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UTILITY OF THE FUTURE

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PUMP DIRECTORY PAGE 30

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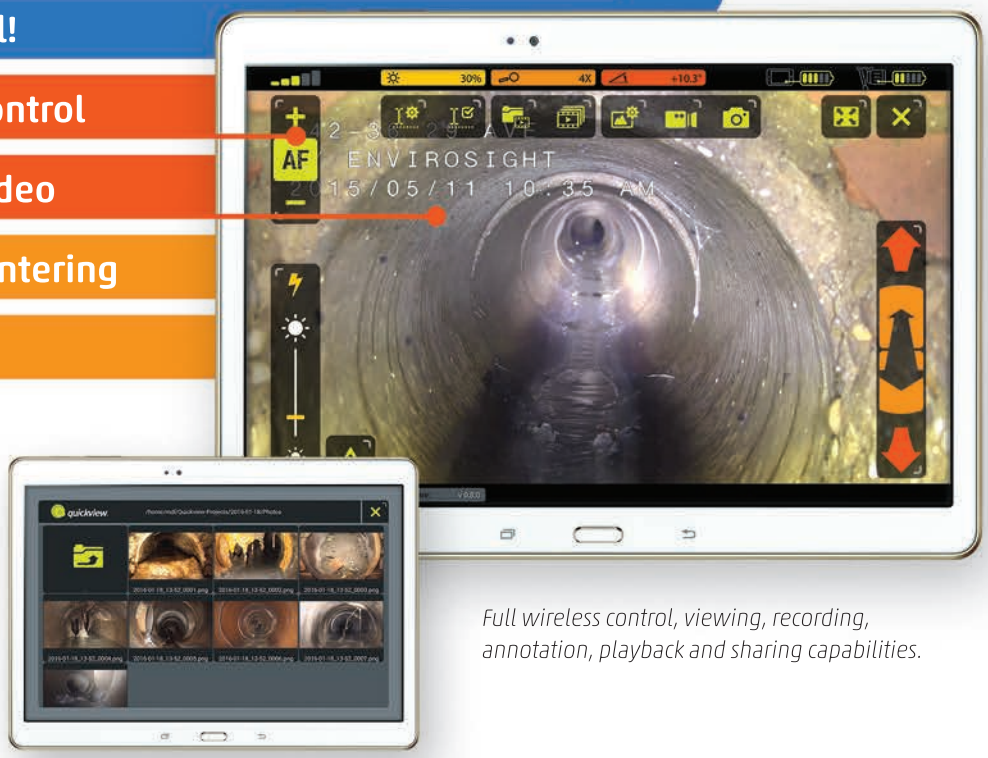

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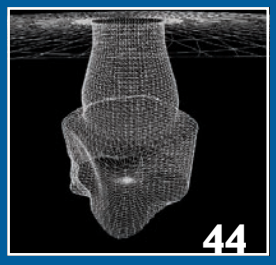

ON THE COVER: A crew member helps move a piece of pipe into place for a new 48-inch force main along N. Miami Avenue, part of the Miami-Dade Water and Sewer Department's $13.5 billion capital improvement program. (Photography by Rob Herrera)

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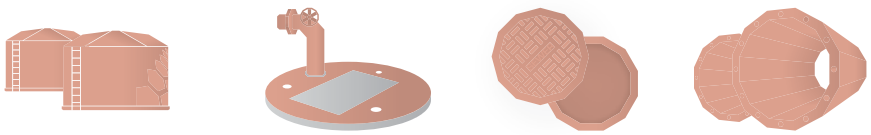

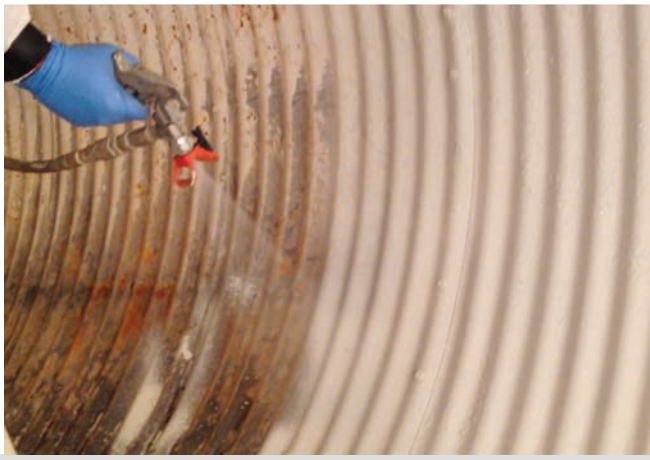

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MORE TO THE STORY

There's so much more to the work you do than a single story can tell

FROM THE EDITOR

Luke Laggis

So much of what you do is unseen. Even when a light is cast on your work, it usually illuminates only the most easily accessible parts of your highest-profile projects.

We bring you stories from a lot of different utilities. Sharing your successes and the lessons you've learned is a big part of what we do. But often there's so much more to the story. Sometimes, the work a utility is doing is so expansive, so progressive, that it doesn't fit neatly into a 1,500-word profile.

The work being done at the Miami-Dade Water and Sewer Department, maybe more so than any utility we've covered, is difficult to encapsulate in a single story.

Miami-Dade is in year four of its $13.5 billion Capital Improvement Program — one of the largest among U.S. water and wastewater utilities. Some 775 projects, representing $1.1 billion in department assets, have been completed. Another 861 are in the planning or construction phase. They range from water and sewer line rehabilitation and replacement, enhanced monitoring, and data systems integration to improved energy efficiency and treatment plant upgrades and expansion — from one end of the service area to the other.

Miami-Dade's $13.5 billion Capital Improvement Program might be $13.4 billion bigger than anything you'll ever take on at your own utility, but the planning, prioritization and other processes they're using can certainly help you tackle your own projects, regardless of the size.

Executing a program of this magnitude requires a tremendous amount of planning, which is dependent on integrating mountains of data from a variety of sources and, as Deputy Director Hardeep Anand says, analyzing it through the lens of utility resiliency and efficiency in order to become a smart utility for both the present and the future.

The data doesn't just need to be analyzed, it must also be communicated. Disseminating information to all of the department's 2,800 employees presents its own challenges, but the utility has been up to the task. And if they can do it successfully with nearly 3,000 employees, surely there's a lesson or two in there that can help you work better with your staff.

You'll notice our coverage of this story is more extensive than the typical profile. With a Capital Improvement Program that encompasses water, wastewater, climate adaptation, integration of technologies, coordination among utilities, pump station projects, construction management, new wellfields and a new wastewater treatment plant, the expanded coverage is deserved.

We're working on bringing you more comprehensive coverage on many of the stories we share. Sometimes it's in print, and sometimes it's online. Our coverage of the downtown streetscape project in my hometown (Rhinelander, Wisconsin) is a good example of the additional online coverage. And you can look forward to further online coverage of the Toledo Waterways Initiative, which we covered in the February issue.

It's fun to take a closer look and give you more of the story, more insight on what it takes to keep a program of that magnitude moving forward. Miami-Dade's $13.5 billion Capital Improvement Program might be $13.4 billion bigger than anything you'll ever take on at your own utility, but the planning, prioritization and other processes they're using can certainly help you tackle your own projects, regardless of the size. That's why we're telling you more of the story. I hope you take something away from it that can help your own utility.

Enjoy this month's issue. ✦

Comments on this column or about any article in this publication may be directed to editor Luke Laggis, 800/257-7222; editor@mswmag.com.

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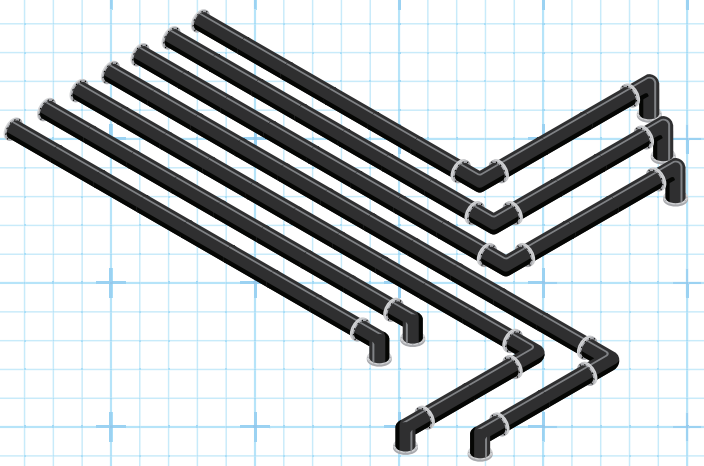

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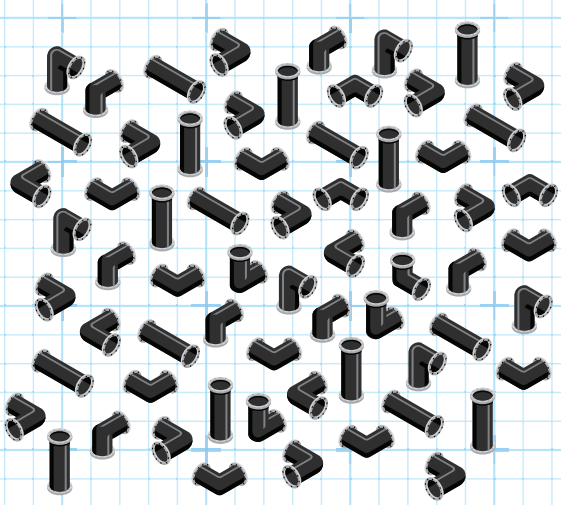

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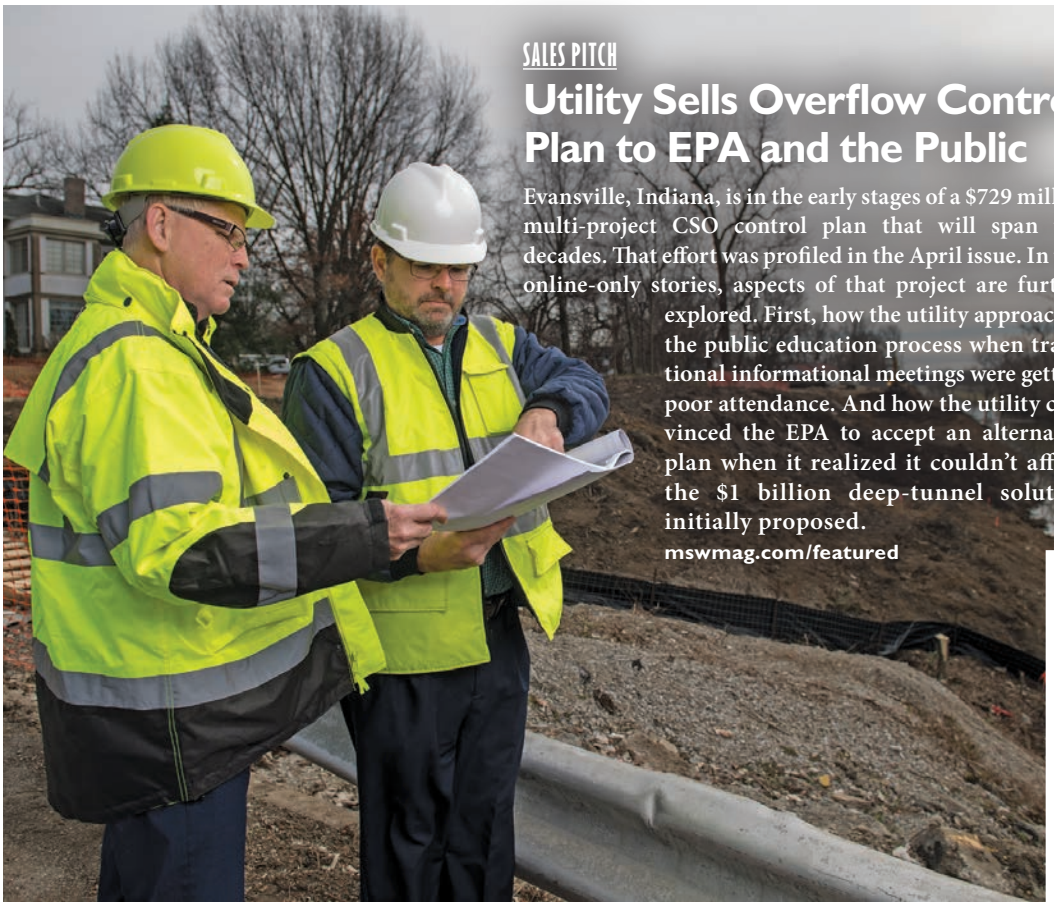

SALES PITCH

Utility Sells Overflow Control Plan to EPA and the Public

Evansville, Indiana, is in the early stages of a $729 million multi-project CSO control plan that will span two decades. That effort was profiled in the April issue. In two online-only stories, aspects of that project are further explored. First, how the utility approached the public education process when traditional informational meetings were getting poor attendance. And how the utility convinced the EPA to accept an alternative plan when it realized it couldn't afford the $1 billion deep-tunnel solution initially proposed.

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OVERHEARD ONLINE

"This drought emergency is over, but the next drought could be around the corner. Conservation must remain a way of life."

— ***California Governor Lifts Emergency Drought Order***
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WEATHER PREPAREDNESS

Online Tool Assists Utilities in Extreme Weather Scenarios

Extreme climate and weather events are occurring more frequently and with more intensity. With that in mind, several water agencies and organizations teamed with the National Oceanic and Atmospheric Administration to develop an online dashboard that's a one-stop resource for weather forecasts, hazard alerts, and watershed and stream flow data. Learn more about how this resource can help your utility become more resilient in extreme weather conditions.

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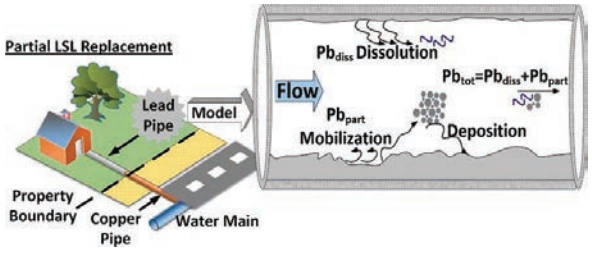

LEAD PIPE PROBLEMS

Helping Utilities Limit Lead Contamination

With more utilities taking on the task of replacing lead pipes, a team of engineers at Washington University in St. Louis decided to try to help. Taking into account several factors, they developed a model to predict how lead particles might travel during a service line replacement. Utilities can use it during their planning to help minimize the spread of lead in their distribution systems.

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IN-HOUSE APPROACH

Lone Star utility makes major inroads on I&I and tackles lift station problems while building self-sufficiency

By Erik Gunn

Amado Rosales (left) and Hunter Willis of the Lufkin Department of Water and Sewer Utilities reconnect a residential lateral line to a new sewer main. (Photography by Dena Strban)

If there's an unofficial watchword for the Lufkin Department of Water and Sewer Utilities, it might be self-sufficiency.

The Texas utilities' management culture emphasizes doing things in-house whenever possible. And while adhering to that ethic, the city has been pressing ahead with a comprehensive sewer system rehab program that has targeted a long-standing stormwater inflow and infiltration problem.

The I&I reduction effort has been underway for more than a decade, and won't be finished until 2023. But the results are already apparent.

To date, the program has led to the repair or replacement of nearly 14 miles of sewer lines, with significantly more on the agenda before the deadline six years from now. And where the repairs have been completed, "We're seeing next to zero stoppages," says Jason Arnold, director of the utilities department. "When we're seeing major rain events, those neighborhoods just aren't having issues anymore."

Located about 120 miles northeast of Houston in eastern Texas, Lufkin sees its population triple every working day.

"We're a town with a population of a little over 35,000," says Arnold. "But our daily population is well over 100,000. The number goes up during the day because we are surrounded by several small communities. People come here to work, shop, dine and do business. We're also a major medical hub."

A major meat processing plant uses lots of water — and generates plenty of wastewater at the other end.

With so much traffic on weekdays, doing whatever it takes to forestall emergency repairs becomes paramount. "It's tough to fix a leak anywhere in town," Arnold says. "It's tough to dig up a sewage stoppage. We pride ourselves on taking care of problems and fixing them quickly."

(continued)

Lufkin has opted for pipe bursting wherever applicable for replacement projects within its 20-year repair and replacement program. In-house crews are handling as much of the work as possible.

PROFILE:
Lufkin, Texas, Water and Sewer Utilities Department

POPULATION SERVED:
35,067

SERVICE AREA:
City of Lufkin, Texas

WASTEWATER TREATMENT CAPACITY:
Maximum 11.3 mgd; average 6.4 mgd

NO. OF EMPLOYEES:
36 full time (all are cross-functional, water and sewer)

WASTEWATER INFRASTRUCTURE:
274 miles of sewer mains; 3,529 manholes, 12,313 service connections, 21 lift stations

ANNUAL OPERATING BUDGET (SEWER ONLY)
$500,000

WEBSITE:
www.cityoflufkin.com/sc/index.htm

Overloaded

Lufkin's I&I problems go back decades. "Around 72 percent of our sewer is clay tile pipe," says Patrick Lynch, a water and sewer utilities department foreman for 27 years who has the day-to-day task of helping to carry out the subsequent rehab programs.

Clay tile pipe is notorious for its vulnerability to cracks and root penetration that contribute to I&I. "A couple of inches of rain would overload our sewer treatment plant," Lynch says. "The lines just couldn't handle the flow. We'd have overflows in low-lying areas. Pretty much the whole system was overloaded — manhole covers were floating off."

In the year 2000, Lufkin undertook an in-depth study tracking the impact of I&I-related overflows. With extensive smoke testing, the study also identified hot spots.

Many of the leaks showed up in the private portion of sewer laterals, and the city wrote to homeowners, informing them of their obligation under city codes to have repairs made. But the study also identified plenty of work needed on city-owned lines.

Setting priorities

In 2003, the city launched its sweeping 20-year repair and replacement program. The city was divided into five separate sectors that were ranked by priority. Work has finished on the two highest-priority sectors. Work on the third sector is underway now, and the lowest-priority fourth and fifth sectors will follow.

Projects have ranged from point repairs for localized leaks to complete replacement of sewer lines.

For full replacement, Lufkin has opted for pipe bursting where possible rather than open-trench replacement. "A lot of our lines are under roadways, so it's more economical to do it by pipe bursting," Lynch says.

For some bigger projects, such as a recent trunk line main replacement using 24-inch pipe, the city will turn to outside help. But for most of the work, "We try to do as much as we can in-house," Lynch adds. "It's easier for us to get material and to service our equipment."

Lufkin uses Vermeer pipe bursting equipment — chosen because the company has a regional office less than 100 miles away as well as for the quality of its machinery. The new pipe going in is all PVC.

"We've become experts in the whole pipe bursting process," Arnold says.

In more than a dozen years since the work started, Lynch has seen the equipment evolve. Where Lufkin once used an 8-ton winch to pull new pipe

(continued)

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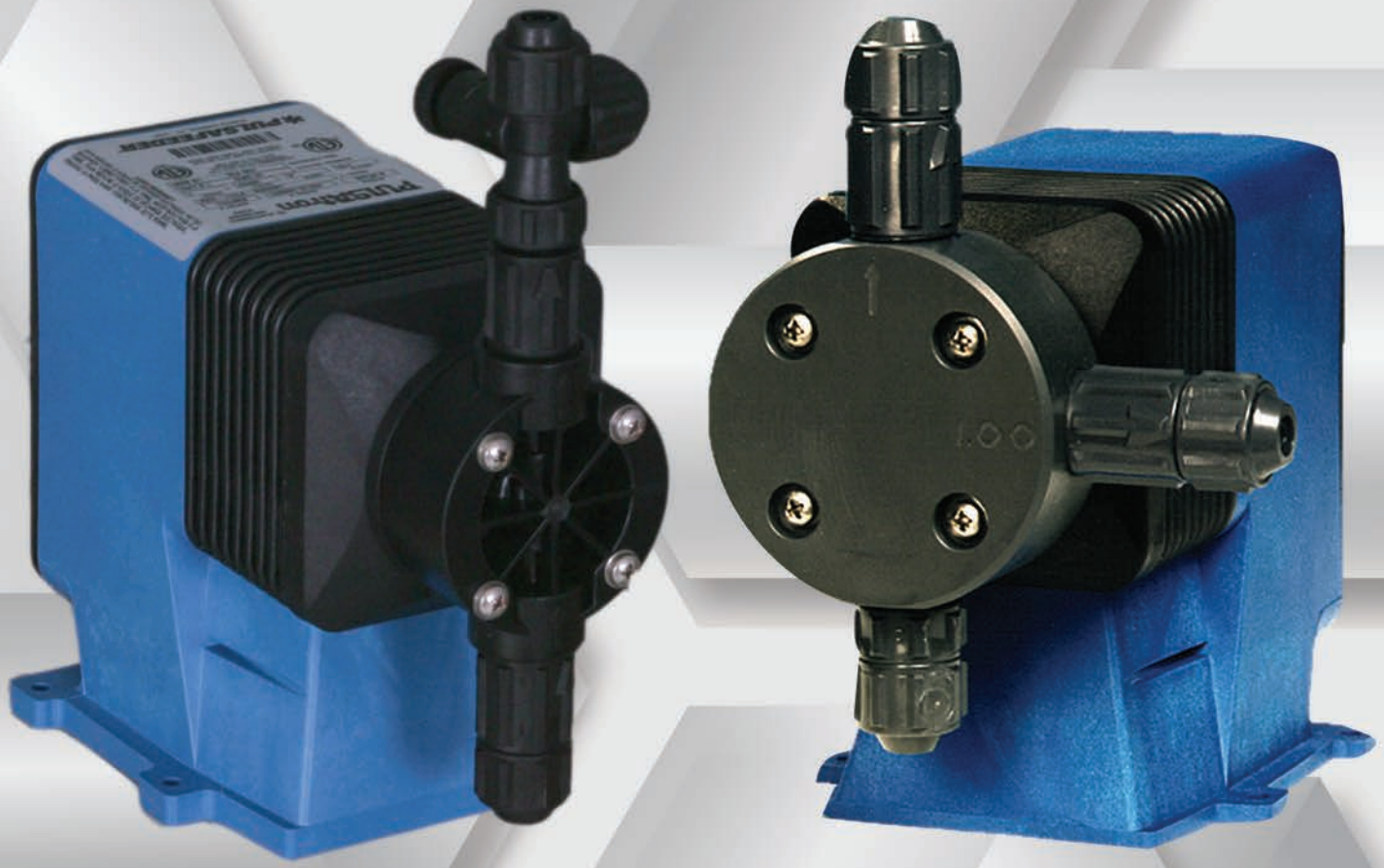

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A Gorman-Rupp pump drives one of Lufkin's 21 lift stations. A lift station operator visits each of the stations daily, and pumps are pulled and inspected on a six-month cycle.

A NEW APPROACH TO LIFT STATION MAINTENANCE

The Lufkin Department of Water and Sewer Utilities has taken a proactive approach to lift-station maintenance and care. The aggressive preventive maintenance effort came about after Director Jason Arnold joined the Water and Sewer Utilities Department from Lufkin's Parks and Recreation Department a couple of years ago.

"It seemed like every week we were having an emergency problem at a lift station," Arnold says.

The utility was regularly spending $8,000 or more to make emergency pump repairs. Arnold knew there was a better way: Instead of waiting for trouble, manage it systematically by looking for it. "I got 100 percent support from my bosses," he says.

The maintenance program has two parts. First, the lift station operator on duty visits each of the system's 21 stations daily — checking on how many hours the pump has run in the last 24 hours, making sure no circuit breakers have been thrown, and opening the lid of the wet well to look for obvious signs of trouble.

Second, every six months, the lift station operator and the city electrician pull every lift station pump "whether we're having a problem or not," Arnold says. They put them on the inspection truck for a visual inspection for wear and tear, a pressure test, and a series of electrical tests.

"We're checking whether they're pulling too many amps, how many hours they're running, and making sure the pumps are alternating properly," Arnold explains. "We're doing everything we can to prolong the life of the pumps that are running properly and identifying a potential hazard, and taking care of that pump before there's an emergency problem."

Such aggressive inspection isn't cheap, at least in the short run. "When you look for problems, you find them," Arnold acknowledges. "It's costing a fair amount of money here. You're finding pumps that need to be replaced — we've replaced quite a few more pumps this year than we would have preferred to do. We've made quite a few more repairs."

But it's also prevented much more costly and disruptive problems. Between the daily visits and the twice-yearly inspections, "We've found pumps that were hours away from getting burnt up," Arnold says. "The only way we would have found them otherwise would have been a few hours later when it did burn up and the lift station was overflowing."

And thanks to the proactive approach, those repairs now take place mostly on regular 8-5 workdays instead of being emergencies in the middle of the night or over the weekend. The program has practically eliminated the need for emergency repairs.

"We've saved thousands of dollars," Arnold says. "We're not sending guys out in the middle of the night, we're not paying overtime, and we're not putting them in a more dangerous situation."

through the old, the city has upgraded to a 12-ton winch that allows for longer pulls — especially through the region's unforgiving clay soil that hampered the smaller tool's pulling capacity.

Venturing into lining

More recently, the city has begun using Perma-Liner cured-in-place products when that approach is feasible. So far, about 2,000 feet of CIPP lining has been completed. In keeping with its DIY ethic, the city has been training its own crews and acquiring the lining equipment rather than contracting out for that work. But it remains in the early stages. "We're still perfecting the system," Arnold says.

In choosing where to use pipe bursting and where to use lining, Lynch says it depends on the situation. Pipe bursting requires some localized excavation, such as where laterals connect to the mains. Since CIPP lining is an entirely no-dig system, it's especially useful where lots of other utilities — waterlines and electrical conduits, for example — are close to each other.

For lining projects, the city is now aided by a TRY TEK Machine Works robotic cutter that it sends through the lines to trim up the material where there are pipe transitions. Arnold says the city also developed its own winch system to help pull the liner material through. The vehicle used for lining work has been supplied with modified refrigeration units to store the liner material.

"Where we're still having to pipe burst are those areas where we're not comfortable putting that cutter in the ground," Arnold says. "And then there are areas that are so long it's difficult to

The Lufkin crew includes (from left) Sammy Stevenson, Dallas Stephenson, Hunter Willis, Amado Rosales and Patrick Lynch.

store [lining] stock that long or blow it in." Longer stretches require precision that can be challenging, he notes. "The biggest we've done so far is 575 feet."

But Lufkin is sold on the trenchless approach wherever it's practical. "The benefits are pretty obvious," Arnold says. "You're saving a lot of time, you're saving a lot of money. But most important, you're not risking a trench accident."

That's a huge benefit. When a trench accident does occur, "it's going to be a serious one," he observes. "We want to get people out of those trenches every chance we get, and that's what we're working towards."

Progress

The city has been happy with the outcome. "We can definitely see that we're making progress on the problems," says Lynch. "If you go through a spot where previously the sewer system was overflowing and where we have gone in and redone a section of it, you can see the system is able to handle it. Just knowing you're making a dent in the problem gives us the motivation to keep moving forward."

And members of the public have noticed, too. "They've acknowledged they know the work we've done is helping."

Training employees to do the work and acquiring the necessary equipment has given the city greater flexibility, Arnold says. "Because we have the expertise, we do everything that we can ourselves."

Doing the work in-house just makes problems easier to solve, the director explains. There are a lot fewer worries about who the city will have to call in an emergency or where the money is going to come from to hire a contractor to fix it.

"Rare is the construction project that we don't do," Arnold says. "We have a good engineering department. We have extremely qualified operators — guys who can really do just about everything, and looking at the whole scope of a job, can do it the best and the safest." And the city's manager, assistant manager, and city council "make sure we have the equipment we need."

Keeping the work in-house also builds morale. "It changes the whole attitude," Arnold says. "Our whole attitude is, there's nothing we can't take care of. Our guys take a lot of pride in not needing to call in contractors to do what we're doing. They enjoy the fact that they're given the tools and the people to do what they need to do." ✦

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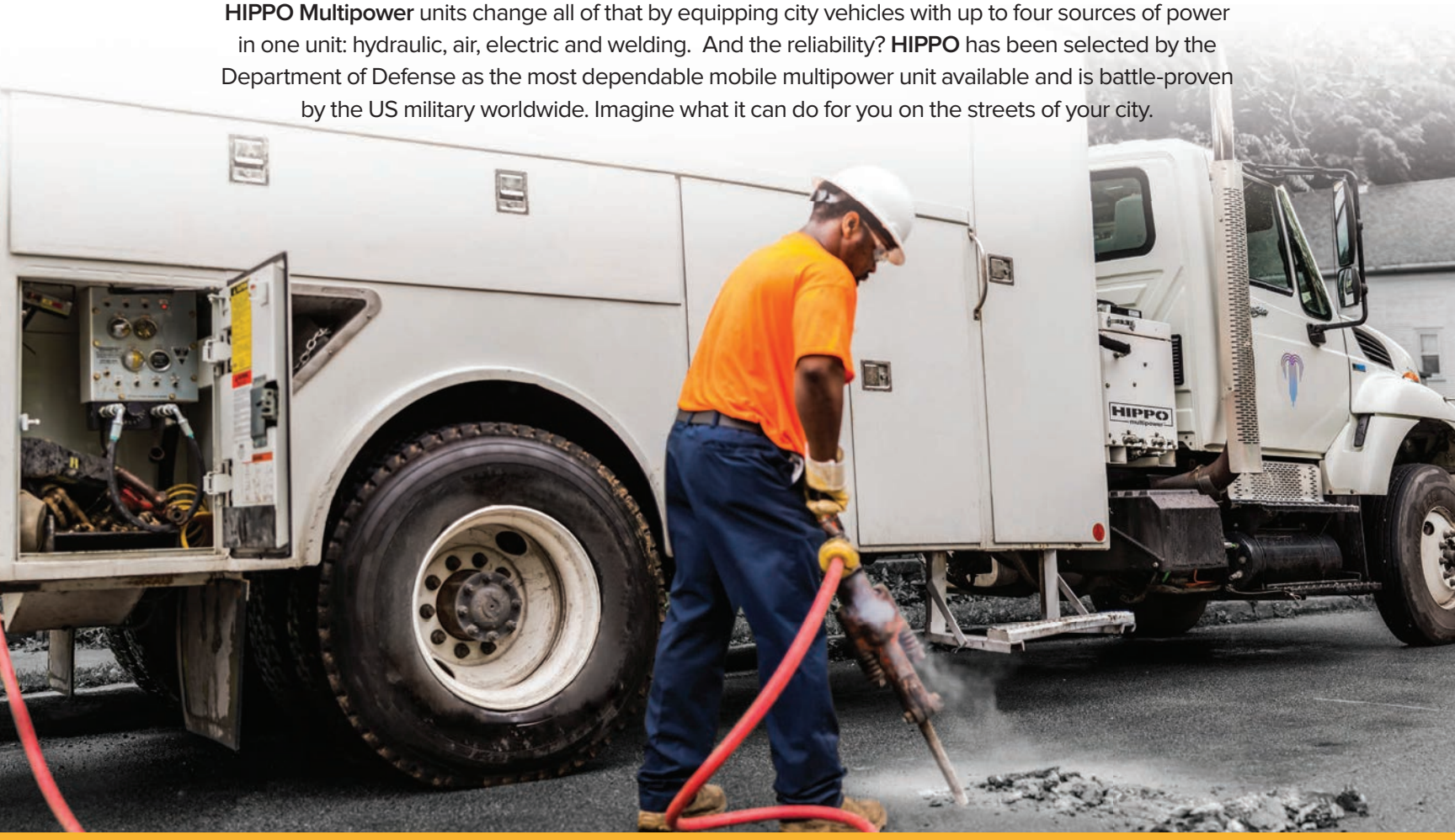

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UTILITY OF THE FUTURE

Miami's master plan encompasses hundreds of improvement projects with a focus on building resilience

By Jim Force

Some utilities struggle to meet the conditions of a consent decree. Others use it as a baseline. The Miami-Dade Water and Sewer Department took the $1.6 billion in improvements outlined in its consent decree and added nearly $12 billion in utility-wide upgrades.

Equipped with a comprehensive master plan, the Water and Sewer Department is already into year four of its $13.5 billion capital improvement program — one of the largest among U.S. water and wastewater utilities. Some 775 projects, representing $1.1 billion in department assets, have been completed. Another 861 are in the planning or construction phase. They range from water and sewer line rehabilitation and replacement, enhanced monitoring, and data systems integration to improved energy efficiency and treatment plant upgrades and expansion — from one end of the service area to the other.

"The challenge for water utilities is resilience," says Hardeep Anand, deputy director for the utility's Capital Improvement Program. "How can we give our customers the comfort that we will be resilient enough to be able to bounce back in the face of a disaster or a disrupting event — large or small — in the future?" he asks. That means being able to overcome climate change — including rising sea levels — replace aging infrastructure, address the threat of cyber security, comply with new regulations, and still meet the demands of economic growth and an expanding population.

For its planning and foresight, the Miami-Dade WASD was one of 61 utilities recognized as "Utilities of the Future" at the Water Environment Federation's annual conference last year.

Sprawling district

Serving 2.3 million people, plus thousands of daily visitors, and covering 400 square miles, WASD is the largest water and wastewater utility in the southeastern U.S. Its water system draws water from the Biscayne Aquifer and treats it at three large regional treatment plants and five smaller plants, plus a new RO water treatment plant. Together, these facilities provide an average of 314 million gallons of high-quality water per day via a distribution system of more than 8,000 miles. The system includes more than 126,000 valves and 38,000 hydrants.

Three wastewater treatment plants process an average of 308 million gallons of wastewater per day, collected through a 6,300-mile system of mains and laterals. There are 1,047 sewer pump stations, two ocean outfalls and 21 deep injection wells.

A crew digs a trench for a new 48-inch force main, part of a $13.5 billion Capital Improvement Program that helped the Miami-Dade Water and Sewer Department earn Utility of the Future honors from the Water Environment Federation. (Photography by Rob Herrera)

PROFILE:
Miami-Dade Water and Sewer Department

FOUNDED:
1972

AREA SERVED:
Miami-Dade County, Florida including unincorporated areas

CUSTOMER ACCOUNTS:
450,000

ANNUAL BUDGET:
Approximately $400 million.

STAFF:
2,800 employees

DIRECTOR:
Lester Sola

WEBSITE:
www.miamidade.gov/water

Miami-Dade's 1,047 pump stations are monitored through a SCADA system at the Water and Sewer Department building.

About 13 mgd of treated wastewater is currently reused.

The department employs more than 2,800 people, and has an annual operating budget of approximately $400 million.

Critical data

Miami-Dade County, the U.S. EPA and the Florida Department of Environmental Protection entered a consent decree for improvements to the wastewater collections and treatment system in June 2013. But while the decree has mandated a number of projects throughout the county, the WASD had been working on improvements in the years prior to the agreement — as part of its comprehensive Master Plan and Capital Improvement Program.

The planning of the program stretching over 15 years depends in large part on data, and operations and maintenance principles contained in its CMOM plan, according to Anand.

"Data is one of our biggest challenges," he says. "We need to be able to integrate data from various sources and analyze it through the lens of utility resiliency and efficiencies in order to become a smart utility for both the present and the future."

New SCADA technology will be key. Anand says the department's SCADA plan is only about 20 percent complete. For now, he says, "We look at data the best we can. The goal is for more SCADA to be deployed, so that incrementally we become a smarter utility."

Anand envisions wider use of dashboarding as the department progresses. "Dashboarding is somewhat new to utilities, though it is common in other industries like marketing and banking," he says. "We need the same concept here — so that we can see big data, run the analytics, and make smart decisions related to predictive maintenance as we build dynamic and adaptive capital improvement plans."

The quality of the data is also important. "We can't make decisions based on corrupt data," Anand believes. "Data governance and integrity becomes critical."

Data should not only be assembled, it must be communicated, he explains. "It's critical that when internal divisions of the utility sit around the table, they are able to discuss global utility data that is consistent rather than from their own roles and perspectives." For the team to work, the barriers of data and traditional information silos will need to be overcome, he says.

Likewise, the information needs to be disseminated down to all 2,800 department employees. "At the end of the day, our workforce, our designers, our consulting workforce all need to know our roadmap."

The role of CMOM

CMOM (Capacity, Management, Operation and Maintenance) is proving to be another useful tool as the WASD moves toward making its assets and services more resilient in the future.

A product of the consent decree, CMOM sets forth several performance parameters the department must meet in its wastewater collection and treatment programs.

"It's required us to focus on specific things," says Anand. "Not just the consent decree requirements — which amount to $1.6 billion in improvements — but the utility-wide aspect. It's a strategic plan ensuring that we consistently deploy asset management, capital planning, and repairs and maintenance across the entire utility."

Typically, CMOM programs help utilities optimize use of human and material resources by shifting maintenance activities from "reactive" to "proactive." In the case of WASD, the utility is building predictive maintenance into its normal operations. "Emergencies will happen, but we want to become predictive, not reactive … know what's coming and plan for it," Anand says. "Good data becomes the basis for all decision-making behind the scenes, and it allows better capital improvement planning."

Pipe projects

Many of the hundreds of projects the WASD is working on involve sewer lines and water mains. The department has thousands of miles of water pipes and sewer lines. Many are old or undersized and in need of repair or replacement. In other cases, new lines are being extended to newly developed parts of the district.

Anand points to a number of showcase projects:

• Kendall Boulevard to SW 104 Street, where a 12-inch wastewater line is being installed without disruption to traffic or the neighborhoods. The project is expected to take five months. The

(continued)

PUMP STATION IMPROVEMENTS TAKE SHAPE

Pump stations are the heartbeat of the sewer system. When they wear out or are overwhelmed, they need to be replaced or repaired.

That's the job of Rolando Roque and the team in charge of the Pump Station Improvement Program (PSIP) at Miami Dade Water and Sewer Department.

Roque, senior professional engineer, says the program began two years ago and is expected to take seven years. Over 100 pump stations are involved, as well as several older gravity-flow sewer lines where I&I from the area's shallow water table is increasing pumping volume. In those cases, the piping needs to be repaired or replaced.

The PSIP was one of the requirements of the consent decree Miami-Dade signed in 2014, and is expected to cost about $200 million.

Roque explains that WASD's system has over 1,000 pump stations. Many are in neighborhoods that have added considerable population since they were constructed — high-rise apartment buildings and condominiums have replaced single-family dwellings. Higher capacities are required. Other stations are simply old and contain equipment that is difficult to replace.

"The consent decree established certain standards we are following to meet regulatory compliance requirements at all of our pump stations," Roque says.

"We look at our pump stations holistically," he adds. In some cases, a station will need newer or larger-capacity pumps. In other situations, a new dry well/wet well combination may need to be installed to handle higher capacity. The WASD uses Flygt, ABS (Sulzer Pumps Solutions), Homa, and KSB submersible pumps.

The department uses CCTV monitoring and quantitative analysis to identify defective piping. Nighttime flows are closely monitored to detect I&I. Most pipes are repaired by relining, usually the CIPP method. Where pipes require complete replacement, WASD uses opencut methods.

Roque says the PSIP has updated about 40 pump stations to date, and the design work for the entire project is 80 percent complete. The department employs a number of different design consultants, and construction work is awarded to smaller, local contractors.

Public outreach is important, as the PSIP affects stations that are often close to houses and streets. Roque says the department has an outreach group that meets with affected citizens and explains the projects, which generally take six months from excavation to completion.

When done, Roque says the results are worth it. "We want to leave an area in better shape than it was."

A crew member levels off fresh concrete on the foundation of a new pump station under construction near the Miami-Dade Water and Sewer Department building.

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Clockwise from top: Crew members prep a section of pipe for installation. The new 48-inch force main is part of the N. Miami Avenue Betterment Project; Contractor foreman Cody Cook uses a TopCon level to shoot grades for the new pipe; A hydraulic pump is loaded onto a flatbed truck along N. Miami Avenue.

areas around construction will be restored at the end of the project.

• Renewal of a large waterline traveling down SW 152 Street parallel to the Miami Zoo.

• A 5,300-foot force main replacement under Norris Cut between Fisher Island and Virginia Key. The pipeline required a 10-foot-diameter tunnel. The line also required opencut replacement of 2,700 feet of 60-inch-diameter pipe in the wastewater treatment plant and directional drilling 1,000 feet of 10-inch-diameter pipe.

Anand says the new lines both impact and improve the daily lives of customers. "In older neighborhoods, many of our lines pass under front yards and backyards."

To avoid community disruption, WASD often turns to sliplining. Chief of Wastewater Collections and Transmission Juan Bedoya points to a 3.7-mile sewer relining project along SW Seventh Street. There, the wire wrap in a 54-inch pre-stressed concrete pressure pipe had badly deteriorated, causing pipe failures. Rather than use opencut methods to replace the line, the department turned to sliplining with HDPE. Bedoya says HDPE is preferred because its smooth surface results in minimum capacity reductions. Plus, he says sliplining with HDPE is cost-effective on a life cycle basis. "From an environmental and public standpoint, sliplining with HDPE is the way to go," he says.

Ric-Man Construction is doing the sliplining work.

A significant portion of the department's large-diameter pipelines are PCCP, and Bedoya says the entire PCCP system is being examined using the PipeDiver tool from Pure Technologies. The device travels through the lines, using electromagnetic waves to identify and locate broken pre-stressed wire wraps, which are the main indication of potential problems.

Anand notes that predictive maintenance enables the department to replace pipes before they fail and cause property damage.

"It's a maximization of existing infrastructure and enhancement in operational resilience."

(continued)

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Miami-Dade Water and Sewer Department Capital Improvement Program Deputy Director Hardeep Anand

Ocean outfalls

In 2008, the Florida Legislature and governor approved a new law requiring all wastewater utilities in southeast Florida using ocean outfalls to reduce nutrient discharges by 2018, and cease using the outfalls by 2025. The law also required utilities to reuse 60 percent of the treated effluent ocean discharges.

WASD explored a number of options and decided to construct a new 100 mgd West District Wastewater Treatment Plant in the western portion of the county, while reducing flows — including storm surges — to its three existing wastewater treatment facilities. "By moving water from east to west, we will be reducing stress on existing pump stations," Anand says.

The nutrient reduction goal will be met through the use of new deep injection wells at the North, Central and West district plants, and a new industrial injection well at the Central plant. The reuse requirements of the Ocean Outfall Program are being evaluated further to identify the most feasible compliance strategies.

Water system

New projects are shoring up the department's leak detection system to reduce water losses, and installing state-of-the-art advanced metering and a fiber-optic emergency response system.

• **Leak detection.** The WASD has piloted its new leak detection technology on a 109-mile section of its transmission and distribution system in a densely populated area. The results have been outstanding, Anand says. In the first four months of the pilot test, the system identified 50 leaks, the repair of which saved 459 million gallons of water, and a significant savings in nonrevenue water. For its work, the department received a 2016 National Association of Counties achievement award in water loss management.

• **Advanced Metering Infrastructure.** The department is preparing to deploy an AMI system throughout its 450,000 accounts. The move is expected to improve customer service and customer engagement with their water utility. Plus, the new system will conserve water and foster more efficiency among its users, while generating meaningful data for the department to use in future planning.

• **Acoustic emergency response.** This technology will provide real-time monitoring of the wire strands in vulnerable PCPP pipe and other high-risk assets. Using fiber optics, the system will enable the WASD to spot potential breaks and address them before emergencies develop.

Energy efficiency

The WASD is Florida Power and Light's single largest customer in South Florida. In an effort to reduce its carbon footprint, while reaping cost savings, the department is strategically pursuing opportunities to reduce energy usage.

The department's Utility Resiliency Plan aims to incorporate energy-efficient measures in technical design standards and capital projects, which will reduce energy costs, as well as the carbon footprint of its water and wastewater treatment plants.

To achieve its goals, the WASD has partnered with the U.S. Department of Energy on a Wastewater Infrastructure Accelerators program focused on resource recovery and a pathway toward a sustainable infrastructure of the future. "The partnership will enable us to tap into ongoing technical assistance from the U.S. DOE and Oak Ridge National Laboratory to perform energy assessments and identify opportunities for incorporating energy efficiency measures within the utility," explains WASD Director Lester Sola.

By adopting innovative and best-practice approaches in data management, technologies and financing for infrastructure improvements, WASD will seek to improve

AWARD HONORS PROACTIVE APPROACH

The Miami-Dade Water and Sewer Department was one of 61 water and wastewater utilities across the U.S., Canada and Denmark to be named a "Utility of the Future" at the 2016 Water Environment Federation annual conference in New Orleans.

The program, sponsored by WEF, the Water Environment Reuse Foundation, and the National Association of Clean Water Agencies, with input from the U.S. EPA, is designed to guide and honor utilities of all sizes for smart, efficient operations. Utilities are encouraged to recover resources and become more sustainable and resilient. Specifically, the program rewards water reuse, watershed stewardship, beneficial biosolids reuse, community engagement, energy efficiency, and recovery of nutrients and other materials.

The selection committee, consisting of peer utility leaders, evaluated utilities based on their ability to demonstrate comprehensive engagement in their selected activity areas in a meaningful and vigorous manner.

"Being acknowledged as a Utility of the Future is a meaningful recognition for us," said WASD Director Lester Sola in a press release. "We continually strive to address the resiliency needs of the region by developing proactive approaches to providing services and upgrading our infrastructure to meet current and future demands."

Added WEF Executive Director Eileen O'Neill, "We are excited about this new opportunity to recognize the achievements of small, medium and large forward-thinking utilities that are providing sustainable, efficient, and value-added service to communities nationwide."

More information about the program can be obtained from the websites of any of the sponsoring organizations, some of which conduct webinars about the program and list and application forms for the next round of awards.

the energy efficiency of its wastewater treatment facilities by at least 30 percent. Miami-Dade was one of the few utilities nationwide taking part in the inaugural partnership at the White House in May 2016.

Energy audits will help identify areas where efficiencies are to be leveraged, and capital improvement projects will be undertaken to realize those efficiencies. A recent example of WASD's commitment to energy efficiency is the 8 MW cogeneration facility at the South District Wastewater Treatment Plant. This project takes methane gas from the treatment plant digesters and an adjacent municipal landfill and produces electricity and heat, which are utilized to operate the facility.

The future

While Anand and others at Miami-Dade brim with confidence and enthusiasm as they push ahead with their Master Plan and Capital Improvement Program, they recognize the challenges. "The next few years will be very challenging as we develop the framework to be a utility of the future," he says.

The plan includes water, wastewater, climate adaptation, integration of technologies, and requires planning and compliance, coordination among utilities, program and construction management for pipeline and pump station projects, design and construction of new wellfields and a new 20 mgd wastewater treatment plant, not to mention an engaged and skilled workforce, best practices, economic growth, and operations optimization.

At the same time, the department has become the founding utility in the Resilient Utility Coalition — a strategic partnership formed between utilities in four South Florida counties and professional organizations to advance utility infrastructure resiliency efforts and help members deal with new challenges, especially the effects of climate change. "The coalition aims to enhance the usefulness of climate science by developing joint adaptation strategies and improving water management decision-making in the face of climate uncertainty," Anand says.

Currently, the coalition plans to develop a regional resiliency scorecard, conduct quarterly roundtable meetings, develop "tech talks" for training and education, and publish materials for community outreach.

Longer term, the RUC recommends utilities have a resiliency plan and prioritize investment based on the plan, implement energy efficiency, achieve economic sustainability and affordability for ratepayers, while engaging employees and reaching out to the community and other partners.

"The collaboration, platform and framework fostered by RUC's members will be vital to the continuous successful delivery of services to our customers," says Anand.

"We're doing the right thing, we're thinking ahead," he continues. "How can we avoid a catastrophic failure if we don't plan for it? It's the path to a smart utility and a resilient utility." ✦

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PROMOTE FROM WITHIN

With the right strategy, a high level of employee turnover doesn't have to be inevitable

By Ken Wysocky

We invite readers to offer ideas for this regular column, designed to help municipal and utility managers deal with day-to-day people issues like motivation, team building, recognition and interpersonal relationships. Feel free to share your secrets for building and maintaining a cohesive, productive team. Or ask a question about a specific issue on which you would like advice. Call editor Luke Laggis at 800/257-7222, or email editor@mswmag.com.

The average person will hold about 12 different jobs between the ages of 18 and 48, according to the U.S. Department of Labor. That's bad news for your utility in terms of general disruption and decreased productivity, not to mention the high cost of recruiting and training new employees.

In fact, the Society of Human Resource Management estimates that organizations spend the equivalent of six to nine months of a departing employee's salary to find and train a replacement. Some estimates run even higher. A survey conducted by the Center for American Progress shows that the cost can range from 16 percent of an hourly, unsalaried employee's pay (that's $6,400 out of a $40,000 annual salary) all the way up to 213 percent of a high-level executive's salary (which comes out to $319,500 for a $150,000 annual salary).

With those figures in mind, wouldn't it be great if your employees could scratch their job-hopping itch and hold most of those 12 different jobs within your organization, rather than leaving and becoming free agents every few years? While it may sound far-fetched, doing so doesn't require bending the time-space continuum or traveling to an alternative dimension. Instead, all it takes is building a culture of internal mobility, says Jack Hill, the director of talent acquisition solutions at PeopleFluent, a talent-management consulting firm (www.peoplefluent.com).

"If managers aren't helping employees evolve, then they're not really managing those employees."
– Jack Hill

"There's a real shift occurring in employee-retention efforts within organizations," says Hill, who has more than 20 years of experience in the employee-recruitment industry. "Corporations are focusing more on programs that help keep people occupied and transitioning within their organization. If employees are going to hop from job to job, companies need to find a way to let them do it internally — allow people to self-manage career paths. Think of it as a totally different spin on talent acquisition."

Utilities with turnover so high that a revolving door makes sense lose more than just productivity and the financial resources required to continually recruit and train new employees. They also lose a valuable base of institutional know-how. "There's no one around to make sure that knowledge trickles down to the next generation of employees," Hill notes. "And it takes time to get a new employee operating at the same level of productivity as the employee they replaced."

Moreover, utilities with high rates of employee turnover run the risk of developing a reputation as a bad place to work. And with the ever-burgeoning spread and impact of social media, it doesn't take long for a utility to find itself with image problems that will likely make recruiting new employees even more difficult, Hill explains.

So what's the solution to this expensive and resource-sucking problem? Create an organizational mindset in which both employees and managers accept — better yet, even embrace — internal job-hopping as a fact of life. And "both" is the operative word here, Hill points out. "It has to be accepted by both managers and employees — that's the big trick."

Managers in particular must walk the walk, not just talk the talk. If they don't, immediate obstacles arise to cultural change. For example, employees will be reluctant to express a desire to try a new job if they fear retribution from an unsupportive manager. Moreover, managers can also thwart the change initiative by consistently refusing to let great employees move on to other positions.

On the other hand, some employees may not deserve new opportunities. "Part of all this is evaluating whether an employee is worth saving," Hill explains. "If someone is not an upwardly mobile employee, is it a loss to the organization if they leave? It's up to organizations to develop succession-planning tools to make those assessments and decisions."

Talent-acquisition teams must also play a key role by quickly and competently backfilling positions as employees get promoted. Managers need to feel confident about the process — be certain that if they promote a rising star, the void will be filled. "If you build that confidence with managers, then they'll engage their direct reports a little more," Hill says.

It's also critical to establish what Hill calls a culture of internal mobility, which requires managers to keep it top-of-mind in the daily cadence of work. "They have to think every day like they're selling an idea," Hill says. He also recommends that internal mobility become a part of the annual job-review process. Managers should talk about their career development within the organization. "If managers aren't helping employees evolve, then they're not really managing those employees," he says.

Organizations also need to more frequently discuss employees' aspirations for mobility. In other words, just because someone says they're not interested now doesn't mean they won't be in six months. "You need a central 'living' data center that we call a talent profile," he notes.

Another critical component is a solid feedback loop in which employees whose applications for new internal jobs are denied receive a thorough explanation and some coaching. "It's a simple idea, yet not often practiced," Hill points out. "You need to keep encouraging them to apply for other positions. If you're going to build up a culture of internal mobility, it all comes crashing down if you don't communicate with them. It's demoralizing."

Last but not least, organizations have to treat employees that take

"If someone is not an upwardly mobile employee, is it a loss to the organization if they leave? It's up to organizations to develop succession-planning tools to make those assessments and decisions."

– Jack Hill

new internal positions just like new employees. Hill calls this "cross-boarding," a hybrid of on-boarding. "It's basically resocializing someone in their new role within an organization."

The beauty of all these strategies is that they're not high-cost propositions, either. So organizations have little to lose financially and everything to gain if they develop a culture where employees are self-directed owners of their career development. ✦

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CHIEF OPERATOR (2000-08)
Shoal Creek Water Reclamation Facility,
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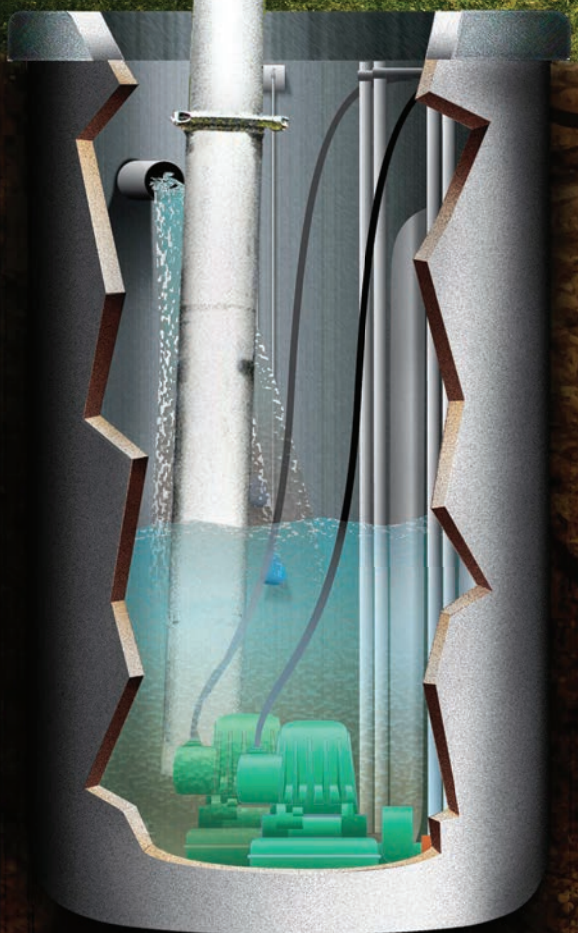

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PARTNERING FOR BETTER MANAGEMENT

More than ever, sound asset management practices are critical for underground infrastructure

By Ted DeBoda

With the White House administration's proposed budget cuts, including the significant 31 percent cut to the EPA, it is more important than ever to understand the value and importance of asset management as it pertains to the preservation of our underground infrastructure.

By the time this article is published, the proposed cut could mean $2.6 billion less in EPA spending than last fiscal year. While the proposed budget does increase state revolving funds by $4 million over last year, these cuts include, among other things, the diminished enforcement of EPA regulatory programs, which could have a significant impact on EPA consent decrees focused on elimination of sanitary and combined sewer overflows. This is happening at a time when the ASCE Report Card gave us a "D+" for our deteriorating wastewater infrastructure.

While regulatory programs are important to guide and keep our industry accountable, it is ultimately up to the system owner to make the most of available funding and manpower to best sustain their systems. To this end, municipalities understand the need for an effective asset management program now more than ever, and NASSCO is doing its part to support this effort. Two ways we do that are through the Pipeline Assessment Certification Program and industry partnerships.

PACP and asset management

As part of our mission to set standards for the assessment, maintenance and rehabilitation of underground infrastructure, since 2002 NASSCO has trained over 28,000 professionals in PACP to standardize data collection protocol for CCTV pipeline inspection. PACP Version 7.0 now includes content that describes how PACP inspection results can be used to help define risk in the development of an asset management plan for pipe networks. Appendix D of PACP Version 7.0, titled "PACP Based Risk Management" provides suggested procedures that can become an integral part in developing an asset management plan for utilities.

In the asset management framework, risk is defined as the likelihood of failure (LoF) or the chances of a negative impact occurring, multiplied by the consequence of failure (CoF) related to a specific asset. The PACP quick rating can be modified to determine LoF values for pipelines. Rules for calculating LoF provide a set of values that allow for the complete range of PACP ratings, to include a flag if no condition assessment data is available.

The CoF score for an asset is determined in terms of the "Triple Bottom Line," which refers to economic, social and environmental costs. Economic factors are typically expressed in dollars and include property damage, repair cost and production loss. Social cost is the impact on society due to asset failure. Environmental cost is the impact to ecological conditions resulting from asset failure. For example, a 56-inch trunk sewer that crosses a stream will have a higher CoF than an 8-inch sanitary sewer at the top of the system that only serves one resident. For consistency, CoF is assigned on a scale similar to the LoF scale, and will take location and demographic information into consideration, including relative network position, location of pipe, environmentally sensitive features, service to customer, and accessibility for maintenance and inspection. The ultimate goal is to achieve sustainability in a manner that balances social, environmental and economic costs.

While appendix D of the manual is not included in the syllabus of NASSCO's PACP class, all PACP trainers have been provided with the training materials and can review these procedures in detail to quantify a utility's risk.

Industry partnerships

Now more than ever it is critical that we come together as an industry to focus on spending money smarter through effective asset management. NASSCO's Asset Management Committee has developed important industry partnerships to achieve this goal. They have worked closely with Buried Asset Management Institute International and the Trenchless Technology Center at Louisiana Tech. Recently, NASSCO teamed with the Center for Underground Infrastructure Research and Education in the development of a new textbook, *Pipeline Infrastructure Renewal and Asset Management.*

In coordination with the Trenchless Technology Center, NASSCO is updating the Trenchless Assessment Guide for Rehabilitation, a program that evaluates different trenchless technologies for a variety of applications, to include asset management programs. In addition to incorporating the latest trenchless rehabilitation technologies, the new release will also provide a mechanism to incorporate PACP data to help define the most accurate range of rehabilitation options.

Our continual updates to educational tools such as PACP, and partnerships with TTC, CUIRE and other organizations, will work to educate, support and encourage system owners and operators to implement a solid asset management program to proactively maintain their systems. ✦

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A LIFT STATION THAT WON'T FAIL

Virginia utility takes redundancy a step further with a permanent backup system that protects against mechanical and power failures

By Asante Cureton

BETTER MOUSETRAPS

PRODUCT:
Godwin Dri-Prime Backup System

MANUFACTURER:
Godwin Pumps, a Xylem brand
800/247-8674
www.xylem.com/dewatering

APPLICATION:
Back up system to minimize sewer overflows

BENEFITS:
Lift stations never stop pumping

USER:
Isle of Wight County, Va.

Isle of Wight County's newest lift station — supporting the new Benn's Grant residential development — was outfitted with a Godwin Dri-Prime Backup System (DBS) capable of handling the station's estimated 1,420 gpm flow.

A big storm sweeps through town and knocks out power to your most critical lift station. Luckily, it's equipped with a backup generator. But then debris chokes the pump.

Lift station redundancy is invaluable. In Isle of Wight County, located 20 miles west of Norfolk in eastern Virginia, the Department of Public Utilities has taken a novel approach to ensuring their stations never stop pumping.

The Department of Public Utilities maintains the county's sewage collections system, which serves a population of about 35,000 people. Gravity lines and force mains, supported by 32 lift stations that address the Isle of Wight's generally level topography, feed into a regional wastewater treatment plant. Minimizing sanitary sewer overflows due to lift station failures is particularly important.

"We've got a clean track record of preventing sanitary sewer overflows from our stations," says Steve Hatcher, public utilities operations manager for Isle of Wight. "One of our key techniques is implementing redundancies whenever possible, whether it's upgrading an existing station or putting in a new one."

At the newest of Isle of Wight's 32 lift stations — supporting the new Benn's Grant residential development — the Public Utilities Division needed to accommodate new sewer lines and equip a new lift station to support the flow. The department wanted the station outfitted with a fail-safe backup system.

The industry standard for lift station redundancies is to install a diesel-driven generator that fires up when the power goes out. This solution has been a perfectly reliable backup in case of power failure, but a generator is of little use if the station's switchgear or primary pump fails.

New twist

The utility turned to the local Xylem branch for an option that would build in system redundancies. The recommended solution added a new twist on existing technology — redundant and independently powered backup pumping in one package for a variety of emergency situations. It made perfect sense to Hatcher and his team.

The Xylem team engineered a more complete solution featuring a Godwin Dri-Prime Backup System (DBS) capable of handling the estimated

(continued)


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www.adsenv.com/echo

The Godwin DBS is an independently powered diesel backup pump that is permanently installed in the lift station. The system automatically protects against loss of power, in the event of transfer switch malfunction, as well as control panel, transducer and permanent pump failures.

1,420 gpm flow rate expected at the new lift station. The Godwin DBS is an independently powered backup pump that runs on diesel, and is permanently installed in a lift station. Plumbing directly into the wet well with independent sets of floats, the system automatically protects against loss of power, in the event of transfer switch malfunction, as well as control panel, transducer and permanent pump failures.

To handle the flow rates at the Benn's Grant lift station, the utility went with a diesel-driven Godwin CD225M critically silenced pump. The new backup pump triggers on and off via level floats in the wet well that are set at predetermined levels. If the water rises due to a failure of any kind, the backup diesel pump kicks on and the lift station continues to move water. Additionally, the backup pump will turn on and support the primary pump if a 100-year storm event inundates the lift station with an overwhelming amount of flow. This extra capacity further reduces the possibility of an overflow.

The backup pump is also equipped with a Godwin PrimeGuard controller to provide greater visibility and peace of mind. The controller sends signals to the county's SCADA system, notifying department personnel that the backup pump is running, so they can initiate a visit to the lift station if needed. Another great benefit to the county is the system's ability to only activate the backup pump when needed, therefore saving fuel and limiting operating hours. When a lift station is equipped with a generator, it runs constantly the whole time the power is out, whether the pump station is requiring standby power or not. As a result of the increased efficiencies and critical service reliability required by Isle of Wight, they have incorporated backup pumps into their standards and specs for all new lift stations and rehabilitation projects.

Besides providing 100 percent redundancy, the Godwin DBS provides convenience to Hatcher and his team. Whenever the primary pump in the lift station requires repair or maintenance, crews can manually start the permanent backup pump, which is much easier than bringing in one of the department's 11 portable pumps for a temporary hookup.

Additional features

Beyond the technical performance specifications, the department requested work lights and a battery charger in case of nighttime work and to ensure remote access to the pump controls during a long-term power outage event. In addition, to manage the chilly Virginia winters and prevent freezing during low-flow activity, the backup pump was outfitted with a block heater and exposed piping was insulated.

Isle of Wight has now equipped six of their 32 lift stations with Xylem's independent backup pumping solution. As they map out their maintenance and upgrade activity, the county plans to upgrade their other lift stations with the same system.

"The Godwin DBS that Xylem offers makes so much sense for our network," Hatcher says. "It gives us the dependability of a tried-and-true product and delivers real peace of mind. No matter what happens, our lift stations will have the capability to move water — and knowing that is very reassuring."✦

About the Author

Asante Cureton is regional applications engineer for Xylem Dewatering's Southeast Region.

MEASURING MANHOLES IN A GLANCE

Inspection system provides 3-D views and complete inspection data in a simple package

By Luke Laggis

TECH CLOSE UP

PRODUCT:
SPiDER

MANUFACTURER:
CUES
800/327-7791
www.cuesinc.com

APPLICATION:
Inspecting manholes

BENEFITS:
Wireless inspection can measure manholes at a glance.

No utility is immune from manhole problems. From I&I and elevation to reconstruction and rehabilitation issues, you're all dealing with them. And with several manholes per mile of pipe, that adds up to a whole lot of potential problems.

Inspection technology has evolved significantly over the past decade, and CUES is pushing the curve further with its new SPiDER manhole inspection system. *MSW* recently spoke with Pierre Mikhail, director of CUES' Manhole Inspection Division, about the new system and how it can help utilities inspect manholes more efficiently.

What was the idea behind the development of this inspection system?

Mikhail: We wanted to create a smart manhole inspection system that is truly wireless, simple to use, and can measure entire manholes in one glance instead of point to point, providing the condition assessment of manholes both before and after rehab.

What issues does the SPiDER resolve over previous manhole systems?

Mikhail: The system isn't tethered to a power or data cable so there is no calibration required. The SPiDER doesn't have to remain centered in the manhole during deployment. There is no inspection review required at the end of the inspection, so all inspections should pass if the user deploys the unit as trained.

The SPiDER is capable of evaluating the manhole video quality and adjusting one or several of its 25 LED lights simultaneously, automatically and instantly with no user controls. When the manhole wall is difficult to see, the SPiDER deploys a pattern generator to ensure a dense point cloud. These adjustments are evaluated by the SPiDER for every frame of data it collects, and adjustments are instantaneous. This frees the user from having to adjust iris, focus, exposure or light intensity. This simplicity means training to use the equipment on site requires only minutes.

The SPiDER also creates a mesh that allows the user to evaluate changes in manhole shape in a custom color gradient that symbolizes change in distance.

What are the advantages of a wireless system for manhole inspection specifically?

Mikhail: Off-road inspection is a big challenge for manhole inspection teams. A wireless system removes the need for a cable reel, and a footage encoder isn't required to determine the depth of the device in the manhole.

How is inspection accuracy improved with the SPiDER?

Mikhail: The unit uses four stereoscopic cameras positioned in a spher-

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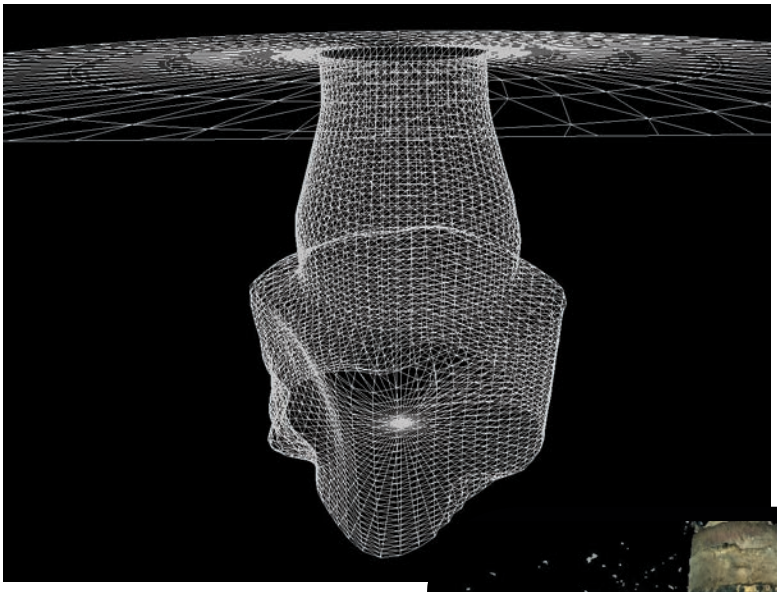
The CUES SPiDER manhole inspection system includes two sets of batteries, control tablet, tablet charger, post-processing computer, tripod, electric winch and carbon-fiber poles.



The SPiDER's four stereoscopic cameras generate point clouds. After the inspection is completed, the SPiDER automatically post-processes the inspection data and provides a 3-D video, 3-D image and the 3-D point cloud that can be exported to CAD or transferred to a measurable mesh.

ical formation. Stereoscopic cameras generate point clouds, which are solid images rather than sparse one-color points like previous systems. The denser the point cloud, the better the accuracy. SPiDER accuracy is less than 5 millimeters and usually as accurate as 1 millimeter in standard manhole widths of 3 to 4 feet.

What are the differences between the data collected by the SPiDER and a traditional manhole camera?

Mikhail: Most manhole inspection systems use multiple sensors to gather information. Usually it is a photographic camera paired with a point cloud generating device such as a Lidar laser. The laser creates a sparse one-color point cloud. The SPiDER uses stereoscopic cameras that collect the photographic imagery and 3-D positioning to generate a solid-image color 3-D point cloud. Since the point cloud is a solid image with minimal spacing between points, it is far more accurate — as low as 1 millimeter. More importantly, the color point cloud can be converted to a mesh, which will be the new standard deliverable to provide manhole condition assessment pre and post rehab.

What type of software is required to read the inspection data?

Mikhail: The SPiDER uses a web browser tool for user review of the inspection. This tool is provided with the unit.

Does the system create a 3-D model of the manhole, or is data overlaid on traditional video footage?

Mikhail: The SPiDER provides a live video tablet review during inspection from the four stereoscopic cameras. After the manhole inspection is completed, the SPiDER automatically post-processes the inspection data while the next manhole is being inspected. After post-processing, the unit provides a 3-D video, 3-D image (which can be unwrapped or viewed in 3-D space), and the 3-D point cloud that can be exported to CAD or transferred to a measurable mesh.

How does the system measure hydrological information for I&I studies?

Mikhail: The user can review the video to observe the pressure of the I&I. The 3-D imagery can be used to measure the size of the infiltration.

Can you walk me through the setup for a typical inspection?

Mikhail: The unit can be set up as a truck-mounted or tripod system. Truck-mounted units are deployed from the rear of a truck positioned at a manhole. The tripod setup requires the SPiDER to be mounted at each manhole. Once the manhole is opened, the user positions the SPiDER over the manhole opening and selects "Start Recording." Additional information such as manhole number, address, etc., can be customized and entered by the user via text or drop-down fields. The SPiDER is then deployed at 10 feet/minute using an electric winch. When the SPiDER reaches the bottom of the manhole (tablet provides distance from bottom in real time), the user stops the electric winch and selects "Stop Recording." The unit is then removed from the manhole.

How long does it take to inspect a manhole with the system?

Mikhail: The majority of the time required to inspect a manhole is the mobilization time between manholes. Once a manhole is opened, the SPiDER inspects at 10 feet/minute. Users can inspect 30 off-road manholes per day with a tripod setup, and more than 50 on-road manholes with a truck-mounted system.

How many manholes can be scanned on a single charge?

Mikhail: The SPiDER is powered by a pair of batteries that last for seven hours with the unit powered on all day. It includes two sets of batteries for up to 14 hours of runtime, and a smart charger that can charge one set of batteries in less than three hours while the other set is in use.

How is the information stored and shared?

Mikhail: The raw data is stored on the SPiDER, not on the tablet. After post-processing, the data is downloaded to a portable drive. The SPiDER auto-manages the data so it is user-friendly for the field crew.

What's included with the system?

Mikhail: The SPiDER includes two sets of batteries, control tablet, tablet charger, post-processing computer, tripod, electric winch, carbon-fiber poles (up to 30 feet deep). Everything necessary to perform SPiDER inspections is included in two wheeled cases. ✦

PUMPS, LIFT STATIONS AND CONVEYANCE

By Craig Mandli

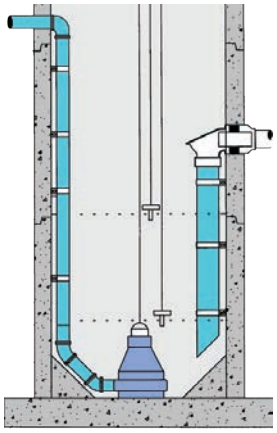
Control Panel

Environment One Corporation iota OneBox

The **iota OneBox** telemetry system from **Environment One Corporation** provides complete command of a fleet of pressure sewer grinder pumps from an office desktop or a smartphone. It allows users to improve customer service and take corrective actions as they arrive, while improving response time and system efficiency. It can be integrated into a SCADA network seamlessly to provide information about tank storage capacities, power failures, blockages and faults. It provides diagnostics for individual properties, streets or whole networks in real time. It can provide alerts even before the customer becomes aware of any faults, along with trend analysis, report generation, peak flow demand determinations, enabling flow smoothing, and maximizing efficiency of downstream infrastructure. **518/346-6161; www.eone.com.**

Lift Station

RELINER/Duran Inside Drop



By using **Inside Drops** from **RELINER/Duran** in lift stations, pump life can be extended by preventing aerated influent from being directly drawn into the pumps. Their use can help dramatically reduce pump-related problems, as well as reduce general maintenance and odor complaints. The drop pipe should be extended below the low-limit level and cut to follow the slope of the base fillet. If there is no fillet, cut the pipe at 45 degrees, one pipe diameter from the floor or fillet. This will create a diffuser by directing the flow back against the structure, thus de-aerating the influent. This simple arrangement is easy to maintain, as there is nothing to collect debris. It can be cleaned from above. **800/508-6001; reliner.com.**

Meters

Blue-White Industries Sonic-Pro

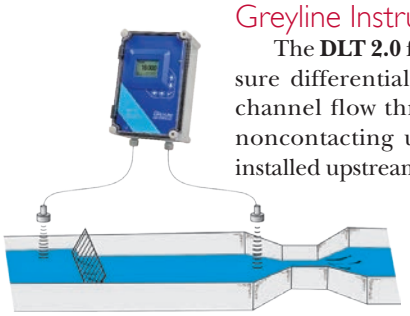
Sonic-Pro hybrid ultrasonic flowmeters from **Blue-White Industries** are designed to measure fluid flow in virtually any fluid in which sound can travel. Noninvasive clamp-on transducers work with both clean and dirty

fluids. They are suited for use in applications where harsh chemicals or abrasive fluids are being used because the meter doesn't come into contact with the fluid being measured. The T-Track mounting system is designed to quickly and accurately mount transducers, utilizing a built-in ruler and mounting base. The heavy-gauge stainless steel cover, anodized aluminum end blocks and polymeric tensioning clamps provide transducer protection for years of service in tough environments. The meter can be equipped with a communication package for PC remote access, allowing for program editing and downloading of data logs. A relay package is available for process control and alarm functions. **714/893-8529; blue-white.com..**

FCI - Fluid Components International FlexSwitch FLT93 Flow Switch

The **FlexSwitch FLT93 Flow Switch** from **FCI - Fluid Components International** reduces pump repair and extends pump life by detecting dry running conditions. It reliably monitors the flow and temperature of liquids, gases and slurries. It is ideal for pump wet/dry detection, where sudden, unexpected reductions in media flow rates may leave pumps vulnerable to over-heating conditions. With no moving parts, it offers a robust scheme for pump protection with its dual alarm capability. With Alarm 1, the switch will detect a low-flow situation anywhere between 0.01 and 3 feet per second. If Alarm 2 occurs because the feed line to the pump is running dry, this condition would be an emergency signal to shut down the pump immediately because the bearings now see gas instead of a liquid as a heat transfer media. **800/854-1993; www.fluidcomponents.com.**

Greyline Instruments DLT 2.0



The **DLT 2.0** from **Greyline Instruments** can measure differential level at a bar screen, plus open channel flow through a flume. It works with two noncontacting ultrasonic sensors. One sensor is installed upstream from the bar screen, with a second sensor downstream for differential level control. The second sensor can also be installed in a flume to control and transmit differential

level control plus flow. The unit includes relays for bar screen rake and level control, as well as three 4-20mA outputs (upstream level, differential level, downstream level or flow). The large backlit LCD display shows level, differential level, flow and total flow. Intrinsically safe sensors and data logger are optional. **888/473-9546; www.greyline.com.**

PRIMEX PSLT Submersible Level Transmitter

The **PSLT Submersible Level Transmitter** from **PRIMEX** provides a reliable and low-maintenance solution for level control applications, including sewage and effluent lift stations, stormwater pump stations, nonpotable water systems, tanks, wet wells and reservoirs. The instrument measures the hydrostatic pressure of the water above the sensor and outputs a 4-20mA signal proportional to the level. Transmitter wetted components are designed with nonconductive materials to provide an electrical isolation barrier. A protective diaphragm isolates the pressure from process material. It is industry-standard 4-20mA, two-wire loop powered, reverse polarity protected and has 18/2 shielded cable with a vent tube. It includes removable a lock-in-place stabilizing weight. Multiple ranges and cable lengths are available. **844/477-4639; www.primexcontrols.com.**

Pumps

Flygt – a Xylem Brand Concertor

The **Concertor** smart, interconnected wastewater pumping system from **Flygt – a Xylem Brand** senses the operating conditions of its environment, adapts its performance in real time and provides feedback to pumping station operators. It offers energy savings of up to 70 percent compared to a conventional pumping system, along with reducing inventory by up to 80 percent due to flexible performance. Clog-free pumping operation and clean wet wells can save up to 80 percent in vacuum cleaning costs. Its compact design reduces cabinet size by up to 50 percent. It offers a wide performance field from which to choose the right operating point, making it simple and facilitating performance fine-tuning. **855/995-4261; www.xylem.com.**

Gorman-Rupp 6500 Series

The **6500 Series** line of solids- and clean liquid-handling end suction centrifugal pumps from **Gorman-Rupp** is based on the Prime Aire and Prime Aire Plus models. The line includes model sizes from 3 to 16 inches, flows to 15,000 gpm, total dynamic head to 530 feet and solids handling capabilities up to 4 inches. The pumps come standard with oversized bearings, atmospheric vent, side-access inspection port (on solids-handling models) and an indexable Smart Scroll discharge locator. **419/755-1011; www.grpumps.com.**

NOV EZstrip

The **EZstrip** maintain-in-place progressing cavity pump from **NOV** is designed for quick and safe removal of the full drivetrain including rotor, stator, shaft, rod and seal in minutes without electrical disconnection. The access covers provide 360-degree access to the coupling rod and drive shaft for easy inspection. With its smooth-profile Positive Torque Split Coupling Rod, maintenance and assembly times are reduced. The tie-bar-free design allows the EZstator clamps to lock the stator securely in place, further reducing stator removal time by over 50 percent and improving safety of common maintenance operations. In addition, the fixed-support foot and stator clamp assembly further aids rotor and stator removal. It is available in cast iron or stainless steel with a choice of rotor and stator materials to suit individual applications. **832/424-7300; www.nov.com.**

Pulsafeeder PULSAtron Electronic Metering Pump

PULSAtron Electronic Metering Pumps from **Pulsafeeder** have a guided check valve system with a seat-and-ball design that ensures reliable and accurate metering. Their fin-cooled solenoid enclosure dissipates heat, ensuring that the pressure-handling capability of the pump can be maintained. The thermally protected solenoid protects the pump from seizing up in extreme heat conditions with an automatic reset feature, allowing the pump to resume operation upon cooldown. Units are tested and rated under hot conditions so flow and pressure ratings meet specifications. They offer flows up to 600 gpd and pressures up to 300 psi, with a wide range of flows and pressures. Agency approvals include CE, ETL, ETL san. and NSF 61 approval on PVDF material and degassing head models. **800/333-6677; www.pulsatron.com.**

Valve

Henry Pratt Company Pratt PSI Surge Inhibitor

The **Pratt PSI Surge Inhibitor** check valve from **Henry Pratt Company** uses a reinforced flexible disc made from a stainless steel hinge pin with nylon reinforcement in the hinge and an alloy steel disc plate fully encapsulated in a specially formulated rubber compound that resists wear. The hinge tab of the disc is secured between the valve body and disc. The disc is able to pivot about the reinforced hinge section. It helps reduce or eliminate valve slam. A stainless steel flexor assembly affixed to the disc increases the speed of closure by stiffening the hinge section of the disc. The valve is field adjustable without removing from the line. It is manufactured to comply with AWWA C508 and is NSF/ANSI 61/372 certified. **877/436-7977; www.henrypratt.com.** ✦

Radar level transmitter provides solution for combined sewer overflow

Problem:

A wastewater treatment plant in Campbell, Ohio, had a narrow manhole that was 30 feet deep with an overflow pipe that was raised up 20 feet from the bottom. The customer needed to measure from the bottom of the 30-foot well up to 18 inches from the top. They were required to read all of the water going into the overflow pipe and didn't have any space to make the measurements. The surface water was contaminated with foam, organic debris and effluent.

Solution:

FLO-CORP's solution was to mount a **Tracer Air Radar Level Transmitter** near the sidewall of the manhole with a clear path down to the bottom of the pit. The noncontacting radar level transmitter was recommended due to the small beam angle (less than 8 degrees) and advanced echo-processing algorithms to eliminate false return echoes from the ladder rungs, piping and sidewall buildup. The Tracer Air is ideal for difficult applications with factors such as vapor, steam, pressure, temperature change, dust and foam.

RESULT:

The wastewater treatment plant now has the ability to measure the 30-foot manhole accurately and reliably. **877/356-5463; www.flowlineoptions.com.**

Grinder keeps wipes at bay in Massachusetts pump station

Problem:

As the population of Billerica, Massachusetts, grows, so has the amount of debris flowing through the area's wastewater treatment system, especially rags and flushable wipes. This extra influent was causing undue stress and equipment damage at one of the area's largest pump stations. The city sought a waste reduction solution to eliminate these problems. "Dealing with wipes has been nothing but a nightmare," says Mike McCaughey, collections supervisor for Billerica. "Our Brown Street pump station has a 24-inch pipeline leading into the station, and when there's not enough flow, rags just build up inside the pipe. Then, during periods of heavy rain, a slug of stormwater rushes through the pipeline and all the rags hit the pumps at once." This influx of wipes and rags would also cause issues during routine cleanings of the wet well. McCaughey wanted a solution that would protect the pumps at Brown Street and the remaining pump stations downstream without inhibiting flow or requiring a major system redesign.

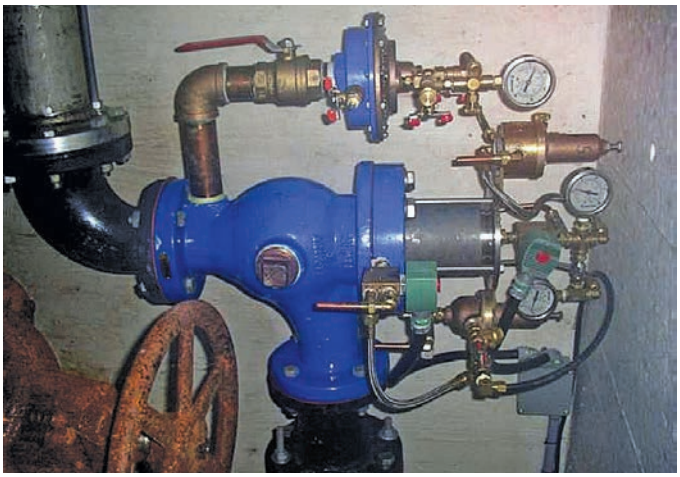
Solution:

Jim Deluca, president of Aqua Solutions, recommended installing a **Channel Monster** grinder with upgraded Wipes Ready Technology from **JWC Environmental** for the Brown Street pump station.

RESULT:

McCaughey found the system to be a durable, cost-effective and versatile solution. "The grinder made a huge difference," McCaughey says. Since the installation of grinder in 2014, the need for daily pump maintenance has been eliminated. **800/331-2277; www.jwce.com.**

Relief valve with surge anticipator eliminates pipe breaks



Problem:

The District of Central Saanich in Victoria, British Columbia, has a widely dispersed sewage collections system with multiple lift stations that pump sewage several miles through force mains to a treatment plant. When fluids travel such long distances, there is always the potential for pressure buildups from even the slightest changes in velocity. Hard stops at the pump or power interruptions caused surges that literally blew lines out of the ground.

Solution:

Singer Valve's Pneumatic Dynamic Lifter (PDL) with surge anticipator was installed to reduce stress on the pipes. The responsive compact sewage relief valve can handle high pressures (200 psi or higher) and uses standard plant air supply to hold the valve closed. This chamber is fitted with a relief pilot that is also normally closed, providing the line pressure is lower than the setpoint. If pressure rises above the setpoint, the relief pilot opens, causing the air in the cylinder to vent, which in turn opens the valve. The anticipating surge relief function has two three-way solenoid valves to put air into the cylinder under the piston, driving the valve open on power failure. This way, when the surge returns to the pump it is not coming back to a closed system where it can cause damage; it comes back to an open valve where it can discharge safely into the storage well underneath the pump.

RESULT:

The relief valve guaranteed no surges, eliminating the cause of pipe breakage in the system. **888/764-7858; www.singervalve.com.** ✦

Product Spotlight

Fuse in tight spots with McElroy interchangeable-carriage line of fusion machines

By Jared Raney

Until the late '90s, pipe fusion machines had to be mounted on wheeled vehicles and manually pulled to the job site. Today, fusion carriages can also be mounted on self-propelled, tracked vehicles, and McElroy is continuing that innovation with the TracStar Series 2 line of interchangeable fusion machines.

"The TracStar Series 2 pipe fusion machines are self-propelled vehicles equipped with a four-jaw carriage that is used to butt-fuse thermoplastic pipe by applying heat and pressure," says Jason Lawrence, director of product development for McElroy. "Prior to the Series 2, each carriage was paired with a corresponding vehicle. But the models for small- and medium-diameter pipe now share a common vehicle that is interchangeable with our full line of machines."

The machines are self-contained, so everything — including the power source — is onboard, and can be moved as one complete unit. In addition, the fusion carriage itself can be removed for tricky fusion scenarios in tight spots.

"A rugged track system allows users to easily move the machine across rough terrain and inclines straight to the fusion site," Lawrence says.

Made with enough fuel capacity for a full day's work, the Series 2 has advanced emissions control technology that meets EU Stage IIIB and EPA Tier 4 standards, without the need for diesel exhaust fluid.

"We also redesigned the cowling to improve airflow and heat dissipation for demanding operating climates, and provided better access to the engine for maintenance," Lawrence says. "We've updated the electrical system for better circuit protection and incorporated a standard battery disconnect for a maintenance lockout.

"We work closely with our channel partners and end users in an effort to understand the unique situations they are faced with every day so that we can offer them a true job site solution that will allow them to work better and smarter," Lawrence says.

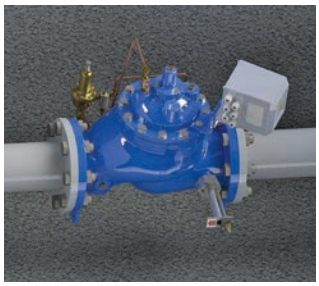
For fusing long polyethylene pipelines installed with sliplining, pipe bursting and directional drilling technologies, the TracStars are offered in a wide range of pipe sizes from 2-inch IPS to 48-inch O.D. pipe. **918/836-8611; www.mcelroy.com.**

Felling Trailers I Series

The I Series from Felling Trailers incorporates additional standard features, structural strength and ease of operator use. The design of the hitch plate area has been simplified to reduce the number of welds needed in production, adding strength in final construction. The tailboard incorporates a four-tail-light LED system and a new design that offers a level transition onto rear deck boards when loading, extending deck life. An additional 2 inches to the ramp width provides an 18-inch center gap between ramps. **800/245-2809; www.felling.com.**

CCI Pipeline Systems pipe stands

Pipe stands from CCI Pipeline Systems are designed to accommodate multiple pipe sizes, allow for 6 inches of grade height adjustment, and offer a standard base height of 30 inches tall. They can be cut to a preferred length in the field and the base plates are predrilled for anchor bolts. The stands are available with HDG or thermoplastic powder-coat finish for corrosion resistance. ArmorCote U-bolts and Armor-Pad pipe supports are used to secure pipe onto the pipe stand, and custom designs are available. **800/867-2772; www.ccipipe.com.**



Singer Valve battery-operated electromagnetic flowmeter

The battery-operated SPI-MV converter from Singer Valve can run independent of an external power source for an estimated three to five years. It can also be paired with an external AC or DC power source so the battery acts as a power backup. A small solar

panel can also be added to extend battery life 10 to 15 years. The flowmeter comes in the standard three-key-touch local converter with diecast aluminum IP67 housing and has variable sampling frequencies that can be adapted to fit installation needs. The unit offers dual totalizer pulse output and internal data logging options that can be used for SCADA integration and flow analysis. **888/764-7858; www.singervalve.com.**

Super Products SuperJet truck-mounted jetter

The SuperJet truck-mounted jetter from Super Products has a double-acting, single-piston, hydraulically powered water pump offering a 1-1 oil to water ratio and rated design capacity of 100 gpm and 3,000 psi continuous duty. Its modular water tank setup accommodates capacities from 1,000 to 3,200 gallons. It has a rear compartment heated by an 80,000 Btu/hr heater that enables year-round operation in freezing environments. The control panel performs a number of functions including adjustable engine throttle with water pressure speed dial; on/off water pump PTO; psi and gpm; and hose reel joystick, pay-in/pay-out with speed control. **800/837-9711; www.superproductsllc.com.**

HOBAS CCFRPM pipe

HOBAS centrifugally cast, fiberglass-reinforced, polymer mortar pipe is corrosion resistant with a life expectancy of 100 years or more. Sections join with push-together, leak-free, gasket-sealed couplings. Nonpressure and pressure classes are manufactured in diameters from 18 to 126 inches and can be installed by a variety of installation methods. **800/856-7473; www.hobaspipe.com.**

Holehat manhole safety cover

Holehat utility manhole safety cover by Manhole Safety Covers provides a raised visual warning and structural fall protection for utility manholes. The retractable cover is lightweight, portable and simple to use. Aluminum construction gives the unit strength while the three-position retractable yellow cover provides space for maintenance, cleaning and inspection equipment. The yellow neon cover has a large warning and reflective fabric for day and nighttime visibility. **480/650-7122; www.holehat.com.** ✦

Blue-White Industries elects VP of operations

Blue-White Industries' board of directors announced the election of Bill McDowell to the position of vice president of operations. With the company for 32 years, he has held the positions of plant maintenance supervisor, engineer and sales engineer.

Bill McDowell

Subsite announces award winners

Subsite Electronics recognized Ditch Witch of Georgia's Brent Goodman and Ditch Witch of the Rockies' Troy Kynaston with the top salesman awards at the annual Ditch Witch Sales Conference held in Orlando, Florida.

Troy Kynaston (left) and Brent Goodman accept the Subsite Electronics top sales awards from Subsite's John Lamerton.

Enerpac Integrated Solutions now Heavy Lifting Technology

Enerpac Integrated Solutions changed its name to Heavy Lifting Technology. A manufacturer of high-pressure hydraulic products, the company has 28 offices in 22 countries and over 1,000 employees.

JLG wins 2017 EquipmentWatch awards

JLG Industries announced their engine-powered articulating boom lifts, engine-powered scissor lifts and SkyTrak telehandlers won awards in EquipmentWatch's 2017 Highest Retained Value program. The award is presented based on residual values for heavy equipment.

John Deere, LHP Telematics announce collaboration

John Deere and LHP Telematics are joining together to further advance the proficiencies of John Deere WorkSight and JDLink data, allowing customers to access data from all machines in a fleet from one location. As part of the collaboration, John Deere customers will have direct access to information such as meter readings, locations, fault codes, utilization hours and fuel consumption for the fleet, regardless of the manufacturer.

Komatsu wins 2017 EquipmentWatch awards

Komatsu America announced it was named a 2017 winner in EquipmentWatch's annual Highest Retained Value awards program. The WA320 wheel loader, GD655 motor grader and BX50 forklift lines were the recognized model series for the awards.

Legacy Building Solutions receives Merit Award

Legacy Building Solutions received the Merit Award from the Design-Build Association – Upper Midwest Region for the IEI Barge Services project. The building measures 63,020 square feet and is located on the banks of the Mississippi River in East Dubuque, Illinois. The Merit Award is given for following the principles of design/build construction and finding innovative solutions for project challenges.

Trelleborg appoints sales director

Trelleborg's pipe seals operation has named Tim Van Putten as sales director for pipe, connector and manhole seals. Based in Lelystad, Netherlands, he will lead business development for sealing systems with a focus on expanding international sales and customer relationships.

Bill McDowell

Polston Applied Technologies now U.S. Submergent Technologies

U.S. Submergent Technologies is the new name of the wastewater system maintenance company previously known as Polston Applied Technologies. All company phone numbers will remain the same, emails will reach corresponding staff and the new website is www.ussubmergent.com.

PIP adds to sales team

Protective Industrial Products announced that Matt Mosely joined the team as a national account manager and will be responsible for Airgas, Anixter, DGI/DoAll, Staples and Veritiv. PIP also announced the appointment of Carlos Melo as regional sales manager for New York and New England. ✦

Matt Mosely

Carlos Melo

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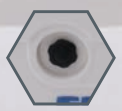
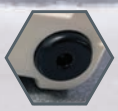


FAST-DRAIN BUTTON

ALL STAINLESS OR ALUMINUM HARDWARE



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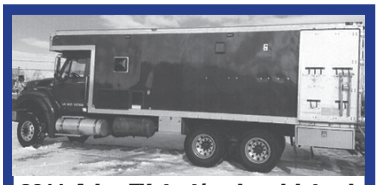

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WORTH NOTING

PEOPLE/AWARDS

Twelve urban conservation water quality initiative demonstration projects have been selected to receive a total of $820,840 in funding through the **Iowa Department of Agriculture's Iowa Water Quality Initiative.** The projects focus on reducing the rate at which stormwater enters Iowa's rivers and creeks by capturing and absorbing it through conservation measures. The efforts are aimed at improving water quality and reducing flooding. The projects that were awarded funds include:

- Parkway Watershed in Prairie Trail (city of Ankeny)
- Implementing and Educating: Stormwater Management for Education Institutions in Black Hawk County (cities of Waterloo and Cedar Falls)
- Tama Building Permeable Alley (city of Burlington)
- Infiltration Practices Along Sixth Street SW Corridor (city of Cedar Rapids)
- Clay County Fair Centennial Plaza (city of Spencer)
- Downtown Denison Urban Conservation Project (city of Denison)
- Five Island Lake Campground Urban Watershed Project (city of Emmetsburg)
- Fourmile Creek Watershed Project Sediment Basin Forebay and Stormwater Wetland (city of Des Moines and Fourmile Watershed Management Authority)
- Walnut Creek WMA Project Implementation: Urbandale and Clive Nutrient Treatment/Flood Storage Wetlands (cities of Urbandale and Clive)
- City of Readlyn Urban WQI: Initial Steps Toward a Large-Scale Effort (city of Readlyn)
- City of Slater Permeable Paver Project (city of Slater)
- Colby Water Quality Demonstration Park (city of Windsor Heights)

The City of Beverly Hills (California) announced the hiring of **Shana Epstein** as its director of public works. Since May 2011, Epstein served as the City of Ventura's water general manager. Prior to that, she was the City of Beverly Hills' Environmental Utilities manager.

The **City of Lima (Ohio) Stormwater Department and the Allen Soil and Water Conservation District** announced that 10 local organizations were named inaugural "Stormwater Superstars." The honor recognizes a variety of efforts and practices from organizations that have an impact on stormwater runoff and a clean, healthy Ottawa River. Recipients include:

- Alloway (rooftop rainwater harvest and filtration through a rain garden)
- Best One Tire & Service (oil recycling and litter cleanup)
- Lima schools (watershed education and community litter cleanup)
- Lima Memorial Health System (tree planting and ongoing litter cleanup)
- ReStore (repurposing household hazardous waste)
- Runkel Landscape Associates (low phosphorus fertilizer applications and installation of rain gardens, as well as pervious pavements)
- St. Mark's United Methodist Church (ongoing neighborhood litter cleanup)
- St. Rita's Health Partners (filtering stormwater through landscape design)
- University of Northwestern Ohio (student stream studies and filtering stormwater through landscape design)
- Wingate by Wyndham (underground stormwater capture with slow release to the storm sewer, and a daily commitment to litter cleanup)

The American Council of Engineering Companies-Illinois awarded the city of **Rockford and Willett, Hofmann & Associates** an ACEC Water and Stormwater Merit Award for the Harmon Park Drainage Phase II project. The project is the cornerstone of a 10-phase project to reduce the impacts of flooding in the Rolling Green neighborhood. Phase II involved the transformation of a park into a detention area and green space which is usable during dry weather but carries major stormwater flows during wet weather.

LEARNING OPPORTUNITIES

Canada

The Water Environment Federation is offering Stormwater Seminar 2017 on June 15-17 at the Quebec City Congress Center in Quebec City. Visit www.wef.org.

Wisconsin

The University of Wisconsin-Madison is offering Essentials of Hydraulics for Civil and Environmental Professionals seminar on Oct. 11-13 in Madison. Visit epdweb.engr.wisc.edu. ✦

CALENDAR

June 4-7
American Society of Civil Engineers' Geo-Risk 2017, Grand Hyatt Denver, Denver. Visit www.asce.org.

June 11-14
American Water Works Association Annual Conference & Exposition, Pennsylvania Convention Center, Philadelphia. Visit www.awwa.org.

June 14-16
Florida Stormwater Association Annual Conference, Sanibel Harbour Marriott Resort and Spa, Ft. Myers, Florida. Call 888/221-3124 or visit www.florida-stormwater.org.

June 25-28
American Water Resources Association 2017 Summer Conference: Climate Change Solutions, Sheraton Tysons Hotel, Tysons, Virginia. Visit www.awra.org.

June 26-29
National Association of Flood and Stormwater Agencies Annual Meeting, Belmond Charleston Place, Charleston, South Carolina. Visit www.nafsma.org.

July 16-19
American Society of Agricultural and Biological Engineers 2017 Annual International Meeting, Spokane, Washington. Visit www.asabe.org.

Aug. 4-6
American Society of Civil Engineers' Younger Member Leadership Symposium, ASCE Headquarters, Reston, Virginia. Visit www.asce.org.

Aug. 27-30
American Public Works Association PWX (Public Works Expo), Orange County Convention Center, Orlando, Florida. Visit www.apwa.net.

Aug. 27-31
StormCon: North American Surface Water Quality Conference & Exposition, Meydenbauer Center, Seattle. Visit www.stormcon.com.

Sept. 18-20
National Rural Water Association WaterPro Conference, Reno, Nevada. Visit www.nrwa.org.

Oct. 8-11
American Society of Civil Engineers 2017 Convention, New Orleans Marriott, New Orleans. Call 800/548-2723 or visit www.asce.org.

Nov. 5-9
American Water Resources Association Annual Conference, Red Lion on the River-Jantzen Beach Hotel, Portland, Oregon. Visit www.awra.org.

Nov. 6-9
American Society of Civil Engineers' Operation & Maintenance of Stormwater Control Measures, Denver. Visit www.asce.org.

Municipal Sewer & Water *invites your national, state or local association to post notices and news items in this column. Send contributions to editor@mswmag.com.*

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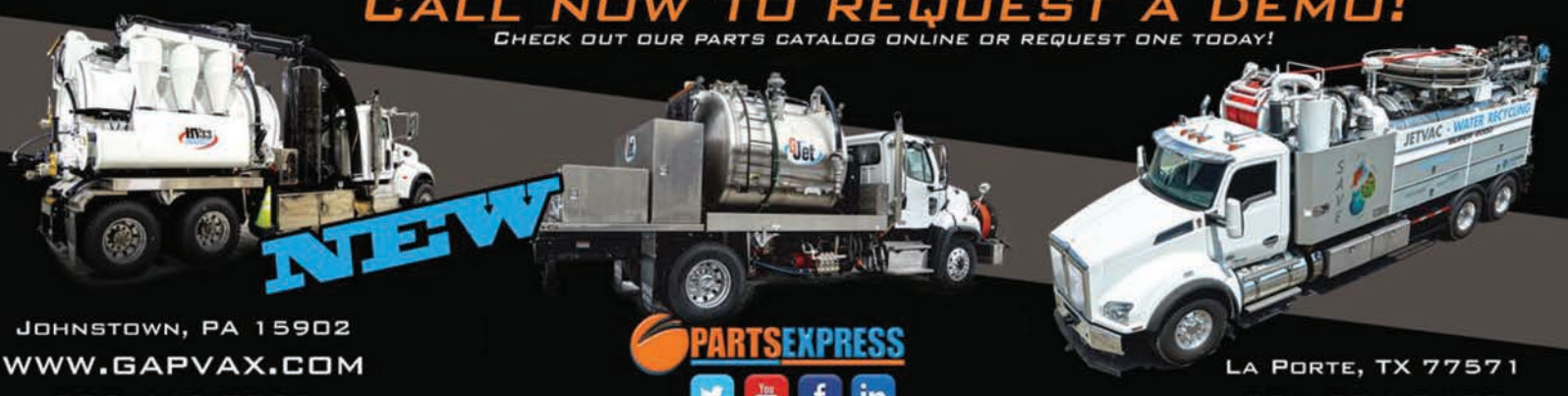

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