



Water Stewardship

Summary Report 2012 - 2019

Value of water

Region's great asset serves as economic driver

We all know we can't live without water. But have you ever considered how critical water is to your community in terms of jobs, tourism and economic vitality?

This region boasts many clean rivers and abundant groundwater.

The Great Miami, Stillwater, and Mad rivers along with their tributaries are wonderful for paddling and recreation. Equally important, they allow communities to develop riverfronts with shopping, attractions, and housing—all of which further enhance recreation and tourism.

Rivers are about jobs, too.

"Today's jobseekers, when deciding where to put down roots, are looking for fun and active experiences," says Chris

Kershner, executive vice president, Dayton Area Chamber of Commerce. "So, all of these new riverfront developments play not only into increasing tourism but into workforce attraction and retention."

It's not just our rivers that provide economic vitality. The buried valley aquifer provides a safe and plentiful supply of water that can be treated for drinking fairly inexpensively.

The buried valley aquifer supplies agriculture and industry with a reliable supply of water for irrigation and manufacturing. The aquifer provides continuous seepage to the Great Miami River even during dry periods, helping to sustain river flow for fish habitat and making the Great Miami attractive for paddling and rowing. And it provides geothermal heating and cooling opportunities.



MCD's work to monitor and protect the water in the aquifer from pollution makes this region more resilient.

Our region's abundant water allows us to better cope with drought conditions. Seasonal water shortages are less common, and communities don't have to pay for more expensive treatment to make groundwater safe for drinking.

MCD and Water Stewardship

MCD works to help protect and improve water for people living and working within the Great Miami River Watershed—a 3,946-square-mile area in southwest Ohio. Using data collected by our staff and partners, we work collaboratively with elected officials and community leaders, providing them with valued research and insight. This helps support the overall health and growth of our region. This work is funded through MCD's Aquifer Preservation Subdistrict.

Water challenges

Actions big and small will be necessary

This region boasts abundant, high-quality water when compared to other parts of the country and the world. Yet, our water supply is vulnerable and could be threatened.

Here are several water challenges that community leaders may have to face for the foreseeable future.

Challenge No. 1 More frequent and intense rain events

Precipitation and runoff are trending upward.

The average annual precipitation has increased about 5 inches over the last 30 years. Runoff, the part of precipitation that flows downhill into streams and rivers, shows a similar trend.

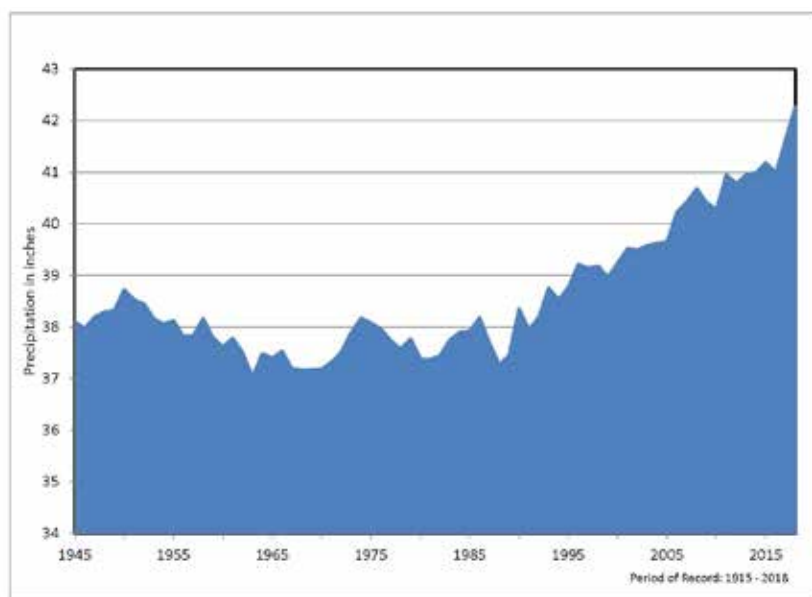
The good news is more rain means the region is unlikely to be susceptible to long-term water shortages. The bad news is our region could experience more fre-



Precipitation is on the rise in the region, increasing about 5 inches over the past 30 years.

quent flooding in areas not protected by MCD dams and levees.

Overcoming this challenge requires rethinking the way we currently manage stormwater. Green engineering uses techniques that filter pollution, slow rainwater, and allow water to drain to the aquifer instead of running off into rivers and streams. These techniques include pervious surfaces in parking lots, rain gardens, and green roofs.



The 30-year average annual precipitation for the Great Miami River Watershed, 1945-2018

Challenge No. 2 Water use is trending downward

Water is used for drinking, manufacturing, and irrigation. But the amount of water used has declined as much as 50 percent over the last 20 years or so, according to the Ohio Department of Natural Resources. Water-efficient plumbing fixtures, increased efficiencies in industry, and a regional decline in manufacturing have led to the downward trend.

Unfortunately, declining water use also results in lower revenues for water utilities at a time when they are faced with rising costs to maintain infrastructure. It is possible that some water utilities will need to restructure rates to ensure adequate revenue.



High levels of nutrients lead to excessive algae growth that can be unsafe for human contact.

Challenge No. 3 Nutrient pollution in rivers and streams

Nitrogen and phosphorus levels in local rivers and streams are too high. This can lead to excessive algae growth and deadly conditions for fish and aquatic insects. Certain kinds of algae can also create toxic water that is unsafe for human contact.

To reduce nutrient pollution, incentives can be created for farmers so they can afford to reduce nutrient runoff and keep fertilizer on the land where it helps crops grow. We also need to reduce the amount of nutrients discharged into rivers from water reclamation facilities, home sewage treatment systems, and lawn application.



Better ways of applying road salt need to be found to protect our drinking water sources. Photo: Butler County Engineer's Office

Challenge No. 4 **Road salt and nutrients** **impact groundwater**

High levels of chloride from road salt can affect the taste of drinking water and make it more corrosive to lead and copper in pipes. High levels of nitrogen (nitrate) in drinking water pulled from private wells can be deadly for infants.

Better methods of applying fertilizers and road salt should be embraced so they don't pollute drinking water sources. In addition, owners of septic systems should maintain them properly so they don't fail and contaminate well water.

Challenge No. 5 **Destruction of natural** **stream habitats**

The day when the factory was the big polluter is history. According to Ohio EPA, changes to the shape of stream channels are perhaps the most widespread cause of stream destruction. Projects that straighten a stream's channel, remove trees and bushes from streambanks, and increase impervious surface area are today's threats to clean rivers and streams.

Overcoming these threats involves a combination of actions, including protecting stream channels and banks, and limiting development in natural floodplains.

Challenge No. 6 **Micropollutants** **threaten clean water**

Only trace amounts of human-made compounds are being found in rivers, streams and aquifers. But no one knows how much is too much when it comes to personal care products (such as shampoos and deodorants), firefighting foams, and prescription drugs. Many of these micropollutants are flushed down the toilet or washed down the drains of kitchen and bathroom sinks. Traditional water treatment technology can't remove all micropollutants and they find their way into rivers and streams when the water leaves the treatment plant.

Ultimately, it may be necessary to eliminate certain chemicals found to be highly toxic to human and/or aquatic life. Keeping them out of consumer markets may be the only way to keep them out of our drinking water, and river and streams. Advanced water treatment technology is costly but may be necessary.

Together, we will need to commit to actions, big and small, to protect our region's water.

Take action

MCD can help your community address these water challenges. Most of these challenges are the direct or indirect result of how we live our lives—the neighborhoods we build, the services we demand, and the value we place on having clean water.

We can help you...

- Fully implement your community's source water protection plan.
- Encourage land developers to use green alternatives to manage stormwater and filter runoff.
- Support voluntary incentives for farmers to reduce nutrient runoff.
- Include water management in short- and long-range community planning.
- Keep water protection at the top of your community's priorities.
- Write local land-use policies that protect water.
- Advocate for federal investment in water infrastructure upgrades.
- Build awareness of the importance of protecting our region's water.



MCD gathers input to help communities protect water.

Building resiliency

Communities taking steps now to prepare for future

Many communities have taken steps to build resiliency and address water challenges. Here are a few examples.

Reducing water pollution by improving land development

Using an inclusive approach to improving development, the City of Springfield invited everyone with a stake in land use, economic development, and water resources to the table. Together, they crafted small changes to codes and ordinances that encourage developers to use green stormwater controls (rain gardens, pervious pavers, etc.) to comply with stormwater requirements.

The city tapped into MCD's knowledge of water management, community planning, and consensus building to create a plan that will save millions of dollars compared to building expensive underground stormwater storage.

Keeping groundwater safe through prairie plantings

Tipp City permanently protected land over the aquifer by using conservation easements and deed restrictions. The city planted a prairie on the land to filter pollutants. With MCD's help and matching funds, Tipp City leveraged Clean Ohio Green Space Conservation grants to secure its source water protection.

Protecting source water areas through planning

Every community that owns, and/or operates wells for drinking water should spend time researching, writing, and implementing a plan to protect its water and well field. MCD has resources to help communities tackle the planning process. Recently, MCD helped the Village of Cleves research and create its source water protection plan.

A plan should include sections on:

- Investigating potential contaminant sources.
- Reducing threats.
- Emergency response for spills.
- Contingency for alternate sources.
- Water monitoring.

Increasing groundwater recharge through progressive stormwater techniques

With assistance from MCD, communities across the watershed have built projects that utilize natural landscapes to reduce runoff and improve recharge back to the aquifer. These practices can be more effective and cheaper than traditional alternatives such as curb and pipe systems.

A few examples include an underground stormwater retention and rainwater reuse system at the Milton-Union Exempted School District; and rain gardens at Montgomery Soil and Water Conservation District office, St. Christopher's Church in Vandalia, and Madden Hills Park in Dayton.



Rain gardens (above) and prairies (right) are helping communities build resilience to our region's water challenges.



MCD helps communities protect water

Need help protecting your water? MCD is here for you.

Our staff can collaborate with you to develop source water protection plans, protect sensitive lands along rivers and over the aquifer, and conduct investigations. Here is a sampling of recent projects:

- Partnered with universities and agencies to study important groundwater issues such as PFAS, nutrient pollution, and naturally occurring contaminants.
- Installed native plants and prairies to filter pollutants and help wildlife.
- Investigated pollution threats to groundwater, including arsenic, micropollutants, road salt, and nutrients.
- Studied the impact of low dam removal on the Great Miami River.
- Developed a model to inform paddlers of river bacteria levels.
- Sealed abandoned wells that otherwise could serve as a conduit for pollution to the aquifer.
- Permanently conserved land over sensitive aquifers and along rivers and floodplains.

■ Partnered with a utility and a university to develop a groundwater observatory. Knowledge scientists gain at the observatory enhance community efforts to protect groundwater that is used for drinking water.

■ Educated septic system owners on the importance of proper maintenance.

■ Helped private well owners test their water to make sure it's healthy for their families.

■ Represented the region at the state and federal levels.

Have a project you need help with? Call Sarah Hippensteel Hall at (937) 223-1271.



MCD Hydro-technician Alex Hackney measures bacteria levels in the Great Miami River.

Lacy named 2019 Technician of the Year

Krystal Lacy, lead worker for the MCD hydrology team, has been named 2019 Technician of the Year by the Water Management Association of Ohio (WMAO).

As the lead worker, Krystal manages a team that is responsible for the operation and maintenance of 24 stream gages, 42 precipitation observer stations, 96 observation wells, 12 groundwater monitoring wells, and four nutrient monitoring stations.



Krystal Lacy



Arsenic poisoning can lead to a number of health-related illnesses, including cancer.

Arsenic

Testing key for private well owners

A silent killer lurks in private wells used for drinking water. An MCD groundwater study shows that drinking water in up to 20 percent of private wells in our region contains high levels of naturally occurring arsenic. Long-term exposure to arsenic through drinking water is associated with multiple serious and chronic health problems, including cancer.

Elevated arsenic levels not uncommon

Arsenic is present in local aquifers but private well owners may not realize it. Under the right conditions, groundwater dissolves arsenic in the aquifer and carries it into wells. Public water systems must test for arsenic. If levels are high, they must remove it. Private well owners usually are not required to test for arsenic so they may be unaware.

Test your well

Everyone with a private well should have their water tested for arsenic. Private well owners can learn more about testing at bit.ly/PrivateWells1 or scan this QR code.



Arsenic removal systems

If tests reveal a high level of arsenic, there are options for removing it. MCD studies have shown the higher the level of arsenic, the less effective arsenic removal systems tend to be. Levels in this region, however, are often low enough for the removal system to be effective.

Nutrient Pollution

No “silver bullet” to improving Great Miami River water quality

Although water quality in our rivers and streams has seen great improvements over the past few decades, there’s still more work to do.

What’s the problem?

MCD’s water experts track nutrient loads in our waterways. Total amounts of phosphorus and nitrogen are very high. Nutrients come from many sources, including agriculture, lawn fertilizers, wastewater treatment plants, sewer overflows, leaking septic systems, and precipitation.

Nutrients fuel excessive algae growth, which can lead to toxic water conditions. Nutrients harm fish and insect communities in rivers and streams. Those same nutrients negatively impact water that flows downstream to the Ohio River all the way to the Gulf of Mexico. High levels of nutrients in groundwater could poison drinking water wells.

What can be done?

It’s a challenge. That’s what a recent study showed. Even with drastic nutrient reductions from wastewater treatment plants, algal levels in the river would remain too high.

The solution to excessive nutrients in this region likely lies in some combination of nutrient reductions at both the farm and wastewater treatment plants.

Market-based solution works to improve water quality

A market-based pilot project showed promise.

MCD partnered with federal, state, and local groups to create the Great Miami River Watershed Water Quality Credit Trading Program.



Farmers can plant cover crops to reduce nutrient (fertilizer) runoff.

Farmers were paid to plant cover crops, and manage fertilizer application and manure storage to keep nitrogen and phosphorus on their land. During the pilot, 467 agricultural projects were installed.

More than \$3 million in funding for the pilot program came from local communities and federal agencies.

The pilot trading program reduced an estimated 626 tons of nutrients and proved that innovative, market-based solutions can be successfully implemented.

MCD facilitated the trading program, the modeling study, and provided technical support and water quality data. A partnership including: the cities of Dayton, Englewood, Union; Tri-Cities Wastewater Authority on behalf of the cities of Huber Heights, Vandalia, and Tipp City; and Butler County provided funds.

Water data pays off

Reports, case studies, and water data may not seem glitzy, but they can provide a big return on investment for communities.

In one instance, several community partners saved hundreds of thousands of dollars when the contractor was able to use research from MCD’s water library.

MCD’s studies and reports, themselves are useful. But together they offer a depth of knowledge to communities, providing great value and better protecting water for the future.

Among MCD’s studies and reports are:

- Investigation of nitrate sources (2019).
- E. coli (bacteria) monitoring report that lead to a model that informs paddlers of river bacteria levels (2018).
- Groundwater quality survey and contaminant trends study/report (2018).
- Study of historic groundwater level trends in the Great Miami River Watershed (2017).
- Summary of nutrient loads, yields, and mean concentrations in the watershed (2006-2016).
- Investigation of the effectiveness of arsenic removal methods from drinking water (2015).
- Survey of pharmaceuticals and personal care products in the streams and aquifers in the watershed (2011).



Access these reports at bit.ly/WaterStudies or scan this QR code.

MCD water data—see for yourself

Want to learn more about precipitation in the region? Groundwater levels? The health of our streams and aquifers?

MCD has a new cloud-based water information management system. A web portal allows you to research everything from recent rainfall to long-term groundwater levels to water quality sampling results.

To access the data, go to waterdata.mcdwater.org.

MCD Hydro-technician Elli Sigmond works to prepare information for the new water data web portal.





Toledo's water crisis

Could it happen here?

In 2015, pollution in Lake Erie halted Toledo's delivery of its drinking water to 400,000 people for several days. It happened when water Toledo pulls from the lake was found to have dangerously high levels of microcystin, a toxin that is produced by algae.

Microcystin is highly toxic to the livers of humans and animals.

Could algal toxins shut down our water, too?

A similar scenario is less likely here because this region draws nearly all of its drinking water from the aquifer rather than a river or lake. However, an overabundance of nutrients in our watershed (the land area that drains to the Great Miami River) can lead to the growth of algae in our rivers, streams, and lakes.

How do we know what's in our waterways?

For 15 years, MCD has collected nutrient data regularly from our rivers. The data show that levels of both nitrogen and phosphorus are too high at certain times of the year. The levels change with rainfall and other seasonal conditions.

So far, MCD has not detected a toxic algal bloom. But because algae can grow in area rivers, MCD will continue to monitor as needed for algal blooms that could impact public health.

Great Miami River Watershed



About the Great Miami River Watershed

- The Great Miami River Watershed is all of the land that drains to the Great Miami River.
- There are 3,946 square miles in the Great Miami River Watershed.
- 68 percent of the land in the watershed is used for agriculture while 18 percent is developed (urban areas). The remainder of land is forested, open water, wetlands and other uses.
- 6,600 miles of rivers and streams flow within the watershed.
- 1.5 trillion gallons of good quality water are stored in the watershed's buried valley aquifer.
- 2.3 million people get their water from the buried valley aquifer.
- Land uses can impact the quality and quantity of our water.



MCD Hydro-technician Maya Canaztuj discusses groundwater with a well owner at a Test Your Well event.

2012-2019

Water stewardship by the numbers

Through sponsorships and leadership, MCD helps protect rivers and streams, helps homeowners test their water, and raises awareness of the value of water.

Sponsorship

1.2 million visitors to the SPLASH! exhibit at the Boonshoft Museum of Discovery.

20,000 visitors to the University of Dayton Rivermobile, a traveling exhibit about water.

1,601 Test Your Well private water samples. Residents received free and confidential screenings for nitrates and other pollutants in their private well water.

124.8 tons of trash and debris, including 3,218 tires, collected by 7,200 volunteers as part of the Clean Sweep of the Great Miami River.

53,400 visitors to the Warren County water education trailer.

20,774 students learned about water during the University of Dayton and Butler County children's water festivals.

1,000 students learned about water resources through hands-on activities with the Trout in the Classroom program.

15 breweries and coffee shops throughout the watershed spread the "value of water" message through drink coasters and coffee sleeves provided by MCD. The campaign was part of a national effort.

Leadership

60 people participated in the Greater Dayton Environmental Leaders program. MCD staff helped create the program that trains early-career community members to become leaders in advocating for the environment.

20 years' recognition of MCD by the Groundwater Foundation for management practices that protect groundwater.

MCD Aquifer Preservation Subdistrict

The purpose of The Aquifer Preservation Subdistrict is to develop and maintain an ongoing, watershed-wide program in support of comprehensive protection, management, and understanding of the

region's water resources; to implement improvements and actions necessary; and to work with existing federal, state, and local agencies.

General Manager



Janet M. Bly

The Team

The Water Stewardship team is led by managers Mike Ekberg and Sarah Hippensteel Hall.

Mike Ekberg is MCD's manager of water resources monitoring and analysis. A hydrogeologist, Mike is responsible for all MCD operations concerning collection of water quantity and quality data.

Sarah Hippensteel Hall, Ph.D., is MCD's manager of watershed partnerships. She builds diverse partnerships throughout the Great Miami River Watershed. In 2012, Sarah received the Distinguished Service Award from the Water Management Association of Ohio.

Team members are lead worker of the monitoring team Krystal Lacy; and hydro-technicians Alex Hackney, Elli Sigmond, and Maya Canaztuj.



Mike Ekberg



Sarah Hippensteel Hall



38 E. Monument Avenue
Dayton, Ohio 45402-1265

MCDWATER.ORG

Contact us at (937) 223-1271 or bgibson@mcdwater.org

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