JANUARY/FEBRUARY/MARCH 2017

PWEA
PENNSYLVANIA WATER ENVIRONMENT ASSOCIATION

KWQM
KEYSTONE WATER QUALITY MANAGER

The Magazine for Pennsylvania Water Quality Professionals

SPECIAL ISSUE: Stormwater

Address Service Requested. P.O. Box 3367, Gettysburg, PA 17325

In this issue:

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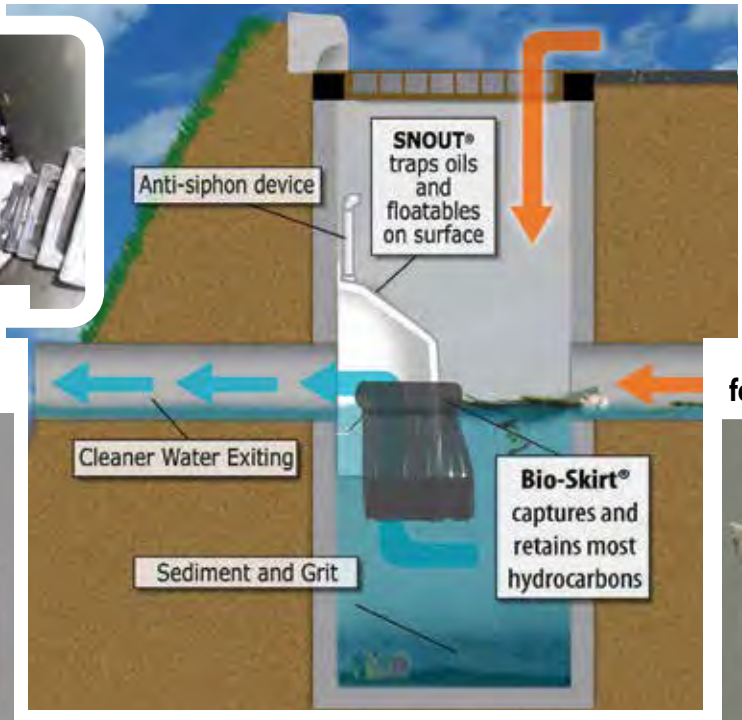

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10-31-2016

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The magazine for Pennsylvania Water Quality Professionals

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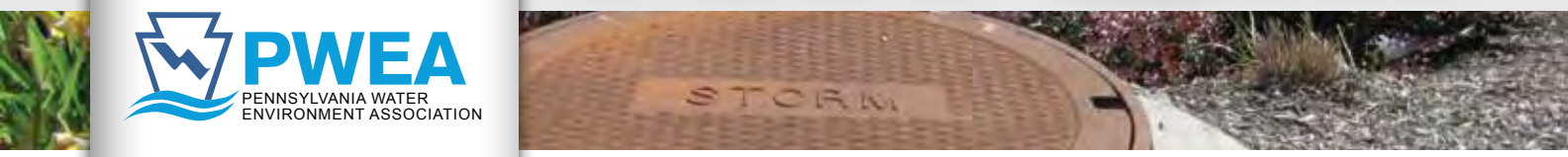
KEYSTONE WATER QUALITY MANAGER



PWEA
PENNSYLVANIA WATER ENVIRONMENT ASSOCIATION

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FEATURES

COVER STORY

DEPARTMENTS

KWQM
KEYSTONE WATER QUALITY MANAGER

MISSION STATEMENT

Enhance the knowledge and abilities of Pennsylvania's water quality professionals, promote sound sustainable water policies, and promote public awareness of the need to protect water resources.

DEADLINES FOR MAGAZINE INFORMATION

JANUARY/FEBRUARY/ MARCH 2017

January 13, 2017 editorial board meeting
February 10, 2017 advertising deadline

Editorial Committee meetings are held at the CDM Smith Harrisburg office at 3605 Vartan Way, Suite 202, Harrisburg, PA 17110 or via teleconference.

If you would like to submit articles or advertising for the *Keystone Water Quality Manager*, please forward to the following:

Articles: Brian Lubenow, Editor, *pweaeditor@pwea.org*

Advertising: Dave Gill, *david@kelman.ca*, 866-985-9791.

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Stormwater

BRIAN LUBENOW
EDITOR

The PWEA Stormwater Committee is back again with another stormwater-themed issue of *KWQM*! After the success of the 2015 stormwater issue, and with the upcoming regulatory requirements for municipal separate storm sewer systems (MS4s), we thought the timing was right. In this issue, we aim to present a number stormwater topics, ranging from regulatory recommendations, to stormwater authorities, to recent green infrastructure success stories, from a wide range of perspectives, including facility owners, consultant engineers and lawyers, and regulators.

The PWEA Stormwater Committee remains one of the most active in PWEA and I offer my thanks to the committee, especially Nathan Walker (Chair) and Jeff Cantwell in leading this effort.

I hope enjoy this issue, focused on the increasingly complex stormwater issues facing our industry and communities today.

Brian Lubenow, PE, BCEE
Editor

"THE PWEA STORMWATER COMMITTEE REMAINS ONE OF THE MOST ACTIVE IN PWEA AND I OFFER MY THANKS TO THE COMMITTEE, ESPECIALLY NATHAN WALKER (CHAIR) AND JEFF CANTWELL IN LEADING THIS EFFORT."

Stormwater Chair's Message

NATHAN WALKER
STORMWATER CHAIR

"THE PWEA STORMWATER COMMITTEE HOPES YOU ENJOY THESE STORM STORIES AND TAKE A MOMENT TO THINK ABOUT HOW THESE TOOLS COULD HELP YOU AND YOUR COMMUNITY."

Everybody's got a memorable story about a storm.

Remember the time when the basement flooded? The time when the bridge was blocked off and you couldn't cross town? The double rainbow? How about going down to the stream after a good frog-choker to see where the new meander was? I remember when the SUV got stuck under the rail culvert, the creek backed up, and blew the rail line out for four months. And then there were the dozen BMWs that were totaled by the flood even before their first test drive.

Well – the PWEA Stormwater Committee has a few storm stories they'd like to share with you in this issue. The seven articles included here are not about catastrophic floods that happened during the night. Instead, they are about the real task of finding solutions to our Commonwealth's stormwater quality and quantity problems. And the current set of problems we have in front of us is not easy to fix.

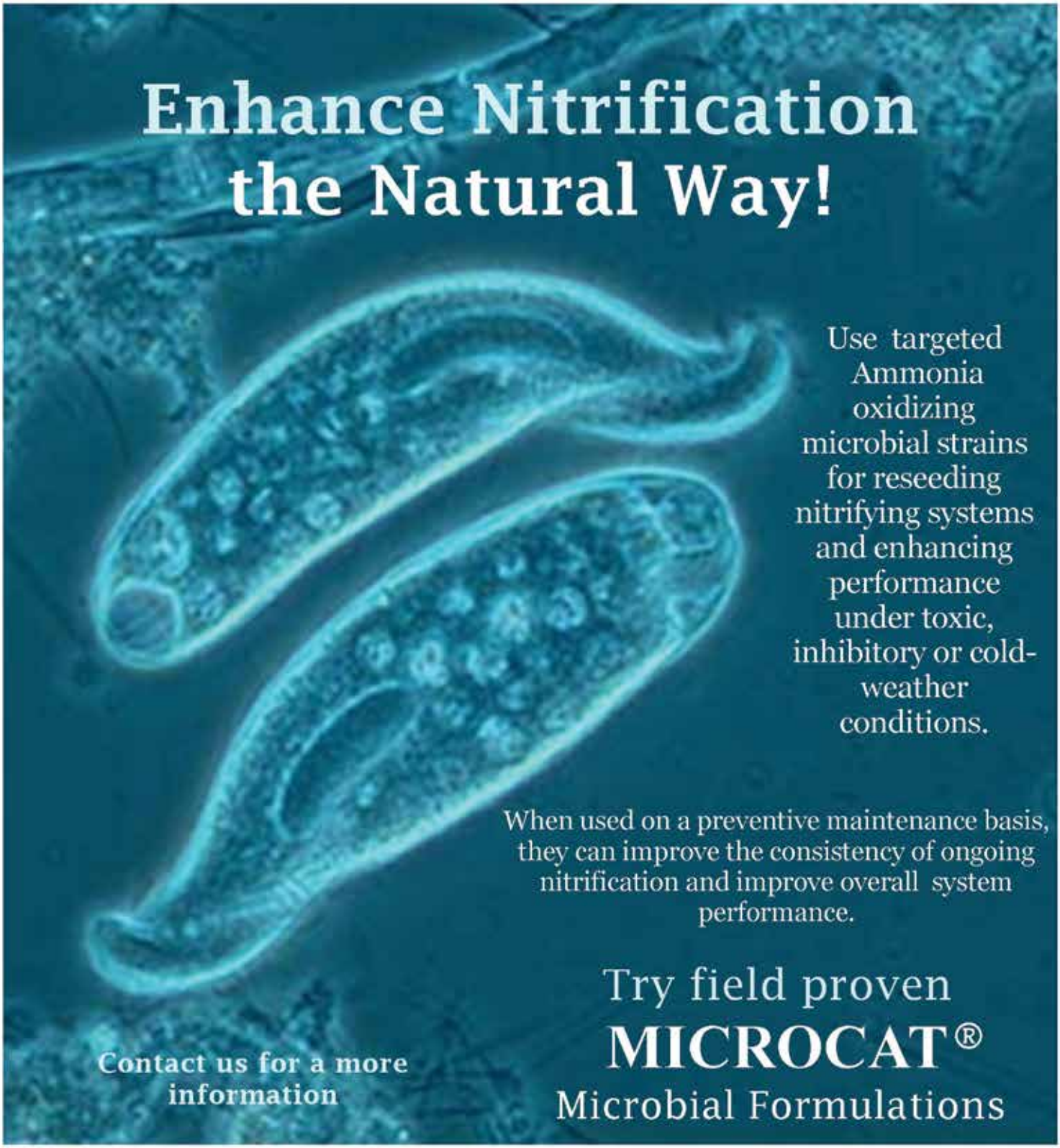
Water quality professionals have a great history of improving the quality of water discharging from point sources to our streams and rivers. While maintaining that good progress, we now need to pivot our attention to some pretty complex sources of stream impairment, like combined sewer overflows, in-stream erosion, urban runoff, and variability of base flow. These issues impair our streams, but there is no way to identify the source of the problem. Therefore there is no silver bullet solution.

However, members or our Stormwater Committee and their colleagues are developing some pretty creative stormwater solutions that are highlighted in this issue. Stormwater management is not just about building a detention basin big enough to hold back the flood. Instead, you'll read that communities are seeking out ways to keep water clean by working together with their neighbors, by partnering with state agencies, by setting a long-term vision, by establishing long term funding. Stormwater management requires a multi-disciplinary approach. That's why I think stormwater is an exciting topic – you never know if you'll be learning about landscape architecture, chemistry, park design, planning, financing, political science, land use planning, intergovernmental cooperation, asset management, biology, or fluvial geomorphology – and I'm sure the list goes on.

The PWEA Stormwater Committee hopes you enjoy these storm stories and take a moment to think about how these tools could help you and your community – to manage the floods, keep water clean, and give you a new stormwater success story to talk about.

Nathan Walker
Stormwater Chair

Enhance Nitrification the Natural Way!



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A New Year

LARRY M. FAIR
PWEA PRESIDENT

"CARL JANSON WAS A RECIPIENT OF THE PRESTIGIOUS 2016 WEF FELLOWS DESIGNATION, WHICH RECOGNIZES WEF MEMBERS' ACHIEVEMENTS, STATURE, AND CONTRIBUTIONS IN THE WATER PROFESSION."

I hope everyone had a great holiday season, and your new year is filled with hope, health, and better opportunities ahead.

Most people have new year resolutions or goals. Some of my goals pertain to PWEA:

- Growth of the membership, especially the young water quality professionals.
- Lots of educational opportunities.
- A successful PennTec 2017 at Kalahari Resort & Conference Center.

If you are not already involved on one of PWEA's many committees, one of your resolutions could be to get involved. If you are not sure which committee to join, please give me a call, and I will help steer you in the right direction.

We had a joint PWEA/Sections meeting in State College in October. A few of the topics discussed included membership, public education, and how to connect with the educators at our colleges, universities and technical schools in order to educate their students on career benefits of being involved with PWEA and any of the PA Sections. We also discussed how to get a team together for the Operation's Challenge competition. Each of the Sections provided a presentation and shared ways of managing membership, training, and recruitment of the Young Professionals.

This past year, WEFTEC 2016 was held in New Orleans, and everyone who attended said it was a great experience. Some of our members participated in the Students & Young Professionals WEF Community Service Project on the grounds of City Hall in New Orleans. They constructed a bioswale and rain garden to help slow and filter stormwater from a parking garage structure and building roof. Our PWEA board is considering adding a similar community service project at future PennTec Conferences.

One of our long time PWEA Board members and past president Carl Janson was a recipient of the prestigious 2016 WEF Fellows designation, which recognizes WEF members' achievements, stature, and contributions in the water profession. This award was presented at WEFTEC in New Orleans. Congratulations, Carl!

In November we co-sponsored a Utility Asset Management Summit with PMAA and PA-AWWA at the Penn Stater Conference Center in State College. We hope to have future endeavors with both of these great organizations.

Don't forget to reserve June 4-7 for PennTec 2017, which will be held at the beautiful Kalahari Resort and Conference Center in the Pocono Mountains.

"Do what you can, with what you have, where you are." – Teddy Roosevelt. Those of you who are the guardians of public health, safety and the environment truly understand this quotation.

Larry M. Fair
President

PWEA MEMBERSHIP & SPONSOR REPORT 3RD QUARTER 2016

AS OF SEPTEMBER 30, 2016

Total PWEA-Only Members: 617
Total WEF/PWEA Members: 1195

JANUARY 1-SEPTEMBER 30, 2016

Sponsor Name	New Member
Beth Dutton	Mark Bowen (WEF/PWEA)
Michael Henry	Deborah Shockley (PWEA)
William Madison	Kevin Gilfoyle (PWEA) and Steven Vosler (PWEA)
Dean Miller	Bryon Killian (PWEA)
Robert Munro	Andrew Antolik (PWEA)
Vijay Rajput	Philip Smythe (WEF/PWEA)
Marykay Steinman	Ronald Madison (PWEA)

The PWEA Race for Recruitment runs from January 1 through December 31. *Winner must have demonstrated superiority in sponsoring by recruiting a minimum of five (5) new PWEA members for a one-year period.* All sponsors must be current PWEA members to participate. The 2016 Membership Recruitment Award will be presented at the 2017 PennTec Annual Dinner and Awards ceremony. In the event of a tie, the award will be divided equally.

GETTING AROUND *WWW.PWEA.ORG*

- **Have you looked at the information and educational documents available in PWEA's Public Education Toolbox?** The articles and brochures can be used in your authority, community or organizaion's website or newsletter. If you haven't checked out this great resource, click on the *Education* tab on the Home Page of PWEA's website and select *Public Education Toolbox* to review the articles and brochures.
- **Did you know open employment positions submitted to PWEA by employers are posted on the PWEA website?** Visit PWEA's Home Page, click on the *News* tab and select *Job Board*.
- **Is there additional information you would like to have available on the PWEA website?** Please send your suggestions to us at *pwea@pwea.org*.

HYDRO INTERNATIONAL UNVEILS ITS ADVANCED HYDRO MICROSCREENTM TECHNOLOGY

Hydro International has officially launched the Hydro MicroScreen™ rotating belt screen, offering wastewater treatment plants an advanced and versatile alternative to a primary clarifier – at a fraction of the footprint, power use and installation costs.

"Already well proven in other parts of the world, the Hydro MicroScreen™ is an effective alternative approach for removing suspended solids and Biochemical Oxygen Demand (BOD) that is fully ready for US operators to take advantage of," says Marcia Sherony, National Sales Manager for Hydro International's Americas Wastewater division.

"This technology was formally recognized in Metcalf and Eddy as an alternative to primary clarification in 2014. We have taken this exciting, emerging technology and developed and refined it, backed by the expertise and experience you would expect from Hydro International."

With its patented continuous rotating belt screen, the Hydro MicroScreen™ effectively separates solids from influent wastewater using just 10% of the footprint of a conventional primary clarifier and only 20% of the power. It is easy to install, saving the construction and installation costs of building or refurbishing a primary clarifier and its small footprint frees up much-needed plant space for other uses.

Moreover, as an advanced treatment solution, the Hydro MicroScreen™ not only achieves between 50-60% Total Suspended Solids (TSS) removal, but also offers operators the versatility to improve their downstream process efficiency.

In particular, operators can optimize their effluent quality to improve nitrification with between 20 and 40% BOD removal rates by removing particulate BOD. The process also offers up to 30-40% removal of Fats, Oils and Grease (FOG), as well as 10% phosphorus reduction by removing phosphorus in particulate form.

"The Hydro MicroScreenTM busts the myth that the fine screening removes too many solids particles for optimum Biological Nutrient Removal (BNR) efficiency. On the contrary, by choosing from a range of screen sizes, engineers can customize the removal rate and favourably alter the ratio of soluble to total BOD in the effluent for optimum nitrification efficiency. The mechanical design also means quicker BOD consumption compared to conventional detention times."

Operators aiming to optimize their energy generation also benefit from a quality primary sludge for anaerobic digestion or gasification. Alternatively, with the optional addition of dewatering components, the Hydro MicroScreen™ can produce up to 50% total solids (TS), without the use of chemicals, ready for disposal.

The Hydro MicroScreen™ can also be used for fine screening, grit removal in small plants, septage receiving and CSO/SSO screening. The technology is also proven for a wide range of uses in industrial applications.

For advice, knowledge, or product information visit *www.hydro-int.com/contact*.

For more information on this exciting new technology contact:
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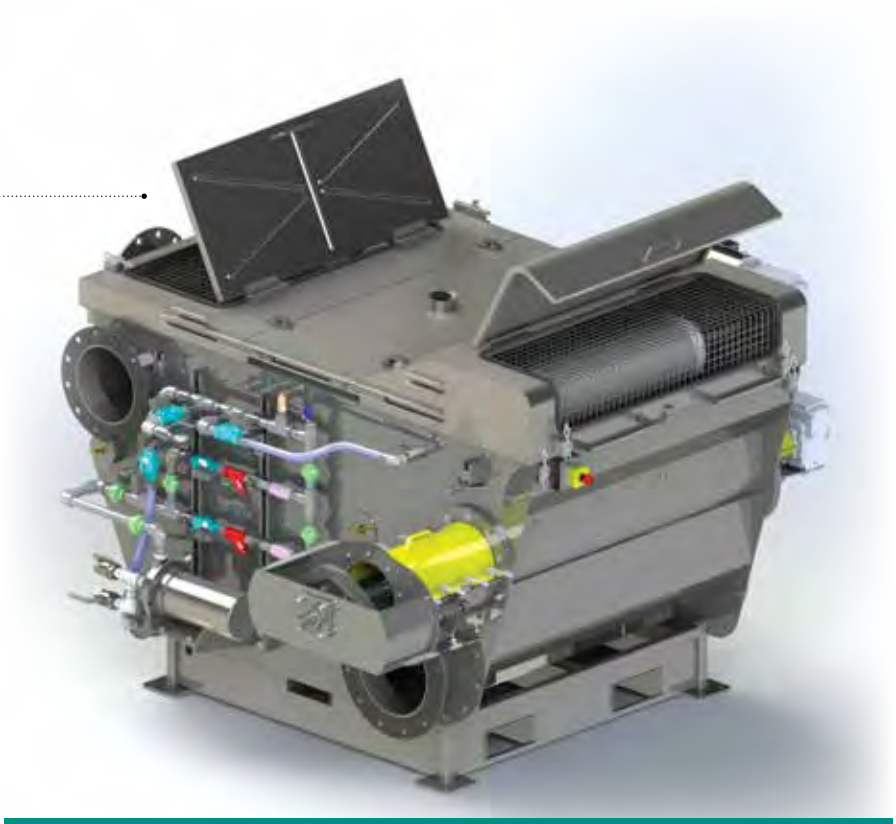

To submit your new product to be featured here, please contact Brian Lubenow, Editor, at *pweaeditor@pwea.org*

CALENDAR OF EVENTS

FRIDAY, JANUARY 13, 2017
PWEA Editorial Committee Meeting
Contact: Cindy Rock, 570-549-2204

WEDNESDAY, JANUARY 18, 2017
PWEA Stormwater Committee Meeting
Contact: Cindy Rock, 570-549-2204

FRIDAY, JANUARY 20, 2017
EPWPCOA Board of Directors Meeting
Contact: Marykay Steinman, 610-670-6072

TUESDAY, JANUARY 31, 2017
PWEA Collection Systems Committee Meeting
Contact: Cindy Rock, 570-549-2204

THURSDAY, FEBRUARY 9, 2017
PWEA Board of Directors Conference Call
Contact: Cindy Rock, 570-549-2204

TUESDAY, MARCH 17, 2017
EPWPCOA Regular
Meeting & Vendor Exhibition
Contact: Marykay Steinman, 610-670-6072

WEDNESDAY, APRIL 5, 2017
EPWPCOA Education & Training
Committee Workshop
Contact: Marykay Steinman, 610-670-6072

THURSDAY/FRIDAY, APRIL 20-21, 2017
EPWPCOA Industrial
Waste Pretreatment Conference
Contact: Marykay Steinman, 610-670-6072

SUNDAY-WEDNESDAY, JUNE 4-11, 2017
PWEA Annual Technical Conference (PennTec)
Kalahari Resort and Convention Center
Pocono Manor, PA
Contact: Cindy Rock, 570-549-2204

EPWPCOA NEWS

To receive additional information on the Eastern Pennsylvania Water Pollution Control Operators Association, Inc. activities see our website at *www.epwpcoa.org*. Visit us on Facebook, Twitter and LinkedIn.

Please contact Marykay Steinman, EPWPCOA Executive Director, at 610-670-6072 or *epwpcoa@ptd.net* for more information.

Whiz Quiz

Stormwater

Answers can be found on page 56

1. Name sources of stormwater pollution:
   a. Leaky fluids including oil, brake fluid, and antifreeze
   b. Washing vehicles and equipment on the street or driveway
   c. Fertilizers, herbicides and insecticides runoff
   d. All of the above

2. The term MS4 stands for:
   a. Municipal Separate Sanitary Sewer System
   b. Multiple Municipality Sanitary Sewer System
   c. Municipal Separate Storm Sewer System
   d. Multijurisdictional Separate Storm Sewer System

3. A municipal separate storm sewer is any conveyance or system of conveyances that is
   a. Owned by a state, city, town, village, or other public entity that discharges to waters of the Commonwealth
   b. Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.)
   c. Not a combined sewer or not part of a wastewater treatment plant
   d. All of the above

4. What is a good reference tool to determine the receiving waters for an MS4 permit?
   a. Magic 8 ball
   b. Topographical map
   c. Ouija board
   d. Consult senior plant operator

5. The sum of individual waste load allocations for point sources, load allocations for nonpoint sources and natural quality and a margin of safety expressed in terms of mass per time, toxicity or other appropriate measures is known as a
   a. PDL
   b. WLA
   c. TBEL
   d. TMDL

6. Which of the following has the greatest percentage of impervious cover in suburban areas?
   a. Rooftops
   b. Lawns
   c. Roads, parking lots and driveways
   d. Vacant lots

7. The Pennsylvania stormwater management act is also known as.
   a. Act 537
   b. Act 252
   c. Act 503
   d. Act 167

8. The benefits of effective storm water runoff management can include:
   a. Protection of wetlands and aquatic ecosystems
   b. Improved quality of receiving waterbodies
   c. Flood control
   d. All of the above

9. Under the MS4 Program, permittees are required to incorporate which of the following into their stormwater management programs:
   a. Public education and outreach
   b. Illicit discharge detection and elimination
   c. Construction site runoff control
   d. Post-construction stormwater management in new development and redevelopment
   e. All of the above

10. Calculate how many gallons of runoff would be expected from a 200 square foot patio during a 1-inch rainfall event. *Note:* The Runoff Coefficient for a patio is 0.98.
    a. 25
    b. 122
    c. 136
    d. 244

ACHIEVING WATER QUALITY GOALS WITH GREEN INFRASTRUCTURE:

A Comprehensive And Integrated Approach To Stormwater Management

BY CHARLOTTE KATZENMOYER, RUTH AYN HOCKER, KARL GRAYBILL, AND DOUGLAS SMITH

The City of Lancaster is a diverse and thriving urban community nestled in the heart of some of Pennsylvania's richest farmlands. Laid out in 1730, incorporated as a city in 1818, and comprised of approximately 7.4 square miles, the city is home to some 60,000 residents who enjoy a diverse menu of amenities. This includes 248-acres of public parklands and playgrounds, a delectable variety of eateries, and a robust public art program all of which contribute to a vibrant, livable, and sustainable Lancaster. As is the case with many established urban areas, the city is heavily paved with impervious surfaces; there are over 150 miles of roadways alone which generate stormwater runoff that must be treated and managed in accordance with clean water regulations. Compounding the challenges associated with stormwater runoff in Lancaster, approximately 45% of the city, its densest urban core, is served by combined sewers. During wet weather events, combined sewage flows exceed the capacity of the city's Advanced Wastewater Treatment Plant, and combined sewage is discharged directly to the Conestoga River and, ultimately, to the Chesapeake Bay. To meet these challenges, the City of Lancaster has developed a comprehensive, integrated approach to stormwater management to reduce the impacts of these pollutant sources through the use of green infrastructure (GI) and is achieving cost savings by integrating stormwater reduction projects as part of its core public works practices.

In 2011, the city prepared a Green Infrastructure Plan which serves as a roadmap for stormwater management and seeks to provide a more livable, sustainable and economically viable city. The plan was prepared, in part, using GIS to analyze and assess the extent and use of impervious surfaces throughout the city and determined that roadways comprise approximately 25% of the total impervious area. As a result, a major component of the city's stormwater program is focused on the vast network of roadways. The city has 27 miles of major roadways (arterials and collectors), over 71 miles of residential roadways, and over 40 miles of public and private alleys accounting for over 16.5 million square feet of asphalt and concrete surface. Streets are relatively narrow, with cartway widths rarely wider than 42 feet; parking is always at a premium, so removing parking is a tough sell, and pedestrians and bicyclists are increasingly present.

On many major roadways, the city is implementing a green streets/complete streets approach to address the needs of the residents while managing stormwater and providing a more walkable/bikeable city. A complete street is one designed and built for all users including people walking, biking, riding transit as well as driving. The selection of potential green/complete streets sites begins with a pavement condition assessment in support of a projected pavement improvement plan that allows the city to prioritize its paving efforts. When a roadway improvement project is proposed, the city considers a plethora of other capital improvements, including water, sewer, green stormwater infrastructure, traffic calming, accessibility, crosswalks and street trees, which can be completed as part of that same project to save on overall implementation costs, as well as feasibility considerations like slope, soil condition, etc. One example of this

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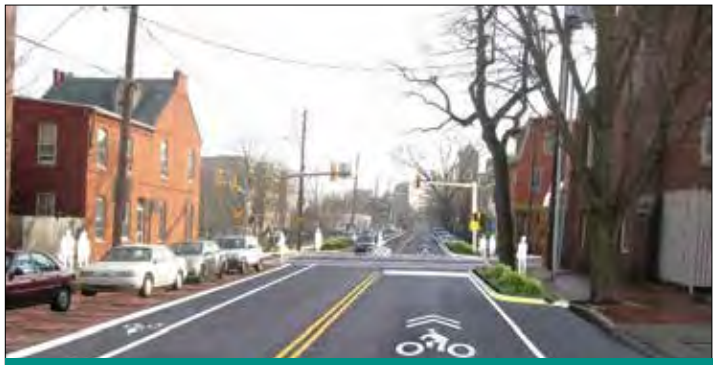
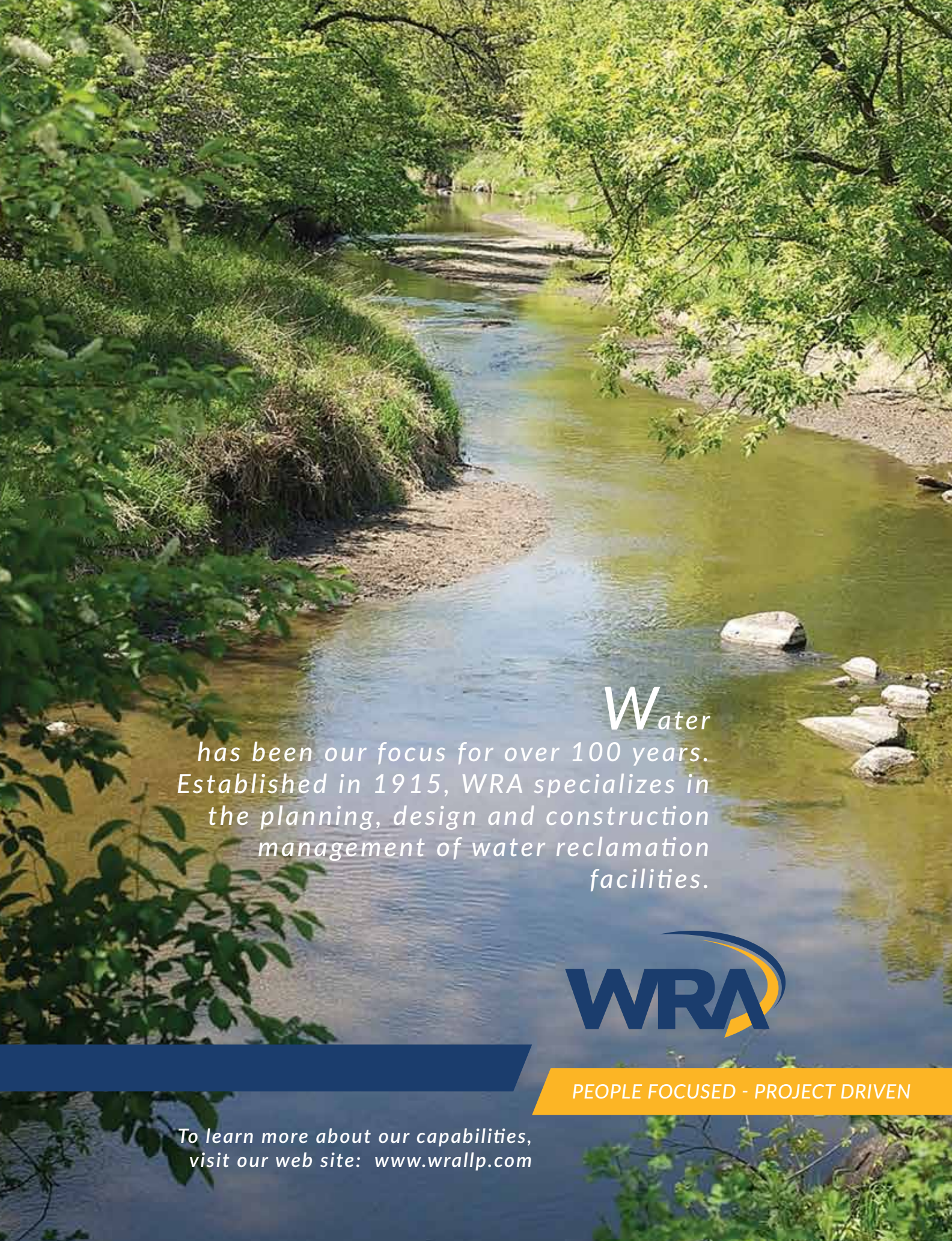


MULBERRY STREET AFTER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Plum & Walnut Streets Aerial View

Brandon Park

component is the work to be completed in spring of 2017 at Mulberry Street, which is a one-way street being modified to two-way traffic while incorporating green infrastructure and bicycle lanes without the loss of any on-street parking. Another example is an intersection safety improvement project at Plum and Walnut Streets designed to integrate green infrastructure, traffic calming, and pedestrian improvements which resulted in a five mile per hour reduction in traffic speed. Since 2011, the city has constructed eighteen green street and alley projects that manage nearly 8 million gallons of stormwater runoff annually at an average cost of $0.24/gallon.

Another component of the city's plan for green infrastructure on public properties lies within public parks and open spaces, which offer extensive improvement integration opportunities. In 2009, the city completed a comprehensive Urban Parks, Recreation and Open Space Plan that developed conceptual drawings and established timelines for selected improvement projects in many of its 30 public parks and open spaces. The city's parks range from the 71-acre Long's Park, home of the world's largest chicken barbecue and a popular summer concert series to the 2,500 square foot Triangle Park consisting of several benches and attractive landscaping. Twenty-six of those parks were also identified in the 2011 Green Infrastructure Plan as candidates for green stormwater infrastructure. Similar to green street and alley projects, when a park improvement is proposed, the city considers other capital improvements, as well as drainage conveyance changes to promote additional management of stormwater runoff from adjacent impervious areas through the installation of stormwater management practices like porous pavements, porous basketball courts, and rain gardens. One example of this is Brandon Park, located in the city's southwest quadrant. The 7.4-acre park was renovated in 2014 for improvements that included play equipment, picnic areas, restroom facilities, lighting, walking trails and ADA accessibility.

"ANOTHER COMPONENT OF THE CITY'S PLAN FOR GREEN INFRASTRUCTURE ON PUBLIC PROPERTIES LIES WITHIN PUBLIC PARKS AND OPEN SPACES, WHICH OFFER EXTENSIVE IMPROVEMENT INTEGRATION OPPORTUNITIES."

The Brandon Park project also manages approximately 4 million gallons of stormwater runoff annually through 12 rain gardens, four porous basketball courts, and vegetated curb extensions, which slow traffic and enhance the safety for children and families walking to the park. The stormwater managed at Brandon Park drains from the adjacent elementary school, recreation center, streets and residential properties. In just a few short years, the city has completed four park improvement projects that manage over 6.5 million gallons annually at an average cost of $0.60/gallon.

The surface parking lots in the City account for another 25 percent of impervious areas. With nearly 500-acres of parking lots, both public and privately owned, these locations are ideal for cost-effective stormwater retrofit when repair, rehabilitation, or reconstruction is required. The city completed four parking lot retrofit projects on city-

Mifflin street parking lot improvements poster

"THE CITY'S GREEN INFRASTRUCTURE PLAN ALSO RECOGNIZES TREES AS AN IMPORTANT COMPONENT OF GREEN INFRASTRUCTURE."

owned lots in the southeast quadrant of the city that manage over 1.6 million gallons annually at a cost of $0.14/gallon while providing a more suitably designed and laid out parking area for residents. For example, the East Mifflin Street parking lot provides parking for 27 neighborhood cars and captures 900,000 gallons of stormwater annually in porous paving and rain gardens. The city also currently has nearly 100,000-square feet of green roof – that's nearly 1.5-square feet per capita!

The city's Green Infrastructure Plan also recognizes trees as an important component of green infrastructure. As part of the plan, an urban tree canopy assessment was completed in partnership with the U.S. Forest Service, revealing that the city has an impressive 28% tree canopy cover. However, the city has a goal of increasing its canopy to 40% over the 25-year life of the GI Plan. Achieving this goal will not only help manage stormwater, but it will reduce air pollution, save energy, increase property values, and beautify the city. Among green infrastructure solutions, trees offer the greatest number of co-benefits to the community. This is not a new priority for the City of Lancaster, which has been designated as a Tree City USA for the past 40 years.

Growing tree canopy requires careful tracking, so the city is working to take a more data-driven approach. In 2012, the city worked with Penn State University to establish a GIS tree inventory of all trees along streets and in parks, recording the species, size, and health, among a variety of other site factors like sidewalk damage and overhead utilities. Maintaining this inventory has become an essential part of the tree program and helps the city to monitor planting opportunities, tree removals, and the spatial equitability of its program.

Furthermore, the inventory has enabled the city to quantify how much these trees contribute to the city's health and prosperity. The tree inventory was analyzed using the U.S. Forest Service's free i-Tree Streets software, which calculates environmental services provided by street trees. The approximately 9,000 inventoried street trees provide $484,000 in energy savings, $3.8 million in stormwater management, and $89,000 in air quality benefits, annually. In other words, these trees save 750 megawatt hours (MWh), intercept 15.2 million gallons of stormwater, and capture over 2,000 pounds of particles under 10 microns.

The city cannot accomplish its tree canopy goal by itself; that requires citizen participation. To address this, the city helped form the Lancaster Tree Tenders in 2015. This is a partnership with the Lancaster County Conservancy and the Lancaster City Alliance to expand community outreach and participation in tree plantings. In just one year the group mailed 1,000 letters offering free trees, planted 100 street trees, handed out 100 free saplings, and coordinated three community plantings with more than 40 volunteers at each event. Most importantly, the group has catalogued over 500 planting opportunities, which have been added to the tree inventory and made public via the city's website. Now residents can explore planting opportunities in their neighborhood and easily get connected to information about purchasing trees. This database of planting sites is also driving the community outreach program and allowing Tree Tenders to target homeowners and businesses with free trees. This has led to a new funding model that allows businesses to contribute per tree planted, providing a steady stream of funding for tree planting. At present, the city plants about 450 trees a year, but with expanded community outreach Tree Tenders hope to double that.

Much of the green infrastructure work completed to date has been funded, in part, through a loan from the Pennsylvania State Revolving Fund, issued by PENNVEST. This loan, totaling nearly $7 million, allowed the city to pilot up to 60 green stormwater infrastructure projects, build its stormwater management program, and establish a stormwater utility and fee. To date, the Department of Public Works has completed 40 projects capturing more than 25 million gallons of stormwater from nearly

"THE CITY CANNOT ACCOMPLISH ITS TREE CANOPY GOAL BY ITSELF; THAT REQUIRES CITIZEN PARTICIPATION. TO ADDRESS THIS, THE CITY HELPED FORM THE LANCASTER TREE TENDERS IN 2015."

Lancaster Brewing Co.

Lancaster Brewing Company Placemat

"IN COOPERATION WITH THE STORMWATER MANAGEMENT FEE, THE CITY DEVELOPED A CREDIT PROGRAM THAT WOULD ALLOW PROPERTY OWNERS TO REDUCE THEIR ANNUAL FEE BY UP TO 50%."

30 acres of impervious surfaces in the combined sewer system area. Additionally, 20 projects are currently under construction or in the design phase to be constructed in 2017. These projects will capture an estimated 20.5 million gallons of runoff from nearly 25 acres of impervious surfaces. Additional funding for these demonstration projects has been secured through a variety of state and federal sources including the PA DEP's Growing Greener program and National Fish and Wildlife Foundation grants. The city has creatively assembled these and other sources into innovative financing packages.

The city also instituted a stormwater management fee in 2014. Based on impervious area, the city's stormwater management fee is dedicated to stormwater-related costs. The fee is approximately $31/1,000-square feet impervious area/year, one of the lowest in the nation. Despite low fees, the city has been able to sustain its efforts through various grants, which allow the city to stretch those revenue dollars even farther, allowing for even greater cost efficiencies.

In cooperation with the stormwater management fee, the city developed a credit program that would allow property owners to reduce their annual fee by up to 50%. In an effort to incentivize retrofit projects for crediting, the city also developed a Public Private Partnership (P3) program which incorporated cost-sharing from private partners to leverage state and federal programmatic funds to accelerate green infrastructure implementation on private properties. One example P3 project built upon the Plum and Walnut Streets improvement project described above; a local business, Lancaster Brewing Company (LBC), partnered with the city to construct a

pervious paver area within the right-of-way that serves as their outdoor beer garden and is maintained by the LBC. LBC also assisted the city with public education and outreach by providing an education stormwater placemat to its customers.

Progress is also being made toward achieving the city's clean water goals through enforcement of updated ordinances. The city has incorporated stormwater management into relevant city ordinances, taking additional steps to close loopholes, clarify requirements, and streamline permitting processes for those projects proposing regulated activities on private properties. Among the recent ordinance amendments to incorporate green infrastructure and complementary sustainable practices are the street trees ordinance and surface parking lots ordinance. Both these revised regulations include supplemental materials and design specifications. In accordance with the Stormwater Management Ordinance, the city regulates and requires stormwater management for projects proposing the construction and reconstruction of impervious areas of 100-square feet and greater. Since 2011, these projects have resulted in the construction of stormwater facilities that manage nearly 5 million gallons of runoff annually from over 11-acres of new and reconstructed impervious areas.

Through concerted and coordinated project planning, the City of Lancaster is demonstrating that a comprehensive, integrated approach to stormwater management, as part of a core public works practice, can achieve clean water goals by cost-effectively integrating green stormwater infrastructure into planned capital improvement projects to reduce the adverse effects of stormwater runoff.

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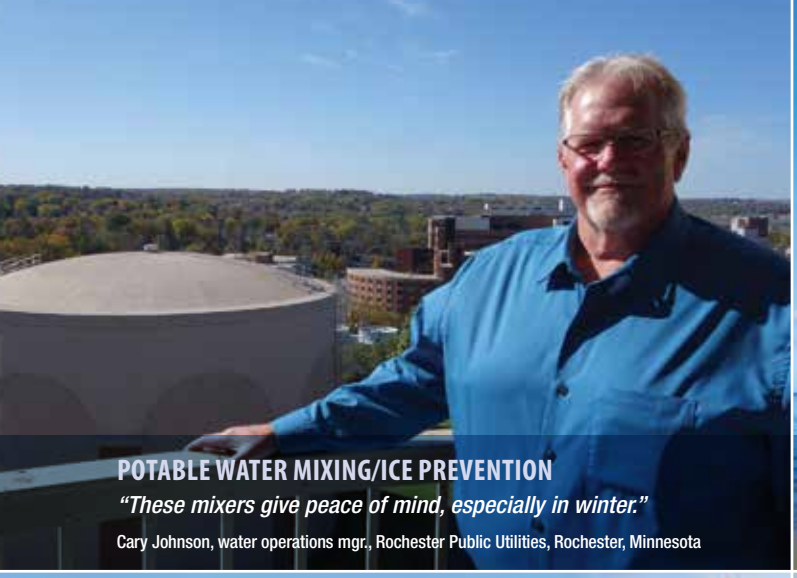

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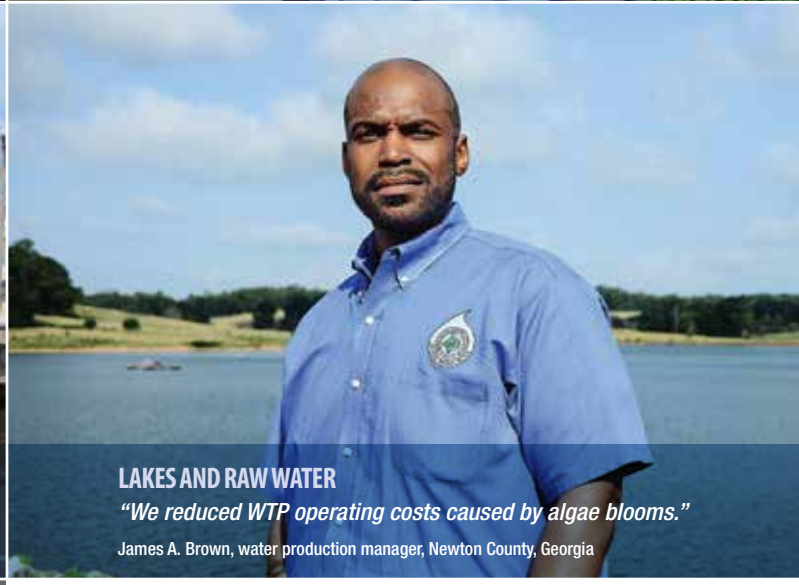

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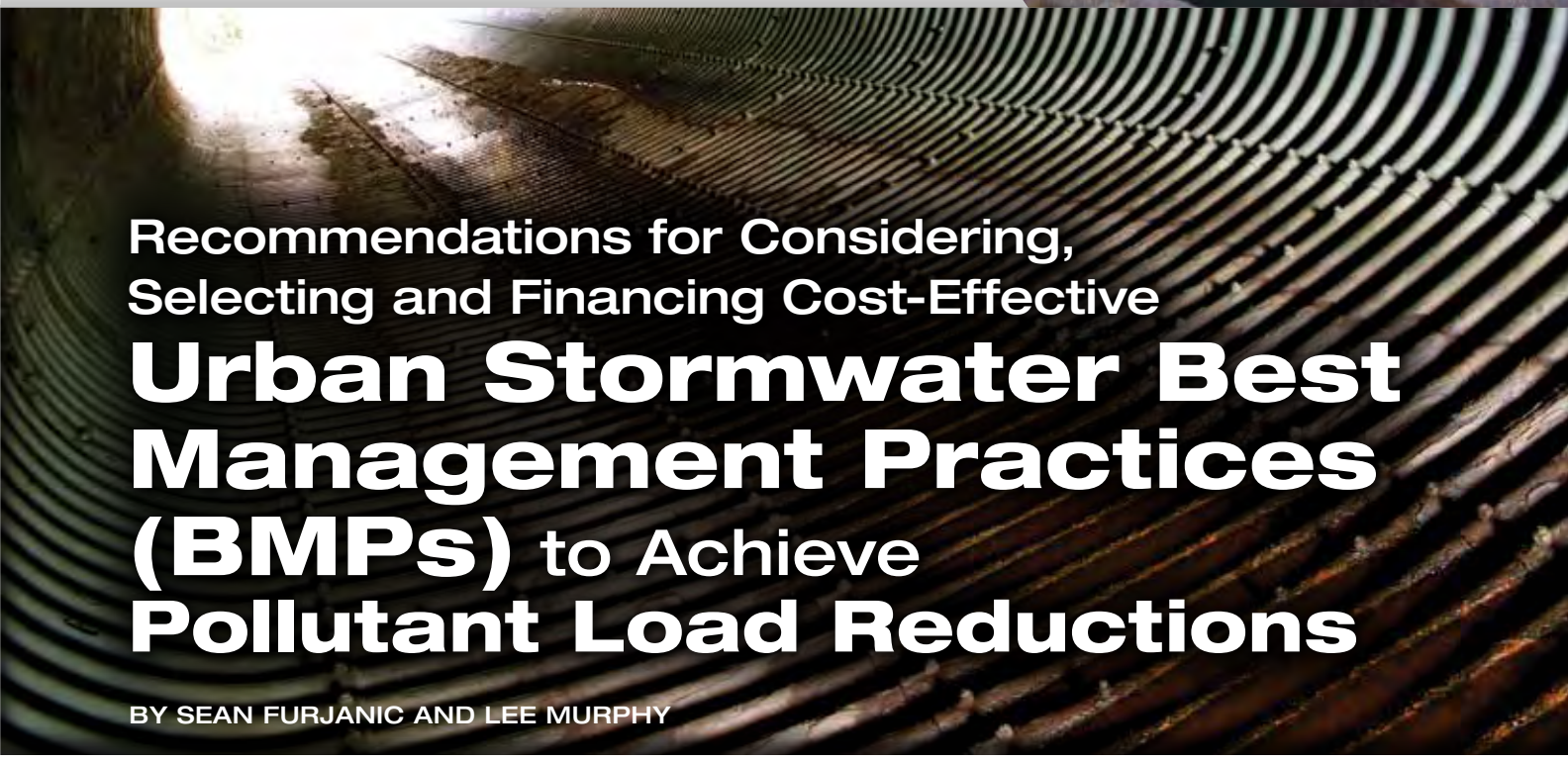

Recommendations for Considering, Selecting and Financing Cost-Effective Urban Stormwater Best Management Practices (BMPs) to Achieve Pollutant Load Reductions

BY SEAN FURJANIC AND LEE MURPHY

Many Pennsylvania municipalities and other entities with National Pollutant Discharge Elimination System (NPDES) permits for discharges from municipal separate storm sewer systems (MS4s) will be developing Pollutant Reduction Plans (PRPs) and/or Total Maximum Daily Load (TMDL) Plans as part of their next notice of intent for general permit coverage or application for an individual permit. Following approval of those plans, actual pollutant load reductions will be expected over the next five years. The following suggestions are provided for consideration by MS4 permittees to help reduce capital expenses.

Consider What Has Already Been Done

The calculation of your existing pollutant load for nutrients and/or sediment can reflect the load reductions achieved by structural BMPs implemented in the past, as long as they continue to function and are within the "planning area," i.e., the storm sewershed(s) of impaired stream(s). The estimated amount of the load reduction from these BMPs – regardless of whether or not they were installed under a Chapter 102 construction stormwater NPDES permit – can be used in calculating the overall existing load from your planning area. While this does not provide "credit" toward load reduction obligations in the permit, it can reduce the amount of load you need to reduce.

For example, assume the existing loading of sediment from your planning area is estimated to be 100,000 lbs/year and you are required to reduce that total by 10%. Without consideration of any existing BMPs you would be required to install new BMPs that would remove 10,000 lbs/year; however, you are aware of an existing BMP that reduces the current load by 10,000 lbs/year, resulting in a current total load of 90,000 lbs/year. The 10% required sediment reduction would subsequently be 10% of the 90,000 lbs/year, or 9,000 lbs/year.

What Can Be Done in the Short Term?

Most jurisdictions with urbanized areas contain stormwater BMPs, such as dry retention ponds, which were designed in earlier decades for flood attenuation. Those features often provide little if any value in terms of stormwater pollution control, but may be readily adapted to improve pollutant reduction efficiency. Look for these opportunities. Many will be privately owned. Discuss the issue with the owners and seek affordable agreements for necessary planning, design, construction and operation and maintenance (O&M).

Where there are no existing, readily adaptable stormwater BMPs to retrofit, encourage existing private property owners to voluntarily install retrofits. Providing simplified designs and lists of experienced designers and contractors may help. Make a special effort to approach large businesses that may see value in contributing to this effort.

Think of every construction project as an opportunity to incorporate improved stormwater management. Projects with multiple purposes will frequently be more cost-effective than "stand-alone" stormwater projects.

For municipalities, consider changes to your stormwater ordinance (and/or zoning ordinance or SALDO) to require stormwater controls at construction sites that disturb less than one acre. The requirements can mirror Chapter 102 or be different, at the discretion of the municipality. The entire pollutant load that is reduced through this requirement can be used by the MS4 permittee toward meeting its pollutant reduction objectives.

Collaboration Helps Identify Cost-Effective Options

Approach neighboring MS4 permittees about collaborating in the development and implementation of PRPs and TMDL Plans to pool resources and expand opportunities for BMPs, or participate in regional efforts already under way.

BMPs can be located anywhere in the jurisdictions of those participating permittees as long as the load reductions are within the overall planning area of the impaired waters. This can provide far more cost-effective choices than each permittee seeking to accomplish their entire load reduction obligation within their own jurisdiction.

Seek quality, low-cost technical support from county planning commissions, county conservation districts, universities, non-profits and others. Help can also

be attained from local groups that have experience in the planning, design, construction and O&M of BMPs, as well as skills needed to pursue funding.

Consider Instituting a Fee System to Provide Resources

Fee systems typically support the repair, replacement, and maintenance of traditional stormwater infrastructure as well as stormwater pollution control.

Advantages of typical fee systems include:

- Revenue source not reliant upon tax-based general revenue.
- Equitable because typically based on "stormwater production" rather than property value.
- Charges all properties (including non-taxable properties).
- May allow credits for voluntary BMPs, encouraging property owners to do their share, benefiting the MS4 community.
- May include reduced property taxes.

Activities in the creation of a typical fee system include:

- Providing start-up funding for planning work in advance of fee availability.
- Calculating how much is currently being spent on stormwater issues (typically more than people realize).
- Identify the current gaps in stormwater management.
- Develop budget.
- Identify the typical impervious area for residential properties. Use GIS to calculate the impervious area of non-residential properties. Add to establish total impervious area.
- Develop fee structure.
- Public education.
- Legal work.

Take care in how you approach your public about fees[1]:

- What the fee is called matters.
- Clearly show ratepayers how the money will be invested.
- Present the fee as a solution to local problems and providing local benefits.
- Present the fee in its smallest increment (dollars per household per month).
- Affirm that the money will be used for its stated purpose.

Consider Funding Sources, Like PENNVEST

The Pennsylvania Infrastructure Investment Authority (PENNVEST) offers financing for stormwater BMPs. See the PENNVEST website at *http://www.pennvest.pa.gov.*

About the Authors:

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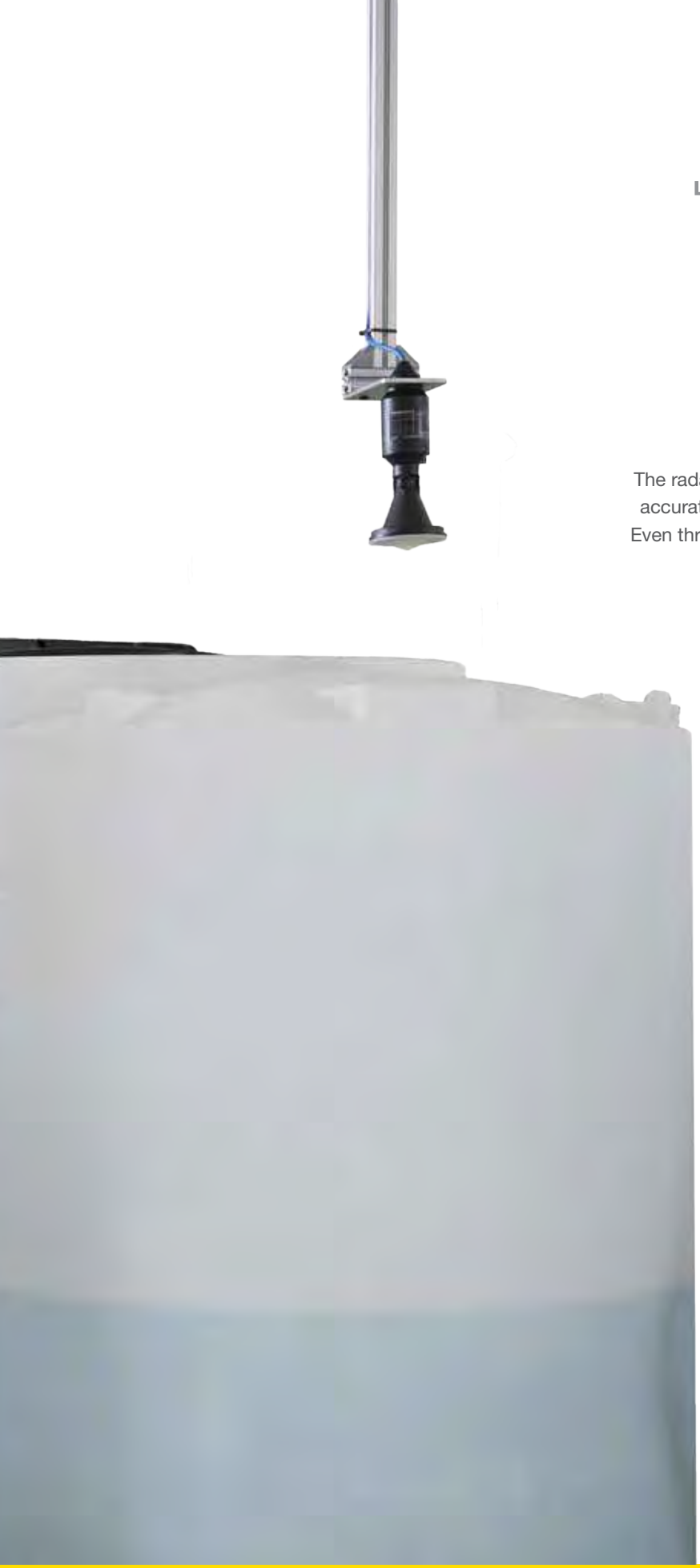
[1] From *Keystone Water Quality Manager*, April/May/June 2015. Erik Eckl, Water Words that Work and Nathan Walker, AICP, AMEC Foster Wheeler.



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Strategies for Addressing Pennsylvania's Chesapeake Bay and TMDL-Related Pollutant Reduction Requirements for Small MS4s

By Paul Calamita & Lisa Ochsenhirt

Background

On June 4, 2016, the Pennsylvania Department of Environmental Protection (DEP) issued its final 2018 NPDES General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (2018 PAG-13). The new permit has a delayed effective date of March 16, 2018, and will replace the previous PAG-13, issued in 2013.

MS4s with existing PAG-13 coverage that have any discharge to surface waters in the Chesapeake Bay Watershed are required to submit a Notice of Intent (NOI) along with a Chesapeake Bay Pollutant Reduction Plan (CBPRP) by September 16, 2017, unless they are eligible for a waiver. Some MS4s will not be eligible for PAG-13 coverage in 2018 for a variety of reasons, including but not limited to discharges to special protection waters or the need to develop a TMDL Plan, and these MS4s will need to submit an individual permit application (by September 16, 2017 if they have existing PAG-13 coverage or no later than 180 days prior to the expiration date if they currently have an individual permit). Although 2013 PAG-13 permittees were also required to submit a CBPRP within 12 months of approved coverage, the 2013 permit did not mandate specific numeric reductions for sediment, Total Nitrogen (TN), and Total Phosphorus (TP).

The 2018 PAG-13 requires that permittees reduce sediment by ten percent, TP by five percent, and TN by three percent within five years of approved coverage (see Appendix D of PAG-13). Similarly, the 2018 PAG-13 requires that any permittee discharging to local surface waters which are impaired for nutrients and/or sediment (whether there is a TMDL in place or not), must submit a Pollutant Reduction Plan (PRP) (consistent with Appendix E) with their NOI to reduce sediment and TP by ten percent and five percent respectively during the five-year permit cycle.

This means that late summer 2017, hundreds of Small MS4s in the Bay Watershed (and elsewhere) covered by the 2018 PAG-13 will each need to prepare a planning document showing which best management practices (BMPs). That document will have to be put out for a 45-day public comment period ahead of submittal to PADEP by September 16, 2017. These plans will guide the permittee's efforts to achieve numeric nutrient and sediment reductions over the five-year permit term. Although DEP has issued instructions on how to prepare a PRP (available on the DEP website), there are still open questions about the CBPRP requirement.

Key Issues Implicated by 2018 PAG-13

The permit raises several key issues for MS4 permittees. For example, how did DEP determine that the numeric reductions would be achievable? In its Comment-Response document (May 2016), with regard to the Bay-related nutrient and sediment reductions, DEP compared 2014 estimated loads for the entire urban sector (including regulated and unregulated dischargers across the entire Bay Watershed) to the 2025 target loads. Meeting target goals would require 44% reduction for sediment, 40% for TN, and 34% for TP. The pollutant reduction requirements were settled upon after 1) an analysis was completed by the Chesapeake Bay Program Office at DEP's request and 2) numerous simulations with urbanized areas considering typical and atypical land uses, land cover and BMP scenarios. With these overall goals in mind, DEP determined that 10% is achievable during the proposed five-year permit term.

While this may be the case for some MS4s, each MS4 is different; some may face challenges in making reductions. Each municipality has a different amount of impervious area. Reductions are based on impervious and pervious acreage, but impervious acres have significantly higher pollutant loadings than pervious acres. This could make it much more challenging for a smaller community with clustered, more impervious development to reach the target as compared to a larger community with more suburban areas.

Each municipality also differs in terms of which BMPs would be workable for the community. Although DEP's PRP instructions suggest MS4 communities will have a number of BMP options, this is not necessarily the case for all MS4s. For example, some may not have municipally owned parking lots of sufficient size to warrant replacing pavement with permeable pavers, taking this option off the table.

Even if a Small MS4 community has options, it may not have adequate time to physically install or implement enough BMPs during the short five-year period to comply with PRP loading reduction requirements. Stream restoration, for example, must be permitted by the federal and state government, and obtaining permits can take time. Identifying areas for BMPs, obtaining permission from private property owners to perform work on their property, hiring professionals to design BMPs, and hiring and overseeing construction consistent with specifications must be factored into BMP schedules. It is unclear whether implementation is possible over the five-year time period for Small MS4 permittees impacted by PRP requirements.

Significantly, affordability should be a key factor in permitting municipalities. Can all of the Small MS4s afford to reduce pollutants by the numeric levels required? If not, Small MS4 permittees could be at risk of permit non-compliance if the reductions are not met. Legally, avoiding affordability is fundamentally inconsistent with the federal compliance standard for MS4 permittees – that permittees must reduce pollutants to the maximum extent practicable, or MEP. MEP will differ for each MS4 system, which is why across-the-board numeric pollutant reduction requirements usually don't make sense in the MS4 permitting arena.

In January 2016, DEP issued a strategy to "change its approach for the Chesapeake Bay." *A DEP Strategy to Enhance Pennsylvania's Chesapeake Bay Restoration Effort.* It is no secret that EPA has expressed its concerns regarding implementation efforts by the Urban/Suburban sector, which includes regulated MS4s. EPA's most recent review of Pennsylvania's 2014-2015 Milestone Progress and 2016-2017 Milestone Commitments notes that "the state will need to place considerably greater emphasis on increasing implementation…in the Urban/Suburban Stormwater sector…" EPA's oversight of the sector continues to be "Backstop Action Levels," the most serious category of EPA oversight and a clear indication that EPA is watching Pennsylvania's efforts very carefully.

The 2018 PAG-13 takes bolder steps to address EPA's concerns regarding the urban stormwater sector in the Bay Watershed. Unfortunately, Pennsylvania's municipalities will pay the price if we rush to plan for and implement sufficient BMPs to meet numeric reductions called for by 2018 PAG-13. It is noted that some municipalities have been able to get a head start on this effort through its CBPRPs developed in 2013 or later, some of which have received funding for BMPs through a DEP-administered grant program. Some municipalities have elected to join collaborative efforts with counties or groups of like-minded municipalities. Those municipalities may be in a better position to meet the pollutant reduction objectives.

DEP is imposing its 10 percent numeric reduction requirement for the five-year permit cycle. It is unclear what DEP's path is for meeting the overall reductions that will be required under the Bay TMDL for 2025. The progress made by permittees during this permit cycle should be factored into the ultimate compliance date so that permittees will have adequate time to implement further reductions. Virginia anticipates achieving required reductions over a three-permit term cycle with increased reduction requirements during each successive permit term.

What options does a Small MS4 in the Chesapeake Bay Watershed (or one otherwise subject to impaired waters/TMDL nutrient/sediment reduction requirements) have when faced with this extraordinary new task?

Talk with your environmental attorney about the pros and cons of an individual permit for your community. Unless you are ineligible for the General Permit, typically, a permittee may elect between coverage under a General Permit and seeking an individual permit (IP). Individual permits should allow a community to tailor requirements to better match financial and operational capacities. Thus, individual permit coverage for communities which will struggle to meet the numeric reduction requirements may provide a good mechanism to allow DEP to provide additional flexibility against the numeric reduction requirement. For example, an individual permit could call for the same numeric "goals" or "targets" as the general permit but give the community an opportunity in its annual reports to propose adjustments to those goals/targets based upon implementation progress to date.

Map/Parse Your MS4 to Identify the Correct Scope of Your Legal Requirements. Each Small MS4 should carefully map/parse their MS4 to exclude non-jurisdictional areas, and then consider whether this would be helpful in minimizing your obligations and legal liability. Review DEP's "Parsing Guidelines for MS4s in Pollutant Reduction Plans" to determine whether you can reduce your existing sediment, TN, and/or TP loadings to the lowest level possible based upon a careful definition of the MS4 service area. This could help you reduce the loading reductions you must attain. If you have third-party partners (for example, PENNDOT) that could help you by making reductions on their property, you will want to consider the value of those reductions as compared to parsing those properties out of your planning area.

Define MEP for Your System in Your CBPRP/TMDL PRP. When developing your CBPRP/PRP each MS4 has the opportunity to define what BMPs to the MEP means for its system during the permit cycle. This is one way to attempt to obtain some certainty and/or legal protection against the numeric reduction requirements. To achieve that, you should define the BMPs to the MEP which you will implement (subject to iterative/adaptive revisions) to achieve the numeric requirements. Once DEP approves/accepts your CBPRP/TMDL PRP you could then argue that you have a permit shield from being in noncompliance as long as you implement the BMPs called for in the CBPRP/TMDL. Each PRP should include an overarching MEP qualifier and clearly state that the permittee can only implement BMPs to the maximum extent practicable. Each plan should memorialize the ongoing need for local flexibility (this is an iterative, adaptive program that will change over time). Consistent with DEP guidance, each plan should also lock-in BMP efficiency assumptions. Occasionally, the Chesapeake Bay expert panels reduce the credit that will be assumed for a particular BMP in a particular year. Such mid-stream technical revisions should not prejudice your good faith reliance on the credits you expected for implementing that BMP. Rather than causing you to be in non-compliance, any mid-stream changes in BMP credits should be addressed in the next annual report.

Lastly, MS4s should avoid to the extent possible making unnecessary or overly precise project-specific deadline commitments. Invariably, there are challenges implementing BMPs with numerous factors which may be beyond the MS4's control. Consider establishing implementation ranges, annual average implementation goals or other qualified deadline approaches to avoid unnecessary non-compliance. For example, rather than an annual requirement, establishing a three or five-year average of a certain type of BMP implementation will give you some flexibility if you get a surprise in one particular year (a long, cold, snowy winter).

Seek Opportunities to Collaborate. Numerous municipalities across the state are working together to make this process more affordable and efficient. Some are pooling resources and some are pursuing the establishment of stormwater authorities to help fund not only PRP efforts, but also long-term operation and maintenance of MS4s. It may be possible for an MS4 community to contribute to a collaborative PRP effort and expend only a fraction of what it would cost for the MS4 community to pursue a PRP on its own, and DEP is promoting these efforts.

Consider seeking help from the Legislature. On a larger scale, the Commonwealth's Small MS4 permittees may wish to pursue legislation during the upcoming session to address several key issues.

A. **Affordability.** Affordability is a key limitation on MS4 communities as they strive to build program capability. The Legislature could require that DEP consider affordability before imposing these significant new permit requirements. Missouri has this type of requirement. By law, the Missouri Department of Natural Resources (DNR) must consider affordability as a part of any permitting decision or enforcement action. The purpose of DNR's affordability analysis is to ensure that entities can financially comply with permitting and enforcement actions. Any proposed permit or enforcement decision not supported by a finding of affordability is null, void, and unenforceable. Pennsylvania's Small MS4 permittees could push for a state law that specifies that if DEP rejects a community's 2017 CBPRPs and/or Appendix E PRPs because DEP wants additional or more aggressive BMPs/requirements then DEP must perform a community-specific affordability finding which can be challenged by the community. However, if DEP approves the community's plan then the affordability review is waived.

B. **Trading.** DEP has proposed to preclude MS4 communities covered by the 2018 PAG-13 from trading to achieve the required numeric sediment and nutrient reductions. Other states impose no such restriction. Typically, MS4s can find enough loadings (especially sediment) from the POTW which serves the MS4's community to help ensure permit compliance – at least in the near term until the MS4 can implement effective BMPs on its own. We believe this is a critical compliance option that MS4s in Pennsylvania should fight for – in the legislature if necessary.

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The Hampden Township Sewer Authority – Funding Stormwater

BY JEREMY MILLER, PE

Hampden Township is a Township of the first class located in the eastern portion of Cumberland County. The Township is approximately 17 square miles and is home to approximately 30,000 residents. The Township is a Phase II Municipal Separate Storm Sewer System (MS-4) permitee.

Hampden's MS-4 consists of more than 250,000 linear feet of storm pipe, 120 centerline miles of streets, 200 plus outfalls and numerous structural Best Management Practices (BMPs). Its current Individual MS-4 Permit was issued January 1, 2014 and is effective until December 31, 2018. Included in the current permit is the requirement of developing a Chesapeake Bay Pollution Reduction Plan. Also included in the Permit is the following statement:

> *"The permittee shall maintain adequate funding and staffing to implement and manage all provisions of the attached Stormwater Management Program."*

Concurrent with the development of the Chesapeake Bay Pollution Reduction Plan, Township staff prepared specifications for a $10,000,000 road resurfacing project. As part of its due diligence effort, the Township televised all storm sewers within the road project area with the intent of completing required repairs prior to paving. As common with many municipalities in the nation, Hampden has been mostly reactive towards storm sewer maintenance and has addressed facilities only when defects became apparent in the form of a sinkhole, street flooding or some other manner visible from the surface. Consequently, the results of the TV inspection were troubling, with more than 75% of the storm sewers in the project area requiring rehabilitation or replacement. Ultimately, $1.5 million was diverted towards storm sewer repairs.

As a result of costs associated with growing MS-4 requirements and a commitment to becoming more proactive with maintenance of the storm sewer system, it is anticipated that the Hampden Stormwater Management Program budget will increase from approximately $600,000 in 2014 to approximately $1.5 million in 2019. The question is "how do you pay for it?"

In July 2013, the Commonwealth passed Act 68 amending the Purposes and Powers of Municipal Authorities to include stormwater as an activity which authorities may oversee. The intent of the Act was to provide a funding source, other than taxes, for stormwater management. During the summer and fall of 2013, Hampden Township and the Hampden Township Sewer Authority (HTSA) evaluated the potential for creating a stormwater authority and implementing a Stormwater Management Fee (Fee). After many meetings and presentations, the decision was made to amend the HTSA Articles of Incorporation and in December of 2013 the HTSA became the first stormwater authority in the Commonwealth. Many factors were considered while making this decision. Several major considerations included:

- Stormwater management costs continue to rise, but tax rates have not. The current tax rate in Hampden Township is 0.157 mills and the Board of Commissioners has indicated no intention of raising taxes.
- A fee is a stable, long-term revenue source dedicated solely to funding stormwater activities. Often, elected officials are forced to make difficult decisions due to limited funds. A question such as "Do we purchase a $750,00 fire engine or spend $200,000 to meet our MS-4 Permit requirement?" is not unthinkable. With a stormwater management fee this question cannot be asked because all revenue generated from the fee **MUST** be spent in support of the stormwater management program.
- A fee provides an equitable distribution of cost based on use of the MS-4. Higher property value does not equate to more stormwater runoff.
- Tax-exempt properties are subject to the Fee. In Hampden Township this means large tax-exempt properties, such as the hospital and the 800-acre Navy Support Activity, would also be billed.

"IMPORTANT TO THE SUCCESS OF THE HTSA EFFORTS TO IMPLEMENT THE FEE WAS A WELL-DEFINED STORMWATER MANAGEMENT PROGRAM WHICH CLEARLY DEMONSTRATES THAT THE RATES REFLECT THE LEVEL OF SERVICE TO BE PROVIDED."

After being tasked with oversite of stormwater management, the HTSA's first action was to retain a consultant to assist with a Fee evaluation. A Request for Proposal was issued in May of 2014 and, after a series of interviews, the HTSA retained Arcadis in October 2014.

The process of calculating the stormwater management fee started with identifying how much revenue was required to support the stormwater management program. In order to do this a level of service had to be determined. During this evaluation Arcadis developed three levels of service: low, medium and high. In general, the low level of service consisted of continuing with the current program of doing what was needed to maintain permit compliance and addressing problems as they came to the surface; the medium level of surface consisted of maintaining permit requirements, developing a proactive maintenance plan for the stormwater system, and starting to address long-standing flooding issues within the Township and; the high level of service included the activities identified in the medium level plus taking ownership and maintenance responsibilities of privately owned stormwater facilities. The medium level of service was chosen and the associated estimated costs were set as the basis of the Fee.

The second step towards calculating the Fee was to identify a billing structure. Based on recommendation from Arcadis, it was decided that residential properties would be billed a flat fee per Equivalent Residential Unit (ERU) and nonresidential properties would be billed multiples of ERUs based on impervious area. There are approximately 10,000 residential properties in Hampden Township. In order to determine the impervious area of an ERU, a representative sample of 1,000 residential properties was digitized by Township staff using GIS and aerial photography. This resulted in an average ERU value of 3,534 square feet of impervious area. Staff then digitized the impervious area of all the more than 700 non-residential properties to determine the total number of billing units within the Township.

The final factor that had to be considered when calculating the fee was credits. Credits promote billing equity in that a property with a stormwater BMP installed onsite will likely discharge less runoff into the MS-4 than a property of the same size and impervious area which does not have a facility installed. Additionally, a credit program will encourage the construction of new stormwater BMPs on properties, which could potentially help the Authority meet future pollution reduction goals. Largely in part to these reasons, the HTSA adopted a credit policy which provided non-residential property owners the opportunity to receive a credit of up to 50%. The HTSA policy includes credits for stormwater rate and volume control, fertilizer management, education programs, and Separate MS-4 permitees. Individual credit values ranged from 15% to 50% and a property owner may take advantage of multiple credits, if applicable, up to the maximum total of 50%.

Once the annual cost of the chosen level of service and the total number of residential and non-residential ERUs were identified, the Fee was determined by dividing the annual cost by the total number of ERUs. The Fee necessary to support the Stormwater Management Program was calculated to be $13.25 per ERU per quarter, which incorporated a 10% credit allowance for non-residential properties.

In July 2015 the Township and HTSA took the action necessary to implement the Fee. This included transfer of ownership of all stormwater facilities from the Township to the HTSA, adoption of a Fee Resolution and Credit Policy, and execution of a maintenance agreement by which Township staff would oversee daily stormwater activities on behalf of the HTSA. Prior to the issuance of the first bills, letters were sent to all non-residential property owners which identified the calculated impervious area and resulting fee for each property. The property owners were given 30 days to appeal the calculation and submit supporting documentation for a revision. Additionally, all non-residential property owners where given a one-time 50% credit on their bill and provided additional time to prepare an application for continued credit. The first bills were issued in October 2015.

Important to the success of the HTSA efforts to implement the fee was a well-defined stormwater management program which clearly demonstrates that the rates reflect the level of service to be provided. Also important was the development of a Stake Holder Advisory Committee. The committee members included representatives from homeowner associations, land developers, chambers of commerce, Council of Governments, state senator and representative offices, builder associations, school districts, and the Department of the Navy. The committee met a total of five times during the Fee evaluation, and although they were not a decision-making body, they provided valuable feedback relative to policy and messaging decisions. Possibly the most important effort was a strong public outreach program. Public outreach efforts included five public meetings, two of which were specific to non-residential properties. Additional outreach methods included numerous newsletter articles, development of a stormwater web page, and a bill stuffer that was included the second quarter 2015 utility bill.

After a year of implementation, the HTSA stormwater management Fee has been successful. Most of the initial concerns of residents and nonresidential property owners seemed to have been addressed, and with the exception of the Navy and PennDOT properties, the delinquency rate for the fee is extremely low. In the first year, the HTSA has collected approximately $1.1 million. These funds have been used to offset costs associated with stormwater system repairs and to support a new stormwater division of the public works department. The stormwater division now oversees permit activities as well as operation and maintenance activities, such as storm sewer inspection, leaf collection, street sweeping, and various other activities completed in support of the stormwater management program.

About the Author

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What Every Authority Should Ask Before Taking Over Stormwater

By Nathan Walker, AICP

Pennsylvania municipalities have traditionally been the stewards of the storm sewer network in their community. As development occurred, pipes and swales were installed within the public right of way to transport runoff away from properties, off streets, and to the local stream. During the 1980s, many municipalities formalized their role of managing stormwater by adding land use regulations that defined standards for how stormwater runoff was to be collected, conveyed, treated, and discharged. Developers regularly dedicated these pipes, swales, and sometimes the basins to the municipality once installation was complete and the minimum construction standard was achieved. The municipality's streets division or public works department was then generally responsible for providing the resources for ongoing system maintenance such as cleaning catch basins and replacing failed sections of pipe.

As part of their compliance with the 2003 version of the Municipal Separate Storm Sewer System (MS4) permit, permitted municipalities were required to adopt a Stormwater Management Ordinance that is generally consistent with the state model ordinance. This Ordinance standardized how stormwater is managed through the development process. It also enables municipalities to require developers installing stormwater management facilities to 1) create maintenance plans for those facilities and 2) place money in escrow for cover the cost of the municipality's inspection of the stormwater management facility. This mechanism somewhat reduces the cost to the municipality to manage new stormwater infrastructure. However, storm sewer operations, maintenance, and repair activities are otherwise dependent on the availability of money from the municipal general fund. In the meantime, municipal stormwater responsibilities related to storm sewer operations and maintenance, pipe replacement, attention to citizen complaints, and design and construction of capital improvements, continue to grow.

The Pennsylvania Department of Environmental Protection (PADEP) will implement its third version of the MS4 general permit in 2018. Most Pennsylvania municipalities that lie within the US Census Bureau's defined Urbanized Area will be required to apply for MS4 permit coverage to discharge stormwater under PADEP's administration of the National Pollutant Discharge Elimination System (NPDES). There are at least 970 MS4 communities in Pennsylvania as shown in Figure 1.

Figure 1. MS4 Municipalities in Pennsylvania (PADEP, 2012)

MS4 permit holders are minimally required to comply with the permit's six Minimum Control Measures, maintain an accurate map of stormwater features, and submit an annual report to PADEP. A significant change in this new permit is the requirement that all MS4s that discharge to a stream impaired by stormwater must create a Pollutant Reduction Plan that commits the community to improving water quality. As municipal leaders see that their growing MS4 responsibilities are added to their current stormwater duties, elected bodies in Pennsylvania have started looking to transfer stormwater management to another party able to give this important infrastructure the attention it needs to function properly. Recent amendments to the *Municipality Authorities Act* have opened the door to allow for this transfer to an authority. In many places across the state, municipalities are in fact considering asking the local sanitary authority to take on this role.

Sanitary authorities have the equipment needed to take care of storm sewers, they are accustomed a long-term approach to managing an asset that serves the community, they know where many water resources problems currently exist, and they speak the language of water quality. So if your elected officials knock on your door to ask your existing authority to manage stormwater, what questions should you ask? Here are five.

1. What's the extent of the stormwater system and what are its components?

Define the asset. Some municipalities consider their MS4 to be just the catch basins, the conveyance pipes, and the outfalls to the stream. Municipalities on the other end of the spectrum may include their curb and gutter system, underground detention chambers, culverts over streams, bio-swales and rain gardens, high hazard flood control structures, and pump stations, to their list of stormwater features. How inclusive it is depends on the municipality's definition of the system. Defining the asset becomes even more critical when considering a multi-municipal authority where participating municipalities may have varying definitions.

Following a clear definition of the types of features to include, necessary action items leading to a potential transfer of responsibility for managing stormwater should include an inventory of the stormwater system. This inventory should include an understanding of which features are regulated as part of the municipality's MS4 permit; the location of access easements on private property; the list of partners on certified flood control structures; and which private stormwater basins were approved with maintenance easements held by the municipality.

2. What is the current level of service provided?

Identify who currently makes decisions. Stormwater managers in the public works department or streets division make day-to-day decisions about MS4 operations; elected officials and municipal managers direct the annual capital improvement budget. The municipality considering transfer of responsibility should provide the authority with detail about both types of decisions: day-to-day operations and capital improvements. Municipalities should document the current standard for the frequency of street sweeping and catch basin cleaning; the length of the pipe inspection cycle; and the threshold at which a catch basin needs to be replaced. Municipalities should also update their list of known capital improvements that are awaiting funding. With historic information about operations and necessary capital improvements, the authority considering taking over management of the stormwater system will be able to make informed decisions about necessary cash flow required to maintain the preferred level of service.

3. What needs to be fixed and where are the knowledge gaps?

Document current and future program gaps. Most municipal stormwater managers can generate a list of stormwater problem areas: where streams overflow, storm sewers back up, streets flood, water flows cloudy, and property erodes. However, many do not have formal documentation of how to address these issues, the upstream source of the problem, or how the cost of solutions. As stormwater management becomes more sophisticated, stormwater managers rely on accurate information about the condition of the storm sewer, the sources of flooding in the watershed, the pinch points where water flow is restricted, and the growing water quality regulations.

4. Who will be responsible and what will they be responsible for?

Delineate the responsibility for all program areas. Authorities that take on a stormwater role may be responsible for general activities like responding to citizen complaints about a clogged pipe or a sheen floating on top of the stream. Authorities may also take on larger tasks, such as fixing a stretch of rusted out pipe or designing and installing a water quality BMP. As stormwater responsibilities increase, authorities that are considering providing stormwater services should have an open dialogue with the municipality about the following responsibilities:

- Who is on the hook for compliance with an MS4 permit?
- Who holds access easements to inspect private BMPs?
- Who enforces necessary maintenance activities on private BMPs?
- Who makes decisions about prioritizing capital projects?
- Which entity will take on financing for capital improvements?
- Which entity reviews the design of extension and upgrade to the existing system?

5. Where does the money come from?

Outline the funding options. An authority taking on stormwater responsibilities will need to know about the sustainability of the funding source and the capacity for that funding source to grow with stormwater demands.

Municipal stormwater services are generally funded from the municipal general fund with some support from grants or the Liquid Fuels Fund when related to the transportation network. Some municipalities are successful reducing the cost of their stormwater program by sharing equipment with neighbors, cooperating on regional watershed plans, and negotiating stormwater controls with developers. As another source of funding, authorities are able to enact a stormwater user fee that can be applied across a municipality. Such a user fee is different from property taxes in that a user fee can be applied to all property owners in a community, not just taxable properties. User fees distribute the cost across the community, often based on the impervious area present on a site, not the property value. User fees also allow property owners to reduce their fee by reducing impervious area or through an approved user fee credit program.

Conclusion

As Pennsylvania municipalities ask existing authorities to take on a new role to serve their community, both parties need to start the process with their eyes wide open. These five questions can serve the basis for the conversation and help municipal officials and authority boards make informed decisions about how to most efficiently manage stormwater into the future.

About the Author

Nathan Walker is a Senior Water Resources Planner at Amec Foster Wheeler's Blue Bell, PA office in Montgomery County. For 17 years, Nathan Walker has advised institutional leaders, property managers, and elected officials on land use policy, permitting, and environmental stewardship issues. In the field of water resources, Nathan writes stormwater management plans for municipalities, state institutions, authorities, and military facilities that provide cost effective, long-term compliance solutions for CSO, TMDL, and MS4 responsibilities. Nathan is PWEA's Stormwater Committee Chair.

STORMWATER FEES: BETTER TOGETHER?

BY BRIAN ALEXANDER CHALFANT

This article aims to identify factors and strategies – particularly those most relevant to Pennsylvania – that facilitate establishing and maintaining multi-municipal stormwater fees. The research described in this article primarily utilized qualitative case study methods, including mining of archival and documentary sources complemented by in-person interviews with key decisionmakers in three metropolitan sewer districts.[1]

Although each region is unique, some common strategies and factors in multi-municipal stormwater fee arrangements are:

(1) Flexibility and innovation in permitting.
(2) Flexibility in institutional design.
(3) The contents and interpretation of state rules governing the creation and empowerment of regional political institutions.
(4) Innovative, competent, and trusted regional leadership.

As stormwater fees continue to spread across the Commonwealth in coming years and decades, some upfront thoughtful deliberation and design can produce more cost-effective and resilient stormwater fee strategies, compared to highly balkanized alternatives.

"THE OVERWHELMING MAJORITY OF STORMWATER FEES ENACTED ACROSS THE UNITED STATES OVER THE PAST 53 YEARS HAVE BEEN ENACTED BY SINGLE, SUBCOUNTY, GENERAL-PURPOSE GOVERNMENTS ACTING INDEPENDENTLY."

What is a stormwater fee?

For the purposes of this article, a stormwater fee is a fee enacted by a governmental entity – typically a municipality, county, or special regional district in the United States – used to fund the operation, maintenance, and capital improvement of stormwater infrastructure. Although various jurisdictions levy a variety of stormwater fees, this article focuses on recurring (e.g., monthly, quarterly, annual) fees assessed against parcels of real property based on some characteristics of those parcels, often the areal extent of impervious surfaces. These recurring, parcel-based fees are distinct from one-time stormwater or development "impact" fees levied against new developments. Just as drinking water utilities charge user fees for collection, treatment, and distribution services, recurring, parcel-based stormwater fees are often implemented as part of a local government authority (or "utility" in the parlance of most places outside Pennsylvania). These stormwater fees serve as user fees for stormwater conveyance, sometimes treatment, and other stormwater services. So, from this point forward, any use of the term "stormwater fee" refers to this type of recurring, parcel-based stormwater fee.

Welcome to Pennsylvania

Stormwater fees have existed in the United States since at least 1964. Over the past five decades, somewhere between 1,600 to 1,900 local governments in 40 states[2] have designed, debated, enacted, amended, and sometimes repealed stormwater fees. As such, stormwater fees – from a national perspective – are relatively new to Pennsylvania. In 2010, the City of Philadelphia was the first locality in the Commonwealth to implement a stormwater fee. At present, a couple dozen Pennsylvania boroughs, townships, cities, and at least one county have considered or implemented a stormwater fee. And – as many municipal engineering firms will attest – more and more local governments across Penn's Woods are considering stormwater fees with each passing week.

Stormwater fee form

The overwhelming majority of stormwater fees enacted across the United States over the past 53 years have been enacted by single, sub-county, general-purpose governments acting independently. However, some stormwater fees have been enacted by groups of local governments acting together on a coordinated, collective basis. In Georgia, for example, the Clayton County Storm Water Utility is a unified, countywide utility that includes all six of the cities in the county, as well all the unincorporated areas of the county. Such county-based stormwater fees are more common in parts of the country with large areas of unincorporated land. In addition to county stormwater fees, multi-municipal stormwater fees in the United States have also been enacted to cover specific watersheds, special stormwater districts, or the service areas of metropolitan sewer districts.

Come together?

As anyone who has participated in any council of government or regional planning board knows, the sheer "cat herding" involved with organizing and sustaining multi-municipal initiatives entails considerable efforts. When it comes to stormwater fees, however, multi-municipal approaches offer some key benefits. One major benefit of multi-municipal stormwater fee arrangements arises from the cost effectiveness of consolidating certain technical and administrative tasks, such as developing and maintaining GIS databases and billing systems. Multi-municipal stormwater fee systems can also account for hydrologic and hydraulic interdependencies among individual municipalities within a shared watershed and/or sewershed, whereas these interdependencies may be ignored and externalized by an alternative system of individual, single-municipal fees.

The rest of this article focuses on strategies and factors that can either foster or inhibit forming and maintaining multi-municipal stormwater fee systems.

The AFC North

To find out why we see multi-municipal stormwater fees in certain places but not in others, this article now presents key aspects of case studies of three metropolitan sewer districts that share many similarities (e.g., population size, service area size, sewer infrastructure configuration, municipal fragmentation, National Football League division) but that have evolved three very different stormwater fee arrangements.

The three metropolitan sewer districts are:

(1) Allegheny County Sanitary Authority (ALCOSAN), which serves the greater Pittsburgh region in southwestern Pennsylvania.

(2) Northeast Ohio Regional Sewer District (NEORSD), which serves the greater Cleveland region.

(3) Metropolitan Sewer District of Greater Cincinnati (MSDGC) in southwestern Ohio.

In the MSDGC service area, most municipalities participate in in the Hamilton County Storm Water District (HCSWD). However, some MSDGC municipalities do not participate in the county stormwater fee system, and either have their own individual stormwater fees, or no stormwater fee at all.

Meanwhile, all 61 municipalities in the NEORSD service area participate in a stormwater fee system administered by NEORSD.

Finally, in the ALCOSAN service area, the home-rule Municipality of Mt. Lebanon is currently the only one of the 83 municipalities in the service area with a stormwater fee in place, although one other municipality – Dormont Borough – did enact, then later repealed a stormwater fee.

So, why do we see such stark variation in stormwater fee forms among these three somewhat-comparable metropolitan regions?

Queen City

In reviewing the history of HCSWD, and in interviewing key decisionmakers in the region, three key dynamics became

apparent as the driving forces behind the conception and longevity of the county stormwater district. When the United States Environmental Protection Agency (USEPA) approached officials representing Hamilton County and each urbanized municipality in the county with the Phase II MS4 permit requirements in 2002, local officials conducted a months-long series of meetings to discuss how they wanted to handle the impending federal permit requirements. These meetings included not only representatives of the county and affected municipalities, but also local watershed, conservancy, business, civic, and other organizations. After months of meetings and deliberation, some members of the local working group approached USEPA with the idea of the affected and willing jurisdictions joining as co-permittees on a shared permit. The local group proposed that a new organization – what would become HCSWD – would handle certain permit requirements and associated tasks (e.g., developing mapping and billing systems). The urbanized municipalities in the county could choose to contract annually with the county stormwater district for certain permit services, or to decline the district services and handle those permit responsibilities in-house individually.

Each municipality that joins HCSWD pays a service fee – the stormwater fee – to the county district proportional to the amount of impervious surface within its borders. For 2017, the county district offered each co-permitted municipality the option to contract for illicit discharge detection and elimination services, local development review and inspection services, as well as GIS map development services. Each co-permittee municipality can choose to contract for all three, any two, just one, or none of these permit services offered by HCSWD. Those municipalities that choose not to contract with the county district fund their own permit activities with their own stormwater fees, general budget revenues, or other mechanisms.

The HCSWD case illustrates a few key factors and strategies that led to the emergence and continuation of the multi-municipal county stormwater district. First, the formation of HCSWD grew directly out of the innovation demonstrated by local officials in coming up with the co-permittee idea, and out of the permitting flexibility demonstrated by USEPA in approving the then-novel idea. Secondly, a flexible institutional design has been central to the longevity of HCSWD. Allowing each urbanized municipality to select their own level of service means that the district can reap some advantages of a collective effort, while avoiding the contentiousness that often occurs in less flexible and less voluntary schemes, such as the NEORSD stormwater fee. Finally, at the outset of the co-permit idea, the consenting municipalities only agreed to turn over certain permit responsibilities to the county because the relevant county departments and individuals had previously demonstrated their competence, and thus earned the trust of their municipal partners.

"THE HCSWD CASE ILLUSTRATES A FEW KEY FACTORS AND STRATEGIES THAT LED TO THE EMERGENCE AND CONTINUATION OF THE MULTI-MUNICIPAL COUNTY STORMWATER DISTRICT."

Cleveland rocks

The experience in the NEORSD service area stands in stark contrast to HCSWD. In January 2010, the NEORSD board voted to implement a stormwater fee – scheduled to go into effect in 2013 – within the sewer district service area. Some of the member municipalities disputed the authority of NEORSD to levy such a fee, and after the 8th Ohio District Court of Appeals overturned a ruling by the Cuyahoga County Common Pleas Court in favor of the sewer district, the matter arrived in front of the Ohio Supreme Court. In September 2015, more than five years after the sewer district originally voted on the fee, the highest Ohio court decided the case in favor of NEORSD with the ruling essentially turning on the interpretation two little words – "waste water" – nestled in subsection 6119.011(K) of the Ohio Revised Code. So, now, all 61 municipal members of NEORSD are judicially compelled to participate in a multi-municipal stormwater fee institution administered by NEORSD.

While many competent, innovative, flexible, and trustworthy people certainly devoted many hours to designing the institutional infrastructure for the NEORSD stormwater fee, the overwhelming dynamic that led to the legitimation of this multi-municipal fee was how seven justices read the legislative language of the state rules governing the powers of regional political institutions.

Prospects for Pennsylvania

Since stormwater fees are relatively new to Pennsylvania, compared with Ohio and many other parts of the country, many individuals and organizations around the greater Pittsburgh region are currently in the process of envisioning and analyzing how different multi-municipal stormwater fee systems and associated authorities might work in the ALCOSAN service area. Could we see some sort of co-permit situation for ALCOSAN's 83-municipality service area? Possibly. However, one major hurdle to this vision is a current lack of the foundational trust we saw in Hamilton County, Ohio among the municipalities, as well as between the municipalities and the managing entity (i.e., the county). Longstanding issues about how municipalities are represented on the ALCOSAN board have resulted in some municipalities distrusting the sanitary authority. So, why not create a new institution? Although many people in the ALCOSAN service area dislike the idea of creating another governing body in a region replete with governing bodies, ALCOSAN stakeholders could look to many other parts of the Commonwealth – such as Lancaster County, York County, Lycoming County, eastern Delaware County, the Spring Creek watershed near State College, the Wissahickon Creek basin, and others – for examples of established and nascent collaborative stormwater institutional arrangements. Or, perhaps the ALCOSAN service area will ultimately opt for the "nuclear

option" evinced in northeast Ohio? As much of a spectacle as this would be, and as many lawyers as it would enrich, this highly coercive approach seems unlikely since the Pennsylvania Code generally grants far fewer and more limited powers to regional political institutions than does the Ohio Revised Code. Or, will the future hold an 83-municipality ALCOSAN service area with 83 unique stormwater fees?

While I personally believe that watershed-based stormwater fees and authorities offer significant appeal, my purpose here is not to promote any one approach to stormwater fee system design. Rather, I mainly hope this article has provided you with useful information and has stimulated your thinking regarding stormwater fee forms, multi-municipal and otherwise. I especially hope that this article has provided you with some practical insights into what dynamics drive multi-municipal stormwater fee formation and durability. If you have any questions about stormwater fee forms, or want to chat about any aspect of stormwater fees, please feel free to contact me at *water.wonk@pitt.edu*.

About the Author

Born and raised in northern Allegheny County, Brian earned a bachelor's degree in biology and a master's degree in environmental science and engineering from the University of North Carolina at Chapel Hill. Currently working to finish up his doctoral studies in environmental policy and natural resource governance at the University of Pittsburgh's Graduate School of Public and International Affairs, Brian's dissertation research investigates the emergence, diffusion, form, and occasional demise of stormwater fees in the United States.

Notes

[1] This article draws on my ongoing doctoral dissertation research at the University of Pittsburgh.

[2] The estimate of the number of local governments that have enacted a stormwater fee is based on my review, verification, and expansion of the 2014 Western Kentucky University Stormwater Utility Survey: *www.wku.edu/engineering/civil/fpm/swusurvey/*.

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Defining the Future of Urban Stormwater Management in Pennsylvania: The I-95 Girard Avenue Interchange Reconstruction Project, Phase 2

BY THOMAS O. LINDSEY, PE

Interstate 95 was constructed in the 1960s as part of the massive Interstate Highway System initiated by President Dwight D. Eisenhower. The freeway stretches from Maine to Florida and serves as the primary north-south route on the American east coast. Within the City of Philadelphia, I-95 follows the alignment of the Delaware River, traversing over 23 miles and carrying significant traffic volume in both the northbound and southbound directions. As the highway completed its third decade in the 1990s, the Pennsylvania Department of Transportation (PennDOT) began planning and scheduling the upcoming reconstruction of the facility.

The I-95 Girard Avenue interchange was identified as one of the highest priority areas for reconstruction, due to the age of the highway and the significant percentage of deteriorating bridge structure. This design section extends for approximately three miles from Race Street to Allegheny Avenue and includes complete reconstruction of the interstate, as well as reconfiguration of the interchange ramps and associated surface streets. This stretch of I-95 is one of the most heavily traveled interstates in Pennsylvania, carrying over 200,000 vehicles per day, and the interchange provides access to and from four major arterials: Girard Avenue, Delaware Avenue, Aramingo Avenue, and Richmond Street. Locally, I-95 is perceived as a barrier between Philadelphia's Riverward neighborhoods and the Delaware River, and has become a focus of development and waterfront planning efforts.

Early in the final design stage, it became apparent that one of the most significant design components would be stormwater management. All I-95 reconstruction projects are required to meet Pennsylvania Department of Environmental Protection (PADEP) National Pollution Discharge Elimination System (NPDES) Phase II permit requirements and Philadelphia Water Department (PWD) stormwater management requirements, among the most stringent in the northeast.

Since the total estimated construction cost for the entire reconstruction of the I-95 Girard Avenue interchange is over one billion dollars, PennDOT separated the project into six individual construction contract sections. Phase 2 is the first mainline construction section completed and, at just over 1,200 feet in length, it is the smallest construction segment. It was built in advance to use as a traffic crossover between reconstruction of the long highway viaduct structures to the north and south during future sections. Despite its small size, this section proved to be a microcosm of the urban stormwater

"EARLY IN THE FINAL DESIGN STAGE, IT BECAME APPARENT THAT ONE OF THE MOST SIGNIFICANT DESIGN COMPONENTS WOULD BE STORMWATER MANAGEMENT."

Rendering of the proposed condition of the Girard Avenue Interchange area

Rendering of large scale stormwater management in the Girard Avenue Interchange with integrated landscape

Rendering of Phase 2 stormwater management with integrated landscape

Dense landscaping within the SMP devices providing the added benefit of improved water quality

Installed bioswale in Phase 2

design challenges that will be faced over the entire length of I-95 in Philadelphia.

Phase 2 extends from Frankford Avenue to Palmer Street in the Fishtown neighborhood. Prior to reconstruction, it was built on embankment with three single-span bridges over city streets. To avoid taking right-of-way from the adjacent neighborhood, the sloped embankments were replaced with retaining walls. This configuration provided space for wider shoulders and continuous auxiliary lanes to increase safety and accommodate projected traffic volumes.

Unfortunately, this approach left very narrow slivers of right-of-way remaining to use for a stormwater management system capable of meeting PWD and PADEP requirements and regulations. The dense urban environment surrounding the project and close proximity to adjacent homes and businesses created additional challenges for the design team. The future maintenance of the facility was also a concern and required realistic assessments of the maintenance capabilities of PennDOT and other entities. The final design solution for the many stormwater challenges in Phase 2 was a series of ten small, shallow bioswales along the project's retaining walls that are landscaped for both stormwater function and to improve the appearance of the highway.

In the current condition of I-95, there are no existing stormwater management facilities to control or treat the roadway runoff. All highway runoff is discharged to the PWD combined sewer overflow (CSO) system which routes storm and sanitary flow to the local water treatment plants during dry weather and smaller storms. During larger rain events, these systems overflow directly into the adjacent waterways, such as the Delaware River. Due to the limited CSO capacity and mandates from the Environmental Protection Agency (EPA), PWD is considering separation of storm and sanitary flows and stormwater treatment as part of any proposed project in the city, including PennDOT's I-95 Girard Avenue interchange reconstruction.

Since the project design and construction schedules span more than twenty years, stormwater regulations have significantly changed during the design phase, resulting in different requirements for each phase. In general, the project is required to treat the first 1" to 1.5" of runoff from the I-95 mainline and ramps for water quality and quantity using stormwater management practice (SMP) devices. While infiltration for groundwater recharge is also encouraged, it is not feasible in some locations. For example, impervious liners are installed in SMPs with closely adjacent basements. These facilities are exempted from the volume reduction requirement but must still meet the water quality requirement.

In cases where storm and sanitary sewer separation is not feasible and the proposed SMPs will connect to the existing CSO system, the project is required to provide water quality treatment as well as peak rate control. In these cases, the post-development peak rate for the two-year storm must be reduced to match the pre-development

peak rate for the one-year storm. In addition, there is a release rate requirement of 0.15 to 0.24 cubic feet per second per acre to avoid overburdening the CSO system.

PWD also prefers a 10:1 loading ratio for all SMP devices; however, this loading ratio can be exceeded if there is pretreatment of runoff prior to entering the stormwater management facility. In the I-95 Girard Avenue interchange project, brick paver forebays are used to collect sediment that would otherwise clog the infiltration system in the main basin. To maximize infiltration, each SMP has a 24" to 42" deep bottom layer of engineered amended soil. As protection against standing water if the SMPs do not infiltrate as expected, each basin has an underdrain that can be uncapped to provide an outlet for trapped runoff.

As part of an unprecedented planning and outreach program driven by PennDOT, the design team was able to engage the neighboring communities to tailor the features surrounding the highway to fit community needs. The landscaping component of the stormwater management design was one of many elements that were guided by the public design charrettes and "near neighbors" meetings. In many instances, the planted portions of the right-of-way function as a backyard for the highway's neighbors, providing aesthetic enhancement, a visual buffer, noise attenuation, and carbon sequestration. For the entire project corridor, the design team conducted an in-depth sun/shade analysis, which informed the locations of planting zones. Areas with enough sunlight were celebrated with a carefully selected planting palette chosen for seasonal interest, tolerance to urban conditions, low maintenance requirements, and where necessary, their suitability for stormwater management. Within the SMP devices, the landscape provides the added benefit of improved water quality. As runoff is captured in the SMP, the planted material acts as a filter for suspended solids. After going below the surface, the plants and their network of roots continue to provide cleaning power through the uptake of pollutants and nutrients.

Construction on Phase 2 was completed at the end of 2015 and the bioswales have been operating for over a year. The facilities are functioning properly and the design team has used this experience to drive the design of the remainder of the Girard Avenue interchange project. The ultimate design of the I-95 Girard Avenue interchange project will include over 70 SMP devices, including rain gardens, bioswales, and bioinfiltration basins. A majority of the highway within the project limits is located on elevated viaduct structure, so the sun/shade analysis mentioned above will be used to determine where SMPs can be placed underneath the highway and still receive enough sunlight to support landscaping. In areas where sunlight is limited to less than four hours per day, hardscaping, such as rock lining, will be used in the SMPs. In addition, many of the open spaces within the interchange ramp infields will be used as stormwater parks, incorporating landscaped rain gardens and bioswales.

Weather sensors and monitoring equipment installed onsite to aid in the research program

The stormwater management design for the overall Girard Avenue interchange project will incorporate many "lessons learned" from the Phase 2 bioswales. For example, the staging for the construction of the bioswales is critical and must be detailed explicitly in the contract documents. Heavy construction traffic or any foot traffic within the footprint of the bioswales can compress the underlying soils and hinder infiltration. The designer must consider adjacent construction tasks and the placement of these tasks in the construction schedule.

In addition to informing the future design of the Girard Avenue interchange, the lessons learned are communicated to the design consultants for other I-95 reconstruction projects during regular coordination meetings. A consistent design review team and a comprehensive set of corridor design guidelines also ensure that experience gained during the early stages of construction is used throughout the I-95 corridor in Philadelphia.

The stormwater management design for the project was also identified by Temple University and Villanova University as an ideal site for unprecedented research on urban stormwater management that may have far-reaching benefits. Through coordination with PennDOT and the design team, these two institutions began work in 2016 to monitor and analyze the function of the bioswales constructed under Phase 2 with respect to water quality and quantity treatment. The results of the study could be used to guide future design standards for landscaping and stormwater management related to transportation facilities in Philadelphia and the entire Commonwealth of Pennsylvania.

For more information on PennDOT's I-95 reconstruction, please visit *www.95revive.com*.

About the Author

Thomas Lindsey is the design consultant's Deputy Project Manager for the I-95 Girard Avenue Interchange Reconstruction Project and is based in AECOM's Conshohocken, PA office.

Structural Stormwater Pollution Reduction Targeting Floatables, Gross-Pollutants, and Trash in Myrtle Beach

T. J. Mullen, President, Best Management Products, Inc., Lyme, CT
Eric Sanford, PE. Principal/Director of Municipal Services, DDC Engineers, Myrtle Beach, SC

Background

The City of Myrtle Beach, SC has evolved in the past few decades into one of the most popular beach resorts on the East Coast of the United States with more than 15 million visitors annually. Removing trash, floatables and other gross-pollutants is a critical function of any stormwater collection system that requires water quality improvement. For a beach resort town like Myrtle Beach, SC, with a year-round population of about 30,000 residents, keeping trash out of the stormwater discharges is a high priority. Beyond keeping the water clean for residents, the perception of water quality by the millions of tourists that visit each year, can have a dramatic impact on the economy of this top-rated family beach destination.

Myrtle Beach has approximately 162 miles of stormwater drainage pipes, with more than 55 beach outfalls with three deep-water outfalls, draining primarily to the Atlantic Ocean along the 10.5 miles of beaches or to the Intracoastal Waterway on the city's western boundary. As such, the floatables and trash that are discharged have a direct impact on the aesthetic beauty of the coastline and beaches as well as posing a risk to public health and aquatic life. For over a decade, the city has used an advanced hooded outlet cover concept, whereby vented hoods cover the outlet pipes of key deep-sump stormwater inlets and distribution structures throughout the drainage network. More than 235 BMP SNOUT® equipped structures are in service at locations throughout Myrtle Beach. Periodic mass loading monitoring has shown a 70% reduction of trash and other gross pollutants.

On average, it is estimated that each structure removes one ton of solids and debris on an annual basis. In total, more than a half million pounds of solids are being collected and removed from the surface waters each year by these hooded structures.

Design Considerations

DDC Engineers, the primary municipal engineering consultant for the City of Myrtle Beach first selected the SNOUT from Best Management Products, Inc. (BMP, Inc.) in 2003 after a search for solutions to minimize the discharge of trash onto the beach. The requirements were three-fold: 1) The technology deployed had to target the pollutants of greatest concern – trash, floatables and roadway oils. 2) The strategy had to be cost-effective. 3) The system had to be easy to install and maintain. For Myrtle Beach, developing the city's stormwater infrastructure moved forward

Figure 1. Pier 14 Restaurant at Myrtle Beach, 14th Avenue and N. Ocean Boulevard

Figure 2. 14th Avenue N. and N. Ocean Boulevard, 30F SNOUT

Figure 3. Withers Drive and 9th Avenue N., 24F SNOUT

Figure 5. S. Ocean Boulevard and 4th Avenue S., near Family Kingdom

Figure 4. S. Ocean Boulevard at 3rd Avenue S., 30F SNOUT

Figure 6. Myrtle Beach Boardwalk at N. 2nd Avenue

that year with a $13 million project to make drainage improvements along N. Ocean Boulevard near 14th Avenue.

Of particular interest to designers was the skimming action of the hoods to remove pollution floating on the surface in the catch basins, along with the high hydraulic capacity and anti-siphon venting that prevents pollutants from being drawn downstream after a flashy high-flow storm – all too common in the southeast US. While the overall project had a significant budget, the 50 hoods and deep sump catch basins were estimated to add no more than $100,000 of material cost to the $13 million effort, with the structures accounting for the majority of that cost. For a project draining nearly 90 acres where the imperviousness approached 90%, this treatment train approach of utilizing over 50 water quality structures was extremely cost-effective. Of course, in a tourist dependent town, the work had to be completed in the off-season. This meant that construction could begin no sooner than late October and had to be finished in late April, before the mass of visitors begin their annual migration to this seaside resort. As the SNOUTs were easy to install in the town's standard inlet, requiring only a deeper sump, retrofitting was possible, and fitting new inlets with this pollution fighting technology was simply a matter of increasing the minimum sump depth based on a factor of 2.5 times the outlet pipe ID. As an example, for a pipe with an 18" ID, a sump depth of 4' is sufficient. For maintenance, BMP, Inc. recommends that the structure be serviced, typically by vacuum truck, when the sump is half full of material, meaning that 2' of material has accumulated in a 4' deep sump. This protocol ensures that floatable solids and liquids are also removed on a timely basis. In Myrtle Beach, structures are typically inspected, and maintained if needed, at six-month intervals.

Applications

The most common application is for the SNOUT is to skim off trash and oils while letting sand and other solids settle out prior to discharge. At 14th Avenue N. and N. Ocean Boulevard, 24" pipe runs parallel to the beach on the western side of Ocean Boulevard, with 15", 18" and 24" lines running perpendicular to the storm line on Ocean Boulevard, between 9th Avenue N. and 18th Avenue N. Here, there are a mix of businesses, condominium residences and hotels along the beachfront as well as a restaurant on a pier (Figure 1).

Among the 50 SNOUTs deployed along this section of the beach are the 18F for the 15" pipe, the 24F for the 18" pipe and the 30F for the 24" pipe. The primary pollutants of concern are trash and floatables that would otherwise be discharged to an ocean outfall (Figure 2). Each structure is typically a 3' x 4' or a 4'x 4' precast concrete catch basin with a 3' to 4' deep sump as a standard.

Nearby the 14th Avenue N., and N. Ocean Boulevard location and running parallel to it is a run of an additional 40 inlets on Withers Drive from 9th Avenue N. to 14th Avenue N. One finds a mix of undeveloped lots, commercial space and parking lots and structures in this area. While not frequented by tourists like the Ocean Boulevard locations, trash and to a greater extent oils are a problem due to more commercial traffic and the prominence of vehicle parking. The structures are served by 15" and 18" pipe terminating into a main header pipe, which is then discharged into an ocean outfall. A structure with an 18" pipe and a 24F SNOUT shows a significant accumulation of oil (Figure 3).

In some cases, stormwater inlets in Myrtle Beach discharge into perforated pipes or other types of infiltration systems, where the benefit of the of deep sump catch basins with SNOUTs are multi-fold. In these infiltration applications, pollutants such as total suspended solids (TSS) and the nutrients that TSS can transport are typically targeted for removal. However by volume, trash and gross-particles can easily contribute an overwhelming mass load that will quickly fill the underground facilities, and greatly hamper the removal of targeted micro-pollutants if the gross solids are not addressed. This is the case at S. Ocean Boulevard between Wither Swash to 2nd Avenue S., where a 24" perforated pipe drains 20 inlets

equipped with 30F SNOUTs (Figure 4). Here, organic debris from foliage in a nearby park mixes with trash and oil, as well as sediment, sand and grit. Whatever flow is not infiltrated is discharged through a flexible rubber check valve that drains to Withers Swash adjacent to the Family Kingdom (Figure 5), a Myrtle Beach seaside amusement park.

One of the resort town's prominent features is its 1.2-mile long ocean front boardwalk (Figure 6). Completed in 2010, at a cost of $6.5 million, the beach side promenade stretches from N. 14th Avenue to N. 2nd Avenue. Along with Gross Solids Removal Devices (GSRDs) from Roscoe Moss Co., 40 SNOUTs were deployed for trash, floatables, oil and fine solids removal prior to discharge into a series of 15" and 18" perforated pipes. As is often the case when protecting an infiltration gallery, hoods are used on both the inlet and outlet pipes as flow can occur in both directions with changes in the level of the water table due to rain events and seasonal fluctuations (Figure 7).

Figure 7. Near 3rd Avenue S., and Ocean Boulevard. Shown is a pair of 30F SNOUTs covering 24" perforated pipe.

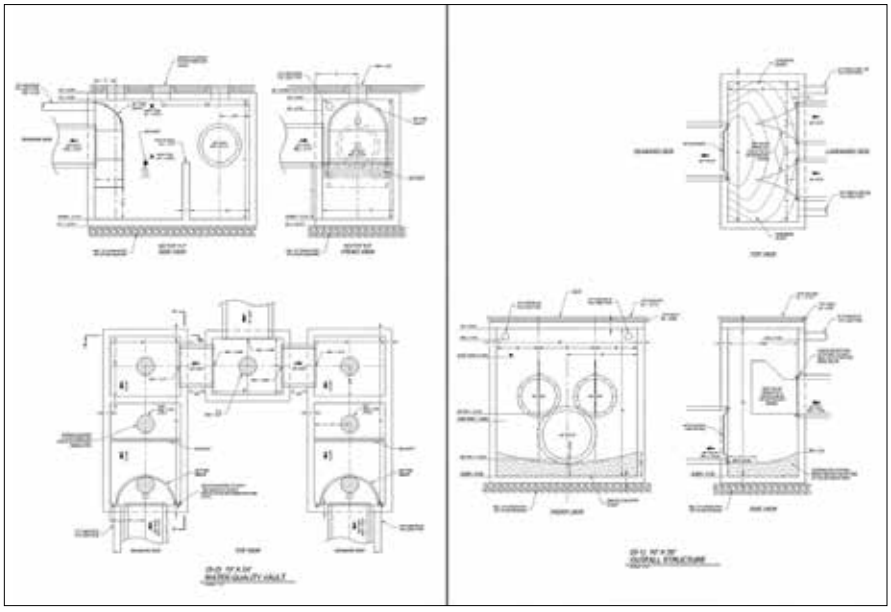

Figure 8. Water Quality Vault with 96FTB SNOUTs, N. Myrtle Beach, SC. by DDC Engineers, Inc., Myrtle Beach, SC.

The implementation of hundreds of SNOUTs in Myrtle Beach, as well as the implementation of other gross-pollutant removal systems in Myrtle Beach including the GSRDs and Crystal Stream devices speak to the importance of addressing the pollution in stormwater runoff. The structural treatment train concept offers simple methods that transform inlets and other storm structures into micro-detention or strategic treatment nodes and is most successfully implemented when combined with Low Impact Development protocols. This application dramatically improves the pollution removal efficiency of stormwater quality, detention, infiltration or re-use systems by separating the high volume gross pollutants prior to the higher resolution treatment steps that target micro-pollutants like nutrients and other dissolved constituents. For next steps, more gross-pollutant removal systems are in planning and design phases. DDC Engineers is designing a 200 CFS gross-pollutant removal system for the Main Street outfall in North Myrtle Beach, which will utilize 96FTB SNOUTs and the BMP Bio-Skirt oil and bacteria reducing booms (Figure 8).

The forward thinking efforts of the municipalities and local engineering designers will insure that the Grand Strand of South Carolina remains one of the top ranked and environmentally sustainable beach destinations in the United States.

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All photos are by T. J. Mullen, BMP, Inc.

The Compatibility of Biosolids Land Application with Nutrient Management Regulations

BY DIANE GARVEY, *diane@garveyresources.com*

The State Conservation Commission (SCC) is in the process of writing draft guidance for the next edition of the *Nutrient Management Technical Manual* dealing with Act 38 participants who utilize Food Processing Residuals (FPRs) and/or Biosolids (Exceptional Quality or Class B) as a nutrient source or soil amendment for agronomic purposes. On October 24, 2016 the SCC distributed a draft supplement for comment to Nutrient Management Planners and the PWEA Biosolids Committee.

NUTRIENT MANAGEMENT REGULATIONS

The Natural Resources Conservation Service (NRCS) Conservation Practice Standard for Nutrient Management, Code 590[i], is defined as: "Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments." The purposes of this National Standard are:

- To minimize agricultural nonpoint source pollution of surface and groundwater resources.
- To properly utilize manure or organic byproducts as a plant nutrient source.
- To protect air quality by reducing odors, nitrogen emissions and the formation of atmospheric particulates.

This Standard applies to animal manure, biosolids, commercial fertilizers, and other materials used to provide plant nutrients. Both Class B biosolids and Exceptional Quality biosolids products, which are marketed as a fertilizer or soil amendment, are managed in accordance with this Standard. Pennsylvania's Nutrient Management Law, Act 38, and Nutrient Management Regulations are at least as stringent as the NRCS Standard.

Nutrient Management Regulations have many of the same restrictions for manure as Class B biosolids land application regulations. These include setbacks from waterways, sinkholes, and wetlands, soil analysis, loading at agronomic rates, etc. In a telephone conversation with Frank X. Schneider, Director, Nutrient and Odor Management Programs, State Conservation Commission, he indicated the Exceptional Quality biosolids products would be treated the same as fertilizer.

Compliance with Nutrient Management Regulations is important to farm operations. Farmers must be in compliance with Code 590, in addition to Soil Conservation Standards, in order to qualify for NRCS funding for manure storage or other farm improvements. Nutrient Management Regulations for agriculture strictly limit the amount of Nitrogen (N) and Phosphorus (P) that may be applied to farm fields. Traditional biosolids products usually have more phosphorus than needed when the crop nitrogen demand is met so this can be problematic. Farmers want to be sure that what goes in or on their fields is available to the crops, otherwise the yield will be reduced.

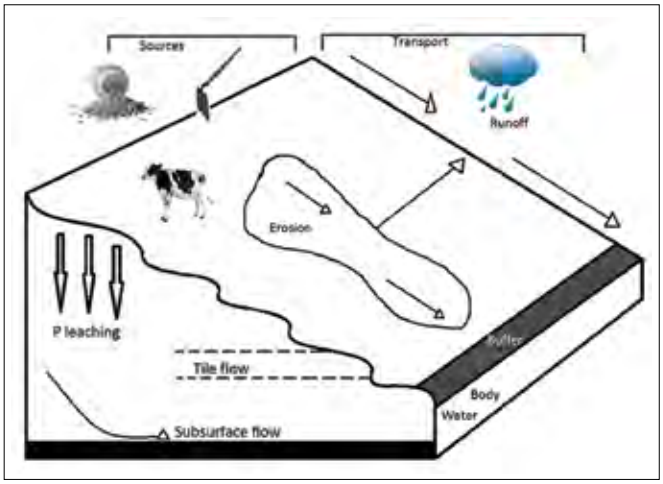

Figure 1. Sources of P and transport mechanisms.

Monitoring P application is a crucial part of nutrient management. Phosphorus is one of many elements essential to life for both plants and animals and is usually non-toxic even in high concentrations. However, excessive levels of P are the primary contributing factor to the over-growth of green algae in aquatic freshwater systems (a process known as eutrophication). The key to slowing or preventing this process is by controlling the P levels of agricultural soil and the soil erosion in the areas surrounding a fresh water ecosystem.

In the past, fertilizer and biosolids were land applied at a loading rate adequate to meet the crop demand for N. Excess N was much more likely to leach than P. Phosphorus was assumed to be associated with soil particles, therefore, efforts to control P loss were focused on erosion control. However, research at Penn State University showed how agricultural practices impact P loss even after soil conservation Best Management Practices (BMPs) are in place.

Although Total P transport by erosion was less in no-till fields, the Soluble P transported in erosion was greater than on a conventionally tilled wheat field. This was because fertilizer, biosolids and manure were surface applied in the no-till fields, rather than injected or incorporated in conventional tillage, which resulted in a buildup of P on the upper surface of the soil. This buildup was more vulnerable and subject to runoff erosion. As a result, NRCS is accepting fertilizer and manure injection using minimal disturbance equipment as a part of a no-till operation.

A common reaction of environmental regulators is to simply prohibit additional P sources on soils that contain enough P for crop growth. This critical crop level would be 60 mg/kg with

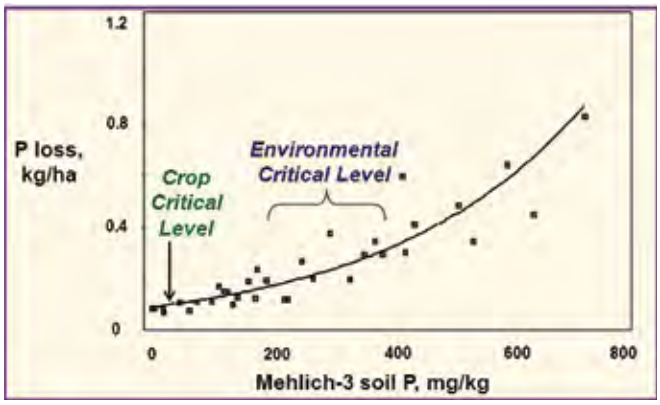

Figure 2. P concentration in soil impacts P losses.

the Mehlich-3 soil test. However, Penn State research showed that between 200 mg/kg and 400 mg/kg is the environmental critical level (See Figure 2). As a result, fields in this range must be evaluated to determine the factors that would influence nutrient losses.

THE PHOSPHORUS INDEX

Pennsylvania has developed a phosphorus risk assessment methodology, called the Phosphorus Index (P Index), to determine how much, if any, phosphorus may be applied to a field. The P Index is used as a tool by Nutrient Management Planners to quantify and rate the risk to water quality from P sources and P transport mechanisms.

In order to determine if a full risk assessment for phosphorus is required, a Nutrient Management Planner must first complete the Part A screening tool. If the answer to any of the following questions is *yes*, Part B must be completed:

- Is the field in a special protection watershed?
- Is there a significant farm management change?
- Is the soil test greater than 200 ppm phosphorus?
- Is the distance to surface water less than 250 feet?

Part B of the P Index then assigns numerical values to both the source of P and transport factors. Source of P factors include the concentration of P in the soil, the pounds of P applied as a fertilizer, manure or biosolids, the method and timing of application, and the Phosphorus Source Coefficient (PSC). The PSC is based on a laboratory water extraction procedure that determines whether the manure or biosolids is likely to leach P.

The biosolids application methods are rated for their risk of leaching P to the watershed. Starting at lowest risk to highest risk, they include:

- Placed or injected two inches or more deep.
- Incorporated less than one week following application.
- Incorporated greater than one week or not incorporated April-October.
- Incorporated greater than one week or not incorporated November-March.

Transport factors assessed by the P Index include:

- The soil loss calculated in the Soil Conservation Plan must be less than 2 tons/acre/year.
- The runoff potential is based on drainage class; i.e. excessively well drained to very poorly drained, with poorly drained soils presenting the highest risk of runoff.
- Subsurface drainage; if there are tile drains or a direct outlet to receiving water.
- Contributing distance to surface water, ranges from greater than 500 feet to less than 100 feet. The closer the field is to surface water, the higher the risk.

All these factors are assigned numerical values. The greater the risk of nutrient loss, the higher the number.

P Index Rating	Nutrient Application Guidance
Low: 59 or less	Nitrogen based management
Medium: 60-79	Nitrogen based management
High: 80-99	Phosphorus limited to crop removal
Zero Threshold: 100 or greater	No additional phosphorus applied

Table 1. Phosphorus management based on results of P Index

Nutrient Management Planners try to minimize the P Index rating. There is not a lot that can be done under transport factors such as location of surface water, slope, soil classification, soil erodibility. But planners could modify how a field is managed to reduce the P Index rating.

HOW BIOSOLIDS MANAGERS CAN HELP FARMERS MEET NUTRIENT MANAGEMENT PLANNING GOALS

Storage and timing: Wastewater treatment plants should be designed to store biosolids so that it is available close to the time the crops need it. For example, large aerobic or anaerobic digesters could provide storage during most of the winter and mid-summer. Also, dewatering equipment could be designed with the capacity to dewater the stored liquid fairly quickly. Field storage on the farm is also feasible provided the dewatered product is 20% total solids or greater.

Produce biosolids with a low Phosphorus Source Coefficient (PSC): Heat dried biosolids, lime stabilized biosolids and composted biosolids have a lower PSC than the standard value of 0.4. Biosolids produced at plants with biological P removal have the highest PSC.

Reduce potential for nutrient loss through erosion using proper placement and rate of application: Land appliers could incorporate biosolids into the soil provided the soil conservation plan allows this practice. Injection of a high solids liquid biosolids could also lower nutrient loss. By placing biosolids into the root zone, any readily available nutrients will be used by the crop and will be less likely to leach.

Suitability for no-till and minimum-till cropping systems: Many farms are converting to no-till to save time plowing, conserve moisture and to improve soil health. It is also a means of reducing erosion and complying with a Soil Conservation Plan. The only tillage allowed in no-till fields is subsurface injection of fertilizer or manure.

Government subsidies: NRCS provides farmers reimbursement for injection of liquid fertilizer or manure rather than for the practice of surface application. There are also subsidies for use of Enhanced Efficiency Fertilizer. Maybe in the future, the slow release nature of biosolids based fertilizers would be recognized and rewarded similarly.

Slow release N and P: Since the N and P are primarily in organic form, they are not all plant available or leachable when applied in the spring. We rely on soil microorganism to break down organic forms of nutrients to plant available

forms. This occurs gradually over the course of the growing season as the growing crop's demand for nutrients increases, thereby reducing the risk of nutrient losses.

Custom blend a fertilizer: Depending on the source of the biosolids, the P loading may exceed demand when the loading to meet the crops nitrogen demand is applied. It is possible to increase the nitrogen and potassium concentrations and custom blend a fertilizer for a farmer's needs.

"NUTRIENT MANAGEMENT PLANNERS TRY TO MINIMIZE THE P INDEX RATING. THERE IS NOT A LOT THAT CAN BE DONE UNDER TRANSPORT FACTORS SUCH AS LOCATION OF SURFACE WATER, SLOPE, SOILCLASSIFICATION, SOIL ERODIBILITY. BUT PLANNERS COULD MODIFY HOW A FIELD IS MANAGED TO REDUCE THE P INDEX RATING."

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[1]Note the date of the last revision was January 2012

Sequence Batch Reactor at Westmoreland

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Pretreatment Compliance Audits

BY JUDY F. MUSSELMAN, BCES, QEP,
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EPA recommends that pretreatment compliance audits (PCA) be conducted of EPA-approved industrial pretreatment programs every five years or so. EPA Region 3 currently contracts with Tetra Tech Inc. to conduct such PCAs at POTWs. Several Pennsylvania facilities were subject to these audits during the past two years. Some of the more common deficiencies noted during these audits will be discussed in this article.

The audit process involves the contractor contacting the POTW with a scheduled audit date. The audit contractor uses checklists similar to those found in a 2010 EPA guidance document and may even provide such checklists to the POTW prior to the site visit. The EPA guidance may be found at: *https://www3.epa.gov/npdes/pubs/final_pca_checklist_and_instructions_%20feb2010.pdf*

Once onsite at the POTW, auditors conduct a data review of various aspects of the industrial pretreatment program for adequacy, including, but not limited to, the following: legal authority, industrial user characteristics (i.e., industrial waste surveys), wastewater discharge permits, applicability of pretreatment standards and requirements, compliance monitoring, enforcement activities, data management, public participation, staff resources, and overall environmental effectiveness and pollution prevention of the industrial pretreatment program. In addition, auditors conduct file reviews of the permitted industrial users and visit at least one or two of the permitted industrial facilities during the day of the audit.

"AUDITORS COMPILE THE FINDINGS FROM THE PRETREATMENT COMPLIANCE AUDIT INTO A FINAL REPORT, WHICH IS DISTRIBUTED TO THE POTW FROM EPA."

Auditors compile the findings from the pretreatment compliance audit into a final report, which is distributed to the POTW from EPA. This report includes requirements and recommendations for improvement to a POTW's industrial pretreatment program. Some of the common deficiencies noted in these PCA reports include the following:

- Failure to conduct periodic industrial waste surveys.
- Failure to report significant noncompliance in local newspaper.
- Missing inspection reports in industrial use file.
- Failure to evaluate need for slug control plan.
- Missing or incomplete chain of custody forms.
- Minimum federal pretreatment standards and requirements not provided in SIU permits.
- Incorrect categorical standard classification for SIU.
- Missing pollutants during routine compliance monitoring of SIU.
- Inconsistent local limits between local ordinance and SIU permit.
- Incomplete sample location identification in SIU permit.
- Lack of fact sheets for SIU permits.
- Failure to implement Enforcement Response Plan.
- Lack of formal procedures for storing SIU confidential business information.
- Lack of formal procedures for handling requests from the public.

That being said, are you ready for your next pretreatment compliance audit? Do your SIU files contain all of the required back-up information? Do your SIU permits contain the necessary pretreatment standards and requirements? When did you last conduct a system-wide industrial waste survey? Good luck!

Smart Pumps Part II

Dumb pumps cost us money

Lenny Lo-Tech[1] is dispatched to Packing Gland, Pennsylvania, to investigate a claim that the plant has installed a second pump robot.

He is interviewing Vicky Volute, plant manager.

After pleasantries, Vicky begins, "Last time I showed you a pump robot that used a variable frequency drive and imbedded pump algorithms to automatically allow the pump to run more efficiently.

Robot Vari

"Since then, we have purchased another robot that monitors a constant speed pump and eliminates pump blockages.

"It is kind of silly, but we name our robots. Vari is our first robot and Sansclog is our newest one.

"As you know, with the introduction of more disposable and allegedly 'flushable' products, pump blockages have become commonplace."

Lenny nods. "Amen. Is your new robot nearby?"

Vicki walks him to another building and opens an electrical panel that is connected to the constant speed pump.

Robot Sansclog

"It doesn't look like a robot. What does it do again?"

"The primary function is to assure the pump doesn't clog."

"How does it work?"

"Lenny, you know over time, debris builds up on the impeller and pump housing. This causes the pump to eventually block and stop working.

The robot detects the blockage and performs a "clean" – a short reverse. The debris is broken down and flushed forward. So, it maintains a clean impeller at all times. It does this using real time monitoring. It eliminates pump blockages before they form."

"How did you learn of this robot?"

"I read in some of the industry association journals that folks in California and Florida had tried and liked Sansclog."

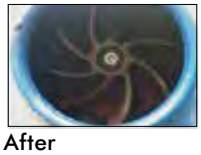
"Based on that you bought it!?"

"No, Sansclog's owner offered us a trial program."

"And what happened?"

Vicki smiles, and shows Lenny two pictures (before and after) from her cell phone.

Before



After

"Usually we have that pump rag-up twice a month. Sansclog has been operating for a year with no clogs."

"So this means your maintenance staff doesn't have to spend time pulling this pump apart and can focus on other priorities?"

"Lenny, absolutely. Additionally, since the robot is watching the pump in real time, it generates a report."

Sansclog Monitoring Report

# of cleans

# of trips over/under current

Phase loss

Motor run hours

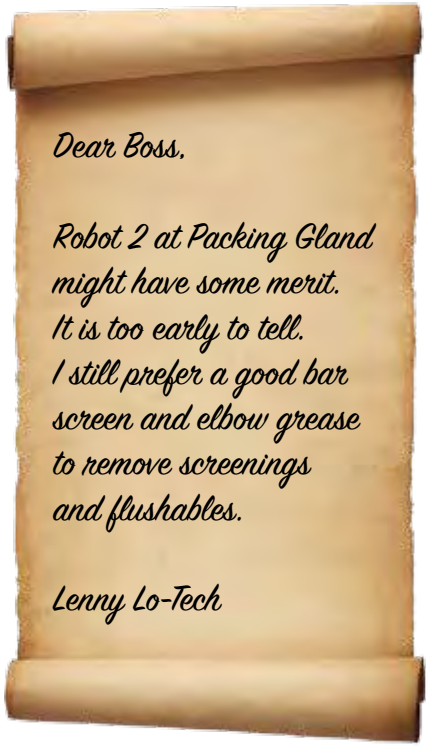
KW hours per pumped flow

Lenny studies the report. "Why does it report on KW hours and motor run time?"

"I forgot to tell you that by using the robot we save energy on the pump operation – around 4%. Also, the other report stats help us schedule our preventive maintenance for the pump."

"Vicky, I need to get back. Thank you for taking the time to show me your robot. You have given me a lot of helpful information I need to sift through before I can write my report."

Lenny, on his return to base, takes out his parchment paper and drafts his report. Readers, **remember** Lenny is an anti-automation advocate!



[1] Lenny is the field representative for Society for the Prevention of Automation (SPA). He is a third-degree Luddite.

ABOUT THE AUTHOR

Mike Nelson is Past President of PWEA. He heads his own firm that specializes in helping operators obtain their DEP certifications and contact hours. Mike is a licensed operator and professional engineer. Refer questions or comments to *mnelsonh2o@aol.com*. His web site is *www.mikenelsonh2o.com*.

Safety Quiz

By the PWEA Safety Committee

1 When presented with naked wires it is important to
- a. Cover them in electrical tape
- b. Warn your co-workers and report it to a superior
- c. Cut the wires so a fire doesn't start
- d. A and C are correct

2 Voltage above which of these levels is considered dangerous?
a. 5 volts b. 30 volts c. 60 volts d. 100 volts

3 Rubber-soled boots prevent exposure to electricity
True False

4 When you come across a tag or lock on a switch
- a. You can turn it on if you are the owner of the equipment
- b. It's alright for you to use this equipment if no one else is already using it
- c. This equipment is restricted from your use
- d. You have to be a manager to utilize this switch

5 When the ground-prong is separated from the equipment plug
- a. You can use the equipment with caution
- b. You can use the equipment if your supervisor gives you a pass
- c. You are restricted from using this equipment
- d. You can only use this if you are the supervisor

ANSWERS are on page 72.

Questions on page 12

Whiz Quiz Answers

Stormwater

1	D	6	C
2	C	7	D
3	D	8	D
4	B	9	E
5	D	10	B

Question 10 detailed solution:

Calculate how many gallons of runoff would be expected from a 200 square foot patio during a 1-inch rainfall event.
Note: The Runoff Coefficient for a patio is 0.98.

Formula: Volume Runoff =
Surface Area x Runoff Coefficient x Rainfall Depth

Volume Runoff = $200ft^2$ x 0.98 x $0.083ft$ = $16.3ft^3$

Convert cu ft. to gallons = $16.3ft^3$ x 7.48 gal/ft^3 = 121.7 gallons

PWEA Delegates

Contribute Their Part to **WEFTEC 2016** in **New Orleans**

Long-time PWEA Members and Past Presidents Carl Janson, Michael Kyle, Douglas Pike, and Dean Miller made substantial contributions to activities, committees, task forces, work groups, and session moderating at WEFTEC 2016.

All of the above PWEA Members served as Delegates in the WEF House of Delegates at WEFTEC 2016. This required an entire day of meetings and activities with the House of Delegates on the day before WEFTEC even got started in New Orleans. In addition to the full day on Saturday, these Delegates attended the Leadership Day event and participated in the Membership and WEFMAX committee meetings. Our Delegates' strong involvement helps build the support between WEF and PWEA.

Part of the activities of that full day included an event where all House of Delegates assisted WEF Young Professionals in a Community Service Project for the City of New Orleans at City Hall directly across the street from the Superdome. At one point during the event, there were a total of 300 Young Professionals and Delegates from the House of Delegates onsite assisting in the Community Service Project.

The WEF Young Professionals have been undertaking a Community Service Project for the past nine years at each WEFTEC location. Each WEFTEC host city benefits from this and demonstrates WEF's dedicated efforts to improve the environment for that host city.

Carl Janson and Douglas Pike currently service as representatives of PWEA in the WEF House of Delegates. Dean Miller serves as Delegate At Large in the WEF House of Delegates and recently completed a three-year term as a representative of PWEA in the WEF House of Delegates. Michael Kyle completed a three-year term as Delegate at Large at WEFTEC 2016 and is continuing to be involved at WEF thru the Committee Leadership Council (CLC).

Ralph Exton, also a PWEA Member, serves as Treasurer for WEF.

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215-785-3000
dmaugle@coynechemical.com
www.coyneenvironmental.com

Data-Command, LLC
526 S. Main St.
Akron, OH 44311
330-294-4477
sale@ddata-command.com
www.data-command.com

DAS Group Inc.
3251C Old Frankstown Rd.
Pittsburgh, PA 15239
724-327-8979
F: 724-733-9066
janine@dasgroupinc.com
www.dasgroupinc.com

Dave Heiner Associates, Inc.
3799 Route 46., Ste. 102
Parsippany, NJ 07054
973-299-9990
F: 973-299-9986
jheiner@daveheinerassoc.com
www.daveheinerassoc.com

Design Plastic Systems, Inc.
2541 General Armistead Ave.
Norristown, PA 19403
610-666-0940
F: 610-666-1806
bbentz@designplasticsystems.com
www.designplasticsystems.com

Edwin Elliott Co., Inc.
P.O. Box 439
Lafayette Hill, PA 19444
610-828-8940
F: 610-828-3892
eeco@edwinelliot.com
www.edwinelliott.com

Geiger Pump & Equipment
830 Tryens Rd.
Aston, PA 19014
610-459-1212
F: 610-459-3992
surban@geigerinc.com
www.geigerinc.com

Geiger Pump & Equipment Co
830 Tryens Rd.
Aston, PA 19014-1533
610-459-5747
F: 610-459-3992
surban@geigerinc.com
www.geigerinc.com

Iron Horse Environmental LLC
PO Box 282
Fairview Village, PA 19409
267-225-0101
F: 610-743-8589
info@ihe-llc.com
www.ihe-llc.com

Joos Equipment Co
PO Box 368
Paoli, PA 19301-0368
610-644-5875
F: 610-889-0819
ejoos@joosequipment.com
www.joosequipment.com

J.T. Seeley & Co., Inc.
PO Box 702
Valley Forge, PA 19482
610-933-5420
F: 610-933-5423
bob.kunzelman@jtseeley.com

Kershner Environmental Technologies
206 Business Center Dr.
Reisterstown, MD 21136
410-581-0555
F: 410-510-1700
t.mazor@ketllc.com
www.ketllc.com

Longo
1 Harry Shupe Blvd.
Wharton, NJ 07885-1646
973-537-0400
F: 973-537-0404
info@elongo.com
www.elongo.com

Mid Atlantic Pump & Equipment Co.
228 N Route 73
Berlin, NJ 08009
856-768-3880
F: 856-768-0925
dzepp@mapeco.com
www.mapeco.com

Perma-Liner Industries LLC
13000 Automobile Blvd., Ste. 300
Clearwater, FL 33762
727-507-9749
F: 727-507-9849
morgan@perma-liner.com

Pyrz Water Supply Co., Inc.
PO Box 107
Harleysville, PA 19438-0107
215-256-8430
F: 215-256-8567
dave@pyrzwater.com
www.pyrzwater.com

Riordan Materials Corporation
6198 Butler Pk., Ste. 150
Blue Bell, PA 19422
215-628-9936
F: 215-628-9979
aauchenbach@riordanmat.com
www.riordanmat.com

Sherwin Williams
357 Northgate Dr., Ste. 6
Warrendale, PA 15086
724-714-1047
F: 724-933-1999
tim.a.bauman@sherwin.com
www.protective.sherwin-williams.com

Sherwood Logan & Associates
370 Middletown Blvd., Ste. 500
Langhorne, PA 19047
610-207-3200
F: 215-702-1402
zalewski.e@sherwoodlogan.com
www.sherwoodlogan.com

TC Tech, LLC
1 Aspen Pl.
Long Valley, NJ 07853
908-294-2140
wdlara@tctechllc.com
www.tctechllc.com

Utility Service Group
1230 Peachtree St. NE., Ste. 1100
Atlanta, GA 30309
855-526-4413
help@utilityservice.com
utilityservice.com

Watermark Environmental Systems, Inc.
558 W Uwchlan Ave.., Ste. 7
Exton, PA 19341
610-363-6515
info@watermarkenvsys.com
www.watermarkenvsys.com

Odor Control

BioTriad Environmental, Inc.
11 Foundry St., Unit 109
Stroudsburg, PA 18360
570-730-4705
F: 570-300-2323
chris@biotriad.com
www.biotriad.com

Coyne Chemical Environmental Services
3015 State Rd.
Croydon, PA 19021-6997
215-785-3000
dmaugle@coynechemical.com
www.coyneenvironmental.com

Kelso Industrial
PO Box 743
East Berlin, PA 17316
717-932-9980
F: 717-932-9985
chris@kelsocompany.com
www.kelsocompany.com

Process Chemicals

Coyne Environmental Services
3015 State Rd.
Croydon, PA 19021
215-785-3000
F: 215-785-1585
dmaugle@coynechemical.com
www.coyneenvironmental.com

Environmental Operating Solutions, Inc.
160 MacArthur Blvd. Unit 6
Bourne, MA 02532-3919
508-322-3080
F: 508-743-8443
info@MicroC.com
www.MicroC.com

Process Control Equipment

AUTOBrine/The Cope Company Salt
549 W Roseville Rd.
Lancaster, PA 17601
717-390-8580
F: 888-602-0013
info@autobrine.com
www.autobrine.com

Coyne Environmental Services
3015 State Rd.
Croydon, PA 19021
215-785-3000
dmaugle@coynechemical.com
www.coyneenvironmental.com

Geo-Precision Solutions, LLC
1120 Ohioview Ave.
Ambridge, PA 15003
724-240-3023
F: 724-266-8161
info@geo-precision.net
www.geo-precision.net

North East Technical Sales, Inc.
171 Ruth Rd.
Harleysville, PA 19438
215-513-1000
F: 215-513-2155
sales@netechsales.com
www.netechsales.com

Process Control Instrumentation

Gilson Engineering Sales
535 Rochester Rd.
Pittsburgh, PA 15237-1747
412-348-3010
F: 412-348-3044
jdf@gilsoneng.com
www.gilsoneng.com

Hach
459 Longleaf Dr.
Perkasie, PA 18944-5418
267-245 2141
orders@hach.com
hach.com

High Tide Technologies
2506 Grandview Ave.
Nashville, TN 37211
615-256-6678
email@htt.io
www.htt.io

Miller Energy Inc.
3200 South Clinton Ave.
South Plainfield, NJ 07080
908-755-6700
cmiller@millerenergy.com
www.millerenergy.com

VEGA Americas, Inc.
4170 Rosslyn Dr.
Cincinnati, OH 45209
1-800-FOR LEVEL
Americas@vega.com
www.vega-americas.com

Safety Equipment

Pennsylvania One Call System, Inc.
925 IrwinRun Rd.
West Mifflin, PA 15122
570-212-2938
jplarkin@pa1call.org

Trumbull Mfg
1040 N. Meridian Rd.
Youngstown, OH 44501
330-270-7896
F: 330-270-3077
bprogers@trumbull.com
www.trumbull-mfg.com

Wastewater/Waste Treatment Services & Equipment

Abel Recon
PO Box 476
Mountville, PA 17554-0476
717-285-3103
info@abelrecon.com
www.abelrecon.com

Aqua-Aerobic Systems, Inc.
6306 North Alpine Rd.
Loves Park, IL 6111
815-654-2501
F: 815-654-2508
solutions@aqua-aerobic.com
www.aqua-aerobic.com

Aqualitec Corp.
3415 S. Sepulveda Blvd., Ste. 1100
Los Angeles, CA 90034
310-703-2174
info@aqualitec.com
www.aqualitec.com

Best Management Products, Inc.
506 Beck Ave.
Baltimore, MD 21221
800-504-8008
tjm@bmpinc.com
www.bmpinc.com

Bioscience, Inc.
966 Postal Rd., Ste. 200
Allentown, PA 18109
484-245-5232
F: 484-245-5236
bioscience@bioscienceinc.com
www.bioscienceinc.com

BissNuss Inc.
2600 Boyce Plaza Rd., Ste. 141
Pittsburgh, PA 15241-3949
412-221-1200
F: 412-221-5952
rbible@bissnussinc.com
www.bissnussinc.com

Blue Water Technologies, Inc.
10450 N Airport Rd.
Hayden, ID 83835
225-620-2376
sales@bluewater-technologies.com
www.bluewater-technologies.com

Boerger, LLC
2860 Water Tower Pl.
Chanhassen, MN 55317
612-435-7300
F: 612-435-7301
america@boerger.com
www.boerger.com

Cabot Norit Activated Carbon
118 Courter Rd.
Franklin Lakes, NJ 07417
201-248-0697
howard.yerger@cabotcorp.com

Charter Machine Co.
720 W Prospect Ave.
North Wales, PA 19454
215-661-9580
chrisb@chartermachine.com
www.chartermachine.co

Wastewater/Waste Treatment Services & Equipment (cont'd)

Daman Superior LLC
754 Kittanning Hollow Rd.
East Brady, PA 16028
724-526-5714 ext 17
F: 724-526-5277
jcurran@damansuperior.com
www.damansuperior.com

Duperon Corporation
1200 Leon Scott Ct.
Saginaw, MI 48601
989-754-8800
F: 989-754-2175
vpopp@duperon.com
www.duperon.com

Dutchland, Inc.
160 Route 41
Gap, PA 17527
717-442-8282
F: 717-442-9330
dbeiler@dutchlandinc.com
www.dutchlandinc.com

Entech Engineering, Inc.
PO Box 32
Reading, PA 19603-0032
610-373-6667
F: 610-373-7537
sgunning@entecheng.com
www.entecheng.com

Envirep/TLC
3705 Trindle Rd.
Camp Hill, PA 17011-4334
717-761-7884
F: 717-737-5817
gsummers@envirep.com
www.envirep.com

Environmental Engineering & Management Associates, Inc.
PO Box 232
Kulpsville, PA 19443
215-368-3375
egillette@eema-inc.com
www.eema-inc.com

Environmental Training Center – Delaware Technical Community College
21179 College Dr.
Georgetown, DE 19947
302-259-6384
hvalent2@dtcc.edu
www.dtcc.edu/owens/ccp

Evoqua Water Technologies
181 Thorn Hill Rd.
Warrendale, PA 15086
724-772-0044
F: 724-772-1300
robert.biase@evoqua.com
www.evoqua.com

Excelsior Blower Systems, Inc.
331 June Ave.
Blandon, PA 19510
610-921-9558
F: 610-921-9727
ted@excelsiorblower.com
www.excelsiorblower.com

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10700 Toebben Dr.
Independence, KY 41051
859-448-2300
F: 859-448-2333
sales@flottweg.net
www.flottweg.com

Franklin Miller, Inc.
60 Okner Pkwy.
Livingston, NJ 07039
973-535-9200
info@franklinmiller.com
www.franklinmiller.com

F.R. Mahony & Associates, Inc.
273 Weymouth St.
Rockland, MA 02370
781-982-9300
F: 781-982-1056
dennisgeran@frmahony.com
www.amphidrome.com

FSRC Tanks Inc.
11029 Industrial Pkwy. NW
Bolivar, OH 44612
234-221-2015
F: 234-221-2017
jbergener@fsrctanks.com
www.fsrctanks.com

Gibson-Thomas Engineering
PO Box 853
Latrobe, PA 15650
724-539-8562
reneestantoine@gmail.com
www.gibson-thomas.com

Greeley and Hansen
1700 Market St.., Ste. 2130
Philadelphia, PA 19103-3613
215-563-3460
www.greeley-hansen.com

Hydro International
2925 NW Aloclek Dr.., Ste. 140
Hillsboro, OR 97124
866-615-8130
wwinquiryus@hydro-int.com
www.hydro-int.com

Inovair
14801 W 114th Ter.
Lenexa, KS 66215
913-469-7244
F: 913-338-2879
glen.roderiques@inovair.com
www.inovair.com

IPM Systems, LLC
4225 NE Port Dr.
Lee's Summit, MO 64064
816-795-6333
F: 816-795-6030
sales@ipm-sys.com
www.ipm-sys.com

JDV Equipment Corporation
1 Princeton Ave.
Dover, NJ 07801
973-366-6556
sales@jdvequipment.com
www.jdvequipment.com

Kappe Associates
100 Wormans Mill Ct.
Frederick, MD 21701
301-846-0200
F: 301-846-0808
jweiand@kappe-inc.com
www.kappe-inc.com

Keystone Pump & Power
1480 S Mountain Rd.
Dillsburg, PA 17019
717-502-8500
F: 717-502-8510
lisa@kpprents.com

KLH Engineers, Inc.
5173 Campbells Run Rd.
Pittsburgh, PA 15205
412-494-0510
F: 412-494-0426
info@klhengineers.com
www.klhengineers.com

LRM, Inc.
215 N Main St.
Souderton, PA 18964
215-721-4840
F: 215-721-4923
mcrawford.lrm@comcast.net

Maryland Biochemical Company
712 Tobacco Run Dr.
Bel Air, MD 21015-1330
410-734-9100
F: 410-734-9102
info@marylandbiochemical.com
www.marylandbiochemical.com

Medora Corp.
3225 Hwy 22
Dickinson, ND 58601
866-437-5076
info@medoraco.com
www.medoraco.com

Mid Atlantic Storage Systems, Inc.
1551 Robinson Rd.
Washington Court House, OH 43160
740-335-2019
F: 740-335-0584
nancy@midatlanticstorage.com
www.midatlanticstorage.com

Nelson Environmental Inc.
101 Falls Rd., Ste. 406
Grafton, WI 53024
262-375-1870
F: 204-237-0660
info@nelsonenvironmental.com
www.nelsonenvironmental.com

Philadelphia Mixing Solutions
1221 E Main St.
Palmyra, PA 17078
717-832-8831
sgable@philamixers.com
www.philamixers.com

Preload, LLC
2613 Industrial Ln.
Garland, TX 75041
972-994-0550
F: 972-994-0845
dwilson@preload.com
www.preload.com

ProChemTech International Inc.
51 ProChemTech Dr.
Brockway, PA 15824
814-265-0959
prochem@prochemtech.com
www.prochemtech.com

Pure Technologies U.S. Inc.
3040 Rte 22 W., Ste. 130
Branchburg, NJ 08876
908-526-6600
F: 908-526-9900
allison.wolfe@puretechltd.com
www.puretechltd.com

RAM Industrial Services, LLC
1095 Montour West Industrial Blvd.
Corapolis, PA 15108
724-695-5333
mpresutti@rammotors.com
www.rammotors.com

Smith & Loveless Inc.
14040 Santa Fe Trail Dr.
Lenexa, KS 66215
913-888-5201
answers@smithandloveless.com
www.smithandloveless.com

SSM Group, Inc.
1047 North Park Rd.
Reading, PA 19610
610-621-2000
F: 610-621-2001
information@ssmgroup.com
ssmgroup.com

Suez Water Advanced Solution
1230 Peachtree St. NE., Ste. 1100
Atlanta, GA 30309
855-526-4413
help@utilityservice.com
www.utilityservice.com

The Kerry Company, Inc.
PO Box 51
Alison Park, PA 15101
412-486-3388
F: 412-486-7449
info@kerryactuator.com
www.kerryactuator.com

USABlueBook
PO Box 9005
Gurnee, IL 60031
847-377-5162
customerservice@usabluebook.com
www.usabluebook.com

USP Technologies
900 Circle 75 Pkwy., Ste. 1330
Atlanta , GA 30339
404-352-6070
info@usptechnologies.com
www.usptechnologies.com

Vogelsang
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Ravenna, OH 44266
330-510-1548
F: 330-296-4113
johnr@vogelsangusa.com
www.vogelsangusa.com

W.C. Weil Company
PO Box 199
Allison Park, PA 15101
412-487-7140
F: 412-487-7144
gmadia@wcweil.com
www.wcweil.com

Xylem Water Solutions
2330 Yellow Springs Rd.
Malvern, PA 19355
610-408-6526
F: 610-647-5563
christopher.candy@xyleminc.com
www.xyleminc.com

Membership Application

Use this application form to join the Pennsylvania Water Environment Association (PWEA) or a combined membership in the Water Environment Federation (WEF) and PWEA. It is important that all information fields are filled in – the information helps WEF and PWEA to better serve its members. **Renewal statements for all membership categories are based on the anniversary date of a member's join date.**

First Name _____ **Middle Initial** _____ **Last Name** _____

Title or Position _____ **Employer/Business Name** _____

Employer/Business Address _____ **City** _____ **State** _____ **Zip + 4-digit ext.** _____

Home Address _____ **City** _____ **State** _____ **Zip + 4-digit ext.** _____

Preferred Mailing Address: ☐ Business ☐ Home

Email Address (*The eNewsletter, Job Board and other important Association information is sent by email only.*) _____
By providing your email address, you consent to receiving electronic communications from PWEA.

Business phone: ( ) _____ Referred to PWEA by: _____

Cell phone: ( ) _____ ☐ Certified Drinking Water Operator ☐ Certified Wastewater Operator

Home phone: ( ) _____ PA DEP Client ID# _____ PE License # _____

Membership Categories (*select one*)	Publications Included with Membership	Dues
☐ **STATE ASSOCIATION (PWEA) ONLY**	✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$55
☐ **PROFESSIONAL Membership Package (WEF & PWEA)** Choose this category if you are involved in or interested in water quality.	✓ *Water Environment & Technology* ✓ *WEF Highlights Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$195
☐ **PROFESSIONAL WASTEWATER OPERATIONS (PWO) Membership Package (WEF & PWEA)** Choose this category if you are involved in the day-to-day ***maintenance or operation*** of a wastewater collection, treatment, or laboratory facility.	✓ *Water Environment & Technology* ✓ *WEF Highlights Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA Newsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$130
☐ **YOUNG PROFESSIONAL Membership Package (WEF & PWEA)** Choose this category if you are age 35 or younger. **Documentation verifying age must accompany membership application**.	✓ *Water Environment & Technology* ✓ *WEF Highlights Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$104
☐ **ACADEMIC Membership Package (WEF & PWEA)** Choose this category if you are an Instructor or Professor interested in subjects related to water quality.	✓ *Water Environment & Technology* ✓ *WEF Highlights Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$195
☐ **STUDENT Membership Package (WEF & PWEA)** Choose this category if you are a full-time student, in an accredited college or university. **Documentation verifying current full-time student status must accompany membership application**.	✓ *Water Environment & Technology* ✓ *WEF Highlights Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$35
☐ **EXECUTIVE Membership Package (WEF & PWEA)** Choose this category if you are an upper level manager interested in an expanded suite of WEF products/services.	✓ *Water Environment & Technology* ✓ *WEF Highlights Online* ✓ *Water Environment Research Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$365
☐ **CORPORATE Membership Package** (WEF & PWEA) ***One person is designated to receive member benefits on behalf of the company***. Companies engaged in the design, construction, operation or management of water quality systems. ***Designate one corporate contact.***	✓ *Water Environment & Technology* ✓ *Water Environment Regulation Watch* ✓ *WEF Highlights Online* ✓ *Water Environment Research Online* ✓ *WEF Conference Proceedings Online* ✓ *Keystone Water Quality Manager* ✓ PWEA eNewsletter (Email & Online) ✓ PWEA Job Board (Email & Online)	$498

Continued on Page 2

Please provide the following information.

How many years have you worked in the water or wastewater sectors?	Education Level:	Optional Information: (Used for Demographic Charting)
☐ 1-5	☐ High School	**Date of Birth:**
☐ 6-10	☐ Technical School	_____/_____
☐ 11-20	☐ Some College	Month Year
☐ 21-30	☐ Associates Degree	**Are you under the age of 35?**
☐ > 30	☐ Bachelor's Degree	☐ Yes ☐ No
	☐ Master's Degree	
	☐ PhD	

Join Online: www.pwea.org

Fax membership application w/credit card payment to: 717-642-9508

Scan and email membership application w/credit card payment to: pwea@pwea.org

Mail membership application with payment to: PWEA, PO Box 3367 – Gettysburg, PA 17325

☐ **Check Enclosed** (made payable to PWEA) ☐ **VISA** ☐ **MasterCard** ☐ **American Express**

Credit Card # _____

3- or 4-digit Security Code from back of card _____ Expiration Date: _____

Name as it appears on credit card: _____

Billing address of credit card: _____
Address

_____ _____ _____
City State Zip

Call us at 717-642-9500 with questions.

CALLING ALL OPERATORS

Are you up to the challenge?

PennTec 2017 89th Annual Technical Conference & Exhibition

PWEA will hold an Operations Challenge on Monday and Tuesday, June 5-6, during PennTec 2017 in Pocono Manor. This is a team event with the winning team going on to represent PWEA at the National Operations Challenge during WEFTEC 2017. If you would like to participate in the Operations Challenge, please submit your team registration by completing and returning this form by April 28, 2017. Teams must register for the PennTec Conference. A special discounted fee will be offered to team members.

Operations Challenge Registration Form

Team Name _____ Coach Name _____

Team Members _____

_____

_____

Organization _____

Address _____

Phone _____ Fax _____

Email _____

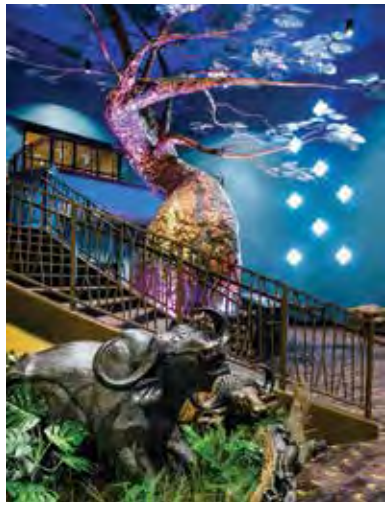
MAIL OR FAX FORM TO: PWEA Ops Challenge Registration, PO Box 61, Blossburg, PA 16912
FAX: 570-549-2221 **PHONE:** 570-549-2204 ***Registration Deadline is April 28, 2017.***

PWEA is pleased to announce that the **PennTec 2017 Conference will be held at the Kalahari Resort in the Pocono Mountains on June 4-7**. The Kalahari offers just about everything you would need for a great conference experience combined with a fun family vacation!

The spirit of Africa is reflected in every aspect of Kalahari – from the handpicked Rwandan coffee beans that are brewed on-property, handcrafted artwork on the convention center walls, furniture placed in guest rooms, recorded music from the streets of Cape Town echoing in the resorts and original crafts for guest souvenirs.

The Kalahari delivers a "world away" family resort and conference experience, featuring a variety of amenities for guests to enjoy, including:

- Pennsylvania's Largest Indoor Waterpark – 100,000 square feet!
- Outdoor Waterpark with a huge outdoor pool, large sundeck, indoor/outdoor whirlpools, and swim-up bar
- Family Entertainment Center, featuring mini-bowling, arcade games, a 5-D theater, black light mini golf and more
- Three full-service signature dining experiences
- Spa Kalahari & Salon and other unique retail space



Phase II of construction is currently underway and projected to open in spring of 2017. Once completed, the indoor waterpark will double in size. Other additions include: new restaurants and retail shops, a Wave Pool and expanded family entertainment center, Lazy River, and an outdoor activities pool. All of this will be in place for **PennTec 2017**!

The room rate for PennTec attendees is $169 per night for June 4-6.
This rate includes up to four waterpark passes per room.

Don't want to wait until the Conference? To learn more and to book your own adventure at Kalahari Resorts and Conventions, visit www.KalahariResorts.com.





PennTec 2017 89th Annual Technical Conference & Exhibition

PENNTEC 2017
PRELIMINARY SCHEDULE

(as of December 1, 2016)

Visit www.pwea.org for the most current program schedule.

Sunday, June 4

9:00am-3:00pm	Golf Tournament
3:00-5:00pm	Registration Open

Monday, June 5

7:30am-5:30pm	Registration Open
8:00-9:00am	Continental Breakfast in Exhibit Hall
9:00-11:45am	Morning Techincal Programs *Biosolids* *Collection Systems* *Engineering* *Stormwater* *Utility Management*
9:00am-4:30pm	Workshops *Courses to be announced*
11:45am-1:00pm	Complimentary Lunch in Exhibit Hall
12:30-1:00pm	Annual Business Meeting with Dessert & Coffee
1:00-3:30pm	PWO Plant Tour
1:00-4:30pm	Afternoon Technical Programs *Biosolids* *Collection Systems* *Engineering* *Utility Management*
2:30-3:30pm	Break Refreshments in Exhibit Hall
4:30-5:30pm	President's Reception in Exhibit Hall
6:00-9:00pm	Annual PWEA Awards Ceremony & Annual Dinner

Tuesday, June 6

7:00-8:30am	Continental Breakfast in Exhibit Hall
7:00am-5:30pm	Registration Open
8:00-11:30am	Morning Technical Programs *Collection Systems* *Engineering* *Industrial Pretreatment* *Water Sustainability & Reuse*
8:00-11:30am	SYP Professional Development Program
8:00am-4:30pm	Workshops *Courses to be announced*
9:00am-12:00pm	Operations Challenge
9:30-10:30am	Break Refreshments in Exhibit Hall
11:30am-1:00pm	Complimentary Lunch in Exhibit Hall Student Research Poster Presentations
12:30-1:30pm	Career Fair (tentative)
1:00-4:30pm	Afternoon Technical Programs *Collection Systems* *Construction* *Finance* *Industrial Pretreatment*
1:00-4:30pm	Student Resarch Podium Presentations
2:30-3:30pm	Break Refreshments in Exhibit Hall
4:30-5:30pm	Beer & Pretzels Reception in Exhibit Hall Operator Olympics in Exhibit Hall
6:00-9:00pm	Social Event *(details to be announced)*

Wednesday, June 7

7:00-8:30am	Continental Breakfast
7:00am-12:00pm	Registration Open
8:00-11:00am	Morning Technical Programs *Professional Wastewater Operations* *Water Sustainability & Reuse*
8:00-11:30am	Workshops *Courses to be announced*
9:30-10:00am	Break Refreshments
11:30am	Conference Concludes

PENNTEC 2017
JUNE 4-7, 2017

Kalahari RESORTS & CONVENTIONS

KALAHARI RESORT
POCONO MANOR, PA

VENDOR OPPORTUNITIES AT PENNTEC 2017

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- Advertising in the On-Site Conference Program

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Booth assignments are confirmed upon receipt of paid contracts. The Exhibit Hall typically sells out, so send your booth contract right away. You don't want to miss this opportunity!

LOOK FOR YOUR EXHIBITOR PROSPECTUS IN JANUARY.

PennTec 2017 89th Annual Technical Conference & Exhibition

Questions?
Contact Cindy Rock
(570) 549-2204
cindyrock@pwea.org

KALAHARI RESORT, POCONO MANOR, PA
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Safety Quiz

ANSWER KEY

1. B
2. B
3. F
4. C
5. C

QUESTIONS on page 55

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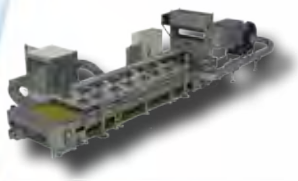

WATER BOOSTER SYSTEMS

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GRIT SYSTEMS

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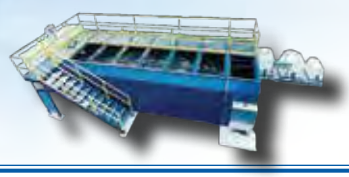

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