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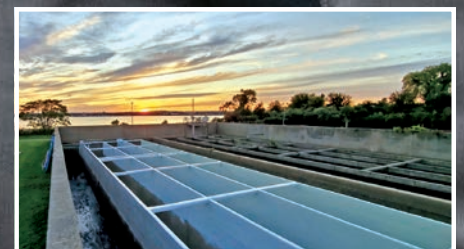
**BEST PRACTICES:**  
Conduit financing  
is your friend  
Page 26

Stanley Caroline  
Authority Manager  
Penn Township Sewage Authority

# Keeping It In-House

Sewage authority promotes  
productive DIY culture

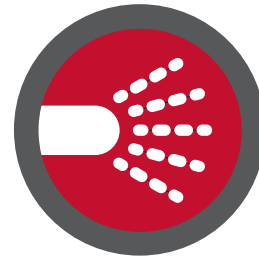
Page 14



**CASE STUDIES**  
Page 22



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## 8 Inundated With Infiltration

For a city struggling with overwhelming I&I, a holistic approach is the answer.

By Traci Browne



## COVER STORY | 14 Keeping It In-House

A Pennsylvania township's affordable DIY culture is inspiring other small communities.

By Giles Lambertson

COVER PHOTO: Stanley Caroline, authority manager for the Penn Township (Pennsylvania) Sewage Authority, stands in front of the utility's main office. Caroline has long advocated for a do-it-yourself approach to sewer projects, and it's paying off for the people of Penn Township. (Photography by Kevin Blackburn)

## BEST PRACTICES | 12 Safety Recommendations for CIPP Projects

Trenchless Technology Center releases new data about CIPP emissions.

By I&I Staff

## UTILITY SPOTLIGHT | 20 The Incremental Victories of I&I Work

Workers battle California's coastal terrain, pursuing steady infiltration reduction.

By Giles Lambertson



## CASE STUDIES | 22

By Craig Mandli

## BEST PRACTICES | 26 Conduit Financing Is Your Friend

A new financing program helps an Ohio utility accomplish I&I goals.

By Todd Danielson

## NEXT ISSUE:

Summer 2020

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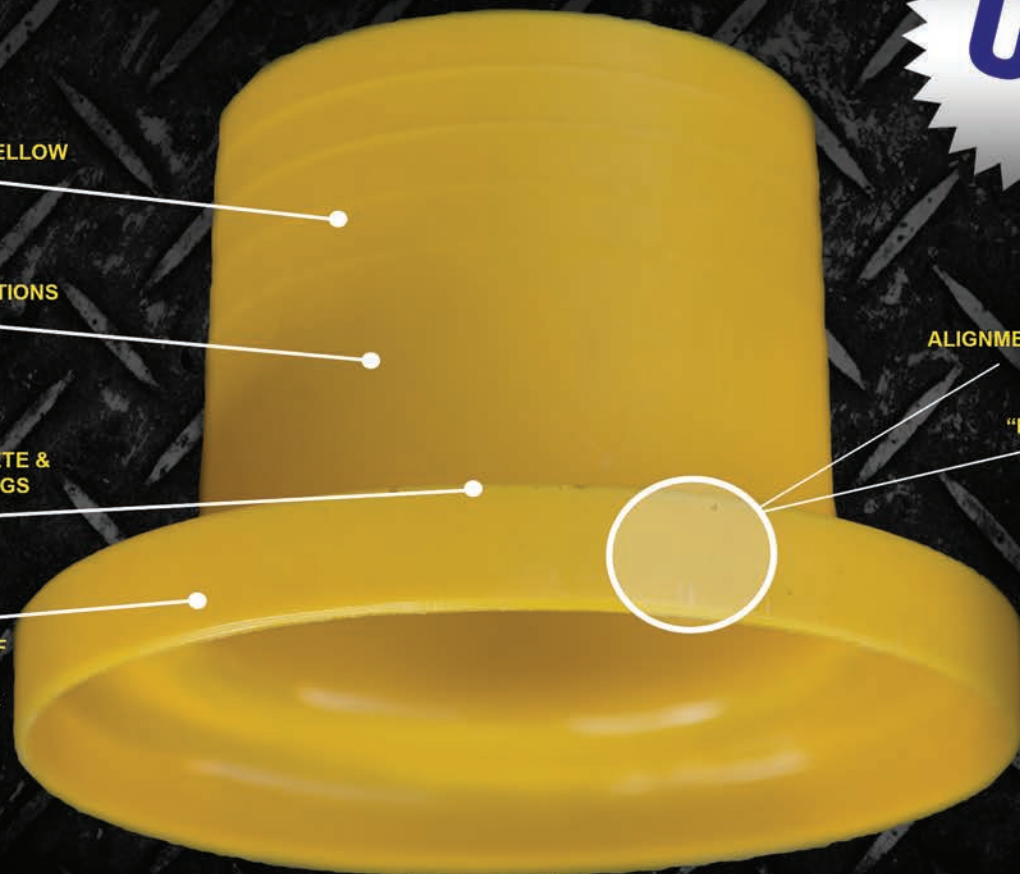
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## Advertiser Index Spring 2020

Composite Access Products (CAP) .....	3	Mr. Manhole .....	17
Cretex Specialty Products .....	13	Parson Environmental Products, Inc. ....	6
CUES, Inc. ....	7	Rainstopper .....	19
 Duke's Root Control, Inc. ....	2	Sealing Systems, Inc. <b>Back Cover</b>	
		Strike Products .....	5



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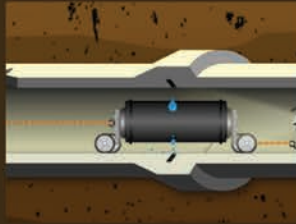
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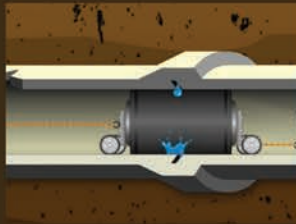
## QUICK 5-STEP PROCESS



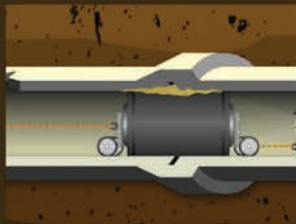
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# Inundated With Infiltration

**For a city struggling with overwhelming I&I, a holistic approach is the answer**

STORY Traci Browne | PHOTOS Noah Willman

**T**he citizens of Revere, Massachusetts, use an average of 3.5 to 4 million gallons of water daily. It's surprising, then, that officials in the city of Revere Water and Sewer Department see double that amount going into its sanitary sewer lines.

While that department is responsible for wastewater collection and conveyance for the city's 55,000 residents, it is the Massachusetts Water Resources Authority that treats its wastewater. That means Revere is paying the MWRA to clean millions of gallons of water that isn't dirty. If that seems bad, wait, it gets worse.

"Now that's during a dry day, right? Twice as much going out as what we are using," says Nicholas Rystrom, city engineer. "During a wet-weather event, it's seven times that. We've had cases of almost 30 million gallons of water going into the sanitary line, which is then going to the MWRA for processing."

But wait, there's more.

Aside from the apparent and significant inflow and infiltration problem, in August of 2010, Revere signed a consent decree with the U.S. Environmental Protection Agency. Per the decree, "The city experienced more than 722 sewer blockages or capacity limitations resulting in basement backups in its wastewater collection system and, on approximately 53 additional occasions, the blockages or capacity limitations resulted in surcharges that discharged raw sewage to surface waters since 2000."

Rystrom blames poor reporting for those issues. The city was reporting its sanitary sewer overflows (approximately 220 per year) but without any detail as to the source. So, without data to show any distinction between dry and wet weather — or to differentiate between private and public of sources of I&I — regulators were left to assume the worst-case scenario. They determined that all reported SSOs were dry-weather events, and they were all the fault of the public system.

Rystrom, who started working for the city in 2011, says what he understood from people who had worked there previously was that most of those SSOs were private blockages or collapsed pipes. A few were the city's responsibility, but the majority were not.

"There was a lot of deferred maintenance that was happening, and a lot of rehab or replacement of the system that should have been happening but wasn't," Rystrom says.



RIGHT: Nicholas Rystrom, city engineer for Revere, Massachusetts, checks designs in his office. BELOW: Crews work on a point repair near Wonderland Greyhound Park, a former dog racing track.



PHOTO COURTESY OF REVERE WATER AND SEWER DEPARTMENT

**“We’ve had cases of almost 30 million gallons of water going into the sanitary line, which is then going to the [treatment plant] for processing.”**

Nicholas Rystrom

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needed to fix its problem. That's when the city of Revere began to get to know its sewer system by deploying CCTV, performing smoke tests and tackling the most apparent deficiencies that needed to be addressed immediately all over the city.

Four or five years later, when they had their heads wrapped around the city-wide problems, city officials embarked on a private inflow removal program.

### ADDRESSING PRIVATE INFLOW

The city of Revere sits just north of Boston and lies along on the Massachusetts Bay. It is a coastal city with many hills and valleys, so Rystrom says it was safe to assume they had many issues with illegal sump pumps, roof leaders and roof drains. The city knew getting residents to volunteer to fix illegal sump pumps would be nearly impossible. Few residents would voluntarily let inspectors into their homes to uncover a problem that is going to cost a lot of money to fix.

To meet the consent decree, the city created a sump pump amnesty program. Notices went out with water bills asking customers to call to set up an inspection appointment. If no problems were found on the property, the homeowner would get a certificate that said they were in the clear. If an illegal sump pump was discovered, the city would assess the situation, take pictures, and then come out and fix it with no expense to the property owner.

"We'd put a plan together to fix 100 pumps at a time, and then we put it out for contractors to bid on." Rystrom credits the amnesty program with the fact that they have fixed about 500 properties, with more in the queue.

Of course, there are those residents who will not cooperate for whatever reason, even if they don't have a sump pump in their basement. Others simply do not respond. In these cases, the city lets the property owner know they will be in violation of the Clean Water Act, and they will eventually be forced to fix the problem and pay for it themselves. Rystrom says sometimes that does the trick.

There are roughly 12,000 buildings in Revere, and the goal is to inspect them all. To date, they are about two-thirds of the way through inspections, and about 12%-15% of the buildings they've inspected have had an issue that needs correction. About 15%-18% require additional follow-up testing. They have also expanded the program to include roof leaders and roof drains. Still,



**"I can't redirect a sump pump and solve one problem by causing a new one."**

Nicholas Rystrom

Again, this was before Rystrom's time, but he suspects that even if the money was there to do the work, it's an age-old problem of a government not wanting to spend money on something their constituency cannot see.

The way Rystrom sees it, people don't care about what's underground until it stops working. "But as soon as they're having backups, then it's the end of the world and the cities are at fault."

The city's initial response to the decree was to ask how it could commit to a consent decree if officials don't even know how big the problem is. The regulators either didn't buy the argument or didn't care, telling Revere it

## INNOVATION IN MANHOLE REHABILITATION

Using a monolithic cementitious or epoxy liner in manholes is a reasonably standard rehabilitation practice. However, Revere dug a little deeper to find cost-effective solutions that would extend the service life of the structures and reduce the amount of maintenance that would need to be done moving forward. For manholes displaying only mild deterioration, they used a flexible corbel lining system called Strong-Seal (The Strong Co.).

These fiber-reinforced cementitious mortars form a mechanical and chemical bond to the substrate. The flexibility allows the liner to adjust to movement due to traffic loading, shifting and expanding soils; temperature variation; and cyclic groundwater loading. The mix will even regulate the microbial activity, which further extends the service life of the manhole through added corrosion protection.

For corbels that were completely deteriorated, Revere opted to use the LADTECH system. These HDPE-grade adjustment rings are made using curbside recyclables and have a 100-year life expectancy. It's a product that's easy to install, requires less equipment and is impervious to hydrogen sulfide gas and road salt, which is a common problem in the Northeast.



PHOTO COURTESY OF REVERE WATER AND SEWER DEPARTMENT

A sewer bypass was installed to allow CIPP rehab of the city's large sewer interceptor. The bypass is shown discharging into the MWRA's "henhouse."

sometimes, even with the cooperation of the homeowner, the repairs must be deferred.

"I can't redirect a sump pump and solve one problem by causing a new one," Rystrom says.

That new problem he's talking about is ice. Some pumps in low-lying areas might run all day long, and there is no drain system into which to tie them. You can't just redirect flow out to the street, because you end up with icy roads and sidewalks in the winter. They must wait until they have about 10 on one street, and then they can make a good case for installing a new drain system for them all.

## PUBLIC SEWER REHABILITATION

In addition to private remediation, the city of Revere also tackled comprehensive public sewer rehabilitation. CIPP lining of Revere's mainline was determined to be the most cost-effective option while also providing structural and operation and maintenance benefits. Revere would see some reduction in I&I, but the extraneous flow would migrate. Engineering and construction firm CDM Smith recommended a comprehensive approach that included not only CIPP lining, by Insituform, of the entire mainline sewer, but service lateral connection lining and manhole rehabilitation as well.

The lining of the mainline sewer was straightforward. CCTV inspections using CUES products were performed to determine if the pipe was in good enough shape to get the CIPP treatment. If the pipe was broken or had a severely offset joint, crews would perform spot repairs before lining. Rystrom says that in some cases, they found dead ends on the mainlines with no structure for clean-outs. In those instances, manholes were added. CDM Smith also recommended including pipe seals or hydrophilic end seals as part of the CIPP lining process to eliminate extraneous flow into the adjacent manholes.

Aside from the mainline rehabilitation, Revere took care of the service laterals. In most cases, they added a 1- or 2-foot top-hat lining that goes into the lateral at the connection to the mainline. However, sometimes where they were seeing significant inflow coming from a service lateral, they would line the full length from the main to the building. Revere expects that the rehabilitation of the mainline and service laterals might remove up to 20-40% of its I&I.

Finally, every manhole within a given area will be lined using a monolithic cementitious or epoxy liner. The flexible Strong-Seal system by The Strong Co. can move and shift during freeze-thaw cycles, extending the service life of the manholes with mildly deteriorated corbels and those showing signs of infiltration. Where corbels are completely deteriorated, recycled



PHOTO COURTESY OF REVERE WATER AND SEWER DEPARTMENT

Workers dug a trench, installed shoring and performed a spot repair on a sewer main ahead of the CIPP rehab of the entire run.

HDPE-grade adjustment rings made by LADTECH are being used instead of brick and mortar. Not only is it a more sustainable option, as they are manufactured from recycled materials, but they're also unaffected by the freeze-thaw cycle and are easy to install.

Rystrom says the cost so far has been about \$100 million, and most of the funding has come from the State Revolving Fund. Revere has not raised customer rates to pay for the work, but Rystrom says those rates are already high due to the city passing along the costs to clean water the equivalent of about 1,500 backyard pools when it rains.

The city is now heading into its 10th year of rehabilitation work, and Rystrom says the job is about 60% complete with 325,000 linear feet of 99 miles of sewer rehabilitated. Once the rehabilitation is finished, the city — named after revolutionary hero Paul Revere — will have the closest thing possible to a brand-new sewer system. While it will go back to being out of sight and most likely unnoticed and underappreciated by the city's residents, Rystrom and everyone in the sewer department will know every pipe, connection, manhole and basement in the city like the back of their hand. **I&I**

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# SAFETY RECOMMENDATIONS FOR CIPP PROJECTS

## Trenchless Technology Center releases new data about CIPP emissions

By I&I Staff

If you're reading *I&I* magazine, you already know the benefits of CIPP are limitless. Compared with traditional excavation approaches, using CIPP where applicable drastically reduces the cost of pipeline rehabilitation projects while limiting the disturbances to residents and the environment.

With the process' ever-growing popularity comes additional opportunity for examination and improvement, which is why entities like Trenchless Technology Center at Louisiana Tech University are looking at how best to protect workers in close contact with CIPP projects that use a steam curing process.

For a while, not much was known about the potential hazards of CIPP emissions, which is why NASSCO formed a work group of industry leaders to put out a call for proposals to take on a two-phase study measuring styrene and other compounds to capture variation in emissions during CIPP rehabilitation.

**“The sites reflected variety – different geographies and climates, high altitude and dry and low altitude and wet, different times of the year.”**

Elizabeth Matthews

NASSCO announced in mid-2018 that Louisiana Tech's Trenchless Technology Center was awarded the project. “As the North American Society for Trenchless Technology representative on the work group for the CIPP emission testing project, I am delighted with the selection of the Trenchless Technology Center as the most meritorious candidate for this important research,” Mike Willmets, NASTT executive director, said at the time in a statement.



PHOTO COURTESY OF THE CITY OF ARCAT, CALIFORNIA

Much of the study's emissions testing showed styrene levels below health risk thresholds offered by the Environmental Protection Agency, OSHA and National Institute for Occupational Safety and Health. However, the Trenchless Technology Center at Louisiana Tech University released some preliminary safety recommendations for CIPP projects.

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## RESULTS AND RECOMMENDATIONS

The preliminary results of that study are in, and the center recently shared its findings via webinar.

As part of the study, the Trenchless Technology Center collected data at nine CIPP project sites.

“The sites reflected variety — different geographies and climates, high altitude and dry and low altitude and wet, different times of the year,” says Elizabeth Matthews, one of the members of the team heading up the study.

The pipe lengths and diameters also varied at the CIPP job sites in Shreveport, Louisiana; St. Louis; and Aurora, Colorado, where data was collected. Various emissions measurements were taken before, during and after curing at the job sites and the surrounding areas. Meteorological measurements like wind speed were also taken into account. Dispersion modeling was used to estimate compound concentrations for areas extending farther away from the job sites.

Though it wasn't the only chemical looked at, styrene was the only volatile organic compound identified with concentrations significant enough to potentially pose a health risk to workers and the surrounding community, based on guidelines published by the Environmental Protection Agency, OSHA and the National Institute for Occupational Safety and Health.

Much of the emissions testing showed styrene amounts below those health risk thresholds. Across the various job sites, the trend that emerged was that the liner truck opening and emissions stack posed the greatest concern.

“Because of the consistency of the data, those are the areas we focused on with our safety recommendations,” says John Matthews, director of the Trenchless Technology Center.

Some of the preliminary recommendations include:

- Active air monitoring for anyone entering the liner truck, as well as the appropriate personal protective equipment for those workers.
- A 15-foot perimeter around exhaust manholes and emissions stacks

**“There was a lot of data collected. We feel this is a pretty comprehensive study, but there’s always an opportunity to collect more data.”**

John Matthews

during curing. The perimeter can be entered for short amounts of time not exceeding five minutes. Beyond five minutes, the appropriate PPE should be used.

- A minimum height of 6 feet for emissions stacks to enhance the dispersion of emissions and lessen the likelihood of workers entering the perimeter from having to cross into the plume, even when wearing PPE.

“There was a lot of data collected,” Matthews says. “We feel this is a pretty comprehensive study, but there’s always an opportunity to collect more data.”

To view and listen to a recording of the webinar, visit [www.nassco.org](http://www.nassco.org). A more detailed report of the study will be available soon, along with answers to questions that were submitted during the webinar. NASSCO will also provide additional safety recommendations through its CIPP Safety Workgroup and is encouraging industrywide participation. Email [director@nassco.org](mailto:director@nassco.org) to join. **I&I**



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PROJECT  
SHOWCASE

# Keeping It In-House

A Pennsylvania township's affordable DIY culture is inspiring other small communities

STORY Giles Lambertson | PHOTOS Kevin Blackburn

For more than six years, the Penn Township Sewage Authority has rented pipe-bursting equipment from TT Technologies to keep costs down while it pursues I&I work. The hydraulic-powered Grundoburst 800G model the authority typically rents pulls the head through sewer lines with 200,000 pounds of pullback force and can split iron or steel pipe.



PHOTO COURTESY OF PENN TOWNSHIP SEWAGE AUTHORITY

**P**enn Township in Pennsylvania was established in 1855 and its sewage authority 100 years later. Today, with the oldest of the sewage authority’s existing pipe dating back 50-plus years, much of the stock needs updating. Stanley Caroline, authority manager, has a plan on how to accomplish the task. It’s called do it yourself.

Perhaps never has DIY been advocated so strongly by a sewer official as it is by Caroline.

“I went to the board in 2012 and said I would like to do pipe bursting in-house with our employees,” Caroline recalls. “The board was very reluctant. They weren’t sure the crew could handle it. I said, ‘I know we can do it.’”

A combination of factors fed Caroline’s confidence. Pennsylvania’s founder William Penn wrote that “experience is a safe guide,” and Caroline certainly brings experience to help guide the process. He has been with the sewer authority for 23 years, beginning as an outside supervisor, so he knows the system. Just as important, he has a good understanding of construction work. “My background is in construction. I knew our guys could do what we needed to do. We have a very good crew, plus a lot of it is project management.”

Caroline says each round of pipe bursting at the authority is well-thought-out. “We know where we will be working next and which method of replacement we’ll be using. We’re basically

going to be digging an entry pit, an exit pit and pulling new pipe — and it’s all figured out ahead of time here in the office.”

#### EARLY DISAPPOINTMENT BATTLING I&I

The Penn Township Sewage Authority crew was exposed to pipe bursting in 1998 when a pilot project was authorized by the board and contracted out. While the work appeared to be successful, Caroline and the board were not yet ready to jump onto the trenchless bandwagon. That stemmed partly from disappointment at the authority’s first encounter with the technology.

**“My background is in construction. I knew our guys could do what we needed to do. We have a very good crew, plus a lot of it is project management.”**

Stanley Caroline

In 1994, the state Department of Environmental Protection had called out the sewage authority in Westmoreland County for chronic inflow and infiltration issues. The leakage largely

PHOTO FACING PAGE: Anthony Caroline (left) and Dane Rose, use a Vactor jet-vac truck to clear a sewer line before running a camera to inspect.



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SEWAGE AUTHORITY**  
Westmoreland County, Pennsylvania

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**WEBSITE:**  
[www.ptsewage.org](http://www.ptsewage.org)

The crew at the Penn Township Sewage Authority includes, from left, Anthony Caroline, Chad Baughman, Heath Crossett, Mike Seice, Stanley Caroline, Mark Jones, Dan Rose and Jeff Pany.

when they hit a rock, they'd just bend the pipe up and over it." In response to the DEP's complaint, a pipe lining project was undertaken to replace the worst of the leaking pipe.

Some 10,000 feet of 8-inch pipe was lined, and the project appeared successful. However, a CCTV inspection of the lined pipe a few years later showed the lining had pulled away from the walls of the pipe and water was filling the space between the pipe and liner. The water eventually found its way to the treatment plant, defeating the whole purpose of lining the pipe. Whether it was product failure or faulty installation wasn't immediately clear, but the experience soured the authority on pipe lining.

"It was the fastest way, but it just didn't work out," says Caroline, who returned to the tried-and-true open-cut method to fix his underground infrastructure. His crews dug away for more than a dozen years, moving lots of dirt and successfully replacing the oldest of the leaking pipe.

In the meantime, video inspections showed that the pipe bursting project from 1998 continued to retain its integrity against groundwater. The

stemmed from improper bedding of pipe decades before, according to Caroline.

"Back in the day, they laid the pipe right on rock and it would crack. Sometimes

new pipe was performing as advertised. So, 14 years after that pipe was laid, Caroline became a believer in pipe bursting and approached the sewer authority board with his proposal to have his crew start doing it.

**HOW IT WORKS**

TT Technologies, an Illinois company, supplies the machinery for the bursting. For the initial project in 2013, the company rented to the sewage authority a pneumatic pipe bursting unit. With it, Caroline and crew replaced 1,600 feet of 8-inch terra cotta, along with eight manholes and 20 connecting taps. The pipe was 12-20 feet deep and ran between houses and, in one instance, under a home addition. "If we'd done the work using the traditional open-cut method, we'd have created a lot of very expensive problems," Caroline says.

**"We have a lot of people calling ... Many are considering pipe bursting projects but probably will sub out the work, though that can add 60% to the cost. They've noticed that we're doing the bursting ourselves and that it's working for us."**

Stanley Caroline





Mike Seice, supervisor, uses a computer tablet to notify the sewage authority offices, local municipal authorities and homeowners of results and pertinent information after completing a job. Technology is an increasingly important part of the daily job and is helping to streamline practices.

With that project, the pattern was established: Caroline's crew would do the bursting and TT Technologies would supply the equipment. So it is that six years after its first bursting job, Penn Township Sewage Authority is still renting pipe bursting machinery and will continue to rent it each construction season for the foreseeable future.

"It doesn't pay to buy the equipment," the manager says. "For each project, we know we will have, say, \$10,000 in equipment rental. It's a fixed cost we budget for each year. The equipment is very expensive. Besides, the technology keeps changing so by renting we always have the latest technology."

An example of changing technology is the difference between the in-house crew's first pipe bursting project and later ones. The 2013 undertaking used a pneumatic pipe bursting system, which was effective in cracking open the old terra cotta pipe and inserting new PVC stock of the same diameter.



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However, the Penn Township system also contains ductile iron, which doesn't split apart as easily. So, TT Technologies now provides a hydraulic-powered Grundoburst static bursting system that employs rolling cutters in the bursting head to split iron or steel pipe. The 800G model that Penn Township typically rents tugs the head through the line with 200,000 pounds of pullback force.

"We haven't tried any cast iron yet, but we've gone through terra cotta sections where there is 15-20 feet of PVC replacement pipe in the middle and

## PUBLIC ASSETS ARE ONLY HALF THE BATTLE

All public sewer systems have responsibility for pipelines carrying the sewage from homes and businesses to a treatment plant. When we talk about sewers, we generally mean the public lines. Stanley Caroline has a broader view.

"One of the interesting things is that, in many systems, there are almost as many feet of pipe on the private side as there are running under the streets," says the manager of Penn Township Sewage Authority in Westmoreland County, Pennsylvania. "Theoretically, we could replace every manhole and length of pipe we own, but if we don't get homeowners and businesses to fix the pipe on their side, at best we are only fixing 50%."

He's put some thought into the matter. "Say a homeowner has a 50-foot-wide lot. Our line runs

parallel with the property's edge for 50 feet. The private lateral lines run 20 feet or more to a house and 30 or 40 feet under a house or beside it, 50 or 60 feet in all. No one thinks about that."

The laterals on older property typically are terra cotta pipe, which is susceptible to the lawn's tree roots that let groundwater enter the system. Caroline has a shot at replacing such cracked lines whenever a property comes up for sale. If an inspection hasn't occurred in the previous three years, one occurs then and any leaking pipes are required to be fixed before the transaction is complete.

The other opportunity to intervene is when a line is being replaced in a neighborhood. Laterals to be served by the new line are camera-

inspected. If there are inflow and infiltration problems, the property owner is notified of them and given time to eliminate the leaks.

Caroline says that, for the most part, property owners in the township are responsive to such requests. "Most people, when you tell them the pipe is bad and that it will cost \$2,000 to fix, will defer doing it," he says. "But if you explain to them about inflow and infiltration and what it costs the system and does downstream, they'll accept it.

"You can't be the bad guy in the situation. If you spend time with people, they come to understand. People want to understand. They just don't want to spend money on something they can't even see."

the roller head just splits whatever is there,” Caroline says. He adds that his crew easily mastered the bursting routines after training by TT Technologies technicians. “They explain what you need to do every step of the way. It’s pretty simple.”

The team also has learned to dig an access hole at a manhole in the middle of a stretch of bursting. Rather than dragging in an entire 300 feet of replacement pipe — which can inconvenience a neighborhood — the crew sends the bursting head one direction and pulls in the line, then turns the machine around and bursts pipe in the other direction. “Once you get down there at pipe level, you want to do as much as you can from a single location and disrupt a neighborhood as little as possible.”

As for excavating the launching points for bursting machinery, the sewer authority owns the necessary digging equipment. Late model Bobcat E55 and E80 excavators make short work of digging the holes with a Bobcat T250 skid-steer and Caterpillar 426 backhoe moving pipe and performing the finer earth-moving tasks. Also in the equipment yard is a Vactor 2103 combination hydrovac truck with a 500-gallon water tank and 500-gallon debris bin for cleaning lines and pump stations.

In every case, Caroline replaces burst pipe with one of two types of PVC. Most of the new pipe is CertaFlo



Dan Rose runs an Aries Industries Badger inspection camera through a sewer line from inside a truck.

**“There are a lot of small communities with, say, 1,500 customers facing \$5 million worth of work. It’s daunting. But if they did 1,000 feet a year for 20 years, they would replace 4 miles of pipe. Just saying, ‘We can’t afford it’ and putting off replacing the pipe is not a solution.”**

Stanley Caroline

(CertainTeed) restrained joint PVC, which has a lockable joint system. It is inserted in 10-foot sections. Up to 380-foot segments of restrained PVC have been pulled into place. The other product used is fusible PVC, which permanently joins the pipe ends instead of employing CertaFlo’s gasket and locking ring connection. The fusible pipe is commonly used when a pipe is being replaced under or near a stream.

#### AN AFFORDABLE PROCESS

The sewage authority budgets to replace 1,500-2,000 feet each working season from April to October. All seven members of Caroline’s crew labor on the replacement projects, four or five at a time. So far, 2 of 9 miles of pipe — 8, 10 and 12 inches in diameter — have been burst and replaced. All this ongoing work is beginning to be noticed by surrounding townships.

“We have a lot of people calling and asking questions. People are wondering what we’re doing,” Caroline says. “Many are considering pipe bursting projects but probably will sub out the work, though that can add 60% to the cost. They’ve noticed that we’re doing the bursting ourselves and that it’s working for us.”

Last March, Penn Township’s in-house pipe bursting initiative was the focus of a TT Technologies presentation at the North American Society for Trenchless Technology’s No-Dig Show. It was well received.

Caroline is convinced many other small sewer system organizations would benefit from following Penn Township Sewage Authority’s example of incrementally fixing I&I problems. “There are a lot of small communities with, say, 1,500 customers facing \$5 million worth of work. It’s daunting. But if they did 1,000 feet a year for 20 years, they would replace 4 miles of pipe.

Just saying, ‘We can’t afford it’ and putting off replacing the pipe is not a solution.”

He advocates doing the work in-house whenever practical to avoid overhead costs. The township has a consulting engineer, but Caroline only consults him when absolutely necessary. “The pipe already is there. It runs from point A to point B. If you run a camera through it, you can plainly see what you’re getting into.”

So, Caroline and his field supervisor determine which sections of pipe are most in need of repair, sending an Aries Industries Badger pan-and-tilt camera into the pipe for close-up inspections. The men work up project

details, call TT Technologies for a machine and set the crew to work. All of that avoids engineering fees, advertising bid costs, prevailing wage considerations and posting a bond for the job. “That really adds to the cost of a project,” Caroline says. Authority crew wages, incidentally, are 5% above union scale.

And, of course, Caroline recommends renting the bursting equipment along with any other needed machinery. “Little communities may not have an excavator, but that doesn’t mean they should put out a project for bid. Rent an excavator and an operator, and let your in-house crew do the grunt work. It makes a project affordable.”

His last recommendation comes from a voice of experience. “Realistically, people have to understand that they are never going to get a sewer system that doesn’t leak. They should work toward a high standard, but to say they will eliminate all the I&I, that’s not going to happen.” **I&I**

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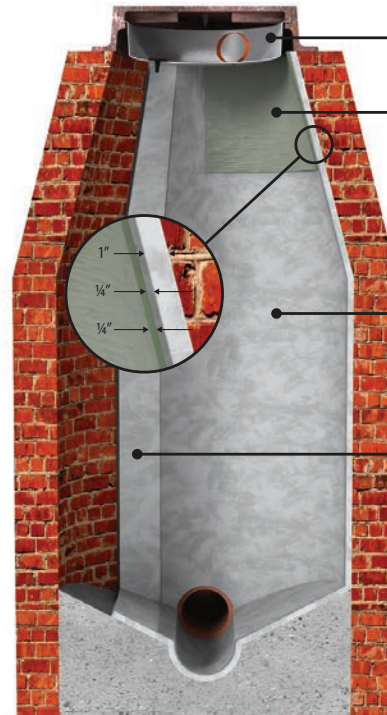
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PHOTOS COURTESY OF THE CITY OF ARCATA



Subcontractor Aegion Insituform installs heat-cured CIPP liners in sewer mains for the city of Arcata, California.

**“We started this six years ago and have 50 more miles or so to go. But if every five years we’re able to do 8 or 9 miles, that’s a good achievable goal for upgrading the system.”**

Netra Khatri

# THE INCREMENTAL VICTORIES OF I&I WORK

Workers battle California’s coastal terrain, pursuing steady infiltration reduction

By Giles Lambertson

The Northern California coastal city of Arcata receives 45-plus inches of rain each year, and too much of that rainwater ends up in the city’s network of sewer pipes. In the older downtown section, some downspouts once emptied into sewer pipe. Consequently, during the wet season, an average of 5.9 mgd of water — sometimes more — flows into the sewer system.

Or it did until recently. City officials hope they have curtailed the infiltration. The first phase in overhauling the system is virtually complete after 18 months’ work, during which crews overcame underground surprises, pushed CUES and RapidView IBAK North America inspection cameras to their limits in small-diameter pipe and weathered wet winters.

“Our goal in this project was to lower the inflow and infiltration by at least 1 mgd during the wet season,” says Netra Khatri, Arcata’s city engineer. “We have to look at the data to see if we succeeded, but indications are that we did. One pipe, for example, that ran a lot is not running a lot now.”

Of such incremental victories are sewer systems made whole. After all, the city’s rehabilitation project was termed an I&I *reduction* task. Elimination of I&I is never envisioned in such undertakings. This is especially true when, as in Arcata, the pipeline has segments 65-70 years old — infrastructure well past its prime.

## ANTIQUÉ INFRASTRUCTURE

Arcata is situated on an inlet of Humboldt Bay and dates to the 19th century. It was incorporated in the early 20th century, and Khatri, working for the city for six years, has seen remnants of the wooden pipes that once

carried sewage beneath city streets. While recently replaced pipe was constructed of vitrified clay, after being in the ground for 70 years, clay pipe qualifies as antique.

The chronic I&I has concerned Arcata sewer officials for nearly 20 years. In 2001, 2004 and again in 2006, the city contracted CIP rehab work to begin to stem the flow. More recently, it adopted regulations that require replacement of leaking laterals on private property when the pipes are 25 years old or older and ownership of a property changes hands or is significantly remodeled.

In 2018, flows sometimes reached 5.9 mgd — exceeding the capacity of the treatment plant. The resulting excess was only partially treated and subject to fines when discharged into bay waters. City officials weighed what to do. They first contemplated a complete makeover, with leaking pipes dug up and replaced. The cost of such a wholesale undertaking was pegged at \$15 million.

In the end, officials opted to replace the worst of the pipe, insert a CIP liner in better sections of pipe, fix a slew of laterals and seal leaking manholes. That approach resulted in lining 7.5 miles of pipe and digging up and replacing 2,200 feet of clay pipe with North American Pipe’s PVC. Some 6,500 feet of lateral pipe was rehabbed — which involved work on 460 of the 4-inch pipelines — and 22 manholes were sealed.

That’s a start, Khatri says. “It’s a long process. There still are some areas with older pipe, mainly in downtown. We started this six years ago and have 50 more miles or so to go. But if every five years we’re able to do 8 or 9 miles, that’s a good achievable goal for upgrading the system.”

The city contracted the work to GR Sundberg, an Arcata general engineering contractor whose bread-and-butter work is underground, according to Casey Poff, project manager. While GR Sundberg has contracted with the city on numerous occasions, this project was the company's first sewer lining and replacement job. GR Sundberg self-performed the excavation part of the project and subbed out relining to Quam Trenchless Technologies. Sometimes the dirt moving and pipe lining activities were going on at the same time in different areas.

The result was a hive of activity. Quam sometimes had a dozen people working on laterals, according to Judd Stattine, company president, while GR Sundberg had another 15-20 on site. A Quam subcontractor, Aegion Insituform, installed heat-cured liners in main sewer pipes, with another GR Sundberg sub, Michels, rehabbing manholes by spray-applying a SewperCoat PG sealant.

## CHALLENGING TERRAIN

Though all this work essentially was confined to downtown and the Sunny Brae neighborhood, as a practical matter, crews were widely separated. To be more precise, about half of the work was concentrated on the east side of U.S. Route 101 and half on the west side. That gave the project a split personality. Poff says terrain east of the 101 is basically flat, while the west side has mountainous slopes and redwood trees. "Grade changes in the pipe were on the west side. That's where roots disrupted things and pipes were broken."

The west-side work also was marked by offsets in the pipeline. These developed when the pipe was improperly installed or the ground shifted, dropping or bumping up the end of a pipe and misaligning the pipe's interior. The result is disrupted flow of sewage.

The offsets sometimes prevented relining. As little as a quarter-inch variation where pipes join can pose problems. The offsets also impeded the travel of inspection cameras "A 6-inch-diameter sewer line, which much of this line is, doesn't have that much tolerance for large video equipment," Poff points out. Khatri had anticipated maybe a dozen such misalignments, but the actual number turned out to be nearly 40.

"That was a surprise. It was way more than we had anticipated," Poff says. Quam crews running video cameras through the line in prelining inspections sometimes failed to navigate these offsets. Meanwhile, Stattine doesn't recall exactly how many times cameras got wedged inside the pipe, only saying that "based on how big the project was, getting stuck as many times as we did was within the parameters of what we could have expected."

In most cases, the camera operators were able to extricate the equipment by pulling it back or otherwise wiggling it out of the predicament. Sometimes, however, a call for an excavator went out to Poff. "That was the last resort," Stattine says of having pipe dug up. "It happens, and it will happen again."

Poff agrees that getting stuck is one of the hazards of sending a camera into a pipe. "Especially at the beginning of a project when operators are feel-



Inflow and infiltration specialist Michels subcontracted on the project to seal 22 leaking manholes by spray-applying SewperCoat PG sealant.

ing their way through and learning the limits of the cameras." When he was asked for a rescue, Poff would send over a crew and one of the company's Caterpillar 304 or 308 mini-excavators.

In each case, a 70 hp mini-excavator would unearth the line, take out the offset area of pipe and drop in a 2- or 3-foot PVC segment to smooth the transition between pipes and let sewage flow smoothly. Aside from these emergency runs, GR Sundberg routinely dug up pipe joints when discovered offsets measured 2 or more inches.

The Aegion Insituform subcontractor installing the company's felt and polypropylene liner worked in pipe ranging from 6 to 15 inches in diameter. Mostly it was 6-inch, which made the work more difficult. "The biggest challenge was the small diameter of the pipe," Poff says. "Tolerances were minimal. There was little room for error for the lining crew or for us."

Stattine agrees: "Small-diameter pipe always presents challenges. And when the new lining is installed, the diameter becomes even smaller. When we went inside to make the lateral service connections, it was very tight."

Schwalm USA cutter and reinstatement robotic machines worked in these claustrophobic conditions as they cut access holes in the pipe for T-Liner lateral connections. The LMK Technologies T-Liner phase of the job especially pleased Khatri. "We're excited we were able to upgrade the lateral connections. In the old days, a lateral was just one pipe running into another, not even sealed. The lateral connection always is the weakest point in a system."

Deteriorating lateral pipes frequently were dug up by GR Sundberg crews and a length of new PVC pipe inserted, on average about 20 feet. Trenches for the sewer main ranged from 3 to 6 feet deep. While trenches of that depth were easily excavated — and required minimal hydraulic shielding for safety — the shallowness of the water table in Arcata played havoc with digging in the wet winter months of December through March. "The work is pretty tough in winter," Poff says.

## ARCHAEOLOGICAL SUPERVISION

Meanwhile, all the excavation work was performed under the scrutiny of archaeologists looking for artifacts of ancient Native American cultures that lived in the area. Wiyot and Yurok tribal members still live in and around Arcata, and the work area was considered archaeologically and culturally sensitive.

"They wanted to see what was coming out of the dirt," Poff says of the watchers. Had they spotted something, the digging would have ceased, the discovered artifact evaluated and the project put on indefinite hold. To the relief of contractors, nothing was found to trigger that process.

With the first phase of the ongoing Arcata I&I project essentially complete, planning for the next phase begins. However, what can't be planned for in this or any other Northern California sewer and water district is the possibility of an earthquake. When the earth shakes, bad things can happen underground. "Things are shifting all the time in the systems," Stattine says of ongoing minor tremors in the region.

**"The biggest challenge was the small diameter of the pipe.**

**Tolerances were minimal. There was little room for error**

**for the lining crew or for us."** Casey Poff

Khatri notes that the city's old pipe, even when properly laid last century, is affected by subtle quaking in the seismologically active area. "Clay pipe comes in short sections, and even a tremor rated a 3 or 4 has an effect. You don't feel it, but over a period of time, the pipe joints shift." And when did the last tremor occur? "Last year," Khatri says. "A 4-point-something quake was recorded last year." **I&I**

By Craig Mandli

## REHABILITATION BRINGS CHLORINE CONTACT CHAMBER BACK TO LIFE

### PROBLEM:

Savy & Sons was contracted to rehabilitate a severely deteriorating and eroding concrete chlorine contact chamber in Connecticut.

### SOLUTION:

They saw-cut and jackhammered out all failing concrete and made all concrete repairs using **Epoxytec's Mortartec Silicate** and **Mortartec Ceramico** to restore the original structure. After making masonry repairs to bring the structure back to its original state, **Epoxytec's CPP Sprayliner** was applied in order to protect the area from future deterioration from wastewater flow, chemical contact and atmospheric elements. CPP Sprayliner is suitable for tanks and other fluid storage structures. It has suitable chemical corrosion resistance, with blended cycloaliphatic polymers for increased cross-linking for chemical resistance (ultrahigh hydrogen sulfide and other chemicals), moisture tolerance, UV stabilization, freeze-thaw tolerance and service abrasion. In total, 10,220 square feet were coated, including five longitudinal tank walls, exterior perimeter walls and seven lateral beams.

**Result:** By resurfacing and epoxy-lining this chlorine contact chamber, Savy & Sons was able to reduce the city's downtime and substantially save costs. The solution is expected to protect the infrastructure's substrate from future deterioration and allow this structure to continue to operate efficiently for years to come.

877-463-7699; [www.epoxytec.com](http://www.epoxytec.com)



## MANHOLE RISERS PROVIDE A COST-EFFECTIVE ALTERNATIVE

### PROBLEM:

Like a lot of municipalities, the city of Walker, Michigan, struggles to keep its infrastructure in good condition while also dealing with reduced budgets. This means that the Walker Public Works Department is always reexamining equipment and procedures, looking for ways to do more with less. "We're on the lookout for better products," says Gary Postema, deputy director of Public Works. "And we'll use any new solution that works better."

### SOLUTION:

Since 2001, Walker has used manhole risers from **American Highway Products** to raise manholes to grade after repaving. Annually, between 20 and 30 risers are installed. The **Pivoted Turnbuckle Manhole Riser** is a rustproof, flexible riser that fits into the existing utility rim. Once set, the riser's turnbuckle is tightened with a screwdriver (used as a lever), which exerts thousands of pounds of force and seats the new riser tightly in the rim.

**Result:** Compared to cast iron, the riser is also lighter, quicker to install, sets tighter and is less likely to rattle out of the rim over time. They're also delivered quickly, within a few days of an order, so they don't need to be stored by the city. When manholes don't sit low, they provide a smooth driving surface and limit inflow and infiltration from gathering at the manhole lid.

888-272-2397; [www.ahp1.com](http://www.ahp1.com)

## SEWER INSPECTOR USES PLUGS TO SEAL CLEAN-OUT OPENINGS WITH FOULED THREADS

### PROBLEM:

A Minneapolis city inspector performing video inspections in search of sewer lateral breaches and improperly plumbed sump pump violations needed a leakproof clean-out plug that could seal fouled, damaged threads.



### SOLUTION:

The inspector replaced the old damaged clean-out plugs with new flush-fitting **Real-Tite expansion clean-out plugs**.

**Result:** The plugs sealed behind and over the damaged threads, incorporating a shoulder seal at the lip of the plug that ensures a leak-proof seal even over damaged thread openings.

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candle produces a volume of 40,000 cubic feet of smoke in just three minutes. Multiple W3C smoke candles can be joined together to create larger volumes of smoke visible for longer periods of time. The company's fluid systems offer a liquid-based alternative for mainline sewer inspection and feature a stainless steel injector to maximize dry smoke output, producing a higher-quality, liquid-based smoke. Superior Smoke's testing techniques were developed over 60 years ago and are still made in the U.S.

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## PERMEABLE PAVERS PROVIDE SOLUTION FOR 500-ACRE DEVELOPMENT

### PROBLEM:

As Idaho's fastest-growing and third largest city, Meridian has experienced intense competition among local developers to attract upscale buyers.

### SOLUTION:

With the goal of maximizing property values and reducing maintenance costs, the BridgeTower Heights subdivision was launched with roadways designed with **Belgard permeable interlocking concrete pavers** from **Oldcastle APG**. This enabled the construction of an underground stormwater system that cost far less than asphalt roadways and traditional infrastructures. With the visual appeal of decorative pavers used to beautify patios and walkways, the permeable pavers offer an alternative to stormwater detention ponds and subsurface

storage structures. They resist cracking, hold up to freeze-thaw, filter road contaminants and drain melted snow. They're also environmentally friendly, with the ability to filter rainwater at cool temperatures into local streams and ponds.

**Result:** With 250,000 square feet of roadways and more than 600,000 square feet of Belgard Aqualine 12-inch, Eco Dublin and Aqua Roc pavers installed, the system is reportedly performing well. The final phases are in the process of being completed, which will bring the total to over 1 million square feet of permeable pavement. Developer Michael McCollum plans to use the pavers for streets, sidewalks and driveways on another 400-acre residential development scheduled for early 2020.

**877-235-4273; www.belgard.com**



(continued)

## PUSH CAMERA AND ROLLER SKID SAVE TIME AND MONEY

### PROBLEM:

By the time Mack Plumbing showed up on a rural Ohio job, the customer was stressed because their sewer pipe was backing up. No amount of plunging by the customer had helped. A plug in the pipe leading to the septic tank was easily accessible in the basement. Once removed, several buckets were used to collect sewage. Even then, strong flashlights could not show the problem.

### SOLUTION:

A Mack technician installed the **CPI Products / Cavallero Plastics Trapmaster** to get a 1.5-inch push camera into the 4-inch pipe and was able to pass by the remaining debris to view the blockage and determine exactly where it was. It turned out to be the last remaining section of a more than 30-year-old asphalt-coated paper pipe that had collapsed. The technician was able to pinpoint the location, and the collapsed section was easily accessed. This saved time compared to the alternative of digging up the entire pipeline.

**Result:** The repair was completed quickly, and the customer has a proper line all the way to the septic tank.  
413-443-0925; [www.cplproducts.com](http://www.cplproducts.com)

## MUNICIPALITY FINDS SOLUTION TO FILL GAP BETWEEN LINING ON MANHOLES

### PROBLEM:

After relining many of its old and deteriorating manholes, a Georgia municipality needed a solution to fill a 3- to 5-inch gap between the new liners and the manholes.

### SOLUTION:

**Precision Fill** from **Prime Resins** was chosen to fill this space due to its high expansion rate, the fact that it is hydro-insensitive and because its slower set time allows for a more consistent pour and prevents void pockets from forming. The project included several manholes, and each one used between 8 and 12 gallons of material. Recommended uses for Precision Fill include under-sealing and stabilizing concrete slabs, compaction grouting of soils, stabilizing soils and filling voids behind pipes, walls, manholes and other structures.

**Result:** The process of lining and filling the annular space cost roughly a third less than tear-out and replacement.  
800-321-7212; [www.primeresins.com](http://www.primeresins.com)



## INTERNAL JOINT SEAL USED TO REPAIR LEAKING BOX CULVERT

### PROBLEM:

A construction joint between a precast section and a cast-in-place box culvert in an elevated 3-by-7-foot aqueduct in Dallas was leaking onto the highway and traffic. The movement of the elevated structure had deteriorated the joint, and previous repairs using cementitious grouts and preformed mastics continued to fail and be ineffective.

### SOLUTION:

Technicians utilized the **HydraTite internal joint seal** from **HydraTech Engineered Products**. It includes an extruded EPDM membrane that provides a flexible, continuous watertight seal for pipes, tunnels and similar conduits. The seal is custom-designed to accommodate the inside dimensions of the box culvert. The compression of the EPDM rubber to create the watertight seal is achieved with stainless steel retaining bands and anchor plates

equally spaced along the perimeter of the seal. Previous repair materials that interfered with the installation of the seal had to be removed, and the surface of the aqueduct on each side of the joint had to be repaired to render a uniform surface. The seal was assembled in place and hydraulically expanded and compressed to create the watertight seal.

**Result:** The seal provided a repair that was able to accommodate the special shape. The leak was sealed, and the aqueduct returned to service after two days of work.  
513-827-9169; [www.hydratechllc.com](http://www.hydratechllc.com)





## UPDATING EXISTING LIFT STATIONS INCREASES COMMUNICATIONS RELIABILITY

### PROBLEM:

The Iowa Great Lakes Sanitary District was looking to replace and modify its operations. Specifically, it wanted a prime contractor to retrofit its existing lift stations with new Allen-Bradley programmable logic controllers, replace its existing collections system and SCADA systems, and move from radio to Ethernet communication.

### SOLUTION:

As the prime contractor, **PRIMEX** first retrofitted 49 different lift stations across the district with Allen-Bradley CompactLogix PLCs. Second, it removed and replaced the PLCs and input/output cards at the wastewater treatment plant main SCADA control panel with an Allen-Bradley ControlLogix PLC. Third, it facilitated combining the separate wastewater plant and lift station's WonderWare software programs into one common WonderWare System Platform software package, installing related hardware as indicated in the project specifications. Finally, it switched the communication style from radio to Ethernet to improve the reliability of the district.



**Result:** PRIMEX increased the district's onsite presence from the standpoint of multiple reviews of submittal packages prior to providing the finished product. The Ethernet communication upgrade represented a large piece of what made this project successful for the Iowa Great Lakes Sanitary District and PRIMEX. Additionally, the process was highly interactive throughout, leading to a strong relationship with the client.

**888-342-5753; [www.primexcontrols.com](http://www.primexcontrols.com)**

## MONITORING SOLUTION PROVES TO BE A MONEY SAVER AND TIMESAVER

### PROBLEM:

With a small staff, South Suburban Sanitary District in Klamath Falls, Oregon, is responsible for more than 100 miles of sewer pipe and more than 1,000 manholes. The utility started monitoring in 2012 to detect and locate I&I by installing four flow monitoring units for a cost of \$50,000, but when the need arose for expanding to more locations, they required a more flexible, easy-to-install and cost-effective solution.

### SOLUTION:

To address the I&I monitoring expansion plans, the district turned to **SmartCover Systems**. The cost per unit was significantly lower than the flowmeter solution, and installation was quick and less invasive because confined-space entry isn't necessary. The system supported flow measurements and in-depth trend analysis to identify where I&I was an issue.

**Result:** A flexible monitoring configuration expanded coverage and defined a subbasin within a sewershed that had specific issues. SmartCover's instant infrastructure design allowed

the district to quickly deploy and get more granular data at a much lower cost without wasting valuable staff time. The district was able to anticipate I&I issues before a storm event caused a spill. The bonus of aggregate flow information from multiple locations and integrated rain data adds more flexibility to analyze relationships between sites and to better understand the dynamics within the subbasin. Results included a significant reduction in sewer spills, mitigation of I&I issues, and more accurate allocation of valuable resources and funds during times of urgency, all while protecting public health and the local environment.

**760-291-1980; [www.smartcoversystems.com](http://www.smartcoversystems.com) I&I**



# CONDUIT FINANCING IS YOUR FRIEND

## A new financing program helps an Ohio utility accomplish I&I goals

By Todd Danielson

The last thing those of us in the utility world want to hear about is someone's basement backing up with wastewater due to a sewer overflow. Unfortunately, the reality is that many utilities have delayed reinvestment into their systems, and compounded with changing weather patterns and more severe storms, basement backups and sewer overflows still occur.

To address sewer overflows, utilities want to find the projects with the best return on investment. However, many utilities have found that inordinate time and money can be spent on wet-weather investigation and repairs — and the end results don't always align with the anticipated benefits.

For years and years, the U.S. Environmental Protection Agency and others have suggested to utilities that an excellent place to reduce wet-weather impacts is on private property. After all, when looking holistically at the collections system, about half of the total length of pipe may be found on private property, and that pipe can contribute up to about 40% of the overall inflow and infiltration into the system.

Even if this is the case, utilities usually don't attempt to address these issues on the private side for a number of reasons. Commonly, public entities are legally limited in their ability to pay for work on private property, or existing laws unduly benefit private entities.



Avon Lake (Ohio) Regional Water's water reclamation facility provides the community's need for safe wastewater treatment. It has a capacity of 6.5 mgd and can accept flows as high as 12.5 mgd during wet-weather periods.

issue. At that point, crews started popping manhole covers but couldn't find any smoking gun.

It was around that time that a stormwater expert suggested that the inflow could be coming from private property and convinced the utility to do a pilot project on one street where he would simulate rain events and position video cameras in the sanitary sewer.

The area was formerly a combined sewer area. In Avon Lake, when the utility separated sewers in the past — though it required customers to prevent downspouts, yard drains and driveway drains from entering the sanitary sewer — it did not require customers to prevent foundation drains from discharging into laterals.

Pilot testing showed that the foundation drains were an immediate inflow source and contributed to sewer overflows and basement flooding. This led to Avon Lake Regional Water changing its regulations and requiring customers to prevent all clearwater sources from entering sanitary laterals, including foundation drains. To complement this, the City Council passed a Resolution of Necessity, which put the force of law behind the requirement.

Additionally, as sewer separations progressed, no houses were allowed to connect to new sanitary sewers until it was proven that all clearwater sources were not connected to the sanitary lateral. The houses remained connected to the combined sewers and were required to remove all sanitary waste from those combined sewers by a certain date when those sewers were to become storm sewers.

With the memory of basement backups, few complained about the new requirement. Avon Lake Regional Water worked to make it easier for customers

**Pilot testing showed that the foundation drains were an immediate inflow source and contributed to sewer overflows and basement flooding. This led to Avon Lake Regional Water changing its regulations and requiring customers to prevent all clearwater sources from entering sanitary laterals, including foundation drains.**

### REFRAMING THE PROBLEM

With mounting infrastructure reinvestment requirements, improved residential and industrial water efficiency that reduces water and sewer revenue, and declining user bases in some areas, many utilities are considering new alternatives.

In 2011, Avon Lake (Ohio) Regional Water — a midsized water and wastewater utility serving Avon Lake and some surrounding areas — had to reframe its problems during the wettest year on record. That year, five different weather events led to residential basement backups, and customers demanded a solution.

As staff assessed what might have changed (aside from the weather), it realized that approximately 20 minutes after the heavy rains started, flows in its major lift station rapidly increased. Obviously, it seemed like an I&I

by providing them \$1,000 in wastewater bill credits over a 10-year period if they separated their clearwater and wastewater sources, ending up with storm and sanitary laterals connected to the respective sewers. The \$1,000 was originally determined by estimating the amount of water that could enter foundation drains and proceed through the collections system and treatment process.

This led to a number of customers undertaking the work. However, as time progressed, Avon Lake Regional Water realized that the rate of customer inspections and separations was not quick enough to meet the deadlines imposed.

### A WIN-WIN-WIN

Avon Lake Regional Water had been hearing from some customers that even with the \$1,000 credit, they could not afford to pay the \$3,000 to \$4,000 out-of-pocket to separate their laterals. Wanting to help make it easier for customers to help end sanitary sewer surcharges, the utility investigated options for helping customers pay for repairs. Unfortunately, very little grant money was available through the Department of Housing and Urban Development's Community Development Block Grant program, and that was very quickly used for the residents who needed it most.

Luckily, Avon Lake Regional Water approached the Ohio EPA, which was interested in piloting a new type of revolving loan.

For frame of reference, the Toledo algae bloom that fouled the city's water treatment plant had only happened about six months earlier. The Ohio EPA was looking for new ways to help speed the reduction of nutrients entering Lake Erie. In addition, the Ohio EPA had understood the wisdom of eliminating inflow sources from private property, but never had a utility interested in borrowing funds to address the issue.

This was a marvelous opportunity for the Ohio EPA to use Clean Water State Revolving Funds to loan to a utility, which in turn established its own revolving program for customers to address wet-weather issues and sewer overflows — a term the Ohio EPA is calling conduit financing.

The Ohio EPA offered Avon Lake Regional Water a 0% interest loan to help address the issue and allowed the utility to charge an appropriate interest rate. In order to make it attractive to customers while also helping build the fund for future use, Avon Lake Regional Water established a 2% interest rate for customers to borrow the money with a 10-year loan to pay contractors for the work.

Under the plan, customers select a contractor and arrive at an approved price. The customers then apply for a loan from Avon Lake Regional Water. Once the contractors do the work and both customers and Avon Lake Regional Water approve the work, the utility pays the contractor. Monthly, the utility submits to the Ohio EPA for repayment of all invoices it paid during the month. Customers repay their loans through quarterly water and wastewater bills, and the utility uses this money to repay its loan from the Ohio EPA.

By charging an interest rate, the utility built a mechanism to provide a certain level of perpetuity. The 2% interest rate means that for every \$1 million loaned to customers, Avon Lake Regional Water will receive over \$100,000 in interest charges that will build the fund for future use.

It is clear how Avon Lake Regional Water and the Ohio EPA win with this program. The third win is for the customer. Homes that were built in combined sewer areas were typically built between the 1940s and 1972. These houses had vitrified clay pipe laterals. A number of these customers were experiencing root intrusion and other failures. This program helped to provide an affordable method to address a maintenance issue for which customers had not typically budgeted.

Today, more than 400 customers have executed loan agreements during the few years the program has been in effect. And Avon Lake Regional Water has committed more than \$1.4 million for the loans to these customers.

### THE FUTURE IS BRIGHT

The lateral loan program established by Avon Lake Regional Water, with the help of the Ohio EPA, has met the needs of the utility, the regulatory authority and the customers in a way that does not affect rates. Wet-weather

testing and sewer modeling has shown that wet-weather peak flow reduction during sewer separations has improved by 10% (from an 85% reduction in peak flow to a 95% reduction in peak flow) during the sewer separation process by now requiring foundation drain disconnection from sanitary laterals. In Avon Lake, that means an additional 640,000 gallons of extraneous water are prevented from entering the sanitary sewers during a 10-year storm event. This reduces the chances for basement backups and overflows into Lake Erie while keeping system capacity available for future growth.

Due to the initial success of the program, as Avon Lake Regional Water's revolving loan program becomes more established, the utility looks forward to expanding the program to meet other customer needs, such as renewing



A new conduit financing program provided by Avon Lake Regional Water with the help of the Ohio EPA is allowing customers to address root intrusion and other inflow and infiltration-related issues in their sewer laterals.



Avon Lake (Ohio) Regional Water was established in 1925, beginning with water service for 1,200 Avon Lake residents for an initial investment of \$390,000. Today, it's a \$60 million operation providing water service to 200,000 people in seven counties and wastewater service to 30,000 near Avon Lake.

and repairing laterals and undertaking other projects that remove private property clearwater from sanitary sewers.

As a service organization with a guiding principle to lead by influencing change that will leave a legacy for future generations, the lateral loan program will benefit customers, the community and the environment.

### ABOUT THE AUTHOR

Todd Danielson is the chief utilities executive of Avon Lake Regional Water, located on the shores of Lake Erie in Ohio. He leads an organization providing drinking water to 200,000 people and wastewater services to 30,000. **I&I**

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