

WATER QUALITY

N10. CREATE LONG-TERM MANAGEMENT PLAN FOR ENTIRE WATERSHED SERVING COLUMBUS THAT ENSURES SUFFICIENT DRINKING WATER

N11. UNDERSTAND THE TYPES OF EVENTS, LIKELIHOOD OF OCCURRENCES, AND RANGES OF SEVERITY THAT ADVERSELY IMPACT DRINKING WATER QUALITY

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A9. IMPROVE DATA COLLECTION TO ANTICIPATE AND RESPOND TO HARMFUL ALGAL BLOOMS (HABs)

A10. CONTINUE UPGRADES TO WATER AND SEWAGE TREATMENT INFRASTRUCTURE TO REDUCE HARMFUL ALGAL BLOOM (HAB) TOXINS IN DRINKING WATER

Since the Hoover brothers pioneered new methods of wastewater treatment in the early 1900's, Columbus has been a leader in providing its residents with high-quality drinking water. This is in part because central Ohio boasts several high-quality water sources. The Columbus water system sources its water from the Scioto River, Big Walnut Creek, and groundwater that is pumped from the Scioto River Valley sediment deposits. In 2016, the Division of Water supplied over 49.5 billion gallons of drinking water to over 1.2 million residents throughout the Greater Columbus Area.¹

However, all three of the water sources are susceptible to numerous pollutants that need to be treated in order to meet water quality standards. Some of these pollutants pose a risk to public health, such as nitrates and toxins from harmful algal blooms, while others affect the odor, taste, or clarity of our water. They can enter the surface water sources – the Scioto River and Big Walnut Creek – through industrial activities, stormwater runoff, and nearby roads and highways. Due to a lack of overlying clay sediments, our groundwater is at a higher risk of contamination than many other groundwater sources.² As Columbus continues to grow and develop, the contamination pathways will increase, and water quality issues may become more frequent. Exacerbating these issues are projected climate changes – increased precipitation and extreme heat events. More frequent and intense precipitation events will

¹ "Water Distribution System." *The City of Columbus, Department of Public Utilities: Water Protection.* <https://www.columbus.gov/utilities/water-protection/Water-Distribution-System/>. Accessed Jan. 2018.

² "Water for Living: Consumer Confidence Report (CCR)." *The City of Columbus Department of Public Utilities: Water Protection.* <https://www.columbus.gov/utilities/water-protection/CCR/>. Accessed Jan. 2018.

likely induce more runoff, while rising temperatures are expected to contribute to increasing pathogen concentrations in surface waters.³

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The Scioto River, Big Walnut Creek, and groundwater in the Scioto basin supply water to three treatment plants that serve the City of Columbus. The Dublin Road Water Plant utilizes water from the Griggs, O'Shaughnessy, and John R. Doult Reservoirs and distributes it throughout all districts of Franklin County. The Hap Cremean Water Plant treats water from the Hoover Reservoir and serves the Ohio State campus and northern Franklin County. The Parsons Avenue Water Plant withdraws groundwater and serves southern Franklin County. In 2015, a partnership led by MORPC released *Sustaining Scioto*, a document to guide actions amongst a number of agencies to ensure that there is sufficient, clean drinking water for residents and businesses of Central Ohio.⁴ This document, which took four years to complete, is a comprehensive look at drinking water provided by the Upper Scioto Basin. *Sustaining Scioto* provides both near and midterm action items related to planning, collaboration, public education, emergency preparedness, operating procedures, and resource protection. Analyses included simulations by USGS that take into account changes in climate, reservoir operations, land cover, and water use within the basin.⁵ While the simulations include population growth for Central Ohio based on projections by MORPC, they did not factor in population relocation from elsewhere in the country due to climate impacts.

There is no need to develop an additional long-term management plan, but *Sustaining Scioto* should be updated periodically, and the continued work of the partners to enact actions in this far-sighted document should continue to be supported. The updates should include re-examinations of land use and development patterns, climate conditions, and population growth that includes climate migrants. These updates will ensure that sufficient drinking water will be provided for Columbus residents, even as the community and the climate continue to change.

N11. UNDERSTAND THE TYPES OF EVENTS, LIKELIHOOD OF OCCURRENCES, AND RANGES OF SEVERITY THAT ADVERSELY IMPACT DRINKING WATER QUALITY

Sustaining Scioto provides guidance in preparing for the amplified hydrologic cycle that will result from climate change, characterized by a greater frequency of extended dry periods interspersed with heavy downpours. The runoff that results from intense rainfall and snowmelt events can lead to excess nutrient loading and the delivery of pollutants into a waterway. Excess nutrients, along with increasing temperatures, may result in harmful algal blooms or greater concentrations of pathogens in the water. As the nutrients and pollutants transported by runoff often originate from many different

³ "Upper Scioto River Watershed, Water Quality Assessment Technical Memorandum." Brown and Caldwell. *Technical Memorandum prepared for Mid-Ohio Regional Planning Commission*. Apr. 8, 2015. http://www.morpc.org/wp-content/uploads/2017/12/1.Water-Quality-Assessment-TM_Final.pdf. Accessed Jan. 2018.

⁴ "Sustaining Scioto." *Mid-Ohio Regional Planning Commission*. <http://www.morpc.org/tool-resource/sustaining-scioto/>. Accessed Jan. 2018.

⁵ A. Ebner, G. F. Koltun, and C. J. Ostheimer. "Hydrologic effects of potential changes in climate, water use, and land cover in the Upper Scioto River Basin, Ohio." *U.S. Geological Survey Scientific Investigations Report 2015–5024*. 34 pp., 7 app. <http://dx.doi.org/10.3133/sir20155024>. Accessed Jan. 2018.

nonpoint sources, it is difficult to control how much is being delivered to our groundwater, streams, rivers, etc. Therefore, in order to protect against this type of pollution, it is first necessary to improve our understanding of the types of events and conditions that can negatively affect our water quality.

In order to better understand the likelihood of occurrence and ranges of severity of these events, additional data, informed by the research community, will need to be collected from watersheds. After the 2014 harmful algal bloom that disrupted the Toledo drinking water supply, there has been an intense focus on development of tools to better forecast algal blooms and their associated toxins.⁶ These tools might also provide insight about nutrient loading in waterways, such as the events that led to a nitrate warning for a portion of Columbus' drinking water system in summer 2016.⁷ Details about facets of an advanced warning system are provided in sections **A9** and **A10**. Additionally, the City of Columbus, Division of Water has a Water Quality Assurance Lab (WQAL), which can provide independent monitoring and analysis of the watershed, while also researching new treatment methods.⁸

Regarding resiliency of water and sewage treatment facilities, critical infrastructure should be assessed to ensure that it is not susceptible to flooding and has redundancy in its power supplies. Likewise, sufficient reserves of critical replacement components and stockpiles of necessary supplies should be maintained on site rather than relying on just-in-time delivery. While flooding and electrical service disruptions might not impact the quality of water within the supply, they could impact the city's ability to deliver treated water to residences and businesses if treatment facilities are offline. FCEM&HS can provide insight in preparing for operations during regional flooding and with electrical service disruptions. Finally, in the case of a major water emergency, the OEPA requires that each community water system have and maintain a written contingency plan for providing safe drinking water.⁹ This plan should be updated as our knowledge regarding the types of events that might lead to water emergencies improves.

N12. CONTINUE UPGRADES TO STORMWATER SEWAGE TREATMENT INFRASTRUCTURE TO REDUCE SEWAGE CONTAMINATION OF WATERWAYS

In 2005, the City of Columbus developed a Wet Weather Management Plan (WWMP) to satisfy two consent orders from the OEPA to reduce combined sewer overflow (CSO) and sanitary sewer overflow (SSO) into a number of drainages. Due to aging infrastructure, combined stormwater and sanitary pipes, and insufficient sewage treatment capacity, Columbus released millions of gallons of sewage each year during multiple events. In addition, some property owners experienced sewage backups in basements. The WWMP proposed both interim and long-term projects and was to be completed over a 40-year schedule; although, most of the improvements were set to take place before

⁶ "Toledo's Water Crisis." *The Blade*. <http://www.toledoblade.com/watercrisis>. Accessed Jan. 2018.

⁷ "Nitrate Advisory." *City of Columbus, Columbus Public Health*. Jun. 30, 2016. https://www.columbus.gov/nitrate_food_advisory/. Accessed Jan. 2018.

⁸ "Water Quality Assurance." *The City of Columbus, Department of Public Utilities: Water Protection*. <https://www.columbus.gov/utilities/water-protection/wqal/Water-Quality-Assurance/>. Accessed Jan. 2018.

⁹ "Security and Emergency Preparedness. Attachment A: Ohio Administrative Code (OAC) rule 3745-85-01." *Ohio Environmental Protection Agency*. http://epa.ohio.gov/portals/28/documents/rules/Final/3745-85-01_effective%2012-23-16.pdf. Accessed Jan. 2018.

2025, reducing pollution by 85% during the first 20 years.¹⁰ Projects outlined in the WWMP included constructing new tunnels to direct flows to treatment plants, building storage tanks, and treatment plant improvements. Priority was given to CSO improvement, and by 2015, over one billion dollars had been spent to complete numerous WWMP projects and substantially reduce CSO volume.

Following the first ten years of implementation, in 2015 the city adopted *Blueprint Columbus* to replace the WWMP and capitalize on new technologies and flexibility provided by US EPA.¹¹ *Blueprint Columbus* deploys green infrastructure (e.g., rain gardens, use of porous pavement, and upgrades to current infrastructure) rather than grey infrastructure (e.g., laying of additional pipes and installation of additional sewage treatment capacity). Green infrastructure was deemed to be less expensive, more rapidly deployable, and of greater benefit to the local economy while providing co-benefits to ecosystems and neighborhoods. *Blueprint Columbus* is currently in the second year of implementation with data being collected as portions of the project are being completed. Based on the results of these projects, plans will need to be adapted.

Currently, *Blueprint Columbus* provides the best plan for actions to reduce sewage contamination of waterways with accountability provided by OEPA. But, the document has one significant drawback. When determining potential capacity problems for the wastewater collection system, the models utilized 20 years (1995-2014) of spatially distributed, 5-minute rainfall data. Although this captures the recent precipitation trends, it does not account for the additional increase in extreme precipitation that is projected for the future. It is also important to consider that the city's actions over more than a decade to reduce overflows of sewage are making up for insufficient investment in infrastructure during rapid growth in the city's past and serves as a cautionary tale for planners.

N13. IMPLEMENT EDUCATIONAL CAMPAIGN FOR INDIVIDUALS AND BUSINESS ON PROPER TREATMENT AND USE OF CONTAMINATED DRINKING WATER

One of the challenges during a drinking water emergency is ensuring individuals and businesses know about the emergency. A second challenge is ensuring that people know in what ways the water may safely be used and how it must be treated before consumption, if at all. Most water outages are due to a water main break, and individuals are accustomed to advisories to boil their water. While boiling will destroy most pathogens, it will not remove toxins and heavy metals from water. In fact, boiling the water will concentrate these materials and make the water more dangerous to drink. During the 2014 Toledo water crisis, individuals were explicitly warned not to boil the water for consumption and, until the concentration of the toxin was known, even bathe in the water. In the case of Flint, Michigan, the state originally recommended citizens boil their water to destroy detected pathogens, but the water also contained elevated levels of lead resulting from the city's transition to a different water supply without addition of anti-corrosion treatments.¹² To safely consume water, most residents of the

¹⁰ "Blueprint Columbus: The Integrated Plan and 2015 WWMP Update Report." *City of Columbus - Department of Public Utilities*. <https://www.columbus.gov/utilities/projects/blueprint/>. Accessed Jan. 2018.

¹¹ "Blueprint Columbus." *The City of Columbus, Public Utilities*. <https://www.columbus.gov/utilities/projects/blueprint/>. Accessed Jan. 2018.

¹² Merrit Kennedy. "Lead-Laced Water In Flint: A Step-By-Step Look At The Makings Of A Crisis." *NPR*. Apr. 20, 2016. <https://www.npr.org/sections/thetwo-way/2016/04/20/465545378/lead-laced-water-in-flint-a-step-by-step-look-at-the-makings-of-a-crisis>. Accessed Jan. 2018.

city needed to install special filters or depend on bottled water. Subsequent water main breaks within the city have created additional confusion as individuals then need to boil their water after having filtered it.¹³

Since most individuals do not have access to detailed knowledge of water contaminants, accurate information needs to be clearly communicated in a timely fashion. Therefore, a team of experts, with backgrounds in science, communication, and the local community, needs to vet information before it is broadcast. To the extent possible, this messaging should be developed in advance of emergencies to facilitate rapid dissemination when needed. In these situations, the expertise is provided by the Division of Water, Columbus Public Health, and the county health department.

**A9. IMPROVE DATA COLLECTION TO ANTICIPATE AND RESPOND TO HARMFUL ALGAL BLOOMS (HABS)
A10. CONTINUE UPGRADES TO WATER AND SEWAGE TREATMENT INFRASTRUCTURE TO REDUCE HARMFUL ALGAL BLOOM (HAB) TOXINS IN DRINKING WATER**

While many inland lakes within Ohio have seen algal blooms, Columbus' reservoirs have maintained relatively good water quality. Nonetheless, algae have already had effects on the taste of Columbus water, and much of the Scioto basin is outside of the city's ability to regulate. Therefore, a data collection system that can allow the city to anticipate blooms and prepare an appropriate response, in essence an advanced warning system, is an action within the locus of city control that can inform both water treatment and emergency response. Fortunately, extensive research is being conducted in the Maumee River Drainage and Western Basin of Lake Erie to forecast algal blooms that impact the water supplies of communities along the lake.¹⁴ This research is expensive, involves extensive technical expertise, and draws from remote sensing and water sampling data. As this research continues, findings can be used to inform a similar advanced warning system for Central Ohio. A benefit of installing such a system sooner rather than later includes having a larger pool of data to inform investment in additional water treatment infrastructure or conservation practices.

A number of communities in Ohio, most notably Toledo, Oregon, and Celina have all installed extensive infrastructure to combat algal toxins in their drinking water. Based on algal blooms that occur, their impact on the Columbus drinking water supplies, and knowledge gathered through an advanced warning system, the city will need to allocate resources for additional treatment infrastructure. Due to infrastructure's high cost, it should be carefully considered well in advance of the need, and options involving conservation practices within the drainage should also be considered. For instance, New York City's water treatment system includes preserves higher in the watershed to protect water resources for the city's needs; part of the reason for these preserves is that they provide sufficient clean drinking water and are less expensive than water treatment infrastructure.¹⁵

¹³ Lindsey Smith. "Boil water advisory adds to confusion over how to make Flint tap water safe to drink." *Michigan Radio*. Feb. 11, 2016.

<http://michiganradio.org/post/boil-water-advisory-adds-confusion-over-how-make-flint-tap-water-safe-drink>. Accessed Jan. 2018.

¹⁴ "Lake Erie Harmful Algal Bloom." *National Weather Service*. <http://www.weather.gov/cle/lakeeriehab>. Accessed Jan. 2018.

¹⁵ "New York City Water Supply." *New York State Department of Environmental Conservation*. <http://www.dec.ny.gov/lands/25599.html>. Accessed Jan. 2018.