WATER METERS CAN'T FIND DISTRIBUTION MAIN LEAKS, CAN THEY?

YOU BET THEY CAN!

Graham Mattison

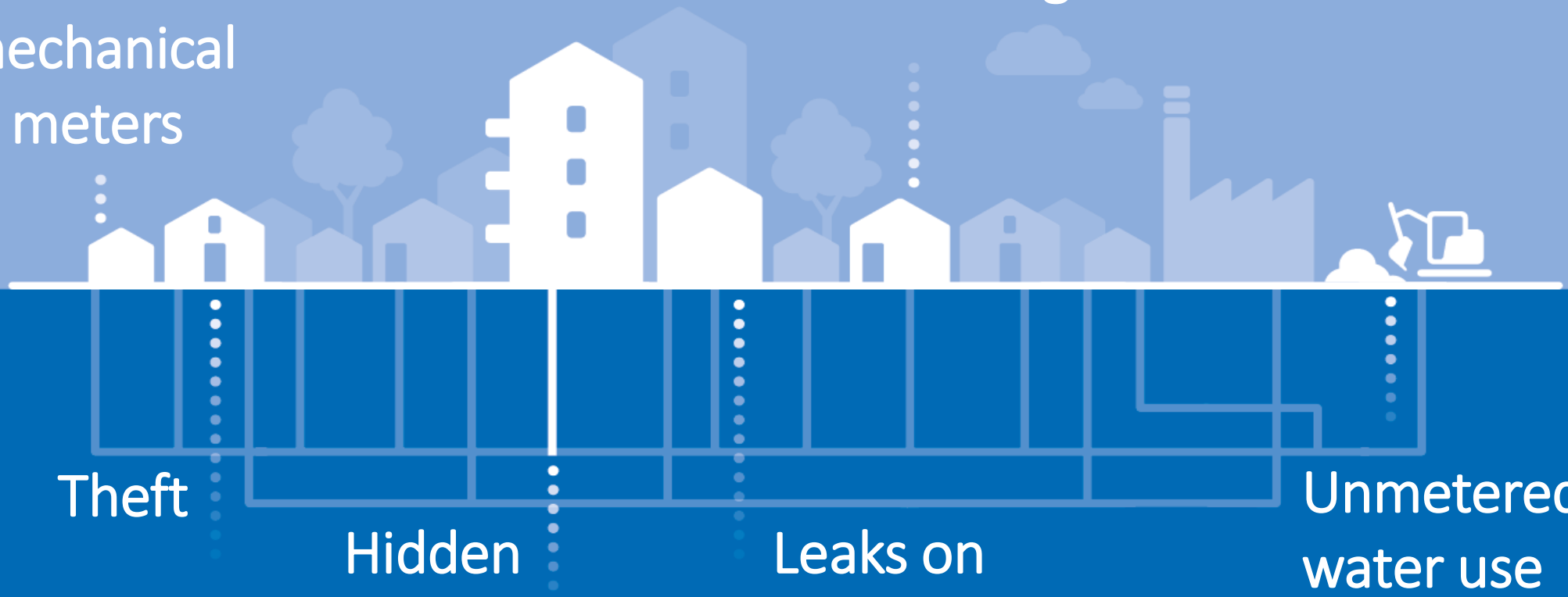
kamstrup

Session Contents

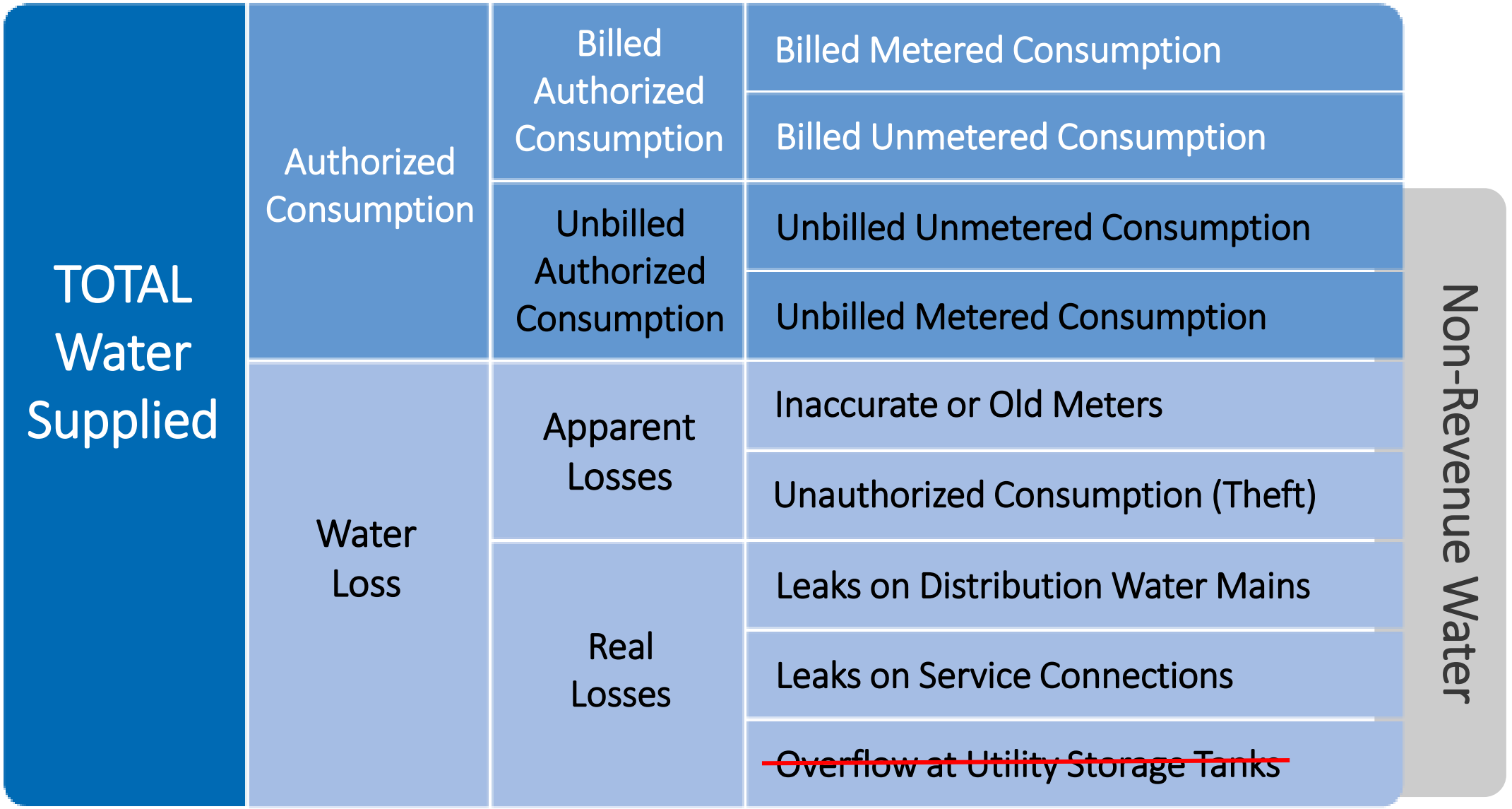
- Water Loss and Why it Matters to Me
- Understanding Leaks
- Leak Detection Technologies & Non-Revenue Water Programs
- New & Patented AMI Solution with “Built-In” Leak Detection Technology
- Case Studies & Testimonials

Water Loss and Why it Matters to Me

Non-Revenue Water is many things…..



AWWA Water Balance



= TOTAL Water Billed

What are your NRW Program Drivers?

Revenue Recovery

Regulations

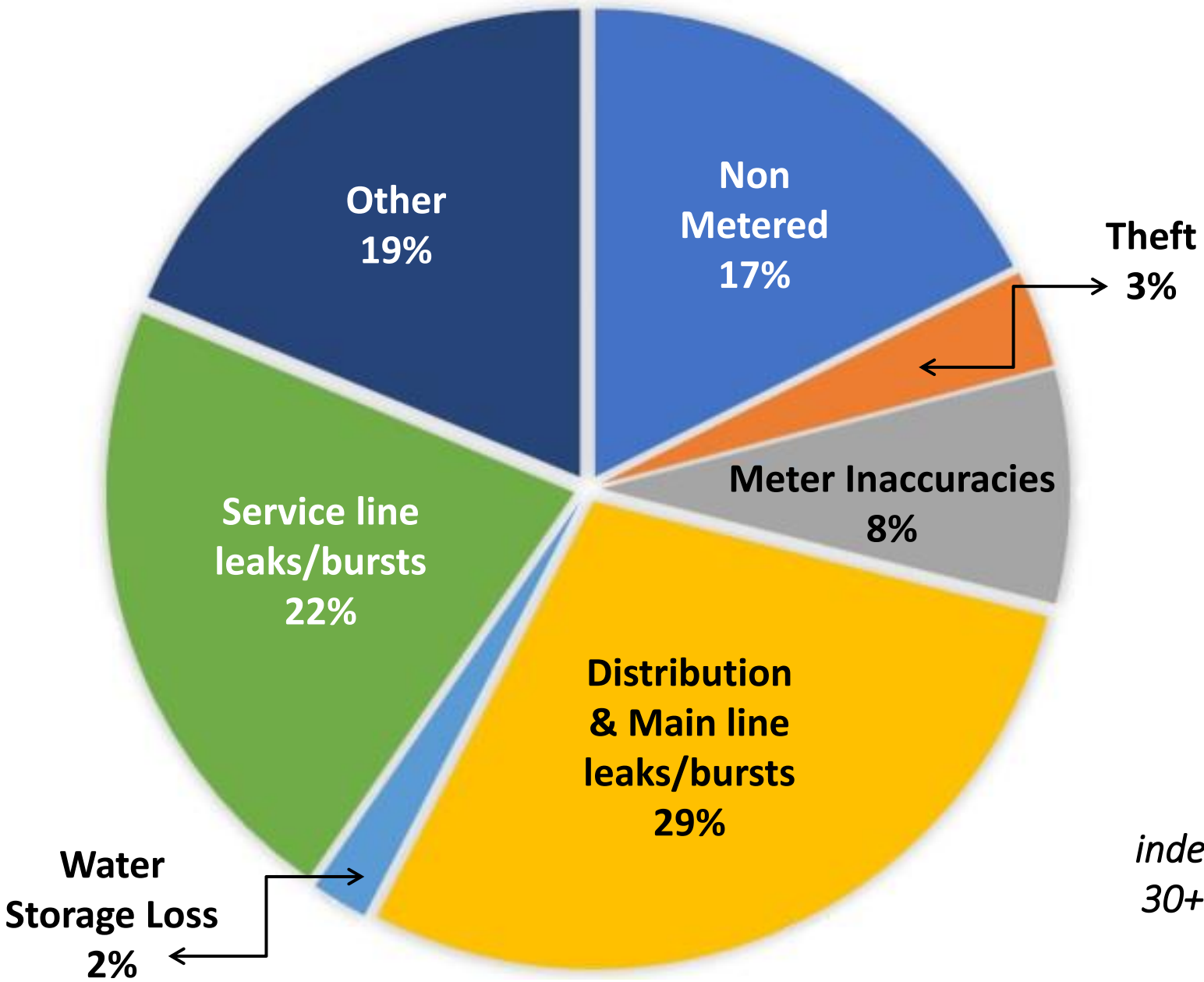
Drought

System Efficiency

Customer Satisfaction

Environmental Impacts

Distribution of Non-Revenue Water



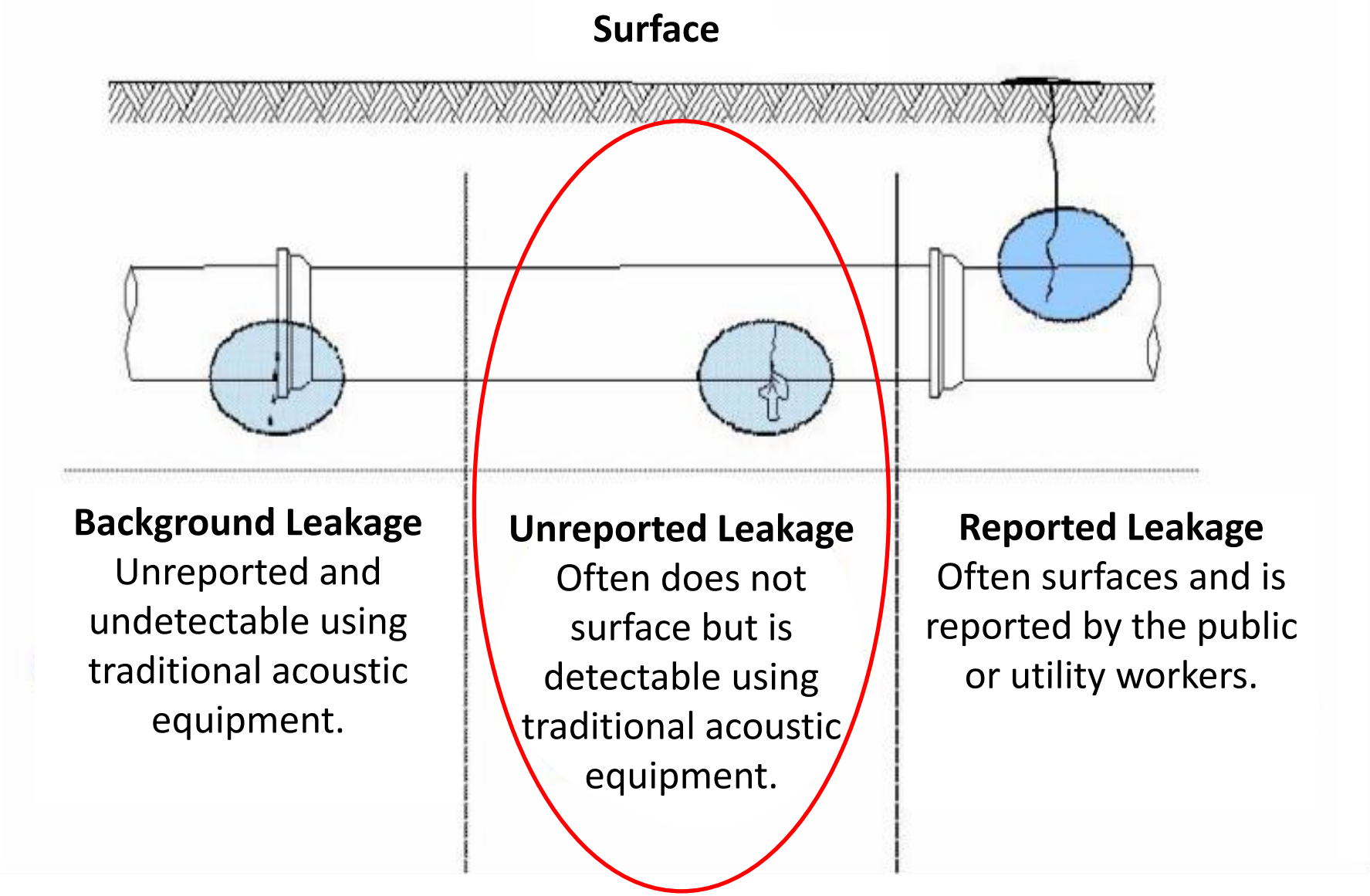
Based on an independent survey of 30+ US water utilities

Understanding Leaks

What Types Of Water Main Leaks Are We Trying To Identify?

(Hint: It’s Not This One)

Different Types of Leaks



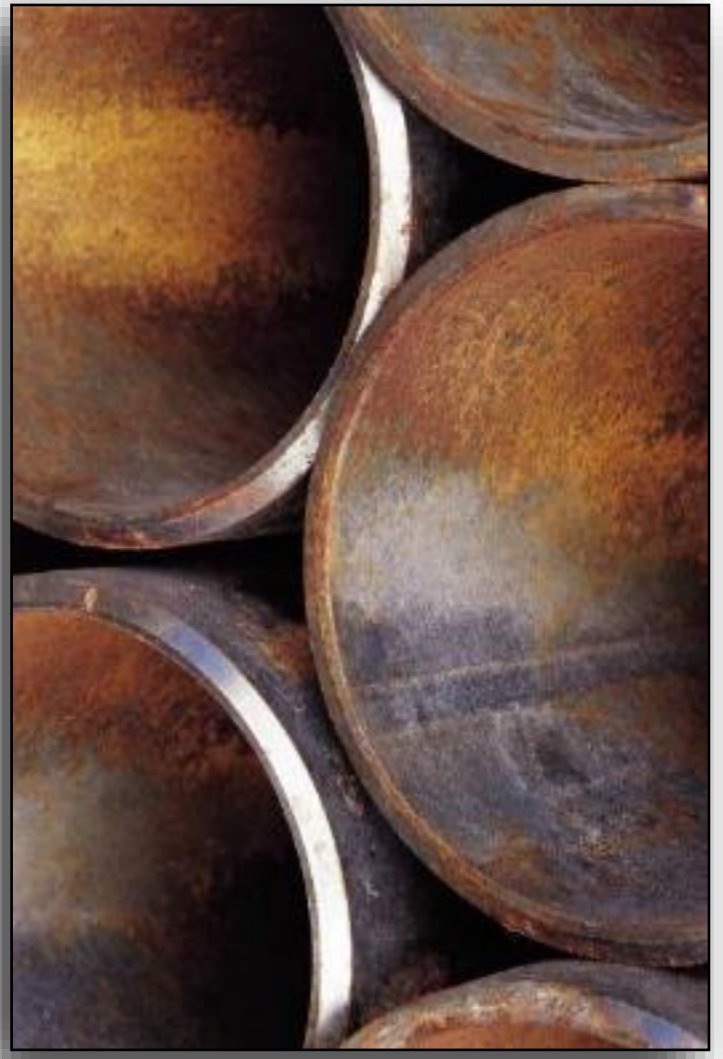
Pipe Properties & Effects on Locating Leaks

Material Types

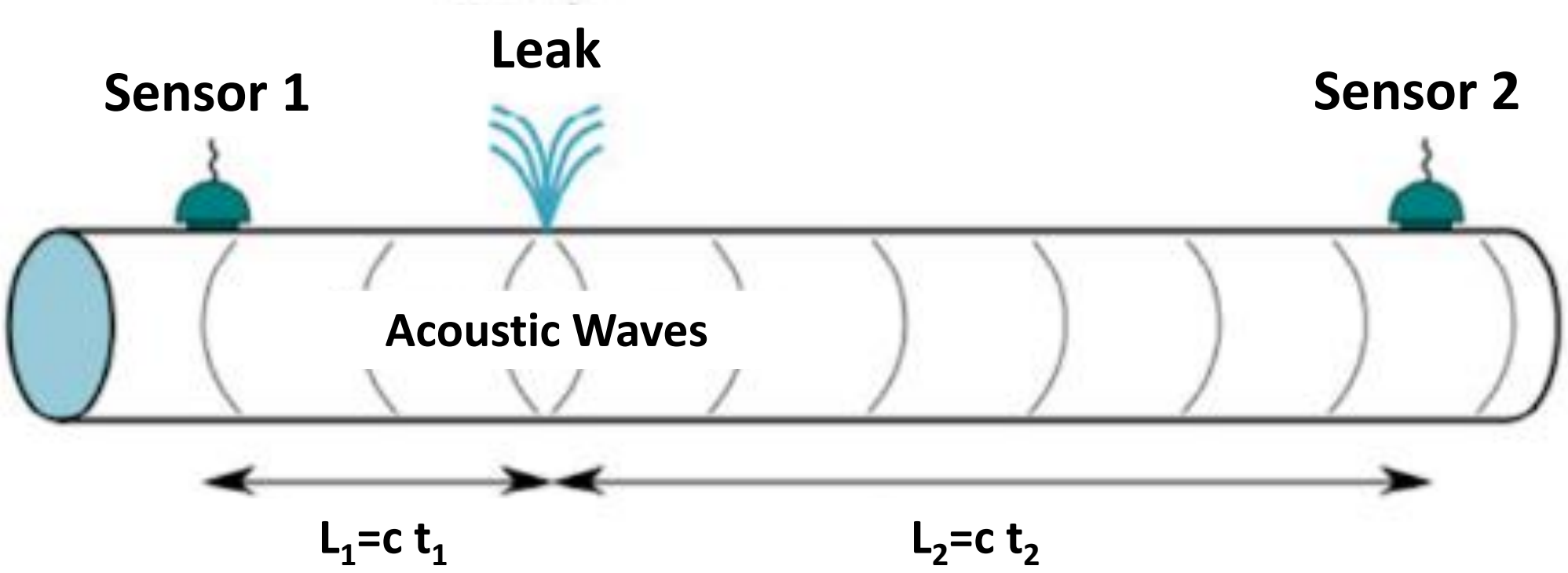
Hardest

Softest

- Steel
- Iron
- Copper
- Asbestos Cement
- Lead
- PVC
- Polyethylene



Pipe Properties & Effects on Locating Leaks



Other Factors Which Affect Our Ability to Locate a Leak?

Site Conditions Impact Leak Noise Quality:

Good Quality Leak Noise	Poor Quality Leak Noise
Metallic (hard) pipe	PVC (softer) pipe
High water pressure	Low water pressure
Hard backfill	Soft backfill
Small rupture	Large rupture
Clean pipes	Encrusted pipes
Small diameter pipes	Large diameter pipes
Shorter distance from the leak	Longer distance from the leak

FYI - Quick Reference for Leak Noise transmission distance thru pipe wall based on pipe size and material

How Do Leak Sounds Travel on Pipes?

Metal pipes, particularly iron mains between 6 inches and 12 inches, copper services, and steel pipes transmit the sounds of water leaks for hundreds of feet in every direction. Asbestos-cement pipe and PVC pipe do not transmit the sounds nearly as far.

Distances transmitted for the "Hiss" or "Whoosh" sounds of water leaks are a function of the pipe diameter as well as the pipe material:

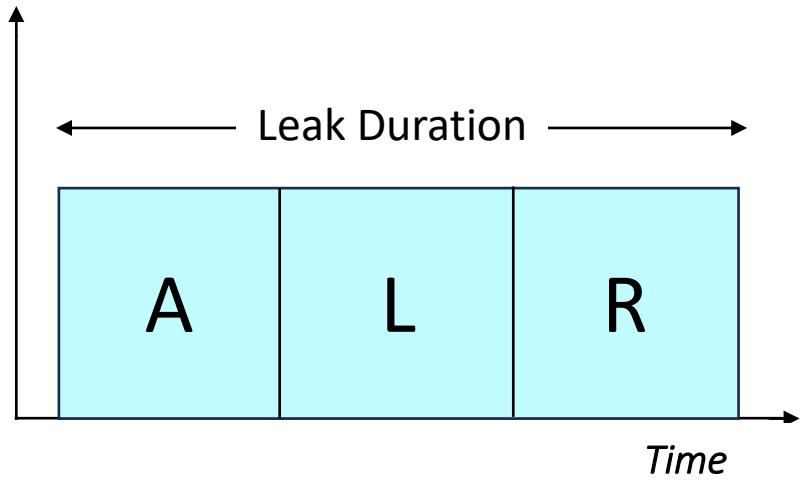
Pipe Material and Diameter	Distance Sounds Travel for 2 GPM Leak at 60 PSI
6 inch Cast Iron Pipe	600 to 1000 feet
12 inch Cast Iron Pipe	400 to 800 feet
24 inch Cast Iron Pipe	200 to 400 feet
6 inch AC Pipe	400 to 800 feet
12 inch AC Pipe	300 to 500 feet
24 inch AC Pipe	100 to 300 feet
6 inch PVC Pipe	200 to 300 feet
12 inch PVC Pipe	100 to 200 feet
24 inch PVC Pipe	50 to 100 feet

Material	Diameter (mm)	Velocity (m/s)
Polyvinyl Chloride (PVC)	40	565
	80	540
	150	530
Cast-Iron	150	1220
	250	1160
	350	1120
Steel	25	1375
	40	1350
	60	1330
	90	1286
	150	1200
	250	1150

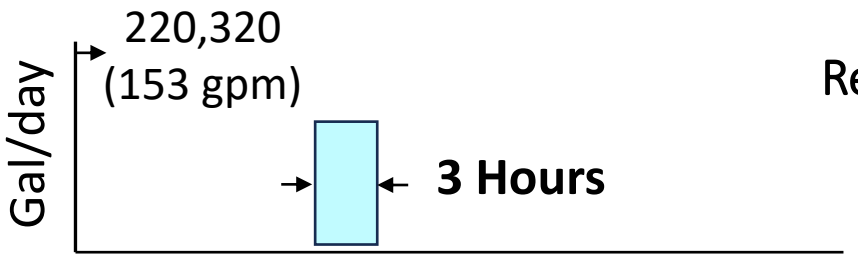
Temperature - t - (°C)	Speed of Sound - c - (m/s)
	Water
0	1403
5	1427
10	1447
20	1481
30	1507
40	1526
50	1541
60	1552
70	1555
80	1555
90	1550

Leak noise travels faster and farther through the water column than it does along the pipe wall.

Leak Run Time & Why it Matters

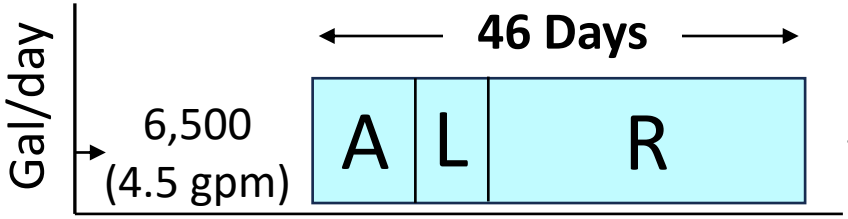


A = Awareness / **L** = Location / **R** = Repair



Reported Circumferential
Break on 8” main
Total Loss = 27,540 gal.

Reported Utility Side
Service Leak
Total Loss = 104,000 gal.



Reported Customer Side
Service Leak
Total Loss = 299,000 gal.

Leak Detection Technologies & Non-Revenue Water Programs

Leak Detection Strategy

Repair / Report

System Assessment

Localize

Investigate

Confirm / Pinpoint

Acoustic Leak Detection – Survey Technologies

Ground Mic /
Listening Stick

Lift-&-Shift Noise Loggers

In-Pipe Surveys

Correlators

Fixed-Base Noise Loggers

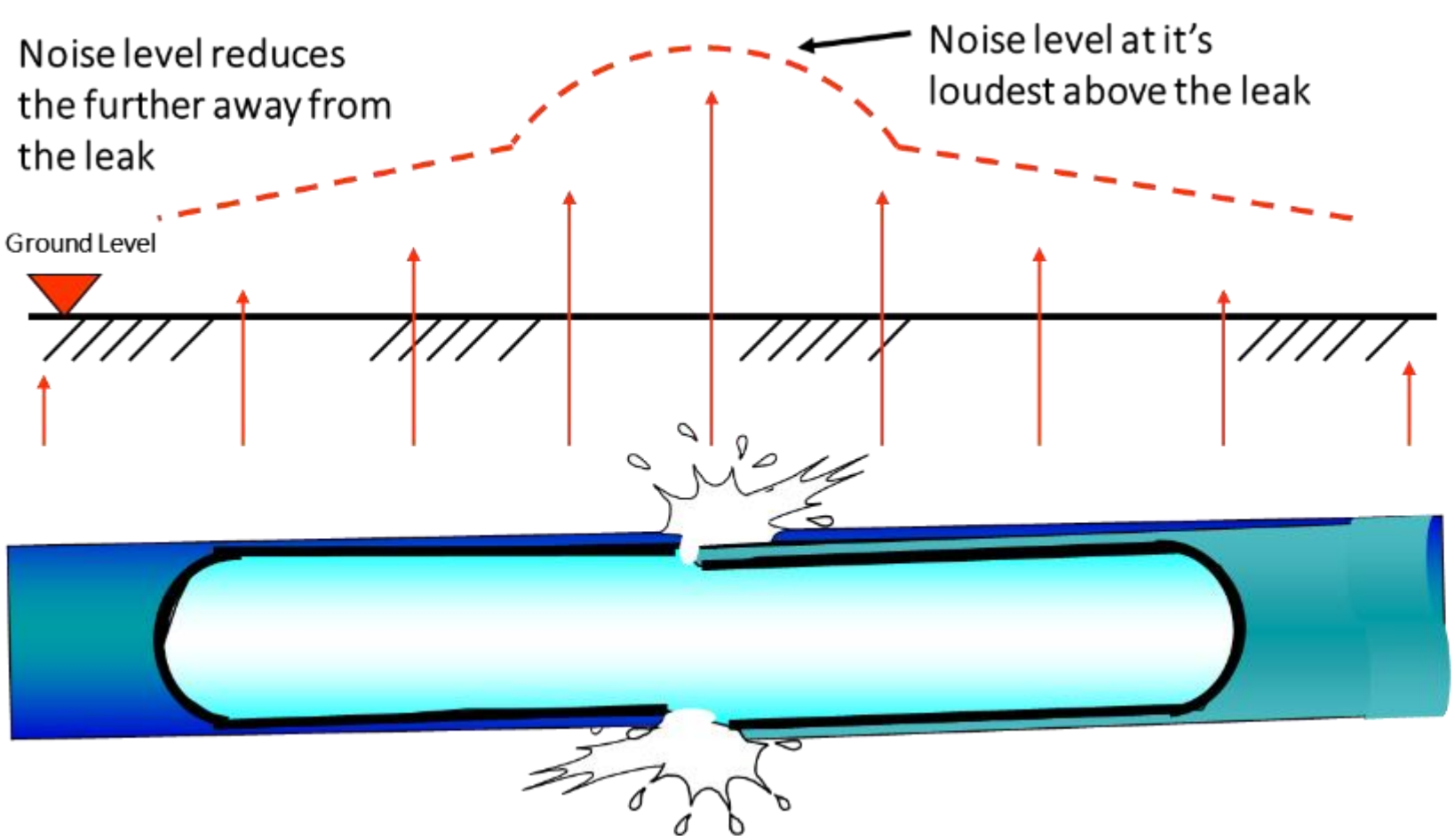
Satellite Leak Detection

Acoustic Leak Detection – Survey Technologies

One-Time Leak Survey Tools

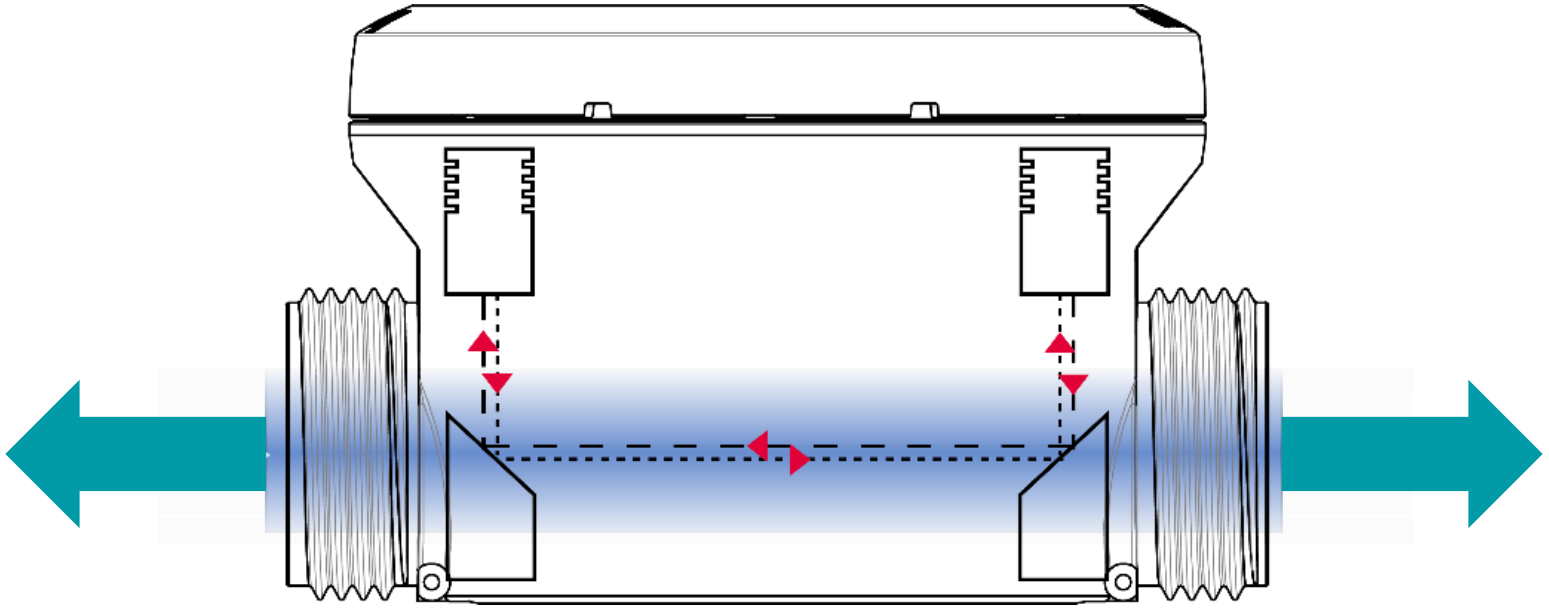
Survey Tool	Primary Use
Electronic Listening Tools “Sticks”	Surveying systems; sounding fittings; confirming leaks
Ground Microphone “Elephant’s Foot”	Confirming leaks on hard surfaces
Leak Noise Correlator	Pinpointing leaks within 3 ft (available in both real and non-rea time systems)
Satellite Leak Detection	One-time survey of large areas to identify potable water within 300 ft radius (282,743 sq. ft. area of interest)
In-Pipe Leak Detection Survey	Surveying large mains (16”+) or to confirm accuracy of leak on smaller pipe
RF/Other Local Communication Acoustic Noise Data Loggers	Identify main leaks and adjacent service line leaks where possible using lift & shift methodology

Acoustic Leak Detection - Survey Technologies



What Is “Built-In” Acoustic Leak Detection?

Acoustic Sensors With The Ultrasonic Measuring Principle



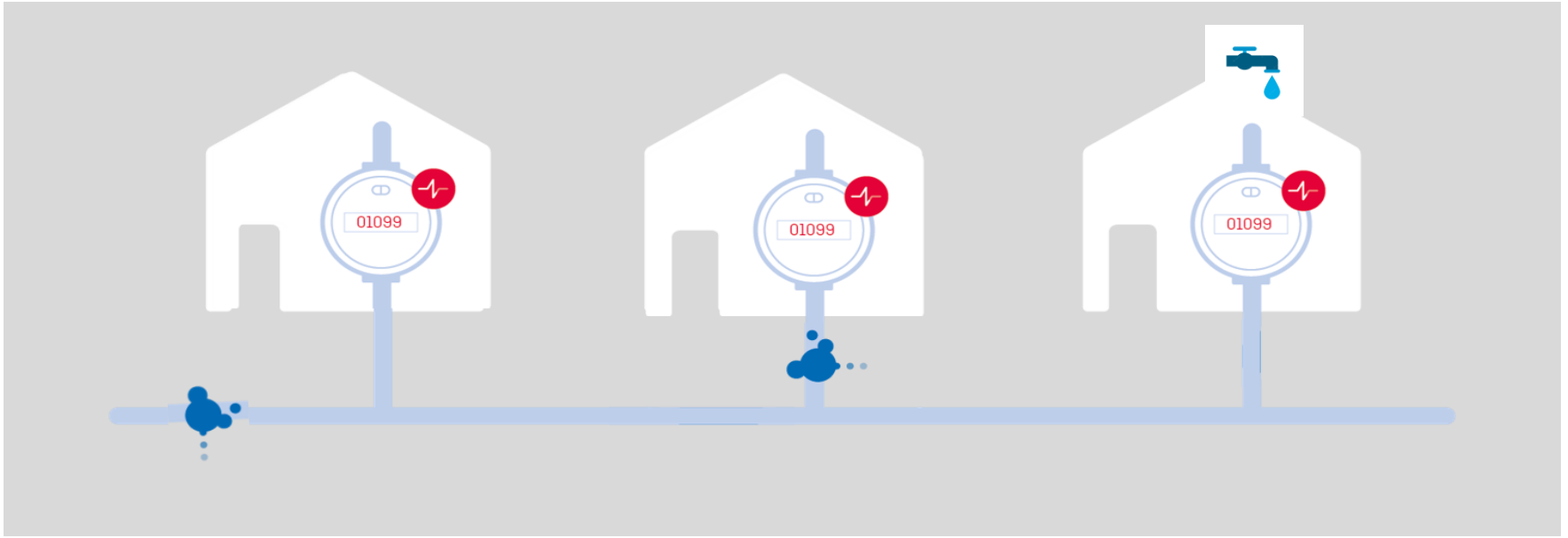
With the integral acoustic sensor, it is possible to measure noise in both direction of the pipe.

The acoustic sensor does not influence the flow measurements at any time.

Listening to Different Types of Leaks – with a Water Meter?

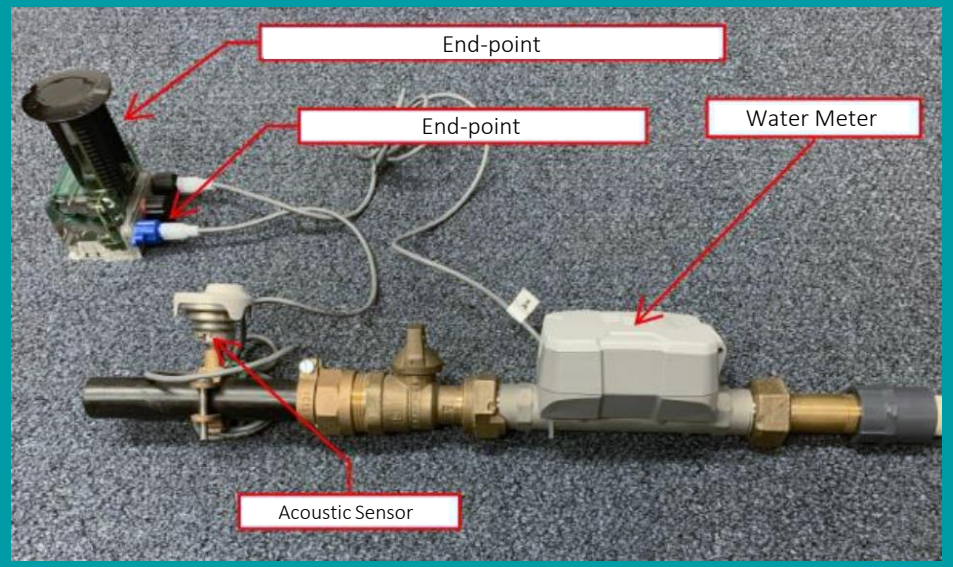
How does it work?

- It is well known that a leak will generate energy in the form of noise / sound.
- The built-in acoustic sensor allows the meters to measure acoustic noise within the distribution network upstream from the meter.
- Provide additional “info codes” (alarms) for any unusual customer side usage (continuous consumption/customer-side leaks).



Why(?) Use “Built-In” Acoustic Leak Detection?

Reduced Complexity to Deliver the Future, Today



Legacy Non-Revenue Water Solutions

Meter Cost + Radio Cost + Leak Sensor Cost

Meter installation + Radio installation + Leak Sensor installation

2 Wires

3 Hardware Components to Manage / Troubleshoot

3 Different Warranties

Unlikely 100% Distribution Coverage

flowIQ® 2200 with Embedded Acoustic Leak Detection Built-in

Just The Meter Cost

Just The Meter Installation

No Wires

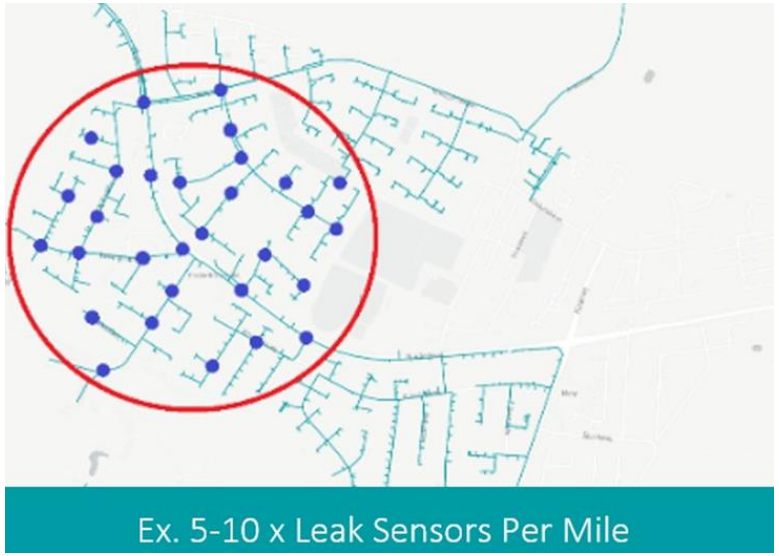
1 Hardware Component to Manage / Troubleshoot

1 Warranty

100% Distribution Coverage

Minimum Viable Survey Deployment vs Complete System Coverage

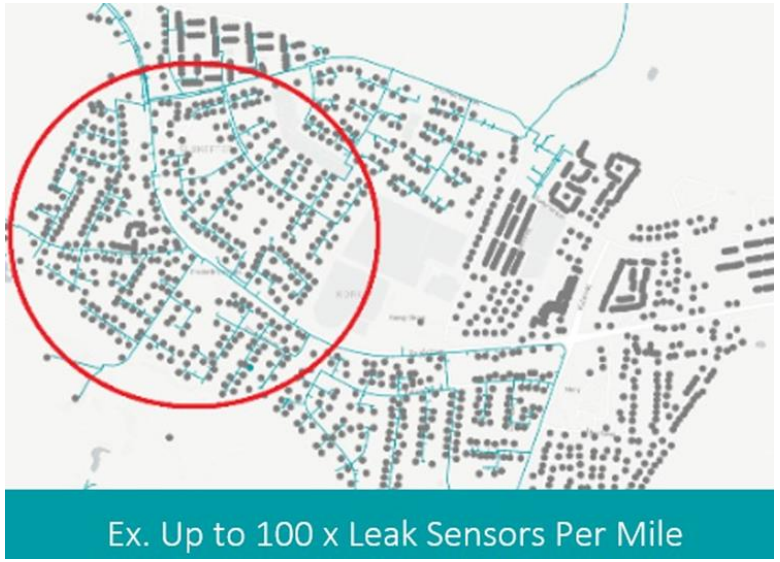
Main Line Coverage Only



Other Solutions

50%+ Of All Distribution System Leaks Occur At Or Near Service Connections.

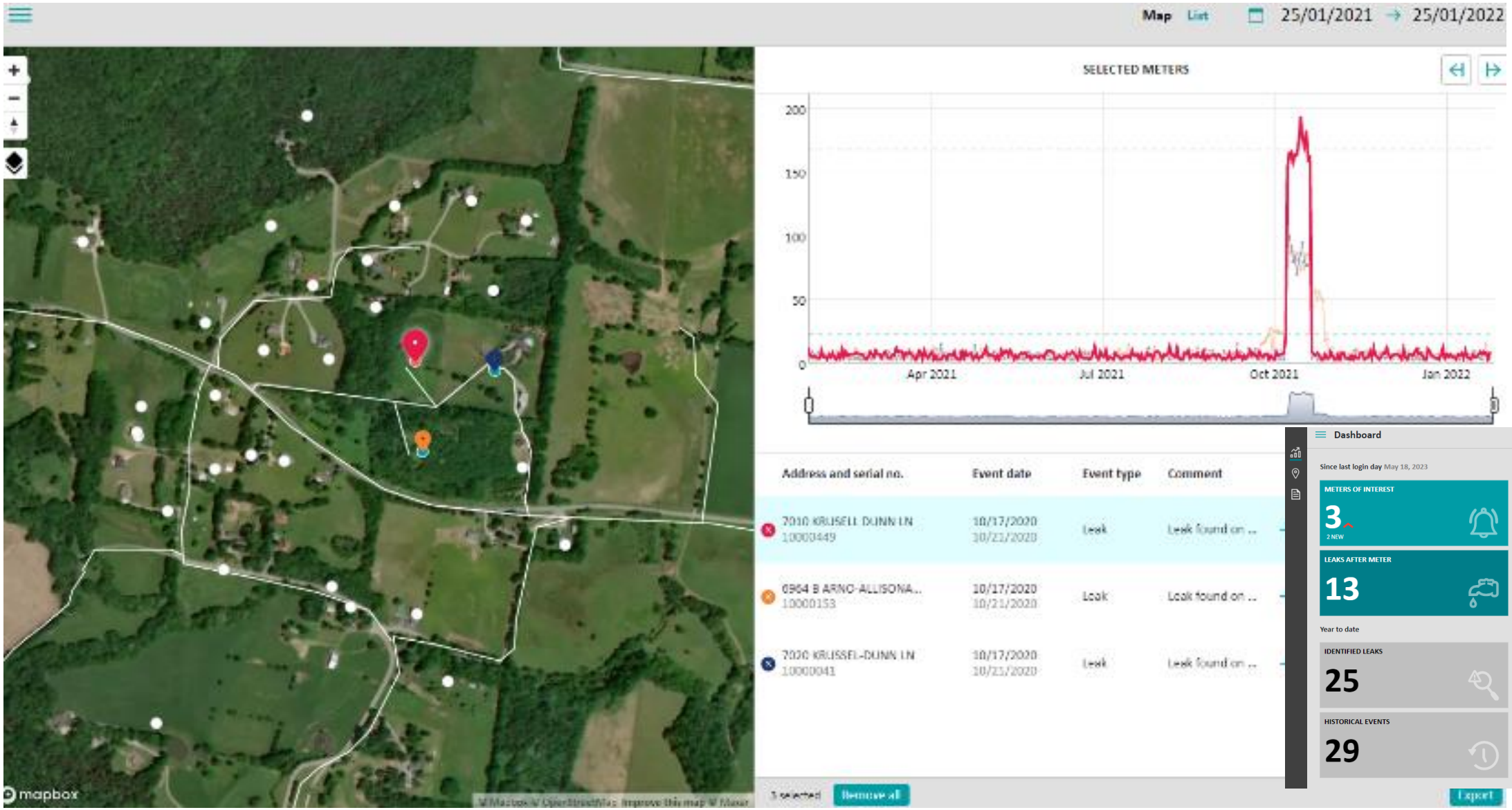
Service & Main Line Coverage



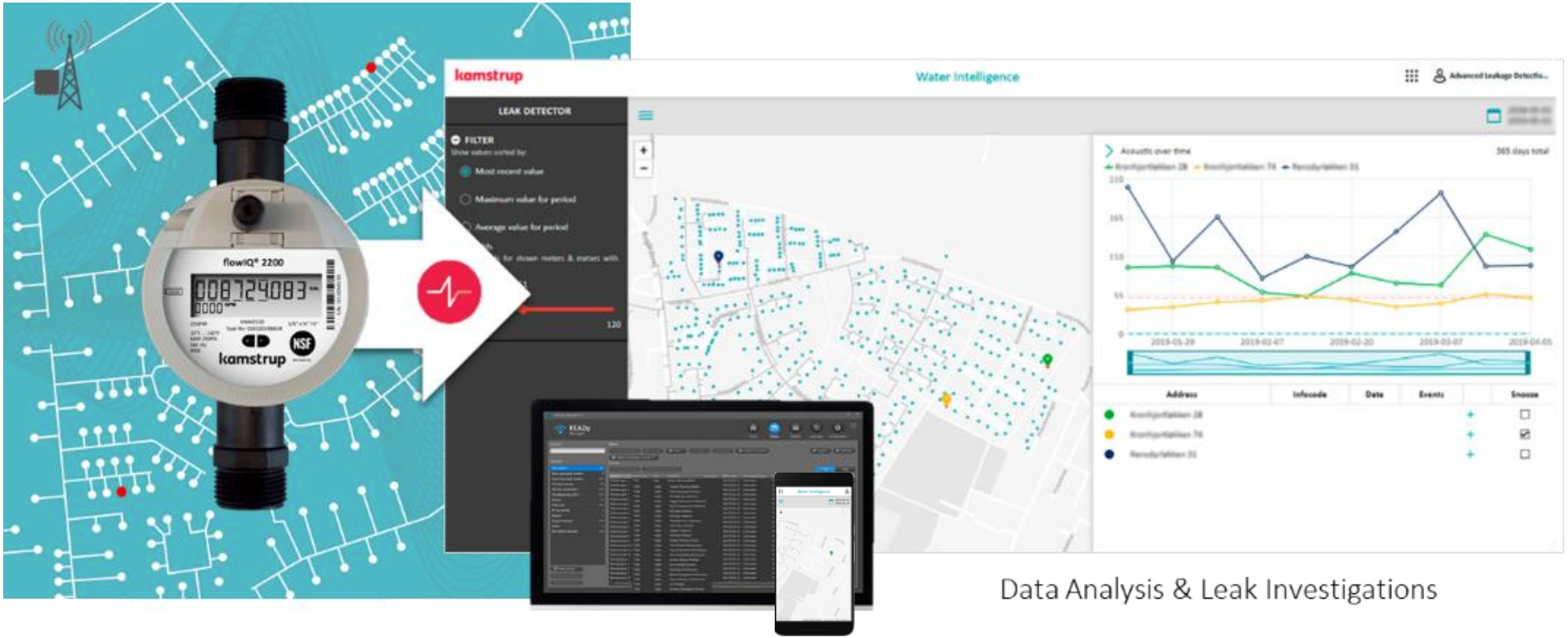
Kamstrup ALD

With 10x As Many Sensors Per Mile Compared To Acoustic Leak Monitoring Solutions Installed On Valves And Hydrants - It's Almost Impossible For Leaks To Hide

Acoustic Leak Detection Software



Built-In Acoustic Monitoring



Data Analysis & Leak Investigations

A Built-In Acoustic Advantage

Acoustic Leak Detection

Across Your Entire Water Distribution Network.

7,300

Distribution-Wide Acoustic Leak Surveys

Over **20** Years

No Additional:

Hardware, Infrastructure

Or

Manpower Required.

Focus & Prioritize

Leak Investigations

Get Closer.

10x More Leak Monitoring Points Per Survey

(Compared To Other Fixed-Base Leak Monitoring Technologies)

More Actionable Data With Less Wasted Effort

Proactively

Monitor For New Distribution Leaks

Every

55

Minutes!

26/7

365 Days A Year

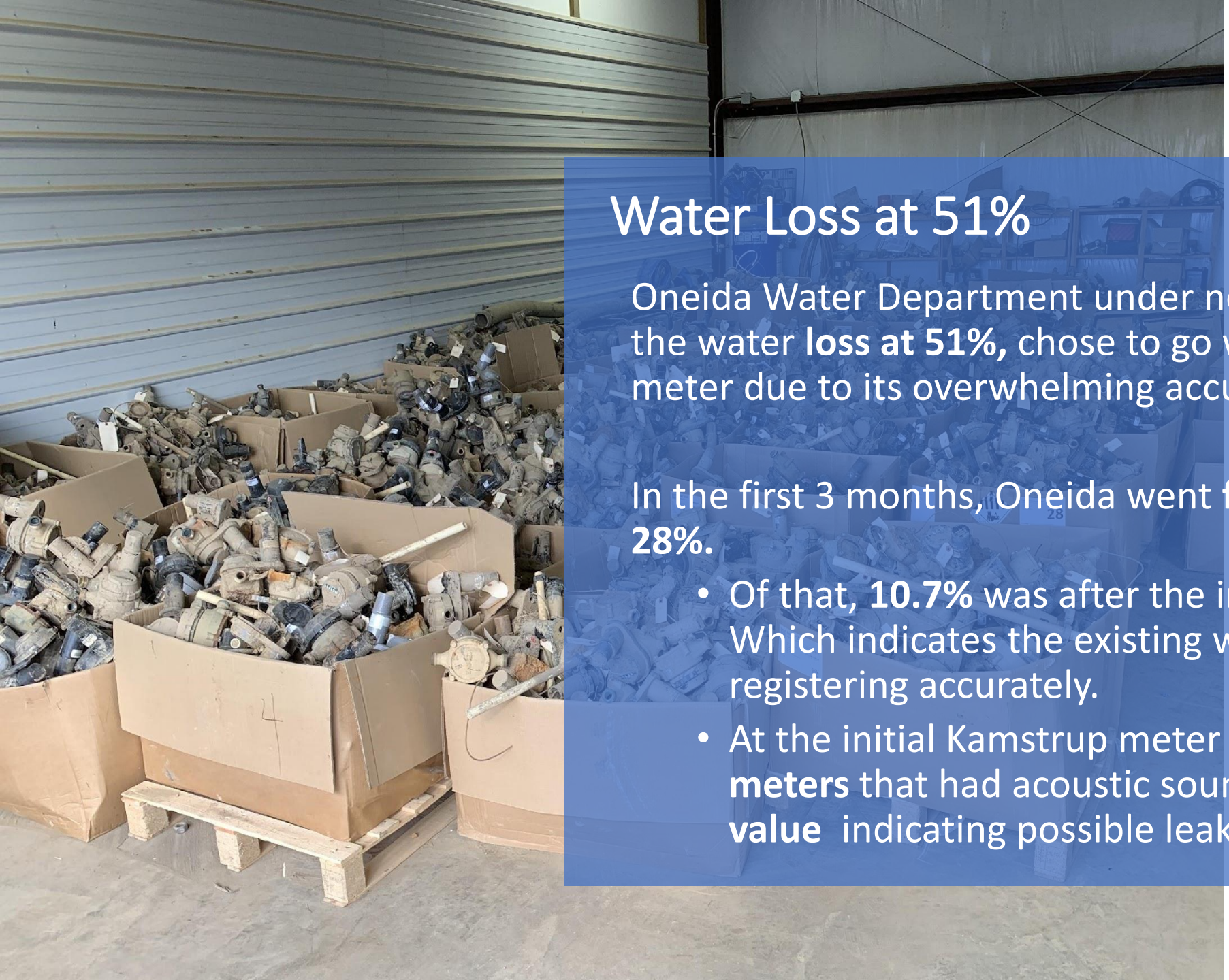
For **20** Years!

Case Studies & Testimonials

Town of Oneida, TN

- **4,620 AMI / ALD Meters**
- **15** Data Collectors
- **118** Square Miles
- **322** Miles of Mainline Pipe
- 6 Month Deployment

Oneida Changed out 4,620 Mechanical AMR Meters in 6 months



Water Loss at 51%

Oneida Water Department under new management seeing the water **loss at 51%,** chose to go with the new AMI/ALD meter due to its overwhelming accuracy and reliability.

In the first 3 months, Oneida went **from 51% water loss to 28%.**

- Of that, **10.7%** was after the initial total changeout. Which indicates the existing water meters were not registering accurately.
- At the initial Kamstrup meter startup Oneida had **77 meters** that had acoustic sound levels over **100 noise value** indicating possible leaks.

Water Loss Recovery

Initiated an aggressive water loss recovery program:

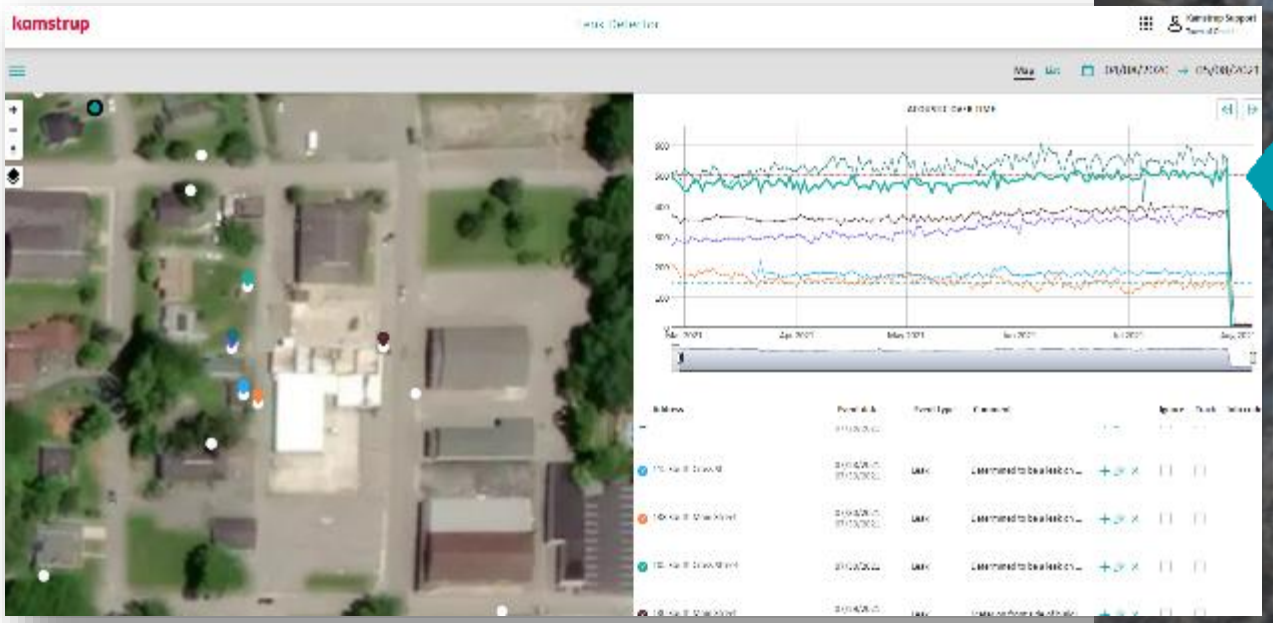
- Placing **2 full time employees** with leak detection equipment.
- Using ALD, **70+ leaks** were located and/or repaired by the Distribution repair crew. (2022)

Currently:

- **Expect to** be at or below **15% water loss in 2024** which will save approximately **$140,000** in lost revenue and **gained 36** working days not having to read meters to spend more time finding water leaks.

Oneida, TN

- High noise detected on several meters
- Service line leak had been running a minimum of 5 months



Leak Repaired

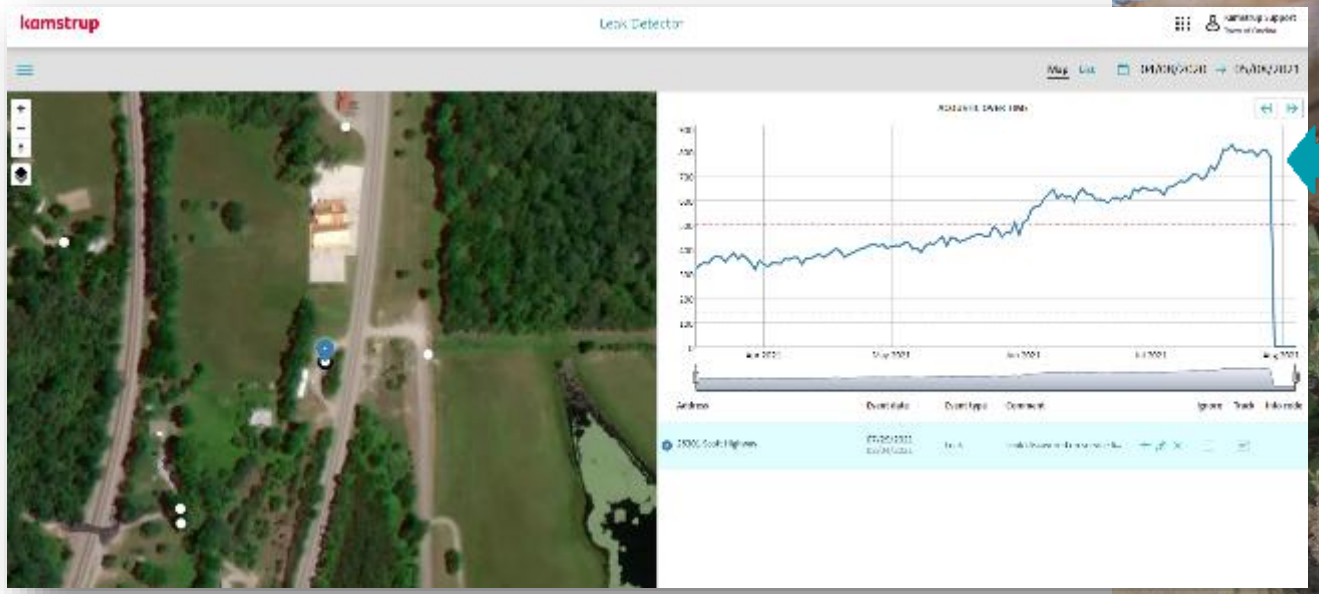
Leak estimated at 2 GPM and had been running for at least 5 months

Utility Service Line made from ductile iron

Distance to leak was approximately 30 feet to 150 ft

Oneida, TN

- High noise detected on single meter
- Service line leak had been running a minimum of 4.5 months
- The total NRW would account to $21,000 in 12 months*



Leak Repaired

Leak estimated at 4 GPM and had been running for at least 4 months
777,600 for 135 days

Utility Service Line made of PVC

Distance to leak was approximately 50 ft

*based on TN American Water base rate

Cost Savings

During the initial changeout, Oneida's water treatment plant was operating on average around **15 hours** per day and is now down to **11 hours per day** resulting in even more dramatic **OPEX Savings** in Electricity, Treatment Chemicals, and Man Hours.

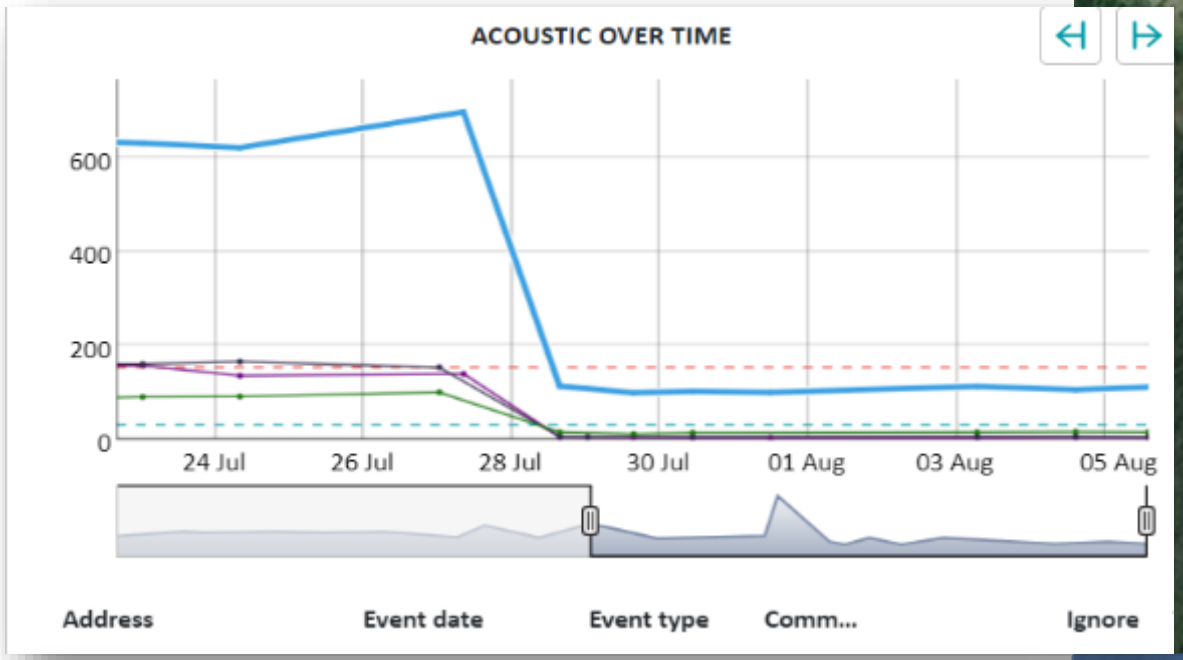
Fun Fact:
A 4 hour per day reduction in water treatment plant runtime equals 2 months less runtime 60 WTP Operating Days Saved in just one year!

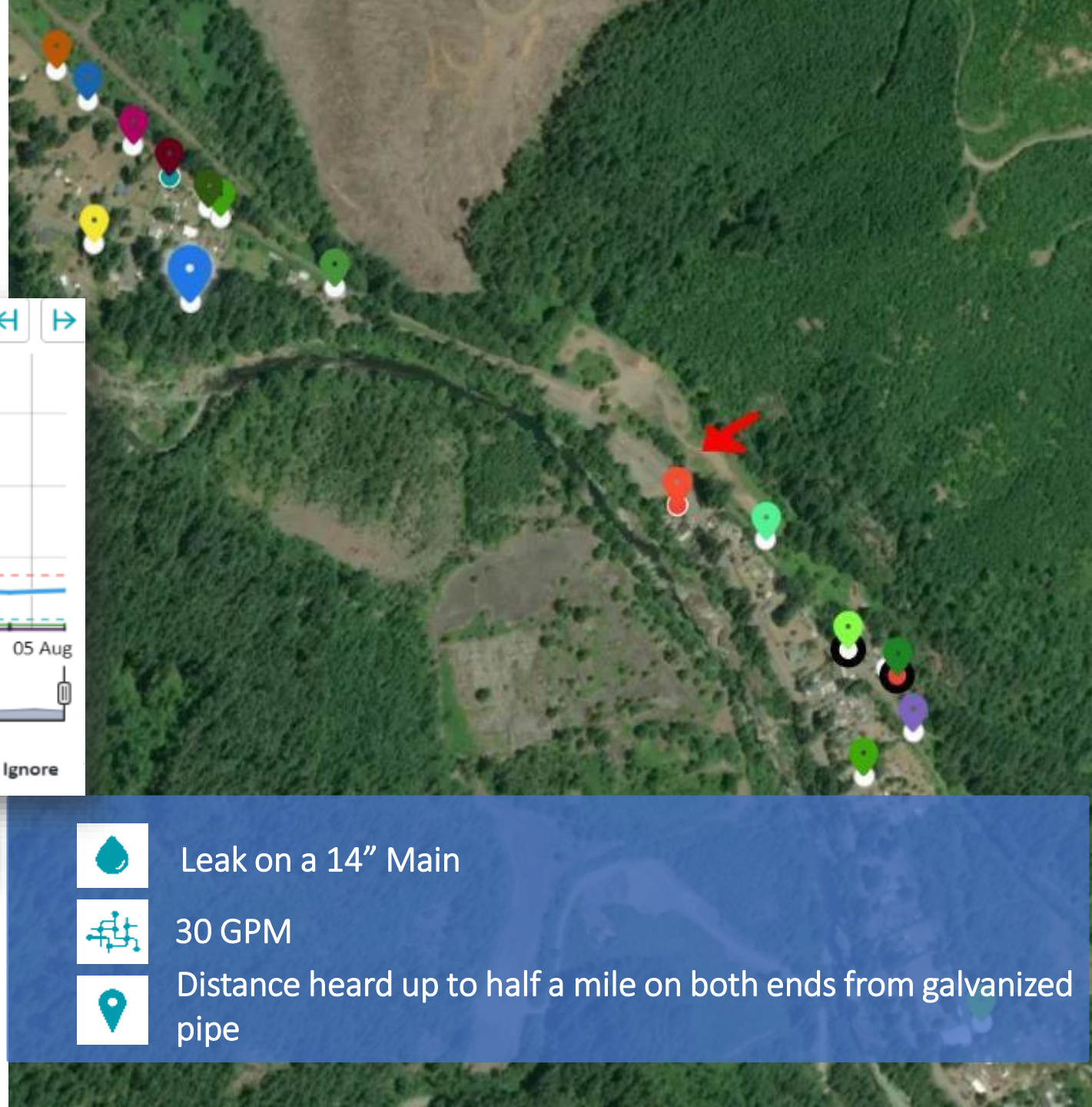
Mapleton Water District, OR

- 180 gpm leak detected, found, and repaired
- 6” AC Main – furthest meter was >1500 ft away
- Possible new leak now being investigated

Row River Valley, OR

- Main line leak found by meters up to <u>0.5 mi away</u>





Leak on a 14” Main

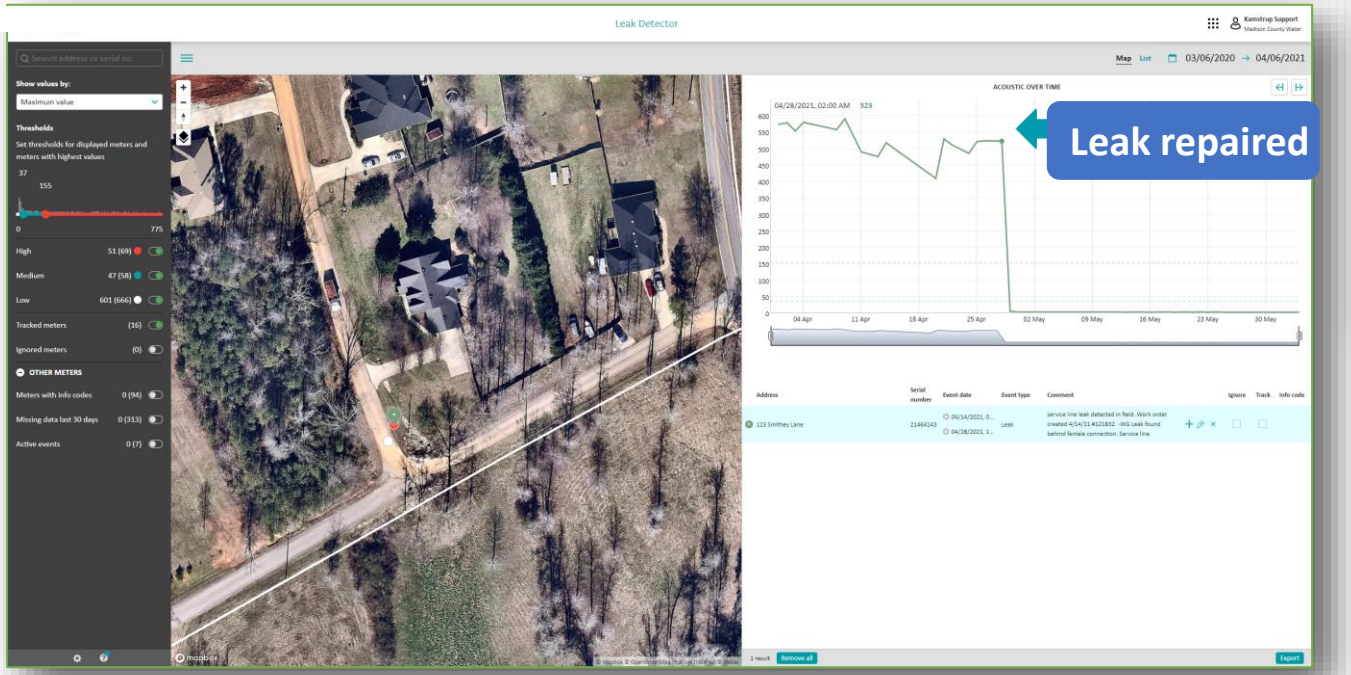
30 GPM

Distance heard up to half a mile on both ends from galvanized pipe

Madison County, AL

- Water leak never reached the surface (nearby creek absorbed it)
- Leak had been running for approximately 2 months
- Total water lost accounted to 432,000 gallons

- *If the leak had been running for 12 months:* 2,628,000 gallons



Leak Detector

Site visit with Madison County, TN

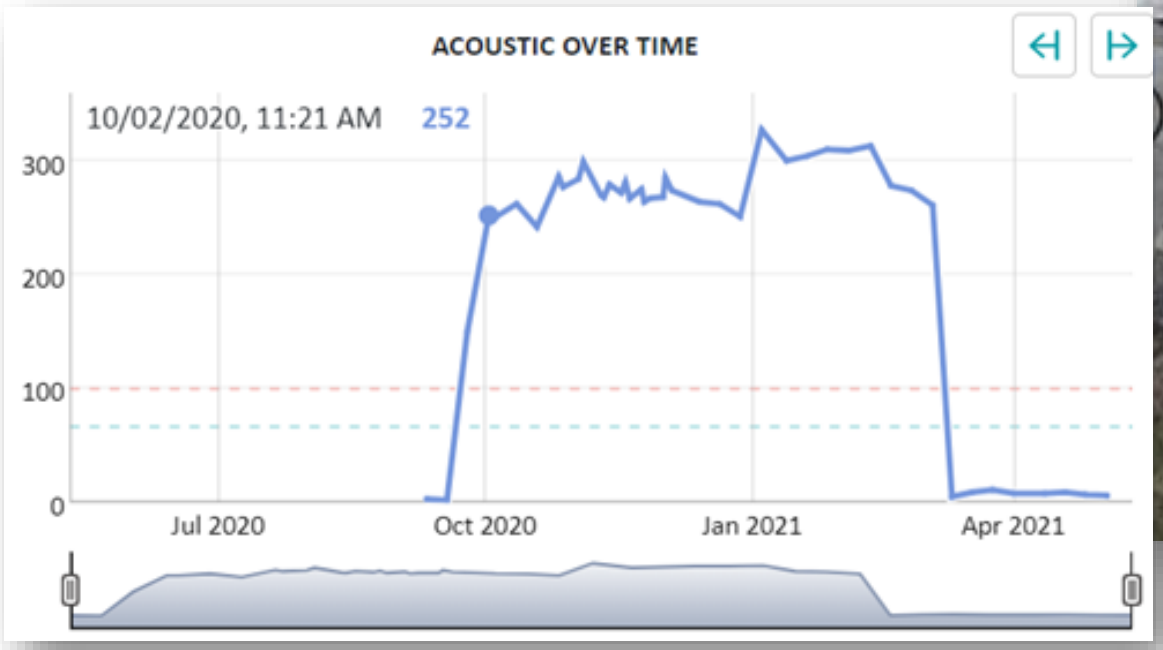
Leak was estimated around 5 GPM and had been running for at least 2 months

Utility service line made from polyethylene

Distance to leak was approximately 6 feet

Ephrata, PA

- Main line leak found before water surfaced or worse



"Something that we wouldn't have found until it got much worse."
- Ephrata JAA

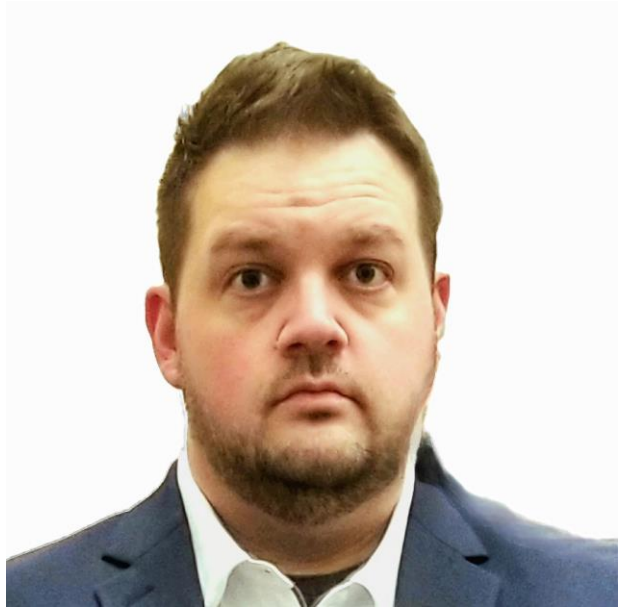
Leak on 12" Main

Leaking from stainless steel clamp

55 ft from copper service line

Q & A

Thank You | kamstrup



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