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By Suzan Chin-Taylor

COVER PHOTO: Charlie Knapp (left) and Josh Dickson of CME Pipe Lining communicate via Sonetics wireless headsets as they cinch the end of a liner (Perma-Liner) while working on a 202-foot segment of 30-inch storm sewer that runs under homes and a golf course in Loveland, Ohio. (Photography by Amy E. Voigt)



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# Water Finds a Way

## Longtime trenchless rehab veteran says I&I must be attacked from all angles

STORY Suzan Chin-Taylor | PHOTOS Amy E. Voigt

hen Charles "Chuck" Menkhaus first started in the pipe lining industry years back, an audience of 40 old-school plumbers nearly laughed him out of a conference room while he spoke about the potential of CIPP technology. Today, his company does CIPP work for 38 of those plumbers solving issues for residential clients.

Menkhaus owns CME Pipe Lining in Cincinnati and is a longtime veteran of the trenchless industry. He's seen CIPP evolve over several decades. Once considered a fad by some of his peers, CIPP has gained traction in his region as a viable solution for solving aging infrastructure issues and mitigating the effects of inflow and infiltration.

Menkhaus and his team are specialists in relining, focusing primarily on specialty contracts for municipalities, industrial rehabilitation and residential repairs. Although the increased use and acceptance of CIPP for pipeline renewal and I&I remediation is encouraging, Menkhaus cautions that it isn't a silver bullet to solve a sewer system's I&I issues completely.

"At a recent conference about treatment facilities, one of the things pointed out is that we're building new treatment plants throughout the country because of the amount of water that is coming into plants to be treated," he says. "The plants can't handle the new levels that are coming through each day and are often forced to release without being fully processed because of capacity overflow."

A great deal of that excess water coming in is from I&I, he says. "In my mind, building bigger treatment plants is counterproductive. Although we are using CIPP to fix some of the issues and at a much faster rate than traditional dig-and-replace, lining of just the mains will not take the burden off of the plants long-term, and eventually they will just need to be expanded again."

Strong programs that include rehabilitation for a community's sanitary mainlines have been shown to mitigate a portion of a system's I&I. However, Menkhaus has seen firsthand that it's only capable of resolving or reducing a fraction of the surcharges coming into the system and that the true predominant source of I&I is coming from laterals and, in some cases, manhole structures.



Trammell uses a wireless headset (Sonetics) to communicate with his peers while working to line a 202-foot section of a 30-inch storm sewer running under homes and a golf course in Loveland, Ohio.



The team at CME Pipe Lining includes, from left, Josh Dickson, Craig Trammell, Derrick Klotter, owner Chuck Menkhaus, Lindsey Jones, Charlie Knapp, Mike Patterson, Justin Beighle, and Jake Ward.



From left, Charlie Knapp, Josh Dickson, Derrick Klotter (in the John Deere excavator) and Jake Ward work together to line a storm sewer using a Perma-Main Top Gun and Viper Steam Cure system from Perma-Liner Industries.

> "[Homeowners] just aren't aware of the nature of things and how water will seek an exit if given a chance. Because the issue isn't affecting their service directly, they aren't aware that a serious problem is taking place underground on their property."

Charles "Chuck" Menkhaus

This makes the resolution of I&I challenging for municipalities, as the sources of this excess are on private property and are the responsibility of homeown-

ers, by and large. Some cities are considering alter-

nate forward-thinking approaches. For instance, employees from a small municipality recently approached Menkhaus seeking advice for proposing a case to their city council that the municipality take over ownership and responsibility of residential laterals so rehab could start as soon as possible. Due to limited funds, treatment plant expansion was off the table.

"Because it is impossible for a municipality to force a property owner to fix something that in their opinion isn't broken, as far as it is not affecting their usage, the case is strong for the city to assume the maintenance and have the freedom to correct the issues," Menkhaus says.

A plan like this may not be possible for most utilities because it would necessitate raising sewer rates, which is a tough sell. But if you're stuck with your current wastewater treatment plant, and you have severe I&I issues, it's an idea that starts to sound more appealing.

#### **CREATING AWARENESS AND UNDERSTANDING**

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Charles "Chuck" Menkhaus

LOCATION: Cincinnati

EMPLOYEES:

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CIPP lining

When Menkhaus' crews perform CIPP rehabilitations in municipal mainlines with the goal of extending the asset life, as well as reducing I&I, they've seen that if the surrounding infrastructure is not addressed, water that once entered the system through the problematic mainline will in all likelihood find its way into the system through the laterals.

Residential property owners may not understand the issues existing in laterals that lead to I&I or the fact that those issues translate to overburdening their public wastewater systems, eventually affecting the rates they pay for service.

"The homeowners aren't doing anything wrong; they just aren't aware of the nature of things and how water will seek an exit if given a chance," Menkhaus says. "Because the issue isn't affecting their service directly, they aren't aware that a serious problem is taking place underground on their property."

Menkhaus suggests that municipalities initiate educational outreach to help residents understand trenchless technology and how CIPP is being used to solve these issues — not just for the parts of the system that the city is responsible for, but also how homeowners can utilize it and be part of the solution long-term.

#### **PRIME EXAMPLE**

CME was called out to inspect and investigate a lateral line for a local municipality after the homeowner had fixed their portion of the line due to a root intrusion problem. The portion of the lateral for which the city was responsible was located under water in a small creek. On drier days, water



Craig Trammell enters a manhole to help line a storm sewer in Loveland, Ohio.

from the creek would go straight into the ground where the lateral was installed, leaving a dry creek bed downstream.

The pipe was buried and could not be seen from the surface, but the crews saw the water stopping suddenly in the creek and disappearing straight into the ground. It was apparent the line was compromised and water from the creek was flowing directly into the lateral line at every possible opening.

Due to its location, excavation and replacement were not possible and trenchless methods were required. Active infiltration from the creek made this line a perfect candidate for CME to deploy proprietary developed techniques and equipment for CIPP rehabilitation.

It was a great example of how I&I issues aren't simply isolated to mainlines or strictly on the property owner side. All the components of the system must be examined and considered a potential source so proper actions can be taken.

#### WHAT ABOUT EXFILTRATION?

In another CME project for the local municipality, a large-diameter sanitary trunk line had sewer officials concerned about both I&I and significant exfiltration. Cracks and joint issues create an opportunity not only for I&I, but also for untreated sewage to leak out of the line into surrounding bodies of water and charging the groundwater.

Pipe bursting and dig-and-replace methods were considered for the project, but due to the location of the line and its condition, lining was the only

From left, Josh Dickson, Craig Trammell and Charlie Knapp perform CIPP rehab on a sewer pipeline via manhole using the Perma-Main Top Gun inversion system by Perma-Liner.



## PREP IS EVERYTHING

CME Pipe Lining of Cincinnati, a specialty contractor focused on CIPP lining, shares that its secret to successful inflow and infiltration projects is in the preparation.

"If you prep your line and your liner properly, your job will always go smoothly," says Charles "Chuck" Menkhaus, company owner. "If you try to cut corners, you're going to have problems and some things just can't be reversed to be prepped any better."

Prevideo inspections are an essential element for all CME projects, and proper cleaning with the appropriate tools is also mandatory. Root intrusion can often be heavy in older areas of the Cincinnati metro area, and sometimes traditional jetting and root cutting machines are ineffective at creating the ideal conditions for pipe lining rehabilitation. In those cases, CME uses a Schwalm robotic cutter outfitted with specific tools that CME has created in its own machine shop that are able to cut through the majority of the debris and items they encounter.

If a specific product or tool is not readily available on the market, Menkhaus and his team will work to develop their own tools in-house that can work in tandem with existing equipment. Some of the specialty tools they have developed include items that can work with either ultra-high pressure dry or water cutting, traditional chain flails and chipping hammers.

Once the line is cleaned and prepped, CME performs the lining and will use lining resins,

liners and configurations from various vendors. A great deal of time is put into planning and assessing the best materials to meet the variables of the project. In addition, the CME teams also take precautions and stay on the lookout for potential cross boring before the lining process can commence.

Post-lining inspection is performed on all lining installations using CCTV inspection cameras from various manufacturers to ensure quality control and that the line is now properly functioning and can be safely returned to service.

"A well-planned project is a profitable and results-delivering project," Menkhaus says.

Environmental Protection Agency can quickly shut down an industrial facility when such things occur. Menkhaus and his team have successfully used CIPP as an effective method for industrial clients to deal with various process pipeline degradation issues in a timely and highly cost-effective manner, thus avoiding costly plant shutdowns.

#### **EVER-EVOLVING SOLUTIONS**

Menkhaus and CME follow the axiom that "one size doesn't fit all" when it comes to CIPP trenchless technology. Having been involved in the industry for many years, Menkhaus has gotten to know many of the manufacturers and equipment providers for the industry. He calls upon numerous vendors for his projects because diverse products are needed for diverse projects. He

"If we recognize that lining of mainlines is just one small portion of the efforts that we should be making and that laterals are a huge contributor to the problem, then contractors, municipalities and property owners can begin to work together to address wastewater systems as a whole ..."

Charles "Chuck" Menkhaus

says some of the product lines and equipment CME uses the most come from Easy Liner, MaxLiner USA and Perma-Liner Industries.

That day early on in his career when Menkhaus says he was nearly laughed out of the room for promoting CIPP, he'd been speaking before a plumbing association audience that told him the technology wouldn't work. Since then, the cured-in-place process has steadily progressed and has been adopted by the mainstream. "Since its inception in 1971, this technology has gotten better and better, and engineers have learned that it works and in what applications it is best suited."

One of the ways that Menkhaus believes CIPP and related technologies can be incorporated more frequently and effectively into solving I&I issues is for engineers and cities to use carbon footprint calculators. These calculators can help assess the costs of implementing a rehabilitation method and how much it will save over the long term. They also help determine the cost of ignoring those issues.

"We may not be able to rid our systems of 100% of the I&I, but if we recognize that lining of mainlines is just one small portion of the efforts that we should be making and that laterals are a huge contributor to the problem, then contractors, municipalities and property owners, as equal stakeholders, can begin to work together to address wastewater systems as a whole interconnected framework — not as individual components," Menkhaus says. "Water is a tough opponent, and the right approach will help our communities win the battle, as well as create solutions that are sustainable for the long haul." **Isil** 

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Owner Chuck Menkhaus prepares a Quickview airHD instant wireless camera for a project (Envirosight).

option. The challenge of this job for CME was that it was 27 inches in diameter, gravity fed and had manholes about every 100 feet, which is uncommon. In addition to the poor condition of the pipe, the manholes along the line were also experiencing water ingress due to poor substrate condition.

As CME began to repair the sections of the mainline, sealing off I&I as well as exfiltration, the water simply sought another way to travel and the level of infiltration into the manholes began to increase. At that point, manhole rehabilitation was inevitable and was performed using cementitious methods.

"This project was a prime example of how repairing only one portion of a system may not correct all of the underlying issues," Menkhaus says. "Water always wins because it will find a way to exit. We have to be vigilant and seal off those opportunities if we really want to eliminate as much infiltration as possible."

Industrial projects have also helped Menkhaus and CME extend their capabilities and knowledge in the areas of I&I and exfiltration for process water pipeline applications. In these projects, exfiltration is typically the primary concern, as manufacturing facilities cannot leak water into surrounding environments and allow any water to leave the process piping.

In most cases, these clients will have an onsite treatment plant, desalinization or acid removal facility on the property before the process water is sent on to the municipal wastewater system. For these customers, I&I and exfiltration issues go hand in hand, and regulatory agencies such as the U.S.

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Rather than committing to clean out sewer lines whether it's needed or not, the Little Rock (Arkansas) Water Reclamation Authority is using acoustic monitoring to identify pipelines that need attention. Here a worker uses the Sewer Line Rapid Assessment Tool, or SL-RAT, by InfoSense on an inspection.

# **PUTTING A STOP TO STOPGAPS**

Little Rock's award-winning sewer rehab program nixes temporary fixes

#### By Traci Browne

wenty years ago, Little Rock, Arkansas, had a significant overflow problem — significant enough to trigger a lawsuit by the Sierra Club and an Administrative Order on Consent. Back then, there could be as many as 350 overflows during a rain event, some lasting for hours.

Today, the Little Rock Water Reclamation Authority has lowered that number to just 50 combined sewer overflows during a two-year rain event, and it intends to eliminate 30 more by the end of this year. It's accomplishing this with two significant programs: the Sewer Service Line Replacement Program on the private side and Project RENEW, which is the utility-facing program.

Before those programs took shape, the authority was reacting to the Administrative Order on Consent and an agreement with the Sierra Club, attempting to solve its problems. To capture excess stormwater, the authority installed attenuation facilities that could hold 45 million gallons.

#### **RENEWING FOR FUTURE GENERATIONS**

In 2014 when Greg Ramon took the job as CEO of the authority, he didn't think capturing excess water was a complete solution. He compares it to a hole in a roof. You can put a bucket under a leak, but it doesn't solve the ongoing problem.

It was at that point that the utility concentrated on renewing its system in earnest and Project RENEW took shape. In 2015, the authority managed

"I think rodding pipes every day for the sake of rodding is the old way of doing things ... Not only is acoustic monitoring cost-effective, but it's environmentally responsible as well. Do we really want an additional 15 trucks out there, spewing smoke and causing congestion?"

#### Greg Ramon

to negotiate an extension from the Sierra Club and the Arkansas Department of Environmental Quality to give the authority until 2023 to fix the leak.

"We're not only rehabilitating the system to keep water out, but we're also renewing the system for generations to come," Ramon says.

Deciding what to work on first required a methodical approach, as Little Rock is spread out across 122 square miles. Ramon says first they considered what they would need to do in the different basins to reduce the amount of flow to prevent overflows. So, they began with flow modeling.

As you can imagine in a service area of that size, when it's raining in one part of the city, it can be sunny in another. The utility settled on placing 14 gauges throughout Little Rock.



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Once it identified the basins causing the most significant problems, the authority started moving upstream, identifying illegal sewer connections via smoke testing with Hurco Technologies' Power Smoker and the 30-L Manhole Liquid Smoke Blower by Superior Signal. Meanwhile, flow monitors were able to track down sump pumps connected to the system. The authority uses the Hach FL900 Series Flow Logger, along with the Triton+ and FlowShark monitors by ADS Environmental Services.

When needed, the utility also conducted CCTV inspections using three CCTV trucks set up with RapidView IBAK North America equipment and another truck set up with CUES equipment.

Another part of Project RENEW was upgrading the treatment plants and setting up a parallel treatment system at one of the biggest plants to alleviate hydraulic pressure on the system. That parallel plant allows the utility to use mechanical versus biological cleaning during a rain event, and ultimately it increases capacity. Another significant piece of the project was a new trunk line to move water from one basin to another.

On top of this, the authority is consistently rehabilitating pipelines, with 350 miles of pipeline restored or replaced already. To do this work, it uses an array of techniques including CIPP, opencut and pipe bursting. It all depends on the situation.

#### **DRY-WEATHER OVERFLOWS**

What Ramon really likes to talk about is what the utility is doing to mitigate dry-weather overflows due to grease in the lines, or just general maintenance issues.

Part of the Little Rock (Arkansas) Water Reclamation Authority's system renewal effort is the Sewer Service Line Replacement Program, which reimburses property owners up to \$2,500 toward the replacement cost of their sewer lateral.





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Ramon says that eliminating the dryweather component relies on maintaining the system. However, cleaning the 1,400 miles of pipe would take up to five years to complete or it would take an additional seven crews and equipment to clean every pipe in the system in one year.

"The average citizen never rods their sewer line unless they have a problem. So, why do we [municipal sewer departments] rod our sewer lines consistently whether they need it or not?" Ramon asks.

Instead, the authority is using the Sewer Line Rapid Assessment Tool, or SL-RAT, acoustic monitoring by InfoSense to identify pipelines that need cleaning. Once cleaned, the line gets tested again, and if it still doesn't meet the threshold, then the authority brings out the CCTV equipment to see what the problem is. This way, it focuses efforts on areas that need attention.

Ramon's theory is that sewer lines are designed to be self-scouring. Of course, it doesn't always work that way; but if 60% to 80% of a system can self-scour, you only need to clean the 40% to 20% that can't. Ramon says they could survey their entire network and complete the cleaning necessary in just one year. Not only that, but he says their dry-weather overflows are a fraction of what they were.

"At this point, I think rodding pipes every day for the sake of rodding is the old way of doing things. It's not the way of the future.

Not only is acoustic monitoring cost-effective, but it's environmentally responsible as well. Do we really want an additional 15 trucks out there, spewing smoke and causing congestion?"

Funding for Project RENEW comes mostly from the state revolving funds. So far, the authority has spent close to half a billion dollars. It has paid



Property owners are charged an additional \$1 on their monthly bills to help fund the Sewer Service Line Replacement Program. That small surcharge gives the program an additional \$650,000 a year to help homeowners replace sewer laterals and alleviate the effects of inflow and infiltration on the city's wastewater system.

"The industry as a whole has always stayed away from getting involved in sewer laterals, but when you study it, they have a huge impact

#### on any agency."

Greg Ramon

off a few of the loans from the storage tank days, and it still has about \$150 million more to spend before the 2023 deadline.

#### **ADDRESSING THE PRIVATE SIDE**

The Sewer Service Line Replacement Program is the other half of the authority's renewal endeavors — the public-facing program. The authority launched the program in 2013 in response to a severe infiltration problem.

The program reimburses residential property owners up to \$2,500 toward the replacement cost of their sewer lateral. It may seem like an extreme move, but Ramon thinks it makes perfect sense.

"The industry as a whole has always stayed away from getting involved in sewer laterals, but when you study it, they have a huge impact on any agency," Ramon says.

For instance, the authority has 1,400 miles of pipe in its collections system. "If you take every sewer lateral and add them up, we're probably at close to 2,800 to 3,000 miles. It almost doubles our system, yet we're only spending money on half because the other half doesn't belong to us, but it's still our problem."

By only concentrating on the public system, Ramon says, a utility is fixing the most expensive pipes while perhaps only reducing I&I into the system by 50%. "The smaller private pipes, which are cheaper to fix, continue to leak."

The Sewer Service Line Replacement Program needed funding, so the authority first went to the City Council for approval of a \$1 charge to be added to property owners' monthly bills. That small change would give the program about \$650,000 a year to fund the project.

The authority set up the program so both the utility and the residents have skin in the game. That's where the \$2,500 maximum reimbursement comes in. On average, it costs about \$3,500 to replace an entire sewer lateral. Homeowners only have to pay \$1,000 to \$2,000 for something they will eventually have to replace, given most laterals were installed as many as 50 to 60 years ago.

Of course, some requirements must be met to qualify for the reimbursement. The entire pipe must be replaced: Homeowners cannot just do point repairs. Only certain materials can be used, clean-out requirements were set and the new pipe cannot leak.

#### **A POPULAR PROGRAM**

The Sewer Service Line Replacement Program, according to Ramon, has been a huge success. Almost too successful. Demand was exceeding the amount of money the authority had set aside, and it found itself with a sixmonth backlog of residents wanting their sewer laterals replaced.

In 2015, the authority went back to the city

and received approval for a series of rate increases over five consecutive years to raise the money needed not just for the program, but to also meet its commitments in general for the Administrative Order on Consent from the Arkansas Department of Environmental Quality. At the same time, the authority also met with the Arkansas Natural Resources Com-

mission, which manages the state's revolving loan program, to help out with the program.

Ramon says it took some doing to get the commission to embrace this new idea. "But boy, when the commission did, it really embraced it." Starting in 2016, ANRC gave the authority an extra \$500,000 a year for the next five years, allowing it to double the number of lateral replacements it funds. "This program is truly a win-win for the community."

But the commission's money came with a catch. Replacements have to be made in the same location and American-made products have to be used, so the authority has juggled the money. If it makes more sense to move the lateral to a new location, it used its own money. If it could just go in the same place, it uses the revolving loan fund.

Since the program's inception, the authority has helped fund the replacement of 2,700 laterals. The authority not only has less infiltration into its system, but it has made a lot of homeowners and plumbers happy as well.

Homeowners are not the only group that is impressed. The authority was awarded the Environmental Protection Agency's Performance and Innovation in the SRF Creating Environmental Success award for its innovative thinking and approach to ratepayer care with the Sewer Service Line Replacement Program.

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# **KEY EQUIPMENT FOR MANHOLE SAFETY**

Provide the right safety gear to ensure your employees make it home after working in manholes

#### By Giles Lambertson

elieve it or not, a hole where toxic gas can lurk and a misstep means a painful fall is a dangerous workplace. To prevent injuries, companies whose employees must enter sewer manholes regularly train their crews to be safe and call upon equipment manufacturers to help them in that effort.

"Every time we go in, we test the gases — opening the manhole and dropping the detector in the hole," Horacio Franco says. "We determine if it's clean of gases so we can safely have the guys go in. Every single guy is in a harness. They have their own gas monitors. They wear hard hats, respirators, gloves, boots."

The owner of H&R Underground sends rehabilitation crews into manholes all the time in and around El Sobrante, California. "Every day we have someone working in a manhole. Some days we might rehab 10 of them," Franco says. In every case, someone is standing at ground level near the manhole opening, sometimes monitoring readouts of air quality below or standing by to help the crew member or team in the hole.

Proper equipment can mean the difference between an uneventful workday and an emergency run to the hospital.

#### **GAS DETECTORS**

The foremost worry is hydrogen sulfide, which can poison more than one system in a body. There are two approaches to mitigating this hazard: gas monitors and ventilation units.

Gas monitors worn by manhole workers take atmospheric readings on a bright LED screen, alerting the wearer to adverse conditions. One such unit is the Multi Gas Clip Plus by Gas Clip Technologies. This model gives readings for four gases: hydrogen sulfide, carbon monoxide, oxygen and the minimum combustible point for ignitable gases. Thus, toxic, sulfocating and explosive threats are all monitored.

When a threat is detected, the device alerts the wearer three ways: an audible sound is released at a minimum of 95 dB, a light flashes and the device vibrates. The unit functions in a temperature range of 4 degrees below zero to 122 degrees F. The battery will power the monitor for three years without recharging.

Ventilation units keep air moving, thus diluting concentrations of explosive and toxic gases. This threat particularly exists at the bottom of manholes where the heavier-than-air compounds accumulate. Allegro offers a variety of types and sizes of ventilation fans powered by electricity, compressed air or gasoline engines. According to Michael Johnson of Industrial Fans Direct, the electric models are favored by contractors.

Blowers producing 2,000 cfm are frequently used, such as the Allegro 9539-12, because such models are easily moved (weighing only 31 pounds) in a constricted area. They are constructed of durable plastic. Some of the fans are explosionproof, which is to say their motors are completely contained to avoid sparking flammable gases. The blowers cost about \$200 apiece.

#### **LIGHTING AIDS**

Working where the sun doesn't shine is a handicap and a danger. Even with the sun directly overhead, walls and deeper recesses sometimes are faintly visible. Some new products address the situation in slightly different ways.

Illuminating the space in front of an individual worker is the goal of the Illumagear Halo. A construction worker, Max Baker, invented it. It came out in 2014 and originally had a cord running to a battery pack, but the latest model is self-contained and is attached to a hard hat. Different intensities of light are available by throwing a switch. The Halo's rechargeable battery lasts up to 34 hours.

Designed to both illuminate work and give workers visibility in low-light situations, the Halo is becoming more popular in underground work, according to Matt Squires, Illumagear director of sales. He says that by using the Halo in confined spaces, you don't have to carry a flashlight or portable light. "The Halo illuminates a whole confined area, with the light in the back reflecting forward."

The patented Light Ring can light an entire manhole. The product's durable aluminum ring fits around a manhole opening and, when activated, an 18-volt battery sends LED light into the space below. The ring is bright orange to catch the eye of any worker approaching at ground level and has a raised edge as an alert in low-light situations.

The patent-pending Light Ring mounts to a downrigger pulley on one

side to facilitate running of cords and hoses. The side-mount pulley frees up the center of the hole for transfer of tools. Without a flashlight, workers can use their tools more effectively hands-free. The device comes in standard manhole opening sizes.

#### **COVER LIFTERS**

Covers fitted onto manhole openings are heavy by design — their bulk helps them withstand the weight and vibration produced by pedestrians or vehicles crossing them. A cover can weigh from about 100 pounds to three times that much. Consequently, removing them can be hazardous. Two types of solutions are offered.

Manual lifts use the principle of a lever to multiply a worker's strength. The fulcrum of the lift is either on the same side as the lifting person, who pushes down to raise the lid, or on the far side, in which case the lifting person pulls up. One pull-up version is the LIFT-PLAQ, a European product. It has an extendable rod handle on one end for 33 extra inches of leverage and a close-set pair of solid-rubber tires on the other end. Midway between is a dangling arm with a flat magnet at its end. The unit weighs about 40 pounds.

"One person can lift up to 300 pounds," says Pascal Philippe, U.S. manager for the manufacturer. The ergonomic tool makes the lift a function of leg power, rather than back exertion. "For very heavy plates, we offer a two-

Wearing proper gear, such as gas masks and hard hats, is vital to safety, but following safety procedures every time you enter a manhole is the best form of incident prevention.

person model with two handles and more magnets." The LIFTPLAQ can be fitted with an extended axle so its tires straddle large rectangular covers and grates.

An automated lift that fits on the front bumper of a pickup truck is simply called The Lifter. A product of an Iowa firm, Rock Mills Enterprise, The Lifter comes in two capacities: one that lifts conventional covers weighing less than 300 pounds and a heavier version that lifts up to 600 pounds. According to company consultant Don Moos, 95% of the units are sold with an optional hinged arm so a lifted cover can be swung to one side and set down.

Also optional is a front-end camera connected to a monitor on the dash of the truck that lets an operator position the lift while seated inside the cab. A wireless remote lowers and activates the electromagnet. This hydraulically operated, higher-tech lifting device with the camera option retails for about \$4,500.

#### **FALL BARRIERS**

When a manhole cover is removed, jeopardy mounts for anyone in its vicinity. A vitreous clay pipe representative, Jeremy Haskins, noticed that on a visit to a job site several years ago. "I saw one person after another almost fall into an open manhole. That was the genesis for designing the Holehat."

His device fits snuggly on the rim of a circular manhole with a 4-inch roller mounted on it for raising and lowering of hose or cable. On its base are affixed pivoting, high-strength, 2-inch-wide aluminum arches that can be pulled up and locked, raising into place a brightly colored, durable canvas cover. When the "hat" is raised like the top on a convertible, anyone standing next to the hole is prevented from stepping into the void, and passersby are alerted to the hazard in their path.

"Contractors will put a piece of plywood over the hole, but that doesn't catch your eye," Haskins says. "The Holehat is both a structural barrier and visual warning." In 2017, the \$700 safety device was named New Product of

the Year by the American Public Works Association. It is currently sold in the U.S., New Zealand and Australia.

#### **EMPLOYEE/TOOL LIFTS**

Manhole work is vertical. Hoist systems keep workers safe on both the descent and ascent. While tripod cable-routing standards are popular, a more robust option is the Miller Durahoist DH-1 davit arm system by Honeywell.

The base of this welded aluminum device offers horizontal extensions that let it straddle rectangular manholes and circular ones. The unit is hand-assembled without tools and its main components each weigh only 31 pounds. The tower can accommodate multiple winches. Whereas tripod lifting units are available for \$1,500, the DH-1 is a \$7,500 piece of safety equipment because it is more durable and widely applicable to a broader range of manholes.

While manhole safety equipment is vital to keeping people safe, trained personnel are the real keys to safety. "One of the things we do not take for granted is safety," Franco says. "The safety rules are there for a reason. Before anyone in our crews goes into a manhole, they have gone through eight hours of training. Then during the year we have refreshers so they don't forget it. There is nothing more important than their health." **Isi** 



# A High-Water Nark After years of investments into its sewers, a New York town sees the fruits of its la town sees the fruits of its labor

**STORY** Giles Lambertson

Workers in West Seneca, New York, apply cementitious liners to manholes as part of the rehabilitation process.

"West Seneca is the leader in correcting the situation. State officials talk to the others about what we are doing to fix the system." Steven Tanner

f only" is for wishful thinkers. As in, if only the sewer infrastructure weren't so old. If only the water table were a little lower. If only Department of Environmental Conservation officials weren't so conscientious. Alas, such idle wishing is all for naught in places like West Seneca, New York, where each of the above factors came into play in 2004. That year, the state environmental patrol rode into town with a consent order — amended twice since — calling for the town to stem the flow of groundwater and stormwater into its sewer system. The extra water was overflowing manholes and producing other public safety headaches.

It still is, though at a reduced rate. As 2020 gets underway, West Seneca officials — including Steven Tanner, town engineer — are themselves conscientiously struggling to comply with the edict. After all these years, they finally can see an end to the environmental and regulatory crisis, the day when both trickling water and regulators ease up on them. The end is in sight, that is, but remains a full seven years away.

TOWN OF WEST SENECA (NEW YORK) SEWER SYSTEM
SERVICE AREA: 21 square miles
CONNECTIONS: 12,000
TREATMENT PLANT: Collected sewage flows to a Buffalo plant
SEWER INFRASTRUCTURE: 140 miles of pipe, 3,500 manholes, 7 lift stations
SEWER EMPLOYEES: 3 on distribution side, 3 on pump station side
WEBSITE: www.westseneca.net

#### **A LEADER IN REMEDIATION**

Tanner inherited the problem in 2011 when the town of West Seneca contracted with CPL — a multistate engineering consultancy with an office in nearby Buffalo — to head the town's engineering department. For eight of the ensuing nine years, Tanner

has worn the two hats of CPL consultant and West Seneca town engineer. During his tenure, the mandate to fix the system has evolved from just getting rid of the overflow to lining most of the system's pipes and sharply reducing inflow and infiltration.

"The whole area has this problem," Tanner says. Sewage from the suburban town flows north past the town of Cheektowaga and into a sewer treatment plant in Buffalo — both of those communities also are laboring under a consent order to correct similar infrastructure problems.

"West Seneca is the leader in correcting the situation," Tanner says with some satisfaction. "State officials talk to the others about what we are doing to fix the system." What the town is doing is methodically playing catch-up.

About half of the sewer lines running under the town are the responsibility of West Seneca; the other half belonging to the Erie County Sewer Districts. In both jurisdictions, the sewer network includes stretches of century-old pipe, mostly clay but with aging concrete sections here and there, as well as cast iron. "The problem is just old infrastructure built in the early 1900s, mostly vitrified clay pipe. We have root intrusion, and there hasn't been a lot of rehab work done over time."

Tanner thus tells a familiar story — the beauty of maple and hickory, hackberry and birch canopies above ground and the infiltration of root systems below. The resulting pipeline leakage and blockage created a half-dozen locations where water overflowed manholes after it rained. "It's better than it used to be. We've got it down to two manholes that overflow when more than a quarter inch of rain falls and one that floods after three-quarters of an inch." Water pouring from a manhole after a quarter inch of rain! It's easy to see why even incremental progress is heralded and why the town has expended some \$19 million through the first five phases of its systematic rehabilitation of pumps and pipes. Tanner says the worst is behind the town, with an estimated program expenditure going forward of \$14 million. That will include penalties to be paid after completion was bumped to 2027, three years behind the original schedule.

#### HALF THE BATTLE

Half the problem — literally, an estimated 50% of the system's I&I — comes from outside the town's immediate jurisdiction. Stormwater misdirected into the sewer system from pipes on private property is the cause of

some of it, while leakage into cracked sewer laterals accounts for the rest. In response, town officials passed an ordinance five years ago requiring that any pre-1970s homes placed on the market must have the property's laterals inspected. Any system failing the inspection had to be repaired or replaced prior to the sale being finalized. While the ordinance could solve the problem, the solution could potentially cost a home seller \$7,000 to \$8,000. Homeowners were not happy, and the ordinance was rescinded.





The left image shows obvious infiltration issues on a pipe underneath Lind Avenue in West Seneca, New York, while the right shows a lined and rehabilitated pipe on Leaside Drive.

All of this water flowing across a land area built of silt and sandy soil invites infiltration into failing pipes. The town's seasonal water table is just 24 inches beneath the surface. "Groundwater can be an issue," Tanner says, with incursions heaviest in spring and summer. Winter brings a separate water hazard: flooding from ice-blocked streams. "Because we are so close to Lake Erie, ice backs up on the flowing streams and makes ice dams that cause localized flooding."

To mitigate such winter flooding, the town rolls out a hydraulic excavator to crack open ice below bridges where ice has formed against abutments, allowing water to burble up, overflow the ice and move downstream. In warmer months, silted areas of creeks sometimes are deepened so water can move more freely and ice can't form as easily when temperatures drop. "You can't do a whole lot about some things, and it probably is only going to get worse. Climate changes will affect it."

#### **STEADY REHABILITATION**

In this water-rich environment, priority No. 1 is restoring the integrity of sewer lines. They range in size from 6 to 48 inches in diameter. Lining the pipes with a cured-in-place product is Tanner's recommended fix. The first four phases of the ongoing project relied exclusively on the CIPP solution and were contracted to United Survey Inc., a Cleveland company. "They take their own quarter-inch felt and inject a two-part epoxy into it. They keep it cold in a refrigerated truck till it's installed and heated up in the pipe," Tanner says.

In the just completed fifth phase, the condition of some of the pipe was

"It's better than it used to be. We've got it down to two manholes that overflow when more than a quarter inch of rain falls and one that floods after three-quarters of an inch." Steven Tanner remedy: grout. National Water Main Cleaning, a Carylon company and Boston area contractor, did that work. Its staff sent cameras into the line to pinpoint locations where failing joints were letting in water and then sent an injectable grout machine into the pipe to robotically seal the failed joint.

such that Tanner could employ a slightly less expensive

Manholes are also being rehabbed. They are grouted

So, as a fallback, the town's engineering department is more frequently inspecting basements of homes — about 250 inspections a year. Workers are finding pipes sending stormwater into the sewer system and downspouts emptying into the system. Homeowners are required to reroute such pipes and eliminate the incursion.

"We're doing a lot of that," Tanner says. "But we're not doing anything to replace leaking laterals. I don't know if the town has the appetite to do more than they've tried on that. If we get calls about sinkholes and find that water is getting into a lateral, we tell a property owner they have to fix it, but we're not looking for those kinds of things."

There is no shortage of water to infiltrate the old pipes. West Seneca, after all, is situated on the east end of Lake Erie. The Buffalo River empties into the lake, and tributary creeks including Buffalo, Cazenovia and Cayuga pass through the town. Flooding periodically occurs at the confluence of the Buffalo and Cayuga creeks, which forms the river. In addition, acres of wetlands are maintained within the town limits.

and spray-sealed, and the area immediately around manhole covers are made more waterproof. In addition, inserts are added below each steel lid to prevent infiltrating water from reaching the sewer. Some 72 miles of sewer lines have been restored — slightly more than half of the total network — with the largest sewer mains still to be fixed. Tanner still is undecided on how to repair pipe larger than 24 inches.

"We've replaced some larger pipes. We haven't lined any. I don't yet have confidence in CIP doing the job on larger-dimensioned pipe," he says. "We haven't had to attack those yet. I'll take some time to analyze it and recommend what I think will work best."

For the smaller pipe, though, Tanner has no qualms about continuing to employ trenchless CIPP. He says the choice is a no-brainer. "It's about cost — not only initial cost, but cost over time. With pipe bursting, who knows how long that pipe will last? We have pipe in which cured-in-place lining was installed 25 or 30 years ago and it's still good. We know we have a sturdy product in CIP, and it's less costly to install."

## WETLAND MANAGEMENT AND I&I

"Water, water, everywhere," laments the narrator of the *Rime* of the Ancient Mariner. Residents of West Seneca, New York, sometimes know the feeling.

The community in western New York lies just off the shore of Lake Erie, is edged by a river, has four creeks and a brook winding through it, and in part falls within 100-year flood plains, as designated by the Federal Emergency Management Agency.

With a seasonal water table just 24 inches underground, it is no surprise that the western part of West Seneca also has at least three designated wetlands, which is to say puddled water or wet and spongy soil. Local environmental groups are keen on preserving the areas as an ecological habitat.

So, how does wetlands preservation mesh with the town's efforts to slow leakage into its sewer system and reduce flooding? Steven Tanner, town engineer, says the two projects and mindsets are not at cross-purposes. "If anything, the wetlands preservation helps. The efforts to preserve some of those wetlands gives water a place to go. It's staying on the land instead of flowing and adding to the flooding."

It is a tightrope the town is walking between the surface water that keeps the area verdant and fruitful and the subterranean water that creates all the inflow and infiltration headaches and investment. "It's a serious situation," Tanner says of the sewer issue. "Anything that causes issues with human health is a serious situation. When sewers are backing up into basements, it's a serious situation." Besides contracting out the yearslong rehab project, West Seneca also looks outside for emergency fixes. To that end, bids are periodically left for a standby contractor. However, ongoing maintenance is the responsibility of town crews, who have a Bobcat skid-steer and John Deere excavator at their disposal. For clearing lines and gutters, they can roll out the town's 2014 Vactor 2000 that rides on a Kenworth chassis or a 2018 Kenworth rig with a Cyncon jetter.

Crews also video the system, both to check the condition of sewer infrastructure and to inspect waterlines. Tanner says the town saves a lot of money on the engineering side with its camera truck. "We'd spend \$180,000 a year if we were contracting it out. Instead, town crews just work it into their work schedule."

West Seneca's sewer line saga has several years yet to run, but Tanner foresees a successful outcome "as long as the town can continue spending money on the problem." The good news is that the governor's office has begun to help with that. Grant money for struggling communities is being made available from a water-quality improvement revolving fund. The final stages of West Seneca's project can tap that fund, beginning in the current phase.

Community residents generally are supportive of all this effort — with the exception of the laterals situation. Customers pay on average \$140 a year to help fund the improvements, on top of their regular sewer bills, and complaints about the cost are relatively few, Tanner says. This partly is because the fruit of the investment and labor has begun to be seen. He notes that the Town Hall used to receive some 2,500 calls a year after sewer lines backed up into basements. "People were not happy."

The relatively happy news in 2020 is that such calls have fallen drastically to about 250 a year.

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Workers feed a liner into a CIPP pipe inversion machine called THE SHOOTER, manufactured by Emagineered Solutions. West Seneca, New York, officials consider the use of CIPP a no-brainer for many pipe rehabilitation projects, as it delivers a reliable and sturdy product and is less costly to install.



# **STAY UP TO THE MARK**

## Surrogate samples for lateral CIPP projects help Ontario city maintain standards

By Anthony Drew

s the popularity of trenchless lateral rehabilitation continues to grow, so does the need for cost-effective quality-control measures for CIPP repairs on the private side.

Like many other cities throughout North America, the city of Hamilton, Ontario, has found a proactive rehab program for sewer laterals is preferable to costly and reactive opencut repairs. The city first developed its lateral rehabilitation program in 2008, has renewed its contract multiple times and, as of 2017, has repaired more than 4,600 laterals. The CIPP liners used for these projects are required by the city to be one-piece lateral liners including sewer connections.

While the program has advanced and adapted since its inception, quality control remained a challenging facet of the strategy due to the difficulties and costs associated with collecting samples.

That's why Robinson Consultants — working with the city and its contractor — came up with quality-control procedures including a "proxy" sampling method and presented its methodology as a white paper titled "Quality Control for Sewer Lateral Rehabilitation" at the North American Society for Trenchless Technology's No-Dig Show.

According to Robinson Consultants, collection of CIPP samples from an actual installed liner is challenging, unless you're planning on excavating a portion of the lateral. Meanwhile, the practice of quality-control sampling remains as important for laterals as it is for sewer mains.

#### THE PROXY METHOD

The city of Hamilton, like other municipalities, uses CCTV video inspections after cleaning and preparing a lateral, and again after liner installation. But for long-term quality-control data, it's now using a proxy method by which it creates aboveground samples using 2-meter lengths of PVC at an actual installation site using the same resin, tube, curing method and installation procedures as the true installation. Especially in colder outdoor air temperatures, the city recommends using an insulation blanket to help simulate an underground environment when creating the proxy sample.

After a sample is completed, it's cut in half and both the utility and contractor keep a sample for records, which offers the ability to perform primary testing and, when necessary, secondary testing. The samples are identified with the installation date, street name, contract number, contractor name, contractor crew, inspector's signature and any special design requirements.



Workers create a lateral sample on the job site using a thermocouple to monitor the temperature and ensure a comparable proxy.

"It is important to recognize that trend analysis is far more important than just the individual test results because samples are not taken from the actual installed liner, but rather independently created."

#### White paper: Quality Control for Sewer Lateral Rehabilitation

"In the case where sample test results indicate that the initial design requirements have not been met, further investigation is undertaken to determine if the liner will still perform adequately within the specification requirements for the particular installation," according to the white paper.

In addition, the city of Hamilton requires contractors to keep installation records for each project including street name; liner size; mix ratio; resin lot numbers; resin volume used; roller separation; inversion pressure; cure pressure; resin mix time; resin gel time; and cure temperature, including



Cured proxy samples using lengths of PVC pipe are marked with the installation date, street name, contract number, contractor name, contractor crew, inspector's signature and any special design requirements.

exothermic temperature, truck temperature, ambient temperature at the invert of the mainline sewer manhole, steam temperature, water temperature and outside weather temperature.

While the contractor notes all the above information, a city inspector also conducts his or her own site inspection to provide an audit record of compliance.

"The information collected in these installation records holds significant value when analyzing the overall quality of lateral liner installations and in determining the cause (or most likely cause) of sample test failures," reads the white paper. "Without installation records, the ability to monitor installation quality and take corrective action in a timely manner is significantly reduced."

#### **TESTING SAMPLES**

When it comes to testing its samples, the city of Hamilton provides a testing agency with design parameters for flexural strength, flexural modulus and original design thickness. The city tests about four or five CIPP samples on a monthly basis and reviews them against the liner design, project specifications and overall trends in three test criteria — flexural strength, flexural modulus and design thickness.

"It is important to recognize that trend analysis is far more important than just the individual test results because samples are not taken from the actual installed liner, but rather independently created," according to Robinson Consultants.

If an initial review of a test report finds any problems associated with the three testing criteria, that triggers a secondary review that establishes whether the liner can still meet its performance standards for its specific project.

The city tracks those results in spreadsheets over time to give a sense of trends, and it uses that data to create easy-to-read lateral sample trend analysis charts that include ambient air temperature in addition to flexural modulus and thickness.

Being able to see these trends over time has helped inform the city of Hamilton's ongoing lateral relining projects and give it confidence in liner performance.

"While the quality control of lateral CIPP installations is more challenging than mainline sewer CIPP, it is equally important in establishing that the installations are achieving the required performance," reads the white paper. "As with all trenchless technologies, continual improvement in the processes and methods in the use of CIPP continues to evolve. It is vital that the same level of effort is put toward the processes and methods for their quality control." **IGI** 





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By Craig Mandli

# INTERNAL JOINT SEAL USED TO REPAIR AGING WATER MAIN

#### **PROBLEM:**

An aging cast iron water main's deteriorating joints were threatening water quality and experiencing exfiltration in a Southwestern U.S. city. Previous repair methods had been employed, but a more permanent solution was required to make the water supply system more efficient, reliable and clean. Trench repair would have



disturbed the museums, galleries, cultural centers, community organizations and trees that are above the water main. Most of the water main was 30 or 36 inches, but there was a point where a 24-inch pipe intersected the water main. This intersection required 24-inch seals, and an abandoned 12-inch connection had to be blocked with a seal. Multiple unused service taps had to be covered with seals as well.

#### **SOLUTION:**

The mechanical **HydraTite internal joint seal** from **HydraTech Engineered Products** was selected for the many needs of the water main. Seals of different diameters and thicknesses were employed for this project. Backing plates were used with the seals to cover the abandoned connecting 12-inch pipe and service taps. The pipe had a low section that required dewatering. More than 800 seals were installed throughout the entire water main. These were used to seal joints, unused service taps and abandoned connecting pipes.

**Result:** The seals eliminated infiltration at all joints. They enabled a trenchless repair at a fraction of the cost of alternatives. None of the aboveground trees or facilities were affected by the water main rehabilitation. The seals proved to be an economical in situ repair solution, making the operation of the water main pipe more cost-effective.

513-827-9169; www.hydratechllc.com



## THRUST BORING MACHINE PROVIDES COST-EFFECTIVE ALTERNATIVE

#### **PROBLEM:**

Aware of aging and deteriorating infrastructure, Military Ocean Terminal Sunny Point in North Carolina employed Ellixson and Sons to inspect its sanitary sewer system. Upon investigation, they noticed several of the 8-inch terra cotta sewer mains were cracked and had root intrusion at the joints. To make matters worse, the damaged areas were in high-traffic areas where open trenching would have been costly and socially disruptive.

#### **SOLUTION:**

Ellixson and Sons used the **PD-6 thrust boring machine** from **Pow-R Mole Trenchless Solutions.** This multifaceted machine with its 85,000 pounds of force can either be used for directional thrust boring or pipe bursting. On this particular project, Ellixson and Sons were able to burst 8-inch terra cotta pipe while installing 8-inch HDPE pipe. Most of the damaged sewer mains were replaced from manhole to manhole in 340-foot sections.

**Result:** The PD-6's power and small footprint enabled Ellixson and Sons to complete six sections of sewer main in 10 days. This allowed one of the largest military terminals in the world to have a cost-effective solution with limited social disruption. **800-344-6653; www.powrmole.com** 

## INSIDE MANHOLE DROPS REPLACE FAILED OUTSIDE DROPS

#### **PROBLEM:**

Aging outside drops in Saugus, Massachusetts, had proven difficult to access for inspection, cleaning and maintenance. Many of the drops were deteriorating, leaking or clogged. The community sought a replacement.



National Water Main Cleaning, using design documents developed by CDM Smith, was contracted to fill in the outside drops and install new inside drops from RELINER/Duran. The base of the outside drop is plugged with concrete prior to the drop being filled with pea stone, flowable fill or sand. A hydraulic cement cap is placed on top and smoothed out with the mainline pipe invert. The mainline pipe is then CIPP-lined, followed by rehabilitation of the manhole. After the installation of a cementitious liner in the manhole, the Inside Drop System is installed. The system consists of a fiberglass drop bowl that is bolted to the manhole wall just beneath the high-level inflow pipe, and stainless steel pipe support brackets are used to attach the drop pipe to the wall. A flexible coupler is used to connect the drop pipe to the drop bowl, and a bend is installed at the pipe base in the manhole invert. The system is easy to install and allows the drop to be cleaned and inspected from above. The system is available to accommodate internal drops ranging from 4 to 24 inches in diameter.

*Result:* The system eliminated the maintenance problems associated with failing outside drops. **800-508-6001; www.reliner.com** 

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## REMOTE CANAL MONITORING SYSTEM IMPROVES OVERFLOW RESPONSE TIME

#### **PROBLEM:**

Lake Worth Drainage District operates approximately 500 miles of canals and 20 major water control structures across more than 200 miles in southwest Florida. The district was hampered by an outdated operational philosophy and lacked a systemwide integration with weather and tidal data. Operators found themselves continuously struggling to react quick enough to protect their customers from overflows.

#### **SOLUTION:**

The district deployed **SmartCover** to remotely monitor its canals while integrating local radar and tidal data with National Oceanic and Atmospheric Administration rainfall information along with the SCADA and remote-control gate operation.

**Result:** This revolutionized the district's response time. "Before SmartCover, we would drive out to check conditions, call the office, make



our operational decisions, drive to the gate, operate the gate. ... It was a two-hour exercise. With SmartCover, we've reduced response time to minutes," says Tommy Stroud, the district's executive director and district engineer. The SmartCover system was put to the test by Hurricane Irma in September 2017. Canal level visibility, in addition to rainfall intensity and duration, enabled the district to monitor flow, predict peak stages and manage its infrastructure during this historic storm event. The system allowed them to minimize the impact of flooding and to operate with no service interruptions before, during or after Irma. **760-291-1980; www.smartcoversystems.com** 





## MANHOLE RISERS ARE A FIT FOR PICTURESQUE TOWN

#### **PROBLEM:**

New Philadelphia, Ohio, population 17,000, is the county seat of Tuscarawas County. Keeping this old, picturesque town in tiptop shape is partly the responsibility of Brian Myers, wastewater superintendent. One of Myers' responsibilities is the raising of city manholes to grade after roads are repaved or when manholes fail and need to be rebuilt or repaired.

#### **SOLUTION:**

Myers employed the pivoted turnbuckle. **American Highway Products manhole risers** are open, flexible rings of high-quality, galvanized steel with a turnbuckle that can be expanded or contracted with a screwdriver to fit snugly into original utility rims. They're available in precisely sized increments to match any manhole rim diameter and any paving lift thickness needed to bring manholes exactly to new paving surface grades. The adjustable risers make it possible to raise dozens of manholes in a day, all while avoiding extensive traffic closures. They can take as little as 10 minutes to install, with no excavation or hot patching required.

**Result:** In 2019, the town installed 35 of the pivoted turnbuckle risers, including 25 on a single resurfacing project carried out by the state on New Philadelphia's South Broadway Street. **888-272-2397; www.ahpl.com** 

## CRAWLER CAMERA HELPS CITY INCREASE PRODUCTIVITY

#### **PROBLEM:**

The Roanoke River, which meanders through Roanoke, Virginia's residential and industrial neighborhoods, serves as one of the main water sources for the city. To protect the water quality for years to come, the city formed the Roanoke Stormwater Utility. To achieve its goals, the utility needed a reliable, efficient inspection system.

#### **SOLUTION:**

**Envirosight's ROVVER X inspection platform** provided the efficiency the utility needed to assess its system for defects and allowed it to find any infiltration and exfiltration that came with that damage. It can be transported in built-out inspection trucks or vans, on the back of a pickup truck or out of an all-terrain vehicle. The crawler is also agile and maneuverable, with a short wheelbase and 0-degree turning radius that makes it easy to overcome any obstacle. The system has the power to tackle long runs, as it features 1,000 feet of lightweight, buoyant cable. It can crawl upstream or down, tackling offsets and inclines with ease.

**Result:** The Roanoke Stormwater Utility improved from inspecting 17,000 feet of pipe in one year to inspecting more than 100,000 feet of pipe in five months. This increase in inspection capacity dramatically improved its ability to identify line defects and ultimately reduce inflow and infiltration. Additionally, the team discovered nearly 200 miles of storm line that had been forgotten and neglected. The city now understands its collections system and can identify sources of stormwater pollution and infiltration and continue working toward its water-quality goals.

866-936-8476; www.envirosight.com



# MOBILE DEVICE ENABLES WATER LEAK DETECTION IN CHALLENGING PVC PIPING

#### **PROBLEM:**

The Florida Keys Aqueduct Authority is the sole provider of potable water for all of the residents of the Florida Keys and presently serves more than 44,000 customers within Monroe County. A history of leaks and several suspected active leaks were a good reason to target Simonton Street, where most of the pipes are PVC in the length of 6,963 feet. This area contains high water loss rates at 1,000 gph.

#### **SOLUTION:**

In January 2019, the authority initiated a pilot with **Aquarius Spectrum** to examine the suitability of its technology. The pilot was carried out by the nonrevenue water department in the authority in collaboration with Aquarius Spectrum and Trimble Water. Aquarius Spectrum installed seven hydrophone sensors to cover half of the selected pipeline. The sensors were installed 450 to 700 feet apart on aboveground hydrants and empty meter boxes. These sensors are part of the **AQS-SYS continuous monitoring system.** It provides a daily picture of the underground hidden leaks from an initial stage of their development. The sensors are equipped with radio frequency technology for optimal synchronization and transmit data to the Aquarius Spectrum cloud-based software via 3G/4G communication.

**Result:** After a couple of days, the AQS-SYS system detected two points of interest. In order to finalize and pinpoint the exact locations of those POIs, Aquarius Spectrum used its iQuarius iQ300 mobile leak detection device. The



actual leaks were around 50 feet from the alert location on the system. These leaks were identified by two hydrophones 518 feet apart. Thanks to the good results, the authority expanded its search territory from a single street to the entire south side of Key West.

www.aquarius-spectrum.com

## GRADE ADJUSTMENT SYSTEM STOPS SEVERE INFILTRATION

#### **PROBLEM:**

In late 2009, a southcentral Wisconsin municipality identified a manhole with a severe infiltration problem needing repair. The water was coming from an extremely high groundwater table due to an underground aquifer, and water was leaking through the joint between the concrete rings and precast manhole cone. This single manhole was contributing an estimated 20,000 gallons of clearwater every day, year-round.

#### **SOLUTION:**

**Cretex Specialty Products** had just introduced **PRO-RING**, a lightweight **manhole grade adjustment system** made from expanded polypropylene, and it was chosen for this repair as a trial. EPP is a high-strength, lightweight plastic, making it a suitable material to replace traditional construction methods using masonry materials. This system is watertight, fast, safe and cost-effective, with one man being able to complete an entire adjustment in minutes. On the day of the repair, the temperature was 15 degrees F, so everyone knew this would be a challenging repair, especially for trying to control the

groundwater. The manhole was excavated, and the frame and existing 20 inches of precast concrete grade rings were removed, exposing the top of the manhole cone. Two pumps were required to keep the water level down to allow the necessary surface preparation and the installation of PRO-RING to be com-



pleted. The total time required from the start of the excavation to PRO-RING installation and completed backfill was approximately 90 minutes.

**Result:** Since the installation was completed more than 10 years ago, this manhole has remained watertight, saving the municipality more than \$150,000 in treatment costs. **800-345-3764; www.cretexseals.com** 



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