

**Division of Surface Water**

# Darby at the Crossroads

A Summary of Ohio EPA's Work  
and Collaboration to Protect and Restore  
an Important Water Resource

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## **Introduction**

The Darby Creek watershed, including Big and Little Darby creeks, is an important water resource in central Ohio and the entire Midwest. Natural resource professionals from private, public and academic institutions are unanimous in citing these streams as among the most biologically diverse streams of their size in the Midwest. Big and Little Darby creeks have been designated as State and National Scenic Rivers, and the watershed is known to provide habitat for several state and federally listed endangered species. While the protection of this unique and valued resource is a goal we can all agree on, there are varying opinions about how best to achieve it.

## **The Challenge**

The Darby watershed is at a crossroads. The unique and diverse biological communities of fish, freshwater mussels and the associated benthic invertebrate fauna (aquatic insects, worms, etc.) can be saved for posterity through wise water resource management and land use decisions. However, without sufficient action and precautions in the near future, declines in water quality and stream habitat may forever change the essential character of these streams. Point source pollution (from pipes), runoff from urban areas and agricultural land, and poor stream bank land management are degrading some stream segments today. Among the most visible and widely publicized future threats to the Darby is conversion of farm land to suburban and commercial land uses, especially in Franklin County.

The purpose of this document is to explain the challenge of protecting the Darby using the latest information on the health of the aquatic ecosystem. We review what has been done so far, what has been learned and what Ohio EPA will be doing in the upcoming year. Saving Darby Creek in its current condition will not be easy. Actions are needed immediately and we cannot wait for additional years of study.

The work to save the Darby does not fall to any one organization, agency or governmental entity, but is spread among many responsible parties and citizens. A well informed public can help shape the vision and protection of the Darby watershed. Success will stem from the collective effort and leadership of all public officials with responsibilities in the watershed. Ultimately, it may be necessary for Central Ohioans to express their willingness to alter their choices and their behaviors regarding how land is developed, farmed and otherwise managed for the collective good of the Darby.

Ohio EPA's efforts to protect the Darby watershed are centered on a pollution analysis process called the Total Maximum Daily Load (TMDL) project. The work identifies sources of pollutants and the reductions in pollutants that must be realized if Big Darby Creek and its tributaries are to be protected. The information gathered in the TMDL process will be used to ensure that adequate protection is given to preserve the unpolluted, but potentially threatened, portions of the Darby watershed. We welcome and need participation from all stakeholders in the challenge ahead.

## **Darby Watershed Facts**

The Darby watershed covers 555 square miles of central Ohio just west of the Columbus metropolitan area (see Figure 1). Big Darby Creek originates in Logan County and flows more than 80 miles before joining the Scioto River near Circleville, Ohio. Land use is predominately row crop agricultural, except for the watershed's suburbanizing eastern edge along the border of Madison and Franklin counties.

Landscape features left by past glaciation play an important role in the character of Big Darby Creek. Ground water flowing through the cable end moraine feeds numerous tributaries in Logan and Champaign counties. The cool ground water provides a base flow in times of drought, and buffers water chemistry and stream biology from some of the harsher impacts of human disturbances. The headwaters of Big Darby Creek and two tributary streams support unique cold water fish and benthic macroinvertebrate communities because of strong ground water flows originating from glacial outwash formations.

Fine clay sediments in glacial lake bed soils are present in Union County and the northern edge of the watershed. Accelerated erosion of these soils has been evident in recent years at road building sites, from industrial complexes and through farming. Once in suspension, clay particles move downstream and harm the fish, mussels and other aquatic life living in Big Darby Creek (see Figure 2). This type of pollution needs to be reduced and is one example of what the TMDL will target.

Coarse glacial deposits (gravels and cobbles) are common in the valleys of lower Big Darby Creek and some of its tributaries. This material, combined with the natural stream gradient, creates excellent stream bed habitat for a wide diversity of plants and animals. Bottom land or flood plain forest of varying age is found adjacent to a significant length of both Big and Little Darby creeks, which is important for stream habitat and water quality. Collectively these features create the home for the diverse array of aquatic plant and animal life in the watershed. Human impacts on these variables (flow, temperature, water chemistry, sediment, stream bed and riparian features) must be understood and properly controlled or managed to protect the ecosystem.

## **What Has Been Done So Far?**

Many organizations have worked over a number of years to protect and promote the Darby watershed and have contributed to what we know about the Darby ecosystem. Ohio EPA's work is summarized below.

The Division of Surface Water (DSW) sampled parts of the Darby watershed several times in the last two decades. However, there had never been a systematic survey of the whole watershed until 2001-2002 when a comprehensive physical, chemical and biological survey was conducted. The results of this survey were published June 2004 (see the division's Web page: <http://www.epa.state.oh.us/dsw/index.html>). The information in this report is the environmental assessment phase of the TMDL project, and is available for water quality planning purposes in the watershed and on a regional level. Major findings are summarized in the next section.

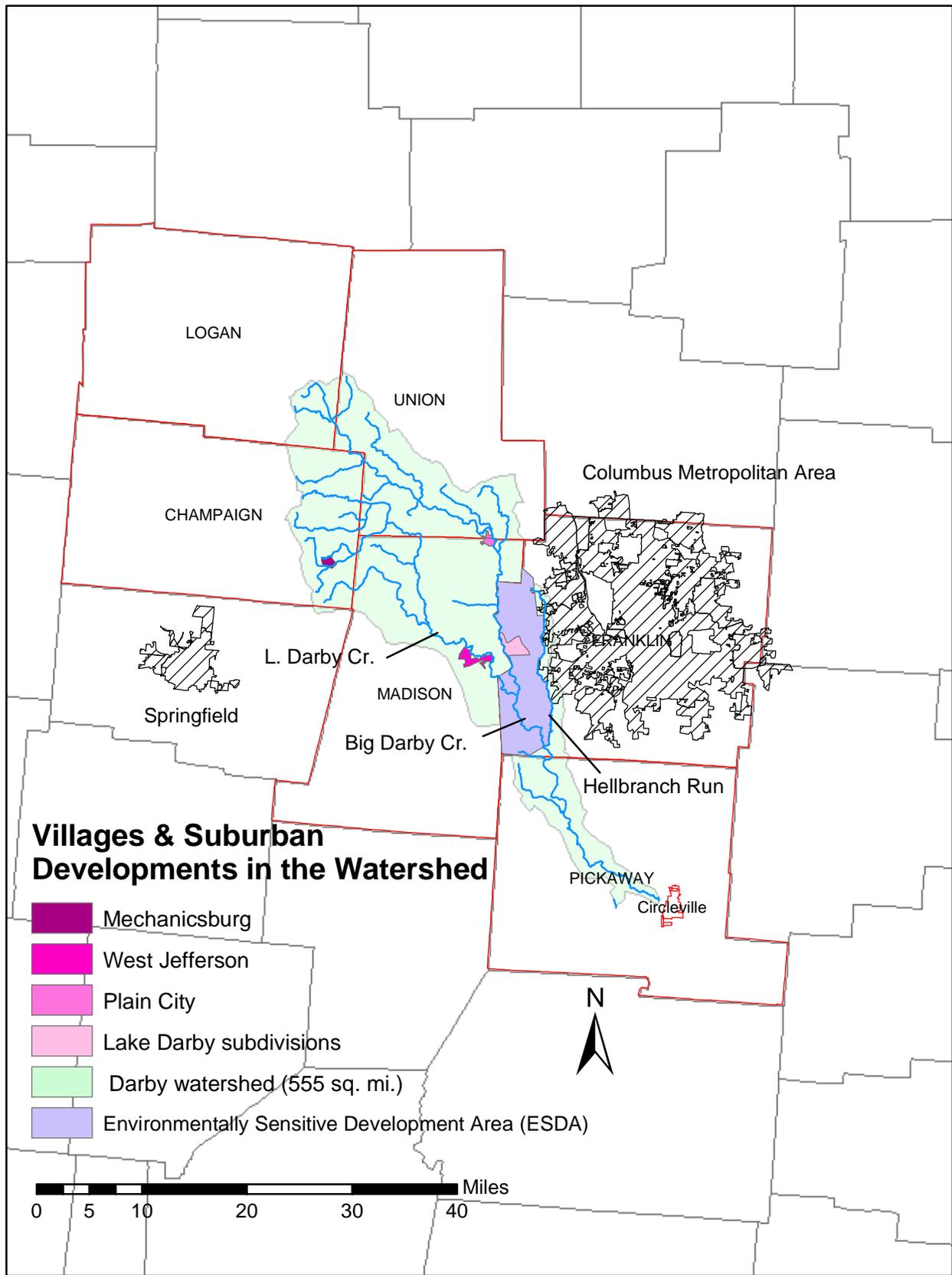


Figure 1. Overview map of the Darby watershed.

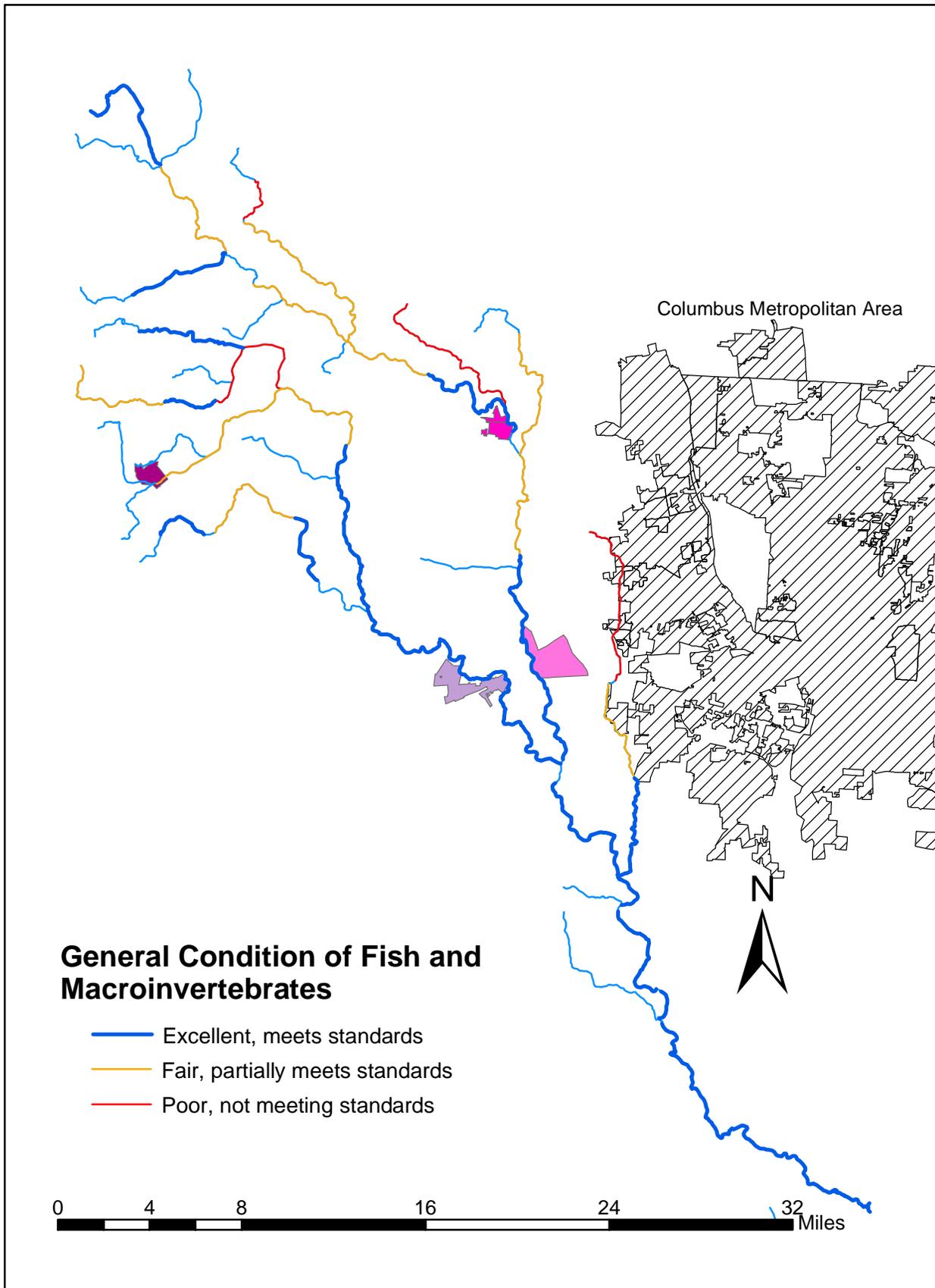


Figure 2. Relative health of aquatic life in Big Darby Creek and tributaries, 2001 - 02.

Planning for wastewater treatment needs and nonpoint pollution (runoff) controls at a regional level is done through the 208 planning process (named after Section 208 of the Clean Water Act). Parts of the Darby watershed in Franklin County are covered by the most recent regional plan, the 2002 Central Scioto Plan Update (CSPU). Realizing that unchecked development of the landscape threatens the health of the Darby ecosystem, the CSPU established a moratorium on installation of additional central sewers in an area of the Hellbranch Run watershed known as the “Environmentally Sensitive Development Area” (ESDA) (see Figure 1). This moratorium will remain in effect until the director of Ohio EPA considers recommendations from an External Advisory Group (EAG) and modifies the 208 plan. The plan will provide protective guidelines for communities to follow as they adopt and administer local ordinances that protect the Darby watershed.

### **What Is the Condition of the Watershed?**

Ohio is one of the few states in the country that measures the health of its streams and rivers by examining the number and types of fish and macroinvertebrates living in the water. So in addition to having specific pollution laws for chemical contaminants (ammonia, mercury, etc.), Ohio has specific standards for the quality of fish and macroinvertebrates living in creeks and rivers. Most streams in the Darby watershed meet their standards for aquatic life quality. However, the upper segments of both Big and Little Darby creeks, and a number of tributaries, do not meet standards. While the lower mainstem of Big and Little Darby creeks attained standards in 2001-2002, there was evidence of stress from pollution and poor habitat. Figure 2 shows the health of aquatic life in streams of the Darby watershed compared to the standards.

Special surveys were conducted to evaluate potential risks to human health from water-borne pathogens and from toxic chemicals in fish tissue. Figure 3 provides a general look at the pattern of indicator bacteria counts measured in Big and Little Darby creek mainstems in 2001. Although water-borne pathogens are not easily or reliably monitored in surface waters, *E. coli* counts in the range of 150 -1000 per 100 ml (~ ½ cup) suggest that there is a slightly elevated risk of contracting water-borne illnesses for anyone swimming or canoeing in these streams. Higher levels of bacteria pollution were measured in the upper segments of Big Darby Creek and some small tributary streams. Mercury and PCBs were detected in channel catfish, carp and freshwater drum. A fish consumption advisory was issued in March 2004 warning against eating more than one meal per month of these species caught in Big Darby Creek.

### **What are the problems?**

Pollution in the watershed is caused by over-abundant plant nutrients (nitrogen and phosphorus), low dissolved oxygen (in part caused by the excessive nutrients), sedimentation and habitat destruction. Sources of the pollution vary from place to place within the watershed, but are most often associated with sewage treatment plants, agricultural runoff or agricultural practices, industrial activity and urbanization. Figure 3 along with the photographs and chart on pages 7 and 8 show problems associated with sediment, livestock access to streams and excessive nutrients.

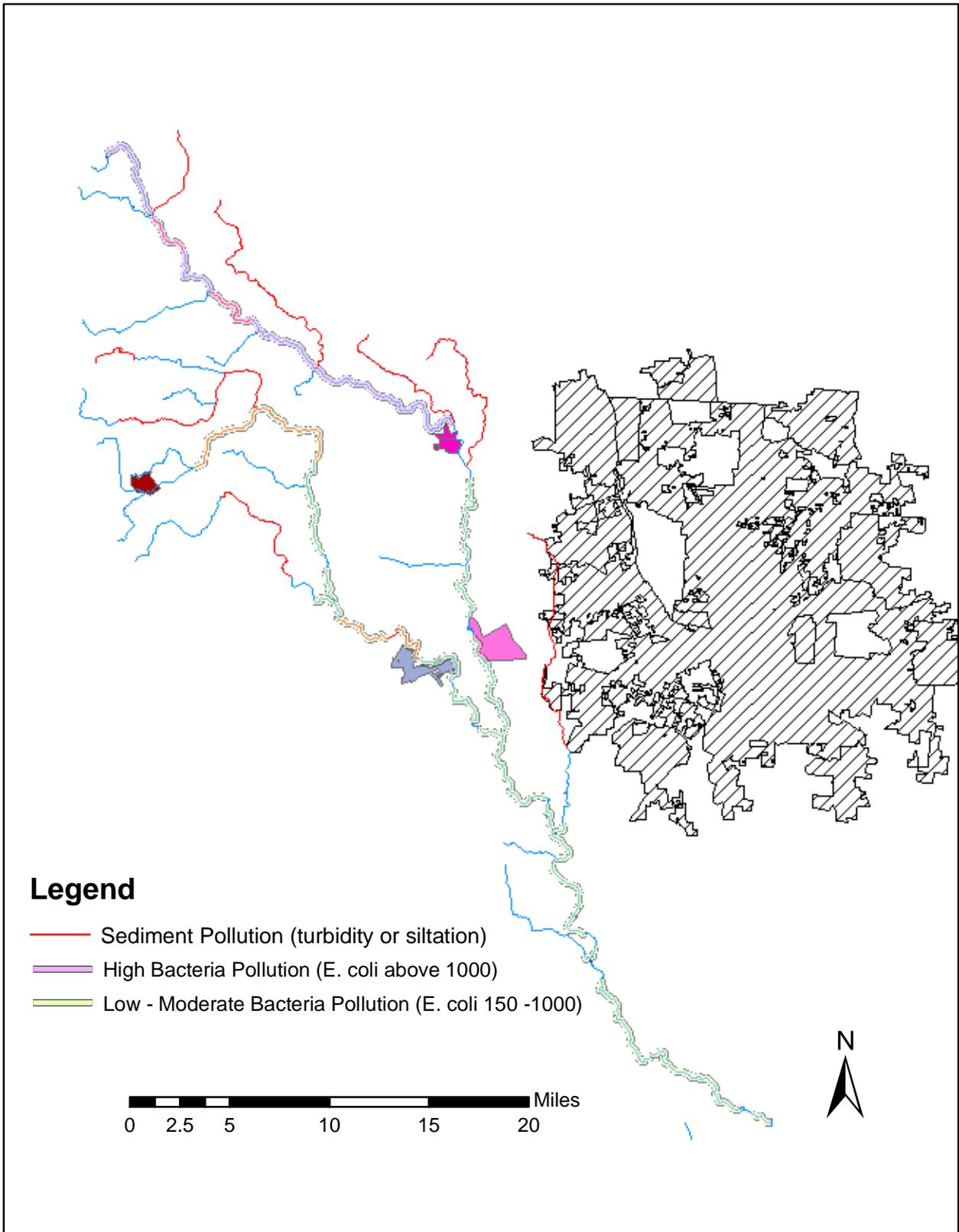
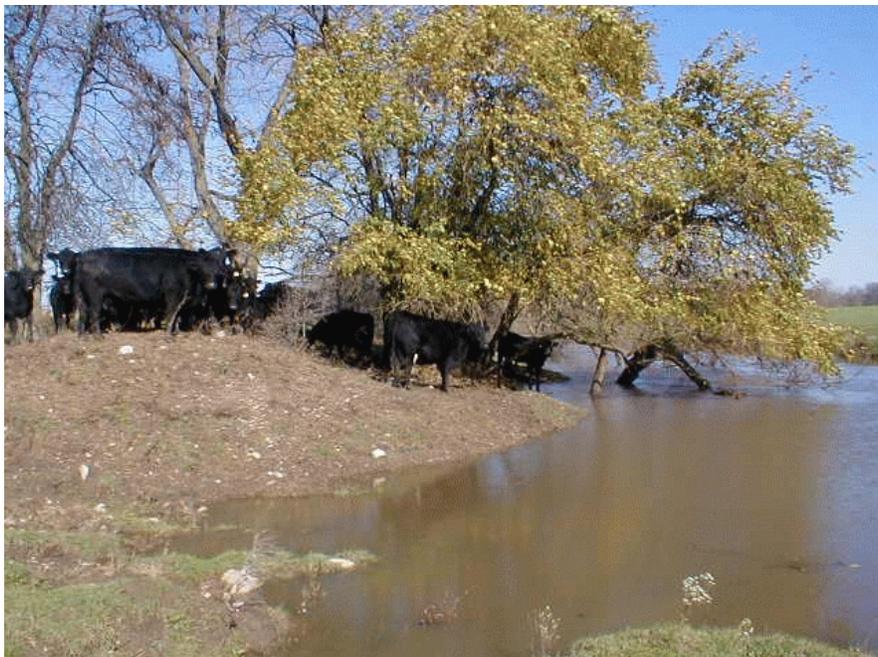


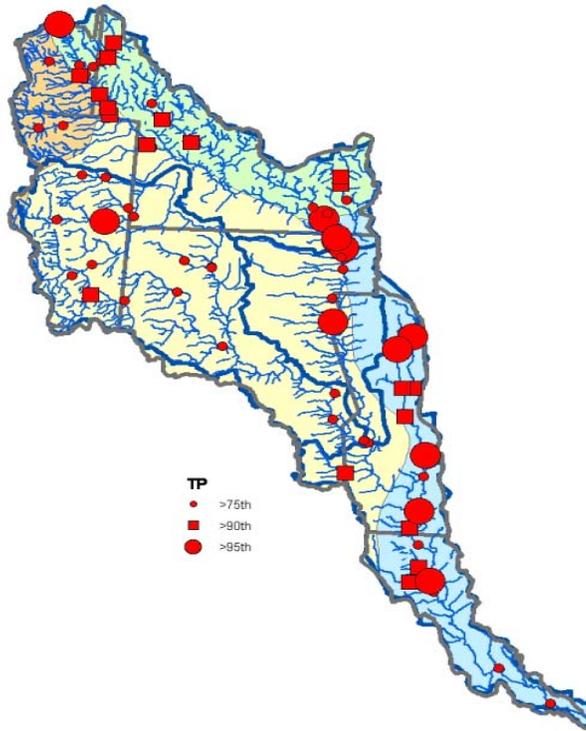
Figure 3. Streams in the Darby watershed with serious sediment pollution and bacteria levels in the Big and Little Darby creeks.



Habitat destruction caused by unrestricted livestock access to the stream. Note the bank erosion due to the removal of vegetation and the impact of cattle.



Unrestricted livestock access to the stream. This introduces bacteria and destroys habitat.



Locations with relatively high total phosphorus concentrations. Largest symbol denotes highest values.



Nuisance algae mats form as a result of excessive nutrients in the water column, as in this photo of lower Big Darby Creek.

The contamination of fish tissue with mercury and PCBs is very common in Ohio and throughout the Midwest. These chemicals persist and cycle within the food chain for many years. The source of these contaminants in the Darby watershed, especially mercury, is likely from atmospheric deposition (rain and snowfall). Ohio EPA will continue to look for and impose controls on point sources, landfills, industrial sites and other potential sources within the watershed.

### **What Are the Next Steps and Key Issues?**

Ohio EPA is taking the following steps in the upcoming months and will focus on a number of key issues described below.

#### *Prepare TMDL Report*

The foundation for doing the TMDL project is knowledge of the pollution causes and sources discussed above. The objectives of the TMDL are to:

- 1) determine how much pollution needs to be reduced to restore currently unhealthy waters;
- 2) create an action plan to reduce pollution stress to safe levels and keep healthy waters from becoming polluted; and,
- 3) identify the landscape features (for example, glacial deposits, forest cover and buffers) that make Big Darby a unique water resource.

Field work to measure physical and chemical conditions in key stream segments will be done in the summer of 2004. Once completed, this work will be used to calculate the allowable amount of pollution in areas where problems have been identified. In addition to this work, an innovative analysis of why biological communities perform so exceptionally well in certain portions of the Big and Little Darby creeks will be attempted. This is very important for the Hellbranch Run portion of the Darby watershed given the urban growth pressure in western Franklin County.

Ohio EPA plans to issue a draft TMDL report for public comment by September 2004 and submit a final report to U.S. EPA in December 2004. Ohio EPA will be contacting people who live in the watershed to identify voluntary activities that can help restore impaired areas in the watershed and to protect areas that are not currently impaired.

#### *Amend Section 208 Water Quality Plan*

Another important means of managing water quality in the Darby watershed is the State's Section 208 Water Quality Management Plan. Past and future amendments to the initial plan done in the 1970s address both conventional water quality planning needs and innovative steps to emerging water quality threats such as urban sprawl. Conventional identifies municipal wastewater treatment needs and the entities that will plan and provide the collection and treatment services. The areas that will need to be sewerred over the next 20 years are mapped.

An example of an innovative planning measure is the Environmentally Sensitive Development Area (ESDA) in western Franklin County. The threat of uncontrolled development overrunning a very sensitive part of the Darby ecosystem resulted in a

moratorium on sewer line installations. The State's last 208 plan amendment (2002) stipulated that Ohio EPA cannot approve permits for central sewers within the ESDA until the plan is updated to include additional environmental protections. These include specifications for stream set-backs or riparian buffers, open space requirements for conservation subdivisions and special storm water management techniques.

An External Advisory Group (EAG) made up of the key governmental entities and public interests has been meeting since 2003 and will provide recommendations regarding these environmental protection measures to the director of Ohio EPA later in 2004. Once the advisory group has developed recommendations in these areas, the director of Ohio EPA will evaluate the recommendations and amend the 208 plan with conditions that protect water quality. Permits to install sewers within the ESDA are not approvable until such time that local governments adopt ordinances that implement the protections included in the plan.

Madison County Commissioners have been working with a consultant and a steering committee of local stakeholders on additional water quality planning updates that would be applicable throughout Madison County, including portions of Big and Little Darby creeks. Ohio EPA is participating on the steering committee and will coordinate wider public input on plan content as materials are drafted.

#### *Review Water Quality Standards*

State and federal laws require periodic reviews of standards that apply to surface waters. Beneficial uses assigned to specific stream segments are an important component of the water quality standards. Beneficial uses are defined broadly as those uses a particular creek or river should supply to the public; examples include recreation, aquatic life (that is, fishing), and water supply.

The recently completed biological and water quality report will help determine which beneficial uses apply to the various streams within the Darby watershed. For example, three small streams in the Darby headwaters were found to support coldwater fish and macroinvertebrate species, and consequently those streams are proposed for a Coldwater Habitat beneficial aquatic life use. Ohio EPA expects to propose changes in beneficial uses for approximately 30 stream segments in the Darby watershed. The rule revision process begins with a preliminary notification to interested parties. Following consideration of reaction from interested parties, the rules would be proposed and adopted later in 2004 or early 2005.

#### *Consider & Protect Endangered Species*

The Darby watershed is home to a very diverse biological community, including a number of species classified as threatened or endangered by State and federal agencies. Populations of two freshwater mussel species listed as endangered by the U.S. Fish and Wildlife Service pose special requirements and challenges as Ohio EPA undertakes preparation of the TMDL. The federal Endangered Species Act requires that actions by federal agencies, in this case the U.S. EPA approval of Ohio's TMDL for the Darby, be carefully examined to ensure the risks to endangered species are minimal.

To assist in the understanding of the issues, Ohio EPA has included extensive information in the Darby biological survey report on freshwater mussel community condition (summarized in Figure 4). Ohio EPA will continue to communicate with both federal agencies regarding these findings and additional analysis of chemical and habitat stressors prepared for the TMDL report. Early communication, including opportunities for public input on measures to protect endangered species, will allow questions to be answered in the final TMDL report.

### Mussel Trends Through Time

Examined all sites that had been sampled in 4 or more years to see if any trends are apparent over the time that each site has been sampled. Of the 42 sites examined, 15 show decreasing mussel richness (36% of sites) while only two show an increase (5% of sites). (Only live or fresh-dead specimens were considered.)

- ▼ Species richness decreased ( $r\text{-squared} > 0.5$ ) over time
- ▲ Species richness increased ( $r\text{-squared} > 0.5$ ) over time
- No apparent change ( $r\text{-squared} < 0.5$ ) in species richness over time



Adapted from Watters and Flaute Myers, 2003.

### *Apply Adaptive Watershed Management*

Ohio EPA's TMDL program is designed to be a repetitive process. The goal is to attain water quality standards. The process includes followup monitoring, feedback and adjustments to pollution control strategies (permits, best management practices, etc.) over a number of years to ensure success. Adaptive watershed management is a term that has been coined to describe this process. It is well suited to situations where we have incomplete knowledge or understanding of the pollution issues and the stream's response to the pollution. The current and future impacts of development in the Hellbranch Run watershed on the exceptional biological communities of the Darby ecosystem certainly fit this description. Ohio EPA is committed to finding ways that an adaptive watershed management process can work to solve this problem. Our initial approach is described below and in Figure 5.

Development pressures in western Franklin County (the area of the ESDA) can be compared to an inflating balloon. The current moratoriums imposed by the City of Columbus and Ohio EPA on larger developments that require service by central sewers create the pressure inflating the balloon. The moratoriums have been effective in slowing growth, although there is some home building on individual lots and small subdivisions with large lot sizes where home sewage treatment systems are approved by the Franklin County Board of Health. Moratoriums on central sewers, however, are unlikely to be a permanent solution. Like the pressure in an expanding balloon, the pressure for growth in the ESDA needs a relief valve to avoid damaging results (see Figure 5).

Local leaders and regulatory agencies have several mechanisms to deal responsibly with the pent up demand for building at higher densities within the ESDA. Local governments can voluntarily organize and collectively complete comprehensive land use planning for the ESDA (as well as other areas within the Darby watershed). Some preliminary discussion of this option is ongoing. The outcome of such work would undoubtedly benefit both quality of life and environmental quality as future growth occurs in western Franklin County. This mechanism is shown with a dashed outline box in Figure 5 because, while Ohio EPA endorses it, comprehensive land use planning cannot be mandated by Ohio EPA.

Other projects such as the locally driven Hellbranch Forum are contributing knowledge about the impacts of land use decisions on runoff and pollutant loadings. This will help the Ohio EPA TMDL project and those embarking on comprehensive land use planning.

To achieve the future desired state of a healthy Darby ecosystem, Ohio EPA will apply adaptive watershed management. The tools we have at our disposal include environmental assessments, Total Maximum Daily Load results, permits for wastewater and storm water and Section 208 water quality planning. These features, along with the recommendations of the External Advisory Group, are shown as solid boxes under the future desired state in Figure 5.

Ohio EPA will apply the output from all this work (TMDL assessment and development results, amended Section 208 Plan, Hellbranch Forum output and comprehensive land use planning, if undertaken) in the adaptive watershed management model. The challenge will

be to gradually meter the release of growth pressure through action, assessment and adjustment of future actions. One possible scenario is shown in Figure 5. An “allocated” acreage cap for central sewers within the Hellbranch watershed might be derived from TMDL analysis of impervious surface area impacts on stream biology. An amended 208 plan would then include this cap as a review criteria for future central sewer projects. More details of this or similar approaches will be part of the TMDL report.

### **How Can You Get Involved?**

Public participation is key to effective implementation of TMDL projects. As the TMDL development process moves forward, Ohio EPA will use existing watershed groups to promote public involvement. In Franklin County the Hellbranch Watershed Forum, created in 2001, already provides a venue for local government officials to discuss storm water management, water quality issues and the protection of the Darby. The water quantity and quality modeling work conducted on behalf of the Forum through contracts with the Army Corps of Engineers and the TMDL results from Ohio EPA will be the subject of future public meetings. To receive notification of upcoming public meetings, or to learn more about the work of the Forum, contact Jennifer Fish, Franklin County Soil and Water Conservation District (614) 486-9613.

In the context of the larger Darby watershed Ohio EPA’s primary public involvement mechanism will be the Darby Vision watershed planning process. The Darby Vision planning work is sponsored by a special joint board of county soil and water conservation districts. Ohio EPA and Ohio Department of Natural Resources have jointly funded this watershed action plan development, so it is appropriate that this process be a focal point of public involvement. To get involved in the Darby Vision watershed planning process, contact Ben Webb, the Darby Creek Watershed Coordinator, at the Union County Soil and Water Conservation District Office (937-642-5871).

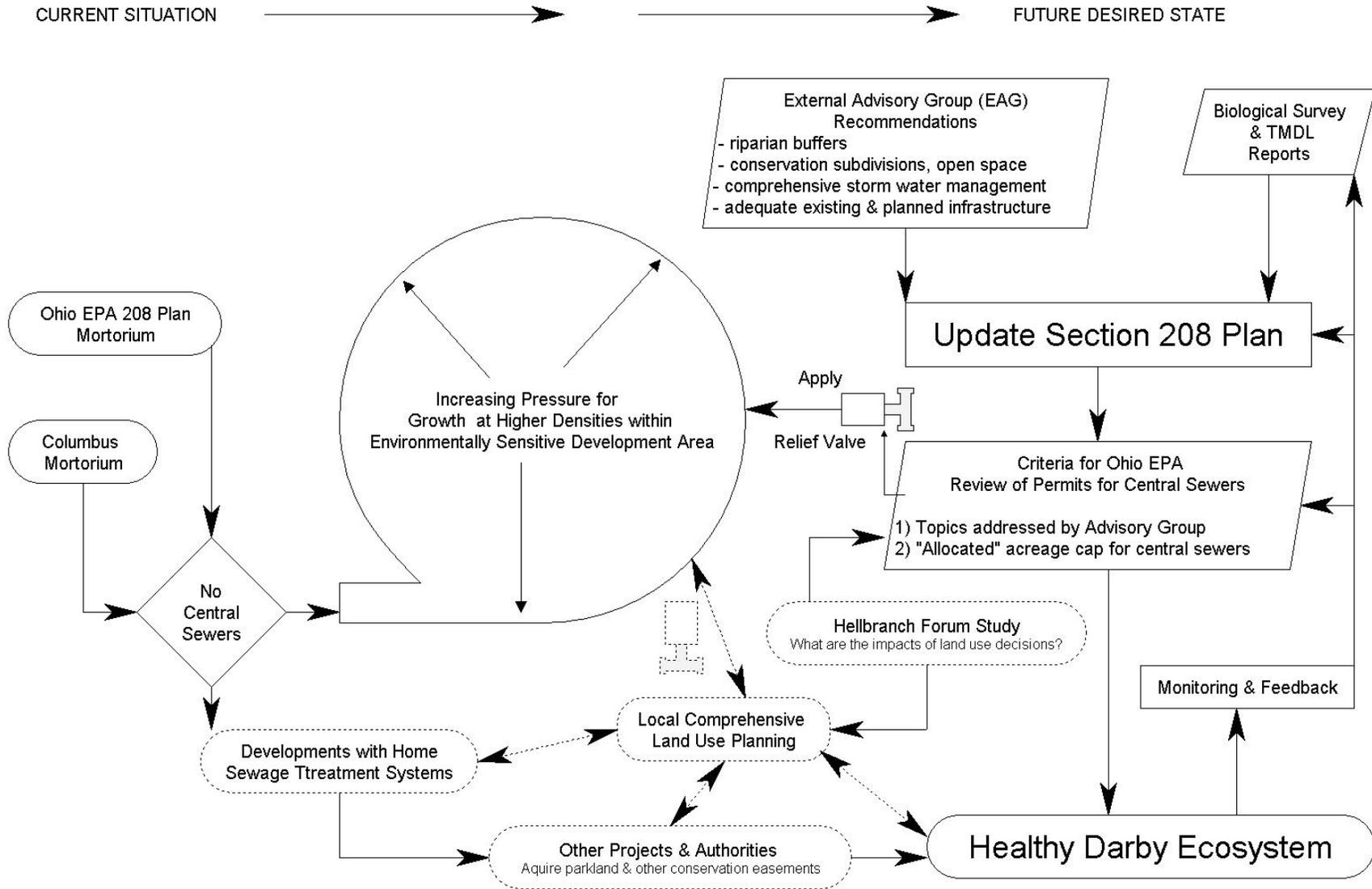


Figure 5. Using an adaptive watershed management model to address growth issues in the Darby watershed.