

# ENVIRONMENTAL ENGINEER & SCIENTIST

Volume 51, Number 2  
Spring 2015

AAEES *Honorees*

2015  
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# ENVIRONMENTAL ENGINEER & SCIENTIST

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### E3S -Where it's At

I am writing this message from the left coast, in the metropolis that defines Los Angeles. The weather is warm and beautiful, but beyond bone dry. To my colleagues in most of the rest of the United States it has been unusually cold and wet. Oh, for a weather trading program and the innovative market solutions it might bring.

While this is a tongue in cheek, pie in the sky thought, much more practical, innovative approaches and solutions to environmental challenges are brought forth by AAEEES members and their agencies and firms on a routine basis. An exemplary package of such work is presented in this edition of the Environmental Engineer and Scientist showcasing both individuals and projects in the AAEEES annual Excellence in Environmental Engineering and Science Awards – Conference and Luncheon (E3S). As is usually the case, our judges were hard-pressed to determine the winning projects from those finishing a close second. I offer the heartiest congratulations to all entrants for an impressive array of projects and the thinking and effort that went into their development.

Some of you may have attended the 2015 edition of E3S which was held in Washington, DC on April 23, where you had the privilege of viewing the individual project story boards and hearing the excellent technical presentations. For those unable to attend, I invite you to examine the project summaries in the following pages – but first, let's touch on some history of the event.

The E3S inaugural event was in 1989. Over its 26-year span, it has become one of the longest-running and most-recognized competitions in our profession. The venue has always been at the prestigious National Press Club in Washington, D.C. It provides a proven setting for professional networking and presentations. Talk with anyone who has attended the E3S and I believe you will receive positive feedback.

With such a great reputation and offerings that shine a spotlight on noteworthy environmental engineering and science endeavors, the Academy staff and leadership wants to be sure we are doing all we can to maximize E3S attendance and participation. While we had the usual array of stellar entries this year, I am sure there are many, many additional qualifying projects that, for whatever reason, were not entered for consideration.

I urge all of you to familiarize yourself with the E3S entry guidelines as set forth in the Academy's website (<http://www.aaees.org/e3competition.php>). You will see that the competition is open to all individuals, companies, or organizations, regardless of affiliation with the Academy. The E3S submittal application has been greatly simplified and is now available in electronic format to facilitate a qualification review and to minimize the time required and the expense of preparing the entry.

We believe that the current platform for the conference and the competition is underappreciated, especially in the context of the exposure that our winners get relative to the nominal cost of entering.

There is a great ROI for entrants in terms of the PR value to be had, and also in the rewards that accrue to your organization from the team building and morale boost your people receive when you recognize them as doing work that is qualified for consideration on a national stage. You know you have a great team that routinely has great ideas. Entering the E3S demonstrates to your people that you hold them in the highest regard.

We believe that we have a great program as it is currently structured. However, we do not want to rest on our laurels. We very much welcome your ideas and suggestions for improvement. We are always looking for ideas that will result in an enhanced E3S experience and an increase in the number of entries.

In addition to project awards, the E3S is also a forum for the Academy to present a series of awards that recognize the noteworthy contributions of individual AAEEES members and environmental engineering and science students. Descriptions of the awards and a brief background on each of the 2015 recipients are set forth in the body of this journal. No need for me to repeat that information or offer my personal knowledge of these outstanding individuals. Suffice it to say, they are eminently qualified and deserve recognition not only for their career technical accomplishments, but also in consideration of their professional and ethical conduct. Many of the recipients made the decision long ago to become a member of the Academy. Their exemplary careers attest to the value of Academy certification, practices and programs. Consider this time of honoring them and their Academy resume as motivation to help us identify and recruit new AAEEES members.

I know you join me in proudly saluting all of the Awardees for their well-deserved recognition. I look forward to seeing all of you at the 2016 E3S. Let's work to make it a record setting year in terms of attendance at the event and in terms of noteworthy, leading-edge entrants to the competition. ☒



Over its 26-year span, it has become one of the longest-running and most-recognized competitions in our profession.

# MEMBER NEWS

## AWARDS AND RECOGNITION

**Venkataramana Gadhamshetty, Ph.D., P.E., BCEE**, was awarded a \$500,000 research grant by the National Science Foundation. The Faculty Early Career Development (CAREER) Program offers the NFS's most prestigious awards to support junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research. Over the next five years, the award will fund Gadhamshetty's research that could pave the way for the next generation of minimally invasive, corrosion-resistant coatings for infrastructure.

Dr. Gadhamshetty, Assistant Professor at the South Dakota School of Mines and Technology, has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2013.

## ON THE MOVE

**Dennis J. Greene, Ph.D., P.E., BCEE**, has joined Kleinfelder (Manchester, NH). Dr. Greene has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1998.

**Thomas Loto, P.E., BCEE**, has joined Kleinfelder (Manchester, NH). Mr. Loto has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2006.

## SPECIALTY CERTIFICATION

**Alan D. Roscoe, P.E., BCEE**, has been transferred from Inactive to Active Status. Mr. Roscoe has been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2005.

### *Environmental Engineering and Scientist Survey*



AAEES is conducting a short survey on our periodical, *Environmental Engineer and Scientist*, to gain insight and feedback from you, our readers, on how to make this publication more compelling.

To participate, go to <http://bit.ly/2015EESSurvey>.

The survey will close on June 1.

## IN MEMORIAM



**Paul Eugene Langdon, Jr., P.E., BCEE**, passed away on October 24, 2014. He was born November 9, 1931, in Evanston, IL, to Paul E. Langdon and Phyllis Langdon. He graduated from New Trier High School in Winnetka, IL, in 1949.

Paul received his bachelor of science degree and master's degree from the California Institute of Technology in 1952 and 1953. For three years, he worked for the Public Health Service, now known as the EPA. This job took him all over the Southeast doing studies on water pollution. In 1957, Paul joined the engineering firm of Greeley and Hansen in Chicago. He became a partner in 1971. Much of his work was in Panama, New York, Michigan, Florida, Georgia, and South Dakota. This involved planning and supervising construction of water treatment plants.

Mr. Langdon was a Life Member of AAEES and had been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 1979.



**Keith Andrews "Andy" Miller, P.E., BCEE**, passed away on February 6, 2014, at St. Vincent's Hospital in Indianapolis, IN. He was born on January 17, 1962, in Roanoke, VA, to Keith William Miller and Frances (Hiteshew) Jensen.

Mr. Miller grew up in Ligonier, IN. He graduated from Howe Military School in Howe, IN, in 1980. After high school, he attended Purdue University in West Lafayette, IN, where he received a Bachelor of Science in Civil Engineering. He later received a Master's of Business Engineering at Purdue.

He started his career in environmental engineering with the Department of Natural Resources in Indianapolis, IN. Mr. Miller then worked with HNTB in Indianapolis, IN, before joining Greeley & Hansen, also in Indianapolis. Most recently, in 2011, he joined CDM Smith as a Principal Environmental Engineer where he led large scale water and waste water projects all around the country. Mr. Miller was a true leader and had a caring and compassionate approach to helping people, the community, and the environment. He was a good friend to countless professionals in the engineering field and maintained those relationships throughout his career.

Mr. Miller had been a Board Certified Environmental Engineer in Water Supply and Wastewater Engineering since 2011. ☐



## Inventing the noPARK

It's that time again. Spring is finally approaching and many of us are looking forward to putting a long, bleak, and record-setting winter behind us. But springtime is also the season that we at the Academy look forward to because it means celebrating the next crop of winners of the Excellence in Environmental Engineering and Science awards. This year we have a better than ever crop of entrants in the competition with topics spanning the latest in research, as well as the application of new techniques in the development of environmental solutions.

### SO MANY IDEAS, SO LITTLE TIME

Unfortunately, that is the one significant flaw in our program. We simply don't have enough time at the conference to properly recognize the implications of the work that has been presented an award. We also, obviously, don't have the time to recognize and honor the projects that were submitted but did not win an award. It seems that every year we get the same complaint from our judges. They tell us that it is getting increasingly hard to select winners from the exemplary field of entrants. Clearly, that is the way we want to keep it.

I'd like to make that my theme for this article. There are so many things going on in the environmental arena that there is no way for someone who is working in this area to keep up with it all. Instead, if you are like me, you set some reminders here and there to take a look at certain publications, or follow certain people, or regularly check out a set of blogs if you can find the time. The search for groundbreaking items and discoveries is what make it all interesting.

I look for items in which the unconventional meets the unexpected to produce some interesting thinking and some new approaches to dealing with problems. These new approaches might be driven by

technology that has not been applied in a particular area. Or they might be the result of people applying a non-technical background and an alternate perspective on the nature of the problem. As a result, we uncover some very interesting approaches for dealing with environmental issues that those of us in the thick of the profession simply wouldn't think of.

That's where the magic begins to happen. Some see it as the combination of science and engineering leading to unexpected results. Others will posit that unconventional thinking most frequently comes from people who don't know any better. That is, their specialty lies in areas that have nothing to do with science or engineering and they have not learned that what they are proposing cannot be done. Instead, we sometimes see artists or sociologists or biologists or philosophers have an approach to a problem that is unique and potentially quite effective. The reason this is important is that we really need to develop a method for not letting these sorts of things fall off the edge of the table. Sometimes the biggest ideas come from the most humble beginnings. Sometimes it is the small ideas that, when scaled up, can yield a surprising system-wide impact.

### THE ART OF THE ECO-MIND SHIFT

I have an example that I ran across recently. I don't recall how I ended up on the TED website, but I was immediately intrigued by the fact that there was someone doing a presentation about the environment and the heading of the presentation was, 'the art of the eco-mind shift.' That alone was enough to get me to stop to investigate further. The description for the Talk stated that the speaker's, "unusual lab puts art to work, and addresses environmental woes by combining engineering know-how with public art and a team of volunteers. These real-life experiments include: walking tadpoles, texting fish, planting fire-hydrant gardens and more."

Adding to the intrigue was the presenter's bio which reveals that she is on the faculty at NYU in the Visual Arts Department. Her PhD work includes biochemistry, engineering (mechatronics, space-systems and precision engineering), neuroscience, and the History and Philosophy of Science. There is some mention of having done environmental studies, but her bio clearly indicates that the interest in



“There are so many things going on in the environmental arena that there is no way for someone who is working in this area to keep up with it all.”



### **NOPARK RETURNS “NO PARKING ZONE” — MOSTLY THOSE ASSOCIATED WITH FIRE HYDRANT PLACEMENT — TO LOW GROWTH MOSSES AND GRASSES.**

These micro engineered green spaces prevent storm water runoff, use foliage to stabilize the soil, and to provide a durable low maintenance surface cover. These microparks continue to provide emergency parking space for fire trucks and exasperated Fresh-direct delivery persons.

But the other 99.9% of the time they now do something more. For all the same rationales that apply to green roofs, greening the no-standing zones is a good thing.

Practically, noPARKS capture more water than green roofs (not being limited to carrying capacity of the 2”, 4”, or 6” of soil that roofs require). These no parking/standing zones are often situated where water collects, capturing the oily runoff from the road before it runs into the river.

noPARKs recharge and replenish soil moisture on the block important to trees — even yards away — to help them dilute the gallons of uric acid poured on city trees plots each day by friendly neighborhood dogs

Lastly, the noPARK reduces the number of standing water pools that are left for days, which are the perfect breeding ground for mosquitoes. In this way, the noPARK may reduce the need for widespread fumigation to combat West Nile virus in New York City.

environmental topics is a function of developing new ways of thinking in bringing technology from other fields into environmental practice. Just as interesting, the presenter has formed what she calls the ‘environmental health clinic.’ This is just what it sounds like, a clinic where you take your local environmental illness issue in search of a remedy. Not unlike a person going to a clinic for a diagnosis and a prescription.

Needless to say, the speaker is a very interesting and accomplished individual. Of the various projects mentioned in the Talk, the one most intrigued me was described as ‘planting fire hydrant gardens.’ I wasn’t sure what that meant, but given the fact that I have been to New York a few times and seen plenty of fire hydrants, the concept of a fire hydrant garden has a variety of interesting potentials.

It actually wasn’t a concept that was at all difficult to understand. What’s interesting is how a germ of understanding can rapidly expand into a realization that the topic presented is completely logical and eminently implementable.

### **NOPARKS IN EVERY NEIGHBORHOOD**

So what’s it all about? Let’s start with the name, creating a ‘noPARK’ park and using the no parking zone around a fire hydrant as the site of the ‘noPARK.’ The concept is simple yet extremely

elegant, and effective in its own right. The starting point for the creation of a noPARK is simply the desire to put the no parking zone around a fire hydrant to use in generating an ecological benefit.

The plan calls for tearing up the pavement that runs 15 feet in both directions from a fire hydrant on any New York City street. The torn up pavement is replaced with dirt and then covered with a generous planting of low growth mosses and grasses, as well as a smattering of wildflowers and related plants that benefit the local insect population. These micro engineered green spaces help prevent storm water runoff, use foliage to stabilize the soil, and provide a durable, low-maintenance surface cover. These microparks continue to provide emergency parking and hydrant access for authorized vehicles. However, the other 99.9% of the time they now do something more.

For all the same rationales that apply to green roofs, greening the no-parking zones is beneficial. Because they are often situated where water collects, they serve to capture the oily runoff from the road before it runs into the river. noPARKs also help to recharge and replenish soil moisture on the block served by the noPARK. This has an important impact as trees — even those yards away — are helped in diluting the gallons of uric acid poured onto their anchoring tree plots each day by neighborhood dogs.





Taking this admittedly cursory introduction to the topic of creating noPARKs, it certainly seems that this is a great idea that will have a potentially significant impact on all the areas of an urban environment where such a plan might be put into place. Clearly, there are questions regarding the costs of doing something like this. Those will have to be investigated and considered fairly before saying yes or no to a noPARK project.

The thing that I want to underscore is that this is the kind of thing that conventional environmental engineers and scientists might not think of. I could be completely wrong in saying that, but I hope we would agree that in the world we work in, ideas from left field are not always welcomed.

As a matter of curiosity, I decided to check out the status of the noPARK concept in terms of popular acceptance. I googled a variety of terms related to fire hydrants, urban green space, microparks, and the like. All I was able to find was a reference to what is known as the Ten-Mile Garden in San Francisco. They borrowed the same concept as the noPARK and have converted a handful of sites into 'parklets'. I would love to hear from Academy members if they are aware of similar efforts in other locations.

### IS THIS A BIG IDEA?

What we need to emphasize is that the impacts of individual small projects like noPARKs, when implemented on a scale that would include an entire urban area, appear to have the potential to generate a significant impact. Just giving it a very simplistic overview, a case can be made that noPARKs in New York City might be a perfectly sensible alternative to other ideas that have been suggested for dealing with the issues that the noPARKs would be able to address. Let's just scale this up to see where that takes us.

The first thing we need to know is how many fire hydrants there are in New York City. A quick surf to the New York City Department of Public Services website reveals that there are just under 110,000 fire hydrants in NYC. Next we need to know what the individual noPARKs would mean in terms of square footage impacted across the entire city. The city parking rules indicate that there is no parking allowed for a zone that extends 15 feet in either direction from a fire hydrant. So that means we have 30 lineal feet of street that we want to convert into a noPARK. The depth of this noPARK on the street I'm going to estimate at 7 feet. That yields a total of 210 ft.<sup>2</sup> available for each noPARK.

Now we get to the interesting part. Assuming that we do a 100% buildout of noPARKs around each city hydrant, an assumption that admittedly is wildly optimistic, we would get a total of 23.1 million ft.<sup>2</sup> of new park space in the city. Converting that to terms we are more familiar with, that would yield roughly 530 acres of new parkland. Lastly, converting back to a measure that every New Yorker

“I would further suggest that you actively reach out to people with different perspectives and backgrounds who just might have the germ of an idea that becomes the next big thing.”


understands, the 530 acres is roughly 65% of the size of Central Park. Bottom line, doing a noPARK buildout in the city would increase nominal park space by that amount. Without even considering the beneficial environmental impacts related to wastewater and other urban pollution problems, transforming pavement to parkland - even at these small scales for individual applications - would seem to be a winning proposition for the city and its residents.

### INSTITUTIONALIZING AUDACITY

Which brings us back full circle to where this discussion began. I suspect that among the Academy's membership there are thousands of similar ideas floating around. Unfortunately, doing our jobs every day probably has a way of leading us to course-correct in the direction of solutions that are on the safe and tried-and-true path. Is that why it takes art professors to help us out in jogging our minds and thinking in ways that are, dare we say, creative? I don't know the answer to that, but I suspect that there is a lot more being thought up than ever gets realized in the form of a new project. That's why it's important to reach out to other disciplines.

The environmental engineering and science profession certainly has no monopoly on innovation, creativity, and finding solutions to the environmental issues that we face today and in the future. My suggestion to all of you is to keep an open mind. If you have the time and inclination, I would further suggest that you actively reach out to people with different perspectives and backgrounds who just might have the germ of an idea that becomes the next big thing.

In case you are wondering, and I hope that you are, the noPARK project was not the only one being done by the professor at NYU through the Environmental Health Clinic. There are several others that were extremely interesting. One I found particularly intriguing was an experiment with an urban solar chimney that was a cheap and effective way of removing carbon black (a.k.a. tire dust and diesel particulates) from a column of rising solar-heated air using commercially available furnace filters at the top of the chimney to capture and remove the carbon from the ambient air. Cheap? Yes. Effective? Apparently so. Implemented on a broad scale? Not that I have seen. I don't know enough about this to be able to determine whether or not this experiment is worthy of ramping up, or if it's just one of those technical oddities that really never will be ready for prime time. Finding the answers will be the fun part.

But for now, suffice it to say that environmental professionals have the ability - or should we say obligation - to make the world a more livable place. We are used to thinking big and working on megaprojects. However, we can't lose sight of the potential impacts of tiny projects repeated a thousand fold. Perhaps next year's E3S competition will have some entrants like this that are submitted by urban botanists who are PhD astronomers who also organize environmental flash-mobs in their spare time. 

All photos courtesy of <http://www.environmentalhealthclinic.net/nopark>



# 2016 Notice of Nominees for Board of Trustees

The Academy's Nominating Committee is chaired by Past President Pasquale (Pat) Canzano. Its members include Brian P. Flynn, Jeffrey H. Greenfield, James Mihelcic, Kristin Morico, and Michael W. Selna. The following candidates have been recommended for 2016.

## PRESIDENT-ELECT

Robert C. Williams, P.E., DEE

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James W. Patterson, Ph.D., BCEEM

## VICE PRESIDENT



**C. Hunter Nolen, P.E., BCEE**, is a Senior Vice President with AMEC a global consulting and engineering firm. He is in charge of its West US Environment & Infrastructure Group, providing environmental, geotechnical, and materials testing services to industrial and public clients throughout the Western US. Mr. Nolen's technical specialties include development and execution of large-scale environmental programs, as well as design and construction projects requiring the integration and coordination of management, technical, community, and financial issues. He has a master's in environmental engineering from Montana State University, a bachelor's in aquatic biology from the University of Texas at Austin, and completed the Executive Education Program at the University of Texas McCombs School of Business.

Mr. Nolen's experience includes analysis, design, and construction of solutions in water and wastewater treatment, storm water management, air pollution control, and groundwater and soils treatment. He has provided these services to a wide range of clients including industry, municipalities, state regulators, and federal agencies.

Mr. Nolen engages in numerous special assignments, committee memberships, consultancy, and responsibilities on behalf of AMEC, clients, and for the American Academy of Environmental Engineers and Scientists. For the Academy, Mr. Nolen is a Trustee-at-Large on the Board of Trustees and Chairman of the Planning Committee. He supported the development of the Academy's Strategic Plan, facilitated the Academy's pre-conference workshops at joint New Jersey Water Environment Association/WEF Industrial Wastewater conferences, and facilitated the Academy's webinar on Environmental Management Challenges in Shale Oil & Gas Development.

If elected to the AAEE Vice President position, Mr. Nolen will continue to bring value to the Academy's successful pursuit of its Vision and Mission, with particular emphasis on furthering the goals defined in the Strategic Plan.



**Dan J. Wittliff, P.E., DEE, F.NSPE**, from Austin, Texas, is managing director of Environmental Services for GDS Associates in Austin. Prior to joining GDS Associates in 2007, he was principal of Dan Wittliff Consulting.

After four years as environmental manager with West Texas Utilities, the state's environmental agency selected Mr. Wittliff as its first Chief Engineer functioning as the organization's chief technical officer with staff authority and oversight over about 1800 engineers and scientists in air, waste, water, wastewater, remediation, compliance, and enforcement activities.

Mr. Wittliff also served as the 2012-13 president of the National Society of Professional Engineers (NSPE). An NSPE member since 1972, Mr. Wittliff served on the Board of Directors and House of Delegates.

## PRESIDENT-ELECT



**Rear Admiral (ret.) Robert C. Williams, P.E., DEE, F.ASCE, F.SAME**, retired from 37 years of Uniformed Service in August 2010. In his last assignment, he served as the Deputy Surgeon General of the United States, maintaining effective relationships and collaborations with executive leadership within the federal government and serving as Chief Executive Officer of

the 6,500-plus members of the United States Public Health Service (USPHS) Commissioned Corps. He currently is a private consultant on public health and environmental engineering matters. He has more than 40 years of experience in environmental engineering and public health, including 6.5 years as the Chief Engineer of the USPHS. He received his B.S. in Civil Engineering and M. Eng. in Environmental Engineering from Texas A&M University and has continued his postgraduate education with courses in public health.

A Registered Professional Engineer, he serves, or has served, as an officer and member of national committees for several professional organizations including: American Water Works Association, Water Environment Federation, American Society of Civil Engineers (ASCE Fellow Grade), Society of American Military Engineers (SAME Fellow), AMSUS, and the Commissioned Officers Association of the USPHS. He currently serves on the AAEE Board of Trustees (BOT), representing the American Public Health Association. He has served on the BOT for more than 10 years in varying capacities. His career has been recognized by numerous awards from AAEE (Stanley E. Kappe Award), ASCE, CFEE, AMSUS, and USPHS awards including two Distinguished Service Medals. He and his wife, Karen, live near Atlanta, Georgia.

He was named an NSPE Fellow in 2004. In addition, he served as president of the Texas Society of Professional Engineers (2002-2003) where he was honored as Engineer of the Year in 1998 and Distinguished Engineer of the Texas Engineering Foundation in 2001. In 2010, Mr. Wittliff was the recipient of the NSPE Presidential Award.

In 2002, Mr. Wittliff retired from the United States Air Force Reserve at the rank of colonel. His military awards and distinctions include the Legion of Merit, Meritorious Service Medal with five oak leaf clusters, Outstanding Graduate of Air War College, and the Air Force Communications-Electronics Professionalism Award.

Licensed as a professional engineer in Texas and Tennessee, Mr. Wittliff earned a BSME from Southern Methodist University and a MBA from the University of Oklahoma.

## TRUSTEE-AT-LARGE



**David M. Gaddis, P.E., BCEE**, is a Corporate Quality Manager at CDM Smith Inc., an employee-owned full service engineering and construction firm founded in 1947. The Firm's focus is on providing solutions in water, environment, transportation, energy and facilities fields. Mr. Gaddis has spent his entire 34-year career with CDM Smith.

David Gaddis works with a core team to monitor the implementation and function of the Firm's ISO 9001:2008-compliant Quality Management System (QMS) and spearheads firm-wide quality initiatives. David ensures QMS process execution and client requirement awareness throughout the organization. This is accomplished through a multi-faceted auditing program, coordination with a nationwide team of quality managers and various data gathering and metric reporting mechanisms. David is also a key member of the core team that drives the firm's QMS and global business best practice improvements.

Mr. Gaddis is a practicing environmental engineer whose experience includes study, design, construction coordination, resident engineering, and start-up of facilities across the spectrum of CDM Smith's practice. He is licensed to practice engineering in 4 states. Among his accomplishments, Mr. Gaddis was a member of the firm's project management training committee.

Mr. Gaddis received his DEE certification in 2001 and became an active member of the AAEEES Engineering Excellence Committee in 2009. He accepted the Chair position in 2012. He has been the New Jersey State Representative for AAEEES since 2009.

Under his direction, several projects have received peer recognition, including The Somerset Hills Interceptor Rehabilitation, Somerset, NJ (CEC of New Jersey Grand Award 1999); Franklin Township Sewerage Authority Sewer Map Automation Project (CEC Honor Award 1999); Montclair Radium Contamination Cleanup, Montclair, New Jersey (CEC of New Jersey Excellence Award 1992); NJDEP, Camden Metropolitan Area Water Supply Feasibility Study, New Jersey (National ACEC Honor Award).

Mr. Gaddis is an FAA-licensed airplane pilot, holds a commercial deep sea diver certificate, and serves his community as a trustee of the 1,000-member homeowner association where he lives. He has a daughter, Sarah who is enjoying college at Loyola University Chicago.



**Jeffrey H. Greenfield, Ph.D., P.E., BCEE**, is currently a Senior Project Engineer in the Public Works Department with the City of West Palm Beach, Florida. He has 20 years of consulting experience and 15 years of Civil and Environmental teaching experience both full-time and part-time at Florida International University and 3 years of part-time teaching experience at the University of Miami.

Dr. Greenfield earned a B.S. in Biology, as well as a M.S. and Ph.D. in Civil Engineering (Environmental Engineering Program), all from the University of Pittsburgh. He became a Board Certified Environmental Engineer in 1999 and holds two specialty certifications in Water Supply/Wastewater and Environmental Sustainability.

Dr. Greenfield became an active member of the AAEEES Water Supply and Wastewater Committee in 2000 and by 2005 was appointed as chair, a position he still holds to date. He continues to serve on the Academy's Awards and Nominating Committees as well as the Education Committee. In addition to volunteering as an ABET program evaluator for both engineering and engineering technology since 2007, Dr. Greenfield currently serves as an ABET engineering technology accreditation commissioner. His most recent Academy activities include participation in the activated sludge anniversary workgroup, helping to prepare the water supply and wastewater exam preparation course, chair of the BCES Surface Water Resources exam workgroup and member of the Tau Chi Alpha committee. Dr. Greenfield is also an active recruiter of new members to become board certified and an avid promoter of the engineering profession.

Dr. Greenfield has focused a considerable amount of time contributing to the advancement of the future of engineering by serving on committees with NSPE, ASCE, and NCEES as well as on both county and state committees with the Florida Engineering Society. He received the 2013 Government Engineer of the Year Award from the Florida Engineering Society's Florida Professional Engineers in Government, and the 2013-2014 Government Engineer of the Year Award from the Florida Section of ASCE.



**Kristin (Kris) Morico, P.E., BCEE, CSP, D. WRE, ENV SP, F.ASCE**, is currently the leader of environmental programs for GE's Global Operations EHS group. Previously, she was the global leader of GE Water Programs and other adjacent activities. In this new role, Kris is responsible for the development and implementation of associated environmental programs globally

working closely with GE's regions and business segments. She has been with GE for 8 years.

Kris began her career working in the municipal water sector as a process engineer for the Regional Water Authority in New Haven, CT, and over the past 30 years (the past 11 of which have been in an executive capacity), she has assumed leadership positions of increasing responsibility. Kris has assumed a variety of positions across several Fortune 500 companies including Clairol, Inc., Malcolm Pirnie, Inc., environmental consultants, Environmental Compliance Officer for ABB/Combustion Engineering, Director of Global Environmental Programs and EHS Governance at Pratt and Whitney (Division



of UTC), and most recently (prior to her present role with GE), she was the Director of Environmental Programs at Tyco International located in Princeton, NJ.

Kris possesses a BS in Biology from Fairfield University, MS Civil Engineering from the University of Connecticut, MEM Environmental Management from Yale University, and an EMBA from the University of Connecticut. She is a licensed Professional Engineer in 8 states, Board Certified Environmental Engineer in the American Academy of Environmental Engineers, Certified Safety Professional, and a Certified Sustainability Professional. She also possesses a Class IV Water Treatment Plant Operators License issued by the State of Connecticut Department of Public Health and is an Environmental Laboratory Director through the same agency. She is an active member in several professional EHS organizations and was elected to the status of Fellow in the American Society of Civil Engineers and Vice President Elect for the National Association of Environmental Managers (NAEM) and serves on the advisory board for the University of Connecticut School of Civil and Environmental Engineering as well as a Board of Trustee of the American Academy of Environmental Engineers. Kris is a visiting lecturer at Yale School of Forestry and Environmental Studies and was inducted into the Academy of Distinguished Engineers at the University of Connecticut School of Engineering in 2011.




**James W. Patterson, Ph.D., BCEEM**, is an internationally-recognized expert on industrial pollution control. Dr. Patterson is completing his first term on the Board of Trustees. He was the 2011 AAEES Kappe Lecturer, has served on the AAEES Membership Committee, and since 2010, as Vice-Chair of the AAEES Certi-

fication by Eminence Committee. He also serves as Vice-Chair of the AAEES Environmental Scientist Certification Board.

He is Principal of Patterson Environmental Consultants, Inc., which specializes in industrial waste management. Dr. Patterson previously served as Professor and Chairman of the Pritzker Department of Environmental Engineering at the Illinois Institute of Technology (IIT) in Chicago for 20 years, and as Director of the EPA-sponsored Industrial Waste Elimination Research Center of Excellence at IIT for 8 years. He received his Ph.D. in Environmental Engineering in 1970 from the University of Florida, and his B.S. and M.S. degrees in 1964 and 1967 respectively, from Auburn University.

Dr. Patterson is the author of two books on industrial wastewater treatment, editor of a three-volume series on industrial pollution prevention, co-editor of a nine-volume series on water quality management, and has authored more than 100 other book chapters and technical papers. He was Chair of the WEF Journal Water Environment Research Board of Editors. He has served as an international consultant and advisor to numerous industries and government agencies, including the U. S. Congressional Office of Technology Assessment, the US EPA, Department of Defense, and Department of Justice, the Illinois Pollution Control Board and Illinois EPA, the Kentucky Department of Natural Resources, the New York State Hazardous Waste Center, and the Ohio EPA.

During 1983-84, Dr. Patterson served as Executive Director of the State of Illinois Hazardous Wastes Task Force. He has served as Chair of the International Joint Commission Expert Committee on Engineering and Technological Aspects of Great Lakes Water Quality, and as Chair of the State of Illinois Effluent Standards Advisory Panel. Dr. Patterson was appointed a Charter Member of the US EPA National Advisory Council for Environmental Technology and Policy. 

**Ballots will be mailed in May.**  
**To be valid, ballots must be received on or before**  
**June 15, 2015.**



# 2015 EXCELLENCE IN ENVIRONMENTAL ENGINEERING AND SCIENCE AWARDS COMPETITION

## *Excellence in Environmental Engineering & Science™*

The Excellence in Environmental Engineering & Science® Awards recognize and promote quality in environmental engineering and science. The Academy encourages entries from all areas of environmental engineering and science practice, such as odors and air pollution control, air quality management, industrial hygiene, radiation protection, solid waste management, resource recovery, waste minimization, hazardous waste management, toxic materials control, water supply, wastewater treatment, residuals and biosolids, nutrients, renew-

able energy, microconstituents/trace organics and field and lab instrumentation.

The competition is open to all individuals, companies, or organizations, regardless of affiliation with the Academy.

Entries and awards are made in each of the following categories.

**Design** – Design of pollution control or other environmental facilities including projects delivered by alternate methods, such as, design-build or design-build-operate.

**Environmental Sustainability** – Environmental Sustainability is the supporting of the quality of life while living within the carrying capacity of all systems. A long term balance of environmental stewardship, economic development, and social well being must be achieved. Research, Planning, Design, or Operations/Management including renewable resources timely regenerated, timely substitute replacement of nonrenewable resources, harmful substances absorbed timely or made harmless.

**Operations/Management** – Operations or Management of pollution control or other environmental facilities, a pollu-







tion prevention program, or environmental regulatory programs (federal, state or local).

**Planning** – Planning related to an environmental control project, system or environmental management facilities or activities.

**Research** – Research of a basic or applied nature that advances the state of the art of environmental engineering or science including research leading to new or improved environmental engineering or science equipment (process, control, instrumentation, environmental testing, etc.)

**Small Firms** – Any Research, Planning, Design, Operations/Management or Small Project conducted by a small firm. A small firm is defined as one that has annual gross revenue of \$5,000,000 or less.

**Small Projects** – Any Research, Planning, Design, or Operations/Management work related to a potential or actual capital expenditure of \$5 million or less or an operation or management activity with an annual budget of \$500,000 or less.

**University Research** – Research of a basic or applied nature that advances the state of the art of environmental engineering or science conducted by a university under the direction of a full-time faculty member. This category differs from the Research category in that a person other than one involved directly with the work can “nominate” another for the award and provide the entry materials, which must be supplied.

Honor Awards are presented to other deserving entries, as determined by competition rules, in each category. Grand Prizes are awarded in each category. The Superior Achievement for Excellence in Environmental Engineering and Science Award is presented to the overall best entry.

An independent panel of judges assesses each entry with respect to the following criteria:

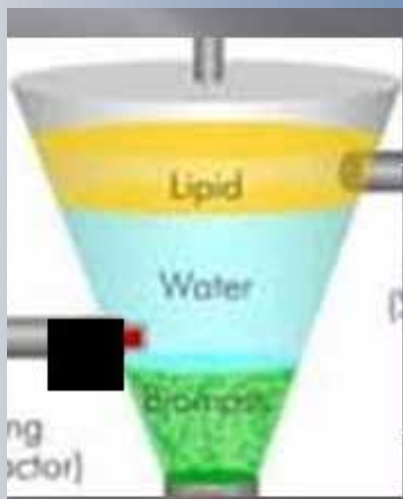
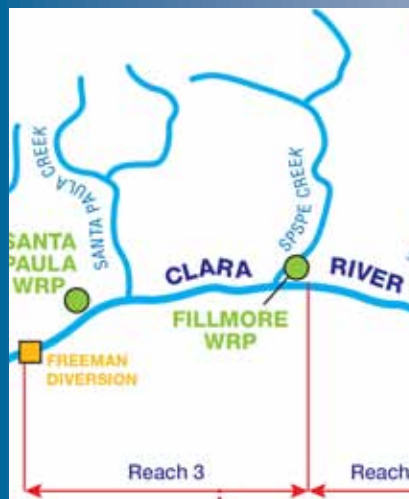
1. Demonstration of a comprehensive, integrated approach that considers all environmental media, i.e., air, water, and land.
2. Quality as evidenced by the degree of user satisfaction and proven performance.
3. Originality and innovation, representing the application of new knowledge, a new application of existing knowledge, or an innovative mix of existing knowledge.
4. The complexity of the problem or situation addressed.
5. The extent to which the project contributes to, or offers the prospect of, contributing to social and economic advancement.

AAEES thanks the following for their time and expertise in serving as judges for the 2015 E3S Competition:

Timothy Berry  
William Celenza  
Mary Clyburn  
Jay Herskowitz  
James Law  
Nancy Manley  
John Morris  
Norbert Schmidtke  
David Wunder

David Cavender  
Majid Chaudhry  
Georgine Grissop  
C.P. Huang  
Kari Mackenbach  
Colin McKenna  
Kevin Morris  
Jerry Snyder  
Xiaoning Zhang

Summaries of the winning projects are on the following pages. Full profiles can be found at on the Academy's website at <http://www.aaees.org/e3competition>.





## BIOCONVERSION OF WASTES (WASTEWATER SLUDGE, GLYCEROL) TO BIODIESEL

ENTRANT: Institut National de la Recherche Scientifique, Centre Eau, Terre &amp; Environnement (INRS-ETE), Université du Québec

ENGINEERS-IN-CHARGE: R.D. Tyagi, Ph.D. and Rao Y. Surampalli, Ph.D., P.E., BCEE

LOCATION: Quebec, Canada

Growing environmental concerns coupled with diminishing crude oil reserves have increased the emphasis on renewable energy. Biodiesel is gaining significant attention as an alternative renewable energy source because it is biodegradable and environmentally friendly; but production costs of biodiesel, which is traditionally produced from oleaginous microorganisms (vegetable oils and animal fats) has grown increasingly expensive. This has left biodiesel producers looking for cheaper raw materials such as wastewater sludge and/or crude glycerol.

In this project, highly active yeast and filamentous fungal strains were isolated from soil/wastewater sludge, then used to develop a process for lipids production using crude glycerol and/or wastewater sludge as raw material.

Municipal wastewater sludge and pulp and paper industrial secondary wastewater sludge were utilized for oleaginous microorganism cultivation to develop a process for lipids production. Lipids separated from the microorganisms were converted to biodiesel by transesterification. Its composition is similar to the biodiesel converted from animal fats. The results showed that 1 tonne of dry sludge produced around 210 kg of biodiesel ( $\approx 61$  gal). The cost estimation showed that biodiesel produced from sludge was around US\$3.5/gal, which is comparable with plant-oil based biodiesel (US\$4.3/gal) and petro-diesel (US\$3.2/gal).

During biodiesel production, glycerol is generated. Glycerol is a simple carbon source that is readily used by microorganisms.

It is normally mixed with methanol, un-transesterified oil, water, and a catalyst, and thus called crude glycerol; but purification is becoming unfavorable due to the rapid decrease of refined glycerol prices. Usage of crude glycerol as a carbon source for oleaginous microorganism will create a clean cycle of biodiesel production.

The addition of crude glycerol to sludge was investigated as a medium for oleaginous microorganism cultivation. The biodiesel contained 40% - 45% of C16 w/w and 50% - 60% of C18, which is similar to palm oil based biodiesel. One tonne of dry sludge and one tonne of glycerol produced around 380 kg of biodiesel (112 gal). Assuming that there was 210 kg of biodiesel from sludge, 180 kg of biodiesel was due to the one tonne of glycerol addition - indicating that the biodiesel yield from glycerol is 0.18 g/g glycerol. It is comparable with the yield of using glycerol synthetic medium (0.19 g/g glycerol) in which chemicals were utilized as nitrogen, phosphorous, and mineral source. It reveals that sludge is an efficient medium for oleaginous microorganism production.

Thus, this study provides an efficient way of managing the wastewater sludge and simultaneously generating bio-energy. It reduces waste quantity and decreases the waste handling cost. In this study, isolated oleaginous microorganisms were successfully employed for biodiesel production from sludge.

The combination of sludge and crude glycerol in biodiesel production seems to provide more economic advantages than solo sludge utilization.

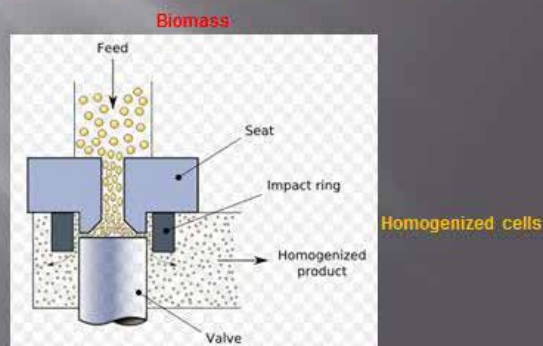
## Process (crude glycerol to lipid)

## Step 1: Fermentation (lipid accumulating)



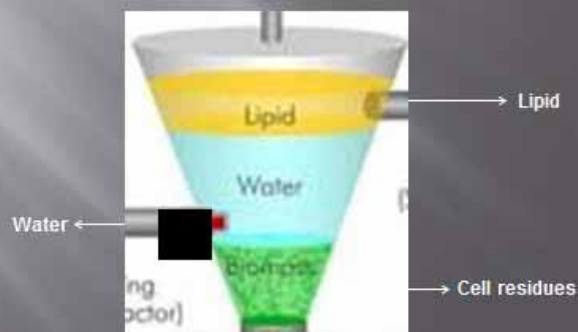
## Process (crude glycerol to lipid)

## Step 2: Cell disruptions (lipid releasing)



## Process (crude glycerol to lipid)

## Step 3: Phase separation (lipid separation)







## GRAND PRIZE - DESIGN

# TUCSON INTERNATIONAL AIRPORT AREA GROUNDWATER REMEDIATION PROJECT (TARP) ADVANCED OXIDATION PROCESS WATER TREATMENT FACILITY

ENTRANTS: ARCADIS and Tucson Water

ENGINEER-IN-CHARGE: George Maseeh, P.E., BCEE

LOCATION: Tucson, Arizona

The Tucson International Airport Area Groundwater Remediation Project (TARP) wells and water treatment plant (WTP) are owned and operated by Tucson Water and have been in operation since 1994. These facilities have been removing volatile organic chemicals (VOCs) from groundwater at one of Arizona's largest Federal Superfund sites and providing high-quality drinking water to Tucson Water's customers.

In 2002, 1,4-dioxane was detected in TARP groundwater. TARP's existing treatment process was ineffective for the removal. As a result, Tucson Water closely monitored 1,4-dioxane levels, practiced blending to reduce concentrations, and engaged ARCADIS to study long-term solutions and develop contingency plans for deploying advanced oxidation, the only proven municipal-scale treatment process for this containment.

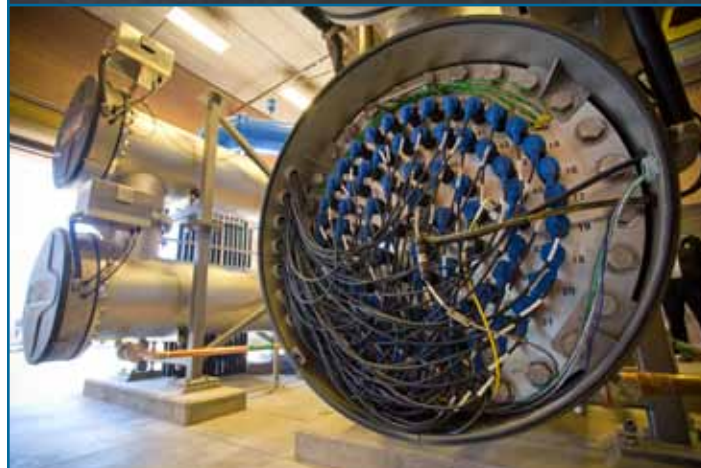
In 2011, EPA revised its 1,4-dioxane Drinking Water Health Advisory Level. In response, Tucson Water, with direction from Tucson's Mayor and Council, commissioned the design and construction of a new AOP WTF to treat groundwater upstream of the TARP WTP. The treatment process employs three parallel trains of advanced oxidation reactors utilizing ultraviolet light (UV) and hydrogen peroxide followed by eight parallel granular activated carbon (GAC) contactors for excess peroxide quenching. The AOP facility purifies up to 5,800 gallons of groundwater per minute, matching the design capacity of the original TARP WTP.

Tucson Water engaged ARCADIS to perform all phases of planning and engineering for the AOP facility, including concept development, pilot testing, design, construction administration, control system programming, and startup/commissioning support.

The AOP WTF is the first municipal drinking water UV AOP facility in the U.S. to utilize GAC specifically for excess peroxide quenching. Peroxide that is not consumed in the AOP reactors is quenched to protect downstream equipment and maintain residual disinfectant levels in the distribution system.

Transforming a significant groundwater quality problem into a high-quality drinking water supply has provided several social and economic benefits to the community. The original facilities stop further migration of VOC contamination, restoring this important water resource in a semi-arid community where all available water resources are critical to economic development and the local quality of life. The new AOP facility restores the TARP facilities to full effectiveness without compromising water quality commitments or requiring additional water supplies for blending.

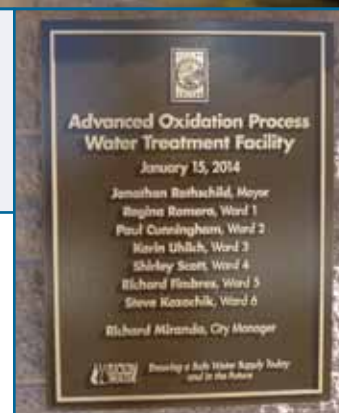
Implementing AOP treatment to address 1,4-dioxane and integrating its design and operation with an existing VOC treatment facility serving as a municipal potable supply is unprecedented in Arizona. Tucson's AOP facility successfully accomplished these goals within the environment of a Federal Superfund site.



**TOP** Advanced Oxidation Process (AOP) Water Treatment Facility building.

**BOTTOM** Dedication Plaque

**RIGHT** Each of the 12 reactors (two per pressure vessel) contains 72 low-pressure, high output UV lamps.



The AOP WTF project has exceeded Tucson Water's goals for 1,4-dioxane treatment, restoration of full operation of the TARP remediation wellfields and elimination of blending with other supplies, operational efficiency, schedule, and cost. The AOP control system allows for fully-automated operation that optimizes the amount of water treated by advanced oxidation or bypassed to the existing TARP

WTP packed columns and optimizes power and peroxide usage. Employing GAC for peroxide quenching resulted in long-term cost savings, while eliminating an additional chemical feed system.



## DIGESTER COMPLEX REHABILITATION IMPROVEMENTS FOR DES MOINES METROPOLITAN WASTEWATER RECLAMATION AUTHORITY

ENTRANT: CDM Smith

ENGINEER-IN-CHARGE: Patrick O'Neill, P.E.

LOCATION: Des Moines, Iowa

**D**es Moines, Iowa, is the state's most populous city and the seat of Polk County. Approximately 600,000 people live in the metropolitan area, which is a growing regional hub for industries, including finance, insurance, transportation and agriculture.

Des Moines Metropolitan Wastewater Reclamation Authority (WRA) operates a 97-million gallon-per-day wastewater treatment facility that produces high-quality treated wastewater discharged into the Des Moines River, biosolids used for agricultural fertilizer, and biogas used for electricity and heat.

In addition to treating wastewater, WRA accepts hauled non-hazardous waste from utility and industrial customers in Des Moines, surrounding communities and adjacent states. Using anaerobic digestion, the WRA facility processes sludge from the wastewater treatment process and treats wastes generated from outside the plant. This includes fats/oils/grease (FOG), dairy, biodiesel, ethanol production byproducts, and other municipal and industrial wastes that are hauled to the facility and processed to produce high-quality biosolids and biogas.

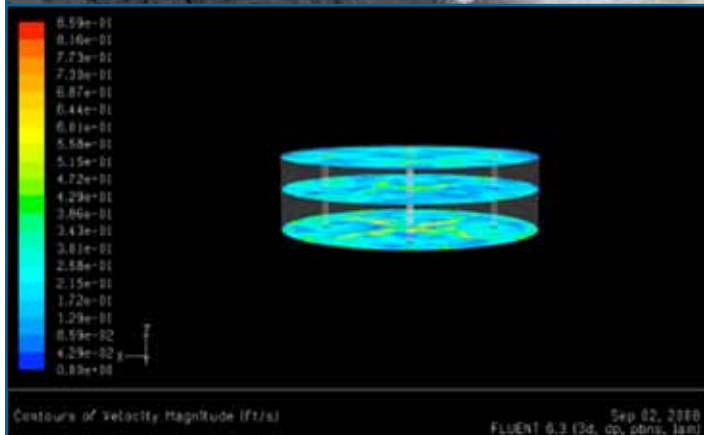
Over the past 10 years, WRA's hauled-waste program has evolved from a pilot facility to a full-scale operation that receives as many as 70 tankers of hauled waste per day. This critical service supports businesses that lack the technology or resources to process their own waste. An environmentally-responsible alternative to typical waste removal, it creates valuable

energy, minimizes pollution, and reduces carbon emissions.

CDM Smith partnered with WRA to create a bioenergy master plan, using life cycle analysis to upgrade the waste-receiving facilities and the anaerobic-treatment process used to treat sludge and trucked wastes. The project team provided design, construction services, training for the improvements, and also developing a process-economics model to help WRA assess the economic benefits of different wastes and alternative uses for the biogas. These improvements include:

- Operation of a central facility, which streamlines costs and benefits the environment.
- Development of a bioenergy plan that integrates planning, technical, and operations processes.
- The upgrading and expansion of digester capacity at the existing WRA facility, helping it to meet the region's growing demand for waste removal and processing.
- Enhancement of biogas production, generating energy and revenue.
- Improvement of digester-cover design to make digesters more versatile.
- Application of an economic/process model to optimize performance and profit.
- Ensurance of optimal energy reuse by providing biogas storage.

These improvements will expand, improve, and support efficient operations and maintenance for the next 20 years.



**TOP** A new gas membrane cover - the largest installed in the United States - provides optimum biogas storage capacity.

**MIDDLE** An extensive column support system was designed to support the 115-foot diameter concrete digester covers and center dome system.

**BOTTOM** Computational fluid dynamic modeling was used to evaluate multiple mixing systems for the five primary digesters and optimize the size of the selected stream.





## HONOR AWARD - DESIGN

### WHALE CREEK SLUDGE DOCK & VESSELS PROJECTS - CONTRACTS NC-50/50A

ENTRANT: Greeley and Hansen

ENGINEERS-IN-CHARGE: Cliff Pomerantz and Sundaram Solai, P.E.

LOCATION: Corona, New York

The New York City Department of Environmental Protection's (NYCDEP) NC-50/50A projects involved the design and construction of a new sludge pumping dock and harboring facilities and the design and procurement of three motorized sludge transportation vessels capable of maneuvering in the narrow and shallow confines of Newtown Creek and Whale Creek Canal and passing-unloaded - beneath bridges at high tide.

The projects involved the "Tri-Venture" partnership of Greeley and Hansen, Hazen and Sawyer, and ARCADIS collaborating with NYCDEP and other government and regulatory agencies.

Despite initial site damage from

Superstorm Sandy, maintenance dredging complications, and delays in securing a qualified shipbuilding contract, the NC-50/50A projects were completed within the scheduled 2014 deadline and within budget, enabling the city of New York to fulfill its promise to local citizens to use the older sludge site and facilities for community redevelopment of affordable housing, parks, and schools.

Engineering challenges involved designing and constructing a multipurpose marine dock and sludge transfer facility in a difficult water-access site without disrupting daily sludge transfer operations essential to the recently overhauled Newtown Creek Wastewater Treatment Plant.



Construction of a new 360 ft long dock and dredging of the canal provides a safe harbor for NYCDEP research and waterway skimming vessels, protecting them from high waves and powerful storms. Locating the new sludge dock adjacent to and across from the Newtown Creek Nature Walk enables the local community to observe and appreciate the civic value of a modern wastewater treatment plant.

## HONOR AWARD - ENVIRONMENTAL SUSTAINABILITY

### DALLAS/FORT WORTH INTERNATIONAL AIRPORT SUSTAINABILITY MANAGEMENT PLAN

ENTRANT: CDM Smith

ENGINEER-IN-CHARGE: Candace Pearson, P.E.

LOCATION: DFW Airport, Texas

Dallas/Fort Worth International Airport (DFWIA), the largest airport in Texas and the second largest in the United States, hosts 1,850 flights per day and serves 60 million customers per year. The 18,000-acre campus is a commercial center for travelers and neighboring communities and generates more than \$30 billion in economic impact annually.

DFWIA is one of 44 airports participating in a pilot program supported by the Federal Aviation Administration (FAA) to promote sustainability. CDM Smith partnered with DFWIA to develop this landmark sustainability management plan.

Through the program, DFWIA engaged tenant, regional and regulatory stakeholders to develop a detailed roadmap that supports continued economic growth for the airport and North Central Texas emphasizing conservation, environmental stewardship and social responsibility.

This innovative plan, which integrates sustainability with the airport's existing business practices, brings together internal and external groups including all departments at DFWIA, campus tenants and representatives from neighboring communities in a holistic effort to improve sustainability at the airport and throughout North Central Texas.



DFWIA is the third busiest airport in the world and the second largest in the United States, hosting 1,850 flights per day and serving more than 60 million customers each year.



## GRAND PRIZE - ENVIRONMENTAL SUSTAINABILITY

### AVEK WESTSIDE WATER BANK

ENTRANT: Kennedy/Jenks Consultants and AECOM

ENGINEER-IN-CHARGE: David Ferguson, Ph.D., P.E., BCEE

LOCATION: Palmdale, California

Completion of the Antelope Valley-East Kern Water Agency (AVEK) Westside Water Bank saved the day during California's historic drought of 2014. The 5% State Water Project (SWP) allocation for 2014 was the lowest in the 50-year history of the SWP. Since AVEK was able to pump nearly 50% of its supply from the new Westside Water Bank, it was able to meet all of its 2014 delivery requests. Without the project, many customers would have been forced to curtail or purchase dry year supplies at 300% to 400% above normal rates.

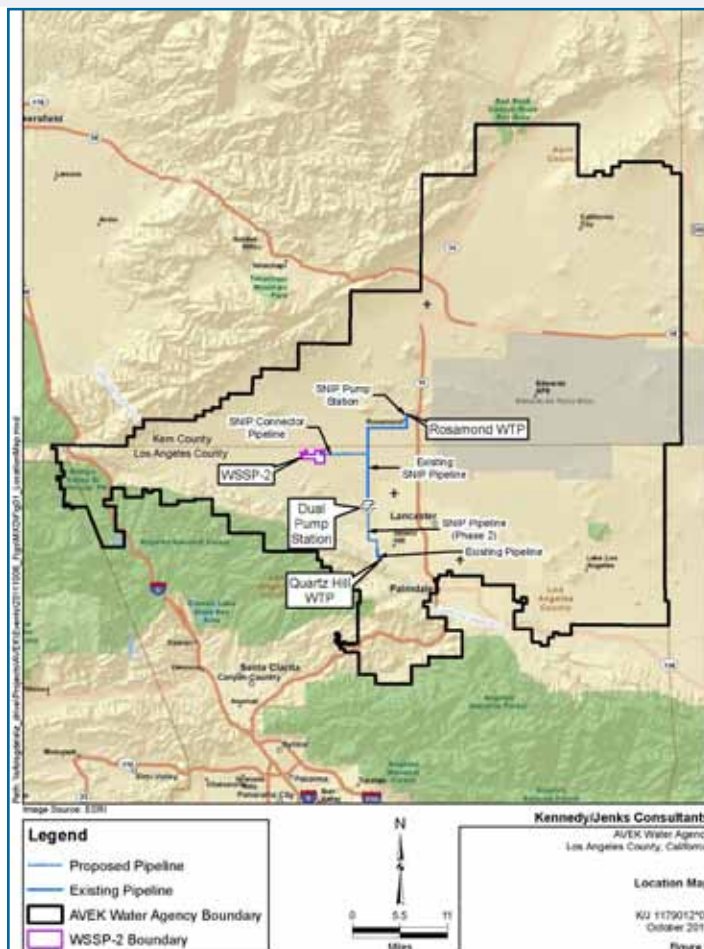
Kennedy/Jenks Consultants and AECOM provided environmental engineering services to create a water bank to achieve water supply stabilization for the AVEK. The completed project consists of the development of a 1,500-acre groundwater recharge and extraction field. SWP water supplies are delivered from the California Aqueduct and recharged in the Antelope Valley Groundwater Basin during periods where SWP supplies exceed demands, and extracted when SWP allocations are low.

An innovative benefit of the project is achieving THM compliance through substitution or blending. The California State Regional Board Division of Drinking Water fully supports AVEK's Operations Plan that includes using the extraction wells for THM compliance, when needed, on a quarterly basis. This simple but creative solution will save AVEK and its members roughly \$60 million compared to construction of post-filtration Granular Activated Carbon (GAC) contactors.

Additionally, the project provides four significant social and economic benefits:

- **Capital and Operational Cost Savings:** The project provided a fifty-fold capital cost savings compared to aboveground surface water reservoir options. It also reduces operational costs by using the water bank as an alternative supply to help ensure distribution system THM compliance. Operations costs are ten-times lower than average operational costs for a post-filtration GAC solution.
- **Grant Revenue:** AVEK received a \$5.4 million grant, nearly all of the \$6 million available to the region from the California Prop 84 Integrated Regional Water Management Planning and Implementation Grant fund.
- **Rate Stabilization:** Supply from the water bank during the 2014 Drought prevented AVEK's members from having to purchase dry year supplies at 300% to 400% above normal rates.
- **Elimination of Traffic and Greenhouse Gas Emissions:** By not having to produce and deliver approximately 3 million pounds of GAC per year necessary for the more traditional THM compliance strategy.

With potable groundwater production in January 2014, the project has proven its worth in extraction well quantity and quality, having extracted 15,000 acre-feet and met all water quality goals and standards.



**TOP** AVEK 2,300-square-mile service area showing the Westside Water Bank (formally referred to as WSSP-2 Water Supply Stabilization Project No. 2) and transmission pipelines enabling delivery from the Westside Water Bank throughout much of the Antelope Valley.

**BOTTOM** Typical Recharge Basin showing low-berm flooding. Individual nozzles allow for manual adjustments to balance recharge flows





## GRAND PRIZE - OPERATIONS/MANAGEMENT

### LOS ANGELES DEPARTMENT OF WATER AND POWER (LADWP) STORMWATER CAPTURE MASTER PLAN

ENTRANT: Los Angeles Department of Water and Power

ENGINEER-IN-CHARGE: Mark Hanna, Ph.D., P.E.

LOCATION: Los Angeles, California

The Los Angeles Department of Water and Power (LADWP) is committed to providing its customers with safe, reliable, high quality water at a reasonable price. The City currently imports over 85% of its water from other sources, costing hundreds of millions of dollars each year. As the drought continues to stress local water supplies, and reliance on imported water sources is threatened by environmental regulations, climate change, and natural resources, LADWP is working to decrease dependence on imported water through the development of local water supplies, including optimizing stormwater capture. LADWP and its technical consultant team lead by Gesoyntec and MWH, with the support of Tree-People, a nonprofit partner, developed the Stormwater Capture Master Plan (SCMP) to codify recently implemented and define new operational guidelines for enhanced management of stormwater facilities in Los Angeles.

Through the SCMP, the LADWP is exploring and identifying opportunities to increase stormwater capture in Los Angeles as part of the effort to increase the local water supply and reduce the dependence on expensive imported water for the City. The SCWP will be the first of its kind to readily adapt to implement the most effective operations and management plans while continuing to enhance the existing network stormwater facilities in the region and will be an outline for policymakers that will explain the LADWP's strategies for the next 20 years to implement stormwater and watershed man-

agement programs, projects, and policies in the City of Los Angeles. It will serve as a guiding document for policymakers to consider when making decisions about programs and policies that impact LA's water resources.

SCMP will include evaluation of existing stormwater capture facilities and projects, quantify the maximum stormwater capture potential, develop feasible stormwater capture alternatives, and provide potential strategies to increase stormwater capture. In addition, the Stormwater Capture Master Plan will evaluate the multi-beneficial aspects of increasing stormwater capture, and recommend stormwater capture projects, programs, policies, incentives, and ordinances throughout the entire City of Los Angeles.

Intensive public outreach was done to solicit project ideas from various communities. Selection criteria used to evaluate project ideas include water supply benefit, initial cost, property ownership, partnership opportunities, multiple benefits and operating costs.

The SCMP has been in progress since Summer 2013. To date, the initial modeling results indicate that the City could potentially capture an additional 105,000 acre-feet of stormwater by 2099 if the required infrastructure, programs, and policies are funded. Once supported, these investments could provide billions of gallons of water for public use, decrease the City's reliance on imported water, improve water quality, manage flood risk, increase green space for habitat and recreation, and also provide local, sustainable jobs.



**TOP** In subregional infiltration, stormwater runoff is collected from multiple parcels, city blocks, or entire neighborhoods into an infiltration facility within the public right-of-way or adjacent public/private lands. Surface channels and/or storm drains are used to convey flows to the desired location where BMPs such as underground infiltration galleries or bio-infiltration basins will be used to artificially recharge local aquifers.

**MIDDLE** Subregional direct use systems are more complex than on-site direct use systems. They typically collect stormwater runoff from a larger tributary area into an underground storage reservoir. A pump, smart cistern technology, and some level of treatment enables the reuse of water for irrigation. Smart cistern technology provides automated control of these systems by allowing BMPs to drain storage in advance of forecasted weather events.

**BOTTOM** Green Streets are public right-of-way projects that maximize stormwater capture through stormwater BMPs and design considerations. Some examples include permeable pavement, dry wells, vegetated swales, bioretention basins, tree wells, and planters. Green Streets provide alternatives to traditional impervious roadways and streetscapes by incorporating BMPs to manage stormwater runoff while maintaining the roadway's primary function of accommodating vehicular traffic and safe pedestrian access.



## SANTA CLARITA VALLEY SANITATION DISTRICT CHLORIDE COMPLIANCE PROGRAM

ENTRANT: Sanitation Districts of Los Angeles County

ENGINEER-IN-CHARGE: Grace Robinson Hyde, P.E., BCEE

LOCATION: Santa Clarita, California

The Sanitation Districts of Los Angeles County (LACSD) function on a regional scale and consist of 23 independent special districts serving the wastewater management needs for about 5.5 million people in 78 out of the 88 cities in Los Angeles County. The Santa Clarita Valley Sanitation District (SCVSD) is one of those independent special districts. LACSD's purpose was to construct, operate, and maintain facilities that collect, treat, recycle and dispose of domestic and industrial wastewater.

The goal of the SCVSD Chloride Compliance Program is to reduce chloride levels in the recycled water discharged to the Santa Clara River through source control, public outreach, certification of planning documents, and design and construction of multiple treatment facilities to protect beneficial uses in the river using a cost-effective and environmentally sound approach.

The SCVSD Chloride Compliance Program will reduce chloride levels in its recycled water discharge through source control, public outreach, certification of planning documents, and design and construction of multiple treatment facilities that are currently underway. Combined, these efforts will protect beneficial uses in the Santa Clara River.

The Santa Clara River is located in northern Los Angeles County, and is the largest river system in southern California that remains in a relatively natural state. The river flows through the Santa Clarita Valley. Further downstream in the watershed, in Ventura County, is a largely

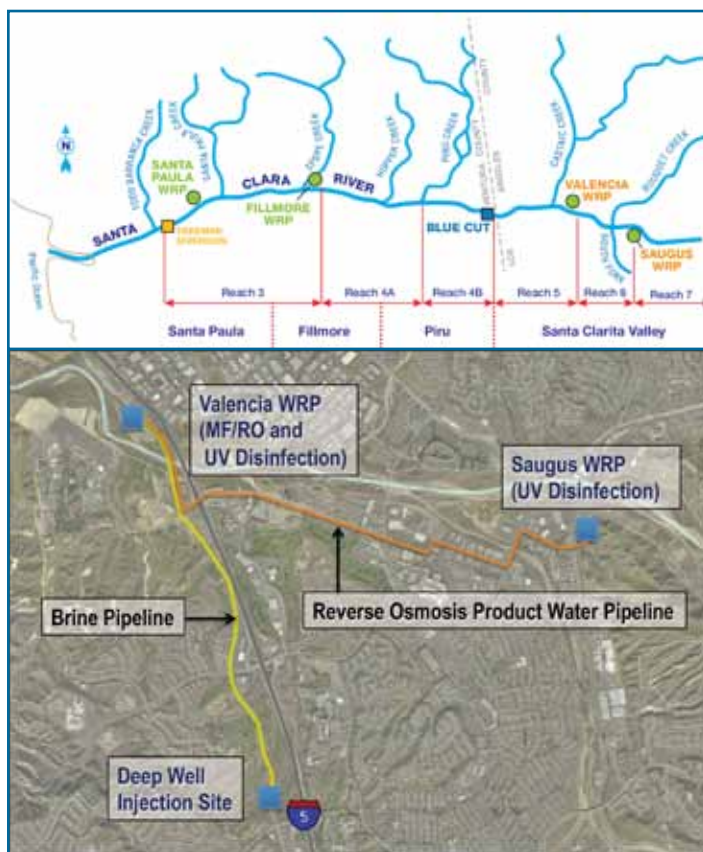
agricultural area where various crops are grown, including salt-sensitive crops such as avocados and strawberries. The California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) is a state agency authorized under the federal Clean Water Act and state Porter-Cologne Water Quality Control Act to regulate discharges to the Santa Clara River for protection of beneficial uses of the river, including salt-sensitive agriculture. As a result of ongoing exceedances of the 100mg/L chloride standard, the LARWQCB first adopted the Upper Santa Clara River Chloride Total Maximum Daily Load (Chloride TMDL) in 2002. The Chloride TMDL imposes a strict limit on the level of chloride (salt) in the recycled water discharged by the SCVSD's two wastewater treatment plants, the Valencia and Saugus Water Reclamation Plants. However, the most significant challenge in complying with the Chloride TMDL has been establishing political and public support to fund a compliance project. The key to this challenge is the perception that Santa Clarita Valley ratepayers will pay for the high cost for compliance while downstream stakeholders in Ventura County will benefit from improved water quality and protection of salt-sensitive agriculture at their expense.

SCVSD has spent over ten years trying to achieve a reasonable chloride standard and find the least costly solution for compliance, focusing on building public support, reducing capital costs, and identifying sustainable, local water supply benefits. SCVSD's

achievements include significant chloride reduction through source control, certification of a Master Facilities Plan and Environmental Impact Report, revision of the Chloride TMDL and amendment to the Basin Plan, and final approval to move forward with an optimized chloride compliance project anticipated to be completed in 2019.

Past compliance project alternatives included large-scale advanced treatment facilities

that were estimated to cost over \$350M. The approved compliance project requires smaller facilities and has a lower estimated cost of \$130M. Additional cost savings may be realized through final approval of the Chloride TMDL revision and regulatory changes, which may result in a cost savings and a revised initial compliance project cost of \$121M. These cost savings will benefit ratepayers by reducing rate increases to some degree.



**TOP** Santa Clara River Watershed. The Santa Clara River Watershed includes the Santa Clarita Valley in Los Angeles County and several cities in Ventura County. Several water reclamation plants, some of which discharge to the river, are located alongside the river in both counties. The river is divided into several reaches that have varying chloride standards.

**BOTTOM** Approved Chloride Compliance Project. An optimized chloride compliance project was approved by the SCVSD Board of Directors in October 2013. Facility upgrades include UV disinfection, MF/RO, and brine disposal through Deep Well Injection. Approval of a revised TMDL and regulatory documents would allow SCVSD to comply with a flow-weighted chloride standard. If approved, the Reverse Osmosis Product Water Pipeline would no longer be required, resulting in capital and O&M cost savings.





## HONOR AWARD - PLANNING

### NORTH VALLEY REGIONAL RECYCLED WATER PROGRAM (PHASE 3)

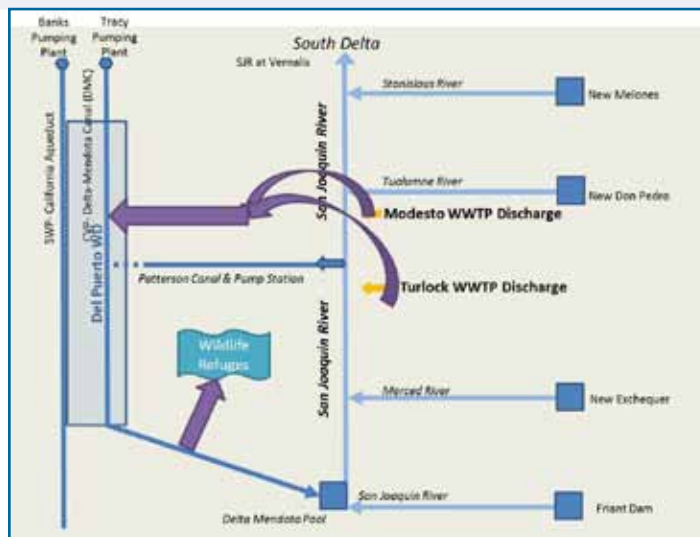
ENTRANT: RMC Water and Environment

ENGINEER-IN-CHARGE: Lyndel Melton, P.E., BCEE

LOCATION: Patterson, California

The North Valley Regional Recycled Water Program (NVRWP) is a regional solution to address part of the continuing California water crisis. The NVRWP will make tertiary-treated recycled water available to the drought-impacted west side of the San Joaquin Valley, south of the Delta. The first phase of NVRWP could produce and deliver up to 59,000 acre-feet per year of tertiary-treated water; water estimated to restore approximately \$29 million in annual agricultural production to the local economy. Participants include the cities of Modesto, Turlock, Ceres, the Del Puerto Water District, and Stanislaus County.

RMC evaluated a number of alternatives for conveying the recycled water to DPWD. Using the Delta-Mendota Canal as a means of conveyance and delivery thus far has shown itself as the most cost effective while at the same time providing the greatest number of benefits. Utilizing the DMC not only provides for the delivery of much-needed irrigation water to local agriculture but, during the non-irrigation season, also provides for the temporary storage of the water for later delivery. DMC conveyance also allows for the possibility of providing some water supply benefits to State and Federal CVPIA-designated wildlife refuges.



RMC is working with USBR to establish a basis for negotiation of a long-term contract for use of the DMC and the policy guidance needed to support the first-of-its-kind introduction of recycled water in the DMC.

## HONOR AWARD - RESEARCH

### LOWERING THE ECONOMIC, OPERATIONAL, AND ENVIRONMENTAL BARRIERS TO SIDESTREAM DEAMMONIFICATION: PILOT TESTING OF THE ANITA Mox® PROCESS

ENTRANT: Sanitation Districts of Los Angeles County

ENGINEER-IN-CHARGE: Grace Robinson Hyde, P.E., BCEE

LOCATION: Whittier, California

Nutrient requirements for wastewater effluents have become increasingly stringent in recent years due to concerns that constituents such as nitrogen that may cause detrimental effects such as hypoxia, acidification, and/or harmful algal blooms in the marine environment. Nitrogen removal from these effluents can be expensive.

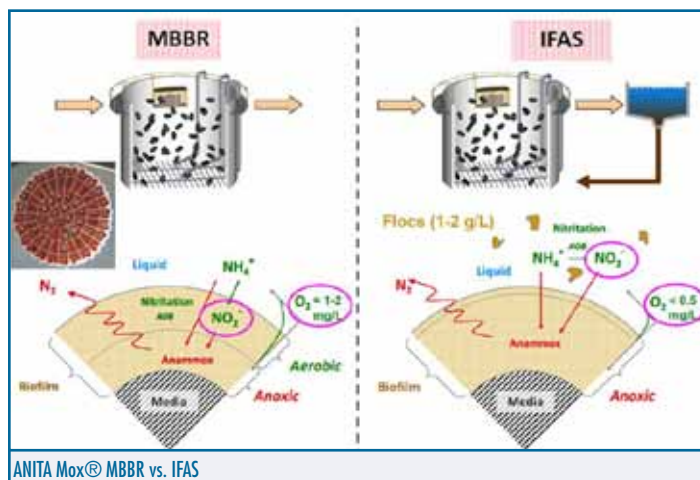
Processes using Anammox bacteria have the potential to reduce the cost of nitrogen removal, particularly suitable for treating sludge dewatering sidestreams. However, Anammox processes are relatively new, with

limited industry experience in the United States. To reduce the barriers to adopting such technologies, the Districts partnered with I. Krüger, Inc./Veolia (Kruger) to evaluate factors of Kruger's ANITA Mox® process, including cost effectiveness, GHG emissions, and sensitivity to operation changes.

Although the technical feasibility of deammonification has been demonstrated previously, the adoption of such technologies depends on a complex set of considerations. The recently developed ANITA Mox® IFAS system was compared to the MBBR configuration and found to ex-

hibit a higher rate of nitrogen removal, which should reduce the required footprint and cost. In addition, operational vari-

ances/upsets were identified and systematically tested, with results showing that ANITA Mox® process is robust.



ANITA Mox® MBBR vs. IFAS



## USING ENVIRONMENTAL ENGINEERING TOOLS, SCIENTIFIC ANALYSES, AND EPIDEMIOLOGICAL STUDIES TO QUANTIFY HUMAN EXPOSURE TO CONTAMINATED DRINKING WATER AND TO BENEFIT PUBLIC HEALTH

ENTRANT: Agency for Toxic Substances and Disease Registry

ENGINEER-IN-CHARGE: Morris L. Maslia, P.E., DEE

LOCATION: Atlanta, Georgia

The Agency for Toxic Substances and Disease Registry (ATSDR), a federal public health agency of the U.S. Department of Health and Human Services, is located in Atlanta, Georgia. ATSDR evaluates the threat to public health of hazardous waste sites by using environmental and health outcome data (information on community-wide rates of illness, disease, and death compared with national and states rates) and community concerns. ATSDR conducts and sponsors applied research to increase scientific knowledge about effects on human health of hazardous substances released from waste sites or other releases into the environment.

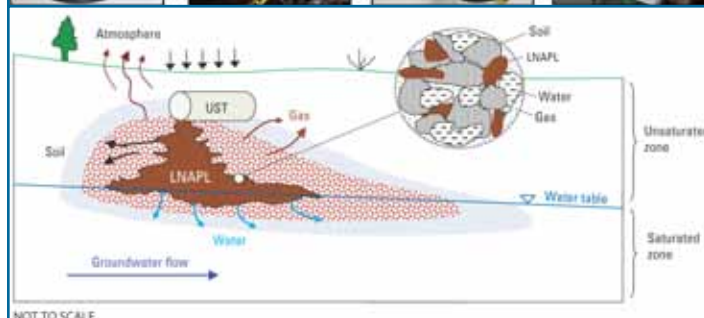
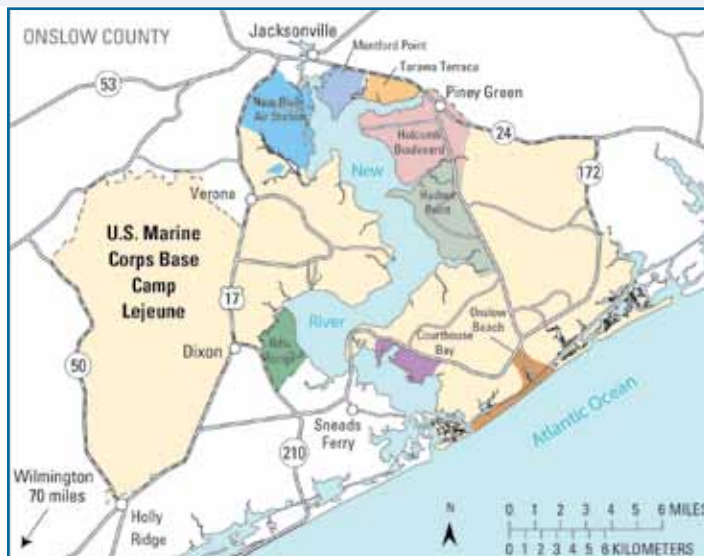
ATSDR conducted epidemiological studies of exposure to drinking water contaminated with volatile organic compounds (VOCs) such as tetrachloroethylene (PCE or perchloroethylene), trichloroethylene (TCE), vinyl chloride, and benzene serving housing areas at U.S. Marine Corps Base Camp Lejeune, North Carolina. TCE, vinyl chloride, and benzene have been classified as known human carcinogens, and PCE is classified as a probable human carcinogen.

To assist ATSDR with the applied research project of reconstructing historical monthly drinking-water concentrations serving base housing needed by the epidemiological studies, additional scientific, engineering, and contractual support was obtained from Eastern Research Group, Inc., the Multimedia Environmental Simulations Laboratory at the Georgia Institute of Technology,

and the Georgia Water Science Center of the U.S. Geological Survey. The ATSDR water-modeling research team created a historical reconstruction of the operations of 112 water-supply wells and three water-distribution systems on a monthly basis supplying drinking water to base housing and other areas so that exposure of residents to contaminated drinking water could be estimated over a 45-year period (1942–1987). This information was used by ATSDR epidemiologists to conduct studies of specific birth defects and childhood cancers, evaluation of mortality among marines and navy personnel, and evaluation of preterm birth, small for gestational age, and birth weight.

These studies found associations between drinking water exposures to TCE and neural tube defects, small for gestational age and low birth weight among term births, and mortality from kidney cancer, liver cancer, multiple myeloma, leukemias, and other cancers. Associations between drinking water exposures to PCE and childhood leukemia, preterm birth, and mortality from several cancers were also found.

These findings would not have been possible without the historical reconstruction using water-modeling methods, which have been recognized by expert peer reviewers as definitive benchmarks for future historical reconstructions for quantifying contaminant concentrations in drinking water and have sparked interest from practitioners, consulting engineers, academic researchers, professional organizations, and the affected Camp Lejeune community.



**TOP** Historical and present-day water-supply areas at U.S. Marine Corps Base Camp Lejeune, North Carolina. Historical family housing areas are Tarawa Terrace, Holcomb Boulevard, and Hadnot Point.

**MIDDLE** Photos of equipment used and activities conducted during extensive field investigation to characterize water-distributions systems and operations serving base housing and other areas, U.S. Marine Corps Base Camp Lejeune, North Carolina.

**BOTTOM** Subsurface light nonaqueous phase liquid (LNAPL) contamination scenario.





## GRAND PRIZE - SMALL FIRMS

### POINT-OF-GENERATION NITROGEN RECOVERY FROM WASTEWATER

ENTRANT: Applied Environmental Technology

ENGINEER-IN-CHARGE: Daniel P. Smith, Ph.D., P.E., BCEE

LOCATION: Tampa, Florida

Applied Environmental Technology (AET) has developed an innovative wastewater treatment system that recovers over 95% of nitrogen from household wastewater. The technology is eminently suited to remove nitrogen from millions of onsite wastewater systems that treat over 20% of household wastewater flow in the United States. AET's system, the Multi-Chamber Treatment and Recovery Process (MCTRP), addresses the crucial need to reduce nitrogen loadings from onsite wastewater in environmentally-sensitive regions such as Florida, Chesapeake Bay, Long Island, and Cape Cod.

The innovative system combines anaerobic biotechnology with ion exchange adsorption for complete capture of wastewater nitrogen. AET employs a passive, low cost and sustainable process that uses environmentally friendly materials, requires no power, and has minimal operation and maintenance.

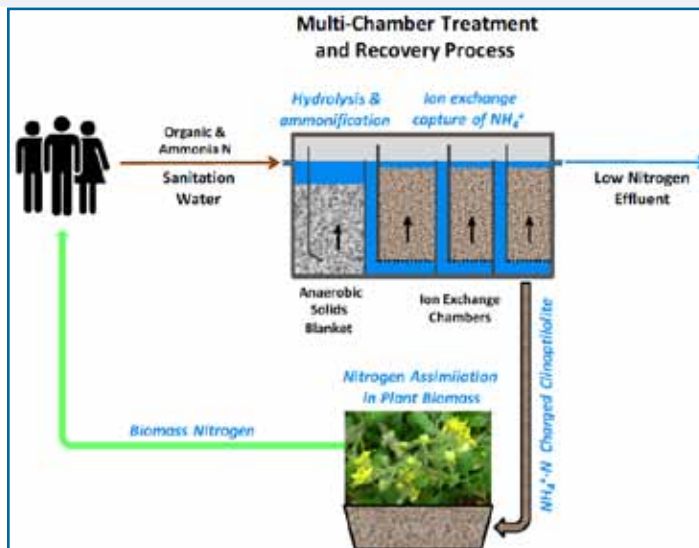
Wastewater movement through the system is by passive gravity flow. AET critically evaluated the technology with funding from a Small Business Innovative Research Grant from the U.S. Environmental Protection Agency. Field testing was conducted for over a one year period using a 55 liter prototype that was operated on actual onsite wastewater. The testing encompassed significant real world variables and provided a compelling truth test.

AET's solution couples anaerobic treatment with anoxic ion exchange. MCTRP is a multi-media, three-phase system: advecting wastewater (liquid), sorptive me-

dia (solid), and headspace (gas). The prototype was designed using rigorous process analysis and engineering judgment. Critical "truth-testing" required real world operation with actual wastewater. AET addressed the complexity of process and design, with gravity-drive wastewater flow through sequential chamber, anaerobic pre-treatment, and staged sorptive media grain sizes to reduce clogging. MCTRP effluent was treated in an external unsaturated media column.

MCTRP is disruptive technology to current U.S. onsite wastewater treatment, where high nitrogen removals without aeration are unorthodox. The success of MCTRP is engendered by the discovery that anoxic  $\text{NH}_4^+$  adsorption is highly effective, and also readily reversible in oxic nitrogen recycling environments. An additional advantage of MCTRP is that the nitrogen recovered from wastewater is in a form that is suitable for crop cultivation. MCTRP is modular, scalable, and adaptable. Fabrication can employ diverse materials while maintaining process functionality. Design simplicity makes MCTRP an appropriate technology for distributed infrastructure and creates avenues for creative deployment in urban and peri-urban contexts. The MCTRP process itself, however, is a varied, complex multi-media system hosting diverse physical, chemical, biochemical, and microbiological processes.

The AET paradigm contrasts with conventional nitrogen removal which destroys nutritive nitrogen value and is costly and energy-consuming.



**TOP** Multi-Chamber Treatment and Recovery Process (MCTRP) as a core component of an integrated system for local-scale nitrogen recovery and beneficial reuse.

**MIDDLE** Project Site: Project site at Mayo Water Reclamation Facility, Anne Arundel County, Maryland. The Mayo facility receives septic tank effluent from Mayo peninsula residents and uses natural treatment processes prior to discharge into Rhode River and the Chesapeake Bay. Influent to the MCTRP prototype was Mayo plant influent pumped from the wet well (brown, open cover shown). The strip chart recorder for Mayo influent flow is on the right.

**BOTTOM** Samples Through MCTRP Treatment System on Day 319: Samples were collected at Day 319. Left to right are: Mayo influent wastewater, Chamber 1 sample taken from water in the clear layer above the solids blanket, and water collected above the ion exchange media in Chambers 2, 3, and 4. The Chamber 1 sample is accompanied by the evident settling of dark material from the anaerobic upflow chamber. Effluent from Chambers 2, 3, and 4 is quite clear in appearance.



## GRAND PRIZE - SMALL PROJECTS

### GREENING GREY INFRASTRUCTURE: A LIGHTWEIGHT ALTERNATIVE TO UPGRADE THE DISTRICT'S WATER SUPPLY FACILITIES

ENTRANT: DC Water

ENGINEER-IN-CHARGE: John Cassidy

LOCATION: Washington, DC

The District of Columbia Water and Sewer Authority (DC Water) is implementing its Long Term Control Plan (LTCP) through the DC Clean Rivers (DCCR) Project to control combined sewer overflows to the District's waterways and improve water quality. In addition to the new grey urban infrastructure (underground tunnels), DCCR has completed a project retrofitting existing DC Water facilities with Green Infrastructure (GI) measures. The most prominent element of this project, due to its size, complexity, sensitive location, and overall project impact, is a 42,390 square foot green roof that was installed over an existing drinking water reservoir located at Fort Reno (FR) in northwest DC.

The FR Reservoir is a covered 5.8 million gallon reservoir system that was constructed in the early 1900's. The roof is made up of an 8-inch thick reinforced concrete slab topped with a built-up roof to protect it from the elements.

Two key drivers dictated the design of the green roof: total green roof system weight and protection of the drinking water supply. These factors guided every design decision to create a lightweight and "leak-proof" green roof.

A complete structural analysis of the existing reservoir roof slab was completed prior to proceeding with the design of the green roof and allowed for the design of a green roof system weighing 50 pounds per s.f. The soil media formulation was chosen to provide just enough organic material to sustain the green

roof plantings while meeting the strict weight requirements. The insulation is composed of extruded polystyrene due to its hydrophobic properties, low water absorption, and low weight. Incorporating this material allowed the designers to create a rolling topography for added visual interest on the roof and permitted greater plant diversity that complemented the topography. Lastly, through the incorporation of a ½ inch thick capillary fabric, the designers were able to minimize the soil media depth while maintaining diversity in plant selection.

To ensure a "leak-proof" green roof, a series of multiple waterproofing layers in conjunction with a continuously-operating leak detection system were used. Both mod-bit waterproofing and thermoplastic membranes were installed as part of the green roof assembly. A vapor barrier was applied directly to the concrete roof slab to inhibit moisture within the reservoir from migrating up through the green roof system and protect the drinking water supply from green roof infiltration. In conjunction with the multi-layer waterproofing, a 40-mil High-Density Polyethylene root barrier tops the mounding insulation to inhibit root growth through the barrier and protect the waterproofing membranes. A continuously-operating leak detection system actively monitors the roof for any potential leaks and is linked to DC Water's Supervisory Control and Data Acquisition System to provide 24-hour monitoring of the roof



**TOP** Fort Reno Reservoir prior to construction of green roof (2011).

**MIDDLE** Fort Reno Reservoir green roof during first growing season (2013).

**LEFT** Fort Reno green roof succulent thriving in its new home on the Fort Reno Reservoir green roof during the first growing season.

and protection of the drinking water supply.

Post-construction monitoring is currently underway for the green roof and indicates a 90% reduction in runoff volume compared to

pre-construction data. In addition to the environmental benefits, this project serves as a showcase to create public awareness and promote the benefits of GI and how it can be successfully implemented.





## HONOR AWARD - SMALL PROJECTS

### REMEDATION OF MIRROR LAKE USING IN-SITU AMENDMENT OF ACTIVATED CARBON TO SEDIMENTS

ENTRANT: Delaware Department of Natural Resources and Environmental Control

ENGINEER-IN-CHARGE: Douglas G. Streaker, P.E.

LOCATION: Dover, Delaware

**M**irror Lake in Dover, Delaware, has been in decline for several decades due to chemical contaminants. Fish in the lake are considered unsafe to eat, and a consumption advisory has been in place since 1988.

Chemical contaminants, including PCBs, PAHs, and mercury had entered Mirror Lake from land-based sources, accumulating in the sediments and remaining as an ongoing source of contamination to the fish. Though declining, the rate of ecosystem improvement lags due to the slow breakdown of these contaminants. If left to restore itself through natural processes, it

would take several decades for the fish in the lake to be safe to eat and for the advisory to be lifted.

Looking to expedite the lake's recovery, DNREC partnered with University of Maryland-Baltimore County's Professor Upal Ghosh to develop an innovative sediment remediation plan, which involved adding activated carbon pellets, known as SediMite™, to the sediments of Mirror Lake. Activated carbon in the pellets acts as a binding agent to permanently immobilize the contaminants in the sediments, preventing entry into the lake's food chain.

In November 2013, DNREC, with help from several partners,

distributed 79 tons of the SediMite™ to over 5 acres of lake bottom and downstream channel sediments, the largest application in the country and the first state-funded sediment remediation project of its kind in the country.

Specialized testing of the sediment, water, and fish samples collected one year after application shows an approximately 60% reduction in the concentration of PCBs. Overall, the project has been able to significantly reduce levels of PCBs in fish after just one year. DNREC scientists say they are well on the way to achieving a 70-90 percent reduction within a 3- to 5-year time frame, which is what was



SediMite™ Activated Carbon Product

projected when remediation and restoration of Mirror Lake began. DNREC and UMBC researchers will continue to monitor progress of the project in future years.

## HONOR AWARD - UNIVERSITY RESEARCH

### DEVELOPMENT OF IN-SITU REMEDIATION OF CONTAMINATED SEDIMENTS WITH ACTIVATED CARBON AND TRANSITION TO PRACTICE

ENTRANT: Department of Chemical, Biochemical, and Environmental Engineering, University of Maryland Baltimore County

ENGINEER-IN-CHARGE: Upal Ghosh

LOCATION: Baltimore, Maryland

**C**leaning up sediment sites contaminated with old pollutants has been a major technological challenge. Traditional approaches for cleaning up of contaminated sediments often does not achieve the goals for environmental protection and can be expensive.

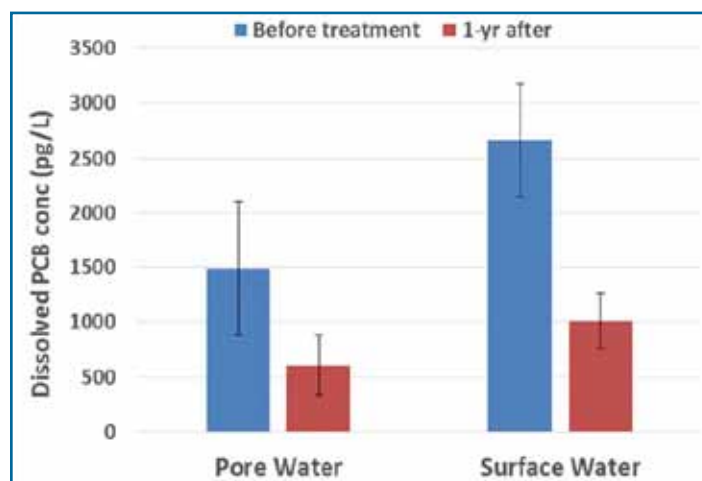
Dr. Upal Ghosh and his team at UMBC have been researching how toxic pollutants such as PCBs, pesticides, and mercury end up in the fish and wildlife. The release of these toxic pollutants from industry has been greatly reduced by current environmental regulations, but prior discharges have caused extensive deposits of these pollutants in the sediments of many waterbodies.

The major exposure to humans and predators in the ecosystem happens through consumption of contaminated fish.

Research by Dr. Ghosh has demonstrated that the natural binding of pollutants in sediments can be greatly enhanced by the addition of strong sorbents such as activated carbon into sediments. Laboratory aquaria experiments and modeling were performed to explore how PCB binding in sediments impacted exposure pathways and bioaccumulation in fish. Results showed that total PCB concentration in fish was reduced by 87% after the sediment is amended with activated carbon. This work was recently demonstrated in full-scale in a 5-acre lake in Dover, DE, in

November 2013. The successful application of the technology in the lake has resulted in a reduc-

tion of PCB concentration in sediment pore water, the water column, and in the fish.



PCB concentrations in sediment porewater and surface water in Mirror Lake were reduced after in-situ treatment with amendment of activated carbon to sediment. Sediment porewater concentration of PCBs was reduced by 60% and lake surface water concentration was reduced by 62%.



### INFLUENCE OF SELECTED LAND APPLICATION STRATEGIES ON THE FATE AND TRANSPORT OF ANTIMICROBIALS AND ANTIMICROBIAL RESISTANCE GENES IN THE AGRICULTURAL ENVIRONMENT

ENTRANT: Department of Civil Engineering, University of Nebraska - Lincoln and Agricultural Research Service, US Department of Agriculture

PERSONS-IN-CHARGE: Xu Li and Shannon Bartelt-Hunt

LOCATION: Lincoln, Nebraska

**A**ntibiotic resistance is a growing threat to public health on a global scale. A diverse research team from the University of Nebraska-Lincoln (UNL) and the USDA Agricultural Research Service (ARS) brought together expertise in the areas of antibiotic resistance, water science, and agricultural systems engineering to identify specific sustainable farming practices that can reduce the spread of antibiotics and antibiotic resistance genes in agricultural settings.

Livestock production is a cornerstone of life in America's agricultural heartland. However, the use of antibiotics on livestock creates the potential for the spread of antibiotics in the surrounding environment. For example, when the nutrient-rich manure from antibiotic-treated animals is used as a soil conditioner, there is a potential for antibiotics to be introduced into land and water systems. When bacteria in those environments are exposed to antibiotics, they are more likely to develop antibiotic resistance genes (ARGs), the genetic materials that make bacteria resistant to antibiotics. Spread of antibiotic resistant bacteria can lower the effectiveness of antibiotics in treating infectious diseases.

The UNL-ARS research team first examined three common methods of applying livestock waste as a soil conditioner. They found that two of the methods – injection and incorporation – were more effective

than a third method – broadcast – in lowering amounts of antibiotics and ARGs in runoff, or the water flow resulting from rainfall. Then, narrow grass hedges planted immediately downslope were investigated for their effectiveness to reduce the transport of antibiotics and ARGs in runoff. The effects of time elapsed between manure application and rainfall was investigated to determine the effect of application timing.

Plot tests were employed in the field to better simulate the real world scenario. With at least three plots for each treatment combination, the team was able to test the statistical significance of their findings. Antibiotics and ARGs in both soil and runoff were quantified using state of the art methods. Results were synthesized to provide a comprehensive evaluation of the impacts of various land application strategies on the fate and transport of antibiotics and ARGs in the agricultural environment. The results showed that the narrow grass hedges were effective in acting as a filter in the soil to remove antibiotics and ARGs from runoff.

This study exemplifies how simple, cost-effective solutions can have significant impacts on environmental outcomes. In this case, two specific practices – the use of certain manure application methods and the planting of grass hedges – can influence the concentration of antibiotics and ARGs in the agricultural environment.



**TOP** Antibiotics and antibiotic resistance genes (ARGs) may remain in agricultural soils following the land application of livestock manure. A portion of the antibiotics and ARGs are transferred to surface water through agricultural runoff.

**MIDDLE** The field tests were conducted at the University of Nebraska – Lincoln Roger's Memorial Farm. To better simulate the real world scenarios, swine manure was collected from a facility at the USDA Meat Animal Research Center and land applied by a commercial company.

**BOTTOM** UNL undergraduate students were recruited to work on the field testing for the project in summers. Some of them became graduate students and continued to work on the project.



# 2015

## ENVIRONMENTAL COMMUNICATIONS AWARDS

Communicating with the public at large and other constituents can be a complex and challenging issue. Communication and marketing plans must be designed to address the objectives and strategies of the campaign to reach target audiences.

With this in mind, in cooperation with the International Water Association and the PIA Awards, AAEEES offered a new area of competition for 2012, the Environmental Communications Award.

The criteria that an independent panel of judges uses to assess the entries include:

- **Future value** to the water engineering profession,
- **Creativity and clarity** in portraying and communicating the messages,

- **Effectiveness in delivery** and achieving desired outcome, and
- **Integrated Design Approach** – Narrative and visual elements work together to achieve the communication objectives.

Two winners were selected for the 2015 Environmental Communications Awards: one Grand Prize winner and three Honor Awards.

AAEEES would like to thank the following individuals who served as judges for the 2015 Environmental Communications Awards:

**Judy Berkun**

**Marlene Hobel**, Vice President, Corporate Communications, CDM Smith

**Marisa Waterman**, Marketing Assistant, AAEEES

### GRAND PRIZE

### "LADY BIRD" — THE TUNNEL BORING MACHINE WITH PERSONALITY

**ENTRANT:** DC Water

**PERSONS-IN-CHARGE:** John Lisle, Chief, External Affairs; Pamela Mooring, Manager, External Communications

#### CHALLENGE

How do you communicate to the public that a massive construction project—the largest since Metro was built—that will double their water/sewer bill and cause construction noise and mess, along with traffic impacts, is a good thing? And in the end, the ratepayers won't even see the massive construction project, as it lies 100 feet below ground.

The \$2.6 billion DC Clean Rivers Project is a court-mandated effort to reduce combined sewer overflows into the waterways in the nation's capital. Despite the significant environmental benefits, and the costs, most of the impressive construction largely takes place out of view, below the Potomac and Anacostia Rivers. That presents a unique challenge and the Authority used the first, giant tunnel boring machine (TBM) as its messenger. TBMs are named much like boats are in the nautical world. DC Water's TBM was named "Lady Bird" after Claudia Alta Lady Bird Johnson, First Lady and wife of President Lyndon B. Johnson. The \$30 million machine stretches more than a football field in length and builds the concrete tunnel walls as it digs.

#### TARGET AUDIENCE

The target audience is the consumers of water who live, work, study or play in the nation's capital. It includes those who pay DC Water bills, especially those who now pay a new charge for impervious area. Media and elected officials are also audiences, as they play a critical public communication role.

#### GOALS, STRATEGIES, OBJECTIVES

The campaign goals were to:

1. educate the public about the important (but hidden) work, its

- environmental benefits and the technical marvel of the project;
2. garner public acceptance of the work, both its cost and disruption; and
3. create an open channel for communication should a specific, immediate need arise.

Strategies for this communication included:

1. Launching a Twitter account for "Lady Bird" giving her a unique personality and a sense of humor,
2. Creating an interactive webpage for Lady Bird, in addition to the project website information,
3. Proactively pitching the media, who responded with overwhelming media coverage.

Objectives included:

1. Engaging on Twitter with the public, local government, media and others and growing followers each year;
2. Providing current information through the use of many media channels to garner more hits and longer visits, and
3. Garnering media coverage in at least two national outlets, two top-tier trade outlets and two local outlets in 2014.

#### RESULTS

##### Media Results:

Lady Bird was featured on the front page, above the fold with a photo, of the Washington Post on February 16, 2014. A full inside spread included a giant graphic describing the TBM, its parts and their function. Online there was a video and photo gallery.

USA Today coverage of Lady Bird gives a great lay explanation of the problem with combined sewer systems and combined sewer overflows.

There were graphics, photos, a fabulous video and a great story.

National Geographic, Marketplace, NPR, are among the national media that have covered Lady Bird. The Washington Business Journal (front page, February 27, 2015), WUSA 9, ABC 7 and other local media have also covered Lady Bird.

Trade media also were kind: It was the cover story for Engineering News Record on April 14, 2014, Gizmodo, Tunnel Business Magazine and Water World were just a few who covered the Clean Rivers Project.

## TWITTER ACCOUNT

On April 9, 2013, DC Water christened Lady Bird in a ceremony at the mouth of the deep launch pit where she later began her dig—a 4 ½ mile tunnel below the District. That very day, DC Water launched both the webpage and the @LadyBirdTBM account with this Tweet: “What a beautiful day. Of course, that won’t matter where I’m going. Not a lot of weather to worry about 100 ft below ground.”

Lady Bird Tweets from deep underground with an oversized personality to match her 1323-ton size. With witty dispatches from the @LadyBirdTBM account, she keeps followers informed during every step of her progress and educates them about the purpose and environmental benefits of the project she is building on their behalf. This unorthodox strategy – how many machines have their own Twitter account? – keeps the project in the public eye.

The feed also relies heavily on multimedia content to engage followers and spread interest through viral sharing. This strategy is successful in part because the massive scale of the project and the tunnel boring machine itself are awe inspiring. Humor also sets the Twitter feed apart, making the project more accessible and interesting for



customers who might be less likely to invest time in learning about a complex engineering project. That allows us to reach a larger audience and to educate them about the importance of the work.

**RESULTS:** Lady Bird ended 2014 with 642 followers on Twitter—local residents and rate-payers as well as environmentalists, members of the media, other utilities, and other TBMs and construction contractors.

## WEBSITE CONTENT:

The Lady Bird webpage at the vanity url [dcwater.com/ladybird](http://dcwater.com/ladybird)

includes an interactive map with Lady Bird’s up-to-the-minute progress displayed visually with a mini Lady Bird icon moving from her start on the Blue Plains plant to her current location. The TBM’s progress is also shown in a key at bottom, in linear feet and percent of mining completed. The interactive map was developed in partnership with the firm managing the tunneling construction.

An inset box includes a few key stats for Lady Bird, including her length, age and speed. (She’s shy about her weight.) A great

image gallery and videos demonstrate the impressive size, scale and complexity of the project. Background information and links to Lady Bird’s media coverage (dozens and growing) round out the contents. There are also links to the larger Clean Rivers Project and other areas of interest on the DC Water website.

**RESULTS:** The Lady Bird webpage (in all its urls) ended 2014 with 7,093 views. Average time spent on the vanity url ([dcwater.com/ladybird](http://dcwater.com/ladybird)) is a whopping seven+ minutes, well above industry averages.



# MEMBER SAVVY

## *The Value of AAEES Membership to you*

The American Academy of Environmental Engineers and Scientists (AAEES) Board certifies environmental engineers and scientists for the benefit of the profession and the public. AAEES's annual Excellence in Environmental Engineering and Science Awards recognize and promote advanced, efficient, and sustainable solutions to environmental challenges. Accredited by the Council of Engineering & Scientific Specialty Boards, AAEES also collaborates on PE licensure and university program accreditation. AAEES offers professional continuing education, student membership and chapters, K-12 education, individual achievement awards, and professional and public resources through the *Environmental Engineering and Science Resource Guidebook*.

Your membership provides you benefits including access to technical information, networking, and career opportunities. In particular, listed below are nine benefits of Academy membership. Are you making the most of them?

### 1. RECOGNITION

Certification in an environmental specialty field is acknowledged when you proudly display the BCEE or BCES title

### 2. PUBLICATIONS

*The Environmental Engineer and Scientist; Who's Who in Environmental Engineering and Science; Environmental Engineering and Science Resource Guidebook; and Environmental Engineering Body of Knowledge*

### 3. NETWORKING

AAEES Website (<http://www.aaees.org>); Social Media connections; Student Chapters and Tau Chi Alpha

### 4. AWARDS

Excellence in Environmental Engineering and Science Competition; Environmental Communication Awards; and AAEES Individual Awards

### 5. MENTORING

AAEES Mentoring Program provides an opportunity to mentor other professionals

### 6. SEMINARS/WORKSHOPS

Local, regional, and national seminars and workshops; Speaking opportunities

### 7. HAPPE LECTURE SERIES

A program that brings professional expertise to universities

### 8. COMMITTEES

Opportunities abound for volunteer work that benefits the Academy and you

### 9. ACCREDITATION

AAEES is a full partner in the Accreditation Board for Engineering and Technology (ABET)

# Congratulations to our 2015 Honorees

## GORDON MASKEW FAIR AWARD

The Gordon Maskew Fair Award honors one of the pioneers of environmental engineering. Dean Fair, in addition to his own exemplary career, spawned a living legacy during his lifetime – those that he taught are now teaching us. Through the Fair Award, the Academy seeks to identify Board Certified Environmental Engineers, Board Certified Environmental Engineering Members, and Board Certified Environmental Scientists who have contributed to the status of the environmental engineering or science professions by exemplary professional conduct; recognized achievements in the practice of environmental engineering or science; and significant contributions to the control of the quality of the world's environment

### *Richard G. Luthy, Ph.D., P.E., BCEE*



**R**ichard G. Luthy is the Silas H. Palmer Professor of Civil and Environmental Engineering and Senior Fellow in the Woods Institute for the Environment at Stanford University. He is the Director of the NSF Engineering Research Center for Re-inventing the Nation's Urban Water Infrastructure (ReNU-WIt), a four-university consortium that seeks more sustainable

solutions to urban water challenges in the arid west.

His area of teaching and research is environmental engineering and water quality with applications to water reuse, stormwater use, and systems-level analysis of our urban water challenges. His research addresses management of persistent organic contaminants and contaminants of emerging concern in natural systems that are engineered to improve water quality and protect the environment and human health.

He is a past chair of the National Research Council's Water Science and Technology Board and is presently the chair of the NRC's study on the beneficial use of graywater and stormwater. He is a member of the National Academy of Engineering, a member of the Academy of Distinguished Alumni—Department of Civil & Environmental Engineering, UC Berkeley, and a Fellow of the Water Environment Federation.

## EDWARD J. CLEARY AWARD

The Cleary Award is given to an individual who is an outstanding performer in the management of environmental protection enterprises conducted under either public or private auspices who have demonstrated exemplary professional conduct, personal leadership, originality in devising new environmental protection techniques and sensitivity and responsiveness to social, economic, and political factors in environmental protection.

### *Kevin Shafer, P.E.*



**K**evin Shafer became executive director at the Milwaukee Metropolitan Sewerage District (MMSD) in 2002. As executive director, he is responsible for the overall management, administration, leadership and direction for MMSD. Under his leadership, MMSD instituted a regional stormwater runoff rule and has been a leader for innovative ways to manage stormwater runoff.

His regional leadership was recognized through the District's receipt of the 2012 U.S. Water Prize, awarded by the U.S. Water Alliance.

Prior to joining the District, Shafer spent 10 years in private in-

dustry and six years with the U.S. Army Corps of Engineers in Fort Worth, Texas. He is a past president of the National Association of Clean Water Agencies. Currently, Kevin is Chair of the Water Environment Research Foundation and as the Chair of the U.S. Water Alliance's Urban Water Sustainability Leadership Council.

Shafer received a bachelor's degree in science and civil engineering with a specialty in water resources from the University of Illinois and a master's in civil engineering from the University of Texas. In 2007, Shafer the Kodak American Greenways award for MMSD's pioneering Greenseams® Program. In 2012, he was recognized by the University of Wisconsin's LaFollette School of Public Affairs with the Lloyd D. Gladfelter Award, honoring his career of innovations aimed at implementing green infrastructure. In 2013, he was awarded the Daniel H. Burnham Visionary Award. In 2014, he was honored by the Public Policy Forum with the Norman N. Gill Award for Individual Excellence.



## INTERNATIONAL HONORARY MEMBER AWARD

One International Honorary Member may be selected each year by the Academy's Board of Trustees by affirmative vote of at least two-thirds of its members. The individual so honored possesses one or more of the following characteristics: has attained a position of eminence in the field of environmental and/or human health protection internationally or in his or her country; has made a single noteworthy contribution or sustained contribution to the advancement of environmental and/or human health protection in a specific area internationally or in his or her country; or has rendered outstanding service over a long period of time resulting in the advancement of environmental and/or human health protection internationally or in his or her country.

### *Tsair-Fuh Lin, Ph.D.*



**T**sair-Fuh Lin is a distinguished professor in the Department of Environmental Engineering (DENV), National Cheng Kung University (NCKU), and the Director of the Global Water Quality Research Center jointly founded by NCKU, Australian Water Quality Centre, and China Steel Group in Taiwan. Professor Lin received his BS, MS, and Ph.D. degrees from NCKU, National Taiwan

University, and University of California, Berkeley, respectively.

Professor Lin is among the leaders of several Taiwanese and international professional societies in environmental engineering, including International Water Association (IWA), Taiwan Water Works

Association, Chinese Institute of Environmental Engineering in Taiwan, and Taiwan Association of Soil and Groundwater Environmental Protection. He also serves as an editor of several international journals, including *Water Science and Technology* and *Sustainable Environment Research*. During his tenure as department chair of DENV at NCKU from 2009 to 2012, he moved the department toward internalization, which is now well known in Taiwan.

Professor Lin is one of the pioneers in several water research areas in Taiwan and Asia, including taste and odor (T&O), cyanotoxins, and ground water remediation. His major research outcomes have been adopted by many Asian agencies for reservoirs and waterworks management. He has been invited by many water utilities and management agencies in Asia for training on solving cyanotoxin and T&O problems, with more than 2,000 professionals trained.

Professor Lin has received many teaching and research awards from NCKU and several national and international organizations. He is a Fellow in Academy of Educators, NCKU and a Fellow of IWA.

## STANLEY E. KAPPE AWARD

The Stanley E. Kappe Award honors the man whose dedicated leadership, strong devotion, and tireless efforts contributed so much to the growth and advancement of AAEEs during the period he served as its Executive Director, 1971 to 1981. This Award is presented to the Board Certified Environmental Engineer or Board Certification Environmental Scientist who has performed extraordinary and outstanding service contributory to significant advancement of public awareness to the betterment of the total environment and other objectives to the Academy.

### *Richard J. Pope, P.E., BCEE*



**R**ichard J. Pope, P.E., BCEE, directs the odor control services for a global company of 22,000. He has worked on air quality and odor related issues for more than 30 years, conducted odor projects at over 250 municipal and industrial facilities across the USA and internationally, been personally involved in the planning and design of over 200 odor control technology systems, has

given over 100 presentations at state, national and international conferences, provides litigation assistance, opinions and court mandated services, and is a proponent of community outreach programs. Mr. Pope manages a centralized team of dedicated odor specialists who

provide full-service, long-term odor control planning.

Dick has a Bachelor's Degree in Civil Engineering and a Master's Degree in Environmental Engineering, is a registered professional engineer in NY and MI, and is Board Certified by the American Academy of Environmental Engineers and Scientists (AAEES) and a former Trustee-at-Large. He is the immediate past chair of the Water Environment Federation's (WEF's) Air Quality and Odor Control Committee, a contributing author on several odor-related text books sponsored by WEF/ASCE, and a member of the Water Environment Research Foundation (WERF) sub-committee that reviews wastewater collection system and wastewater treatment plant odor related research projects. As Chair of the Kindergarten through 12th Grade (K-12) Committee for the AAEEs, he believes in reaching out to and educating our young on societal issues in environmental engineering, and drives that message home by talking to students at middle schools, high schools and colleges around the US about the advantages, challenges and benefits of environmental engineering.

# Congratulations to our 2015 Honorees

## EXCELLENCE IN ENVIRONMENTAL ENGINEERING EDUCATION AWARD

Awarded to an educator who has made a significant contribution to the profession in the area of educating practitioners. The award will be jointly administered by AAEEES and AEESP.

### *Dr. Larry Nies*



**D**r. Larry (Loring) Nies is Professor of Environmental and Ecological Engineering and Professor of Civil Engineering at Purdue University, West Lafayette, Indiana.

He has been teaching Sustainable Engineering at Purdue since founding the courses in 2002. He is a licensed Professional Engineer. His consulting work involves water treatment, wastewater treatment and water and carbon footprint assessment. His research interests span across macro-scale human systems down to nano-scale molecular processes. For more than 20 years, he has studied the fate and effects of anthro-

pogenic chemicals in microbial ecosystems including a focus on the molecular genetic characterization of the structure and function of microbial communities. Currently techniques developed by his students are being used in industry to evaluate bioremediation at petroleum contaminated sites and in research settings to assess the effects of nanomaterials on biological systems.

More recently, Dr. Nies has been studying how to transform industrial and urban systems toward a sustainable trajectory. The watershed scale analysis of water resources reveals many vulnerabilities and opportunities to practice holistic management schemes to promote ecological health and economic prosperity.

Dr. Nies is engaged in the emerging area of life cycle and end-of-life management of products that are capital, energy, and material intensive. The recovery of material and energy value from waste or manufactured products at the end-of-life is necessary to maximize environmental and economic benefits.

## W. WESLEY ECHENFELDER GRADUATE RESEARCH AWARD

Awarded to a student whose research contributes to the knowledge pool of industrial wastewater management.

### *Bryan D. Coday*



**B**ryan D. Coday received a BS in Engineering and an MS in Environmental Science & Engineering from the Colorado School of Mines. After completing his MS, he continued to pursue his passion for research and development of advanced water treatment technologies as a PhD student under the advisement of Prof. Tzahi Cath in Civil & Environmental Engineering at Mines. His graduate

work has focused on the advanced development of engineered osmosis, osmotic dilution, and ultrafiltration membrane processes for the treatment of impaired water resources. Specifically, his doctoral dissertation investigates membrane separation and advanced water

treatment technologies for dewatering of drilling and well stimulation wastewaters and produced water from unconventional oil and gas exploration. He will be graduating with his PhD degree with at least nine peer reviewed publications in several prestigious journals, more than three conference proceeding papers, and more than 20 conference presentations. Mr. Coday has also remained strongly engaged in outreach activities, including serving as the president and vice president of the AWWA/WEA student chapter at Mines, conference chair of the 10th Annual Rocky Mountain Student Research Conference in 2013 (participation of 9 universities), and led the AWWA Desalination Community website in 2014, being responsible for the collection of important news—informing the research and professional communities. His dissertation, presented on March 18, 2015, is titled *Engineered Osmosis Technology for Desalination of Oil and Gas Exploration Wastewaters: Assessment of Membrane Performance and Process Sustainability*.



## W. BREWSTER SNOW AWARD

Awarded to an outstanding engineering student currently pursuing or recently completing a Masters degree in Environmental Engineering or closely related degree program.

### John Trimmer



After graduating from Bucknell University, John entered the Peace Corps Master's International program at the University of South Florida. As part of this program, John served for three years as a Peace Corps Volunteer in Uganda, where he worked with a local organization known as Brick by Brick. This organization partners with primary schools, focusing on infrastructure improvement, health education, and economic development. John helped to expand a construction company, founded by Brick by Brick in 2011, which employs local masons and promotes the use of Interlocking Stabilized Soil Bricks, which are more sustainable than

locally-produced burned bricks. In three years, the company constructed over fifty water tanks, as well as several other structures, using these bricks.

In his final year in Uganda, John spearheaded a project to install Ecological Sanitation systems, designed to recover nutrients from human waste, at two local schools. During this project, John conducted research on local acceptance of these systems, and on a fecal treatment technique in which ammonia levels are elevated through urine addition.

At least as important as these projects is the cultural understanding that John has gained, and his experiences in Uganda will undoubtedly be a key component of his future work. This August, John will be entering a doctoral program at the University of Illinois, where he hopes to continue exploring the safety and sustainability of rural sanitation systems in developing contexts, and to continue highlighting the diverse lives of people who still have a small voice in the global community.

## INNOVYZE EXCELLENCE IN COMPUTATIONAL HYDRAULICS/HYDROLOGY AWARD

Awarded to a student whose research contributes to the knowledge pool in the area of Computational Hydraulics & Hydrology.

### Amy Dale



Amy Dale is a Ph.D. candidate pursuing a joint degree in the Departments of Engineering and Public Policy and Civil and Environmental Engineering at Carnegie Mellon University. Her thesis research focuses on understanding the connections between watershed hydrology, water quality, and the environmental fate of

engineered nanoparticles comprised of metals and metal oxides, an emerging pollutant increasingly found in consumer goods.

Her publications related to this work include a recent Feature article in *Environmental Science and Technology*. Among other achievements, she is a national 2010 Udall Scholar, a 2011 ARCS ("Achievement Rewards for College Scientists") Scholar, a former NSF IGERT Fellow, and a current EPA STAR Graduate Research Fellow. She received a B.S. in Bioinformatics (summa cum laude) from the University of Pittsburgh in 2011. In her free time, she is an avid watercolorist, hiker, and environmentalist.

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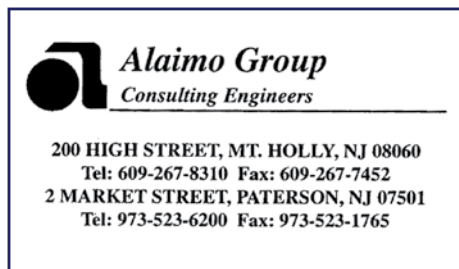
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# Start planning your entry now!

## 2016 *Excellence in Environmental Engineering & Science*

The Excellence in Environmental Engineering & Science (E3S) Awards competition is the **Gold Standard** for identifying state-of-the-art projects in environmental engineering and science. Awards and presentations are held in late spring at the National Press Club, Washington, DC. Winning entries automatically qualify for the International Water Association's Project Innovation Awards.

Entries are accepted in the following categories:

- ❖ Design
- ❖ Industrial Waste Practice\*
- ❖ Planning
- ❖ Small Firms
- ❖ University Research
- ❖ Environmental Sustainability
- ❖ Operations/Management
- ❖ Research
- ❖ Small Projects

*\*The top prize for Industrial Waste Practice will also be presented with the W. Wesley Eckenfelder Industrial Waste Management Medal*

To see profiles of the 2015 winning projects, go to **<http://www.aees.org>** and click on **Excellence in Environmental Engineering and Science**.

**Entries are due by February 1, 2016.**

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