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An Overview of Water Quality in Ohio

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A1. Introduction

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, the Ohio River on the south and 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 is critical to sustaining Ohio's economy and the standard of living of its citizens. Surface waters such as rivers, streams, and lakes provide most of the water used for public drinking, 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 (Ohio EPA). 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. This report, updated every two years, is required by the federal Clean Water Act to fulfill two purposes: 1) to provide a summary of the status of the State's surface waters; and 2) to develop a list of waters that do not meet established goals—the impaired waters list.

Under the Clean Water Act, once impaired waters are identified, the state must act to improve them. Typically, the actions include developing restoration plans [total maximum daily loads (TMDLs)]; water quality-based permits; and nonpoint source 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/technical assistance, permitting and nonpoint source programs.

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 the time. A healthy stream community is also associated with high quality recreational opportunities (for example, fishing and boating). Stream assessments are based on the experience gained through the collection of more than 28,000 fish population samples and nearly 14,500 aquatic insect community samples, depicted in Figure A-1.

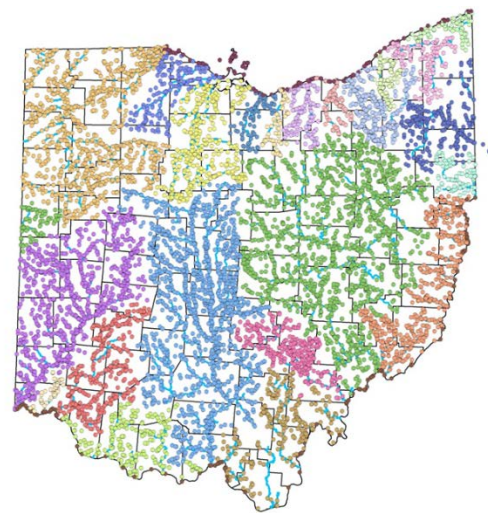


Figure A-1 — Ohio EPA's Biological Sampling Locations 1978 - 2018

In addition to biological data, Ohio EPA collects information on the chemical quality of the water (nearly 250,000 water chemistry samples), sediment and wastewater discharges; data on the contaminants in fish flesh; and physical habitat information about streams. Taken together, this information identifies the factors that limit the health of aquatic life and that constitute threats to human health.

Reporting results

Ohio EPA reports out on four types of water bodies, called assessment units (AUs), as defined below. Section D1 of this report contains additional details and maps of the AUs. Information on Ohio's inland lakes is currently reported through the watershed unit in which it is located. Specific information on inland lakes can be found in the individual beneficial use sections (Sections F through H) in this report.

- Watersheds or watershed assessment units (WAUs) are delineated by the 12-digit hydrological unit code (HUC) system.
- Large rivers or large river assessment units (LRAUs) are segments of the 23 rivers that drain more than 500 square miles.
- Lake Erie or Lake Erie assessment units (LEAUs) consist of open water and shoreline units.
- Ohio River or Ohio River assessment units (ORAUs) are 10 segments of the Ohio River divided by the lock and dams.

ATTAINS

The 2020 Integrated Water Quality Monitoring and Assessment Report (IR) marked the transition of Ohio EPA's report into U.S. EPA's Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS). Ohio EPA's data in ATTAINS is available to the public through U.S. EPA's How's My Waterway mobile app and a spreadsheet posted on Ohio EPA's website. Data presented in this 2022 IR will be available in How's My Waterway when Ohio EPA submits the final report to U.S. EPA for review and approval. In addition to data from ATTAINS, How's My Waterway will pull information from U.S. EPA's other databases, allowing users to query data from one place. The app is available at:

mywaterway.epa.gov/.

Overall water quality

Ohio EPA developed methods to determine how well Ohio's waters support four specific water uses:

- 1) human health impacts related to sport fish tissue contamination;
- 2) recreation;
- 3) human health impacts related to drinking water; and
- 4) aquatic life (fish and aquatic insects).

Available data are 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. Additional details on the four uses are available in Section D of this report.

When the results of the assessments of the four beneficial uses for each AU are combined, a high-level picture of Ohio's water quality can be drawn. See Figure A-2.

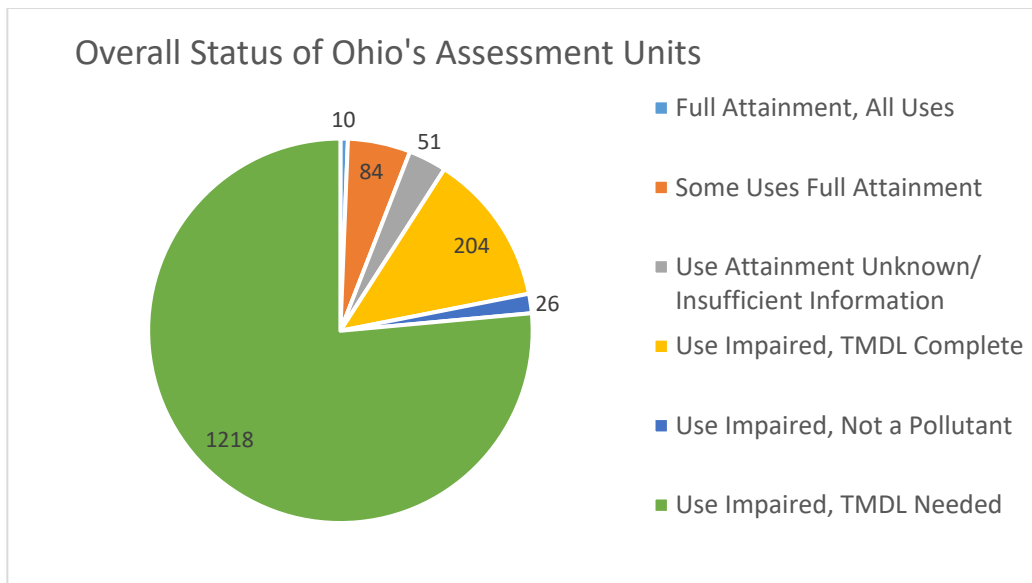


Figure A-2 — Overall summary of Ohio’s combined assessment units. Output from ATTAINS.

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. A link to the fish consumption advisory website is available at the end of this section.

For analysis in this report, data on the six fish tissue contaminants [mercury, polychlorinated biphenyls (PCBs), chlordane, mirex, hexachlorobenzene and dichlorodiphenyltrichloroethane (DDT)] are used to assign waters into the different reporting categories. See the results in Table A-1 below.

Are fish safe to eat?

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

To help protect the health of Ohioans, 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.

Table A-1 — Summary of Human Health Fish Tissue Results

Water Type	Full Attainment	Not Supporting	Insufficient Information	Not Assessed	Total
Watershed Assessment Units	245	429	56	808	1,538
Large Rivers	9	29	-	-	38
Lake Erie	-	7	-	-	7
Ohio River	-	10	-	-	10
Inland Lakes	58	9	40	-	107

The most common contaminant is PCBs, followed by mercury. A few waters contain fish whose flesh is contaminated by dichlorodiphenyltrichloroethane (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 traceable contamination and areas of special concern are being addressed through federal 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. For example, Ohio targeted 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 or mirex are already in the process of being restored through various initiatives in state and federal waste remediation programs.



Much of the **recreation** analysis focuses on the amount of **bacteria** in the water. For Lake Erie public beaches, the frequency with which individual beaches were recommended for a swimming advisory based on elevated bacteria levels above the state water quality standards for the entire five-year reporting period (2017-2021) ranged from near zero at Battery Park, Catawba Island State Park, Conneaut Township Park, East Harbor State Park, Geneva State Park, Lakeside, Parkland, South Bass Island State Park and

Walnut to nearly a third or more of the season on average at nine beaches: Bay View West, Darby, Huron River-West, Lakeview, Maumee Bay State Park (inland), Nokomis, Sawmill, Veteran's and Villa Angela State Park.

Considerable variation in the frequency of advisories was observed between beaches and from season-to-season at many beaches. However, several beaches stand out as consistently good performers over the past five recreation seasons, including Battery Park, Bay Park, Catawba Island, Cedar Point, Conneaut, East Harbor State Park, Geneva State Park, Kiwanis, Lakeside, Old Woman (West), Parklawn, South Bass Island State Park and Walnut, which all had a cumulative exceedance frequency of less than 10 percent on a seasonal basis. These beaches rarely exceeded 10 days per season under advisement.

There were also several beaches that consistently performed poorly with three beaches, including Bay View West, Lakeview, and Maumee (inland) beaches under advisement nearly 40 percent of the time or more during the past five recreation seasons on a cumulative basis.

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 PCBs and polyaromatic hydrocarbons (PAHs), so swimming or wading in these areas is not recommended.

As for inland lakes, the frequency of exceedances during the five-year reporting period was 12.2 percent, slightly higher than the 11.9 percent reported in the previous cycle. There were 31 inland lake beaches where the aggregated exceedance frequency was more than 10 percent. The highest aggregated exceedance frequency of 42 percent was observed at the Buckeye Lake Crystal Beach followed by the Buckeye Lake Fairfield Beach at 37 percent and beaches at Dillon and Madison Lake both at 35 percent.

No new watershed or large river assessments were made in this IR. No new data is available for the 2020 or 2021 reporting period. The data collected on the large river assessment units during this timeframe will be reported in the 2024 IR.

Table A-2 — Summary of Recreation (Bacteria) Use Results

Water Type	Full Attainment	Not Supporting	Insufficient Information	Not Assessed	Total
Watershed Assessment Units	159	1173	36	170	1538
Large Rivers	3	32	1	2	38
Lake Erie	-	4	-	3	7
Ohio River	4	6	-	-	10
Inland Lakes	38	31	-	-	69

Lake Erie has also been assessed for **recreation** use impacted by significant **algae** biomass present during the recreation season. As a result, Ohio is listing the shorelines and open water in the western basin as impaired for recreation use. Additional details on the assessment and results for Lake Erie can be found in Section F.4 of this report.

Human health impacts related to drinking water focus on nitrate, pesticides and cyanotoxins (due to certain algae). In Ohio, 109 public water systems use surface water (excluding purchased water systems and multiple facilities at a water system) in 123 separate AUs.

Sufficient data were available to complete nitrate evaluations for half (55 percent) of the AUs of which 7 percent were identified as impaired and 49 percent were in full support. Of the large river AUs, three Maumee River AUs, one Sandusky River AU, and one Scioto River AU remain impaired. Most of the 31 AUs on the nitrate watch list are in northwestern Ohio.

Pesticides were evaluated for 37 AUs. Five of the AUs were impaired while the remaining 32 AUs were in full support. During this reporting cycle, there were no new assessment units identified as impaired due to pesticides. A total of 23 AUs are on the pesticide watch list because of elevated atrazine. These areas of elevated atrazine coincide with the predominantly agricultural land use in western and northwestern Ohio.

During this reporting cycle, the numeric cyanotoxin drinking water thresholds were aligned with the current threshold values in the 2020 State of Ohio Public Water System Harmful Algal Bloom Response

Is water safe to drink?

Ohio EPA and public water systems around the state work hard to ensure that drinking water meets safe drinking water standards and that users have important information available about the sources and quality of the water. 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 2010, 99 percent of all public water systems met all chemical standards. 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 ensure that safe water is delivered to their customers.

Strategy. The monitoring of microcystins and cyanobacteria by Ohio public water systems greatly increased the data available to assess the algae indicator. Sufficient data were available to list 37 percent of the AUs as impaired due to algae, including four new AUs identified as impaired this reporting cycle. The impairment listing includes all AUs in Lake Erie with drinking water intakes. In addition, 35 WAUs, three LRAUs, and one ORAU are assessed as impaired. An additional 26 AUs are on the algae watch list. WAUs that are impaired or on the watch list for cyanotoxins were found distributed across Ohio virtually in every geographic region.

Table A-3 — Summary of Public Water Supply Use Results

Water Type	Full Attainment	Not Supporting	Insufficient Information	Not Assessed	Total
Watershed Assessment Units	29	41	32	-	102
Large Rivers	0	5	4	-	9
Lake Erie	0	6	-	-	6
Ohio River	3	1	2		6

Data evaluated for the **aquatic life use** is largely unchanged from the 2020 IR. In 2019, Ohio EPA sampled areas in the Upper Auglaize River watershed. In 2020 and 2021, Ohio EPA surveyed all of Ohio's large rivers. The results of this sampling will be reported in the 2024 IR. Detailed watershed survey reports for basins sampled in previous years are or will be available from Ohio EPA's Division of Surface Water (see Biological and Water Quality Report Index, epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/surface-water/reports-data/biological-and-water-quality-reports).

Most common causes of aquatic life impairment

As carried forward from the 2020 Integrated Report, the top five most common causes of aquatic life impairment in LRAUs across the state are depicted in Figure A-6. Principal causes for LRAU impairments are commonly linked back to impoundments, whether that be directly through habitat/hydromodification or with sediment/nutrient/organic loading that is exacerbated by the impounded sections.



As carried forward from the 2020 Integrated Report, the top five most common causes of aquatic life impairment in WAUs across the state are depicted in Figure A-7. Principal causes for HUC12 WAU impairments were those primarily related to landscape modification issues involving agricultural land use and urban development. These types of impairments would be most manifest in smaller streams. Over half of the impaired WAUs had at least one monitored site impaired by one of these individual causes and many WAUs had several sites affected by three or more of the five causes listed as responsible for the aquatic life use impairment. This would not be an unusual situation given the frequently close association between these impairment causes (for example, nutrients, sedimentation/siltation, habitat modifications and hydromodifications in rural/agricultural landscapes relying on channelization and field tiles for drainage).

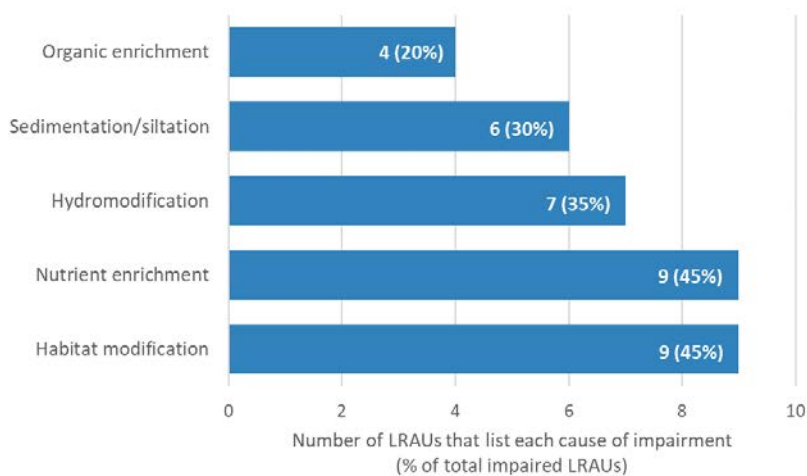


Figure A-3 — Top five causes of impairment in LRAUs.

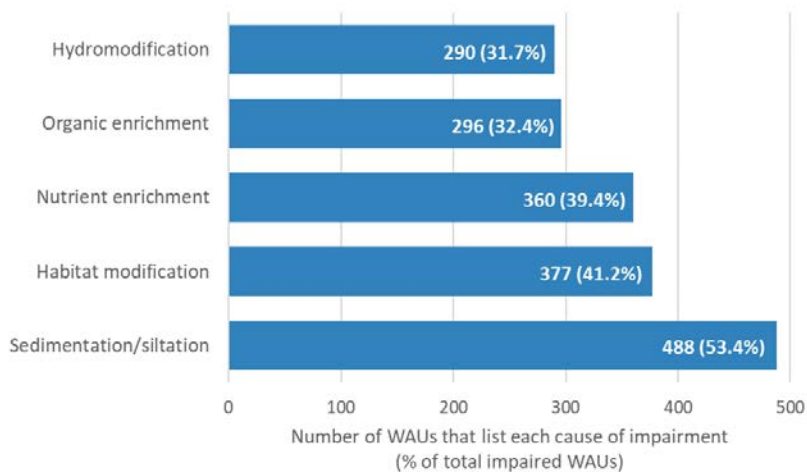


Figure A-4 — Top five causes of impairment in WAUs.

The major causes and sources of water quality problems are described 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 or within the stream channel. As the flow decreases, the soil particles fall to the stream bottom. This reduces the diversity of stream habitat available to aquatic organisms. Soil particles also transport other pollutants.



Habitat modification is the straightening, widening or deepening of a stream's natural channel. Habitat modification can also include the degrading or complete removal of vegetation from stream banks; such vegetation is essential to a healthy stream.

These activities can effectively transform a stream from a functioning ecosystem to a simple drainage conveyance. Some aquatic life will not be protected from predators and stressful flows and temperatures. The stream also often loses its ability to naturally process water pollutants.

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. Such changes can cause extended periods without stream flow, more extreme or frequent floods and loss of fast current habitat in dam pool areas.



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.

Nutrient enrichment describes the excess contribution of materials such as nitrogen and phosphorus used for plant growth. 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. The aquatic community is stressed on both a daily basis and over the long term.



The same nutrients that cause impairment of the aquatic life beneficial use also are a major contributing factor to the recent extensive HABs that have been observed in Lake Erie, the Ohio River and many inland Ohio water bodies. Grand Lake St. Marys in western Ohio has been particularly affected. HABs, a visually identified concentration of cyanobacteria, can occur almost anywhere there is water: lakes, ponds, storm water retention basins, rivers, streams, or reservoirs.

Many HAB-forming organisms are native to Ohio, but only cause problems when environmental conditions favor them. HABs can cause taste and odor problems in drinking waters; pollute beaches with scums; reduce oxygen levels for fish and other animals; cause processing problems for public water supplies; and may generate toxic chemicals. Knowing what triggers HABs is key to reducing their occurrence and impacts. HABs may be minimized, and some completely avoided, by reducing the nutrients and pollutants added to the water.

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 years, so it is not surprising that there is a large variety of causes and sources of impairment some of which are described below.

Row crop cultivation is a common land use in Ohio. Frequently, cultivated cropland involves tile drainage. The 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, is often 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 regularity of the stream channel and lack of in-stream cover reduces 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 (for example, hard surfaces such as roads, parking lots, and rooftops) 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 (for example, nutrients, metals, sediment, salts and pesticides).

Another problem is that stream temperatures can be raised when water runs over hot pavement and rooftops or sits 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 the 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 in terms of application and storage.



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 solids.

Acid mine drainage impacts streams with high levels of acidity (low pH); high metal concentrations; elevated sulfate levels; and/or excessive dissolved and suspended solids and/or siltation. Acid mine drainage often has toxic effects on stream organisms and degrades habitat quality when deposited metals form a crust on the stream bed and susceptible soils erode from areas disturbed from mining. Ultimately it reduces biological diversity, eliminates sensitive aquatic life, and lowers ecosystem productivity.



Solving Ohio's water quality problems will require collaboration and creativity.

Most of Ohio's water quality problems will not be solved by issuing a permit or building a new wastewater treatment system to treat point sources of pollution. Improving Ohio's surface water quality will require effectively managing land use changes to ensure that polluted runoff is either captured and treated or allowed to infiltrate through the soil before running off into a stream.

Restoring and protecting natural stream functions so that pollutants may be more effectively assimilated by streams is also critical. These actions will require various programs and people working collaboratively on local water quality issues and concerns. Local educational efforts and enhanced water quality

monitoring will also play important roles if we are to see significant water quality improvements throughout Ohio.

Many areas of the state are benefitting by the participation of individuals and organizations in local watershed organizations. Some of these organizations have been active for quite some time and are successfully influencing local land use decision making and implementing projects designed to improve water quality in their watershed. In recent years, the emphasis for section 319(h) grant funding has shifted from hiring local watershed coordinators and developing plans to implementing water quality improvement projects such as stream restoration, dam removals, agricultural best management practices and others. Ohio EPA is measuring improvements resulting from these projects; however, there remain challenges associated with changing land use decisions and finding cooperative partners. Ohio EPA encourages interested individuals and groups to register for the TMDL program listserv to be notified of opportunities to get involved in the TMDL development process.

Ohio EPA is also actively working with ODNR and the Ohio Department of Health (ODH) to protect people from toxins produced by cyanobacteria that may be in recreational waters at concentrations that can affect human health. Ohio's 2020 Harmful Algal Bloom Response Strategy for Recreational Waters (epa.ohio.gov/static/Portals/35/hab/HABResponseStrategy.pdf?ver=2020-10-28-164629-413) outlines thresholds for identified algal toxins, establishes monitoring protocols and identifies the process for posting and removing recreation use advisories. Furthermore, a website was established to provide background information about HABs; tips for staying safe when visiting public lakes; links to sampling information and current advisories; and contact information for reporting suspected HABs. A link to this website is at the end of this section.

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 summary of water quality conditions, progress and challenges in Ohio; it is only the first section of the much larger and more detailed 2022 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 AU.

The closing sections describe how waters found to be impaired will be scheduled for further study. The report concludes with summary tables of various types. Additional tables, including the impaired waters (303(d)) list, are available on Ohio EPA's website at epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/surface-water/reports-data/ohio-integrated-water-quality-monitoring-and-assessment-report. Summaries of the condition of each AU are available through the Interactive Maps link on that webpage as well.

More Information

Many water quality reports on specific watersheds are mentioned in this overview. Find these reports at <https://epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/surface-water/reports-data/biological-and-water-quality-reports>

- Watershed restoration reports (TMDLs) — epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/surface-water/reports-data/total-maximum-daily-load-tmdl-program
- Integrated Water Quality Monitoring and Assessment Report — epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/surface-water/reports-data/ohio-integrated-water-quality-monitoring-and-assessment-report
- Ohio EPA Division of Surface Water — epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/surface-water/surface-water
- Ohio EPA Division of Drinking and Ground Waters — epa.ohio.gov/wps/portal/gov/epa/divisions-and-offices/drinking-ground-and-waters
- Ohio EPA district office contact info — epa.ohio.gov/wps/portal/gov/epa/help-center/contact-list
- Fish consumption advisory — odh.ohio.gov/wps/portal/gov/odh/know-our-programs/ohio-sport-fish-consumption-advisory
- Harmful algal blooms — epa.ohio.gov/wps/portal/gov/epa/monitor-pollution/pollution-issues/harmful-algae-blooms
- Ohio Department of Health Beachguard (bacteria and algae) — publicapps.odh.ohio.gov/beachguardpublic/
- List of Ohio watershed groups — ohiowatersheds.osu.edu/watershed-groups
- Ohio Department of Agriculture, Soil, and Water Conservation — agri.ohio.gov/wps/portal/gov/oda/divisions/soil-and-water-conservation
- U.S. Environmental Protection Agency water program — epa.gov/environmental-topics/water-topics