

# CRITICAL SEWER & WATER CHRONICLES

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## Utility Managers & Ratepayers Benefit From New Pipeline Construction Specifications



### New Construction Standard for Leak Testing Impacts New Pipe, Repairs, & CIPP Acceptance

“Independent testing & certification of pipelines as watertight using Focused Electrode Leak Location (FELL) eliminates the guesswork and reduces the risk of failure from poor installations,” stated Ken Kerri, Ph.D., P.E., former Program Director, Office of Water Programs, California State University, Sacramento.

Traditionally, Contractors were allowed to make repairs, install new pipes, and rehabilitate existing ones, with little, if any, testing of their work; especially after customer service laterals were installed or connected.

Since neither acoustic nor visual inspection are able to *hear* or *see* most leaks, many pipes were assumed by their owners & managers to be *watertight*, only to find leaking joints, bad connections, leaks inside manholes, and defective service laterals - all major contributors to sewer overflows or non-revenue water losses, without knowing precise locations of each defect.

ASTM Standard F2550, ISO Quality, and Electro Scan’s patented Focused Electrode Leak Location (FELL) technology changed all that. **Continued on Page 23**



Electro Scan’s Matt Campos prepares to test a CIPP lined pipe.

**Partners**  
**WRC**

**McIntire Management Group**  
D&W Systems Sales

**JWB Company**

**Kershner Environmental Technologies, LLC**

**IAC**  
International Aramoon Co. Ltd.

**ClearWater, Inc.**  
See Pages 14-19

**CONSTRUCTION PRODUCT MARKETING**

### WRC\* Case Study Finds Infiltration Missed By CCTV

#### FELL Finds 63 Sources of Infiltration, CCTV Finds 1

##### The Challenge

A major water company had a problem with infiltration into its gravity sewer network, which began to overwhelm a pumping station to the point it could not cope with flow, particularly during the winter season. As a result, contingency measures (tankers) had to be put in place, at great expense and disruption.

##### The Solution

The services of WRC were engaged to provide a survey of the 150mm diameter pipe using Electro Scan’s technology. This advanced sensor allows the location (within 1cm) and quantification of defect flows from cracks, bad joints, and poorly-made connections. It works by introducing a small current into the water, with the locations of infiltration identified where the current escapes to earth. The larger the dissipation of current to earth, the larger the defect. Electro Scan’s technology is proven to detect infiltration missed by conventional CCTV surveys.

##### The Outcome

Over a survey length of 600m, Electro Scan detected 63 sources of infiltration. A CCTV survey performed simultaneously found just one. Furthermore, Electro Scan discovered that 80% of the infiltration was restricted to just three sections of pipe. As a result, the water company could line these three sections, rather than the entire 600m pipe run, providing a cost-effective solution to relieve flow on the pumping station.



\* Developers of NASSCO CCTV Codes.

## Leaks & Permeability in CIPP Liners Are Located & Quantified in GPM By FELL

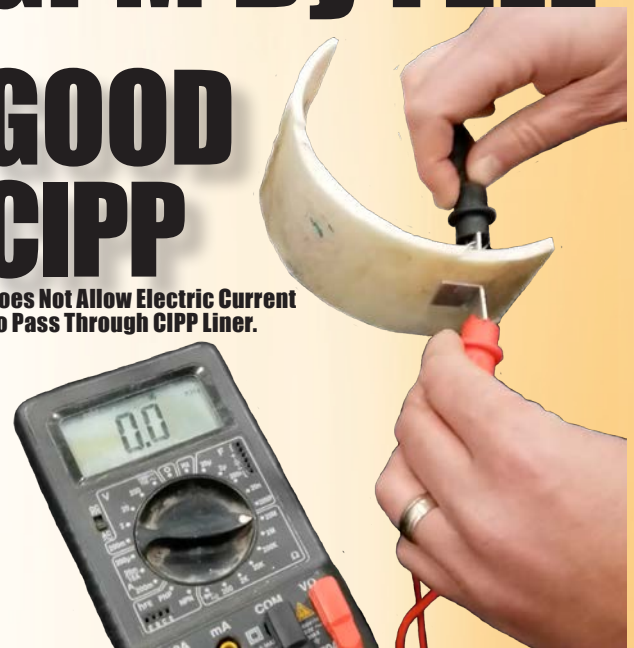
When Electro Scan first got started in 2011, the company was most often asked, ‘How does it work?’ Today, the most frequently asked question is, ‘Where was this 40 years ago when Cured-In-Place Pipe (CIPP) was first introduced?’ & ‘What ASTM Standard can we add to our CIPP specification?’

In 2010, Ken Kerri, Ph.D., P.E., Program Director, Office of Water Programs at Calif. State University, Sacramento, was the first to mention his former students were having problems with recently installed CIPP liners that were “OK’d” by Closed-Circuit Television (CCTV) Inspection, but were leaking.

As shown (Right) on a recently exhumed CIPP, no electric current should ever pass through a liner. Electro Scan is able to test **full-length liners** – from manhole-to-manhole – **covering 360-degrees of the liner wall**, in minutes. ASTM F2550 is the new quality assurance & quality control standard to test CIPP as watertight.

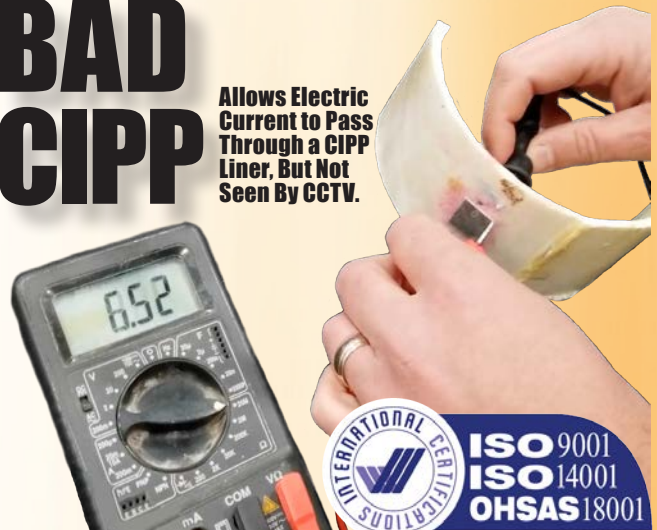
### GOOD CIPP

Does Not Allow Electric Current To Pass Through CIPP Liner.



### BAD CIPP

Allows Electric Current to Pass Through a CIPP Liner, But Not Seen By CCTV.



### electro scan inc.

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# Accurate. Fast. Repeatable.

## Pipe Assessment Made Easy Using Electro Scan

### Eliminate Biased Observations, Third-Party Data Interpretation, And Missed Defects By Utilizing Machine-Intelligent Technology

Before rehabilitating pipelines, make sure you have correctly prioritized which pipes should be fixed and why.

Using legacy testing methods to 'inspect' old pipes and to 'certify' new pipes, cities risk repairing the wrong pipes and accepting defective new pipes the day they are put in the ground.

Machine-intelligent technology is here. Replacing less accurate Acoustic Data Loggers, CCTV, Gas Tracer, Smoke & Dye Testing to eliminate the risk of replacing 'good' pipes with 'bad.'

Accurate to 3/8<sup>th</sup> of an inch or 1cm with defects identified in Gallons Per Minute or Litres Per Second, Electro Scan is accurate, fast, repeatable, and proven. Call us today!

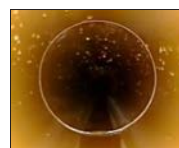
### Common Pipe Materials Assessed By Electro Scan

ABS	Acrylonitrile-butadiene-styrene
ACP	Asbestos Cement Pipe
BRK	Brick
CMLSP	Cement Mortar Lined Steel
CON	Concrete
CIPP	Cured-In-Place Pipe
DIP	Ductile Iron (w/Protector 401)
FRP	Fiberglass Reinforced Pipe
FRPM	Fiberglass Reinforced Polymer
GRP	Glass Reinforced Pipe
HDPE	High Density Polyethylene
ORP	Orangeburg Pipe
PB	Polybutylene
PCCP	Prestressed Concrete Cylinder Pipe
PE	Polyethylene
PFP	Pitch Fiber Pipe
PP	Plastic Pipe
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
RPM	Reinforced Plastic Mortar
RTR	Reinforced Thermosetting Resin
SIPP	Spray-in-Place Pipe
SPR	Spiral Wound Pipe
TC	Terracotta or Clay Pipe
VCP	Vitrified Clay Pipe

### PRE-REHABILITATION



**Asbestos Cement Pipe**



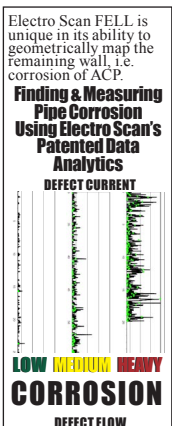
**High Density Polyethylene Pipe**



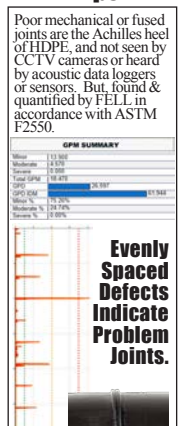
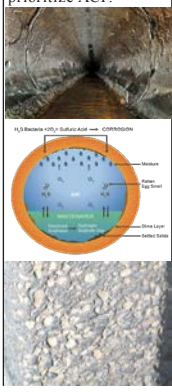
**Prestressed Concrete Cylinder Pipe**



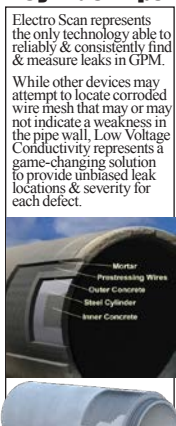
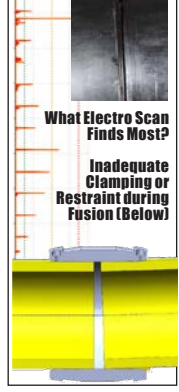
**Vitrified Clay Pipe**



As demonstrated by independent benchmarks, since acoustic and transient pressure sensors are unable to provide detail geometric assessments of pipe walls, and therefore unable to estimate remaining pipe walls, Electro Scan represents a game changing solution to assess & prioritize ACP.

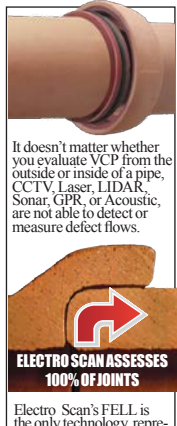
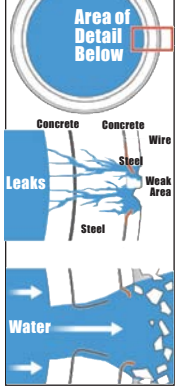


Poor mechanical or fused joints are the Achilles heel of HDPE, and not seen by CCTV cameras or heard by acoustic data loggers or sensors. But, found & quantified by FELL in accordance with ASTM F2550.

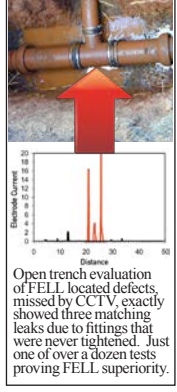


Electro Scan represents the only technology able to reliably & consistently find & measure leaks in GPM.

While other devices may attempt to locate corroded wire mesh that may or may not indicate a weakness in the pipe wall, Low Voltage Conductivity represents a game-changing solution to provide unbiased leak locations & severity for each defect.



It doesn't matter whether you evaluate VCP from the outside or inside of a pipe, CCTV, Laser, LIDAR, Sonar, GPR, or Acoustic, are not able to detect or measure defect flows.



### POST-REHABILITATION



**Cured-In-Place Pipe**



**Grout**



**Spray-In-Place Pipe**



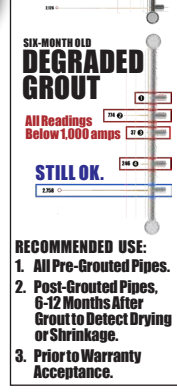
**Spiral Wrap Pipe**



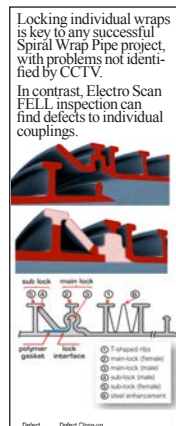
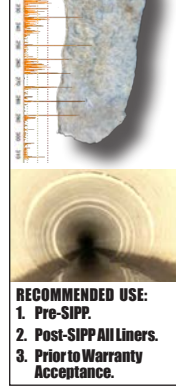
CIPP liners may not be watertight and defects not seen by certified operators using CCTV cameras. As a result, ASTM F2550 should be added to CIPP specifications to ensure pipe quality & integrity.



FELL is now preferred over using traditional packers to test joints for water tightness, due to FELL's Non-Destructive Testing (NDT) of joints, laterals, and cracks.

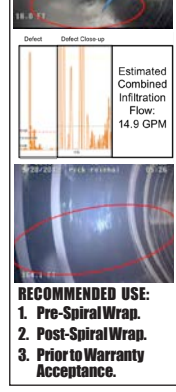


Unlike air testing, FELL does not force any added pressure on joints or laterals. Since air testing can open joints, shift pipes, and even temporarily correct out-of-round conditions in plastic pipes as areas around joints are inflated, packers are no longer recommended for testing the quality of joints or laterals.



Locking individual wraps is key to any successful Spiral Wrap Pipe project, with problems not identified by CCTV.

In contrast, Electro Scan FELL inspection can find defects to individual couplings.



# Electro Scan Provides 'Real Time' Post-CIPP Infiltration % & Flow Rates

The City of Racine, in association with Short Elliott Hendrickson Inc. (SEH®), recently compared flow monitoring data with Electro Scan's machine-intelligent defect flow rating technology. The results were impressive, nearly matching both the 1-Hour and 15-Minute flow meter results, in the opinion of the consulting engineer.

### 'Same Day' FELL v. 'Two-Year' Metered Flow % Reductions

**75%** FELL 'Same-Day' Infiltration Reduction  
**67%** 1-Hour Peak Flow Meter, 5/12/14–5/10/16  
**63%** 15-Min. Peak Flow Meter, 5/12/14–5/10/16

**NOTE: Engineers elected to present FELL results to the City as reductions from rehabilitation.**

### Project Goals & Objectives

- Estimate percent of reduction in peak flows
- Evaluate new approach to certify & accept CIPP
- Help justify future CIPP projects
- Shorten Pre- & Post-CIPP performance reporting

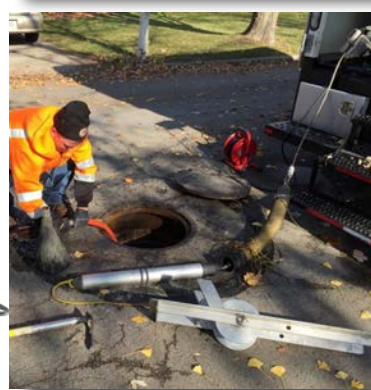
### Major Project Location Features

- 5,560 feet of pipe main – 28 pipe segments
- 8" and 10" concrete pipe
- 103 laterals serving single-family properties
- 'Closed' network served by 1 lift station
- Independent review by consulting engineer

### Project Findings

Flow monitoring results aligned with Electro Scan's FELL results that estimated a 75% flow reduction, without data variations from:

- Variable Storm Events
- Long Reporting Lead Times
- Equipment Malfunctions
- Battery Issues
- Operator Data Interpretation

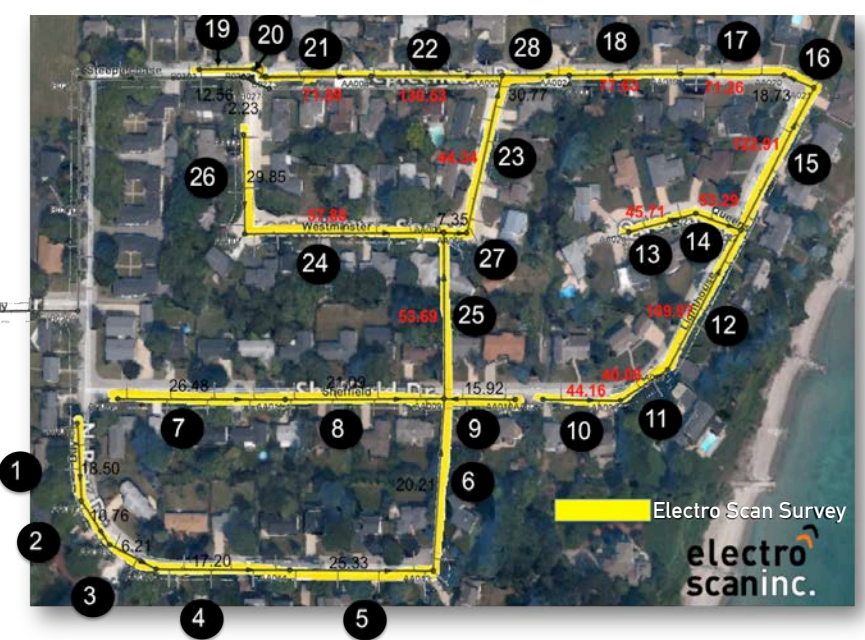


### Post-CIPP Project Assessment

	Feet	%	Emoji Rating
Post-CIPP Liners with 99-100% Reduction	1,061	19%	😄
Post-CIPP Liners with 75-99% Reduction	1,692	31%	😊
Post-CIPP Liners with 65-75% Reduction	1,743	31%	😐
<b>Sewers That Leak More After CIPP Lining*</b>	<b>1,067</b>	<b>19%</b>	😞

\* Resulting from Contractor Damage of Lateral Reconnections.

**TEST AREA: Twenty-eight (28) sewer mains served by a single lift station with flow results measured by a Teledyne ISCO 2150 Area Velocity Flow Module and Sensor.**





# FELL Replaces CCTV to Locate Infiltration & Certify Repairs After CCTV Misses 80-100% of Leaks

**“Disruption From Electro Scan Inc. FELL TECHNOLOGY Is a Result, Not a Cause, of Doing Things The Old Way!”**

Chuck Hansen, Founder, Electro Scan Inc.

## Why New Technology Replaces Old?

**AMAZON** DIDN'T KILL BRICK & MORTAR RETAILERS. POOR CUSTOMER SERVICE, HIGH PRICES, AND CONVENIENCE DID.  
**APPLE** DIDN'T KILL THE MUSIC BUSINESS. BEING FORCED TO BUY FULL ALBUMS AND RECORD LABELS DID.  
**FACEBOOK** DIDN'T KILL MYSPACE. THE LACK OF CONNECTING PEOPLE AND THEIR INTERESTS DID.  
**NETFLIX** DIDN'T KILL BLOCKBUSTER. THE INTERNET AND RIDICULOUS LATE FEES DID.  
**UBER** DIDN'T KILL THE TAXI BUSINESS. LIMITED ACCESS, FARE CONTROLS, AND HIGHER PERMIT FEES DID.  
**ELECTRO SCAN** DIDN'T KILL THE CCTV or ACOUSTIC INSPECTION BUSINESS. MISSED DEFECTS, SUBJECTIVE CALLOUTS & INABILITY TO CERTIFY REHAB DID.

No one likes to be told that they 'missed a spot.' I didn't like it when my mother had me clean my room or wash the dishes. So, I'm sure Trenchless Contractors, CIPP Suppliers, and Certified CCTV Operators don't like it when told that they missed a *defect* or *leak* that may compromise the life span of a new pipe, repair, or relined pipe.

**“Hey, You Missed A Spot!”**



They say 'the devil is always in the details.' If you only missed 1 or 2 defects it might be OK, but missing 80-100% of infiltration or leaks in new or existing pipes is no longer acceptable.

Since visual inspection can't precisely locate or quantify defects, utilities and consulting engineers are adopting Electro Scan's machine-intelligent technology and ISO Assessments.

**Question: What Does This Mean for Cities that Routinely Budget for Annual 'Clean and TV' Work?**

**Answer: Adopting ASTM F2550 & Electro Scan's FELL technology will benefit utility ratepayers.**

By incorrectly assessing sewer mains, manholes, and laterals using CCTV, cities and consulting engineers risk fixing the wrong pipes or approving pipes that have major defects that can't be seen.

Financial impact to budgets when CCTV does not accurately assess pipes are numerous:

- Incorrectly prioritizing pipes for rehabilitation.
- Recommending the wrong repair method. For example, recommending a point repair to fix a single problem when a complete line may need replacement.
- Repair and renewals projects that relied on CCTV may have been inadvertently OK'd pipes with major defects.
- New pipes that have defects, inadvertently approved by CCTV, may cause infiltration rates to return to pre-rehabilitation levels.

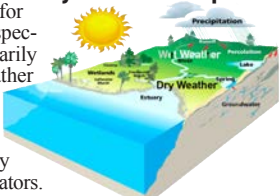
Contact Electro Scan Inc. to see how you can transition to new condition assessment standards for sewer and water pipelines.



## Major Limitations of CCTV Inspection Drives Adoption of FELL

### 1 Reliance on Dry Weather Pipes

A key reason for curtailing CCTV inspection is that it is primarily used during dry weather conditions – when pipes are less likely to leak and more likely to be missed by certified CCTV operators.



### 2 Pipe Full, Half-Full, Empty?

CCTV cameras are not effective in full or half-full pipes, missing major leaks below the waterline.



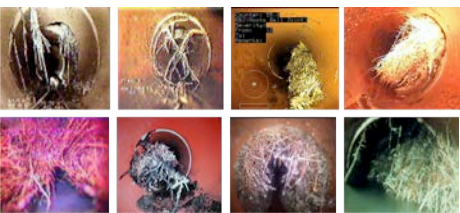
### 3 Fats, Oil, and Grease

While grease is a frequent call out by certified CCTV operators, it often covers up structural problems & leaks that may only be assessed if the pipe is thoroughly cleaned.



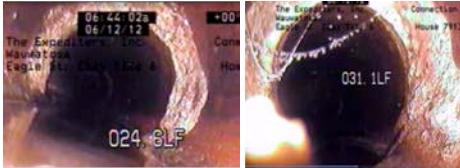
### 4 Roots

Representing a clear pathway between the inside of a pipe and surrounding ground, roots are an obvious source of infiltration. Yet, CCTV coding standards recommend that CCTV operators rate the level of roots, and not identify or estimate the potential for infiltration.



### 5 Encrustations

Often referred to as self-healing defects – at last check, encrustations are still not an approved method of rehabilitation. Encrustations can harden and cover-up cracks and fissures to the point of 'passing' pressure tests but their non-conductive material can still allow machine-intelligent FELL technology to locate and quantify leakage rates.



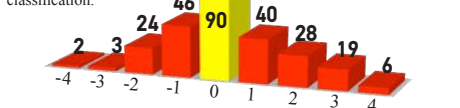
### 6 Different Codes, Same Defect

It is unfortunate, but true. Train and certify two TV operators on the same day, using the same instructor, utilizing the same materials (i.e. videos, photographs, etc.). Then test both using the same video, and you probably get two completely different interpretations of pipe defects. Not to mention a different number of defects & severity. It's human nature and has been studied extensively, as shown below.

Studies confirm that CCTV is not reliable.

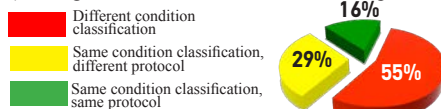
In a 2006 study of parallel TV inspections of 307 sewer mains, only 49 or 16% of participants had the same condition assessment classification.

CCTV is an error-prone condition assessment tool having a considerable potential for making the wrong decisions on rehabilitation scheduling and development of rehabilitation strategies.



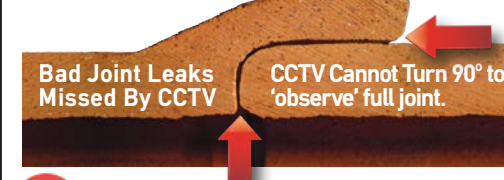
### 7 Same Code, Different Defects

Certified CCTV operators frequently use the same codes to describe different defects. As confirmed in the 2013 EPA/WRF study in Milwaukee, WI, independent review of certified TV operators found repeated use of the same code for different defects & severities, leading to questionable Overall Pipe Rating Index (OPRI) scoring often used to determine rehabilitation priorities.



### 8 Can't Record What You Don't See

CCTV is not good at assessing the condition of pipe joints, primarily due to the basic design of joints. No matter how close an operator zooms into the surface of a joint, there is no possible way to assess the integrity, water tightness, or remaining useful life of the mortar inside the joint. That is, unless using Electro Scan.



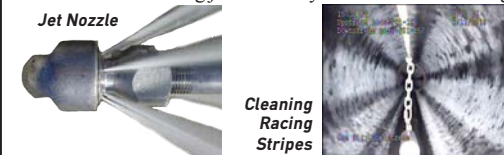
### 9 Silt

CCTV cameras cannot see through silt on the bottom of a pipe, and if heavy amounts are present, silt must be cleaned or the inspection must be abandoned as camera may get stuck in the pipe.



### 10 Clean v. Dirty Pipe Assessments

A 2010 EPA study found that while cleaning may eliminate fats, oils, and grease, roots, debris, and silt, it also eliminates key evidence of leaks. As a result, CCTV inspections found fewer defects when pipes were televised after cleaning, then were found before. Use of the wrong jet nozzle may also cause further damage.



### 11 Cracks

Unfortunately, CCTV cameras are not able to tell the difference between a superficial crack and a crack that goes completely through a pipe's wall. Too often, cracks are blamed for infiltration, when in reality, the unsealed joint, a few inches away has a larger leak potential than the crack.



### 12 Same Operator/Same Defect/Different Codes

Some operators use different codes for the same pipe-line defect. Whether a simple data entry error or not, certified CCTV operators often lack consistency in visually assessing defects. Some may favor some codes, while others may not understand the difference in using correct codes, leading to poorly labeled callouts, missed classifications, and incomplete assessments.

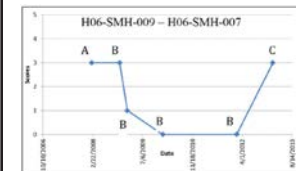


### 13 Many Contractors Are Not ISO-Certified

Few contractors adhere to international ISO quality standards resulting in wide variations in defect classifications.

### 14 Repeatability of Overall Scoring

Recent studies suggest that certified CCTV operators are often unable to repeat the same CCTV criticality scores, when evaluating the same pipe at different times – undermining development of an accurate visual assessment of sewer mains.



Note how CCTV operator A, B, and C, scored the same pipe as 0, 1, and 3, in using a Vendor Supported Overall 1-5 Scale.

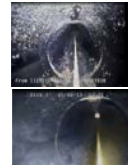
### 15 Fittings & Ferncos

CCTV cameras do not have the ability to test or validate the water tightness of fittings or Ferncos often used in clay pipes. Located outside the pipe, defects found by FELL were confirmed in open trench testing, missed by CCTV.



### 16 Dark-Colored Pipe

Dark pipe walls not only mask visual signs of defects, but also may absorb a camera's lighting, further reducing the chance of proper defect identification.



### 17 Point Repairs

CCTV is not a reliable tool to certify point or spot repairs. Whether completed with trenchless or open-cut methods, CCTV should not be used for final acceptance.



### 18 CIPP Permeability

CIPP liners, especially felt liners, can leak and never be seen by certified CCTV operators. Whether due to poor resin-to-felt ratio, inadequate curing, overheating, or contractor damage, cities should never rely on CCTV to approve a liner as watertight.



### 19 Missed Defects

Relying on a visual technology results in missed defects more often than not. Smudges on the lens, build up of debris, effluent on pipe walls, high flows, and operator inattentiveness, all contribute to missed callouts and unrecorded defects.



### 20 Infiltration/Exfiltration

The requirement to have an empty pipe during CCTV inspection and inability to readily quantify openings in a pipe make identification of 'infiltration' difficult, if not impossible; however, while certified CCTV operators may occasionally see & record active infiltration, this tends to be the exception, rather than the rule. Certified CCTV operators, also find it almost impossible to find active 'exfiltration' as effluent or water sources exit a buried pipe.



### 21 Camera Breakdown

A multitude of moving parts coupled with considerable heat build up while inside a pipe, results in a treacherous environment for cameras and their crawlers, requiring ongoing maintenance and repair.



# CIPP Projects Show Fewer Defects When FELL Required to Assess Pre- and Post- CIPP

Dec 31, 2017

Electro Scan Inc. is the first to admit that its first 1 million feet of CIPP assessments may be a little biased. After all, over half of its U.S. business is dedicated to assessing CIPP with known problems or cities that think they have problems and want to quantify leakage rates of their recently rehabilitated pipes.

As CIPP suppliers continue to resist new standards for testing CIPP as watertight, it is clear that new standards are having a favorable impact on improving the quality of liners being supplied. Take the example of the CIPP Contractor that won a lining job that required FELL Testing, and asked Electro Scan to pre-test its liners being installed at another city. After finding numerous leaks the Contractor said they would simply increase their *resin-to-felt ratio* to provide a better liner; easily reduced when cities only rely on CCTV or visual inspections to approve CIPP liners.

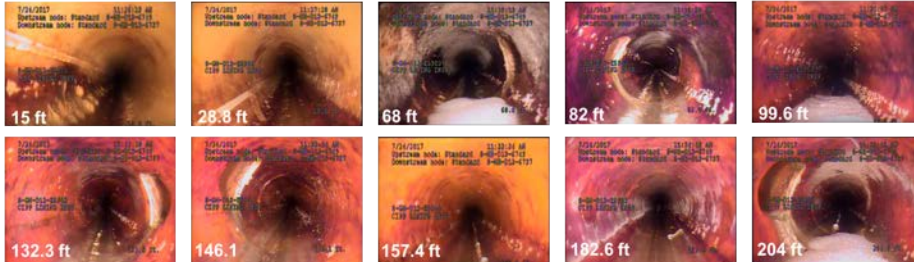
**The Good News:** Since 2013, when ASTM F2550 was first included in CIPP Specifications, projects have been found to have fewer defects. Just ask the cities of Grass Valley, Kansas City, Manteca, Roseville, Hamilton Township Municipal Utilities, Lower Paxton Township, Sanitation Districts of Los Angeles County, Upper Montgomery Joint Sewer Agency, and others, “Why ASTM Standard F2550 was added to recent specifications?”

## ✓ Iowa Sewer Agency Finds Defects in 100% of Active CIPP Project.



(Left) This 10,000 LF CIPP project was halted near the end of the project after the CIPP Contractor submitted NASSCO CCTV reports that claimed No Defects, with unexplained increases in flow.

## ✓ California Sewer District Finds Significant Leaks Approved By CCTV.



CIPP Liners with Defect Flows	88%
CIPP Liners with ZERO Defect Flow (Watertight)	12%
<b>Defect Flow By Severity</b>	
More than 1 GPM	72%
More than 2 GPM	63%
More than 3 GPM	59%
More than 4 GPM	52%
More than 5 GPM	48%
More than 10 GPM More Leakage Than Pre-CIPP	34%
More than 20 GPM More Leakage Than Pre-CIPP	19%



## ✓ Illinois Sewer Agency Finds Recent CIPP Worse Than Earlier CIPP Project.

### 2018 CIPP Lining Project Approved by CCTV. Worse Than 2014 Liner.



### 2014 CIPP Lining Project



# UV CIPP Supplier Recommends City Use FELL Testing

Some cities have specified air or hydrostatic testing to certify their CIPP liners as watertight. So Electro Scan was surprised when a national UV CIPP lining contractor recommended a City use FELL & ASTM F2550, instead of ASTM F1216 or ASTM E1003-13 (2018) *Standard Practice for Hydrostatic Leak Testing* to perform pressure tests. Whether using ASTM E1003, F1216, or AWWA C600, Section 5.2, hydrostatic testing has a number of limitations that favor the use of alternative inline testing, like Electro Scan's FELL.

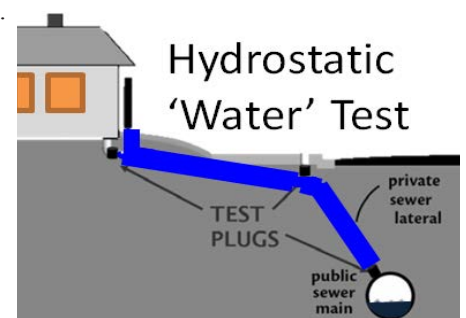


## Challenges with Hydrostatic and Air Testing

- PASS/FAIL Testing can't tell you how many defects or where each are located.
- Cost mobilization is high, including people, equipment, and testing devices.
- If leaks are found, contaminated water may exfiltrate through openings possibly causing environmental damage.
- Reproducibility of test results is difficult.
- Reliability of test is not guaranteed.

## Advantages of FELL

- Pinpoints leak locations to 3/8".
- Measures leak severity in GPM.
- Faster testing.
- Less expensive.
- Reporting available minutes after testing, while still mobilized in the field.
- Results are repeatable.



# Retrofit Your CCTV Truck to Find Infiltration



## Integrate Electro Scan with Leading CCTV Vans.



# City of Parsons, KS, Buys Electro Scan Equipment; 1st in EPA Region 7 to Quantify Rehab Effectiveness



As the setting for the 2018 movie “Kodachrome,” starring Jason Sudekis, Parsons, Kansas, is a city that, like many others, had ignored its I/I problem for years. But under the direction of Utilities Director Derek Clevenger, that is changing.

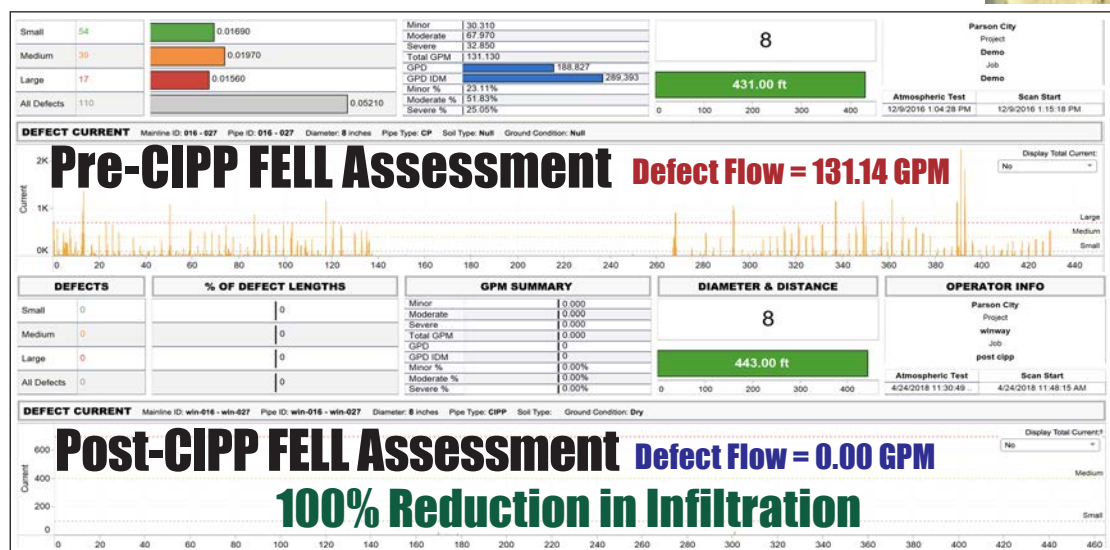
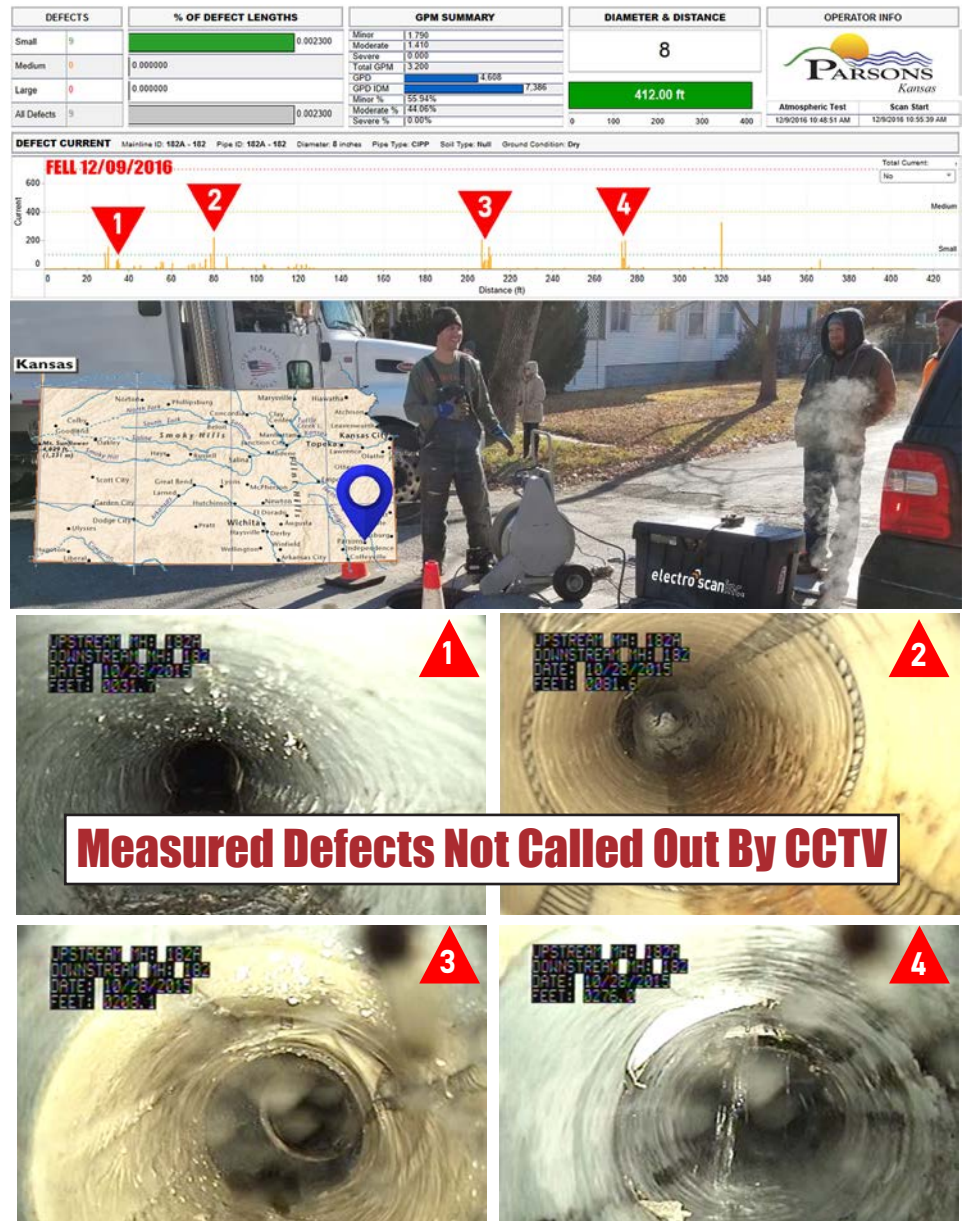
Clevenger is actively addressing I/I problems head-on for the City’s 70-mile sanitary sewer system, relying mostly on in-house crews, led by Ron Bias.

After Electro Scan conducted a Post-CIPP survey of 16-month old liners using ASTM F2550 Focused Electrode Leak Location (FELL), the City knew its own crews could take charge of Pre- and Post-Rehabilitation Assessments by adding equipment to their trailer-based CCTV equipment and quantifying rehabilitation effectiveness.

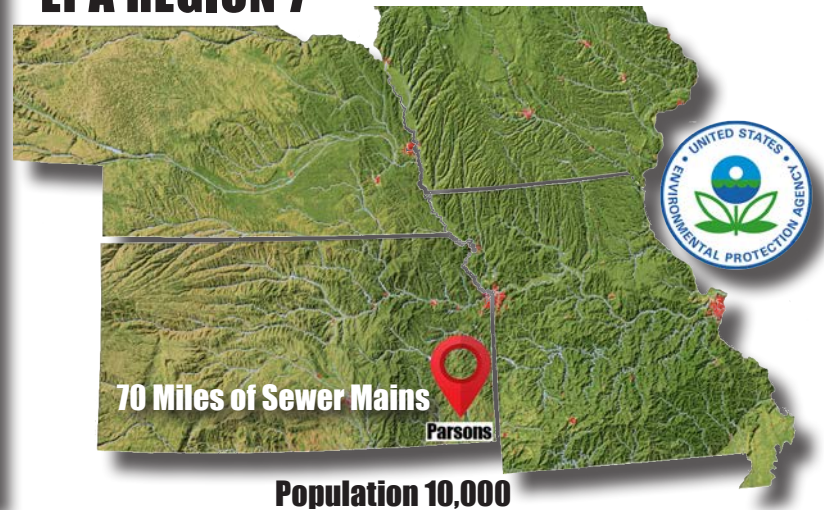
In May 2018 the City of Parsons purchased an Electro Scan ES-620 system, integrated with their Cues CCTV camera trailer allowing crews to change from CCTV to FELL, and back again, in minutes. After field training, crews immediately got to work, prioritizing older sewers for rehabilitation and inspecting CIPP liners that were still under warranty.

As the city is currently under a Consent Decree from the EPA, the ultimate goal of Clevenger is to create a pre-vs-post rehabilitation comparison of all rehabilitated pipes to produce quantifiable data showing progress towards reducing their infiltration.

While some cities might consider only testing a small portion or sample of their CIPP, or restrict certification to Post-CIPP Only, Electro Scan and its partners recommend that 100% of CIPP should be tested **BEFORE** and **AFTER REHABILITATION**, as is planned with the City of Parsons, Kansas; at least until cities can assure that selected Contractors will deliver watertight CIPP liners.

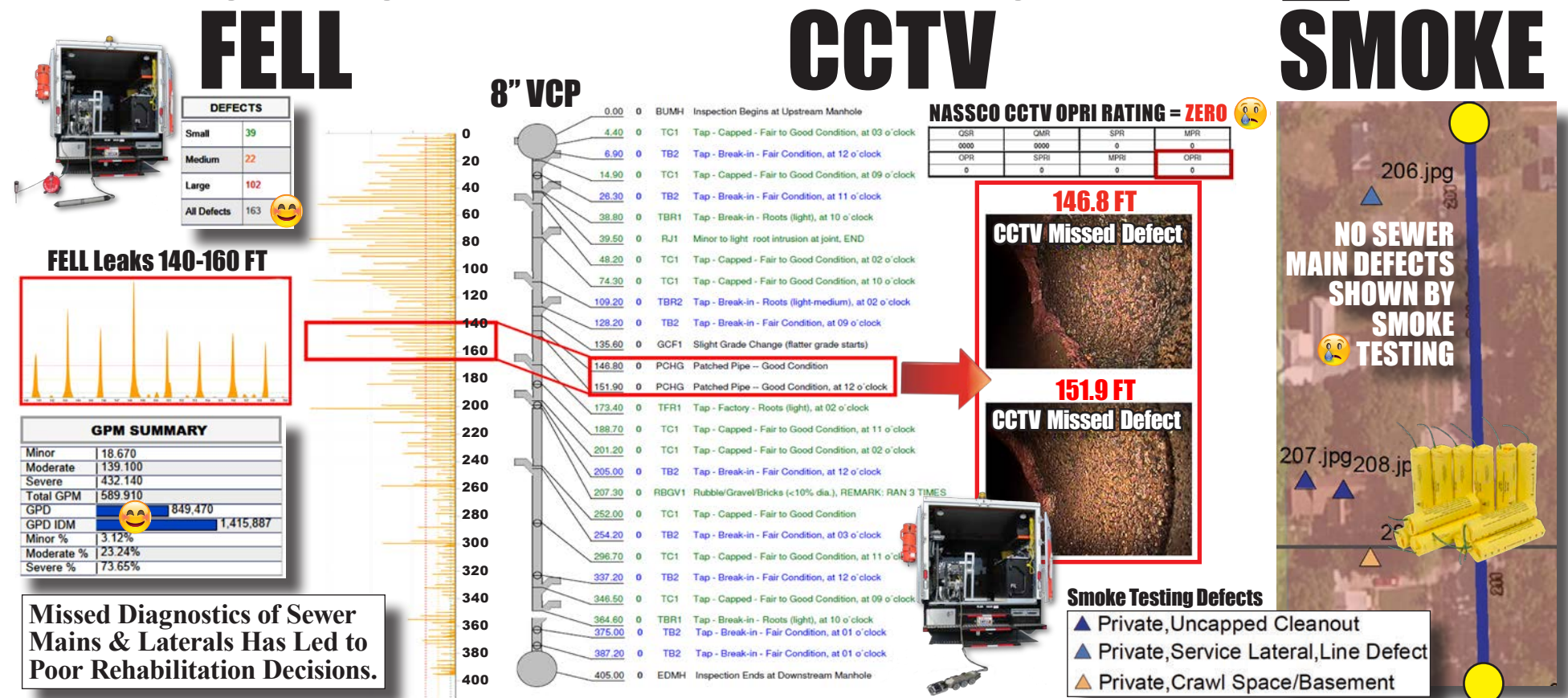


## EPA REGION 7



# CCTV & Smoke Testing Miss 100% of Sewer Main Defects

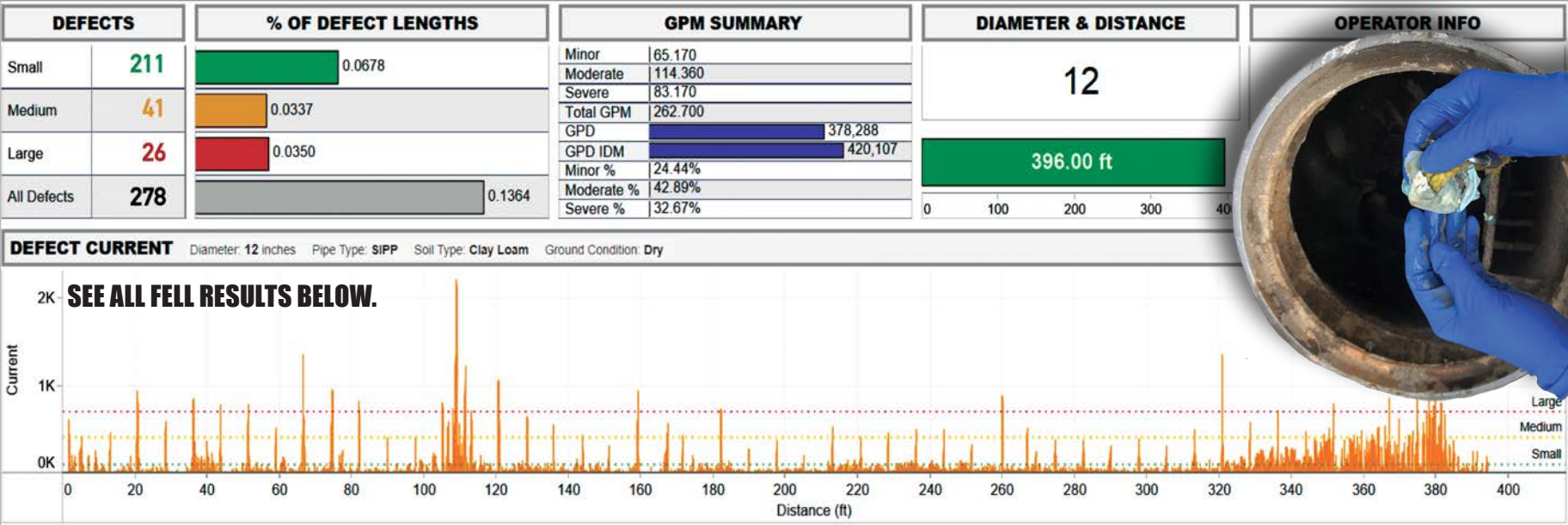
## Midwest Engineering Firm Learns CCTV & Smoke Testing Failed to Find Any Infiltration



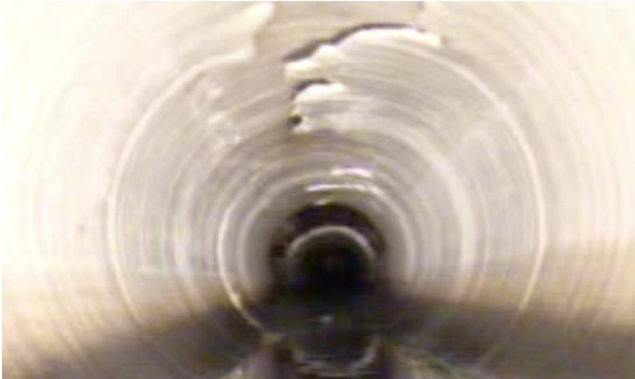


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# Spray-In-Place Pipe OK'd By CCTV, Fails After Installation



## 3,425 LF FELL Project Finds & Quantifies 1,285 Total Defects in 10" to 16" Sewer Mains



Electro Scan Inc. evaluated 3,425 LF of Spray-In-Place Pipe (SIPP), including one Cured-In-Place Pipe (CIPP), finding 1,285 defects measuring an estimated 1,896.48 GPM.

All sewer and water agencies are advised to include ASTM F2550 as part of all rehabilitation projects to ensure watertight pipelines are delivered as part of SIPP and CIPP Rehabilitation.

Scans		Distance	Total Defects	GPM
14		3,425	1,285	1,896.48

Date	Pipe ID	Pipe Type	Diameter	Distance	Small	Medium	Large	GPM	GPD	GPD/IDM
7/26/2018	11 - 10	SIPP	15	306.5	206	64	55	396.94	571,594	656,497
7/26/2018	12 - 11	SIPP	10	314.8	266	34	34	285.85	411,624	690,349
7/26/2018	- 6	SIPP	12	394.5	65	19	38	263.85	379,944	423,781
6/21/2018	8 - 7	SIPP	12	396.2	211	41	26	262.70	378,288	420,107
7/26/2018	20 - 19	SIPP	10	350.0	8	3	24	184.18	265,219	400,143
7/26/2018	14 - 13	SIPP	10	344.5	16	5	17	132.43	190,699	292,303
7/26/2018	15 - 14	SIPP	10	345.5	50	18	14	118.49	170,626	260,732
7/26/2018	18 - 15	SIPP	10	207.7	2	3	15	82.08	118,195	300,462
7/26/2018	13 - 12	SIPP	10	185.5	10	2	11	67.64	97,402	277,208
7/26/2018	16 - 15	SIPP	10	122.7	1	2	9	47.76	68,774	295,956
7/26/2018	18 - 17	SIPP	10	70.5	0	0	5	28.53	41,083	307,750
7/26/2018	19 - 18	SIPP	10	137.8	3	3	5	26.03	37,483	143,572
6/21/2018	6 - 5	CIPP	16	239.2	0	0	0	0.00	0	0

## Roseville Adds ES-620 to New CCTV Truck

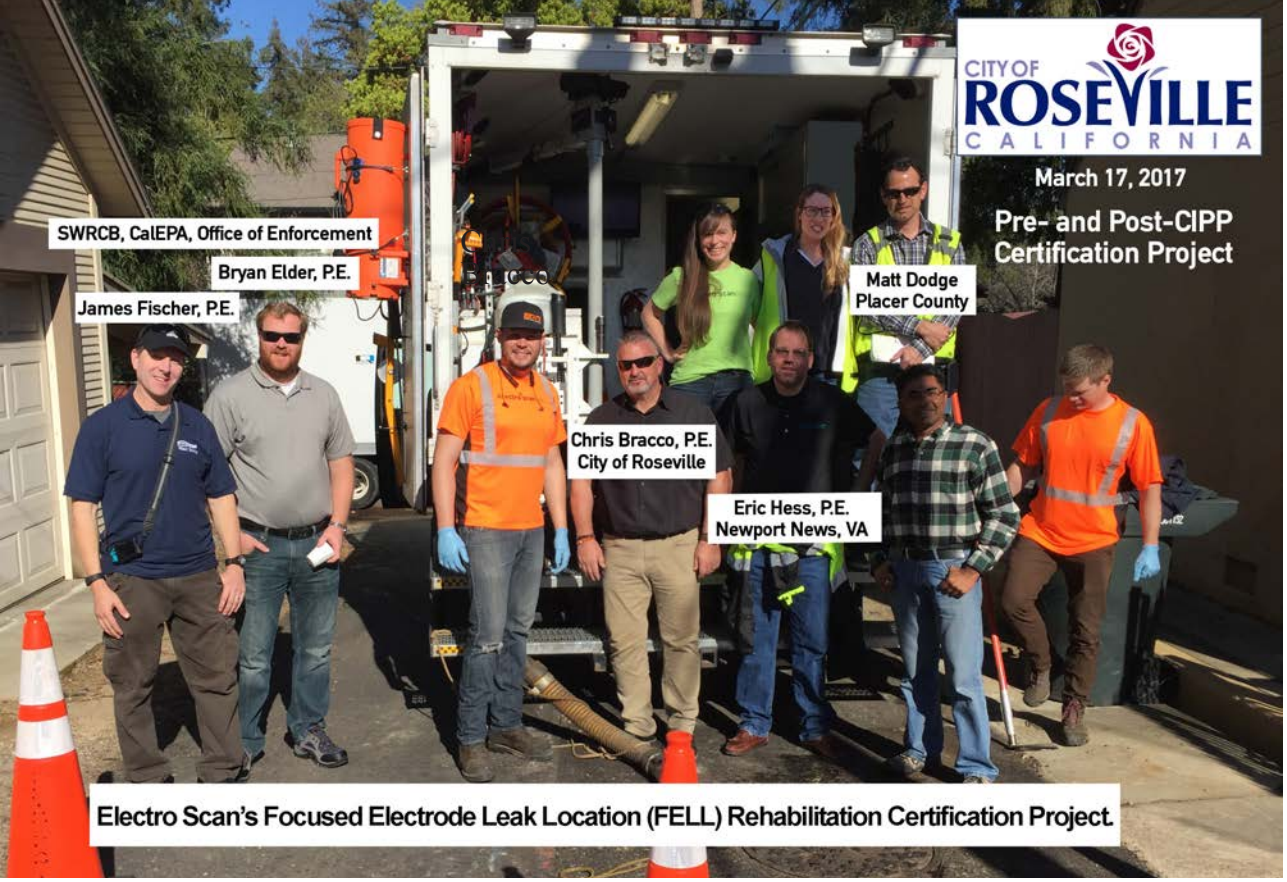
After undertaking a 3-year investigation of the City of Roseville's previous CIPP lining projects, resulting in specifying FELL for Pre- & Post-CIPP Testing & Acceptance in 2016, the City looks forward to conducting their own FELL Certification with its new Electro Scan system, just ordered as part of its new Cues TV truck.

Job# 854.  
6"x4.5mm  
1-19-17  
Seg 5  
SWPL

ST: ALLY

Change from CCTV to FELL in Minutes!

Exhumed CIPP with No Defects Found Using NASSCO CCTV Standards, But Found & Measured By FELL.





# Webinar

# Record Attendees For Trenchless Webinar!

+450

67%

94

**Registered Webinar Connections With 1-12 Attendees Per Location.**

We are delighted that so many of you joined us. Thanks to everyone for answering our polls and follow-up questions. To request more information, email [carissa@electroscan.com](mailto:carissa@electroscan.com).

**% Attendees Interested in Safeguarding Their CIPP Projects Using FELL.**

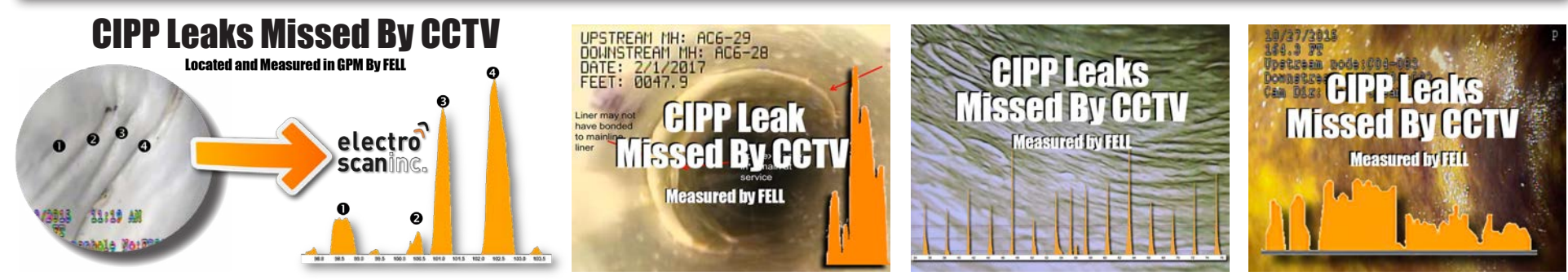
Interested attendees were sent sample specifications, a certified copy of ASTM F2550, and a new 7th Edition, Volume 1, *Operation and Maintenance of Wastewater Collection Systems* manual.

**Had Issues With CIPP Contractor or Found Issues After Warranty Expiration.**

Failure can be predicted and addressed before Contractor Acceptance and within the warranty period by using Electro Scanning Inspection as your new certification standard.

## Trenchless Webinar Speakers

<p><b>Chuck Hansen</b> Managing Partner Hansen Holdings LLC <b>HANSEN</b> Hansen Investment Holdings LLC</p> <ul style="list-style-type: none"> <li>• Founder &amp; Patent holder, Electro Scan Inc.</li> <li>• Founder &amp; Chairman, Hansen Software (1983-2007)</li> <li>• Private Equity Investor &amp; CleanTech Advisor</li> </ul>	<p><b>Paul Pasko, P.E.</b> Principal/Client Service Project Manager SEH® (1996-Present)</p> <ul style="list-style-type: none"> <li>• Electro Scan Projects: Racine, WI, Golden Valley, MN</li> <li>• Senior Sewer &amp; Water CIPP Thought-Leader</li> <li>• Expert, Acoustic Leak Detection</li> </ul>	<p><b>Peter Henley</b> Technical Consultant WRc plc <b>wrc</b></p> <ul style="list-style-type: none"> <li>• Electro Scan Projects</li> <li>- Thames Water</li> <li>- Wessex Water</li> <li>- Dwr Cymru Welsh Water</li> <li>- Southern Water</li> </ul>	<p><b>Mark Grabowski</b> GM and Senior VP Electro Scan Inc. <b>electroscaninc.</b></p> <ul style="list-style-type: none"> <li>• Multiple Patent holder</li> <li>• Chief Product Officer</li> <li>• International Business Partnerships</li> </ul>
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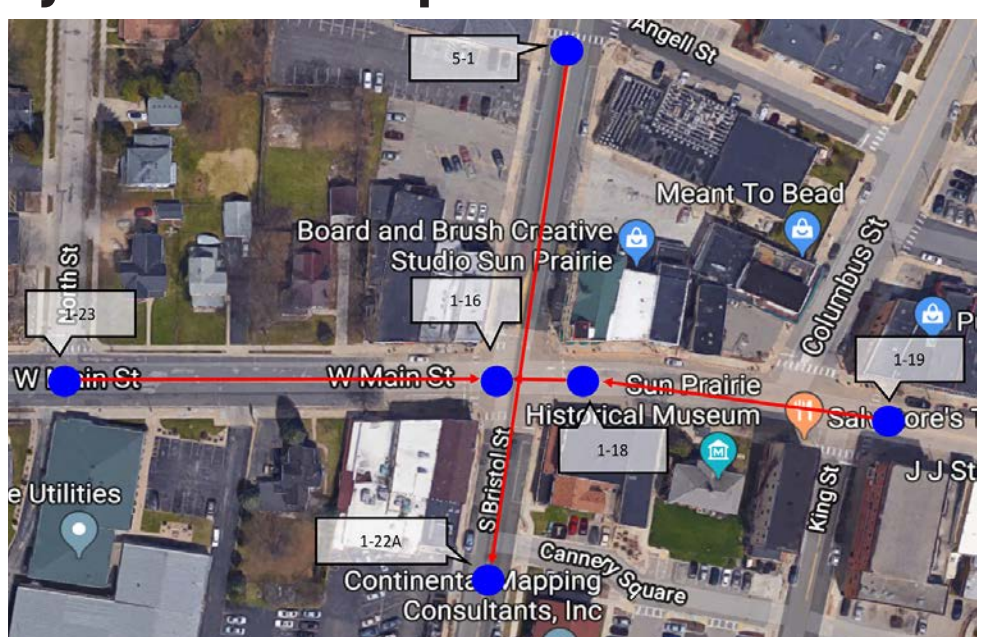
# Post-Disaster FELL Assessment of CIPP Liners in Sun Prairie, WI

## Electro Scan Services Support City's Critical Pipeline Assessment After Deadly Gas Main Explosion

At the request of the City of Sun Prairie, WI, Electro Scan Inc.'s Sacramento Team immediately began assembling equipment that was shipped over a weekend and delivered to on-site staff. In July 2018, Mark Grabowski, Electro Scan's GM, worked with InterCon Construction (Waunakee, WI) to perform a detailed leak assessment of the City's downtown sanitary sewer system after a contractor's gas main strike led to an explosion on July 10.

Decimating two city blocks, the explosion sadly took the life of a Fire Captain. Three (3) CIPP and one (1) reinforced concrete pipe (RCP) were tested, totaling 1,054 linear feet. Testing was in accordance with ASTM F2550 *Standard Practice For Locating Leaks in Sewer Pipes by Measuring the Variation of Electric Current Flow Through the Pipe Wall*.

Just remember that unsafe work activities or "cutting corners" put at risk not only you and your crews, but also the general public and our first responders. Never risk anything, especially around buried utilities. And always call an authorized FELL provider after any major natural disaster, fire, or flood to correctly assess leaking sewer & water pipes, missed by CCTV.



**Gas Main Explosion July 2018. Electro Scan Project July 24, 2018.**





# Calif. Pre- & Post-CIPP Project Determines % Flow Reduction

## But, CIPP Liner Pinholes & Issues With Grout Need Follow-Up!

The **GOOD NEWS** for this groundbreaking rehabilitation assessment project was that Electro Scan Inc. determined that Post-CIPP Lining, including Grouting of Service Laterals, reduced infiltration by 95%.

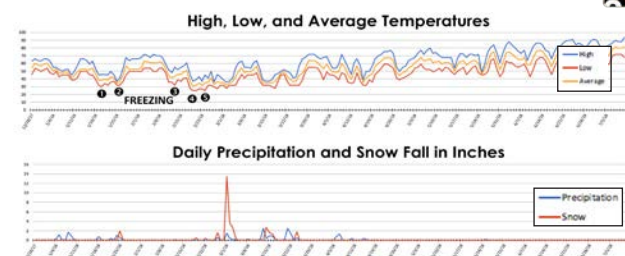
Electro Scan evaluated thirty-one (31) Sewer Mains (i.e. 28 Sewer Mains FELL Tested Before & After CIPP Lining, plus 3 Sewer Mains FELL Tested Post-CIPP), approximating 5,545LF or 17.6% of a 31,426LF Total Project.

The (potential) **BAD NEWS** for this project was the numerous pinhole defects found in the CIPP liner and low FELL readings found on newly grouted laterals that indicated that grout had (a) degraded, possibly from repeated freeze-thaw occurrences, absence of high groundwater, and high temperatures, (b) insufficiently applied amounts of grout, or (c) suspected leaks were not sufficiently large enough to warrant the addition of grout.

Since FELL tests pipes at their static condition, it does not force any additional pressure on joints or laterals, unlike air tests which can open joints and shift pipes, creating openings where none had previously existed.

**According to the American Concrete Pipe Association "if a test pressure required is greater than six pounds per square inch gage, the air test should not be used." Given that packer air tests of joints and laterals require 10 psi, and often repeated if a test fails with added grout injected until it passes, cities are now recommended to use FELL in all Pre- and Post-Grouting of Joints and Laterals.**

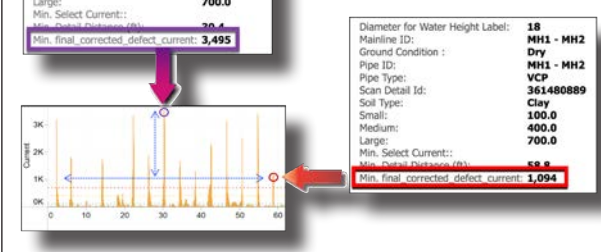
As a result, Electro Scan recommended that the sewer agency review detail grout records for each lateral to review mixture and gallons of grout applied, and to consider dye flood testing or additional pressure testing of laterals in six months to a year.



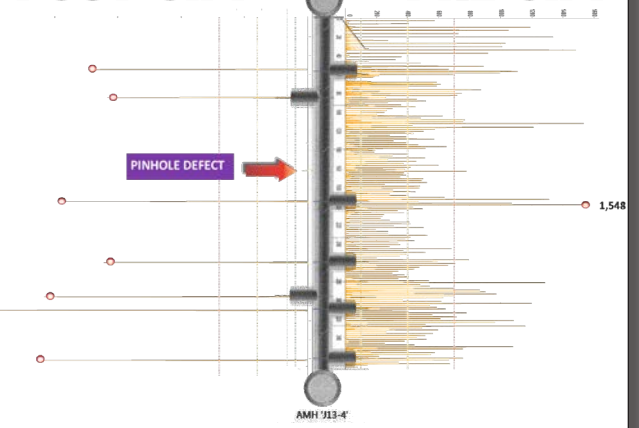
### A. GOOD POST-CIPP GROUDED LATERALS

The use of acrylamide grout should act as a hydrophilic chemical resulting in a maximum FELL reading for all grouted laterals (or joints). Based on previous studies

Electro Scan showed a max. current reading of 3,495 on *same-day* grouted joints, with a minimum reading of 1,094 amps.



### POST-CIPP PRE-CIPP



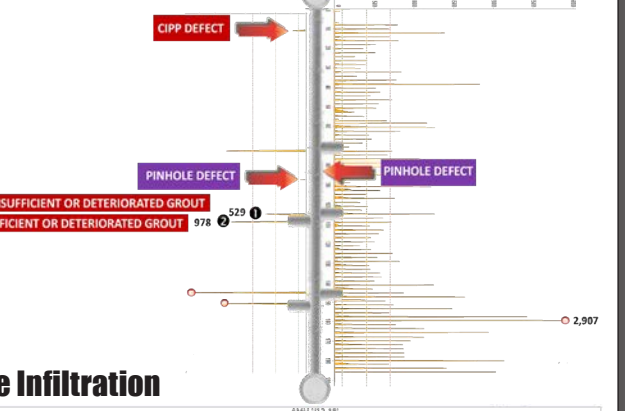
### B. POSSIBLE INSUFFICIENT GROUDED LATERALS

When FELL readings are 1,000 amps or below, calibration tests of 15-year old grouted joints confirms that visible infiltration was evident where lines were previously grouted.

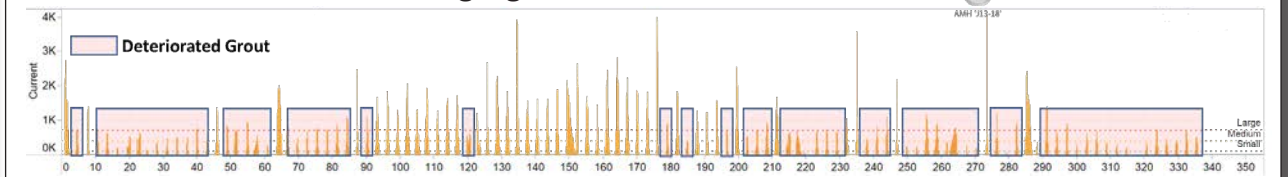
As a result, all laterals that had been grouted during the Post-CIPP phase of the project, with FELL readings of 1,000 or below were identified and reported. Key factors for FELL readings for grouted joints or laterals of 1,000 or lower, may indicate one of the following:

- Grout has decayed and is now defective.
- Grout was not applied in enough quantities to fully correct a prior leak.
- Suspected 'leak' was not sufficient to warrant grout, therefore resulting in a lower FELL reading.

### POST-CIPP PRE-CIPP



### SAMPLE 15-Year Old Grout Showing Signs of Active Infiltration



### PRE-CIPP FELL ASSESSMENT

RANK	DATE	UPSTREAM ID	DOWNSTREAM ID	PIPE ID	CUMULATIVE FOOTAGE	ELECTRO SCAN SURVEY LENGTH	PIPE MATERIAL	PIPE DIAMETER	SMALL	MEDIUM	LARGE	TOTAL	MINOR GPM FLOW	MODERATE GPM FLOW	SEVERE GPM FLOW	TOTAL GPM	TOTAL GPD	GPD / ID	CUMULATIVE DEFECT FLOW	CUMULATIVE % DEFECT FLOW
PRE-CIPP FELL ASSESSMENT					5,542				635	445	606	1,686	333.1	1,637.3	664.3	2,634.77	3,794,069			
1	12/29/2017	J14-6	J14-5	S65	6.9%				382.0	VCP	6	25	5.2	121	198	25.20	306.44	177.83	661.637	13%
2	12/29/2017	J15-8	J15-9	S105	13.0%				337.0	VCP	6	21	42	113	176	19.00	254.66	165.47	439.13	34%
3	12/29/2017	J14-8	J14-6	S67	19.2%				345.9	VCP	6	41	38	104	183	28.39	258.71	110.02	397.12	49%
4	12/29/2017	J12-7	J13-4	S30	25.9%				372.0	VCP	6	68	73	38	179	59.59	139.00	17.82	216.41	57%
5	12/29/2017	J13-17	J13-18	S48	29.4%				191.1	VCP	6	16	34	41	91	11.59	128.89	58.79	199.27	65%
6	12/29/2017	J14-3	J14-5	S63	33.5%				227.7	VCP	6	33	53	30	116	34.03	99.76	17.00	150.79	73%
7	12/29/2017	J13-23	J13-24	S50	36.4%				162.0	VCP	6	31	13	37	81	12.97	88.35	37.87	144.19	76%
8	12/29/2017	J14-4	J14-5	S65																
9	12/29/2017	J14-4	J14-5	S65																
10	12/29/2017	J13-3	J13-4	S30																
11	12/29/2017	J13-3	J13-4	S30																
12	12/28/2017	J11-1	J11-2	S3																
13	12/28/2017	J12-9	J12-11	S21																
14	12/28/2017	J11-1	J11-2	S3																
15	12/28/2017	K10-11	J10-2	S4	62.5%				254.1	VCP	6	18	8	2	28	3.52	0.00	12.19	15.71	22.82%
16	12/28/2017	J10-1	J10-2	S5	67.7%				288.6	VCP	6	31	1	1	33	6.76	2.61	4.71	14.08	20.27%
17	12/28/2017	K10-13	K10-11	S5	73.2%				192.5	VCP	6	16	2	2	20	3.46	8.19	0.00	11.65	16.77%
18	12/28/2017	J12-6	J12-9	S20	75.7%				252.2	VCP	6	49	0	1	50	9.11	0.00	0.00	9.11	13.11%
19	12/28/2017	J11-2	J11-3	S10	78.3%				199.5	VCP	6	26	0	2	28	5.66	0.00	0.00	5.66	8.15%
20	12/28/2017	J12-1	J12-2	S14	80.5%				66.8	VCP	6	11	1	0	12	3.14	1.75	0.00	4.89	7.04%
21	12/28/2017	J12-9	J12-11	S21	83.4%				160.3	VCP	6	25	0	0	25	4.02	0.00	0.00	4.02	5.78%
22	12/28/2017	J12-3	J12-5	S18	86.0%				143.0	VCP	6	19	1	0	20	3.91	0.00	0.00	3.91	5.64%
23	12/28/2017	J12-11	J13-26	S22	87.1%				63.5	VCP	6	9	0	0	9	3.25	0.00	0.00	3.25	4.68%
24	12/28/2017	J10-2	J11-1	S2	90.2%				168.2	VCP	6	15	0	0	15	1.67	1.23	0.00	2.90	4.17%
25	12/28/2017	J11-4	J11-5	S12	94.1%				220.0	VCP	6	5	1	0	6	1.25	1.64	0.00	2.89	4.16%
26	12/28/2017	J12-2	J12-3	S15	97.0%				159.4	VCP	6	13	0	0	13	1.53	0.00	0.00	1.53	2.20%
27	12/28/2017	J11-3	J11-4	S11	99.9%				157.7	VCP	6	4	0	0	4	0.74	0.00	0.00	0.74	1.06%
28	12/28/2017	K13-26	K13-1	S25	100.0%				7.2	VCP	6	2	0	0	2	0.42	0.00	0.00	0.42	0.60%

### POST-CIPP FELL ASSESSMENT

RANK	DATE	UPSTREAM ID	DOWNSTREAM ID	PIPE ID	CUMULATIVE FOOTAGE	ELECTRO SCAN SURVEY LENGTH	PIPE MATERIAL	PIPE DIAMETER	TOTAL				TOTAL GPM				TOTAL GPD	GPD / ID	CUMULATIVE DEFECT FLOW	CUMULATIVE % DEFECT FLOW			
									SMALL	MEDIUM	LARGE	TOTAL	MINOR GPM FLOW	MODERATE GPM FLOW	SEVERE GPM FLOW	TOTAL GPM							
POST-CIPP FELL ASSESSMENT						5,576			18	14	51	83	4.5	30.7	467.3	502.38	723,425						
1	7/5/2018	J14-6	J14-5	S65	6.8%				381.6	CIPP	6	0	1	4	5	0.00	2.62	37.60	40.22	57.917	133.551	57.917	8%
2	7/5/2018	J15-8	J15-9	S105	12.9%				339.1	CIPP	6	1	3	6	10	0.15	3.85	59.36	63.36	91.238	236.754	149.155	21%
3	7/5/2018	J14-8	J14-6	S67	19.1%				344.0	CIPP	6	1	0	5	6	0.19	0.00	48.82	49.01	70.574	180.531	219.729	30%
4	7/5/2018	J12-7	J13-4	S30	25.7%				371.0	CIPP	6	0	0	7	7	0.00	0.00	70.00	70.00	100.800	239.117	320.529	44%
5	7/5/2018	J13-17	J13-18	S48	29.2%				191.8	CIPP	6	1	1	4	6	0.46	3.72	30.48	34.66	49.910	229.028	370.439	51%
6	7/5/2018	J14-3	J14-5	S63	33.7%				250.1	CIPP	6	0	0	5	5	0.00	0.00	42.32	42.32	60.941	214.396	451.180	60%
7	7/5/2018	J13-23	J13-24	S50	36.7%				166.8	CIPP	6	0	0	1	2	0.00	0.00	18.80	18.80	27.072	142.791	458.452	63%
																			996	487,252	67%		
																			843	538,055	74%		
																			760	558,597	77%		
																			690	569,597	78%		
																			848	572,039	79%		
																			478	572,543	79%		
																			0	572,543	79%		
15	7/3/2018	K10-13	J10-2	S4	62.5%				253.8	CIPP	6	0	0	2	2	0.00	0.00	20.00	20.00	28.800	99.843	601.343	83%
16	7/3/2018	J10-1	J10-2	S5	67.7%				290.3	CIPP	6	1	1	5	7	0.10	1.87	38.09	40.06	57.686	174.841	698.029	91%
17	7/3/2018	K10-13	K10-11	S5	71.1%				189.3	CIPP	6	1	0	3	4	0.50	0.00	24.22	24.72	35.597	155.478	694.626	90%
18	7/5/2018	J12-6	J12-9	S20	75.4%				253.5	CIPP	6	1	3	0	4	0.38	5.90	0.00	6.28	9.043	31.991	703.669	97%
19	7/3/2018	J11-2	J11-3	S10	79.2%				199.5	CIPP	6	0	0	0	0	0.00	0.00	0.00	0.00	0	0	703.669	97%
20	7/3/2018	J12-1	J12-2	S14	80.3%				63.4	CIPP	6	0	0	0	0	0.00	0.00	0.00	0.00	0	0	703.669	97%
21	7/5/2018	J12-9	J12-11	S21	83.2%				158.8	CIPP	6	2	0	0	2	0.33	1.48	0.00	1.81	2.606	14.446	704.275	98%
22	7/3/2018	J12-3	J12-5	S18	85.6%				134.9	CIPP	6	1	1	0	2	0.24	0.00	4.71	4.95	7.128	46.490	713.403	99%
23	7/5/2018	J12-11	K13-26	S22	86.8%				65.5	CIPP	6	0	1	0	1	0.00	0.00	5.58	5.58	8.035	108.005	721.438	100%
24	7/3/2018	J10-2	J11-1	S2	89.8%				170.5	CIPP	6	2	0	0	2	1.01	0.00	1.01	1.454	7.506	22.892	100%	
25	7/3/2018	J11-4	J11-5	S12	93.8%				218.8	CIPP	6	0	0	0	0	0.00	0.00	0.00	0.00	0	0	722.892	100%
26	7/3/2018	J12-2	J12-3	S15	96.7%				167.7	CIPP	6	0	0	0	0	0.00	0.00	0.00	0.00	0	0	722.892	100%
27	7/3/2018	J11-3	J11-4	S11	99.4%				153.8	CIPP	6	2	0	0	2	0.37	0.00	0.37	0.53	3.048	723.425	100%	
28	7/5/2018	K13-26	K13-1	S25	100.0%				32.8	CIPP	6	0	0	0	0	0.00	0.00	0.00	0.00	0	0	723.425	100%

## Measured Flow Reductions Available Minutes After Scanning.

14	12/28/2017	J11-1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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# FELL Inspection Certifies CIPP Lined Water Mains

## Defects Typically Missed by Acoustic Inspection Picked Up By Electro Scan

Defects in water mains using Cured-In-Place Pipe lining typically go unnoticed by visual inspection. When pressure testing is used, it's often before services are reinstated and is unable to locate the leak inside the pipeline.

While both ASTM F1216 (2016) and F1743 (2017) recommend visual inspection of CIPP, newer inspection methods have been welcomed into the industry as standards of practice. Superior to legacy acoustic sensors or data loggers & correlators, Electro Scan is pleased to announce it has been awarded U.S. Patent #9933329, Multi-Sensor Inspection for Identification of Pressurized Pipe Defects That Leak.

As seen in ASTM F2550 (2018), Electro Scanning Inspection or Low Voltage Conductivity, has been frequently required to find defects previously missed by CCTV inspection in CIPP liners.

The upcoming AWWA Manual M77, *Manual of Practice: Condition Assessment of Water Mains* also indicates that Low Voltage Conductivity is able to assess CIPP lining for water tightness, too.

As a result, Electro Scan Inspection should be an integral part of any water main lining project specification. Contact us for sample specifications and budget pricing.

### Condition Assessment of Water Mains

AWWA Manual M77

Chapter 7

#### Leak Detection

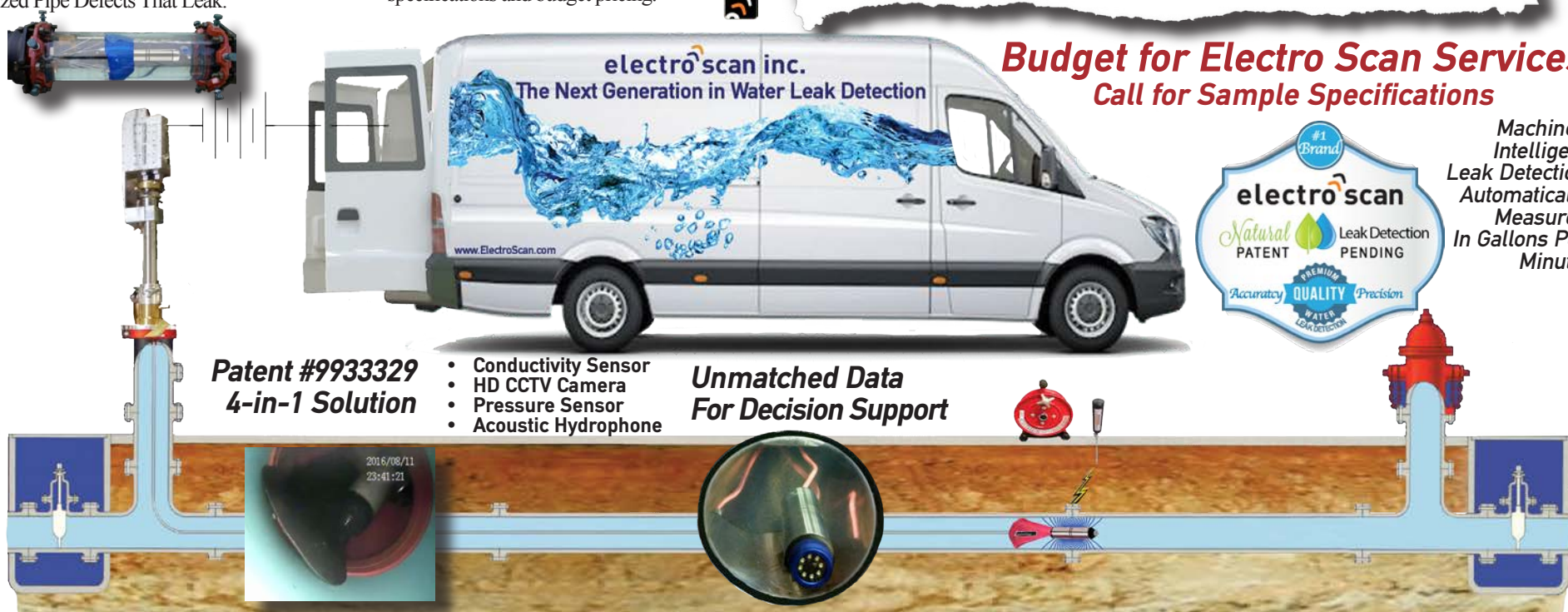
First Edition

**NEW**

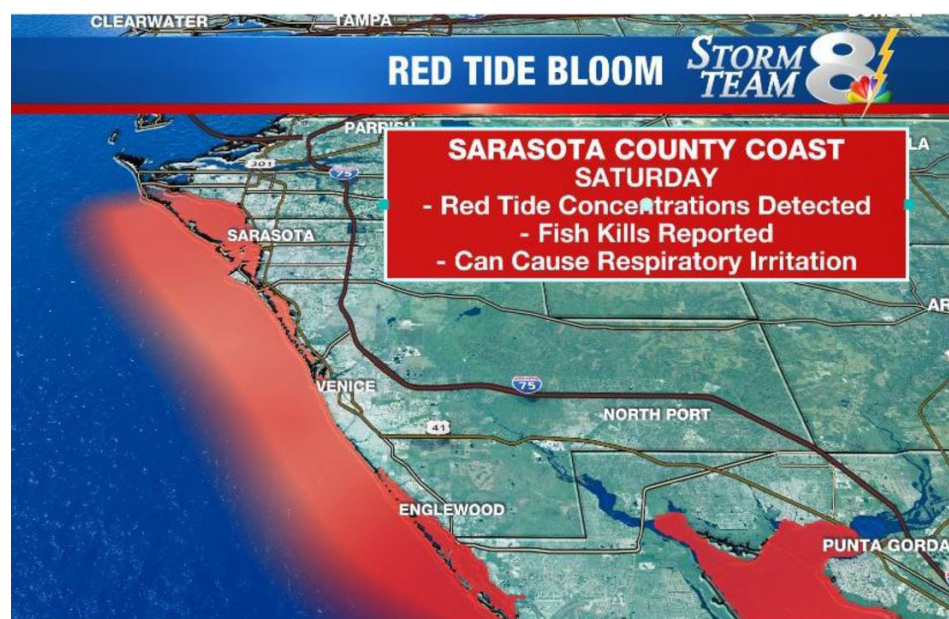
**Low-voltage conductivity testing.** Low-voltage conductivity testing (also referred to in other manuals and standards as "focused electrode leak locating") is the process by which leaks are identified and quantified within non-conductive pipes, using a focused electrical current. It is an in-pipe, tethered inspection method, and uses the fluid within the pipe to analyze the pipe walls for leaks. At the locations where the fluid leaks out, the current will leak out, and using the earth as an electrical return path, the technology will record the leak and estimate its leakage potential.

**Budget for Electro Scan Services**  
**Call for Sample Specifications**

**Machine-Intelligent Leak Detection Automatically Measures In Gallons Per Minute.**



## Is CCTV Missing Leaks Contributing to Red & Green Tides?



It's a simple chain of cause-and-effect events. First, man-made activities and industries pollute the environment with nitrogen and phosphorous rich nutrients. These feed the Cyanobacteria green slime. Then, the Red Tide organism feeds off of the green slime. Blooming results. Scientific and peer-reviewed studies indicate sewage and urea nitrogen are major contributors to red and green tides.

Don't plan in using closed-circuit television (CCTV) to find where sewage is leaking out of shoreline sewers to find these cause-and-effect sources of red and green tide - it can't. Since CCTV inspection misses 80-100% of sewer leaks, coastal communities are recommended to specify ASTM F2550-18 and Focused Electrode Leak Location (FELL) to pinpoint and quantify leaks in gallons per minute (GPM).



## Testing Post-CIPP in Hawaii Hi-Rise Condos

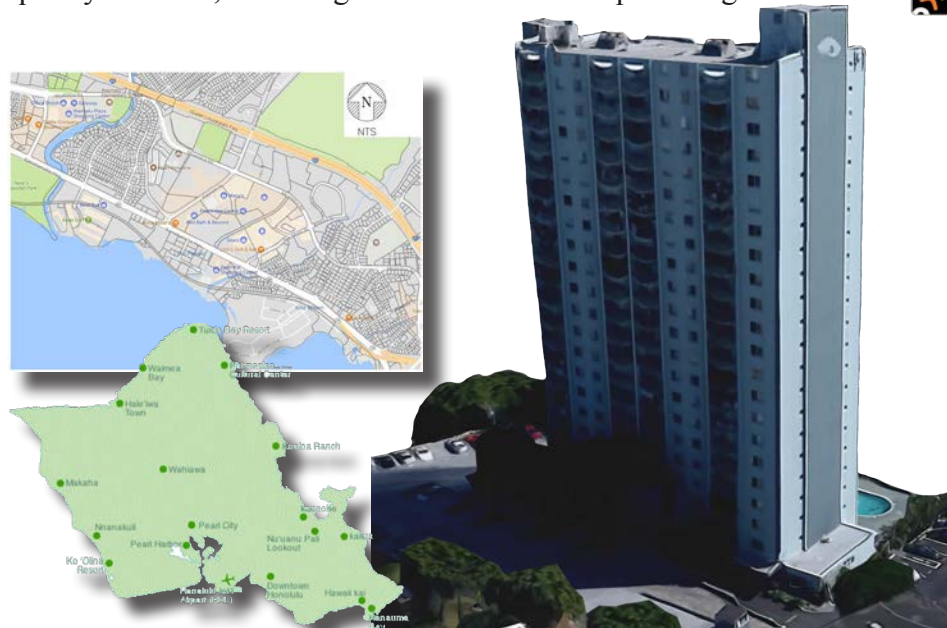
Electro Scan's ability to test small diameter pipes from 3" to 8" (76-150mm) is not limited to residential laterals, but also for low-rise and high-rise plumbing, inside apartment buildings & condominiums.

Frequently, when premium apartment complexes are due to replace internal sewer & water pipes, many Associations of Apartment Owners

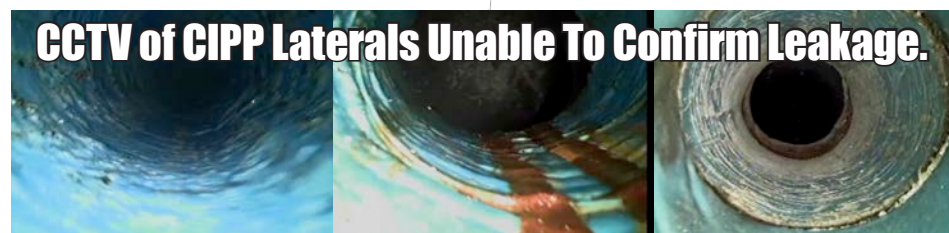
### Condominium Vertical Sewer & Water Pipes.



(AOAO) and Homeowner Associations (HOA) don't undertake the necessary Post-CIPP and Rehabilitation testing needed to ensure their capital investments are properly spent. Since CCTV inspection is unable to determine whether liners are watertight or permeable, Electro Scan's FELL and ASTM F2550 is now the recommended standard to test & certify the quality of liners, including customer laterals & plumbing.



**CCTV of CIPP Laterals Unable To Confirm Leakage.**





# HTMA Provides FELL Service to Shippensburg, PA

Pennsylvania-based Hamilton Township Municipal Authority (HTMA) is known for being neighborly. So when the Borough of Shippensburg (under a consent order) was struggling to televise sewer lines that were full of water having and obscuring visibility, HTMA was glad to help. Shippensburg called upon HTMA to inspect their surcharged sewers using their agency-owned FELL inspection truck. Being senior Electro Scan users since 2014, FELL-certified HTMA field crews were glad assist.

HTMA staff also performed an in-house pilot project on a basin within their own conveyance network. From there, the top 10 to 20 segments with the worst infiltration were identified. The Borough of Chambersburg was designing an Interceptor project, which initially would have impacted HTMA's Washington Street meter station.

Knowing the results of the scans, HTMA authorized the Authority Engineer to design a project to divert flows to another interceptor line, abandon in place a section of sewer line that would no longer be needed, and replace three segments of ACP by pipe bursting with HDPE pipe.

The flow was diverted and sewer lines in the state roadway were filled. A large support bridge over the Conococheague Creek was removed and the meter station was demolished so the pipe bursting could begin. As a part of the project, HTMA installed a new metering manhole so they could monitor flows from the area and compare them to historical records.

It was found that after the flow diversion was completed, there was still clear water flowing to the meter station; the meter in place logged nearly 30,000 gallons of water in one day when there was some rain.



Shippensburg and HTMA crews from left to right: Mike Misner, Hunter Stevens, & Mark Ryder (Shippensburg), Josh Eyer (HTMA), Wade Farner (Shippensburg), Todd Hummer, & Brandon Dice (HTMA).



## HTMA Annual BBQ Wednesday October 10, 2018

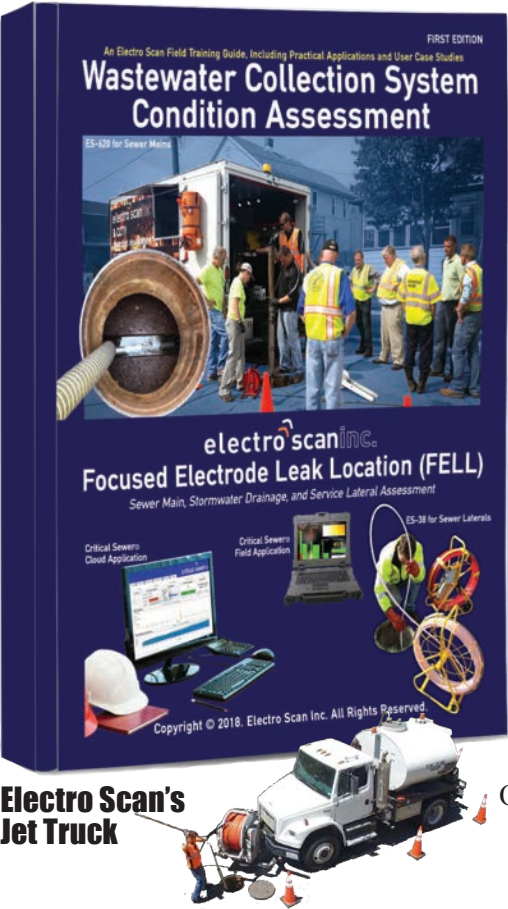


## HTMA FELL Assessment at the Borough of Shippensburg, PA

Scans		Distance		S		M		L		GPM	GPD
7		1,904		113		12		16		105.72	152,237
Date	Mainline ID	Pipe ID	Pipe Type	Diameter							
7/31/2018	108 - 145	108-145	SP	15	494.9	23	3	6	30.61	44,078	31,352
7/3/2018	111 - 110	111 - 110	CAS	15	53.5	24	0	3	19.95	28,728	189,186
7/3/2018	R17 - 111	R17 - 111	CT	12	170.1	18	5	4	19.83	28,555	73,875
7/31/2018	145 - 132	145 - 132	SP	15	369.2	11	1	3	15.70	22,608	21,556
7/31/2018	109 - 108	109 - 108	SP	15	243.5	16	0	0	8.72	12,557	18,154
7/3/2018	110 - 109	110 - 109	VCP	15	245.3	14	3	0	7.86	11,318	16,239
7/31/2018	132 - 133	132 - 133	SP	15	327.6	7	0	0	3.05	4,392	4,719

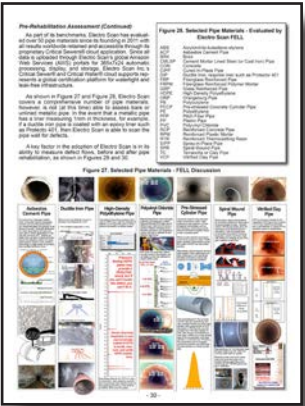
# New Electro Scan Inc. Reference Manual Comprehensive User Manual Includes Field Operations, Practical Applications, and Worldwide FELL Case Studies

After seven years and hundreds of projects, Electro Scan decided it was time to put together a manual detailing the ‘ins’ and ‘outs’ of its low voltage conductivity assessment technology. Everything from explanations of the technology & mechanics to information about operations & practical applications were included, plus US and international case studies. Assessing a complete cross-section of pipe materials & diameters, including force mains, and lined metallic & ductile iron pipes, email us at [info@electroscan.com](mailto:info@electroscan.com) to request a copy.



### About the Technology

About FELL, Required Equipment & Components, Staffing Requirements, Operations - Preparation, Setup, Scanning, Cleanup, Reporting, & MORE!



### Pipe Materials

Asbestos Cement, Brick, Cement Mortar Lined, CIPP, Concrete, FRP, GRP, HDPE, PCCP, Plastic, Reinforced Concrete, SIPP, Spiral Wound, VCP, & MORE!



### Practical Applications

Sewer Main, Post-CIPP, Pre- and Post-Grout, Sinkholes, Gravity Water Mains, Spiral Wrap Pipe, PVC, SIPP, Post-Flooding Assessments, & MORE!



### Case Studies

+60 Case Studies, Including Sewer & Water Agencies in the U.S., Canada, Denmark, Germany, Japan, New Zealand, Switzerland, UAE, UK, & MORE!

This manual helps you learn about Electro Scan's disruptive technology known as FELL or low voltage conductivity. CCTV and other technologies simply do not reliably find all leaks and cannot provide unbiased, unambiguous results while *Electro Scanning Inspection Can*. As Chuck Hansen, founder of Electro Scan, put it, "as often is the case when adopting new technologies, its simply a better way to assess and accept new and rehabilitated pipes, i.e. less subjective, more reliable, and accurate." Get your copy today and learn how to better manage your infrastructure.





# UAE, RAKWA Project Update

The City West Trunk Main, Mairid Network & Force Main Assessment Project was not the typical sewer inspection project undertaken in the United Arab Emirates.

Known for the world's tallest skyscrapers, most modern transportation system, and intricate infrastructure projects, the region's high groundwater and tidal infiltration seeks out every weak joint, service connection, and crack, to fill their collection system.

### Project Objective

To assess a newly installed wastewater collection system, prior to the addition of laterals to connect residential, business, and commercial users.



*Electro Scan's results were used to reduce more than 12 mega liters per day in leakage from new pipelines.*



### CCTV = 125 Potential Leaks

Summary				TOTAL DEFECT/OBSERVATIONS	Water Levels					Debris					Obstruction					Deformation					Infiltration					Abandoned Survey																							
CCTV Surveys Evaluated	ZERO Defect Observations	SINGLE (1) Defect Observations	Abandoned Surveys		Water Level 5%	Water Level 10%	Water Level 15%	Water Level 20%	Water Level 25%	Water Level 30%	Water Level 40%	Water Level 50%	Water Level 60%	Water Level - Full	Debris-Silt, 5%	Debris-Silt, 10%	Debris-Silt, 15%	Debris-Silt, 20%	Debris-Coarse - 5%	Debris-Coarse - 10%	Debris-Coarse - 15%	Debris-Coarse - 20%	Obstruction 5% - Excess Lamination	Obstruction 10% - Excess Lamination	Obstruction 5% - Dried Concrete	Obstruction 10% - Dried Concrete	Obstruction 50% - Mechanical Plug	Encrustation - 5%	Fouling 5%	Vertical Deflection 5%	Deformed Pipe - 5%	Deformed Pipe - 10%	Displaced Joint - Medium	Displaced Joint - Large	Open Joint - Large	Open Joint - Medium	Broken Pipe	Infiltration - Gushing	Infiltration - Running	Infiltration - Dripping	Infiltration - Seeping	Exfiltration	Exposed Rubber Seal	Crack - Circumferential	Fracture - Longitudinal	Fracture - Circumferential	Camera Underwater	Abandoned Survey - Poor Visibility	Abandoned Survey - Camera	Obstructed By Rubber Seal	Abandoned Survey - Camera	Obstructed	Abandoned Survey - Opposite End Reached
161	27	40	26	367	35	40	18	9	4	10	5	6	1	1	10	9	1	2	13	3	3	1	17	2	1	1	1	1	1	3	15	2	17	5	4	41	1	9	11	5	1	1	26	1	1	2	3	4	8	5	6	1	

### FELL = 1,724 Defect Locations

Scans	Distance (m)	Number of Defects				Defect Flow				LPD
		Small	Medium	Large	Total	Minor	Moderate	Severe	Total LPS	
161	11,111	894	385	445	1,724	20.88	61.16	54.53	136.54	12,568,571



شركة عرمون لفحص وإصلاح الأنابيب ذ.م.م  
Aramoon Pipe Inspection & Rehabilitation L.L.C.

electro scan  
الالكترو سكان



## Pikeville, KY Pressurized Pipe Leak Detection



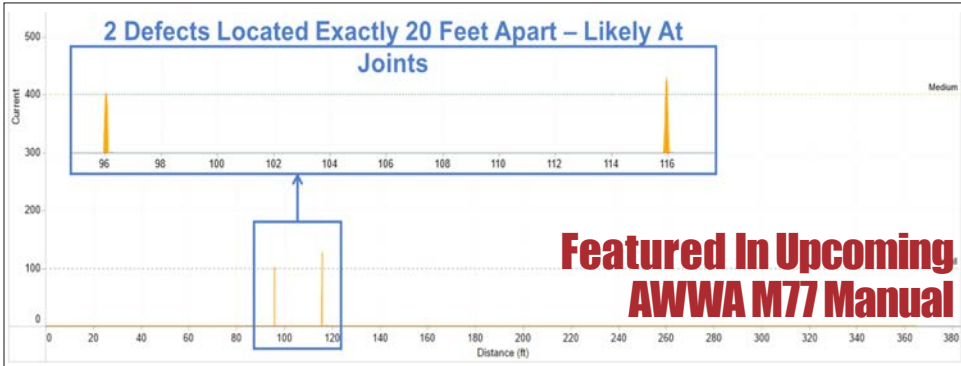
Leaks Found in 60psi High Density PE Pipe By Electro Scan FELL in Less Than 3 Hrs.

**ACOUSTIC & CCTV Failed to Find Any Leaks After More Than a Year of Investigation.**



### Drawbacks of Acoustic Sensors & Data Loggers

- Ambient noise interference.
- Variable water table affects results.
- Unable to assess innovative pipe materials, especially PE, PVC, & HDPE pipes.
- Different results for different pipe diameters.
- Leak size is difficult or unable to determine.
- Multiple false-positive readings.
- Cost of missed leaks exceed cost of survey.
- Lack of repeatability, by crew, by equipment.
- Repair clamps on previous leaks often bypassed by acoustic waves.
- Inability to quantify defect flow rates in GPM.
- Customer's continuous water use generates similar sound as a leak.
- Affected by changes in backfill materials.
- Lengthy data processing & reporting times.
- Special training required for field crews.
- Need for third-party data interpretation.
- Misses silent or undetected leaks.
- Claims of measuring 'remaining pipe wall thickness' disproved.



Electro Scan Breakfast Club . . . Matthew Campos showed up at the jobsite at 9AM in Pikeville, Kentucky. And, before lunch had successfully located & quantified two (2) separate pinhole leaks in a 400' run of HDPE geothermal pipeline using FELL.

These two pinhole leaks had been plaguing this new hospital – and its general & mechanical contractor – *for over a year*. Acoustic sensors, data loggers, correlators, and CCTV could not hear or see anything! Losing 300-400 gallons per day running at 60psi meant the defects identified were less than 0.5mm each – *smaller than pencil lead* – found by Electro Scan!

Remember, you get what you *inspect*, not what you *expect*.



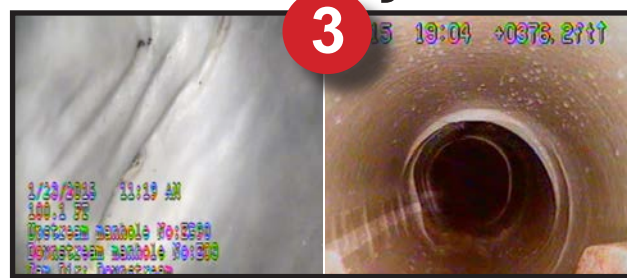
# Common CIPP Defects Not Quantified or Recorded By CCTV



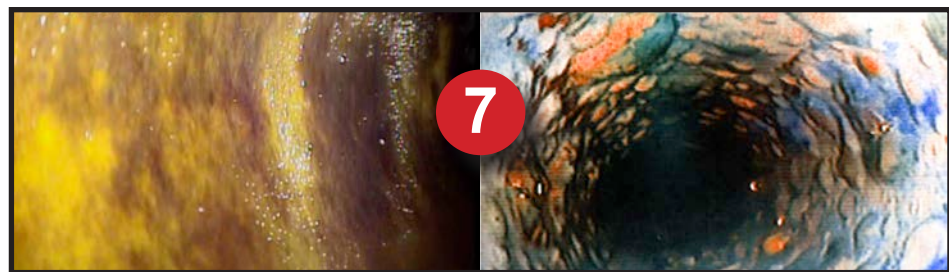
1. Post-CIPP, Bad Service Reconnection



2. Post-CIPP, Bad Service Reconnection - Infiltration.



3. Wrinkles - They May Leak!



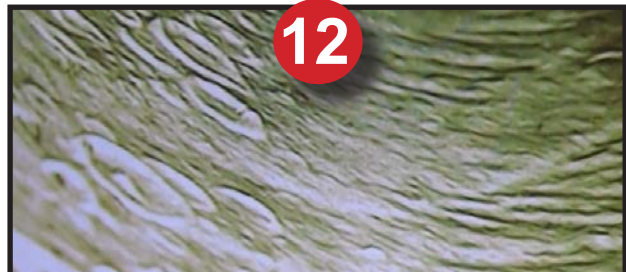
7. Accelerant Burns, Called Out As 'Discolored' But Actually Leak Water



8. Bad Resin



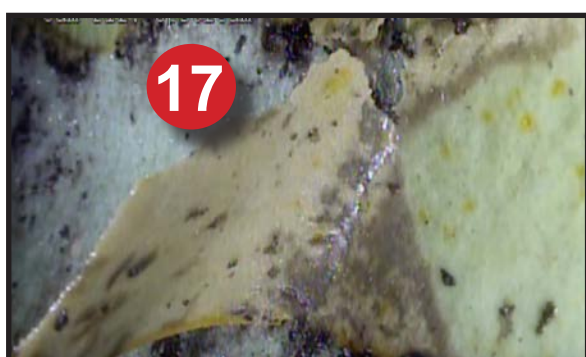
11. Defective/ Porous/ Weak Liner



12. Overcooked Liner



13. Unreported Contractor Equipment Damage



17. Defective Epoxy



18. Mis-Reported Bad Reconnection. Same Leak, 4 Years Running.



19. Annular Space

## Top 12 Reasons To Update CIPP Specifications

### 1 Cured-In-Place Pipe (CIPP) Leaks If Not Properly Cured or Installed

Over 80% of CIPP liners have defects that leak and are not identified by Visual or CCTV inspection. If cities or counties publish CIPP specifications utilizing F1216-16, which recommends only Visual and CCTV inspection to certify liners with service connections, in pipes less than 36" diameter, they eliminate the ability to reject lining work as part of their negotiated warranty period where *unseen* leaks occur. As a result, FOCUSED ELECTRODE LEAK LOCATION (FELL) should be recommended to certify and accept CIPP as *watertight*.

### 5 CIPP Samples Taken at Manholes ARE NOT Representative of Liner Quality

In many specifications, cities and consulting engineers may require liner coupons or samples to be cut-out of the upstream manhole and submitted for testing. Yet, many industry experts have concluded that liners that extend into manholes may not be representative of the overall quality of the liner, i.e. not subject to the same overall curing or cool down.

### 9 AWWA M77, Condition Assessment of Water Mains, References 'Low Voltage Conductivity' to Assess CIPP

In 2016, the American Water Works Association (AWWA) M77 Committee on Condition Assessment of Water Mains circulated its first edition draft standard of practice. Scheduled for publication sometime in 2019, Chapter 7 Leak Detection, identifies a single technology able to accurately assess leak locations and estimate defect flow rates in gallons per minute (GPM) in Cured-In-Place Pipe (CIPP): **Low Voltage Conductivity!**

### 2 Resin Mixtures May Be Lowered If Only CCTV Is Required

According to Interplastic Corp., under ideal controlled conditions, the recommended resin-to-felt ratio should be 86.2:13.8 or about 6.25-to-1. Unfortunately, CCTV will not detect permeable liners due to accidental or planned lowering of a resin-to-felt ratio. And if recent reports are true, CIPP contractors may be using lower resin-to-felt and catalyst ratios when Owners limit CIPP acceptance to *Visual or CCTV inspection only*. In contrast, FELL inspection will locate & quantify liner permeability throughout any lined pipe.

### 6 NASSCO Codes DO NOT Assess the Water Tightness of CIPP Liners

Many cities and counties have traditionally utilized NASSCO CCTV codes to visually inspect the inside surfaces of pipes. Developed and supported by British-based WRc plc (Swindon, England), and used worldwide, including by NASSCO, visual inspection coding **DOES NOT** ensure that liners have been delivered in a *watertight* condition.

### 10 ASTM F1216 DOES NOT Ensure the Water Tightness of Liners

As stated in ASTM F1216-16, *Gravity Pipe Leakage Testing* should be used to test CIPP by plugging both ends and filling the entire pipeline with water; however, the standard goes on to state that this test should be limited to pipe lengths with no service laterals and diameters of 36 in. or less, relying exclusively on Visual or CCTV inspection to determine the watertightness of liners. Now that cities & engineers have learned that CIPP may be permeable (i.e. not watertight) if improperly installed, ASTM F2550 (2018) should be added to all CIPP specifications to accurately assess liners.

### 3 ASTM F2550 Standard Developed to Address CIPP Quality Issues

ASTM published ASTM F2550 *Standard Practice for Locating Leaks in Sewer Pipes by Measuring the Variation of Electric Current Flow Through the Pipe Wall*, stating "It is recommended that separate scanning tests be taken before and after any pipe repair, relining, or renewal activity to compare electrode current values, and for closed-circuit television (CCTV) video to re-examine pipes to determine if any visual defects were missed or not recorded during initial examination." ASTM F2550-13 (2018) was recently re-approved through 2026.

### 7 CIPP May Leak More AFTER LINING Due To Contractor Damage

Just as CCTV is unable to identify defects after lining, new standards help identify Post-CIPP sewer mains that have greater leakage rates AFTER CIPP, than BEFORE CIPP. The biggest source of larger leaks AFTER LINING, is due to Contractors over-cutting liners when reinstating laterals. Smoothly connected taps before lining, can be broken as part of remote tap cutting to open lateral connections, and not discovered by CCTV.

### 11 Fortunately for Cities, Marginal CIPP Suppliers May 'Boycott' or 'No Bid' Specs Using FELL

Can you believe it? Some of the nations largest CIPP suppliers have contacted their competitors encouraging them to "boycott" new inspection standards! **Better standards must be a good thing**, especially if CIPP companies unable to pass new testing standards for pipeline water tightness don't bid on your project. Municipal sewer departments and utilities have long suspected poor liner quality, but only had visual inspection to base their claims. Electro Scan's unbiased results changes all that, saving ratepayers from poorly installed CIPP.

### 4 Despite Contractor Assurances, CIPP Pinholes ARE NOT 'Self-Healing'

"I've heard that one before," was recently said by a consulting engineer, dealing with high flows in a Post-CIPP sewer. Not easily identified by visual inspection, pinholes occur when curing has been uneven or incomplete, and in some cases results from accidental cuts, especially from bad lateral reinstatements. CIPP pinholes **ARE NOT 'self-healing'** and if a CIPP sales person or business development representative says it does, your City should disqualify the firm from bidding until past work is re-tested.

### 8 Testing Before & After CIPP Provides 'Same Day' Infiltration % Reduction

As originally authored by Ken Kerri, Ph.D., P.E. in his *Seventh Edition, Volume 1, Operations & Maintenance of Wastewater Collection Systems manual*, **Electro Scanning Inspection** should now be used as a primary resource for managing Sanitary Sewer Overflow (SSO) Reductions, able to quantify reductions in infiltration, BEFORE & AFTER REHABILITATION.

### 12 FELL CIPP Testing Is Recommended By Contractors Having ISO 9001, 14001, 18001 Certifications

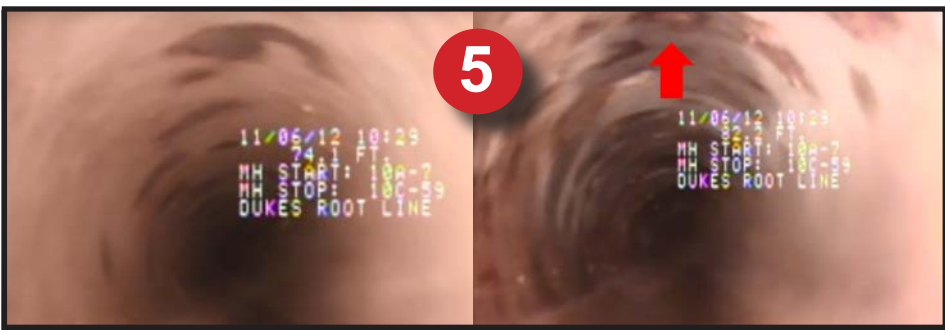
In addition to evaluating CIPP immediately after curing so Contractors can fix, repair, or replace their liner, CIPP should also be surveyed prior to warranty expirations by an ISO certified FELL Contractor, certified by ISO 9001 Quality Management System (QMS), ISO 14001 Environmental Management System (EMS), and ISO 18001 Occupational Health and Safety Management (OHSAS).



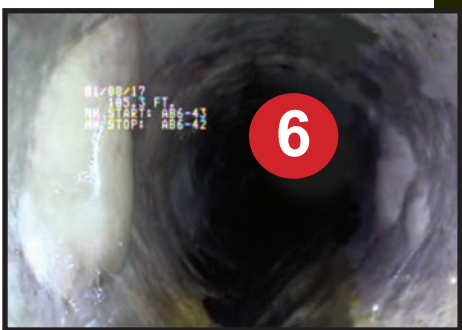




4. Bad Sectional Spot Repair



5. Infiltration Spotting and Staining



6. Bulges



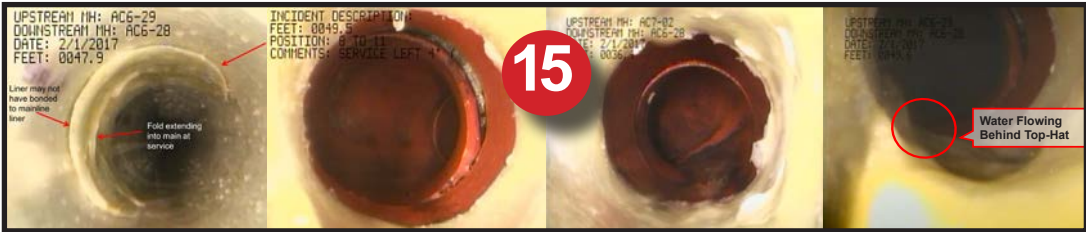
9. Missed Lateral Reinstatement



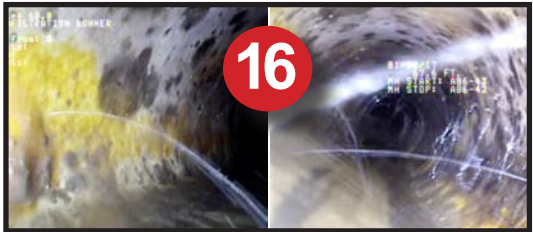
10. Bad Epoxy Lining



14. Sag In Liner



15. Defective Top-Hats



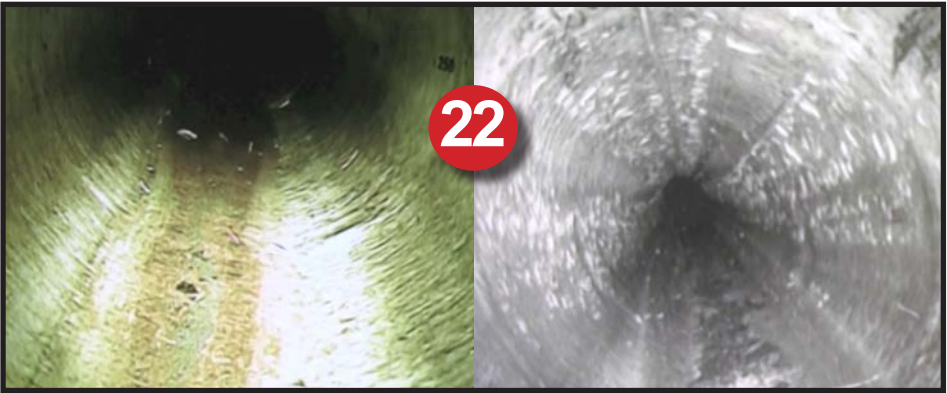
16. Pinhole Leaks



20. Infestation



21. Post-CIPP Misaligned / Open Joint

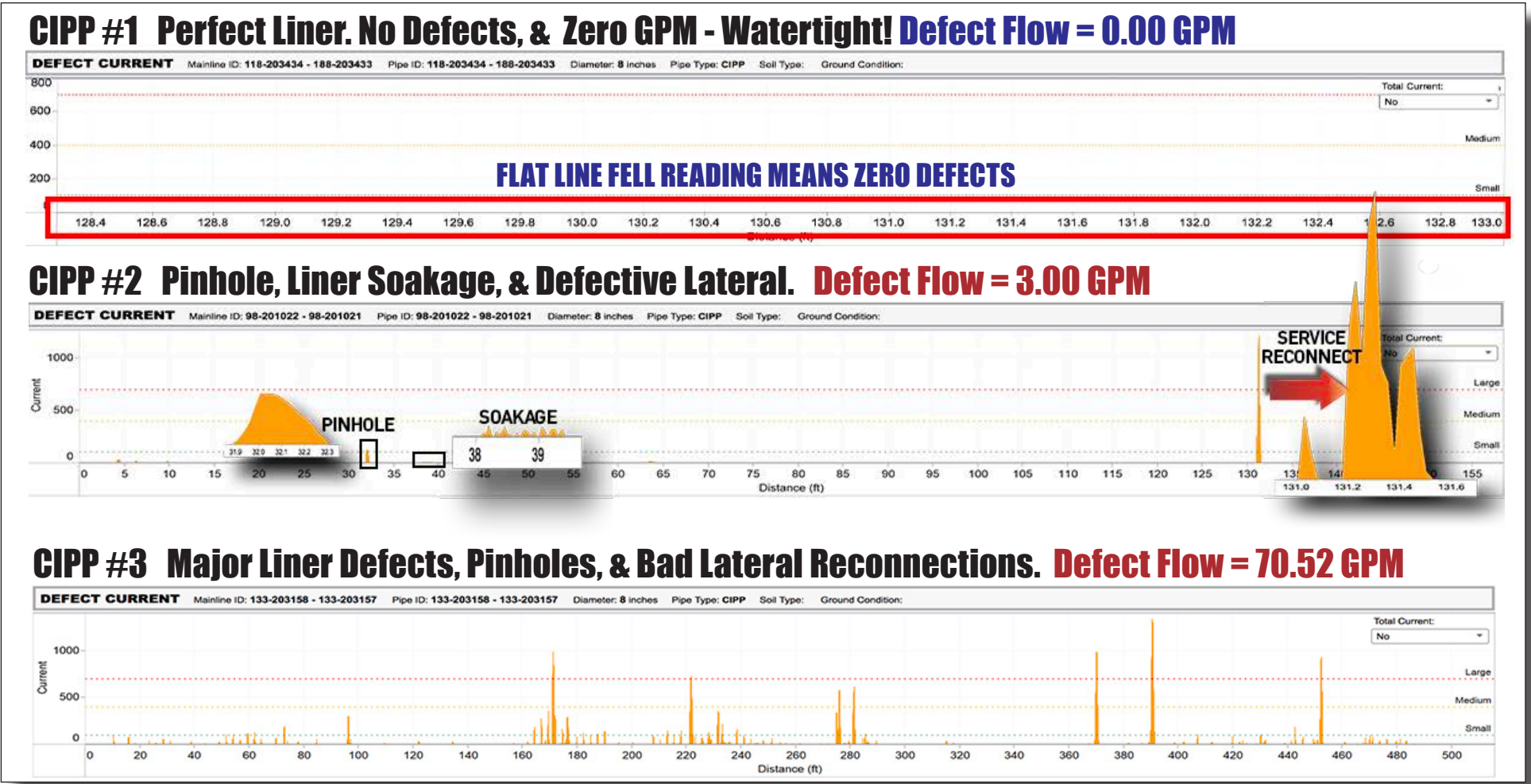


22. Blistering

# Consulting Engineer Decides NOT to Update CIPP Specification

Then, City Calls Electro Scan to Audit Lining Project Finding 2 of 3 CIPP With Major Defects.

Date	Mainline ID	Pipe Type	Diameter	Length	Small	Medium	Large	GPM	GPD	GPD/IDM
2/21/2018	118-203434 - 188-203433	CIPP	8	292.8	0	0	0	0.00	0	0
	98-201022 - 98-201021	CIPP	8	151.0	2	0	1	3.00	4,320	18,883
	133-203158 - 133-203157	CIPP	8	491.3	27	2	5	70.52	101,549	136,431





# Sales Partner: UK-Based WRc plc



WRc plc

Frankland Road, Blagrove

Swindon SN5 8YF UK

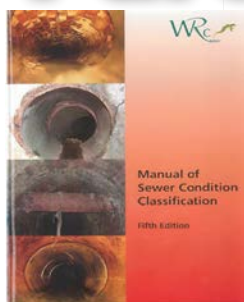
www.wrcplc.co.uk

Peter Henley, Technical Consultant

Email: [peter.henley@wrcplc.co.uk](mailto:peter.henley@wrcplc.co.uk)

Tel: +44 01793 865022

@WRc\_PeterHenley



## UK Sewerage Industry

Ranked By Revenue	Ownership				Revenue £ Millions	Revenue \$ Millions	Customers	Sewer	
	Private Equity	Listed Company	Government	Private				km	mi
1					£12,187.2	\$14,868.4	49,505,000	608,275	377,739
2					1,800.0	2,196.0	15,000,000	109,400	67,937
3					1,730.0	2,110.6	3,000,000	72,000	44,712
4					1,506.1	1,837.4	4,300,000	91,000	56,511
5					1,196.8	1,460.1	2,460,000	50,000	31,050
6					1,185.4	1,446.2	4,200,000	75,931	47,153
7					975.8	1,190.5	5,000,000	52,000	32,292
8					805.5	982.7	2,700,000	29,923	18,582
9					803.7	980.5	4,600,000	39,600	24,592
10					743.2	906.7	3,000,000	30,000	18,630
11					520.8	635.4	2,800,000	34,700	21,549
12					506.4	617.8	1,700,000	9,221	5,726
13					413.5	504.5	745,000	14,500	9,005

## About

WRc has a reputation for driving innovation across water, waste, and gas sectors, leading the development and application of innovative technologies for inspection, monitoring, and management of pipeline infrastructure.

While most people have heard of the NASSCO CCTV Codes, most didn't realize their codes are actually from UK-based WRc plc. For example, why do you think one of the codes for infiltration is WEEPER? Thank the British. Now in its Fifth Edition, the Manual for Sewer Condition Classification is used worldwide.

A Strategic Alliance Agreement with Electro Scan Inc. in September 2015 was executed, after a series

of demonstrations in the UK and US, including testing Pre- and Post-CIPP sewer mains at the City of Monterey, California. Today, Electro Scan is delighted to be partnered with the great team at WRc.

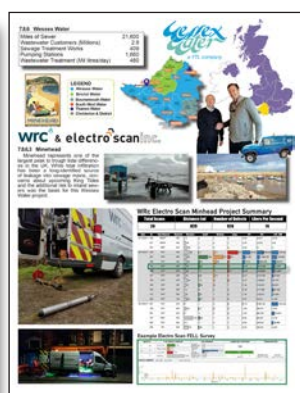
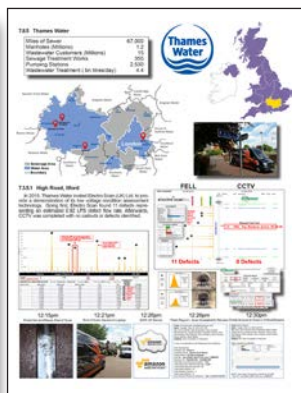
Deploying a metric version of its Critical Sewers® cloud application, Electro Scan FELL reporting of defect flows and their respective Litres Per Second are available minutes after scans are completed in the field.

Today, a number of innovative case studies are included in Electro Scan's 2018 User Manual.



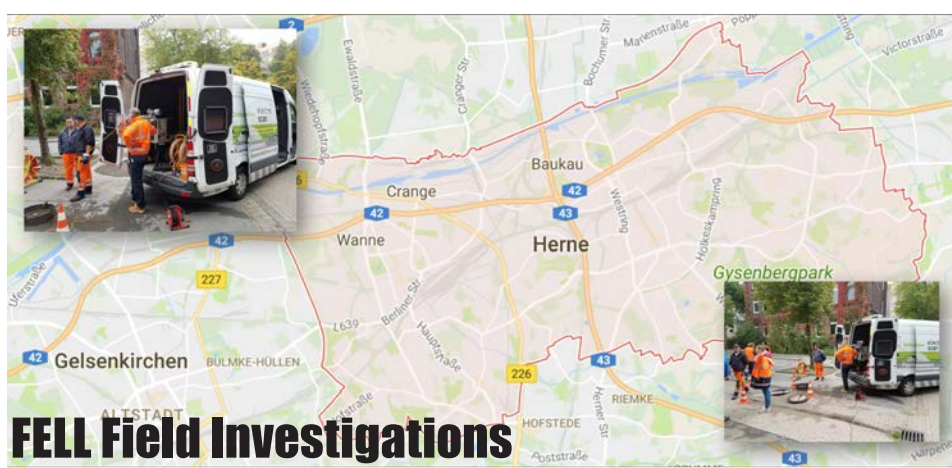
Peter Henley, Technical Consultant, WRc plc

## Selected WRc-Electro Scan Case Studies



## FEATURED PROJECT - CIPP Testing for IKT, Germany

Benchmarking earlier versions of FELL in 2001, IKT contracted with WRc plc to provide Electro Scan Testing Services as part of a recent project on assessing defects in CIPP. One of the world's foremost research organizations for sewer networks and trenchless rehabilitation, WRc in partnership with Electro Scan completed both in-field FELL surveys and laboratory FELL testing.





# Sales Partner: McIntire Mgmt Group

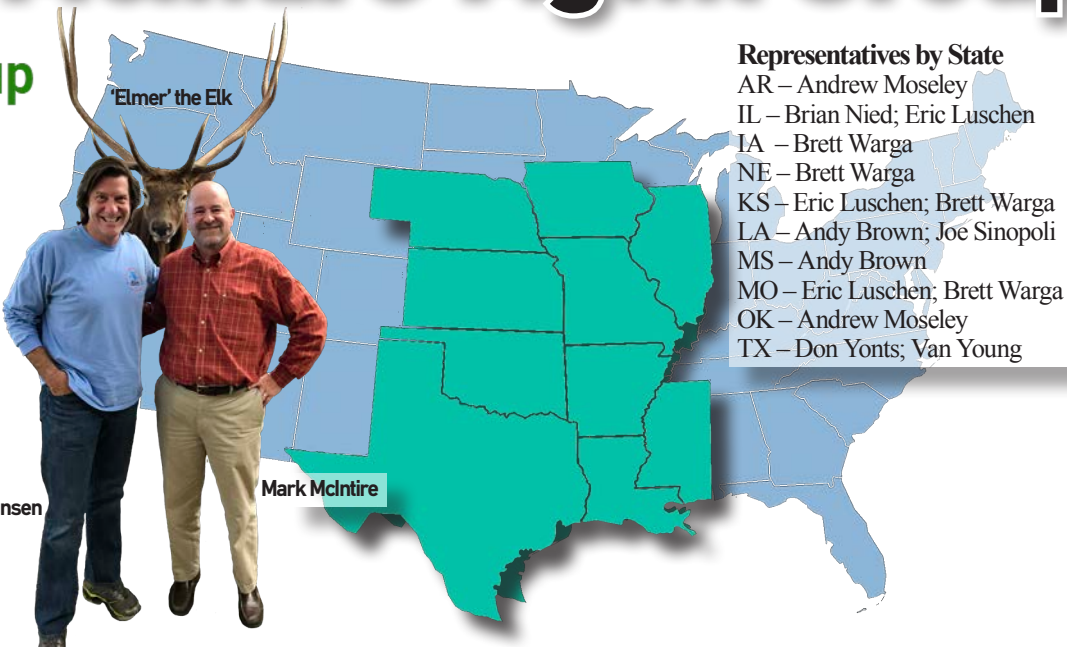


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**About**  
Spanning ten states, McIntire Management Group and D&W Systems Sales (MMG), who joined together in 2010, is the largest representative firm of Electro Scan products and services in the United States. MMG serves the water and wastewater industry with more than fifty years of experience as manufacturers’ representatives, forty years of inside sales experiences, and a fourteen-man team.

MMG became the first sales partner exclusively representing Electro Scan products and services in a ten-state territory since January 2018. MMG hit the ground running, completing ten projects in four states, including Arkansas, Louisiana, Illinois, and Kansas.

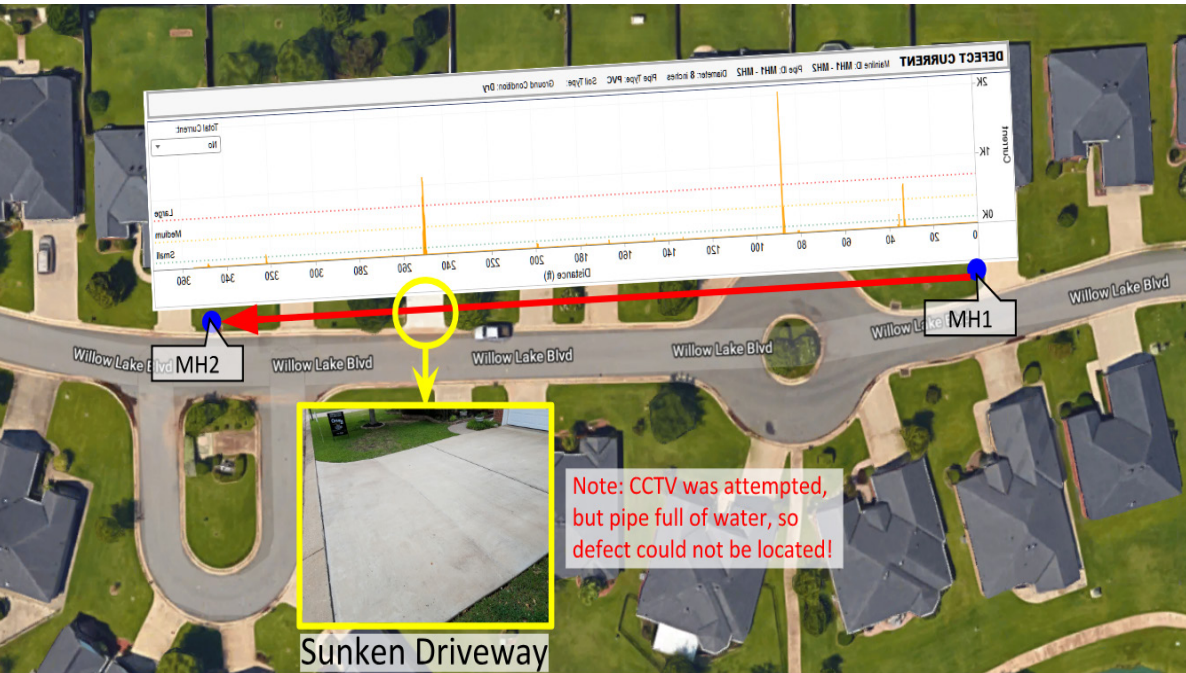


## Louisiana Sewer Agency

	Scans	Footage	Total Defects	GPM	GPD
<b>Total:</b>	<b>3</b>	<b>933</b>	<b>107</b>	<b>95.10</b>	<b>136,944</b>

### Mainlines Ranked by GPM

Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD	OK	400K
5/2/2018	09-083 - 09-082	09-083 - 09-082	VCP	8	285.23	60	3	10	63.82	91,901	212,649	
	04-232 - 04-231	04-232 - 04-231	CIPP	8	292.13	26	2	0	14.25	20,520	46,361	
	MH1 - MH2	MH1 - MH2	PVC	8	355.53	3	1	2	17.03	24,523	45,524	
<b>VCP Leaks 2x MORE Than The PVC &amp; CIPP COMBINED!</b>					Distance (ft)	Small	Medium	Large	GPM	GPD	OK	400K



## PVC Assessment

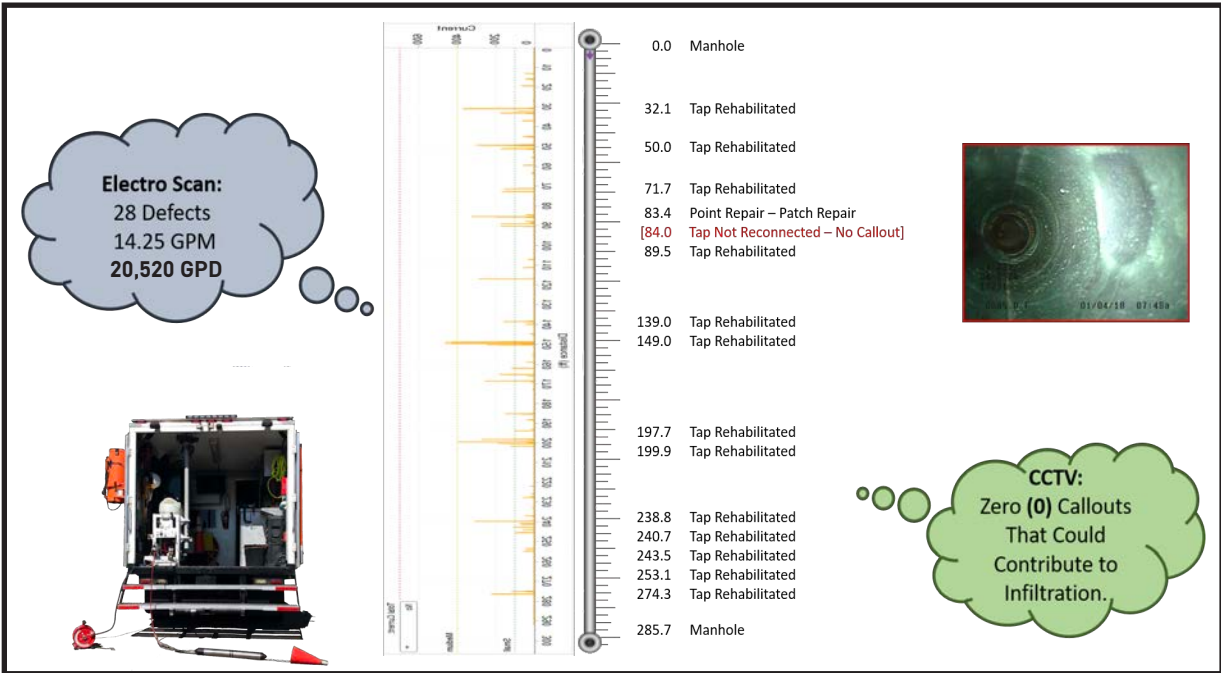
Pictured to the left is a map of the PVC sewer main route. Along this stretch was a sunken driveway, which was thought to be caused by a sewer defect. CCTV was unable to determine the source due to water in the pipe. Electro Scan, however, identified and located the defect in just ten (10) minutes.

## CIPP Assessment

The CIPP lined pipe (Scan Results Pictured Right) had 28 defects amounting to 14.25 GPM of defect flow, excluding the several defects found below the small defect threshold (which aren’t counted or included in the estimated defect flow). These pinhole leaks, however, need to be watched as they can develop into more serious issues. In addition, visual inspection was once again proved to be inadequate. For this CIPP scan, CCTV found zero (0) defects and didn’t identify the tap that wasn’t reconnected.

A VCP pipe was also assessed, which Electro Scan found to have 73 individual defects, while CCTV called out only two (2) possible sources of infiltration.

### FELL v. CCTV Comparison of CIPP Liner





# Sales Partner: JWB Company

## JWB Company

JWB Company  
65 August Avenue, Wolcott, CT 06716  
203-879-6959  
www.jwbcompany.net  
James Birkenberger, [Jamie@jwbcompany.net](mailto:Jamie@jwbcompany.net)

About

Founded by John W. Birkenberger in 1987, JWB has all the tools and more to provide all types of process control instrumentation, Supervisory Control And Data Acquisition (SCADA) and telemetry equipment, installation and calibration services, radio path analysis, radio site surveys, engineering assistance, and expert advice.

Since joining Electro Scan Inc. in January of this year, JWB has performed five demonstrations in the New England region, which includes the states of Connecticut, New Hampshire, Massachusetts, Maine, Rhode Island, and Vermont.



James Birkenberger  
President

### Connecticut Sewer Agency

	Scans	Footage	Total Defects	GPM	GPD
Total:	8	1,529	52	166.6	239,904

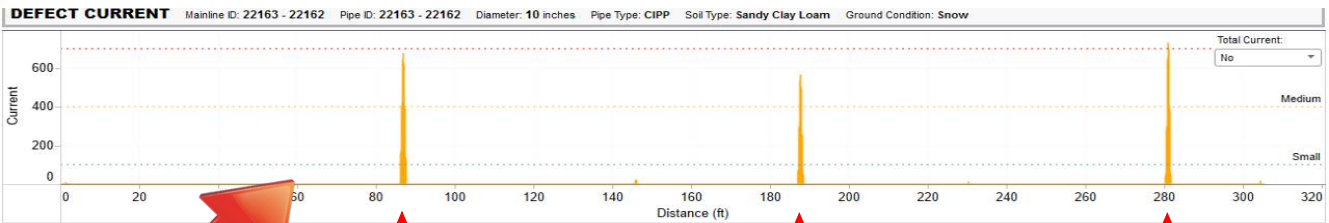
Mainlines Ranked by GPM

Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD	OK 200K 400K GPD IDM
1/19/2018	22165 - 22164	22165 - 22164	VCP	10	322.7	18	7	11	112.07	161,381	264,072
	22163 - 22162	22163 - 22162	CIPP	10	305.5	0	2	1	23.85	34,344	59,357
	22162 - 22161	22162 - 22161	CIPP	10	291.0	1	2	1	21.17	30,485	55,322
	22158 - 22157	22158 - 22157	CIPP	10	280.2	1	1	0	7.48	10,771	21,119
	22164 - 22163	22164 - 22163	VCP	10	86.2	0	1	1	1.27	1,829	11,199
	22159 - 22158	22159 - 22158	CIPP	10	100.7	5	0	0	0.76	1,094	5,737
	22161 - 22160	22161 - 22160	CIPP	10	49.4	0	0	0	0.00	0	0
	22160 - 22159	22160 - 22159	CIPP	10	93.0	0	0	0	0.00	0	0

### THREE of the CIPP are Worse than One (1) of the Clay Pipes!

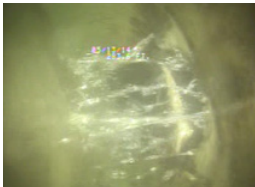
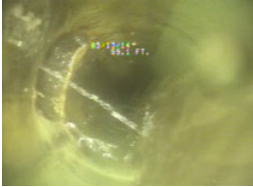
Electro Scan inspected six (6) CIPP liners which contained a total of 14 individual defect locations and contributed a combined total of 53.26 GPM.

Overall, these liners were in relatively good condition and CCTV showed that many of the medium & large defects were located at service connections. However, a few defects were unable to be identified due to water obscuring the CCTV video.



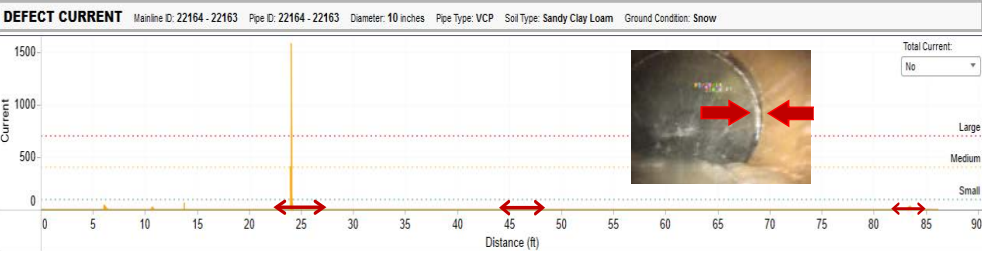
Footage obscured by water in the pipe.

This CIPP has interstitial flows occurring at service lateral connections.



Electro Scan inspected two (2) vitrified clay pipes (VCP), finding 38 defects contributing a total of 113.34 GPM. Even spacing of defects indicated that several of the leaks were located at joints. The first VCP inspected contained 3 pipe material changes to Ductile Iron Pipe which were not called out by CCTV. It should also be noted that large portions of the CCTV videos were underwater, making the footage nearly impossible to visually identify defects.

DEFECTS	% OF DEFECT LENGTHS	GPM SUMMARY	DIAMETER & DISTANCE	OPERATOR INFO
Small 0	0.000000	Minor 0.230 Moderate 1.040 Severe 0.000 Total GPM 1.270	10	Tech Electroscan Project Demo Job Demo
Medium 1	0.000300	GPD 1.829 GPD IDM 11,199	86.00 ft	Atmospheric Test Scan Start 1/19/2018 6:13:51 AM 1/19/2018 6:38:10 AM
Large 1	0.000900	Minor % 18.11% Moderate % 81.89% Severe % 0.00%		
All Defects 2	0.001100			



3 sections of the VCP main shown above had a change in material to Ductile Iron (DI), which were not called out by CCTV.





# Sales Partner: ClearWater Inc.



ClearWater, Inc.  
1105 8th Street, Court SE, PO Box 1469 (28603), Hickory, NC 28602  
828-855-3182 | [www.clearwaterinc.net](http://www.clearwaterinc.net)  
Manager: Roger Lyman  
[roger@clearwaterinc.net](mailto:roger@clearwaterinc.net) | 704-821-6777

**About**  
Electro Scan is delighted to have ClearWater representing FELL in the Eastern states of Virginia, North Carolina, and South Carolina. Clearwater Inc. provides a wide selection of demonstration & pilot study equipment and specializes in municipal and industrial water and wastewater equipment, they offer comprehensive selection of products, manufacturers, and services.

Since becoming a representative in February, Clearwater Inc. has arranged eight (8) Electro Scan demonstrations, including the City of Apex, City of Goldsboro, City of Hickory, City of Manassas, Harnett County, Metropolitan Sewer District of Buncombe County, Stafford County, and Spotsylvania County.



## North Carolina Sewer Agency

	Scans	Footage	Total Defects	GPM	GPD
Total:	7	1,532	49	19.31	27,806

### Mainlines Ranked by GPM

Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD	0K	20K
2/8/2018	50-28008 - 50-28007	50-28008 - 50-28007	RCP	36	266.4	36	3	1	18.58	26,755	14,733	
	50-28011 - 50-28036	50-28011 - 50-28036	CIPP	36	385.8	6	0	0	0.52	749	285	
	110482 - 18101	24-387073	VCP	8	140.3	2	0	0	0.17	245	1,152	
	18101 - 18102	24-387070	PVC	8	197.6	1	0	0	0.04	58	192	
	445599 - 19846	5-375870	CIPP	8	220.7	0	0	0	0.00	0	0	
	18102 - 360177	24-386504	PVC	8	187.1	0	0	0	0.00	0	0	
	50-28036 - 50-28008	50-28036 - 50-28008	CIPP	36	134.5	0	0	0	0.00	0	0	

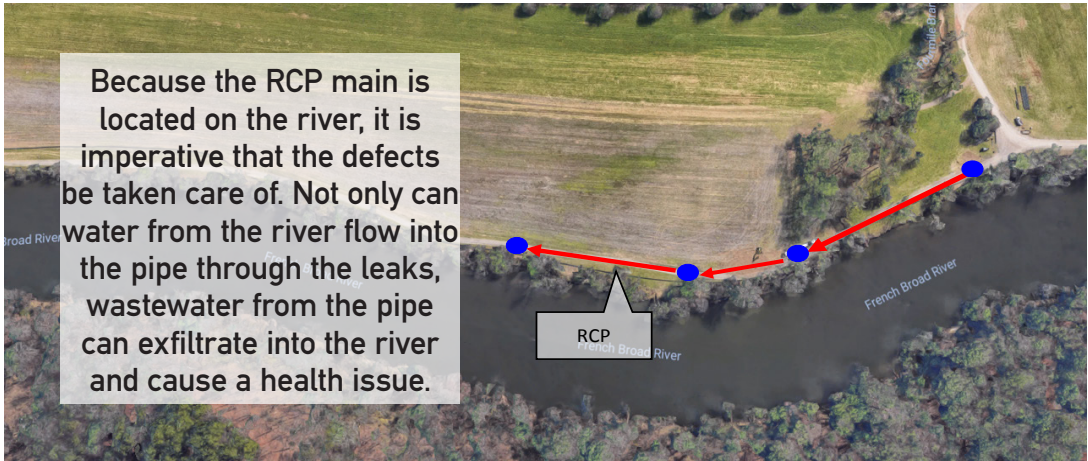
GOOD  
PIPES

### FELL Findings

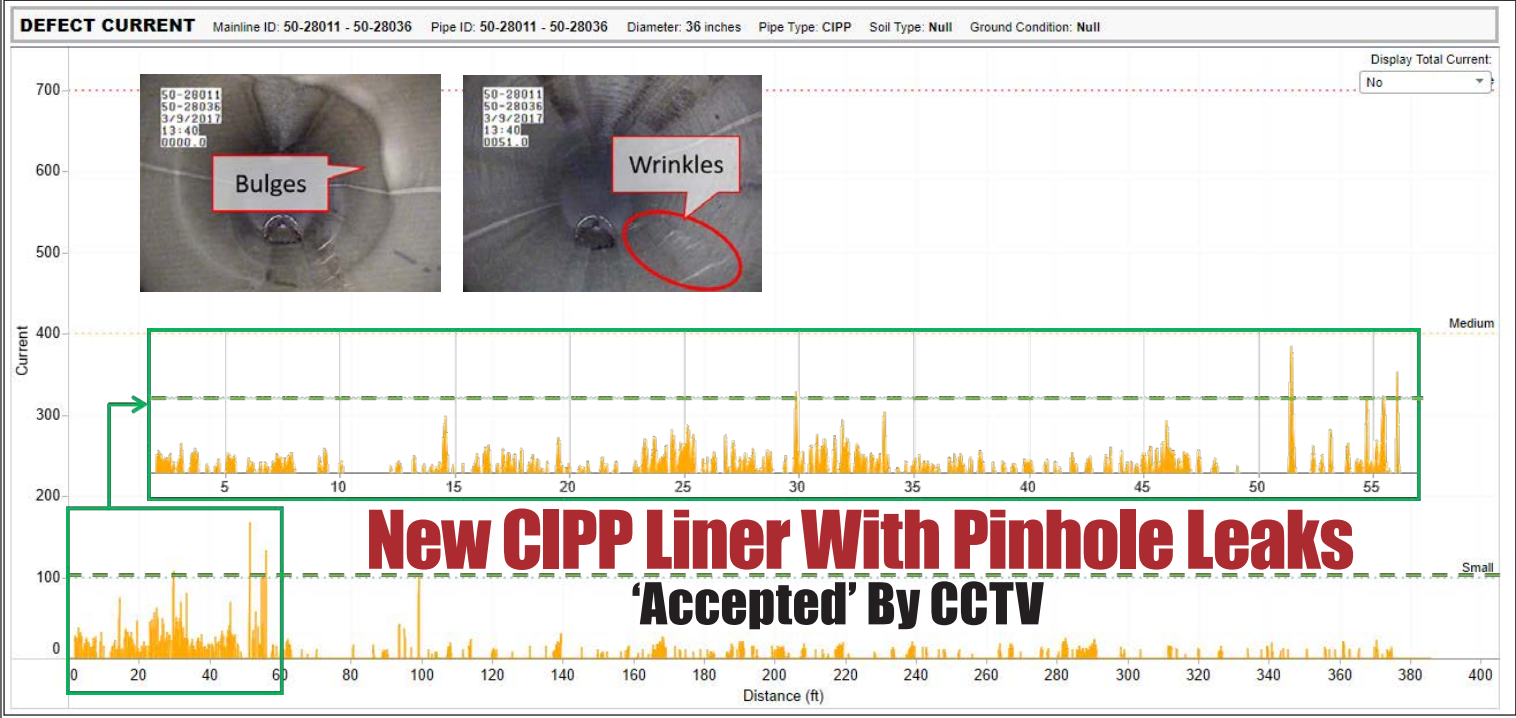
While two (2) CIPP liners and two (2) PVC pipe were “leak-free,” Electro Scan found six (6) small defects in a 36” CIPP liner. The next pipe downstream was an unlined RCP and would have been a great candidate for lining as it was riddled with defects.

Representing the worst line surveyed for the day, the decision NOT TO LINE the RCP was based on CCTV that didn’t record any defects, but had to be abandoned midway through the pipe. Steam also obstructed the visibility for a large portion of the half televised pipe. This is another reason CCTV should not be used for prioritization.

Electro Scan found 40 defects in the RCP, with three (3) of the worst leaks contributing 56% of the defect flow.



### CIPP FELL Survey Finds Hundreds of Pinhole Leaks



(Left) While the CIPP liner registered only a few defects above the FELL Small Defect Threshold, hundreds of pinhole leaks were found below the small threshold that are excluded in Electro Scan’s GPM calculation.

While not included in overall GPM, these defects are still important as they will only get worse and can develop into serious problems over time.

Electro Scan doesn’t recommend accepting more than seven (7) pinhole defects for any single liner. CCTV footage showed some of the visible issues with the liner such as bulges, staining, and wrinkles.

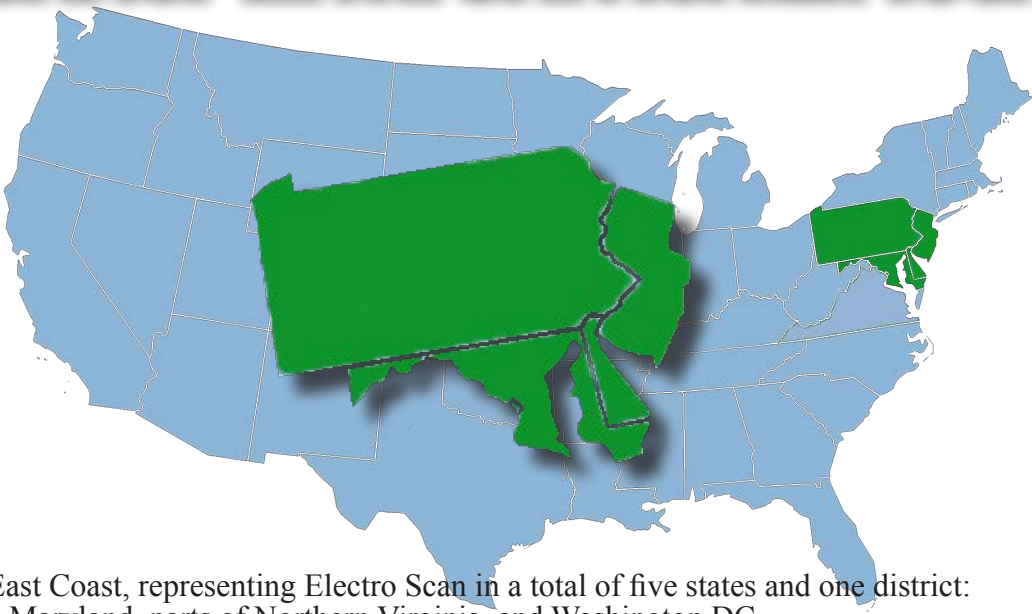






Ideas & Innovations

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**About**  
Kershner Environmental Technologies (KET) is stationed on the East Coast, representing Electro Scan in a total of five states and one district: Eastern and Central Pennsylvania, Southern New Jersey, Delaware, Maryland, parts of Northern Virginia, and Washington DC.

Representing over sixty different manufacturers with an expert team, KET strives to provide the best sales and marketing coverage to the manufacturers they represent and the most effective, innovative solutions to their clients’ water and wastewater treatment system problems.

Electro Scan is pleased to be joining the team and partnering with KET this year.

## New Jersey Sewer Agency

	Scans	Footage	Total Defects	GPM	GPD
Total:	5	1,228	464	562.03	809,323

### Mainlines Ranked by GPM

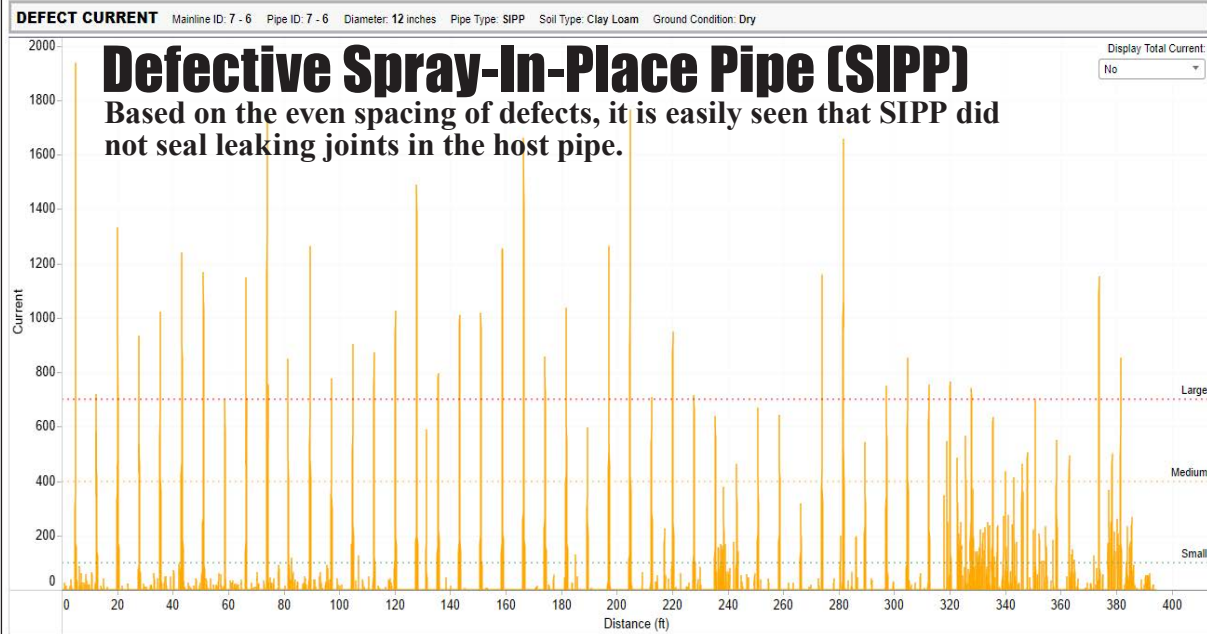
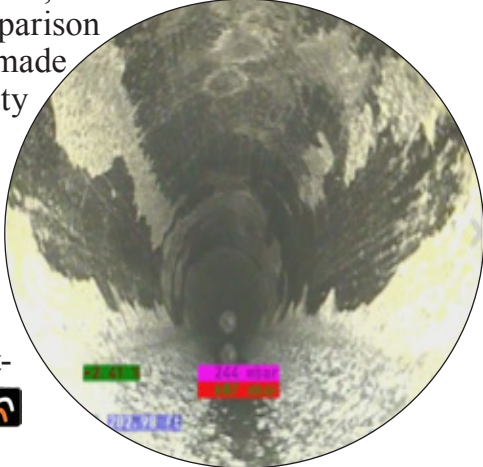
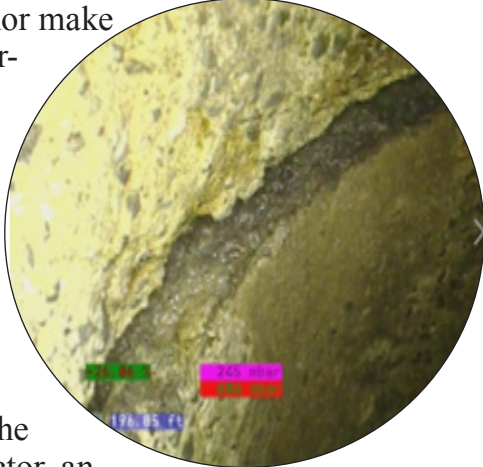
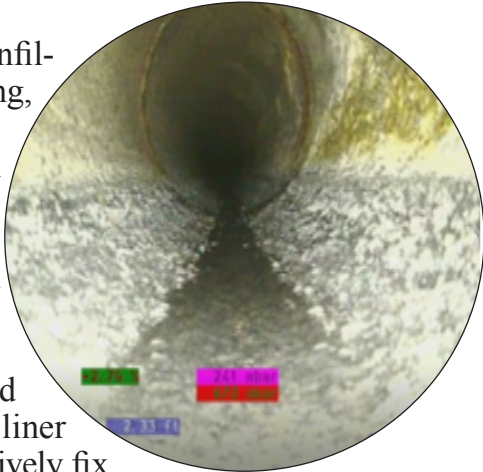
Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD	OK	800K
6/21/2018	7 - 6	7 - 6	SIPP	12	394.5	65	19	38	263.85	379,944	423,781	
	8 - 7	8 - 7	SIPP	12	396.2	211	41	26	262.70	378,288	420,107	
	5 - 6	5 - 6	ACP	8	136.8	30	1	1	21.05	30,312	146,279	
	4 - 5	4 - 5	ACP	8	61.5	31	1	0	14.43	20,779	223,046	
	6 - 5	6 - 5	CIPP	16	239.2	0	0	0	0.00	0	0	

Each SIPP Liner Leaks More Than All Mainlines, **COMBINED!**



Corrosion, infiltration staining, and more could be seen in pre-SIPP video, as demonstrated to the right. Electro Scan results showed that the SIPP liner did not effectively fix these issues nor make the pipe water-tight.

It should also be noted that, while Electro Scan attempted to use CCTV footage provided by the lining contractor, an accurate comparison could not be made due to a variety of discrepancies and errors with the video (such as no header and delayed footage counter).





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19

# Sales Partner: Construction Product Mktg

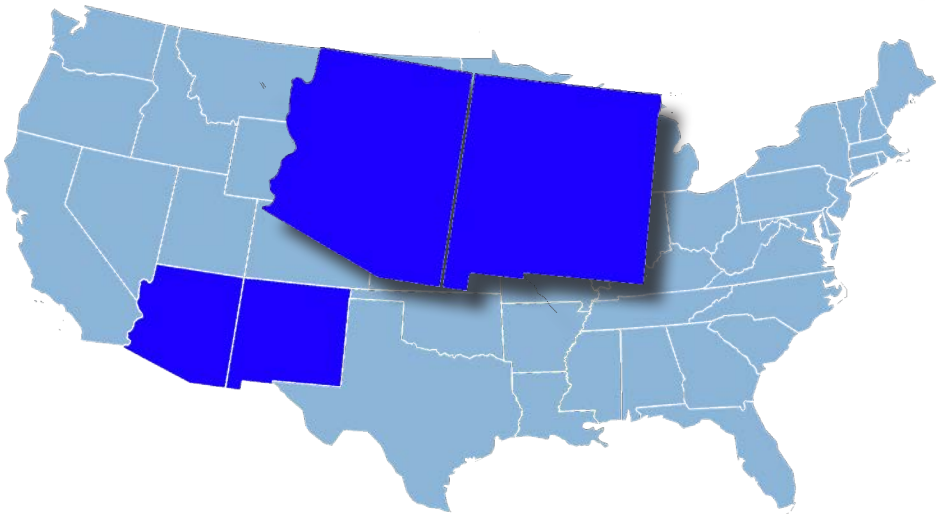


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**About**  
Construction Product Marketing (CPM) has proudly served the Southwestern states of Arizona, where it is headquartered, and New Mexico since its foundation eight years ago in 2010. CPM’s partners Chris MacDonald and Mike Ambroziak have used their combined thirty-plus years of experience in the industry to build this company, which values quality service and around-the-clock availability to clients.

CPM provides a wide range of services, including valves, maintenance, rehabilitation, and assessments. Electro Scan partnered with CPM this April and has since worked on three projects with them.

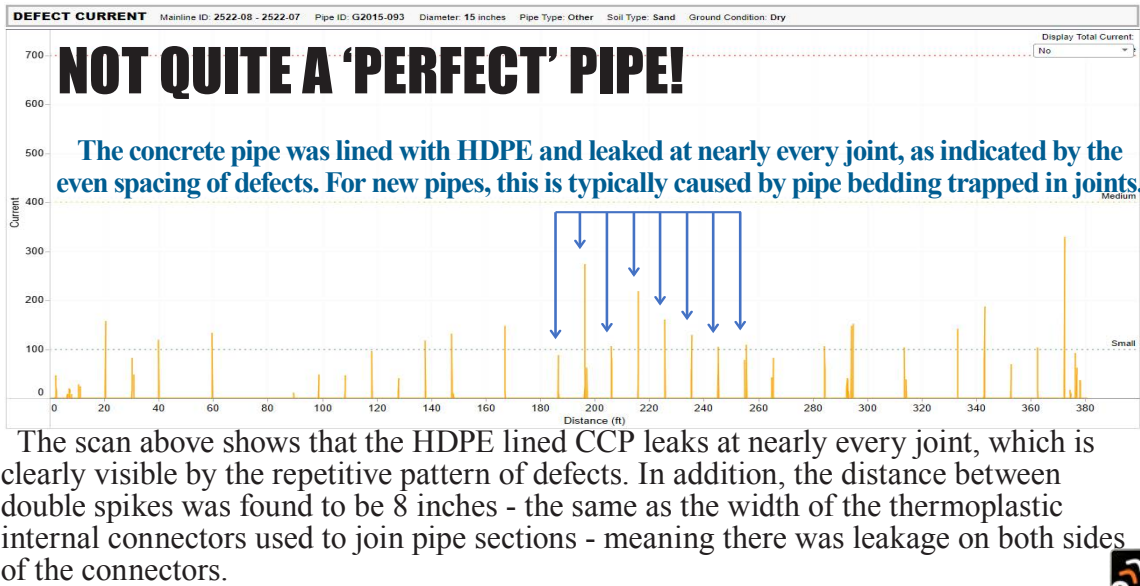
## Arizona Metropolitan Sewer Agency

	Scans	Footage	Total Defects	GPM	GPD
Total:	4	1,482	81	37.74	54,346

### Mainlines Ranked by GPM

Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD	0K	150K
6/26/2018	8909-58 - 8909-59	8909-58 - 8909-59	VCP	8	305.4	57	1	0	29.82	42,941	92,801	
	2522-08 - 2522-07	G2015-093	Other	15	380.8	21	0	0	5.73	8,251	7,626	
	2749-02 - 2749-01	Collector	CIPP	8	447.2	1	1	0	2.19	3,154	4,654	
	8909-57 - 8909-58	8909-57 - 8909-58	CIPP	8	348.9	0	0	0	0.00	0	0	

VCP Leaks 3X More Than The Rest of the Pipes, COMBINED!



## Field Set-Up Measures Water Tightness of Sewers

How can you accurately and consistently locate and measure defects after service reinstatements? The answer is using Focused Electrode Leak Location (FELL) — recognized by WEF, WERF, and WRc as the recommended way to provide unambiguous and unbiased data when assessing pre- and post-rehabilitation. Either purchase your own equipment for your municipal crew to assess your pipes or hire Electro Scan Services to provide same-day reporting of pipe condition and contractor acceptance.





# Welcome Aboard!



**Mike App**  
mike@electroscan.com  
917-817-0090

Electro Scan Inc. is pleased to announce nationally-known trenchless expert, Mike App, as Vice President, Northeast Region.

Mike opens Electro Scan's Syracuse, NY office to test and certify CIPP, locate and measure infiltration, and detect water losses for gravity and pressurized pipes.

Mike will be heading up Electro Scan's East Coast Business Development and Project Management efforts.

Mike's background of educating, specifying, selling, installing, and managing large-scale rehabilitation projects, including the world's first UV-Cured NSF-61 liner, will help Owners & Consulting Engineers design and implement CIPP, SSSES, and water loss leak detection projects.



**Mike Condran**

michael.condran@electroscan.com  
813-431-2103

Electro Scan Inc. welcomes Mike Condran, P.E. as Vice President, Southeast Region. Mike brings 35 years of engineering expertise with municipal water & wastewater utilities to support new standards for

pipe condition assessment & rehabilitation certification.

A registered Professional Engineer in Florida, Colorado, North Carolina, and Washington, Condran will be overseeing new customer acquisition, consulting services, and project management throughout the Southeast from his office in Tampa, Florida.

Prior to joining Electro Scan, Condran managed a wide range of water and wastewater projects, holding senior management roles with GHD, MWH Global, HDR, and URS.



## Taha Gabajiwala

Graduated from CSU, Sacramento as a Civil Engineer with an emphasis in the water resource and environmental engineering disciplines.

**Job at Electro Scan**  
Creating and editing project reports, creating project take-offs, and data monitoring.

**Interests**  
Watching the Philadelphia Eagles and LA Lakers on TV, playing basketball, hiking, bike riding, and playing on the Xbox.



## Sean Blottie

Graduated from CSU, Sacramento as an Electrical Engineer focused on controls and robotics engineering.

**Job at Electro Scan**  
Product Development and Engineering.

**Interests**  
Passion for the outdoors—hiking, camping and traveling. Newlywed with three crazy dogs at home. Loves to tinker on cars & bikes.



## Mackenzie App

A recent graduate of Canisius College in Buffalo, NY, Mackenzie earned her Bachelors in Environmental Studies and a separate Bachelors in Animal Behavior, Ecology, and Conservation. A Division I oarsman for all 4 years, Mackenzie was awarded the Daniel Starr Outstanding Athletic Team in 2016 and 2018. Prior to joining Electro Scan, she worked summers on UV lining crews.

**Job at Electro Scan**  
Field Services Manager and Certified Electro Scan Operator.



## John Murdock

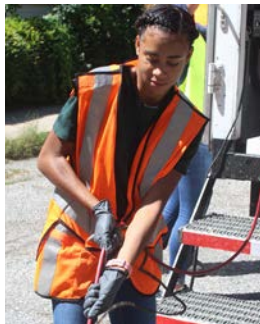
New to the sewer and water industry, John had worked construction for several

years and heard that the company was hiring field positions.

**Job at Electro Scan**  
Field Technician and Certified Electro Scan Operator.



## Summer Interns



**Education**  
Freshman at Sierra College.

**Work Experience**  
Recreational leader at Camp Rockin' U.

**Summer Projects**  
Helped design and write Critical Sewer & Water Chronicles, Issue 10.

**Fun Fact**  
"I've seen Moana at least 30 times! I love that movie!!!!!!"

**Olivia Brown**

**Favorite Moment**  
"Winning free stuff at ACE 18 and Heidi got mad."



**Education**  
H.S. Senior at Sacramento Country Day School.

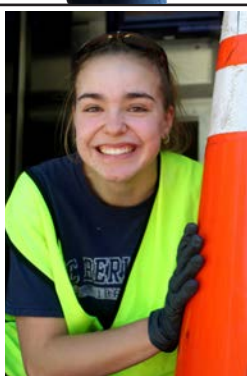
**Work Experience**  
Technically, her first job, but she was working on Electro Scan rigs since age 14, including the WRc trials in Monterey, CA.

**Summer Projects**  
Computer-aided design (CAD) using Solidworks to create submittals for the company's latest patents.

**Fun Fact**  
I've completed three half-marathons.

**Bianca Hansen**

**Favorite Moment**  
"My favorite moment was when we made the intern quote wall."



**Education**  
Senior at Sacramento Country Day School. Track Team.

**Work Experience**  
Lifeguarded at the YMCA.

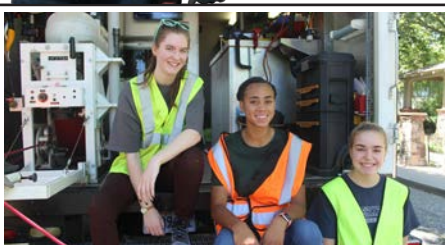
**Summer Projects**  
Helped design and write Critical Sewer & Water Chronicles, Issue 10.

**Fun Fact**  
My elbows are hyper-mobile.

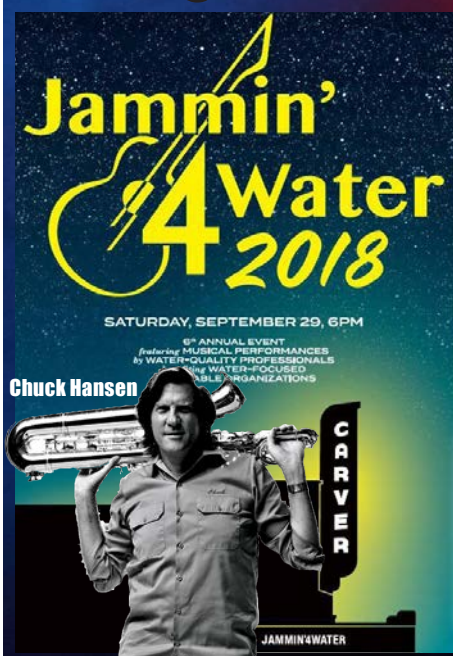
**Favorite Moment**  
"When Bianca and I accidentally left Olivia's chai tea latte hidden in the iron man mask over the weekend and it rotted"

**Heidi Johnson**

(Right) The Annual End-of-Summer Breakfast Prepared by the Interns!



## Coming to WEFTEC in New Orleans?



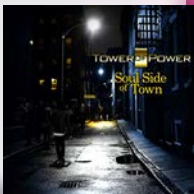
Looking for a good time before WEFTEC? We have the place for you.

This year marks the 7th Annual J4W event the Saturday before WEFTEC.

Electro Scan, Inc. is excited to be a Diamond Sponsor.

In addition to high energy performances by water professionals, proceeds benefit a variety of Water-focused charities.

Visit [www.Jammin4Water.org](http://www.Jammin4Water.org)



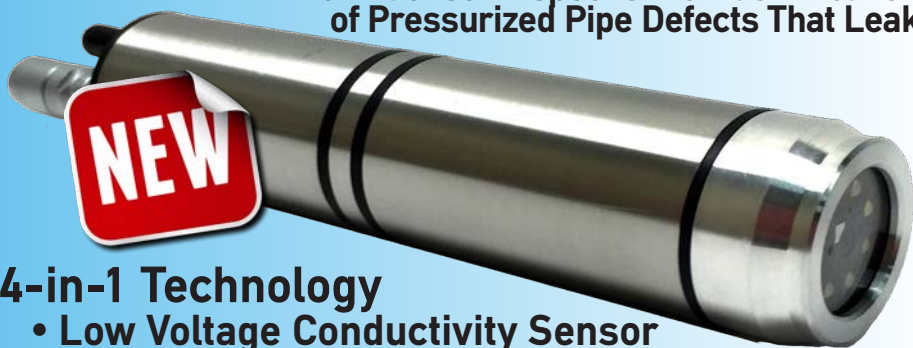
\*\*\* Scheduled to Appear \*\*\*

Electro Scan's Founder & CEO, Chuck Hansen! Also Featured On Tower of Power's 2018 Album & CD

## New Patent for Water Leak Detection

US Patent #9933329

Multi-Sensor Inspection for Identification of Pressurized Pipe Defects That Leak



### 4-in-1 Technology

- Low Voltage Conductivity Sensor
- High Definition CCTV
- Pressure Sensor
- Acoustic Hydrophone

## Where To See Us Next

### Water JAM

#### Joint VA AWWA & WEA

When: September 10-13, 2018

Where: Virginia Beach, VA

Mark Grabowski to Speak



### No-Dig Live

When: September 18-20

Where: Peterborough, UK

Booth #119



### WEFTEC

When: October 1-3

Where: New Orleans, LA

Booth #3107



### COMSOL Conference

When: October 4-5

Where: Boston, MA

Chuck Hansen to Speak



### AWWA CA-NV Fall Conference

When: October 22-25

Where: Palm Springs, CA

Booth #402



### NEWEA CSO/Wet Weather Issues Conference

When: October 29-30

Where: Portland, ME

Chuck Hansen to Speak



### AWWA-WEA Conference

When: November 6

Where: Raleigh, NC

Chuck Hansen to Speak



### FSAWWA 2018 Conference

When: November 26-28

Where: Champions Gate, Florida

Booth #208, Chuck Hansen to Speak



### Florida Water Resources 2019 Conference

When: April 14-17

Where: Tampa, F



### NASTT/No-Dig Conference 2019

When: March 17-21

Where: Chicago, IL





# Groundbreaking Leak Detection Technology Unveiled at AWWA ACE18 in Las Vegas, Nevada

Electro Scan’s Booth Was a Popular Stop Showing ‘Live’ Demonstrations of FELL Technology and Scorecards Comparing Different Leak Detection Technologies



“Most Accurate Leak Detection Solution for Pressurized & Gravity Pipelines”



See Us Present At AWWA ACE19

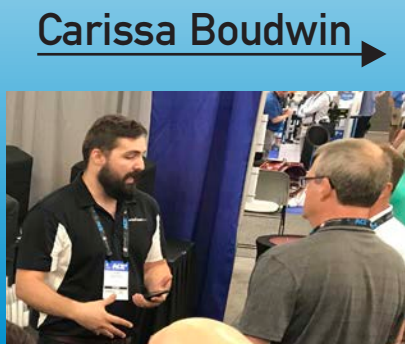
Las Vegas, NV, June 12-14 – The American Water Works Association held their 2018 Annual Conference & Exposition (ACE18) in co-partnership with the California-Nevada Section. More than 12,000 attendees from around the world traveled to the Mandalay Bay Convention Center to participate in the largest water technology show in the United States.

Electro Scan Inc. conducted live demonstration scans using their low voltage conductivity technology, highlighting pin-point accuracy and repeatability. In addition, they live-processed and displayed results within ten (10) minutes (Left).

### Representing at ACE18:



Chuck Hansen & Mike App



Carissa Boudwin



Sean Blottie

Cory Peters



Above is the “live” leak detection set-up at Electro Scan’s booth at ACE18. The tethered probe is run through the clear tube while emitting a low-voltage electrical current. At any point of defect (indicated with red), the current will escape and travel back to the grounding rod. If the pipe leaks electricity, it leaks water. The monitor displays the results of the scan just minutes after, showing the defect current chart along with other information such as distance scanned, leak location, and a quantification of the leaks in gallons per minute.

## How Electro Scan Compares to Other Technologies?

Countless leak detection technologies and methods exist today, including CCTV, Acoustic Sensors, and the industry’s latest . . . leak sniffing dogs! To aid in comparing a few of the most prevalent technologies, Electro Scan’s summer interns were assigned to interview key vendors at the recent ACE18 Exhibition in Las Vegas, NV and to fill out the Scorecard below. Their results were so helpful that staff decided to give out copies at the booth to interested convention attendees so they, too, could understand the advantages of Electro Scan’s disruptive technology when it comes to locating and measuring leaks in pressurized water pipelines.

A unifying feature of other technologies is that they are subjective, denoting inaccuracy and lacking repeatability. CCTV, for example, relies on human interpretation of inspections to find possible leaks, many of which *aren’t visible* because water is exfiltrating. Acoustic sensors require third-party data interpretation, on top of being vulnerable to interference by ambient noises and unable to reliably assess plastic pipe materials such as HDPE and PVC. Electro Scan’s technology is a reliable, unbiased, machine-intelligent solution for automatically locating, and measuring, leaks.

### LEAK DETECTION SCORECARD: THOSE THAT CAN, DO!

# ACE18

electro scan inc.

CCTV & Acoustic Sensing

Acoustic Sensing

Inverse Transient Analysis

Free-Swimming Acoustic Sensing

1. Pressurized Mains (AWWA M77)	YES	YES	YES	YES	YES
2. Gravity Mains (ASTM F2550)	YES	NO	NO	NO	NO
3. Low Voltage Conductivity	YES	NO	NO	NO	NO
4. Acoustic Sensor	YES	YES	YES	NO	YES
5. Closed-Circuit Television (CCTV)	YES	YES	NO	NO	NO
6. CCTV is IP Addressable	YES	NO	NO	NO	NO
7. Measures Leaks in Gallons Per Min.	YES	NO	NO	NO	NO
8. Cloud Reporting Done in Minutes	YES	NO	NO	NO	NO
9. Finds All Leaks in Plastic Pipe	YES	NO	NO	NO	NO
10. Certifies Cured-In-Place Pipe (CIPP)	YES	NO	NO	NO	NO
11. Certifies Total Pipe As 'Watertight'	YES	NO	NO	NO	NO
12. Repeatability Testing, By Crew & Eq.	YES	NO	NO	NO	NO
13. COMSOL® Multiphysics Validated	YES	NO	NO	NO	NO
14. Maps Corrosion in Asbestos Cement	YES	NO	NO	NO	NO
15. Leak Location Accuracy	0.4"	Varies by Pip 3-20ft. Not Plastic Pipes.	NA	6 meters	6 feet
16. CCTV Resolution	1080p	640 X 40	NA	NA	NA
17. CCTV Lighting (lumens)	4400	46 LED	NA	NA	NA
18. CCTV Zoom	16x	NO	NA	NA	NA

## ACE 'LIVE' DEMONSTRATION

Automatic Leak Location With GPM	YES	NO	NO	NO	NO
Results Immediately Displayed	YES	NO	NO	NO	NO



Canine Leak Detection?

Recently, dogs have been explored as an option for leak location. These canines are trained to sniff out defects by detecting a special odorous gas which, after being injected into the pipe, rises to the surface of the ground if it escapes through a leak. Like with many other technologies, this method is subjective and unable to quantify the size of leaks.





**City of Benicia, CA** completed a 3,189LF FELL project including 8" and 10" PVC and VCP sewer mains.

**City of Manteca, CA** has completed an 8,300LF FELL inspection and certification project of their UV lining project.

**City of North Miami Beach, FL** has issued an RFP that included 6,000LF of FELL inspection.

**City of Grass Valley, CA** has completed a 6,133LF Pre- and Post-CIPP FELL Inspection.

**City of Scotts Valley, CA** has budgeted to complete FELL testing for its entire wastewater collection system over the next three years.

**Iowa Great Lakes Sewer Authority, IA** has completed a 8,517LF CIPP investigation of its most recent lining project.

**Jurupa Community Services District, CA** has awarded a contract to complete a 6,508LF FELL investigation of its most recent CIPP project, with some of the liners still under warranty.

**Kansas City Water, MO** recently issued two (2) Requests for Proposals for CIPP totaling over 100,000LF, including FELL testing requirements.

**Lower Paxton Township Authority, PA** has completed its FELL assessment of a recent UV lining project that utilized ASTM F2550.

**Orange County Sanitation District, CA** completed its first FELL investigation of a CIPP Force Main crossing the Pacific Coast Highway.

**Pennsylvania American Company, a subsidiary of American Water Co.,** has included FELL Testing in its 2018-2020 Budget for Wastewater Collection Systems. Proposals were due August 2018.

**St. Croix, U.S. Virgin Island**-based refinery has leased an ES-620 to complete field investigations of its entire wastewater network to ensure watertight piping.

**San Francisco Public Utilities Commission, CA** has issued its 30th bid for wastewater rehabilitation – since 2017 – requiring ASTM F2550 and FELL. Capital investment for the projects total over \$250 million.

**Sanitation Districts of Los Angeles County, CA** has issued a RFP for a CIPP project, including ASTM F2550 & FELL inspection.

**Town of Andrews, SC** working with Keck & Wood Engineers, will begin a full FELL investigation of its entire town, representing over 135,000LF of sewer main. The town had suffered 3 massive floods, including Hurricane Matthew.

**Township of East Brunswick, NJ** has completed two FELL projects, including assessment of its most recent rehabilitation project.

**Tri-Cities Northern Regional Wastewater Authority, OH,** working with **Veolia Services, NA,** has completed 164,239LF of Electro Scan FELL inspection.

**Vista Irrigation District, CA** has issued a Request for Proposal to use CIPP to reline a 24" siphon, including a requirement for FELL testing.

**Washoe County, NV** has budgeted to use Electro Scan FELL Services to survey 14,000LF 24-30" diameter Asbestos Cement Pipe. The project will inspect their main interceptors, upstream from their treatment plant.

**Electro Scan Inc. – The global catalyst for infrastructure pipeline quality control.**

# Chuck Hansen Featured in The New York Times

New York, NY – Electro Scan's Founder and Chairman was featured in both Sunday print and online editions of The New York Times.

Former Founder & Chairman of Hansen Information Technologies, a leading asset management solution provider sold in 2007 to INFOR GLOBAL for \$100 million, Hansen has been involved in a number of start-ups, private investments, and venture capital fund, including as an Advisory Board member of Folsom, CA-based Moneta Ventures.

So it was no surprise that he was contacted by the NY Times to get his opinion on new tax regulations and their impact on small business.

A long-time tax client of Ernst & Young LLP, working with **James Markham** and **Burga Pucci**, Hansen was delighted to share his views on setting up businesses given today's tax environment.

## BUSINESS DAY

**Can You Get Rich From the New Tax Law by Becoming a Company?**  
By CONRAD DE AENILLE  
FEB. 23, 2018

The new law has given the benefits to corporations. If you're in a working self-employed or sole proprietor, you may be tempted to hand in your cards and start over as a company.

It may be possible, but be careful. There's more to running a business than deciding to be so, as far as the Internal Revenue Service is concerned.

Independent contractors, whether as sole traders or within corporations, must meet certain requirements. For example, they must show that they determine what tasks they perform and when and how they perform those tasks, primarily for a variety of customers, and not for one.

Then the thinking and the math get a bit tricky. For just 3 years to decide what sort of corporation you want to form. And if you already operate under certain types of corporate entities, you may need to consider whether it's time to change to a different one.

Income tax rates were slashed on conventional corporations (known as C corporations), but the great majority of corporations, especially smaller ones, are in another category.

There are two main categories: S corporations and limited liability companies (LLCs). S corporations are subject to the same rules as C corporations, but with some exceptions. LLCs are subject to the same rules as S corporations, but with some exceptions.

The discrepancy in taxation has prompted some owners of pass-through entities, which include partnerships, S corporations and limited liability companies, to consider converting to corporations rather than S corporations.

But the new law has changed the game. It has lowered the tax rates for S corporations and limited liability companies, and it has increased the tax rates for C corporations.

Still, when all tax consequences are factored in, they expect most people to be better off keeping what they're doing.

Mr. Hansen said that he expects a new wave of S corporations to be formed, but he expects a new wave of C corporations to be formed as well.

He also expects a new wave of LLCs to be formed, but he expects a new wave of S corporations to be formed as well.

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He also expects a new wave of LLCs to be formed, but he expects a new wave of S corporations to be formed as well.



Details remain to be pondered about the tax law and its effect on Electro Scan, but Mr. Hansen says is leaning toward making the change.

Another aspect of the law could affect the rates regarding how much pass-through income is paid to shareholders. If you are an S corporation, but you want to make a change to a C corporation, you may be able to do so.

That incentive given under the new law because salary does not receive the 21 percent qualified income deduction.

So to each that reality. Mr. Hansen said, the rates generally require that the deduction be capped at 50 percent of a firm's W-2 wages, and small salaries will result in smaller deductions. But this provision applies only to businesses with income above the \$150,000-\$200,000 threshold, he said.

While the new law adds some complications, Mr. Hansen at Ernst & Young said it makes the change for some not very small businesses. One with gross receipts below \$25 million can use the simplified method of accounting rather than the accrual method, the provision says.

Provisions such as this and the ability to write off equipment expenses fully are "help in terms of complexity for small businesses," Mr. Hansen said.

The law gives business owners a lot to ponder, but Mr. Hansen says he is leaning toward making the change.

He also expects a new wave of LLCs to be formed, but he expects a new wave of S corporations to be formed as well.

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He also expects a new wave of LLCs to be formed, but he expects a new wave of S corporations to be formed as well.

# Electro Scan Founder, Chuck Hansen, Selected to Present at 2018 COMSOL Conference, Boston, MA

Electro Scan's Founder & Chairman, Chuck Hansen, will present at the 2018 COMSOL Conference in Boston, Massachusetts, October 4, 2018, on his paper, entitled "Using Multiphysics to Quantify Leakage Rates in New and Rehabilitated Sewer and Water Pipes." A limited number of users were invited to present, with abstracts reviewed by a 55-person Selection Committee with representatives from 13 countries.



Validation testing was conducted on various pipe materials, sizes, lengths, depth of cover, soil types, and lining materials, including both live pipelines and exhumed pipe sections.

"Disruptive machine-intelligent technologies, like Electro Scan, take the guesswork out of decision-making," said Hansen. "And, ensure reliability, resiliency, and sustainability of our valuable water infrastructure."



**U.S. Patents 9143740, 9304055, 9933329 AND INTERNATIONAL PATENTS PENDING.**

**COMSOL MULTIPHYSICS**

# Electro Scan Releases Application Interface

Electro Scan Inc. is delighted to integrate its game-changing pipe condition assessment solution with the leading business analytics solutions for the wastewater industry—Innovyze® InfoMaster, ESRI, Wincan, and IT Pipes.

The application programming interface (API) has secure endpoints (URLs) that deliver scan data directly from Electro Scan's production database and put them into JSON format when a successfully authenticated request is made of it.

The API provides many endpoints to minimize engineering time and has a set of parameters per endpoint engineers can use to pre-filter the data.

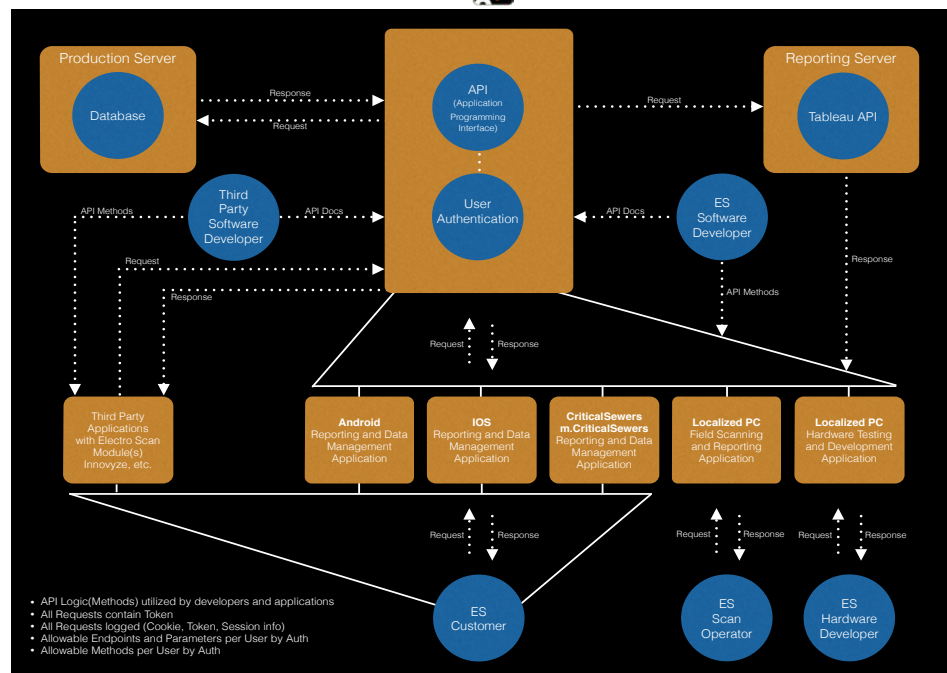
Clients have enjoyed the immediate availability of data to display in their software.

# NEW API

**Innovyze®**

**WinCan**

**it pipes™**



- API Login(Methods) utilized by developers and applications
- All Requests contain Token
- All Requests logged (Cookie, Token, Session info)
- Allowable Endpoints and Parameters per User by Auth
- Allowable Methods per User by Auth



# New Pipe Testing Standards Among Toughest in Nation



*Continued From Page 1*

## New Construction Acceptance Standards

An Electro Scan customer since 2016, San Francisco Public Utilities Commission (SFPUC) updated their Construction Specifications later that year to require all new and rehabilitated wastewater collection pipelines to be delivered in accordance with water tightness standards in ASTM F2550.

By September 2018, over 30 bids were published with a total value of \$250 million requiring FELL testing.

Prior to Focused Electrode Leak Location (FELL), SFPUC relied heavily on contractor provided & city reviewed visual inspections to accept new construction and rehabilitation. But after purchasing their own Electro Scan equipment and testing new and existing Vitrified Clay, CIPP, and Plastic Pipe materials, pipe leakage – not easily identified by Closed-Circuit Television Inspection – was found and measured.

The two most frequently asked questions about Electro Scan FELL, working in San Francisco, include the following:

1. **What are the Standards for Accepting New or Rehabilitated Pipes?**
2. **How do you Scan Pipes When There is a Steep Grade or Hill?**

## SFPUC and DPW Pipe Acceptance Standards

Once a FELL inspection is completed and uploaded to the SFPUC Critical Sewers® cloud application, results are reviewed by a City Representative. Individual leaks calculated to have the potential to be in excess of 0.05 Gallons Per Minute (GPM), and/or pipelines exceeding a total 0.20 GPM must be repaired by the Contractor prior to final acceptance. Post-processing GPM calculations use a theoretical variable of one (1) foot of ground water head pressure over the entire pipe length and one percent (1%) pipe gradient.

Leaks determined to be excessive by the City Representative must be repaired by the Contractor at no cost to the City, prior to final acceptance.

## Field Set-Up for Pipe Gradients of 10% or More

With forty-three (43) named hills in San Francisco, like Nob Hill, Russian Hill, Twin Peaks, and Mount Sutro, inspecting pipes can be a challenge. *See Right.*

## FELL Scanning on Steep Streets of San Francisco

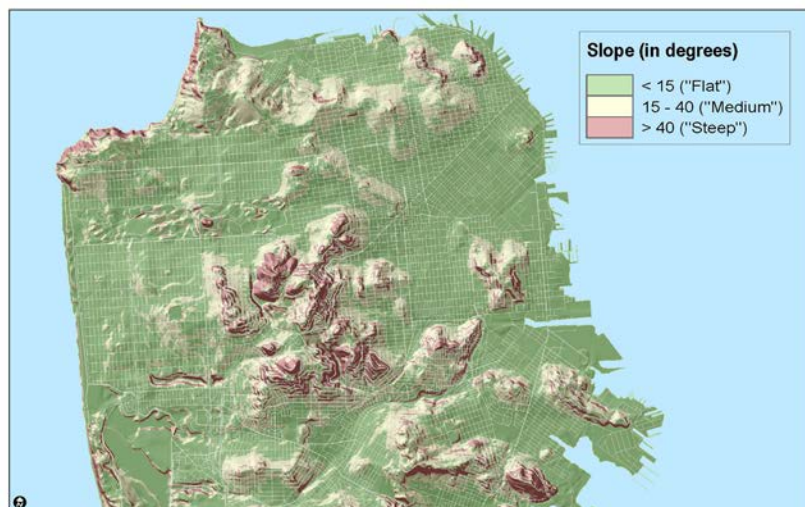
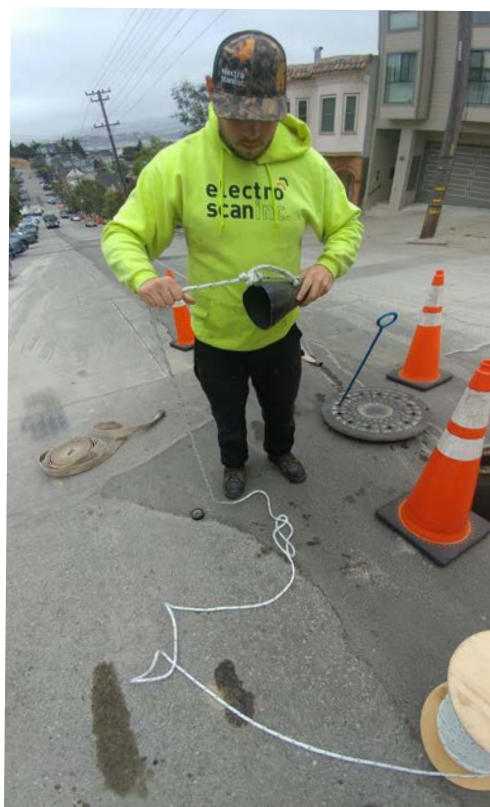
Electro Scan Services Team has scanned sewer & water pipes around the world. But, who knew we would be challenged in our own backyard doing FELL testing on the steep hills in San Francisco.

Many cities and consulting engineers know that we use water to surround our probe to use low voltage electric current to measure leaks. But, how is this done on steep slopes without filling the entire pipe?

Simple. By floating a line to a downstream manhole, we connect a jet hose and use an AB Chance 1000 lb Capacity Capstan hitch-mount powered hoist. Ideal for erecting towers, raising antennas, and pulling jet hoses up 41% pipe gradients, Electro Scan crews can pull our jet hose to the upstream manhole, set our probe and complete scanning in minutes. Some jet trucks could actually make it to the upstream manhole, but it was just too hard to pull 500ft of hose the last 10 feet to attach an appropriate-sized funnel cone and attach our probe. Write us at [sales@electroscan.com](mailto:sales@electroscan.com) for more information.

### Steepest Streets in San Francisco

	Grade
1. Bradford above Tompkins	41.0%
2. Romolo between Vallejo and Fresno	37.5%
3. Prentiss between Chapman and Powhattan	37.0%
4. Nevada above Chapman	35.0%
5. Baden above Mangels	34.0%
6. Ripley between Peralta and Alabama	31.5%
7. 24th between De Haro and Rhode Island	31.5%
8. Filbert between Hyde and Leavenworth	31.5%
9. 22nd between Vicksburg and Church	31.5%
10. Broadway above Taylor	31.0%



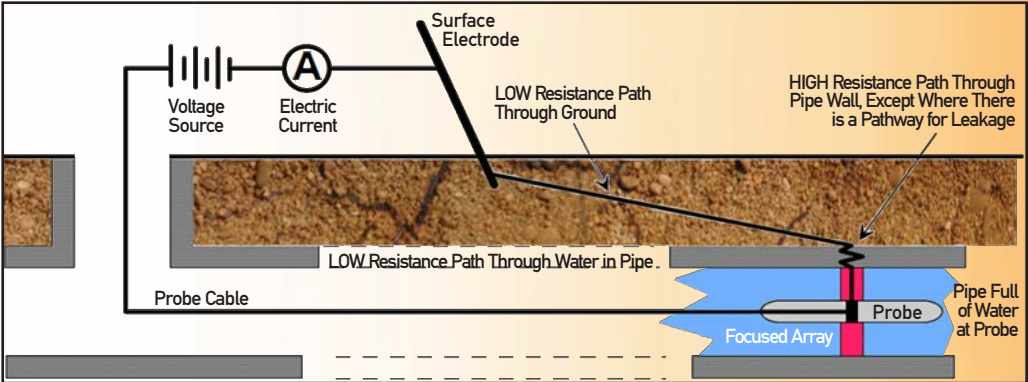


# ASTM F2550 Renewed to 2026

## Locating Leaks in Pipelines Using Variation of Electric Current Flow Through the Pipe Wall

Achieving a well-deserved reputation for identifying defects missed by CCTV and weeding out marginal contractors & suppliers on trenchless rehabilitation projects, ASTM Standard F2550 is now actively specified to test & certify pre- and post-rehabilitation projects for municipal, commercial, and industrial pipelines – *both gravity & pressurized*.

In addition to replacing high resolution cameras and acoustic sensors to find & quantify leakage rates in Gallons Per Minute (GPM) or Litres Per Second (LPS), Sacramento-based Electro Scan Inc. has expanded its product line to include Manhole Leak Detection – *replacing digital side scanning cameras that can't find leaks* – and Pressurized Water Mains *superior to acoustic sensors & data loggers*.



100% of all openings or leaks are automatically identified & measured using electric current.

## Find Leaks & CIPP Defects Missed By Acoustic & CCTV

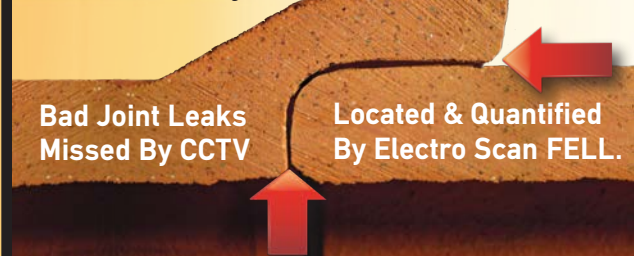
### Sewer Mains

After confirming CCTV misses 80-100% of infiltration, agencies are replacing CCTV with Focused Electrode Leak Location (FELL) and ASTM F2550.



### Bad Joints

Because high-resolution cameras are unable to look into joints or turn 90-degrees to 'see' if water infiltrates, Electro Scan has become the new standard to assess joints.



### Bad Lateral Connections

Most lateral defects can't be seen, especially after rehab, except if Electro Scan is used.

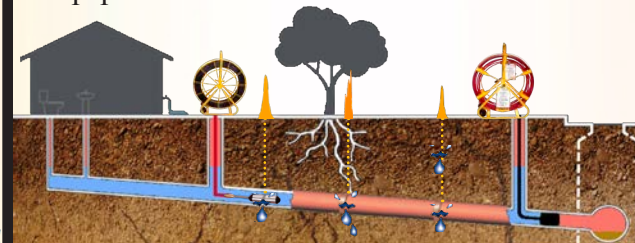


UPSTREAM MH: AC6-29 Lateral Connection  
DOWNSTREAM MH: AC6-28  
DATE: 2/1/2017  
FEET: 0047.9



### Laterals

Electro Scan has become the new standard to test & accept private sewer laterals and lateral connections.

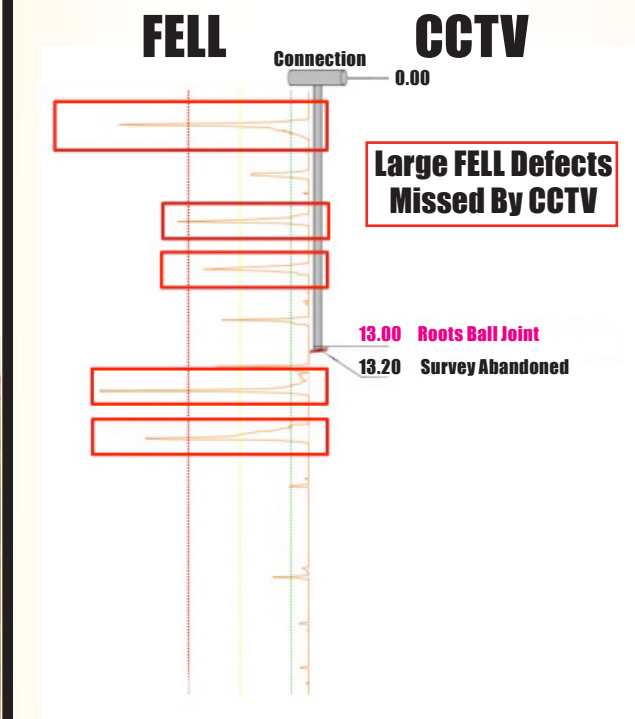


After repeatedly hearing that "private sewer laterals were responsible for 80% of I&I," a leading sewer authority contracted to have Electro Scan Services evaluate Sewer Mains & Laterals, before and after rehabilitation.

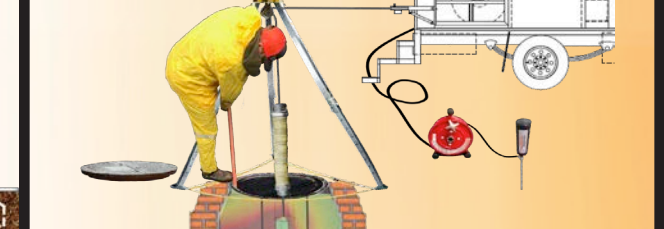
Instead of confirming their worst suspicions, the surprising results showed that 95% of leaks were exclusively found in sewer mains, including lateral connections at the main, with only 5% from laterals, from sewer main to cleanout.

### Water Research Foundation & EPA-Funded Project

In one of the first comprehensive studies of its kind, CCTV was compared to FELL, showing that CCTV missed all major defects.

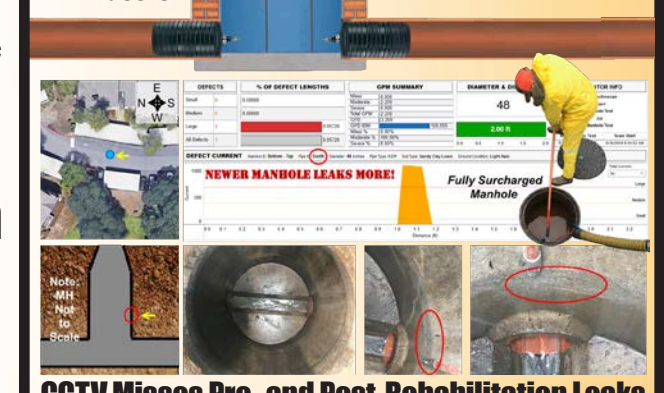


### Manholes



Finally... Locate & Measure Infiltration Missed By Digital Side Scanning CCTV Cameras & Lasers!

After learning of the inability to detect leaks using *digital side-scanning cameras*, cities are now selecting Electro Scan Services & FELL technology for Manhole Inspections to accurately *quantify infiltration*.



### Water Mains



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ISO-Certified Electro Scan Vehicles Hit the Streets to Find Defects Missed by CCTV and Acoustic Sensors.

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