

The Ohio Water Table

A Publication of the Water Management Association of Ohio

No. 128 / Quarterly



Introducing Students to Environmental Science and Engineering Professions

Carolyn Watkins, Chief, Ohio EPA Office of Environmental Education

Where will the next generation of environmental scientists and engineers come from? Could you play a role in inspiring this career choice among today's students? Consider these converging trends:

- Employers looking to hire professionals in environmental science and engineering are reporting a shortage of qualified applicants.
- Most high school students, and even teachers and career counselors, have little understanding of the wide variety of things environmental professionals do, or the training and skills required.
- Ohio is emphasizing Science, Technology, Engineering and Mathematics (STEM) fields

to prepare students for jobs in the state's emerging high-tech economy.

- The Ohio Department of Education's learning standards and model curriculum also emphasize student learning about real-world careers.

Schools and career centers are looking for professionals in the public and private sectors to provide role models and diverse work-place experiences for their students. They are having trouble finding us.

Ohio EPA has been working with the Environmental Education Council of Ohio (EECO) to recruit **environmental career ambassadors** who are willing to participate in local school career days or make an occasional classroom presentation to students about their career paths.

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Water Quality Testing of MWCD Lakes Now in 5th Decade

Darrin Lautenschleger, Public Affairs Administrator, Muskingum Watershed Conservancy District

Water quality testing at the 10 lakes in the Muskingum Watershed Conservancy District (MWCD) system has been conducted since the 1970s, and has expanded in recent years.

The MWCD, which has managed a total of 14 reservoirs in Eastern Ohio for flood reduction and conservation in partnership with the U.S. Army Corps of Engineers (USACE) for nearly

80 years, has cooperated with the USACE for sampling its lakes since 1973. In recent years the MWCD has participated in the U.S. Geological Survey (USGS) water quality data collection program for advisory data at three of its swimming beaches and supports the Ohio Lake Management Society's (OLMS) citizen monitoring program at nine of its lakes.

"As the interest in surface water quality has increased in recent years, the MWCD determined that in addition to the data

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Points of Interest:

- *Efforts to increase student interest in the environmental sciences.*
- *Fifty years of water quality data in the Muskingum River Watershed.*
- *WMAO water luncheon focuses on combined sewer overflows.*
- *WMAO Annual Conference had a high turnout and great presentations.*
- *Publications available that provide information on water resources.*

President's Column

Boris E. Slogar, P.E.

I'm sitting at home the day after New Year's looking out the window watching the snow fall as I write this. I love this time of year. My daughters will tell you that I'm crazy about the holidays in an optimistic and goofy "Clark W. Griswold" sort of way. And much like Clark, I find myself building up expectations for the holidays that no family can live up to. It's the same thing each year...the holiday season kicks off with WMAO's annual conference, Thanksgiving shows up a week or so later, before I know it its Christmas and I watch the ball drop on New Year's Eve. I then start watching the more meaningful bowl games and before I know it, it's back to reality. Did anyone catch the number of that freight train??

In looking ahead towards the New Year, I just read that Lake Superior State University had issued its annual list of annoying words they wish to ban. Those words include "selfie", "twerking", "Twittersphere", "t-bone", "Obamacare", "intellectually/morally bankrupt", and anything on "steroids". In looking these words over (I'm reminded of George Carlin's 7 words you can't say on TV), I'm perfectly at ease with eliminating all of these words except for one. How can anyone take offense to "t-bone"? Beyond the fact that I find that particular cut of beef enticing, isn't "t-bone" used as part of the name describing any good jazz or blues musician? At any rate, I take solace in knowing that I am the first WMAO president to use the word "twerk" in a newsletter article. Take that Peter Soltys!

With the New Year comes the usual reflection on the year past as well as predictions for the new one. I find these predictions amusing and plentiful. There are the usual political predictions which I can't bring myself to read so I have no idea how accurate they are. There are the sports predictions and living in northeast Ohio, I can say for the first time that the rose-colored glasses are off for next year's Browns predictions. Reality has set in after nearly two decades of futility up here. Then there are the techie predictions telling us what to expect in the world of tablets, phablets, smart phones, laptops, cloud computing, iThis and iThat and so forth. I don't really follow these tech predictions too closely but I can predict one thing for sure, Best Buy will continue to reach into my wallet in the coming year.



Looking ahead towards 2014 from a "WMAOsphere" perspective (are you reading this Lake Superior State?), things look a bit more certain and predictable. I offer the following predictions: There will be water luncheon seminars with engaging topics and great speakers. There will be board meetings filled with robust and thought-provoking banter. There will be conferences, workshops, and other forums where our Divisions provide learning opportunities and forums to share ideas and network. There will be our annual conference which brings us all together in a theme meant to remind us of how our diverse divisions and interests in water resources are all interwoven and complimentary of each other as part of a bigger system. Look for information regarding all of these events on our website at www.wmao.org.

"...as our organization continues to grow and evolve, we must take the time to review and reflect and make changes as necessary."

In kicking off my administration at the November WMAO conference, I presented the following tasks as our priorities for 2014: 1.) Continue the transition/evolution of WMAO's administrative services for its members and divisions; 2.) Review the mission and funding of WRFO (Water Resources Foundation of Ohio) WMAO's educational arm; 3.) Review WMAO's corporate structure with particular focus upon the relationship and expectations between WMAO and its Divisions. This is a full slate to tackle in the upcoming year, but as our organization continues to grow and evolve, we must take the time to review and reflect and make changes as necessary. We will do so as a team and will provide opportunities for input from all WMAO members.

I would be remiss if I closed out this article without a few words about our previous president Peter Soltys. We all owe Peter a big thank you for his continued dedication to WMAO. Peter just closed out his second term as president and during his past term (and looking back over the years) Peter embodies what our organization is meant to be about...a commitment to our state through the lens of water resources while building relationships across all water resource interests and academic, private, and public sectors. He is truly one of the good guys in our field. Thank you Peter... and I look forward to your continued input and guidance.

As we continue to work together in the WMAOsphere, I wish you all a prosperous, successful, safe, happy and twerk-free 2014.

Introducing Students to Environmental Science and Engineering Professions

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Would your company or agency consider hosting a school field trip? Do you have internships for high school or college students? Could you provide a shadowing opportunity for students to see what professionals do? Could you help recruit other career ambassadors?

The Ohio State University (OSU) recently created the **Environmental Professionals Network (EPN)**, an online community connecting Ohio professionals in:

- Air quality;
- Environmental health and policy;
- Energy, materials and sustainability;
- Land use and conservation;
- Water resources and water quality; and Wildlife and ecosystems.

We encourage you to join EPN. Members share information, announce events and training opportunities, post/seek jobs, internships and volunteer opportunities, and find collaborators for projects. The network is not limited to OSU faculty and alumnae.

Now EPN members can also volunteer to be a career ambassador to introduce Ohio high school students to careers in environmental science and engineering. Simply check **Career Ambassador** in your EPN member profile and select the activities you might want to be involved in. Teachers and career counselors in your area will be able to contact you through the EPN to invite you to speak to students in local schools, schedule a field trip, or whatever activities you selected based on your level of interest and availability. Short on time? Not sure you would be good at speaking to young people? You only sign up for what you're comfortable doing, and you can decline any request from a school.

More than 70 large companies and local, state and federal agencies have signed on as supporters of this initiative. OSU, Ohio EPA and EECO are trying to recruit at least 500 environmental career ambassadors, with some available in every Ohio county. Watch for more information at <http://epn.osu.edu> and www.eeco-online or contact Carolyn.watkins@epa.ohio.gov.

The graphic features a dark red background at the top with the Ohio State University logo (T · H · E OHIO STATE UNIVERSITY) and the text "ENVIRONMENTAL PROFESSIONALS NETWORK". Below this, the slogan "Connecting our community. Online, in person, or both. You choose!" is displayed. The central part of the graphic is a collage of images: yellow maple leaves, a wind turbine, a path with people, and a person in a kayak on a lake. A list of activities is shown with red square icons: Share, Query, Network, Learn, Innovate, Collaborate, Recruit, Volunteer, Inspire, Be inspired. The website "epn.osu.edu" and the phrase "Sign up today! It's free!" are prominently displayed. At the bottom, it states "A service of the SCHOOL OF ENVIRONMENT AND NATURAL RESOURCES COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES".

Water Quality Testing of MWCD Lakes Now in 5th Decade

Continued from Page 1

that has been available through the USACE program for many years, there also were other opportunities available to enhance the knowledge of the MWCD staff and the general public,” said Mark Swiger, MWCD natural resources administrator with more than 35 years of service. “The first question the MWCD receives when the subject of water quality comes up is, ‘Are the lakes clean?’ And I am pleased to say that yes, overall the lakes are clean.”

The 10 MWCD lakes are:

- Atwood in Carroll and Tuscarawas counties
- Beach City in Stark and Tuscarawas counties
- Charles Mill in Ashland and Richland counties
- Clendening in Harrison County
- Leesville in Carroll County
- Piedmont in Belmont, Guernsey and Harrison counties
- Pleasant Hill in Ashland and Richland counties
- Seneca in Guernsey and Noble counties
- Tappan in Harrison County
- Wills Creek in Coshocton, Guernsey and Muskingum counties

MWCD staff members work with the water management staff of the Huntington (WV) District of the USACE to sample the MWCD reservoirs, their primary inflowing streams and outflow. Equipment, supplies and training are provided by the USACE, while the MWCD offers field personnel and local oversight for the program.

Temperature, dissolved oxygen, hydrogen ion concentration (pH), specific conductivity, oxygen reduction potential, turbidity and alkalinity are sampled. Water transparency is measured in inches through the program and samples of aquatic insects from the inflowing streams also are collected.

Water samples are analyzed in a contract lab for metals, nutrients and some inorganics. The data is available through files and spreadsheets through the USACE.

“The MWCD and the USACE have been partners for nearly the entire history of the conservancy district, so

this data collection collaboration is a natural extension of that relationship,” Swiger said.

In the last four years, the MWCD also has worked with USGS to test an inland “Nowcast” program to quickly estimate bacteria levels and provide advisories for the swimming beach locations at lake parks managed by the MWCD at Atwood, Seneca and Tappan lakes. The MWCD funds an intern position during the summer season to collect and process bacteria samples while USGS provides training, equipment and data analysis. The program is similar to one that has been in place for many years along locations at Lake Erie.

Swiger said the MWCD eventually hopes to expand the program to other lakes and to post data on its website.

Through funding assistance from the MWCD, the Citizen Lake Awareness and Monitoring (CLAM) program operated by OLMS allows citizens to take an active role in learning about aquatic ecology, lake and stream water quality and watershed management in the MWCD region.

Participants collect information to determine turbidity, surface water temperature and water color at nine MWCD lakes, and more recently training has been provided for collection of total nutrients and monitoring for harmful algae blooms. Chlorophyll samples also will be collected in 2014. OLMS facilitates all aspects of the program and posts information and data on its website at www.eyesonthewater.org.

“Citizens, when properly trained, collect reliable data to complement what is professionally collected,” Swiger said. “Citizens can be valuable partners and we have found the CLAMS participants to be both interested and dedicated to the program.”

The MWCD, a political subdivision of the state, was organized in 1933 to develop and implement a plan to reduce flooding and conserve water for beneficial public uses in the Muskingum River Watershed, the largest wholly contained watershed in Ohio. Since their construction, the 16 reservoirs and dams in the MWCD region have been credited for saving an estimated \$10.7 billion worth of potential property damage from flooding, according to the federal government, as well as providing popular recreational opportunities that bolster the region’s economy. A significant portion of the reservoirs are managed by the MWCD and the dams are managed for flood-risk management by the federal U.S. Army Corps of Engineers (USACE).

For more information about the MWCD, visit www.mwcd.org and follow the MWCD on Facebook and Twitter.

“...dams in the MWCD region have been credited for saving an estimated \$10.7 billion worth of potential property damage...”

Research Highlights from the State of Ohio Water Resources Center

The Ohio Water Resources Center is a federally authorized center situated at The Ohio State University. We fund State relevant water related research. Below are highlights from a recently completed project conducted by Dr. Xiaozhen Mou. If you are interested learning more about our research projects see the Ohio Water Resources Center webpage at wrc.osu.edu.

Dr. Xiaozhen Mou, Assistant Professor in Biological Sciences at Kent State University recently completed an Ohio Water Resources Center 104(b) funded project titled “**Identification of Microcystin Degrading Bacteria in Lake Erie Western Basin and the Grand Lake St. Marys**”. Despite significant Federal and State research and restoration efforts made to regulate and monitor the nutrient loading, periodic nuisance cyanobacterial harmful blooms (such as *Microcystis*) occur every summer. They impact both lakes in the study and in recent years they have increased the affected area and occur at a higher frequency and intensity. Although they might aid in management of the toxin, research on in situ microcystin-degrading bacteria is limited and virtually absent in Ohio lakes.

Figure 1. Sampling sites and photos taken during GLSM sampling in June 2012. The dark green color of the water indicates an intense *Microcystis* bloom.



The focus of Dr. Mou’s study was to investigate the ability of lake bacteria to degrade microcystins. Based on incubation experiments, her team found that both Grand Lake St. Marys (GLSM) and Lake Erie bacteria have high potentials in degrading microcystins (see Figure 1 for GLSM sampling sites). Of the 50 isolates screened based on the BIOLOG assay, one isolate from Lake Erie was found to degrade Microcystin-LR (Figure 2). Work on this project is ongoing to sequence and characterize the microbial community and microcystin degrading isolates.

Researcher: Research in Dr. Mou’s lab focuses on linking bacterial phylogeny with their metabolic functions in natural aquatic environments. This direct linkage is important to understand fundamental questions in an ecological/ environmental context, such as the role of bacteria in biogeochemical cycling of essential nutrients, e.g., carbon, nitrogen and sulfur. Experimental metagenomics and metatranscriptomics, coupled with bioinformatics, are employed as the core approach to simultaneously identify the taxonomic diversity, genetic capability, and metabolic activity of selected taxonomic and functional groups of aquatic bacteria. Other advanced molecular biology techniques, such as T-RFLP, DGGE, qPCR, RT-PCR, CARD-FISH, and flow cytometry, and cultivation-based studies, such as whole genome microarray, are also regularly employed.

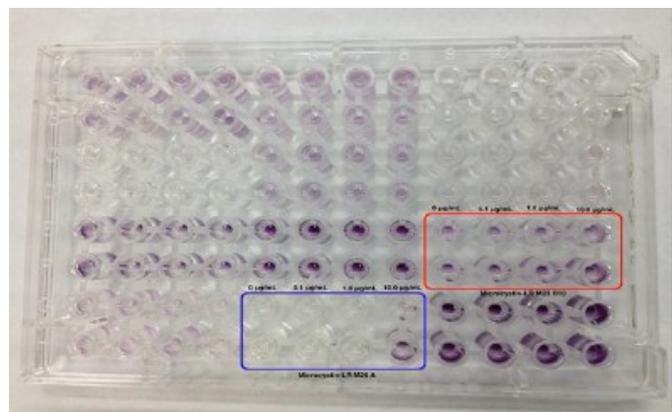


Figure 2. MT2 MicroPlate™ results. The red box denotes the microcystin-LR M21 B10 isolate that showed negative results for microcystin degradation. The blue box denotes the microcystin-LR M26, an isolate that showed positive results for microcystin-LR degradation. Each well is carbon limited and pre-treated with nutrients and tetrazolium violet. Four concentrations (0 µg/mL, 0.1 µg/mL, 1.0 µg/mL, 10.0µg/mL) of microcystin-LR or microcystin-RR were added to each well, which acted as the sole carbon source for the bacterial isolates. Color change from transparent to purple indicates the usage of microcystin.

A Water Luncheon Seminar



▶ Presented by:

The Water Management Association of Ohio
and
The Ohio Water Resources Center

January 21, 2014; 11:30 a.m. - 1:00 p.m.

Wilma H. Schiermeier Olentangy River Wetland Research Park,
The Heffner Building, 352 Dodridge St., Columbus, OH 43202



Green-Gray Decentralized Detention Infrastructure to Control Combined Sewer Overflows

Nestor Alonso Mancipe-Munoz, University of Cincinnati, Department of Biomedical, Chemical and Environmental Engineering.

Combined sewer overflows (CSO) are uncontrolled and untreated discharges of wastewater into urban streams that occur when the capacity of the collection system or the treatment facility are exceeded during heavy rainfall or snowmelt events. Resilient and affordable solutions are needed to control CSOs and help manage urban flooding and improve water quality. Typically, *Gray infrastructure* (i.e. sewers and treatment facilities) are proposed to mitigate CSO impacts. A more environmentally friendly approach called *Green infrastructure* (i.e. bio-infiltration, green roofs, rain gardens, etc) is being considered to solve this problem. Interest has grown in using a combination of "green" and "gray" infrastructure because it not only mitigates CSOs, but also maximizes social, economic, and environmental benefits. A unique framework that combines state-of-the-art mathematical modeling complemented with Geographical Information Systems (GIS) was developed to assess a non-conventional "green" and "gray" infrastructure alternative, composed of short storm sewers (gray) that convey stormwater runoff into small decentralized detention ponds (green). The detention ponds release the captured runoff back into the existing sewer at a constant rate controlled to prevent the occurrence of a downstream CSO. The proposed framework includes methods to calibrate a high resolution rainfall-runoff model, identify potential sites for small detention ponds, and produce control-operation policies. Results show that the green-gray infrastructure alternative is feasible and provides a higher CSO reduction at a lower cost than a

Please register by January 15, 2014. Late or on-site registrations cost \$5 extra and are not guaranteed a meal. For registered engineers who need Professional Development Hours (PDHs), this presentation offers 1 PDH.

WMAO Member (\$10) Nonmember (\$15) Student (\$7) Special meal? _____

Name _____

Organization _____

Address _____

City _____ State _____ Zip _____

Phone _____ Email _____

Please send form and check to: WMAO-Luncheon, 8440 E. Washington St. #206, Chagrin Falls OH 44023.

OR, register online, with MasterCard, Visa, or Discover, at: www.wmao.org.

Proceeds from the luncheon benefit the continued operation of WMAO and our scholarships. Sponsorship opportunities are available for those interested in providing extra support. More information on sponsorship is available at www.wmao.org.

Annual WMAO Conference a Huge Success!

The 42nd Annual Water Management Association of Ohio Conference, Now Trending: Innovations in Water Resource Management, was held November 13 and 14, 2013 at the Quest Conference Center in Columbus.

The conference was a great success and included presentations that covered a multitude of water resource topics. Over 200 attendees joined in for the two day event. Highlights from the conference include:

- Keynote speaker Alan Vicory, Principal Engineer at Stantec and past Executive Director at ORSANCO, presented “Water Technologies - A Global Imperative; An Emerging Driver of Local Economic Growth; Game Changers for Water Resources Management.”
- Attendees received a credit-card-thin flashlight displaying the WMAO logo.
- Thirteen water industry companies supported the conference as sponsors and exhibitors...Thank You!



Bluye' DeMessie with his award winning poster entitled "Sustainable and Low Cost Approach for Cleaning Metal Contaminated Water Using Pyrolyzed Banana Peels."

WMAO Conference 2013

"Special Thanks To Our Sponsors"



- * Applied Biochemists
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- * Aquatic Control Inc.
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- * Civil & Environmental Consultants, Inc.
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- * Fondriest Environmental, Inc.
- * Hach—Hydromet
- * Hull & Associates, Inc.
- * Muskingum Watershed Conservancy District
- * URS Corporation
- * Vertex Water Features.

- A third concurrent track on day two was dedicated for Ohio Lake Management Society to hold their annual conference.
- Eight Awards were presented to recipients at the Awards Luncheon:
 - * WMAO Distinguished Service Award - Jessica Glowczewski
 - * WMAO President's Service Award - Ohio Water Resources Center
 - * ODSO Best Maintained Dam Award (Property Owner Association) - Sunrise Lake Dam, operated by Sunrise Lake Board
 - * ODSO Best Maintained Dam Award (Conservancy District) - Rush Creek Structure No. 5-A, operated by Rush Creek Conservancy District
 - * ODSO Best Maintained Dam Award (Local Public) - Munroe Falls Lake Dam, operated by Metro Parks, Serving Summit County
 - * WMAO Peter G. Finke Science Day Award (7th-9th grade) - Jeremy J. DeMuth of Miller City Middle School in Miller City, Ohio
 - * WMAO Peter G. Finke Science Day Award (10th-12th grade) - Bluyé B. DeMessie of William Mason High School in Mason, Ohio
 - * Winner of the 2013 WMAO Scholarship - Jacob Cochran, a Senior at Heidelberg University.
- WMAO President, Peter Soltys, provided an overview on the Association's successes in 2013.
- WMAO Executive Board of Directors election was held during the annual membership meeting resulting in a change in leadership roles with the following members voted into office (see Page 10 for current Executive Board of Directors):
 - * Alex Covert – Vice President
 - * Greg Nageotte – Treasurer
 - * Stuart Ravary – Secretary
 - * Craig Smith – Director-at-Large.
- Changseok Han, University of Cincinnati, won the award of Best Poster with his presentation of “UV-visible/Visible Light Activated Nano-TiO₂ Photocatalysts for Water Treatment.”
- A closing panel discussed "Climate Smart Communities" with Kara Reeve (National Wildlife Federation), Corey Timko (French Creek Wastewater Treatment Facility), and Christine Kirchoff (University of Michigan).

Thank you to all who attended, the wonderful presenters, and the generous conference sponsors. We hope to see you at the WMAO 2014 Conference!



Taking Root
 A REGIONAL CAMPAIGN
 FOR REFORESTATION

Did you know that in the early 1800's Cincinnati and much of the nation was deforested? Regional leaders stepped up to reverse this situation. They led widespread reforestation campaigns that included the planting of Eden Park in 1882 by school children, the creation of Mt. Airy Forest and extensive replanting of trees in our Ohio, Kentucky and Indiana region.

Once again our tree canopy is threatened with devastating losses, now from the effects of the emerald ash borer, Asian long-horned beetle, diseases, development, and rising temperatures. Trees add enormous value to our lives by bringing environmental, economic, health and happiness benefits. They also improve our climate and reduce energy costs by sequestering carbon, providing shade and help storm water management. Imagine losing 30% of our trees in this region – a very real possibility.

WE NEED TO REFOREST FOR PRESENT & FUTURE GENERATIONS! TAKING ROOT is a collaborative, broad-based campaign to address the current historic loss of our region's tree canopy by planting trees, better managing our local forests, promoting the many benefits of healthy trees, and fostering a sense of stewardship among individuals and communities.

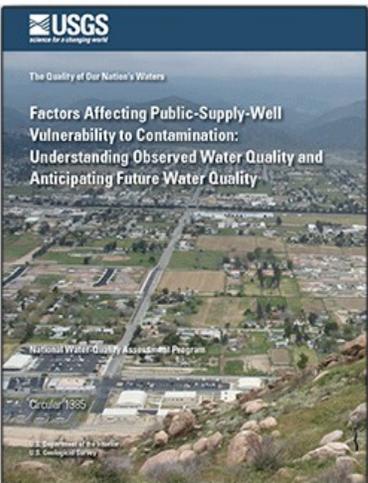
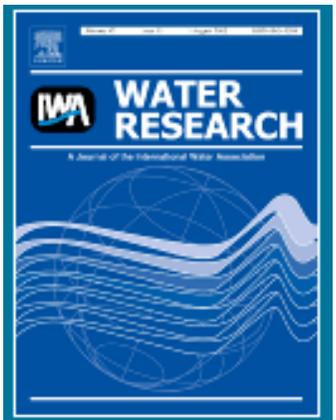
JOIN THE CAMPAIGN: Volunteer, Contribute, Plant trees

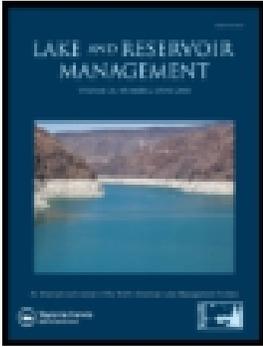
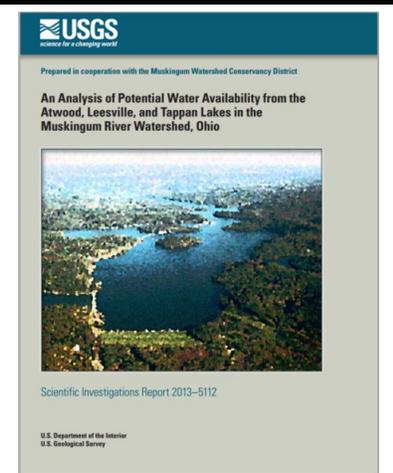
CONTACT: www.GreenUmbrella.org/TakingRoot

Phone: Jody Grundy 513-503-1536, Email: takingroot@greenumbrella.org



Publications

Title	USGS Publications	Title	Scientific Journals
<p>Factors affecting public-supply-well vulnerability to contamination: Understanding observed water quality and anticipating future water quality</p> <p>http://pubs.usgs.gov/circ/1385/</p>		<p>Comparative effectiveness of membrane bioreactors, conventional secondary treatment, and chlorine and UV disinfection to remove microorganisms from municipal wastewaters</p> <p>http://www.sciencedirect.com/science/article/pii/S0043135412003065</p>	 <p>Water Research, v. 46, no. 13, 2012, p. 4164–4178</p>

<p>Methods for estimating selected low-flow statistics and development of annual flow-duration statistics for Ohio</p> <p>http://pubs.er.usgs.gov/publication/sir20125138</p>	 <p>USGS science for a changing world</p> <p>Prepared in cooperation with the Ohio Water Development Authority</p> <p>Methods for Estimating Selected Low-Flow Statistics and Development of Annual Flow-Duration Statistics for Ohio</p> <p>Scientific Investigations Report 2012–5138</p> <p>U.S. Department of the Interior U.S. Geological Survey</p>	<p>Comparing rapid and culture indicator bacteria methods at inland lake beaches</p> <p>http://www.tandfonline.com/doi/full/10.1080/10402381.2013.789941</p>	 <p>Lake and Reservoir Management, v. 29, no. 2, 2013, p. 99–102</p>
<p>Microbial source tracking markers at three inland recreational lakes in Ohio, 2011</p> <p>http://pubs.er.usgs.gov/publication/ofr20121222</p>	 <p>USGS science for a changing world</p> <p>Prepared in cooperation with the Ohio Water Development Authority and Muskingum Watershed Conservancy District</p> <p>Microbial Source Tracking Markers at Three Inland Recreational Lakes in Ohio, 2011</p> <p>Open-File Report 2012–1222</p> <p>U.S. Department of the Interior U.S. Geological Survey</p>	<p>Predictive models for <i>Escherichia coli</i> concentrations at inland lake beaches and relationship of model variables to pathogen detection</p> <p>http://aem.asm.org/content/79/5/1676</p>	 <p>Applied and Environmental Microbiology, v. 79, no. 5, March 2013, p. 1676–1688</p>
<p>An analysis of potential water availability from the Atwood, Leesville, and Tappan Lakes in the Muskingum River Watershed, Ohio</p> <p>http://pubs.usgs.gov/sir/2013/5112</p>	 <p>USGS science for a changing world</p> <p>Prepared in cooperation with the Muskingum Watershed Conservancy District</p> <p>An Analysis of Potential Water Availability from the Atwood, Leesville, and Tappan Lakes in the Muskingum River Watershed, Ohio</p> <p>Scientific Investigations Report 2013–5112</p> <p>U.S. Department of the Interior U.S. Geological Survey</p>	<p>Comparison of filters for concentrating microbial indicators and pathogens in lake-water samples</p> <p>http://aem.asm.org/content/79/4/1342</p>	 <p>Applied and Environmental Microbiology, v. 79, no. 4, February 2013, p. 1342–1352</p>

WATER MANAGEMENT ASSOCIATION OF OHIO

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Dana Oleskiewicz, WMAO Administrator

www.wmao.org

The Water Management Association of Ohio (WMAO) is the one organization dedicated to all of Ohio's water resources.

VISION: The Water Management Association of Ohio will be the most effective and respected independent water resources organization in Ohio.

MISSION: The Water Management Association of Ohio promotes the comprehensive understanding, conservation and multifaceted use of Ohio's water resources.

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2014 WMAO Executive Board of Directors



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