SPECIAL ISSUE: Stormwater

In this issue:

• 2017 Annual Business Directory
• Strategies for Addressing Pennsylvania’s Chesapeake Bay and TMDL-Related Pollutant Reduction Requirements for Small MS4s
• PWEA Delegates Contribute to WEFTEC 2016 in New Orleans
<table>
<thead>
<tr>
<th><strong>AERZEN</strong>: Positive Displacement and Turbo Blowers</th>
<th><strong>GORMAN-RUPP</strong>: Wastewater Pumping Stations, Sewage and Sludge Pumps, Water Booster Stations, Submersible Pumps, Engine Driven Pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMT</strong>: Small Utility Pumps, Sump Pumps</td>
<td><strong>HERON INNOVATORS</strong>: Suspended Air® Flotation (SAF™) Systems</td>
</tr>
<tr>
<td><strong>ANDRITZ</strong>: Centrifuges, Belt Filter Presses, Screw Presses, Thickeners, Sludge Dryers, Screening Equipment</td>
<td><strong>H-TEC</strong>: Air Release and Vacuum Valves</td>
</tr>
<tr>
<td><strong>ANOKKALDNES</strong>: IFAS and MBBR Systems for BNR, ENR and Plant Expansion Applications</td>
<td><strong>KRUGER</strong>: BIOSTYR™, ACTIFLO™ and BIOACTIFLO™ Systems, Oxidation Ditches and Pure Oxygen Activated Sludge Systems, NEOSEP™ MBRs, Class A Sludge Systems, Potable Water Membrane Filtration Systems, STAMO Vertical Shaft Mixers</td>
</tr>
<tr>
<td><strong>AQUARIUS</strong>: Fine and Coarse Bubble Aeration Systems, Fixed Biofilm System (FBS), Advanced Biological Systems</td>
<td><strong>LIQUID TECH</strong>: Bolted Stainless Steel Tanks</td>
</tr>
<tr>
<td><strong>CUSTOM CONVEYOR CORPORATION</strong>: Screw Conveyors, Belt Conveyors</td>
<td><strong>OMNISITE</strong>: Web Based Cellular Monitoring</td>
</tr>
<tr>
<td><strong>D.R. CORDELL</strong>: Dumpster-Veyor™ Container Handling Systems</td>
<td><strong>PATTERSON FLO-PAK</strong>: Water Booster Pumping Systems</td>
</tr>
<tr>
<td><strong>EBARA FLUID HANDLING</strong>: Wet Pit and Dry Pit Submersible Pumps</td>
<td><strong>PURAFIL</strong>: Odor Control and Gas Scrubbers</td>
</tr>
<tr>
<td><strong>ECOVERDE</strong>: Odor Control Systems</td>
<td><strong>PW TECH</strong>: Volute Dewatering Presses and Thickeners, CSO/SSO Products</td>
</tr>
<tr>
<td><strong>EGGER TURO PUMPS</strong>: Centrifugal Pumps and Iris Control Valves</td>
<td><strong>RAMPARTS</strong>: Air Operated Diaphragm Pumps</td>
</tr>
<tr>
<td><strong>ENGINEERED TREATMENT SYSTEMS</strong>: Closed Vessel UV Disinfection Systems</td>
<td><strong>SHELTER WORKS</strong>: Fiberglass Enclosures</td>
</tr>
<tr>
<td><strong>ENVIRO-CARE</strong>: Screens, Septage Receiving Units, Solids/Grit Handling Equipment</td>
<td><strong>SPS ENGINEERING</strong>: Circular Clarifiers, Thickeners, Flocculators, Rotary Distributors</td>
</tr>
<tr>
<td><strong>ENVIRONETICS</strong>: Floating Baffles and Covers, Clearwell Baffles</td>
<td><strong>THERMAL PROCESS SYSTEMS</strong>: ThermAer™ ATAD Class A Biosolids Reduction Process, MesoAer™ Class B Biosolids Reduction Process</td>
</tr>
<tr>
<td><strong>FONTAINE-AQUANOX</strong>: Stainless Steel Slide Gates, Stop Logs</td>
<td><strong>VOGELSANG</strong>: Rotary Lobe Sludge Pumps and In-Line Grinders</td>
</tr>
<tr>
<td><strong>FRANKLIN ELECTRIC</strong>: Grinder Pumps and Pump Stations, Package Submersible Pump Stations</td>
<td><strong>VULCAN INDUSTRIES</strong>: Screens, Thickeners, Grit Handling Equipment</td>
</tr>
<tr>
<td><strong>G.E.T. INDUSTRIES</strong>: GrindHog™ Comminutors</td>
<td></td>
</tr>
</tbody>
</table>

**PHILADELPHIA OFFICE**
Phoenixville, PA

**MARYLAND OFFICES**
Marriottsville, MD
Fallston, MD
BMP, Inc. makes stormwater quality affordable!

Make the most of your stormwater dollars with the SNOUT® system. More than 65,000 SNOUTs have been installed in North America since 1999. We have stormwater quality experts on staff to help you design with the SNOUT, Bio-Skirt, Stainless Steel TrashScreen and SAFL Baffle.

Whether it is for highway or municipal drainage, government facilities, harbor use, educational or healthcare institutions, LID, or commercial and industrial development— we have the experience. **Now get verified T.S.S. reductions with the SAFL Baffle.** Visit bmpinc.com or call 800-504-8008.

US Patents 6126817, 7951294, 7857966, 8512556
Canada Patent 2285146, 2688012, 2690156 Others Pending
The SAFL Baffle is a patented and trademarked product of Upstream Technologies, Inc.
Eastern & Central PA, Southern NJ & DE

AbTech Industries
Acme Engineering Products
Acrison, Inc.
Aerator Solutions, Inc.
Albin Peristaltic Pumps
Amiad Filtration Systems
ASA Analytics Chemscan®
Atlas-Copco Blowers
AWI Phoenix® Underdrains
Axiall Accu-Tab® Systems
BDP Industries
Binder Group
BlueInGreen®
Branch Environmental Corp.
Centrisys Centrifuges
CNP PONDUS & Airprex
Concord Screen
DDI Heat Exchangers
De Nora UltraDynamics UV
DMP
Dynatec Systems, Inc.
ElectroCell
EMG International
Entex Technologies
Envirodyne Systems, Inc.
EPI Chopper Pumps
FIBREPlate™ MBR
Fluid Dynamics DynaBlend®
Fluidyne Corporation
FRC DAF Systems
FTC Tanks
Guardian Environmental Technologies
Guardian Ozone
HRS Heat Exchangers
ICS Filter Magic Filter Controls
ITP Clarifier CleanSweep
ITP miniMBR
Keystone Conveyor Corporation
MFG Water Treatment Products
Neptune Chemical Pump & Mixer Co.
Orenco Systems, Inc.
Parkson Corporation
PAX Water RCS
PCI Oxygen Systems
Philadelphia Mixing Solutions, Inc.
Pinnacle Ozone Solutions
Prime Solution, Inc.
QCEC Samplers
Separmatic DE Filters
Shand & Jurs
Spaans Babcock
SSI Diffused Aeration Systems
Tarsco Bolted Tanks
Tuthill PD Blowers by Gasho
UltraTech UV Systems, Inc.
Vapex Environmental Technologies
Wastecorp Pumps
Waterman Industries
Wigen Water Technologies

Aeration Systems
Analytical Instrumentation
Biological BNR/ENR Processes
Blowers & Compressors
Chemical Feed Systems
Clarifiers
Belt & Screw Conveyors
Pumps
Covers & Enclosures
Filtration Systems
Floculation & Mixing
Industrial Wastewater
Membrane Filtration
Odor Control
Screening Systems
Grit Removal Systems
Sludge Dewatering

Chris Evans
E. PA, S. NJ & DE Municipal
215-668-1746
c.evans@ketllc.com

John Tremblay
E.PA & S. NJ Industrial
610-392-1863
j.tremblay@ketllc.com

David Kershner
PA, NJ & DE Aftermarket
215-896-4849
d.kershner@ketllc.com

Anne Marek
Central PA
215-589-2162
a.marek@ketllc.com
FEATURES

COVER STORY

15 Achieving Water Quality Goals With Green Infrastructure

23 Recommendations for Cost-Effective Urban Stormwater BMPs to Achieve Pollutant Load Reductions

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

31 The Hampden Township Sewer Authority – Funding Stormwater

34 What Every Authority Should Ask Before Taking Over Stormwater

36 Stormwater Fees: Better Together?

41 Defining the Future of Urban Stormwater Management in Pennsylvania

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

47 Biosolids Corner

51 Pretreatment Corner

53 Spotlight on Savings

57 Delegates at WEFTEC

59 2017 Business Directory

DEPARTMENTS

7 Editor’s Message

9 President’s Message

10 Member News

11 Calendar of Events

12 Whiz Quiz

55 Safety Quiz

72 Professional Directory

56, 72 Quiz Answers

74 Index of Advertisers
MARCH 2017

david@kelman.ca
Manager advertising for the Keystone Water Quality Manager, Harrisburg, PA 17110 or via teleconference.

3605 Vartan Way, Suite 202, the CDM Smith Harrisburg office at February 10, 2017 advertising deadline January 13, 2017 editorial board meeting.

**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.

**NOTICE TO ALL READERS**

The concepts, ideas, procedures and opinions contained in the articles in this publication are those as expressed by the various authors who submit the material for publication. The Pennsylvania Water Environment Association, its Board of Directors, the Editor, the Editorial Administrator and the Editorial Staff hereby assume no responsibility for any errors or omissions in the articles as presented in this publication, nor are the concepts, ideas, procedures and opinions contained in these articles necessarily recommended or endorsed as valid or invalid by the Pennsylvania Water Environment Association, its Board of Directors, the Editor, the Editorial Administrator or the Editorial Staff. All persons reading this publication should do so only with this aforementioned disclaimer in mind.

**KEYSTONE WATER QUALITY MANAGER**

PO Box 3367, Gettysburg, PA 17325
Phone: 717-642-9500 Fax: 717-642-9508
www.pwea.org | pwea@pwea.org

**Editor**
Brian Lubenow, 717-560-7500, pweaeditor@pwea.org

**Publisher**
Craig Kelman & Associates, www.kelmanonline.com, 866-985-9780, info@kelman.ca

**Editorial Committee Members**

Assistant Editor: Karl Shellenger, PE (State College) 814-237-7111
Brian Book (State College) 814-470-0778
Kelly Brenner (Lancaster) 717-560-2788
Jeff Cantwell (West Chester) 610-918-3857
Peter Flezza, PE (Hummelstown) 717-731-1579
Sean Furianic (Harrisburg) 717-787-2137
Jennifer Kintzer (Mohrsville) 717-269-6249
Dennis Michael (Harrisburg) 717-564-1121
Josh Owens (Williamsport) 570-323-6603
Mark Pickering, PE (Camp Hill) 717-763-7211
Meredith Welle (Pittsburgh) 412-497-6249

**PWEA Board of Directors**

President: Larry Fair (Palmyra) 717-867-3050
First Vice President: Michael Sedon (Cranberry Township) 724-776-4806
Second Vice President: Kevin Shannon (Harrisburg) 717-541-0622
First Past President: Brian Book (Williamsport) 570-244-3571
Second Past President: Daniel Slagle (Moon Township) 412-269-9440
Secretary/Treasurer: Scot Fertich (Lancaster) 717-299-4843 x25

Editor: Brian Lubenow (Lancaster) 717-560-7500
First Federation Delegate: Carl Janson (Blue Bell) 215-628-9936
Second Federation Delegate: Douglas Pike (Greensburg) 724-850-7417
WEP Delegate-at-Large: Dean Miller (Doughlassville) 610-937-0574
PWO Director: Carrie Keeley (Philadelphia) 215-685-8007
Young Professionals Director: Anthony Elberti (Audubon) 610-650-8101
Central Section Director: Nicholas Sahd (Elizabethtown) 717-367-9697
Eastern Section Director: Tina Myers (New Holland) 717-354-2345
Western Section Director: Joseph Rost (Renfrew) 724-789-7345

**Staff Contacts**


**NOTICE TO ALL READERS**

The concepts, ideas, procedures and opinions contained in the articles in this publication are those as expressed by the various authors who submit the material for publication. The Pennsylvania Water Environment Association, its Board of Directors, the Editor, the Editorial Administrator and the Editorial Staff hereby assume no responsibility for any errors or omissions in the articles as presented in this publication, nor are the concepts, ideas, procedures and opinions contained in these articles necessarily recommended or endorsed as valid or invalid by the Pennsylvania Water Environment Association, its Board of Directors, the Editor, the Editorial Administrator or the Editorial Staff. All persons reading this publication should do so only with this aforementioned disclaimer in mind.

**KEYSTONE WATER QUALITY MANAGER**

PO Box 3367, Gettysburg, PA 17325
Phone: 717-642-9500 Fax: 717-642-9508
www.pwea.org | pwea@pwea.org

**Editor**
Brian Lubenow, 717-560-7500, pweaeditor@pwea.org

**Publisher**
Craig Kelman & Associates, www.kelmanonline.com, 866-985-9780, info@kelman.ca

**Editorial Committee Members**

Assistant Editor: Karl Shellenger, PE (State College) 814-237-7111
Brian Book (State College) 814-470-0778
Kelly Brenner (Lancaster) 717-560-2788
Jeff Cantwell (West Chester) 610-918-3857
Peter Flezza, PE (Hummelstown) 717-731-1579
Sean Furianic (Harrisburg) 717-787-2137
Jennifer Kintzer (Mohrsville) 717-269-6249
Dennis Michael (Harrisburg) 717-564-1121
Josh Owens (Williamsport) 570-323-6603
Mark Pickering, PE (Camp Hill) 717-763-7211
Meredith Welle (Pittsburgh) 412-497-6249

**PWEA Board of Directors**

President: Larry Fair (Palmyra) 717-867-3050
First Vice President: Michael Sedon (Cranberry Township) 724-776-4806
Second Vice President: Kevin Shannon (Harrisburg) 717-541-0622
First Past President: Brian Book (Williamsport) 570-244-3571
Second Past President: Daniel Slagle (Moon Township) 412-269-9440
Secretary/Treasurer: Scot Fertich (Lancaster) 717-299-4843 x25

Editor: Brian Lubenow (Lancaster) 717-560-7500
First Federation Delegate: Carl Janson (Blue Bell) 215-628-9936
Second Federation Delegate: Douglas Pike (Greensburg) 724-850-7417
WEP Delegate-at-Large: Dean Miller (Doughlassville) 610-937-0574
PWO Director: Carrie Keeley (Philadelphia) 215-685-8007
Young Professionals Director: Anthony Elberti (Audubon) 610-650-8101
Central Section Director: Nicholas Sahd (Elizabethtown) 717-367-9697
Eastern Section Director: Tina Myers (New Holland) 717-354-2345
Western Section Director: Joseph Rost (Renfrew) 724-789-7345

**Staff Contacts**

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.

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 of 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.

Nathan Walker
Stormwater Chair

“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.”

Brian Lubenow, PE, BCEE
Editor
Enhance Nitrification the Natural Way!

Use targeted Ammonia oxidizing microbial strains for reseeding nitrifying systems and enhancing performance under toxic, inhibitory or cold-weather conditions.

When used on a preventive maintenance basis, they can improve the consistency of ongoing nitrification and improve overall system performance.

Try field proven MICROCAT® Microbial Formulations

Contact us for more information

Bioscience, Inc. has been a global leader in wastewater treatment and monitoring for over 30 years.
A New Year

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
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.

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 ............ Bryan 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.

HYDRO INTERNATIONAL UNVEILS ITS ADVANCED HYDRO MICROSCREEN™ 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 MicroScreen™ 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:
800-733-7884, sales@envirep.com, www.envirep.com

Iron Horse Environmental
Managers Representative

Water & Wastewater Equipment & Services
610-222-2525 • info@ihe-llc.com • www.ihe-llc.com
Regional offices: Reading, PA • Fairview Village, PA • Woodbury, NJ
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

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

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

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.

Environmental Training Center
DELAWARE TECHNICAL COMMUNITY COLLEGE | GEORGETOWN, DELAWARE

Technical training for water quality professionals including water operators, wastewater operators, onsite technicians and well drillers.
(302) 259-6384 | www.dtcc.edu

Customized contract training is available onsite and online to meet your needs.

KEYSTONE WATER QUALITY MANAGER
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
Sludge Treatment  Coagulants and flocculants for clarification, dewatering & thickening
Nutrient Removal  Lower discharge of phosphorous by reliable chemical precipitation
Odor & Corrosion Control  Kemira S-Guard™ solution measures, monitors & controls odor & corrosion
Scale Control  Iron coagulants control struvite & other mineral scales promoting a cleaner system
TOC & DBP's Reduction through enhanced coagulation

Contact us at water@kemira.com

Does primary treatment have to take up so much space?

Traditional primary wastewater treatment has required large, energy-hungry settling tanks, but this need not be the case. Technological advancements now mean that the same capability can be achieved in a much smaller footprint and at a much lower energy requirement – freeing up space and cutting costs.

Challenge convention: visit hydro-int.com/microscreen or search hydro microscreen online.
Reliable. Efficient. Easy and Safe to maintain. And most importantly, long-lasting to deliver superior return on investment. Our next generation EVERLAST™ above-grade Wet Well Mounted Pump Station series embodies this philosophy with:

- New, stylish looks and enclosures
- Convenient package options
- New features like the quick-clean RapidJack™ Check Valve

We back EVERLAST™ with the industry’s top warranty protection... because life is too short for submersibles.
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
Water has been our focus for over 100 years. Established in 1915, WRA specializes in the planning, design and construction management of water reclamation facilities.

To learn more about our capabilities, visit our web site: www.wrallp.com
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.

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-
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

Free up your budget & resources with Cloud-Based SCADA.

Remote monitoring & control for water, wastewater, and just about anything you can imagine.

We offer around-the-clock support and service throughout the life of our products. Our solution utilizes field units, satellite, cellular or ethernet communications, and the Internet to monitor and provide automatic control of your systems.

Via our TelemetryVIEW graphical interface software, you can view data and initiate manual controls from any Internet-connected device. Simply by logging in to a secure web page, you will have access to information about pump runtimes, electrical consumption, flow rates and more.
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.

About the Authors:
Charlotte Katzenmoyer is the Director of Public Works for the City of Lancaster, Pennsylvania. Ruth Ayn Hocker, P.E., is the Stormwater Program Manager for the City of Lancaster, Pennsylvania. Karl Graybill, AICP, is Senior Environmental Planner for the City of Lancaster, Pennsylvania. Douglas Smith is Sustainability Planner for the City of Lancaster, Pennsylvania.
Improve all of your water

Water operators and engineers rely on GridBee® electric and air-powered mixers and SolarBee® circulators to help reduce operating costs, achieve better compliance and improve water quality. Factory field service available.

Call us today for prompt, friendly service and fast, reliable results. 1-866-437-8076

POTABLE WATER MIXING/ICE PREVENTION
“These mixers give peace of mind, especially in winter.”
Cary Johnson, water operations mg, Rochester Public Utilities, Rochester, Minnesota

POTABLE WATER THM REMOVAL
“GridBee in-tank aeration is effective and affordable.”
Tony Linder, WTP division chief, Dept. of Water Supply, County of Maui, Hawaii

WASTEWATER MIXING/BASINS AND LAGOONS
“We reduced our nitrate levels and lowered our energy costs.”
John Willis, wastewater plant supervisor, Ventura, California

LAKES AND RAW WATER
“We reduced WTP operating costs caused by algae blooms.”
James A. Brown, water production manager, Newton County, Georgia

WASTEWATER MIXING/WET WELLS
“Don’t let wipes clog your pumps.”
Curtis Booth, foreman, Sewer Dept., Cromwell, Connecticut

We’re expanding!
District Sales Management
dm@medoraco.com
Positions Open Nationwide

Medora Corporation GridBee SolarBee
Dickinson, ND • www.medoraco.com • 866-437-8076 • info@medoraco.com
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:

- 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:**

Sean Furjanic, P.E., is an Environmental Program Manager with DEP’s Bureau of Clean Water and was the lead developer of Pennsylvania’s NPDES General Permit for MS4s. Lee Murphy is a Water Program Specialist in DEP’s Bureau of Clean Water who supported development of the NPDES General Permit for MS4s, assists DEP regional offices with MS4 issues, and is the lead developer of DEP’s statewide MS4 training.

Reliable level. No contact.

The radar signals of the VEGAPULS WL 61 deliver reliable, accurate level measurement without contacting the liquid. Even through plastic and fiberglass, the VEGAPULS WL 61 outperforms the competition.
TOTAL WATER MANAGEMENT SOLUTIONS
ADAPTABLE FOR TODAY’S CHANGING DEMANDS

Our experience in Aeration and Mixing, coupled with years of expertise in Biological Processes and Filtration Systems allows us to provide you with the most adaptable treatment solutions that offer the lowest cost of ownership. Aqua-Aerobic Systems’ advanced wastewater technologies meet or exceed the most stringent effluent requirements, including nutrient removal and water reuse, and are designed to easily accommodate changing effluent demands.

AERATION & MIXING
- Range of models, sizes and options
- Proven high-efficiency and reliable performance for over 40 years
- Aqua MixAir® process reduces power consumption; low total cost of ownership
- Endura® Series limited maintenance motors

BIOLOGICAL PROCESSES
Batch Processes
- Time-managed nutrient removal
- Unique subsurface decant avoids undesirable solids discharge
- IntelliPro® monitoring and control system enhances operation and performance
- Aqua MixAir® process reduces energy consumption; low total cost of ownership

Flow-Through Systems
- Flow-through operation with multi-stage performance
- Enhanced nutrient removal capabilities
- Ideal for a wide range of design flows
- Unique phase separator reduces WAS volume 20-50%

Filtration
- Unique OptiFiber® cloth filtration media offer high quality effluent with minimal backwash
- Variety of customized mechanical designs for retrofitting existing filters or for new installations
- High filtration capacity results in a small footprint
- Low cost of ownership

Membrane Systems
- Combines biological treatment with ultrafiltration membranes
- Direct filtration of mixed liquor with submerged membrane systems
- Enhanced process control with the IntelliPro® system

IntelliPro® Monitoring and Control System
- Combines process monitoring and integrated comparative analysis
- Automatic adjustment of biological nutrient removal and chemical addition
- Proactive operator guidance via BioAlert™ process notification program
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 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 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 goal 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 the 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. Invanarily, 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.

About the Authors:
Paul Calamita and Lisa Ochsenhirt are environmental attorneys with AquaLaw PLC. They practice in Pennsylvania and nationally representing water, sewer, and stormwater utilities.

Bethel Park Municipal Authority
Pinney Fork WWTP Upgrade

WadeTrim
Three Gateway Center
401 Liberty Avenue, Suite 1600
Pittsburgh, PA 15222
412.454.5566 • www.wadetrim.com

Trusted professionals delivering America’s infrastructure solutions
Municipal Services • Wet Weather & Facility Planning • Wastewater Design • Water Design • Operations Services
Construction Services • Land Development & Planning • Transportation Planning & Design
Monitor and control your SCADA, towers and lift stations with Data-Command. View your data, create reports and receive alarms. So you can be securely connected to your data wherever you are. Packages starting from only $24.95 a month.

Visit data-command.com
330.294.4477

Don’t Rebuild Your Grinder...
Re-NEW it!

Say goodbye to grinder headaches with Franklin Miller’s Re-NEW it Program. When other companies’ grinders choke, stall or wear out prematurely, Franklin Miller can get you up and running fast with a better, stronger swap-out unit!

It’s easy! We can replace the full working end of your major-brand grinder with a brand new grinder “lower works” featuring Cutter Cartridge Technology for a higher level of reliability and durability. So why settle for a rebuild of that same old tired unit?

Contact DN Tanks for all of your wastewater tank needs.
Frank Houston, P.E., Regional Manager
717.521.7595 | frank.houston@dntanks.com

We bring decades of tank design and construction experience for all types of wastewater applications, from basic to complex, with durability to last a lifetime.

2.0 MG Equalization Tank | Williamsport, PA | Engineering by Arcadis, Inc.

WASTEWATER TANKS.
EXPERTS

Cutter Cartridge™ Technology

www.franklinmiller.com
Call Toll Free 1-800-932-0599
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) permittee.

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.

The Hampden Township Sewer Authority – Funding Stormwater

BY JEREMY MILLER, PE

KEYSTONE WATER QUALITY MANAGER 31
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 permittees. Individual credit values ranged from 15% to 50% and a property owner may take advantage of multiple credits, if applicable, to 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 sticker 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
Jeremy Miller, PE, is a graduate of Penn State University with a Bachelor of Science in Environmental Systems Engineering and is the Hampden Township Director of Public Works.
If you’re trusted to protect public health or the environment, we can help.

hazenandsawyer.com

MUNICIPAL AND INDUSTRIAL WASTEWATER TREATMENT

Coyne Environmental Is Your Chemical Solutions Partner

We offer the most diverse product line of any national chemical supplier for the wastewater treatment industry. Our practical, economical, and user-specific chemical solutions include:

New technologies and expertise capable of meeting today’s more stringent water quality parameters.

Alternative products and services to help reduce costs while maintaining quality treatment.

Unparalleled packaging and delivery options including our unique Mini Bulk program.

Coyne Chemical Environmental Services
215-785-3000
coyneenvironmental.com
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 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. The 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.

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 resource 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, bioswales 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 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 as 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.
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.

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 states2 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, subcounty, 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 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 of 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
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/.

The SH Series delivers excellent clogging resistance with three styles of impellers to match varying conditions and solids. We feature an innovative Plug-n-Play technology for simplified maintenance. In rigorous clog testing, Barnes SH clog-resistant pumps outperforms the competition. Barnes SH Series now includes 3”, 4”, 6”, 8”, and 10” discharge sizes along with motors ranging from 2 through 150 HP.

Best lead time in the industry and made in the U.S.A.
Trash Chewing Up Your Plant? BITE BACK

For 40 years JWCE has provided the finest in wastewater grinders and screens. We offer the best protection solutions for preventing pump ragging caused by non-dispersible rags in sewers. Call your local rep today for more information.

P: (610) 363-6515 | www.watermarkenvsys.com
E: info@watermarkenvsys.com
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...
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 Penn-DOT, 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.

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...
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 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 Mass 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).

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.

**About the Authors:**

Eric K. Sanford, PE, CPSWQ, M. ASCE, is a Principal and Director of Municipal Services DDC Engineers, Inc. in Myrtle Beach, SC. He can be reached at eks@ddcinc.com or (843) 692-3200; www.ddcinc.com.

T. J. Mullen is the President and Co-founder of Best Management Products, Inc. of Lyme, CT. He can be reached at tjm@bmpinc.com or (800) 504-8008; www.bmpinc.com.

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

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
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 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.

<table>
<thead>
<tr>
<th>P Index Rating</th>
<th>Nutrient Application Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low: 59 or less</td>
<td>Nitrogen based management</td>
</tr>
<tr>
<td>Medium: 60-79</td>
<td>Nitrogen based management</td>
</tr>
<tr>
<td>High: 80-99</td>
<td>Phosphorus limited to crop removal</td>
</tr>
<tr>
<td>Zero Threshold: 100 or greater</td>
<td>No additional phosphorus applied</td>
</tr>
</tbody>
</table>

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 applicators 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 microorganisms to break down organic forms of nutrients to plant available.

Figure 2. P concentration in soil impacts P losses.
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, SOIL CLASSIFICATION, SOIL ERODIBILITY. BUT PLANNERS COULD MODIFY HOW A FIELD IS MANAGED TO REDUCE THE P INDEX RATING."

REFERENCES
Natural Resources Conservation Service, 2012 “Nutrient Management Standards” (Code 590)
Penn State University, 2007 “The Pennsylvania Phosphorus Index Version 2” College of Agricultural Sciences, Agricultural Research and Cooperative Extension
Soil Association (United Kingdom). 2010. A rock and a hard Place: Peak phosphorus and the threat to food security.
USDA 2015 “Soil Health Bucket – Guides and Reference”
USEPA, USDA, 2000 “Guide to Field Storage of Biosolids”
Water Environment Federation 2014 “Phosphorus in Biosolids Fact Sheet”

1Note the date of the last revision was January 2012
RAM Industrial Services (Water Technology Division) is located in Pittsburgh, Pennsylvania. RAM manufactures and represents “Best in Class” products and services for municipal and industrial water and wastewater treatment applications.

Pumps & Pumping Systems

Aqualitec Screens
  • Screentec
  • Raketec
  • Compactec
  • Grittec

Aqualitec EMO—Sludge Dewatering
  • Belt Filter Presses—0.6 to 3 meters
  • Combo GBT & BFP—0.6 to 3 meters
  • Fully Enclosed Option
  • Stand Alone GBT
  • Plate & Frame Filter Press

Wastewater Treatment Systems
  • Sequencing Batch Reactors (SBR)
  • Continuous & Batch Style
  • Retrofitting of Existing SBRs
  • Conversion of Conventional Style Activated Sludge Design
  • Extended Aeration Treatment Plants
  • Tertiary Filters—Multimedia Downflow Design
  • Denitrification Filters (Anoxic Style)
  • Membrane Bioreactors (MBR)
  • Moving Bed Bioreactors (MBBR)
  • Iron & Manganese Filters
  • Packaged Surface Water Treatment Systems
  • Pre-Engineered, Prefabricated Pump Stations

Control Panels
  • NEMA 1, 3R, 4, 4x, 7, 12
  • PLC—Programable Logic Control
  • VFD’s Cutler Hammer, Allen Bradley, ABB
  • NEMA Starter
  • IEC Starter
  • SCADA Systems
  • Engineering & Design

Experience

Talk to an expert.

(724) 695-5333
(724) 695-5366
mpresutti@rammotors.com
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. 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!
Leaders in sustainable wastewater management

Mott MacDonald’s expertise in wastewater and stormwater management, trenchless technology, biosolids, and more is helping clients in Pennsylvania save money, reduce their carbon footprint, and protect the state’s waterways. Find out what Mott MacDonald can do for you.

Hatch Mott MacDonald in the US is now Mott MacDonald

Philadelphia, PA 215.627.2277
Pittsburgh, PA 412.497.2900
www.mottmac.com/americas

Local roots, global resources

Providing engineering solutions for water, energy and resources, environment, property and buildings, and transportation

Contact Scott Crosswell at (717) 541.0622 or visit www.ghd.com
Smart Pumps Part II
Dumb pumps cost us money

Lenny Lo-Tech1 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.

“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.”


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

“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.

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

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

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!

Dear Boss,

Robot 2 at Packing Gland might have some merit. It is too early to tell. I still prefer a good bar screen and elbow grease to remove screenings and flushables.

Lenny Lo-Tech

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.

1 Lenny is the field representative for Society for the Prevention of Automation (SPA). He is a third-degree Luddite.
Guaranteed Environmental Maintenance Services

Industrial Cleaning
- Sewer, Storm Water, Water Line Cleaning and Maintenance
- Water Line Leak Detection
- Vacuum Truck Services
- Sewer Line Cleaning
- Water Blasting
- CCTV/Sonar Pipeline Inspection

Dredging & Dewatering Services
- Digester/Tank Cleaning
- Hydraulic Lake and Marina Dredging
- Lagoon Cleaning
- Sludge and Sediment Dewatering
- Excavation and Soil Solidification

All Work Performed to Your Complete Satisfaction
Call Us Toll Free 1-800-635-9689

Mobile Dredging & Video Pipe, Inc.
The Environmental Protection Specialists
3100 Bethel Road • Chester, PA 19013
www.mobiliedredging.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.

Kim Swinford
West Pennsylvania Account Manager
800-876-3837 Ext. 16520
kswinford@badgermeter.com

Kayla Schultz
Account Manager, United Utilities
262-398-0963
kschultz@badgermeter.com
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 = 200 ft\(^2\) x 0.98 x 0.083 ft = 16.3 ft\(^3\)

Convert cu ft. to gallons = 16.3 ft\(^3\) x 7.48 gal/ft\(^3\) = 121.7 gallons
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 serve 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.
Dial 8-1-1 Before You Dig.

PA Law Requires 3 Business Days Notice
1-800-242-1776

www.paonecall.org

Water is critical to all life.

It’s your job to keep it: clean, abundant, and affordable.

[ No pressure ]
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Phone</th>
<th>Email</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazen and Sawyer</td>
<td>1 S Broad St., Ste. 1630 Philadelphia, PA 19107 215-392-4402 <a href="mailto:mboothin@hazenandsawyer.com">mboothin@hazenandsawyer.com</a> <a href="http://www.hazenandsawyer.com">www.hazenandsawyer.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDR</td>
<td>11 Stanwix St., Ste. 800 Pittsburgh, PA 15222 412-497-6002 <a href="mailto:raeanne.flery@hdrinc.com">raeanne.flery@hdrinc.com</a> <a href="http://www.hdrinc.com">www.hdrinc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herbert, Rowland &amp; Grubic, Inc.</td>
<td>369 East Park Dr. Harrisburg, PA 17111 717-564-1121 F: 717-564-1158 <a href="mailto:hrg@hrg-inc.com">hrg@hrg-inc.com</a> <a href="http://www.hrg-inc.com">www.hrg-inc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larson Design Group</td>
<td>1000 Commerce Park Dr., Ste. 201 Williamsport, PA 17701 570-244-3476 <a href="mailto:jibbs@larsondesigngroup.com">jibbs@larsondesigngroup.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levine Engineering, LLC</td>
<td>1108 13th Ave. PO Box 429 Altoona, PA 16603-0429 814-946-4859 <a href="mailto:ttleverne@atlanticcbb.net">ttleverne@atlanticcbb.net</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miller Environmental Inc.</td>
<td>320 South 17th St. Reading, PA 19602 610-376-9162 F: 610-376-9164 <a href="mailto:deami@aal.com">deami@aal.com</a> <a href="http://www.miller-env.com">www.miller-env.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mott MacDonald</td>
<td>1600 W Carson St. Pittsburgh, PA 15219 412-497-2900 F: 412-497-2901 <a href="mailto:jason.marie@hatchmott.com">jason.marie@hatchmott.com</a> <a href="http://www.hatchmott.com">www.hatchmott.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REMTEW</td>
<td>3020 Columbia Ave. Lancaster, PA 17603 717-394-3721 F: 717-394-1063 <a href="mailto:remtew@remtew.com">remtew@remtew.com</a> <a href="http://www.remtew.com">www.remtew.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RK&amp;K</td>
<td>81 Mosher St. Baltimore, MD 21217 410-468-9205 <a href="mailto:marketing@rkk.com">marketing@rkk.com</a> <a href="http://www.rkk.com">www.rkk.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T &amp; M Associates</td>
<td>74 W Broad St., Ste. 530 Bethlehem, PA 18018 610-625-2999 F: 610-625-2996 <a href="mailto:rutz@tandmassociates.com">rutz@tandmassociates.com</a> <a href="http://www.tandmassociates.com">www.tandmassociates.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thaddeus, Steens College</td>
<td>750 E King St. Lancaster, PA 17602 717-650-2655 <a href="mailto:surrak@stevenscollege.edu">surrak@stevenscollege.edu</a> <a href="http://www.stevenscollege.edu">www.stevenscollege.edu</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wade Trim</td>
<td>401 Liberty Ave., Ste. 1600 Pittsburgh, PA 15222 412-454-5566 F: 412-454-9001 <a href="mailto:dgoodwin@wadetrim.com">dgoodwin@wadetrim.com</a> <a href="http://www.wadetrim.com">www.wadetrim.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wm. F. Hill &amp; Assoc., Inc.</td>
<td>207 Baltimore St. Gethersburg, PA 17325 717-334-9137 <a href="mailto:bhill@wmfullinc.com">bhill@wmfullinc.com</a> <a href="http://www.wmfullinc.com">www.wmfullinc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Consultants</td>
<td>CDM Smith Inc.</td>
<td>280 Granite Run Dr., Ste. 160 Lancaster, PA 17601 717-560-7500 <a href="mailto:hammerj@cdmsmith.com">hammerj@cdmsmith.com</a> cdmsmith.com</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dixon Engineering, Inc.</td>
<td>815 W. Liberty St., Ste. 1 Medina, OH 44256 330-983-0062 <a href="mailto:shannon.vidak@idexxengineering.com">shannon.vidak@idexxengineering.com</a> <a href="http://www.idexxengineering.net">www.idexxengineering.net</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Johnson, Mirmiran &amp; Thompson, Inc.</td>
<td>1600 Market St., Ste. 520 Philadelphia, PA 19103 267-256-0300 F: 267-256-0399 <a href="mailto:ssfarara@jmt.com">ssfarara@jmt.com</a> <a href="http://www.jmt.com">www.jmt.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Senate Engineering Company</td>
<td>420 William Pitt Way Pittsburgh, PA 15238 412-825-5454 F: 412-825-5458 <a href="mailto:gravennik@senateengineering.com">gravennik@senateengineering.com</a> <a href="http://www.senateengineering.com">www.senateengineering.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory Services &amp; Equipment</td>
<td>IDEXX Laboratories, Inc.</td>
<td>One IDEXX Dr. Westbrook, ME 04092 207-556-3091 F: 207-556-4630 <a href="mailto:water@idexx.com">water@idexx.com</a> <a href="http://www.idexx.com/water">www.idexx.com/water</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DN Tanks</td>
<td>672 Main St., Ste. H Harleyville, PA 19438 717-521-7595 frank.houston@dnタンクス.com <a href="http://www.dn%E3%82%BF%E3%83%B3%E3%82%AF%E3%82%B9.com">www.dnタンクス.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DRV Inc.</td>
<td>1 DRV Dr. Pittsburgh, PA 15221 412-247-4816 F: 412-247-0821 <a href="mailto:dshims@DRV-inc.com">dshims@DRV-inc.com</a> <a href="http://www.DRV-inc.com">www.DRV-inc.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial Pump &amp; Motor Repair</td>
<td>1642 Butler Plant Rd. Glenshaw, PA 15116 412-478-2015 <a href="mailto:kjazzi@industrialpumpandmotor.com">kjazzi@industrialpumpandmotor.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lee Supply Co., Inc.</td>
<td>PO Box 36 Chartier, PA 15022 724-483-3543 F: 724-483-0577 <a href="mailto:info@leesupply.com">info@leesupply.com</a> <a href="http://www.leesupply.com">www.leesupply.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Municipal Maintenance Co., Inc.</td>
<td>1352 Taylors Ln. Charleroi, PA 15022 724-826-9000 <a href="mailto:sales@pttg.com">sales@pttg.com</a> <a href="http://www.pttg.com">www.pttg.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>City, State, Zip</td>
<td>Contact Person</td>
<td>Phone</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
<td>-----------------</td>
<td>----------------</td>
<td>-------</td>
</tr>
<tr>
<td>Iron Horse Environmental LLC</td>
<td>PO Box 282</td>
<td>Fairview Village, PA 19409</td>
<td>F. 610-743-8589</td>
<td><a href="mailto:info@ih-llc.com">info@ih-llc.com</a></td>
</tr>
<tr>
<td>Joos Equipment Co</td>
<td>PO Box 368</td>
<td>Paoli, PA 19301-0368</td>
<td>F. 610-628-9936</td>
<td><a href="mailto:info@joos-equipment.com">info@joos-equipment.com</a></td>
</tr>
<tr>
<td>Kerschner Environmental Technologies</td>
<td>206 Business Center Dr.</td>
<td>Reisterstown, MD 21136</td>
<td>F. 717-507-9849</td>
<td><a href="mailto:info@biotriad.com">info@biotriad.com</a></td>
</tr>
<tr>
<td>Mid Atlantic Pump &amp; Equipment Co.</td>
<td>228 N Route 73</td>
<td>Berlin, NJ 08009</td>
<td>F. 717-256-8430</td>
<td>Dave <a href="mailto:dave@pyrwater.com">dave@pyrwater.com</a></td>
</tr>
<tr>
<td>Perma-Liner Industries LLC</td>
<td>13000 Automobile Blvd., Ste 300</td>
<td>Clearwater, FL 33762</td>
<td>F. 727-507-9974</td>
<td><a href="mailto:morgan@perma-liner.com">morgan@perma-liner.com</a></td>
</tr>
<tr>
<td>Pyrz Water Supply Co., Inc.</td>
<td>PO Box 107</td>
<td>Harleysville, PA 19438-0107</td>
<td>F. 215-256-8430</td>
<td>Dave <a href="mailto:dave@pyrwater.com">dave@pyrwater.com</a></td>
</tr>
<tr>
<td>Riordan Materials Corporation</td>
<td>6198 Butler Pl., Ste. 150</td>
<td>Blue Bell, PA 19422</td>
<td>F. 215-628-9997</td>
<td><a href="mailto:aachenbach@riordanmat.com">aachenbach@riordanmat.com</a></td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>357 Northgate Dr., Ste. 6</td>
<td>Warrenville, IL 60555</td>
<td>F. 215-628-9933</td>
<td><a href="mailto:tim.a.bauman@sherwin.com">tim.a.bauman@sherwin.com</a></td>
</tr>
<tr>
<td>Utility Service Group</td>
<td>1230 Peachtree St. NE., Ste. 1100</td>
<td>Atlanta, GA 30309</td>
<td>F. 724-240-3023</td>
<td><a href="mailto:info@watersmarkenvsys.com">info@watersmarkenvsys.com</a></td>
</tr>
<tr>
<td>Watermark Environmental Systems, Inc.</td>
<td>558 W Uwchland Ave., Ste. 7</td>
<td>Exton, PA 19341</td>
<td>F. 724-240-3023</td>
<td><a href="mailto:info@watersmarkenvsys.com">info@watersmarkenvsys.com</a></td>
</tr>
<tr>
<td>Longo</td>
<td>1 Harry Shupe Blvd.</td>
<td>Wharton, NJ 07885-1646</td>
<td>F. 717-507-9974</td>
<td><a href="mailto:morgan@perma-liner.com">morgan@perma-liner.com</a></td>
</tr>
<tr>
<td>Kerschner Environmental Technologies</td>
<td>206 Business Center Dr.</td>
<td>Reisterstown, MD 21136</td>
<td>F. 717-507-9849</td>
<td><a href="mailto:info@biotriad.com">info@biotriad.com</a></td>
</tr>
<tr>
<td>Mid Atlantic Pump &amp; Equipment Co.</td>
<td>228 N Route 73</td>
<td>Berlin, NJ 08009</td>
<td>F. 717-507-9974</td>
<td><a href="mailto:morgan@perma-liner.com">morgan@perma-liner.com</a></td>
</tr>
<tr>
<td>Perma-Liner Industries LLC</td>
<td>13000 Automobile Blvd., Ste 300</td>
<td>Clearwater, FL 33762</td>
<td>F. 727-507-9974</td>
<td><a href="mailto:morgan@perma-liner.com">morgan@perma-liner.com</a></td>
</tr>
<tr>
<td>Pyrz Water Supply Co., Inc.</td>
<td>PO Box 107</td>
<td>Harleysville, PA 19438-0107</td>
<td>F. 215-256-8430</td>
<td>Dave <a href="mailto:dave@pyrwater.com">dave@pyrwater.com</a></td>
</tr>
<tr>
<td>Riordan Materials Corporation</td>
<td>6198 Butler Pl., Ste. 150</td>
<td>Blue Bell, PA 19422</td>
<td>F. 215-628-9997</td>
<td><a href="mailto:aachenbach@riordanmat.com">aachenbach@riordanmat.com</a></td>
</tr>
<tr>
<td>Company Name</td>
<td>Contact Information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Franklin Miller, Inc.</td>
<td>60 Okner Pkwy, Livingston, NJ 07039</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 973-535-9200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@franklinmiller.com">info@franklinmiller.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.franklinmiller.com">www.franklinmiller.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F.R. Mahony &amp; Associates, Inc.</td>
<td>273 Weymouth St, Rockland, MA 02370</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>781-982-9300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 781-982-1056</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:dennisgeran@frmahony.com">dennisgeran@frmahony.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.amphidrome.com">www.amphidrome.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSBC Tanks Inc.</td>
<td>11029 Industrial Pkwy, NW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolivar, OH 44612</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>234-221-2015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 234-221-2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:jbergen@fsctanks.com">jbergen@fsctanks.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.fsctanks.com">www.fsctanks.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gibson-Thomas Engineering</td>
<td>PO Box 853</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Latrobe, PA 15650</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>724-539-8562</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:reneestantaine@gmail.com">reneestantaine@gmail.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.gibson-thomas.com">www.gibson-thomas.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gleeley and Hansen</td>
<td>1700 Market St., Ste. 2130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Philadelphia, PA 19103-3613</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>215-563-3460</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.gleeley-hansen.com">www.gleeley-hansen.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydro International</td>
<td>2925 NW Aloclek Dr., Ste. 140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hillsboro, OR 97124</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>866-615-8130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:wwinquiry@hydro-int.com">wwinquiry@hydro-int.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.hydro-int.com">www.hydro-int.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inovair</td>
<td>14801 W 114th Ter, Lenexa, KS 66215</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>913-469-7244</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 913-338-2879</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:glen.rodeniques@inovair.com">glen.rodeniques@inovair.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.inovair.com">www.inovair.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPM Systems, LLC</td>
<td>4225 NE Port Dr, Lee’s Summit, MO 64064</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>816-795-6333</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 816-795-6030</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:sales@ipm-sys.com">sales@ipm-sys.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.ipm-sys.com">www.ipm-sys.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JVD Equipment Corporation</td>
<td>1 Princeton Ave, Dover, NJ 07801</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>973-366-6556</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:sales@jvedquipment.com">sales@jvedquipment.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.jvedquipment.com">www.jvedquipment.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kappe Associates</td>
<td>100 Warnams Mill Ct, Frederick, MD 21701</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>301-846-0200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 301-846-0808</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:jweian@kappe-inc.com">jweian@kappe-inc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.kappe-inc.com">www.kappe-inc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keystone Pump &amp; Power</td>
<td>1480 S Mountain Rd, Dillsburg, PA 17019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>717-502-8500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 717-502-8510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:lisa@kpprents.com">lisa@kpprents.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.kpprents.com">www.kpprents.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KLH Engineers, Inc.</td>
<td>5173 Campbells Run Rd, Pittsburgh, PA 15205</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>412-494-0510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 412-494-0426</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@klhengineers.com">info@klhengineers.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.klhengineers.com">www.klhengineers.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LRM, Inc.</td>
<td>215 N Main St, Souderlon, PA 18964</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>215-721-4840</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 215-721-4923</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:mcrawford.lrm@csanet.com">mcrawford.lrm@csanet.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maryland Biochemical Company</td>
<td>712 Tabacco Run Dr, Bel Air, MD 21015-1330</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>410-734-9100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 410-734-9102</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@marylandbiochemical.com">info@marylandbiochemical.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.marylandbiochemical.com">www.marylandbiochemical.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medora Corp.</td>
<td>3225 Hwy 22, Dickinson, ND 58601</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>866-457-5076</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@medaraco.com">info@medaraco.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.medaraco.com">www.medaraco.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid Atlantic Storage Systems, Inc.</td>
<td>1551 Robinson Rd, Washington Court House, OH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>43160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>740-335-2019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 740-335-0584</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:nancy@MidAtlanticStorage.com">nancy@MidAtlanticStorage.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.MidAtlanticStorage.com">www.MidAtlanticStorage.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nelson Environmental Inc.</td>
<td>101 Falls Rd, Ste. 406, Grafton, WI 53024</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>262-375-1870</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 204-237-0660</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@nelsonenvironmental.com">info@nelsonenvironmental.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.nelsonenvironmental.com">www.nelsonenvironmental.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philadelphia Mixing Solutions</td>
<td>1221 E Main St, Palmyra, PA 17078</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>717-832-8831</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:sgable@philamixers.com">sgable@philamixers.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.philamixers.com">www.philamixers.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ProChemTech International Inc.</td>
<td>51 ProChemTech Dr, Brockway, PA 15824</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>814-265-0959</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 972-994-0845</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:dwilson@preload.com">dwilson@preload.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.preload.com">www.preload.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preload, LLC</td>
<td>2613 Industrial Ln, Garland, TX 75041</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>972-994-0550</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 972-994-0845</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:dwilson@preload.com">dwilson@preload.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.preload.com">www.preload.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ProChemTech International Inc.</td>
<td>51 ProChemTech Dr, Brockway, PA 15824</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>814-265-0959</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 972-994-0845</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:dwilson@preload.com">dwilson@preload.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.preload.com">www.preload.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Technologies U.S. Inc.</td>
<td>3040 Rte 22 W., Ste. 130, Branchburg, NJ 08876</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>908-526-6600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 908-526-9900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:allison.wolfe@puretechltd.com">allison.wolfe@puretechltd.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.puretechltd.com">www.puretechltd.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAM Industrial Services, LLC</td>
<td>1095 Montour West Industrial Blvd, Coraopolis, PA 15108</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>724-695-5333</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:mpreusuti@rammotors.com">mpreusuti@rammotors.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.rammotors.com">www.rammotors.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smith &amp; Loveless Inc.</td>
<td>14040 Santa Fe Trail Dr, Lenexa, KS 66215</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>913-888-5201</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:answers@smithandloveless.com">answers@smithandloveless.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.smithandloveless.com">www.smithandloveless.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSM Group, Inc.</td>
<td>1047 North Park Rd, Reading, PA 19610</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>610-621-2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 610-621-2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.ssmgroup.com">www.ssmgroup.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ssmgroup.com</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suez Water Advanced Solution</td>
<td>1230 Peachtree St. NE., Ste. 1100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Atlanta, GA 30309</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>855-526-4413</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:help@utilityservice.com">help@utilityservice.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.utilityservice.com">www.utilityservice.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Kerry Company, Inc.</td>
<td>PO Box 51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allison Park, PA 15101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>412-486-3388</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 412-486-7449</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@kerryactuator.com">info@kerryactuator.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.kerryactuator.com">www.kerryactuator.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USABlueBook</td>
<td>PO Box 9005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gurnee, IL 60031</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>847-377-5162</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:customerservice@usabluebook.com">customerservice@usabluebook.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.usabluebook.com">www.usabluebook.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USP Technologies</td>
<td>900 Circle 75 Pkwy., Ste. 1330</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Atlanta , GA 30339</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>404-352-6070</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:info@usptechnologies.com">info@usptechnologies.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.usptechnologies.com">www.usptechnologies.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vogelsang</td>
<td>PO Box 751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ravenna, OH 44266</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>330-510-1548</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 330-296-4131</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:johnr@vogelsangusa.com">johnr@vogelsangusa.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.vogelsangusa.com">www.vogelsangusa.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W.C. Weil Company, Inc.</td>
<td>PO Box 199</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allison Park, PA 15101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>412-487-7140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 412-487-7149</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:gmadia@wcweil.com">gmadia@wcweil.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.wcweil.com">www.wcweil.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylem Water Solutions</td>
<td>2330 Yellow Springs Rd, Malvern, PA 19355</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>610-408-6526</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F: 610-647-5563</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:christopher.candy@xyleminc.com">christopher.candy@xyleminc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.xyleminc.com">www.xyleminc.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Membership Categories (select one)</th>
<th>Publications Included with Membership</th>
<th>Dues</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ STATE ASSOCIATION (PWEA) ONLY</td>
<td>Keystone Water Quality Manager</td>
<td>$55</td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ PROFESSIONAL Membership Package (WEF &amp; PWEA)</td>
<td>Water Environment &amp; Technology</td>
<td>$195</td>
</tr>
<tr>
<td></td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEF Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ PROFESSIONAL WASTEWATER OPERATIONS (PWO)</td>
<td>Water Environment &amp; Technology</td>
<td>$130</td>
</tr>
<tr>
<td>Membership Package (WEF &amp; PWEA)</td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEF Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Newsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ YOUNG PROFESSIONAL Membership Package (WEF &amp; PWEA)</td>
<td>Water Environment &amp; Technology</td>
<td>$104</td>
</tr>
<tr>
<td>Choose this category if you are 35 or younger. Documentation verifying age must accompany membership application.</td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEF Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ ACADEMIC Membership Package (WEF &amp; PWEA)</td>
<td>Water Environment &amp; Technology</td>
<td>$195</td>
</tr>
<tr>
<td>Choose this category if you are an Instructor or Professor interested in subjects related to water quality.</td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEF Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ STUDENT Membership Package (WEF &amp; PWEA)</td>
<td>Water Environment &amp; Technology</td>
<td>$35</td>
</tr>
<tr>
<td>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.</td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEF Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ EXECUTIVE Membership Package (WEF &amp; PWEA)</td>
<td>Water Environment &amp; Technology</td>
<td>$365</td>
</tr>
<tr>
<td>Choose this category if you are an upper level manager interested in an expanded suite of WEF products/services.</td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Environment Research Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEF Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td>☐ CORPORATE Membership Package (WEF &amp; PWEA)</td>
<td>Water Environment &amp; Technology</td>
<td>$498</td>
</tr>
<tr>
<td>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.</td>
<td>WEF Highlights Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Environment Research Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Conference Proceedings Online</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keystone Water Quality Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA eNewsletter (Email &amp; Online)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWEA Job Board (Email &amp; Online)</td>
<td></td>
</tr>
</tbody>
</table>

Continued on Page 2
Please provide the following information.

<table>
<thead>
<tr>
<th>How many years have you worked in the water or wastewater sectors?</th>
<th>Education Level:</th>
<th>Optional Information:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 1-5</td>
<td>□ High School</td>
<td>(Used for Demographic Charting)</td>
</tr>
<tr>
<td>□ 6-10</td>
<td>□ Technical School</td>
<td></td>
</tr>
<tr>
<td>□ 11-20</td>
<td>□ Some College</td>
<td></td>
</tr>
<tr>
<td>□ 21-30</td>
<td>□ Associates Degree</td>
<td></td>
</tr>
<tr>
<td>□ &gt; 30</td>
<td>□ Bachelor’s Degree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Master’s Degree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ PhD</td>
<td></td>
</tr>
</tbody>
</table>

| Date of Birth: | ____________________ / ____________________ |
|               | Month  Year          |

<table>
<thead>
<tr>
<th>Are you under the age of 35?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes</td>
</tr>
<tr>
<td>□ No</td>
</tr>
</tbody>
</table>

Join Online:  [www.pwea.org](http://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.
COMPREHENSIVE ENGINEERING AND ENVIRONMENTAL SOLUTIONS
To meet the needs of your community and advance economic opportunity

T&M's experts can help you with:
- Engineer of Record
- Capital Improvement Programs
- Annual Road Programs
- Bridges and Structures
- MS4 and TMDL Permit Compliance
- Stormwater Management
- Green Infrastructure Design
- Water and Sanitary Sewer Infrastructure
- Parks and Recreation Facilities
- Landscape Architecture
- Professional Construction Management
- Grant Consulting, Writing and Administration

tandmassociates.com | 844.614.4177

SERVING CLIENTS FROM FIVE PENNSYLVANIA LOCATIONS...
Bethlehem | Fairless Hills | Lancaster | Philadelphia | Plymouth Meeting

Flow Monitoring & Collection System Testing
Inflow & Infiltration
Capacity
Inter-Municipal Billing
Independent 3rd Party
Online Data
Text or Email Alarms
CSO Flow

Collection System Flow Monitoring for I/I, Model Calibration, Billing, etc.

Flow Assessment Services, LLC
West Chester, PA
610-918-3857 jcantwell@flowassessment.com

Flow Assessment Services, LLC
Goffstown, NH
603-656-9799 dvigliotte@flowassessment.com

Flow Assessment Services, LLC
Goffstown, NH
603-656-9799 dvigliotte@flowassessment.com

www.flowassessment.com

KEYSTONE WATER QUALITY MANAGER 65
Inclined Plate Clarifiers

Effective treatment technology for industrial wastewaters.

www.prochemtech.com prochem@prochemtech.com
814-265-0959

rotork®

Electric (IQ3) Actuators
Pneumatic Actuators

Cast Iron & Stainless Steel
Sluice, Slide, and Weir Gates
FRP Gates / Flap Valve
Cast / Flexible Flap Valves
Hydraulic Control Systems

Surge Relief Valves
Cushioned Check Valves
Checktronic Pump Control
Rotary Ball & Cone Valves
AWWA Butterfly / Plug Valves
Air/Vacuum Valves

Bi-Directional Knife Gate Valves
Re-Packable Under Line Pressure
High Cv Values (Lower Operating Cost)
Zero Leakage (Bubble Tight Shut-off)
Transverse Seal (No Packing Gland)

meet your dream team

we maximize asset performance, simplify utility operation, and deliver peace of mind.

Asset Maintenance Program
tanks | water wells | meters | filters | network distribution | concrete water assets

Technologies & Services
ice pigging | helium leak detection | tank mixing | THM removal | biosolids management

Contact your local Water System Consultant:
Dan Frum (Western PA) • Russ Brown (Eastern PA)
855.526.4413 • help@utilityservice.com

Utility Service Co., Inc. • www.utilityservice.com
CALLING ALL OPERATORS
Are you up to the challenge?

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
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 Technical 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
12:30-1:00pm Annual Business Meeting
   with Dessert & Coffee
1:00-4:30pm Afternoon Technical Programs
   Collection Systems
   Construction
   Finance
   Industrial Pretreatment
2:30-3:30pm Break Refreshments in Exhibit Hall
3:30-4:30pm Beer & Pretzels Reception in Exhibit Hall
4:30-5:30pm 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
Are you looking for ways to get your equipment, products, and services noticed by water quality professionals in Pennsylvania?

**Here is your opportunity!**
The PennTec 2017 Annual Technical Conference & Exhibition will be held **June 4-7**, at the Kalahari Resort in Pocono Manor, PA. PennTec attendance averages about 700 people - so this would be a great place to bring your company to the attention of a large audience.

You can participate by:
- Setting up a booth in the Exhibit Hall
- Becoming a Sponsor
- Advertising in the On-Site Conference Program

**Want more information?**
Details about these opportunities can be found in the Exhibitor Prospectus, which will be mailed at the beginning of January. The Prospectus will also be available at www.pwea.org in January, or you can email us at pwea@pwea.org to request one.

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!

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

**PennTec 2017**  
89th Annual Technical Conference & Exhibition  
KALAHARI RESORT, POCONO MANOR, PA  
**JUNE 4-7, 2017**
Creating harmony and balance between people and the planet.

We are 27,000 smart, talented and driven people committed to exceptional and sustainable outcomes. We collaborate. We innovate. We deliver results.

Arcadis.
Improving quality of life.

WWW.ARCADIS.COM
**Safety Quiz**

**ANSWER KEY**

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

**QUESTIONS** on page 55
Hanover Engineering
Hanovereng.com
Civil • Municipal • Structural • Mechanical • Environmental
Offices: Bethlehem • Allentown • Poconos • Lancaster
Elizabethtown • Towanda • Wellsboro • New Castle
Envisioning and engineering sustainable, cost-effective and environmentally responsible projects since 1971

Gibson-Thomas Engineering
ESTABLISHED 1916
Water • Wastewater • Bridge & Highway • Civil & Municipal
www.gibson-thomas.com
Corporate Office: 1004 Ligonier St.
PO Box 853
Latrobe, PA 15650
Phone: 724-539-8562
GTECorporate@gibson-thomas.com

VISIT www.pwea.org for association updates

The Right Solution. Right Now.
1-800-844-4974
www.rootx.com

Filtration Sand & Gravel
BUY THE BAG OR BY THE TON
• Silica Sand • Anthracite • Gravel
• Greensand • Activated Carbon
• Prompt shipment or pickup • Easy access • Central location

1-800-854-7263
BROWNS HILL SAND
www.brownsillsand.com

Be the utility of the future...
www.quasareg.com
Be the utility of the future...
renewable energy
regulatory compliance
nutrient recovery

Committed to providing cost effective services
• Municipal Engineering
• Water / Wastewater Systems
• Stormwater Management
• Geographic Information Systems
• Construction Observation / Mgmt.
• Geologic / Hydrogeologic Studies
115 Millersville Road
Lancaster, PA 17603
Tel. 717-295-4975
www.beckereng.net

ENVISIONING AND ENGINEERING SUSTAINABLE, COST-EFFECTIVE AND ENVIRONMENTALLY RESPONSIBLE PROJECTS SINCE 1971
<table>
<thead>
<tr>
<th>COMPANY</th>
<th>PHONE</th>
<th>WEBSITE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqualitec</td>
<td>855-650-2214</td>
<td><a href="http://www.aqualitec.com">www.aqualitec.com</a></td>
<td>67</td>
</tr>
<tr>
<td>ARCADIS U.S., Inc.</td>
<td>724-742-9180</td>
<td><a href="http://www.arcadis-us.com">www.arcadis-us.com</a></td>
<td>71</td>
</tr>
<tr>
<td>Badger Meter</td>
<td>800-876-3837</td>
<td><a href="http://www.badgermeter.com">www.badgermeter.com</a></td>
<td>55</td>
</tr>
<tr>
<td>Becker Engineering</td>
<td>717-295-4975</td>
<td><a href="http://www.beckereng.net">www.beckereng.net</a></td>
<td>73</td>
</tr>
<tr>
<td>Bioscience, Inc.</td>
<td>484-245-5332</td>
<td><a href="http://www.biosciencelinc.com">www.biosciencelinc.com</a></td>
<td>82</td>
</tr>
<tr>
<td>BisNuss, Inc.</td>
<td>412-221-1200</td>
<td><a href="http://www.bisnussinc.com">www.bisnussinc.com</a></td>
<td>72</td>
</tr>
<tr>
<td>BMP, Inc.</td>
<td>410-687-6256</td>
<td><a href="http://www.bmpinc.com">www.bmpinc.com</a></td>
<td>3</td>
</tr>
<tr>
<td>Browns Hill Sand</td>
<td>800-854-7263</td>
<td><a href="http://www.brownshillsand.com">www.brownshillsand.com</a></td>
<td>73</td>
</tr>
<tr>
<td>Buchart Horn, Inc.</td>
<td>800-274-2224</td>
<td><a href="http://www.bucharthorn.com">www.bucharthorn.com</a></td>
<td>72</td>
</tr>
<tr>
<td>Carroll Engineering Corporation</td>
<td>215-343-5700</td>
<td><a href="http://www.carrorellengineering.com">www.carrorellengineering.com</a></td>
<td>58</td>
</tr>
<tr>
<td>CDM Smith</td>
<td>717-560-7500</td>
<td><a href="http://www.cdmsmith.com">www.cdmsmith.com</a></td>
<td>71</td>
</tr>
<tr>
<td>Coyne Environmental Services</td>
<td>215-785-3000</td>
<td><a href="http://www.coyneevironmental.com">www.coyneevironmental.com</a></td>
<td>33</td>
</tr>
<tr>
<td>Crane Pumps &amp; Systems</td>
<td>937-778-8947</td>
<td><a href="http://www.craneumps.com">www.craneumps.com</a></td>
<td>20, 39</td>
</tr>
<tr>
<td>Data-Command</td>
<td>330-294-4477</td>
<td><a href="http://www.data-command.com">www.data-command.com</a></td>
<td>30</td>
</tr>
<tr>
<td>Delaware Technical Community College</td>
<td>302-259-6384</td>
<td><a href="http://www.dtcc.edu">www.dtcc.edu</a></td>
<td>11</td>
</tr>
<tr>
<td>Dixon Engineering, Inc.</td>
<td>616-374-3221</td>
<td><a href="http://www.dixonengineering.net">www.dixonengineering.net</a></td>
<td>56</td>
</tr>
<tr>
<td>DN Tanks</td>
<td>800-227-8181</td>
<td><a href="http://www.dntanks.com">www.dntanks.com</a></td>
<td>30</td>
</tr>
<tr>
<td>Edwin Elliot &amp; Co. Inc.</td>
<td>610-828-8940</td>
<td><a href="http://www.edwinelliot.com">www.edwinelliot.com</a></td>
<td>66</td>
</tr>
<tr>
<td>Entech Engineering, Inc.</td>
<td>610-373-6667</td>
<td><a href="http://www.entecheng.com">www.entecheng.com</a></td>
<td>58</td>
</tr>
<tr>
<td>Envireq, LLC</td>
<td>717-761-7884</td>
<td><a href="http://www.envireq.com">www.envireq.com</a></td>
<td>1F</td>
</tr>
<tr>
<td>Environmental Engineering &amp; Management Assocs, Inc.</td>
<td>215-368-3375</td>
<td><a href="http://www.eema-inc.com">www.eema-inc.com</a></td>
<td>72</td>
</tr>
<tr>
<td>Flow Assessment Services</td>
<td>888-311-9799</td>
<td><a href="http://www.flowassessment.com">www.flowassessment.com</a></td>
<td>65</td>
</tr>
<tr>
<td>Franklin Miller, Inc.</td>
<td>800-932-0599</td>
<td><a href="http://www.franklinmiller.com">www.franklinmiller.com</a></td>
<td>30</td>
</tr>
<tr>
<td>Gannett Fleming</td>
<td>800-233-1055</td>
<td><a href="http://www.gannettfleming.com">www.gannettfleming.com</a></td>
<td>73</td>
</tr>
<tr>
<td>GHD</td>
<td>717-541-0622</td>
<td><a href="http://www.ghd.com">www.ghd.com</a></td>
<td>52</td>
</tr>
<tr>
<td>Gibson-Thomas Engineering Co., Inc.</td>
<td>724-539-8562</td>
<td><a href="http://www.gibson-thomas.com">www.gibson-thomas.com</a></td>
<td>73</td>
</tr>
<tr>
<td>Greeley and Hansen</td>
<td>800-837-9779</td>
<td><a href="http://www.greeley-hansen.com">www.greeley-hansen.com</a></td>
<td>54</td>
</tr>
<tr>
<td>Gwin, Dobson, &amp; Foreman, Inc.</td>
<td>814-943-5214</td>
<td><a href="http://www.gdfengineers.com">www.gdfengineers.com</a></td>
<td>54</td>
</tr>
<tr>
<td>Hanover Engineering</td>
<td>610-691-5644</td>
<td><a href="http://www.hanovereng.com">www.hanovereng.com</a></td>
<td>73</td>
</tr>
<tr>
<td>Hazen and Sawyer</td>
<td>215-592-0600</td>
<td><a href="http://www.hazenandsawyer.com">www.hazenandsawyer.com</a></td>
<td>33</td>
</tr>
<tr>
<td>HD Supply Waterworks</td>
<td>610-481-9979</td>
<td><a href="http://www.hdsupplywaterworks.com">www.hdsupplywaterworks.com</a></td>
<td>21</td>
</tr>
<tr>
<td>HDR</td>
<td>412-497-6000</td>
<td><a href="http://www.hdrinc.com">www.hdrinc.com</a></td>
<td>51</td>
</tr>
<tr>
<td>Herbert, Rowland &amp; Grubic, Inc. (HRG)</td>
<td>717-564-1121</td>
<td><a href="http://www.hrg-inc.com">www.hrg-inc.com</a></td>
<td>14</td>
</tr>
<tr>
<td>High Tide Technologies</td>
<td>615-256-6678</td>
<td><a href="http://www.hightidedotechnologies.com">www.hightidedotechnologies.com</a></td>
<td>19</td>
</tr>
<tr>
<td>Hydro International</td>
<td>866-615-8130</td>
<td><a href="http://www.hydro-int.com">www.hydro-int.com</a></td>
<td>13</td>
</tr>
<tr>
<td>InfoSense, Inc.</td>
<td>877-747-3245</td>
<td><a href="http://www.infosenseinc.com">www.infosenseinc.com</a></td>
<td>54</td>
</tr>
<tr>
<td>Iron Horse Environmental Corporation</td>
<td>610-222-2525</td>
<td><a href="http://www.ihanna-m.com">www.ihanna-m.com</a></td>
<td>10</td>
</tr>
<tr>
<td>JDV Equipment Corporation</td>
<td>973-366-6556</td>
<td><a href="http://www.jdevquipment.com">www.jdevquipment.com</a></td>
<td>52</td>
</tr>
<tr>
<td>KCI Technologies</td>
<td>800-572-7496</td>
<td><a href="http://www.kci.com">www.kci.com</a></td>
<td>72</td>
</tr>
<tr>
<td>Kemira</td>
<td>863-533-5990</td>
<td><a href="http://www.kemira.com">www.kemira.com</a></td>
<td>13</td>
</tr>
<tr>
<td>KHL Engineers Inc.</td>
<td>412-494-0510</td>
<td><a href="http://www.khhengineers.com">www.khhengineers.com</a></td>
<td>71</td>
</tr>
<tr>
<td>Levine Design Group</td>
<td>570-651-1546</td>
<td><a href="http://www.larsondesigngroup.com">www.larsondesigngroup.com</a></td>
<td>9</td>
</tr>
<tr>
<td>Levine Engineering, LLC</td>
<td>814-946-4859</td>
<td></td>
<td>49</td>
</tr>
<tr>
<td>Medora Corporation (SolarBee and GridBee brands)</td>
<td>866-437-8076</td>
<td><a href="http://www.medoraco.com">www.medoraco.com</a></td>
<td>22</td>
</tr>
<tr>
<td>Mid Atlantic Storage Systems, Inc.</td>
<td>740-895-6028</td>
<td><a href="http://www.midatlanticstorage.com">www.midatlanticstorage.com</a></td>
<td>72</td>
</tr>
<tr>
<td>Mobile Dredging &amp; Pumping Co.</td>
<td>610-497-9500</td>
<td><a href="http://www.mobiledredging.com">www.mobiledredging.com</a></td>
<td>54</td>
</tr>
<tr>
<td>Mott MacDonald</td>
<td>215-627-2277</td>
<td><a href="http://www.mottmac.com/americas">www.mottmac.com/americas</a></td>
<td>52</td>
</tr>
<tr>
<td>Pennoni</td>
<td>855-754-3565</td>
<td><a href="http://www.pennoni.com">www.pennoni.com</a></td>
<td>56</td>
</tr>
<tr>
<td>Pennsylvania One Call System, Inc.</td>
<td>717-600-2220</td>
<td><a href="http://www.pangoonecall.org">www.pangoonecall.org</a></td>
<td>58</td>
</tr>
<tr>
<td>Pittsburg Tank &amp; Tower Maintenance Co.</td>
<td>270-826-9000</td>
<td><a href="http://www.watertank.com">www.watertank.com</a></td>
<td>18</td>
</tr>
<tr>
<td>Quasar Energy Group</td>
<td>216-986-9999</td>
<td><a href="http://www.quasareg.com">www.quasareg.com</a></td>
<td>73</td>
</tr>
<tr>
<td>RAM Industrial Services</td>
<td>724-695-5333</td>
<td><a href="http://www.rammotors.com">www.rammotors.com</a></td>
<td>50</td>
</tr>
<tr>
<td>Riordan Materials Corp.</td>
<td>215-628-9936</td>
<td><a href="http://www.riordanmat.com">www.riordanmat.com</a></td>
<td>18C</td>
</tr>
<tr>
<td>RK&amp;K</td>
<td>717-600-2220</td>
<td><a href="http://www.rkk.com">www.rkk.com</a></td>
<td>58</td>
</tr>
<tr>
<td>RootX</td>
<td>800-844-4974</td>
<td><a href="http://www.rootsx.com">www.rootsx.com</a></td>
<td>73</td>
</tr>
<tr>
<td>Smith &amp; Loveless Inc.</td>
<td>704-844-1100</td>
<td><a href="http://www.smithandlevellness.com">www.smithandlevellness.com</a></td>
<td>14</td>
</tr>
<tr>
<td>T&amp;M Associates</td>
<td>610-625-2999</td>
<td><a href="http://www.tandmassociates.com">www.tandmassociates.com</a></td>
<td>65</td>
</tr>
<tr>
<td>Utility Service Group</td>
<td>717-443-8136</td>
<td><a href="http://www.utilityservice.com">www.utilityservice.com</a></td>
<td>66</td>
</tr>
<tr>
<td>VEGA Americas, Inc.</td>
<td>800-FOR-LEVEL</td>
<td><a href="http://www.vega-americas.com">www.vega-americas.com</a></td>
<td>25</td>
</tr>
<tr>
<td>Wade Trim</td>
<td>412-454-5566</td>
<td><a href="http://www.wadetrim.com">www.wadetrim.com</a></td>
<td>29</td>
</tr>
<tr>
<td>Watermark Environmental Systems, Inc.</td>
<td>610-363-6515</td>
<td><a href="http://www.watermarkenvsys.com">www.watermarkenvsys.com</a></td>
<td>40</td>
</tr>
<tr>
<td>Whitman, Requardt &amp; Associates, LLP</td>
<td>443-224-1531</td>
<td><a href="http://www.wrappll.com">www.wrappll.com</a></td>
<td>16</td>
</tr>
</tbody>
</table>
Riordan Materials Corporation
Water & Wastewater Treatment Equipment

A to Z - Riordan has you covered!

From Amwell to Zimpro, Riordan has over 50 years experience representing the industry leaders in water and wastewater equipment and technologies.

Our mission is to provide quality, cost effective solutions for our clients, while providing the best technical support services available before, during, and after installation. We are proud to represent the premiere line of products for water treatment, wastewater treatment, odor control, solids handling, pumping, and biosolids processes. Our history of consultative sales, combined with our outstanding platform of equipment, provide you the best alternatives available.

At Riordan we’re not just sales......

......we’re solutions.

Riordan Proudly Represents:

- Amwell/E&I Corporation clarification & grit systems
- Amphidrome packaged BNR systems
- AquaTurbo aerators & mixers (fixed & floating)
- Charter Machine dewatering equipment
- CBI Walker digestion systems
- Cook Legacy intake screens
- CST Storage (MASSI) bolted steel tanks
- Environmental Dynamics Inc. diffused aeration systems
- Engineered Fluid, Inc. (EFI) packaged stations
- Environmental Fabrics, Inc. baffles & liners
- Enviroquip of TX (Ovivo) process equipment
- Evoqua - Biomag, Jettech, Davco, Memcor, RJ, Zimpro
- Filter One USA screening systems & conveyors
- Flottweg solids dewatering centrifuges
- Flygt (a xylem brand) submersible pumps, mixers
- Ford Hall lauder brush systems
- Franklin Miller grinders and screens
- FreshCreek Technologies stormwater treatment
- GNA CSO Stormwater & CSO technologies
- Headworks automatic wastewater screens
- Headworks BIO IFAS & MBBR systems
- IPM Systems, Inc. chem. feed systems
- Ishigaki, Inc. Rotary Screw Presses
- KLA Systems Jet aeration & mixing systems
- Kubota USA Membrane Bioreactors
- Merit Media Systems sludge drying beds
- UGSI Micro-Clor onsite hypochlorite generation
- UGSI Tank Shark tank & chemical mixing system
- Midwestern Fabricators fiberglass items
- Mitsubishi Electric ozone generators
- Noreva nozzle check valves
- Pulsed Hydraulics, Inc. (PHI) mixing systems
- Rainbird Inline filters & separators
- RedZone collection system & mapping equipment
- S&N Airoflo floating aerators
- Tenco Hydro DAF systems
- Wagner Fluid Systems package plants

Proud Supporter of:
PA Sales Staff
Art Auchenbach
Augie Koloras
Carl Janson
Mark Wilks

MD Sales Staff
Tom Schell
Tom Rainier

Offices Locations
Blue Bell, PA
Reading, PA
York, PA
Crofton, MD
Kappe Associates works hand-in-hand to help our clients meet the constantly changing needs of the environmental community. We can help you find the most advanced, reliable and cost-effective technology available to solve your waste-water and drinking water management problems and meet ever-tightening regulations.