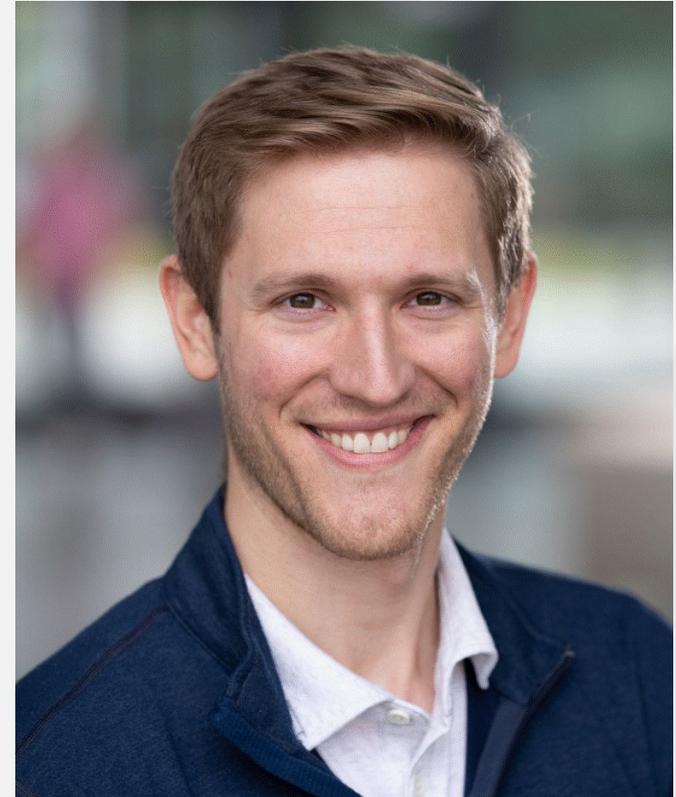


**Listen Up: Reverse Water Loss
and Improve Operational
Efficiency with Embedded
Acoustic Leak Detection**



Jake Waidmann
Solution Manager, Kamstrup

Water Loss: Why it Matters

TOTAL Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption
			Billed Unmetered Consumption
		Unbilled Authorized Consumption	Unbilled Unmetered Consumption
			Unbilled Metered Consumption
	Water Loss	Apparent Losses	Inaccurate or Old Meters
			Unauthorized Consumption (Theft)
		Real Losses	Leaks on Distribution Water Mains
			Leaks on Service Connections

Non-Revenue Water

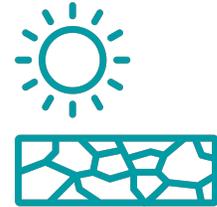
Water Loss: Why It Matters



Revenue



Regulations



Drought



System Efficiency

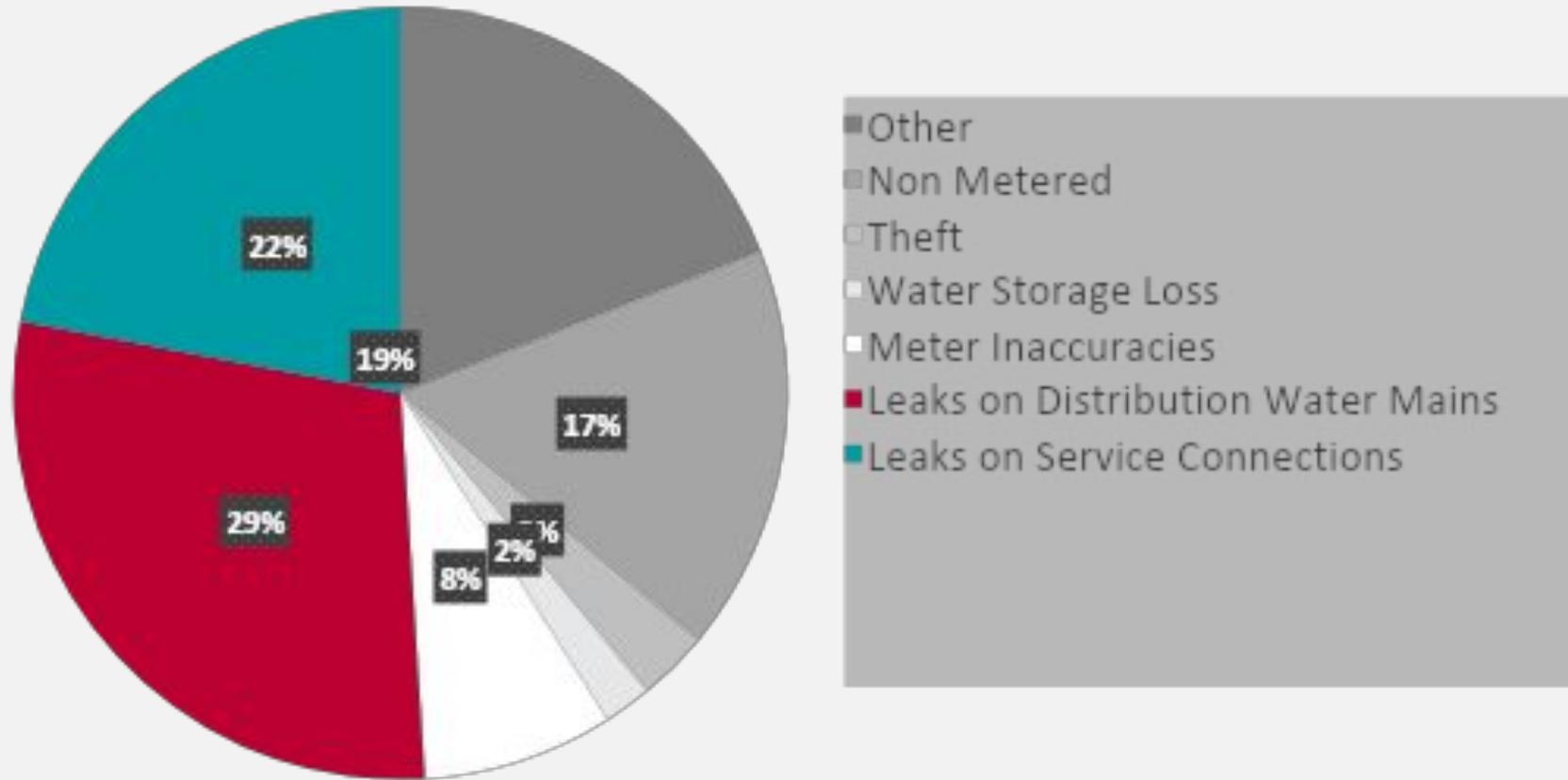


Customer Satisfaction



Environmental Impacts

Distribution of Non-Revenue Water



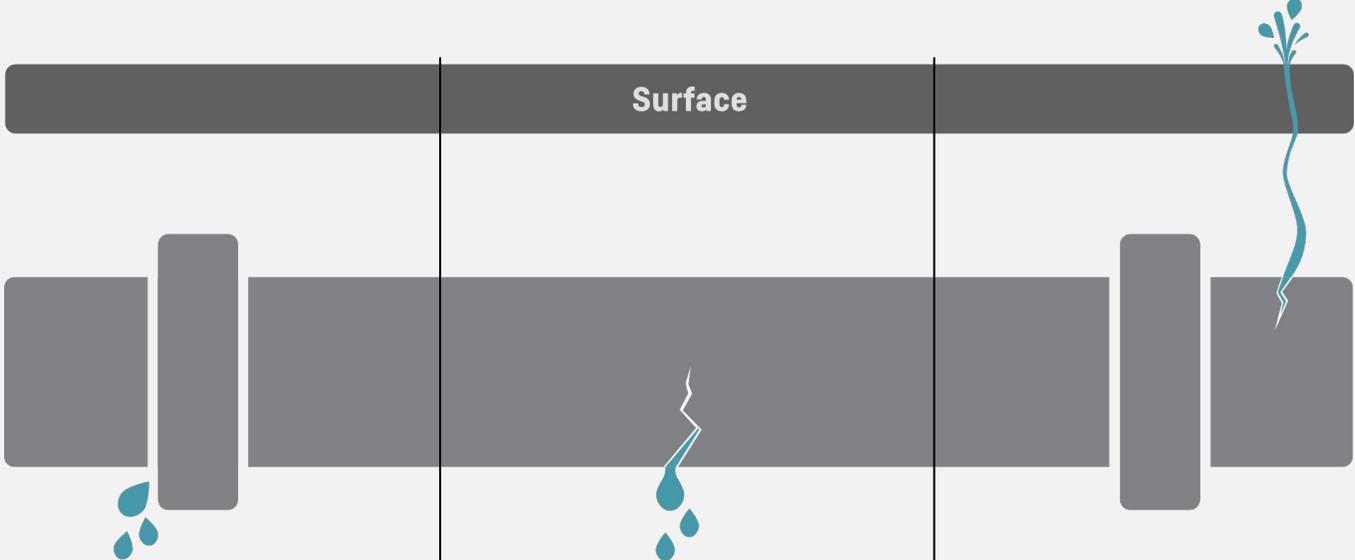
*Based on an independent
survey
of 30+ US water utilities*

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

(Hint: Not This One)



Types of Leaks

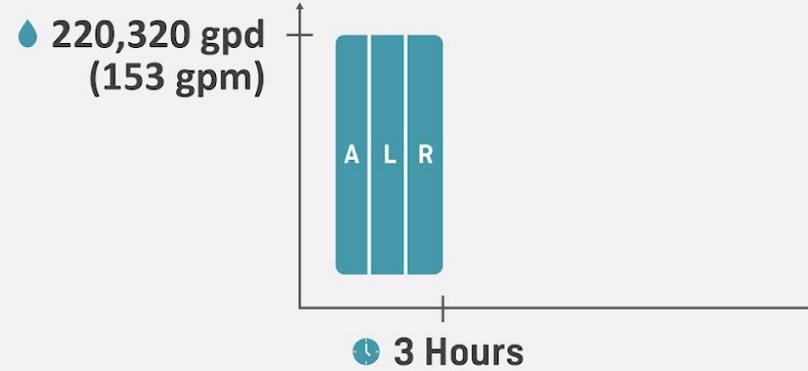


Background Leakage
Unreported and undetectable using traditional acoustic equipment.

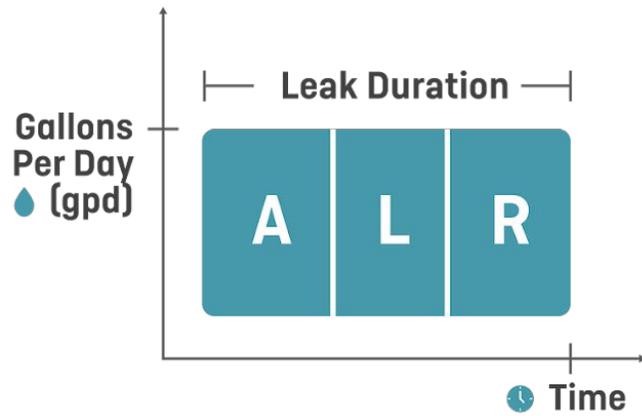
Unreported Leakage
Often does not surface but is detectable using traditional acoustic equipment.

Reported Leakage
Often surfaces and is reported by the public or utility workers.

Run Time Matters:



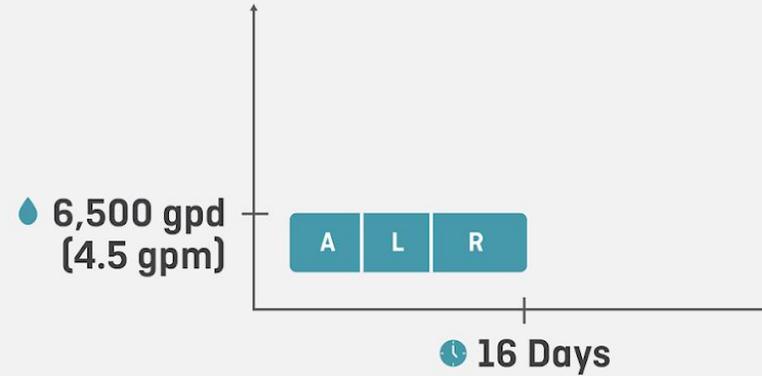
Reported Circumferential
Break on 8" Main
Total Loss = **27,540 gal**



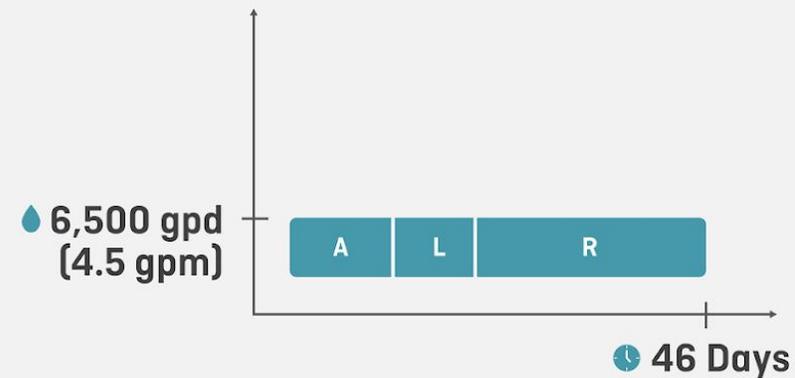
A = Awareness

L = Location

R = Repair



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



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

Leak Detection Strategy

The Process - As We Know It



Acoustic Leak Detection – Survey Technologies



**Ground Mic /
Listening Stick**



Lift-&-Shift Noise Loggers



In-Pipe Surveys



Correlators



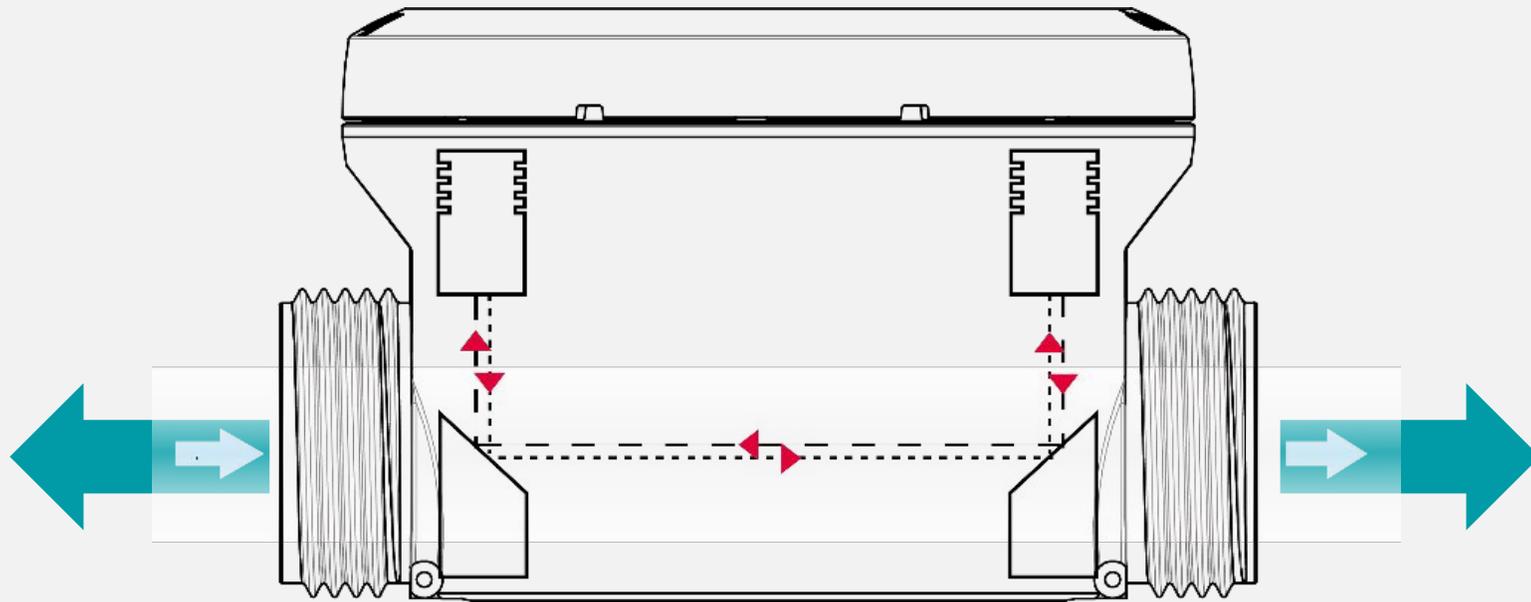
**Cellular Correlating Leak
Noise Loggers**



Satellite Leak Detection

What Is “Built-In” Acoustic Leak Detection?

Acoustic Sensors with the Ultrasonic Measuring Principle

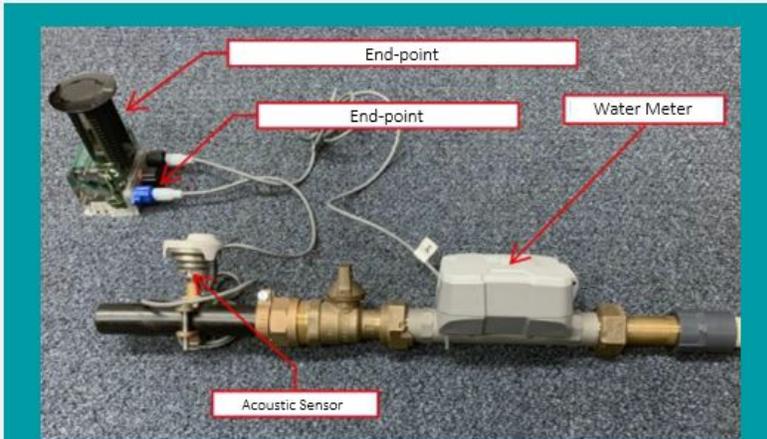


With the integral acoustic sensor, it is possible to measure noise in both directions of the pipe.

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

**So... What Does That
Actually Look Like?**

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

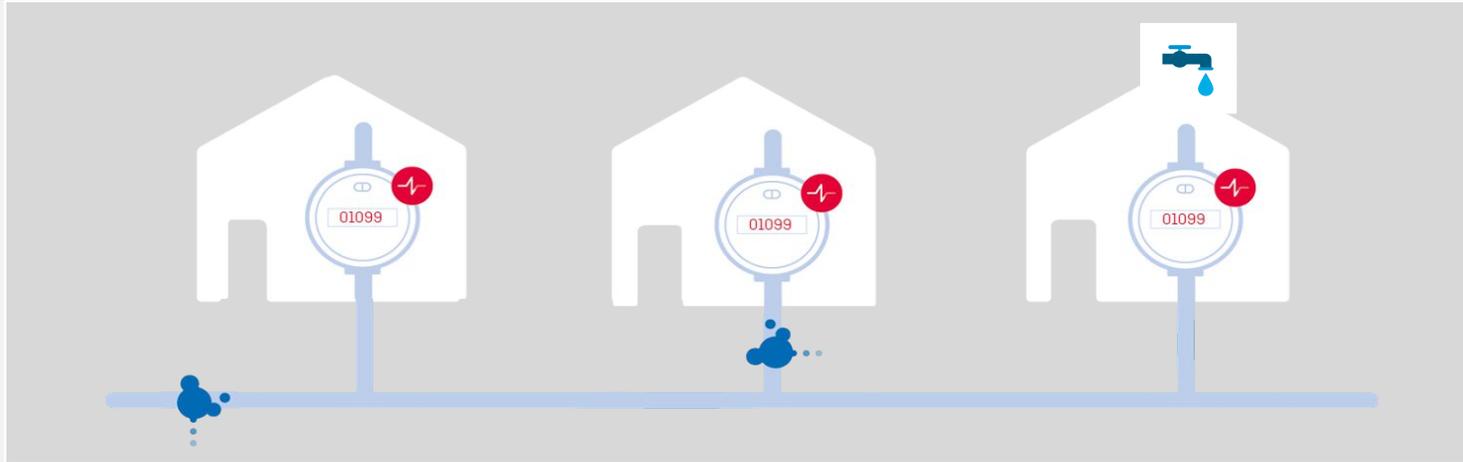
1 Warranty

100% Distribution Coverage

What Types of Leaks can be Identified.... 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?

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

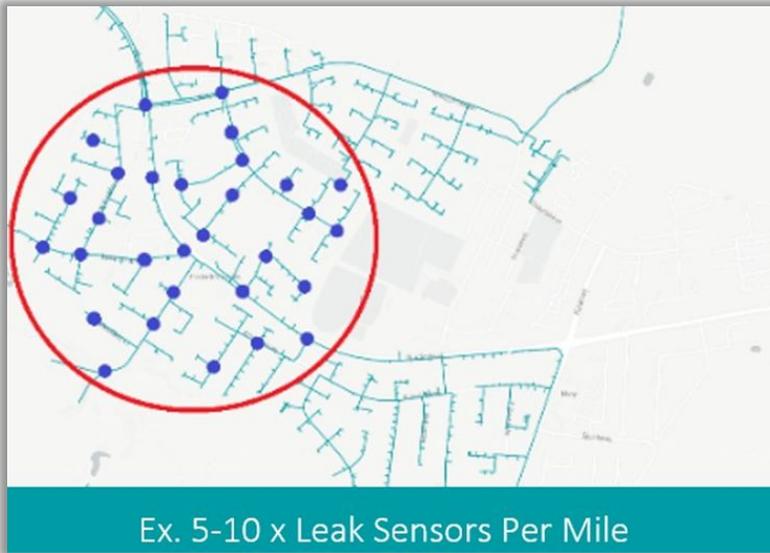
Material	Diameter (mm)	Velocity (m/s)
Polyvinyl Chloride (PVC)	40	565
	80	540
	150	530
Cast-Iron	150	1220
	250	1160
	350	1120
Steel	25	1375
	40	1350
	60	1330
	90	1286
	150	1200
	250	1150

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.

Minimum Viable Survey Deployment vs Complete System Coverage

Traditional Leak Loggers
(MAIN LINE COVERAGE ONLY)

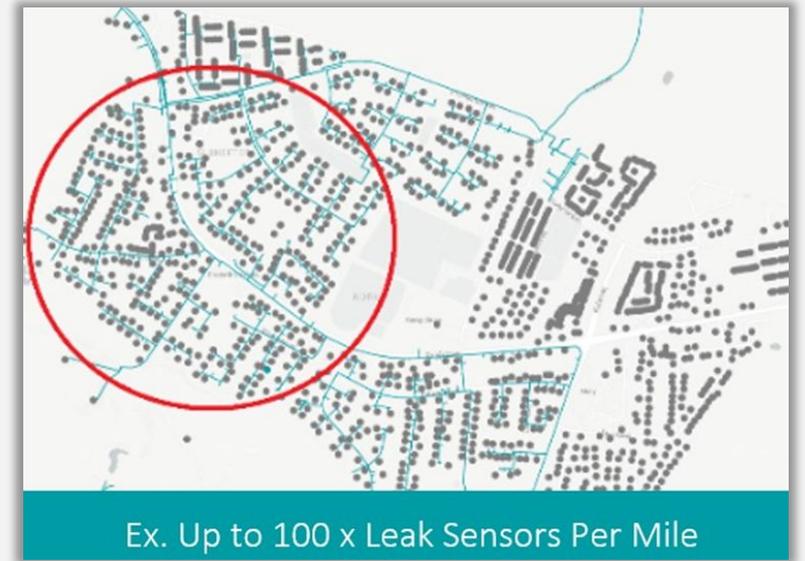


50%+

*Of All Distribution System
Leaks Occur At Or Near
Service Connections.*

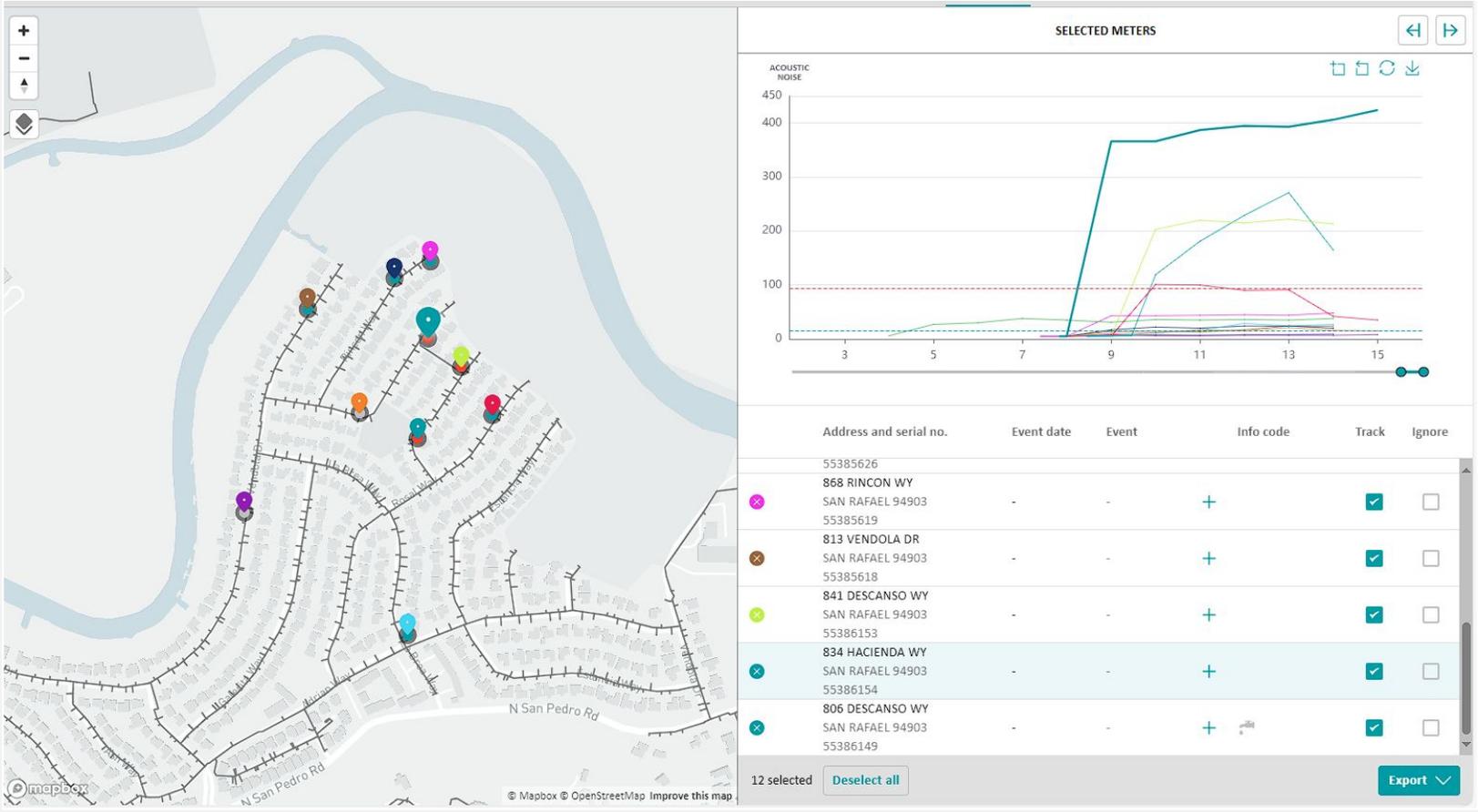
ALD Meters

(SERVICE + MAIN LINE COVERAGE)



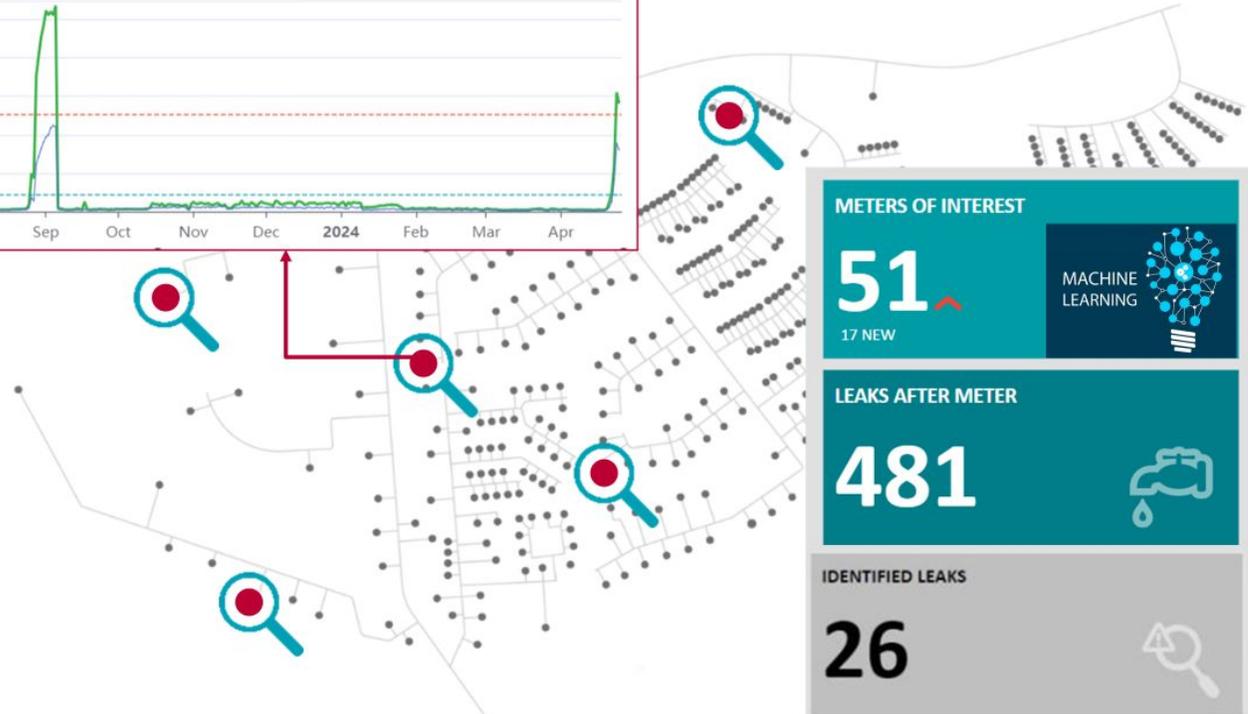
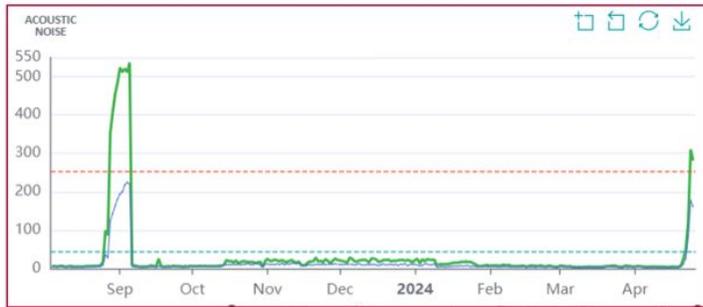
**With 10x As Many Sensors Per Mile Compared To Acoustic Leak Monitoring Solutions
Installed On Valves And Hydrants - *It's Almost Impossible For Leaks To Hide!***

Leak Detection – Minimum Viable Survey Deployment



Leak Detector Software

Imagine easily surveying your entire system every day



METERS OF INTEREST 51 17 NEW	MACHINE LEARNING 	METERS IN WARNING LEVEL 871 45 NEW	
LEAKS AFTER METER 481 	BURSTS AFTER METER 581 		
IDENTIFIED LEAKS 26 	ESTIMATED WATER LOSS 988,230 gal		

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

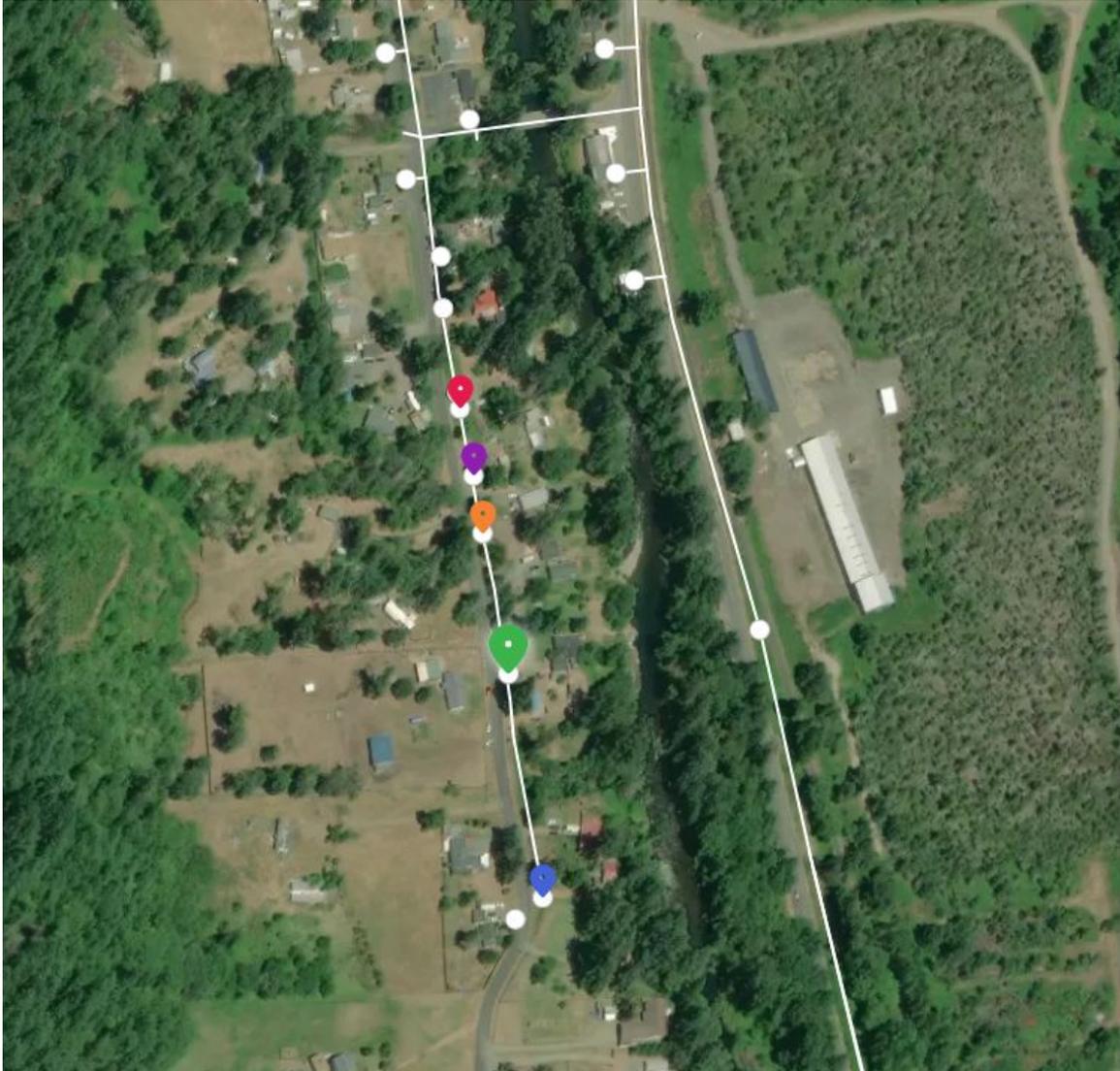
Every
55
Minutes!

26/7
365 Days A Year
For **20** Years!

Case Studies & Testimonials

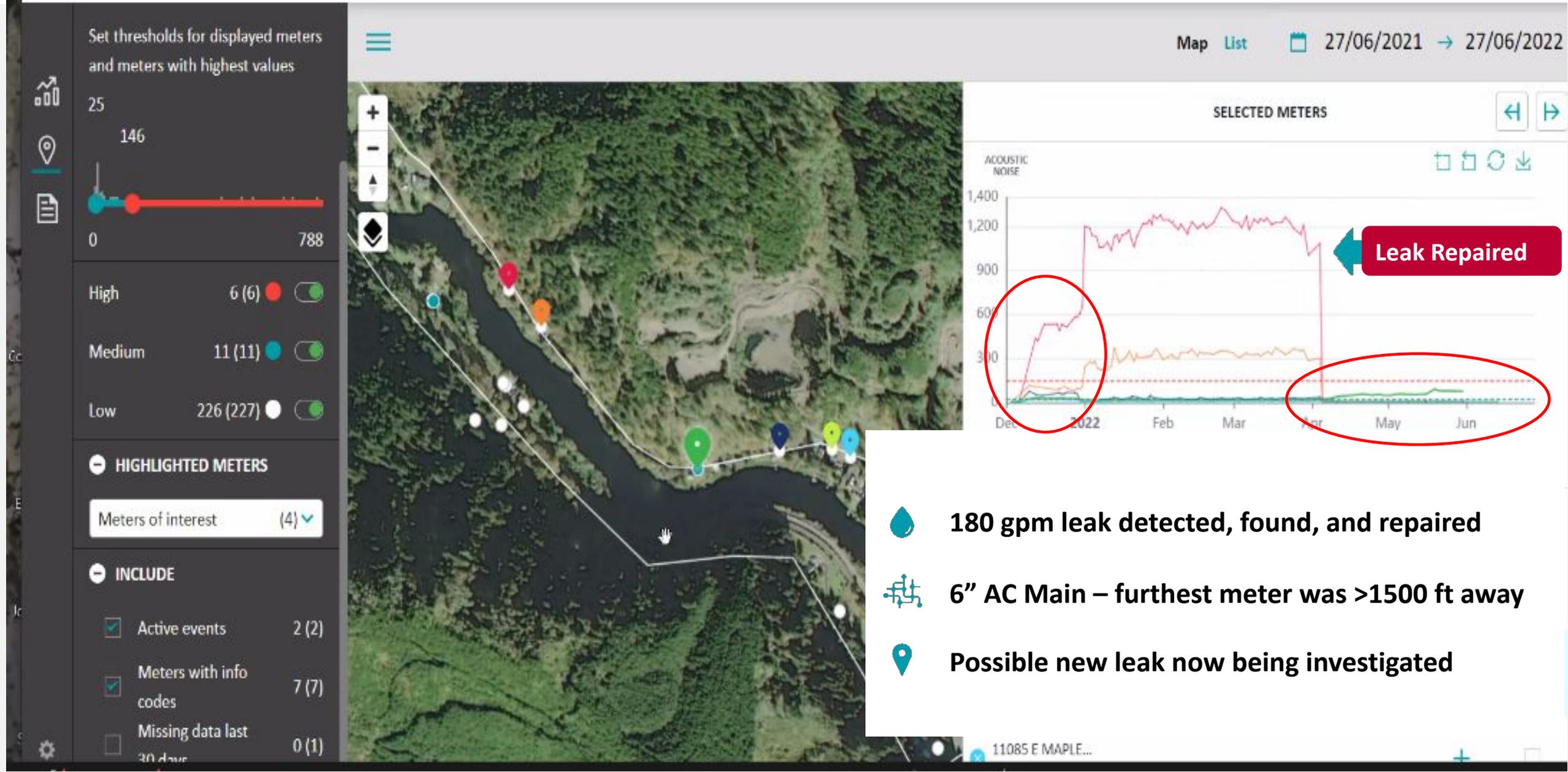
Row River Valley Water District

Service Line leak



Address and serial no.	Event date	Event type	Comment	Ignore	Track	Info code
75587 Wicks Rd Dorena, 97434 21578632			Leak estimated at 2 GPM			
75527 Wicks Rd Dorena, 97434 21578631			Leak on copper service line, no surfacing water			
75613 Wicks Rd Dorena, 97434 21578633			Leak highlighted by sensors > 1500 feet away			
75621 Wicks Rd Dorena, 97434						

Mapleton Water District, OR



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% Non-Revenue water loss, down 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.



Cost Savings

During the initial changeout, Oneida's water treatment plant was operating on average around **14-15 hours** per day.

3 months later it was now down to **11-12 hours per day** resulting in even more dramatic **OPEX Savings** in Electricity, Treatment Chemicals, and Man Hours.

Fun Fact:

A 3 hour per day reduction in water treatment plant runtime equals 1.5 months less runtime (Over 45 WTP Operating Days Saved) in just year one!

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 poly



Distance to leak was approximately 50 ft

*based on TN American Water base rate

ALD meters provide water utilities with an exceptional before & after comparison of the acoustic noise floor across the entire distribution network.



What if you could find & fix ALL of the leaks before they ever got paved over?



51% of Water Loss is Attributed to Leaks

Now, there's something we can do about that.



Questions?