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• Tank Shark® reservoir mixing systems deliver ample mixing energy to reservoirs without the hassle of rotating mechanical equipment or the use of installation divers. Tank mixing without the hype or drama.

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ACCEPTABLE FORMATS INCLUDE:
- High-resolution PDF files with fonts embedded,
- Adobe Illustrator 9.0 .eps files, .tif files, .jpg files, or Microsoft Word files.
- Include any high-resolution (300-dpi) photos or artwork used with Microsoft files separately as either .tif or .jpg.

E-mail all articles or advertisements to:
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AZ WATER ASSOCIATION
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Queen Creek, AZ 85142
www.azwater.org

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## Calendar of Events: February through May 2017

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I have found myself reflecting on the turmoil of this past election year, and wondering what opportunities it might present for the AZ Water Association in 2017. At a national level, the Democratic and Republican campaigns that were run and the election of Donald Trump as the next President of the United States will reshape this country collectively to a degree not seen in quite some time. How happy or unhappy one is with this outcome depends, of course, on where one sits with respect to the political spectrum. But there is one issue, at least, that both presidential candidates promoted during their hard-fought campaigns and gave a great deal of attention to, and that is INFRASTRUCTURE. It turns out that voters, too, agreed that rebuilding the nation’s infrastructure is critical as dozens of local and state ballots supporting infrastructure were passed on Election Day. There was even a large headline the day after in a national newspaper that stated loudly and clearly: “What Trump, Clinton and Voters Agreed On: Better Infrastructure.”

Unfortunately, what most people think of when they hear the word “infrastructure,” is transportation (highways, bridges, public transit, airports), and local ballot measures did tend to target transportation, particularly public transit. Facilities such as schools and hospitals are also frequently included in discussions about infrastructure. But – and here comes the main point – what about WATER/WASTEWATER INFRASTRUCTURE? Here’s where the AZ Water Association, its members, and all of us as water and wastewater professionals come in: it’s up to us to seize this moment and strongly support the investment necessary to develop and maintain the water and wastewater systems that serve our communities, help create thriving economies throughout Arizona, and do so much to enhance our quality of life. Over the past year, as we have implemented the Association’s Strategic Plan through an updated Business Plan, one key focus area has been to make AZ Water visible and vocal in supporting investment in water supplies and in water and wastewater infrastructure. Optimizing the development and use of all our water resources and ultimately providing a safe and reliable water supply require robust infrastructure. Investment is critical in maintaining the infrastructure we have, as well as for long-term planning to secure our water future in Arizona.

One great example of how working together on this issue produces results has been announced recently by the American Water Works Association (AWWA): On December 10th President Obama signed legislation that will allow the Water Infrastructure Finance and Innovation Act (WIFIA) program to begin making loans to tackle the nation’s trillion-dollar infrastructure challenge. Included in the legislative package was $100 million in state revolving loan (SRF) funds to assist communities in which a water emergency has been declared, such as in Flint, MI. In addition, according to AWWA’s press release, previous appropriation and authorization of WIFIA funding has resulted in $17 million with which to seed loans, which means that with federal leveraging, up to $1.02 billion could be available nationwide for loans targeting water utility infrastructure. Not bad, eh? But it took numerous AWWA water utility members, volunteer leaders, and staff - as well as efforts by AZ Water members - and much tireless work over the past several years to enact passage and funding of WIFIA.

But this is just one avenue to finance water and wastewater infrastructure. We also need to work with our elected officials to educate them regarding the need to maintain our infrastructure and to support them when difficult decisions need to be made, such as putting a bond package targeting water/wastewater infrastructure in front of voters or adopting effective water and wastewater rates. We need to help our local and state legislators, as well as our neighbors and the general public, understand that adequate funding for water and wastewater programs is vital to ensuring adequate investment in wastewater collection and treatment, water production, and delivery infrastructure.

Even though President-Elect Donald Trump cited infrastructure as a top priority for his administration in a victory speech on November 10th, it’s critical that we continue to advocate at all levels – local, state, regional and national – for the funding necessary to grow and maintain our water and wastewater infrastructure here, in Arizona. A national spotlight has been shown on the necessity to rebuild and maintain the nation’s infrastructure; now let’s take advantage of that opportunity.
AWWA’s “The Water Equation” Campaign, in cooperation with AZ Water, awards the One AWWA Operator Scholarship annually in the amount of $2,500 for Water Operator training and education. The scholarship award can be used for certification/licensure, two-year water related associate degree, technical school program, professional training program, books and manuals, and operator related conferences. Each scholarship recipient also receives a one-year AWWA Operator membership.

The AZ Water Association is proud to recognize Louis G. Cipolla as the recipient of this year’s One AWWA Operator Scholarship. Louis currently serves as a Senior Utility Operator at the City of Phoenix, Union Hills Water Treatment plant. He holds multiple certifications in water and wastewater treatment, including an ADEQ Water Treatment Plant Operator Grade 3 License. Louis plans to obtain an Associates in Applied Science Degree for Water Treatment within the next 3 years. He believes the skills he will gain through classes and professional development would immediately improve his abilities as an Operator working in this industry. Louis finds enjoyment and pride working within an industry that provides one of the most basic elements to life on earth: clean water.

AZ Water is excited to award Louis with this scholarship. The Association wishes him the best moving forward with his studies and career!

The Department of Energy (DOE) is offering technical assistance to water and wastewater utilities through their Better Plants™ program. The City of Phoenix Water Services Department joined Better Plants in early 2016 and has recently been awarded in-plant training to be conducted at their 23rd Avenue Wastewater Treatment Facility this spring. During the three-day session, experts from the DOE will train plant staff on how to conduct assessments, use DOE analytic tools, and implementing cost-effective energy conservation/management projects. The training is geared towards staff engineers, facility supervisors, operators, electricians, and process control specialists.

There are 25 seats available for the class. Phoenix will be offering approximately 20 openings to AZ Water members, with preference given to staff from other wastewater utilities. A formal announcement on the in-plant training opportunity will be sent out in January with registration done on a first-come, first-served basis. If you would like to be placed on a special notification list for this event, please contact Energy Management and Sustainability Committee Chairman, Noah Mundt, at noah.mundt@siemens.com.
TWAS THE SEASON

We have all just gone through the time of year when everyone was looking for “value”, whether it is for a new television set, a new car, a piece of jewelry, a new gaming system or a new toy for one’s family member. When it comes to the AZ Water Association, that same question needs to be asked: “what is the value of me being a member of this organization and what will this organization be as to effective advocacy and support for who I am, what I do, how I do it and why I do it”?

For starters, members and the public at large need to realize that we have been in existence for almost 90 years and that we represent over 2200 members throughout the State – people who have worked in, supported and who have represented the water profession for most of their extended careers. The Association is dedicated to encouraging and supporting the men and women who wake up every morning knowing that their efforts are directly related to ensuring that a safe, reliable drinking water supply is available to residential, commercial and industrial customers and that wastewater is being treated to a standard for subsequent beneficial reuse and/or recharge into our aquifers in order to supplement groundwater supplies. In addition, we have an ethic to protect the environment, promote conservation and bring a concise and precise educational message about our industry into the classroom – elementary, high school, community colleges and the universities. On a personal note, being a veteran of four years on active duty with the Army, I would like to see a robust outreach to our veterans who can bring their background and experiences into this profession of ours.

What is that “value”? Starting with you being a member – you are part of an organization that provides a steady diet of professional training and development; identifies employment opportunities; gives a structured process to acquire qualifying credits for operator certifications; mentoring; networking; succession planning for younger members; access to seasoned professionals who can guide, encourage and identify professional direction so that those individuals can maximize individual potential; and knowing that there is an association that will always have your back – that this association can provide liaison with regulators, elected officials, business leaders and the general public as to the value of and importance of water to every human and economic activity. The Board has made it a priority to enhance the Association’s web-site, and we have hired a social media firm to promote our messaging and to construct a full-bore outreach strategy which will result in individuals becoming part of the AZ Water Association “family”.

As your Executive Director, the Board of Directors has given me the following tasks: (1) assume an active role in implementing the updated Strategic Plan and the Business Plan that was discussed and approved this past Summer up in Flagstaff where the Board, all Committee Chairs, guest speakers and professional staff brainstormed to finalize a document that serves as the blueprint for future activities; (2) grow and develop membership so that we can double the number of individuals added to our organization - this seems like an impossible deliverable, but if this organization really wants to be “the go-to voice when it comes to water challenges in Arizona” then we need to broaden the base and get all of the membership actively involved; (3) encourage interface and membership in our national affiliates the American Water Works Association and the Water Environment Federation; (4) approach elected officials at all levels of government and business leaders to let them know that the AZ Water Association is a non-partisan resource that they can call upon any time for information, advice and guidance; and, (5) allow for the membership to voice their concerns, issues and challenges so that they, as members, feel without question, that their thoughts are being heard, that they feel “value” is being provided and that what they have to say and the concerns that they have are being properly vetted and acted upon by the Board of Directors, the Committee Chairs and their Executive Director.
IS WASTEWATER REUSE IN YOUR PLANT'S FUTURE?

Today's water treatment standards are rapidly changing, requiring plants to implement adaptive water management strategies. Aqua-Aerobic Systems' experience in Biological Processes and Filtration provide you with the most advanced technologies for reuse applications and meeting the most stringent effluent demands. Whether utilizing filtration following a secondary biological process or implementing a "green" approach to your plant's water reuse initiatives, we have the ideal solutions to meet your water reuse goals.

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*Featuring OptiFiber® Pleat Cloth Media*

- **AquaDisk® Cloth Media Filter**
  - Vertically mounted disks reduce required footprint
  - High solids and hydraulic loading rates
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- **AquaDiamond® Cloth Media Filter**
  - Up to eight vertically oriented diamond laterals
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  - Provides two to three times flow capacity of a traveling bridge filter with an equivalent footprint

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VOLUNTEERISM

Above is a simple, yet very descriptive definition of volunteerism. So, why did I start this article with a definition of volunteerism? Isn’t this publication supposed to be about water “stuff”? Well, you may not know this, but the AZ Water Association is a volunteer driven organization. What this means is that many of the services we provide our members, the water industry and the citizens of Arizona are provided by our members, for free. We rely heavily on “volunteerism” to accomplish all of the great things we do on behalf of our members and the communities we serve. And, you don’t have to be an officer of the organization, or a member of the Board of Directors to serve – you just have to be a member of AZ Water, with an interest in getting involved to help make this organization the best it can be.

“Everybody can be great. Because anybody can serve. You don’t have to have a college degree to serve. You don’t have to make your subject and verb agree to serve… You don’t have to know the second theory of thermodynamics in physics to serve. You only need a heart full of grace. A soul generated by love”

Martin Luther King, Jr.

Get Involved – Join A Committee!

The AZ Water Association has more than 30 different committees that you might be interested in joining. Our committees generally fall into the following four categories: Administration, Education, Outreach, and Special Interest. Joining a committee is free and easy, and is a great way to network with your peers and keep current with new developments in the water and wastewater industry. Our committees are a nexus for social interaction, opportunities, technical support, professional and advanced continuing education activities and training.

Committee membership is only open to members of the AZ Water Association. You can learn more about these opportunities and how to join a committee by visiting our website and clicking on the name of any committee you find of interesting.

More Ways To Get Involved!

In addition to committee membership, the AZ Water Association offers a number of other volunteer opportunities for our members to get involved with. As an association we are actively involved in many philanthropic endeavors. These include Water for People, the Community Engineering Corps, our AZ Water Scholarship Fund and the American Water Works Association (AWWA) One AWWA Operator Scholarship. I’m assuming most of you are familiar with Water for People and the AZ Water Scholarship fund and I have talked about the One AWWA Operator Scholarship in past Kachina News articles. However, you may not be familiar with the Community Engineering Corps.

The Community Engineering Corps is an alliance between AWWA, the American Society of Civil Engineers and Engineers Without Borders-USA. The alliance combines the strengths of these three organizations to provide technical expertise to underserved communities in the United States and ensure that their infrastructure meets their community’s needs. As the Arizona Section for AWWA, AZ Water has been very involved in supporting the Community Engineering Corps with projects right here in Arizona. This is a great opportunity if you are interested in rolling up your sleeves and getting your hands dirty, so to speak. You can find more information on how you can get involved in the Community Engineering Corps by visiting AWWA’s website.

Get Involved on a National Scale!

Much like AZ Water, AWWA is a volunteer driven organization and the benefits you and I receive as members are enhanced due to the dedication of about 3,000 volunteers – water professionals like you and I – who donate their talents and skills to the betterment of AWWA. As a member of AWWA, you have a huge selection of Standing Committees, Councils, and Divisions from which to choose from. Unlike AZ Water, the number of participants in these committees is limited and each member serves a predetermined term. So, there must be a vacancy within the committee you are interested in and you must also submit an application to fill that vacancy. There is a formal selection process that AWWA utilizes to fill these vacancies, but I know that there is a huge need for volunteers within many of the 160+ AWWA committees. So, if you have any interest, AWWA has the right volunteer opportunity for you.

Again you can find more information regarding these opportunities by visiting AWWA’s website and clicking on the MEMBERSHIP tab and you will find everything you need to locate and apply for a committee that appeals to you. However, if you are interested applying for any of the current committee vacancies you will have to move pretty quickly, because applications are due into AWWA by January 31, 2017.
Discover new ways to get your Section involved with Community Engineering Corps

Engage Volunteers
Communicate
Start talking about the CECorps program.

Cooperate
Form a committee of interested volunteers.

Brainstorm
Identify your next steps.

Connect
Work with local organizations or your state primacy agency to reach out to communities in need.

Support
Work with the community to complete a community project application.

Build Relationships

Responds to Needs
Research
Find Open Projects listed on the CECorps website.

Recruit
Build an all-star project team of Section members with the appropriate experience.

Collaborate
Complete a project team application and get to work with a community!

Make an Impact!

www.communityengineeringcorps.org
Contact: Lindsey Geiger (lgeiger@awwa.org)
What is your new year’s resolution? Every year I start the year off with the usual plan to lose weight, eat healthier, and get out and enjoy Arizona. Some years these goals last into the spring. But most years I barely make it into February!

This year I am taking a new approach, education. In September I attended the Water Environment Federation’s Annual Technical Exhibition and Conference (WEFTEC) in New Orleans. The Water Environment Federation (WEF) is a non-profit association that provides technical education and training for thousands of water quality professionals who clean water and return it safely to the environment. WEF members have proudly protected public health, served their local communities, and support clean water worldwide since 1928. The annual conference is their largest event of the year. With over 25,000 registrants and 1,000 exhibitors in attendance, the 2016 conference was a great experience. There were seminars on our aging workforce, infrastructure needs, wastewater treatment operations, wastewater collections and lift stations, and odor control technologies. This industry is constantly changing and vendors are developing new methods and products to meet our treatment needs. I encourage water professionals to broaden your knowledge base and look into some of the new ideas that are emerging.

As your new WEF Delegate, I have some big shoes to fill. Don Manthe has been your Delegate for the past four years and has done a remarkable job. Thank you Don for setting the bar high. I plan to carry on many of the House of Delegate initiatives that Don participated in. In September I attended my first Public Communications and Outreach workgroup. This workgroup is charged with working with member associations (MAs) to help disseminate positive messaging. They will identify materials that MAs can use and will work with them to promote programs such as the Day Without Water campaign. WEF has many conferences, webcasts, and training workshops to offer. Go to Wef.org to see the WEF events planned for 2017. Likewise, AZ Water also has a full schedule of events listed at azwater.org.

Back to my new year’s resolution, education. Education is not just about professional development hours, college credits, or seminars. It is also about educating the public. Why not talk to at least one person a week about water. As an industry, we still have a lot of educating of the general public to do. So, my new year’s resolution this year is to talk to one random person per week about water. And….this year I am going to achieve my resolution. Water education – Join me.
TRANSFERRING OF KNOWLEDGE FROM ONE GENERATION TO THE NEXT
THE CITY OF TEMPE’S ENVIRONMENTAL SAMPLING CAMPUS

Introduction

One of the primary challenges of maintaining a utility’s functional and performance integrity is the preservation, and transfer of, critical information, processes, and techniques to the next generation of workers that will succeed them. In 2013, the City of Tempe’s Water Utilities Division had 25 employees with over 850 years of accumulated institutional knowledge that were eligible to retire from service before the end of 2017. To overcome this obstacle, the Environmental Services Section, of the division, has constructed a multi-purpose 432 square foot sample training campus with a 50 feet loop of four inch clear PVC piping that contains several of the primary flume devices used in wastewater monitoring. In addition to the flow loop, the facility contains a drinking water well, groundwater monitoring well, and a surface water impoundment. The sample campus concept was derived to prepare sampling and monitoring staff with the knowledge and tools to effectively serve the needs of the water and industrial pretreatment community, and to assist in troubleshooting equipment by reproducing field or other conditions of known and unknown causation.

The sample campus was completed in July of 2014 and has provided dynamic equipment and the environment that allows senior staff to proactively educate and pass knowledge to their successors as the inevitable process of natural attrition occurs within the organizational structure. All of the successes, failures, lessons learned, and mistakes made can be reproduced, dissected, and discussed in a controlled and relaxed setting. Additionally, new technologies and equipment can be mastered and tested prior to being put into a compliance monitoring situation.

To date, the facility has been toured and/or utilized by the Environmental Protection Agency (EPA), Arizona Department of Environmental Quality (ADEQ), and staff from over a dozen Arizona’s local pretreatment programs. Additionally, the facility has been utilized by several private agencies, and a community college program designed to educate the utility professionals of tomorrow. This project has been presented at a local Arizona Water Conference.

The sample campus will ensure that the future of sampling and monitoring within the Tempe utility and any other willing utility in the State of Arizona and the United States of America will have the means, and the tool box, to preserve the knowledge of their professional forefathers/foremothers. Additionally, they will be prepared with the confidence, ethics, and integrity that comes with a solid educational foundation, and inherit the desire to expand upon that and one day pass their knowledge on to the generation that succeeds them.

Concept and Design

With a multitude of retirements likely to occur, and the organizational movement that can create, five members of the Environmental Services Section at the City Tempe began to brainstorm ideas to address the unique and diverse training needs of our industry. It was quickly realized that there is not an adequate training regimen to address the technical and situational aspects of environmental sampling and monitoring. Training specific to the analytical techniques, lab methods, and proper quality assurance & control (QA/QC) are present, but training on the installation and use of specific water and wastewater monitoring equipment have proven difficult to find. When training was available, it was usually provided by a sales vendor selling the equipment and rarely, if ever, covered situational encounters such as access, weather conditions, or any other issue outside the scope of the specific piece of equipment they were selling.

The decision was made to identify the common sampling needs, and build an environment conducive to training, situation reproduction under controlled conditions, and equipment troubleshooting. As a team, we began with a six inch flow loop design, which was ultimately reduced to four inches due to spatial limitations. The initial drawing showed two flumes, a V-Notch Weir, sewer manhole, double sweep cleanout, and magnetic flowmeter, as shown below.

![Initial Design](image)

Additionally, a rain gauge and the backflow assembly devices commonly used in water distribution systems were put in the initial design. As construction progressed it was determined that the permanent drinking water well as well as the groundwater pump, and water treatment plant impoundment ponds on site were also able to be used in a training capacity, and The City of Tempe’s Environmental Sampling Campus was born.

Construction and Operation

Once an initial concept and design was in place, we were given a budget to construct and equip the sampling campus. With the exception of some electrical reconfiguration, the flow loop was constructed entirely by in-house staff within the City’s Water Utilities Division.

The sample campus is located at the South Tempe Water Treatment Plant (WTP) and consists of four physical sites. The flow lab is located in the WTP basement, and this area was selected due to the fact that it was the only location on the premise that had adequate space to permanently lay out the loop, house the equipment, and be converted into a quasi-academic environment.

The flow loop is a 432 square foot area with approximately 50 feet of four inch clear PVC piping. As flow travels through the...
loop, it passes through a four inch electromagnetic flow meter w/ transmitter (EMT), a four inch Palmer Bowlus flume, a four inch Parshall flume, a 22 ½ degree v-notch weir, an eight inch simulated manhole, and a double sweep clean out, all of which are typical primary devices used in wastewater monitoring.

Flow is generated gravimetrically from an elevated tank that drops water through the EMT, flumes and weir box, and then proceeds through the manhole and cleanout to a return tank where a submerged sump pump feeds the water back into the elevated tank. The EMT generates real time flow readings on a display panel and each flume station is equipped with a dedicated ultrasonic probe and an ISCO 2110 ultrasonic flow module that will interface with an auto sampler to allow for the collection of flow base sampling in conditions similar to those generated by industrial user. Each of the three flumes are equipped with removable union joints to allow for removal and replacement should the need arise. Additionally, this provides the flexibility to move devices around and simulate different up and downstream conditions.

The manhole was designed by cutting into a circular irrigation box and running a strategically cut piece of 8 inches PVC, with a 4 inch reduction union on each end, through the irrigation box. This allows a stainless steel sleeve to be installed simulating street level installation. The sleeve contains an area velocity probe connected to an ISCO 2160 area velocity meter, which is inserted into the pipe. This provides the capability to create flow based sampling and monitoring conditions similar to those generated in an actual sewer main. The simulated manhole can also be configured with ultrasonic, or laser flow monitoring equipment.

An ISCO Avalanche refrigerated sampler is installed with an area velocity flow meter, rain gage, and interface unit to simulate rain event sampling through the manhole pipe. During operation, rain is simulated and when pre-programmed trigger points are met, notification alarms will be sent out as they are during an actual storm. This will allow for training on Municipal Separate Storm Sewer System (MS4) monitoring events as well as giving staff the ability to recreate flow conditions that previously could not be explained. The MS4 monitoring station will be equipped to look exactly as it does in the field with wireless modem to transmit information online.

Applications

The original intent of the sample campus was to educate and train staff within the City of Tempe in the areas of sampling, monitoring, field analysis, and backflow assembly testing and repair. As a clear void in available training within the State of Arizona became more apparent, the concept quickly evolved into a regional training environment when the City began showcasing the facility to other jurisdictions at the Federal, State and Local level. The facility is designed to allow for training that includes, but is not limited to, all drinking and wastewater sampling, groundwater monitoring, backflow assembly testing and device maintenance, and stormwater compliance monitoring. Additionally, the flow loop has the capability to reproduce system conditions that will allow staff to identify and report causation for equipment failure. Also, conditions, such as a sanitary sewer overflow, and plumbing back

continued on page 14
up can be simulated by restricting flow at specific points in the loop, which will allow staff to safely prepare for these situations when they occur in the field.

Since its completion in July of 2014, there have been two statewide industrial sampling training classes, and several custom training and equipment review sessions that included over a dozen government agencies as well as private sector attendees. The City has also been working with a local community college to include recurring use of the facility in their Water Resources curriculum.

Moving Forward

Given the knowledges and the tools to effectively perform their jobs, future water & wastewater staff will be prepared to address all of the existing and emerging challenges that are put in front of them. Proper preparation will also promote an environment of integrity, professionalism, and quality that is not only required by the regulations that govern our work, but also expected by our leaders, rate payers and the general public. When the project was completed, I reverted to a quote from Actor, John Ritter. “Don’t just tell your child to get better grades, give them the tool that makes it possible.” That is the foundational philosophy of this project.
**Water Treatment Committee Seminar Series**

**Water Quality from Source to Tap in the 21st Century - Key Parameter Changes through the Treatment Facility and the Distribution System that Impact the Potable Product**

**Wednesday February 22, 2017**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
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<tbody>
<tr>
<td>7:00 a.m. - 8:55 a.m.</td>
<td><strong>EARLY REGISTRATION</strong> Operator Training (Open to all) Gary Whitten, AmeC Foster Wheeler; Luiza Yardanova, Tempe</td>
</tr>
<tr>
<td>7:15 a.m. - 8:45 a.m.</td>
<td>Introduction Eric Kaupanger, Maricopa County Environmental Services</td>
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<tr>
<td>8:45 a.m. - 8:55 a.m.</td>
<td><strong>Introduction</strong> Eric Kaupanger, Maricopa County Environmental Services</td>
</tr>
<tr>
<td>8:55 a.m. - 9:15 a.m.</td>
<td>Salt River Project’s Water Quality Monitoring Mike Plougue, Salt River Project</td>
</tr>
<tr>
<td>9:15 a.m. - 9:45 a.m.</td>
<td>pH, Corrosion, Scaling, Langelier Indices, Pipe Materials Carolllo Engineers</td>
</tr>
<tr>
<td>9:45 a.m. - 10:15 a.m.</td>
<td>Impact of Treatment Chemicals on Distribution System Victoria Sharp, Anupa Jain, PhD, Chandler</td>
</tr>
<tr>
<td>10:15 a.m. - 10:30 a.m.</td>
<td><strong>MORNING BREAK</strong></td>
</tr>
<tr>
<td>10:30 a.m. - 11:00 a.m.</td>
<td>Operator Advertisement, Facilities Hiring Operators Public and Private Utilities, Jason Bobko, Gilbert</td>
</tr>
<tr>
<td>11:00 a.m. - 11:30 a.m.</td>
<td>Corrosion Control Study Jason Bobko, Gilbert</td>
</tr>
<tr>
<td>11:30 a.m. - 12:15 p.m.</td>
<td><strong>LUNCH BREAK</strong></td>
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<tr>
<td>12:15 p.m. - 1:00 p.m.</td>
<td>Panel Presentation - Water Treatment Perspectives/Source to Tap Mark Gross and Blake Abts, Carolllo Engineers Mike Plougue, Salt River Project Victoria Sharp and Anupa Jain, Chandler Michael Kennedy, Mesa Moderator, Jason Bobko, Gilbert</td>
</tr>
<tr>
<td>1:00 p.m. - 1:30 p.m.</td>
<td>Ferric Chloride for Water Treatment Kevin Rose, Phoenix</td>
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<tr>
<td>1:30 p.m. - 2:00 p.m.</td>
<td>Water Quality Maintenance in the Distribution System through Blending Plans, Water Age, and In-Situ Air Stripping</td>
</tr>
<tr>
<td>2:00 p.m. - 2:15 p.m.</td>
<td><strong>AFTERNOON BREAK</strong></td>
</tr>
<tr>
<td>2:15 p.m. - 2:45 p.m.</td>
<td>Chlorine Contact Time- What does it Mean? Consideration of the Basic Components of a Rural Public Water System and Wellhead Treatment Brian Hamrick, PE, AmeC Foster Wheeler</td>
</tr>
<tr>
<td>2:45 p.m. - 3:15 p.m.</td>
<td>THM Control in the Distribution System Jared Carr, EPCOR</td>
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<tr>
<td>3:15 p.m.</td>
<td>Wrap Up, and Prize Drawings</td>
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**February 23, 2017**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m. - 11:00 a.m.</td>
<td>Tour City Chandler Pecos Surface Water Treatment Facility, Victoria Sharp</td>
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</tbody>
</table>

**GateWay Community College**

Center for Health Careers Education Auditorium
108 N. 40th Street, Rm CH1106, Phoenix, AZ 85034
Since Leonard White first attempted to predict the future of public service, scholars have been throwing darts at the proverbial target of what comes next. Understanding what motivates the newest members of the public sector will help to develop strategies for recruitment, development and retention of a new generation of public administrators and employees.

Exploring Public Service Motivation In The New Generation Of Public Employees

Introduction

Somewhere between the crystal ball and the retrospective exists the predictive clarity event horizon – the point at which we can start to examine the near future with relative confidence and certainty. Though to date a number of theories have been posted regarding the next generation’s profile in the workplace, it is only now, as the so-called Millennial Generation or, perhaps more descriptively, Generation We, moves out of college dorms and into their offices and cubicles that we can start to examine the decisions driving their anticipated career trajectories. This on-coming generation is an opportunity to examine how public service is advertised to potential and current employees to maximize the alignments between their interests and the needs of the public service arena.

Considering A Generation

The Millennial generation has achieved their majority now, with most Millennials falling between 18-30 years old; the generation being defined roughly and inconsistently defined as having been born between the early 1980s and early 2000s. Specifically looking at American Millennials, this generation was shaped by key political events which signaled the globalization of our modern experience: the Space Shuttle Challenger explosion, Operation Desert Storm, the end of the Cold War, widespread internet access, the terrorist attacks of 9/11, and the Great Recession. It is impossible to conceive of an isolationist world anymore as an American Millennial. The United States has been involved in numerous global events during this generation, including the activities in the Gulf, Afghanistan, Kosovo, and a multitude of others.

Demographics

The Millennial Generation is the most ethnically and racially diverse generation in modern American history. The single-ethnicity majority is shifting towards a broader swath of ethnic and racial representation in the US as shown in the following figure. However, it is important to note that American Millennials are not significantly more likely to be foreign born than previous generations, but their nativity more closely reflects the growing immigrant population with 11% having at least one parent that is an immigrant as compared to the Generation X (7%) or the Baby Boomers (5%) (Pew Research Center, 2010).

Education

In addition to the change in racial and ethnic diversity, Millennials are also one of the most educated American generations in history. 54% of Millennials have at least some college education, compared with 49%, 36%, and 24% of Gen Xers, Boomers and Silent generation, respectively (Pew Research Center, 2010).

Family Status

Millennials are significantly less likely to be married or to have children than earlier
generations were at the same age, with 25% having married (20% currently married), compared with 57% of the Silent generation, 48% of Boomers and 33% of Gen Xers at comparable ages (Pew Research Center, 2010).

Community Type

Millennials are also the most “urbanized” generation as compared to those that have come before, with only 14% living in rural areas as compared to 29% of Boomers and 36% of the Silent Generation (Pew Research Center, 2010). This shift in residency changes the experiences that Millennials have faced growing up and will be noted in their developed priorities moving forward.

Making A Difference: Engaging Millennials In Public Service

This heavy change in demographics and the move to a more integrated society is making the Millennials a uniquely interconnected generation. This interdependence shows in a number of unique ways, including the nearly omnipresent technology and social media, emphasis on volunteerism, and the optimistic viewpoints about the future reflected in countless surveys.

Inclusion, Optimism, and Dedication

In addition to the shifting general demographics, massive societal and cultural change is underway, comparable to the Civil Rights Movement, which allows for the inclusion of a wide array of historically excluded groups, including the lesbian, gay, bisexual, transgender, questioning, intersex, asexual, etc. (LGBTQIA+) as well as the disabled, and other marginalized identities. This inclusive response will allow for more people to engage at the local government level even outside of the formal employment sphere. Greater degrees of acceptance will lead to higher engagement and an expectation that government service is accessible to everyone. Instead of the historically derided role of government to identify and stabilize the middle classes to the oversight of the disenfranchised and the success of the upper class, the expectation to provide equitable opportunity will be emphasized.

This next generation coming into their own, the Millennials, is also refreshingly optimistic about the opportunities for change. 83% of U.S. Millennials believe they can make a local difference in their communities (Telefónica, S. A., 2013). This generation also wants stability, after hard-won successes during the Great Recession, this group of new employees feels strongly about staying in a steady employment opportunity, with 66% answering that steady employment is more important than changing jobs to match opportunities (Villanueva, 2013). The public sector has an amazing opportunity to engage optimistic, talented, educated, dedicated employees and the onus is on getting those people into the best roles for them and keeping them engaged.

In order to appeal to this generation of optimistic, interested individuals, the public sector is going to need to invest in individual employee development over bulk initiatives and training. Programs should be tailored as to provide culturally diverse, inclusive elements that underscore the importance of community. This is a group that believes in supporting the home first and making sure it is in order before dedicating resources far and wide.

Economic uncertainty has clearly bumped the number of people interested in working for the government, but the lasting effect will likely continue to reveal itself in the Millennial generation. 83% of Millennials agree that “everyone has an obligation to give back to their community,” a public service orientation that will reveal itself through volunteer, non-profit work, and an eagerness to serve in the community (Telefónica, S. A., 2013).

Respecting the Individual

Recognizing the capacities and drivers of the individual is absolutely critical to any attempt to understand the motivations of those drawn to public service. It should go without saying that generations are not monoliths; each individual will have specific experiences and histories which shape their individual views of the world and their place within it. However, in attempting to understand what the next wave of entrants to the public service sector will bring we have to acknowledge the commonalities among the Millennials and the driving motivations that can benefit the public at large.

Recruiting and Branding

As administrators, we can support that latent call to service many Millennials reflect in their core values. The key will be in identifying valuable work and constructing narratives that support that messaging. Rather than say that you are hiring for garbage men, consider rephrasing that line level service is needed to protect the community’s health and welfare. The work of the government is in service to its constituents and having a broad base of invested people is a huge boon to us as we consider the next steps in public administration. Identifying, developing, and supporting key hires will help rebrand the message of public service and hopefully return the relationship of the government to a less adversarial role as the markedly disappointed and world-weary previous generations take the opportunity to let Generation We lead.

CONCLUSION

Trying to picture the next 40 years of public service is a challenge well beyond the scope of any simple generational review, but as we officially welcome the Millennial Generation into the fold of public service we must take a few moments to determine how best to serve and be served by this crop of talent. There is an unprecedented opportunity to instill the value of service and reestablish the relationship of the role of the public administrator as one of inclusive authority and conscientious engagement.

BIBLIOGRAPHY


When he came to Arizona State University 26 years ago, Peter Fox joined only one other faculty member with expertise in environmental engineering — and that colleague retired one semester after Fox’s arrival.

At that time, ASU students interested in doing research or obtaining a degree in that emerging branch of engineering had to move on to graduate school at another university.

Professor Peter Fox has been the academic adviser to more than 120 students who have earned master’s and doctoral engineering degrees at Arizona State University, and mentored hundreds of undergraduates in their studies — as well as providing both graduate and undergraduates opportunities for research experience in his laboratory. Fox is pictured here in his lab, working with Nikou Hesari, who completed studies for a doctoral degree in environmental engineering last year. Photographer: Jessica Hochreiter/ASU

Today, ASU’s Ira A. Fulton Schools of Engineering has a highly reputable environmental engineering graduate program that has been recognized nationally and internationally, and now Professor Fox’s ASU colleagues include many prominent researchers in the field.

Many people had a hand in making that happen, but Fox is acknowledged as “the one who got it all started,” says Bruce Rittmann, a fellow professor in the Fulton Schools and a much-awarded researcher in environmental biotechnology.

Fox has served as adviser to more than 100 students who have earned master’s degrees and more than 20 who earned doctoral degrees in civil, environmental and sustainable engineering, and he has mentored hundreds of undergraduates who have focused their studies on a concentration in environmental engineering within the accredited civil engineering program.

But in the near future, he will be able to see ASU students earn degrees from a new undergraduate program focused specifically on environmental engineering.

Joining a list of all-stars

Fox’s leading role in all this progress is a large part of what has earned him this year’s top educator award from the Water Environment Federation, a major international organization of water-quality professionals.

He accepted the Fair Distinguished Engineering Educator Medal on September 27 at the WEF Annual Technical Exhibition and Conference, the largest event of its kind in the world.

The award, which “recognizes accomplishments in the education and development of future engineers,” is named in honor of Gordon Maskew Fair, a Harvard University professor of sanitary engineering known for not only teaching students the technical aspects of the field but inspiring them to use their skills to protect and enhance environmental quality.

The medal is awarded to recognize the contributions of those whose work as educators reflects Professor Fair’s ideals.

“Peter’s past body of work and his current service, research and outreach have been instrumental in driving our environmental engineering graduate program to national prominence. I cannot think of anyone else who is so deserving of this award,” says Professor G. Edward Gibson Jr., director of the School of Sustainable Engineering and the Built Environment, one of the Fulton Schools.

Sought-after water resources expert

Fox says he is further honored because the past winners of the award comprise “a list of all-stars” in the environmental engineering profession.

Fox’s all-star status is emphasized by former student Carlos Padilla, who nominated Fox for the award.

Padilla earned a master’s degree under Fox’s mentorship and is now the water resources department assistant director for the

continued on page 34
“PCL’s CMAR expertise is consistently demonstrated throughout this multi-year rehabilitation project beginning with the early involvement during design, the preconstruction site preparations, and efficient work scheduling to meet the project’s milestones. Their attention to safety and quality is a true testament to their commitment to Tucson Water’s long-term goals for this reservoir.”

DOROTHY DOLAN, RESERVOIR REHABILITATION PROGRAM MANAGER
TUCSON WATER

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ENGAGE, ENERGIZE AND MAKE A DIFFERENCE

By Lisa Jackson, AZ Water Board Vice President

There’s nothing better than the smell of the desert after rain. So the morning after a rare rainy day, I decided I’d enjoy a cool and cloudy fall hike up Piestewa Peak. I was rewarded at the top with a spectacular sunrise and community connection. One hiker was struggling with the difficult last 50 feet to the peak, and as she came to the top, a white haired, spry man sitting on a rock near the peak offered words of encouragement. He took the initiative to build a connection; told her she could do it; then added he was 82 years old and hiked it every day. Who can resist an invitation to engage like that? I felt energized for the rest of the day not by the hike but by the connection with the 82 year old hiker that I made. I know it would have been a different, less fulfilling experience without that connection.

The 82 year old “catalyst” knew the importance of engaging, taking action and making a difference. AZ Water Association is like Piestewa Peak; we have gone by other names but have been here for as long as any of us in the water community can remember, but there is a need for more members to step out of their comfort zone, volunteer and engage. Join a committee, engage in that committee, and make a difference by supporting and advocating for the future of Arizona’s water resources, water infrastructure and our human capital that is crucial to water in Arizona.

It is a critical time for our water community. A larger percentage of our utility professionals, operators, laboratory analysts and other water professionals are retiring soon while our water infrastructure and resource needs are growing and in need of rehabilitation and replacement. AZ Water recognizes this and has made strides in the last three years to address future needs beginning with updating our Association’s Strategic Plan. (You can find the Strategic Plan on the AZ Water Association website under the ABOUT tab at the top.) As stated in the Strategic Plan, our Mission is to: “Advocate for Arizona’s Water through bold leadership, connecting professionals, providing education and inspiring environmental stewardship.” Engaging and participating in an AZ Water Committee connects you with other water professionals, strengthens our water community and advocacy. The opportunities to participate are as varied as our water professionals. If you are a “seasoned” professional think about offering to mentor and sharing your knowledge with new professionals or discussing what you do with youth and others to recruit them into a very rewarding career. Invite a council-person, high school class, outside industry professional and a neighbor to the next water treatment plant tour. If you are mid-career or just getting started look at participation in a committee as an opportunity to grow, try something new, build your leadership skills, network and elevate your career.

Hopefully you are thinking “I’m willing to give it a try; how can I join and get engaged?” Go to the AZ Water Website and click on the Committees tab then go to the Join a Committee to see a listing of all of our committees, the committee leaders and leader contacts. You can go back up to the Committee tab and scroll down to the committee categories and names to read more information about each committee.

There are big opportunities starting with the Communications Committee. The Communications Committee is more than finding and developing content for the Kachina News, it is involved with identifying content from various sources inside and outside Arizona (such as links to relevant AWWA and WEF content) that our AZ Water Membership and authorizing public will find informative, relevant and helpful to their careers and decisions. It’s about communicating the value of water, water infrastructure, operators, contractors, scientists, engineers and other leaders working together to make Arizona’s water safe and reliable. The Communications Committee is also about finding ways to connect AZ Water members with opportunities for training, education, volunteering and fun by getting the word out through e-blasts, Facebook, Twitter and Pinterest.

Another committee that has been recently transformed is the Leadership Committee. This committee is charged with identifying and developing Arizona’s future water leaders. It will develop, support, and facilitate leadership training events including the annual AZ Water Leadership Summit, provide leadership articles for the Kachina News, disseminate AZ Water information to our authorizing public, and be responsible for bringing in a variety of elected officials to our events such as the Annual Conference. This year the committee intends to hold a round table session that our elected officials can attend to openly exchange ideas about the Value of Water and supporting investment in supplies, infrastructure and people.

One of the Association’s four strategic objectives is to continue to be a thriving and healthy volunteer organization. The Membership Committee is key to achieving this objective. At the 2016 Leadership Summit the 2016-2017 Membership Growth and Development Plan was presented. It includes conducting a survey to better understand membership needs and demographics, developing website content and leave behind literature identifying the value proposition AZ Water provides individuals, utilities, consulting firms and private industry, revitalizing the membership website page and hosting membership drives and events to retain existing members and recruit new members. The Membership Committee is in need of new energized members who represent our diverse Association membership’s experience, geography, private and utility services and products, skill-sets and outreach capabilities.

Other committees represented at the Leadership Summit who put out a call for more members and engagement include: the Biosolids, Pretreatment and Wastewater Collections committees, the Research and Lab Practices committees, Safety, and Water Distribution. Please reach out to a Board Member, Committee Chair, or Staff if you want to join, engage and be a part of Arizona’s largest water organization. I promise you if you engage, volunteer and be active the connections you make will make a difference.
DURABILITY FOR GENERATIONS TO COME

The decisions you make today regarding water/wastewater infrastructure projects will have an impact on your community for generations to come. Our 80 years of experience provides you with the confidence to choose DN Tanks as the best water or wastewater storage solution for your community. Never a need for routine maintenance or out of service time, just decade after decade of reliable service. Now that’s a legacy worth building.

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Sean Sudol, Arizona Regional Manager | sean.sudol@dntanks.com | 619.820.5327
committee news

The Wastewater Treatment Committee (WWTC) has had another excellent year in 2016 working to fulfill its mission to “provide value to our colleagues and the public through training, education, and increased awareness of wastewater treatment… to protect water quality, public health and the environment.”

We are very proud to report that the WWTC recently passed a milestone—we now have over 50 members participating in the committee, up from the core group of eight that restarted the group four years ago. This demonstrates the kind of momentum that can be generated when an energetic group gets together to help our profession and our colleagues. We enjoy working together, have a lot of fun, and take pride in our accomplishments.

The committee’s third annual Technical Seminar, entitled “Advancing Wastewater Treatment Plant Operations” was held on October 25. With an operations-oriented theme this year, the seminar provided an outstanding lineup of speakers from the Arizona wastewater profession, covering a wide range of topics including optimizing underloaded treatment facilities, career paths and training for operators, and new technologies. A group of about 85 persons gathered at the SRP Pera Club in Tempe for a full-day of speakers, lots of great networking opportunities, and participants received six Professional Development Hours.

The committee has continued to provide an active slate of plant tours, trainings, and other educational opportunities. In 2016, the committee organized six treatment plant tours that included a breakfast or lunch (thanks to our generous sponsors), provided two PDHs, and was free of charge to AZ Water members. Watch for more plant tours in 2017. The committee’s “Five Amigos of Math,” Miguel Ayala, Doug Berschauer, Jesse Black, Tyson Glock, and Gary Whitten, donate their time to provide operator math training workshops, and presented six such workshops in 2016. Again, these were offered as a service to AZ Water members free of charge, and they typically provided three PDHs. Please contact us if you are interested in having a training at your facility.

The committee presented three webinars with plans to continue and expand that effort in 2017. The webinars were free of charge to AZ Water members, and offered one PDH each. Many webinars were filled to capacity, so watch for upcoming webinars and be sure to sign up early.

Ongoing projects and upcoming initiatives include a Level 1/Level 2 wastewater plant operator training class now being developed, a moderated wastewater treatment discussion forum on our webpage, and the launch of a mentor bank of senior professionals available to help the less-experienced members of the industry.

An initiative we are particularly excited about is high school outreach. Several members of the WWTC will be working with groups of high school students this year to inform them about Arizona water/wastewater issues, show them the opportunities in our industry, and to make a connection between AZ Water and the larger community in which we live. Our tentative plans include some in-class time, a plant tour, a joint project with the students, and a visit for the students to the exhibition hall at the Annual Conference & Exhibition in May.

You are encouraged to join us! We have a very diverse group ranging from young professionals to industry veterans and spanning all of the different professions and organizations that serve our industry. All are welcome! Our meetings are typically held on the third Wednesday of the month from noon – 1 p.m. at the offices of the Maricopa County Environmental Services Department in midtown Phoenix (light rail accessible), or you can call in if unable to attend in person. We hope to see you at an upcoming meeting!

If you have any questions or need additional information please contact committee chair Doug Kobrick at 602-826-2454 or dkobrick@hazenandsawyer.com.

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Construction Committee

The Construction Committee continues to make progress with the Curriculum initiative. The following topics are being developed and we will be ready to hold these sessions starting in 2017. Keep checking back on the AZ Water website events calendar at www.azwater.org for session updates.

- Pipeline Constructability (Lloyd Hiser)
- Startup and Commissioning (Jesus Angulo)
- How to read C-E-M-PID Drawing (Richard Jaquay)
- MOPO Process Coordination (Gary Hornberger)
- Risk Assessment for YP’s (Larry Ayers)
Stormwater Committee

Please welcome AZ Water’s newest addition ... The Stormwater Committee.

There has been a hole in AZ Water's picture for many years, but on October 25, 2016 that hole was filled. On that date, members of the Phoenix area stormwater community gathered and elected its first Chair and Co-Chair to lead the formation of the special interest committee focusing on Stormwater. The addition of a Stormwater Committee completes the “water picture” for Arizona’s water professionals and gives voice and home to those impacted by both quantitative (flooding and drainage) and qualitative (compliance) aspects of our valuable stormwater resource.

While the Stormwater Committee is still in its infancy, Todd Williams (Chair), Rebecca Sydnor (Co-Chair), and Carl D’Acosta (web master) have begun working with stormwater community representatives to develop the Mission and Vision of the committee. During this establishment period, we’re planning to meet on a monthly basis, both in-person in the Phoenix-metro area and simultaneously via Go-To-Meeting for everyone state wide. We also have plans to introduce the committee at AZ Water meetings and events throughout Arizona and across multiple market sectors.

Professionals who may be interested in participating with this committee include those involved with mining, construction, animal feeding operations, and industrial activities as well as municipal stormwater compliance and flood water management. Engineers, designers, water practitioners, educators, researchers, and regulators are all invited to attend and contribute to this committee as we move forward on defining our mission and vision.

While not yet formalized or adopted, our Committee plans to focus on sharing resources and information, promoting continuous improvement to respond to the changing regulatory environment, addressing design standards and requirements, providing professional development and training, and promoting understanding and awareness of stormwater related issues.

Our next meeting will be held on January 24, 2017 at 12:00pm at 2801 W. Durango Street, Phoenix, Arizona 85009. For Go-To-Meeting instructions, please contact Todd or Rebecca or visit our website at https://azwater.site-ym.com/group/stormwater. At our website, we also encourage you to join our stormwater committee. Click on the join us tab and request membership into our committee.

As the youngest child in the water family, we’ll do our best not to be too wild. We look forward to working together to grow the committee and contribute to the preservation of our valuable Arizona.

Chair:
Todd G. Williams, M.Sc.
Michael Baker International
602-733-6051
todd.williams@mbakerintl.com

Co-Chair
Rebecca Sydnor, PE, LEED-AP
Amec Foster Wheeler
602-798-7556
rebecca.sydnor@amecfw.com

Webmaster:
Carl D’Acosta MS, R.S., CPM
Maricopa County
602-506-6944
cdacosta@mail.mmaricopa.gov

continued on page 24
Young Professionals Committee

The AZ Water Young Professionals (YP) Committee wrapped up another successful year – educational outreach, networking and reaching out to our members and the public. Last school semester the YP Committee visited several of the state’s educational institutions with the intention of bringing awareness of the Association’s message and an opportunity for students to get involved with the Committee. Members of the committee sponsored a technical presentation at both U of A and ASU’s Environmental seminar class, and visited Gateway Community College’s WAVES club.

The YP Committee has plenty of social events to offer a relaxed environment for Young Professionals to get to know each other and create a strong bond amongst committee members. One example of this is our networking lunches and our happy hours. Our October monthly meeting was a combination paintball event. Other events include hiking, kickball, and our annual Holiday Party.

Last fall we also had our annual kickball event. This event turned into a competitive bout between the AZ Water YPs and ASCE young professionals group, the YMFs. We look forward to the rematch next year and this event is always a good time!

Biosolids Committee

The Biosolids Committee was very busy in 2016. We held a plant tour at the Tres Rios WRF in Tucson during March. We also have held a number of webinars offered during the year, starting with our Presentation on the Biosolids Incineration rule change, and some of the Energy Recovery processes available from Thermal Processes. That was followed by a webinar titled “Going Green with Digester Gas”. Both webinars were well attended. In January, 2017, we held a webinar which focused on Biosolids Incineration, Facts vs Myths, and in February we have an additional webinar scheduled which will focus on Net-Zero Carbon and Energy Use. For all of these webinars, we try to offer the top experts in the field as presenters.

The Committee generally meets once a month, during the 4th Thursday of the month, from 12:00 noon to 1:00pm. Locations vary.

The Committee will continue working on more webinars as well as plant tours. However, we need more help. If you are interested in joining the Biosolids Committee and working with us in planning some events, please e-mail me at dave.quinby@surpriseaz.gov and I will contact you with more details concerning our next meeting. Everyone is welcome!

continued on page 26
BUILDING WATER PROJECTS FOR THE SOUTHWEST

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(Rankings via Engineering-News Record, 2015)
In December, the YPs sponsored a site tour at the San Tan Vista Water Treatment Plant in Gilbert; thank you to the Town of Gilbert and Sundt Construction for making this possible.

The Committee ended the year with an annual Holiday Party hosted by Lourdes Rodriguez.

The YPs would like to thank Lourdes Rodriguez from the Whiting Turner Contracting Company for an outstanding job as the 2016 Committee Chair. Lourdes will continue to be an active committee member while Clayton Freed with the City of Phoenix becomes the 2017 Chair. We’d like to Congratulate Nashita Naureen with Carollo Engineers on becoming the 2017 Vice-Chair.

Upcoming events for the YP Committee include: an association sponsored award for the Future Cities youth contest, judging for the Stockholm Junior Water Prize competition, booth participation at the Science Center for E-Day, and the WEF/AWWA YP Summit in Tampa, Florida. If you’re interested in getting involved with the YP Committee contact Clayton.Freed@Phoenix.gov or NNaureen@carollo.com for more information.
AZ Water Association - WASTEWATER TREATMENT COMMITTEE

MENTOR BANK

The purpose of the AZ Water Association Wastewater Treatment Committee’s MENTOR BANK is to provide a resource for plant operators and other industry professionals to obtain guidance from senior members of the profession.

We have heard from many younger operators that they could benefit from career and technical advice, but do not know where to turn. Our industry’s senior professionals have the wisdom of years of experience to offer. The MENTOR BANK provides an informal and anonymous (if you choose) resource for those in need of advice or guidance to obtain it from those who have been there, seen it, and done it.

The MENTOR BANK is informal. A person seeking guidance can contact one of the Mentors directly (see the list below), or can request a Mentor at the following website:

WastewaterTreatment@azwater.org

Our goal is to keep this program simple and easy to access. The Mentor and mentee are free to choose how they would like to communicate, and to make the arrangements between themselves. Our Mentors have all volunteered their valuable time and are eager to help you, in whatever method best meets your needs. You can also request that things be handled confidentially if you wish.

If you have any questions or would like other assistance, you can also send an email request to the same email address: WastewaterTreatment@azwater.org

AZ Water WWTC MENTOR BANK
Current members and contact information

<table>
<thead>
<tr>
<th>Mentor</th>
<th>Employer</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miguel Ayala</td>
<td>City of Avondale</td>
<td><a href="mailto:mayala@avondale.org">mayala@avondale.org</a></td>
<td>(623) 333-4437</td>
</tr>
<tr>
<td>Robert Garcia</td>
<td>City of Peoria</td>
<td><a href="mailto:robert.garcia@peoriaaz.gov">robert.garcia@peoriaaz.gov</a></td>
<td>(623) 332-0033</td>
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<tr>
<td>Karla Guerra</td>
<td>City of Glendale</td>
<td><a href="mailto:kcamouguerra@glendaleaz.com">kcamouguerra@glendaleaz.com</a></td>
<td>(623) 930-4757</td>
</tr>
<tr>
<td>Paul Hendricks</td>
<td>EUSI</td>
<td><a href="mailto:phendricks@cox.net">phendricks@cox.net</a></td>
<td>(623) 204-4901</td>
</tr>
<tr>
<td>Jim Huchel</td>
<td>City of Flagstaff</td>
<td><a href="mailto:jhuchel@flagstaffaz.gov">jhuchel@flagstaffaz.gov</a></td>
<td>(928) 213-2426</td>
</tr>
<tr>
<td>Art Nunez</td>
<td>City of Scottsdale</td>
<td><a href="mailto:anunez@scottsdaleaz.gov">anunez@scottsdaleaz.gov</a></td>
<td>(480) 220-3798</td>
</tr>
<tr>
<td>Hector Ortiz</td>
<td>City of Scottsdale</td>
<td><a href="mailto:hortiz@scottsdaleaz.gov">hortiz@scottsdaleaz.gov</a></td>
<td>(480) 312-8710</td>
</tr>
<tr>
<td>John Pinkston</td>
<td>City of Chandler</td>
<td><a href="mailto:john.pinkston@chandleraz.gov">john.pinkston@chandleraz.gov</a></td>
<td>(480) 782-3719</td>
</tr>
<tr>
<td>Charles Stewart</td>
<td>City of Mesa</td>
<td><a href="mailto:charles.stewart@mesaaz.gov">charles.stewart@mesaaz.gov</a></td>
<td>(480) 644-6000</td>
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A HOT SOLUTION
NITRIFICATION AT ELEVATED TEMPERATURES IS NO PROBLEM FOR A REFINERY MBBR

By Caroline Dale

Introduction

Wastewater in refinery applications frequently reaches temperatures in excess of 40°C, making biological treatment a challenge; in particular, nitrification. The Suncor Refinery in Montreal, Quebec, is no exception. The refinery processes 130,000 barrels per day, producing gasoline, distillates, asphalts, heavy fuel oil, petrochemicals, solvents, and feedstock for lubricants.

The process of refining crude oil into finished products such as gasoline and other petrochemicals requires complex systems and generates large quantities of water. The desalter unit requires washwater and heat to remove dissolved salts from the crude oil before it can be further processed. Steam is used in many refining processes; it is used as a stripping agent in distillation and for dilution in the cracking process.

Refinery wastewater contains a range of hydrocarbons as well as ammonia. The most common process used to remove organic carbon and ammonia is biological treatment, either in a suspended growth system such as activated sludge or a fixed-film system such as trickling filters or moving bed biofilm reactors (MBBRs).

Long-term operating data has shown that the MBBR is a robust process that allows nitrification to take place at elevated temperatures. An MBBR was installed at the Suncor refinery to increase the plant’s nitrification capacity. As a result, the facility has seen improved treated effluent quality.

Suncor Refinery in Montreal

The wastewater treatment plant at Suncor is typical of refineries. Wastewater flows through an oil separator followed by air flotation. The pretreated effluent is then collected in an equalization tank prior to being pumped to the MBBR. The MBBR effluent is discharged into a lagoon prior to discharge to the Saint Lawrence River.

MBBR overview

The MBBR process was developed at the Norwegian University of Science and Technology around 25 years ago. It is a completely mixed, continuous flow-through process combining the benefits of fixed-film and suspended-growth processes.

An MBBR consists of a tank equipped with an outlet sieve to retain media, the media itself, and an aeration or mixing system. The aeration system utilizes a medium-bubble design with stainless steel laterals and diffusers. An important feature is that biofilm thickness is controlled by media movement so that oxygen diffusion through the biofilm is encouraged. The MBBR at the Suncor refinery uses AnoxKaldnes™ K3 media, shown in Figure 1. The media is made of high-density polyethylene, with a protected surface area of 500 m²/m³ and a specific gravity of 0.95 kg/dm³. Typical fill ratios range from 10% to 65% of total reactor volume.

![Figure 1. AnoxKaldnes™ K3 media](image)

Nitrification

The nitrification rate in an MBBR is directly related to the organic loading rate, dissolved oxygen concentration, and temperature. In most industrial applications where the organic load is significant compared to the nitrogen load, a two-stage system is recommended, consisting of carbon removal followed by nitrification. However, the wastewater at the Suncor refinery is relatively dilute compared to other refinery effluents, so the MBBR was designed for combined carbon removal and nitrification to allow existing tanks to be used. The MBBR was designed to achieve discharge requirements of less than 10 mg/L of soluble biochemical oxygen demand (BOD), 0.1 mg/L of phenols, and less than 3 mg/L of ammonia nitrogen (NH₃-N).

The design parameters for the process are given in Table 1.

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<td>40</td>
<td>42</td>
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<td>TBOD</td>
<td>mg/L</td>
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<td>100</td>
<td>150</td>
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<td>mg/L</td>
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<td>mg/L</td>
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<td>pH</td>
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Table 1. Influent design parameters for an MBBR

Temperature

As mentioned earlier, one of the design challenges was water temperature. Although the nitrification requirements are very low (assuming a BOD-to-nitrogen requirement for cellular synthesis of 100:3.5—only 5.9 mg/L of NH₃-N needs to be nitrified under average load conditions), there is little information available on nitrification rates at high temperatures. Many researchers have investigated the impact of temperature on fixed-film systems; however, very few have operated at temperatures in excess of 35°C. The optimal activity of Nitrosomonas has been shown to occur at 35°C, while the optimal activity of Nitrobacter occurs at 38°C, with a sharp drop-off in activity beyond these temperatures. Due to the limited data available at the time of the Suncor project, a conservative design approach was adopted to ensure that the monthly average discharge concentration could be achieved under all operating conditions.

Treatment results

Effluent monitoring is undertaken on a biweekly basis by Suncor personnel. The MBBR influent and effluent characteristics from February 2011 through May 2014 are summarized in Table 2.

The temperature and dissolved oxygen profiles in the MBBR are shown in Figure 2. The temperature increased gradually from April...
through May and remained above 40°C from May until October. The dissolved oxygen profile is almost the direct inverse of the temperature—as temperature increases, the dissolved oxygen concentration decreases. However, the aeration capacity was sufficient to maintain DO concentrations above 2.5 mg/L under most conditions, ensuring that the nitrification rate would not be limited by oxygen.

Figure 3 shows inlet and outlet total BOD concentrations over time. BOD removal across the MBBR is consistently meeting discharge requirements, even at temperatures in excess of 45°C. The three data points showing BOD levels higher than 40 mg/L reflect days when the influent load exceeded the maximum daily design load of 1600 kg BOD/d and are not related to high temperature.

Figure 4 shows the inlet and outlet NH4-N concentrations with nitrogen oxides in the MBBR effluent. Nitrate production is clear evidence of nitrification activity. To demonstrate nitrification, a nitrogen balance must be undertaken across the system. Nitrogen will be consumed for cellular synthesis. In this case, with an average influent total BOD of 61 mg/L and assuming a BOD:N ratio of 100:3.5 for a low-load system, an average of 2.1 mg/L N will be assimilated. For nitrification to be the dominant ammonia removal process, the total inorganic nitrogen in the effluent must be nearly equal to the inlet total inorganic nitrogen. Based on the data collected, the theoretic nitrate production should be 5.9 mg/L. The observed nitrate production was 4.8 mg/L at the Suncor facility.

Researchers have conducted continuous laboratory studies with MBBRs operated at 35°C, 40°C, and 45°C (Shore J.L., W.S. M’Coy, C.K. Gunsch, and M.A. Deshusses. 2012. “Application of a moving bed biofilm reactor for tertiary ammonia treatment in high temperature industrial wastewater,” Bioresource Technology, 112, continued on page 49

<table>
<thead>
<tr>
<th>Parameter</th>
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<td>Temperature</td>
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<tr>
<td>SCOD</td>
<td>mg/L</td>
<td>84</td>
<td>29</td>
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<tr>
<td>TBOD</td>
<td>mg/L</td>
<td>61</td>
<td>14</td>
</tr>
<tr>
<td>SBOD</td>
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<td>T-P</td>
<td>mg/L</td>
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Table 2. MBBR influent and effluent characteristics

Figure 2. Yearly temperature profile

Figure 3. TBOD profile across the MBBR

Figure 4. Nitrogen profile across the MBBR
2017 AZ WATER ASSOCIATION ANNUAL CONFERENCE AWARDS

It is that time of the year again to think about nominating your fellow Arizona water and wastewater operators, professionals, projects, and systems for recognition at the 2017 AZ Water Association Annual Conference & Exhibition. Nominations will begin in January 2017 and run through March 2017. Award descriptions and criteria for the AZ Water Awards Program can be found ONLY online at www.azwater.org.

2017 AWARDS LISTING

AZ WATER AWARDS
- Environmental Stewardship
- Kachina Award for Outstanding Service
- Nathan Burbank Environmental Educator of the Year
- Quentin Mees Research Award
- Kenneth J. Miller WFP Award
- Select Society of Sanitary Sludge Shoveler
- Gimmicks & Gadgets
- Operator of the Year
  - Large & Small Systems
- Plant of the Year
  - Large & Small Systems

• NATIONAL AWARDS •

AWWA AWARDS
- Warren G. Fuller Award
- Exemplary Source Water Protection
- John Lechner Award

WEF AWARDS
- Arthur Sydney Bedell Award
- George W. Burke, Jr. Award
- William D. Hatfield Award
- Laboratory Analyst Excellence Award

Questions can be directed to the Awards Program Committee Chair, Sarah Rogowski at awards@azwater.org.

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-Tricia Cook, Project Manager

Design with community in mind

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City of Mesa, one of many of Fox’s students who have gone on to leading roles in industry and at national laboratories, or have started entrepreneurial ventures and run successful businesses.

Those and many other students have gotten the benefit of learning from a teacher whose work to develop improved techniques, processes and systems for water treatment, recharge, reclamation and reuse have made him a sought-after consultant and research collaborator.

Fox has advised federal, state and regional government agencies and served on public task forces for major water resource sustainability efforts throughout the western United States and in other countries — including Australia, Israel and Jordan.

Locally, he earned the AZ Water Association’s Environmental Education Award in 2013 and the organization’s top research award, the Quentin Mees Research Award four times in previous years.

On a larger stage, he helped to establish the National Center for Sustainable Water Supply. Headquartered at ASU, its partners included Stanford University, the University of Colorado-Boulder and the University of Arizona. He directed the center for eight years.

Biggest reward is impact on students

He was an executive committee member for the effort to develop a national road map for water desalination and purification, a joint venture of the U.S. Bureau of Reclamation and Sandia National Laboratories.

Fox is currently a project leader for one of the major research thrusts of the Nanotechnology Enabled Water Treatment Systems center, called NEWT, a National Science Foundation Engineering Research Center.

The center is charged with developing compact, mobile, off-grid water-treatment systems that can provide clean water to millions of people who lack it and make U.S. energy production more sustainable and cost effective.

For the past five years, he has also been serving as the graduate program chair for the School of Sustainable Engineering and the Built Environment, where he impacts students’ education across all discipline areas in the school, including civil, environmental and sustainable engineering, construction engineering and construction management.

Fox says the bonus for all this varied work is being able to share the lessons and results from his leadership and research endeavors with his students.

“That is what makes this a great job, the combination of doing research and teaching,” he says. “In the end, the biggest reward is contributing to the lives of the students.”

Media Contact
Joe Kullman, joe.kullman@asu.edu
480-965-8122
Ira A. Fulton Schools of Engineering
2017 Board of Director Nominations

The Nomination Committee is accepting qualified and willing members to fill the position of Vice President within the Board of Directors of the AZ Water Association for 2017. In the event the Vice President is selected from the current sitting Board of Directors, a Director position might be open for consideration. So please send your nominations for a Director as well. Nominees will be listed in the spring 2017 Kachina News and voted on at the Annual Business meeting on May 4, 2017 during AZ Water’s 90th Annual Conference & Exhibition at the Phoenix Convention Center in Phoenix, Arizona.

Submittals should include nominee contact information and an explanation why this person should be considered for a leadership position within AZ Water. **Please submit your nomination in writing by March 1, 2017** to the chair of the Nomination Committee.

VOLUNTEER

Board Nomination Committee Chair
Kevin Conway, 5th Past President
602-432-9663, kconway@epcor.com

Vice President Duties
The Vice President serves within the structure of the AZ Water Association, Arizona Water Environment Association and Arizona Section of the American Water Works Association. This position oversees the activities of various committees during June 2017 - June 2018. The Vice President shall assist the President and President Elect and shall be the presiding officer of the Association in the absence of both the President and President Elect. The Vice President will have served as a Director, Secretary, or Treasurer of the AZ Water for at least one year and will have been a member of the AZ Water for at least one year and a member of both the AWWA and WEF at the time of elections. The term for the Vice President is one year (2017-2018). This person must be willing to commit to move through the officer chairs and serve as President Elect, President, and first Past President (three additional years).

Director Duties
The Director serves within the structure of the AZ Water Association, Arizona Water Environment Association and Arizona Section of the American Water Works Association. Directors are expected to attend all AZ Water Board Meetings (nine per year) and other meetings as designated by the President. All Director positions oversee assigned AZ Water committees. Directors must be members in good standing of the WEF, AWWA, and AZ Water. Terms are for one year, with an understanding that a three-year commitment is involved. Each year’s term is subject to re-election. If you have the energy, drive, and commitment to serve AZ Water, please consider placing your name or the name of a colleague in nomination for a Board seat.
A paradigm shift in the water sector is taking place, where treated wastewater is being recognized as a high-quality resource that can be recovered. This shift has enhanced the status of water reuse as an alternative water source in integrated water supply planning. Economic evaluations of water reuse often focus on the project itself and its direct benefits to the utility. But as utilities expand their analyses beyond the project itself, the economic development indicators sometimes are seen in the social leg of the triple bottom line, such as the number of jobs created and the water resources used for recreation.

To help decision-makers better quantify the indirect and induced economic development impacts of water investments, we can look at the metrics from existing economic frameworks in other sectors, such as transportation. These frameworks can be applied to the water sector to help planners see holistic economic alternatives and sustainable investments that water reuse and reclamation projects can contribute to their local communities.

**Adopting tools from transportation**

Other infrastructure sectors are much more developed than the water sector when it comes to identifying the economic impacts for project investments. Full economic frameworks and tools already exist in the transportation sector and have been successfully implemented in communities throughout the country and the world. The Transportation Economic Development Impact System (TREDIS) is a commonly used model used to provide economic development impact evaluation and benefit-cost analysis. Currently, 45 U.S. governmental agencies use this tool in 35 states.

In 2014, the Water Research Foundation (Denver, Colo.) and the Water Environment Research Foundation (Alexandria, Va.) released the report *National Economic & Labor Impacts of the Water Utility Sector*. This study examined the actual or planned expenditures of 30 water utilities across the United States and quantified direct, indirect, and induced economic benefits. This report was the first to aggregate the national economic impact of water utilities’ planned and capital budgets using an economic input-output analysis. The study used the IMPLAN model, which is part of TREDIS to model the way a dollar injected into one sector is spent and respent in other sectors of the economy, generating waves of economic activity. The study found the expenditures resulted in a combined total of 289,000 jobs and $52 billion per year generated in economic activity. The utilities involved in the study directly employ 36,500 workers.

In 2016, the Water Environment Federation (WEF) and the WaterReuse Association, both headquartered in Alexandria, Va., conducted an analysis to estimate the economic impact of the Clean Water and Drinking Water State Revolving Fund (SRF) programs. These programs are considered to be among the most successful infrastructure funding programs administered by the federal government and implemented by individual states, having provided billions of dollars in low-interest loans for thousands of projects.

The study showed that for every SRF dollar spent, 21.4% is returned to the federal government in the form of taxes. An advantage of the SRF program is the leveraging of state program funds to enhance the investment. Thus, the proposed $34.7 billion in federal allocation will leverage an additional $116.2 billion in state spending. Together, the proposed federal allocations and state SRF program funds will result in $32.3 billion in federal tax revenue. When these leveraged state funds are taken into account, $0.93 of federal tax revenue is generated for every $1 of federal investment. The study also documented increased employment and labor income as well as increases in total economic output.

WEF and WaterReuse also used the IMPLAN model to evaluate the economic impacts of proposed federal SRF allocations used through an IMPLAN model results per 1 billion of SRF summary. SRF spending generates high-paying jobs — each job is estimated to bring about $60,000 in labor income. On average, 16.5 jobs are generated for every million dollars in water and wastewater capital investments. The figure shows the distribution of employment impacts and compares the water and transportation sectors.

The water sector gains between 10 and 25 jobs per million dollars of capital expenditures. Comparatively, the transportation sector show equivalent impacts, with job creation estimates ranging between 13 and 20 jobs per million dollars invested. The most important areas that overlapped in both sectors were syphoned down to six categories: The economic role of water reuse, impact of water spending, benefit of water reuse investment, economic return on investment, impact of future scenarios for strategic planning, and online performance tracking. The framework developed is outlined below with specific impact measure questions that planners can refer to when evaluating their utilities:

**Category 1: The economic role of water reuse.** What is the role of current water supply facilities and services in supporting the local economy? What are the stakes associated with failure to continue to support them?

**Category 2: Impact of water spending.** How does ongoing and planned water spending affect the regional economy, and what is the income benefit from it?

**Category 3: Benefit of water reuse investment.** How does ongoing and planned spending on water reuse in provide benefits for users of those facilities?

**Category 4: Economic return on investment.** How will planned future capital investments affect the future competitiveness, productivity, and growth of the region’s economy? What is the payback from it?

**Category 5: Impact of future scenarios for strategic planning.** How will alternative scenarios for future water supply capital investments affect the future competitiveness and growth of the region’s economy? How can that information help identify investment gaps that require funding to allow economic growth?
• Category 6: Ongoing performance tracking. How can the evaluation and selection of future projects incorporate economic impacts and benefit-cost relationships? How can this approach apply to integrated water resources planning?

The water sector can learn from the transportation sector and better identify the indirect and induced impacts of a water project. By highlighting these impact measure categories that help drive economic growth, water reuse projects may have opportunities for additional allies in a region’s economic development initiatives, especially since water sector investments are comparable to transportation investments on a job creation and return-on-investment basis.

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Marisa Tricas, MS, ENV SP is Manager, Water Resources, Innovation & Policy in the Water Science & Engineering Center at the Water Environment Federation.
WATER TREATMENT GRADES 1 AND 2
1. What is the current MCL for THM’s?
A. 0.020 mg/L
B. 0.040 mg/L
C. 0.080 mg/L
D. 0.100 mg/L

2. Jar testing indicates 37.5 mg/L Alum is required for TOC reduction. Calculate how much Alum in gallons per hour is needed to treat 24 million gallons per day. The Alum has a concentration of 5.32 #/gal.
A. 37.5 gph
B. 88.0 gph
C. 98.9 gph
D. 99.0 gph

3. Which of the following chemicals is sometimes used to ‘shock’ disinfect filters that have been drained and maintained?
A. NH4OH
B. Ca(OH)2
C. NaMnO4
D. Ca(OCl)2

4. For large slow sand filtration plants, the turbidity of filtered water shall not exceed a maximum turbidity limit of:
A. 0.3 NTU’s
B. 0.5 NTU’s
C. 1.0 NTU
D. 5.0 NTU’s

5. During cold weather your water temperature drops to 4˚C. Your chlorine demand is 2.0 mg/L and you want a residual of 0.5 mg/L. What should you set your dosage at?
A. 1.5 mg/L
B. 2.0 mg/L
C. 2.5 mg/L
D. None of the above.

WATER TREATMENT GRADES 3 AND 4
1. Excess lime addition to remove if you apply 12.0 MGD to a basin that is 60 feet wide, 180 feet long, and 15 feet deep, what is the surface application rate in gpm/psf?
A. 0.50 gpm/psf
B. 0.63 gpm/psf
C. 0.77 gpm/psf
D. 0.834 gpm/psf

2. Which of the following piece of laboratory equipment is mostly associated with jar testing on a Phipps & Byrd 6-place jar tester?
A. Beaker
B. Flask

3. Graduated cylinder
D. Pipet

4. In Arizona, how many square feet of filter area is required to treat 50 MGD in a conventional water treatment plant, presuming 5% of the filter area is in backwash at any given time?
A. 5,000 sq.ft.
B. 5,800 sq.ft.
C. 6,100 sq.ft.
D. It cannot be determined.

4. You have switched from chlorine to a safer chemical and have found an approved 15% sodium hypochlorite solution for your treatment plant which weighs 10.5 #/gallon. How much should you feed in mL/min to dose 12.6 MGD with 1.75 mg/L?
A. 10.5 mL/min
B. 310 mL/min
C. 640 mL/min
D. 1440 mL/min

5. How many gallons of alum should you retain on site to keep a 30-day supply when you are feeding to dose 8.5 mg/L in 36 MGD. The alum is 48% and contains 5.36 #/gallon aluminum sulfate.
A. 10,000 gal
B. 14,300 gal
C. 15,333 gal
D. 26,050 gal

WATER DISTRIBUTION GRADES 3 & 4
1. What condition would be considered a cross connection in a water distribution system?
A. Corroded pipe.
B. A hose connecting raw CAP water to a reclaim main.
C. A hose connecting a private well to a water service.
D. A hose draped in a swimming pool.
E. C or D

2. What is another name for a nutating disk meter?
A. Piston meter
B. Service meter
C. Filter meter
D. Wobble meter

3. How many cubic feet are inside a 16” pipe that is 300 feet long?
A. 183 cu. ft.
B. 235 cu. ft.
C. 420 cu. ft.
D. 628 cu. ft.

4. How many pounds per day of chlorine gas are needed to disinfect 3475 gpm well water flow with 1.2 mg/L chlorine?
A. 50 lbs/day
B. 8 lbs/day
C. 83.4 lbs/day
D. 100 lbs/day

5. How many chemicals may be used to maintain a residual in a distribution system?
A. 1
B. 2
C. 3
D. Any that provides chlorine or chloramine residual and is approved for drinking water use.
WASTEWATER COLLECTION GRADES 1 & 2
1. A rigid pipe will:
   A. Bend or bulge from its usual shape when subjected to a load.
   B. Not crack when a load exceeds the strength of the pipe.
   C. Require less support than a flexible pipe.
   D. Return to its original shape when a load is removed.
2. Rat bites can transmit:
   A. Malaria.
   B. Polio.
   C. Rabies.
   D. Typhoid fever.
3. What is the water horsepower needed to lift an average sewer flow of 1390 GPM from a wet well measuring 8 ft in diameter, uphill at total of 80 feet? Assume head loss is 11 feet.
   A. 15 hp
   B. 32 hp
   C. 48 hp
   D. 80 hp
4. One method of televising through flooded low spots or dips in a sewer line is to:
   A. Dig up the low spot and repair the sewer.
   B. Install a high-powered lamp on the camera.
   C. Pull the camera quickly through the low spot.
   D. Use a high-velocity cleaner to push water clear of the dip.
5. Poly pigs are used to clean:
   A. Gravity sewers.
   B. Force mains.
   C. Large-diameter sewers.
   D. Sewers plugged with edible food.
WASTEWATER COLLECTION GRADES 3 & 4
1. Wastewater collection system repairs are necessary to:
   A. Correct damage to a sewer.
   B. Cut roots out of a sewer.
   C. Hydraulically clean a sewer.
   D. Remove grease buildup in a sewer.
2. The purpose of a check valve on a collection system pump discharge line is to:
   A. Adjust discharge flows from the pump.
   B. Isolate the pump from the system.
   C. Prevent the force main from draining back into the wet well.
   D. Prevent plugging of the pump.
3. What is the flow in GPM in a 16 inch sewer force main flowing at a velocity of 2.25 ft/sec?
   A. 3.14 GPM
   B. 695 GPM
   C. 834 GPM
   D. 1410 GPM
4. Very few maintenance operators do pump station electrical repairs or troubleshooting.
   A. True
   B. False
5. Your sewer system uses Hydrogen Peroxide (H2O2) to keep sewers from going septic. How many gallons per day of 25% H2O2 weighing 8.8 lbs/gallon should be added to dose 10 mg/L to a flow of 1000 gpm?
   A. 20 gal/day
   B. 55 gal/day
   C. 89 gal/day
   D. 100 gal/day
WASTEWATER TREATMENT GRADES 1 & 2
1. What should be the average velocity through a grit chamber be?
   A. 0.5 ft/sec
   B. 1.0 ft/sec
   C. 2.0 ft/sec
   D. 3.0 ft/sec
2. Sludge bulking is a condition in which sludge does not settle properly.
   A. True
   B. False
3. Estimate the surface loading rate for a trickling filter 90 feet in diameter and 12 feet deep if the flow through the trickling filter is 6.0 MGD. The inlet BOD is 170 mg/L and the efficiency of the clarifier is 70%.
   A. 0.25 gpm/sq.ft.
   B. 0.66 gpm/sq.ft.
   C. 0.75 gpm/sq.ft.
   D. 4.58 gpm/sq.ft.
4. Estimate the pounds of BOD removed daily by a clarifier that handles 12 MGD. The inlet BOD is 170 mg/L and the efficiency of the clarifier is 70%.
   A. 6,200
   B. 7,000
   C. 11,900
   D. 17,000
5. If sodium hypochlorite with an activity level of about 1 pound per gallon is used as a disinfectant to disinfect 8 MGD wastewater effluent, and 20 mg/L are added to a demand of 18.5, how many gallons of sodium hypochlorite are needed daily?
   A. 1.5 mg/L
   B. 1234 lbs/day
   C. 1334 gal/day
   D. 1440 gal/day
WASTEWATER TREATMENT GRADES 3 & 4
1. For activated sludge processes, the microorganisms usually associated with a good quality effluent include:
   A. Ciliates and rotifers.
   B. Amoebas and rotifers.
   C. Nocardia and long filaments.
   D. Rotifiers and flagellates.
2. Land disposal systems can remove unwanted materials from the effluent of a treatment plant.
   A. True
   B. False
3. What is the organic surface application rate in pounds per day per square foot of wastewater going to a basin 80 feet in diameter, with an influent BOD of 275 and a flow of 4.2 MGD?
   A. 1.55 lbs/day/sf
   B. 1.92 lbs/day/sf
   C. 10.0 lbs/day/sf
   D. It cannot be determined.
4. What is the sodium hypochlorite dosage in gallons per day if the flow is 4.35 MGD and the dosage is 5.5 mg/L and the sodium hypochlorite solution is 12% and weighs 11 lbs/gallon?
   A. 31.4 gal/day
   B. 144 gal/day
   C. 151 gal/day
   D. 199 gal/day
5. If your dried sludge weighs 72 lbs/cu.ft., and there is a weight limit for hauling the sludge of 35,000 lbs, how many yards can you put in your 20-yard roll-offs to be hauled away?
   A. 20 yards
   B. 18 yards
   C. 15 yards
   D. 10 yards

SEE ANSWERS ON PAGE 47
Beer is a product that everybody likes to talk about. The explosion of microbreweries around the United States gave Clean Water Services (Portland, Ore.) an idea for a program to start conversations about the reusable nature of all water. The utility began partnering with Oregon home brewers in 2014 to brew beer from reclaimed water to demonstrate that water should be judged by its quality, not its history.

**Sustainable Beer Smackdown**

The utility produced a batch of high-purity water that far exceeds safe drinking water standards and provided it to local home brewers. The beers, using the Pure Water Brew brand, were featured at WEFTEC 2014 and WEFTEC 2015 as part of the Sustainable Beer Smackdown. Each successive year, the Smackdown has gained new contenders. In September 2016, at the WEFTEC 2016 Innovation Pavilion, Hillsborough County in Florida introduced its New Water Brew, joining Clean Water Services and the Activated Sludge beers from the Milwaukee Metropolitan Sewerage District and The Water Council (Milwaukee, Wis.). In addition, CDM Smith (Boston), in partnership with the Water Replenishment District of Southern California, served up an Indian pale ale called the FAT Californian, named after the full advanced treatment (FAT) model of treatment for potable reuse applications.

This year, the Reuse Beer Smackdown dovetailed nicely with the release of the WEF Water Reuse Roadmap, a collaborative effort by WaterReuse (Alexandria, Va.), Water Environment & Reuse Foundation (WE&RF; Alexandria, Va.), and the National Water Research Institute (NWRI; Fountain Valley, Calif.). Such efforts serve to engage industry professionals, public leaders, and imbibers everywhere in this conversation about clean water, not only for its role in health, but also in supporting big and small businesses.

**The importance of legitimacy in reuse**

While the beer events are fun and engaging, the most important aspect of these efforts is the focus on creating an authentic conversation with the larger community about water quality. These conversations are the cornerstones of a sociological concept known as “legitimacy.”

Legitimacy is more important as communities consider reuse projects, particularly potable water reuse. Reuse projects have often been met with public opposition, despite having proven that the technology and water quality meet or exceed drinking water standards. Oftentimes, technical professionals such as engineers and scientists believe the public will accept new technologies for potable reuse applications.

Three levels of legitimacy need to be addressed to have a successful project.

- The Pragmatic level focuses on the user’s self-interest, seeking to answer questions such as “How do I benefit personally?”
- The Moral level deals with social values and welfare, addressing questions like “How is quality and process safety guaranteed?” and “Is the organization trustworthy?”
- The final level, Cognitive, deals with customs and routines that are taken for granted. “Does the technology fit with my daily life?” and “Is the technology essential, with no feasible alternatives?” are examples of the inquiries that community members need answered.

**Orange County and Nevada strive for legitimacy**

One example of how legitimacy can produce successful results is the Orange County Groundwater Replenishment System in California. Through its dedication to the outreach efforts, utility managers were recognized as trustworthy and competent experts in the community. (Learn more in the publications listed in “Further Reading”). Taking the lessons that Orange County learned to heart, a northern Nevada utility values legitimacy as part of a feasibility study that may someday lead to Nevada’s first potable reuse project.

Essentially, the feasibility study must show that every aspect of the treatment train is robust and redundant. The utility takes full ownership from the home lateral to the final compliance testing, ensuring the public it should have the full confidence in the water utility. This also includes looking carefully at pretreatment ordinances, collection systems, resource recovery treatment processes, and the most advanced water purification processes.

One cornerstone of the feasibility study is a demonstration-scale project. Not only will this project show that treatment technologies are able to perform and meet stringent regulations, but community leaders and the general public also will be able to visit and see water purification processes in action. The public will be able to meet with the utility’s operations and laboratory staff, and these events will showcase the agencies’ technical skills and dedication to quality and also give the utility an opportunity to interact and share ideas with customers.

Building trust and confidence with each community is vital. The Northern Nevada Regional Effluent Management Team driving this feasibility effort includes representatives from the City of Reno, Truckee Meadows Water Reclamation Facility, Truckee Meadows Water Authority, the City of Sparks, Washoe County, and the Northern Nevada Water Planning Commission. It is an exciting time to be in the water business, and the Northern Nevada Effluent Management Team demonstrates that utility leaders take the trust the public has afforded them very seriously.
**FURTHER READING**


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Local beers created by utilities and microbreweries were showcased at WEFTEC 2016.

Photo credit: Water Environment Federation
The 2017 AZ Water Annual Conference & Exhibition will require members to login to verify their membership status to receive member discounts. We highly recommend that members login to the AZ Water Association Website prior to conference registration opening up. Your account is linked to the email address that we have on file. This article is to assist you with signing into the site and resetting your password.

Because of the built-in security features at the website, you must be a registered member and sign-in before accessing many sections within the website. When you navigate through the website you will be prompted when registration and/or sign-in is necessary if you are not already a member or signed in.

Member Sign In

There are two options available for signing in from the home page as shown on the screen shot below. The first option is to click the ‘Sign In’ menu at the top right of the home page. Clicking this menu will take you to the “Sign-in” web page which displays the ‘Sign In’ username/password fields. The second option is to sign-in using the username/password fields in the ‘Sign In’ section located at the bottom right of the home page.
The first option might be a good choice for mobile devices that have a small screen as you can avoid scrolling through the home page. The second option avoids having to navigate to a new web page to sign in and might be the preferred option for large screen desktop devices. Which option you choose is up to you.

If you have forgotten your password, a link is provided to have your password sent to your e-mail account. If you are not a member, this link will take you to the registration web page where you can join the Association.

You can check the ‘Remember Me’ check box to avoid having to sign in when you return to the website. This action will remain in effect unless you block/erase cookies on your web browser or you sign out from the website. If you are using a shared or public computer (e.g., multiple users or a computer at a public library) you will want to uncheck this option so that other users cannot access your account after you log-off the computer.

If you have trouble signing in or have questions about becoming a member of the Association, then click the ‘Contact Us’ menu at the top left of the home page. This menu will display a web page where you can send a request for additional information or assistance.

When you signed in you are taken to the “AZ Water Membership Committee Survey” page. If you are new to the website then please take this survey as it will assist the Association in determining how to improve membership services.

Forgot your Username or Password?

With the plethora of website passwords that we must keep track of in this day and age, it is not uncommon to have forgotten your username or password. If you have forgotten, or did know what your username or password was in the first place, simply click on the reset password link below the “Sign-in” button.

On the following page, simply enter your email address, complete the validation code and click reset password. You should receive an email from admin@azwater.org within a few minutes.

Resetting Your Password

Please enter a new password below:
Your password must be a minimum of eight (8) characters in length and contain at least one number and one non-numeric character (letters, punctuation, etc.)

For security purposes your IP address has been logged: 206.16.95.56

Password: ************
Confirm Password: ************

Reset Password

Upon completion of the password reset, the website will display your username and prompt you to sign into the website.

Not receiving the reset password email?

If you do not receive the automated email within 10 minutes (double check spam/junk folders), please send an email to it-help@azwater.org with the subject line “AZ Water Password Reset Request” and we will be happy to assist you. Please include your full name and current email address and we will attempt to resolve the issue.

The most common reason that you don’t receive the password reset email is the email address does not match the email currently on file.

 Portions of this article were printed in the Winter 2016 Kachina News.
GREAT COMMUNICATION HABITS

I recently heard a presentation from a speaker named Paul Tsika titled “Habits if Effective Communicators”. I trust that this will help you in your work and personal life relationships.

As we think about communication we all naturally think we are good communicators. I think that is because we always “know what we meant”. My dad told me that the human being has an unlimited capacity to rationalize their own behavior.

Communication is the basis of all of our lives. Everything that we do in life requires communication of some type. People who are successful in life have great communication habits. Each of us can improve our communication skills, and be able to improve our successes in most everything we do. It’s been said that real communication is about dialogue and not about monologue.

Effective communication is about making what you want to say, what you actually say, and what people actually hear. Effective communication is about dialogue and not about monologue.

Some people say more and more about less and less, and wind up having nothing to say at all. Effective communication has many benefits:

• It reduces misunderstanding
• It’s a timesaver
• It eliminates potential embarrassment
• It creates a non-threatening environment
• It allows people to build trust and reduces negative emotions
• It increases self-esteem
• It increases and improves your relationships with others

Developing excellent communication skills is essential to effective leadership. The leader must be able to share knowledge and ideas while transmitting a sense of urgency and enthusiasm to others.

The following are a list of habits of highly effective communicators:

• They make their words and actions line up. Behavior is the foundation of effective communication.
• They know how to keep it simple. The best way to keep what you’re going to say simple, is to write it down.
• They let their eyes do the talking. A good communicator listens with both eyes and both ears. Make a conscious effort to focus in on the person who is speaking.
• They are easy to touch. You must be relatable to the person you want to communicate with. You must show interest in others.
• They emphasize key points through repetition. Not by merely repeating but by emphasizing the importance elements in the communication.
• They know how to laugh and laugh at themselves. People open up with appropriate and lighthearted communication. A good communicator laughs about themselves and not about others.
• They know how to listen. The best communicators are normally the best listeners. When you listen to others you are showing respect. It has been said that, “Nothing you say today will teach you anything. Only by listening will you learn.”

Things to avoid:

- Don’t interrupt
- Don’t interpret what you think they are saying
- Believe what they are trying to communicate to you with your eyes and your body language
- Do not allow distractions - Focus Focus Focus
- Don’t judge what they are saying
- Don’t criticize in your mind, because it will close your thinking and potential success
- Don’t argue with them in your mind
- Don’t get pulled into responding emotionally
- Don’t change the subject
- Don’t rehearse in your mind what you plan to say next
- Don’t give advice - Just Listen

They are encouragers. It’s very important that your words are encouraging to others. The world is full of critical people, while most people are looking for encouragement. Be the encourager.

They learn to read body language. Nonverbal communication is a major factor in effective communication. Body language that is consistent with the verbal language improves communication. If you are not sure about how to read or interpret body language, there are many references available that will help you understand the importance of body language.

They know how to remove barriers. It is essential that you remove barriers for effective communication. These can be
things like confusing or lengthy conversation without specific purpose or understanding. As you better understand body language you can also understand when someone is not connecting with your communication.

• They make practice a priority. An effective communicator practices their message to ensure that they are clear and that their message is understood.

• They know how to disarm the person with whom they are speaking. Approaching others with an attitude of humility will open the door to effective communication.

• They keep their focus. They do not let the conversation wander and lose the other persons attention. When you’re getting ready to go and speak with someone, take a few minutes and write down what you plan to discuss. It is been said that the weakest ink is stronger than the strongest memory.

• They use reinforcements. Reinforcement is different than repetition. This can be done by taking that fact or truth and telling a story that allows people to relate to the fact you are trying to communicate. Using illustrations and quotes can help you make your communication more effective.

• They know when to shut up. When you have major point stop talking!! How many times have you thought back and said to yourself, I should have stopped when I first made my point? When you see the light go on you have successfully communicated, then stop and listen and smile.

We all want things to go right. My experience is that when things go wrong, it is normally because communication has been ineffective. Communication is a necessary skill in every aspect of your life. How you communicate will determine if you lead, command respect, earn trust, and are well-liked.

So each of us know we can be better communicators. I suggest we start with becoming better listeners, to achieve your goals and dreams and start in the road to “SUCCESS and FUN” make the decision today, I hope to hear from you, contact me at phendricks@cox.net if I can be of assistance to you.
85 % WBV Wine Tasting Event 2016

The AZ Water Association | Water For People Committee would like to thank all of our sponsors, silent auction in-kind donators, and attendees for their support. With your help, we were able to raise $6,500 for Water For People!

IN-KIND DONATIONS

Phoenix Art Museum
Terroir Wine Pub

Carrie’s Salon
Where Style is an Art

ALPACA
Vineyard

PINOT'S PALETTE

INDIVIDUAL DONATIONS

Chelsea Hagen-Swiecki
Antonette Messina
Harold Koehn
Chelsea Francis

Jesus Villa
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Carrie Vogelsong
Julie Lorenzen
Laura McCasland
Jenny Lopez
PIPELINE ANSWERS

See questions on pages 38-39

WATER TREATMENT GRADES 1 & 2

WATER TREATMENT GRADES 3 & 4

WATER DISTRIBUTION GRADES 1 & 2

WATER DISTRIBUTION GRADES 3 & 4

WASTEWATER COLLECTION GRADES 1 & 2

WASTEWATER COLLECTION GRADES 3 & 4

WASTEWATER TREATMENT GRADES 1 & 2

WASTEWATER TREATMENT GRADES 3 & 4
Southern Arizona Technical Luncheon Program

January 5

Topic: Extreme Construction — The Trans-Canyon Pipeline Project
Presented by: Erik Christenson, Westland Resources
Sponsors: Carollo & Victaulic

February 2

Topic: South Houghton Area Recharge Project (SHARP)
Presented by: Wally Wilson, Tucson Water
Sponsors: Terracon & Southwest Utility Management
Note: Venue to be Announced

March 2

Topic: Special Joint Luncheon Presentation with ASCE
Presented by: Speaker to be Announced
Sponsors: To be Announced
Note: If interested in sponsoring this luncheon, please contact us!

April 6

Topic: Advisory Panel on Emerging Contaminants (APEC)
Presented by: Chuck Graf, ADEQ
Sponsors: Brown and Caldwell & Turner Labs

Scholarships are available for college students interested in attending an AZWater Technical Luncheon. Please contact us.

Time: 11:30 am to 1:00 pm
Location: Hotel Tucson City Center
425 N. Granada, Tucson Arizona

Cost: AZ Water Members: $20 per person
Non-Members: $25 per person
Contact: Carol Johnson | 520.724.6334 | carol.johnson@pima.gov

PDH Certificates are available for attendance at these meetings.
For more information, please register online at the AZWater website under “Featured Events” @ http://www.azwater.org
pp. 51–60). They showed that, with acclimatization, nitrification could be sustained at 40°C, but not at 45°C. Their tests were carried out over a short period of time, with a step increase in temperature rather than a long-term gradual increase, which may have resulted in insufficient adaptation time.

The results at the Suncor facility indicate that, provided that the temperature increase is gradual over a period of weeks, nitrification can be sustained at temperatures up to 50°C. This is supported by the nitrogen balance described previously.

Occasional high-effluent NH4-N concentrations have been observed at the facility; the data were reviewed to determine the cause of the decreased nitrification. However, no clear correlation with the temperature could be found. In most instances, the higher NH4-N concentration in the effluent could be attributed to a high influent NH4-N load.

Lower costs overall
Most of the ammonia removal in MBBRs is accomplished through nitrification, as demonstrated by the production of nitrate. It can be deduced that the capacity for complete nitrification at the Suncor system is approximately 150 kg N/d. Being able to operate at elevated temperatures without cooling prior to biological treatment significantly benefits Suncor both in terms of capital and operating expenses, allowing substantial cost savings.

The Water Environment Federation (WEF), author and the publisher of this article assume no liability of any kind with respect to the accuracy or completeness of the contents and specifically disclaim any implied warranties of merchantability or fitness of use for a particular purpose. Any references included are provided for informational purposes only and do not constitute endorsement of any sources.”

Caroline Dale (caroline.dale@veolia.com) is a principal process engineer at the Cary, N.C., office of Veolia Water Technologies (Saint-Maurice, France).
Ribbon-cutting ceremonies to celebrate two recently completed projects

Apache Junction’s Superstition Area Water Plant
New $9M Apache Junction treatment plant

Wickenburg’s Stormwater Management Project
$1M project to reduce stormwater pollution to Hassayampa River
Completed Loans

Prescott, City of
Population: 12,065
Airport WWTP Upgrades
Loan Amount: $43,202,549
Project Results: The Airport WWTP will be expanded to a treatment capacity of 3.75 mgd to accommodate current flows and account for growth in the area since the previous upgrade in 1998 (brought capacity to 2.25 mgd). This capacity allows the City of Prescott to meet current and near-term needs from a flow and regulatory standpoint and results in an increased ability to reliably treat the City of Prescott’s current and future wastewater flows and reliably produce Class A+ reclaimed water.

Q3 Summary:

6 projects completed (5 loans, 1 technical assistance projects)
- $118,000,227
  - $117,965,227 in loans
  - $35,000 in technical assistance funding
- 3 drinking water projects
  - 1 completed by small/rural communities (less than 10,000) for small/rural communities
  - 3 clean water (wastewater/stormwater) projects

completed on page 52
Buckeye, City of
Population: 25,000
Downtown to Sundance 16” Waterline Interconnect
Loan Amount: $5,065,000
Project Results: WIFA financing allowed the City of Buckeye to construct approximately six miles of 16” waterline. As a result of the project, Buckeye is now able to blend two water sources thereby improving the water quality to the downtown area and eliminating the need for treatment.

Apache Junction Water Utilities Community Facilities District
Population: 13,657
Water Treatment Facility
Loan Amount: $9,077,296
Project Results: The WIFA loan allowed Apache Junction Water Utilities Community Facilities District to build another treatment facility and reduce costs of water deliveries. The District designed and constructed an additional water treatment plant to treat 1.5 million gallons of water per day.
Truxton Canyon Water Company  
Population: 2,132  
Arsenic Treatment  
Loan Amount: $350,950  
**Project Results:** WIFA financing was used for critical infrastructure improvements including the installation of a centralized arsenic treatment system and a structure to house the treatment facility. Truxton Canyon Water Company resolved arsenic exceedances and is now able to provide water to customers that meets drinking water quality standards.

Lake Havasu City  
Population: 52,844  
Mulberry Effluent Basin Expansion and Refinance  
Loan Amount: $60,269,432 ($58M refinance of the City’s 2005 Greater Arizona Development Authority loan; $1.2M project construction)  
**Project Results:** As a result of the project, Lake Havasu City modified the existing effluent basin and suction line to allow for the reuse pump station to pull sufficient effluent from the Mulberry Wastewater Treatment Plant to supply reuse. The effluent will be used to expand the City’s effort to reduce potable water use at city parks.

Complete Technical Assistance Projects

Oro Valley, Town of  
Population: 41,388  
Green Stormwater Infrastructure Action Plan  
TA Amount: $35,000  
**Project Results:** Technical Assistance funding was used to produce a written Green Stormwater Infrastructure Action Plan report. This report included training materials, conceptual designs for parks with green stormwater infrastructure features and documentation showing the cost/benefit analysis for the Town parks.

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**WIFA**

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[Image of drill rigs and equipment sales]
The Wastewater Collection Systems Committee is offering an educational workshop designed to assist collection system operators with career and skill enhancement utilizing new technologies.

Thursday, March 23, 2017
Avondale, AZ
8:30am—3:00pm

WORKSHOP TOPICS INCLUDE:
- Confined Space Entry (This is not a certification class)
- Cleaning Nozzle Technologies and Demonstrations
- Odor Control Monitoring/Testing and Supplies
- Collection System Root Control
- Collection System Rehabilitation

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$75 Members
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Location: Avondale, AZ
Check website events calendar or workshop location address and details

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(indicate 1st, 2nd, 3rd choice)

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___Water Resources
___Water Reuse
___Water Treatment

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☐ I would like to know more information about the committee(s) indicated above.
☐ I am looking for suggestions for a committee on which to serve. My skills are:
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The capability to build large public works projects was boosted by devices, machines and processes developed/bettered during the industrial revolution – late 1800’s.

The article below from “Engineering News” entitled The Harlem Creek Sewer and Its Steel Centering: St. Louis, Mo. (30 July 1908 edition, pages 131-133) exemplifies the use of then new innovations to construct the new large combined sewer (Harlem Creek Sewer) in the St. Louis, Mo. area. For those times, this was a massive endeavor: an open excavation in combination with poured in place reinforced concrete. One of the interesting facets of this construction project was the use of steel centering (i.e., the inner form for the new horse shoe cross-sectioned sewer) – made to be pulled into position, expanded, then when that particular 25’ long segment of sewer was finished being poured, it would be “collapsed” and moved ahead into position for the next 25’ piece of new sewer.

It was thought by many that this 3000’ reach of new sewer was the largest concrete sewer built in the U.S. – at least, up to that point in time (1908).

Enjoy the article; especially the graphics/photos of the construction equipment used.
enable it to be packed closely around the steel reinforcing bars. The reinforcement comprises curved transverse rods near the intrados and extrados of the arch, with longitudinal bars wired to them. Vertical bars are set in the haunches. Twisted bars are used throughout, while Johnson corrugated bars were used in the first section.

The concreting of each 25-ft. length of the arch is done at one operation, no stoppage being allowed until the work is complete. The two cableways (described further on) deposit the concrete on opposite sides, working backward and forward along the 25-ft. length. A gang at the crown attends to the dumping of the buckets and pushing the concrete down the sides. Two gangs, one on each side, tamp the concrete into place with wooden bars.

Steel Centering
One of the special features of the construction work is the use of steel centering, the steel structure being collapsed, moved ahead, and expanded as the work progresses. The present centering is 25 ft. long, but another 25-ft. length has been ordered, and it is intended to build the arch in 50-ft. sections. The centering is of the Blaw type, built by the Blaw Collapsible Steel Centering Co., of Pittsburg, PA. The weight of the 25-ft. length is about 15 tons. This type of centering has been used extensively on smaller work, but this is the largest diameter that has yet been built.

The centering consists of a steel shell riveted to arched ribs of steel channels. As shown by the view in Fig. 2, the interior framing is composed principally of two sets of truss frames, one on each side. The straight chord of each truss extends diagonally from the crown to the horizontal member at the springing line, and the arch rib forms the curved chord. The web members are secured to the chords by connection plates. These truss frames are spaced 30 ins. apart. On each side of each arch rib is an angle rib having one leg riveted to the side of the channel and the other leg riveted to the shell plates. Stiffness is further secured by an intermediate channel rib between each pair of main ribs. Across the central triangular space, between the two inclined chords of each pair of frames, are placed three horizontal timber struts, in line with the horizontal truss members. These struts carry screw jacks. In this way the frames can be extended to give the shell the full diameter, or can be drawn inward so as to contract the diameter and thus free the shell from the concrete arch which has set around it. At three days after concreting, but the actual time depends upon the rate at which the construction of the invert progresses.

When ready to move, the horizontal jacks draw the sides of the shell inward, and (the blocking being removed) the vertical jacks under the I-beams lower the structure bodily about 6 ins., until the rollers rest on the steel angles which form the rails. It is then hauled forward on length by means of a cable. With four laborers, the 25-ft. centering can be collapsed, moved head, and set up ready for concreting in less than two hours. It is expected that equally rapid work can be done with the 50-ft. section. The arch is left with a smooth and even finish, free from irregularities of surface. The exterior of the shell is oiled to prevent the concrete from sticking to the steel.

Timber is used to form the outside face of the form at the haunches. The joints between the planks are caulked with clay, and the joints with the steel end bulkhead are closed in the same way to prevent the escape of water and cement when the concrete happens to be very wet.

The excavation is kept well ahead of the centering and a 25-ft. length of the bottom is first built. When the lower part is completed, the reinforcing bars for the invert are set in position, the form is placed, and the concrete is filled in to form the invert of the sewer. The brick lining is also set in place. After this part of the work has set for a sufficient time, the supports for the arch centering are laid upon it, and the centering is hauled forward as described above. Pumps mounted on the centering keep the bottom of the excavation dry.

Construction Plant and Methods of Working
The upper part of the excavation is in continued on page 61
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a firm dry clayey soil. The lower 6 ft. is in solid limestone rock, and this rock depth will increase to about 8 ft. Immediately above the rock is a bed of stiff blue clay, which is difficult to handle, as it sticks in the 1¼-yd. bucket of the steam shovel. This is a Little Giant machine, carried on traction wheels. It is now intended to excavate to the rock by means of large slips or scraper buckets handled by a cable from a hoisting engine; and to use the steam shovel to load the rock broken up by blasting. At present the rock is broken by blasting and sledding into sizes small enough to allow of loading by hand into skips or buckets. The rock is used for the concrete, and some of it is sold for use elsewhere.

Fig. 3 is a view of the work in progress. In front is the steam shovel, and beside it is the steam drill used in breaking up the rock bench. In the excavation behind the steam shovel is the steel centering. Behind this again is the end of the completed concrete sewer, partly covered by the back-filling. Overhead are the two cableways which handle the excavated material and the concrete buckets.

Fig. 4 is a sketch plan of the construction plant, which is of interest for its combination of cableways and narrow-gage industrial railways. It may be noted in this connection that there is an increasing tendency to use railways of this class on construction work in this country, following a practice which has been common in Europe for many years. The concrete-mixing plant is located directly into it. A conveyor carries the crushed stone to the overhead screens, from which the stone passes to a row of elevated bins. Adjoining these is the sand bin. The cement and sand are brought in by railway cars. The cement (in paper sacks) is delivered into a storage shed along side the track. The sand is shoveled or dumped into a concrete hopper forming the boot of a bucket elevator which delivers it to the elevated bin. Underneath the bins and extending around to the cement house is a narrow-gage track on which run two small side-dump charging cars. One car is loaded with the proper amount of cement, and then runs under the spout of the sand bin. The other car is filled from spouts under the stone bins, taking stone from different parts of the bins in order to ensure a proper proportioning of the different sizes.

At one side of the charging car track is the concrete mixer. This is a Chicago cube concrete mixer, of 1¼ yds. capacity, and has an elevating charging hopper operated by a cable hoist. The sand, cement and stone are dumped into the hopper, which is then raised and automatically discharges its contents into the

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continued from page 59
The method of handling the concrete and the excavated material is of interest, being a combination of narrow-gage gravity tracks and cableways. Extending over the line of the sewer are two parallel Lambert cableways 500 ft. long. The concrete mixing plant to the head of the cableways is a gravity loop track for Koppel narrow-gage flat cars carrying Koppel bottom-dump concrete buckets of 1 ¼ yds. capacity. The lowest point of the track is at the concrete mixer. When a car has received its charge of concrete (by tilting the mixer), it is pushed forward to a platform elevator which raises it to the head of the gravity track. A man then starts it down a short grade of about 1% beyond which there is a grade of 0.05% to the level portion near the cableway. Here two laborers check the car in position under the hoist of one or other of the cableways.

The bucket is then lifted from the car and run out to the desired point, where it is lowered and dumped. The empty bucket is run back and dropped upon a car, and the two men then start it on the gravity return track from the cableway to the concrete mixer. At present the distance from the cableway to the mixer is about 800 ft., and there are in all about 4,000 ft. of the industrial railway. A man stationed at the back-filling dump, directs the cableway enginemen by signs. Another man, on the platform at the forward end of the cableway, signals the former as to hoisting and lowering movements of the buckets. He also signals the man at the car elevator when to start a loaded bucket of concrete.

The rock from the excavation is used for concrete, as already noted. It is loaded into buckets, which are carried by the cableways to a dumping platform having chutes through which the rock falls into steel side-dump Koppel cars of 40 cu. ft. capacity. The car runs by gravity to a trestle over the rock pile at the crusher. When empty, it passes round a loop to a return gravity track. This ends near the loading point, and a mule hauls the car up a short incline to this point, under the platform. The earth excavated is loaded by the steam shovel into buckets of 36 cu. ft. capacity. These (as well as the large excavating slip scrapers already mentioned) are raised by the cableway and carried back to the completed part of the work, where the material is dumped for backfilling.

The excavating and removal of earth, and the removal of rock, are carried on at night. The concreting and rock excavation are done during the day. Arc electric lights are erected on poles along the work. Electric motors are used to operate the rock crusher, elevator and screens, and concrete mixer and its charging hopper, and the car elevator. Current is obtained from the Union Electric Light & Power Co., of St. Louis.
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