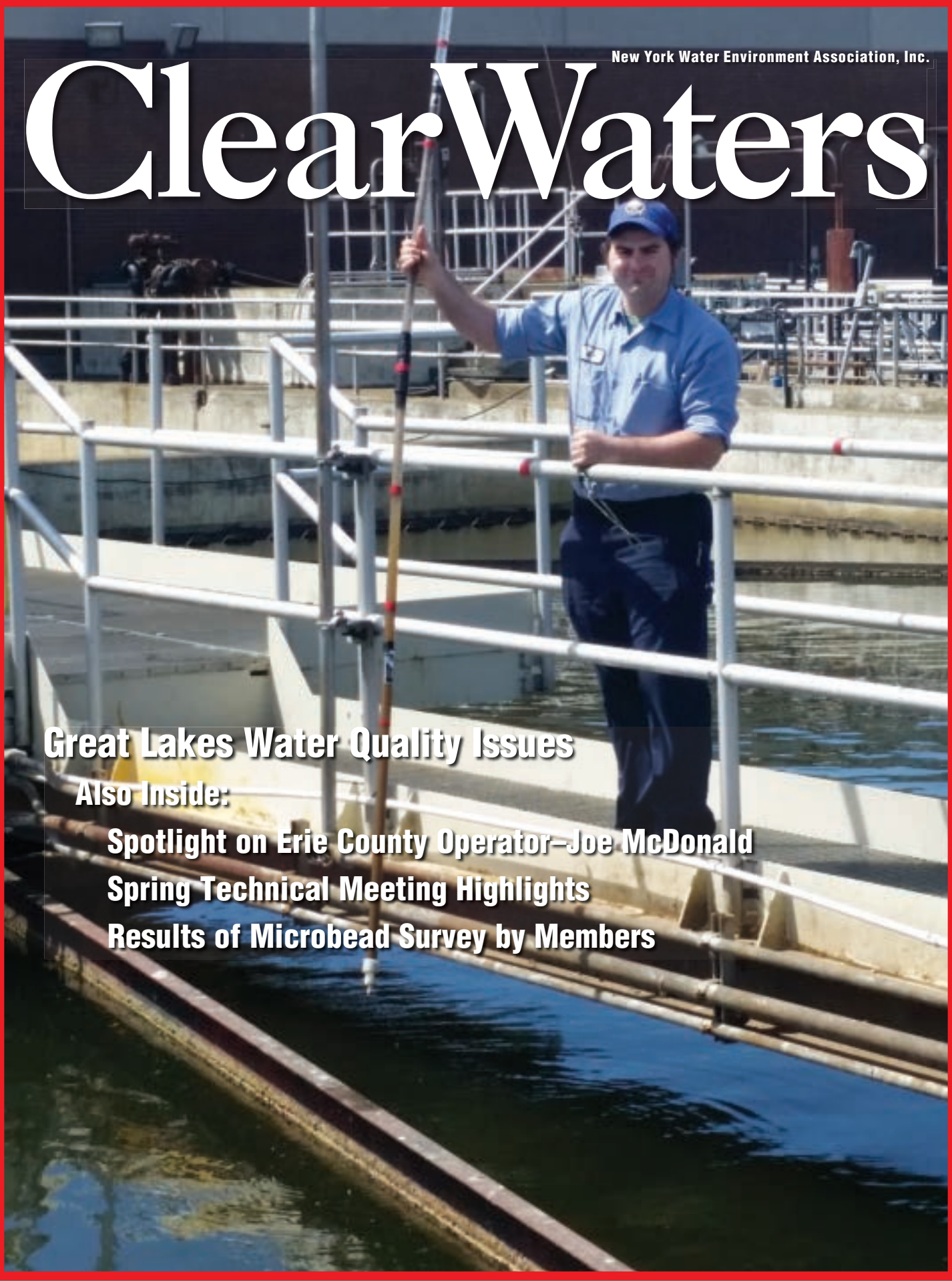
Summer 2015, Vol. 45, No. 2

New York Water Environment Association, Inc.

ClearWaters



Great Lakes Water Quality Issues

Also Inside:

- Spotlight on Erie County Operator–Joe McDonald
- Spring Technical Meeting Highlights
- Results of Microbead Survey by Members

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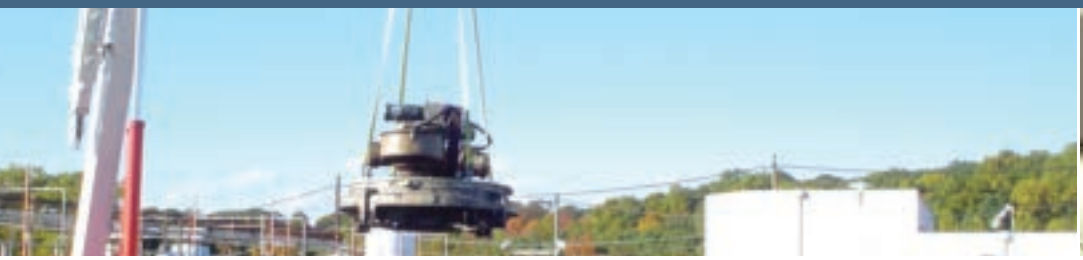

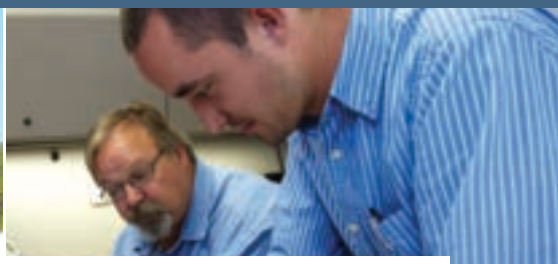

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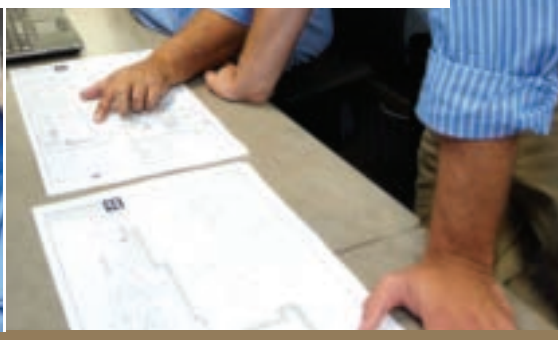

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Cover Image: Joe McDonald, an Erie County WWTP operator, is using a "sludge judge" to measure the height of solids in a bioclarifier. See the Operator Spotlight story, page 48.
Photo by Megan Kaszubowski (megan.kaszubowski@erie.gov)

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♻ **Clear Waters** ***is printed on recycled paper, using soy-based ink.***

President's Message | Summer 2015

Year of the Operator!

I'm pleased to report we are making great strides during NYWEA's Year of the Operator! The Year of the Operator has already received national mention in *Treatment Plant Operator* magazine. I'd like to recognize the ongoing efforts of Jonathan Ruff (City of Plattsburgh) and Billy Grandner (formerly NYCDEP) who lead the 12-member Operator of the Future Task Force. The task force is surveying operators as well as plant managers to understand firsthand their thoughts and opinions on how we can attract new and retain existing operators. I look forward to the task force white paper this fall. I'm pleased to report that NYWEA's 2015–2016 budget includes funding for new scholarships specifically for operators.

I had the pleasure of moderating the Operator Panel during the Spring Technical Conference Opening Session where we heard from operators (representing small, medium and large plants and collections systems) about what inspired them to enter the profession, the daily challenges they face, and opportunities for growth and development on the job.

I'm sure you've noticed the covers of this year's *Clear Waters* magazine and conference programs have prominently featured operators in keeping with my commitment to celebrate the dedication and diversity of operators across the state.

WEF/NACWA Fly-In to Washington DC

In April, I attended the National Water Policy Forum, Fly-In and Expo in Washington, DC along with Patricia Cerro-Reehil (NYWEA Executive Director), Steve Fangmann (D&B Engineers & Architects) and Drew Smith (Monroe County DES). We pounded the pavement and pressed the flesh, meeting with the offices of 10 congressional representatives and senators! Our message to them was to support important legislative items, such as increased funding for the Clean Water State Revolving Fund, Water Infrastructure Finance and Innovations Act, as well as Integrated Water Resources Planning. It was my distinct honor to introduce Representative Paul Tonko (D-NY 20th District) at the Water Week 2015 Congressional Reception. Rep. Tonko has been a steadfast advocate for our water industry at both the state and national levels.

Legislative and Regulatory Dialogue

In early May, a well attended annual Legislative and Regulatory Dialogue was held in Albany. We heard from Senators Tom O'Mara and Marc Panepinto, as well as Assemblyman Steve Englebright. Four technical sessions were conducted on relevant topics, including water infrastructure funding, drug take-back programs, nutrients management and municipal stormwater management. I am grateful for the hard work of the Government Affairs Committee and its chair, Boris Rukovets, in preparing for this event.

WEFMAX Meeting in Quebec City

In late May, I had the unique opportunity to attend the annual WEFMAX meeting in beautiful Quebec City along with Patricia Cerro-Reehil and John Fortin (WEF House of Delegates). We were inspired by WEF President Ed McCormick's opening remarks concerning "Utilities of the Future" transforming waste resource recovery facilities into sustainable and financially viable "green factories," as well as the importance of water professions worldwide. Patricia and I presented NYWEA's success story on financial management which was well received by the WEF Member Associations (MAs) from across North America. I am very grateful for Réseau Environment's hospitality. It was a great opportunity to network with other MAs and catch up with friends, especially close colleagues from NEWEA and NJWEA.

Annual Spring Technical Conference

Despite the inclement weather, our annual NYWEA Spring Technical Conference at the Sagamore Resort on Lake George got off to a fun start. I'd like to extend many thanks to those who came that Sunday evening for the live musical entertainment at Mr. Brown's Pub. Monday's Opening Session included presentations from Mark Klotz (NYSDEC), David Wick (Lake George Park Commission) and Tim Burns (NYSEFC). Tuesday's events included the Operator Challenge Team Competition in the exhibit hall. The success of the event was made possible through the hard work of the coordinators and judges. Congratulations to the **Brown Tide** and **Met Chapter Jamaica Sludge Hustlers –** the Operator Challenge teams that took first and second places, and will compete at WEFTEC in Chicago, September 26–30. Kudos also go to Maureen Kozol of NYWEA for creating a very effective Guidebook application, allowing users to go paperless throughout the conference. Many thanks go to the Capital Chapter for hosting a hospitality suite Tuesday night. Finally, personal thanks to conference management co-chairs, Dave Barnes and Joyette Tyler, for their behind-the-scenes efforts to make the Spring Technical Conference an overwhelming success!

Hot Topics

There are a number of state legislative matters that are and will be areas of focus and attention for the Association and its Government Affairs and Utility Executives committees. They include proposed changes to disinfection, microbeads ban, remote net metering, paint stewardship, and the tax cap. Once again, I would like to acknowledge the Government Affairs Committee, including Boris Rukovets (chair), Bill McMillen (vice chair) and Libby Ford for their hard work, dedication and tenacity on these impactful legislative matters. I created a Disinfection Task Force for an in-depth look at the operational and financial impacts of the Total Coliform Rule of the Safe Drinking Water Act.

Congratulations to Past President and Water Ambassador Rich Lyons (Albany Sewer District) and Utility Executive Committee Chair Dave Comerford (Buffalo Sewer Authority) on their impending retirements from public service.

Looking Ahead

Mark your calendars for the Annual **Watershed Science and Technical Conference**, September 9 at the Hotel Thayer in West Point. Make sure you join us there!

Michael J. Garland, PE
NYWEA President

Getting More Operators to Pass Exams

The transition of the Wastewater Operator Certification Program from NYSDEC to NYWEA took place in 2011. Since then, we have reported monthly to the Wastewater Operator Certification Governance Council the important statistics regarding how many new operators become certified, how many are processed for testing, how many renewal applications come in and, most important, how many people take the test and fail the exam. As it turns out, the failure rate is quite high – more than you might think. Tanya May Jennings, the NYWEA Operator Certification Administrator, has compiled a summary report given to us by the Association of Boards of Certification. For the big picture, during the timeframe 2011 to present, a total of 761 people took certification exams. During the same time period, for Grades 1-2A, of 440 people who took the exam, 26.3% failed; for Grades 3-4A, of 321 people who took the exam, 52.3% failed. These are striking statistics which beg the question, "What are we doing wrong?" This leads to the question, "What can we do to help more operators pass?"

The members of the NYWEA Operator Certification Governance Council are looking at this situation and will be making recommendations on how to correct this. In this declared Year of the Operator, NYWEA needs to do everything in its power to reverse this statistic.

Surveys Help Us Do Better!

Thank you to all of the operators who took the time to fill out the survey that was recently circulated. Based on survey feedback, the Operator of the Future Task Force will make recommendations and specific actions to overcome challenges. NYWEA leaders will also look at these statistics to help our organization plan accordingly for the future as we head into a strategic planning/visioning session to cover the timeframe 2017–2019.

It's the season of surveys, so please bear with us and give freely of your input, as surveys help us to answer important questions and, in general, help us improve our programs. Another recent survey where NYWEA members had a great impact was regarding microbeads. See page 26 for the article by Lemuel Srolovic and Jennifer Nalbone of the Office of the Attorney General that covers the results of NYWEA members assisting in sampling wastewater effluent to detect the presence of microbeads. Many thanks go out to Jen of the OAG who reached out to us for assistance. Additional appreciation goes out to our members who took the time to perform water sampling and answer the questions!

There's one final survey coming down the pike on the subject of flushable wipes. We hope to share the results of that survey which we hope will lead to a call to action for change!

100th Anniversaries and Retirements

NJWEA's Executive Director Jack Lagrosa presents NYWEA Executive Director with an award of appreciation for NYWEA's Gold Sponsorship support as NJWEA celebrated their 100th Anniversary.

I recently had the privilege of attending NJWEA's 100th Anniversary celebration in Atlantic City, NJ and saw firsthand what its annual meeting was like. It was something special! Like the NY Section American Water Works Association's 100th Anniversary, the historical section of the exhibit hall was spectacular and gave the membership a real sense of how far water quality management has come in 100 years. As NYWEA embarks on its 88th Annual Meeting, our leaders have 12 years to plan for our organization's 100th Anniversary!

Several NYWEA Water Ambassadors and members attended a retirement party for Richard J. Lyons in Albany in June. We presented Rich with a proclamation and acknowledged his service to the Association. Fortunately, Rich is going to stay an active member of NYWEA and, for that matter, stay employed part-time with the Albany County Sewer District. We look forward to seeing and hearing more from Rich "Doc" Lyons!

NYWEA's Water Ambassadors (Past Presidents) that were in attendance for Richard Lyons' retirement (l-r): Bruce Munn, Mark Koester, Richard Lyons, Patricia Cerro-Reehil (Executive Director), Bob Kukenberger and Keneck Skibinski

This issue is devoted to the Great Lakes, where nearly 80 percent of New York's fresh surface water is contained. We hope you find the articles educational and informative. Many thanks to Theresa Baker for the suggestion to cover the theme of the Great Lakes!

Here's wishing you all a wonderful Summer!

Patricia Cerro-Reehil
pcr@nywea.org

How Would You Like to Be NYWEA President in 2019?

If you are interested in a long-term, career-enriching opportunity, please consider applying for this important position. Being an officer is a rewarding experience, but it is also a commitment of five years (Vice President–Elect, Vice President, President–Elect, President, Immediate Past President). When reviewing applicants, the Nominating Committee will take the following items into consideration (no one is expected to have all of these items in their resumé):

- Leadership skills
- Vision and managerial skills
- Active and viable state committee chair
- Active and viable state committee involvement
- Continuous membership tenure greater than 7 years
- NYWEA award recipient
- Chapter endorsement (in writing)
- Chapter representative
- Active member of Chapter Executive Board
- Chapter officer
- Regular attendance at state meetings
- WEF Board of Directors service

Please submit an electronic resumé with a cover letter that highlights any of the attribute areas above to: Patricia Cerro-Reehil, Executive Director, NYWEA, 525 Plum Street, Suite 102, Syracuse, NY 13204 • Phone 315-422-7811 • Fax 315-422-3851 • Email pcr@nywea.org

NOMINATION DEADLINE IS AUGUST 7, 2015. ALL MEMBERS ARE ELIGIBLE TO APPLY!

The Sagamore, Bolton Landing, NY

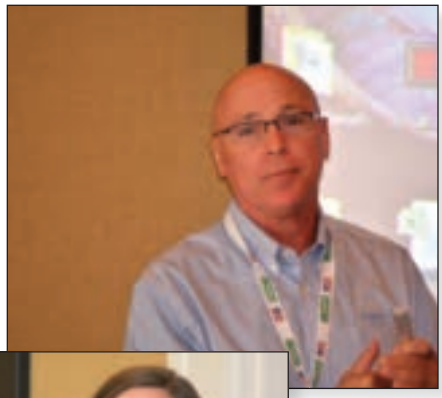
Highlights of Spring Technical Conference & Exhibition

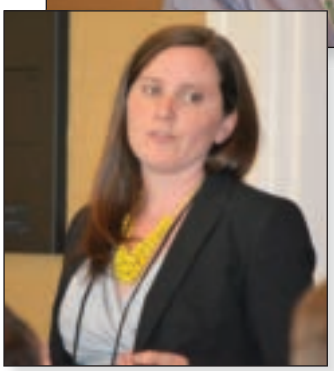
NYWEA President Garland speaks about the Operator panelists' willingness to learn, their ability to adapt and their pride in performance.

Mark Klotz, director of the Division of Water, addresses NYWEA members during the Opening Session of the Spring Meeting.

Timothy Burns of NYSEFC discusses funding opportunities available.

Matt Wilson of MWH Global speaks about sewer separation in Cambridge, MA.





Above: Randy Ott of G.P. Jager moderates Session 6 on Plant Operations.

Tara Dougherty of CRA talks about plant hydraulics at Brewerton, NY, WWTP.

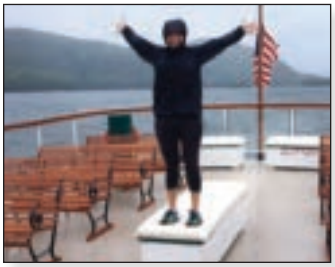
David Wick, executive director of the Lake George Park Commission, gives NYWEA members an update on the water quality protection of Lake George.

Robert Albright (left), chair of the Collection Systems Committee, awards Richard Crescenzo with the Golden Manhole Award.

Peter Radosta and Silvia Marpicati chat during a break.

Jake Miller from the Long Island Brown Tide Operations Challenge team

President Mike Garland and his band, Boss Tweed, entertain members during a memorable and fun President's Reception.



Left: Erin Cunningham illustrates she has the entire top deck of the Morgan to herself during the cold and rainy trip out on Lake George!

Right: Despite the cold, wet rainy weather, NYWEA members enjoyed their time spent in the Adirondacks!

Op Challenge 2015

The Opening Session "Year of the Operator" panel discussion featuring (l-r): J. Kirk Rowland, Vince Cordi, Kevin McCormick, Steve Peletz and Donna Bee

President Garland thanks the Operations Challenge team participants, judges and coordinators for their efforts.

Brown Tide member, Alec Breen, concentrates on the task at hand during the Operations Challenge competition. Brown Tide won First Place!

Cinar Akman, right, is inducted into the Select Society of Sanitary Sludge Shovelers by the Operator in Chief, William Grandner.

Teams respond to the Operations Challenge interesting and fun live questions event.

Robert Wither during the Operation's Challenge "Live" event

Donna Hagar, left, is inducted into the Select Society of Sanitary Sludge Shovelers by the Operator in Chief, William Grandner.

Donna Bee (left), NYWEA Operator Representative on the Board and Tanya Jennings, NYWEA Operator Certification Administrator

(L–r): Maggie Hoose, Christina Fortin, Tamara Spills and Maureen Kozol

Left: Joe Brilling prepares a slide to place under the microscope during the Public Outreach session – Rotifer included!

Fred Falleson, center, of Falleson Associates explains dewatering and stormwater equipment to 8th grade class members from Glens Falls.

Water Views | Summer 2015

Treasuring our Great Lakes

Our treasured Great Lakes are one of the largest freshwater ecosystems on Earth. New York State is fortunate to have a 700-mile "north coast" along Lake Ontario, Lake Erie and the St. Lawrence and Niagara Rivers. More than a third of New York is part of the Great Lakes watershed.

Historic discharges of PCBs and other persistent toxic contaminants have fouled this ecosystem. Nutrient pollution was such that at one time Lake Erie was designated as "dead." Since the early 1970s, tremendous progress has been made to restore the water quality and eco-system health of the Great Lakes basin. With the comprehensive Great Lakes Restoration Initiative, progress accelerated dramatically, though much work remains. For our part, New Yorkers are implementing numerous restoration projects and have developed an exciting Action Agenda to propel further progress.

In Lake Ontario, for example, numerous sources of toxic contaminants have been remediated, lowering levels of contaminants in fish and wildlife. In 2015, fish consumption advisories were relaxed for five sport fish species, and lake sturgeon and bald eagles have returned. Additional projects are managing certain invasive species outbreaks.

Excess nutrient phosphorus levels in some near-shore portions of Lake Ontario, with associated algae blooms, remain a problematic issue. At the same time, levels of phosphorus in the offshore waters have declined dramatically and, in some instances, may be deemed to be too low. Research and assessments are underway to better understand and address the sources and ecological dynamics of this problem.

In Lake Erie, environmental cleanups and restoration are helping to drive urban re-development along the Buffalo River corridor, Buffalo's harbor, and the lake's greater shoreline. Approximately 1 million cubic yards of contaminated sediment have been removed from the Buffalo River, and 15 habitat projects are in progress. The Buffalo Sewer Authority is implementing a long-term program to significantly reduce CSO discharges, and the Western NY Stormwater Coordinating Committee, which collaborates among county and municipal governments and sewer authorities, is improving the management of polluted runoff and implementing green infrastructure throughout the region.

The Great Lakes are dynamic systems. As conditions change, new challenges arise. Harmful and large scale algal blooms have returned to western Lake Erie along the coasts of Ohio and Michigan. The increasingly severe and fluctuating weather associated with climate change needs to be understood and managed as best as possible. Invasive species and their spread (e.g., the risk of Asian carp), pose almost an existential threat to today's Great Lakes. Funding for clean water infrastructure remains a critical concern, as are the numerous contaminated toxic sites that also remain.

Current and future work to restore the Great Lakes will require more partnerships and collaboration. Under the Action Agenda framework, NYSDEC is seeking the participation of stakeholder work groups to develop sub-basin watershed work plans and to implement projects toward bringing our Great Lakes "all the way back."

Get involved at: *http://www.dec.ny.gov/lands/91881.html.*

– James Tierney, Assistant Commissioner for Water Resources
NYS Department of Environmental Conservation

Focus on Safety | Summer 2015

Lone Worker Safety

Working at a water treatment plant isn't office work from 9 to 5. Water treatment is 24/7 and a lot of that 24 is when no one else is around. This can mean that operators at certain times can find themselves working alone or isolated physically from other workers at the site. These operators are considered "lone workers" and they have many of the same challenges as a crew, but also some very unique ones. Nonetheless, lone workers should have the expectation of the same level of safety as those who work "traditional" hours or in a group setting.

It should be no surprise that each employer is responsible for identifying workplace hazards and assessing risk. This is normal operating procedure. However, with lone worker safety, sometimes the operational risks or their severity may change with the time of day, the worker's experience level, physical location, and type of work undertaken. The risk assessment may reveal that the level of risk, while perhaps acceptable in a crew situation, is unacceptably high for the lone worker. This would lead to additional assessment and problem-solving to determine alternatives and whether additional precautions should be taken to further reduce or eliminate the risk. Care must be taken, however, to avoid the complacency of categorizing a risk as unavoidable. In most cases, these risks may be foreseen and prevented. It is the reluctance of making the effort, paying the cost, or having the imagination which can label a hazard "unavoidable." Once the hazards are identified and their risks assessed, all efforts should be made to eliminate the risk from as many hazards as possible, and then to control the remaining risk. If the risk cannot be eliminated, it must be controlled by using the hierarchy of controls: engineering control, administrative control and, lastly, personal protective equipment.

Additionally, some operations have instituted a "check-in" procedure that requires lone workers to call into a center or service on a regular basis, with the interval being tied to the level of risk that the worker is exposed. Other facilities use a "man down" device that may automatically send a trouble alarm if the worker hasn't moved in a defined interval, or a worker-initiated panic alarm. Keep in mind, however, that a mobile phone is not a sufficient safeguard in itself.

Each of these steps needs to be documented and then reviewed periodically by both the leadership of the organization and the workers. These safety steps need to be maintained as a living document and communicated to the workers. The ultimate reason for this process is to convey the important message that all employees are valued – whether they work a 10 am shift or by themselves at 10 pm – and that management is interested and invested in their well-being.

– Eileen M. Reynolds, Certified Safety Professional
Owner, Coracle Safety Management

Lake Ontario Lakewide Management – Historical and Transitioning Roles

by Aisha M. Sexton-Sims and Frederick J. Luckey

Lake Ontario, translated in the native language of the Iroquois/Haudenosaunee as "beautiful lake," is the largest source of fresh water in New York State. The last lake in the chain of Great Lakes, it is the smallest of the five lakes in terms of surface area. Nonetheless, it is a treasured resource providing over 8 million people with drinking water, supporting substantial commercial and recreational fisheries, and providing abundant recreational boating opportunities, fishing and swimming, tourism, hydropower generation and a valuable maritime transportation network. The surface area of the lake is 18,960 km^2 (7,340 mi^2), but the drainage area is 64,000 km^2 (24,720 mi^2), giving it the highest ratio of watershed area to lake surface area among the Great Lakes.

The lake ecosystem supports a rich variety of aquatic and terrestrial biota, but it has seen major changes over the last century. By the 1960s and 70s, a significant decline in the lake's water quality and ecology occurred due to over-fishing, lake level controls, habitat loss, invasive species (e.g., sea lamprey and alewife), high phosphorus loading, and contaminants from industrial, agricultural and residential sources around the basin. Hence, there was a great need to take action on both sides of the lake to restore its ecosystem.

The Great Lakes Water Quality Agreement (GLWQA) between the US and Canada established the cornerstone plan of the governments to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes. Annex 2 of the agreement requires the development and implementation of the Lakewide Action and Management Plan (LAMP) for each of the great lakes. The GLWQA has undergone several amendments from its inception in 1972 to its most recent change in 2012. Those amendments have defined and reformed the roles of the LAMP. Meanwhile, its functions continue to evolve.

Roles of the Lake Ontario LAMP of 1987 versus LAMP of 2012: The LAMP was first established in Protocol Amendments to the

Image by Environment Canada

Lake Ontario Drainage Basin

GLWQA in 1987 to reduce critical pollutant loadings to restore lakewide beneficial uses through a comprehensive ecosystem approach. The roles of the 1987 LAMP were to define the problems caused by critical pollutants, to determine the total loadings of pollutants and to define the reductions necessary to meet the terms of the GLWQA. Remedial actions were then to be identified and implemented. Finally, the LAMP was to document that critical pollutants are no longer a cause of beneficial use impairments, such as degraded fish and wildlife populations and fish consumption advisories.

Over several decades, the lakes have seen many improvements and yet a large number of challenges persist. Environmental concentrations of critical pollutants, such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and mercury have seen major declines due to regulatory and voluntary controls. However, due to their persistence in the environment, they still exist in the lakes at levels of concern that warrant fish consumption advisories. Reductions of phosphorus inputs through the use of phosphorus-free detergents, improved municipal waste treatment facilities and agricultural management practices succeeded in meeting earlier GLWQA targets for phosphorus levels in Lake Ontario. However, in recent years, reports of eutrophication problems in the nearshore zone (region of land extending seaward from the shoreline to the open lake) have increased. Although the cause of this apparent increase is not well understood, increased nutrient loadings to the lake and invasive mussel impacts are suspected to have a role. But while the nearshore zone appears to have nutrient over-enrichment, the open lake may not be able to tolerate further reductions in nutrients without negative impacts on the fishery. These complex nutrient transport and cycling relationships pose significant management challenges. Since the LAMP plays a critical role in meeting the challenges of changing conditions in the lakes, it must adapt to those challenges.

The 2012 GLWQA charged all the LAMPs with establishing Lake Ecosystem Objectives that would apply to all reports and assessments on the state of Great Lakes waters and priorities for taking management actions on threats to each lake. The LAMPs are also charged with developing and implementing lake-specific binational strategies to address substance objectives, and developing an integrated nearshore framework for each Great Lake. In addition, added emphasis has been given to the connecting channels, in the case of Lake Ontario, the Niagara River (major inlet to Lake Ontario) and the St. Lawrence River (major outlet to Lake Ontario). The 2012 GLWQA and LAMP also expands the involvement of cooperating entities, such as indigenous peoples of both the US and Canada, municipal governments, watershed management agencies and local public agencies.

The GLWQA of 2012 reflects the new challenges to the Great Lakes ecosystem and, thus, major changes to the LAMP. This includes a focus much broader than critical pollutants to include concerns such as nutrient over-enrichment in nearshore waters, restoration of native fish communities and native species, reduction of the impact of aquatic invasive species and conserving critical habitats. These changes in the scope of LAMP priorities reflect the progress achieved to date as well as more recent issues of concern.

Multi-partner collaboration is essential in restoring the Great Lakes. The LAMP serves as the overall binational planning process to address lakewide problems requiring coordinated binational actions. The LAMP partnership's major role is to assist in planning and coordinating resources among multiple partners and existing government programs to restore the Great Lakes ecosystem.

Accomplishments of Lake Ontario LAMP

Since its inception in the 1980s, the Lake Ontario LAMP has made great strides in restoring and protecting Lake Ontario's ecosystem by coordinating binational efforts to address environmental impairments. The pace of progress has accelerated with Congress's approval of the Great Lakes Restoration Initiative (GLRI) in 2010. To date, New York State received more than $114 million in GLRI funds that were provided to non-governmental organizations (NGOs), local governments and federal partner agencies for restoration actions. On the Canadian side, the government of Canada and the province of Ontario have an agreement in place, the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (2014), to implement the GLWQA. The active involvement of federal, state and provincial government agencies, tribal governments, academic institutions, NGOs, local governments and stakeholders on both the US and Canadian sides of the lake is essential to achieve success in Lake Ontario.

The following are some examples of the binational progress achieved by the Lake Ontario LAMP.

continued on page 12

Public Domain - http://epa.gov/greatlakes/image/index.htm

The Lake Guardian is the USEPA's largest research and monitoring vessel on the Great Lakes.

Public Domain - http://epa.gov/greatlakes/image/index.htm

The box corer, a device for extracting sediment samples from the bottom of the lake to find contaminants, is shown being lowered.

continued from page 11

Bioaccumulative Contaminants: Much of the early work of the LAMP focused on controlling sources of bioaccumulative contaminants responsible for fish consumption advisories, such as PCBs and mercury. Special contaminant source trackdown efforts along streams and tributaries, coupled with computer contaminant loading models able to predict fish tissue contaminant concentrations, helped develop a comprehensive understanding of this complex issue. This work showed that the majority of contaminants of concern entering Lake Ontario originated from the highly industrialized Niagara River area and the upper Great Lakes. The Binational Niagara River Toxics Management Plan provided the main planning mechanism to track progress in controlling these contaminant sources:

- By 2012, loadings of PCBs, DDT, mirex and chlordane to the Niagara River from hazardous waste sites were reduced by more than 90 percent from about 700 lbs/day in 1988, to less than 50 lbs/day in 2012.
- Controls implemented in the 1990s to direct dry weather wastewater from the unlined Falls Street Tunnel industrial sewer to the Niagara Falls wastewater treatment plant also significantly reduced bioaccumulative contaminant inputs to the Niagara River and Lake Ontario.
- Over the same time frame, PCB concentrations in Lake Ontario lake trout decreased by about 75 percent. Reductions were seen in other contaminants as well. New York State fish consumption advisories were relaxed in 2014 to reflect these overall environmental improvements.
- Computer modeling indicates that current Lake Ontario fish tissue PCB concentrations are controlled by historical PCB loadings that now reside in the bottom sediments throughout the lake. Current PCB loadings from tributaries and other sources have only a very minor bearing on fish concentrations. Fish tissue PCB concentrations are expected to continue to decrease as the ecosystem slowly eliminates these contaminants through deep burial, volatilization and other chemical and biological processes.

Biodiversity Conservation Strategy: In 2011, the LAMP, working with US and Canadian stakeholders, developed a binational biodiversity conservation strategy (BCS) that identifies priority actions needed to conserve the Lake Ontario ecosystem, such as protecting fish spawning habitat, critical wetlands and migratory bird habitats. The BCS identified 24 priority action sites and five program focus areas that are key to conserving and restoring biodiversity in Lake Ontario. The strategy also serves as a tool that the various involved entities may use to leverage funding in their efforts to restore the lake. Dozens of projects are currently being implemented in the priority action sites to meet the BCS objectives. The LAMP is working to update the strategy and identify further needed actions.

Fish and Wildlife Restoration: Lake Ontario fisheries have been altered by over-fishing, damming of tributaries, pollution of nearshore waters, and the impacts of invasive species. Restoration of naturally reproducing native species is a major goal of the LAMP and the Great Lakes Fishery Commission. There are several notable examples of progress:

- **Lake Trout –** More naturally reproduced lake trout were caught in 2014 than in any of the previous survey years going back more than 30 years.
- **Deepwater Sculpin –** This important source of food for lake trout was rare by the 1960s and none were caught from 1973-1995. Today, deepwater sculpin have rebounded and are now being caught in high numbers.
- **Lake Sturgeon –** Stocking, habitat studies and monitoring efforts are underway in the St. Lawrence, Genesee and Niagara rivers. The survival and condition of stocked fish have been good and it appears that they are on the trajectory for recovery.
- **Deepwater Ciscoes (bloater) and Lake Herring –** Bloaters, once considered extirpated from Lake Ontario, were re-introduced beginning in 2012 with nearly 98,000 stocked to date in Ontario and US waters. Lake herring have also been stocked into Irondequoit Bay (near Rochester, NY) for three consecutive years in efforts to restore spawning populations there. The restoration of native prey fish populations, such as herring and bloaters, will play a key part in restoring natural reproduction of trout and salmon.

Source: USGS (nonproprietary)

Lake herring were stocked into Irondequoit Bay for three consecutive years 2012–2014.

New Challenges

There is much to celebrate in the restoration efforts of Lake Ontario, but significant challenges remain and must be addressed to continue the momentum of progress.

Lake Level Controls (Plan 2014): Lake Ontario water levels have been controlled by the Moses Saunders Dam on the St. Lawrence River since 1958 to prevent flooding and allow for navigation. These controls reduced the natural range of water fluctuations, resulting in the degradation of coastal wetland communities. A new regulation plan, known as Plan 2014, is currently under consideration by the US and Canadian governments. The plan would help restore more than 64,000 acres of coastal wetlands by allowing more natural hydrologic conditions to support native wetland plant seed germination and growth. If Plan 2014 is approved, coastal wetland indicators adopted by the Lake Ontario LAMP can be used to track the effects of water level fluctuations on coastal wetlands in the lake and river.

Invasive Species: New species of aquatic invasive species (AIS) are introduced to the lake through discharge of ballast water from ships, hull and equipment fouling, and canals. Other transport pathways include recreational or work vessels that inadvertently carry invasive species between local waterbodies and through the aquarium trade. Despite regulatory measures in some jurisdictions, the spread of invasive species continues. Prior to the early 1990s, the sea lamprey was the main invasive species of concern. Sea lamprey can decimate trout and salmon populations. They have been controlled by the Great Lakes Fishery Commission through the use

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Source: Great Lakes Sea Grant Network Exotic Species Graphics Library, http://epa.gov/greatlakes/

Prior to 1990s, the sea lamprey was the main invasive species of the Great Lakes, but it is now controlled effectively by the Great Lakes Fishery Commission.

Source: http://nas.er.usgs.gov

The Lake Guardian is the USEPA's largest research and monitoring vessel on the Great Lakes.

of lampricides (pesticides selective to lampreys), barriers and traps, and still require ongoing control measures. Zebra and quagga mussels arrived in the early 1990s, transforming the lake's aquatic food web in a few short years as they altered the way nutrients moved through the food web. These changes have had negative impacts on water quality and fish populations. Invasive, predatory zooplankton has also altered the food web.

Besides regulatory measures, there are some methods to control AIS. Early Detection/Rapid Response (ED/RR) is a method that establishes prevention zones in areas of high ecological value. Seasonal monitoring protocols are implemented near the prevention sites for early detection. If an AIS is detected, rapid response and immediate control efforts are implemented to help prevent the AIS from becoming established in the prevention zone. This method is currently being used in several coastal wetland and embayment areas around Lake Ontario.

Nutrients: Although nutrient concentrations are below target levels in the open lake and have been stable for more than a decade, the apparent incidence of nearshore eutrophication problems has increased. It is thought that the invasive mussels may be focusing nutrients into the lake bottom sediments, promoting the growth of algae/cladophora (green algae). Controlling nutrient sources within Lake Ontario's watersheds and understanding the relationship of nutrient loadings from the tributaries and Lake Ontario's nearshore waters is a high priority.

The development of the LAMP's Nearshore Framework, called for in the 2012 GLWQA, will assess the condition of the nearshore waters, identify factors and cumulative effects causing stress to the nearshore, and establish priorities and collaborative partnerships for improving water quality and ecosystem health in nearshore areas. Intensive nearshore research conducted in 2008 and 2013, as part of Lake Ontario's Cooperative Science and Monitoring Initiative (CSMI), as well as the monitoring efforts of other entities, will contribute to understanding the Lake Ontario nearshore. Data from these monitoring efforts can subsequently be used in a nutrient modeling framework, as required in Annex 4 of the 2012 GLWQA to establish and implement nutrient objectives, loading targets and allocations by country.

Though Lake Ontario is faced with new challenges on a regular basis, the LAMP is in a position to respond to those challenges because it is an adaptable plan that works with various governmental, non-governmental and stakeholder entities to address emerging issues as they arise. The 2012 GLWQA charged all of the LAMPs to address the issues of today, but as the ecosystems of the Great Lakes evolve, we can expect the LAMPs to follow suit.

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Great Lakes Water Levels: Monitoring Change in Earth's Largest Surface Freshwater System

by Andrew D. Gronewold, Anne H. Clites and Laura Rear-McLaughlin

The Great Lakes, their connecting waterways and their watersheds, comprise the largest surface freshwater system on Earth. They are a dominant physical feature of North America and form part of the political boundary between the United States and Canada. The Great Lakes contain nearly 20 percent of the world's fresh surface water and have a coastline longer than the east or west coast of the US. One-third of the North American population lives within the Great Lakes watershed. The lakes provide drinking water to 40 million people as well as abundant aquatic recreation and natural beauty.

Coastal regions along the Great Lakes are impacted by lake level changes. The lakes rise and fall in regular seasonal patterns corresponding with rainfall, snow melt, and evaporation. Changes in the water levels of these inland seas impact environmental systems and basin residents across a broad spectrum of time and space scales. Storm events can result in short-term storm surge conditions threatening lives and property, sometimes with little warning. In addition to the annual pattern of rise and fall, periodic changes in regional precipitation and evaporation rates can lead to very high or low Great Lakes water levels that may last for many years. These periods of extreme water levels are very hard to predict. Long periods of low water levels cause difficulty for commercial shipping, recreational boating and hydropower concerns. High water levels lead to coastal erosion, flooding, and increased damage due to storm events.

Water Level Monitoring Network

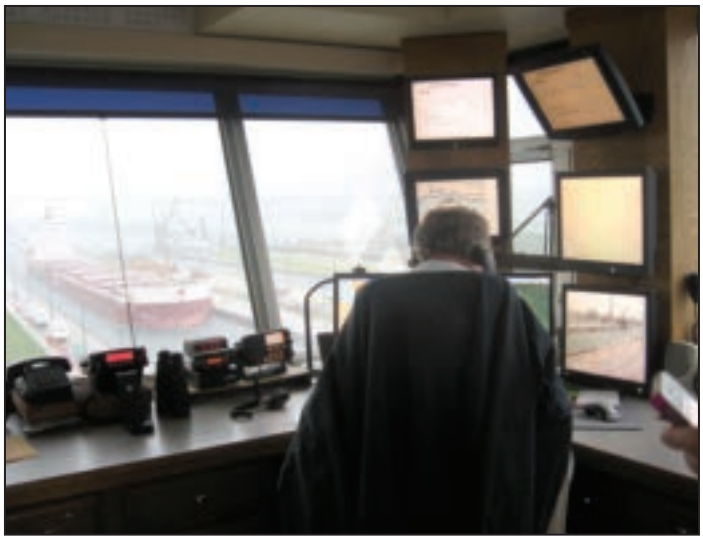
The water levels of the Great Lakes and the flows in the connecting channels between them are monitored, analyzed and forecast by an international network of federal agencies including the National Oceanic and Atmospheric Administration (NOAA), the Army Corps of Engineers, the US Geological Survey, Environment Canada, and Canada's Department of Fisheries and Oceans. Seasonal six-month forecasts for Great Lakes water levels are a collaborative effort between the Army Corps of Engineers and Environment Canada. The effort that goes into the collaboration underscores the fact that the Great Lakes system is significant far beyond the borders of its watershed.

Monitoring Great Lakes water levels is an important part of NOAA's mission to understand and predict changes in climate, weather, oceans and coasts. Great Lakes water level data constitutes one of the longest high quality hydrometeorological data sets in North America, with the United States' reference gauge records beginning in 1860. The US Great Lakes water level monitoring network of 53 water level recording stations is maintained by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), part of the National Ocean Service. The Canadian Hydrographic Service (Department of Fisheries and Oceans) maintains an additional 35 stations on Canadian shorelines. These data sets are critically important for international navigation, planning for coastal development, monitoring regional climate change, and improving seasonal water level forecasts.

NOAA CO-OPS Great Lakes stations record a three-minute water level average every six minutes. Data is available at the CO-OPS website (http://tidesandcurrents.NOAA.gov/map/) at six-minute, hourly, daily, and monthly intervals. Primary features of a NOAA water level station in the lakes include a valve-controlled intake pipe into a "stilling" well or sump, data collection platforms, and GOES (Geostationary Operational Environmental Satellite) antenna for data transmission. Many of these stations also include meteorological sensors such as wind speed, air and water temperature, barometric pressure, and relative humidity.

NOAA/Great Lakes Environmental Research Laboratory

NOAA water level station at Mackinaw City, MI



NOAA/GLERL

US Army Corps of Engineers lock master uses NOAA water level data to guide freighter traffic through the St. Marys River locks at Sault Ste. Marie, MI.

Historical Great Lakes Water Levels

It is important to recognize the magnitude of water level variability along the Great Lakes coastline in the context of that experienced on other US coasts. Great Lakes coastal residents have historically adapted to water level fluctuations through internationally coordinated water resources management, careful evaluation and occasional modification of expected ecosystem services, and technological innovation. Each of the four Great Lakes systems (Lakes Michigan and Huron, joined at the Straits of Mackinac, are considered one lake in terms of hydrology) fluctuate in response to different drivers and at different time and space scales. Monthly, interannual, and decadal Great Lakes water level variation, for example, is greater than water level variability along marine coasts, for similar time scales. Changes in hourly-scale Great Lakes water levels are driven by storms that produce storm surges and seiches that can threaten lives and property and are difficult to predict. NOAA's Great Lakes Environmental Research Laboratory (GLERL), part of NOAA's research branch, Oceanic and Atmospheric Research (OAR), uses historical water level data to analyze the relationships between water level dynamics and components of the regional water cycle (precipitation, over-lake evaporation, and basin runoff). GLERL's research is used to improve predictive models of both seasonal water level dynamics, and short-term hydrodynamics.

Recent Great Lakes Water Level Dynamics

The upper Great Lakes basin has experienced dramatic swings in water levels in recent years. A precipitous drop in the levels of Lakes Superior, Michigan and Huron began in 1997, leaving the upper lakes more than three feet lower in less than two years. These lakes stayed below their monthly averages, at times significantly below, for a period of 15 years, including an all-time record low set in January 2013 on Lakes Michigan and Huron. This long period of low water levels caused financial difficulties for the commercial shipping and hydropower industries, access issues for small harbor towns, and

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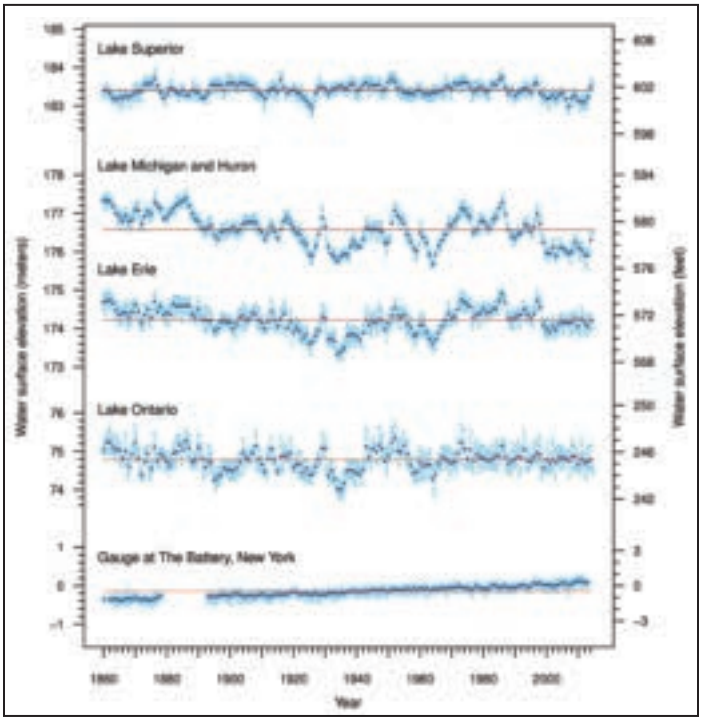

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Historical water levels for the Great Lakes and The Battery gauge, 1860–Present

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NOAA Great Lakes CoastWatch image of the Great Lakes basin and St. Lawrence Seaway

NOAA/Great Lakes CoastWatch Program – Space Science & Engineering Ctr., Univ. of Wisconsin-Madison

a renewed interest in structural methods to reducing flow from the upper basin. During 2013 and 2014, consistently above average precipitation contributed to remarkably swift water level rises on the upper lakes. By October 2014, all of the upper lakes were above their monthly averages for the first time since 1998. Interestingly enough, Lake Erie and Ontario water levels hovered around their long-term averages during this same period. Why the upper lakes stayed so low for such a long period, and how much of an impact two very cold winters had on the recent water level rise are questions GLERL hydrologists are still evaluating.

Vertical Reference for Great Lakes Water Levels

The vertical plane used to define water level heights within the Great Lakes – St. Lawrence River basin is the International Great Lakes Datum, or IGLD. This internationally-coordinated vertical datum plane must be redefined approximately every 25-30 years because the Earth's crust is still moving in response to the retreat of the glaciers 10,000 years ago. This "bounce back" of Earth's crust is known as isostatic rebound, or crustal movement. Although this movement is very small, it is significant enough to require this readjustment regularly. The current datum, IGLD 1985, went into effect in 1992. NOAA has begun working with its Canadian counterparts toward establishing the next vertical datum, IGLD 2020, which will go into effect in 2025. Changing the vertical datum will impact all nautical charts, and any reference to water levels in the Great Lakes will need to be adjusted once the new datum is in place.

Although the future of Great Lakes water levels is highly uncertain, the Great Lakes region has a long history of adapting to fluctuating levels. Changes in regional climate and meteorology could impact the water cycle and heat budgets of the lakes to either keep water levels above average, as all but Lake Ontario are today, or return them to another period of extended low levels. Continued monitoring of water levels, improvements in seasonal and long range forecasting, and anticipation of needed adaptation measures will ensure system resilience as future challenges are met.

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NOAA Forecasts and Monitors Blooms of Toxic Cyanobacteria in Lake Erie

by Timothy T. Wynne, Timothy Davis, Ruth Kelty, Eric Anderson and Sonia Joseph Joshi

Blooms of cyanobacteria (commonly referred to as blue-green algae) have been reported in Lake Erie as far back as the 1960s and 1970s. These blooms were nearly eliminated in Lake Erie by phosphorus abatement strategies in the 1970s that were part of the Great Lakes Water Quality Agreement, but re-emerged as a major water quality issue in the mid-1990s. The re-emergence of the blooms has been hypothesized to be a result of increases in agricultural pollution (nitrogen and phosphorus) into western Lake Erie. The role of the colonization of the invasive *dreissenid* mussels (a collective term for three similar mussel species) in promoting the re-emergence of the blooms is also being investigated.

Harmful algal blooms (HABs) pose a potential human health hazard due to the production of toxins which have caused domestic and wildlife mortalities. The primary toxins produced by the cyanobacteria in Lake Erie are the microcystins. The algae can also affect the taste and odor of drinking water.

This is an overview of National Oceanic and Atmospheric Administration's (NOAA) efforts to detect, predict and mitigate the impacts of HABs in Lake Erie. The agency provides information for decision-making in the Great Lakes region in partnership with Heidelberg University, Ohio Sea Grant's Stone Laboratory, the University of Toledo, Ohio EPA, University of Michigan, Bowling Green State University, Michigan Technological University, University of Tennessee, State University of New York–College of Environmental Science and Forestry, Stony Brook University, Environment Canada, and others. This Great Lakes work is part of a larger NOAA effort to deliver ecological forecasts that support human health and well-being, coastal economies, and coastal and marine stewardship.

NOAA has been monitoring and issuing forecasts on cyanobacteria's location and concentration in the Great Lakes since 2008 *(Wynne et al., 2013a)*. There are multiple components to this effort, all of which involve many of the partners listed above.

1. A seasonal forecast gives coastal managers and drinking water facility operators a general sense of how "bad" a bloom season has the potential to be. The seasonal forecast is an ensemble of models based largely upon phosphorus discharge from the Maumee River.
2. A bulletin provides the current extent and potential trajectory of the bloom, allowing managers to determine whether to take preventative actions. It is produced multiple times a week during the bloom season, typically from June until the bloom finally dissipates, usually around mid to end of October. The forecasts are posted on the web *(http://coastalscience.noaa.gov/research/habs/forecasting)* and emailed to subscribers.
3. The HAB Tracker for Lake Erie at *http://www.glerl.noaa.gov/res/waterQuality/habsTracker.html,* combines remote sensing, field observations, and modeling to project 10-day outlooks of bloom trajectory and concentrations.
4. These forecasting efforts are complemented by on-lake monitoring of the algal bloom on a weekly basis from June - October.
5. NOAA and its partners are establishing a citizen monitoring network for Great Lakes HABs using phytoplankton monitoring protocols in communities in the region. Twenty citizen monitoring sites are to be operational this Summer 2015, providing early warning of cyanobacteria HABs spanning the western to eastern basins of Lake Erie.
6. A newly developed microcystin sensor will be deployed in western Lake Erie in 2016 on an autonomous robotic Environmental Sample Processor (ESP). The ESP and microcystin sensor will provide real-time, early warning of cyanoHAB development and toxicity to stakeholders, including drinking water facilities and public health officials.

Development of NOAA's Forecast Products

NOAA relies on satellite imagery for initial detection *(Wynne et al., 2008)*. This year, the detection algorithm is using images from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) sensor *(Wynne et al., 2013b)*. However, MODIS is at the end of its operational lifetime and is deteriorating. The system formerly used images from the European Space Agency's MEdium Resolution Imaging Spectrometer (MERIS) sensor until operations ceased in April 2012. The European Space Agency is planning to launch a follow up to MERIS called the Ocean and Land Colour Instrument (OLCI) at the end of 2015. It will replace MODIS for the forecasting purposes in Summer 2016.

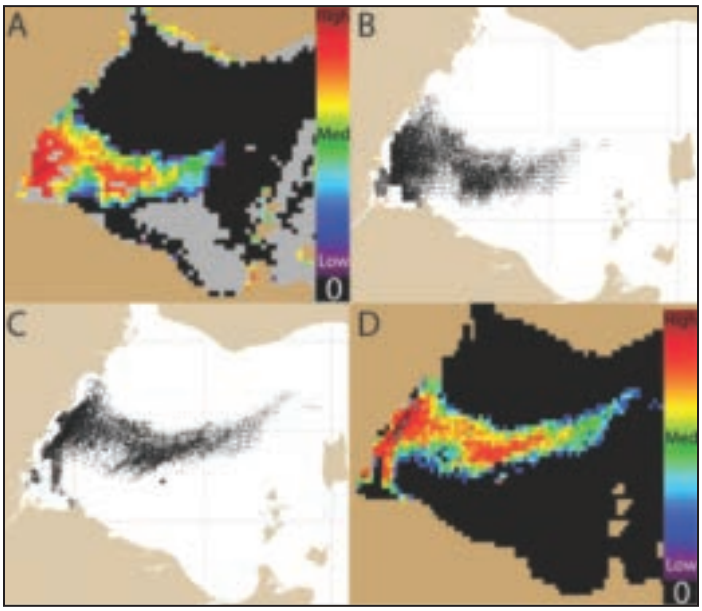

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Figure 1. Shows an example of how the initial satellite image (A) is converted to passive particles (B) moved within a hydrodynamic model (C) and written back into an image (D)

With a solid detection method in place, the next step is to predict where the bloom is likely to go. The initial image and concentration is determined by satellite imagery ***(Figure 1A)***. The concentration is then read into a particle tracking software package called GNOME (General NOAA Operational Modeling Environment) and is written out into a series of passive particles, which can be thought of as a proxy for cyanobacterial cells ***(Figure 1B)***. Data on currents and winds read into GNOME move the passive particles around the lake

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for a period of up to 72 hours from the present ***(Figure 1C)***. Finally, these particles are written back out into an image ***(Figure 1D;*** *Wynne et al., 2011).*

The NOAA HAB Tracker product takes daily satellite imagery and real-time monitoring to estimate the current expanse and intensity of the bloom. NOAA uses forecasted meteorology and hydrodynamic modeling to predict where the bloom will travel and what concentrations are likely to be seen on a three-dimensional scale. These predictions can provide water intake managers timely information for public health decision-making.

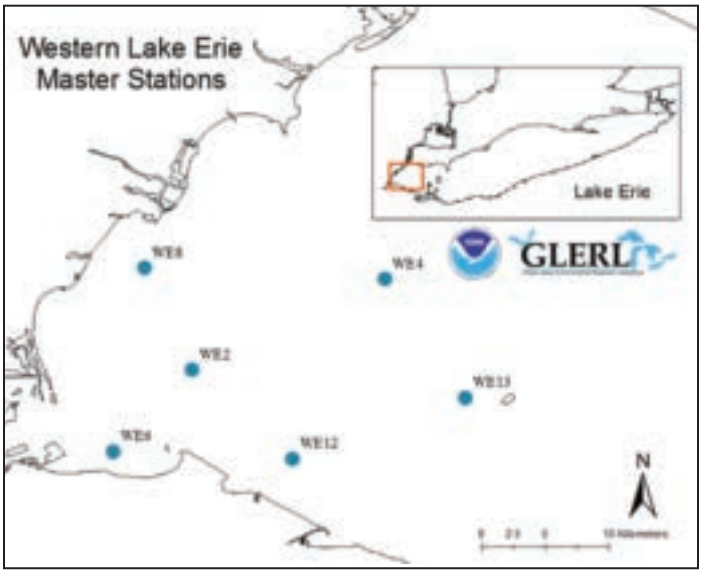

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Figure 2. Master stations sampled weekly by NOAA for harmful algal bloom toxins

NOAA Monitoring of Toxic Algae

NOAA conducts a comprehensive spatial and temporal HAB monitoring program. Every week from June – October six master stations ***(Figure 2)*** are sampled. Surface water at each location is collected and water quality parameters including, but not limited to, water temperature, dissolved oxygen, nitrogen and phosphorus concentrations, total algal biomass (measured using chlorophyll a, a pigment found in all algae) total cyanobacteria biomass (measured using phycocyanin, a pigment only found in cyanobacteria), preserved samples for microscopic identification of specific algal species, toxins (i.e., microcystins) and samples for genetic analysis are measured. Microcystin concentrations are analyzed within 48 hours and this information is uploaded to NOAA's western Lake Erie toxin tracking page *(http://www.glerl.noaa.gov/res/waterQuality/WLEMicrocystin.html).*

NOAA also uses a sophisticated network of near-real-time water quality measurement instruments that can collect samples for many of the important parameters listed above, including dissolved phosphorus on a frequent basis in between the weekly boat samplings. These data are updated on NOAA's water quality page under the HAB Tracker images *(http://www.glerl.noaa.gov/res/waterQuality/habsTracker.html).* In 2016, NOAA will have the capability to measure microcystins near-real-time via newly developed microcystin sensors deployed on an ESP in western Lake Erie.

This summer these efforts will be complimented by citizen monitoring at 20 sites spanning the western to eastern basins of Lake Erie. The newly established citizen monitoring network for Great Lakes HABs is part of a larger *phytoplankton monitoring network* coordinated by NOAA.

NOAA also manages the Monitoring and Event Response for Harmful Algal Blooms (MERHAB) Program *(http://coastalscience.noaa.gov/research/habs/merhab/),* through which NOAA and other federal agencies can provide assistance for local management agencies when unexpected HAB events exceed their capacities. Potential assistance includes targeted sample efforts, analyzing toxins in water or tissue samples, and other technical expertise.

2014 HAB Impacts on Toledo, OH

During Summer 2014, municipal water supplies in Lake Erie were closed when levels of the toxin micocystin exceeded the World Health Organization's guideline level for safe drinking water (1 part per billion). On August 1, 2014, NOAA released its weekly HAB bulletin for Lake Erie. A weekly data share sent the same day reported toxicity at six sites including the Toledo drinking water intake. Both the bulletin and weekly data share warned of an intensifying cyanobacteria bloom that could introduce toxins into drinking water in the City of Toledo, OH.

The next day, the city issued a drinking water advisory, restricting drinking water access to 500,000 residents. NOAA responded to this human health crisis by increasing its bulletin production and conducting a targeted event response sampling effort to analyze samples throughout the water column around the Toledo water intake and from across western Lake Erie, for a broad suite of cyanotoxins having known human health risk but that are not routinely monitored. The agency's HAB trajectories warned of potential impacts to water suppliers in Oregon, OH and Monroe, MI. The greatly expanded information on the potential risk of the bloom directly supported state and city managers and federal agencies such as the state of Ohio's Environmental Protection Agency.

Frequency of Blooms and Their Impacts

Blooms vary from year to year ***(Figure 3)***. The 2014 bloom hit a particularly vulnerable area, but the 2013 bloom was actually bigger and had a more widespread impact. Carrol Township, Ohio, had 2,000 people that were without water in September 2013 due to elevated levels of microcystins in the finished drinking water. The bloom moved north and led to multiple beach closures in Ontario.

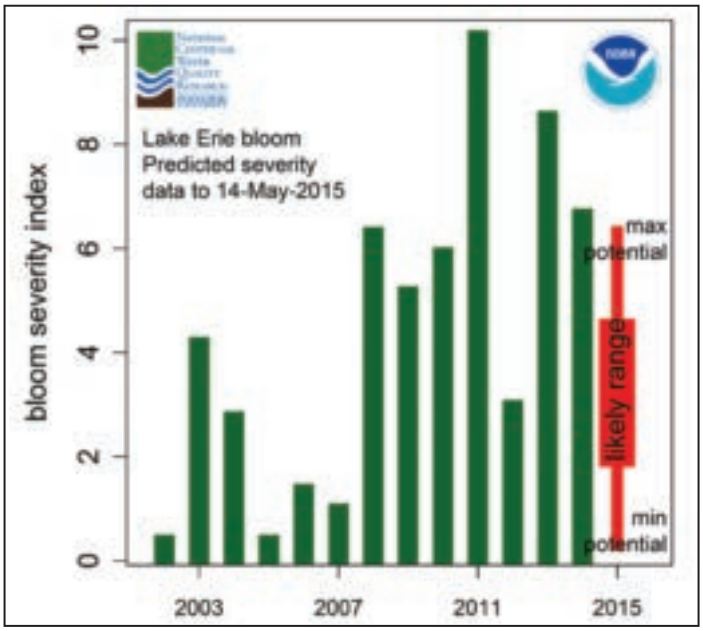

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Figure 3. Seasonal severity of Lake Erie harmful algal blooms since 2002

The 2011 bloom was the worst in recorded history with a size roughly double that of the 2013 and 2014 blooms, and with concentrations of microcystins that were many times higher than what was measured in either 2013 or 2014. The majority of bloom activity occurs within the shallow and warm western basin of Lake Erie. Central basin blooms in 2012 and 2013 may indicate that the conditions that promote bloom activity in Lake Erie are spreading. There have not been blooms in the far eastern regions of Lake Erie since the start of the forecasts in 2008. If a bloom did start in eastern Lake Erie, a forecast would be issued and the bloom would be monitored throughout its duration.

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- Custom Conveyor Corporation
- Enviro-Care
- EnviroMix
- Environetics Inc
- Fairfield Service Co. of Indiana LLC
- FKC Co,. Ltd.
- Fluid Dynamics Inc
- Force Flow Technologies
- Ford Hall "Weir-Wolf"
- Fournier Industries, Inc.
- GEA 2H WaterTechnologies
- H_2O Controls
- Hallsten Corp
- Haarslev Industries
- Infilco Degremont (IDI)
- Integrity Municipal Systems
- Ishigaki USA
- JCS Industries
- JWC Environmental - Muffin Monster®
- Koch Membrane Systems
- Komline Sanderson
- Kusters Water
- Liberty Tanks
- Lonza (formerly Arch Chemicals)
- Marley/SPX
- ML Separation & Conveying, Inc.
- Morris Pump (6100 Series)
- M2 Renewables
- Nelson Environmental
- Neptune Chemical Pump Inc
- Netzsch Pumps North America
- Noreva GmbH
- Ozonia North America LLC
- PeroxyChem (formerly FMC)
- Piller TSC Blower Corp
- PureAir Filtration
- Putzmeister
- S.P. Kinney Engineers, Inc.
- Shand & Jurs Biogas
- Sodimate Inc.
- Stanco Projects LLC
- Thirsty Duck, LP
- Tonka Equipment Co.
- UGSI Chemical Feed, Inc. (PolyBlend®, Encore®, Varea-Meter®)
- WACO Products
- WAM Group
- Watson Marlow Bredel
- WesTech Engineering
- Wilo USA (Formerly EMU)
- WSG & Solutions (FMC®, Link-Belt®, Rex®)
- Xylem F.B. Leopold Co.
- Xylem Wedeco UV & Ozone

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Microbeads – A Threat to New York Waters

NYWEA members from across the state volunteered to participate in a ground-breaking study by the New York Attorney General's Office and strengthen the call to ban an emerging pollutant entering our waters.

by Lemuel M. Srolovic

New York State is blessed with abundant water resources, both fresh and saltwater. Its citizens are stewards of thousands of freshwater lakes, ponds and reservoirs, two of the five Great Lakes and tens of thousands of miles of rivers and streams. The marine waters of Long Island Sound and the Atlantic Ocean lie at our doorstep.

Our drinking water is drawn from these waters, and they support commercial transport, recreation, tourism, agriculture, fishing, power generation and manufacturing in our state. They also provide habitats for diverse aquatic plant and animal life.

For decades, New Yorkers have worked hard to protect our waters and to restore waterways that have been degraded. Major point source controls were put in place after the passage of the Clean Water Act, and today communities are working to modernize aging water and sewer infrastructure and develop and implement pollution prevention strategies to reduce stormwater and nutrient runoff. Significant progress has been made, and much work still remains.

But now we face a significant and new pollution threat to New York waters – from plastic microbeads. There is no known way to clean these pollutants up once they're released into the environment.

Survey of Plastic in Great Lakes

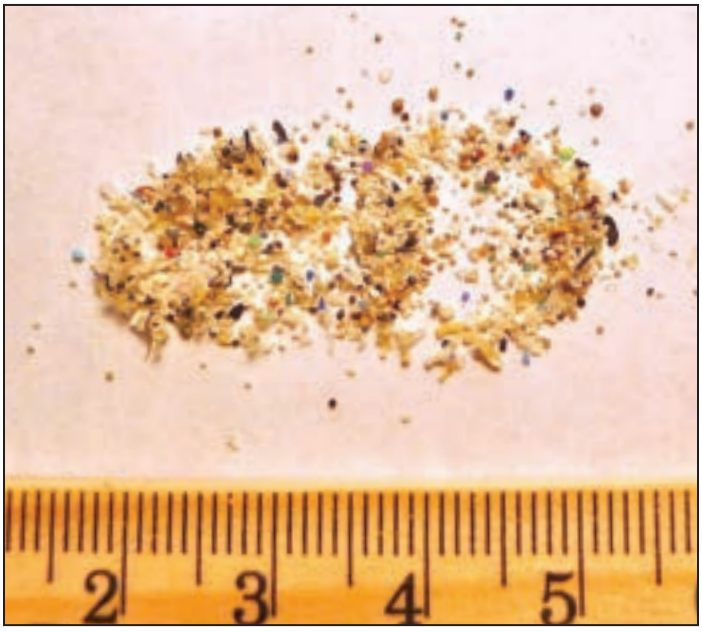
The office of the Attorney General (OAG) became aware of this emerging source of environmental pollution based on the work of Dr. Sherri Mason, a professor at the State University of New York at Fredonia. In 2012, Dr. Mason and a research team that included scientists from the 5 Gyres Institute performed the first open-water survey of the Great Lakes looking for plastic pollution. Until that time, open-water surveys had only been performed in the oceans and research on the magnitude of plastic pollution in the Great Lakes consisted of beach and shoreline surveys for large pieces of plastic litter.

The 2012 survey revealed that the Great Lakes have some of the highest concentrations of plastic found in any open-water environment. Counts rivaled the highest concentrations collected from the garbage patches in the Earth's oceans – areas where floating plastic litter is concentrated in the center of major spirals, or gyres, of circling currents occurring both north and south of the equator. Like in the ocean's garbage patches, most of the plastic collected in the Great Lakes open-water survey wasn't recognizable as items normally associated with plastic pollution – like water bottles, six-pack rings and disposable bags – but were microplastics measuring less than 5 millimeters in diameter.

That is where the similarities ended. The microplastics collected from ocean garbage patches were mainly tiny fragments of plastic that had broken down from large objects into unidentifiable pieces. The Great Lakes samples were also chock full of unidentifiable fragments, but also contained a surprising abundance of even smaller microplastics, less than 1 millimeter in diameter and perfectly spherical. The beads were identical to some of the intentionally produced microplastic, called microbeads, which began replacing natural material, such as almond shells and oatmeal, in personal care products a few decades ago.

Dr. S. Mason, SUNY Fredonia

Manta trawl shown deployed during the first-ever open-water Great Lakes survey to examine plastic pollution in the Great Lakes



Dr. S. Mason, SUNY Fredonia

Microbeads made up over half of the microplastic less than 1 millimeter in diameter collected from the New York waters of Lake Erie in Summer 2012.

Courtesy of NYS OAG

Types of products sold, such as facial scrubs, body washes and toothpaste, that contain plastic microbeads as abrasives

Origins of Microbeads

Microbeads are tiny plastic particles that serve as abrasives in products such as facial scrubs, body washes and toothpaste. Often, consumers don't even know they're there. But while they may be invisible to users, roughly 19 tons of microbeads are washed down drains into New York's wastewater stream every year.

These 19 tons are mostly comprised of small plastic fragments, difficult to capture and even more difficult to identify in a water sample, plus easily identifiable spherical microbeads that Dr. Mason and her colleagues found in such high concentrations in New York's Great Lakes. In fact, the tell-tale microbeads found in the Great Lakes average less than six percent of the microbeads found, on average, in face and body scrubs. The personal care product industry uses the term "microbead" to describe any plastic particle, regardless of size, shape or color, added to personal care products for use as an abrasive. Microbeads vary in size, with a median ranging from 0.2 to 0.4 mm (millimeters) in scrubs, while those found in toothpaste are about 100 times smaller, or about 2 to 5 um (micrometers) in size.

How Microbeads Do Harm: NY First to Act

When personal care products containing microbeads are used by consumers, these tiny plastic particles are washed down bathroom drains into the sewage collection system en route to treatment plants. From there, because of the high concentrations found in the environment, the widely held assumption was that many are not captured by the treatment process but instead pass through New York treatment plants and discharge into our waterways with the post-treatment effluent. As *Clear Waters* readers know, wastewater treatment plants are designed to capture, remove or break down and treat sewage. They are not designed to capture tiny microbeads.

When microbeads enter bodies of water, they can persist for

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decades, accumulating toxic chemical pollutants, like highly toxic PCBs, on their surface, and transporting pollutants as they float with currents. When mistaken for food by small aquatic organisms, these chemicals become readily available to be consumed by aquatic species. This can result in dangerous chemicals being passed up the food chain and also contaminating fish and other wildlife. When people wash their faces or brush their teeth, they don't intend to pollute lakes and rivers with plastic that can harm wildlife and their own environment – but that's exactly what is happening.

After the NYS OAG learned that the Great Lakes were being polluted by a new form of plastic pollution, it acted quickly. In 2014, it introduced first-in-the-nation legislation to ban microbeads in personal care products titled, The Microbead-Free Waters Act, which the New York Assembly passed unanimously. The OAG issued a 2014 report on microbeads – "Unseen Threat: How Microbeads Harm New York Waters, Wildlife, Health and the Environment" – to educate New Yorkers on the risks to wildlife and the environment from this pollution. Now at least 19 states have enacted or proposed state bans, and legislation on the federal level also is being considered.

NYWEA Survey Helps Answer Questions

Meanwhile, new academic research has emerged showing even higher counts of microbeads found in the open waters of Lake Ontario and buried in St. Lawrence River sediments. Citizen groups began finding microbeads in Cayuga Lake, Oneida Lake, the Erie Canal, and the Mohawk River.

Despite microbeads rapidly entering the spotlight for researchers and policymakers alike, questions remained. Some legislators asked if this was a problem in their district, and data gaps existed in New York that definitively linked the transport of microbeads from the drain through the wastewater treatment plant to the environment. The OAG wanted to answer these questions, but it needed help doing so. That's when NYWEA and its members came in.

In September 2014, the OAG reached out to the New York Water Environment Association (NYWEA) with a request for help. The OAG knew that the association supported the Microbead-Free Waters Act and efforts to remove plastic from the

Microbeads	Treatment Plant Facility	County	Receiving Waterbody
✔	Albany County Sewer District	Albany	Hudson River
✔	Mohawk View Water Pollution Control Plant	Albany	Mohawk River
	Village of Endicott Water Pollution Control Plant	Broome	Susquehanna River
✔	Village of Silver Creek Treatment Plant	Chautauqua	Lake Erie
✔	City of Hudson Wastewater Treatment Plant	Columbia	Hudson River
✔	Village of Delhi Wastewater Treatment Plant	Delaware	West Branch of the Delaware River
	Town of Andes Sewer District	Delaware	Tremper Kill
	Village of Walton Sewage Treatment Plant	Delaware	West Branch of the Delaware River
✔	Erie County Sewer District No. 3, Southtowns Advanced Wastewater Treatment Plant	Erie	Lake Erie
✔	Town of Grand Island Wastewater Treatment Plant	Erie	Niagara River
✔	Erie County Sewer District No. 6, Lackawanna Wastewater Treatment Plant	Erie	Smokes Creek, tributary to Lake Erie
✔	Erie County Sewer District No. 2, Big Sister Creek Wastewater Treatment Plant	Erie	Big Sister Creek, tributary to Lake Erie
✔	Village of Lake Placid Sewage Treatment Plant	Essex	Chubb River, tributary to the Ausable River
✔	Town of Westport Wastewater Treatment Plant	Essex	Lake Champlain
	Village of Chateaugay Wastewater Treatment Plant	Franklin	Chateaugay River
	Village of Hunter Wastewater Treatment Plant	Greene	Schoharie Creek
	Town of Windham Wastewater Treatment Plant	Greene	Batavia Kill
✔	Village of Athens Wastewater Treatment Plant	Greene	Hudson River
✔	Newtown Creek Water Pollution Control Plant	Kings	East River
✔	Frank E. VanLare Wastewater Treatment Plant	Monroe	Lake Ontario
✔	Northwest Quadrant Wastewater Treatment Plant	Monroe	Lake Ontario
✔	Cedar Creek Water Pollution Control Plant	Nassau	Atlantic Ocean
✔	Niagara County Sewer No. 1	Niagara	East Branch of the Niagara River
✔	City of Middletown Wastewater Treatment Plant	Orange	Wallkill River
✔	Port Jervis Sewage Treatment Plant	Orange	Neversink River
	Villa Roma Resort & Conference Center	Sullivan	Jones Brook
✔	Village of Potsdam Water Pollution Control Plant	St. Lawrence	Racquette River
✔	Ithaca Area Wastewater Treatment Facility	Tompkins	Cayuga Lake
	Lake Mohonk Mountain House	Ulster	Tributary to Coxing Kill
	Pine Hill Wastewater Treatment Plant	Ulster	Birch Creek
✔	City of Glens Falls Wastewater Treatment Plant	Warren	Hudson River
✔	Village of Palmyra Wastewater Treatment Plant	Wayne	Erie Canal
✔	Westchester County DEF–Yonkers Joint	Westchester	Hudson River
✔	Westchester County DEF–Port Chester Waste Treatment Plant	Westchester	Long Island Sound

Results of effluent sampling from NYS wastewater treatment plants – microbeads were detected in the samples submitted by facilities shown with a check mark. *Courtesy of NYS OAG*

wastewater stream, so it asked NYWEA members to participate in a study to survey post-processing effluent for microbeads. The OAG wanted to know, without a shadow of a doubt, that wastewater treatment plants were indeed incapable of capturing the tiny beads.

NYWEA's Executive Director Patricia Cerro-Reehil responded by circulating an invitation to NYWEA members to participate in the study. The OAG quickly received over 50 responses from wastewater treatment plant supervisors and operators across New York State asking for the sampling protocol to determine if they could sample at their facility. Ultimately, 34 treatment plant volunteers supplied post-processing effluent samples, and they were taken during the most inhospitable times for collecting water samples outdoors – this past fall and winter.

The attorney general's study detected microbeads in samples of post-processing effluent from 25 out of 34 – or 74 percent – of the sampled treatment plants. The detection of microbeads in effluent samples from 25 treatment plants confirms that microbeads are being released into water bodies across the state, including into the Great Lakes, Finger Lakes, Lake Champlain, Hudson River, Mohawk River, Delaware River, Long Island Sound and the Atlantic Ocean. The study suggests that microbeads from personal care products are passing through the majority of the additional 600-plus wastewater treatment plants operating in New York.

The study did not verify microbeads in the effluent at nine of the 34 wastewater treatment plants sampled. Of these nine facilities, six of them use a form of advanced filtration that may increase the efficacy of microbead removal from the wastewater stream. These include treatment units classified as membrane microfiltration, continuous backwash upflow dual sand (CBUDS) microfiltration, and rapid sand filters.

However, the absence of microbeads in the one-time samples from the nine treatment plants is not conclusive evidence that all microbeads are captured at those facilities during wastewater processing. Factors such as possible daily fluctuation in microbead concentrations in effluent due to personal use habits, the potential for some specific primary or secondary treatments to capture microbeads, or samples taken at the bottom of effluent pools wherein microbeads may be floating at the surface, could contribute to the reasons why microbeads were not found.

Treatment Findings and Results

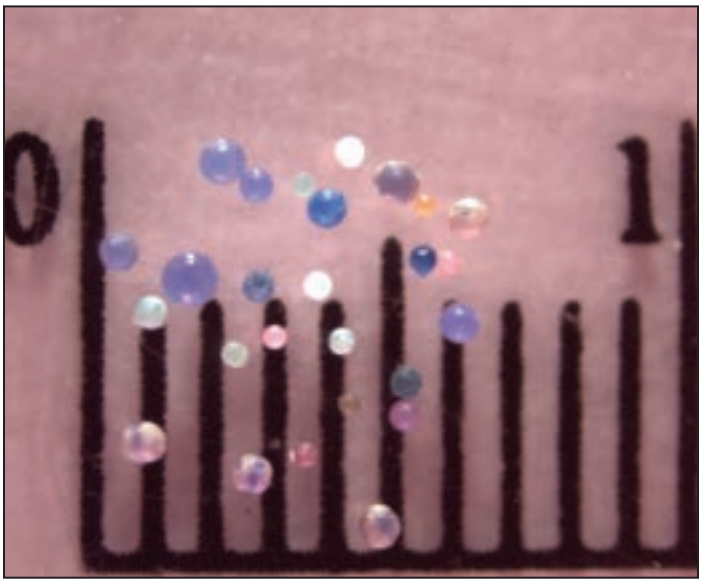
In Spring 2015, the OAG released the study findings in a report titled, "Discharging Microbeads to Our Waters: An Examination of Wastewater Treatment Plants in New York." The attorney general's ability to perform this first-of-its kind study confirming that microbeads are escaping treatment at wastewater treatment plants was only possible because of NYWEA and the 34 municipal and private treatment plant operators who collaborated on the project.

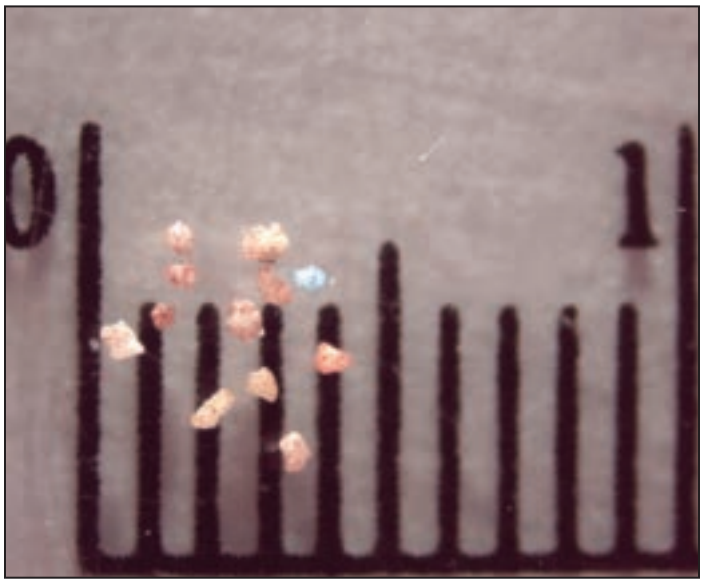
The conclusion is that most of New York's treatment plants are not designed to remove microbeads from the wastewater stream. Stopping the use of these beads in personal care products is the only efficient and environmentally- friendly approach to addressing the emerging problem of microbead pollution in New York's waters.

Many industry leaders recognize the environmental and health threat posed by microbeads, and some companies have committed to replacing them with readily available natural alternatives. Nonetheless, New Yorkers cannot afford to wait for hold-out companies to act voluntarily. The attorney general is working this spring to obtain passage of the Microbead-Free Waters Act. The law would prohibit the sale in New York of any personal care product containing plastic particles less than 5 millimeters in size. At the time of this writing, the NYS Assembly has passed the bill and, in the Senate, The Microbead-Free Waters Act has gained enough co-sponsors to pass as soon as it gets to the senate floor.

New York has come too far in cleaning up and protecting its rivers and lakes to allow a new and unnecessary type of pollution to flow into the waters unchecked. The Office of the New York State Attorney General extends its sincere appreciation to NYWEA and its members for their willingness to contribute to the study and help it take action to stop microbead pollution at its source, before it causes irreparable harm to the environment and public health.

Lemuel M. Srolovic is chief of Attorney General Eric T. Schneiderman's Environmental Protection Bureau. Under the attorney general's leadership, the office released "Unseen Threat: How Microbeads Harm New York Waters, Wildlife, Health and Environment" and "Discharging Microbeads to Our Waters: An Examination of Wastewater Treatment Plants in New York." Both reports were prepared by Environmental Scientist Jennifer Nalbone, and can be found on the OAG website at: www.ag.ny.gov.





Courtesy of NYS OAG

Some of the spherical and speckled microbeads collected from the effluent samples of participating wastewater treatment plants and verified as the same size, shape and chemical composition as microbeads removed from personal care products

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Study Explores Green Infrastructure's Economic Benefits for Two Great Lakes Cities

Customizing the strategy to fit local stormwater issues is key.

by Tashya Allen, Lori Cary-Kothera and Kitty Fahey

As the climate changes, flood-related impacts are rising for communities along the US coast and Great Lakes. Concern by community planners and other officials is also on the rise, as they look for cost-effective ways to strengthen flood resilience and lessen the financial drain of handling polluted runoff, structural damage, cleanup, and business interruptions.

Green infrastructure appeals to many communities because it provides ways to capture, store, and filter floodwater by using natural areas and man-made systems that mimic natural processes.

However, no one green infrastructure approach will work for all places, because the needs and natural features of each community differ. This was the take-home message of a pilot study that analyzed how specific green infrastructure strategies could lower the risks of current and future flooding in two cities along the Great Lakes – Duluth, Minnesota, and Toledo, Ohio. (See pilot study at *www.coast.noaa.gov/digitalcoast/publications/climate-change-adaptation-pilot.*)

The study, funded by the US Environmental Protection Agency's (USEPA) Great Lakes Restoration Initiative, was commissioned by the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management (previously named the Coastal Services Center).

The findings from Duluth and Toledo are leading this NOAA office to develop a process guide that will help US coastal and Great Lakes communities assess the specific benefits and costs of different green infrastructure approaches.

University of Connecticut

On the left is flooded, conventional street pavement; on the right is permeable street pavement that absorbs water to keep roads passable during heavy rains.

Slated for release in Fall 2015, the guide will join a suite of green infrastructure data, trainings, tools, and other aids featured on the Digital Coast website. The focus in bringing out the guide is to help reduce flooding impacts, but many of these approaches also can improve water quality.

Duluth

In June 2012, this city along Lake Superior's western edge was hit by an extreme storm event that caused millions of dollars in damage to stream banks, stormwater culverts, and a community park that is a linchpin of the area's recreation economy.

Floodwater storage is a key issue for this city. Heavy rainfall cascades down Duluth's entrenched streams, overwhelming storm infrastructure and causing bank erosion and failure.

The study revealed that if Duluth would use green infrastructure to reduce peak discharge by 20 percent in the Chester Creek watershed, the economic losses associated with a 100-year storm would decrease by 27 percent under current precipitation conditions. This would help reduce the costs of maintaining the city's stormwater infrastructure and stream bank restoration.

Since the study, NOAA and Minnesota Sea Grant have worked with city officials and partners to identify potential green infrastructure options that will provide more floodwater storage. The pilot study has increased community outreach on green infrastructure and has helped to inform a new stormwater ordinance.

Toledo

This highly urbanized city fronting Lake Erie and the Maumee River began to consider green infrastructure approaches in 2006, following a major flood.

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NOAA

Toledo and Duluth encourage homeowners to invest in water storage devices such as these rain barrels.

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NOAA

Toledo has installed bioswales similar to this South Carolina one, with vegetation and sloping sides that filter the silt and pollution from runoff.

Longstanding issues with flooding and water quality led the city to take a proactive approach. Toledo has a higher water table and flatter land area than Duluth, and its Silver Creek watershed contains a great deal of impervious surface.

The city's density closed off the option of purchasing large, low-development parcels for floodwater storage, so officials looked to other green infrastructure strategies.

An early, neighborhood-scale project featured porous pavement and bioswales, which are plant-filled stormwater ditches that absorb, filter, and slow down the release of stormwater. The project cost less than $1 million, while a gray infrastructure fix would have cost many millions more.

Photo by Alisa Goldstein

Stormwater tree trenches help channel excess water from the street through a trench or existing storm drainage, filtering and slowing the water along the way.

The NOAA pilot study found that if Toledo would use green infrastructure to lessen peak discharge by 10 percent in the Silver Creek watershed, the economic losses from a 100-year storm would decrease by 39 percent under current precipitation conditions.

These and other findings have given added momentum to local green infrastructure initiatives. Municipal and county staff members, academia, the private sector, and green infrastructure leaders all have played a part.

Influenced by the pilot study results, the City of Toledo and USEPA funded a bioswale project. Signs have been posted locally that describe how these projects help to reduce runoff and flooding.

Additional pilot studies have been launched to identify future green infrastructure projects. A stormwater utility credits manual was updated. The city is helping large industries conduct their own stormwater assessments and develop green infrastructure proposals. And a city task force is considering next steps for funding, partnerships, and further outreach.

More Green Infrastructure Resources

Next up for the Office for Coastal Management is a technical assistance project to help a Great Lakes community in New York refine its best management practices for green infrastructure.

Meanwhile, this study joins other green infrastructure aids that continue to be added to the Digital Coast.

Products include a tool highlighting the specific benefits of wetlands within each coastal and Great Lakes county; a green infrastructure training and a mapping guide; a tool that helps users visualize green infrastructure proposals, and other resources. (See the green infrastructure offerings at *www.coast.noaa.gov/digitalcoast/topic/green-infrastructure.*)

Pilot Study Collaborators

The data, information, and green infrastructure strategies featured in the pilot study were made possible by these partners:

Association of State Floodplain Managers
City of Duluth
City of Toledo
Eastern Research Group, Inc.
Minnesota Sea Grant
NOAA Office for Coastal Management
US Army Corps of Engineers
US Environmental Protection Agency's Great Lakes Restoration Initiative

Tashya Allen (tashya.allen@noaa.gov) is a hazards specialist for The Baldwin Group on contract with the NOAA Office for Coastal Management. Lori Cary-Kothera is the operations manager for the Science and Geospatial Services Division at the Office for Coastal Management. Kitty Fahey is a technical writer for The Baldwin Group on contract with the Office for Coastal Management.

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Credit Characteristics of Great Lakes Utilities

by Eva D. Rippeteau, Adrienne Booker, Andrew DeStefano and Bern Fischer

Importance of the Great Lakes

The Great Lakes system (or system) – one of the largest and most important freshwater systems in the United States – is a crucial facilitator of economic activity. The system includes all of the streams, rivers, lakes, and other bodies of water within the Great Lakes drainage basin, most prominently: Lakes Ontario, Erie, Huron (including Lake Saint Clair), Michigan and Superior, as well as the Saint Mary's, Saint Clair, Detroit, Niagara and St. Lawrence rivers. According to the US Environmental Protection Agency (USEPA), the eight Great Lakes border states make up the world's third largest economy and, geographically, would equate to the world's eleventh largest country.[1] These states, from east to west, are New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin and Minnesota.

The water quality of the Great Lakes is a constant concern and must be vigilantly protected. Approximately 35 million people in the US and Canada live on or near the coastlines of the Great Lakes and consume an average of 56 billion gallons per day (bgd) of fresh water for drinking, agriculture, industry, and more. The surrounding regional and national economies depend on the connectivity of the Great Lakes for domestic and international trade for delivery of various goods and services, including tourism and recreation. The extensive use of the Great Lakes system creates an enormous impact on its water quality, especially since the system also serves as the major receiving body for regional wastewater, stormwater and runoff discharges.

Source: Ohio Department of Natural Resources

A map of the Great Lakes watershed basins

Recently, the National Oceanic and Atmospheric Association (NOAA) observed that water levels were dropping to record levels in several lakes following a particularly dry late winter season in early 2015. The NOAA outlook predicts a continuation of below average precipitation and drought development in parts of the northern Plains, upper Mississippi Valley and western Great Lakes. A prolonged disruption in water levels, availability and environmental quality would be disastrous to the economies and livelihoods of the surrounding communities.

Fitch's Credit Rating Process

Fitch Ratings rates the general obligation (GO) and revenue bonds issued by several utilities situated on or adjacent to – and inherently reliant upon – the Great Lakes system. The utilities highlighted here include the Milwaukee Metropolitan Sewerage District, WI; the Metropolitan Water Reclamation District of Greater Chicago, IL; the water and sewer systems of Toledo, OH; and the sewer system for Columbus, OH. The credit profiles of these four entities were selected because they represent a sample of large and regionally important utility providers of varying credit quality, with ratings ranging from (lowest to highest) "A+" to "AAA" (reflecting relatively weaker to stronger credit strength).

The primary purpose of assessing credit quality is to determine an entity's ability to repay debts to bond investors. Fitch's analysis is multifaceted and includes the strength of an entity's governance and management team; the past, current and projected financial performance; management of the system's capital program and relative amount of outstanding debt; and the quality of the utility's operational and regulatory compliance profile. The following analyses introduce each utility and describe Fitch's ratings relative to the overall credit profiles, highlighting in particular each utility's approach to environmental remediation, whether voluntary or mandated.

Case #1: Milwaukee Metropolitan Sanitary District (MMSD)

The MMSD (or district) is one of the largest regional wastewater systems in the US, providing wholesale wastewater treatment and flood management services for 1.1 million people in 28 communities in the greater 411-square-mile Milwaukee area. The Milwaukee metropolitan area is the state's largest economic engine. The regional economy has benefited from its location along the southern shore of Lake Michigan and other waterways facilitating shipping for manufacturing facilities, stockyards, rendering plants and other heavy industry.

Wastewater treatment occurs at two district-owned water reclamation facilities (WRFs) that treat more than 200 million gallons per day (mgd), discharging effluent into Lake Michigan. One of the district's largest priorities is stormwater recapture and the

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Milwaukee shoreline

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WASTEWATER TREATMENT CLARIFICATION
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elimination of combined sewer overflows (CSOs) in order to ensure regulatory compliance and protect Lake Michigan water quality. The district's reduction strategy, approved by the USEPA in 2013, includes both green and gray elements. The "green" component includes the installation of green infrastructure (GI) structures that capture wet weather as it falls, preventing it from entering and overwhelming the system. The district's Wisconsin Pollution Discharge Elimination System (PDES) permit requires an increase in stormwater capture by an additional 1 million gallons annually through the use of GI through 2035.[2] The remaining work, considered "gray," includes the construction of additional concrete storage tanks and tunnels and expanding existing infrastructure to accommodate flows.

To date, the district's largest gray stormwater/CSO mitigation project has been the completion of two in-line storage tunnels with a combined water capture volume of nearly 550 million gallons. Other gray projects have focused on system optimization and enhancements to the WRFs and conveyance systems, as well as a targeted inflow and infiltration program for private residential system connections. Green projects have included the distribution of rain barrels to homes and business owners; the use of porous pavers for parking lots, driveways and sidewalks; the construction of green roofs and bioswales; and the installation of rain gardens and extended tree pits.

The district has three major sources of revenue: user fees, an unlimited property tax levy (not subject to state tax levy limitations), and non-member community payments. The user fees support ongoing wastewater treatment operations, and the tax levy and payments fund capital projects and repay debt. The district's debt is comprised of GO bonds and state revolving fund (SRF) loans. Although slightly high, the district's debt load is considered manageable by Fitch. The average MMSD customer (from anywhere within the 28-community service area) pays close to $40 per month for the treatment service. Fitch views this standalone charge as affordable, allowing the district flexibility to increase the tax rate if and when needed. Management's historic willingness to adjust rates when necessary is positive.

In light of these (and other) attributes, Fitch rates MMSD's outstanding debt "AAA." The utility is a large, essential regional sewer service provider with a stable operating profile. A tenured management team enacts prudent financial and debt policies and long-term operational and capital planning.

Case #2: Metropolitan Water Reclamation District of Greater Chicago (MWRD)

The MWRD (or district) is an independent governmental agency that provides wastewater treatment services for 10.35 million people located in the city of Chicago and 125 suburban municipalities across 880 square miles. The MWRD is a regional wastewater treatment provider and the underlying municipalities served constitute a stable, broad-based property tax base, which is a strong credit quality for any system. Wastewater and stormwater are transported to the district's seven wastewater treatment plants (WWTPs) from separate individually owned and operated municipal sewer systems.

Generally, MWRD's treatment capacity is well above the average daily treatment volume of 1.3 bgd. However, during extreme wet weather events, the district has historically been unable to accommodate the much larger and temporary additional flows that result in CSOs into local waterways and backups in the basements of homes and businesses. To address the CSO problem and meet federal and state water quality standards, MWRD created the Tunnel and Reservoir Plan (TARP) in 1972. The TARP is a system of underground tunnels and reservoirs that capture and store excess flows until there is sufficient capacity at the WWTP to treat the additional volume. To date, TARP has resulted in the construction of over 109 miles of tunnels with a combined storage capacity of approximately 2.3 billion gallons, and the completion of one of three stormwater storage reservoirs (the second of which is slated to open this year). Upon completion of TARP construction in 2029, the MWRD expects to have combined sewer storage capacity of up to 20 billion gallons.

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Chicago Harbor Lighthouse on Lake Michigan

Fitch rates MWRD's outstanding unlimited tax general obligation bonds "AAA with a Stable Outlook." Similar to the MMSD, MWRD pays for its operations, capital program and debt service with revenues from user charges and property taxes. However, annual increases are limited to the lesser of 5 percent or the consumer price index, not unrestricted like the MSSD. However, increases have consistently been below the legally allowable maximum, demonstrating a measure of financial flexibility. The district also funds its capital program, which is fairly significant over the next five years, with GO bonds and SRF loans. The district received a commitment from the state for loans up to $200 million per year through 2017.

The "AAA" rating is based on the district's positive financial results; limited operational responsibilities as a treatment-only provider; demonstrated expenditure flexibility; a deep and diverse economy; a strong management team; and long-term capital initiatives to mitigate CSOs and maintain regulatory compliance.

Case #3: Toledo, OH

Toledo, Ohio is located on the southwestern-most corner of Lake Erie and is the state's fourth largest city. Toledo's economy was once dominated by car and industrial manufacturing, benefitting greatly from its positioning along the lake for shipping. Today, health care and higher education are the largest local employers; however, the city still maintains an automotive manufacturing presence. Fitch rates the city's water system "AA- with a Stable Outlook," and the sewer system "A+ with a Stable Outlook."

Both the water and sewer bonds are secured by the net revenues derived from their respective user charges. Rate increases are subject to city council approval and have historically been approved as needed to fund debt service obligations and preserve financial

continued on page 41

"The new pumps are so quiet, we actually have to look to see if they are running." – Matt Lawrence, Assistant Plant Manager, Mahanoy City Sewer Authority

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Source: NASA/GSFC Rapid Response

Lake Erie stirred up showing sediment and algae blooms

margins. The water system derives its potable water from Lake Erie and serves over 100,000 residential, commercial, industrial and wholesale connections.

Lake Erie is the shallowest, warmest, and most intensely developed of the five lakes. These factors, combined with substantial nutrients contained in runoff from industry, agriculture, animal-feeding operations, etc., that enter the lake, cause frequent and sometimes toxic algal blooms to form in the lake. Not surprisingly, in Summer 2014 an elevated level of microcystin – a toxin indicative of poisonous algae – was detected in the city's water supply. This finding led to public alarm and for about three days nearly 500,000 people who depend on the system avoided the municipal water supply. Though the scare was only temporary, it brought to light the ongoing concern about water quality in the Great Lakes, specifically Lake Erie, and the steps municipalities take to ensure clean, safe drinking water.

Toledo's water system is currently in compliance with federal and state drinking water requirements. However, the city recently accelerated a significant amount of its capital program into the next five years in anticipation of future regulatory intervention due to aging and failing water system infrastructure. The "AA-" rating is based on a sound financial profile with weak forecast results expected?; a very large capital program to preclude potential regulatory concerns; an elevated and growing debt burden to meet these capital needs; and an improving – albeit concentrated – economy. Fitch views positively the city's efforts to get ahead of future regulatory action by addressing much needed system needs now.

In 2002, the city's sewer system entered into a 20-year consent decree with the OEPA to address CSO and SSO violations. This resulted in a litany of mandated projects in order to achieve regulatory compliance. In order to manage and properly sequence the expenditure of $520 million, the city created and branded the Toledo Waterways Initiative (TWI). The TWI consists of a range of projects; however, those that drive the bulk of spending and are currently underway include the construction of massive underground CSO and SSO retention tanks and the elimination of overflow outfall locations. Further, scientists at Michigan State University are assisting the city with investigating an innovative system to significantly eliminate pathogens and viruses in wastewater effluent beyond the current capacity. Management reports show that 62 percent of required consent decree/TWI capital outlays have been expended as of August 2014. The city has until 2020 to fulfill its consent decree requirements and reports it is on target to meet that goal.

Fitch's "A+" rating on the city's sewer bonds reflects a system with notably weaker credit characteristics than the prior case studies. This is due to weaker financial metrics; a slowly improving and concentrated economy; a very high debt load (the system's six-year capital plan is about 99 percent debt-funded); limited rate-setting flexibility due to high customer charges; and the need to meet mandated regulatory requirements.

Case #4: Columbus, Ohio

Columbus is Ohio's capital and, with a population of over 850,000, it is also the state's largest city. While not directly adjacent to Lake Erie, Columbus is notable for its current handling of water quality consent orders. Fitch maintains a rating of "AA with a Stable Outlook" on Columbus's sanitary sewer system, which serves approximately 1 million residents, including all or portions of the surrounding 23 suburban municipalities. The city's primary service includes collection, treatment and discharge of wastewater, but Columbus is also tasked with stormwater management throughout its jurisdiction where the sanitary sewer and stormwater systems are combined. The system's revenue bonds are supported by the net revenues (i.e., the water and sewer service charges) collected from

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View of Columbus, Ohio and Broad Street Bridge crossing the Scioto River

ownership and operation of the system. Rates have been raised almost annually since the 1990s.

The city entered into two separate consent orders with the State of Ohio Environmental Protection Agency (OEPA) in 2004 to address environmental issues related to sanitary sewer overflows (SSOs) and CSOs. The city devised a comprehensive wet weather management plan (WWMP) to address its consent order and submitted to the USEPA in 2005. The WWMP includes, among other things, the construction of two large diameter underground tunnels to handle high flows, costing upwards of $2.5 billion (2005 dollars) over the course of 40 years.

The city has spent $1.8 billion in consent order projects to date with an additional $1.8 billion earmarked for its concrete, or gray, infrastructure projects. Projects include the completion of a substantial capacity expansion at one of the city's two interconnected wastewater treatment plants and the near completion of a 4.5-mile long, 20-foot diameter tunnel located 180 feet below ground. The tunnel project, known as the OARS (Olentangy-Scioto interceptor Augmentation Relief Sewer), will provide significant combined sewer storage and conveyance capacity. With an estimated cost of $371 million, it is the city's most expensive capital project in recent history and will be completed in late 2017. Due to these expensive projects, the system's debt levels are high and expected to continue rising, and remains a significant rating factor.

In 2012, Columbus re-evaluated its WWMP in response to a change in guidance from the USEPA to place greater emphasis on stormwater improvements and to evaluate the need for construction of a second storage tunnel for excess stormwater flows. To avoid the need for a costly second tunnel, which would likely be used only a handful of days in any given year, the city came up with an alternative GI plan known as Blueprint Columbus. Under this plan, the city will transform areas with old infrastructure into green spaces with highly absorbent rain gardens and other GI components to help capture stormwater as it falls. The Ohio EPA is currently reviewing this plan and more information should be available towards the end of 2015.

Fitch Ratings Methodology

Governance & Management
• Leadership
• Policies & Forecasts
• Political Impartiality
Operations
• Customers & Service Area
• Water & Sewer Statistics
• Regulatory Compliance & Climate
Debt & Capital
• Capital Improvement Plan
• Funding Sources
• Leverage and Debt Structure (Fixed vs. Variable)
• Legal Bond Covenants
Financial
• Billing & Collections
• Rates & Charges
• Audited Financial Trends & Performance
• Stress Test Performance

Multiple Factors Considered in Ratings

In sum, credit analysis incorporates several factors. Individual metrics – whether financial and debt-related, or regulatory – are incomplete descriptors in isolation. A holistic, multi-faceted analysis is critical to understanding and drawing conclusions for rating purposes. Consistently, the strongest credits rated by Fitch are those with managers that implement and enact sound fiscal and operational programs in order to preclude costly, retroactive corrective capital programs. Yet strong systems are also those that, when put on notice, are able to work with the regulators to agree on a productive, cost effective and sometimes creative compliance program.

Above all else, Fitch merits stronger credit to systems that strive to maintain regulatory compliance while demonstrating a sustainable ability to meet financial and debt repayment obligations. The common credit thread of each of the four case studies is their shared dependence (by varying degrees) on the Great Lakes. While the economies, public health and quality of living around these systems are enabled by the Great Lakes, so too are the Great Lakes dependent on strong stewardship of the water quality and on healthy local economies to remain the important ecosystem and economic drivers that they are.

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Great Lakes Toxic Algae Prompts Big Investment and Rare Political Agreement

After last summer's toxic algae outbreak, safe drinking water is a priority again in Ohio, the state that spurred the Clean Water Act more than four decades ago.

by Codi Yeager-Kozacek

State and federal lawmakers have mobilized more than $188 million since last August to understand and respond to the toxic algae outbreaks in Lake Erie that poisoned the water supply for 500,000 people in Toledo, Ohio. The surge in algae-related spending over the last six months doubles the amount that has been directed over the past four years to the Great Lakes Restoration Initiative (GLRI) for addressing the causes of toxic algae outbreaks, a serious pollution and public health threat across the basin.

In all, more than $336 million have been invested by Ohio and the federal government to clear Great Lakes waters of the nutrients that are the primary cause of the algae and microcystin toxins which are poisoning water. Managed by the US Environmental Protection Agency (EPA), the algae-reduction program is a facet of the Great Lakes Restoration Initiative, one of the largest investments in environmental research, conservation, and recovery in the United States. It follows in the footsteps of focused contemporary projects to reduce water pollution in the United States like the Chesapeake Bay Program and the plan to restore Florida's Everglades.

Photo courtesy of Kelsey Dick / Ohio Sea Grant via Flickr creative commons

US Senator Sherrod Brown (D-Ohio) is seen, left, speaking with algae researchers at Ohio State University's Stone Laboratory in September 2014. Brown and other Ohio lawmakers have worked to secure federal and state funding to tackle toxic algae in Lake Erie.

"These projects and funds are a first step – not a silver bullet – to solve the problem of harmful algal blooms," said US Senator Sherrod Brown (D-Ohio), who helped direct federal funds to the Great Lakes states, in a statement to Circle of Blue. "We also need the EPA to issue guidance on microcystin now, and we need to be sure communities have the resources to update antiquated sewer systems."

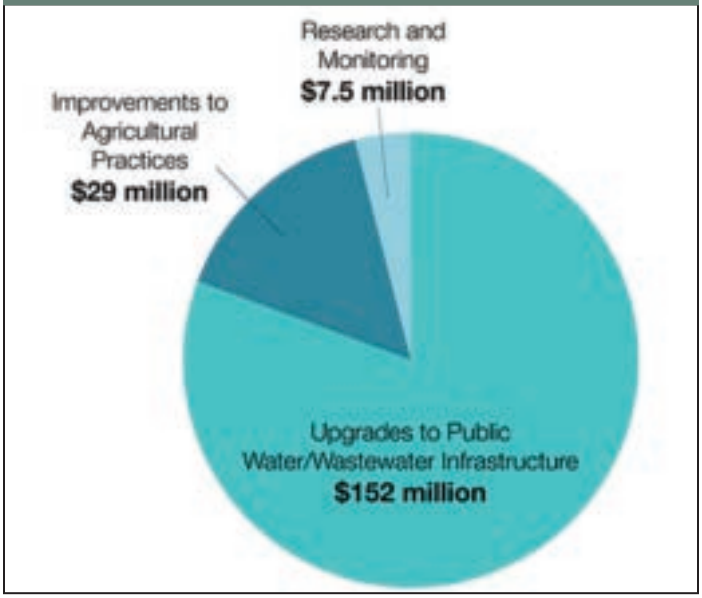
The program is a display of the powerful public concern about contaminants in drinking water.

While both major political parties disagree about almost every major issue, dirty drinking water is an important departure. The Great Lakes algae project is the work of a Democratic president and a Republican governor, and it has bipartisan support in both the US Congress and the state legislatures.

The project also is the latest reflection of Ohio's prominence in regional and national clean water policy and practices. In the 1940s, Ohio lawmakers and scientists were instrumental in developing water pollution control regulations to stem contamination in the Ohio River. Those regulatory innovations were influential in developing central provisions of the 1972 federal Clean Water Act, the nation's most important water quality statute. Three years prior to the Clean Water Act's congressional passage, the Cuyahoga River caught fire in Cleveland, a signal event that alerted the nation to the seriously degraded quality of American rivers, lakes, and bays.

Millions Pledged to Tackle Lake Erie Algae Since Toledo Water Crisis

In the past six months, $31 million in federal funds and $157 million in state funds have been activated.



Graphic by Kaye LaFond / Circle of Blue

In the six months following Toledo's drinking water crisis in August 2014, $31 million in federal funds and $157 million in state funds have been activated. The majority of the money will be used for upgrades to public water and wastewater infrastructure, with smaller fractions for improvements to agricultural practices, as well as research and monitoring.

> *"These projects and funds are a first step – not a silver bullet – to solve the problem of harmful algal blooms."* –*Sherrod Brown (D-Ohio), US Senator*

Along with steps to deal with poisoned algae, the Great Lakes Restoration Initiative (GLRI) includes the cleanup of toxic industrial sites, efforts to control invasive species, and conservation projects to protect native species and habitat. Over the last five years,

spending on these steps has injected more than $1.6 billion into the Great Lakes region.

President Obama's new budget, released this week [week of February 1, 2015], proposes a $50 million cut to the program's funding level for 2016, but previous attempts to scale back the GLRI have failed in Congress. The program will receive $300 million this year. Last fall, the project's leaders completed a new strategy plan to guide GLRI priorities for the next five years. That action plan outlined, for the first time, goals for reducing harmful algae blooms and the phosphorus pollution that drives them.

> ***"The politicians can't really claim that no one told them this was likely to happen."***
>
> *–David Schindler, scientist, University of Alberta*

Scientists and other experts, however, have long warned that an investment strategy is not enough to rid the lakes of toxic blooms.

They say regulations that include agriculture – the source of nearly two-thirds of the phosphorus that is causing Lake Erie's algae blooms – are also needed under the federal Clean Water Act, which currently addresses only urban phosphorus pollution in a meaningful way.

"They said, 'No, we invested enough money in the problem. We've signed an agreement now. We've declared that eutrophication will go away,'" said David Schindler, a scientist at the University of Alberta, in an interview with Circle of Blue last fall. Dr. Schindler produced landmark experiments on Canadian lakes in the 1960s that identified phosphorus as the key driver of algae growth in fresh water. "Now, with increasing populations, we have used more and more fertilizer, grown more and more livestock on the land, and turned more and more natural ecosystems into concrete jungles. And all of those things have increased these nonpoint sources. The politicians can't really claim that no one told them this was likely to happen."

Lawmakers seem reluctant to impose regulations to reconcile the economically and politically powerful agriculture industry with drinking water safety.

But new legislation introduced in Ohio this year could begin to change that. The proposals – which call for restrictions on the timing of fertilizer application, stricter rules for the disposal of dredged lake sediment, and the creation of a new algae management office – set up a significant test for the state at a time when drinking water in the United States is once again under assault from chemical and oil spills, nitrate pollution, and aging infrastructure.

> ***"We talk a lot about the need for studies. But there is also a need for action."***
>
> *–Adam Rissien, director, Ag and Water Policy, Ohio Environmental Council*

"It's going to require some very nuanced legislation," said Adam Rissien, director of agricultural and water policy at the Ohio Environmental Council, in an interview with Circle of Blue. "We talk a lot about the need for studies. But there is also a need for action. We have enough studies that have recommended actions, and I think it is time we start moving on some of those."

Ohio Senate Bill Would Ban Spreading Manure on Frozen Ground

First in line is SB 1, a bill introduced this week by Ohio State Senators Randy Gardner (R) and Bob Peterson (R). The legislation revives many of the provisions that were proposed in a state senate bill at the end of 2014, including a clause that would ban farmers from spreading manure or fertilizer on frozen ground. Unlike the previous bill, which died in December, SB 1 focuses solely on controlling nutrient pollution from farms and combating algae blooms. In addition to the manure ban, SB 1 would:

- Transfer the Agricultural Pollution Abatement Program from the Department of Natural Resources to the Department of Agriculture.
- Create an Office of Harmful Algae Management and Response within the state's Environmental Protection Agency.
- Establish requirements for the disposal of dredge material, nutrient loading, and phosphorus testing by public water utilities.
- Include an emergency clause that would make the law effective immediately.

The bill, as well as all of the funding that has been pledged in the last six months, is a good start, according to Ohio State Representative Mike Sheehy (D).

"We need to go in to look at this bill and see if it's going to do all of the desired things to bring down the level of phosphorus that's occurring in the Western Basin of Lake Erie every spring, because that's the goal we're driving at right now," Sheehy told Circle of Blue. "If this legislation starts to address that, I'm going to support it. But if there are loopholes and some people don't have to comply, I'm going to fight that. Everyone here in the House of Representatives,

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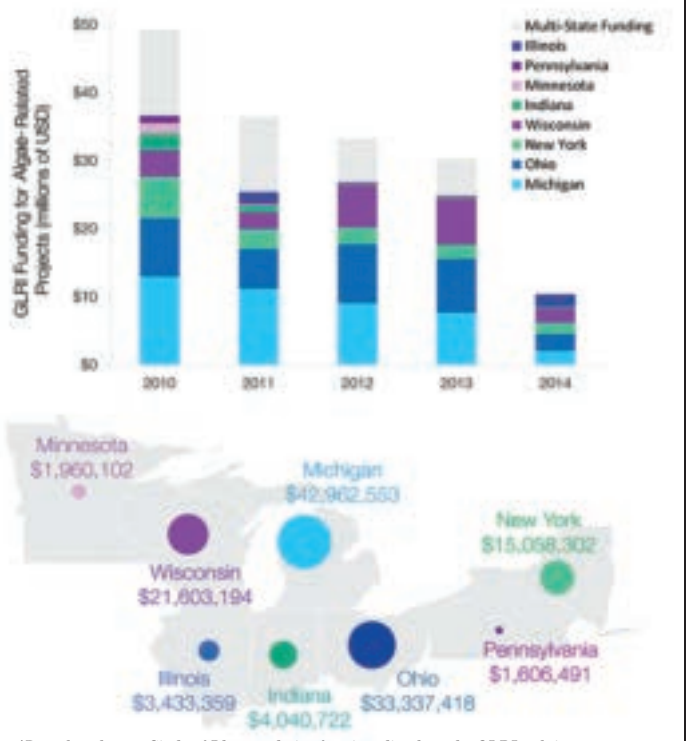
Great Lakes Restoration Initiative Funds Toxic Algae Fight

Federal program provides $159 million for research, monitoring, conservation, and restoration activities in first five years. Total algae-related GLRI funding by State 2010–2014*



**Data based on a Circle of Blue analysis of projects listed on the GLRI website (http://greatlakesrestoration.us/projects/). Project list for 2014 is not yet comprehensive.*

Graphic by Kaye LaFond /Circle of Blue

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and in the Senate, and certainly the governor – all of them are talking about the need to address this problem. Hopefully we can get something done early here in the 131st Assembly."

The Great Lakes Restoration Initiative, a federal program, provided $159 million to eight states for research, monitoring, conservation, and restoration activities within the program's first five years. The majority of algae-related funding went to Michigan, Ohio, Wisconsin, and New York.

Farms Support Safe Drinking Water and Regulation with Caveats

The urgency of the problem is being echoed by leaders in Ohio's agriculture industry, which has largely supported initiatives like the potential manure ban and a fertilizer application certification program, required by legislation last year.

"Farmers have known for a while that we have some challenges. But when you wake up one morning and nearly half a million people can't drink their water, it quickly screams to the top of the priority list," said Joe Cornely, senior director of corporate communications for the Ohio Farm Bureau, in an interview with Circle of Blue. "So it served as a wake-up call that, something we knew we needed to be working on, it needed to become more of a priority."

In the short term, the Farm Bureau is working with state and federal funding programs to help farmers to implement best management practices in areas where nutrient reductions will have the biggest, quickest effect on algae blooms, Cornely said.

While there is support for some regulation, he emphasized that one of the biggest concerns is knowing which management practices are most effective. Research into this question – known as "edge-of-field" studies – is being conducted by a number of Ohio agencies and universities with funding from the state, as well as the agricultural community.

"Everyone here in the House of Representatives, and in the Senate, and certainly the governor – all of them are talking about the need to address this problem."

–Mike Sheehy (D) Ohio State Representative

"We have to be cautious and smart about the steps we take so we don't fix one set of problems and create another," Cornely said. "We are very confident that it is not either/or. We're not going to choose between producing food and having clean water; we think we can have both. Unfortunately, getting there, there are no flip-the-switch solutions. We can't just make everything perfect tomorrow."

Federal Funding a 'Shot-in-the-Arm' for Farmers

Federal dollars will help put some of the practices that are known to reduce nutrient runoff – such as buffer strips and control structures that manage when water is released from tile-drainage systems – on the ground in the western Lake Erie basin. Ohio, Michigan, and Indiana received $17.5 million from the Regional Conservation Partnership Program to assist farmers with financial and technical resources.

"We have to be cautious and smart about the steps we take so we don't fix one set of problems and create another."

–Joe Cornely, senior director corporate communications, Ohio Farm Bureau

"It certainly is a huge shot in the arm, and it is on top of some state efforts and other federal efforts," Steve Davis told Circle of Blue. Davis is a watershed coordinator with the Natural Resources Conservation Service in Ohio. "At the same time, this is a 7-million acre watershed."

"The RCPP funding will help identify important points at which runoff becomes a problem and will help with the development of best management practices in agriculture," Senator Brown said. "This targeted approach will have significant long-term benefits."

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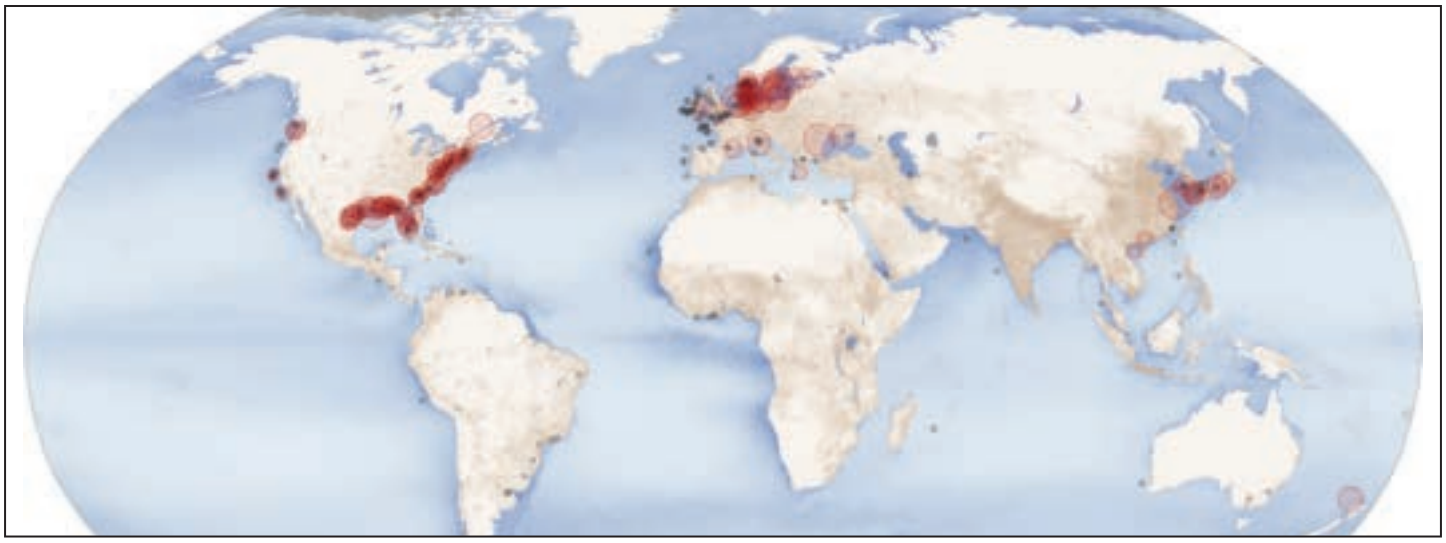

Map courtesy Robert Simmon & Jesse Allen / NASA via Flickr Creative Commons

For a global perspective: A 2008 study by the Virginia Institute of Marine Science found that there were more than 400 dead zones worldwide, covering a total of 245,000 square kilometers. Some of the largest and most problematic include the dead zone in northern Europe's Baltic Sea and the dead zone in North America's Gulf of Mexico, which supports a $2.8 billion fishery. *Map based on data from Robert Diaz, Virginia Institute of Marine Science*

Erie County's Wastewater Treatment Workforce Delivers

by Joseph Fiegl and Megan Kaszubowski

The Erie County Division of Sewerage Management is responsible for seven wastewater treatment plants that protect water quality and public health in the Great Lakes basin. The county's treatment facilities include two with pure oxygen aeration systems, one with a traditional extended aeration system, a "Schreiber" process plant, a trickling filter facility, a rotating biological contactor plant, and a small activated sludge package plant. A staff of 53 treatment plant operators (six positions presently vacant) operates, maintains, monitors, repairs and/or improves these facilities 24 hours a day, seven days a week. In addition, there is a dedicated staff of mechanics, electricians, collection system workers and other professionals that work on the assets of the Erie County Sewer Districts (districts), including the aforementioned treatment plants, five overflow retention facilities, close to 100 pumping stations, and over 1,000 miles of sewer.

Being in the Buffalo, NY area, the Erie County workforce is accustomed to functioning in all sorts of conditions. In the last nine years, there have been three FEMA declared weather-related disaster events that have affected sewer district operations. It is during these times that the county's staff reaffirms its incredible commitment to the public and the environment. In the most recent November 2014 disaster event, an enormous storm deposited seven feet of snow over vast areas encompassing the county sewer districts. Because this event closed many roadways for days, the only means of egress from the county's largest treatment facility and the hub of its central region operations was to travel the wrong way on a major roadway exit ramp during a driving ban. As is the case in the sewer industry, the county's district operations continued regardless. Field staff worked incredibly long hours under difficult conditions, with several operators and other field professionals sleeping at treatment facilities. Less than a week later, a significant warm up and rainstorm led to a massive melt-off that brought its own challenges and further tested the mettle of the districts' workforce. Once again, Erie County's employees delivered.

The county is constantly improving its operations to become more efficient and effective. At the Erie County Sewer District No. 2 Big Sister Creek Wastewater Treatment Plant, an energy performance contract is wrapping up in 2015 that will reduce the facility's energy usage by approximately 12 percent and lead to better process control. In construction now is the Rush Creek Interceptor project, which includes significant upgrades at the Erie County Sewer District No. 3 Southtowns Advanced Wastewater Treatment Plant (AWTF). This project allows for the elimination of facilities that the county took over from other municipalities as part of a regional merger program commenced in the 2000s. The facilities to be eliminated by installation of the new interceptor sewer include the Blasdell Wastewater Treatment Plant, three pumping stations, and three overflow points that existed when the mergers occurred.

As is the case with many other sewer service providers in New York State, this county has recently experienced numerous retirements, with several more expected in the next few years. Erie County is fortunate in that it has several "rising stars" in its ranks that represent the future of its operations staff. One such rising star is Joseph McDonald.

Photo by Trent Wellott, T Wellott Photography, @http://twphoto.us

Southtowns AWTF Chief Operator Joe Orzechowski (right) discusses the scheduled maintenance being performed on a bioclarifier with operator, Joe McDonald.

Operator Spotlight:

Joe McDonald

Although he's only been with the Erie County Sewer Districts two years, Joe McDonald, 25, has shown great promise for a successful career. Based out of the Southtowns AWTF, Joe has also gained experience training at several of the county's smaller wastewater treatment plants.

Before working for the county, Joe worked as a residential electrician for five years, some of which were part time while attending Buffalo State College where he graduated with a BA in biology. What led him to study biology?

"For many years, I've had an interest in working within a wildlife or environmental field and planned to work for such a firm or conservation group of some sort," he said. He further grew his interest in biology while employed at a tree company for two years.

Since beginning his career as an operator with Erie County, Joe has discovered that "everyday can be, and often is, a challenge." One specific example he shared was adjusting the new polymer metering system at the Southtowns plant to supply the proper dosage of polymer to the conditioned biosolids. In turn, the operators created a drier cake and significantly reduced costs. An ongoing construction project at the plant has also kept Joe on his toes, requiring coordination with the contractors when parts of the plant need to go on or offline.

According to Joe, it seems his family and friends, and probably the general public, have a hard time comprehending or even appreciating the work operators do. "To most people, we're just the place that emits a foul odor, or even worse, the place that they believe causes the beach to close, when in actuality, this has nothing to do with our plant."

While the tasks of an operator can include some difficulties, "Working as an operator gives you a nice balance of lab time, paperwork and manual labor," he noted. "This variety of tasks keeps things from getting too monotonous."

Employment in wastewater treatment has other bonuses too, so Joe encourages those with an interest in the environment to pursue the career. "Anyone contemplating this career should definitely take a tour of a facility to get an idea of the settings we work in, as well as the responsibilities it carries."

Although it's not as glamorous as some other forms of civil service, Joe knows it's equally as important. "The most rewarding part of the job is creating a crystal-clear effluent and knowing that we did our part to keep the local waterways clean."

The many different aspects of working as an operator have peaked Joe's interest in opportunities to advance in the field. "It's hard to say what the future holds, but my skill set is geared towards organizing people, so being a project coordinator or eventually a chief operator are in my options." Joe received a Grade 2A operator certificate in May 2015 and intends on taking Grade 3 and 4 wastewater operator supervision courses in June 2015 to qualify for higher operator positions in the county's workforce. He has also considered returning to school to obtain an engineering degree, and some day perhaps he will be designing upgrades and projects for future facilities.

Photo by Trent Wellott, T Wellott Photography, @http://twphoto.us

Joe McDonald, operator, on the roof of the Erie County Southtowns Advanced Treatment Facility in Buffalo. Shown in background are bioclarifiers and portions of a building containing the monomedia filters and solids processing equipment.

Joe has a particularly busy year ahead of him – an October wedding is quickly approaching and he newly purchased a home with his fiancée, Sarah. He should have his hands full! When he does find some free time, Joe plays drums with the Buffalo Gordon Highlanders, a local bagpipe band. He's also a member of the Niagara Association of Homebrewers, and works with a friend to make "as much good beer as we can!"

As a former Erie County Chief Operator once observed, "wastewater treatment plant operators do more in a day for the environment than most people do in their lifetimes."

Along with the many other operators of Western New York, Joe McDonald's efforts have not gone unnoticed.

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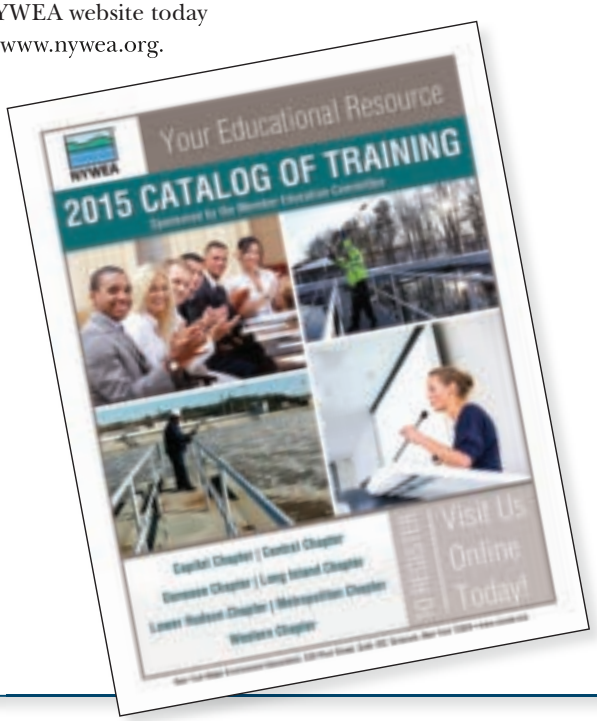

WWTP to WRRF – The Future of Biogas in New York

by Nora Goldstein

New York State is in the midst of a once-in-a-century revision of electric utility rates and regulations. The intent is to spur distributed energy, make the grid more resilient and lower its carbon intensity. At the same time, public officials, consumer advocates and environmental organizations are promoting diversion of food waste from landfills – first by recovering edible food, and then diverting non-edible food to anaerobic digestion and composting.

Combined, these two trends create an opportunity for New York State's wastewater treatment plants to transform into water resource recovery facilities (WRRFs). How to turn that opportunity into reality was the focus of a recent Market Development Summit: "Boosting Biogas Production at Wastewater Treatment Plants," organized by the New York Biogas Study Group (NYSBG) and sponsored by the New York State Energy Research and Development Authority (NYSERDA). Over 75 people from the wastewater, biogas, financing and public sectors attended the afternoon summit at the Cornell Club in Manhattan on May 21.

"To transition to the wastewater utility of the future, treatment plants have to be Resource Recovery Facilities and energy net zero," noted Kathleen O'Connor, senior project manager at NYSERDA.

The NYBSG was formed in Winter 2015 to give the biogas sector a voice in helping to shape New York State's future energy marketplace, explained Jack Huttner, NYBSG's director. "The solar and energy efficiency industries, consumer groups and other stakeholders are well organized and fully engaged in the substantive discussion now taking place," he said. "With the formation of NYBSG, the industry finally has a voice and a vehicle to press for its interests. Biogas potential in New York State is enormous. NYBSG will work to make sure the industry reaches its full potential to contribute to the state's renewable energy future."

Photo courtesy of Gresham WWTP/BioCycle

Codigestion and a solar array used for optimal, renewable energy at a city wastewater treatment plant

The Energy Vision

The road map to a renewable energy future is laid out in "REV" –New York's comprehensive State Energy Plan to enable self-sustaining clean energy markets at scale, supporting a cleaner, more reliable, and affordable energy system. REV – Reforming the Energy Vision – is spearheaded by Governor Andrew Cuomo's Energy Leadership Team, which includes Richard Kauffman, chairman of Energy and Finance, Office of the Governor; Audrey Zibelman, chair, New York State Public Service Commission; John Rhodes, president and CEO of NYSERDA; and Gil Quiniones, president and CEO, New York Power Authority.

Greg Hale, senior advisor to Richard Kauffman, walked participants at the Market Development Summit through the REV framework by first explaining the three main components to reforming New York's energy policy:

1. Lowering greenhouse gas emissions
2. Preparation before and after extreme weather events to ensure the energy system is resilient and reliable
3. Affordability in energy bills for consumers – for both residents and businesses

Concurrently, there are billions of dollars of investment required just to maintain the state's electric grid. "Over the past 10 years, New York spent $17 billion to maintain the infrastructure of our electric power grid," noted Hale. "We predict that number to jump to $30 billion over the next decade under a business-as-usual approach. While we will still need to fix our central grid, we need to be more efficient and thoughtful with how we rebuild it. We can't keep using ratepayer funds to patch an antiquated system. It's about modernizing. We will still spend this money on infrastructure investments but we need to be smarter about it, by targeting investments that improve overall system efficiency."

The reality for electric utilities is having an adequate power supply to meet peak load demand. "To be responsive, the grid is designed to ensure there is capacity on the hottest days of the year, but we pay for that extra capacity all year round," Hale added. "Peak load is growing several times faster than baseload demand, so we need to find solutions that reduce or shift peak load."

The bottom line, said Hale, is that business-as-usual is no longer an acceptable option for New Yorkers: "The challenges are aging infrastructure, poor system efficiency, flat load growth, and climate change. Wastewater treatment plants are an important part of the grid infrastructure, and shouldn't be left out of the system efficiency and climate equation."

The REV approach has three core pillars:

- Regulatory Reform
- Evolution of State Programs (such as NYSERDA's Clean Energy Fund)
- Leading by Example

At the heart of the regulatory reform, said Hale, is "realigning the utility business model, and making market-based price signals work better. By changing how utilities do business and refining energy price signals, New York will introduce opportunities for new business models, attract new energy service companies (ESCOs), create new products and services that customers want, and create a customer-centric marketplace that embraces clean energy and new technologies in a capital efficient manner."

He added that the public sector can't afford to make the needed fixes to the electric grid infrastructure alone. "We need to get private capital engaged in these fixes and improvements through self-sustaining markets. Our policy aims to achieve scale by putting a regulatory system in place that enables these clean energy

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markets to grow, in part by encouraging new utility business models using better price signals."

REV also recognizes the need for the state to fill in financing gaps where new markets for clean energy have been at a competitive disadvantage. New York State's Clean Energy Fund (CEF) was created to fill those gaps, explained Hale. "We can meaningfully influence the costs of financing or customer acquisition of clean energy solutions such as solar or energy efficiency. So, we are gradually shifting how NYSERDA uses ratepayer funds to a market transformation approach that uses these funds to bridge toward self-sustaining clean energy markets by improving public access to information, reducing project 'soft costs,' and better leveraging these ratepayer funds."

He cites the Green Bank as a good example. "In its first set of announced transactions, the Green Bank is investing $200 million to leverage $800 million of projects, such as energy efficiency and solar, across the state by partnering with private sector institutions whose progress is limited by financing gaps in the market. Unlike grants or subsidies, the Green Bank's initial $200 million investment will be returned, and available to reinvest in subsequent clean energy projects. Once private financing institutions have participated with the Green Bank in a particular transaction type, they can undertake these deals on their own in the future – just like they do in every other significant industry – and the Green Bank can step out of the way and move on to address other clean energy financing gaps."

Hale finished his presentation by connecting REV and the opportunities for New York State's water resource recovery facilities (WRRFs). In terms of emergency preparedness, WRRFs can provide power to themselves to keep the plants operating, as well as potentially feed power into a community micro-grid. There is also the potential to add other distributed energy resources, such as solar, and reduce overall power consumption through energy efficiency. While the current REV regulatory docket is focused on electricity, the overall State Energy Plan recognizes that there could be biogas opportunities to enhance the state's natural gas and vehicle fuel sectors.

Financing Models for Wastewater Sector

As noted, REV encourages private sector investment in public sector projects. Therefore, four presentations at the NYBSG Market Development Summit focused on models and tools for raising capital to finance infrastructure investments at WWRFs to improve energy efficiency and generate biogas. Ben Vitale, a principal at Wastewater Capital Management (WCM) and Equilibrium Capital, discussed use of institutional-grade investments in the wastewater sector. WCM manages the first US investment fund solely focused on providing biogas and wastewater project-level equity. "We are looking to invest in permitted facilities with long-term contracts for feedstocks and energy," said Vitale, "along with a clear path to risk-adjusted returns. Municipalities can drive organics recycling/reuse as well as provide a stable base to attract private capital. States can provide a clear pricing signal and an enabling environment for renewable electricity and low-carbon transportation fuel."

Richard McCarthy, president of Environmental Capital, discussed tax exempt financing for biogas production facilities at WWTPs utilizing public/private partnerships. "The public entity may exert control of the main waste stream from the wastewater treatment facility and the site, and may be able to exert control over other wastes that might be included, such as food or other organic wastes," explained McCarthy. "The private sector possesses the expertise and experience to make the facility work. The service agreement makes the public entity responsible for payment so an investment grade rating may be obtained."

Photo courtesy of Hill Canyon WWTP/BioCycle

A FOG receiving station at a wastewater treatment plant

Another financing tool for public-private partnerships to build AD (anaerobic digestion) projects at WWTPs and manage project risks is New York State's GML-120w. "The GML-120w allows competitive procurement of a solid waste management resource recovery facility," noted Ted Pytlar, Vice-President of D&B Engineering. "Solid waste as defined in New York State Part 360 regulations includes both municipal solid waste and sludge from a WWTP. A municipality may award a contract on the basis of cost, facility design, system reliability, energy efficiency, compatibility with source separation and other recycling systems and environmental protection." For WRRFs seeking high-strength organics such as food waste, utilizing the GML-120w to finance a public-private partnership project becomes viable.

Albany County Sewer District Pilot: The Albany County Sewer District (ACSD) is hoping to utilize a mechanism like a GML-120w to finance its new organics codigestion and combined heat and power (CHP) facility at its South Wastewater Treatment Plant. The plant is permitted for 29 mgd, with 45 mgd peak flow. While the South Plant is hydraulically at capacity, it is significantly below design loadings organically, said Rich Lyons, executive director of ACSD. It conducted a pilot study in 2012 to investigate codigestion of mixed waste streams to determine biogas yields. "The project successfully demonstrated higher biogas/energy yields when sewage sludge is codigested with high energy waste, such as residential

food waste, bakery waste and fats oils and grease (FOG)," noted Lyons. "The highest gas yields were a ratio of 5:4:1 of sewage sludge: bakery: FOG."

ACSD conducted a feasibility study that was finalized in November 2013 and presented to the Albany County Board of Commissioners, Legislature and the County Executive's office in January 2014. "The report concluded the project is feasible from a technical and regulatory perspective," Lyons added. "It provides environmental, economic and community benefits. Projected digester feedstocks include 9.8 dry tons/day (tpd) of sewage sludge, 0.2 dry tpd of FOG and 6.8 dry tpd of food waste. The projected CHP is 1.0 MW. We estimate that there are 95 tpd available within a 60-mile radius of the South Plant, which is located at the crossroads of three major interstates."

The ACSD does not intend to do a traditional design-build-own approach to project development. "That is why we are evaluating other approaches: Performance Based Contracting, under Energy Law Article 9 that provides for privately financed improvements to public facilities for the purpose of attaining reductions in energy consumption; the NY GML 120-w Solid Waste Management and Disposal; a land-lease agreement; or some sort of hybrid public-private partnership."

Building on Experience – NYC's DEP

The New York Department of Environmental Protection (NYDEP) is the water and wastewater utility for New York City (NYC). All 14 of NYC's WWTPs have anaerobic digesters. In the One New York City plan (OneNYC), Mayor Bill DeBlasio set a goal that all of the city's WWTPs need to be net zero energy by 2050. The city's water and wastewater system account for 16 percent of municipal operations energy consumption. In addition, OneNYC sets a 35 percent reduction in GHG emissions from municipal government operations (below 2006 fiscal year) by 2025, and states that NYC must achieve a 90 percent reduction in residential and commercial waste going to landfills by 2030.

That combination of factors sets the stage for reinventing the infrastructure and management of NYC's wastewater treatment plants, noted Anthony Fiore, director of the DEP Office of Energy. "The three basic strategies we can pursue to reduce our carbon footprint are: 1) Changing our operations to use less gross energy and net energy. By the former, I mean reducing demand, by the latter, I mean increasing efficiency; 2) Optimize onsite energy generation through use of biogas to offset fossil-fuel derived energy; and 3) Install renewable energy systems like solar, hydro, wind and geothermal." A total of 3.5 billion ft^3/yr of digester biogas are produced and about 40 percent is beneficially used. "If we look at the suite of projects we have identified to date for each WWTP, we see that eight of the 14 WWTPs have potential to become net energy positive," he added.

Codigestion, i.e., using food waste generated in NYC that is currently being landfilled, has been identified as a key tool in becoming net energy positive. NYDEP has been testing codigestion at its Newtown Creek WWTP. Its initial one-year pilot tested preprocessing of 1.5 tpd of source separated organics from schools, greenmarkets and other sources. "The pilot helped us learn about contamination rates, pumping requirements, control strategy and equipment bracing," explained Fiore. "This winter we will begin the demonstration phase, introducing 50 tpd of separated organics, and then scale up to 250 tpd over a three-year period."

For the pilot, NYDEP used polyethelyne tanks to receive the slurry – preprocessed at the Waste Management's Varick 1 Solid Waste Transfer Station – and fed it into the anaerobic digester at a controlled rate. For the 50 tpd demonstration project, a repurposed abandoned thickener tank will be used to receive the bioslurry. An onsite gas cleaning system will be installed to remove impurities from the digester biogas and yield pipeline-quality gas suitable for introduction into National Grid's gas distribution system. The gas cleaning system is expected to be operational in Fall 2016.

During the pilot, NYDEP was only able to do bench-scale testing in a laboratory to assess the impact of codigestion of food waste on the anaerobic digester system. To conduct more comprehensive testing and monitoring, NYDEP received a $250,000 grant from NYSERDA in 2014. The testing and monitoring program will get underway during the 50 tpd demonstration phase, helping to calculate the true costs and benefits of managing food waste through anaerobic digestion. " The monitoring program covers pretreatment, digestion and post-digestion parameters," explained Fiore. "It includes the impact on biogas production."

Photo by Eva Ripperteau

New York City's Department of Environmental Protection has been testing codigestion of organic waste at its Newtown Creek Wastewater Treatment Plant.

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Turning a Pollutant into a Resource

Overview of Nutrient Removal and Recovery at WRRFs

by Barry Liner and Sam Jeyanayagam

In excess, nutrients can be harmful water pollutants. Nutrients are found in agricultural and home fertilizers as well as agricultural operations. Sources include confined animal feeding operations, industrial pretreatment facilities, septic systems, and water resource recovery facilities (WRRFs) as well as municipal and industrial stormwater runoff.

According to the US Environmental Protection Agency (USEPA), more than 100,000 mi^2 of rivers and streams, close to 2.5 million acres of lakes and ponds, and more than 800 mi^2 of bays and estuaries are affected by nitrogen and phosphorus pollution. Excess nutrients can lead to algal blooms, which can produce toxins and result in hypoxic zones. Algal blooms cost the tourism industry some $1 billion annually, according to the USEPA. These substantial impacts are the reason regulatory nutrient limits are expanding across the country.

Nutrient Removal at WRRFs

Nutrient management begins with nutrient removal to meet permit requirements. WRRFs can achieve very low nutrient discharges through a variety of processes, primarily biological nutrient removal (BNR), physical separation, and chemical methods. Most technologies capable of removing both nitrogen and phosphorus utilize BNR, which relies on bacteria to transform nutrients present in wastewater. In BNR, bacteria are exposed to the influent from primary treatment. The selection of a BNR process should be based on influent flow and loadings, such as biochemical oxygen demand (BOD), nutrient concentrations, and other constituents as well as target effluent requirements.

Select species of bacteria can accumulate phosphorus, while others can transform nitrogen, and a few can do both. Achieving significant reductions in both nitrogen and phosphorus requires careful design, analysis, and process control to optimize the environment of nutrient-removing organisms. The uptake of nutrients and growth of microorganisms could be inhibited by a limiting nutrient, available carbon, or other factors, including oxygen levels.

Some nutrient removal systems rely on two separate processes for nitrogen and phosphorus removal. In some cases, BNR is used to remove the majority of nitrogen and phosphorus, and then chemical methods are used to further reduce phosphorus concentrations. Mainstream nutrient treatment takes place within the typical plant process flow. However, sidestream treatment refers to liquid resulting from biosolids treatment (anaerobic digestion and dewatering) that is intercepted with an additional treatment goal – to remove nutrients from a concentrated stream and minimize mainstream impacts. Like mainstream nutrient treatment processes, sidestream treatment can also vary from biological to physical and chemical removal methods.

Nitrogen Removal

Nitrogen can be removed from wastewater through physiochemical methods, such as air-stripping at high pH, but it is more cost efficient to use BNR. Conventionally, this method utilizes the natural nitrogen cycle, which relies on ammonia-oxidizing bacteria to transform ammonia into nitrites (NO_2^-) after which nitrite-oxidizing bacteria form nitrates (NO_3^-) – a process called *nitrification*. Other species of bacteria can transform these compounds into nitrogen, a harmless gas (N_2) – a process called *denitrification*. Nitrification can occur in the aeration basin together with BOD oxidation as they both require aerobic conditions. In contrast, denitrification takes place in an anoxic reactor with the nitrate

MERIS/NASA – processed by NOAA/NOS/NCCOS

Nutrient removal is an essential part of wastewater treatment to help prevent algal blooms, as shown in this 2011 satellite photo of an especially severe case in Lake Erie.

Troy Bishopp, Grazing Specialist Madison Co. SWCD

Runoff of nutrients from agricultural operations can add to water pollution/excess nutrient levels that can cause algal blooms in lakes.

providing the required oxygen. As denitrification occurs, nitrogen gas is produced and released safely into the atmosphere, where nitrogen gas is more abundant than oxygen. Nitrogen gas is inert and does not pollute the atmosphere.

When performing biological nitrogen removal, it is important that the activated sludge has enough available carbon to sustain denitrification. The bacteria that mediate denitrification need carbon to build new cells as they remove nitrogen. This means that utilities must make decisions on how best to use the carbon for the combinations of nutrient removal/recovery, energy generation, and/or recovery of value-added non-nutrient products.

The nitrogen removal rate is also dependent on the amount of time that sludge spends in the reactor (solids retention time), the reactor temperature, dissolved oxygen, pH, and inhibitory compounds. Optimal conditions differ for nitrification and denitrification, but both can be carried out simultaneously in the same unit if anoxic and aerobic zones exist. Some process configurations, such as oxidation ditches and sequencing batch reactors, combine nitrification and denitrification within a single tank while others incorporate two separate stages. Nitrogen removal processes can also be broken down into two categories based on whether bacteria are suspended within the waste stream or fixed to media. Examples include integrated fixed film activated sludge (IFAS) and denitrification filters.

A method of nitrogen removal that has gained favor over the past decade is deammonification, a two-step process that avoids nitrate formation. Aerobic ammonia oxidation to nitrite occurs in the first phase, then nitrogen gas is produced through anaerobic ammonium oxidation (also known as *anammox*). Anammox is a biological process carried out by specialized bacteria that oxidize ammonia, and nitrite is used as an electron acceptor (oxygen source) under anaerobic conditions.

Phosphorus Removal

Unlike nitrogen, phosphorus cannot be removed from wastewater as a gas. Instead, it must be removed in particulate form through chemical, biological, hybrid chemical–biological processes, or nano-processes. Nano methods involve membranes and include reverse-osmosis, nanofiltration, and electrodialysis reversal. Chemical methods (chem-P) typically utilize metal ions, such as alum or ferric chloride. These compounds bind with phosphorus and cause it to precipitate and be removed by sedimentation and filtration. Chemical methods are influenced by a number of factors including the phosphorus species, choice of chemical, chemical-to-phosphorus ratio, the location and number of feed points, mixing, and pH.

Enhanced biological phosphorus removal (EBPR or bio-P) relies on phosphorus-accumulating organisms (PAOs) capable of removing phosphorus in excess of metabolic requirements. While many factors impact the EBPR process, the two most important requirements are availability of a readily biodegradable carbon source (food) and cycling of the PAOs between anaerobic and aerobic conditions. In the anaerobic zone, PAOs take up and store carbon. The energy required for this is obtained by releasing internally stored phosphorus. In the subsequent aerobic zone, the stored carbon is assimilated and the energy is used to uptake excess phosphorus.

Consequently, the design and operation of EBPR systems must consider the availability of a readily biodegradable carbon source (such as volatile fatty acids) and the integrity of the anaerobic zone

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by eliminating dissolved oxygen and/or nitrate contributions from the influent, return streams, and backflow from the downstream aerobic zone. As with biological nitrogen removal, oxygen levels, solids retention time, and temperature play an important role in EBPR efficiency. It is common practice to add a standby chemical system to account for poor EBPR performance. Many existing biological nitrogen removal processes can be modified to remove phosphorus by adding an anaerobic phase. However, economic and environmental trade-offs exist, such as greenhouse gas production in the form of nitrous oxide as well as increased energy demands. Nutrient removal techniques can also affect biogas production and dewatering. The dewatering process is negatively affected by bio-P. During anaerobic digestion, flow from the bio-P process can decrease the efficiency of dewatering and require additional polymer as a coagulant, particularly when there are fewer beneficial metal ions, such as iron and aluminum.

From Removal to Recovery

Beyond simply removing nutrients, WRRFs also can reclaim nutrients. Recovery not only prevents nutrients from entering waterbodies but provides a supply of these essential resources. The most straightforward way of recovering nutrients is through biosolids. The USEPA estimates that the approximately 16,000 WRRFs in the United States generate about 7 million tons of biosolids. About 60 percent of these biosolids are beneficially applied to agricultural land, with only 1 percent of crops actually fertilized with biosolids. However, generating solid fertilizer from biosolids is the most common method of nutrient recovery from wastewater.

Wastewater operations that have adopted the principles of becoming a utility of the future are using the nutrient removal process to produce marketable products beyond simple biosolids, including nutrients, energy, electricity, and vehicle fuels. Phosphorus used for fertilizer is a finite resource, with some estimating that demand will outpace supply within the next century. In a similar vein, ammonia is produced via the Haber-Bosch process, which consumes natural gas (a nonrenewable resource), is an energy-intensive process, and is associated with greenhouse gas emissions. Interest in recovering nutrients from wastewater has increased over the last decade. However, the maturity of nutrient recovery technologies varies, and each has its advantages and disadvantages.

Sidestream treatment of sludge and sludge liquor, where nutrients are more concentrated, is generally the preferable target for nutrient recovery, but resource recovery complexity can vary widely depending on local conditions. In addition to nutrients, there are other types of products that can be recovered, such as metals, heat, and potable or drinking water, which may bring financial rewards and benefits to help offset utility costs.

These are some nutrient-based and other resources that can be recovered at a WRRF:

- Solid fertilizer from biosolids
  - o Land application of biosolids recycles nitrogen, phosphorus, carbon, and other macronutrients.
  - o Soil blends and composts are potential phosphorus recovery products.
  - o Incinerator ash is also a source of phosphorus for recovery.
- Solid fertilizer from the treatment process
  - o Struvite precipitation and recovery: By this method, both phosphorus and ammonium can be simultaneously recovered, producing a high-quality fertilizer from some sidestream systems.
  - o Other methods of phosphate precipitation such as brushite are also becoming common.
- Water reuse
  - o Irrigation with reclaimed water can have some nitrogen and phosphorus benefits.
- Chemical recovery
  - o Structural materials can be obtained from carbonates and phosphorus compounds.
  - o Proteins and other chemicals, such as ammonia, hydrogen peroxides, and methanol, can be recovered.
  - o Solids can be stored for future mining.

Roadmap to Nutrient Recovery

With the complexity of nutrient removal and recovery alternatives available, utility staff may wonder how to move forward to address current needs or plan for future impacts of nutrient limits. The Water Environment Federation (Alexandria, Va.) has released a Nutrient Roadmap to support the movement toward smarter and sustainable nutrient management in the context of each WRRF's specific regulatory climate and stakeholder preference. The Roadmap provides a straightforward, high-level framework for planning, implementing, and evaluating different steps of a net-zero nutrient discharge strategy and can be found at www.wef.org/nutrientroadmap.

Barry Liner, PhD, PE, is director of the Water Science and Engineering Center at the Water Environment Federation (WEF) Water Science and Engineering Center. Sam Jeyanayagam PhD, PE, BCEE, is chair of the WEF Nutrient Roadmap publication task force.

Barry Liner

Sam Jeyanayagam

A Meeting of Substance – NYWEA's Women's Initiative Dinner

NYWEA's Women's Initiative Dinner Meeting, held on May 6, 2015 in Rego Park, NY, drew a large contingent to network and hear directly from an expert in water management and urban planning, Vlada Kenniff, ENV SP. Kenniff is the managing director of the Demand Management and Resiliency Group, New York City Department of Environmental Protection (DEP) Bureau of Environmental Planning and Analysis. She covered the various programs and projects within her portfolio, including the Water Resiliency Program and progress made related to PlaNYC, as well as new directions taken in integrated water management planning linked with sustainability initiatives.

Vlada Kenniff, ENV SP, speaker at NYWEA Women's Initiative Meeting

"My focus has shifted from issue to issue when I started over a decade ago, to an ongoing list of challenges and opportunities – sometimes these are one in the same," Kenniff commented. "It is a vast spectrum, ranging from aging infrastructure and droughts, to excess water in urban centers. I believe we've done a tremendous job in solving water issues, and it is the extreme challenges that really require our attention today. Although it is sometimes overwhelming to recognize these extreme challenges, I also believe that we live in a very exciting time when sustainability and resiliency are both mainstream, as well as finding opportunities in a green manner."

Fifty-seven attendees enjoyed the lively discussion held at the Woodhaven House. They were representatives from DEP, Duke University and various engineering firms, including: Cameron Engineering and Associates, LLP; MWH Global; AECOM; Dvirka and Bartilucci Engineers and Architects, PC; Hatch Mott MacDonald; AKRF, Inc.; Black and Veatch Corporation; Michael Baker International; Hazen and Sawyer, PC; Gannett Fleming; HDR Engineering, Inc.; Woodard and Curran; Arcadis – US, Inc.; Greeley and Hansen; and Granite Construction.

The event coordinator was Toby Siegman, PE, civil engineer with the DEP Bureau of Wastewater Treatment and former chair of the NYWEA Membership Committee.

Colleagues at NYC DEP, Wendy Sperduto (left), of the Bureau of Environmental Design and Construction; and Angela DeLillo, of the Bureau of Water and Sewer Operations

The women pictured begin an enjoyable and informational evening together.

New Clean Water Rule Protects Streams and Wetlands

In an historic step for the protection of clean water, the US Environmental Protection Agency and the US Army finalized the Clean Water Rule on May 27, 2015 "to clearly protect from pollution and degradation the streams and wetlands that form the foundation of the nation's water resources," according to a joint US EPA/Army news release. The rule ensures that waters protected under the Clean Water Act are more precisely defined and predictably determined, "making permitting less costly, easier, and faster for businesses and industry. The rule is grounded in law and the latest science, and is shaped by public input. The rule does not create any new permitting requirements for agriculture and maintains all previous exemptions and exclusions," according to the statement.

"For the water in the rivers and lakes in our communities that flow to our drinking water to be clean, the streams and wetlands that feed them need to be clean too," said US EPA Administrator Gina McCarthy. "Protecting our water sources is a critical component of adapting to climate change impacts like drought, sea level rise, stronger storms, and warmer temperatures – which is why EPA and the Army have finalized the Clean Water Rule to protect these important waters, so we can strengthen our economy and provide certainty to American businesses."

"Today's rule marks the beginning of a new era in the history of the Clean Water Act," said Assistant Secretary for the Army (Civil Works) Jo-Ellen Darcy. "This rule responds to the public's demand for greater clarity, consistency, and predictability when making jurisdictional determinations. The result will be better public service nationwide."

About 117 million Americans – one in three people – get drinking water from streams that lacked clear protection before the Clean Water Rule. The health of rivers, lakes, bays, and coastal waters are impacted by the streams and wetlands where they begin. Protection for many of the nation's streams and wetlands has been confusing, complex, and time consuming as the result of Supreme Court decisions in 2001 and 2006. The USEPA and the Army are taking this action to provide clarity on protections under the Clean Water Act after receiving requests for over a decade from members of Congress, state and local officials, industry, agriculture, environmental groups, scientists, and the public for a rulemaking, the statement said.

In developing the rule, the agencies held more than 400 meetings with stakeholders across the country, reviewed over one million public comments, and listened to perspectives from all sides. The USEPA and the Army also utilized a report summarizing more than 1,200 peer-reviewed, published scientific studies which showed that small streams and wetlands play an integral role in the health of larger downstream water bodies. Streams and wetlands provide many benefits to communities by trapping floodwaters, recharging groundwater supplies, filtering pollution, and providing habitat for fish and wildlife. Impacts from climate change like drought, sea level rise, stronger storms, and warmer temperatures threaten the quantity and quality of America's water. Protecting streams and wetlands will improve the nation's resilience to climate change.

Specifically, the Clean Water Rule:

- **Defines and protects tributaries that impact the health of downstream waters.** The Clean Water Act protects navigable waterways and their tributaries. The rule says that a tributary must show physical features of flowing water – a bed, bank, and ordinary high water mark – to warrant protection. The rule provides protection for headwaters that have these features and science shows they can have a significant connection to downstream waters.
- **Provides certainty in how far safeguards extend to nearby waters.** The rule protects waters that are next to rivers and lakes and their tributaries because science shows that they impact downstream waters. The rule sets boundaries on covering nearby waters for the first time that are physical and measurable.
- **Protects the nation's regional water treasures.** Science shows that specific water features can function like a system and impact the health of downstream waters. The rule protects prairie potholes, Carolina and Delmarva bays, pocosins, western vernal pools in California, and Texas coastal prairie wetlands when they impact downstream waters.
- **Focuses on streams, not ditches.** The rule limits protection to ditches that are constructed out of streams or function like streams and can carry pollution downstream. So ditches that are not constructed in streams and that flow only when it rains, are not covered.
- **Maintains the status of waters within Municipal Separate Storm Sewer Systems.** The rule does not change how those waters are treated and encourages the use of green infrastructure.
- **Reduces the use of case-specific analysis of waters.** Previously, almost any water could be put through a lengthy case-specific analysis, even if it would not be subject to the Clean Water Act. The rule significantly limits the use of case-specific analysis by creating clarity and certainty on protected waters and limiting the number of similarly situated water features.

Photo by Lois P. Hickey

For the rivers and lakes to be clean, the streams and wetlands that feed them must also be clean.

A Clean Water Act permit is needed only if a water is going to be polluted or destroyed. The statement further reports that the Clean Water Rule only protects the types of waters that have historically been covered under the Clean Water Act. It does not regulate most ditches and does not regulate groundwater, shallow subsurface flows, or tile drains. It does not make changes to current policies on irrigation or water transfers or apply to erosion in a field. The Clean Water Rule addresses the pollution and destruction of waterways – not land use or private property rights.. The rule protects clean water necessary for farming, ranching, and forestry and provides greater clarity and certainty to farmers about coverage of the Clean Water Act. The rule does not create any new permitting requirements for America's farmers. Activities like planting, harvesting, and moving livestock have long been exempt from Clean Water Act regulation, and the Clean Water Rule preserves those exemptions.

The Clean Water Rule will be effective 60 days after publication in the Federal Register. More information is available at: *www.epa.gov/cleanwaterrule.*

Operator Quiz Test No. 108 – Laboratory

The following questions are designed for trainees as they prepare to take the ABC wastewater operator test. It is also designed for existing operators to test their knowledge. Each issue of *Clear Waters* will have more questions from a different section of wastewater treatment. Good Luck!

1. The incubation temperature range for BOD_5 test is:
   a. 19.0°C – 21.0°C
   b. 20.0°C – 22.0°C
   c. 20.0°C – 20.9°C
   d. 18.0°C – 20.0°C

2. Calculate the Biochemical Oxygen Demand for the following:
   Initial Dissolved Oxygen: 8.3 mg/L
   Final Dissolved Oxygen: 5.4 mg/L
   Initial Sample Temperature: 12°C
   Sample Size: 20 mL
   a. BOD cannot be determined
   b. 43.5 mg/L
   c. 12.8 mg/L
   d. 75.9 mg/L

3. Determine the Total Suspended Solids given the following information:
   Weight of crucible and filter: 22.2213 g
   Weight of crucible, filter and dry sample: 22.2310 g
   Sample size: 5.0 mL
   a. 9700 mg/L
   b. 194.0 mg/L
   c. 1940 mg/L
   d. 4850 mg/L

4. 75 mL of 15°C tap water requires 18 mL of 0.0200N sulfuric acid to change the pH to 4.5. What is the alkalinity of the sample of tap water?
   a. 9.14 mg $CaCO_3$/L
   b. 9722 mg $CaCO_3$/L
   c. 102.9 mg $CaCO_3$/L
   d. 0.0021 mg $CaCO_3$/L

5. The minimal residual dissolved oxygen content for a BOD_5 test is:
   a. 9.2 mg/L
   b. 2.6 mg/L
   c. 2.0 mg/L
   d. 1.0 mg/L

6. What is the chemical formula for nitric acid?
   a. H_2SO_4
   b. HCl
   c. HNO_3
   d. NaOH

7. A dish containing a lab sample is ignited to 550°C in a muffle furnace, cooled for 30 minutes in a desiccator, and then weighed. The most likely reason for this procedure is to test for:
   a. Total Solids
   b. BOD
   c. Volatile Solids
   d. Fecal Coliform

8. Calculate the suspended solids of a plant influent composite sample:
   i. Volume of sample = 50 mL
   ii. Crucible weight = 22.5326 grams
   iii. Crucible weight plus dry solids = 22.5463 grams
   a. 274 mg/L
   b. 180 mg/L
   c. 108 mg/L
   d. 430 mg/L

9. Which list of equipment is most appropriate to use for separating a sample containing solids in a mixture?
   a. Filtering flask, glass fiber filter, separatory funnel, vacuum apparatus
   b. Filtering flask, glass fiber filter, Buchner funnel, muffle furnace
   c. Kjeldahl flask, glass fiber filter, separatory funnel, Gooch crucible
   d. Filtering flask, glass fiber filter, Gooch crucible, vacuum apparatus

10. A wastewater final effluent sample is inoculated with lauryl tryptose broth and incubated for 48 hours at 35°C. The results show gas production and a color change most likely due to fermentation. The most appropriate next step is to
    a. Inoculate with EC broth, incubate for another 24 hours at 44.5°C and calculate fecal MPN
    b. Incubate for another 24 hours until gas production ceases and calculate fecal MPN
    c. Discard sample tubes as this result denotes no coliform present.
    d. Immediately calculate the fecal MPN before fermentation stops.

11. What reagent is used to extract materials such as oil and grease from a wastewater sample, also known as HEM?
    a. Freon
    b. Hydrogen ions
    c. Hexane
    d. Sodium sulfate

12. What physical apparatus can be used in the field to test for clarity?
    a. Clarity flask
    b. Sludge blanket level indicator
    c. Total solids meter
    d. Secchi disk

Answers on page 62.

For those who have questions concerning operator certification requirements and scheduling, please contact Tanya May Jennings at 315-422-7811 ext. 4, tmj@nywea.org, or visit www.nywea.org/OpCert.

Resources

To advertise or to become a member, contact Rebecca Martin at 315-422-7811 ext. 5 or e-mail her at rebecca@nywea.org.

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Team Leader/Project Manager: Candidate will be responsible for client and project development, client interaction, and client meetings. Individual will represent the firm in meetings and conferences with clients, regulatory agencies, and officials of other organizations. Candidate must have experience and background with civil engineering disciplines, especially water and wastewater conveyance and treatment. Team Leader/Project Manager will develop projects with clients and then will be involved in the oversight and management of the design and construction of those projects while maintaining client contact. Only candidates with the ability to apply advanced engineering techniques and to demonstrate exceptional problem solving and communication skills will be considered. Public speaking and interactions with clients, politicians, and municipal officials will expected. Licensure is required with a minimum of 10 years of experience.

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MRB Group has offices in Rochester, Watertown, Saratoga Springs, Seneca Falls, and Elmira, New York.

Please e-mail your resume to: resume@mrbgroup.com or mail a copy to: MRB Group, The Culver Road Armory, 145 Culver Road, Suite 160, Rochester, NY 14620.

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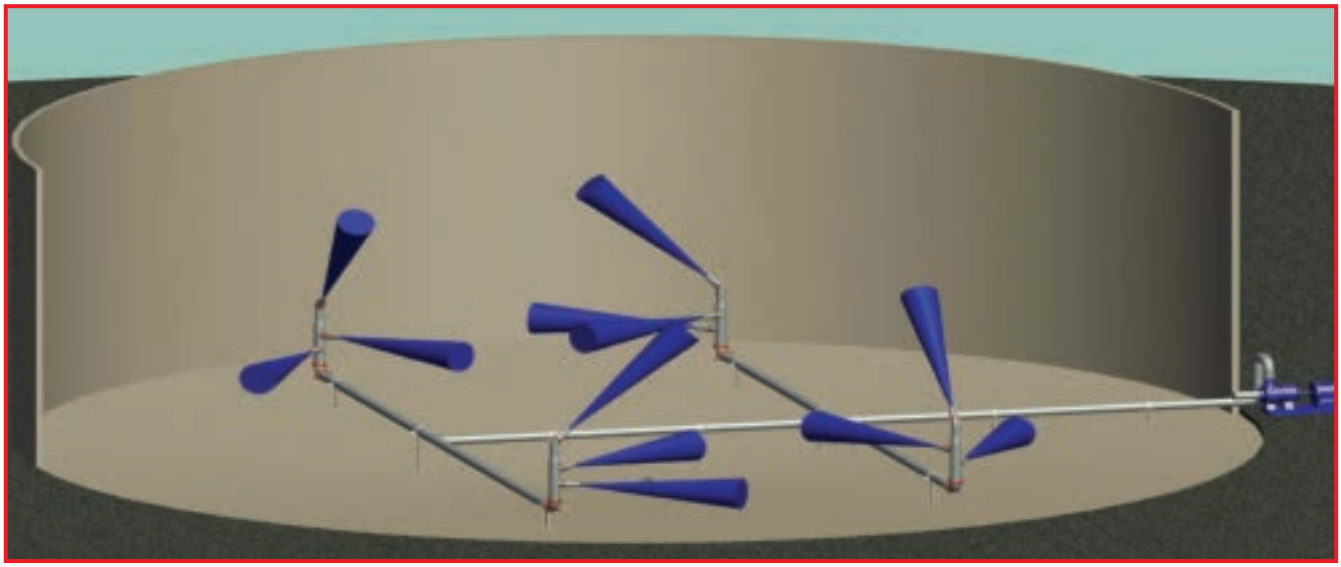

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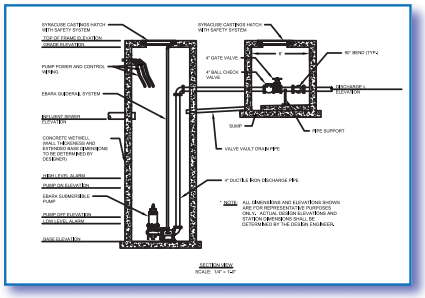

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