray Sebastion, Chief Building Official	(513) 732-7213
Clermont SWCD	Paul Berringer, District Administrator	(513) 732-7075
Office of the Clermont County Engineer	Pat Manger, County Engineer	(513) 732-8857
Clermont County Park District	Chris Clingman, Director	(513) 732-2977
OSU Extension, Clermont County Office	Stephanie Simstad, Ag & Natural Resources Agent	(513) 732-7070
Batavia Township	Rex Parsons, Administrator	(513) 732-3888
Miami Township	Walt Fischer, Services Director	(513) 248-3728
Union Township	Mike Powell, Services Director	(513) 753-2221

East Fork Watershed Collaborative

- Protecting & Enhancing the East Fork Since 2001 -

Lower East Fork Watershed Action Plan
Public Outreach Effort

6-11-02	Draft Shayler subwatershed plan presented to County Commissioners - (Aired on public access television)
6-19-02	Meeting with Union Township Officials to review draft Shayler subwatershed plan and set public meeting date
6-24-02	Meeting announcement posted on OEQ web site
7-08-02	Article appeared in OEQ Newsletter
7-11-02	Newspaper Article in The Clermont Sun
7-12-02	1000 Direct-mail postcards sent to residents of Shayler Run - Used Union Township's Mailing List
7-12-02	Personal Letters of Invitation & Draft copies of the plan hand-delivered to the Trustees, zoning officials, service directors, and administrators of Union, Batavia, & Pierce Townships
7-12-02	Meeting Announcement postcards were left for distribution at Batavia Township Hall at the Bristol Lake Homeowners Association Pool
7-15-02	Meeting date and time advertised on the Union TWP Hall Marquis
7-16-02	Article appeared on Cincinnati Enquirer web site
7-17-02	Newspaper Article appeared in Cincinnati Enquirer
7-17-02	Public Meeting Held at Union Township Hall – 32 Stakeholders Attended
7-19-02	Follow-up article appears in Cincinnati Enquirer

7-31-02	All written public comments received for incorporation into the plan
8-15-02	Press release issued for Lower East Fork public stakeholders meeting
8-15-02	Meeting announcement on OEQ's web site
8-15-02	Article about public meeting in Soil and Water Conservation District's (SWCD) Summer newsletter
8-19-02	1000 Direct-mail postcards sent to residents of Lower East Fork subwatershed
8-28-02	Meeting announcement on SWCD web site
8-29-02	Article appeared in Clermont Sun
9-04-02	Public Meeting Held at Cincinnati Nature Center – approximately 30 people in attendance
9-18-02	All written public comments received for incorporation into the plan
4-08-03	Postcard notices of Hall Run watershed public meeting sent out to landowners bordering Hall Run
4-16-03	Hall Run Public Meeting at Child Focus, Inc. in Union Township - 49 people in attendance.

BOARD OF COUNTY COMMISSIONERS
CLERMONT COUNTY, OHIO

MARY C. WALKER MARTHA DORSEY ROBERT L. PROUD

Press Release
July 5, 2002

Clermont County Turns to Citizens for Help in Protecting Water Quality

Batavia, Ohio. In an effort to protect the high quality of its streams and lakes, Clermont County is in the midst of creating management plans for different segments of the East Fork Little Miami River watershed. A draft of the first of these plans has been developed for Shayler Creek and its tributaries. The County will present the plan to the public and solicit input from residents at a public meeting scheduled for **Wednesday, July 17 at 5:30 p.m. at the Union Township Hall on Glen Este-Withamsville Road .**

Clermont County has placed a high priority on protecting the quality of the streams and lakes within its borders. In 1996, the County's Office of Environmental Quality began an extensive monitoring program that involves analyzing water samples for various pollutants, conducting surveys of the biological life in the streams, and investigating the physical characteristics of the streams, so that the County might gain a better understanding of water quality as well as flooding issues.

The County's environmental program has gained attention at both the state and national level. Both the Ohio Environmental Protection Agency (EPA) and the U.S. EPA have indicated that grant funds will be available to the County to help implement some of the management programs.

While the County has successfully been able to identify the level of pollution and some of the different sources contributing to these problems, taking steps to correct problems or protect currently healthy streams will require participation and help from many. The July 17th meeting will provide elected officials, administrators, businesses and the public to provide input on how they think water quality can be protected. For more information on the public meeting, contact the Office of Environmental Quality at (513) 732-7745.

###

OFFICE OF PUBLIC INFORMATION
175 E. MAIN STREET, BATAVIA, OHIO 45103
TELEPHONE: (513) 732-7597 FAX: (513) 732-7553

Shayler Creek Watershed Action Plan
Public Meeting
Wednesday, July 17, 2002
Union Township Hall
5:30 pm-7:00 pm

5:30 - 5:35 pm	Process for Developing Management Strategies for the East Fork Little Miami River Watershed - Paul Braasch, Coordinator, Clermont County Office of Environmental Quality (OEQ)
5:35 - 5:45 pm	Review of Water Quality Conditions in Shayler Creek and its tributaries - John McManus, Clermont County OEQ
5:45 - 6:50 pm	Discussion of Watershed Management Strategies - Ryan Taylor, East Fork Watershed Coordinator, Clermont Soil and Water Conservation District

- 5:45 - 6:00 pm Discussion - Stormwater Management Strategies
- 6:00 - 6:15 pm Discussion - Water Quality Management Strategies for Construction Activities
- 6:15 - 6:30 pm Discussion - Strategies to Address Problems from On-Site Wastewater Treatment Systems (Septic Tanks)
- 6:30 - 6:40 pm Discussion - Strategies to Improve Performance of Central Sewer System
- 6:40 - 6:50 pm Discussion - Agricultural and Other Management Strategies

6:50 - 7:00 pm Next Steps and Wrap-Up - Paul Braasch, Clermont OEQ

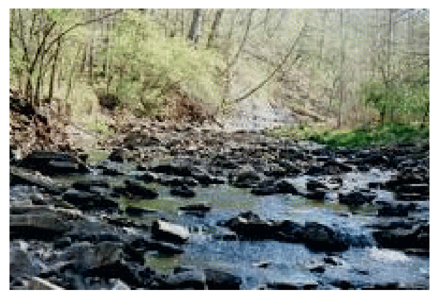
BOARD OF COUNTY COMMISSIONERS
CLERMONT COUNTY, OHIO

MARY C. WALKER MARTHA DORSEY ROBERT L. PROUD

Press Release

Clermont County Needs Help to Protect East Fork

Batavia, Ohio. Clermont County is hosting the third in a series of meetings that provide citizens with an opportunity to provide input on how the quality of lakes, rivers and streams in the County can be protected. A meeting to review draft management strategies for the Lower East Fork of the Little Miami River has been scheduled for **Wednesday, September 4, 2002 at the Cincinnati Nature Center's Rowe Woods, from 5:30 to 7:00 p.m.**



Hall Run Near Roundbottom Road

In an effort to promote strategies to improve stream conditions, a set of management plans are being developed for different areas within the East Fork Little Miami River watershed. The first two plans to be developed included recommended actions for Shayler and Stonelick Creeks. Comments on these plans are still being accepted.

The September 4 meeting will give elected officials, administrators, businesses and citizens an opportunity to pool information on how water quality can be best protected in the lower East Fork area. For more information on the public meeting or to request a copy of the Watershed Action Plan, contact the **Office of Environmental Quality at (513) 732-7745**, or visit **www.oeq.net**

###

OFFICE OF PUBLIC INFORMATION
175 E. MAIN STREET, BATAVIA, OHIO 45103
TELEPHONE: (513) 732-7597 FAX: (513) 732-7553

Lower East Fork Watershed Action Plan
Public Meeting
Wednesday, September 4, 2002
Cincinnati Nature Center
5:30 pm-7:00 pm

5:30 - 5:35 pm	Process for Developing Management Strategies for the East Fork Little Miami River Watershed - Paul Braasch, Coordinator, Clermont County Office of Environmental Quality (OEQ)
5:35 - 5:45 pm	Review of Water Quality Conditions in the Lower East Fork and its tributaries - John McManus, Clermont County OEQ
5:45 - 6:50 pm	Discussion of Watershed Management Strategies - Ryan Taylor, East Fork Watershed Coordinator, Clermont Soil and Water Conservation District

- 5:45 - 6:00 pm Discussion - Stormwater Management Strategies
- 6:00 - 6:15 pm Discussion - Water Quality Management Strategies for Construction Activities
- 6:15 - 6:30 pm Discussion - Strategies to Improve Performance of Central Sewer System Discussion
- 6:30 - 6:40 pm Discussion - Strategies to Address Problems from On-Site Wastewater Treatment Systems (Septic Tanks) Discussion
- 6:40 - 6:50 pm Discussion - Agricultural and Other Management Strategies

6:50 - 7:00 pm	Next Steps and Wrap-Up - Paul Braasch, Clermont OEQ

APPENDIX 2:
Summary of Clermont County's
Lower East Fork Monitoring and Sampling Program
1996-2003

1996 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6	Upstream Roundbottom Rd
East Fork Little Miami R	5.4	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4.0	US 50 and I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2	Roundbottom Road d/s Bzak
Salt Run	2.5	Shephard Road Lift Station
Wolfpen Run	0.1	US 50 at Hotel Trucking

1997 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6*	Upstream Roundbottom Rd
East Fork Little Miami R	5.4	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4.0	I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2	Roundbottom Road d/s Bzak
Hall Run	0.3	Roundbottom Road u/s Bzak
Salt Run	2.5	Shephard Road Lift Station
Shayler Road	1.7	Baldwin Road bridge
Wolfpen Run	0.1	US 50

** Represents biological and chemical sampling site*

1998 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6*	Upstream Roundbottom Rd
East Fork Little Miami R	5.4	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4.0	I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2*	Roundbottom Road d/s Bzak
Hall Run	0.3*	Roundbottom Road u/s Bzak
Salt Run	2.5	Shephard Road Lift Station
Shayler Road	1.7*	Baldwin Road bridge
Wolfpen Run	0.1	US 50 at Hotel Trucking

** Represents biological and chemical sampling site*

1999 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6*	Upstream Roundbottom Rd
East Fork Little Miami R	5.4	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4*	I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2*	Roundbottom Road d/s Bzak
Hall Run	5.0	Brantner Road bridge
Salt Run	2.5	Shephard Road Lift Station
Shayler Road	1.7	Baldwin Road bridge
Wolfpen Run	0.1	US 50 at Hotel Trucking

** Represents biological and chemical sampling site*

In addition, autosampler equipment installed at Shayler RM 1.7 was used to sample 13 storms. Composite samples were anyalyzed for the rising, peak/level, and falling portions of the hydrograph

2000 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6*	Upstream Roundbottom Rd
East Fork Little Miami R	5.5	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4*	I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2*	Roundbottom Road d/s Bzak
Hall Run	5.0	Brantner Road bridge
Salt Run	2.5	Shephard Road Lift Station
Shayler Road	1.7	Baldwin Road bridge
Wolfpen Run	0.1	US 50 at Hotel Trucking

** Represents biological and chemical sampling site*

2001 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6*	Upstream Roundbottom Rd
East Fork Little Miami R	5.5	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4.0	I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2	Roundbottom Road d/s Bzak
Salt Run	2.5	Shephard Road Lift Station
Shayler Road	1.7	Baldwin Road bridge

** Represents biological and chemical sampling site*

2002 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	6.6	Upstream Roundbottom Rd
East Fork Little Miami R	5.5	Upstream LEF WWTP @ P&G intake
East Fork Little Miami R	4.0	I-275 entrance ramp
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2	Roundbottom Road d/s Bzak
Salt Run	2.5	Shephard Road Lift Station

Shayler Road storm samples were collected for seven storms at Baldwin Road
Discrete samples were collected every two hours for a 12 hour period

2003 Sampling Program

Sample Sites	River Mile	Site Location
East Fork Little Miami R	2.1	Milford Parkway bridge
East Fork Little Miami R	0.8	S. Milford Road bridge
East Fork Little Miami R	0.5	475 Roundbottom Road
Hall Run	0.2*	Roundbottom Road d/s Bzak
Hall Run	2.4	Summerside Road bridge
Hall Run	4.0	576 Marjorie Lane
Hall Run	5.0	Brantner Road bridge
Hall Run	5.6	Clough Pike

** Represents biological and chemical sampling site*

1996 Sampling Program ***January through December, 1996***

Parameter	EFRM0.5	EFRM4.0	EFRM5.5	EFRM6.6	HALL0.2	SALT2.5	WOLFPEN0.1
Ammonia	x	x	x	x	x	x	x
Nitrate-Nitrite	x	x	x	x	x	x	x
TKN	x	x	x	x	x	x	x
Total Phosphorus	x	x	x	x	x	x	x
Ortho-phosphorus	x	x	x	x	x	x	x
Total Suspended Solids	x	x	x	x	x	x	x
Total Volatile Suspended Solids	x	x	x	x	x	x	x
CBOD5	x	x	x	x	x	x	x
Dissolved Oxygen	x	x	x	x	x	x	x
Conductivity	x	x	x	x	x	x	x
pH	x	x	x	x	x	x	x
Stream temperature	x	x	x	x	x	x	x
Fecal Coliform	x	x	x	x	x	x	x
Cadmium, Total	x	x	x	x	x	x	x
Chromium, Total	x	x	x	x	x	x	x
Copper, Total	x	x	x	x	x	x	x
Lead, Total	x	x	x	x	x	x	x
Nickel, Total	x	x	x	x	x	x	x
Silver, Total	x	x	x	x	x	N/A	N/A
Hardness, Total	x	x	x	x	x	x	x
Chlorophyll-a	x	x	x	x	x	x	x

Note: Sampling frequencies in 1996 were irregular. For exact dates of sampling by station or parameter, contact the Clermont County Office of Environmental Quality at (513) 732-7894

1997 Sampling Program ***June 4 through November 14***

Parameter	EFRM0.5	EFRM4.0*	EFRM5.5*	EFRM6.6	HALL0.2	HALL0.3	SALT2.5	SHAYLER1.6	WOLFPEN0.1
Ammonia	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Nitrate-Nitrite	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
TKN	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Total Phosphorus	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Ortho-phosphorus	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Total Suspended Solids	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Total Volatile Suspended Solids	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
CBOD5	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Dissolved Oxygen	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Conductivity	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
pH	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Stream temperature	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Fecal Coliform	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/two weeks
Cadmium, Total	1/two weeks	N/A	N/A	3 samples	N/A	N/A	N/A	N/A	N/A
Chromium, Total	1/two weeks	N/A	N/A	3 samples	N/A	N/A	N/A	N/A	N/A
Copper, Total	1/two weeks	N/A	N/A	3 samples	N/A	N/A	N/A	N/A	N/A
Lead, Total	1/two weeks	N/A	N/A	3 samples	N/A	N/A	N/A	N/A	N/A
Nickel, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hardness, Total	1/two weeks	1/month	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chlorophyll-a (June - Sept)	N/A	Jan-Mar	Jan-Mar	N/A	N/A	N/A	N/A	N/A	N/A

** - also sampled weekly from Jan. 8 to Mar 26*

Macroinvertebrate and fish surveys were also conducted at EFRM6.6

1998 Sampling Program ***May 3 through October 31***

Parameter	**EFRM0.5**	**EFRM4.0**	**EFRM5.5**	**EFRM6.6**	**HALL0.2**	**HALL0.3**	**SALT2.5**	**SHAYLER1.6**	**WOLFPEN0.1**
Ammonia	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Nitrate-Nitrite	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
TKN	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Total Phosphorus	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Ortho-phosphorus	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Total Suspended Solids	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Total Volatile Suspended Solids	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Turbidity	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
CBOD5	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Dissolved Oxygen	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Chlorides	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Conductivity	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
pH	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Stream temperature	1/week	1/week	1/week	1/week	1/week	1/week	1/week	2/month	1/month
Fecal Coliform	5/month	5/month	5/month	5/month	5/month	5/month	5/month	N/A	1/month
E. coli	5/month	5/month	5/month	5/month	N/A	N/A	N/A	N/A	N/A
Cadmium, Total	1/week	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper, Total	1/week	N/A	N/A	N/A	N/A	N/A	N/A	2/month	N/A
Lead, Total	1/week	N/A	N/A	N/A	N/A	N/A	N/A	2/month	N/A
Zinc, Total	1/week	N/A	N/A	N/A	N/A	N/A	N/A	2/month	N/A
Chlorophyll-a (June - Sept)	1/week	1/week	1/week	1/week	N/A	N/A	N/A	N/A	N/A

Macroinvertebrate and fish surveys were also conducted at EFRM6.6, HALL0.2, HALL0.3 and SHAYLER1.7

1999 Sampling Program ***May 3 through October 13***

Parameter	**EFRM0.5**	**EFRM4.0**	**EFRM5.5**	**EFRM6.6**	**HALL0.2**	**HALL5.0**	**SALT2.5**	**SHAYLER1.7**	**Shayler Autosampler**	**WOLFPEN0.1**
Ammonia	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Nitrate-Nitrite	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
TKN	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Total Phosphorus	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Ortho-phosphorus	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Total Suspended Solids	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Total Volatile Suspended Solids	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Turbidity	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
CBOD5	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Dissolved Oxygen	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
Chlorides	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Conductivity	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
pH	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
Stream temperature	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
E. coli	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	13 storms	1/two weeks
Cadmium, Total (May-June)	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks	13 storms	N/A
Lead, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks	13 storms	N/A
Zinc, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks	13 storms	N/A
Hardness, Total	N/A	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chlorophyll-a (July-Sept)	1/two weeks	1/two weeks	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks

Note: HALL0.2, SALT2.5 and SHAYLER1.7 sampled from mid May to early Sept; Hall Run 5.0 sampled from May 27 to Aug 5
Macroinvertebrate and fish surveys were also conducted at EFRM4.2, EFRM6.6 and HALL0.2

2000 Sampling Program ***May 1 through October 10***

Parameter	**EFRM0.5**	**EFRM4.0**	**EFRM5.5**	**EFRM6.6**	**HALL0.2**	**HALL5.0**	**SALT2.5**	**SHAYLER1.7**	**Shayler Autosampler**	**WOLFPEN0.1**
Ammonia	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Nitrate-Nitrite	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
TKN	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Total Phosphorus	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Ortho-phosphorus	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Total Suspended Solids	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Total Volatile Suspended Solids	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Turbidity	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
CBOD5	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Dissolved Oxygen	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
Chlorides	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Conductivity	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
pH	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
Stream temperature	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A	1/two weeks
E. coli	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	1/two weeks	7 storms	1/two weeks
Copper, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks	7 storms	N/A
Lead, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks	7 storms	N/A
Zinc, Total	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks	7 storms	N/A
Chlorophyll-a (June-Oct)	1/two weeks	1/two weeks	1/two weeks	N/A	N/A	N/A	N/A	N/A	N/A	1/two weeks

Macroinvertebrate, fish and habitat surveys were also conducted at EFRM4.2, EFRM6.6 and HALL0.2

2001 Sampling Program ***May 8 through October 17***

Parameter	**EFRM0.5**	**EFRM4.0**	**EFRM5.5**	**EFRM6.6**	**HALL0.2**	**SALT2.5**	**SHAYLER1.7**	**Shayler Autosampler**
Ammonia	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
Nitrate-Nitrite	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
TKN	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
Total Phosphorus	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
Ortho-phosphorus	1/month	1/month	1/month	1/month	1/month	1/month	1/month	12 storms
Total Suspended Solids	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
Total Volatile Suspended Solids	1/month	1/month	1/month	1/month	1/month	1/month	1/month	12 storms
Turbidity	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
CBOD5	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
Dissolved Oxygen	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A
Conductivity	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A
pH	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A
Stream temperature	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	N/A
E. coli	1/two weeks	1/two weeks	1/month	1/two weeks	1/two weeks	1/two weeks	1/two weeks	12 storms
Copper, Total	1/two weeks	1/month	1/month	N/A	N/A	N/A	1/two weeks	12 storms
Lead, Total	1/two weeks	1/month	1/month	N/A	N/A	N/A	1/two weeks	12 storms
Zinc, Total	1/two weeks	1/month	1/month	N/A	N/A	N/A	1/two weeks	12 storms
Hardness, Total	1/two weeks	1/month	1/month	1/month	1/month	N/A	1/two weeks	12 storms
Chlorophyll-a (June-Oct)	1/two weeks	1/two weeks	1/month	N/A	N/A	N/A	N/A	N/A

Macroinvertebrate, fish and habitat surveys were also conducted at EFRM6.6

2002 Sampling Program ***May 21 through October 28***

Parameter	**EFRM0.5**	**EFRM4.0**	**EFRM5.5**	**EFRM6.6**	**HALL0.2**	**SALT2.5**	**Shayler Autosampler**
Ammonia	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Nitrate-Nitrite	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
TKN	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Total Phosphorus	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Ortho-phosphorus	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Total Suspended Solids	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Total Dissolved Solids	N/A	N/A	N/A	1/month	N/A	N/A	N/A
Turbidity	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
CBOD5	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Dissolved Oxygen	1/month	1/month	1/month	1/month	1/month	1/month	N/A
Conductivity	1/month	1/month	1/month	1/month	1/month	1/month	N/A
pH	1/month	1/month	1/month	1/month	1/month	1/month	N/A
Stream temperature	1/month	1/month	1/month	1/month	1/month	1/month	N/A
E. coli	1/month	1/month	1/month	1/month	1/month	1/month	7 storms
Copper, Total	1/month	N/A	N/A	1/month	N/A	N/A	7 storms
Lead, Total	1/month	N/A	N/A	1/month	N/A	N/A	7 storms
Zinc, Total	1/month	N/A	N/A	1/month	N/A	N/A	7 storms
Hardness, Total	1/month	N/A	N/A	1/month	N/A	N/A	7 storms
Chlorophyll-a	1/month	1/month	1/month	N/A	N/A	N/A	N/A

2003 Sampling Program

Parameter	**EFRM0.5**	**EFRM0.8**	**EFRM2.1**	**HALL0.2**	**HALL2.4**	**HALL4.0**	**HALL5.0**	**HALL5.6**
Ammonia	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Nitrate-Nitrite	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
TKN	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Total Phosphorus	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Ortho-phosphorus	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Total Suspended Solids	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Total Dissolved Solids	N/A	N/A	N/A	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
CBOD5	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Dissolved Oxygen	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Conductivity	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
pH	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Stream temperature	1/two weeks	1/two weeks	1/two weeks	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
E. coli	N/A	N/A	N/A	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Copper, Total	N/A	N/A	N/A	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Lead, Total	N/A	N/A	N/A	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Zinc, Total	N/A	N/A	N/A	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry
Hardness, Total	N/A	N/A	N/A	2 wet/2 dry	2 wet/2 dry	2 wet/2 dry	2 dry	2 dry

Hall Run Surveys
Two dry weather and two wet weather surveys were conducted in the Hall Run watershed
Dry weather surveys included a single grab sample from each site
Wet weather surveys included six sets of samples collected at two hour increments

Appendix 3: Summary of Sewage Spills, Bypasses, and Overflows in Lower East Fork Watershed, January 2000 to March 2003

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Lower East Fork				
Roundbottom	02/22/03	Unknown	Unknown	Excess wet weather flow
Roundbottom	09/27/02	Unknown	4.25 hours	Excess wet weather flow
Happy Hollow LS	06/10/02	Unknown	Unknown	Equipment malfunction
Happy Hollow LS	06/09/02	20-20,000 gallons	4 hours	Equipment malfunction
Lower East Fork WWTP	05/18/02	1.0 Mgal	Unknown	Excess wet weather flow
Lower East Fork WWTP	05/13/02	8 Mgal	24 hours	Excess wet weather flow
Lower East Fork WWTP	05/08/02	8 Mgal	36 hour	Excess wet weather flow
Lower East Fork WWTP	04/29/02	0.508 Mgal	11 hours	Excess wet weather flow
Lower East Fork WWTP	04/21/02	11.2 Mgal	36 hours	Excess wet weather flow
Lower East Fork WWTP	03/25/02	5.686 Mgal	63 hours	Excess wet weather flow
Lower East Fork WWTP	03/19/02	10.249 Mgal	43.5 hours	Excess wet weather flow
Lower East Fork WWTP	01/31/02	7.814 Mgal	54 hours	Excess wet weather flow
Lower East Fork WWTP	12/20/01	3.73 Mgal	26 hours	Excess wet weather flow
Lower East Fork WWTP	12/03/01	2.92 Mgal	26 hours	Excess wet weather flow
Lower East Fork WWTP	10/24/01	2.1 Mgal	22 hour	Excess wet weather flow
Roundbottom	10/24/01	Unknown	Unknown	Excess wet weather flow
Roundbottom - 24" line	07/26/01	Unknown	Unknown	Excess wet weather flow

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Lower East Fork (cont.)				
Happy Hollow LS	07/18/01	Unknown	5 hours	100 yr storm
Polo Fields I	07/08/01	< 50,000 gal	2 hours	Power failure
Happy Hollow LS	06/07/01	30,000 gal	3 hours	Excess wet weather flow
Highview LS	03/09/01	18-20,000 gal	1 hour	Grease buildup
Lower East Fork WWTP	01/24/01	0.102 Mgal	20 minutes	Power interruption
Lower East Fork WWTP	12/17/00	5.25 Mgal	35 hours	Excess wet weather flow
Lower East Fork WWTP	09/26/00	2.085 Mgal	14 hours	Excess wet weather flow
Happy Hollow LS	09/26/00	Unknown	Unknown	Excess wet weather flow
Lower East Fork WWTP	07/14/00	0.12 Mgal	30 min	Power interruption
Highview LS	06/18/00	Unknown	Unknown	Excess wet weather flow
Polo Fields II	06/13/00	Unknown	Unknown	Tripped breaker
Lower East Fork WWTP	06/02/00	0.7 Mgal	3.5 hours	Power interruption
Lower East Fork WWTP	04/08/00	3.2 Mgal	20.5 hours	Excess wet weather flow
Lower East Fork WWTP	04/04/00	6.74 Mgal	26 hours	Excess wet weather flow
Lower East Fork WWTP	02/18/00	12.61 Mgal	34 hours	Excess wet weather flow
Lower East Fork WWTP	01/04/00	2.97 Mgal	16 hours	Excess wet weather flow
Happy Hollow LS	01/03/00	Unknown	Unknown	Excess wet weather flow

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Hall Run				
Old Beechmont WWTP	02/22/03	Unknown	Unknown	Excess wet weather flow
Hall Run Trunk Sewer	10/29/02	Unknown	6 hours	Blocked manhole - vandalism
Old Beechmont WWTP	09/27/02	Unknown	6.25 hours	Excess wet weather flow
Todd Rose Lane MH	09/27/02	Unknown	6 hours	Excess wet weather flow
Old Beechmont WWTP	03/26/02	Unknown	6.5 hours	Excess wet weather flow
Todd Rose Lane MH	03/26/02	Unknown	Unknown	Excess wet weather flow
Fern Court Old WWTP	03/26/02	Unknown	2.5 hours	Excess wet weather flow
Old Beechmont WWTP	03/20/02	Unknown	7 hours	Excess wet weather flow
Todd Rose Lane MH	03/20/02	Unknown	8 hours	Excess wet weather flow
Fern Court Old WWTP	03/20/02	Unknown	4.5 hours	Excess wet weather flow
Old Beechmont WWTP	12/17/01	Unknown	Unknown	Not reported
Fern Court Old WWTP	10/24/01	Unknown	Unknown	Excess wet weather flow
Summerside Road - 8" line	07/26/01	Unknown	Unknown	Excess wet weather flow
Fern Court - 12" line	07/26/01	Unknown	Unknown	Excess wet weather flow
Mt. Carmel Tobasco - 8" line	07/26/01	Unknown	Unknown	Excess wet weather flow
Mt. Carmel Tobasco trunk	07/17/01	Unknown	Est 24 hours	100 yr storm
Hall Run Trunk Sewer	07/17/01	Unknown	Est 48 hours	100 yr storm
Meyers lane (?) MH	02/23/01	Unknown	Unknown	Blocked manhole / broken pipe
Summeride manhole	01/02/01	Less than 30,000 gal	3 hours	Blocked manhole - grease
Beechmont Dr manhole	06/22/00	Unknown	Unknown	Blocked manhole

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Salt Run				
Edwilla LS	09/27/02	Unknown	6 hours	Excess wet weather flow
Blocked manhole	09/06/02	Unknown	Unknown	Blocked manhole - vandalism
Shephard Road LS	02/19/02	40-100,000 gal	2-6 hours	Grease/Bioxide - equip malfunction
Shephard Road LS	12/06/01	1,500 gallons	15 min	Operator error
Locust Grove Ct MH	03/31/01	Less than 5,000 gal	Unknown	Blocked manhole - grease
Audubon LS	02/24/01	Unknown	Unknown	Deterioration of force main
Shephard Road force main	02/02/01	Unknown	24-48 hours	2 force mains cracked
Shephard Road/Nature Run LS	01/21/01	500,000 gal	24 hours	System failure
Fox Creek Ln MH	11/11/00	Unknown	Unknown	Blocked manhole - vandalism
Nature Run LS	06/04/00	Unknown	Unknown	Mechanical failure
Dry Run				
Orchard Valley Lift Station	08/13/01	< 40,000 gal	Unknown	Equipment malfunction
Orchard Valley Lift Station	07/18/01	Unknown	Unknown	100 year storm
Wolfpen Run				
None reported				

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Shayler Run				
Pharo Drive LS	02/22/03	Unknown	Unknown	Excess wet weather flow
Benjamin Street	02/22/03	Unknown	Unknown	Excess wet weather flow
Binning Road	09/27/02	Unknown	4.5 hours	Excess wet weather flow
Binning Road	12/17/01	Unknown	Unknown	Not reported
Forsythia LS	07/26/01	Unknown	Unknown	Excess wet weather flow
Forsythia LS	07/18/01	Unknown	4 hours	100 yr storm
Winding Creek Rd MH	05/18/01	Unknown	5-6 hours	Blocked manhole
Oak Street LS	02/23/01	Unknown	Unknown	Blocked manhole / broken pipe
Clough/Taylor Rd MH	12/16/00	32,760 gallons	3 hours	3-inch rain
Trunk MH @ Baldwin/Binning	12/16/00	87,360 gallons	8 hours	3-inch rain
East Clough LS	08/26/00	Unknown	Unknown	Grease imapired float control
Mountain Ash St MH	07/15/00	Unknown	Unknown	Blocked manhole - grease
Emery Ridge	03/17/00	Unknown	Unknown	Line failure

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Sugarcamp Run				
SR 131 LS	03/05/03	Less than 10,000 gal	Est 4 hours	Excess wet weather flow
SR 131 LS	02/22/03	Unknown	Unknown	Excess wet weather flow
SR 131 LS	02/04/03	Less than 5,000 gal	1.5 hours	Excess wet weather flow
SR 131 LS	01/01/03	Unknown	Unknown	Excess wet weather flow
SR 131 LS	12/19/02	Unknown	Unknown	Excess wet weather flow
SR 131 LS	12/01/02	50-70,000 gal	10 hours	Excess wet weather flow
SR 131 LS	10/29/02	50-75,000 gal	8-12 hours	Excess wet weather flow
SR 131 LS	09/27/02	Unknown	11.5 hours	Excess wet weather flow
SR 131 LS	05/17/02	Unknown	Unknown	Excess wet weather flow
SR 131 LS	05/13/02	Unknown	Unknown	Excess wet weather flow
SR 131 LS	05/08/02	Unknown	Unknown	Excess wet weather flow
SR 131 LS	04/28/02	Unknown	Unknown	Excess wet weather flow
SR 131 LS	04/21/02	Unknown	Unknown	Excess wet weather flow
SR 131 LS	04/13/02	40,000 gal	3 hrs, 10 min	Excess wet weather flow
SR 131 LS	03/26/02	Unknown	18+ hours	Excess wet weather flow
SR 131 LS	03/15/02	less than 75,000 gal	6-8 hours	Excess wet weather flow
SR 131 LS	01/24/02	75,000 gallons	8-10 hours	Excess wet weather flow
SR 131 LS	12/17/01	Unknown	Unknown	Not reported

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Sugarcamp Run (cont.)				
SR 131 LS	11/27/01	Unknown	10-12 hours	Excess wet weather flow
SR 131 LS	10/24/01	Unknown	> 7.5 hours	Excess wet weather flow
SR 131 LS	10/14/01	75,000 gallons	6-8 hours	Excess wet weather flow
SR 131 LS	08/31/01	Unknown	7.5 hours	Excess wet weather flow
SR 131 LS	07/26/01	Unknown	Unknown	Excess wet weather flow
SR 131 LS	07/17/01	Unknown	17.5 hours	100 yr storm
SR 131 LS	06/16/01	< 50,000 gal	5-6 hours	Excess wet weather flow
SR 131 LS	06/07/01	Unknown	10.5 hours	Excess wet weather flow
SR 131 LS	05/18/01	Unknown	Unknown	Excess wet weather flow
SR 131 LS	02/20/01	45,000 gal	3 hours	Excess wet weather flow
SR 131 LS	02/09/01	45,000 gal	3 hours	Excess wet weather flow
SR 131 LS	01/30/01	90,000 gal	6 hours	Excess wet weather flow
SR 131 LS	12/16/00	96,000 gal	8 hours	Excess wet weather flow
SR 131 LS	09/26/00	Unknown	Unknown	Excess wet weather flow
SR 131 LS	09/08/00	Unknown	Unknown	Pump failure
SR 131 LS	08/07/00	Unknown	15 min	Excess wet weather flow
SR 131 LS	07/15/00	Unknown	Unknown	Power failure

Summary of WWTP spills in Lower East Fork watershed.

Summary of WWTP Spills in Lower East Fork Watershed				
Name	**Date**	**Amount**	**Duration**	**Reason**
Sugarcamp Run (cont.)				
SR 131 LS	07/14/00	Unknown	Unknown	Excess wet weather flow
SR 131 LS	07/05/00	Unknown	Unknown	Excess wet weather flow
SR 131 LS	07/04/00	Unknown	Unknown	Excess wet weather flow
SR 131 LS	06/20/00	Unknown	Unknown	Excess wet weather flow
SR 131 LS	06/18/00	Unknown	Unknown	Excess wet weather flow
SR 131 LS	01/03/00	Unknown	Unknown	Excess wet weather flow