Section A:

An Overview of Water Quality in Ohio: 2008

2008 Integrated Report

Tributary to the Olentangy River near Delaware, Ohio

Clean water is important to Ohio's economy and standard of living.

Ohio is an economically important and diverse state with strong agriculture, manufacturing, and service industries. Ohio is also a water-rich state bounded by Lake Erie on the north and the Ohio River on the south, with more than 25,000 miles of named and designated streams and rivers within its borders. The suitability of these waters to support society's needs for water supplies and recreation is critical to sustaining Ohio's economy and the standard of living of Ohio citizens. Surface waters—rivers, streams, lakes—provide the majority of water used for public drinking water; for recreation such as swimming, boating, and fishing; and for industrial uses including manufacturing, power generation, irrigation, and mining.

Ohio EPA monitors water quality in Ohio and reports its findings.

Monitoring the quality of Ohio's valuable water resources is an important function of the Ohio Environmental Protection Agency. Since the early 1970s, Ohio EPA has measured the quality of Ohio's water resources and worked with industries, local governments, and citizens to restore the quality of substandard waters. The Agency reports its findings through meetings and reports. This particular report is required by the federal Clean Water Act to fulfill two purposes:

- to provide a summary of the status of the state's surface waters
- to develop a list of waters that do not meet established goals—the "impaired waters."

Under the Clean Water Act, once impaired waters are identified the state must take action to improve them. Typically, the actions include developing restoration plans (total maximum daily loads (TMDLs)), water quality based permits, and nonpoint pollution control measures. As such, this report is an important document that provides information and direction to much of the State's work in water quality planning, monitoring, financial and technical assistance, permitting, and nonpoint source programs. The report is updated every two years.

Over the past 30 years, Ohio EPA has developed innovative monitoring methods that directly measure progress toward the goals of the Clean Water Act. Generally recognized as a leader in water quality monitoring, Ohio uses the fish and aquatic insects that live in streams to assess the health of Ohio's flowing waters. Aquatic animals are generally the most sensitive indicators of pollution because they inhabit the water all of the time. A healthy stream community is also associated with high quality recreational opportunities (e.g., fishing and boating). Stream assessments are based on the experience gained through the collection of over 23,500 fish population samples and nearly 10,000 aquatic insect community samples.

Ohio EPA biologists collect fish samples

In addition to biological data, Ohio EPA collects information on the chemical quality of the water (more than 72,500 water chemistry samples), sediment, and wastewater discharges; data on the contaminants in fish flesh; and physical information about streams. Taken together, this information identifies the factors that limit the health of aquatic life and that constitute threats to human health.

Same data – different results?

The statistics that Ohio reports for the condition of its waters can seem confusing. On the one hand, streams and watersheds show steady improvement, while on the other, nearly all are considered impaired. Why is there a difference when the same data are being used? Perhaps the easiest way to explain the apparent discrepancy is a simple analogy.

Think back to your school days. Imagine you are taking four subjects. You must pass all four to get credit, and you can pass each subject only if you get a perfect score—100%! So, little by little, you make progress—45%, 55%, 70%, good news without a doubt—but the "pass" distinction eludes you. It is either perfection or failure, with no room for "almost" or "getting better." At the least you would be frustrated, and in the end not really all that well informed about your progress.

Ohio EPA's four "subjects" are the four beneficial uses evaluated in this report. We see progress, but none is perfect. That's why Ohio EPA focuses on the "80% attainment of aquatic life use" goal and other tools rather than simply the impaired/unimpaired status of waters. Nearly all waters that have data are considered impaired for one or more uses. By focusing on the incremental progress instead of just a pass/fail system, a more accurate picture of the progress that's been measured can be communicated. It's also important to know how far there is to go to restore Ohio's water resources.

Results show water quality is impaired but continues to improve.

Ohio EPA developed methods to determine how well Ohio's waters support four specific uses of water: human health impacts related to fish tissue contamination, recreation, human health impacts related to drinking water, and aquatic life (fish and aquatic insects). Available data were compared with established water quality goals, and the results of the comparison indicate which waters are meeting goals and which are not. The results for each use are discussed in the next few pages.

Are fish safe to eat?

While most Ohio sport fish are safe to eat, low levels of chemicals like polychlorinated biphenyls (PCBs) and mercury have been found in some fish from certain waters.

To help protect the health of Ohioans, the Ohio EPA in conjunction with the Ohio Department of Health offers an advisory for how often these fish can be safely eaten. An advisory is advice, and should not be viewed as law or regulation. It is intended to help anglers and their families make educated choices about where to fish, what types of fish to eat, how to determine the amount and frequency of fish consumed, and how to prepare fish for cooking.

By following these advisories, citizens can gain the health benefits of eating fish while reducing their exposure to unwanted contaminants.

To assess the **human health impacts related to fish tissue contamination**, Ohio EPA uses the same data that are used to generate Ohio's sport fish consumption advisory. Although the data are the same, the analyses are different. Ohio EPA urges Ohio's anglers to consult the sport fish consumption advisory regarding which and how much fish to eat.

For the analysis in this report, approximately two-thirds of Ohio's medium and large streams and publicly owned lakes have some fish tissue data available. Of those, about one-third do not have enough data to determine the impairment status. About 8% of monitored streams were "unimpaired" for the contaminants, while almost two-thirds of streams are "impaired." For lakes, almost two in five are impaired and almost one-third are not impaired by the six fish tissue contaminants.

Is it safe to swim or wade?

For the most part, water in Ohio is safe for swimming or wading. Water activities are more dangerous after heavy rains due to the obvious physical dangers of being swept into the faster flows, but also because chemicals and bacteria wash into the streams along with the water that runs over the land. In some communities, sewage systems cannot handle the extra volume of water and release untreated sewage during and after heavy rains.

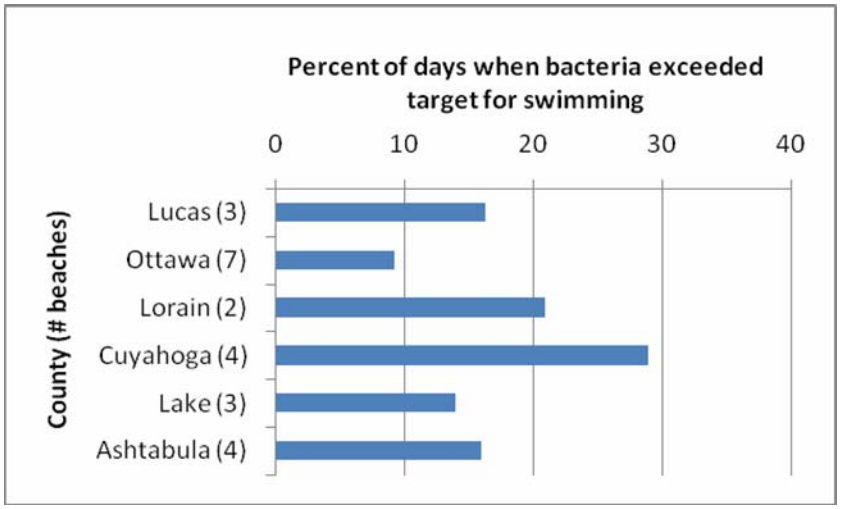
There are some areas where the waters and/or sediments have high levels of contaminants, including polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs), so swimming or wading in these areas is not recommended. A list of these waters is at http://www.epa.state.oh.us/dsw/fishadvisory/donotwade.html.

The most common contaminant is polychlorinated biphenyls (PCBs), followed by mercury. A few waters contain fish whose flesh is contaminated by DDT, mirex, or hexachlorobenzene; data show no streams or lakes with fish contaminated by lead. PCB contamination is widespread usually because of historical sources. Areas with attributable contamination and areas of special concern are being addressed through programs such as the Great Lakes Legacy Act, Superfund or the Resource Conservation and Recovery Act.

Mercury contamination is ubiquitous because of aerial deposition from local, regional and global sources. Thus, solving the problem of mercury contamination requires solutions on a broader scale than at a watershed level. Ohio is targeting mercury from consumer products such as switches and thermometers through legislation banning the sale of such products. Ultimately, increases in renewable energy sources and clean coal technology usage will lessen Ohio's mercury burden.

Fish populations contaminated by hexachlorobenzene, DDT and mirex are already in the process of being restored through various initiatives in state and federal waste remediation programs.

The **recreation** analysis focuses on the amount of bacteria in the water. For Lake Erie public beaches, the results vary widely; those located near population centers appear to have the most problems. Beaches on the Lake Erie islands are nearly always suitable for swimming. While Lucas, Ottawa, Lorain, and Ashtabula counties each had one beach where at least one of five available swimming days had bacteria levels that exceeded the target, all four beaches in Cuyahoga County surpassed this level.



For inland streams, bacteria levels were low in about one in five watersheds. About two in five watersheds had high levels of bacteria. The remaining two in five did not have enough data for evaluation. Ohio's 23 large rivers fare somewhat better, with nearly half having low bacteria levels. About one-fourth showed high levels of bacteria, and the other one-fourth did not have enough data to evaluate. High bacteria levels often with higher stream flows associated with heavy rains.

For the first time, **human health impacts related to drinking water** are being included in this report. The initial focus is on nitrate and pesticides, and Ohio EPA plans to expand the analysis in future reports. There are a total of 120 public water systems with 126 treatment plants using surface water (excluding Ohio River intakes).

Sufficient data were available to evaluate about half of the drinking water source waters for nitrate. The only impaired areas were the Maumee River (the systems for the communities of Defiance, Napoleon, McClure and Bowling Green and the Campbell Soup system) and a portion of the Sandusky River (Fremont). Some areas were identified for a watch list; all were located in the northwestern and central parts of the state. It is difficult and expensive to remove nitrate from drinking water, so no Ohio surface water systems currently use treatment specific for nitrate removal. Ohio public water systems rely on blending the surface water with other sources such as ground water, selective pumping from the stream to avoid high nitrate levels by using off-stream storage in upground reservoirs, or issue public notice advisories warning sensitive population to avoid drinking the water while nitrate levels are high.

Pesticides could be evaluated for about one-quarter of the drinking water source waters. Two of 35 areas were identified as impaired, one in Brown County (Mt. Orab) and the other in Miami County (Piqua). Thirteen areas were identified for a watch list because of elevated atrazine. These areas coincide with the predominantly agricultural lands of western and northwestern Ohio.

Is water safe to drink?

Yes. Public water systems around the state and Ohio EPA work hard to ensure that the water provided meets safe drinking water standards and to make important information available about the sources and quality of the water you drink. However, drinking water advisories do occur from time to time due to treatment plant malfunctions, water line breaks, and the rare case when source water contaminant levels exceed the plant's capacity to remove them. It is important to remember that only a relatively small number of water systems have situations that warrant advisories. In 2006, 98% of all public water systems met all chemical standards. In order to get information about your local drinking water you can read the Consumer Confidence Report (CCR) provided annually by your community water system.

In this report several waters are identified as impaired due to elevated nitrate or pesticides. Water systems in these areas and others with source water contaminants will issue public notice advisories or use additional treatment and water management strategies to assure that safe water is delivered to their customers.

The bulk of the new data evaluated for the **aquatic life use** are in areas Ohio EPA sampled during 2005 and 2006: the Blanchard River, Yellow Creek, Twin Creek, Fourmile Creek, Indian Creek, Walnut Creek, Salt Creek, Paint Creek, Scioto Brush Creek, White Oak Creek, upper Mahoning River, and Swan Creek watersheds. Large rivers studied included the Tuscarawas River, Blanchard River, Scioto River, Paint Creek, and the Muskingum River. Detailed watershed survey reports for many of these watersheds are or will be available at http://www.epa.state.oh.us/dsw/document_index/psdindx.html.

Large rivers have almost met the "80% attainment by 2010" aquatic life goal.

Ohio's large rivers (the 23 rivers that drain more than 500 square miles) continue to show improvement. The "80% attainment by 2010" aquatic life goal statistic now stands at 78.7% full attainment. The modest increase in full attainment across all large rivers between 2006 and 2008 is largely because of new assessments of four large rivers. The table shows that three of the large rivers have improved dramatically, while the quality of Paint Creek has declined slightly.

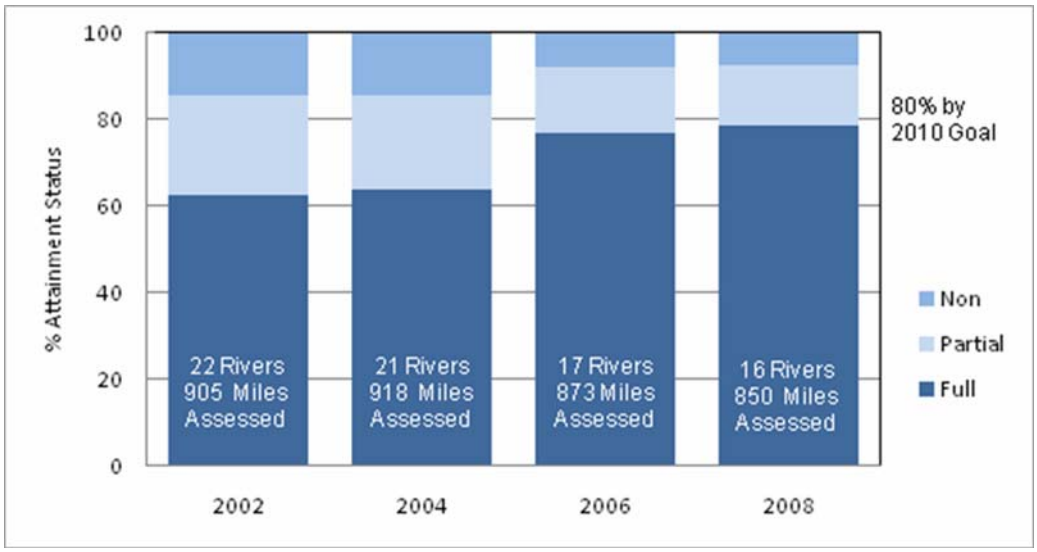
Stream	Year Studied	% of Stream Monitored	% of Aquatic Life Standard		
			Meeting	Partially Meeting	Not Meeting
Paint Creek	1997	100	100	0	0
	2006	100	82	18	0
Tuscarawas River	1994	33	0	30	70
	2004	100	86	14	0
Muskingum River	1994	20	54	46	0
	2006	100	100	0	0
Blanchard River	1996	41	66	34	0
	2005	100	100	0	0

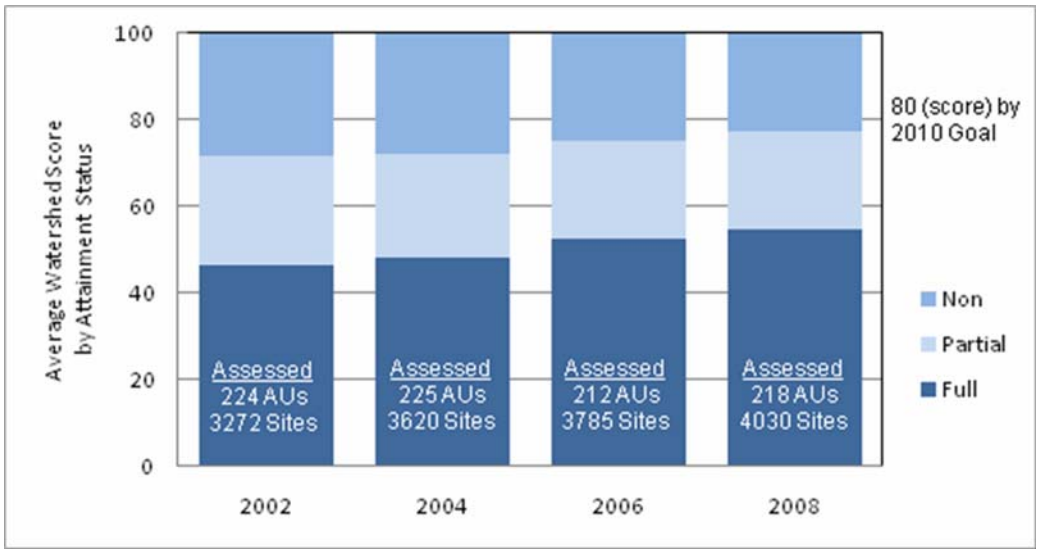
Taking a longer view back to the 1980s, the collective quality of aquatic life in Ohio's large rivers has shown a remarkable improvement. Then, only 21% of the large rivers met water quality standards, increasing to 62% in the 1990s, to almost 79% today. Areas not meeting the

standards have decreased from 41% in the 1980s to 17% in the 1990s to 7% today. Investment in the treatment of sewage and industrial wastewater and improvement in agriculture conservation practices are credited with the turnaround. For example, in the Scioto River, the percent of attainment in the river increased from 11% in the 1980s to 90% during the 1990s after Columbus improved sewage treatment. Being able to track these water quality trends attests to the value of consistent monitoring over time.

For Ohio's 331 watershed units, the score calculated from measurements at individual sites also continued its steady increase, although with an average score considerably lower than the large river full attainment statistic. Based on monitoring through 2006, the average watershed score is now 54.7. However, several high quality watersheds do exist. For example, one of the more recently monitored watersheds, Twin Creek in southwestern Ohio, averaged a score of 82 for its two watershed units and the main stem was in full attainment of its aquatic life uses.

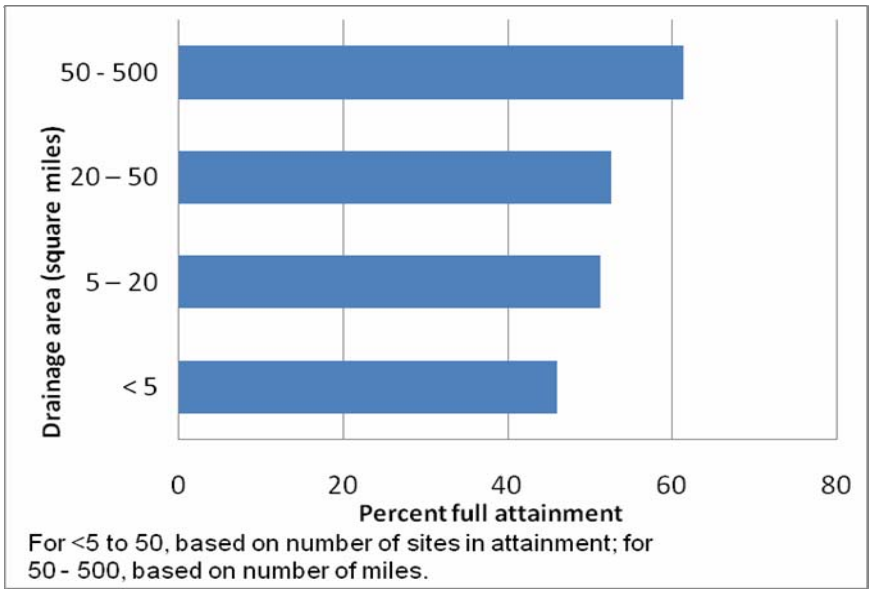
The following charts show the progress in attainment status of aquatic life in recent years for both large rivers and watersheds.





Most aquatic life impairment is caused by land disturbances related to agriculture activities and urban development.

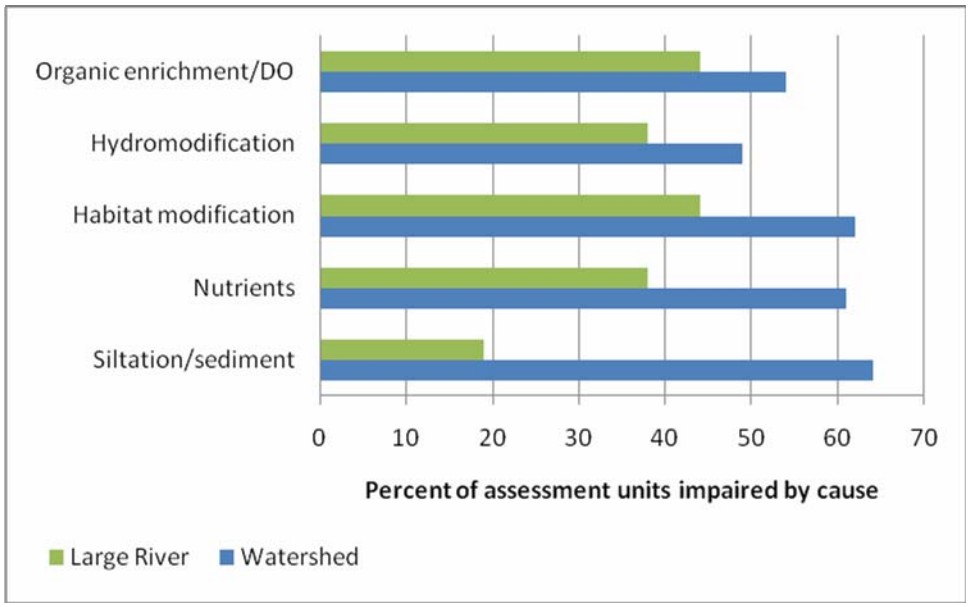
Taking a closer look at the attainment status of individual sites grouped by the amount of land area drained by the stream at that point reveals that unhealthy fish and aquatic insect populations are more common on smaller streams. In other words, the larger the drainage area (and usually the larger the stream), the more likely the stream is to be healthy. This phenomenon correlates well with the most widespread causes associated with the aquatic life impairment in these watersheds.



The top five aquatic life impairment causes for the period 1997 through 2006 are

- siltation/sediment
- nutrients
- habitat modification
- hydromodification
- organic enrichment / dissolved oxygen (DO).

For watersheds, most impairments are related to modification of the landscape. These types of impairments have the most impact on smaller streams. Nearly all impaired watershed units (202 of 209) had at least one of these causes contributing to impairment and 65% (136 of 209) had three or more of the top five causes listed.



These major causes and sources of water quality problems are discussed below.

Organic enrichment is the addition of carbon-based materials from living organisms beyond natural rates and amounts. Natural decomposition of these materials can deplete oxygen supplies in surface waters. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odors associated with the decomposition process.

Siltation/sedimentation describes the deposition of fine soil particles on the bottom of stream and river channels. Deposition typically follows high-flow events that erode and pick up soil particles from the land. Soil particles also transport other pollutants. As the flow decreases, the soil particles fall to the stream bottom. This reduces the diversity of stream habitat available to aquatic organisms.

Nutrient enrichment describes the excess contribution of materials such as nitrogen and phosphorus used by plants during photosynthesis. Excess nutrients are not toxic to aquatic life, but can have an indirect effect because algae flourish where excess nutrients exist. The algae die and their decay uses up the dissolved oxygen that other organisms need to live.

Habitat modification describes the straightening, widening, or deepening of a stream's natural channel. Habitat modification can also include the degradation or complete removal of vegetation from stream banks, which is essential to a healthy stream. These activities can effectively transform a stream from a functioning ecosystem to a simple drainage conveyance.

Hydromodification, or flow alteration, describes any disruption to the natural hydrology of a stream system. Flow alteration includes stream impoundment, increased peak flows associated with the urbanization of watersheds, and water-table regulation through sub-surface drainage.

Contamination by pathogens occurs when human or animal waste reaches the stream. Pathogenic organisms include bacteria, viruses, and protozoa. Contamination by pathogens is a human health issue, as skin contact or accidental ingestion can lead to various conditions such as skin irritation, gastroenteritis, or other more serious illnesses.

Understanding how various land uses impact water quality can lead to more effective prevention and restoration.

Ohio has embraced a wide variety of economic enterprises over the past 150 years, so it is not surprising that there is a large variety of causes and sources of impairment.

Row crop cultivation is a common land use in Ohio. Frequently, cultivated cropland involves surface (ditch construction and stream modification) and subsurface (tile) drainage, and a challenge is to carry out actions that improve water quality while maintaining adequate drainage for profitable agriculture. The land application of manure, especially during winter months, can be a large source of both bacteria and nutrients entering streams and subsurface drainage tiles. Many cropland practices involve the channelization of streams, which creates deeply incised and straight ditches or streams. This disconnects waterways from floodplains, which has damaging impacts on the quality of the system. The resulting channel is less able to assimilate nutrients and other pollution. The regularity of the stream channel, lack of in-stream cover and increased water temperatures reduce biological diversity.

Land development is the conversion of natural areas or agriculture to residential, industrial, or commercial uses. Numerous scientific studies show that increasing impervious cover—hard surfaces such as roads, parking lots, rooftops, and lawns—harms water quality. More water

runs off the hard surfaces and more quickly. The rate of erosion increases and streams become unstable. The resulting channel is less able to assimilate nutrients and other pollution. Higher runoff volume increases the amount of pollutants (e.g., nutrients, metals, sediment, salts, pesticides). Another problem is that stream temperatures can be raised when water runs over hot pavement and rooftops or sets in detention basins. When this heated water enters a stream, the higher temperatures reduce dissolved oxygen concentrations that aquatic life need to survive. With proper planning of development, many of these problems can be mitigated or avoided entirely.

Agricultural livestock operations can vary widely in how they are managed. Pasture land and animal feeding operations can be sources of nutrients and pathogens. Frequently livestock are permitted direct access to streams. Direct access not only allows direct input of nutrients and pathogens, but also erodes the stream bank, causing excess sediments to enter the stream and habitat degradation. The most critical aspect of minimizing water quality impacts from any size animal feeding operation is the proper management of manure.

Industrial and municipal point sources include wastewater treatment plants and factories. Wastewater treatment plants can contribute to bacteria, nutrient enrichment, siltation, and flow alteration problems. Industrial point sources, such as factories, sometimes discharge water that is excessively warm or cold, changing the temperature of the stream. Point sources may contain other pollutants such as chemicals, metals and silt.

Acid mine drainage is a complex environmental stressor that impacts aquatic ecosystems with high levels of acidity, elevated concentrations of dissolved metals and/or the deposition of metal precipitants. Acid mine drainage has one or more of the following characteristics: high acidity (low pH), high metal concentrations, elevated sulfate levels, and excessive suspended solids and/or siltation. It often reduces biological diversity, eliminates sensitive aquatic life, and lowers ecosystem productivity.

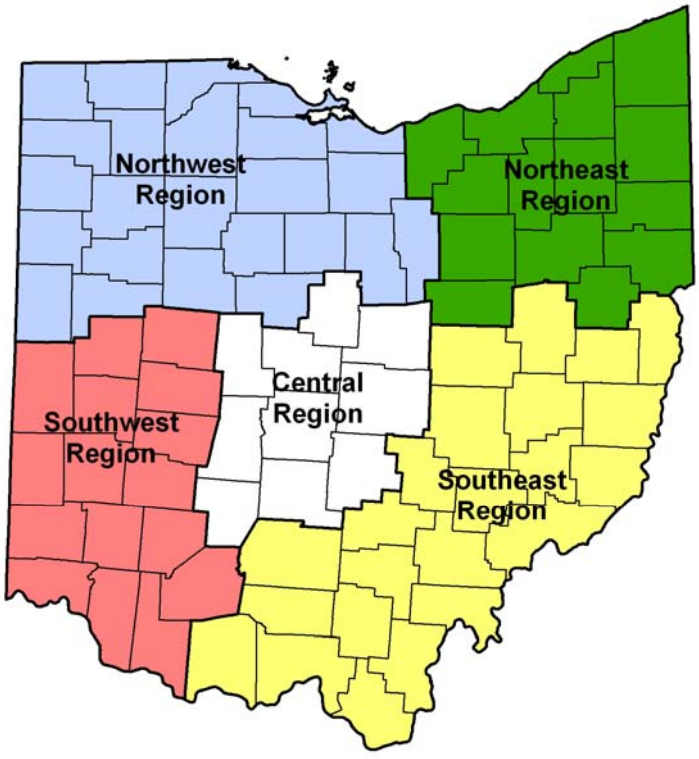
Although many issues are common to all areas of the state, regional differences in landscape, population, and history influence water quality in Ohio.

Ohio's diverse landscape influences water quality naturally, providing a regional flavor to improving water quality. Ohio EPA has incorporated these regional ecological differences into its monitoring and water quality standards programs so that appropriate expectations are set as goals in different areas of the state. Water quality also reflects the history of the landscape and the activities that have taken place on the land. The location of cities and the concentration of population is a factor. However, not all aspects of water quality are regional, so a brief discussion of some common elements is helpful.

In the early 1970s, water quality problems were dominated by the effects of poorly treated wastewater from communities and industries. Permits were issued to these point sources of pollution and the communities and industries spent millions of dollars to provide better wastewater treatment. By the early 1990s, other sources of pollution emerged, having been "unmasked" when the obvious pollution was removed.

As discussed earlier, many of today's problems are caused by disturbance: of habitat in the stream, of land adjacent to streams, and of natural flow regimes. The increase in the amount of impervious surfaces (rooftops, roadways, parking lots, lawns) that accompany outward growth of urban areas contributes to additional nonpoint source impacts in streams, as does the increase in residential development on land formerly used for agriculture.

Many of these problems will not be solved by issuing a permit and building a better treatment system to clean up pollution after it has been created. Rather, the solution lies in not creating new problems as land uses change, in restoring or maintaining natural stream functions and in preserving the ability of the land to store water in place. This requires solving problems collaboratively and locally with a broader general knowledge of water quality issues and present conditions, so education and water quality monitoring take on new importance.



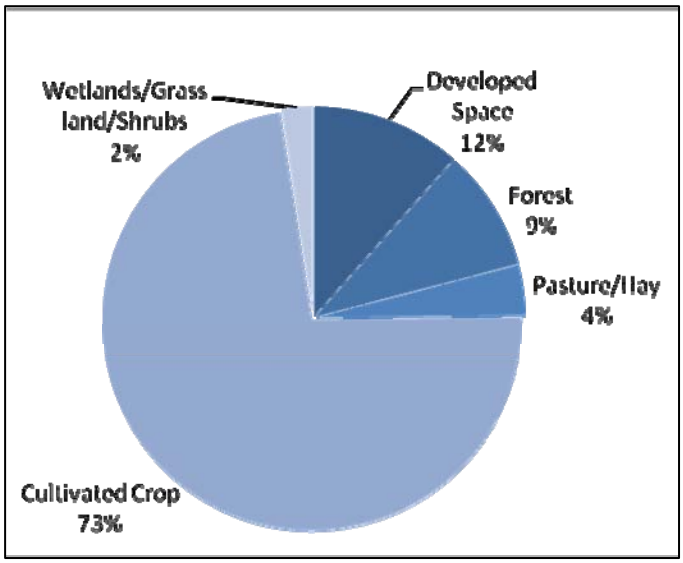
All areas of the state have benefitted from the participation of local citizens in watershed organizations. Some of these organizations have functioned for quite some time, achieving stable funding through various mechanisms. Using federal grant funds and state monies, Ohio EPA has worked with the Ohio Department of Natural Resources to place full-time watershed coordinators in several watersheds since 2000. This has increased the capacity to develop local watershed action plans that address comprehensive water resource management and water quality improvement. The investment

in planning and project implementation has begun to yield some measurable changes in water quality, but the social science aspect of changing land use decisions and consumer/producer attitudes will take some time. The success and future challenge of improving water quality lies in the ability to effect change on the landscape that translates to instream improvements.

Regional summaries are provided to give a sense of the variety of water quality issues facing the different areas of Ohio. The regions are divided along the boundaries of Ohio EPA's districts (see figure above).

Agriculture dominates the flat landscape of much of northwest Ohio.

While portions of northwest Ohio have relatively rolling topography, rocky outcroppings and even cliffs, the majority of this part of the State is relatively flat, with agriculture the primary land use. Much of the arable land is crossed by a square grid of drainage ditches and field tiles. This drainage grid, along with a parallel set of roads, dominates the appearance of the land. The soils are extremely rich for farming, and agriculture continues to be the dominant commercial enterprise in northwest Ohio.



The major land use in the northwestern region of Ohio is cultivated crop land as shown here; each of these land uses affects water quality in slightly different ways as discussed earlier. This area encompasses 24 of Ohio's 88 counties and 15% of the state's population. Ohio's drainage divide crosses this area, so some streams flow north into Lake Erie and others flow south toward the Ohio River.

Certainly there have been many improvements in wastewater treatment by cities and large industries in northwest Ohio, but one of the major success stories is the implementation of sewers and treatment facilities for a substantial number of small communities. These improvements have a significant effect on water quality in the small streams that receive this treated water.

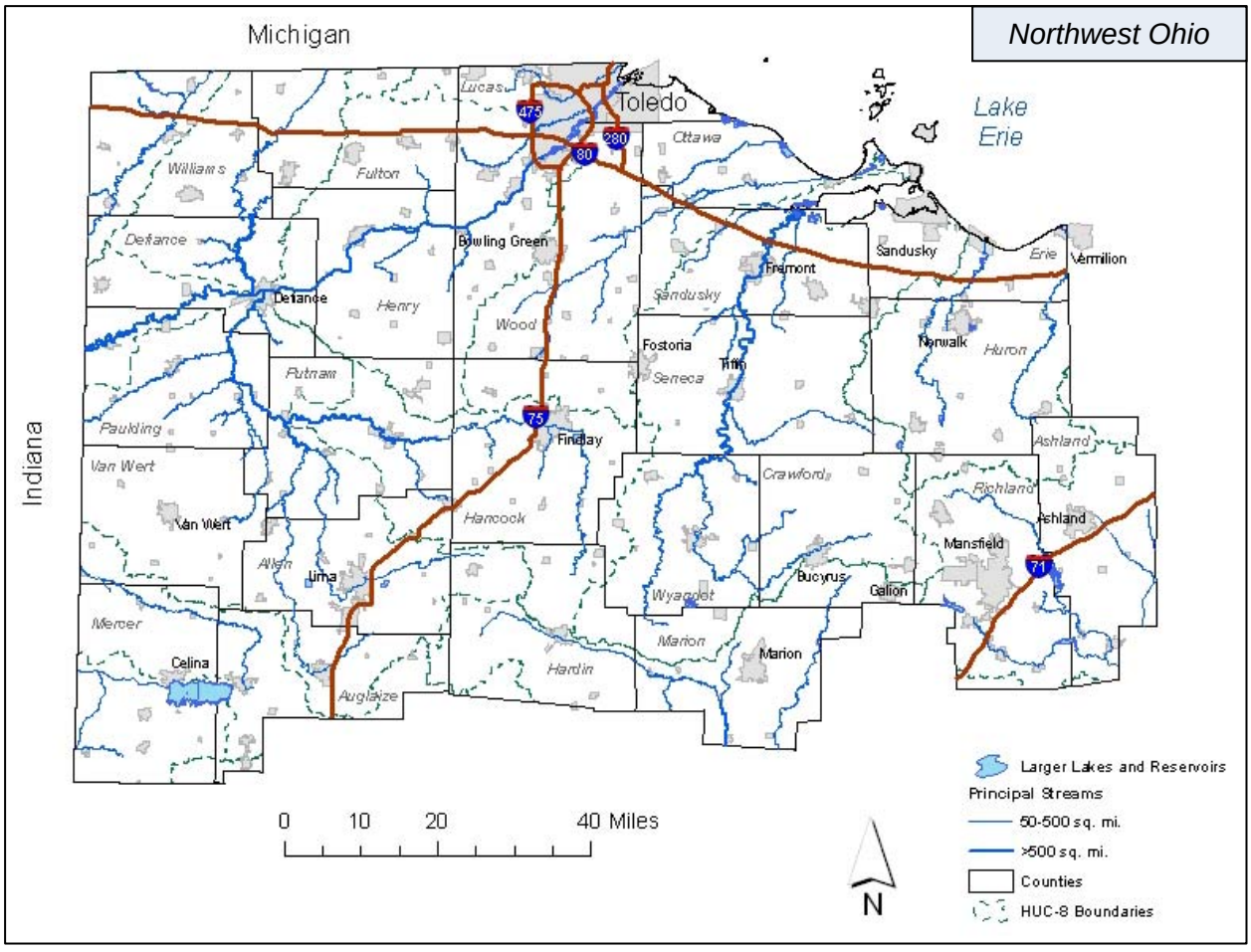
A continuing challenge will be to continue the effort to provide wastewater treatment for small communities in northwest Ohio, as well as to reduce the impact of rural subdivision and scattered development in the rural areas, which have the potential to increase the nonpoint source inputs to nearby streams.

A major success story in this area is the upper Auglaize River. The majority of the upper main stem is now fully attaining the water quality standards for aquatic life use. Changes in agricultural management practices such as conservation tillage and conservation reserve that occurred over a period of about 10 years, from 1991 to 2000, hastened this improvement. Similar improvements are needed in other watersheds in northwest Ohio. The Lake Erie

Conservation Reserve Enhancement Program (CREP) provides funding opportunities for agriculture best management practices.

In northwest Ohio, the necessity for subsurface drainage to support agricultural production must be balanced with water quality goals. A Rural Drainage Advisory Committee with representatives from local, state and federal resource agencies along with agricultural producers and environmental interest groups was formed in 2006 by the Ohio Federation of Soil and Water Conservation Districts. This Committee studied the condition of Ohio's rural drainage infrastructure and investigated the means to foster drainage improvement projects with a high level of environmental stewardship. The findings and recommendations of the Committee are reported in a joint publication of the Federation and Ohio DNR, Division of Soil and Water Conservation (January 2008). This report provides an excellent framework for further discussion and education and may in the long term help fund both traditional and innovative drainage improvement projects that are compatible with water quality goals.

Much assessment and remediation has been done in the lower Maumee watershed. This has resulted from a combination of efforts, primarily through the Maumee Remedial Action Plan (RAP), but also through the Maumee Area of Concern (MAOC) Project, which generated baseline information on water chemistry, sediment chemistry, and biological conditions in the lower Maumee watershed. Remedial activities supported by the MAOC project and other work have contributed to improvement of conditions, especially in the Ottawa River, and will continue into the future.



At the same time, a major challenge now is to carry out activities in the Maumee River watershed to decrease the input of agricultural soil runoff and nutrient input, which have negative effects on the Maumee Bay and the Western Basin of Lake Erie. This effort will need to advance in step with RAP efforts to remediate problem areas in the Bay, efforts to reduce the amount of dredge spoil being relocated in the Bay area, and research to better understand the dynamics of nutrient/algae interactions in Western Lake Erie, particularly the influence of dissolved reactive phosphorus and increased growth of troublesome algae, including *Microcystis* and *Lyngbya*.

Another major challenge is the potential threat posed by the recent quest for alternative fuel sources, which has recently caused a boom in the siting and construction of ethanol plants in this area. If the dramatic increase in corn production continues, land use and agricultural cropping patterns will likely shift, contributing to water quality degradation. To meet market demands, farms may revert to monoculture and more traditional tillage methods with increased fertilizer and pesticide inputs. The Ohio farm agencies are not predicting a decrease in conservation reserve acres; but in the midwestern plains states, some whole field (100+ acre tract) contracts have been cancelled to increase corn production on marginal lands.

The major population centers in northwest Ohio are Toledo, Lima, Findlay and Mansfield.

The Maumee River flows through the City of **Toledo**. While much of the city is developed urban land, some of the surrounding areas are agricultural. The most recent Ohio EPA watershed studies were for Swan Creek, which flows into the Maumee River, and the lower tributaries to the Maumee River. The Maumee River and other streams in the Toledo area are part of the Maumee Area of Concern (AOC) and Remedial Action Plan (RAP), as discussed earlier.

Lima is an urban area surrounded by small forests and agricultural lands. The Ottawa River flows through Lima. The most recent Ohio EPA watershed studies were in 1996 with the next visit scheduled for 2010, depending on available funding.

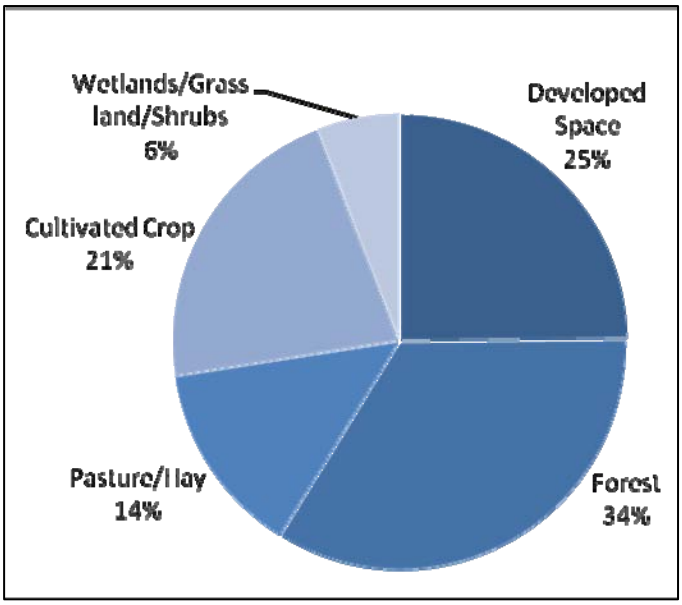
Findlay is an urban area surrounded primarily by agricultural lands, located within the Blanchard River watershed. A report on the water quality of the Blanchard River, which flows into the Auglaize River, was published by the Ohio EPA in 2007. As discussed earlier, the lower "large river" part of the Blanchard River is meeting water quality goals for aquatic life, but the upper river does not. The combination of habitat modification to the upper Blanchard River main stem and tributary streams, nutrient impacts, and organic enrichment related to agriculture, unsewered areas and small WWTPs discharges combined to degrade the upper Blanchard River main stem.

The City of **Mansfield** is a developed urban area surrounded by a large amount of forest and some agricultural lands. Mansfield is located in the Mohican River watershed, which Ohio EPA monitored in 2007; results of this study will be publicized when available. The Mohican River, which was recently designated as a State Scenic River, flows southeast into the Walhonding River.

Current plans call for Ohio EPA to monitor the Portage River watershed in 2008 and the lower Sandusky River watershed in 2009.

In Northeast Ohio, the burning Cuyahoga River once provided the impetus for the Clean Water Act; now the same river provides excellent examples of community-led efforts to restore water quality.

The predominant land uses in the northeastern region of Ohio are developed (urban) area and forest. This area encompasses only 15 of Ohio's 88 counties but is home to 35% of the state's population. Ohio's drainage divide crosses this area, so some streams flow north to Lake Erie and others flow south toward the Ohio River.



Northeastern Ohio is known for its history of heavy manufacturing industries, particularly iron and steel in the areas around Cleveland and Youngstown and rubber in Akron. Today, the metropolitan areas are coping with aging infrastructure that contributes to water quality problems (e.g., leaky sewers, combined sewer overflows that discharge inadequately treated sewage during and after rains).

The area is home to Ohio's only national park, the Cuyahoga Valley National Park.

General water quality conditions for several larger metropolitan areas are discussed here. Many large rivers flow into Lake Erie through **Cleveland** and the smaller lakeshore communities from Lorain to Painesville, including the Black River, the Rocky River, the Cuyahoga River, the Chagrin River, and the Grand River. Ohio EPA has studied many of these stream in recent years and restoration plans (TMDL reports) are either completed or in progress.

The Black River is part of a Remedial Action Plan and Area of Concern (see http://www.epa.state.oh.us/dsw/rap/blk_home.html). The Black River has undergone extensive sediment remediation and pollution control efforts. Recent data show that these efforts have resulted in a much cleaner Black River. An Ohio Department of Health risk assessment showed that the water and sediment in the river are safe for human contact through wading and swimming. The contact advisory was removed in 2004. A contact advisory issued in 1983 was removed in 2004 following an Ohio Department of Health risk assessment. Also, the incidence of tumors in brown bullhead has declined significantly.

Seventy-one miles of streams in the Chagrin River watershed are designated as Scenic Rivers. Diminished water quality is generally noted in the tributary streams, while the main stem is generally in attainment. Although the watershed is experiencing significant development pressure from Cleveland's population migration to outlying suburbs, the majority of the river retains its riparian forest cover.

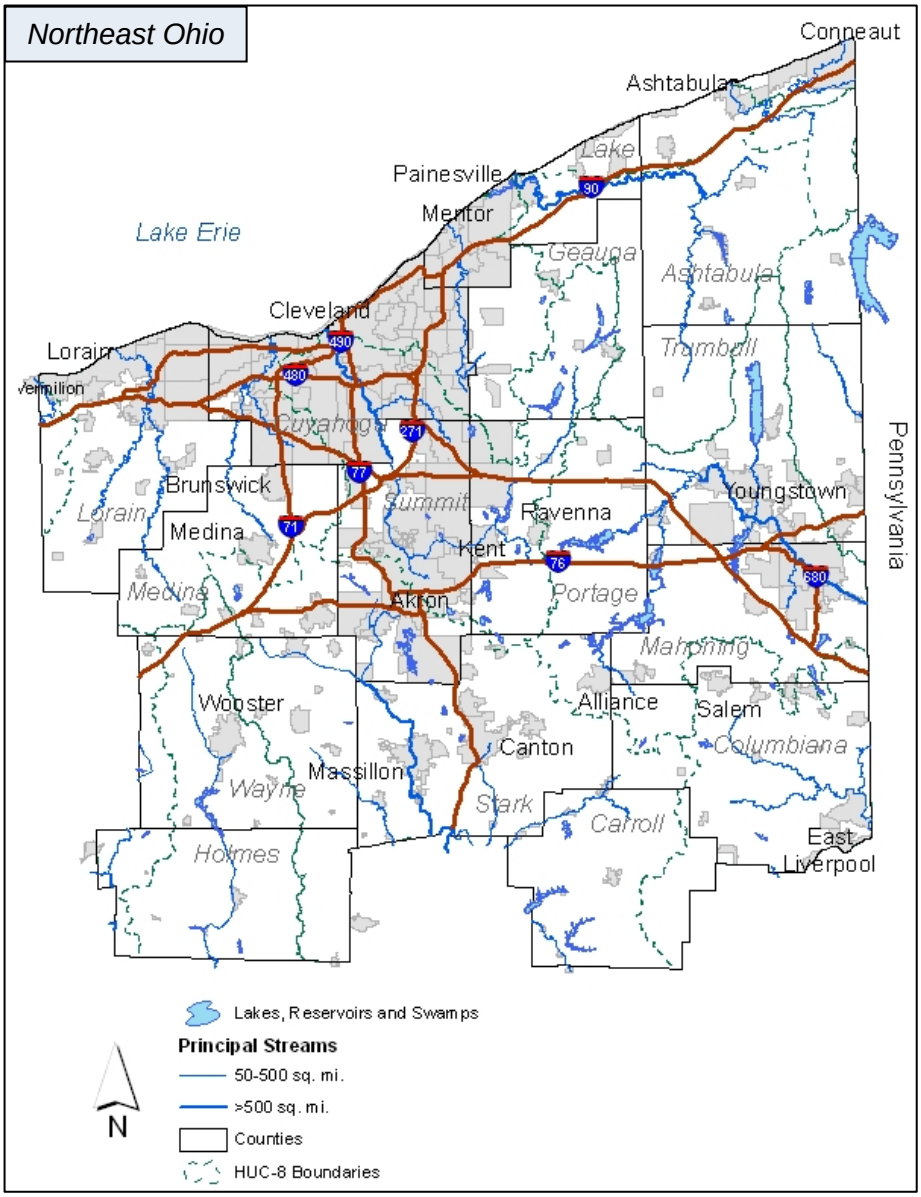
The Cuyahoga River has seen some of the most intensive restoration efforts in the state, spurred by the TMDL (Total Maximum Daily Load) program. Dam modifications/removals in the middle Cuyahoga River have resulted in improved fish communities. See the "Restoring our waters" box for additional information. Evidence of a longer-term commitment to restoration, the

Cuyahoga River Remedial Action Plan (RAP) is celebrating its 20 year anniversary in 2008. Numerous community-driven efforts are underway on the Cuyahoga and its tributaries (see www.crcpo.org). Ten years ago, the Cuyahoga River was named one of fourteen rivers designated as American Heritage Rivers based on its cultural, environmental and economic importance to the region.

The City of **Akron** is an urban area surrounded by small forests and agricultural lands. Part of the city drains to the Cuyahoga River, including the sewage treatment plant. Some parts of Akron, as well as **Canton**, drain to the headwaters and tributary watersheds of the Tuscarawas River, which flows south into the Muskingum River and eventually into the Ohio River. As noted earlier, the quality of the Tuscarawas River has improved dramatically due mostly to improved wastewater treatment, increased storm water detention, and an increase in conservation farming practices. A TMDL report is in preparation for the Tuscarawas River watershed and for Nimishillen Creek.

The Mahoning River flows through the City of **Youngstown**, which is an urban area surrounded by small forests and some pasture land. Ohio EPA studied the upper portion of the Mahoning River watershed in 2006 and a TMDL report is in preparation. U.S. EPA completed a TMDL report for fecal coliform contamination in the lower river in 2004.

Currently, Ohio EPA plans to monitor the Pymatuning River watershed in 2008 and the Killbuck Creek watershed in 2009.



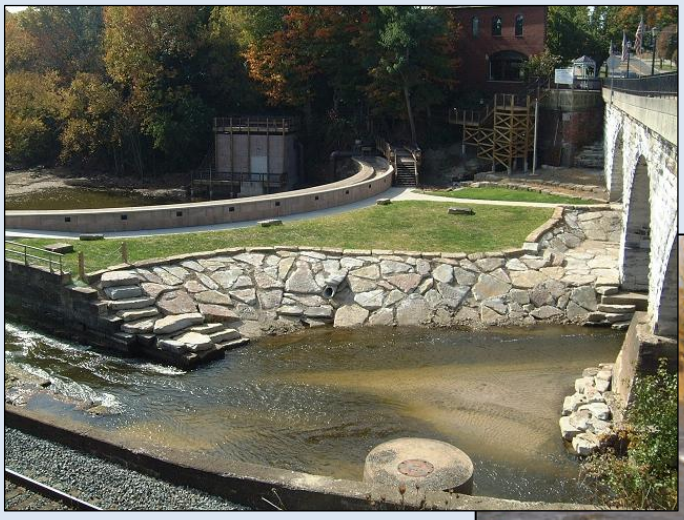
Restoring our waters…

After nearly 200 years, a 12-mile section of the **middle Cuyahoga River** runs free. First, the City of Kent modified their 160-year-old dam, then a second dam a few miles downstream in Munroe Falls was removed. What spurred this action?

In a 1999 study, Ohio EPA identified impairment in the middle Cuyahoga River (near Kent). At the time, it was estimated that $5 to $7 million in wastewater treatment upgrades would be necessary to meet water quality standards. But the study encouraged an alternative solution: could the dams be modified or removed to eliminate stagnant dam pools and to allow fish to migrate freely in the river? The City of Kent and Summit County engaged the public to debate the options, eventually deciding to modify the dams. Follow-up monitoring shows significant improvement and Ohio EPA anticipates that the Cuyahoga in this area will fully attain water quality standards for aquatic life.

Were there any additional benefits? Yes. Besides saving on sewage treatment costs, Kent improved access to its downtown riverfront, enhancing the historic area with a park and educational signage. The community of Munroe Falls plans a riverside outdoor amphitheater beside the former dam. Recreation is significantly increased; canoes and kayaks are a frequent sight as they rediscover the Cuyahoga's once lost "whitewater."

Local and state government worked together to secure the funding for these projects, including section 319 grants, the Clean Ohio program, and Ohio EPA's Water Resources Restoration Sponsor Program.

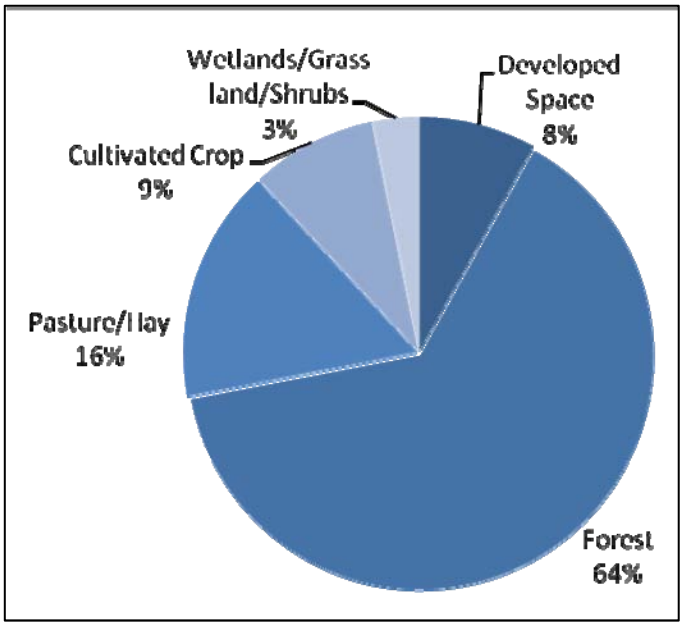


Kent dam modified, with new park

Munroe Falls dam removed

Habitat destruction, leftover mining impacts and small communities with no sewers are the major sources of water quality problems in southeastern Ohio.

Forest land is the dominant land use in southeastern Ohio. This area includes 23 of Ohio's 88 counties but is home to only 9% of the state's population. The streams in this area flow south toward the Ohio River. Ohio's only national forest, the fragmented Wayne National Forest is located here, along with the Zaleski State Forest.



Southeastern Ohio has a long history of both surface and underground coal mining and pockets of mine impacted areas remain. Any biological life has been totally eliminated within the streams draining these areas. Although these "orange" streams have usually been considered a "side effect" of mineral extraction, recent evidence suggests that they may have the ability to recover. Remediation of acid mine seeps and numerous gob (waste coal) piles is necessary. Aggressive, collaborative action by the Ohio Department of Natural Resources, the U.S. Forest Service, the U.S. Office of Surface Mines, Ohio University, citizen groups and others has demonstrated that recovery is possible.

Nonpoint source pollution from agricultural fields, urban areas, and lands that have been severely stripped of timber is another problem. In recent years, mining within the stream has been noted, especially in the western portion of the area. Bulldozers are taken into the streams to remove stone from the stream beds, destroying the natural habitat when the substrate is removed. Using streams as trails for off-road vehicles (e.g., "four-wheelers") also destroys the habitat that aquatic life needs to thrive.

In farming areas, riparian destruction is prevalent. Trees are routinely removed along the banks of the streams and rivers to provide more crop area and to keep logs out of the streams. The removal of trees and shrubs promotes erosion and the runoff of soil, herbicides, and pesticides, all of which harm the stream.

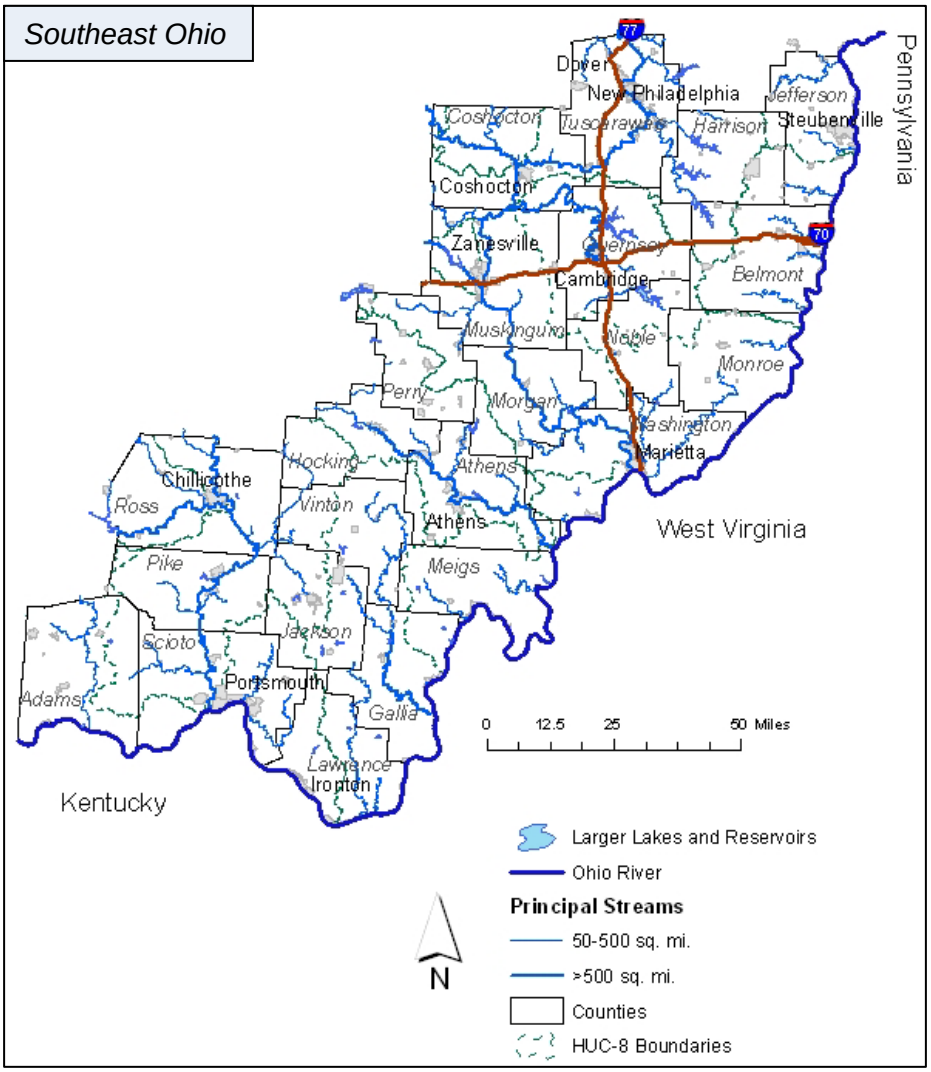
Southeast Ohio also has numerous, scattered communities that have no central sewer systems. Many of these areas discharge sanitary wastewater into storm sewers that empty into a nearby stream, resulting in high levels of bacteria. Many of these small communities have little money to build a collection and treatment system to clean up the problems.

Watershed groups, some schools and universities, and some Soil and Water Conservation Districts have been very active in promoting water quality education. Educating the public about the value of clean water is important to protecting water quality and reversing years of abuse or indifference.

The biggest cities in southeastern Ohio are Athens, Chillicothe, Marietta, Zanesville, and Portsmouth.

Athens, situated on the banks of the Hocking River, is an urban area surrounded by pasture land and forest. The Hocking River is one of Ohio's success stories. During the 1980s, the Hocking River main stem was fairly degraded, suffering from multiple sources of pollution. Ohio EPA returned to complete a full assessment of the biology and chemistry in the Hocking River watershed in 2004. The Hocking River main stem was found to be in nearly full attainment of aquatic life goals. Impairment in the watershed results primarily from agricultural and acid mine drainage impacts. A TMDL study on the Hocking is underway; reports were already completed for Sunday and Monday Creeks, two tributaries to the Hocking River. Sunday and Monday Creeks have been the particular focus of intensive remediation of acid mine drainage impacts.

Chillicothe is an urban area with agricultural lands to the northwest and forest to the southeast. Paint Creek flows into the Scioto River just south of the city. Ohio EPA studied the water quality of Paint Creek in 2006, finding that the water quality is influenced by physical habitat quality, agricultural land uses, and treated wastewater effluent. Agriculture has greater effects in the northern part of this basin (located in the central region of the state). Land use in the southern portion of the watershed changes to a greater percentage of pasture and forest cover and biological communities are generally in good condition. The main stem of Paint Creek near Chillicothe supports diverse and exceptional aquatic communities and serves as a source population refuge for large river fish species in the Scioto River watershed.



The Muskingum River is formed when the Walhonding and Tuscarawas Rivers join in Coshocton. It then flows through **Zanesville** and empties into the Ohio River at **Marietta**. Ohio EPA studied the entire Muskingum River main stem in 2006, finding full attainment of the aquatic life use. Elevated bacteria levels were found in

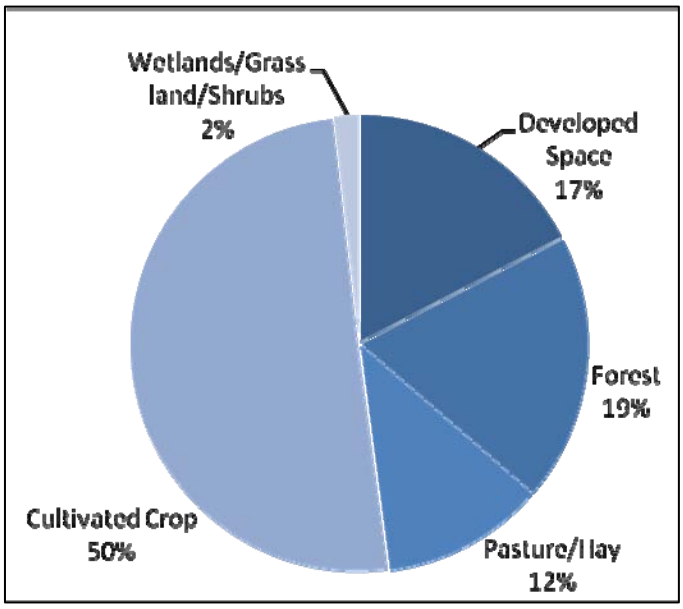
only two locations. Improvements at a wastewater treatment plant will reduce bacterial inputs to the river in one area, while source of the problem in the other area is unknown but being studied further. The last study that Ohio EPA completed for this river was in 1988; the 2006 study showed substantial biological improvement.

Portsmouth, located on the Ohio River, is surrounded primarily by forested land. The Scioto River is one of Ohio's larger rivers, emptying into the Ohio River in Portsmouth. Major tributaries include the Olentangy River, Big Walnut Creek, Walnut Creek, Big Darby Creek, Deer Creek, Paint Creek, and Salt Creek. The lower Scioto River provides a crucial link between the rich aquatic life found in its major tributaries and the larger Ohio River basin. The lower Scioto River is a network of connected high-quality streams in a mostly rural setting, including five watersheds that have been chosen for immediate conservation action due to their aquatic biological diversity: the Little and Big Darby Creeks, middle and lower Scioto River, Paint Creek, Salt Creek, and Scioto Brush Creek.

Currently, Ohio EPA plans to monitor the Licking River watershed and Jonathon, Moxahala and Salt Creeks in 2008 and some Ohio River tributaries east of Portsmouth in 2009.

Southwestern Ohio faces water quality problems associated with rapid and large-scale development.

Southwest Ohio has numerous high quality streams and the largest trout stream in Ohio. The predominant land uses in the area are cultivated crops and developed (urban) area. Land uses affect water quality in different ways as discussed earlier. This area encompasses 16 of Ohio's 88 counties and is home to 25% of the state's population.



The biggest issues affecting water quality north and east of Dayton and extending to Cincinnati are related to rapid and large-scale development and insufficient soil/erosion controls. Development also impacts headwater streams and wetlands by either modifying them or filling them in.

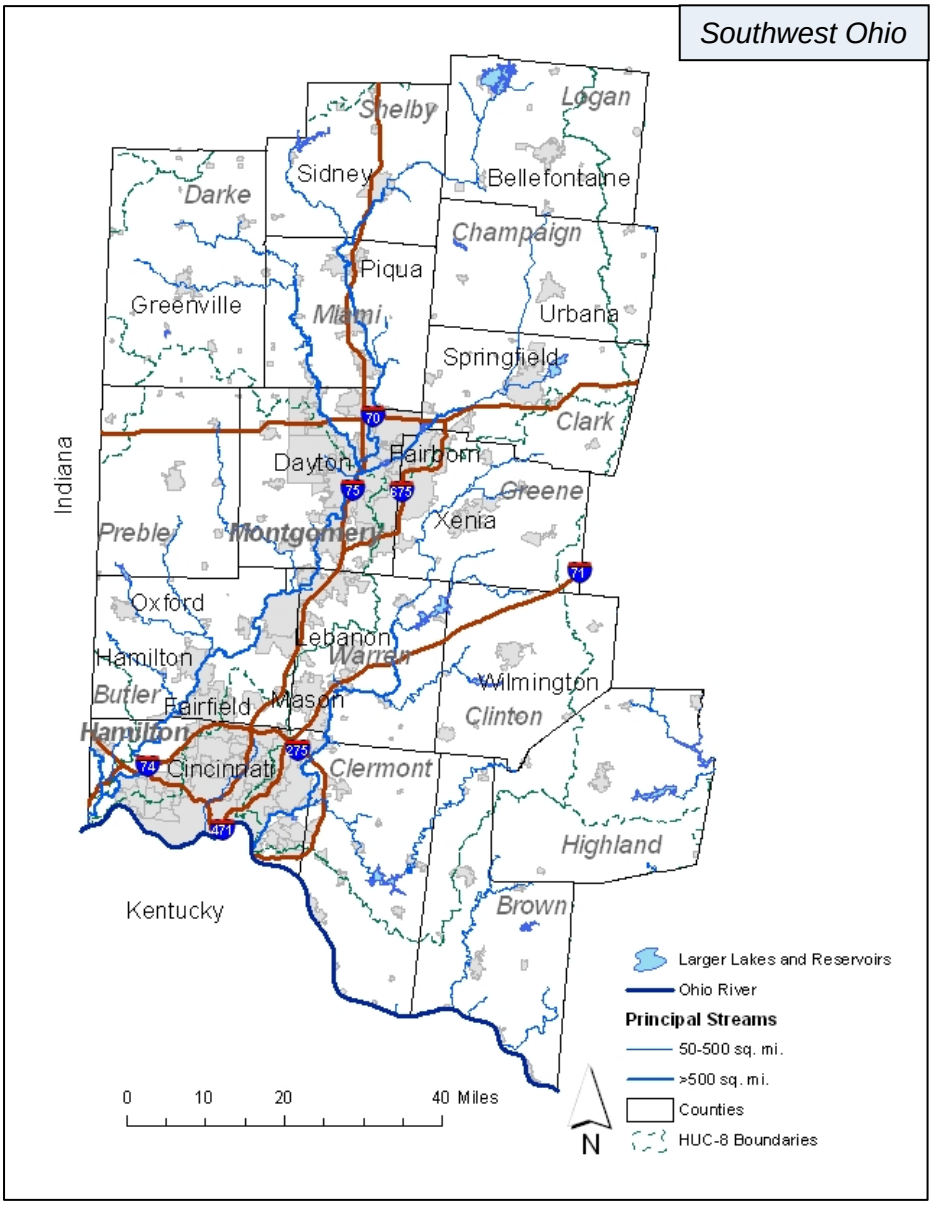
The Little Miami watershed is experiencing the highest development pressures in this part of the state. Expansions of WWTPs in the Little Miami watershed to accommodate development are stressing the limits of the watershed to assimilate the pollution load. Excessive nutrients are a particular issue in this case and the increase of impervious surfaces through development are also impacting the watershed.

Similar to southeastern Ohio, this area experiences destruction of stream habitat due to instream mining. The gravel and sand are removed, significantly impacting the substrate and destroying the habitat for fish and aquatic insects.

Southwestern Ohio also experiences problems in farming areas with the destruction of stream banks to maximize field size, leading to increased sediment and higher levels of chemicals in streams. Agriculture dominates the landscape west, north and southeast of the Dayton-to-Cincinnati corridor. Conservation tillage has been documented to improve and protect water quality of streams. Conservation practices in the Indian Lake region (upper Great Miami watershed) have improved not only the quality of the streams, but the quality of Indian Lake, making it a much more desirable recreational area. The northwestern part of this region has some of the highest numbers of concentrated animal feedlot operations (CAFOs) in Ohio. Some of these CAFOs have been documented for causing organic enrichment and bacterial contaminations of area streams.

General water quality conditions for several larger metropolitan areas are discussed below.

Springfield is surrounded primarily by cultivated crop land, pasture and hay land, and some small areas of forested land. Ohio EPA measured the water quality of the Mad River in 2003, finding the main stem to be in good condition with impairment noted at only a few sites. Further impairment, primarily contributed by urbanization, agriculture, point sources and failing home sewage treatment systems, existed on tributaries to the Mad River. The upper portion of the Mad River is the largest Coldwater Habitat in Ohio due to the abundant ground water input to the river, making it a popular trout fishing stream. A TMDL report is being developed by Ohio EPA.



Dayton and its suburbs are an urban area surrounded primarily by cultivated crop land. Heavy development pressures exist to the north, east, and south of Dayton. The Great Miami River flows through Dayton, joined

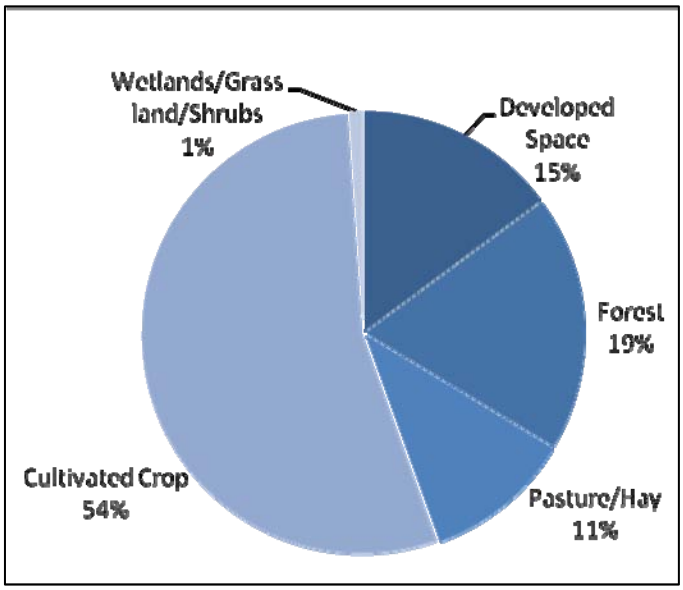
by the Stillwater and Mad Rivers. A 2004 TMDL report for the Stillwater River recommended increasing the width and amount of stream buffers, stream habitat restoration, nutrient management planning, septic system improvements, education and cost-sharing for conservation and nutrient management. As mentioned above, a restoration and preservation study (TMDL) of the Mad River is underway.

The City of **Cincinnati** lies between the Great Miami River to the west and the Little Miami River to the east; both flow into the Ohio River. The upper Little Miami River watershed, not including the East Fork, was studied in 1998. Most impacts were attributed to point source dischargers in the basin. A TMDL report with improvement suggestions was completed in 2002. The water quality of the lower Little Miami watershed was assessed in 2007; the results will be publicized when available.

Water quality was evaluated in the Great Miami River and selected tributaries in the mid 1990s. The 1994 upper Great Miami study documented exceptional quality of the river in the majority of its length. The 1995 study of the middle and lower Great Miami found the majority of water quality issues between Dayton and Middletown were due to habitat alterations caused by the numerous low-head dams. Problems between Middletown and the Ohio River were caused by a combination of combined sewer overflow impacts, contaminated sediment, and inadequately treated effluent from numerous point source discharges. Ohio EPA has worked with the point source dischargers and other local interests to improve the situation, and plans to reassess the Great Miami River watershed in three consecutive years, beginning with the headwaters in 2008.

Water quality in central Ohio is dominated by a mixture of agriculture and urban development.

The predominant land uses in the central region of Ohio are cultivated crop lands and developed (urban) area as shown here; land uses affect water quality in different ways as discussed earlier. This area encompasses 10 of Ohio's 88 counties and is home to 16% of the state's population.



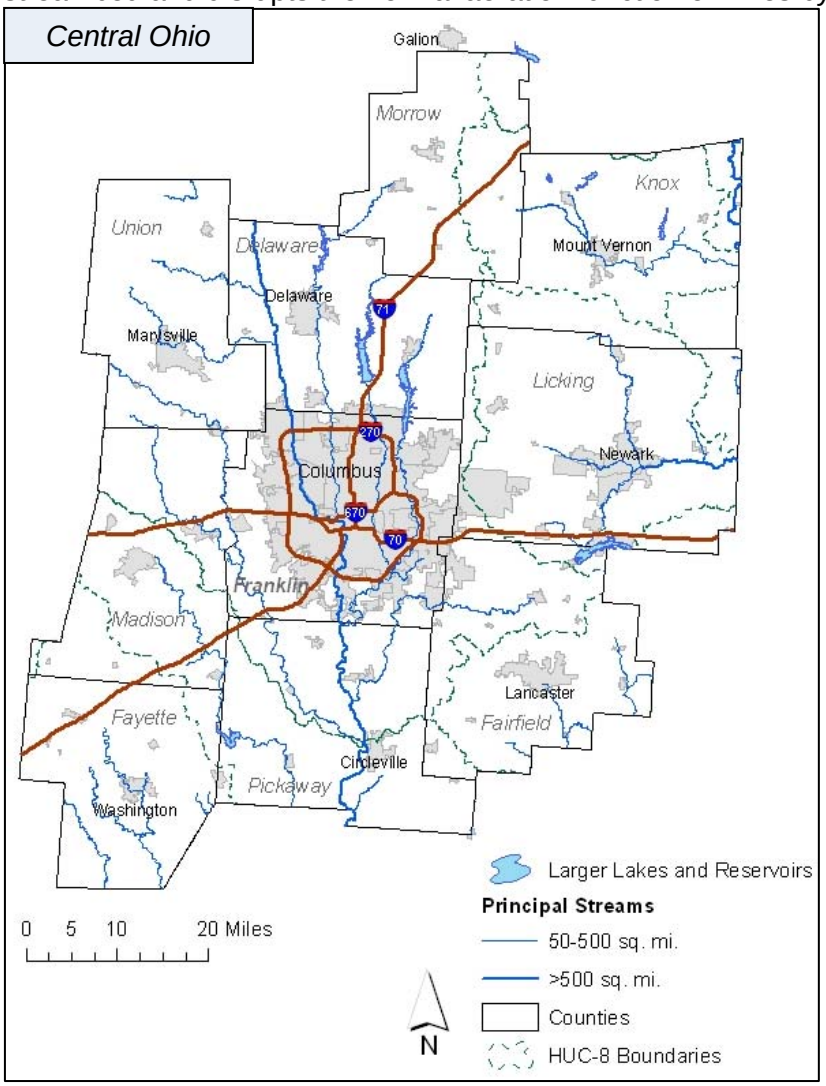
Agricultural land use is most prominent in the western part of the area where crop production is dominated by corn and soy beans with less significant occurrences of organic farming and other miscellaneous vegetable crops. Animal operations consist largely of cattle, hogs, chickens and horses. The Scioto River Conservation Reserve Enhancement Program (CREP) provides a possible source of funding ($207 million) for select agricultural best management practices in the Scioto watershed.

The largest city in central Ohio is Columbus with a population of approximately 712,000 people. The area surrounding Columbus and the surrounding smaller cities is undergoing constant

change, expanding outwardly into previously farmed land. Sometimes called "urban sprawl," this expansion brings with it roadways and rooftops, which are impervious surfaces that deliver water to streams more quickly than the previously undisturbed land. The rate of erosion increases and unnatural loads of silt and other pollutants enter the stream network. Many streams in these urbanized and agricultural areas have been modified through channelization, damming and ditch maintenance efforts.

In central Ohio today, pollution sources include agricultural chemicals and manure runoff, metals and chemicals that runoff from roads, lawn chemicals, industrial chemicals, and bacteria and nutrients associated with municipal sewage discharges and failing home sewage treatment systems (HSTS). Impacts from urban, suburban, and agriculture land uses are the primary cause of water quality problems in smaller streams. The Olentangy River is an example of a central Ohio stream with several small tributaries that have been threatened by urban expansion into a rural setting. Many of these tributaries have experienced excessive silt loads and overwhelming nutrient inputs.

Central Ohio streams are impacted by overland transport of soil particles during significant rainfalls at construction sites and to a lesser extent from farmed fields. The silt settles in the streambed and disrupts the normal aeration function of riffles by clogging the interstitial areas where agitation and natural aeration occur. Silt can smother fish and invertebrates' eggs thus damaging aquatic life in both smaller and larger streams.



Improvements in WWTP discharge quality have resulted in better water quality both in the main stem rivers and their tributaries. A good example is the Scioto River below Columbus where recovery has exceeded even Ohio EPA's expectations.

Species that once existed and were lost are reappearing and some species that have never been recorded have pioneered their way into some central Ohio streams. Examples include the spotted, variegate, bluebreast and tippecanoe darters in Walnut Creek and the blue sucker in the Scioto River.

Columbus and its suburbs are highly developed urban areas

surrounded on the south and west by cultivated crop and pasture lands and on the north and east by a mixture of crop land and forest. The Scioto River, Olentangy River, and Big Walnut Creek all run through Columbus and Big Darby Creek flows just west of the city. Big Walnut Creek was studied by Ohio EPA in 2000; the resulting TMDL recommended habitat improvements, point source controls, stream restoration, and improvements in home sewage treatment systems. TMDL reports for Big Darby and the Olentangy contained similar recommendations, in addition to special storm water measures to help mitigate the impacts of development.

Mill Creek flows through **Marysville** before it flows into the Scioto River. A 2003 TMDL report addressed an in-stream dissolved oxygen problem attributed to the Marysville WWTP, and ammonia and nutrient loading to Crosses Run, attributed to the Scotts Company.

The Licking River begins at the confluence of the North Fork and the South Fork in **Newark**, flowing east through the Black Hand Gorge State Nature Preserve into Muskingum County. There it turns to flow southeast into the Muskingum River at Zanesville. The water quality of the watershed is scheduled to be studied by Ohio EPA in 2008.

Mt. Vernon is surrounded by a mixture of agricultural and forested lands. The Kokosing River, which flows through Mount Vernon, is designated a State Scenic River. The watershed was studied by Ohio EPA in 2007. Preliminary results indicate that the main stem of the river is in good condition with some impairment in the tributaries. A TMDL report is being prepared.

Lancaster is surrounded by a mixture of forest, pasture land and cultivated crop land. The Hocking River begins in western Fairfield County and flows southeast for about 95 miles to the Ohio River. As explained in the discussion of southeastern Ohio, the Hocking River is one of Ohio's success stories. During the 1980s, the Hocking River main stem was fairly degraded, but showed significant improvement when Ohio EPA returned to complete a full assessment in 2004. Better sewage treatment in the Lancaster area played a significant role in this improvement. A TMDL study of the remaining problems in the Hocking watershed is underway.

Delaware is rapidly growing, surrounded by cultivated crop land, pasture land, and forest. The city is located on the Olentangy River. Twenty-two miles of the Olentangy River have been designated a State Scenic River. Ohio EPA studied the watershed in 2003 and 2004 and a TMDL report was approved in 2007. Recommendations included the use of agricultural conservation practices for upland areas and progressive channel maintenance, addressing failing home sewage treatment systems, better waste treatment for point sources, and a higher level of storm water management in urban and developing areas.

Restoring our waters…

Powderlick Run in the **Bokes Creek** watershed is impaired by severe hydromodification and nutrient enrichment. A TMDL study (Bokes Creek, 2002) identified habitat restoration of Powderlick Run as a high priority.

Using natural channel design techniques, 3,900 linear feet of previously maintained agricultural ditch was restored to meandering two-stage channel morphology and over 10,000 trees and shrubs were planted. What was once a straight maintained ditch channel is now five times wider, allowing for slower flow and improving the stream's capacity to assimilate the high nitrogen loadings that remain in the soil after years of applying chicken manure as fertilizer.

A diverse funding partnership formed to support the project: a $189,000 CWA section 319(h) sub-grant and matching funds provided by the city of Columbus and Oxbow River & Stream Restoration Inc. Additional funding was provided by Ohio EPA's Water Resources Restoration Sponsor Program for restoration work in other nearby segments of Powderlick Run. Other partners were DayLay Egg Farm, Union County Soil and Water Conservation District, and the Scioto River Federation.

An additional 5,100 lineal feet of restoration will be completed under 319 grants awarded in 2007 and 2008.

Powderlick Run before…

… and after restoration

The report provides more detail, including Ohio's Section 303(d) list of impaired waters, as required by the Clean Water Act.

This overview is intended to provide a snapshot of water quality conditions, progress and challenges in Ohio; it is only the first section of the much larger and more detailed 2008 Integrated Report.

The opening sections of the report describe the universe of water quality in Ohio—the size and scope of Ohio's water resources, programs that are used to evaluate and improve water quality, and funding sources for water quality improvement.

The middle sections are more technical and explain the beneficial uses assigned to Ohio's waters, the assessment methodologies used for the analyses of those uses, the data used to determine whether those uses are being supported, and the conclusions drawn about water quality conditions in each assessment unit.

The closing sections describe how waters found to be impaired will be scheduled for further study. A collection of maps that illustrate current conditions and future plans follow the text. The report concludes with summary tables of various types. The 303(d) list is contained in Section L, Table L4. Section M contains a one-page summary of the condition of each assessment unit.

For more information, please consult these Internet web sites:

Many water quality reports on specific watersheds are mentioned in this overview. Find these reports at http://www.epa.state.oh.us/dsw/document_index/psdindx.html

Watershed restoration reports (TMDLs) … http://www.epa.state.oh.us/dsw/tmdl/index.html

Fish consumption advisory … http://www.epa.state.oh.us/dsw/fishadvisory/

Integrated Report … http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.html

Ohio EPA Division of Surface Water … http://www.epa.state.oh.us/dsw/

Ohio EPA Division of Drinking and Ground Waters … http://www.epa.state.oh.us/ddagw/

Ohio EPA district office contact info … http://www.epa.state.oh.us/new/directions.html

List of Ohio watershed groups … http://ohiowatersheds.osu.edu/groups/

Ohio Department of Natural Resources, Division of Soil and Water Conservation … http://www.dnr.state.oh.us/default/tabid/8637/Default.aspx

U.S. Environmental Protection Agency water program … http://www.epa.gov/ow/