JOURNAL

OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

VOLUME 55 NUMBER 3 / ISSN 1077-3002 **FALL 2021**

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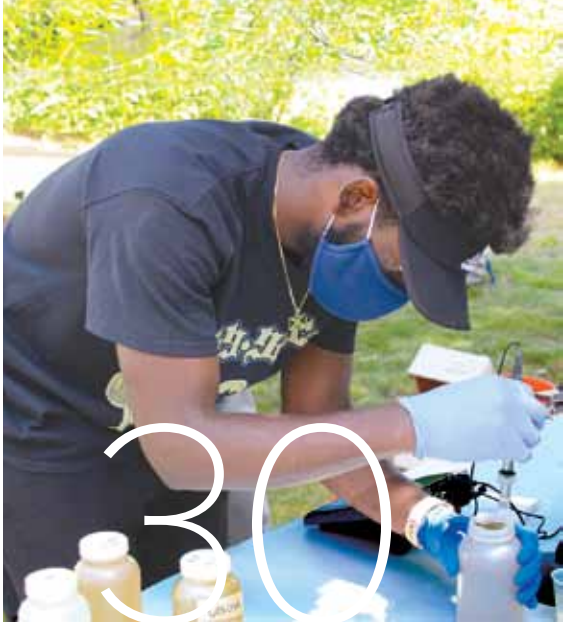

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WORKING FOR WATER QUALITY

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New England Water Environment Association, Inc.
10 Tower Office Park, Suite 601
Woburn, MA 01801-2155
Telephone: 781-939-0908
Fax: 781-939-0907
Email: mail@newea.org
Website: newea.org

Postmaster:
Send address changes to:
NEWEA Journal
10 Tower Office Park, Suite 601
Woburn, MA 01801-2155

Journal Committee Chair & Editor
Alexandra B. Greenfield (Bowen)
bowenab@cdmsmith.com

Journal Committee
Jennifer Lawrence (Vice Chair), Alan Slater, Joseph Boccadoro Charles Tyler, William Murphy Meredith Sullivan, Marie Rivers Dan Coughlin, Don St. Marie Eric Staunton, Robert Mack Helen Gordon, James Barsanti Mac Richardson, Matthew Hross Meredith Zona, Michael Sullivan Janine Burke-Wells

Guest Editors
Jennifer Lawrence
JLawrence@TigheBond.com

William Murphy
wgm@envpartners.com

Technical Editor
Charles Tyler
charleswtyler@msn.com

Copy Editor
Thomas Heinlein

Design/Production
Robert Randazzo

Photo Credits
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OUR ASSOCIATION WAS ORGANIZED NINETY-TWO YEARS AGO in Hartford, Connecticut, on April 23, 1929, with the objectives of advancing the knowledge of design, construction, operation and management of waste treatment works and other water pollution control activities, and encouraging a friendly exchange of information and experience. From 40 charter members, the membership has steadily grown to more than 2,000 today. Membership is divided into the following classes:

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2021 RATES ($)

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Academic	185
Young Professional	70
PWO	110
Dual	45
Student	15

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Virgil J. Lloyd
Senior Vice President
Fuss & O'Neill, Inc., Manchester, CT
VLloyd@fando.com

President's Message

This continues to be a year unlike any other due to Covid-19 (except maybe last year for the same reason)! Conditions were improving earlier in the summer, and I am sure all of you enjoyed the resumption of pre-Covid-19 life-style activities as much as I did, by spending time with friends and getting out to various venues, especially as the warm weather moved in. But even as the "old-normal" was again becoming pleasantly familiar, in many areas the emergence of the Delta variant upended our perceived progress and reminded us that the pandemic is not yet defeated. We will still get through this and emerge stronger on the other side. Until then, I am comforted by the thought that we are in this together, and that the sacrifices each of us makes individually contribute to the benefit of our communities and nation at large.

How appropriate then that the theme this year is about navigating NEWEA through the tides of change in the world around us, including working together to foster diversity—essentially becoming leaders of change. With that spirit on full display, the dedication of our NEWEA volunteers continues to shine and make this a highly vital and dynamic organization. Recent highlights and upcoming events are discussed below.

Our first official NEWEA in-person event was the Operations Challenge Team Training Day on August 6 in New Haven, Connecticut, at the Greater New Haven Water Pollution Control Authority. More than 20 operators from around New England attended. Teams from Massachusetts, Maine, and a combined Connecticut and Rhode Island will represent NEWEA this October at WEFTEC in Chicago. We wish all three teams the best of luck next month!

This was followed on August 12 by our annual Committee Member Appreciation Event at Kimball Farm in Westford, Massachusetts. The attendance was impressive, obviously reflecting some pent-up need for actual in-person interaction! In addition to the usual fun and camaraderie, the event featured a personal moment, with the posthumous awarding of the Committee Service Award to our dearly missed friend Kate Biedron. The award, which was received by her family, recognizes Kate's contributions to NEWEA, including as chair of the Registration and Public Awareness committees, and as Meeting Management Council director. She was also very active with the Young Professionals Committee. Kate was a tireless volunteer and always had a smile and warm greeting. Her legacy will continue with the establishment of the Kate Biedron Memorial Fund.

Operations Challenge Team Training Day was held on August 6 in New Haven, Connecticut

On a more lighthearted note, the event also featured the induction of not one but two "classes" of inductees into the "Select Society of Sanitary Sludge Shovelers"—also known as the 5S. This event is normally conducted during the Spring Meeting; however, with the pandemic preventing us from congregating during the past two Junes, it was eagerly added to the agenda of this first available in-person gathering. As usual, "Influent Integrator" Charlie Tyler struck a near-perfect balance of seriousness with tongue-in-cheek humor! Congratulations to all of the inductees, and a sincere thank you for your dedication to NEWEA.

The Diversity, Equity, and Inclusion (DE&I) Committee continued with an energized agenda over the summer. Recognizing the different natures of organizations (including our membership), the committee presented a well-attended webinar in September that focused on "DE&I 101." The webinar highlighted awareness of DE&I challenges and opportunities at the personal, workplace, and professional levels. The attendees also engaged in a dialogue on how we can advance DE&I in our own workplaces and communities. The DE&I Committee is also reaching outside our membership to develop a hands-on training program. This training is envisioned to be presented initially on Sunday afternoon during the NEWEA Annual Conference, to be coordinated with the Executive Committee and Young Professionals Summit meetings.

And, looking back at other summer successes, hats off to the state operator associations, which have conducted their individual golf tournaments successfully. While I was not able to attend all, for those that I missed I was present in spirit!

Looking ahead to the fall, we are proud that we will have two presentations at WEFTEC's Innovation Pavilion in Chicago, presenting NEWEA's uncommon approach to innovation through the merger with NEWIN and the Innovative/Alternative Onsite Wastewater Treatment Systems (I/A OWTS) task force work to support distributed systems. The Innovation Council I/A OWTS task force is planning a mid-September panel to present its work with the EPA Southeast New England program and to prepare for next steps to move solutions forward.

One main goal of the Innovation Council is facilitating connections with people and organizations to bring innovative ideas and products to market. The Innovation Council has made connections with over 200 people and organizations in support of this effort, and is also exploring exciting new collaborations with incubators, universities, startups, and private companies to support solving water treatment challenges for our members.

On September 29, the CSO/Wet Weather Issues Committee will be conducting a hybrid specialty conference—it will be both an in-person event as well as virtual. This will be our first in-person conference in 18 months, and the committee selected a great venue in Portsmouth, New Hampshire. The program will feature a forum discussion and presentations on integrated planning, as well as case studies on long-term and recent projects both in New England and nationally.

The Meeting Management Committee is moving ahead with planning for the Annual Conference in January 2022. We expect this to be an in-person event at the Marriott Copley Place in Boston and, judging from the volume and quality of abstracts received, we are expecting robust attendance. Mark your calendar for January 23–26, for a welcome resumption of our signature event.

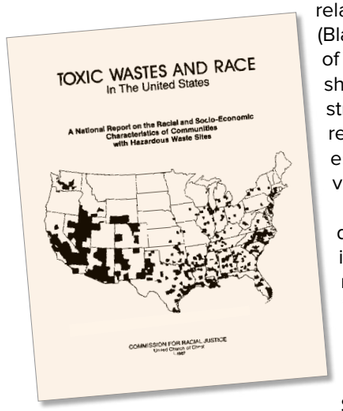
From the Editor

The theme of this *Journal* is environmental justice (EJ). When the co-chair of the Journal Committee, Jen Lawrence, suggested this theme for the fall issue, I was thrilled and excited. The concept of EJ is not new, but recent current events have led EJ to become more prevalent in our daily lives—and rightfully so. After all, fundamentally, do we all not deserve the most basic rights—clean air, a healthy home, and clean water?

Some may not be familiar with the definition of EJ. It is defined as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA, 2021)." Both environmental exposure and community demographics change health outcomes for people.

EJ is a movement intended to start unraveling years of systemic environmental racism. Public policies and industry practices disproportionately place the burden of pollution, waste, and climate-related disasters on BIPOC (Black, Indigenous, People of Color) communities and shows that a lack of infrastructure and community resources only exacerbates a population's vulnerability.

Alexandra Greenfield (Bowen), PE
Environmental Engineer
CDM Smith
BowenAB@cdmsmith.com



One example of such discrimination manifests in redlining—when mortgage lenders draw "red lines" around communities that they do not want to give loans to. In the United States, redlining has pushed BIPOC and other historically marginalized communities out of city centers, further away from natural, green spaces, closer to highways and factories and into lower-quality homes.

Perhaps the most well-known instance of environmental protest by POC dates back to 1982 in the predominantly Black and low-income residents of Warren County. Reverend Joseph Lowery led a sit-in protest against North Carolina's plan to build a polychlorinated biphenyl (PCB) disposal landfill. One of the 500 arrests during this nonviolent civil disobedience campaign was U.S. Congressional delegate Walter Fauntroy. As a result of his arrest, he requested that the General Accounting Office investigate the racial and socio-economic status of communities surrounding four major landfills in the southeastern United States. The resulting study, *Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities,* reported that three of the four landfills were disproportionately near Black communities with incomes below the poverty level.

A few years later, amid the Reagan administration's dwindling environmental monitoring, the Commission for Racial Justice of the United Church of Christ released a breakthrough report, *Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites*, showing that three out of five Latino and Black Americans lived near a toxic waste site.

More than a decade later, Dr. Robert Bullard, a professor at Texas Southern University, wrote *Dumping in Dixie,* which was believed to be the first book that documented environmental injustice in the United States. Recently, I decided to read this book. Although it's disheartening to see how little progress has been made in 31 years, I highly recommend reading this book and recommending it to others.

In 1993, EPA created the National Environmental Justice Advisory Council (NEJAC). A year later the Environmental Justice Small Grants program was established to provide financial assistance to organizations tasked with offsetting results of inequity and public health issues.

President Bill Clinton signed the Environmental Justice Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income populations. The order also established an Interagency Working Group on EJ and directed federal agencies to address disproportionally adverse human health and environmental effects of policies on minority and low-income populations. There's room to grow, but EJ communities are still receiving funding through state revolving fund (SRF) projects, as they deserve.

We're pleased to publish this issue of the *Journal*, and I want to especially thank Jen Lawrence for bringing together all these exciting articles highlighting the important work being done in EJ communities.

Industry News

EPA is awarding $1.1 million to fund beach water quality monitoring and public notification programs in the five coastal New England states

EPA Announces $1.1 million in BEACH Act Grants to New England States

On June 30, EPA announced funding to carry out beach water quality monitoring and public notification programs in the five coastal New England states. EPA is awarding $1,111,000 for Rhode Island, Connecticut, Maine, Massachusetts, and New Hampshire to assist in these efforts.

The announcement came on Scarborough State Beach in Narragansett, Rhode Island, where U.S. Senator Jack Reed and senior Rhode Island officials joined EPA Acting Regional Administrator Deborah Szaro to emphasize the importance of federal funding to assist EPA's partners with local monitoring of bacteria levels, which can become too high for safe swimming, and public notification of potential health risks.

EPA anticipates awarding Beaches Environmental Assessment and Coastal Health (BEACH) Act grants to help the New England states monitor beaches for fecal indicator bacteria, maintain and operate public notification systems, identify local pollution sources, and report results of monitoring and notification to EPA and the public. When elevated levels of bacteria are detected, this funding supports beach warning or beach closing notifications to protect public health.

Since 2002, EPA has provided $22.5 million to the five New England states for water quality monitoring and public dissemination of those findings under the BEACH Act funding.

"Water quality is so important for drinking, swimming, fishing, and tourism. Testing water quality, collecting data, and publicly releasing the results keeps the government accountable for maintaining good water quality," said Senator Reed, a senior member of the Appropriations Committee. "This program ensures people are informed when temporary beach closures are warranted, and it's a smart investment in protecting public health and the health of our waterways."

"Thanks to the Beach Act Grant, the Rhode Island Department of Health is able to conduct monitoring and notification of coastal water quality across the state," said Seema Dixit, director of the Division of Environmental Health at the Rhode Island Department of Health. "It is only through this year-over-year monitoring that we are able to develop and share our understanding of ongoing risks with the public, and also to demonstrate improvements in water quality. Improvements result from reductions in pollution source problems ranging from large-scale upgrades of wastewater treatment plants to local-scale projects that reduce storm-water runoff and pet waste."

Senate Passes Bipartisan Infrastructure Bill

– Source: National Association of Clean Water Agencies (NACWA)

On August 10, the U.S. Senate passed the *Infrastructure Investment and Jobs Act*. Passage of this legislation comes after months of negotiations between the Biden Administration and a bipartisan group of senators.

The legislative package contains $550 billion in new spending, of which $55 billion will go toward clean water and drinking water improvements. The bill's provisions for the water sector include the following:

- $11.713 billion each for both the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF), or a total of $23.5 billion in new federal investment, of which half must be grants or 100 percent principal loan forgiveness. These SRF increases would be on top of additional funds from annual federal spending bills.
- The SRFs would be further leveraged to deliver funding for specific concerns, with an additional $1 billion through the CWSRF and $4 billion through the DWSRF to address emerging contaminants including per- and polyfluoroalkyl substances (PFAS), and $15 billion through the DWSRF to address lead in drinking water.
- Robust funding for EPA's geographic programs supporting water quality around the country.

The bill also contains important authorizations for new, key clean water programs, including requiring EPA to conduct a study of low-income water assistance needs around the country and giving approval to start a pilot program of federal assistance for low-income households as well as a grant program for clean water infrastructure resiliency and sustainability.

The bill also reauthorizes the sewer overflow and storm-water reuse grants program in the CWSRF, both at increased funding, while also allowing states to provide a greater share of their CWSRF as additional subsidization. These changes to the CWSRF statute would facilitate higher funding for years to come, in addition to the direct funding provided in this package.

The bill is critical in improving the delivery of clean and safe water for households around the country, and NACWA applauds Congress for prioritizing water in the bipartisan package. However, the investments are only roughly half the amount initially proposed for water in an infrastructure bill. NACWA will continue working with Congress to advocate for the strongest package possible as negotiations advance with the U.S. House.

Note: All EPA industry news provided by EPA Press Office

EPA released three new resources to help address adverse effects of nutrient pollution

EPA to Help Partners Better Address Nutrient Pollution Affecting Waters

EPA released three new resources to assist the agency's state, territorial, and authorized Tribal partners to address adverse effects of nutrient pollution, including freshwater harmful algal blooms (HAB). These resources will help EPA's co-regulators and partners better protect recreators, aquatic life, and drinking water sources from the detrimental effects of nutrient pollution. The three resources include the agency's Final Recommended Nutrient Criteria for Lakes and Reservoirs, a web-based tool with information and tracking capabilities for HAB, and a technical support document to aid implementation of HAB reduction.

Final Recommended Nutrient Criteria for Lakes and Reservoirs

EPA has published revised recommended ambient water quality criteria under the Clean Water Act to help address nutrient pollution in lakes and reservoirs. As the first update to EPA's nutrient criteria in 20 years, these recommendations advance the scientific understanding of the impacts of nitrogen and phosphorus in our waters. These new criteria will help protect drinking water sources, and recreational uses and aquatic life in our nation's lakes and reservoirs. The new recommendations are based on statistical stressor-response relationships developed from data collected in 1,800 lakes nationwide and incorporated into national models.

The national models help states, territories, and authorized Tribes incorporate local data into the models to account for unique local conditions. EPA's Nutrient Scientific Technical Exchange Partnership & Support (N-STEPS) program is available to help partners use the new models. States, territories, and authorized Tribes can consider adopting the recommended criteria into their water quality standards but are not compelled to revise EPA-approved criteria or total maximum daily load (TMDL) targets.

Tracking CyanoHABs StoryMap

EPA has also published a new ArcGIS StoryMap that will allow the public to learn about and track reported cyanobacterial HAB (cyanoHABs) in freshwaters across the country. CyanoHABs can harm ecosystems and contaminate freshwaters with toxins that can lead to serious human health impacts. Scientific consensus is that the incidence of cyanoHABs has increased in the nation's freshwater systems, in part due to climate change. EPA's *Tracking CyanoHABs* story map creates an online resource for information about cyanoHAB events across the United States. It consolidates freshwater advisory and closure information from state environmental and health agencies into user-friendly, interactive maps. In addition, the story map includes links to information on causes and effects of freshwater HAB; several EPA tools on HAB preparedness and response; and state and local HAB resources such as the laboratories that analyze water samples for cyanobacterial toxins (cyanotoxins).

Implementation Support for EPA's Recreational HAB Criteria

To help states, territories, and authorized Tribes protect swimmers from two cyanotoxins produced by cyanoHABs, EPA has also published *Final Technical Support Document: Implementing the 2019 Recommended Recreational Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin*. This document explains how states, territories, and authorized Tribes may adopt EPA's 2019 recommended criteria for the two cyanotoxins into their water quality standards or use the criteria in swimming advisory programs. The document also addresses implementation of the 2019 criteria's recommendations through other Clean Water Act programs, including identifying and listing of impaired waters, and TMDL development.

EPA and Army Announce Next Steps for Crafting Enduring Definition of Waters of the United States

On June 9, EPA and the U.S. Department of the Army (Army) announced their intent to revise the definition of "waters of the United States" (WOTUS) to better protect our nation's vital water resources that support public health, environmental protection, agricultural activity, and economic growth. Upon review of the Navigable Waters Protection Rule, the agencies determined the rule is significantly reducing clean water protections. On July 30, EPA and the Army further announced upcoming community engagements to revise the definition of WOTUS to ensure clean and safe water for all.

"We are committed to crafting an enduring definition of WOTUS by listening to all sides so that we can build on an inclusive foundation," said EPA Administrator Michael S. Regan. "Uncertainty over the definition of WOTUS has

harmed our waters and the stakeholders and communities that rely on them. I look forward to engaging all parties as we move forward to provide the certainty that's needed to protect our precious natural water resources."

The agencies intend to revise the definition of WOTUS following a process that includes two rulemakings. A forthcoming foundational rule would restore the regulations defining WOTUS that were in place for decades until 2015, with updates to be consistent with relevant Supreme Court decisions. A separate, second rulemaking process would refine this regulatory foundation and establish an updated and durable definition of "waters of the United States."

So that EPA and the Army hear from diverse perspectives, future engagement activities will be developed in coordination with the U.S. Department of Agriculture. "It is vital that farmers and rural Americans have a seat at the table and a voice in this process so that the rule responds to concerns and realities on the ground. The engagement in the coming months is important, and I encourage all stakeholders to provide their experiences and views in order to help shape future policy," said U.S. Secretary of Agriculture Tom Vilsack.

EPA and the Army will be providing an opportunity for stakeholders and the public to provide written recommendations and in August launched a series of public meetings to hear perspectives on both rules. In addition, the agencies have initiated Federalism and Tribal consultations for the foundational rule. The agencies intend to host a series of dialogues with state and Tribal co-regulators this fall to discuss both rulemakings.

Ten regionally focused and inclusive roundtables are planned for the fall and winter. These roundtables will allow a full range of stakeholders to engage and discuss their experience with definitions of WOTUS—including what has worked and what has not within their geographic areas. The roundtables will provide opportunities to discuss geographic similarities and differences and water resources characteristic of or unique to each region and to obtain site-specific feedback about implementation.

Boston River Report Cards Show Widespread Improvements in Bacteria Concentrations and Remaining Localized Challenges

Three Boston-area watershed associations, in collaboration with EPA, jointly announced water quality grades for major Boston Harbor tributary watersheds for the 2020 calendar year.

For the first time, the Mystic River, Charles River, and Neponset River Watershed associations have collaborated on their grading calculations and river report card announcements.

EPA New England and many partners have worked for decades to improve the water quality in Boston Harbor. In addition to the sewage treatment infrastructure built by the Commonwealth of Massachusetts and the Massachusetts Water Resources Authority (MWRA) at Deer Island and elsewhere around the harbor, much effort has focused on water quality in rivers discharging into the harbor.

"By highlighting locations with water quality impairment, we find that we are also directing our action to improving environmental conditions for historically underserved environmental justice neighborhoods."

– Deborah Szaro, EPA NE Acting Regional Administrator

This effort included employing citizen scientists—volunteers from local communities—to gather water quality data in local urban neighborhoods, many of which have historically suffered from neglect and inadequate resources. This citizen science contribution of water quality data assists local, state, and federal officials to target resources strategically, targeting areas most at need and ultimately ensuring the three urban rivers have clean and safe water to support recreation and enjoyment for all Boston-area residents and visitors.

"The contributions of citizen scientists to our efforts to improve water quality in these urban rivers cannot be overstated," said EPA New England Acting Regional Administrator Deborah Szaro. "EPA is grateful to the three watershed associations for the scientific data collection that has helped us to direct our resources to the most critical areas in need of attention. By highlighting locations with water quality impairment, we find that we are also directing our action to improving environmental conditions for historically underserved environmental justice neighborhoods."

Overview

During the past 30 years, water quality improvements in the Boston Harbor have transitioned from addressing major outflows of raw sewage that discharge into the harbor to identifying and addressing many smaller sources of bacterial and other contamination further up the watersheds that also discharge into it.

The three watersheds make up much of the freshwater inputs to Boston Harbor, and all three affect the harbor's water quality. Just as each watershed is unique, each watershed association calculates the grade slightly differently; however, the grades provide a science-based indication of what many Boston-area residents may not have realized—bacteria concentrations in the harbor and rivers are low in dry weather, but major problems arise during and after rainstorms, and localized problems occur in some river tributaries.

The grading systems are based on the percentage of time bacterial levels in the water meet swimming and boating standards for recreational safety during wet and dry weather. Boating standards are often met throughout the watersheds, while swimming standards are typically met in dry weather but continue to be affected by precipitation events. All three grading systems use a three-year rolling average, which helps account for interannual variation in the weather.

"The investment of over $225 million to improve wastewater, stormwater, and combined sewer systems' infrastructure in the Charles River, Neponset River, and Mystic River watersheds has led to significant improvement in the water quality in all three of these important commonwealth resources," said Eric Worrall, Northeast regional director of Massachusetts Department of Environmental Protection (MassDEP). The information we receive from citizen scientists helps to inform policy decisions that lead to cleaner waterways in the commonwealth."

Neponset River Watershed

This year marks the first time the Neponset River Watershed Association has announced individual report card grades based on the data for streams throughout the watershed. The organization has been collecting watershed data since 1995 and samples 41 sites throughout the watershed monthly, from May through October. Sites are sampled on the mainstream of the Neponset River, smaller tributaries, and ponds.

In the Neponset watershed, most segments rated in the A or B range, with Unquity Brook, Purgatory Brook, Germany Brook, and Meadow Brook rating in the D to F range. The grades for the main portions of each watershed, where most recreation occurs, were mostly in the A or B range. In addition to grades for bacteria, the Neponset River Watershed Association prepared separate grades for phosphorus and dissolved oxygen, the concentrations of which can affect fish and wildlife as well as recreation.

"The cleanup of the Neponset and its tributaries has come a long way, and it's gratifying to see so many more people out discovering and enjoying the river as it has gotten cleaner," said Ian Cooke, executive director of the Neponset River Watershed Association. "By continuing to find and fix sewer defects, and by working with private and municipal partners to solve the big challenge of polluted rain runoff from roads and parking lots, we will make the river an even more valuable resource for recreation, fish, and wildlife in all our communities, including our environmental justice neighborhoods."

Mystic River Watershed

Continuing patterns from recent years in the Mystic River watershed, the main stem of the Mystic River received grades in the A to B range, with several smaller tributaries receiving poor grades, such as an F for Mill Creek in Chelsea and a D for Winn Brook in Belmont.

"The good news is that the Mystic—like each of the three great rivers of Boston Harbor—is a relatively clean urban river, safe and accessible for a variety of recreational uses," said Patrick Herron, executive director of the Mystic River Watershed Association. "This news represents a great success story of the Clean Water Act, and its 50-year history of improving environmental and even economic conditions in cities. But there is still work to be done, and the report card we publish with EPA's collaboration shows where effort should be directed on the ground."

Charles River Watershed

Similar to trends identified for several years, five out of six segments in the Charles River watershed were graded in the A or B range, with Muddy River the lone exception, receiving a D-.

In addition to grades for E. Coli bacteria, the Charles River is separately graded on cyanobacteria blooms and combined sewer overflow (CSO) discharges—both public health hazards—especially for boaters and other people coming into contact with the water when these contaminants are present. Cyanobacterial blooms, which have occurred with greater frequency over the past several years, are caused in part by excess phosphorous washing into the watershed from lawns and impervious surfaces. CSO discharges occur when heavy precipitation events overwhelm portions of the sewer system, making discharges of sewage mixed with stormwater necessary to prevent sewage backups into streets and residences.

"The wide variety in Charles River grades from an A in the middle watershed to the D- in the Muddy River reflects the predominant land use around each area," said Emily Norton, executive director of the Charles River Water Association. "Areas with more development and impervious surface are more polluted. We have work to do to restore all areas of the Charles to be ecologically healthy."

Sewage Connections and Nutrient Runoff Concerns

Many Boston Harbor watershed communities continue to struggle with identifying and removing sources of sewage that discharge to the rivers directly or through vast networks of storm drains. In addition, while CSOs have been significantly reduced over the years, they still occur and can impact water quality.

Since 1985, the MWRA has worked with EPA and MassDEP to design, construct, and operate one of the largest wastewater collection and treatment systems in the country. MWRA has closed 35 CSO outfalls and reduced CSO discharges by approximately 87 percent. MWRA, in coordination with EPA and MassDEP, is analyzing if work to date is sufficient or whether additional projects are needed.

"While there is still work to do, our progress to date has transformed Boston Harbor and its tributary rivers," said MWRA Executive Director Fred Laskey. "MWRA is happy to be able to provide laboratory services to the watershed organizations. It helps the public stay safe while enjoying these recreational resources, and it helps us focus on areas that may need more work."

In addition to E.coli bacteria, sampling results indicate other problems faced by all three watersheds. Precipitation events continue to wash phosphorus and other pollutants off lawns or impervious surfaces (streets, parking lots, rooftops, etc.) into local waterbodies, causing excess plant growth and, in some cases, cyanobacteria blooms.

EPA has also further addressed elevated levels of nutrients harming water quality throughout the Charles River watershed, with an eye toward how a similar approach would work in the Mystic and Neponset watersheds. Last year, EPA gathered stakeholder input about a potential path to address stormwater runoff from commercial, industrial, institutional, and residential properties in the Charles River watershed not currently regulated. EPA is evaluating that input along with existing data, with a decision about next steps expected by year-end.

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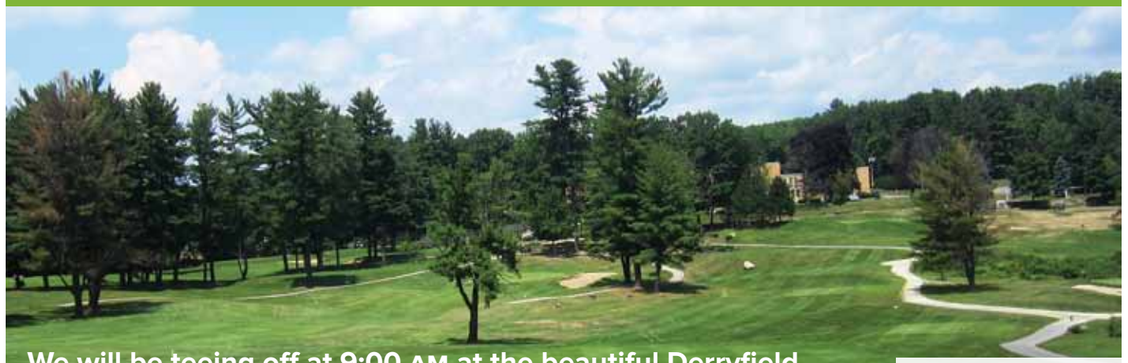

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Catalyzing investment in tree equity with data

ROHIT MUSTI, American Forests, Washington, DC
MOLLY HENRY, American Forests, Providence, Rhode Island

ABSTRACT | Urban trees are critical infrastructure for cities that offer a variety of climate, health, and economic benefits. In most American cities, tree cover is not equitable. Trees are often sparse in socioeconomically disadvantaged and neighborhoods of color, while more prominent in wealthier and whiter neighborhoods. American Forests developed Tree Equity Score to address these inequities and drive investment to plant and maintain trees where they are needed most.

Tree Equity Score is, to the best of our knowledge, a first-of-its-kind nationwide data-driven tool that provides cities and neighborhoods with a blueprint for expanding tree canopy where it has the most socioeconomic and heat island benefits. Analyses include the calculated benefits of planting trees, from economic value to rainwater interception benefits to air quality improvements, unique to each city and census block group. All of the data in the Tree Equity Score is presented for analysis and decision-making in two applications: the Tree Equity Score National Explorer and the Tree Equity Score Analyzer.

KEYWORDS | Tree Equity, Tree Equity Score, health equity, natural climate solution, urban heat island, stormwater, co-benefits

Urban forests are critical for both climate mitigation and adaptation. Trees are a natural climate solution, capturing and storing carbon dioxide. Urban trees also cool cities and block winter winds, giving residents more capacity to adapt to rapidly increasing temperatures, while also reducing heating and cooling costs and the associated carbon dioxide emission.

American Forests, the nation's oldest national nonprofit conservation organization, coined the term Tree Equity to formalize the need for trees as a vital part of urban infrastructure. In most cities today, however, a map of tree cover is also often a map of income and race that depicts consistent tree deficits in "high potential communities" and communities of color (Schwarz *et al.,* 2015). These tree canopy discrepancies track the legacy of redlining disinvestment (Grove *et al.,* 2018) and cause poorer health outcomes, dangerous air quality, higher temperatures, and reduced prosperity in these communities (Wolf *et al.,* 2015).

Significant disparities in tree canopy distribution also have implications for waterways. Trees provide essential functions to protect and preserve drinking water supplies and recreational sites. Urban tree canopy decreases the amount of both peak water discharge during storms (Kuehler et al. 2016) and phosphorus leaching to groundwater (Nidzgorski & Hobbie, 2017). If cities do not achieve Tree Equity, they will lose critical opportunities to restore soil health and improve stormwater systems.

The Tree Equity Score reveals that we need to plant the equivalent of an additional 522 million medium deciduous trees within urbanized areas (populations greater than 50,000) of the continental United States if we want to achieve Tree Equity and slow climate change. Integrating the U.S. Department of Agriculture (USDA) Forest Service's i-Tree software calculations to quantify the ecosystem benefits, American Forests' analysis determines that if every urbanized neighborhood in the United States achieved Tree Equity, we would sequester 9.3 million tons (8.45 million tonnes) of carbon (34.13 million tons [31.01 million tonnes] of carbon dioxide) annually and avoid over 126 billion gallons (478 million cubic meters) of stormwater runoff.

Moreover, a recent USDA Forest Service study reveals that urban tree loss due to extreme weather events, insects, disease, and development pressure has us on a path to lose 8.3 percent in urban tree canopy in the next 40 years (Nowak et al., 2020). We need swift and strategic action to reforest America's cities, and we need to start with the neighborhoods that need it most. Tree Equity Score provides the blueprint for action.

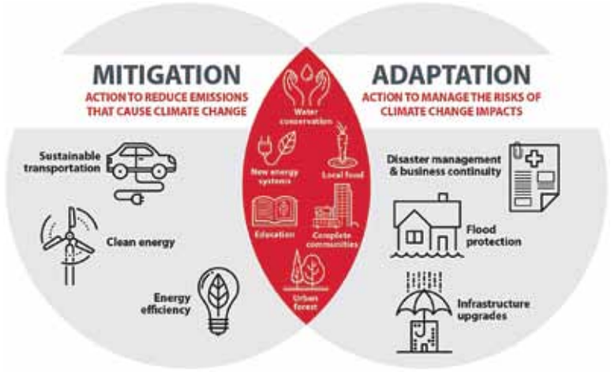
TREE EQUITY SCORE

Momentum for Tree Equity Score started in 2019, when forestry and resilience experts gathered in Washington, D.C., for the U.S. Climate Alliance National Learning Lab. Rhode Island, the one state that chose to frame its entire natural climate solutions strategy around urban forestry, was joined by Maine, Massachusetts, Vermont, Connecticut, and 15 other Climate Alliance member states, all of whom walked away with a detailed plan to maximize the role of their natural lands in reducing global warming.

Following the Learning Lab, American Forests partnered with the state of Rhode Island on an urban forestry pilot initiative (funded by a national charitable foundation) that would serve as a model for other cities and states within the Climate Alliance. This two-year effort required close collaboration with the 19-member stakeholder group composed of state agencies, local and national nonprofits, and municipal foresters.

Throughout the pilot program, American Forests developed, tested, and deployed a suite of analysis, planning, policy, and finance tools that optimize urban forests to capture carbon while improving public health. A GIS decision-support tool was also proposed but a robust market of public and private sector urban forestry mapping platforms that integrated socioeconomic, temperature, and tree canopy data already existed. While these hotspot maps representing a snapshot in time were useful for technical audiences, a cohesive narrative structure was missing around which a broad social and political movement could be built. They were also generally only available to those jurisdictions willing and able to pay their high price.

Tree Equity Score was, therefore, conceived as a more democratic tool to synthesize complex data into a concise narrative through a 100-point index that could prompt action and measure progress from the neighborhood to the national scale. A geospatial data services contractor collaborated to provide a free national dataset and interactive platform available to all urbanized communities.



Building climate resilience—urban forestry is situated at the nexus of mitigation and adaptation[1]

The quantified climate, health, and social impacts of Tree Equity[2]

Historically, trees have largely been planted or allowed to grow along race and class lines. If we continue to plant and protect trees without consciously prioritizing communities that have been neglected, we will reproduce the biases of the past, as illustrated by analysis of New York City's "Million Trees" campaign. With this problem in mind, American Forests proceeded with creating Tree Equity Score.

TREE EQUITY SCORE METHODOLOGY

Tree Equity Score evaluates data at the neighborhood level by combining tree canopy data with population density, income, employment, surface temperature, race, age, and health. These metrics are combined into a single score with values from 0 to 100, where 100 indicates total Tree Equity. Therefore, municipalities should prioritize

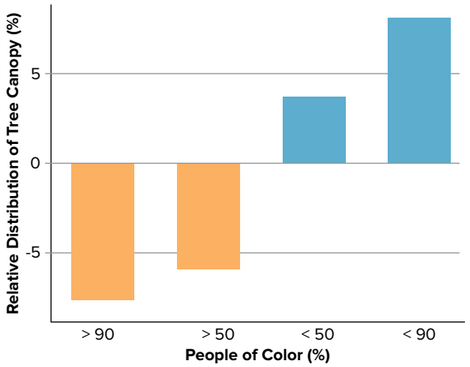


Figure 1. Nationwide people of color vs. tree canopy[2]

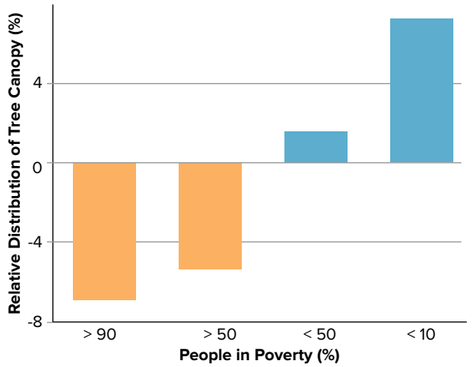


Figure 2. Nationwide people in poverty vs. tree canopy[2]

neighborhoods with the lowest scores for planting and preservation.

The methodology for the score comprises four steps:

1. Identify the Tree Canopy Neighborhood Goal

The Tree Equity Score methodology starts with the canopy goal. How many trees are appropriate for a given neighborhood? The canopy goal is identified by breaking down the country into three eco-regions: forest (40 percent), grassland (20 percent), and desert (15 percent).

1.1 Adjust for Population Density

The canopy goal is adjusted based on the population density of each neighborhood; a denser neighborhood has less room for trees. Thus:

- If the population density is greater than 20,800 people per mi² (8,000 per km²), the goal is reduced by 50 percent
- If it is between 10,400 and 20,800 people per mi² (4,000 and 8,000 per km²), the goal is reduced by 20 percent
- If it is between 5,200 and 10,400 people per mi² (2,000 and 4,000 per km²), the goal is not adjusted
- If the population density is less than 5,200 people per mi² (2,000 per km²), the goal is increased by 20 percent

2. Determine the Tree Canopy Gap

Once the tree canopy goal is established, the difference between the tree canopy goal and the existing tree canopy equals the tree canopy gap. The tree canopy gap is then normalized against the municipal maximum of the neighborhood.

3. Combine with the Priority Index

The Priority Index pinpoints which neighborhoods the municipalities should prioritize to achieve Tree Equity. American Forests hopes to prioritize populations with higher health risks that are exacerbated by climate change and has included Centers for Disease Control and Prevention health risk data in the Tree Equity Score's latest iteration. The priority index includes the following equally weighted characteristics:

- Income: percentage of population below 200 percent of the poverty guidelines
- Employment: unemployment rate
- Race: percentage of people who are other than white non-Hispanic
- Age: ratio of seniors and children to working-age adults
- Climate: Urban Heat Island severity
- Health: prevalence of poor mental, physical, respiratory, and cardiac health (composite index)

The measures are normalized and combined to create a simple priority index from 0 to 1, where 1 indicates a high risk.

4. Calculate Tree Equity Score

To calculate Tree Equity Score at the Census Block Group level, the normalized tree canopy gap is multiplied by the priority index. Municipal scores are achieved by rolling up the block group scores for that city or town. The lower the score (the closer to 0), the greater the need to prioritize tree planting in that neighborhood. For example, a city should prioritize a neighborhood with a score of 57 over a neighborhood with a score of 90.

EQUITY INSIGHTS FROM DATASETS

When American Forests delivered Tree Equity Score nationwide, to the best of our knowledge, it created and shared a first-of-its-kind dataset for analyzing tree equity nationally. While local leaders were familiar with nuances of their area, no nationwide data analysis of this scale existed to supplement the work of federal, state, and local advocates. As a part of delivering this dataset, American Forests offers exploratory analysis to highlight the glaring inequities.

National Insights

Neighborhoods (census block groups) that are majority people of color (POC [greater than or equal to 50 percent people of color]) have an average of 33 percent less canopy than their minority POC counterparts. This gap widens at the extremes; neighborhoods with an extremely low minority population have almost double the tree canopy of high minority block groups. (Figure 1)

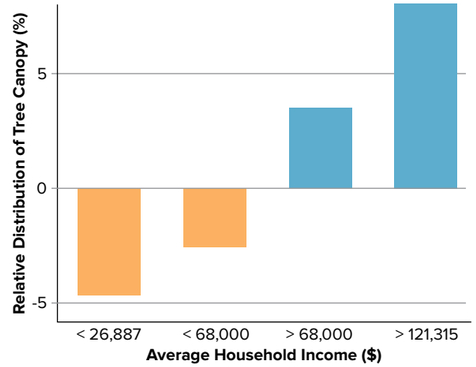


Figure 3. Nationwide household income vs. tree canopy[2]

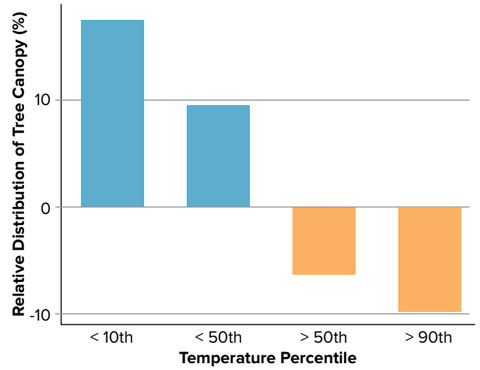


Figure 4. Nationwide temp. percentile vs. tree canopy[2]

Neighborhoods where most households make incomes under 200 percent of the federal poverty line average 25 percent less canopy than their richer counterparts. This gap widens at the extremes; neighborhoods with the highest average incomes average 65 percent more tree canopy than neighborhoods with the highest concentrations of poverty. (Figure 2)

Neighborhoods above the national average for median household income have 20 percent more tree canopy on average than those beneath the national average. Very wealthy neighborhoods (90th percentile) have 50 percent more tree canopy than very poor neighborhoods (10th percentile). (Figure 3)

Warmer neighborhoods (above their city's 50th percentile for temperature) have 21 percent less tree canopy than the national average; cooler neighborhoods (beneath their city's 50th percentile for temperature) have 10 percent less canopy than the national average. This gap grows even wider at the extremes with the coolest neighborhoods (10th percentile) averaging 65 percent more tree canopy than the national average and hotter neighborhoods (90th percentile) averaging 36 percent less tree canopy than the national average. (Figure 4)

Boston Insights

The national trends continue into localities. For example, Boston's wealthiest neighborhoods have 35 percent more tree canopy than its poorest neighborhoods. (Figure 5)

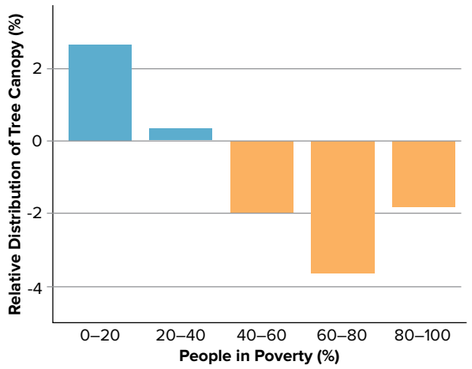


Figure 5. Boston people in poverty vs. tree canopy[2]

BOSTON'S SIGNIFICANT HEAT DISPARITIES

American Forests' new Tree Equity Score Explorer reveals that Boston has one of the most significant heat disparities of any large city in the nation. Residents in some areas of Boston can experience temperatures of up to 10.5°F (5.8°C) hotter than the city-wide average.

Those same neighborhoods have as little as 1 to 3 percent tree cover, whereas other neighborhoods benefit from 61 percent tree cover. The presence of trees can reduce surface temperatures by as much as 10°F (5.6°C), which could mean life or death for children, seniors, and other health-vulnerable populations. Tree Equity Score—an indicator of whether an area has enough trees in the right places so that all people can benefit—is a powerful tool for understanding and redressing the relationship between tree cover and social equity.

TREE EQUITY SCORE APPLICATIONS

American Forests developed two GIS-based decision-support applications to help municipalities explore the data, develop strategies, and catalyze investments for achieving Tree Equity.

Tree Equity Score National Explorer

American Forests launched the Tree Equity Score National Explorer in June 2021. The Explorer delivers

Figure 6. Tree Equity Score National Explorer, Municipal Report for Boston[2]

Tree Equity Scores to 150,000 neighborhoods and 486 urbanized areas (places with at least 50,000 residents) across the contiguous United States. Tree canopy and priority indicators can be viewed or filtered at the block group level. The Explorer provides municipal, congressional district, and statewide reports for the entire study area as well as an ecosystem services calculator based on minimum Tree Equity Score thresholds. Services—calculated using the USDA Forest Service's i-Tree Landscape Tool—include avoided carbon dioxide, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates (PM10 and PM2.5), ozone, and runoff and rain interception. Tree canopy data was donated by a geospatial data services contractor, and a charitable foundation supported tool development. (Figure 6)

Figure 7. The Tree Equity Score Analyzer was first developed for Rhode Island and launched in 2020. Several more Analyzers are being developed for cities across the nation.[2]

The Tree Equity Score Analyzer is a deep-dive tool piloted in Rhode Island. In addition to the data and functions available on the Explorer, the Analyzer can be used to plan tree planting projects at the parcel level and quantifies the specific local benefits to planting trees in that area. Climate and health benefits are calculated using a nonprofit organization's Quantification Tool and include the following estimated benefits based on the user's custom project: new canopy added, total carbon dioxide stored annually and at maturity, rain interception, ozone, nitrogen oxide, particulate matter, volatile organic compounds, and cooling and heating energy conserved. High-resolution Lidar tree canopy data for Rhode Island were purchased from a commercial geospatial specialist and the Urban Tree Canopy Analysis was provided by a New England university's spatial analysis lab. (Figure 7)

To develop a Tree Equity Score Analyzer for other areas, we must engage local tree planting organizations, municipal staff, state agency staff, and community organizers for input on the data most valuable to the area. For example, in the Rhode Island Analyzer, geographic boundaries for the state's Health Equity Zones, managed by the state's Department of Health, were included as were the local watersheds. American Forests is working with the city of Richmond, Virginia, and other cities to develop the next Tree Equity Score Analyzers.

TREE EQUITY SCORE IN ACTION

Prior to rolling out Tree Equity Score nationally, American Forests hosted an interactive workshop (known as a Learning Lab) in Rhode Island. The event engaged 26 municipal practitioners representing 15 diverse communities across the state of Rhode Island. Participants included professionals in planning, public works, town managers, city council, GIS, conservation commissions, parks and recreation, housing, and the private tree care industry. Before expanding this effort nationally, participants were asked to interact with Rhode Island's new Tree Equity tools, including the Tree Equity Score Analyzer.

Following the Learning Lab, participants from several municipalities presented to their conservation commissions, city council, and mayors, encouraging the use of Tree Equity Score and the Analyzer to inform their urban forestry budgets and make programmatic shifts that support Tree Equity.

A few municipalities have used the Analyzer to leverage federal funding. Recently, the Rhode Island Department of Environmental Management was awarded a $100,000 tree planting grant from the National Association of State Foresters and the USDA Forest Service to incorporate Tree Equity Score and the Analyzer into tree planting decision-making.

In the fall of 2020, the Rhode Island Health Equity Zones were invited to design and lead a community-driven Tree Equity demonstration project as a capstone to the two-year pilot. A $100,000 grant was awarded to the Pawtucket and Central Falls Health Equity Zone. By the fall of 2021, 140 trees will have been planted in high-need areas—Pawtucket and Central Falls—including many on private properties. Both cities have some of the highest rates of impervious surfaces in the state and suffer disproportionately from heat islands. The capstone project is a national model for implementing Tree Equity Score and the Analyzer to deliver competitive grant proposals that lead to successful plantings and move the needle on Tree Equity.

Tree plantings in Pawtucket and Central Falls are part of the capstone tree planting[3]

CONCLUSION

Establishing city-wide canopy goals is not enough to ensure that cities are delivering the many benefits of trees to all residents. Tree Equity Score provides cities with the blueprint to center equity in urban forestry. The accompanying Explorer and Analyzer tools provide advocates with the data they need to quantify the benefits of a robust urban canopy, develop planting scenarios, and track progress toward equity. Tree Equity Score helps make the case to prioritize resources in neighborhoods most in need of trees; it is what communities choose to do with the data and tools that matters most.

ACKNOWLEDGMENTS

Development of Tree Equity Score is supported by the Doris Duke Charitable Foundation's Environment Program. Owing to a generous in-kind donation of tree canopy data Tree Equity Scores could be calculated for all urbanized neighborhoods in the contiguous United States.

1. Source: Penn State University
2. Source: American Forests
3. Source: Groundwork Rhode Island

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ABOUT THE AUTHORS

- Molly Henry is the senior manager of climate and health at American Forests. She manages stakeholder engagement to develop, advance, and deploy the organization's climate and health tools to cities and regions with a focus on the Northeast.
- Rohit Musti is the senior manager of data science at American Forests. He leads the software and data engineering projects for the organization.

The Gentilly Resilience District—a case study of resilience and social equity in New Orleans

MARY KINCAID, PE, City of New Orleans Project Delivery Unit, New Orleans, Louisiana
BERNADETTE CALLAHAN, PE, Stantec Consulting Services Inc., Philadelphia, Pennsylvania

ABSTRACT | In 2017, New Orleans received $141 million in funding from the U.S. Department of Housing and Urban Development National Disaster Resilience Competition to create the city's first resilience district in Gentilly. The Gentilly Resilience District combines projects and programs within the Gentilly neighborhood, a low-lying community with heightened urban heat, flood, and soil subsidence risks. The Gentilly Resilience District focuses on innovative water management solutions to increase both physical and social resiliency in the community. This is accomplished through projects and programs that not only reduce flood risk but spur economic growth potential and build equity and employment opportunities in the most vulnerable neighborhoods. This paper provides an overview of the Gentilly Resilience District and highlights the importance of a holistic view to water management.

KEYWORDS | New Orleans, Living with Water, environmental justice, climate resiliency, Gentilly Resilience District, pumped drainage, blue, green, and gray infrastructure, triple bottom line benefits

INTRODUCTION

New Orleans is a coastal city in Louisiana within the Mississippi River delta. The identity of New Orleans is defined by water with three distinct waterfronts—Lake Pontchartrain to the north, the Mississippi River to the south and west, and coastal wetlands along the Gulf of Mexico to the east. The city is surrounded by water on all sides with much of it at or below sea level. In the most extreme cases, neighborhoods sit up to 8 ft (2.4 m) below sea level. This topography creates a "bowl-shaped" community susceptible to flooding.

New Orleans was initially settled along higher land in the French quarter and uptown areas along natural levees formed by the Mississippi River. In the early 20th century, levees, canals, and pumps revolutionized the city's drainage systems. These pumps made it feasible to artificially lower the water table in low-lying swamp lands to allow for additional development in the city. This pumping technology was so innovative and successful, in fact, that New Orleans became a model for other low-lying areas in the world. New Orleans quickly became a place of opportunity for low- to moderate-income households with opportunities for home ownership within the affordable, newly drained swamp lands.

DRAINAGE IN NEW ORLEANS

Given that much of New Orleans sits at or below sea level, its drainage system operates under a pumped drainage model. In other words, every drop of water that lands within the "bowl" is pumped out. The city's drainage system comprises more than 68,000 catch basins, 1,500 mi (2,414 km) of storm drains, 200 mi (321 km) of canals, and 120 pumps housed in 24 pumping stations.[1] Water from rainfall events is directed from impervious surfaces, such as rooftops and roadways, into catch basins and underground storm drains and canals. From there, water is pumped into aboveground canal systems and directed to Lake Pontchartrain. The canal systems physically divide neighborhoods, with different conditions and health outcomes on either side.

The pumping stations in New Orleans have a combined capacity of over 50,000 ft^3/sec (1,416 m^3/sec). This equates to roughly a 10-year level of service, or 4.7 in. (11.9 cm) of rain over three hours.[2] Operational capacity of the pumps can differ, however, depending on the status of pumps in service. Although New Orleans has one of the largest pumping systems in the world, it is still overwhelmed with modest rainfall events. The reason is that pump capacity cannot keep up with the peaks in rainfall intensity, causing water to back up in the pipe network and streets. It is not uncommon for residents to relocate their cars to higher ground when a storm is expected for fear of property damage. This limited pumping capacity is further exceeded by increases in rainfall intensity and frequency due to climate change.

Large-scale investments have been made over the last 10 years to address the city's aging infrastructure, including its energy, perimeter flood control, and pumping systems. The $14.45 billion federal investment for the hurricane and storm damage risk reduction system is the most significant of these investments. This project provides front-line protection with 350 mi (563 km) of levees and floodwalls, 73 non-federal pumping stations, three canal closure structures with pumps, and four gated outlets. These perimeter flood controls provide storm surge protection with a 100-year level of service.[3] In addition, the canal closure structures add pumping capacity of 24,300 ft^3/sec (688 m^3/sec). This pumping system can drain an Olympic-sized pool in four seconds, or drain the volume held within the New Orleans Superdome in 90 minutes. These pumps operate independently from the city's traditional energy and pumping station network, strengthening resiliency. They operate during hurricanes and the largest storm events to prevent storm surge from overtopping the system and to pump stormwater out of the city. Though these systems are planned to be incorporated into the stormwater system in the future, New Orleans still relies on its traditional pumping station system for interior stormwater drainage.

With an average of over 60 in. (152.4 cm) of annual rainfall, pumps are run frequently. Although this constant pumping keeps the city dry, it has resulted in an artificially low water table and varying soil conditions. This constant wetting and drying of soils has increased the rate of soil subsidence, increasing the need for pumping as the city sinks further below sea level.

Although these challenged soil conditions are a city-wide issue, not all residents are affected equally. Former redlining practices and generations of intrafamily property succession have led to a continuing concentration of minorities in low-lying areas. Low-to-moderate income individuals disproportionately reside in older homes built at lower elevations where soil subsidence and flood risk are most acute, creating a disproportionate impact to these communities. Neighborhoods are physically separated by canals and flood walls, further contributing to segregation, blight, and disinvestment. Lakefront beaches along Lake Pontchartrain that once provided access to swimming were closed in the 1960s due to a lack of investment. City Park and Bayou St. John offer fishing and kayaking, but most water recreation in New Orleans requires a boat. Consequently, more residents associate water with flooding and hurricane events than recreation and climate adaptation. For many neighborhoods in New Orleans, flood risk is a matter of environmental justice.

ENVIRONMENTAL JUSTICE

EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[4] Environmental injustices are apparent in many of the low-lying communities in New Orleans. Low-lying and heavily paved areas of a city tend to offer the most affordable housing, exposing low- to moderate-income households to flood and urban heat risks.

According to a recent study by Climate Central, New Orleans was ranked as having the worst urban heat out of 158 cities analyzed. The study noted that heavily paved areas with little tree cover and vegetation can be as much as 15°F to 20°F (8°C to 11°C) hotter than surrounding areas. That places a disproportionate burden on low- to moderate-income households to spend a greater portion of their income on energy use, while living in less energy-efficient housing.

Extreme heat and poor air quality increase the risk of death from hyperthermia and cardiovascular disease. Moreover, those with chronic diseases such as diabetes, kidney disease, or high blood pressure are much more vulnerable in these unfavorable environments. According to a 2013 study from the City of New Orleans health department, life expectancy in New Orleans can differ by as much as 25 years across neighborhoods due to conditions and socioeconomic factors such as income and education. The City of New Orleans is taking steps to resolve these disparities. Through climate resiliency and adaptation programs, New Orleans can combat these issues by ensuring that disproportionately affected and underserved areas have infrastructure solutions with the greatest contribution to the community.

In the Blue and Green Corridors project, "blue corridors" are not merely water detention systems but living, linear wetlands that fundamentally change how water flows through the lowland area and transform the typical suburban grid into a lush and distinctive area of opportunity

LIVING WITH WATER

To reduce pumping demands and the rate of soil subsidence, the city is adopting a Living with Water approach through strategic investments in innovative water management. This new approach treats water as a resource by creating space within the public realm to manage water where it falls. This is a big shift from the traditional drainage model that collects and conveys water to pumping stations as quickly as possible.

Living with Water is accomplished by introducing vegetated, green infrastructure practices upstream of catch basins to manage runoff block by block, in combination with larger, strategic storage solutions to capture and detain water during rainfall events. This additional storage increases groundwater recharge, reduces soil subsidence, and improves water quality. It also provides many environmental, economic, and social benefits for the surrounding community. These benefits can include more green space for recreation, fewer urban heat island effects, improved public health, economic growth and investment, and new local "green" jobs.

INTRODUCING THE GENTILLY RESILIENCE DISTRICT

In 2015, the City of New Orleans participated in the U.S. Department of Housing and Urban Development's (HUD) National Disaster Resilience Competition (NDRC) with a proposal to create the city's first Resilience District in Gentilly. The Gentilly neighborhood was selected for its elevated social and physical resilience risks as well as to support the area's recovery and revitalization and to leverage existing projects and investments in the area. Gentilly was one of the worst-hit areas during Hurricane Katrina with over 15 ft (4.6 m) of flooding in the low-lying areas. New Orleans continues to restore amenities, tree canopy, and homes damaged by Hurricane Katrina. The city was awarded $141 million to implement the Gentilly Resilience District proposal, building upon $250 million in stormwater infrastructure investments funded through the U.S. Federal Emergency Management Agency (FEMA) hazard mitigation grant program.

HUD NDRC funding encourages a holistic view of water management by incorporating social and environmental benefits into the benefit–cost analysis, in addition to the benefits of reduced flood risk. This view encourages the use of smaller, more distributed systems and programs. In addition, part of the funding can be used for non-stormwater items such as playgrounds, improved bicycle and pedestrian facilities, and placemaking (process of creating quality public spaces that people want to live, work, play, and learn in) improvements. As a result, HUD NDRC-funded projects often have a wider focus than traditional flood management ones.

The Gentilly Resilience District is, to the best of our knowledge, the first resilience district that focuses on rebuilding and strengthening all aspects of the community. The district's overarching goals are to reduce flood risk and subsidence, improve energy reliability and community quality of life, and encourage economic and social revitalization. To accomplish these goals, the City of New Orleans has partnered with the New Orleans Redevelopment Authority and the Sewerage and Water Board of New Orleans to leverage existing investments and to build upon their experience from other pilot resilience projects.

The Gentilly Resilience District includes the following projects and programs:

- **Mirabeau water garden** is a stormwater retrofit to the 25 ac (10.1 ha) former Sisters of Saint Joseph convent site along Mirabeau Avenue. The water garden diverts and temporarily stores 10 MG (37.9 ML) of stormwater from the public storm system into constructed wetlands while also being a space for recreation and environmental learning.
- **Pontilly neighborhood stormwater network** enhances the aesthetics of the Dwyer Canal and makes green infrastructure retrofits to vacant lots, streets, and alleyways in the surrounding Pontchartrain Park and Gentilly Woods neighborhoods. This project improves drainage and beautifies and connects the two neighborhoods historically divided by the canal system.
- **Blue and Green Corridors project** combines green, gray, and blue infrastructure retrofits and aesthetic enhancements to six public parcels and 3 mi (4.8 km) of the public right-of-way. Blue and Green Corridors will rethink streetscapes to slow and store stormwater runoff while facilitating safe and comfortable spaces for travel and recreation. Parks and community spaces are strategically planned along the project's length to maximize the surrounding community's benefits.
- **St. Bernard neighborhood campus** includes green and gray infrastructure retrofits and recreational improvements at McDonogh High School and Willie Hall Playground. The project sits along the banks of Bayou St. John to serve as a community nexus and provide much needed flood storage. It includes both underground and aboveground detention, updated recreation fields, playgrounds, and major tree plantings.
- **St. Anthony green streets project** establishes a new standard for neighborhood streets and playgrounds by making stormwater management integral to neighborhood revitalization. Stormwater bumpouts and major tree plantings will soak up water and change the character of the streetscape.

A system of parks, playgrounds, and community amenities alongside linear features in the Blue and Green Corridors project help to build social resilience through vibrant public spaces that encourage movement and activity

- **Dillard wetlands** includes the retrofit of woodlands to capture water from neighboring areas and provide a nature preserve.
- **Dillard campus** includes green infrastructure and drainage improvements throughout the campus of Dillard University.
- **Community adaptation program**, offered through the New Orleans Redevelopment Authority, provides $5 million in investment to residential homeowners to retrofit their properties with small-scale stormwater management. This program will provide up to $25,000 in funding for up to 200 eligible low-income applicants to construct rain gardens, porous pavement, or other vegetated systems on their properties.
- **Reliable energy and smart systems program** increases energy and water utility resilience through investments in micro-grids, energy redundancy at critical water infrastructure sites, and a water monitoring network.
- **Workforce development program** trains and prepares Gentilly residents to build water management projects and develop increasingly vital skills in water infrastructure development and maintenance. This provides opportunities for unemployed and under-employed city residents to enter the growing economy in water management.
- **Placemaking program**, offered through the Arts Council of New Orleans, involves youth and local artists in public art installations along the London Avenue canal and other Gentilly water features to enhance public understanding of the Living with Water initiative.

Together, these complementary projects transform the community, providing benefits beyond water management, such as improved health, economic opportunity, environmental education, and recreation. Gentilly will show communities aspiring to resilient, safer, and more equitable living how to adapt and thrive in a changing environment.

COMMUNITY ENGAGEMENT

One core principle of environmental justice is enabling stakeholders to play an active role in planning and design. Such engagement ensures that the community is aware of the proposed projects and understands their importance. It also empowers the community to take ownership. Community members play an important role by informing design teams about hyper-local environmental considerations and priorities and providing inspiration for the design.

The City of New Orleans has worked closely with the RoadWork Nola and Neighborhood Engagement offices, building on existing networks and neighborhood ambassadors. The approach to community engagement and participation was extensive and different from most engineering projects. First, the teams organized a workshop to inform the community about the project goals, funding guidelines, timelines, benefits, and impacts. Through several workshops and public forums, design teams and City staff asked residents open-ended questions about the accessibility of their neighborhoods to inform project scoping and design. Residents could pick from a range of engagement styles at events, from one-on-one conversations with designers to voting on various elements of design. The teams were thoughtful about offering options for time of day and styles of engagement to increase accessibility. In the planning and design phases the teams educated the public about potentially beneficial solutions to explore further. The teams requested community input on their priorities and preferences at critical stages of design. As the designs progressed based on public needs and comments, the teams gave regular updates and requests for input via public meetings, social media and website updates, signage and branding, targeted mailings, and neighborhood meetings. As restrictions associated with Covid-19 are lifted, the teams anticipate more in-person meetings to include community garden plantings, bike events, and parties within the newly built parks and community spaces to build excitement. By providing different types of opportunities and various venues and platforms, the City expanded the engagement and increased public buy-in.

The biggest challenge has been convincing the community it is safe and desirable to allow water into the streetscape and public realm. While the identity of New Orleans is tied to water, most residents see water as a threat. Their connection to water management is limited since most live behind levees and floodwalls. Through public education, pilot projects, and job training programs, the goal has been to transform residents' perception of water as a threat to one of water as a resource and asset.

FUTURE OF NEW ORLEANS

The future of New Orleans depends on projects and programs such as the Gentilly Resilience District to further connect the physical resilience of the city with its social resilience. This requires a holistic view of water management strategies and investments in the community that facilitate education, empowerment, and social equity. The Gentilly Resilience District provides a model for other communities aspiring for greater resilience, safety, and equity.

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ABOUT THE AUTHORS

- Mary Kincaid, PE, is the sustainable infrastructure program manager for the City of New Orleans project delivery unit. As an engineer, Ms. Kincaid believes in the transformative power of infrastructure to elevate human society and foster community. She is one of several project managers overseeing the Gentilly Resilience District on behalf of the City of New Orleans.
- Bernadette Callahan, PE, is the green infrastructure leader for Stantec Consulting Services, Inc. and project manager for the Blue and Green Corridors project. Ms. Callahan has dedicated her career to the planning and design of green infrastructure and related practices that capitalize on triple bottom line benefits for the communities she serves.

Green jobs in blue fields—a field with tremendous potential for equity

NISHAILA PORTER, GIP; EMILY NORTON; and JANET MOONAN, PE
Charles River Watershed Association, Boston, Massachusetts

ABSTRACT | The water industry is at a critical juncture: Many workers in public works and water-related utilities are retiring, at a time when the mitigation of climate change and pollution of local waterbodies through nature-based solutions, including stormwater infrastructure, is urgent. As we prepare for the U.S. government's major investment in infrastructure, a key piece of our plan must be training programs that make stable, sustainable jobs in water management accessible to individuals from underserved communities. Supporting the necessary institutional and policy changes to do this is one of many ways Charles River Watershed Association (CRWA) and others in the field are advancing racial equity and opportunity for those who have been excluded from pathways to economic success in the water management industry.

KEYWORDS | Green jobs, equity, stormwater, wastewater, clean water, workforce development, climate change

THE PROBLEMS

Investments in our water infrastructure are long overdue. A 2016 survey of Massachusetts municipalities found spending needs of some $17 billion, including $7.24 billion for clean (drinking) water delivery, $8.99 billion for wastewater treatment and handling, and $1.58 billion for stormwater management. In 2019, the American Society of Civil Engineers estimated an $81 billion annual investment gap across the country in water and wastewater systems, an amount predicted to grow to $136 billion before the end of the decade if investment trends continue. These figures likely undercount the true fiscal gap, particularly if we account for climate change.

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan outlines the anticipated impacts of climate change in the state. In addition to increasing temperatures, the plan projects increases in precipitation events and the number of rainy days, events that will result in more stormwater runoff, higher surface water levels, more frequent flooding, and inundation of land not typically affected by flooding. The plan also notes an increase in the number of continuous dry days, including more frequent and intense droughts. Overall, the climate in Massachusetts will become warmer and more extreme, with increased severe winter storms, nor'easters, tropical storms, hurricanes, thunderstorms, and high winds. Since this plan was developed for the commonwealth, predictions such as those in the Sixth Assessment Report released by the United Nations in August 2021 have become even more dire.

The impacts of climate change are disproportionately affecting people from disadvantaged socioeconomic backgrounds, which include minority, low-income, and English isolation communities (i.e., environmental justice communities). Often, these communities have been pushed into less favorable areas due to systemic racism, and/or environmental and public health hazards have been foisted on the neighborhood without its consent. Myriad factors have limited access for these communities to the decision-making and governing processes, perpetuating the cycle of disproportionate impacts. As a consequence, these environmental justice communities disproportionately bear the health impacts of environmental pollution.

We also face a near crisis in employment, as more workers are retiring from water, wastewater, and stormwater jobs than are entering them; currently, retirement eligibility in the water utility industry is estimated to be as high as 30 to 50 percent. Historically, this industry has comprised a predominantly white male workforce: A recent Brookings Institute report found not only that these jobs are held mainly by older people, but that racial and gender diversity is largely absent. In a space where one-third of all jobs are estimated to be obtained through family, friends, or colleagues, underrepresentation of these diverse groups can be a major barrier to workforce entry. Subsequently, education, exposure, and technical experience become the gatekeepers to securing and advancing careers in the industry.

Boston's X-Cel Conservation Corps prepares young people for careers in water management and conservation

AN OPPORTUNITY

In August 2021, the U.S. Senate approved a $1 trillion infrastructure bill. Assuming the bill is passed by the U.S. House of Representatives and signed by President Biden, this funding will allow our country to repair not only roads and bridges but also water, wastewater, and stormwater systems. Investing in our infrastructure will mean thousands of new jobs. But who will get them?

With the upcoming infusion of funding, we have a unique opportunity to reduce the barriers to entry so we can diversify our workforce, provide economic opportunity to underserved communities, and ensure a skilled workforce to rebuild our country's infrastructure. But that will also require proactive outreach to women, people of color, individuals leaving the prison system, and others who have been systematically shut out of good employment opportunities due to historical, systemic racism or discrimination.

If we are to succeed in connecting people from disadvantaged backgrounds with these jobs, we must lower numerous barriers to entry into the industry. One barrier is simply awareness. When it comes to "green jobs," the public discussion tends to focus on energy, i.e., solar, offshore wind, insulation, etc. Yet jobs related to the delivery of clean drinking water, disposal of wastewater, and stormwater management are also green jobs—sustainable clean water is essential for a healthy environment.

In fact, in the hierarchy of green jobs, those related to water management are often more desirable than those in the energy fields. Jobs in clean energy, such as solar panel installer or energy efficiency auditor, are relatively low-paying and do not easily lead to advancement or higher pay. In contrast, an applicant with a high school diploma or a GED who obtains a wastewater operator certificate and gets a job at a wastewater treatment plant can climb a career ladder to higher pay and greater responsibility. For example, Mark Young began his career in wastewater with a Grade 2 certification at the age of 16 and is now the executive director of the Lowell Regional Wastewater Utility. We must make policymakers and workforce development programs aware of the attractiveness of water management careers, and make sure that the message is equitably disseminated to all communities across New England.

Other barriers are more fundamental. Individuals born into poverty are more likely to suffer poor nutrition, chronic disease, family instability, and mental health problems, some or all of which often combine to exacerbate the various inequalities faced by low-income individuals. They are less likely to have access to good quality education and career exposure, and often are not taught the hard skills required for school or professional skills for the workplace. This does not mean they cannot succeed, but it does mean they may require more support to do so.

EXISTING PROGRAMS—SUCCESS STORIES

One program that is increasing the accessibility of water management careers is EPA's "Youth in Environment," which gives four to six school students from Lowell and Lawrence summer internships at the Lowell and Lawrence wastewater treatment plants. Daily responsibilities include everything from painting and plumbing to collecting water quality samples and learning about the overall treatment process and other details about the wastewater plant. Students take field trips to places such as the New England Aquarium, Squam Lake, and Boston's Deer Island Treatment Facility. Program graduates have gone on to pursue environmental studies in college, while others have found employment in various trades. With a large boost in funding, this program could expose many more young people from more communities to water management careers.

Boston's X-Cel Conservation Corps is another excellent program working to break the cycle of poverty by preparing young people from Boston for

X-Cel prepares members for the Massachusetts Grade 2 municipal wastewater operator's license exam. Once they obtain their wastewater operator's licenses, members enter paid internships at wastewater treatment plants to obtain hands-on experience.

careers in water management and conservation. The Charles River Watershed Association (CRWA) trains X-Cel students in installing and maintaining green stormwater infrastructure (GSI) as well as in making public presentations about GSI. From their work with CRWA, X-Cel members better understand the GSI field, gain technical expertise, and engage with the public.

X-Cel offers its members traditional education in preparing for the Massachusetts Grade 2 municipal wastewater operator's license exam, and it goes above and beyond that to ensure students succeed. For example, if necessary, X-Cel members get help obtaining their high school equivalency credentials, learner's permits, and driving licenses. They also participate in job readiness training that incorporates advice on navigating a largely white workplace, as many of these young people have grown up in relatively segregated communities. Once they obtain their wastewater operator's licenses, members enter paid internships at wastewater treatment plants to obtain hands-on experience, leading toward well-paying jobs in the industry. Presently, X-Cel graduates approximately 30 students per year. With additional funding the program could expand to train and support dozens or hundreds more young people in entering the wastewater management field.

A promising initiative still in the early stages is a conservation corps for the city of Boston, modeled on Philadelphia's Power Corp (PowerCorpsPHL) program. Sixty percent of PowerCorpsPHL members have adult criminal records, 10 percent come through the foster-family system, and others come from alternative high schools. Participants receive training in 21st-century fields through "industry academies": Urban Forestry Academy, GSI Academy, and Solar and Electrical Academy. Importantly, PowerCorpsPHL members also receive help with broader life skills: A full-time social worker offers mental health counseling, and members also receive help obtaining federal Supplemental Nutrition Assistance program benefits, childcare, tuition benefits, and even assistance with paperwork. PowerCorpsPHL connects members to employment or post-secondary education and offers lifelong access to support services for all alumni. A city-level conservation corps in Boston would likely increase representation for underrepresented individuals in the workforce on a practical hands-on level while also combating systemic issues. It would also unify green job initiatives by leaning on community connections to capture currently engaged individuals and by incorporating existing programs and training into workforce development.

The Codman Square Neighborhood Development Corporation (CSNDC) is another program that provides workforce development. Through its green infrastructure program, CSNDC trains residents from disadvantaged backgrounds in green infrastructure practices with a focus on climate resiliency. Aimed at creating economic opportunity for low- and moderate-income residents, the program provides skills that make residents attractive to employers such as contractors and landscapers. Empowering residents through knowledge and economic stability can encourage them to become community decision-makers.

CRWA staff Nishaila Porter, with support from a local environmental engineering firm, facilitating GI Ambassador training with X-Cel Conservation Corps members at the Washington Irving Middle School in Boston

Finally, a workforce development program that does not concentrate on water management jobs but that could be expanded to do so is the pathways in technology program (P-TECH). Founded in 2011 by a large multinational technology company and now involving some 600 industry partners, P-TECH targets underserved populations to better prepare a workforce for "new collar" jobs in science, technology, engineering, and mathematics (STEM)—skilled positions that do not necessarily require a traditional, four-year college degree. P-TECH students earn high school diplomas and associate degrees aligned to industry needs while receiving paid mentorship and paid internships, all within six years or less, and they are often first in line for employment with an industry partner. P-TECH is available in high schools in 11 states, including Connecticut and Rhode Island; though not currently available in Massachusetts, the program would like to expand there and elsewhere.

GREEN JOBS AND WATERSHED HEALTH

The Charles River watershed has a diverse population; to be successful in building the support necessary to further clean up and enhance the watershed, all must feel they have a stake in the health of the Charles River. That means equal access not only to enjoy the river recreationally but also to access the jobs that further cleanup of the Charles River relies upon.

When CRWA was founded in 1965, releases of sewage and industrial pollution into the river were common. Since then—and after billions of dollars have been spent on the Boston Harbor cleanup—sewage releases have been reduced by over 90 percent. Now the biggest threat to Charles River's health is stormwater runoff from our built environment that carries phosphorus and other pollutants to the nearest waterbody and ultimately into the river and Boston Harbor.

Through the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program, EPA regulates discharges from municipal separate storm sewer systems (MS4s) to local water bodies and wetlands. In Massachusetts, this program is managed by a general permit (2016 NPDES General Permit for Stormwater Discharges from Small MS4s or MS4GP), which became effective on July 1, 2018, and was subsequently modified on December 7, 2020. Among many other requirements, the MS4GP requires communities to meet total maximum daily loads (TMDLs), or pollution budgets, for nearby water bodies.

In the Charles River watershed, two approved nutrient TMDLs for phosphorus exist: one for the Lower Charles River basin, published in 2007, and one for the Upper/Middle Charles River basin, published in 2011. Per the MS4GP, Charles River watershed communities must reduce phosphorus pollution consistent with the TMDLs through a phosphorus control plan (PCP). Appendix F of the MS4GP describes the PCP requirements, implementation of which is anticipated to achieve the TMDL-established, targeted phosphorus reductions over a 20-year period. Compliance requires that both non-structural best management practices ([BMPs], e.g., street sweeping, catch basin cleaning, and an advanced leaf litter pickup program) and structural BMPs (e.g., infiltration systems, rain gardens, and porous surfaces) be implemented through local programs, projects, and policies.

Non-structural controls can only go so far. EPA's credits for non-structural BMPs can achieve up to 17 percent of the required phosphorus load reduction, likely impossible without a major investment that may not be balanced by the tangible benefits. That leaves the remaining pollution reduction to be achieved through planning, permitting, design, and construction of structural stormwater BMPs.

Long-term success of phosphorus pollution reduction will depend on maintenance of these BMPs.

In most communities, public works will manage the care and ongoing operation of structural BMPs; however, such organizations are already stretched to capacity. It will be difficult, if not impossible, to find time for training on stormwater BMP asset management, including maintenance workflows and tracking, while performing critical proactive and reactive public health and safety efforts related to water, wastewater, and parks, as well as daily operations like catch basin cleaning and street sweeping. So who is going to do the work necessary to ensure that the major investment made in creating clean water will be maintained? Communities should think ahead about adding staff or outsourcing to manage expanded stormwater needs. Having more individuals who have successfully completed the programs previously discussed is one way to make a qualified workforce more readily available.

CO-BENEFITS FOR CLIMATE RESILIENCE

An important co-benefit of upgrading stormwater systems to address pollution problems is enabling communities to increase resiliency to climate change. When our stormwater systems were built many decades ago, they were designed to manage the amount of rainfall and snowmelt we received at that time. However, as previously cited, climate change will lead to more frequent and extreme flooding. By investing in nature-based solutions, including GSI, as well as traditional gray infrastructure solutions where appropriate, cities and towns can protect people and property from these dramatic rainstorm events. These practices will also mitigate climatic impacts of increased heat by adding vegetation and tree canopy that create shade and improve air quality, and in some cases assist with cooling of buildings, thus reducing energy costs. GSI practices also decrease impervious cover, which typically captures heat and contributes to the urban heat island effect. Practices that infiltrate stormwater help protect from drought by recharging groundwater and contributing to baseflows.

Determining where stormwater management practices should be installed requires community input. In environmental justice areas, given the historical exclusion from decision-making that has negatively affected public and environmental health in the neighborhood, giving residents access to the process is critical. The programs discussed previously are one way to foster this goal; by training and employing members from the community, residents are given a role and may feel more comfortable participating in the processes and trusting the recommendations.

Another way to further this goal is to engage the next generation, including youth from historically disadvantaged communities. CRWA is working with the town of Milford to design and construct two rain gardens and an infiltration system in the community's Town Park. Once installed, these systems will remove 28.6 lbs (13 kg) of phosphorus and recharge 0.5 ac ft (167 m^3) annually. This project was chosen to address the issues of reduced groundwater recharge, low river flow conditions, stormwater flooding, and water pollution, all of which were identified as key vulnerabilities during the town's Municipal Vulnerability and Preparedness (MVP) planning workshop in 2018. Milford Town Park is a well-used area and is next to the Memorial Elementary School and the Stacy Middle School. It also is close to an EPA-designated environmental justice population. Just under 20 percent of Milford's population is non-white. Approximately 66 percent of Milford's residents speak only English, while the remaining residents speak predominantly Spanish and other Indo-European languages. Just over 10 percent are considered to be under the poverty line. Approximately 40 percent have graduated from a college or university as their highest level of education. Generally, Milford is a diverse community that needs expanded and creative engagement not only around climate change but also stormwater.

The project location offers an opportunity to engage students on climate change and how stormwater infrastructure can help make our communities more resilient to flooding, drought, and heat. Getting the next generation thinking about water, wastewater, and stormwater is one way that CRWA can inspire involvement of environmental justice and other targeted communities in the water industry. CRWA is also providing extensive outreach in various languages that are predominant locally and directly engaging residents where they live and work (e.g., churches, parades, festivals, community days, etc.). Helping a municipality reach a predominantly non-English speaking population is another way CRWA is working to right our society's past wrongs.

CONCLUSION

Investments in our water, wastewater, and stormwater infrastructure are badly needed and long overdue. Increasing demand for these services, a retiring workforce, and infusions of federal funds make this time ideal to prioritize training and support for underrepresented individuals to access these jobs and achieve economic security. By investing in programs that have demonstrated success in helping people get onto career paths in blue and green jobs, we can right wrongs while building a healthier, more resilient environment and society.

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ABOUT THE AUTHORS

- Nishaila Porter, GIP, advocates for projects and policy changes that build climate resilience in more heavily developed areas within the Charles River watershed. Ms. Porter also leads CRWA's Green Infrastructure Ambassador program, which partners with Boston's X-Cel Conservation Corps to provide training and hands-on learning to help lower barriers for underprivileged individuals to enter the wastewater management field. Ms. Porter recently completed certification through the National Green Infrastructure Certification Program.
- Emily Norton is executive director of CRWA, which over the last 50 years has helped oversee the transformation of the Charles River from the "dirty water" of the Standells song to one of the cleanest urban rivers in America.
- Janet Moonan began as CRWA's stormwater program director in early 2021. She has over 15 years of experience as a consulting engineer for communities of all sizes across New England to solve drinking water, stormwater, and wastewater needs, with a focus on NPDES compliance (including MS4), climate resiliency, and asset management. At CRWA, Ms. Moonan is charged with collaborating to design and implement GSI; supporting compliance with the Massachusetts MS4 stormwater permit; integrating environmental restoration, conservation, and climate resilience into stormwater efforts; collaborating with and educating residents and community groups; advocating for improvements in stormwater management; and integrating environmental and climate justice populations into all work.

On the road to a sustainable infrastructure—Part 3: sustainability values in action

LAURA STOCK, P.Eng., SUEZ WTS, Oakville, Ontario
JENNIFER LAWRENCE, PhD, Tighe & Bond, Westwood, Massachusetts

ABSTRACT | The last in a three-part series, this article highlights four case studies in which the core values of sustainability—economic prosperity, environmental stewardship, and social well-being—were successfully balanced during the planning, design, and construction of clean water projects. Each project was previously featured in the *Journal*; here we bring a fresh eye toward the sustainable components. Through these examples, we reinforce the concepts discussed in parts 1 and 2 of this series ("Defining our Responsibilities," *Journal*, winter 2019, and "Integrating Sustainability in Planning, Design, and Construction," *Journal*, spring 2020). We also emphasize how these projects promote environmental justice, the principle that all people have a right to a clean and healthy environment.

KEYWORDS | Sustainability, economic prosperity, environmental stewardship, social well-being, environmental justice

POWER GENERATION THROUGH HEAT RECOVERY IN HARTFORD, CONNECTICUT

The Hartford Water Pollution Control Facility (HWPCF), operated by the Metropolitan District (MDC) in Hartford, Connecticut, is the state's largest wastewater treatment plant. It is permitted to treat 60 mgd (227 ML/d) through its secondary treatment processes, with a peak daily wet weather flow capacity of 200 mgd (757 ML/d). The HWPCF began incinerating its own sludge and sludge from several other water pollution control facilities across the district to manage disposal in the 1970s. In 2009, master planning determined that heat recovery from incineration would be economically viable and benefit the community. Shortly after, design of a heat recovery facility (HRF) began, and construction was completed in 2012. The HRF takes heat from the incinerator exhaust and turns it into steam in large boilers. The steam then spins a turbine that is connected to a generator and produces electricity that directly offsets the HWPCF's power costs.

Economic

Economics was a key driver of the HRF project. The MDC saw an opportunity to take waste heat from its incineration process and convert it into valuable energy. The HRF was designed to produce up to 40 percent of the HWPCF's energy needs, and its energy production has been trending upward since operation was turned over to operations staff in 2014. This positive trend is attributed to increased operational experience, equipment maintenance and overhauling, system optimization, and an enhanced understanding of and reliance on automation. In 2020, the HRF's energy production amounted to 10.6 million KWh (38.2 billion kJ), which equated to about $1.4 million.

The reduced baseline energy consumption for the HWPCF also benefits the MDC by reducing its electric utility fees. As a commercial user, the HWPCF is charged a fee based on its potential to use electricity. By reducing the plant's peak energy demand, the HWPCF can significantly reduce utility fees, which have historically been nearly half of its monthly power bill. Some of these savings are translated into reductions in the community's sewer service rates.

The MDC obtained grants and low-interest loans for more than 60 percent of the project cost through green stimulus funding. Combined with the power savings described above, this funding created an eight-year project payback for the HRF that, given the expected equipment life of 20 to 40 years, may generate decades of savings.

Ground level view of Hartford's two heat recovery boilers—the HRF takes heat from the incinerator exhaust and turns it into steam in large boilers

Hartford's Steam Turbine—the steam then spins a turbine that is connected to a generator and produces electricity that directly offsets HWPCF's power costs

Environmental

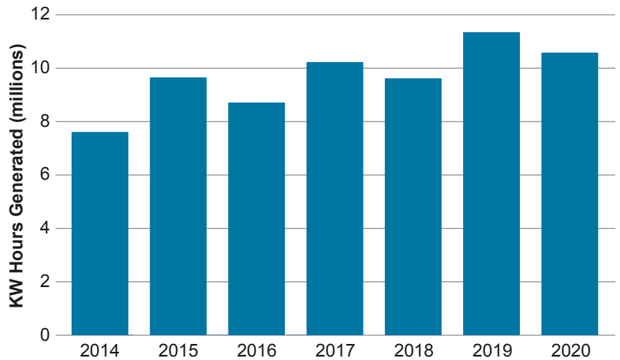
Heat recovery provides many benefits to the HWPCF. Waste heat is used in place of other valuable resources to create renewable energy from the biosolids incineration process. In turn, this reduces pollution emissions from conventional energy generation sources, as less power is produced to satisfy the HWPCF's electrical demand. The HRF system also reduces thermal waste to the environment, as the heat is now converted to electricity. Finally, onsite power reduces electrical line losses that would occur from power produced far from its point of use.

Social

At the HWPCF, the MDC is committed to community outreach and equitable education (MDC 2021). Education and engagement were key to the success of the HRF, with staff involvement at all project stages. Engagement started with reference facility site tours during planning and continued through design, construction, commissioning, and start-up. Each discipline was encouraged to provide input into the HRF design; this included maintenance staff weighing in on equipment accessibility, instrumentation and controls staff ensuring proper communication within the plant supervisory control and data acquisition (SCADA) system, and electricians ensuring consistency with power distribution standards. Staff took part in more than 20 equipment-specific and system-wide training sessions on the overall treatment process and how the equipment worked together to form a complete system. This approach enabled the HWPCF staff to learn new skills and take ownership of the HRF, in turn leading to high staff retention and high equipment uptimes.

Worker safety has also been integral to the project's success and was considered in every aspect. Every operator is authorized to implement an "emergency stop" to the facility at any time for any reason. The SCADA system monitors many different points within the facility and can automatically shut the system down or deliver alarms indicating an instance or trend requiring attention. To date, there have been zero reportable injuries at the facility.

The HRF project was part of the MDC's much larger Clean Water Project, which included upgrades to both the wastewater and stormwater collection systems and the wastewater treatment plant. At the onset of the Clean Water Project, the MDC formed a Citizens' Advisory Committee (CAC) to provide



HWPCF electricity production 2014–2020 (1 KWh = 3,600 kJ)

Lowell's restored flood pump station

Pump station pre-restoration

community outreach and education. The CAC consisted of MDC customers, environmental groups, business groups, and environmental justice organizations, and acted as a bridge between the MDC and the communities it serves.

This project was originally published in the fall 2016 *Journal*: "It is all about energy—power generation through heat recovery in Hartford."

RESTORATION OF A FLOOD PUMP STATION IN LOWELL, MASSACHUSETTS

Part of Lowell, Massachusetts, located along the Merrimack River, lost its flood protection certification years ago because the city's West Street Flood pump station (WSFPS) was inoperable. This portion of the city, known as Centralville, is designated as an environmental justice population by Massachusetts due to the prevalence of minority households and the low median household income (mass.gov 2021). To restore flood protection to the area, the city rehabilitated two of the three 42 in. (107 cm) axial flow pumps and gate valves and reinstalled them with new right-angle gear drives and 475 hp (354 kW) diesel engines. The project also included structural and operational improvements to the pump station to mitigate operational issues from infrequent use. After the city completed construction in 2018, the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE) ran successful field tests. Given the promising results, FEMA re-accredited, and USACE re-certified, this critical component of the city's flood damage reduction system. The success of this rehabilitation project, combined with operational changes, could be repeated in other flood pump stations across the country that have similar maintenance issues due to infrequent use.

Economic

Before embarking on this project, the city evaluated alternatives for restoring flood pumping capability. It did so by comparing the cost of rehabilitation of the existing flood pump station to the cost of constructing a new flood pump station at an alternative location. The project aptly integrated sustainability into the planning phase of the project life cycle to identify the most economically viable path forward. The evaluation revealed that rehabilitation of the pump station (constructed around 1940) was more cost-effective than decommissioning the station and starting anew. The rehabilitation of the pumps and the pump station saved the city about $1 million compared to the cost of replacing them.

Environmental

This project exemplifies the sustainable principle of "reuse." Instead of razing the entire pump station and building anew at a new location, the city identified the pump station components that could be salvaged and restored. These components included the structure, pumps, piping, and valves. Reusing materials saved them from being sent to a landfill and avoided wasting precious resources on manufacturing new materials. The city preserved the building superstructure and substructure by making minor, targeted concrete repairs. Finally, reuse of the site also allowed the city to preserve the alternate site that was considered for a new flood pump station. The alternate site remained as open space and in the future may be used for other wastewater needs.

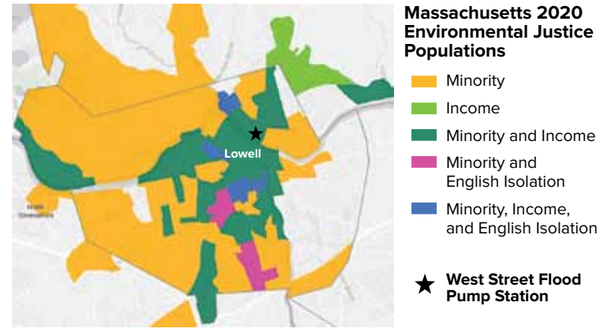
During the planning process, the designers also considered the original reason for the pump station's disrepair and made sure the rehabilitated facility would not fail because of similar circumstances. The original pump station was activated only during a combined sewer overflow event that coincided with high river level, resulting in infrequent activation. The original design did not allow the pump station to be exercised during non-activation events. The lack of activations and inability to exercise the pump station led to its disrepair. In the redesign, the station was reconfigured with innovative features that enabled regular testing and system upkeep. The ability to exercise, maintain, and verify the readiness of the rehabilitated flood pump station will support not only the longevity of its lifespan but also flood resiliency in the neighboring environment.

Social

Prior to rehabilitation, the WSFPS had been inoperable for 30 years. Consequently, FEMA updated its flood zone mapping to include part of the Centralville neighborhood within high-risk flood zones. Homes and businesses in high-risk flood areas with mortgages from government-backed lenders must have flood insurance, so many residents within the neighborhood had to take on this costly expense (FEMA 2021). Flood insurance premiums can easily exceed $1,000 per year in Massachusetts, a possibly significant portion of household income in environmental justice communities such as Centralville (Moon 2019).

Removing these homes from high-risk flood zones was a priority. Not only would the properties be better protected from the damage caused by flooding, but also the burden of flood insurance would be removed from an environmental justice population. After the station was re-certified by the USACE and re-accredited by FEMA, FEMA updated its flood zone mapping to remove the same portion of the Centralville neighborhood from high-risk flood zones. This means that the neighborhood's low-income residents no longer have to pay for costly flood insurance premiums. Instead, they benefit from greater flood protection and lower homeownership costs.

This project was originally published in the spring 2019 *Journal*: "Restoring flood resiliency with a flood pump station rehabilitation in Lowell."



Lowell environmental justice populations

BIOSOLIDS CONVERSION TO COMPOST IN FAIRFIELD, CONNECTICUT

The Fairfield Water Pollution Control Facility (FWPCF) is home to the last remaining biosolids composting facility in Connecticut. It is also one of the oldest, continuously operating biosolids composting facilities in North America. The plant was constructed in 1950, and the composting facility was added in 1988. Other than replacement of the steel building in 1998 with a stainless-steel version, much of the equipment and infrastructure in the composting facility is original.

The FWPCF uses advanced secondary treatment to process a design average daily flow of 9 mgd (34 ML/d) and a peak daily flow of 24 mgd (91 ML/d). Biosolids are removed from the primary and secondary treatment processes and sent to anaerobic digesters for solids reduction and stabilization. Methane generated in digestion heats the digesters, and excess methane is flared. Following digestion, solids are dewatered using a belt filter press and discharged into an agricultural mixing dump truck where they are combined with a similar mass of wood chips and mixed using the truck's internal equipment. The biosolids and wood chip material is then transferred into one of six bays in the main composting building. The bays are 220 ft (67 m) long with large agitators that mix and slowly move the compost material down the bay. Air is regularly blown through the composting material within the bays, and the plant's SCADA system monitors compost time and temperature to meet EPA requirements for pathogen and vector attraction reduction. This part of the composting process takes 28 days, after which 24 truckloads per week are loaded onto a truck and taken to another area for 30 days of storage. Following this storage period, the compost material is tested for fecal coliform prior to distribution.

Economic

The Town of Fairfield maintains contracts with two third-party contractors for composting-related activities. The first contract is for processing the town's yard waste and includes the supply of all

Fairfield—compost loaded onto a truck at the end of the 28-day agitation and aeration period

51 new trees along Somerville Avenue

Mulch placement at tree pits

Porous flexipave increases water retention

wood chips for composting, the supply of wood chips for the FWPCF's biofilters, and final storage and testing of the compost material. The second contract is for marketing, distribution, and assistance with submission of distribution planning documents to the Connecticut Department of Energy and Environmental Protection. The contracts provide a combined annual revenue of roughly $70,000 to the town. The town also saves around $300,000 per year by composting its biosolids instead of hauling them offsite and paying tipping fees for incineration.

Environmental

Creating compost from the FWPCF's biosolids and the town's yard waste is emblematic of a circular economy. Two products typically seen as waste are recognized for their value and combined to create a salable good. The composting practice provides for beneficial reuse of the biosolids, a reduction in the FWPCF's carbon footprint for biosolids management, and a reduction in the carbon footprint associated with production of soil amendments and fertilizers that the compost replaces. The FWPCF produces 5,250 yd^3 (4,010 m^3) per year of compost material.

Social

The FWPCF creates a Class B compost product that is used as a soil amendment for general landscaping, including tree planting and the construction or top-dressing of lawns and sports fields, for crops not directly consumed by humans, and as an ingredient in potting media. It is sold at an affordable rate to local customers, with 85 percent of the compost going to Connecticut and the remainder to New York.

The FWPCF also creates public awareness around what happens when a toilet is flushed. Prior to the pandemic, Fairfield regularly hosted site tours of the FWPCF and composting facility for groups including the Boy Scouts, junior high school, high school, and college classes. The tours provided insight into the different treatment steps, the type and purpose of upgrades made to the facility over time, and the important role facilities like the FWPCF play in protecting our environment.

This project was originally published in the spring 2018 *Journal*: "The last one standing—Fairfield, Connecticut's compost facility."

RESILIENT STORMWATER INFRASTRUCTURE IN SOMERVILLE, MASSACHUSETTS

Somerville, Massachusetts, is upgrading its infrastructure that will change how it manages much of its combined drainage system. The upgrades include macro improvements to stormwater conveyance, storage, and pumping as well as to green stormwater infrastructure in public and private developments. The new "gray" infrastructure will provide 860,000 gal (3,255,400 L) of stormwater storage. Additionally, the new green infrastructure will provide stormwater storage for 1.5 in. (3.8 cm) of runoff from the contributing drainage area, reduce impervious surfaces, expand the urban forest, and improve the quality of downstream waterbodies. The project is expected to be substantially complete and ready for use by the fall of 2021.

Economic

This project's improvements, developed through the city's comprehensive planning process, prioritize pedestrians and bicyclists by improving the amenities for these groups on the street, while minimizing the impacts of storm surge and sea level rise. By incorporating a grand vision into the planning and inception phases, the city has taken great steps to ensure that they are "doing the right project" and are "doing the project right," as outlined in Part 1 of this three-part sustainability series. By making the investments in the combined drainage system, the city expects to see returns via increased commercial activity and the associated tax revenue.

Environmental

This project addresses legacy flooding issues in and around Union Square. Incorporating green infrastructure to absorb stormwater runoff reduces flooding issues and creates urban ecosystems. As part of the project, the city is reintroducing native plant and tree species. These plant and tree selections will provide resiliency and enhance the urban ecosystem by creating food and habitat for butterflies, insects, birds, and other wildlife, while reducing irrigation needs. The improvements to the flooding issues will also help with area development.

Social

This holistic project was driven by the community-based Union Square Neighborhood Plan, Vision Zero, and SomerVision, with an aggressive plan to eliminate traffic-related deaths and serious injuries in Somerville (City of Somerville, 2020). Through these plans, Somerville strives to become the most walkable, bikeable, and transit-friendly city in America. The social well-being of the community is right at the heart of this clean water project.

Most of Somerville is designated as an environmental justice population due to its minority population. This can be traced to a historic "redline" map released by the federal government in 1930 that designated major parts of the city as "hazardous and undesirable" due to its relatively large minority and immigrant population. Redlining not only excluded people from owning, and potentially profiting, from home ownership, but confined them to areas of poverty and minimal investment. Though redlining is now outlawed, its effects on urban neighborhoods persist in many ways. One prominent example is the lack of green and open spaces, which are known to promote health and buffer stress (Lowell General Hospital, 2021). The city is providing more equitable access to green spaces through this project.

This project was originally published in the winter 2020 *Journal*: "Integrating green and gray infrastructure in the most densely populated city in New England—stormwater mitigation in Somerville, Massachusetts."

ACKNOWLEDGMENTS

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ABOUT THE AUTHORS

- Laura Stock is a municipal sales manager with SUEZ Water Technologies & Solutions. Her nine years in the water and wastewater treatment industry have included roles in equipment commissioning, detailed design, and technical sales. Ms. Stock has been an active member of the NEWEA Sustainability Committee since January 2021.
- Jennifer Lawrence is a staff engineer at Tighe & Bond, where she applies her experience in identifying creative, sustainable solutions to water and wastewater quality challenges. Dr. Lawrence has been a member of the Sustainability Committee since January 2020.

Diversity, Equity, and Inclusion

The Diversity, Equity, and Inclusion (DE&I) Committee strives to ensure a welcoming climate for all members of our clean water workforce. We want to create an environment where everyone feels empowered, valued, respected, and safe regardless of race, ethnicity, gender, or disability status. The diversity of people and ideas is integral to our success as an industry and as an organization.

To learn more about the DE&I Committee, Isabella Cobble recently reached out to its founding chairs, Marina Fernandes and Stephen King.

Journal *The newly formed NEWEA DE&I Committee has already accomplished a lot in the few months since it became an official ad-hoc committee. What are some events that the committee has helped with and/or hosted? What events are planned in the coming months?*

Marina: In January 2021, the committee hosted a DE&I forum at NEWEA's Annual Conference to highlight racial inequalities in the water industry as well as to provide a call to action to enhance diverse representation and foster greater inclusion in the water workforce. The full forum, including a keynote address from Oluwole A. (OJ) McFoy, general manager of the Buffalo Sewer Authority, can be viewed on NEWEA's YouTube channel.

Marina Fernandes

Also in January, the committee supported the development of an article, "Confronting racial inequalities in the water and wastewater industry," which was published in NEWEA's 2020 winter *Journal* and was written by committee members Isabella Cobble, Jennifer Lawrence, Stephen King, Nick Tooker, and me. The article highlights racial injustices in our communities, educational systems, and workforce. Give it a read!

In June 2021, the committee hosted the Disability in the Workplace Panel Discussion at NEWEA's 2021 Spring Meeting. Resources from this discussion can be found on the NEWEA webpage.

The committee has established the NEWEA DE&I Award to recognize individuals, groups, or organizations in the wastewater field that have created, promoted, and maintained the principles of DE&I in their organization, profession, or community. We have also worked with the Nominating Committee on a short video about nominations to diversify NEWEA's Executive Committee.

Within the next few months, the committee plans to do the following:

- Develop a free webinar in the fall of 2021 on the basics of DE&I
- Work with the Young Professionals (YP) Committee and the Executive Committee to establish a training on DE&I to be hosted at the YP Summit and Executive Committee Meeting, both of which will be held during the 2022 Annual Conference
- Work with a local technical high school to establish mentorships and partnerships with high school students

Stephen: It has been an honor to be involved in an organization and committee that want DE&I to be recognized as a vital piece of the clean water community. Since creating the committee last year, we have made great strides in promoting DE&I in the industry while also educating our members on its importance and meaning in our everyday lives. I thought the DE&I panel discussion at the NEWEA 2021 Annual Conference was a huge success and a great introduction into making changes in our industry. The subsequent committee meetings, discussions, and guest speakers this spring have been another layer of keeping the engagement and discussion moving forward.

■ *What do you see as major challenges to increasing diversity in the field?*

Marina: A major challenge to increasing diversity in the field is awareness and intention. To increase diversity in our field, we need to be aware of the current discrepancies in our field, the challenges, and the tools available to reach out to people not currently in our field. None of this happens by accident; we need to make intentional choices to move forward.

Stephen: I see a major challenge in the lack of diversity in the pipeline to education and employment in our industry. We hope that the committee can become more engaged in youth organizations, STEM (science, technology, engineering, and mathematics) schools, and professional societies to help bring a more diverse background of candidates into the clean water field.

■ *What do you hope the work of the committee will accomplish and/or change in the clean water industry?*

Marina: I hope that this industry can be seen as an inclusive industry that provides the same opportunities to all, regardless of their background.

Stephen: I hope the committee can steer local, state, federal, and private consultants and organizations toward creating a more equitable and diverse workforce that reflects the demographics of the areas they work in. I hope we can get these entities to recognize how important it is for the public to see these efforts in all clean water projects, because this affects our way of life.

■ *What can NEWEA members outside the DE&I Committee do to increase diversity in the field?*

Marina: Be intentional about reaching out to and mentoring people from diverse backgrounds.

Stephen: Volunteer at local youth organizations, present in elementary schools, become active in your community, join DE&I Committee calls and events, look at all the different ways your projects may affect the public, and mentor people in our industry from diverse backgrounds. These are all great ways to educate people on why our field is so important and has a direct impact on their everyday lives.

■ *What types of support have been most impactful to you in your career?*

Marina: I remember having a professor in my undergraduate career who helped me get a co-op position that fit with my goals and aspirations, which meant that I would be exposed to the field and engaged in my future career. A little later, another professor was instrumental in my decision to continue on to my graduate degree right after I finished my undergraduate degree. Then, throughout my professional career I have had a professional mentor who provides countless hours of advice and input on my work, and advocates for me when I need it. I believe that support is important and impactful at every stage.

Stephen: Support from individuals and co-workers has been the most impactful in my career. Seeing how everybody has approached a problem from different viewpoints has helped me analyze situations of my own and enabled me to recognize unique solutions to solve a problem. When people come from different backgrounds, it can enhance the development of the workforce and provide more solutions than problems.

In my career, I have made it a point always to listen, understand, and respect others. This has built many long-lasting relationships among co-workers, clients, the public, and contractors. It has also provided me with great mentors and teachers who have different experiences from mine, but we are able to find some common ground on providing solutions to complex engineering problems.

Stephen King

■ *What would you say to young people of color who are considering careers in the engineering or clean water industries?*

Marina: Do not take no for an answer. Work hard and be confident in yourself. Look for advocates, mentors, and supporters throughout every step of your way. Sometimes you will need the help from mentors and advocates who are in a position above you; however, don't forget to also align yourself with other professionals at your own level.

Stephen: It is imperative to work together and find a common bond between you and your classmates or colleagues. Engineering takes a team approach, and no one can do it alone. It's a great field and career. It's exciting to see how your work provides a public or private benefit.

■ *What's one piece of advice you'd give to other people of color working in the clean water industry?*

Marina: Be a mentor to others coming after you. Following the words of Maya Angelou: "In order to be a mentor, and an effective one, one must care."

Stephen: If you're in the clean water industry, you already have a common denominator with others. Use that to form bonds and working relationships. Don't be discouraged, be yourself, ask questions, and don't be afraid to make mistakes.

■ *Do you have any messages for your white colleagues in the industry?*

Marina: I believe that people can educate themselves as much as possible by reading and listening to members of diverse groups within the industry and within our communities. Then, they can take action by assuming whatever roles they find most helpful, being mentors, advocates, or allies.

Stephen: I find that many people find it hard to be themselves when they are the minority in a situation. There may be misconceptions of how one should act, talk, walk, etc. Their voices may not

always be heard, or their opinions accepted. I ask you to listen and try to help your co-workers in these situations and understand that all of us want to be part of the conversation and feel that we can also achieve our goals, dreams, and advancement.

■ *One last question for Marina: What additional challenges do women face in engineering and the clean water industry?*

Marina: I believe that there are still a lot of stereotypes and labels that are assumed because of gender. Therefore, as women in this industry we have to deal with microaggressions every day stemming from those stereotypical labels. For example, I have had people ask me if I had been offered a position or promotion because I was a woman and not because of my earned merit. Some contractors have initially pushed back on my decisions, expecting that I will not be assertive enough to question their construction methods—something I have never seen done to male engineers. Generally, the advice I give is that women need to expect that this will happen at some point in their careers, and they should not deal with this as a source of doubt of themselves, their skills, or their knowledge. However, they should be ready to push back, continue to be assertive, and believe in themselves.

ABOUT THE MEMBERS

- Marina Fernandes, PE, LEED AP, (she/her) is the town engineer in Milton, Massachusetts. She has 14 years of experience leading the design and construction of various wastewater rehabilitation projects. Ms. Fernandes is the chair of the NEWEA ad-hoc DE&I Committee and identifies as a white female and first-generation Brazilian American.
- Stephen King, PE, (he/him) is the town engineer in Danvers, Massachusetts. He has over 15 years of experience in managing capital programs and providing engineering technical support to the various departments and divisions within the town of Danvers. Mr. King identifies as an African-American male and believes that championing the inclusion of diverse backgrounds in the engineering field will benefit all communities as cities and towns look to upgrade and expand their public services and utilities.

Additional information on the NEWEA DE&I Committee can be found at newea.org/about-us/committees/diversity-equity-and-inclusion-committee.

NEBRA Highlights

NEBRA Responds to Sierra Club's "Sludge in the Garden" Report

On May 25 the Sierra Club issued a report, *SLUDGE IN THE GARDEN: Toxic PFAS in Home Fertilizers Made from Sewage Sludge*, about a study done with the Ecology Center of Michigan.

For the report, the Sierra Club purchased nine biosolids-based soil amendments and fertilizers and tested them for per- and poly-fluoroalkyl substances (PFAS). This report can be viewed at scribd.com. The products purchased included DC Water's BLOOM, Tacoma, Washington's TAGRO, and Earthlife, which contains biosolids from the Massachusetts Water Resources Authority. The report recommends that home gardeners do not use these products in fruit and vegetable beds and urges states not to wait for EPA to act. It discusses the biosolids management programs and regulations in Maine and Michigan, in particular.

Although there are questions about PFAS sampling protocols, the results are similar to what researchers have found in previous studies such as "Characterizing and Comparing Per- and Polyfluoroalkyl Substances in Commercially Available Biosolid and Organic Non-Biosolid-Based Products | Environmental Science & Technology (acs.org)" from Purdue University. The Sierra Club report found that eight of the nine products tested exceeded Maine's PFAS screening standards. The Ecology Center tested for 33 PFAS and found 24 of them, ranging from 38 to 233 parts per billion (ppb). They found 14 to 20 PFAS in every product.

The Mid-Atlantic Biosolids Association has summarized the report at mabiosolids.org.

Despite some issues with the report, NEBRA agreed with the main recommendation, that is to limit PFAS production and use, which will reduce what ends up in the solids. The Sierra Club report acknowledged, "When it comes to highly persistent chemicals in biosolids, such as PFAS, each of the current alternative disposal options will not fully destroy or contain chemical contaminants in sewage wastes," and "For the large-scale problem of disposing of sewage waste, however, simple solutions are elusive."

NEBRA is working with the Water Environment Federation and others on additional responses to the report. NEBRA's July research abstracts for members also responded to the Sierra Club report with a "PFAS Reality Check." (See nebiosolids.org.)

NACWA Builds on NEBRA Work, Issues "How-To" Guide for Modeling PFAS Fate and Transport

In June, the National Association of Clean Water Agencies (NACWA), in partnership with the National Council for Air and Stream Improvement (NCASI) and the American Forest and Paper Association (AF&PA), issued a report, initially prepared and updated by a New England consulting firm, as a "how-to" guide to understanding the pesticide root zone model (PRZM) and how it may be used to screen PFAS potentially leaching into groundwater from land-applied residuals and biosolids. The PRZM approach uses EPA's pesticide water calculator to simulate pesticide applications to land surfaces and the subsequent transport to and fate of these chemicals to surface water and groundwater. This method is widely used by EPA and states for screening-level assessments and refined risk assessments and may be the best model for estimating PFAS fate and transport.

NACWA hopes the updated report will help state and federal regulators, as they continue to work on management strategies for PFAS and consider screening models, to better understand key inputs, outputs, local site-specific conditions, and the role of sensitivities and assumptions in such simulations. This step-by-step guide to PRZM includes simulations and provides the necessary applications to yield the greatest confidence when using this modeling approach. This approach will allow regulators and other stakeholders to evaluate PFAS groundwater contamination potential efficiently and determine whether a more comprehensive and rigorous modeling or field investigation is warranted.

The report simulates land-applied biosolids in Maine soils using the EPA health advisory limit for PFAS in drinking water, 70 parts per trillion for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). That simulation conservatively results in screening concentrations of 32 ppb for PFOA and 35 ppb for PFOS in biosolids. Maine used the SEVIEW/SESOIL® "seasonal soil compartment" model to arrive at its screening limits of 2.5 for PFOA and 5.2 for PFOS.

This NACWA/NCASI effort followed work commissioned by NEBRA on behalf of its Maine members as well as a review of other models for evaluating PFAS in land-applied biosolids (see ncasi.org). The initial consultant report for NEBRA in 2019 queried use of the SEVIEW/SESOIL to model PFAS fate and transport. The 2019 report found the following: "The primary impediment to off-site transport of PFOA/PFOS in biosolids is sorption to the higher organic matter content of biosolids and soils in the upper layers of the profile. A modeling approach capable of more accurately representing this concept is required to enable a more accurate assessment of maximum biosolids PFOA/PFOS concentrations to meet tap water protection goals."

DOE Awards $27.5 Million for 16 Water Resource Recovery Systems Projects, NEBRA Partners with UConn on Anaerobic Digestion

The U.S. Department of Energy (DOE) awarded $27.5 million in grants for 16 research projects to advance resource recovery from wastewater (see FY21 Research and Development for Advanced Water Resource Recovery Systems Selections Table | Department of Energy at energy.gov). DOE has focused resources on water resource recovery facilities (WRRFs), mainly energy efficiency grants in the past, and has found that the energy coming into WRRFs in the wastewater far exceeds the energy required to operate them. These grants seek to harness that energy, generate enough to power the facility, and even export energy as renewable fuels.

NEBRA is assisting in one such research project being led by Jeffrey McCutcheon at the University of Connecticut's Department of Chemical & Biomolecular Engineering. The project, "A Digitalization, Automation, and Optimization Platform for Improved Resiliency and Consistency of Distributed Anaerobic Digestion for Wastewater Resource Recovery," received $2 million in DOE funding. Dr. McCutcheon has teamed with Dr. Baikun Li, from the UConn Department of Civil and Environmental Engineering, who has led the development of millimeter-sized electrode array sensors for real-time in situ high-resolution profiling of various parameters in anaerobic digestion (AD) systems. The researchers are particularly interested in AD systems that co-digest with food wastes.

The grant program will further research, development, and deployment of innovations in resource recovery technologies. The UConn research project aims to test artificial intelligence/machine learning (AI/ML) for more efficiently operating ADs, including generating more biogas. The UConn team will develop a "machine learning algorithm-aided process model and control capabilities for ADs to predict and thus prevent system meltdown while simultaneously optimizing system performance for variable feedstocks for a number of DOE-specified metrics." UConn will team with the Greater Lawrence Sanitary District (NEBRA member, award-winning), which has long been co-digesting its sludges with waste food slurry (see youtu.be/qv2nxrWG8jI).

Worcester Polytechnic Institute (WPI) in Massachusetts was the other New England institution to receive funding, also $2 million, for its project to turn wastewater solids into renewable natural gas (RNG). The WPI research is being led by chemical engineering professor Michael Timko and will use hydrothermal gasification technology to generate RNG and extract nutrients for recycling as well (see "WPI Works to Turn Toxic Sewage Sludge Into Renewable Energy," at wpi.edu).

Michigan Issues Interim Strategy for Land Application

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) has released its *Interim Strategy for Land Application of Biosolids Containing PFAS,* published in late March, to formalize EGLE's guidance for recycling biosolids given the concerns about PFAS. The strategy document has been expected for a while. EGLE reports issued so far are as follows: *Initiatives to Evaluate the Presence of PFAS in Municipal Wastewater and Associated Residuals (Sludge/Biosolids) in Michigan* and *Evaluation of PFAS in Influent, Effluent, and Residuals of Wastewater Treatment Plants (WWTPs) in Michigan*. (See michigan.gov.)

The interim strategy will be effective for land application occurring after July 1, 2021, but EGLE recommended that biosolids producers consider following the guidelines starting this past spring. Testing of biosolids for PFAS prior to land application is required. Based on previous work by EGLE to understand the concentrations and impacts of PFAS in land-applied biosolids, EGLE has established the following guidelines for PFOS:

- Biosolids with concentrations at or above 150 µg/kg (equivalent to ppb) are considered industrially impacted and cannot be land applied. WRRF biosolids managers must immediately notify EGLE of these test results, and then begin effluent sampling and investigate potential sources of PFOS in their sewersheds. They will also have to make other arrangements for treatment or disposal of the industrially impacted biosolids.
- If PFOS concentrations are less than 150 ppb but greater than 50 ppb, the generators must again notify

EGLE immediately and initiate effluent testing and investigations into the sources of PFOS to develop a source reduction program. Materials in this concentration range can be land applied, but to reduce the overall PFOS loading to the site, EGLE is restricting application rates to 1.5 dry tons per ac (3.36 dry tonnes per ha).

- Biosolids with PFOS concentrations below 50 ppb, which was the case for most WRRFs EGLE studied, can continue to be land applied. EGLE recommends for PFOS concentrations above 20 ppb that the WRRF consider investigating possible sources and doing more sampling.

EGLE is also conducting a state-wide soil study to "help provide context" for the PFAS issues in Michigan. The full strategy report, *Land Application of Biosolids Containing PFAS Interim Strategy,* is at michigan.gov.

NEBRA Member Proposes Biosolids Gasification Facility in Massachusetts

One NEBRA member has proposed a biosolids gasification facility in Taunton, Massachusetts. The proposed facility would be at the city's former landfill site on East Britannia Street and could become a major—and much needed—new outlet for biosolids in Massachusetts. The project is undergoing environmental and local planning reviews. The Taunton City Council approved a Host Community Agreement in February.

Gasification is one of the thermal technologies that EPA is studying for its potential to destroy PFAS that collect in wastewater solids. EPA's PFAS innovative technologies team (PITT) has a research brief on pyrolysis and gasification, "Research Brief on Potential PFAS Destruction Technology: Pyrolysis and Gasification | Safer Chemicals Research," and has included these technologies in its interim guidance on the destruction/disposal of PFAS-containing materials. Research and debate continue about what temperature is required to break the carbon–fluorine bonds in PFAS, but some manufacturers say pyrolysis/gasification processes can destroy PFAS.

The proposed facility in Taunton would process 470 tons (426 tonnes) of sludge per day from the city as well as other regional sources that could generate significant revenue for the city. It would also provide a more cost-effective outlet for the wastewater solids from the city's WRRF every day. Currently, the WRRF operator trucks the solids 150 miles (240 km) to an incinerator in Naugatuck, Connecticut. The NEBRA member's process would generate biochar as well that will be used in making cement.

For septage haulers and biosolids managers on Cape Cod, this proposed regional gasification facility is welcomed. It has become more difficult to manage biosolids and other residuals generated on the Cape as outlets have shrunk and costs increased as a result of market pressures on all three biosolids management methods. Incineration capacity continues to be tight, and few landfills accept sludge in Massachusetts. Land application is being affected by concerns about PFAS.

NEBRA Issues Letter to Support Changes to Compost Labeling

On June 11, NEBRA wrote to the Terms and Definitions Committee of the American Association of Plant Food Control Officials (AAPFCO) supporting proposed changes to compost labels and information about phosphorus that reflects its actual availability in organic-based fertilizers such as biosolids, manures, digestates, and composts. The changes being proposed by the U.S. Composting Council would allow for water extractable phosphorus (WEP) testing and information on the label indicating the more "slowly available" phosphate content based on that WEP testing. This update to AAPFCO definitions and labeling standards is necessary and important to reflect the value of organic-based fertilizers more accurately. The *AAPFCO Product Label Guide* already includes definitions and labeling for slowly available urea nitrogen. Adding a parallel labeling system for slowly available phosphate will provide similar valuable information about a fertilizer's phosphorus content.

Committee Meeting Schedule

- Carbon & Nutrient Trading: fourth Tuesday of the month at 1:00 PM
- Regulation-Legislation: third Tuesday of the month at 2:00 PM
- Research: fourth Wednesday of the month at noon
- Residuals: third Tuesday of the month at 10:00 AM
- nebiosolids.org/join-a-committee

Upcoming Events

- October 7: The Northeast Residuals & Biosolids Conference and Annual Members Meeting, UMass Lowell Inn & Conference Center
- October 8: North East Digestion Roundtable discussion about the Environmental Research & Education Foundation's study of anaerobic digestion
- October 22: Lunch & Learn about high temperature pyrolysis to eliminate PFAS & generate hydrogen from biosolids

Read more and stay abreast of the latest biosolids/residuals news and events at nebiosolids.org/news.

Janine Burke-Wells, Executive Director
603-323-7654 / info@nebiosolids.org

For additional news or to subscribe to NEBRAMail, NEBRA's email newsletter, visit nebiosolids.org

nebra
North East Biosolids & Residuals Association

2021 Stockholm Junior Water Prize

The Stockholm Junior Water Prize (SJWP) is the world's most prestigious youth award for a water-related science project. National and international competitions are open to students 15 to 20 years of age who have conducted water-related projects of proven environmental, scientific, social, or technological significance. The projects aim to increase students' interest in water-related issues and research, raise awareness about global water challenges, and improve water quality, water resources management, water protection, and drinking water and wastewater treatment.

Since the SJWP's inception in 1997 as an international award, the Water Environment Federation (WEF), of which NEWEA is a regional member association (MA), has facilitated the U.S. SJWP. In 2001, a state competition was incorporated in which state winners are selected and sponsored nationally by their local MAs. MA sponsorship of the state SJWP has been essential to the program. Since NEWEA relies on affiliated associations from six states—whereas some WEF MAs represent only a single state—state association involvement is also integral to the SJWP program in New England.

WEF organizes the national SJWP competition and solicits electronic research paper entries for each state competition and returns New England entries to NEWEA following the announced deadline. By having applicants apply directly through WEF's website, project presentations can be ranked fairly by local volunteer judges. This year, applications were received from five of the six New England states.

Thank you to the state associations for their continued support and to this year's dedicated judging panel: Carina Hart, Lenny Young, Paul Russell, Mitchell Green, Teri Demers, Allie Bowen, Janine Burke-Wells, Geri Ciardelli, David Moering, Charlie Tyler, Mary White, and NEWEA SJWP Coordinator Annalisa Onnis-Hayden.

Massachusetts

Maxim Attiogbe
Massachusetts Academy of Math and Science, Worcester, MA

A Novel, Generalized Approach to Colorimetric Water Testing Using a Mobile App

Contaminated water crises like the Flint water crisis highlight the importance of accessible, accurate water testing that allows citizens to easily assess drinking water safety. Lab tests are expensive and time-consuming but highly accurate, and commercially available home kits are affordable and quick but not as accurate. To resolve this conflict, this project begins the development of a novel mobile app, ColorHead (see logo in adjacent image) that will ultimately read any colorimetric water test (e.g., paper strips) by implementing a generalized mathematical model for converting color to its corresponding quantitative value of interest. This paper focuses on the development and evaluation of the generalized math modeling concept behind ColorHead applied to reading pH strips. The best mathematical model performance thus far is from a multivariate cubic polynomial with an average percent error of 2.87 percent on a testing data set made from pH paper strips dipped in vinegar and clear ammonia solutions. Rigorously assessing the performance of ColorHead itself is currently difficult, but future developments will not only make that easier by reducing estimate variability but also expand ColorHead's functionality.

Connecticut

Elizabeth Wallace
Greenwich High School, Greenwich, CT

Eco-friendly Remediation of Arsenic and Phosphates from Contaminated Water Resources Using Iron Fortified Spinach Roots and Biochar

Increased industrialization continues to release many pollutants, including arsenic (As) and phosphates (PO_4), into groundwater resources. A simple, effective, and easily constructed filtration system is needed to remove both contaminants, particularly where potable water is scarce. Recent research has highlighted the use of iron as an arsenic adsorbent via unique electrostatic interactions; however, its preparation is difficult. Iron's absorbance of soluble phosphates remains uninvestigated. Herein, a simple filtration column was designed from common materials (sand, gravel, and biochar), along with Fe^{3+}-fortified spinach root (FeSR). To create FeSR, 2.5 grams of chopped spinach root was added to 250 ml 0.1 molar solution of $FeCl_3$, stirred overnight, and adjusted to pH=5 to facilitate stronger adsorption of As(V)/As(III). A filter system was constructed in a 2.5 by 30 cm borosilicate tube, to facilitate contaminant-medium interaction, in the following top–bottom order: sand:FeSR:sand:biochar:gravel at respective depths of 15:1:5:1.5:15 mm. 50 ml each of 100 ppb As and 10 ppm PO_4^{3-} were separately passed through the filter column (at a rate of ~50 ml/min). Inductively coupled plasma spectroscopy (ICP) analysis confirmed removal of ~90 percent As in one filter pass to 10.2 ppb, well below the EPA water action level (WAL) of 15 ppb. Continued filtration (five passes) reduced As to 0.42 ppb. For phosphates, two filtration passes were required to reduce the contaminant below the 25 ppb EPA-WAL, to 3.6 ppb, and down to 1.4 ppb in five passes. Filtration with a FeSR-free column reduced As and PO_4^{3-} to 74.2 ppb and 703 ppb, respectively, further highlighting FeSR's absorbent nature. Fourier transform infrared spectroscopy (FTIR) analyses of all filtrates demonstrated that they were free of filter-column materials. Scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS) analyses of the post-filtration column materials further highlighted FeSR and biochar's affinity for both contaminants, and confirmed the efficiency of the column construction for complete removal of As/PO_4^{3-}. The FeSR filter, easily fabricated using crop waste products, with no additional lab resources, performed exceedingly well, and represents a viable, inexpensive (~$5) option for filtration of contaminated water, regardless of location or circumstance.

New Hampshire

Abhinav Avvaru
Nashua High School South
Nashua, NH

An Economical Approach for Detecting Nitrates in Water At Homes

There has been a rise in water pollution with nitrates over the past few years. Presently, there is no cost-effective option to detect nitrates in water. The current nitrate detection options are expensive and not economically feasible. The goal of this research is to develop an economic and practical device to detect nitrates. A chemi-resistor sensor, based on conducting polymers doped with protonic acids, was created to detect nitrates in water. The sensor was tested with various concentrations of nitrates, and a regression model was established. The model was used to predict the concentration of nitrates present in water and display it on an LCD screen, based on the change in voltage in the sensor.

Vermont

Hiba Ali
South Burlington High School
South Burlington, VT

Functional Roles of *Mysis* and Amphipods Between Lake Basins Faced by Two Different Stressors: Zebra Mussels and Cyanobacteria Blooms

Temperate aquatic ecosystems in North America face threats due to the introduction of zebra mussels and harmful algal blooms (HABs). Zebra mussels and cyanobacteria, a common type of HAB, can affect benthic invertebrates by making it difficult for them to find food sources. *Mysis diluviana* and *Gammarus fasciatus* are two benthic invertebrates found in the main body of Lake Champlain (where zebra mussel densities are high), and in the northeast (NE) arm of the lake (where cyanobacteria blooms are common in the summer). Studying their ecological function in the setting of these stressors is crucial to understanding their ecological roles in the food web. Results showed that from May to June, *Mysis* and zooplankton in the main lake shared a similar carbon isotope value, indicating their common food source of diatoms in the deep chlorophyll layer, while in the later months, *Mysis* preyed on zooplankton. In the NE arm, both amphipods and zooplankton mainly preyed on epilimnetic phytoplankton. These results suggest that amphipods and *Mysis* are adaptable to their respective stressors and play a similar ecological role within the food web of their respective resident basins in Lake Champlain.

Maine

Ginny Hunt
Bangor High School
Bangor, ME

Novel Detection Method for the Identification of Microplastics in the Sediment of the Penobscot River Watershed

Microplastics are polluting beaches, rivers, lakes, and oceans across the world. Owing to their size, it is difficult to identify them and determine the extent of their pollution. This study focuses on microplastic pollution in the Penobscot River watershed in Maine. Sediment samples were collected from eight different shores along the watershed, and microplastics were separated and identified using density separation, filtration, and Nile Red dye. An image-processing program was created to determine the percentage of microplastics in each sample based on the area of 110 mm filter paper. Traces of microplastics were found in all samples. Deer Isle, the southernmost site, had the highest traces of microplastics. Dolby Pond, a site on the upper West Branch of the Penobscot River, had the lowest traces. Using Arc-GIS, population and human activity were mapped and examined. Sites with high human activity had higher percentages of microplastics. This project shows the extent of microplastic pollution along the Penobscot River watershed, and how population, development, and human activity affect the pollution. These methods could be replicated by citizen scientists studying microplastics in their local environment.

California Student Wins 2021 U.S. Stockholm Junior Water Prize

Eshani Jha, a student at Lynbrook High School in San Jose, California, developed a method to use modified biochar to remove toxic contaminants from water. Her research aimed to remove contaminants by manipulating the biochar surface area, controlling chemical composition and catalytic properties for oxidative breakdown, adding surface complexing agents, and modifying intrinsic pore size. Results indicate that the modified biochar removed over 94 percent of pesticides, 53 percent of pharmaceuticals, 95 percent of microplastics, and 96 percent of heavy metals within 10 minutes. Ms. Jha won $10,000 and represented the United States at the international competition in August.

Connecticut State Director Report

by Bill Norton
WNorton@fairfieldct.org

As we've entered what we believed to be the final stages of Covid-19, life has begun to move back toward normalcy. Meetings and events have been in person rather than virtual. Although we have all negotiated the pandemic effectively and continued our work providing clean water back to the environment, new variants loom, infection rates are climbing, and we are unsure whether or not Covid-19 restrictions will resume.

General Permit for Discharge from Miscellaneous Industrial Users

As of April 29, the Connecticut Department of Energy and Environmental Protection (CT DEEP) transferred permitting and monitoring requirements for this program to the municipalities. After a long negotiating process between the state and a committee of municipality officials led by Sally Keating of the Hartford Metropolitan District, an agreement was reached, with give and take on both sides, to attain this final permit.

Connecticut Water Pollution Abatement Association

The Connecticut Water Pollution Abatement Association (CWPAA, also known lately as the Connecticut Water Environment Association [CTWEA]), continued to meet virtually over the summer and fall, discussing emerging topics that affect operators throughout the state, including continuing education, leadership program, legislative affairs, events, and membership. Ray Bahr and his Golf Committee once again held a spectacular golf outing, the Sewer Open, on Friday, June 18, at the Skungamaug River Golf Club in Coventry. The weather was fantastic, and owing to the lifting of the outdoor Covid-19 restrictions, the tournament accommodated the maximum number of golfers (144) compared to last year's reduced number of 80. The outing raised $3,800 for the CWPAA Scholarship Fund and an additional $4,740 (from green sponsors and a driver raffle) for the Operations Challenge team. A great day of networking, golf, and picnic was enjoyed by all who attended. A second in-person planned event was the annual CWPAA Trade Show, which is normally held in April but was re-scheduled this year for Thursday, September 9, at the New Life Church in Wallingford. Also scheduled for this fall is our Operator Exchange program with Maine.

This year's four CWPAA Scholarship recipients, all attending colleges with water-related degree programs, are Hannah Leibowitz and Mya Darrow, both from the village of Moodus, Rachel Gerlach of Ellington, and William Rooney of Fairfield.

Connecticut Association of Water Pollution Control Authorities

Connecticut Association of Water Pollution Control Authorities (CAWPCA) President Tom Sgroi reports the following:

CAWPCA held a live workshop at the Aqua Turf in Southington for the first time since the fall of 2019 because of Covid-19. NEWEA indicated that this was the first live post-Covid-19 wastewater association event of any kind in New England, and we thank the state's wastewater operators and professionals for showing up in great numbers. Expanding on the necessary communications opportunities that the "Covid-19 era" required, CAWPCA provided a live feed registration opportunity that was attended by many and, most important, by several CT DEEP regulators who could not attend due to department restrictions. The workshop was video recorded, so please log on to cawpca.org to view the presentations along with a great update and introduction to new CT DEEP staff.

Over the last 12 months, the CAWPCA Board of Directors along with the CWPAA Board of Directors accomplished a lot together. CAWPCA, along with its sibling organization CWPAA (our state operators' group), established the CTWEA Merger Committee to begin merging the two Connecticut wastewater associations into one combined organizational voice. The genesis of this merger occurred years ago in a meeting at WEFTEC in Chicago with then NEWEA President Mike Bonomo and a few leaders from each of the two organizations. Although both organizations do well in hosting events and educating their respective member bases, the existence of two wastewater organizations in Connecticut has always been confusing for members, sponsors, and state and national agencies. The joint Merger Committee has made great progress, and we look forward to a formally merged CTWEA (the chosen name for the joint association) announcement in November at the kickoff of the first CTWEA event. Keep an eye out for this welcome announcement!

The most important and impactful collaboration of the Merger Committee was determined to be legislative outreach and advocacy. Together with our legislative counsel, Melissa Biggs, we established the first joint committee outside the Merger Committee, the CTWEA Legislative Committee.

The Legislative Committee was busy during the latest legislative session. We effectively spoke out and filed testimony against Senate Bill 968, which sought to limit the ability for WPCAs to use the foreclosure process as an avenue to collect unpaid sewer fees. The bill had language that would have effectively prevented foreclosing on a property until the sewer fee debt on a property reached $10,000. For most WPCAs this amount would result in a customer "license not to pay" for 20 years. The pared-down version of the bill reduced that amount to $4,000 or the average equivalent of two years of nonpayment. This "pared-down" version was the result of this committee's hard work. Ultimately, however, the bill never did pass, most likely because it never reached the floor for a vote due to a busy legislative schedule. The new CTWEA will keep an eye on this bill for changes in language and if it appears again next session.

The second bill this committee worked on vigorously was SB 376, "An Act Expanding the Sewage Right-to-know." The work on this bill was more a collaborative effort to ensure that the language was crafted such that it could be reasonably managed by municipal managers and operators. Much of the language in this bill surrounds the responsibilities that the regulators assume in disseminating the information from the various WPCAs; however, it also provides direct responsibilities for the WPCA operators to notify chief elected officials within a two-hour window. The committee's input made for a better bill.

CTWEA also formed a second joint committee, the Educational Outreach Committee. This committee was brought about by technical schools' interests in exploring internship programs to support careers in wastewater.


Golf Tournament Committee: (l to r) Jay Sheehan, Carmen Krzesik, Tournament Director Ray Bahr, Ray Weaver, Tracy Santoro, NEWEA President Virgil Lloyd, and Megan Ambrose

CTWEA's Merger Committee continues to meet monthly and has created subcommittees for writing the new bylaws, starting a new website, and planning our first joint event. With all of this collaboration, this is an exciting time to be involved in the Connecticut wastewater community!

Washington, DC Virtual Fly-in

Because of Covid-19 travel restrictions, this year's Washington, DC Fly-in was held virtually. NEWEA along with WEF and the numerous other professional water organizations "met" with their political representatives, informing them of the critical need for funding of water and wastewater projects and urging that pertinent funding be included in the upcoming infrastructure bill. Held at the end of April, Virtual Water Week furnished several webinars providing information, awareness, and tools to inform lawmakers of the needs of the water industry. The New England states are positioned well with several key federal representatives holding prominent committee positions. Here in Connecticut, Representative Rosa DeLauro from New Haven is the chair of the House Appropriations Committee; Representative Richard Neal of Springfield, Massachusetts, is the chair of the House Ways and Means Committee, and Representative James McGovern of Worcester, Massachusetts, is the chair of the House Rules Committee. With the Senate passing President Biden's $1 trillion "Build Back Better" infrastructure bill, with hopes for eventual passage in Congress, New England should be situated well to receive substantial funding.

Upcoming Events

- **CTWEA Managers' Forum**, Date and Time TBD (check website)
- **Operator Exchange** with Maine, TBD
- **WEFTEC 2021/Operations Challenge**, Chicago, October 16–20

Maine State Director Report

by Jeffrey McBurnie
Jeff.McBurnie@casella.com

This marks my final submission to the *Journal* as state director to NEWEA from Maine. I am sincerely honored to have had this privilege and responsibility for the last three years. I know statements such as that are often judged as hollow, false humility; however, I have gained a lot from this experience and from networking with so many engaging and thoughtful industry leaders. It has been truly humbling.

Finding a theme for this state director's report is a lot like picking a prom theme. Some are shot down immediately, some remain in consideration for a while, and, of those chosen, sooner or later we look back at them and begin to question our lucidity and intellect. Hopefully, this theme will avoid that conclusion. I usually try to include a thought from pop culture; this quarter's source of inspiration is the fourth book in Douglas Adams' Hitchhiker's Guide series, *So Long, and Thanks for All the Fish.* This was the message left for humans by dolphins who were departing a soon-to-be destroyed Earth. Nothing so dire here; quite the opposite. As I say "So long," I prefer to think this citation is a biblical reference to serving loaves and fishes to the masses, that is, making a lot out of a little. At least that is my unsophisticated interpretation (full disclosure, not a theology major). NEWEA's small band of enthusiastic, hard-working volunteers (fishes) has an industry (the masses) impact much greater than its limited numbers would belie. I am eternally grateful to have been a small part of that, and my expectation is that this group's impact and influence will continue to grow. Please consider becoming one of these special fishes.

Urban Runoff 5K (April 1–30)

The Young Professionals Committee participated in the Cumberland County Soil and Water Conservation District's virtual Urban Runoff 5K, held to support clean water education in the Casco Bay watershed. It ran the entire month of April. Participants did not congregate at a central location but ran or walked individually at their own favorite venue.

MEWEA Spring Conference (April 8–9)

The 2021 MEWEA Spring Conference was held virtually this year. In MEWEA's humble opinion, it was successful, even if it did not match the attendance numbers of an in-person event. Five quality sessions were presented over the two days with topics such as ductile iron pipe joints, collection system hydrogen sulfide reduction, cyber security, combined sewer separation, and sludge dewatering options. We also convened a virtual Business Meeting, where our recent NEWEA and WEF award winners were acknowledged and the current state of affairs of the association was discussed.

Washington, DC Fly-In (April 26–27)

MEWEA's Washington, DC Fly-In (Zoom-In), much like its legislative work at home, was hampered by being limited to virtual participation in the WEF/National Association of Clean Water Agencies (NACWA) National Water Policy Event. We collaborated with Maine Water Utilities Association's (MWUA's) Legislative Committee to present the needs of One Water (drinking water, stormwater, and wastewater). While we had good engagement with one representative's staff (Pingree) and one senator (Collins) and her staff, our effectiveness was not the same as our in-person visits. There has been at-home follow-up, so as the state continues to "return to normal" we will refine our messages to our delegation and local staffs with in-person interactions.

Clean Water Week Poster Contest

Another casualty of the pandemic, though not seriously affected, was MEWEA's annual Clean Water Week poster contest. Rather than in-person judging at our Spring Conference, which was also virtual, the contest was held on Facebook. More than 500 posters were submitted, and more than 4,000 votes were cast. The grades 1 to 3 winner was Brayden Dionne from Madawaska Elementary School, the grades 4 to 6 winner was Logan Dawe from Canaan Elementary School, and the grades 7 to 12 winner was Rebekah St. Pierre from Bath Middle School.

MEWEA Government Affairs Committee

In July with the adjournment of the Maine Legislature, the Government Affairs Committee concluded an active legislative session. Although we understood remote participation was the only way to move forward this year, the lack of personal interaction with our legislators affected our ability to influence legislation impactful to clean water utilities. Still, we won some, we lost some, and some were rained out (carried over to a future legislative session). One loss was related to PFAS testing. While MEWEA fully supports development of a PFAS database of affected waters and soils, it costs $10 per ton ($9.07 per tonne) of sludge handled. "Handled" has a broad definition in Maine law, so the impact remains to be seen.

MWUA Summer Outing

MEWEA joined MWUA as a co-sponsor of its traditional summer outing. Held August 12 at Brunswick Landing (formerly Brunswick Naval Air Station), the event featured networking, training opportunities, vendor booths, a pipe tapping competition, a cornhole tournament sponsored by MEWEA, and great food including an on-site pig roast.

MEWEA Fall Convention

Barring a serious pandemic setback, by the time you receive this publication, MEWEA's first in-person event of the year will have recently concluded. Hosted by the beautiful Sunday River Resort in Newry, the conference kicked off September 15 with a golf tournament, followed by a barbeque buffet banquet. The next two days were packed with informative training sessions with a broad range of wastewater and drinking water topics, in addition to our business meeting and awards ceremony. Also returning was the NEWEA Operator Exchange, in which MEWEA this year was assigned to host an operator from Connecticut and send a Maine operator to Connecticut.

Clean Water Week Poster Contest Winners

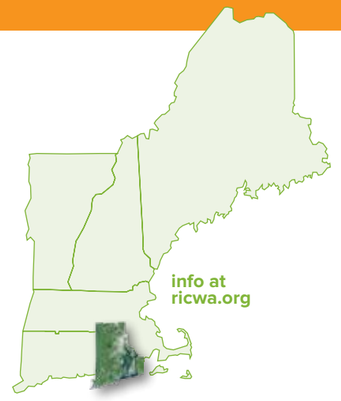
Rebekah St. Pierre, grades 7 to 12

Logan Dawe, grades 4 to 6

Brayden Dionne, grades 1 to 3

Rhode Island State Director Report

by Eddie Davies
edavies@quonset.com



Rhode Island Clean Water Association (RICWA) is pleased to announce that it is back to in-person meetings, training, and events. After more than a year of virtual meetings, it is nice to collaborate face to face and continue to advocate for clean water and its dedicated, hard-working professionals.

DEM Announces Reclassification of Shellfishing Grounds in Lower Providence River and Portion of the Upper Bay

The Rhode Island Department of Environmental Management (RIDEM) announced the reclassification of two areas of the state's shellfish harvesting waters. As a result of continued water quality improvements in Narragansett Bay, for the first time in the 75 years since records have been kept, the lower 2 mi (3.2 km) of the 7 mi (11.3 km) Providence River known as Conditional Area E will soon be open for quahog harvesting. Areas of the Upper Bay near Old Mill Creek in Warwick have also been reclassified based on water quality monitoring results.

The opening of this area is expected to greatly expand Rhode Island's quahog fishery, with millions of additional clams available for harvest. "This is a tremendous day for Rhode Island that many never thought possible," said RIDEM Director Janet Coit. "The opening of these new shellfish grounds is the result of water quality improvements from decades of intense efforts to clean up the Providence River and Narragansett Bay."

Rules and Regulations Update

In the mid-2010s, the Rhode Island Board of Certification of Operators for Wastewater Treatment Facilities began discussing an update of its Rules and Regulations. That process accelerated in the spring of 2018 when discussions held as part of RIDEM's Wastewater Operator Leadership Boot Camp brought to light insights about a long-standing request within the wastewater profession: allowing some pathway for those working exclusively in the maintenance field to sit for the Grade 3 exam. Other proposals from the profession, especially through working sessions held by the board, resulted in the current draft regulations that have been issued for public review and comment. During the public review period, RICWA advocated to also grant laboratory professionals the same opportunity as maintenance workers.

The Rhode Island Board of Certification of Operators for Wastewater Treatment Facilities met on June 2 to discuss the proposed amendments and with the majority voting in favor, the motion passed, allowing laboratory technicians (as defined in the board regulations) to sit for the Grade 3 exam, with the same criteria to be met as maintenance technicians. As more key supervisory positions become available due to our aging workforce, RICWA sees these regulation changes producing a larger and more diverse pool of managerial candidates to choose from when hiring. Let us all continue to help pave the way for the expansion of a diverse, yet highly qualified, workforce for the future of our rewarding industry!

Annual Golf Tournament

On June 21, 144 golfers participated in RICWA's annual golf tournament at the Potowomut Country Club. This tournament raised over $7,000 to support the RICWA Scholarship Fund, which funds educational opportunities for both clean-water professionals and college-bound high school seniors, as well as supports the Operations Challenge team.

Special thanks to the following:

- Golf Committee Members: Peter Connell (chair), Bill Wilber, Ralph Wilber, Bernie Bishop, Steve Buckley, Paul Desrosiers, Scott Goodinson, Kelly Bailey, Dana DiScuillo, and Mike Bedard

RICWA's annual golf tournament at the Potowomut Country Club

- Volunteers: Bill Patenaude, Traci Pena, Marisa Desautel, Melissa Mooradian, Jim DeLuca, James Lauzon, Patty Sheridan, Fern Johnson, Pat Rimkoski, and Lidia Goodinson
- Sponsors: Synagro, Hart Corporation, PARE Corporation, Arcadis, EJ Prescott, NEIWPCC, Wright-Pierce, C3ND, The Maher Corp., Aqua Solutions, BETA Group, EJ Prescott, Fasteson Machine, Holland Company, Majestic Cleaners, Pond Technical, Safety Source, Seacoast Supply, United Rentals Fluid Solutions, Weston & Sampson, and Wilkem Scientific

Operations Challenge

On August 6, newly formed "RI-CONN UNITED" traveled to the East Shore Water Pollution Abatement Facility in New Haven, Connecticut, for NEWEA's Annual Training Day, to prepare for WEFTEC in Chicago. Because of both the cancellation of the Spring Meeting competition and the shortened training season, Connecticut's and Rhode Island's veteran participants joined forces in hopes of making a strong push for the 2021 National Division II title this October.

To be ready for WEFTEC, the team also traveled to Ocean City, Maryland, on September 1, and competed in the Chesapeake WEA Tri-Association Conference Competition. Good luck to team members Jason Nenninger (Greater New Haven Water Pollution Control Authority), Ryan Harrold (Greater New Haven Water Pollution Control Authority), Riley Greene (Town of Narragansett, Rhode Island), and Eddie Davies (Quonset Development Corporation).

Operator Bootcamp

RIDEM and RICWA will host a 2021–2022 Wastewater Leadership Boot Camp program beginning this October. A year-long program to groom mid-level clean water professionals for upper management, "Operator Boot Camp" graduated its first class in 2008, with 13 participants receiving a broad range of training. An astounding 21 applicants have been accepted into this year's program. Training will be one day a month, moving locations throughout Rhode Island, and will include topics such as management and leadership basics, industrial pretreatment, microscopic observation, Rhode Island pollutant discharge elimination system permitting development, facilities engineering and design, emergency response and preparedness, finance and budgets, and media relations.

Annual Scholarships

RICWA is pleased to provide several scholarships annually to college students, sponsored by our members and fundraising. Scholarships range from $500 to $1,000, depending on the number and quality of applications received. Please check ricwa.org for more information.

Upcoming Event Highlights

- Annual Awards Banquet (October)
- Annual Holiday Party, Food Drive, and Elections (December)

Please check ricwa.org or our Facebook page for all association news and full event listings.

Vermont State Director Report

by Michael A. Smith
smithm@wseinc.com

Despite the incredible challenges all of us have faced over the past year and a half with the pandemic, the Green Mountain Water Environment Association (GMWEA) has been very active. The following summarizes major activities and programs GMWEA has advanced most recently and personnel highlights from our membership.

Utility Staffing Shortfalls

In the last six months GMWEA helped re-establish the Vermont WARN (water/wastewater agency response network) system that allows utilities to exchange staff and resources to cover shortfalls caused by Covid-19. This has been especially important given the potential for critical environmental protection infrastructure to go unstaffed should operators be absent due to illness.

PFAS Legislation

A new bill taken up in January 2021 by the Vermont House proposes to impose restrictions on the use, manufacturing, sale, and distribution of several products containing per- and polyfluoroalkyl substances (PFAS). GMWEA's Government Affairs Committee (GAC) testified to the House to educate it on this matter and advocated for source control to reduce PFAS in our environment.

House Bill 26 (H.26) names the products known to have the highest PFAS concentrations or those most likely to be absorbed or ingested by humans, notably class B firefighting foam, food packaging, and residential rugs and carpets. In addition, H.26 also designated PFAS as "chemicals of high concern to children." The terms relating to firefighting foam and chemicals of high concern to children are proposed to take effect on July 1, 2022; those relating to carpets and food packaging on July 1, 2023. A parallel bill, H.27, proposed requiring warning labels on products containing PFAS. GMWEA welcomes this important legislation.

Water and Sewer Arrearages

GMWEA conducted a survey of the state's water, wastewater, and stormwater facilities in January. The goal was to determine the magnitude of past due balances left unpaid by households and businesses (primarily resulting from Covid-19). This information was used to assess future funding needs for the Vermont Covid-19 arrearages assistance program (VCAAP), which provides grants to eligible individuals and entities to pay utility bills.

Led by Joe Duncan of the GMWEA Public Relations Committee, staff contacted some 900 individuals in city and town governments statewide to gather this information, with 96 municipalities responding, representing approximately 71 percent of the total population served. GMWEA extrapolated from this information that water, wastewater, and stormwater utilities are facing more than $5.2 million in unpaid user fees, having a significant impact on individuals and businesses, and towns' operation and maintenance of critical infrastructure. GMWEA has recommended that $5.25 million be provided to VCAAP to ease pandemic-related financial hardships.

New Board Members

Two new members, Joanna Bisceglio and Jennifer Garrison, have been elected to the GMWEA Board of Directors this year. The association is excited about the talent this "new blood" brings to our future administration.

Ms. Bisceglio has worked for Weston & Sampson in Vermont since the office was opened in 2003. She conducts training and works in public relations, conferences, and social media outreach. She has served on several Vermont industry committees, including Vermont Drinking Water Week, Vermont Recreation and Parks Conference Committee, and others.

Ms. Garrison is the lab analyst for the South Burlington Water Quality (Wastewater) Department. She has a Grade V Operator's License, and a Lab Analyst II Certificate. She performs all the daily lab work for the Airport Parkway facility as well as the weekly lab testing for the Bartlett Bay facility. She also serves as the facility's safety officer and on the City's Safety Committee.

While we welcome these two great new board members, we will miss those stepping down, and we thank them for their years of service to GMWEA. More about them, in case you have not had the pleasure of meeting them at NEWEA functions:

Chris Robinson, water quality superintendent of Shelburne, has quietly become a legend in his field. Mr. Robinson recently announced his intention to retire from GMWEA's Board of Directors after 14 years. His board service included two years as president, three years as NEWEA state director, and deep involvement in the Vermont Operations Challenge and Service Excellence Awards programs.

Bob Fisher, water quality superintendent for the City of South Burlington, is stepping down after 15 years on the board to focus on his increasing role in NEWEA. Mr. Fisher is NEWEA vice president (soon to become president). At GMWEA, he has served as president, vice president, treasurer, NEWEA state director, and long-time chair of the GAC.

Rick Kenney, water system chief operator for the Town of Hartford, is stepping down from the board after 14 years of volunteering. Mr. Kenney, who has 48 years in the industry, with 33 in Hartford, served among other functions for two years as GMWEA president and most recently as GMWEA treasurer.

Collaboration with the Vermont Agency of Natural Resources and Vermont Rural Water Association

GMWEA and Vermont Rural Water Association (VRWA) continue to meet quarterly with the Vermont Agency of Natural Resources water division staff, maintaining that crucial connection between regulators and boots-on-the-ground professionals. GMWEA and VRWA together recently advocated that more of Vermont's $1 billion in anticipated Federal American Rescue Plan Act (ARPA) funds be designated for desperately needed water quality infrastructure upgrades and repairs. Our most recent quarterly meeting was on July 30.

Operator Continuing Education

GMWEA launched Lunch & Learn, a new initiative of monthly noon-hour trainings for water quality professionals. Intended to provide continuing education for staff with limited availability, this program worked well virtually during Covid-19 workplace restrictions. The first session was in April, on Laboratory Procedures, and was attended by a full (virtual) house of 31.

Infrastructure Funding

Over the next 10 years, Vermont municipalities and taxpayers will face costs exceeding $1 billion to upgrade our aging wastewater, drinking water, and stormwater systems. In addition, over the next three years it is anticipated that the Vermont drinking and clean water sectors will require $350 million to address our immediate infrastructure and water quality challenges.

The infusion of $1.052 billion of federal money into Vermont's economy from the ARPA is something that could be a game changer for many, if not all, Vermont communities. ARPA is broadly defined in its intent and leaves much flexibility for states to allocate funds as they see fit. Of the $1.052 billion in ARPA funding coming to Vermont, Governor Scott has proposed allocating $170 million to drinking water and clean water projects. GMWEA and VRWA are jointly advocating for Vermont's legislators to increase that proposed ARPA allocation for drinking water and clean water projects from $170 million to $350 million and to include $180 million to replace aging water, wastewater, and stormwater infrastructure as a further targeted investment. This funding should be provided at a minimum of 90 percent grant funding. GMWEA and VRWA encourage members and municipalities to contact their legislators and voice their opinions.

While the final avenue for this funding to get to the municipalities has not been formalized, it appears much of it will pass through the Clean Water and Drinking Water state revolving fund (SRF) programs, and will benefit communities through low-interest loans, pollution control grants, and loan principal forgiveness. Currently, coffers for the SRF program are full, and we hope this stimulus will allow for more of the current funding to be used to offset planning and final design for low-income and high-need community projects.

To summarize, things are looking up in Vermont; we sincerely hope the same is true for our other New England state associations. I am grateful to the GMWEA members who have directly (and indirectly) contributed to this report.

New Hampshire State Director Report

by Steve Clifton
sclifton@underwoodengineers.com

Greetings from the great state of New Hampshire. We are proud to be represented in the fall NEWEA *Journal* by providing this article to you. Information from around the state regarding the environmental health and welfare of our wastewater systems and the people who maintain them are offered, discussing the wastewater flushing, conveying, and treatment systems we work so hard to maintain and sustain for future generations. New Hampshire's wastewater infrastructure includes about 120 municipal wastewater systems operated by hundreds of licensed operators, professional engineers, and support staff. We are also home to many well-known businesses in the environmental field.

NHWPCA News

The New Hampshire Water Pollution Control Association (NHWPCA) is led by President Mike Carle of Hampton and Vice President Rob Robinson of Manchester along with a strong board of directors. The pandemic and subsequent shutdown of the state in March 2020 upset the routine programs provided throughout the year for the wastewater operators. Mr. Carle and Mr. Robinson navigated 2021 skillfully to maintain the financial and social viability of the association, after last year's president, Ken Conaty, set the stage with his leadership. New Hampshire was first in the nation for presidential primaries and was also one of the first in the nation to reduce Covid-19 restrictions, and many in the state applauded the state's executive office for their perceptive leadership in balancing protection of human health and individual rights.

NHWPCA is taking advantage of the loosening restrictions by holding the Annual Trade Fair, usually a spring event, on October 1 at the Doubletree by Hilton Manchester Downtown. Our summer and fall meetings were dropped this year so that we could organize our first in-person meeting since the pandemic began. Regardless of drought or high water, our Golf Tournament took place on August 5 at the beautiful Beaver Meadow Golf Course in Concord, led by Fred McNeill of Manchester.

Changes this year within NHWPCA include a new Affiliate and Group membership category. Aaron Costa of Keene, our third director, presented the board with these new categories after several brainstorming subcommittee sessions. The Group category was created so that large municipalities could take advantage of reduced group rates. The Affiliate category addresses providers of products and services. Benefits of these membership options are described at nhwpca.org. Credit should be given to Dennehy & Bouley Associates and Dee Rainville for providing the administrative assistance to keep NHWPCA running.

This year also saw the issuance of the NPDES Great Bay Total Nitrogen General Permit for Wastewater Treatment Facilities in New Hampshire (NHG58A000) that became effective on February 1 and affected 13 wastewater treatment facilities in New Hampshire. Nitrogen limits start at 8 mg/L Total Nitrogen if the facility design flow is > 2 mgd (7.6 ML/d) or else the facility has to "hold the load." Major parts of the general permit include a seasonal monthly rolling average from April 1 to October 21 and an adaptive management framework to propose a process to establish approaches for ambient monitoring, pollution tracking, nutrient reduction, and review of the nitrogen target and goals. Leadership provided by the professional staff from several municipalities including Portsmouth, Rochester, and Dover continue to lead

NH wastewater treatment facilities affected by the NPDES Great Bay Total Nitrogen General Permit:

- Rochester
- Portsmouth
- Dover
- Exeter
- Durham
- Somersworth
- Pease
- Newmarket
- Epping
- Newington
- Rollinsford
- Newfields
- Milton

New Hampshire *continued on page 65*

Massachusetts State Director Report

by Adam Yanulis
FAYanulis@tigheBond.com

As did most other professional organizations, the Massachusetts Water Environment Association (MAWEA) continued to do business in virtual format for most of the spring and summer, with the uncertainty of the pandemic weighing heavily on every activity. A virtual Spring Meeting was held on March 18, with an attendance of over 80 individuals and lively discussion regarding presentations of the subject matter, per- and polyfluoroalkyl substances (PFAS) and their effects on the industry.

Elections

Since there was no June quarterly meeting (normally the annual election meeting), the MAWEA annual election of directors was managed virtually for a second year. A nominating committee candidate roster was shared with enrolled membership well in advance of a dated vote of approval; there being no dissent with regard to the nominees, the roster was declared approved. Directors for 2021 are as follows: Robert Greene of Delta, Michael Jennings of Utiliency, Landon Kendricks of Rockwell Automation, and Eric Smith of WhiteWater (terms ending in 2024); Benjamin Smith of EOS, Raymond Willis of Onsite Engineering, Robert Delgado of the Town of Barnstable, John Digiacomo of the Town of Natick (terms ending in 2023); Michael Burke of Suez, John Downey of Veolia, Jennifer Lichtensteiger of NEIWPCC, and Peter Lyons of Woodard & Curran (terms ending in 2022). By vote of the sitting board, officers for fiscal year 2022 are President John Downey, President-elect Ben Smith, vice president (vacant), and Past President Eric Smith; the board also appointed Treasurer Richard Nash, Meeting Management Coordinator Robert Greene, Education Coordinator Larry Thomas, Department of Environmental Protection (DEP) Representative John Murphy, and Recording Secretary Charles Tyler. Congratulations and thanks to these willing and worthy volunteers.

Programs

MAWEA held a successful golf tournament on June 16 that furnished a welcome budgetary shot in the arm following a difficult year. Membership is on the low side, and we hope participation will pick up as the year progresses, with increased membership advantages forthcoming.

A September quarterly meeting was held on September 22 in a virtual format with a technical theme of practical automated process control. Hopefully December's quarterly meeting (historically the southeastern area meeting) will be held in person in the Mansfield area, with a technical theme focused on energy efficiency. The board has discussed future training offerings and other ideas to increase services available for association membership.

MAWEA is offering sponsorship money to encourage our first-in-years Massachusetts Operations Challenge team, Mass Chaos, in its quest for glory at WEFTEC. Safe travels and good luck to team members Scott Urban, Brian Peltier, Dennis Flores, Joe Griffin, and well-seasoned coach Jason Swain!

New Massachusetts combined sewer overflow discharge notification law

On January 12, 2021, Governor Baker signed a law requiring wastewater utilities to notify the public and other local entities of any sewage discharge within two hours of an occurrence. The bill, H4921; Acts (2020) Chapter 322 "An Act Promoting Awareness of Sewage Pollution in Public Waters," was declared to be an emergency law necessary for preservation of public health. The bill as enacted has several notification requirements and follow-up notifications including response plans. DEP is developing these regulations for enforcement. This process will take place over the next several months and will include a comment period. Utility managers are encouraged to participate in this process. Once finalized, the regulations are scheduled to take effect in 2022. Utility managers have expressed concern over this single-definition approach to notification and favor more flexibility to

Massachusetts *continued on page 65*

New Members June–August 2021

Somil Singh
Reading, MA (STU)

Emmy Radich
Infiltrator Water Technologies
Old Saybrook, CT (PRO)

Mason Fields
CDM Smith
Boston, MA (PRO)

Keith Goldberg
United Concrete Products, Inc.
Yalesville, CT (PRO)

Sarah Traore
University of Massachusetts
Amherst, MA (STU)

Jeff Warden
Greenwood, ME (PWO)

Zachary Weiland
West Springfield, MA (YP)

Rich Lapointe
Waterbury, CT (PRO)

Robert Sarmanian
Gloucester, MA (PRO)

Adam Lewis
West Lebanon, NH (PWO)

Erica DeDonato
Milton, MA (YP)

Mark Kondelis
West Lebanon, NH (PWO)

Travis Streeter
West Lebanon, NH (PWO)

Tanner Hibbard
West Lebanon, NH (PWO)

Tom Carter
West Lebanon, NH (PWO)

Curtis Slayton
Seabrook, NH (PRO)

Paula Mouser
University of New Hampshire
Durham, NH (ACAD)

Tom Halgas
Flow Tech, Inc.
South Windsor, CT (PRO)

Christine Foss
Lowell, MA (PRO)

Elise Scholl
Somerville, MA (STU)

Randy Tobine
Auburn, NH (PRO)

Sarah Viola
Portsmouth, NH (YP)

Andrew Goldberg
Andover, MA (YP)

Griffin Parodi
Portsmouth, NH (YP)

Mark Casella
Lowell, MA (STU)

Simon Dukes
Lowell, MA (STU)

Joshua Griffis
Warrendale, PA (PRO)

John Koskovich
United Concrete Products Inc.
Yalesville, CT (PRO)

Martha Duffield
Danvers, MA (PRO)

Hannah Zafar
Woburn, MA (YP)

Jacob Telepciak
Lowell, MA (PRO)

David Nieves
New Bedford, MA (PRO)

Nathan Buzzell
Spencer, MA (PRO)

Erin O'Shea
West Hartford, CT (YP)

Nicole Veronesi
Berlin, CT (YP)

Hannah Sullivan
Boston, MA (YP)

Laurel Pickard
Wethersfield, CT (PRO)

Tasha Lewis
Lee, NH (PRO)

Kristen Ferguson
Haddon Twp, NJ (PRO)

Laura Stock
Oakville, ON (PRO)

Bruce Walton
Needham, MA (PRO)

Kennedy Brown
Burlington, VT (STU)

Thomas Roberts
Palmer, MA (STU)

William Cotter
Hope Valley, RI (PRO)

Marianna Coombs
Reading, MA (PWO)

Meghan Otis
Litchfield, NH (YP)

Oxana Fartushnaya
Cambridge, MA (YP)

Nicolas Lamonica
Rocky Hill, CT (YP)

Chuck Raymond
Worcester, MA (PRO)

Matthew Vareika
Technology Sales Associates
Nashua, NH (YP)

Charles Ramey
South Burlington, VT (YP)

Ian Piro
Anaergia Inc
Media, PA (YP)

Sydney Adams
University of New Hampshire
Newmarket, NH (STU)

Mina Aghababaei
University of New Hampshire
Durham, NH (STU)

Phillip Boisvert
Pease Wastewater Treatment
Portsmouth, NH (PWO)

David Lovely
Pease Wastewater Treatment
Portsmouth, NH (PWO)

Andrew Whitaker
City of Saco Water Resource
Recovery Department
Saco, ME (PWO)

Adam Simonsen
MWH Soft Ltd
formerly Wallingford Software
Bridgeport, CT (PRO)

Evan Karsberg
North Reading, MA (YP)

Kevin Desjardins
Wakefield, MA (PRO)

Daniel Thompson
East Hartford, CT (PRO)

Tim Pasakarnis
Cape Cod Commission
Barnstable, MA (PRO)

Drey Annachie
New Bedford, MA (PWO)

Salvatore Parisi
ITW Performance Polymers
Danvers, MA (PRO)

Patterson Riley, Jr.
Massachusetts Water
Resources Authority
Norwood, MA (COMP)

Brian Delventhal
University of Connecticut
Water Pollution Control
Storrs, CT (COMP)

Mark J. Flynn
University of Connecticut
Water Pollution Control
Storrs, CT (COMP)

Academic (ACAD)
Affiliate (AFF)
Complimentary (COMP)
Corporate (COR)
Dual (DUAL)
Executive (EXEC)
Honorary (HON)
Life (LIFE)
Public Official (POFF)
Professional (PRO)
Professional WW/OPS (PWO)
Student (STU)
Young Professional (YP)

New Hampshire *continued from page 64*

the way in addressing the voluntary adaptive management approach required in the general permit. Four treatment plants in Maine discharge to the same watershed. North Berwick, Berwick, South Berwick, and Kittery may face similar issues in the future. Maine will benefit from work by EPA and the New Hampshire Department of Environmental Services (NHDES).

NHDES deserves special recognition for its efforts. Staff are always available to answer questions, review information, and support the public in addressing environmental issues within the state. A few people with whom I have had the pleasure of working and who deserve this special recognition include the following:

- Ken Kessler, formerly in the Wastewater Operations section
- Dennis Greene in the Design Review section
- Alexis Rastorguyeff in the Industrial Pretreatment section
- Beth Malcolm, administrator of the Clean Water State Revolving Fund/State Aid Grants program
- Tracy Wood, administrator of the Wastewater Bureau

If you are not already a member of NEWEA or NHWPCA, please consider joining to enhance your growth as a professional in the industry. As the NEWEA New Hampshire state director, I can be reached at sclifton@underwoodengineers.com or at 603-436-6192. Please feel free to contact me with any NEWEA questions.

Finally, I want to thank NHWPCA and NEWEA for the opportunity to serve as state director for the past three years. My term will end in January 2022 when a new director is elected. To the wonderful group of professionals with whom I have had the pleasure to meet and interact, I offer my sincere thanks and gratitude for the camaraderie, support, and assistance. To those who follow, I say to relish the experience, grab that opportunity, and live life to the fullest.

Massachusetts *continued from page 64*

accommodate utilities with unique circumstances in size and design complexity. Many would recommend the opportunity for each utility to develop more practical notification plans followed by realistic response plans.

Letter regarding PFAS In biosolids

MAWEA has recently written a letter to DEP Commissioner Martin Suuberg expressing concern over the growing problem of biosolids management in wastewater utilities. Currently in Massachusetts, 43 percent of biosolids are incinerated, 38 percent are land applied, and 18 percent are landfilled, in most cases out of state. Land application and landfilling are increasingly being restricted due to the presence of PFAS and landfill instability. This reduction of two of the three available options for biosolids disposal has a significant impact on operations and budgets as utilities determine viable solutions. MAWEA urges DEP to consider the technically and financially onerous implications as these restrictions are put in place. Massachusetts wastewater utilities are looking to collaborate with DEP so that short- and long-term solutions can be developed and implemented practically. This will allow utilities to prepare and plan for appropriate, feasible long-term solutions to this growing problem.

Committee Member Appreciation Event

Kimball Farm, Westford, MA
August 12, 2021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1. Kate Biedron Memorial Fund Task Force member Meg Tabacsko (far left) and NEWEA President Virgil Lloyd (far right) congratulate Kate's family (sister Mary, brother Wally III, mother Peggy, and father Wally II) as Kate was posthumously presented with the NEWEA Committee Service Award 2. Youth Education Committee Chair Lenny Young and family relax during dinner, (l-r) Lenny with his daughter Kaylen, wife Kristina, son Lenny III, and family friend Asia-lee Raymond 3. 5S inductee Ned Beecher's son, Jesse, helps his daughters navigate the event's beverage dispensers


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1. Some of the 5S inductees from 2020: (l–r) Tim Loftus, Mike Harris, Denise Descheneau, Kate Edwards, and Scott Firmin are gently introduced by Influent Integrator Charlie Tyler (far right) 2. Old friends Geri Ciardelli and Jim Barsanti took advantage of the occasion to catch up 3. 2021 5S inductee Jonathan Kunay and his son converse with Diversity, Equity, and Inclusion Committee Chair Marina Fernandes and her son 4. Past President Phyllis Arnold Rand congratulates 2020 5S inductee Tim Loftus 5. NEWEA Communications Director Jordan Gosselin and Administrative Assistant Heather Howard share a laugh as Roberta Wells and a masked Grayson Moran look on

Upcoming Meetings & Events

CSO/WWI CONFERENCE & EXHIBIT
Sheraton Portsmouth, NH
September 29–30, 2021

RESIDUALS & BIOSOLIDS
UMASS Lowell Inn & Conference Center, Lowell, MA
October 7, 2021

NEWEA GOLF TOURNAMENT
Derryfield Country Club, Manchester, NH
October 8, 2021

JOINT NEWEA ASSET MGMT & NEWWA IT FAIR
NEWWA Office, Holliston, MA
November 2, 2021

JOINT COLLECTION SYSTEMS & PNCWA WEBINAR
Virtual
November 9, 2021

NEWEA ANNUAL CONFERENCE & EXHIBIT
Boston Marriott Copley Place Hotel, Boston, MA
January 23–26, 2022

AFFILIATED STATE ASSOCIATIONS AND OTHER EVENTS

NEAPWA SUMMER MEETING
Red Jacket Inn, South Yarmouth, MA
October 4–6, 2021

NEW ENGLAND INDUSTRIAL PRETREATMENT CONFERENCE
UMASS Lowell, Lowell, MA
October 26–28, 2021

GMWEA FALL TRADESHOW
Doubletree, Burlington, VT
October 27–28, 2021

CTWEA FALL WORKSHOP
Aqua Turf, Plantsville, CT
November 8, 2021

Measurement unit conversions and (abbreviations) used in the *Journal*

U.S.	International System of Units (SI)	U.S.	International System of Units (SI)
Liquid volume		**Length**	
gallon (gal)	liter (L)	inches (in.)	centimeters (cm)
cubic feet (ft^3)	cubic meters (m^3)	feet (ft)	meters (m)
cubic yards (yd^3)	cubic meters (m^3)	miles (mi)	kilometers (km)
acre-feet (ac ft)	cubic meters (m^3)	**Area**	
Flow		square feet (ft^2) or yards (yd^2)	square meters (m^2)
million gallons per day (mgd)	million liters per day (ML/d)	acre (ac)	hectare (ha)
for larger flows (over 264 mgd)	cubic meters per day (m^3/d)	square miles (mi^2)	square kilometers (km^2)
gallons per minute (gpm)	liters per minute (L/min)	**Weight**	
Power		pounds (lb)	kilograms (kg)
horsepower (hp)	kilowatts (kW)	pounds per day (lb/d)	kilograms per day (kg/d)
British Thermal Units (BTUs)	kilojoules (kJ) / watt-hours (Wh)	ton – aka short ton (tn)	metric ton or tonne (MT)
Velocity		**Pressure**	
feet per second (fps)	meters per second (m/s)	pounds/square inch (psi)	kiloPascals (kPa)
miles per hour (mph)	kilometers per hour (km/h)	Inches water column (in wc)	kiloPascals (kPa)
Gas		**Head**	
cubic feet per minute (ft^3/min)	cubic meters per minute (m^3/min)	feet of head (ft of head)	meters of head (m of head)

THANK YOU
TO ALL OUR 2021 ANNUAL SPONSOR PROGRAM PARTICIPANTS

Platinum
Dewberry
Flow Assessment Services, LLC

Gold
AECOM
Aqua Solutions, Inc.
Arcadis
Brown and Caldwell
Casella Resource Solutions
CDM Smith
Englobe
Environmental Partners Group, Inc.
EST Associates, Inc.
F.R. Mahony & Associates, Inc. (div. of Cummins-Wagner)
Fuss & O'Neill, Inc.
Green Mountain Pipeline Services
HDR
Hoyle, Tanner & Associates, Inc.
Jacobs
The MAHER Corporation
Stacey DePasquale Engineering, Inc.
Weston & Sampson
Woodard & Curran

Silver
Carlsen Systems, LLC
Duke's Root Control, Inc.
Hazen and Sawyer
Kimley-Horn and Associates, Inc.
Kleinfelder
LandTech Consultants
Mott MacDonald
NEFCO
Stantec
Synagro Northeast, LLC
Tata & Howard, Inc.
Technology Sales Assoc., Inc.
Tighe & Bond, Inc.
Williamson Pump & Motor
Wright-Pierce

Bronze
ADS Environmental Services
Black & Veatch
GHD
Hobas Pipe USA
JDV Equipment Corp
Surpass Chemical Company, Inc.

Build relationships with water industry leaders *and* make a positive impact on the water environment

Join NEWEA's 2022 Annual Sponsor Program

NEWEA offers companies the opportunity to promote their products and services throughout the year by participating in multiple sponsorship activities. Annual Sponsorships include:

- NEWEA Annual Conference
- NEWEA Spring Meeting & Golf Tournament
- NEWEA Golf Classic
- A web presence on NEWEA.org's sponsorship program page
- The option to customize sponsorship levels by selecting to participate in up to eight additional unique NEWEA events plus additional activities

Sponsorship Benefits:

- Increased corporate visibility and marketing opportunities before a wide audience of water industry professionals
- Relationship-building access to key influencers involved in advancing water industry services, technology, and policy
- Recognition as an environmental leader among peers and customers

For more information
contact Jordan Gosselin
Email: jgosselin@newea.org
Phone: 781-939-0908

NEWEA
WORKING FOR WATER QUALITY

Advertiser Index

Upcoming 2021 *Journal* Themes

Winter—**Operator Ingenuity**

NEWEA/WEF* Membership Application

Water Environment Federation® the water quality people®

NEWEA WORKING FOR WATER QUALITY

Personal Information (please print clearly)

First Name | M.I. | Last Name | (jr. sr. etc)

Business Name (if applicable)

Street or P.O. Box (☐ Business Address ☐ Home Address)

City, State, Zip, Country

Home Phone | Cell Phone | Business Phone

Email Address

☐ Check here if renewing, please provide current member I.D.

***NEWEA is a member association of WEF (Water Environment Federation). By joining NEWEA, you also become a member of WEF.**

ACQ. Code for WEF use only | WEF 21

Membership Categories (select one only)

		Member Benefit Subscription	Dues
☐ **Professional**	Individuals involved in or interested in water quality	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$185
☐ **Young Professional**	Water quality professionals, with fewer than five years working experience and under the age of 35, are eligible to join WEF as an Active Member, while participating in the NEWEA/WEF Young Professionals Program. This program allows up to 50% off of the Active Member dues, valid for the first three years of membership. This program is available for new member applicants and Student Members.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$70
☐ **Professional Operator**	Individuals in the day-to-day operation of wastewater collection, treatment or laboratory facility, or for facilities with a daily flow of < 1 mgd or 40 L/sec. License # _____	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$110
☐ **Academic**	Instructors/Professors interested in subjects related to water quality.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$185
☐ **Student**	Students enrolled for a minimum of six credit hours in an accredited college or university. Must provide written documentation on school letterhead verifying status, signed by an advisor or faculty member.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online)	$15
☐ **Executive**	Upper level managers interested in an expanded suite of WEF products/services.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online) ■ *WEF SmartBrief* ■ Complimentary WEF Webcasts and more	$355
☐ **Corporate** (member benefits for one person)	Companies engaged in the design, construction, operation or management of water quality systems. Designate one membership contact.	■ *Water Environment & Technology* ■ *Water Environment Research* (Online) ■ *WEF SmartBrief* ■ Complimentary WEF Webcasts and more	$420
☐ **Dual**	If you are already a member of WEF and wish to join NEWEA		$45
☐ **Associate Membership**	This membership category is a NEWEA only membership reserved for the general public who have an interest in water and the environment but are NOT currently employed in the industry (e.g., attorney or supplier). Examples of Associate Members include: teachers; journalists who cover water quality issues; citizen samplers/members of various watershed/ sportsman/conservation organizations, etc.		$45
☐ **New England Regulator**	This membership category is a NEWEA only membership reserved for New England Environmental Regulatory Agencies, including: USEPA Region 1, CT Department of Energy and Environmental Protection, ME Department of Environmental Protection, MA Department of Environmental Protection, NH Department of Environmental Services, VT Department of Environmental Conservation, and RI Department of Environmental Management		$50

WEF Utility Partnership Program (UPP): NEWEA participates in the WEF Utility Partnership Program (UPP) that supports utilities to join WEF and NEWEA while creating a comprehensive membership package for designated employees. As a UPP Utilities can consolidate all members within their organization onto one account and have the flexibility to tailor the appropriate value packages based on the designated employees' needs. Contact WEF for questions & enrollment (703-684-2400 x7750).

Payment

☐ **Check or money order enclosed**
Made payable to NEWEA
10 Tower Office Park, Suite 601
Woburn, MA 01801
For more information: 781.939.0908
Fax 781.939.0907 NEWEA.org

Charge
☐ Visa
☐ American Express
☐ Master Card
☐ Discover

Card # | Security/CVC

Signature | Exp. Date

Name on Card (please print)

Billing Address (☐ check here if same as above) | Street/PO Box | City, State, Zip

Depending upon your membership level, $10 of your dues is allocated towards a subscription to the NEWEA Journal.

NEWEA/WEF Membership Application

MEMBERSHIP PROFILE

Please take a few moments to tell us about your background and professional interests.

What is the nature of your ORGANIZATION? (select only one–required) (ORG)

1 Consulting, Contracting, Planning Services

2 Educational Institution

3 Industrial Systems/ Plants)

4 Manufacturer or Distributor of Equipment & Supplies (including representatives)

5 Non-profits/NGOs

6 Finance, Investment, and Banking

7 Laboratories

8 State or Federal Government

9 Utility: Wastewater

10 Utility: Drinking Water

11 Utility: Stormwater

12 Utility: Wastewater, Drinking Water, and Stormwater

13 Utility: Wastewater and Drinking Water

14 Utility: Wastewater and Stormwater

15 Other

_____

(please define)

What is your Primary JOB FUNCTION? (select only one) (JOB)

1 Executive Level

2 ManagementLevel

3 Elected or Appointed Official

4 Educator

5 Student

6 Consultant/Contractor

7 Engineering/Design

8 Operator

9 Scientist/Researcher

10 Legislator/Regulator

11 Analyst

12 Sales/Marketing

13 Manufacturer's Representative

14 Communications/ Public Relations

15 IT/OT

16 Other

_____

(please define)

What are your KEY FOCUS AREAS? (circle all that apply) (FOC)

1 Air Quality and Odor Control

2 Biosolids and Residuals

3 Climate

4 Collection Systems

5 Disinfection and Public Health

6 Drinking Water

7 Energy

8 Finance and Investment

9 Industrial

10 Intelligent Water Technology

11 Laboratory Analysis and Practices

12 Nutrients

13 Plant Operations and Maintenance

14 Public Communications and Outreach

15 Regulation, Policy, Legislation

16 Research and Innovation

17 Resource Recovery

18 Safety, Security, Resilience

19 Small Communities

20 Stormwater

21 Utility Management and Leadership

22 Watershed Management

23 Wastewater Treatment, Design, and Modeling

24 Water Reuse and Reclamation

25 Workforce

Demographic Information (Check box) The following is requested for informational purposes only.

Gender: ☐ Female ☐ Male

Education: ☐ Doctorate ☐ MA/MBA/MS ☐ BA/BS ☐ AA/AAS ☐ Technical School ☐ High School

Race/Ethnic Origin (Check box) The following is requested for informational purposes only.

☐ African-American (Not of Hispanic Origin) ☐ American Indian or Alaskan Native ☐ Asian ☐ Caucasian ☐ Hispanic/Latino ☐ Pacific Islander or Native Hawaiian ☐ Other

Did Anyone Recommend that You Join WEF?

Referring member's name: _____ Referring member's email: _____

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