PROJECT SHOWCASE: Better inspection, big improvements Page 26

iandimag.com
Spring 2018

I&I

INFLOW & INFILTRATION SOLUTIONS AND EQUIPMENT

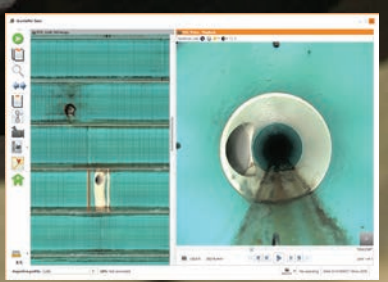
Supplement to:
MUNICIPAL SEWER & WATER

A BETTER FIX:
Joint seals save leaking sewer line
Page 36

Going to Great Depths

Kim Construction tackles I&I, no matter how far underground
Page 12

BEST PRACTICES
Page 18



DUKE'S
ROOT CONTROL, INC.
Product. Service. Guarantee.

SSO prevention starts here.

Duke's Razorooter® II is the only diquat-based herbicide registered by the EPA for controlling roots in sewer lines.

Duke's has sewer root control down to a science. Nearly 40 years of experience, 250 million feet of treated sewer lines, and a quality guarantee make Duke's the root and grease control company you can count on. This long-term success is possible because of what happens behind the scenes. Duke's trained team of experts in the laboratory, on the street and in the office constantly work to develop the best products, deliver world-class customer service and ensure every application is successful. Guaranteed. **Visit dukes.com or call 1-800-447-6687 today.**

Sewer root control done right.

GO GREEN WITH PREDL SYSTEMS

WWW.PREDLSYSTEMS.COM

MEET EVEN THE MOST AGGRESSIVE ENVIRONMENTAL AND SUSTAINABILITY TARGETS:

- Primary + Secondary Containment = **Dual Containment**
- **Primary Containment** by **Resilient, Monolithic** Concrete Protective Liner
- **Secondary Containment** by Steel-Reinforced Precast or Field Cast Concrete
- Proven **infiltration reduction** by specifying jurisdictions
- **More capacity** for conveyance of sewer
- **Carbon footprint reduction:** less pumping and treatment plant volume = reduced energy consumption & **measurable GHG reduction**
- Proven **maintenance cost reduction** in specifying jurisdictions
- **Blue Water Conservation**
- Extension of underground municipal infrastructure **useful life**, reducing both **environmental footprint** and overall **capital expenditure** of replacement and renewal projects
- **ISO 14001 certified** production facility
- ISO 14040 and 14044 compliant **Life Cycle Assessment** (Spring 2018 completion)

WITH PREDL SYSTEMS, YOU GET INDUSTRY LEADING CONCRETE PROTECTION WITH:

- Microbial and chemical **corrosion protection**
- **3rd party tested** and **Green Book compliant** product line
- Compatibility with all **new construction** and **rehabilitation** projects
- 30 years of **proven performance** in the most challenging environments and **100-year design life**
- Extended fabrication capabilities accommodating your specific requirements
- Either **precast** or **cast-in-place** applications

CONTACT US FOR DETAILED DOCUMENTATION AND CUSTOM ENGINEERING DESIGNS AND QUOTES.

INCLUDE PREDL SYSTEMS IN YOUR SPECIFICATIONS TO REACH YOUR GREEN TARGETS AND BENEFIT FROM OUR EXTENDED KNOW-HOW IN CONCRETE PROTECTION IN WASTEWATER CONVEYANCE SYSTEMS.

SCAN ME

PERFORMANCE REPORT

INTERTEK CERTIFICATION
ISO 9001:2015
ISO 14001:2015

ISO 14040 IN PROGRESS

ISO 14044 IN PROGRESS

GET IN TOUCH

7520 Conrad Street, Burnaby, BC - V5A 2H7
Phone: +1.855.773.3562
Email: predl.online@predlsystems.com

Spring 2018

I&I

INFLOW & INFILTRATION SOLUTIONS AND EQUIPMENT

FOCUS: Inspection

PROJECT SHOWCASE

COVER STORY | 12

Going to Great Depths

Illinois contractor provides options for municipalities with inflow and infiltration problems.

By Ken Wysocky

COVER PHOTO: Kim Construction employee Felipe Servin trowels and brushes a final coat of Strong-Seal cement liner inside a manhole (The Strong Company). The Illinois-based company, owned by Kim and Lawrence Vallow, specializes in manhole rehabilitation. (Photography by Mark Hirsch)

PROJECT SHOWCASE

26

Long-Term View

A proactive approach to inspection and maintenance helps a small Colorado utility cut inflow and infiltration and sanitary sewer overflows.

By Kyle Rogers

BEST PRACTICES | **8**

Eyes in the Pipe

Well-trained CCTV operators form the backbone of any successful inspection program.

By Jim Aanderud

BEST PRACTICES | **18**

A Better View of Your Infrastructure

Digital side-scanning technology offers rapid condition assessment, enabling more informed decisions.

By Chris Parker

CASE STUDIES | **22**

Inspection

By Craig Mandli

Establishing Basin Size and Uniformity | 32

Avoid the three major pitfalls of rainfall-dependent inflow and infiltration studies for more accurate results.

By Patrick Stevens, P.E., and Peter Frick

A BETTER FIX | **36**

Finding a Fix for 473 Leaks

HydraTite seals provide a no-dig solution after improper sewer line installation.

By Cynthia Smith

NEXT ISSUE:

Summer 2018

FOCUS: Monitoring | Pinpoint unwanted flow and focus your I&I abatement program

MANHOLE INFILTRATION SOLUTIONS

FLEX SEAL UTILITY SEALANT®

An aromatic urethane rubber noted for extreme toughness, elongation, abrasion, resistance, acidic resistance and longevity.

INFI-SHIELD® UNI-BAND

An inexpensive and permanent method of externally sealing the grade adjustment ring area of a manhole or catch basin.

AQUA SEAL®

A dual component hydrophobic polyurethane water stop system designed to stop high infiltration in precast or brick lined structures.

MANHOLE INSERT

Stop the unwanted inflow of rainwater through manhole covers.

GATOR WRAP®

Forms a continuous rubber seal on a manhole joint which prevents water and soil from infiltrating through the manhole, catch basin or concrete pipe joint.

S.S.I. SEALING SYSTEMS, INC.
Sealing Systems, Inc.
800-478-2054
www.ssisealingsystems.com

Advertiser Index

Spring 2018

ADS LLC **7, 17**

Aries Industries, Inc. **Back Cover**

Composite Access Products (CAP) **31**

Cretex Specialty Products **33**

CUES, Inc. **25**

Duke's Root Control, Inc. **2**

Hurco Technologies, Inc. **35**

HydraTech Engineered Products **37**

Inflow Seal **35**

Logiball, Inc. **37**

Mr. Manhole **39**

Parson Environmental Products, Inc. **6**

PREDL Systems North America Inc. **3**

RootX **9**

Sealing Systems, Inc. **5**

SmartCover Systems **21**

SpectraShield Liner Systems **11**

Marketplace **39**

I&I

Published four times yearly by COLE Publishing, Inc.
1720 Maple Lake Dam Rd., PO Box 220, Three Lakes, WI 54562

Call toll free 800-257-7222 | Outside of U.S. or Canada call 715-546-3346
Mon.-Fri., 7:30 a.m.-5 p.m. CST

Website: iandimag.com | Email: info@iandimag.com | Fax: 715-546-3786

SUBSCRIPTIONS: I&I™ is included quarterly (Jan., April, July, Oct.) along with a one-year (12 issues/monthly) subscription to Municipal Sewer & Water™ (MSW). MSW and I&I are free for qualified subscribers in the United States, Canada and Mexico. A qualified subscriber is any individual or company in the United States, Canada and Mexico that maintains, manages, designs or installs municipal or commercial sewer, water and storm infrastructures. To qualify, visit www.mswmag.com or call 800-257-7222.

Non-qualified subscriptions are available at a cost of $60 per year in the United States and Canada/Mexico. Subscriptions to all other foreign countries cost $150 per year. To subscribe, visit www.mswmag.com or send company name, mailing address, phone number and check or money order (U.S. funds payable to COLE Publishing Inc.) to the address above. MasterCard, VISA, American Express and Discover are also accepted. Include credit card information with your order.

Our subscriber list is occasionally made available to carefully selected companies whose products or services may be of interest to you. Your privacy is important to us. If you prefer not to be a part of these lists, please contact Nicole at nicole.labeau@colepublishing.com.

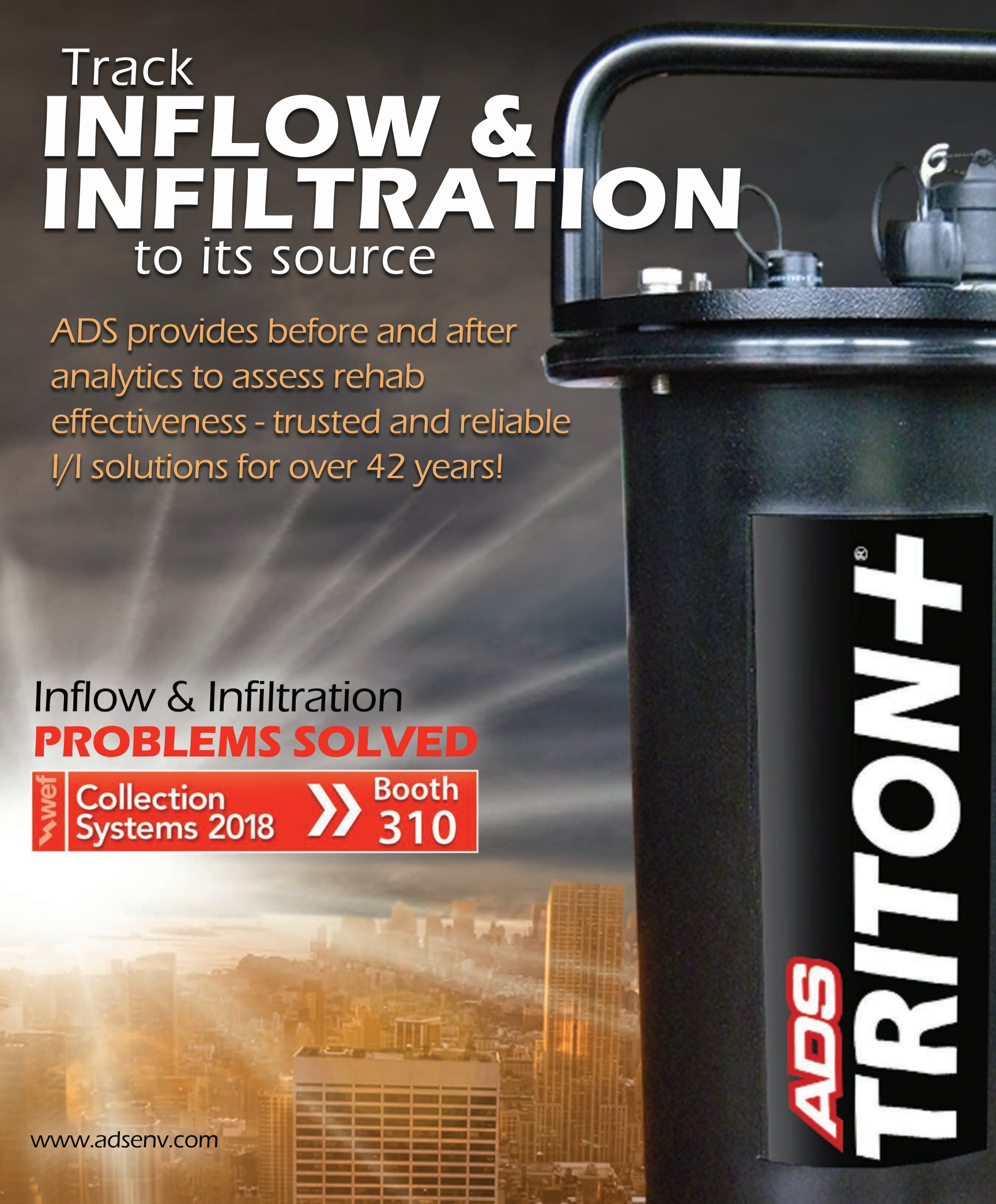
ADVERTISING RATES: Call Jim Koshuta at 800-994-7990 or email jim.koshuta@colepublishing.com. Publisher reserves the right to reject advertising which it considers misleading, unfair or incompatible with the character of the publication.

Jim Koshuta

EDITORIAL CORRESPONDENCE: Address to Editor, I&I, P.O. Box 220, Three Lakes, WI, 54562 or email editor@iandimag.com.

REPRINTS AND BACK ISSUES: Visit iandimag.com for options and pricing. To order reprints, call Jeff Lane at 800-257-7222 (715-546-3346) or email jeff.lane@colepublishing.com. To order back issues, call Nicole at 800-257-7222 (715-546-3346) or email nicole.labeau@colepublishing.com.

CIRCULATION: 9,577 copies, four times yearly.


Track
INFLOW &
INFILTRATION
to its source
ADS provides before and after analytics to assess rehab effectiveness - trusted and reliable I/I solutions for over 42 years!
Inflow & Infiltration
PROBLEMS SOLVED
wef
Collection Systems 2018
Booth 310
www.adsenv.com
ADS
TRITON+

EYES IN THE PIPE

Well-trained CCTV operators form the backbone of any successful inspection program

By Jim Aanderud

Properly trained operators are critical for success in any pipeline inspection program. Rushing a candidate into the operator's chair is a common but big mistake.

Proper inspection lays the foundation for any successful inflow and infiltration abatement program, and proper inspection requires proper training.

The No. 1 decision that will make or break your CCTV inspection program is the operator who runs the equipment. The wrong person will sink your program faster than anything else, while the right one will ensure everything runs smoothly.

There are three areas to consider when hiring a CCTV operator — innate skills, learned skills and attitude.

Innate skills are the talents a person is born with. These include things like intelligence, aptitude, organization and meticulousness.

Learned skills are abilities that a person has picked up from life experiences. Things such as computer knowledge, electrical capabilities and mechanical capabilities fall into this category.

The last area to consider is a person's attitude and level of maturity. This may be a little more difficult to determine from an application and interview. Make sure to ask challenging questions, and do your homework by checking the person's work history and calling references. Ask those who have worked with the person how he or she reacts under pressure and when faced with difficult tasks.

SLOW AND STEADY

Training a good CCTV inspection operator doesn't happen by accident; it requires a clear and focused plan. This will ensure that training covers every important and necessary point. A plan will also provide a measuring stick of the candidate's progress.

A common mistake that agencies make is rushing a candidate into the operator chair. Many utilities want to get a new operator working as soon as possible, so they tend to hurry them through the training process.

Ideally, a candidate should be placed in a support role to learn the outside of the truck first — six months to a year is ideal. Once the individual is sitting in the operator's chair, they are so focused on the inspection process that they miss learning some of the more important lessons. During the training period, the candidate must be given sufficient time to learn and observe the effect they have on traffic, pedestrians and safety.

It's critical that the person training the candidate be a competent pipeline inspection operator. This individual will be passing on knowledge as well as habits, both good and bad.

NASSCO and Pipeline Assessment and Certification Program training is an important part of the overall training. However, you need to refrain from sending the candidate to this training too soon. Having just been introduced to the industry, the person will need some time to take in their new surround-

(continued)

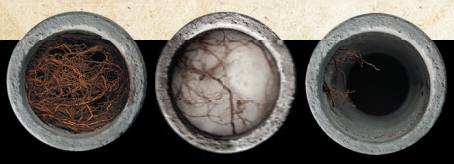
ROOTX CASE STUDY No. 25

"I trust RootX® because it works."

Steve Cijka, Chief Operator, Town of Brandon, VT

In Brandon, Vermont — where Steve Cijka is responsible for preventing root damage to the town's sewer lines — a lot of the pipes were laid in the 1930s and are easy prey for the roots of Brandon's many sugar maples. Until they started using RootX®, Steve and his crews used a root cutting machine and the slow going made for a lot of unpleasant work in the 20-degree Brandon winters. Since he switched to RootX®, Steve reports that he sees the evidence of RootX® working in real time, killing roots while not damaging the town's beloved trees.

Vermont Sugar Maple
[acer saccharum]



THE RIGHT SOLUTION. RIGHT NOW.

- **EPA-accepted, proven root-killing solution**
- **Easily applied by sewer crews with your existing equipment— no waiting for contractors**
- **Cost effective and guaranteed to work up to 36 months.***

Eliminate SSOs today! Visit www.RootX.com, or talk to your RootX® representative at 1-800-844-4974.

ROOTX®

*visit www.rootx.com/municipalities/guarantee for details.

LEFT: An inspection crew lowers a camera into a remote manhole to inspect the line. Proper setup and technique is important on every job. BELOW: Equipment care and maintenance are critical parts of training. The success of an inspection program is based on the ability to maximize efficiency in the field.

Many operators are asked to begin inspecting pipe after only receiving a few days of factory orientation and PACP training. As valuable as this training is, it doesn't come close to sufficiently preparing an operator.

ings. Once they have had time to acclimate and learn the industry terminology, they will be able to absorb and retain much more of the training.

Many operators are asked to begin inspecting pipe after only receiving a few days of factory orientation and PACP training. As valuable as this training is, it doesn't come close to sufficiently preparing an operator. There are many other areas that need to be learned and practiced.

Training goals should be documented and then checked off as milestones are achieved. Ensuring that each area is covered in detail will guarantee the operator is fully competent at the conclusion of the training period.

THE FOUR PILLARS

Training can be broken down into four areas:

1. Safety, setups and traffic control are a great place to begin. By observing how the CCTV van pulls up to the work site and sets up traffic control, they will learn the proper way by example. It's important to always remind them of the safety concerns while working in and around traffic. Contractors need to teach them the right method for opening manholes and then maintaining a safe work environment while the manhole is open. Finally, you need to give them time to observe the effect on traffic flows and pedestrians while encouraging them to make appropriate changes when necessary.

2. Equipment care and maintenance are critical parts of training. The success of a CCTV inspection program is achieved based on the candidate's ability to fix broken equipment and keep it working in the field. The candidate must learn the right way to configure the CCTV camera and crawler for various pipe sizes and perform regular preventive maintenance. They should learn how to make minor repairs and how to diagnose major ones.

Maintaining the generator and vehicle engine is another important part of training. The candidate must be instructed on the proper way to perform daily fluid and engine checks and document them accordingly.

3. Inspection software and data management may be one of the most challenging areas of CCTV inspection training. The overall success of an operator will depend greatly on their ability to thoroughly learn the inspection program. They must become very familiar with creating databases, setting up new inspections, conducting inspections and then exporting the data out of the program.

Computer ability is key. Without a strong knowledge of Microsoft Windows, a candidate will be lost when it comes time to moving and exporting files to external hard drives and merging databases.

4. Inspecting pipe is the core of an operator's function. With PACP certification under their belt, they should be familiar with the process of driving a camera down a line and making correct observations. Operator candidates should be encouraged to memorize the codes in order to become more efficient during the inspections.

Candidates need be given examples of what high-quality inspection videos look like. They should take the time to watch good videos in order to emulate correct methods for inspecting pipe. Last of all, as they begin to inspect pipe, their videos and reports should be reviewed thoroughly by a seasoned operator in order to catch incorrect procedures long before they become bad habits.

One of the best ways to prepare a future operator is by placing them in a support role. With early exposure to the industry, each party (operator and contractor) can decide if it's a fit long before time and money are invested in training.

Training a future operator in a support role will also help absorb some of the cost of training and provide a perfect environment to prepare a quality pipeline inspection operator. I&I


SpectraShield®
YOUR DEFENSE AGAINST CORROSION & INFILTRATION
Wastewater Structure Rehabilitation
25TH ANNIVERSARY
SINCE 1993
PROVEN PROTECTION
Manholes | Lift Stations | Wetwells | WWTPs
» Rapid Installation
» Strength & Flexibility
» 100 year Design Life
» Superior Return on Investment
PRODUCTS:
SpectraShield®
SpectraPrep®
SpectraGrout®
SpectraPrime®
SpectraGarde®
SpectraCat®
1-800-284-2030 | SpectraShield.com
Layers of quality, years of protection.

Julian Banuelos (left) and Roberto Lopez finish installation of a metal manhole column over a caulk ring to seal the Ladtech riser ring as they rebuild an existing brick manhole.

"Grouting and cement linings work hand in hand. Groundwater moves around and finds the weakest spots in manholes, so we use the two technologies together for the best success." Brett Vallow

PROJECT SHOWCASE

Going to Great Depths

Illinois contractor provides options for municipalities with inflow and infiltration problems

STORY Ken Wysocky | **PHOTOS** Mark Hirsch

Some infiltration problems are simply beyond what the average utility can handle on its own. That's where Kim Construction comes in.

During the last 35 years, Kim Construction has established itself as a national player in a niche but fast-growing market: manhole rehabilitation. The company's blueprint for success centered on quick adoption of emerging technology, fiscal prudence and quality workmanship.

The suburban-Chicago-based company, owned by Kim and Lawrence Vallow, now stands as a multimillion-dollar-a-year business that has rehabbed more than 50,000 manholes. The company has completed projects all over the country, including Arkansas, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, Oklahoma, Texas and Wisconsin. Not bad for two former physical education teachers who took a calculated risk and made an abrupt career change back in 1982.

"When we saw an opportunity, we seized it and capitalized on it," says Kim, the majority owner of the company, which is a certified women's business enterprise. "If you see an opportunity, research it … then take a chance and go for it."

Based in the southern Chicago suburb of Steger, the company has grown significantly since the Vallows started out with one truck and a backhoe, tying in residential sewer laterals in nearby East Hazel Crest as a side business to their teaching careers. Today, the company employs 20 people, serves customers mainly throughout the Upper Midwest and owns a fleet of equipment that represents an investment of several million dollars.

LEARNING COMES NATURALLY

The Vallows graduated from college in 1970 with education degrees: Kim from the University of Illinois, and Lawrence from the University of Northern Colorado. They both taught for about five years, Kim at a local grade school and Lawrence at a local high school. Lawrence also worked briefly for a paving contractor, but everything changed when East Hazel Crest switched from septic systems to sewers around 1979.

Roberto Lopez levels an existing brick manhole using Strong-Seal QSR cement (The Strong Company) prior to installing the riser ring.

KIM CONSTRUCTION
Steger, Illinois

FOUNDED:
1982
OWNERS:
Kim and Lawrence Vallow
EMPLOYEES:
20
SPECIALTIES:
Manhole rehabilitation
SERVICE AREA:
Primarily Midwest states
WEBSITE:
www.kimconstruction.com

"We saw this as an opportunity to establish a little startup business, doing the tie-ins for local residences," explains Kim, age 65. "After a few years, we decided to do it full time."

Opportunity knocked again when the Vallows realized that paving contractors needed manholes adjusted during road projects. Moreover, the Environmental Protection Agency was just starting to order communities nationwide to take steps to stop sewer system inflow and infiltration. As such, government funding for such projects was on the rise.

So the Vallows decided to get into chemical grouting, a process in which grout is injected by a pump through holes drilled into the inside of manholes. The Vallows invested in equipment made by ChemGrout, which provided training.

A key turning point occurred in 1983, when Kim Construction won a bid to grout 700 manholes in nearby Chicago Heights, working as a subcontractor for a prominent general contractor. "All of a sudden, we were in the big leagues," she notes. "They took a chance on us and gave us a foothold in the industry for which we're still grateful today."

It was daunting to tackle such a large project, she admits, but also a great opportunity. It's also a vivid example of the nothing-ventured, nothing-gained mentality that spurred the company's growth, as that project led to more work in the following years.

ROLL WITH THE CHANGES

Another hallmark of the company's growth has been an ability to adapt to changing technology. A good example was the emergence in the late 1980s of cementitious spray lining, in which a pump sprays a layer of fiber-reinforced mortar that bonds to the interior of a manhole. It enhances the structural integrity of a manhole and often is used in conjunction with chemical grouting.

Responding to demand for the new technology, the Vallows invested in a Strong-Seal cementitious spray-lining rig made by The Strong Company in 1991. After getting employees trained and certified, the investment opened up an even larger segment of the manhole rehabilitation industry, Kim notes.

"Grouting and cement linings work hand in hand," explains Brett Vallow, 35, project manager and the son of Kim and Lawrence. "Groundwater moves around and finds the weakest spots in manholes, so we use the two technologies together for the best success. I'd say that we use both methods together about 50 to 60 percent of the time."

"You're really on edge most of the time. You need to know where everything is up on top. You don't want to accidentally kick a wrench or some other tool down the manhole."

Brett Vallow

The new technology trend continued when epoxy spray-lining emerged in the 1990s as another manhole rehab alternative. Depending on the application, epoxy lining can be used alone or along with cementitious lining and chemical grouting. The epoxy coating helps preserve the cementitious lining, which is vulnerable to damage from hydrogen sulfide, a gas that naturally occurs in manholes. After gauging demand, the company invested in a spraying rig made by Raven Lining Systems. "As the manhole rehabilitation industry evolved, so did we," Brett says.

Through word-of-mouth referrals, the company's reputation kept growing. In 1987, the company started a five-year project in Johnson County, Kansas, rehabbing more than 10,000 manholes.

"Our secret sauce is our knowledge and our experience, combined with

a great safety record on confined-space-entry work," Brett says. "With knowledge comes efficiency and the ability to finish a project in a timely manner."

A fleet of quality equipment also plays a role. Along with rigs made by ChemGrout, The Strong Company and Raven Lining Systems, the company relies on Ingersoll Rand and Atlas Copco CMT air compressors, skid-steers made by New Holland Construction, backhoes made by New Holland Construction and Ford, a Takeuchi track excavator, Martin Diesel generators, epoxy sprayers made by AirTech Spray Systems, Water Cannon Inc. - MWBE and Hotsy Cleaning Systems pressure washers, a gas detector manufactured by BW Technologies / Honeywell, and epoxy-thickness testing equipment made by DeFelsko and Elcometer USA.

Kim and Lawrence Vallow, founders and owners of Kim Construction

Brett Vallow, project manager

TACKLING THE TOUGH JOBS

The Vallows don't mind tackling challenging jobs, like rehabbing a manhole for the Milwaukee Metropolitan Sewerage District that was 105 feet deep — a record depth for the company. That 60-inch-diameter manhole, which connected to a 74-inch gravity mainline, was part of a nine-manhole rehab project the company completed in 2011, Brett says.

"One of most challenging aspects is that we had to cut out all the manhole rungs — about 100 in all — and put in new ones," he explains. "So our guys were suspended (in harnesses) at certain points in the project. We started from the bottom up ... it's a little intimidating to go 105 feet down and start your work." For lighting, employees clipped halogen lamps onto the rungs.

MANHOLE REHAB REPELS INFLOW AND INFILTRATION

When Kim Construction first started rehabbing manholes in 1982, the only technique available was chemical grouting. Since then, new technologies have periodically emerged to the point that the Steger, Illinois-based company now offers customers three different solutions that are often used together: grouting, cement lining and epoxy lining.

With chemical grouting, company technicians drill holes through the manhole's walls from the inside. Then they use a grout-pumping rig made by Graco to inject the grout, which swells and encapsulates the soil outside the manhole to form a protective seal, says Brett Vallow, project manager and the son of owners Kim and Lawrence Vallow.

How many holes must be drilled on average? "It depends on what you're grouting," Brett says. "If it's a barrel joint around the manhole, you might need four to six holes. If you're grouting at a pipe seal, you'll probably need at least three holes at the pipe connection and at the bench connection as well."

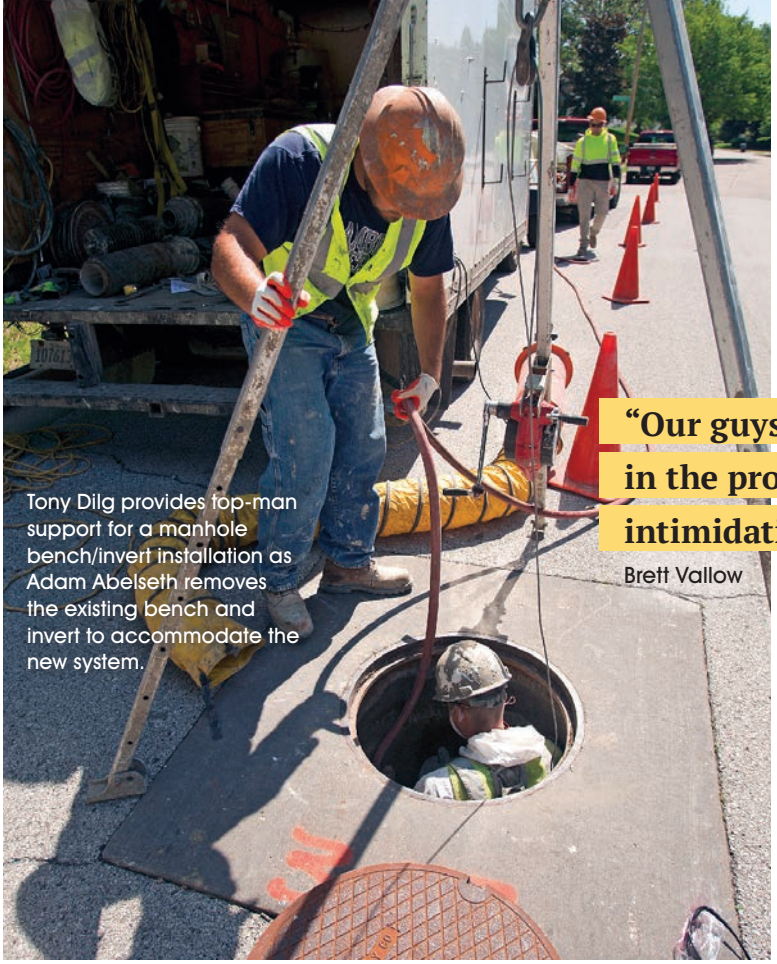
The company uses Avanti International grout products — either acrylamide or urethane grouts. The former is better suited for regions where frost occurs because it's stronger and less vulnerable to groundwater contamination. Urethane grouts are more expensive and better suited for corbel and pipe-sealing applications, he says.

A hand-sprayed cement liner is usually applied in conjunction with grouting. A cement lining is the most cost-effective way to fix an old brick manhole because the liner adds structural strength. Technicians use ChemGrout CG-570 pumping rigs and cement products made by The Strong Company. "With a cement liner, you effectively create a new manhole within the old brick manhole, which has hundreds of thousands of joints," Brett says. "It has the strength of 9,000 psi concrete."

Some cement lining blends include calcium aluminate, which fights decay caused by hydrogen sulfide gases that naturally occur inside sanitary sewers. "Sometimes we use it even on precast concrete manholes because if they're tied into a force main, they're exposed to extremely high gas levels that decay the concrete — make it chalky and soft," he explains.

The third technique involves spraying an epoxy coating on the cement liner. Kim Construction uses epoxy-pumping rigs made by AirTech Spray Systems and epoxies made by Raven Lining Systems. Most times, project specifications will dictate how many of the three technologies are used, but the company almost always does chemical grouting before applying a new cement liner, he notes.

The epoxy lining provides only protection from corrosion; it adds no structural strength the way a cement liner does. It can be applied only if the manhole substrate is in good condition. It's usually applied about 1/8 to 1/4 of an inch thick. "We mostly see epoxy being specified on interceptor manholes with higher gas levels and, as such, more corrosion," Brett says. "We also see it specified more often for lift stations, which also are exposed to very high amounts of hydrogen sulfide gases."



Tony Dilg provides top-man support for a manhole bench/invert installation as Adam Abelseth removes the existing bench and invert to accommodate the new system.

Brett Vallow

That manhole alone, which required both cementitious lining topped by an epoxy coating, took about 25 days to line. That included a week for the concrete lining to cure. The manhole was located in the middle of a busy road, so equipment, safety gates, and other items had to be set up and broken down each day in order to reopen the street at 4 p.m.; setup and takedown took about two hours every day, he says.

Providing proper ventilation for the manhole, which contained high levels of hydrogen sulfide, posed another challenge since the manholes upstream and downstream were a quarter-mile and about 500 feet away, respectively. "They definitely weren't the usual 300 or 400 feet apart," Brett notes. "So we had to put safety gates around them (the downstream manhole was also deep — about 80 feet) with station employees there to man them. The last thing we wanted was someone to take a fall."

"Another big challenge was communication with the crew," he adds. "We used walkie-talkies to communicate. Sometimes we'd also put an extra man between the bottom man and the top to relay messages and equipment. It gets too confusing if too many people are trying to communicate (with the bottom man), so it's easier to communicate through just one point man. Things definitely got easier the closer we got to the top."

SAFETY COMES FIRST

The biggest consideration with such deep manholes is safety. Employees up top were tethered to safety lines, and anyone working in the manhole was tethered to two safety lines, just in case one failed. "You're really on edge most of the time," Brett says. "You need to know where everything is up on top. You don't want to accidentally kick a wrench or some other tool down the manhole."

But the company had a valuable advantage: previous experience with deep manholes, including 60-footers in Kansas City, Missouri, in the 1990s and 75-footers in another part of Milwaukee in the mid-2000s. "So we sort of eased into it over the decades," he says. "We basically used the same techniques and a lot of what we'd already learned, just on a bigger scale.

"We also knew things would go slower because the project involved a lot of handwork," he continues. "You just have to keep things calm and orderly. You don't want workers to feel rushed. We knew from the start it would be a slower go, so we factored that into our proposal."

The company completed another challenging job in 2012 in Hot Springs, Arkansas, rehabbing between 2,500 to 3,000 manholes — many of them more than a century old. The two-year-long project was complicated by the fact that the city is a popular tourist destination because of its 1800s and early 1900s bathhouses (fed by hot mineral springs) on historic Bathhouse Row downtown and the famous Hot Springs National Park on the north end of the city.

Many of the manholes downtown were made of brick and dated back to the 1880s. To seal the manholes, the company used chemical-injection grouting and cementitious lining; many of the manholes also required frame-and-grade adjustments. Access was a challenge, especially with so much pedestrian traffic, which had to be rerouted. "At the same time, we had to try to keep disturbance to a minimum — finish all excavation work as quickly as possible," Brett notes.

"Our guys were suspended (in harnesses) at certain points in the project. We started from the bottom up … it's a little intimidating to go 105 feet down and start your work."

Mineral deposits inside the manholes, caused by groundwater I&I, also posed a challenge. Crews used everything from small pneumatic chipping hammers to electric roto-hammers to high-pressure water jetters to prepare the manholes for relining.

PLENTY OF MANHOLES LEFT

Brett says the future outlook for manhole rehabilitation work is very good, thanks to an ever-increasing population in the U.S. and an aging infrastructure. As a matter of fact, there are 20 million manholes in America, with many of them in need of rehabbing, according to the EPA.

"Manholes may be underground and out of sight, but you can't put off fixing them when they become a problem," he points out. "Even in small communities, there are a lot of manholes when you consider there's one every 300 to 400 feet. If you divide the total length of sewer lines in our country and divide it by 300 or 400, it's a shockingly high number. So I think we're just scraping the surface in our markets." I&I

Featured products from:

Atlas Copco CMT
800-732-6762 | www.atlascopco.us

Avanti International
800-877-2570 | www.avantigrout.com

BW Technologies / Honeywell
888-749-8878 | www.honeywellanalytics.com

ChemGrout
708-354-7112 | www.chemgrout.com

Graco, Inc.
612-623-6000 | www.graco.com

Hotsy Cleaning Systems
800-525-1976 | www.hotsy.com

Ingersoll Rand
704-655-4000 | www.ingersollrandproducts.com

Ladtech, Inc.
877-235-7464 | www.ladtech.com

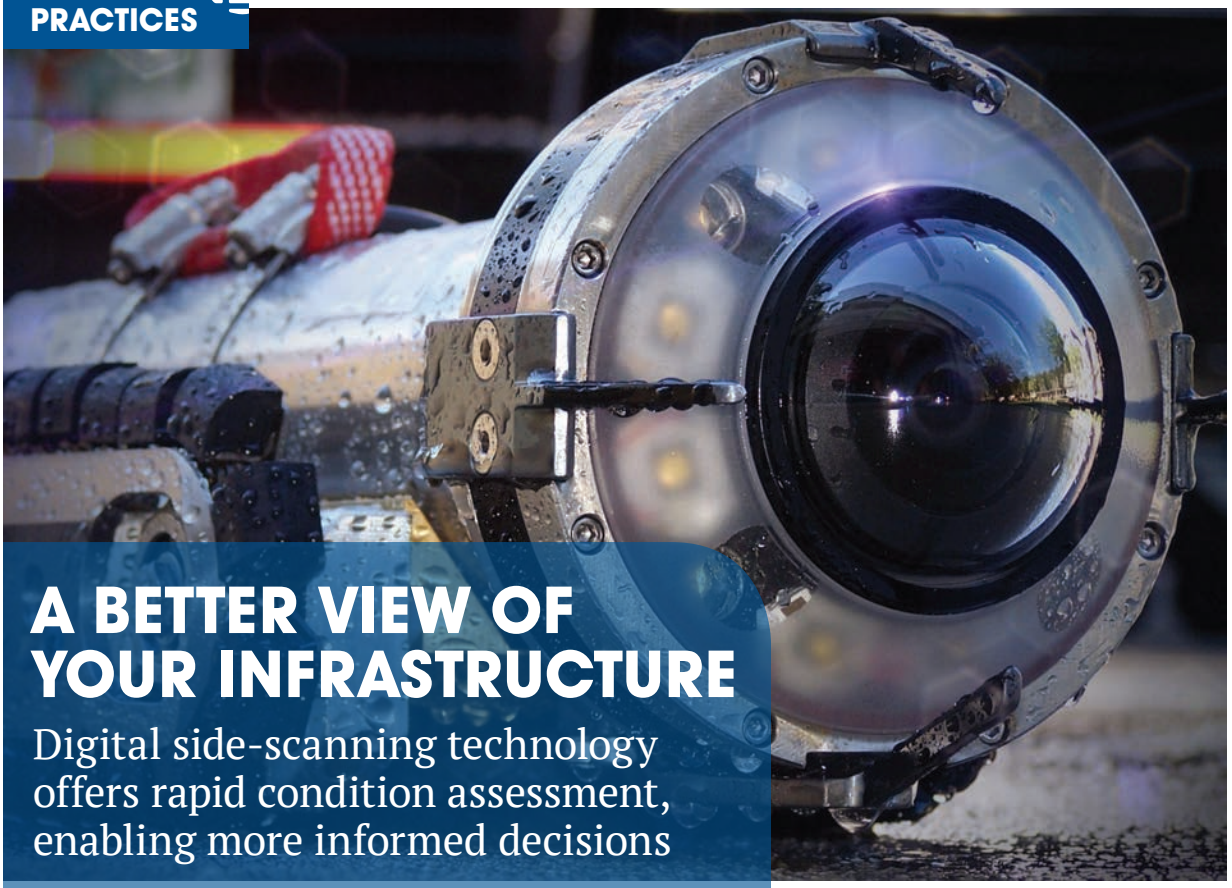
Raven Lining Systems
800-324-2810 | www.ravenlining.com

The Strong Company, Inc.
800-982-8009 | www.strongseal.com

Water Cannon, Inc. – MWBE
800-333-9274 | www.watercannon.com/catalogrequest.aspx


Your city is now safe from
SEWER OVERFLOWS . . .
ECHO
ADS
ECHO
Advanced Sewer Level Monitoring
• System-wide performance at a glance
• Detect overflow conditions early
• Optimize sewer cleaning
• Eliminate customer complaints
wef
Collection Systems 2018
Booth 310
ADS
www.adsenv.com/echo

BEST PRACTICES



Digital side-scanning is becoming more common as municipalities embrace new technologies that enable rapid assessment of pipelines and provide high-quality data to efficiently quantify repair and replacement needs.

A BETTER VIEW OF YOUR INFRASTRUCTURE

Digital side-scanning technology offers rapid condition assessment, enabling more informed decisions

By Chris Parker

There is somewhere between 700,000 and 800,000 miles of public sewer running below homes, businesses, parks and playgrounds across the U.S. — much of it largely brittle if not broken.

Improving that infrastructure first requires thorough inspection and condition assessment to properly catalog, document, quantify and prioritize the repair or replacement of each asset.

Considering the quantity of assets and how swiftly the pipeline infrastructure is deteriorating, it will be difficult to meet the inspection challenges most municipal entities are facing utilizing traditional CCTV inspection.

To meet the demand, municipalities may consider embracing new technologies that enable rapid assessment of pipelines while providing the highest quality data to efficiently quantify repair and replacement needs.

Digital side-scanning technology offers a solution for municipal entities to meet the ever-increasing challenges and demands of America's failing sanitary sewer and stormwater systems.

NEW APPROACH

The American Society of Civil Engineers estimates the need for $300 billion in the next 20 years to revitalize and rebuild America's wastewater infrastructure, with 75 percent slated toward the rebuilding and rehabbing of pipelines alone.

With less staff, limited resources, little or no federal funding, and the inability to turn back time, most municipalities face a harsh reality as to how to address these failing pipelines. An even harsher reality is that most municipalities lack the proper inspection equipment to perform thorough condition assessments of all of their pipeline assets within an appropriate amount of time.

Having an active pipeline inspection program with traditional CCTV equipment in some cases is no longer sufficient to meet the demands most municipalities face. Every dollar must be spent as wisely as possible.

By utilizing digital side-scanning technology, a thorough 360-degree visual assessment is accomplished in a fraction of the time it takes for a traditional CCTV inspection. The advantages of digital side-scanning inspection are quantifiable and enable the operations and engineering teams to work together collectively to rapidly perform condition assessments of an entire pipeline system, but most importantly, to collect high-quality, usable data to make appropriate repair and replacement calls to ensure defensible, efficient and wise spending.

THOROUGH ASSESSMENT

While fixing pipes will correct overflows and other pipe-related issues, the difficulty in that process begins far before making the necessary repairs or replacement. With over 700,000 miles of public sewers in the U.S., these pipes must initially have a condition assessment performed via a visual inspection in order to determine whether they are in good standing, need of repair or complete replacement. This proves to be troublesome for most municipal utilities that are underequipped to properly inspect the current state of their sanitary and stormwater systems.

From the smaller town of Framingham, Massachusetts, with 68,000 residents who were facing $200 million for repairs, to the cautionary tale of Atlanta's $2 billion overhaul of its system, the stories continue to repeat over and over again from communities across the U.S. having major sewer issues, with few reported on a national level. Sanitary sewer backups are not just an inconvenience, but also a major public health concern.

Having raw sewage in streets, yards, and sidewalks is not acceptable, yet not nearly enough is being done. Municipalities can avoid the majority of these situations by having an effective and efficient pipeline condition assessment program and utilizing the latest technologies available to rapidly inspect an entire city system.

Continuing with traditional pipeline inspection methods in today's climate will not allow utilities to get ahead of the problems at hand or to make informed decisions at a rapid rate to help avoid more sewer system problems.

While population density is a good indicator of areas with the most repair and replacement needs, every municipality, regardless of size, should have a thorough condition assessment program in place for their pipeline assets.

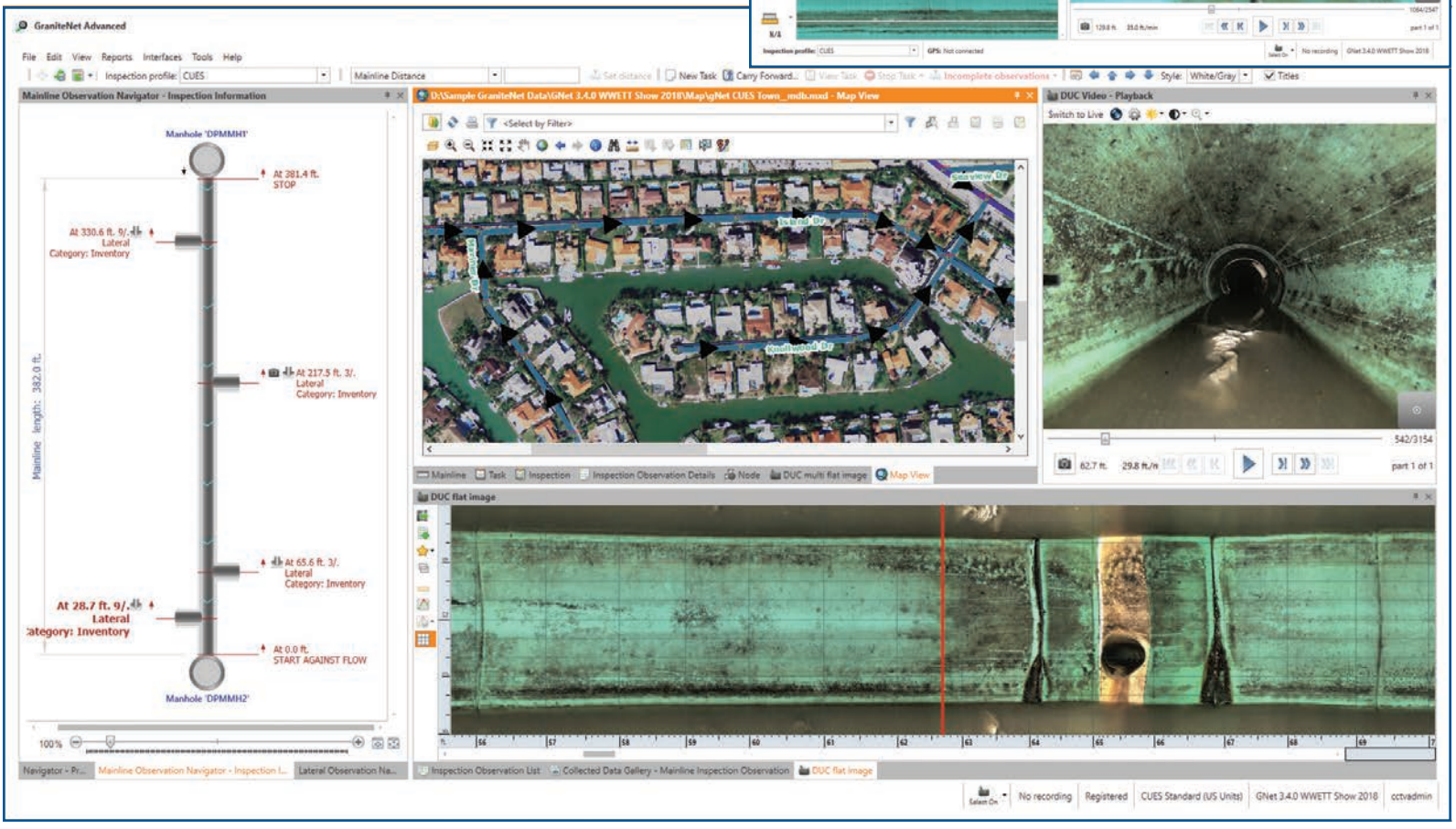
While analog pan-and-tilt camera technology has been the standard for pipeline assessment for over 20 years, this technology has never been known to save time or rapidly expedite the assessment process. Given the current state of the pipeline assets in this country, a more thorough and rapid approach was necessary to meet the true needs of municipal entities and the challenges they face.

Any municipality that does not have an active inspection program is doing a disservice to the residents and the city. They are essentially spending capital funds blindly for repairs and replacements on pipes that may never have been assessed or that have not been assessed for a long time.

Serious pipeline problems will continue to develop unnoticed due to the lack of a pipeline assessment program. These problems include:

- Infiltration into the system causing great costs at the processing plant not being addressed.
- Continued hydrogen sulfide pipe wall corrosion not being addressed.
- Poor construction and workmanship not being exposed.
- Protruding lateral services causing reduced line capacity and contributing to blockages.
- Excessive settling of solids in pipelines, which can lead to obstruction or blockages.
- Excessive buildup of grease, slime and other viscous materials leading to blockages.

Side-scanning camera systems work by capturing several images per second, which are then stitched together, producing three deliverables: high-resolution video, a flat unfolded view of the pipe from manhole to manhole (multiflat view), and an expanded flat unfolded view of the pipe for close-up views and measurements of defects.



All of the above detrimental factors could be mitigated along with a directly related substantial reduction of capital expenditures via a regularly scheduled pipeline condition assessment program.

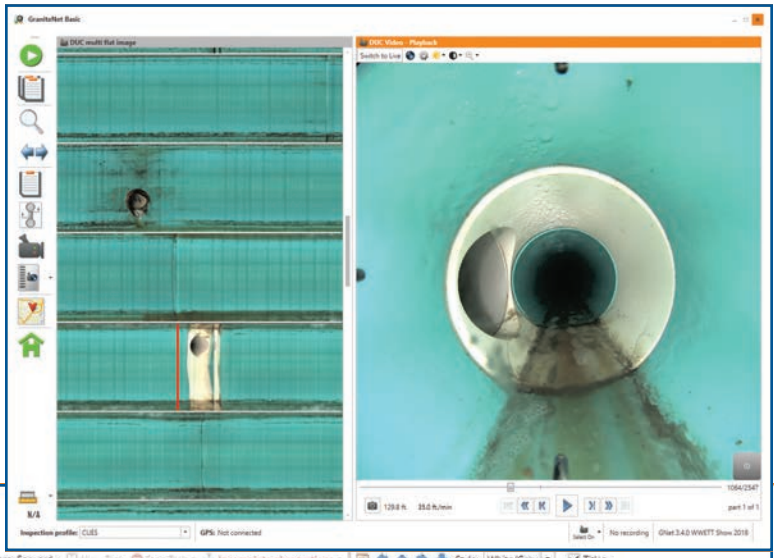
Most cities lack any level of visual data of their pipelines and have no data for comparison purposes when additional assessments are performed. This lack of data leads to further indecision or wrong decisions being made for pipeline repairs.

SOLUTION TO THE PROBLEM

Early adopters of digital side-scanning technology have been more than pleased with the results. One of those early adopters, McKim & Creed, an engineering firm with numerous locations throughout the U.S., has been using the technology since May 2014.

Greg Anderson, vice president for McKim & Creed, feels that their pipe-

By removing the need to pan and tilt while traversing the structure, digital side-scanning saves time and increases production. The camera captures the entire 360 degrees of the pipe.



line condition assessment programs for various entities has doubled in production over traditional analog surveys.

Anderson says without a doubt that the quality of the digital side-scanning data enables his end clients to make better informed decisions for repair and replacement over that of traditional CCTV surveys. "The quality of the video stream is substantially more defined, and the evaluation process much easier to complete," he says.

Digital side-scanning inspection technology enables rapid assessment of the pipeline structure with the highest quality scan of the pipe possible without the need to stop during inspection. It's important to understand the differences between the previous technologies available and that of the newest technology, digital side-scanning cameras.

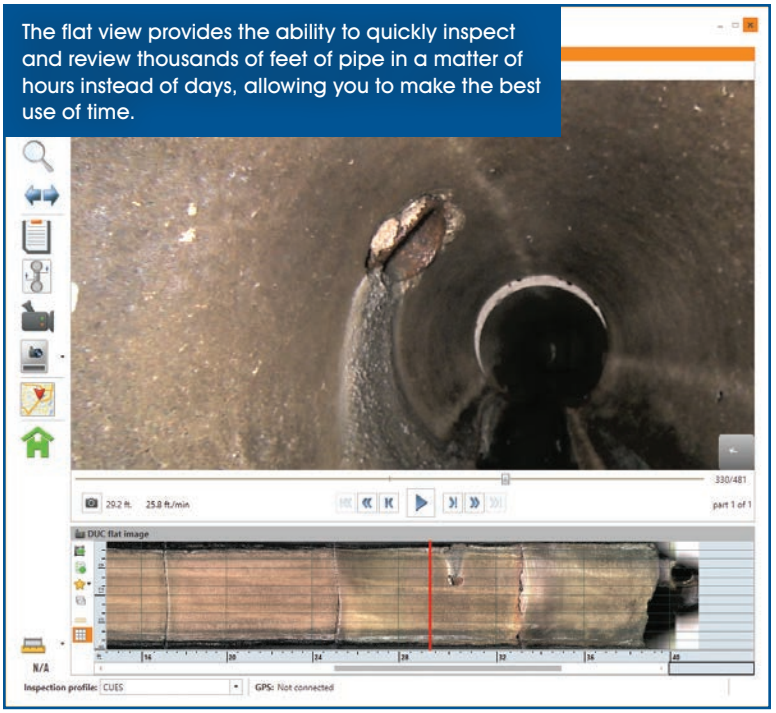
Side-scanning camera systems are designed to provide the highest quality video/photos for review along with significantly increasing footage while augmenting the quality of data available for condition assessment.

The technology works by capturing several images per second, which are then stitched together, producing three deliverables: high-resolution video that is a permanent and accurate record with the ability to virtually pan, tilt, and zoom to any area of interest; a flat unfolded view of the pipe from manhole to manhole (multiflat view), and an expanded flat unfolded view of the pipe for close-up views of defects and to perform measurements.

The flat view provides the ability to quickly inspect and review thousands of feet of pipe in a matter of hours instead of days, allowing you to make the best use of the one resource that is not replaceable … time.

The digital side-scanning method saves you that most valuable resource. When compared to traditional analog camera surveys, the time savings are significant.

The positive results of digital side-scanning technology are echoed from numerous municipalities from across the U.S. that embraced the technology in its early stages and have significantly improved their position for the future while making better informed decisions on repair and replacement calls, enabling wise and efficient spending of public funds.



The flat view provides the ability to quickly inspect and review thousands of feet of pipe in a matter of hours instead of days, allowing you to make the best use of time.

The Metropolitan St. Louis Sewer District was one of the early pioneers in embracing the technology, and the results are clear. A footage report from September 2013 provided by the district showcases the type of production increases they are experiencing with the digital side-scanning systems over their remaining traditional CCTV systems.

The two digital side-scanning trucks outperformed the traditional CCTV systems by 4,023 feet. Essentially, the digital side-scanning trucks were three times more productive in the same working day than that of their traditional counterparts.

Beyond the potential increase in data collection, what's more important is the increase of quality sustained with the digital side-scanning technology over traditional systems.

The digital side-scanning technology advancement most notably enables users to view the interior of a pipe like never before, not missing a single detail.

By removing the need to pan and tilt while traversing the structure, the time savings and production instantly increase. The camera captures the entire 360 degrees of the pipe, which means fewer errors and elimination of repeat inspections and high-resolution images to ensure the condition assessment of the pipe will be accurate and properly coded. That results in the correct rehabilitation or repair call being scheduled.

Digital side-scanning technology is a comprehensive data collection platform that offers high-quality video inspections at a rapid rate that meets accelerated time frames for inspections, especially in regards to fulfilling consent decree requirements and Environmental Protection Agency expectations, enabling the end user to do more with less. Additionally, the system improves accuracy and consistency, even though inspections are completed within a compressed time frame.

Any municipality that does not have an active inspection program is doing a disservice to the residents and the city. They are essentially spending capital funds blindly for repairs and replacements on pipes that may never have been assessed or that have not been assessed for a long time.

CHALLENGES AHEAD

There are vast challenges ahead pertaining to wastewater infrastructure maintenance and rehabilitation. It is essential to adapt new condition assessment processes and systems such as digital side-scanning in order to meet these requirements. Traditional pipeline inspection has worked well for years, but most municipalities are faced with a new set of objectives and problems.

Not every new technology that enters the market is worth adapting. It is important to perform due diligence to verify that the new wastewater inspection systems now available will meet your long-term requirements, be cost-effective, and produce a positive return on investment.

Digital side-scanning technology will provide a comprehensive, 360-degree view of the pipeline while allowing rapid condition assessment to make intelligent, informed decisions on where to spend repair and replacement dollars. Pipeline condition assessment and maintaining a fleet of inspection vehicles is expensive. However, the expenses of not having an inspection program that utilizes the best available technologies on the market can be even greater.

Digital side-scanning technology can help you identify costly infiltration and thus save funds related to pumping, treatment and disposal. It can also help rapidly identify problem areas and major pipeline issues, which allows you to react before there is a backup and possible fines due to an overflow.

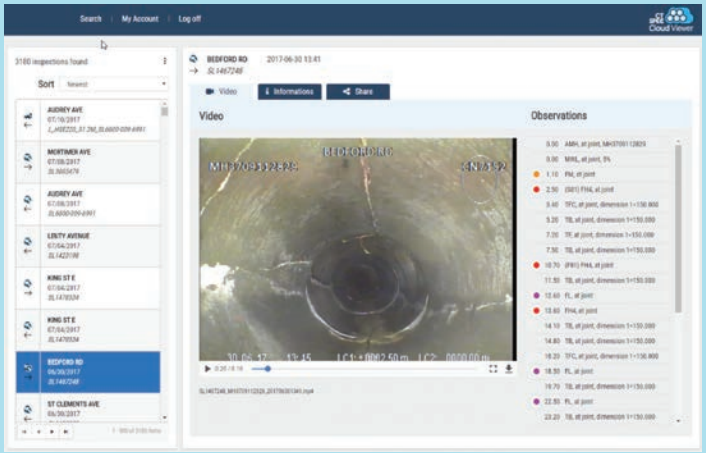
By maintaining an inspection program that includes digital side-scanning technology, there is less risk of regulatory action and an enhanced reputation for proper operation and management of the public sewer system.

Ensure you are investing your dollars wisely in technologies and programs that can provide benefits on several levels to offer the best possible return on investment. Digital side-scanning technology is proven and reliable, and it will surely accelerate your municipality in the direction of success.

ABOUT THE AUTHOR

Chris Parker is a regional sales manager for CUES. I&I

INSPECTION By Craig Mandli



CITY SEEKS SOLUTION TO ELIMINATE DATA CAPTURE ERRORS

PROBLEM:

In 2008, the city of Toronto sought to create and facilitate access to a complete asset inventory that would virtually eliminate all errors during the inspection data capture.

SOLUTION:

By choosing **CTSPEC,** the city became aware of the complete inventory of sewer assets, including pipe and manhole conditions. The solution was rapidly adopted by the contractor responsible for the sewer asset inspections, ensuring continuity and accuracy throughout the chain of information — from the field data collection to its processing by city analysts and engineers. A single system — covering asset inspection all the way through to report preparation — made it possible to provide a consistent, comprehensive approach to information management.

Result: All of the city's teams were able to increase their productivity because of the automated update of infrastructure conditions, the production of thematic maps and the improvement of information sharing. Information was highly reliable, allowing analysts to focus their efforts on asset management and operational priorities. It is easy to produce specific reports on the condition of sewer systems and the need for inspection, maintenance and repair operations.
888-965-8987; www.ctspec.com

ACOUSTIC INSPECTION APPROVED AS PART OF CLEANING MANDATE

PROBLEM:

New Castle County, Delaware, serves a population of over 550,000 that generates 50 mgd of wastewater, which is conveyed using 1,700 miles of underground sanitary sewer pipes. As part of a mandate from the Delaware Department of Natural Resources and Environmental Control, they are required to clean 500 miles per year, which roughly equates to a three-year cleaning frequency for the entire system.

SOLUTION:

InfoSense's Sewer Line Rapid Assessment Tool, or **SL-RAT** technology was developed for rapidly identifying sewer line blockage conditions. It is based on measuring an acoustic signal transmitted between manholes in an active sewer line segment. As part of the initial pilot study, 56,000 linear feet were evaluated in mid-2014. An average of seven line segments (1,450 linear feet) per hour was achieved.

Result: Results showed that less than 10 percent of the inspected pipes needed immediate cleaning, which created an opportunity to better allocate resources to pipes that actually needed attention. Pilot studies have continued, and to date, over 1,450 inspections have been performed (320,000 linear feet). On average, over 55 percent of the pipes received a "Good" score (7-10) and only 11.4 percent needed immediate cleaning (acoustic score of 0-3). Use of the SL-RAT has been approved by the Department of Natural Resources and Environmental Control and the Environmental Protection Agency to count toward the annual 500-mile cleaning requirement. There are no immediate plans to reduce cleaning. Instead, they'll use the preliminary acoustic inspection data to focus cleaning efforts on the pipes that actually need it.
877-747-3245; www.infosense.com

PLUGS AND SLEEVES FROM REAL-TITE PLUGS SEAL DAMAGED CLEAN-OUTS

PROBLEM:

A Midwest city inspector doing video inspections of homes with possible inflow and infiltration breeches needed a dependable, nonleaking expansion clean-out plug to seal clean-out openings where the inside diameter of pipes were increased due to corrosion; odd-sized pipe; or fouled, damaged threads.

SOLUTION:

The city inspector installed **Real-Tite expansion clean-out plugs** fitted with **Real-Tite expansion sleeves** in place of the old, worn brass clean-out plugs.

Result: The Real-Tite plugs, gaskets and expansion sleeves fit the expanded openings by seating behind and over the damaged threads, providing dependable leak-free seals.

800-877-0610; www.real-titeplugs.com

FEATURED PRODUCT

SPECTRASHIELD POLYMERIC LINING SYSTEM

SpectraShield is the only **polymeric lining system** of its type designed specifically for wastewater structures. In addition to preventing corrosion and stopping infiltration, SpectraShield restores structural integrity with a semiflexible, stress skin panel effect. It is not susceptible to cracking with common ground movement conditions like freeze/thaw, wet/dry and traffic loading. Because of its ease of application and rapid curing, project costs and interferences are minimized. SpectraShield has been independently assessed to have a 100-year design life and tested extensively for adhesion, corrosion performance and resistance to hydrostatic pressure. The system's track record is now evident in thousands of structures throughout the U.S. and abroad, covering over 7.5 million square feet.

800-284-2030; www.spectrashield.com

PROGRAM ALLOWS CITY TO SCAN 3,000 FEET OF PIPE QUICKLY

PROBLEM:

The city of Muscatine, Iowa, experiences high-flow conditions in its sanitary sewer interceptors that run through flood control levees on the Mississippi River. As a designated critical sewer, the Army Corps of Engineers ordered the city to inspect its interceptors on a regular basis. However, bypassing and dewatering high-flow pipes so they can be taken offline to accommodate CCTV inspection can be an expensive and time-consuming process, often with mixed results.

SOLUTION:

The city chose instead to use low-voltage conductivity to test its large-diameter mains. By turning off the pump station and allowing a temporary buildup in effluent flow, **Electro Scan,** in partnership with Municipal Pipe Tool, was able to inspect all 3,000 feet (12 segments) of 24- and 27-inch, CIPP-lined RCP in less than a day and a half. Additionally, defects often not seen on CCTV were located and quantified in gallons per minute. All work was done in accordance with ASTM F2550 and newly issued 7th Edition, Volume 1 of the *Operations and Maintenance of Wastewater Collection Systems.*

Result: While nine of 12 pipes had little to no defects, two segments had multiple defects. In fact, combined defect flows for the two pipes accounted for nearly 80 percent of the infiltration flows for the 3,000-foot project. The city was happy with the speed and efficiency of the project and the level of data provided.

800-975-6149; www.electroscan.com

(continued)

INSPECTION

VIDEO NOZZLE SAVES ON INSPECTION COSTS

PROBLEM:

The city of Denton, Texas, was looking for a way to increase CCTV footage to document successful cleaning and to decrease the cost of operation of their conventional CCTV mainline camera truck.

SOLUTION:

The city purchased an **Envirosight Jetscan video nozzle,** distributed by **Green Equipment.** The nozzle is an easy way to see what is being jetted. The video nozzle is affordable, yet quickly captures valuable, high-definition footage of pipe that can be viewed moments later on a PC or tablet. "We can identify the cause of any kind of stoppage that we have (roots, grease, bore through)," says Drew Huffman, Denton field services supervisor. "With this information, the combo truck operators can clean the line more efficiently by being able to choose the right kind of nozzle for the kind of problem that is found in the line."

Result: The city has been able to increase overall CCTV footage while reducing cost and improving productivity. They've been able to keep the CCTV crew on plan, with the ability to not waste time on good lines that don't require full PACP review. The city also found that the cost of operating the Jetscan came in at a cost of 19 cents per foot of operation, versus a cost of 83 cents for a conventional CCTV camera truck, saving $181,674 for 283,866 feet of sewer line inspection.
800-391-7612; www.greenequipco.com

TOWN LEVERAGES INSPECTION TECHNOLOGY TO MEET GOALS

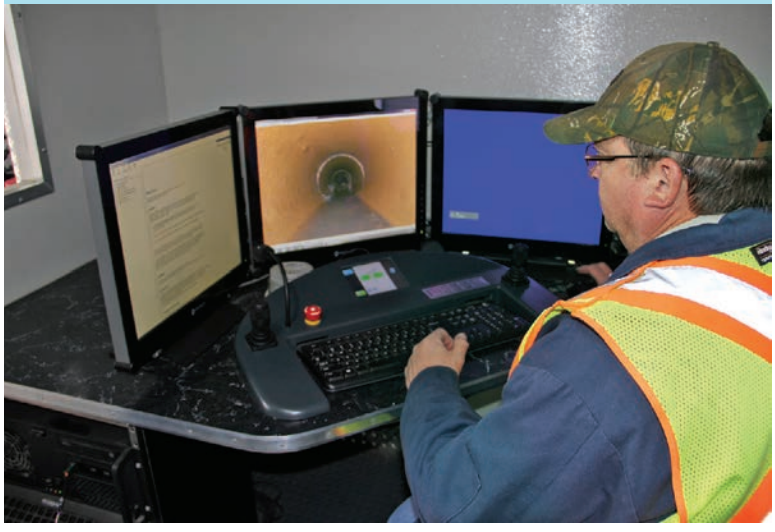
PROBLEM:

In 2013, the city of Warsaw, Indiana, knew they had problems. Like many other similar-sized towns, the city desperately needed to assess the condition of their storm and sanitary sewers in order to develop an improvement plan. Substantial portions of their system dated back to 1899 and had never received a visual inspection.

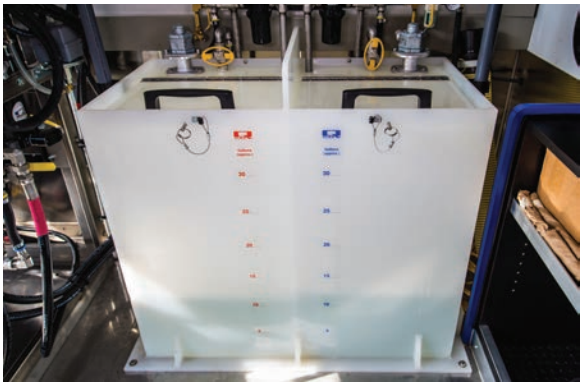
SOLUTION:

The management team undertook an extensive refit of their existing equipment, starting with new combination cleaning trucks and new **RapidView IBAK North America camera inspection system.** The management team set the ambitious goal of inspecting the entire sanitary system within 3 years. With over 86 miles of pipelines, this would equate to over 450,000 linear feet, or 150,000 linear feet a year. They immediately began to see success and leveraged the information they received from their new camera system to make better rehabilitation and maintenance decisions. As the project progressed, they understood the need for a faster, more proactive inspection tool and chose to add a **PANORAMO 2** system to their fleet. This system not only put them on a path to meet their inspection goals, but provided data that engineering and management staff used to make critical decisions and prioritize rehabilitation efforts.

Result: Although they faced some unforeseen delays due to flooding and emergencies, within four years they had completed their goal of inspecting their entire sanitary system. As a result of this effort, the city recently approved $10 million in rehabilitation efforts.
800-656-4225; www.rapidview.com I&I



NoDig solutions with the best GROUT/REHABILITATION vehicles in the industry! No one offers you more.



CUES CUSTOM GROUT INSPECTION VEHICLES

Customize a TV/Seal truck-mounted system based on your needs! CUES is the industry leader of portable, truck, and trailer mounted grout rehabilitation systems for mainline, manhole, and lateral joint sealing with the latest CCTV equipment and decision support software.

- Retrofit any vehicle or trailer
- Combo trucks are available for TV, Cutter & Easy Grout
- Do not need an office using wireless Easy Grout
- Plenty of room for packers & grout material
- Climate-controlled office
- ***Contractor-grade***

"The Standard of the Industry"

CUES®

www.cuesinc.com

Long-Term View

A proactive approach to inspection and maintenance helps a small Colorado utility cut inflow and infiltration and sanitary sewer overflows

STORY Kyle Rogers | **PHOTOS** Carl Scofield

The Fruita wastewater collections crew includes (from left) crew leader John Carrillo, technicians Gary Link and Bill Wolf, crew leader Tony Cinqunini and Public Works Superintendent John McBride.

PROJECT SHOWCASE

Frequent sanitary sewer overflows once plagued the city of Fruita, Colorado. As is often the case, one of the many factors contributing to the problem was inflow and infiltration.

But those chronic SSO issues are a thing of the past. The city has not had an incident in over a decade. It's largely thanks to an ambitious staff of three, who take a proactive approach to maintaining the entire 74-mile collections system in the western Colorado city.

"We run into challenges, but I think we do a great job considering the amount of staff we have," says John Carrillo, wastewater collections crew leader for the city's Public Works Department.

Fruita implemented a systematic cleaning and inspection cycle in 2002. Carrillo and two others spend the majority of their time maintaining the collections system. The cleaning and inspection program has gradually evolved and is paying dividends for Fruita. Beyond simply eliminating SSOs, the program has helped the city better manage funds and prepare for the future.

"We're able to actually look at the conditions of our system, compare it against road overlay work and try to schedule work so we can do all the repairs at the same time," Carrillo says. "We're not 100 percent there yet, but we're moving in that direction of being more responsible to the citizens with the decisions we're making about road and utility maintenance."

NEW APPROACH

Fruita has a population of 12,881 with a projected growth rate of 2.5 percent per year over the next 30 years. The collections system serving that population is a combination of new and old. About 86 percent of the 74 miles of sewer line is PVC. Older clay tile makes up about 9 percent of the system. Concrete accounts for 3 percent, 1 percent is sliplined, and another 1 percent is Orangeburg. Fruita maintains that system with an annual operating budget of $360,000, about a quarter of the entire Public Works operations budget.

Carrillo has worked for the city for 10 years, and for the past seven, he has focused on the collections system, overseeing maintenance for eight lift stations, as well as the administrative side of collections. Two other Collections Division employees assist him. Gary Link handles the cleaning work with a Vactor 2100. A smaller unit, a Vactor 2103, is used as a backup and also for working in more restrictive areas of the city. Bill Wulff inspects pipes

Bill Wolf (left) and Gary Link set up the vacuum boom on a Vactor 2100 while cleaning a sewer line in Fruita.

using a RapidView IBAK North America system with two tractors and three cameras capable of handling pipe from 4 to 48 inches in diameter.

"Prior to 2002, the city only had one outdated jetter truck without a vacuum system," Carrillo says. "There was about one SSO a month on average at that time, and there was no way of removing anything from the collections system. They were just pushing debris down the line from manhole to manhole."

So, the city purchased a Vactor 2100 and immediately went full-bore into a cleaning program.

"At that point, between two and four full loads of sludge and grit were coming out of the collections system daily," Carrillo says. "As this progressed, we were able to start identifying problem areas of the city. For example, if we started to pull out mud in a line, it usually pointed to a broken or collapsed section of pipe."

"Once we started moving this way, we were able to start coordinating these inspections with other planned projects like road overlays and other utility repairs. That has really turned into a big win-win for us."

John Carrillo

Problem areas were cataloged in handwritten reports. The crew began targeting I&I problem areas through reports from the Vactor operator and tracking of flow conditions in manholes throughout the city. A year into the cleaning program, Fruita added the inspection component with the purchase of a camera van retrofitted with CUES equipment. That aided in more clearly defining the exact sources of I&I and fixing the problems, which mostly center around the oldest parts of the system, Carrillo says. Early on, Fruita identified storm drain inlet connections into the system and took care of them immediately.

SYSTEM UPGRADES

The main I&I culprit for Fruita, though, is groundwater from the irrigation season that runs March to October. Again, it's the oldest parts of the system with clay tile and Orangeburg pipe that are largely affected, so the inspection program has helped identify the areas in greatest need of repair or replacement.

"What we see is the irrigation water follows the existing trench and service lines, which leads to I&I along with mineral deposits near service taps and jointed segments," Carrillo says. "In the extreme cases, we utilize a cutting attachment on our Vactor to remove deposits. The city does implement a watering schedule for the citizens, but overall during the irrigation season, soils become hydrated and the areas of our collections system with poor ratings collect the excess water."

When the inspection program was first implemented, the city was making a move to a Microsoft Access database system to log every maintenanc$_e$

event or callout that occurred in the city, and the CCTV inspections became a part of that initiative. As problem areas were identified, funding was allocated to do spot repairs or minor capital projects. But all the inspections were on DVDs stored in filing cabinets.

"They were fairly well-organized, but imagine 1,000 DVDs and you need to find a specific line. You're pulling out every DVD trying to find it," Carrillo says.

When the camera van was scheduled for replacement in 2012, Fruita made a technological upgrade. The city tested out equipment from several vendors and settled on a RapidView IBAK North America system using PipeLogix software.

"We were able to get away from DVDs and actually export the entire video inspection along with graphic reporting to a separate server," Carrillo says. "Now anyone working for the city can get into our server file and see all the lines that have been inspected."

A simple scoring system on a 1 to 5 scale (bad to good) was established, taking into account the length of a pipe, its material, and its condition. A score was tied into every event in the database, and that information was used alongside the city's GIS and mapping system to create a more easily navigable format for identifying problem areas and prioritizing work.

"We can pull up a utility map of the collections system, click on a line and see all the attributes of that line," Carrillo says. "And then there's a hyperlink you can select to see the actual video inspection, the score and any reports. There's also a secondary map that just has the numerical scores of the entire system and color coordinates our troubled areas. Once we started moving this way, we were able to start coordinating these inspections with other planned projects like road overlays and other utility repairs. That has really turned into a big win-win for us."

FRUITA (COLORADO) COLLECTIONS DIVISION

SERVICE AREA:
7 square miles

POPULATION:
12,881

INITIATIVE:
Establishing cleaning and inspection program, reducing inflow and infiltration and sanitary sewer overflows

ANNUAL BUDGET:
$360,000 for collections system

EMPLOYEES:
3

WEBSITE:
www.fruita.org

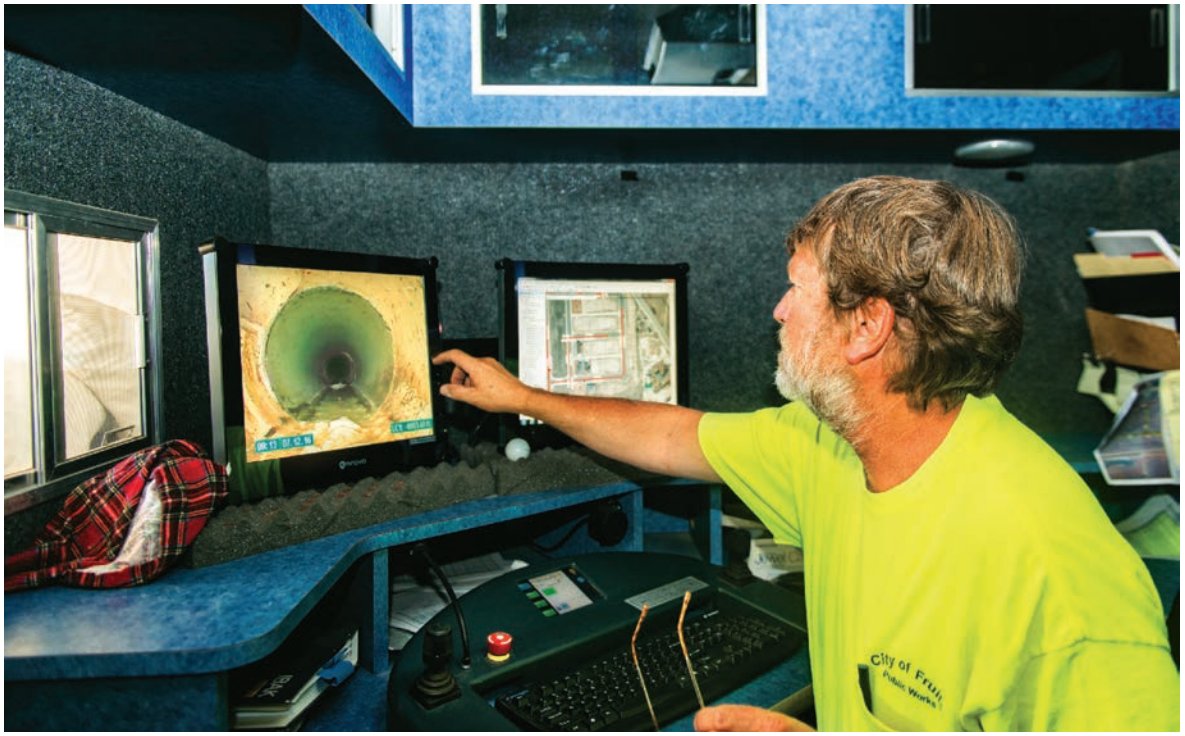
Fruita wastewater collections crew leader John Carrillo stands above ground at one of Fruita's eight lift stations.

SMALL BUT MIGHTY

Growing the cleaning and inspection program has not been without its challenges. One is maintaining such a proactive approach with a small staff, Carrillo says.

"Some months are greater than others, but we really like to maintain a two-year schedule for cleaning and a three-year schedule for inspection," Carrillo says. "If we're a mile short, it's not the end of the world, but we try to stay as close as possible to that schedule."

Keeping that schedule means cleaning about 35 miles of sewer line every year and inspecting about 25 miles. Carrillo says Link and Wulff each keep their own schedule. On a typical day, they'll come in, prep their equipment, and go out in the field for eight hours. The Vactor will take about two loads to the treatment plant, and anywhere from five to 25 inspections will be done, depend-



Bill Wolf monitors the live video feed while controlling a Rapidview IBAK T66 camera tractor in the monitor room of Fruita's custom pipe inspection van.

Bill Wolf (left) and Gary Link lower a camera tractor through a manhole to a sewer line for video inspection.

"The biggest thing to remember is that everything costs money, but in the large spectrum, you need to determine the long-term savings over the cost today."

John Carrillo

ing on the area and the length of the line. The next day, before heading out again, Link will enter all the previous day's events into the database — every line that was cleaned and any additional notes. After four full days of inspections, Wulff will usually spend a day exporting everything from the camera into the database, adding notes and scoring each line on the 1 to 5 scale. Any immediate concerns are dealt with along the way.

MORE FOR THE MONEY

Fruita is currently replacing about a quarter-mile of pipe a year, an amount Carrillo says is acceptable considering the capital funds available, but he'd like to do more.

"You can't raise rates all the time," he says.

But Carrillo adds that his advice to other small utilities is to look at it all with a long-term view. "The biggest thing to remember is that everything costs money, but in the large spectrum, you need to determine the long-term savings over the cost today," he says.

For example, the money put into regularly cleaning and inspecting the system has cut down on Fruita's lift station maintenance in the long term. Carrillo says there used to be up to 10 maintenance callouts a month on average because of debris, rags and grease coming into the lift stations. Now the city sometimes goes months without a single lift station issue, and when there is a problem, it's typically a power outage or a mechanical or electrical failure — not anything collections system-related.

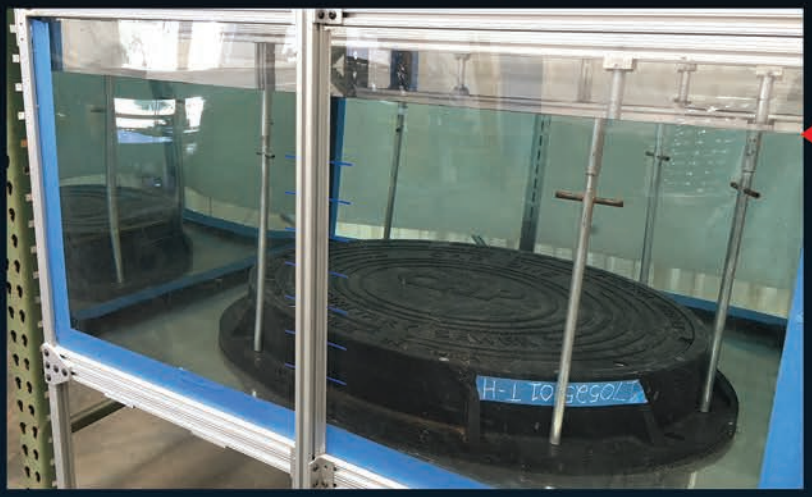
Treatment costs have also gone down.

"Our overall treatment cost has reduced 5 cents per 1,000 gallons, which was $16,000 to $18,000 per year in 2016 and 2017. We have seen an increase of 42.7 mg/L COD, showing that the reduction of I&I is working by concentrations increasing at the treatment plant," Carrillo says. "By resolving problems with I&I, it allows us to continue with repairs and upgrades to our existing system without having to build 'new' conditions to expand capacity. Projects we've completed have allowed 140 homes to be tied into our system over the last three years without having to increase capacity. That is a huge win for our department to be able to keep up with the growth of our community.

"You don't have to blow your budget, but if you're able to do something to reduce maintenance costs and treatment costs and increase the capacity of the collections system without actually expanding the system, that's worthwhile. You'll be money ahead in the end. The long-term investment in infrastructure always needs to be in the back of your head." **I&I**

Submarine Hatches Don't Leak... Neither Should Manhole Covers

CAP Covers Demonstrate Superior I&I Resistance



Water Line

16 inches of water above cover in tank for 1 month

No cover leaks through port in tank bottom... 100% watertight!

Suffering from Infiltration and Inflow?

Just CAP That!

Composite Access Products

Innovation, Infrastructure, Made-In-The-USA

5216 N. 26th Street
McAllen, TX 78504

844-344-CAP1 (2271)
www.justcapthat.com

ESTABLISHING BASIN SIZE AND UNIFORMITY

Avoid the three major pitfalls of rainfall-dependent inflow and infiltration studies for more accurate results

By Patrick Stevens, P.E., and Peter Frick

Understanding the impact of basin size and uniformity will improve the odds of a successful flow monitoring project and help you spend the public's money wisely.

For the purposes of this article, a basin or sewer shed is defined as the portion of a sewer system or sewer shed upstream of a flowmeter or between meters. Basin sizes can be defined by the length of public sewer, inch/diameter/miles of public sewer or acres of developed area in the sewer shed. The concept of limiting basin size and having roughly equal basins to study is born out of the idea that rainfall-dependent inflow and infiltration is not uniformly distributed within a collections system.

The 80-20 rule, or Pareto Principle, states generally that most things in nature are not uniformly distributed and the majority of occurrences appear in a minority of events. For example, 80 percent of the revenue from a grocery store comes from 20 percent of the items. Originally, the Pareto Principle referred to Vilfredo Pareto's observation that 80 percent of Italy's wealth belonged to only 20 percent of the population.

Our historical approach to removing RDII has tended to ignore this principle, and most of the procedures we created generally assumed that the intrusion of RDII into sewers was uniformly distributed. After all, the prime tools for locating sources of RDII were based on CCTV and smoke testing, and those tools turned up defects most everywhere.

PINPOINTING PROBLEMS

The most important benefit of controlling basin size is the ability to pinpoint the offending sewer segments. Figure 1 shows how the location of apparent areas of excessive RDII changes as a function of basin size. At a basin size of 31,000 linear feet, 60 percent of this 385,000-linear-foot study area appeared to have excessive RDII. At a basin size of 8,100 linear feet, only 42 percent of the study area appeared to have excessive RDII, and the location of excessive RDII (red areas) shifted with the change in basin size.

There are two levels of offenses that can be committed by the manager responsible for spending the public's money. The first is to accomplish the task but spend more money than was necessary. This could arise from a change order that was avoidable. The second and more severe offense is to spend the money and not accomplish the task. A manager starting with the results (Figure 1) of the flow study on the left (basin size 31,000 linear feet) would ignore problem areas that are evident in a flow study on the right (basin size 8,100 linear feet).

Much of the flowmetering data collected for RDII reduction projects is simultaneously used to set up and calibrate a hydraulic model. Hydraulic modelers will select calibration points at logical nodes and typically are not looking to create basins with uniform sizes. The result is a mix of very large and small basins.

Smaller meter basins will result in isolating sources of RDII in smaller portions of the system and will require less CCTV and smoke testing to develop rehabilitation plans.

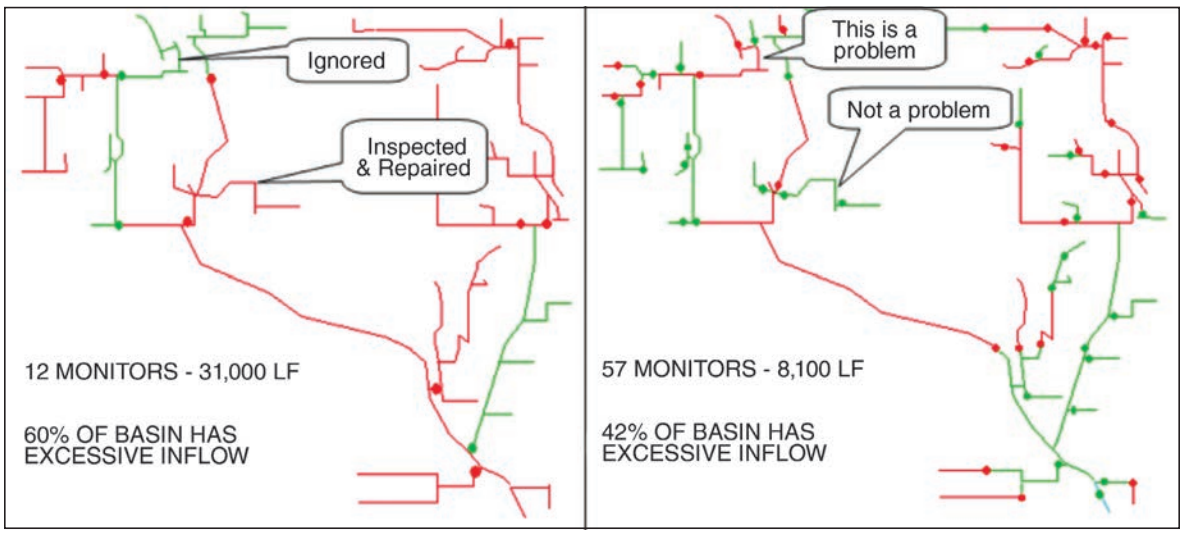


FIGURE 1: The size of the study basin affects the apparent location of excessive RDII.

A corollary to the basin size rule is: The larger the basin, the closer the RDII severity will be to the system average. If basins are not uniform in size, the analyst may be tricked into believing that RDII is less severe in the larger basins. The larger the metered basin, the narrower the measured performance will be.

You can demonstrate this by calculating the capture coefficient for your entire collections system. During the wet season, calculate the total volume of rain falling on the sewered area and calculate the percentage of extra flow arriving at the treatment plant. There is an 80 percent chance that your calculated value will fall between 3 and 7 percent, whereas a smaller basin size study will produce results in a range of 0.5 to 20 percent.

REDUCING COST

Utilizing smaller study basins can also help reduce cost. Most modern RDII studies start with some form of flowmetering followed by CCTV and perhaps smoke testing in the basin with the most severe RDII. Smaller meter basins will result in isolating sources of RDII in smaller portions of the system and will require less CCTV and smoke testing to develop rehabilitation plans.

An example of the cost reduction comes from the widely published King County Regional I&I Control Program. A long-term metering project was conducted on modeling basins that averaged around 300,000 feet in size. A short-term metering program divided the modeling basins into smaller mini basins of around 21,000 feet.

The county had established the threshold for excessive RDII as a capture coefficient of 5 percent. Figure 2 displays the service area with modeling basins outlined in blue. We will look at the two modeling basins shaded in pink and blue. The upper basin (pink) had a capture coefficient of 8.9 percent (excessive), and the lower basin (blue) had a capture coefficient of 3.5 percent (nonexcessive). Had they conducted the RDII study with these basins, the upper basin would have undergone a sanitary sewer evaluation survey and the lower basin would have been ignored.

When the upper modeling basin was divided into smaller basins, a more detailed picture emerged. Approximately half of the modeling basin suffered from excessive RDII. Had the SSES activity (estimated at $2 per foot) been conducted for the model basin, the SSES cost would have been approximately $600,000, but at the smaller basin level, SSES cost would have been just over

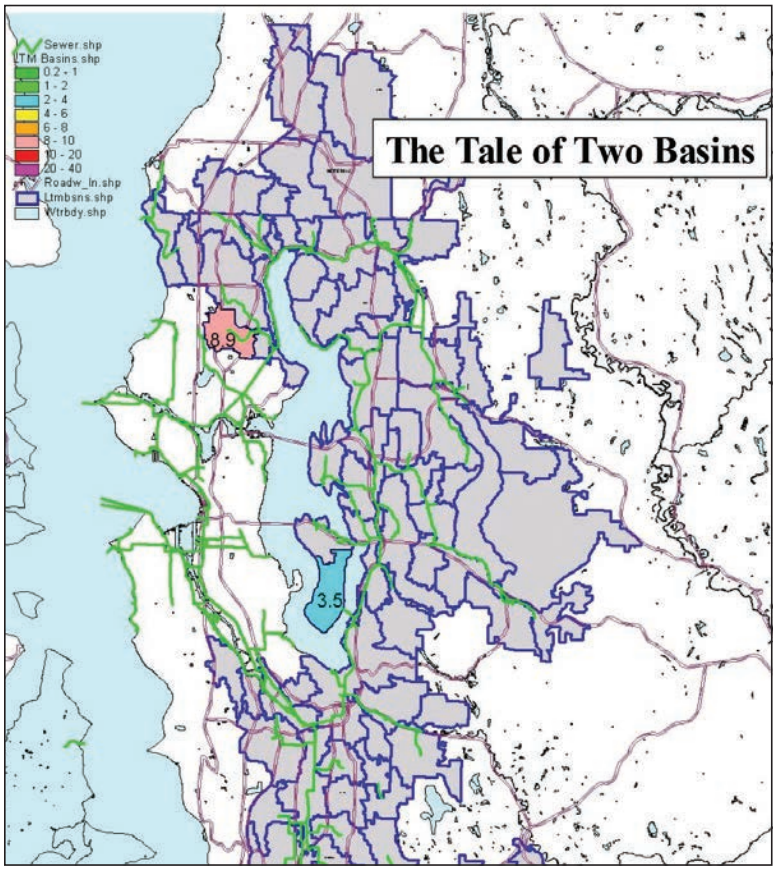


FIGURE 2: Capture coefficients in two model basins in King County.

Basin size is the most important variable that a project manager can control. If basin size is sufficiently small, the distribution of RDII volume will approximately conform to the 80-20 rule.

$300,000. The metering cost for the smaller basin size was $65,000 for a savings of nearly $300,000. There would certainly be as much or more savings in rehabilitation costs, but it is difficult to develop two comparative rehabilitation scenarios.

In the lower modeling basin, division into smaller basins discovered two mini basins with excessive RDII. In this case, the manager would have walked away from sources of RDII because the model basin was nonexcessive. This phenomenon is the second problem with working with large meter basins: It is easy to miss poorly performing sections of sewer because they are lost in the close-to-average performance of a large basin.

The third problem with large basins is the difficulty in measuring relatively small RDII reduction in basins with high flows. If the manager found these defects through conventional CCTV and smoke testing techniques and made repairs, the improvement would be statistically hard to find if the pre- and post-rehabilitation analysis was conducted on the model basin level. This phenomenon contributes to the common belief that RDII reduction doesn't work well.

TWO-TIER APPROACH

In Saco, Maine, wastewater operators took an innovative two-tier approach to locating the sources of RDII in the Bear Brook sewer shed.

The Bear Brook pump station has experienced severe RDII flows, and sewer overflows have occurred during heavy rains. Part of the sewer shed parallels Bear Brook, and it was assumed that most of the RDII was originating in that section of sewer. Instead of using the traditional smoke testing and CCTV in the 109,000-linear-foot sewer shed, the city elected to deploy a two-tier mini basin metering strategy.

Tier 2 metering involved relocating and installing additional meters to create eight smaller mini basins in the three worst Tier 1 basins. Of the eight mini basins, two showed severe RDII. Further investigation revealed a source of RDII from Thornton Academy and Bear Brook itself.

By following the two-tier metering process, the city was able to better delineate areas of low and high RDII without requiring extensive follow-up SSES activity. It was found that during one particular storm of 2.13 inches, 88 percent of the RDII was generated in two of the mini basins. The two basins contained 24,106 linear feet or 20 percent of the total system size. The results showed an 88/20 ratio — 88 percent of the RDII volume originated in 20 percent of the sewer shed.

For projects conducted in basins over 30,000 linear feet, studies show that 80 percent of RDII volume originates in 50 to 60 percent of the system. This would require further metering or SSES to more specifically locate the RDII source. In contrast, for small basins, 80 percent of the RDII volume can be isolated to less than 20 percent of the study area.

DIAGNOSTIC SAVINGS

Adherence to the Pareto Principle is more than just an interesting phenomenon. There are significant time and financial savings implications. This project identified three possible options for locating sources of RDII:

1. The old way of doing SSES over the entire Bear Brook sewer shed
2. Doing SSES on the worst of the five large basins
3. Doing SSES on the worst of the mini basins

The metering cost for both phases of the work using option 3 was $25,000, and the payback over straight SSES was approximately 13:1. Savings from reduced construction will be even greater.

Shortly after the conclusion of the metering project, the stormwater connection at Thornton Academy was removed and the sewer along Bear Brook was relined (as was originally planned).

The preliminary result is that the peak flows arriving at the Bear Brook pump station have been reduced from a 6:1 peaking factor to a 2:1 peaking factor. This improvement also helps reduce the volume of flow bypassing secondary treatment that occurs downstream at the treatment plant.

SUMMARY

Basin size is the most important variable that a project manager can control. If basin size is sufficiently small, the distribution of RDII volume will approximately conform to the 80-20 rule. Several practitioners have attempted to develop an optimum basin and, based on their specific projects, the values have varied from 3,000 to 9,000 linear feet. It is not apparent that there is a specific basin size that should be deployed for best results, but it is clear that it is less than 10,000 linear feet.

The cost reduction in SSES work alone is usually greater than the cost to reduce basin size. Construction cost is also reduced because a smaller portion of the system is repaired based on the mini basin metering data.

The second benefit to conducting a project with small basins is that it is much easier to demonstrate that RDII has been reduced. The RDII reduction is easier to spot in a smaller basin with lower flows than trying to spot the reduction in a larger flow. All other things being equal, starting with small meter basins provides a better chance of answering the question, "What have you accomplished with the money?" I&I

FINDING A FIX FOR 473 LEAKS

HydraTite seals provide a no-dig solution after improper sewer line installation

By Cynthia Smith

After installing a brand-new, 36-inch-diameter, 3,700-foot reinforced concrete sewer line segment, an Ohio River Valley municipality found to their horror that it was leaking along its entire length.

Perfunctory testing showed that every one of the pipe's 473 joints was leaking due to improper installation. It would be impossible to put the line into service with so much infiltration.

The municipality considered several options for repair, including lining the entire length of pipe and ripping the pipe out entirely. Both options were expensive overkill; the pipe was new, the trench was already filled, and the infiltration was only at the joints. Municipal officials also discussed the possibility of using chemical grout.

LESS DISRUPTION

A Louisville company that specializes in sewer inspection and testing had another suggestion. Robinson Pipe Cleaning recommended HydraTech Engineered Products' HydraTite internal joint seal. The seals require no excavation and are often used to rehabilitate older pipes with inflow and infiltration issues.

HydraTite seals are used to repair deteriorating pipes from the inside. Often used for emergency repairs, it is a proven solution for joint leaks. The system consists of a customized rubber seal held in place by stainless steel retaining bands. Each seal is manufactured in the U.S.

The sealing system for this job needed to meet the expected head pressure of a 100-year flood. HydraTech solved this problem by reinforcing the standard seal with an extra steel band.

Considering lead times, costs, and job duration, the municipality decided to go with this all-mechanical, no-excavation fix.

JOINING FORCES

Because the municipality had an aggressive schedule to repair the pipe and bring it online, HydraTech and Robinson Pipe Cleaning decided to join forces. HydraTech fabricated the seals on an expedited schedule and provided installation training and certification for Robinson Pipe Cleaning. The city approved the team's repair plan and quickly moved on to the installation process.

The goal was to install all 473 seals in just six weeks. The process moved quickly and was replicated at each joint. First, the rubber seal manufactured to match the pipe diameter was laid into the joint. Then, the first stainless steel retaining band was locked into place with a hydraulic expander, utilizing the HydraTech wedge-lock system. The second steel band was then added, along with the value pressure tester. The Robinson Pipe Cleaning crew was able to install each seal in less than 90 minutes.

Everyone held their breath as each joint was pressure tested using the HydraTech valve (it works like a "soap test" to see if air is getting into pipe joints.) Much to the relief of the installation crew and utility, each one sealed properly with no leaks. The team had completed the job on time, and the municipality was able to put the repaired line into service quicker and more affordably than they had dared hope.

One of the Robinson Pipe Cleaning project supervisors summed up the process like this: "Installation was extremely simple and made it easy to meet

When an Ohio utility discovered a new 36-inch pipe was leaking at all 473 joints before it was even put into service, full rehabilitation and complete replacement seemed like the only options.

A view down the pipe after 473 HydraTite internal joint seals were installed to eliminate infiltration without full rehabilitation or excavation.

Inspectors determined improper installation was causing significant infiltration immediately after installation, but only at the joints.

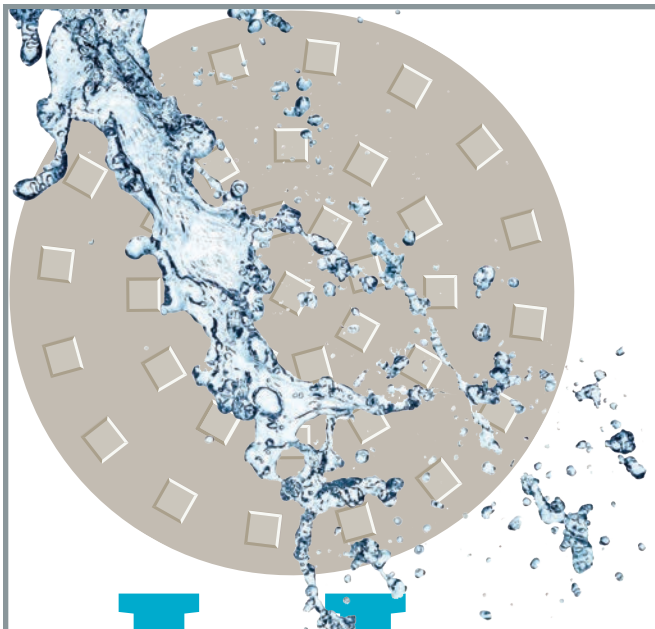
production numbers. The training staff was very helpful and great to work with on this project. The onsite inspector was blown away during the low-pressure air test because the pressure didn't drop at all." I&I

“Like we say in the sewer, ‘time and tide wait for no man.’”

— Ed Norton, *The Honeymooners*

Keep learning what they do about it.

GET YOUR OWN FREE SUBSCRIPTION AT IANDIMAG.COM
or call 800-257-7222



I&I

How do you deal with it? We're interested.

Share Your Story

Send a note to editor@iandimag.com

Like something?
Hate something?
Agree? Disagree?

Share your opinions about I&I articles through our Letters to the Editor.

Send your letters to editor@iandimag.com

facebook.com/iaimag
twitter.com/InflowandIMag
linkedin.com/company/iaimag

ARIES SEWER GROUTING SYSTEM

TEST & SEAL

An air-pressure test detects a failed joint, which is then sealed by grout pumped to the packer. The grout flows through the leak, sealing the soil to form an impenetrable barrier.

YOUR FIRST CHOICE TO STOP INFILTRATION

Grouting is a cost-effective process to halt infiltration and inflow in structurally-sound sewer pipes. It can also seal the annular space between the liner and host pipe during CIPP rehabilitation.

Aries' professional working platform provides efficient hands-on control and reduced set-up time for high productivity.

- Custom truck designs with quality material and workmanship
- Large 60-gallon mixing tanks to seal large voids
- 800-foot hose for long runs for high productivity
- Simple push-button operation for fast grouting cycles

Make Aries Sewer Grouting System your first choice to stop your I&I permanently. Call today to learn more.

ARIES
INDUSTRIES, INC.

See what you're missing.

ariesindustries.com
(800) 234-7205