Advantages of Low Flow and Identifying Leaks

- Ultrasonic Meters with Built-in Acoustic Leak Detection Result in Dramatic Water Loss Reductions

Presenters:

Graham Mattison- Solutions Manager Kamstrup

Devin Peterson- Smart Utility Professional Everett J. Prescott

- **Dedicated Smart Utility Team Specializing in AMI Networks, Remote Monitoring, and Leak Detection**
- **Located locally in Shelbyville, IL**
- **Headquartered in Gardiner, ME and we have been family owned and operated for 68 years serving the utility market**
- **Over 67 years providing metering solutions**
- **27 divisions covering 13 states**
- **Local support and technical expertise supporting every customer**

TEAM EJP

WATER • WASTEWATER • STORMWATER

SOLUTIONS

GM0

Who is Kamstrup?

A world leading manufacturer of advanced solid-state, or “static,” metering solutions for smart energy and water utilities, Kamstrup is headquartered in Denmark with employees in more than 20 countries. For over 75 years, utilities around the world have trusted Kamstrup to deliver reliable metering solutions.

20+
Countries

75+
Years

Here in North America, Kamstrup is focused on empower water utilities.

+ Ultrasonic metering solutions
+ Network communications
+ Software applications

IT’S TIME TO KNOW

Slide 3

GM0 The right side feels a little awkward. If we're going to talk about ourselves - let's toot our own horn a little:
Change the word "supporting" to "empowering"

Keep the 3 bullet points:
+ Ultrasonic metering solutions
+ Network communications
+ Software applications

ADD: Made In Cumming, GA - USA!

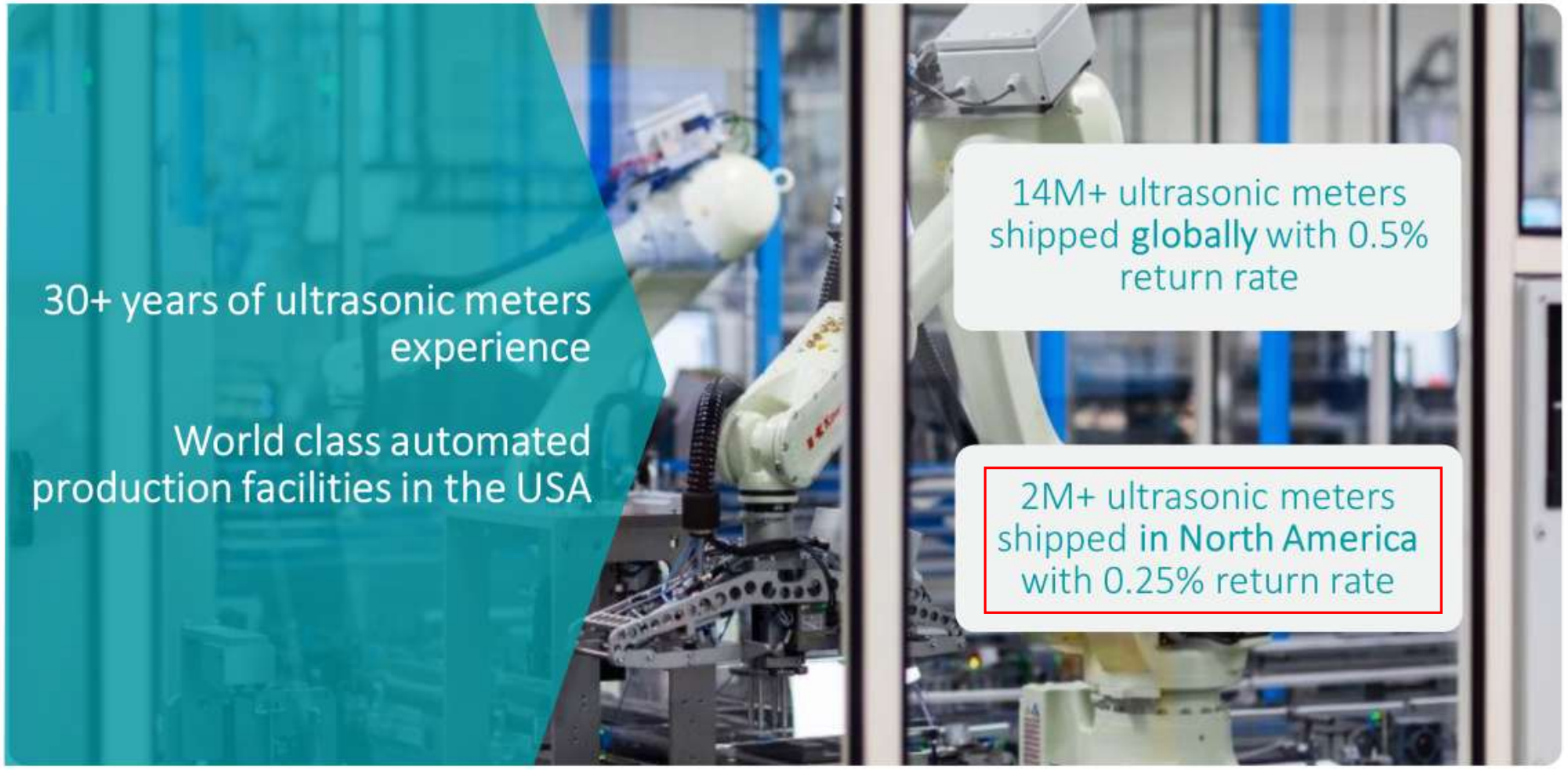
Presenter notes:
Here in North American, Kamstrup is focused on empowering water utilities. with reliable, state-of-the-art, intelligent solutions that won't break the bank.

Kamstrup's industry leading portfolio of ultrasonic smart metering solutions for water utilities consistently rank highest in ultra-low flow accuracy, initial quality, long-term reliability and battery service life.

Graham Mattison, 2024-06-21T01:26:25.519

GM1

kamstrup



Slide 4

GM0 I want this slide to emphasize our reliability and differentiate on our return rate for warranty service.
Graham Mattison, 2024-06-20T23:49:24.544

GM0 0 Pretty it up however
Graham Mattison, 2024-06-21T01:19:12.284

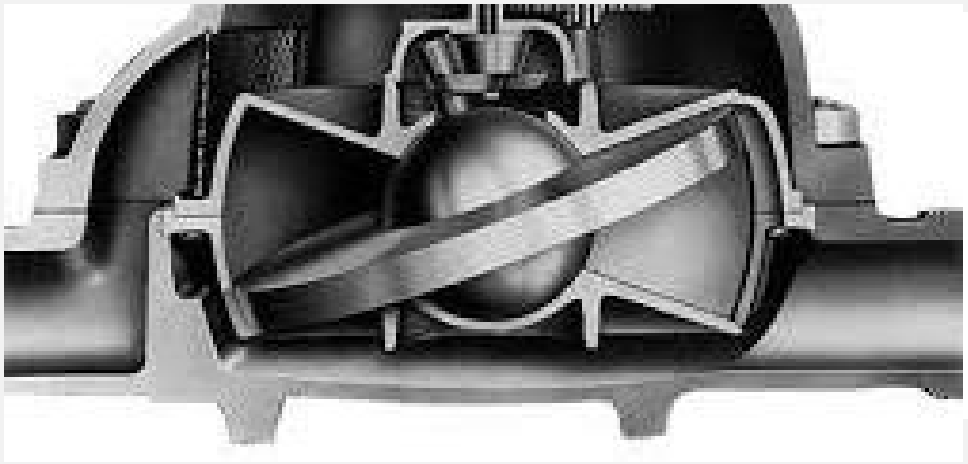
GM1 Presenter Notes:
While it's true that a significant number of meter manufacturers have introduced ultrasonic water meters in recent years, At Kamstrup we've been doing ultrasonics for over 30 years. Our technology is mature and extremely reliable. All of the meters we are gonna discuss here today are manufactured at our world class automated production facility in Cumming, GA.

Before we start diving into the technology, I just want to briefly say, at Kamstrup, we take pride in the quality of our products. Of the more than 14 million ultrasonic meters we've shipped globally our return rate is one-half of 1%. In North America, our return rate is less than one-quarter of 1%. And we use the phrase "return rate" for a very good reason - if a meter returns to the factory for service at any point during its 20 year warranty period, for any reason other than physical damage, we count that. And our return rate in North America is still less than 1/4 of 1%
Graham Mattison, 2024-06-24T08:50:16.853

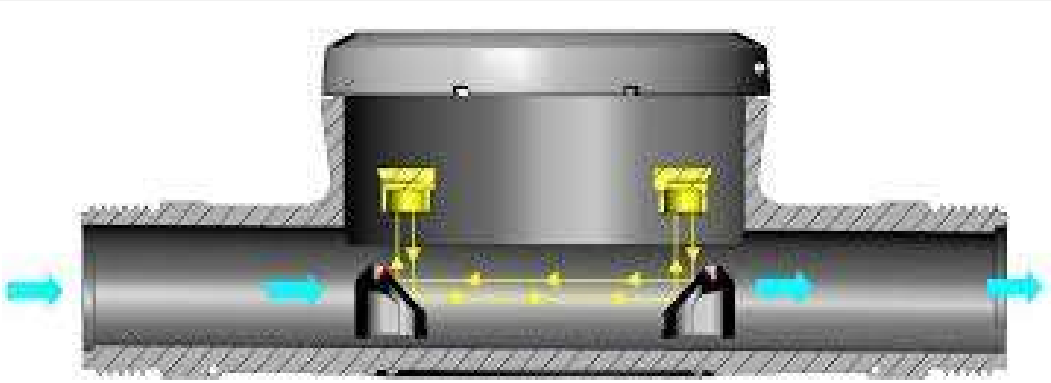
GM0

Physical Overview – PD vs. Static (Ultrasonic): Why It Matters

Nutating Disc



ALD Ultrasonic

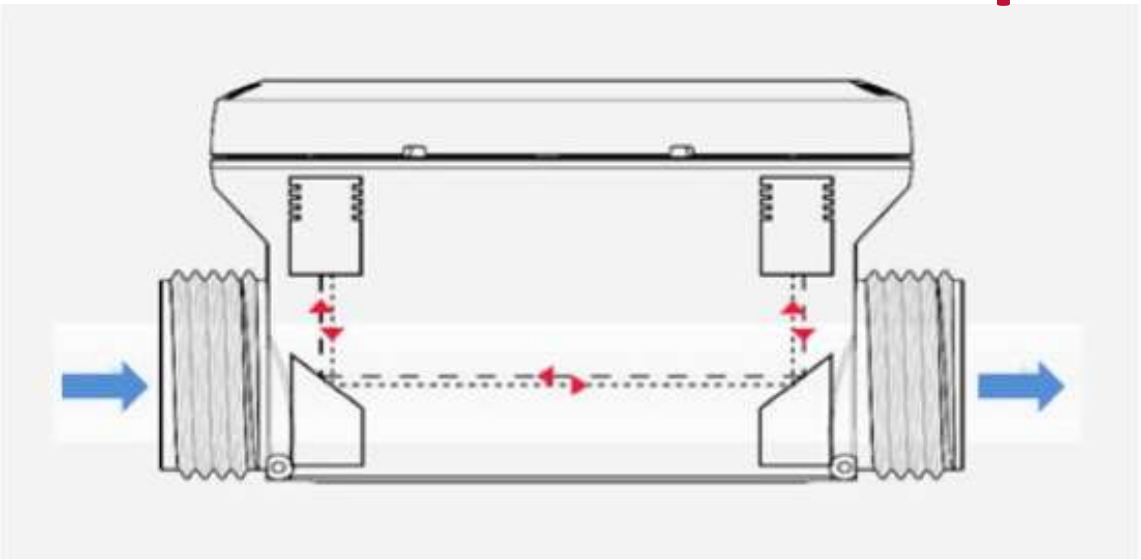


Slide 5

GM0 The drought icon is weird. Let's brainstorm on that.
Graham Mattison, 2024-06-21T10:33:22.451

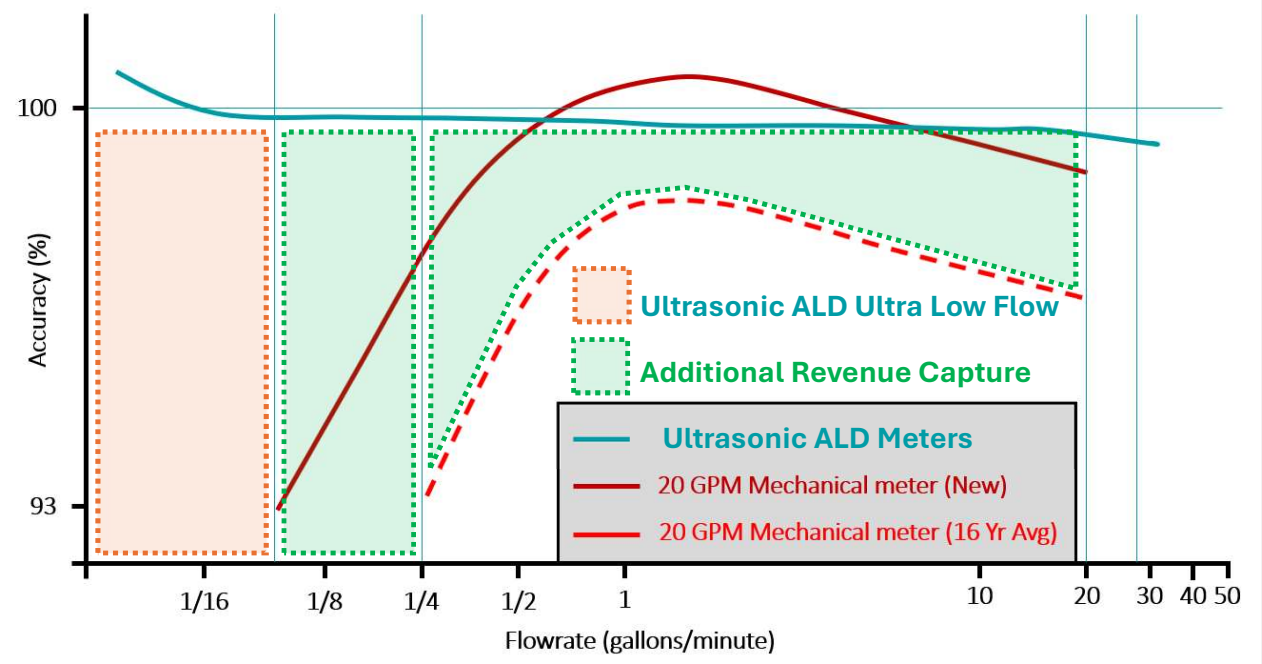
GM0 0 When it comes to water loss and NRW programs in general, we surveyed 30 different utilities to get a sense of what is driving their investment in their non-revenue water and water loss recovery programs. And obviously, you see the 3 big ones at the top - Revenue, Regulations, Drought/Water Scarcity. One of the biggest drivers that we weren't expecting - was customer satisfaction - and it ties hand in had with system efficiency and environmental impacts. Consumers want to know - what is the utility doing to conserve water and reduce water loss - yes, there are rebate programs for low-flow toilets and shower heads and more efficient appliances - but consumers, especially in areas affected by drought and water scarcity issues, increasingly want to know - what is my utility doing to conserve water and help reduce water loss.
Graham Mattison, 2024-06-24T09:45:52.883

Ultra-Low Flow Capture & The Ultrasonic Measuring Principle



IT'S TIME TO KNOW

ALD Meters Lead the industry in Low Flow Accuracy!



Comparative linear accuracy after 16 years

IT'S TIME TO KNOW

Water Leakage: EPA Statistics

“The average household's leaks can account for more than 10,000 gallons of water wasted every year…”

*Source: EPA, WaterSense: Fix a Leak Week | WaterSense | US EPA

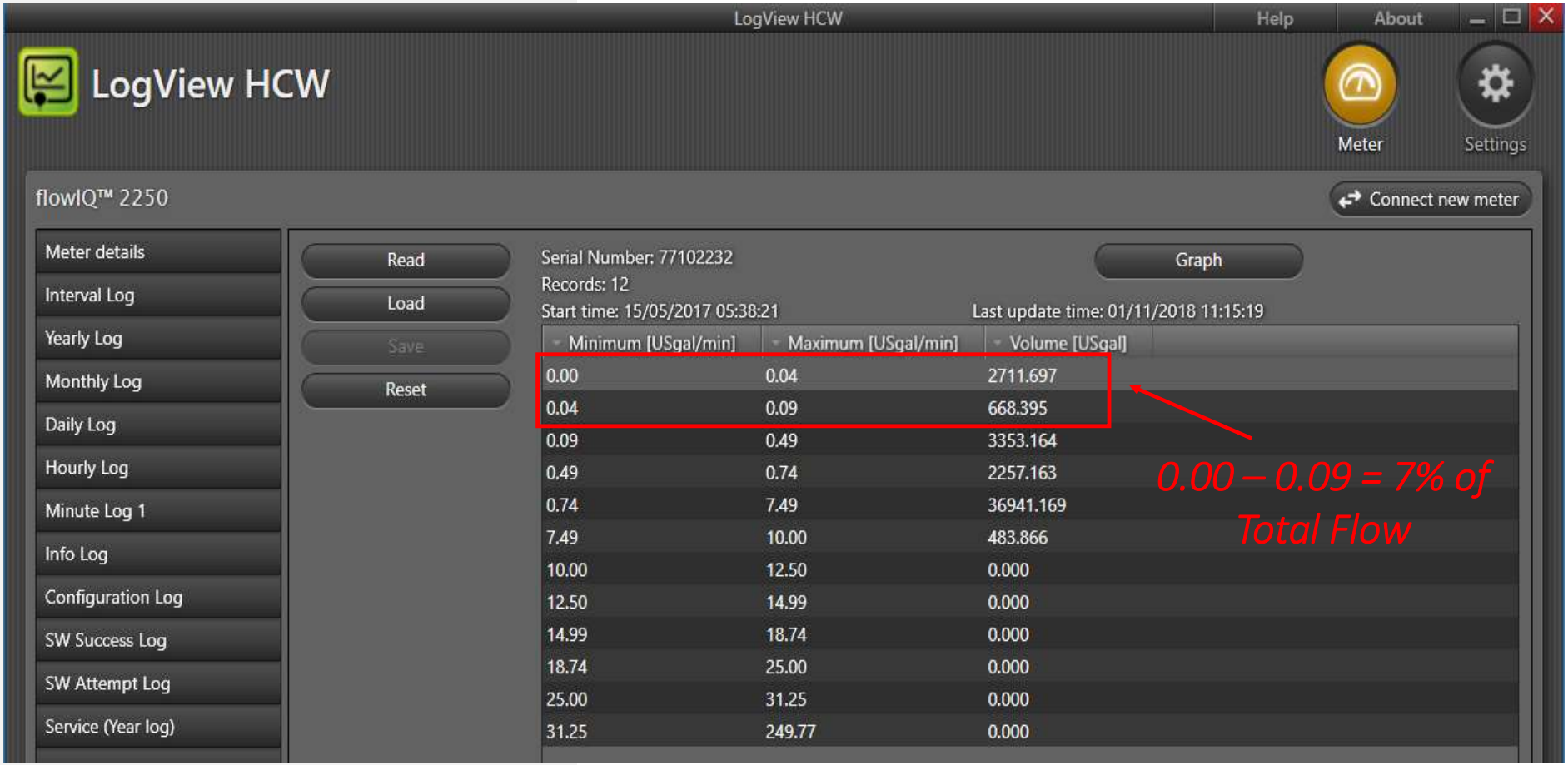
Let's Do The Math!

- **What is the flow rate of 10,000 gallons per year?**
- **10,000 ÷ 365 ÷ 1440 = 0.019 GPM**

Gallons per year	Days per year	Minutes per day	Average flow rate

- **Why this is important?????**
- ***Only ALD Meters have a starting flow at 0.010 GPM***

Low Flow Analysis Study



IT'S TIME TO KNOW

Efficiency Causes Challenges

Flow rate histogram examples

Minimum [US gal/min]	Maximum [US gal/min]	Volume [US gal]
0.00	0.04	26,234.619
0.04	0.09	9,503.887
0.09	0.49	5,898.728
0.49	0.74	936.064
0.74	7.49	184,894.119
7.49	10.00	3,922.904
10.00	12.50	245.578
12.50	14.99	0.748
14.99	18.74	0.544

Installed May 2022 – read Aug 2023

Townhouse

35,738.5
gallons below
1/10 GPM
or
17.18% of all flow

Minimum [US gal/min]	Maximum [US gal/min]	Volume [US gal]
0.00	0.04	23,822.802
0.04	0.09	57,232.910
0.09	0.49	47,952.197
0.49	0.74	10,496.208
0.74	7.49	98,882.182
7.49	10.00	5,898.479
10.00	12.50	9,884.411
12.50	14.99	25,264.692
14.99	18.74	45,447.810

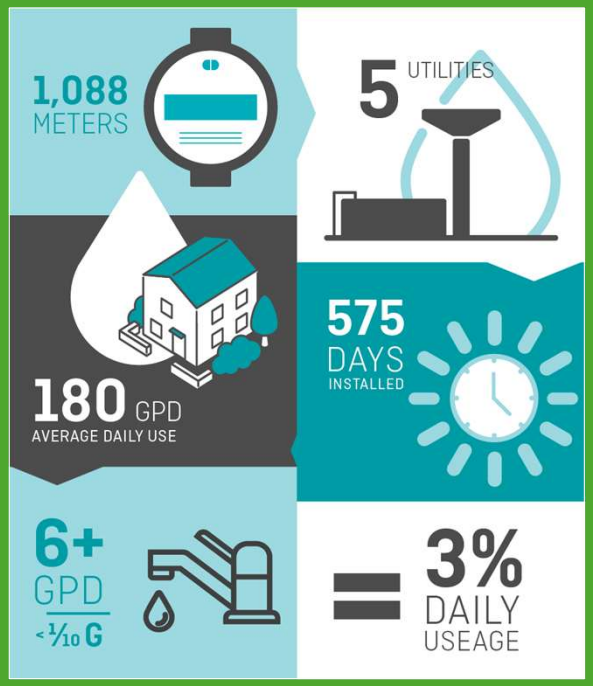
Installed March 2021 – read Nov 2023

Home on Large Lot

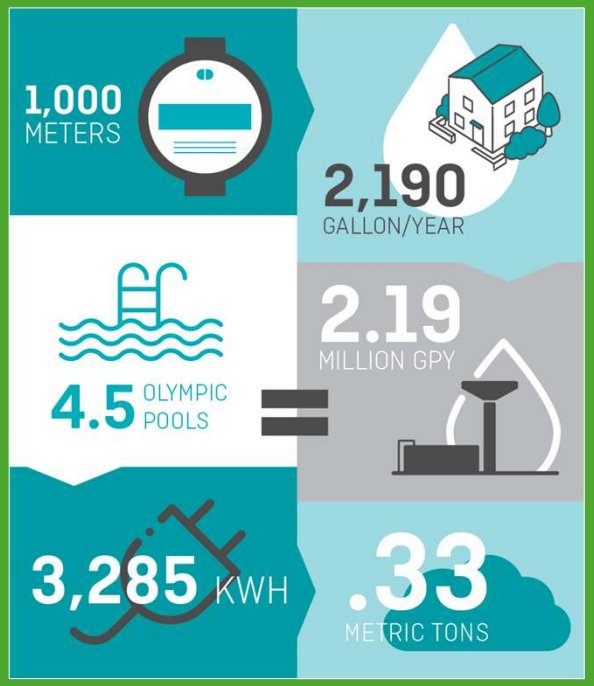
81,055.7
gallons below
1/10 GPM
or
24.95% of all flow
(83 gal / day)

Ultra-Low Flow is not inconsequential

Random Sampling Utility Customers



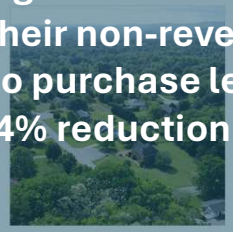
1,000 Customer Utility Example



8% Annual Revenue

63% NRW

They leveraged solid-state ultrasonic meter technology to gain an average increase of 8% in annual revenues. They reduced their non-revenue water by 63% which allowed them to purchase less wholesale water resulting in a 54% reduction in their water cost.



Milcrofton System Overview

Service Area: 94 sq miles

Water Mains: 330 miles

Primary Source: Wholesale Purchase

Service Connections: 11,000+

C&I Meters: 40 (2”+)

Billing: Water Only

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 C…
	Water Loss	Apparent Losses	U…Consumption (Theft)
		Real Losses	**Leaks on Distribution Water Mains**
			Leaks on Service Connections

Non-Revenue Water

ALD Meters start registering consumption @ 1/100th of a gallon per minute Lowest Starting Flow Rate In The Industry! (0.01 gpm)[1]te

GM0

Non-Revenue Water – Ultra Low Flow + ALD: Why It Matters

Revenue

Regulations

Drought

System Efficiency

Customer Satisfaction

Environmental Impacts

Slide 15

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Graham Mattison, 2024-06-21T10:33:22.451

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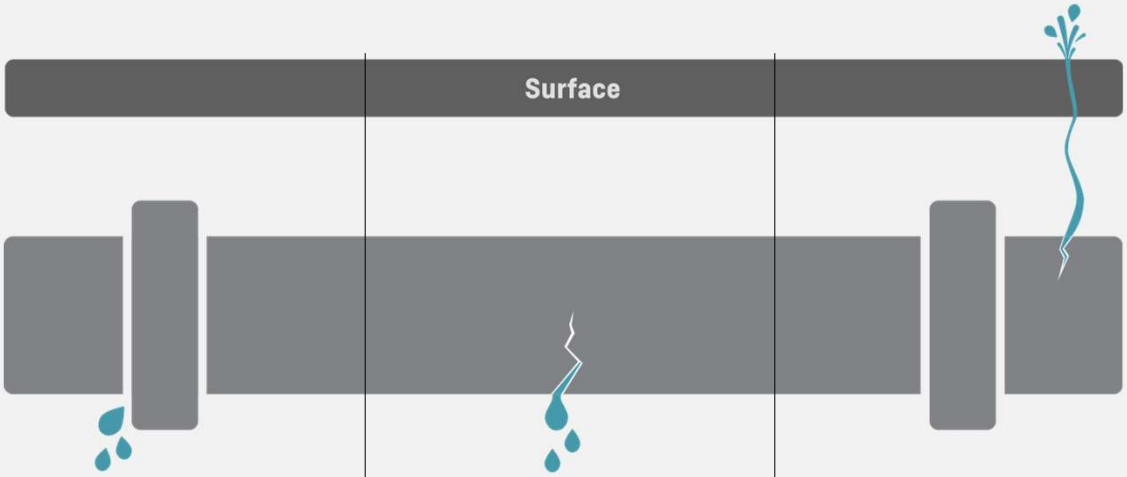
Graham Mattison, 2024-06-24T09:45:52.883

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

(Hint: Not This One)

Types of Leaks

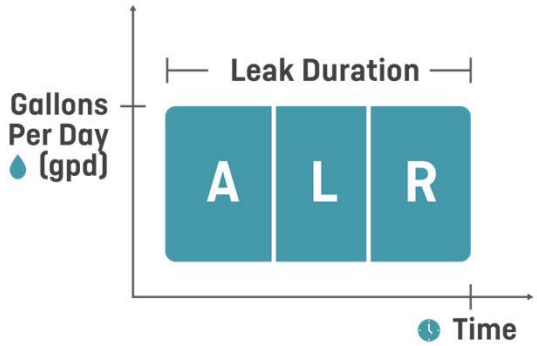


Background Leakage
Unreported and undetectable using traditional acoustic equipment.

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.

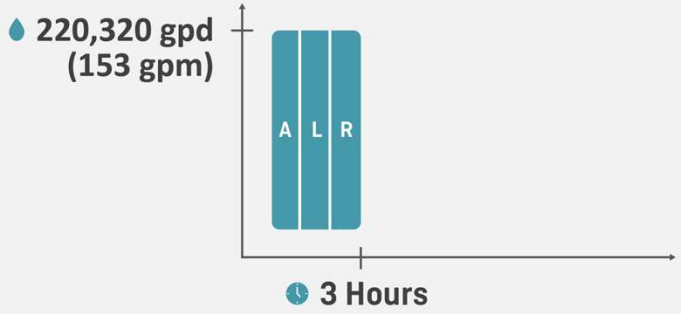
Run Time Matters



A = Awareness

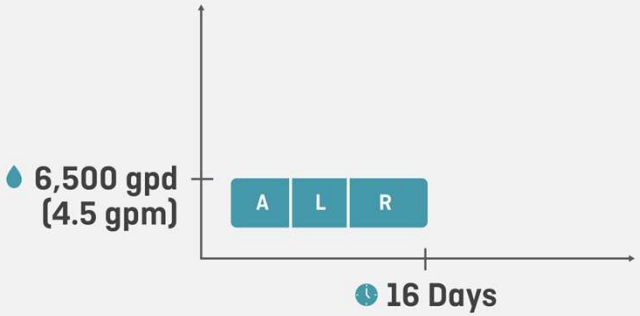
L = Location

R = Repair



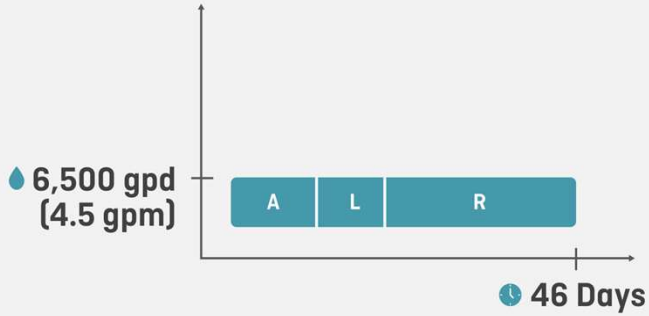
Reported Circumferential Break on 8" Main

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 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

Acoustic Leak Detection – Survey Technologies

One-Time Leak Survey Tools

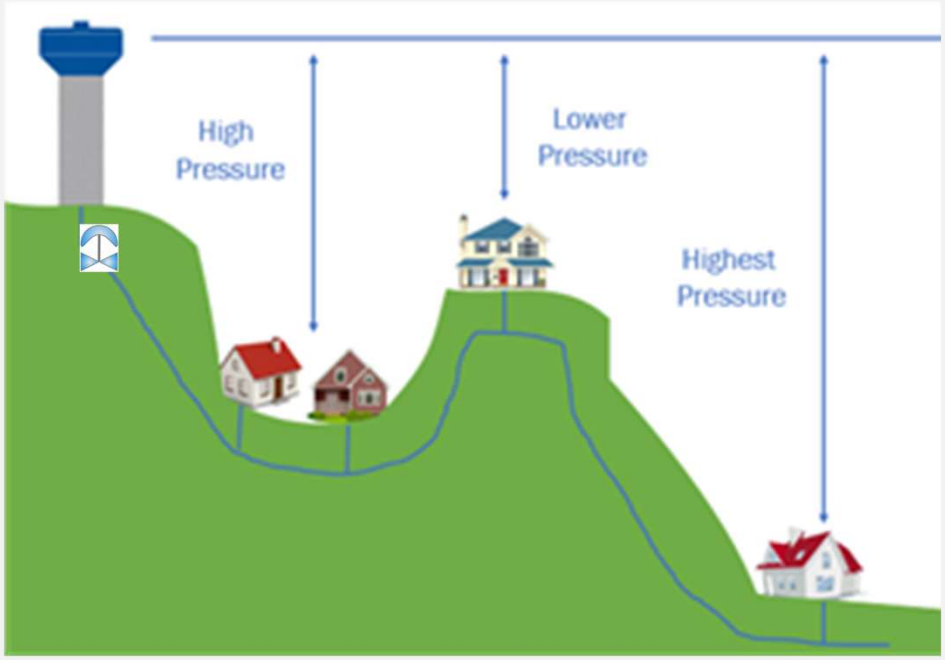
Survey Tool	Primary Use
Electronic Listening Tools “Sticks” Ground Microphones	Surveying systems; sounding fittings; confirming leaks
RF/Other Local Communication Acoustic Noise Data Loggers	Identify main leaks and adjacent service line leaks where possible using lift & shift methodology
Leak Noise Correlator	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
In-Meter Pressure Monitoring	Quickly Identify catastrophic leaks. Great for verifying a hydraulic model. Zero–Point drifts continuously, can’t be re-zeroed in-service.

What Are Critical Points?

Critical points are the high elevation areas within the pressure zone that are most adversely affected during peak demand periods

–OR –

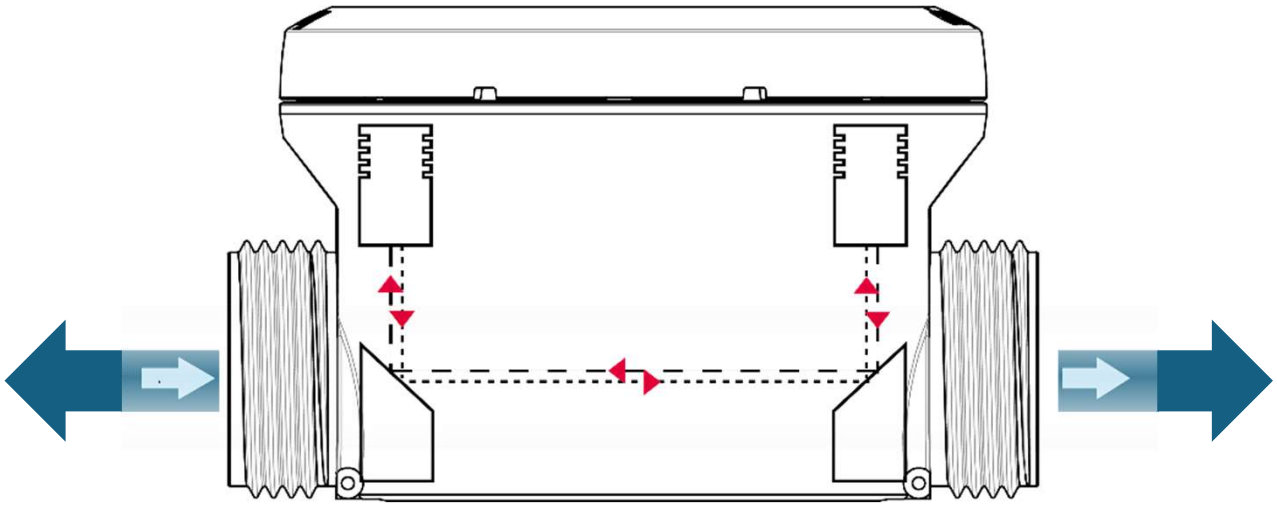
Critical and Essential Infrastructure (Hospitals, Assisted Living Facilities, Schools, etc.) where any supply disruption or pressure deficiency poses a high risk to public health and human safety.



“The high point, beyond the low point, in the zone.

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.

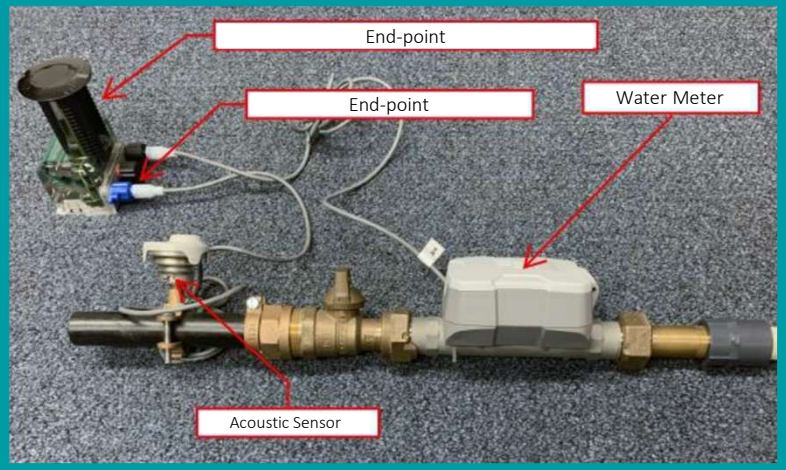
So… What Does That Actually Look Like?

It Looks Like A Water Meter.

Because That's All It Is.

That's The Magic!

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

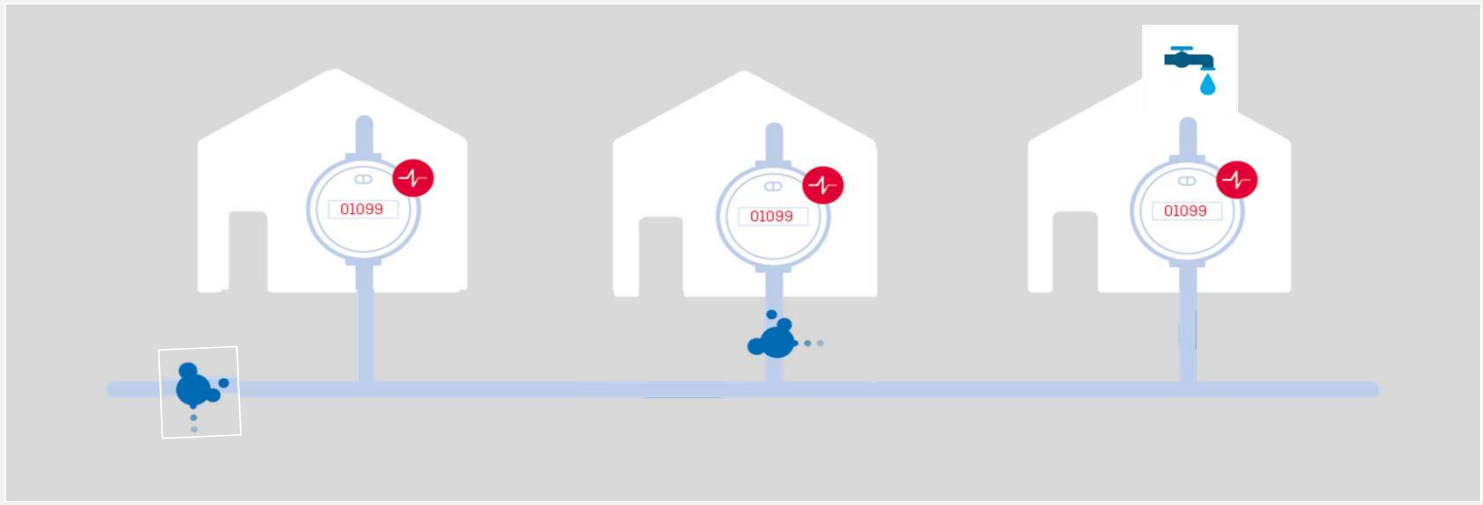
100% Distribution Coverage

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

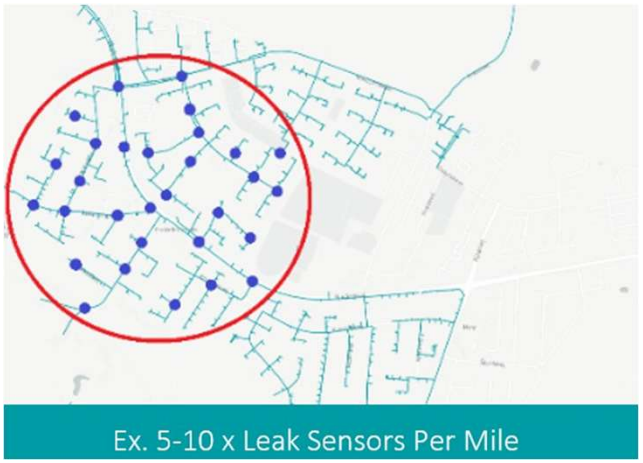
Leak noise travels faster and farther through the water column than it does along the pipe wall.

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

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

Minimum Viable Survey Deployment vs Complete System Coverage

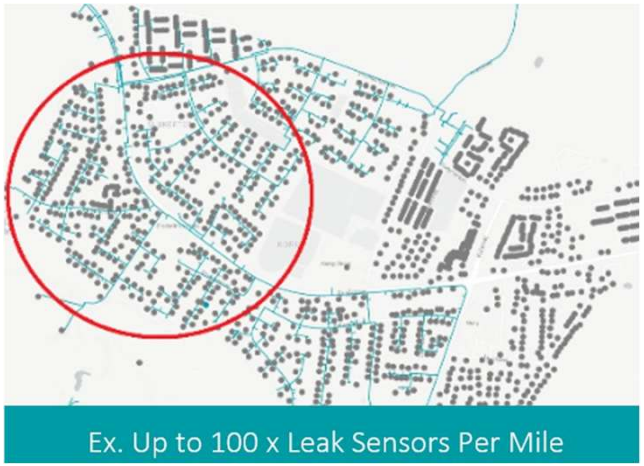
Main Line Coverage Only



Traditional Leak Loggers

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

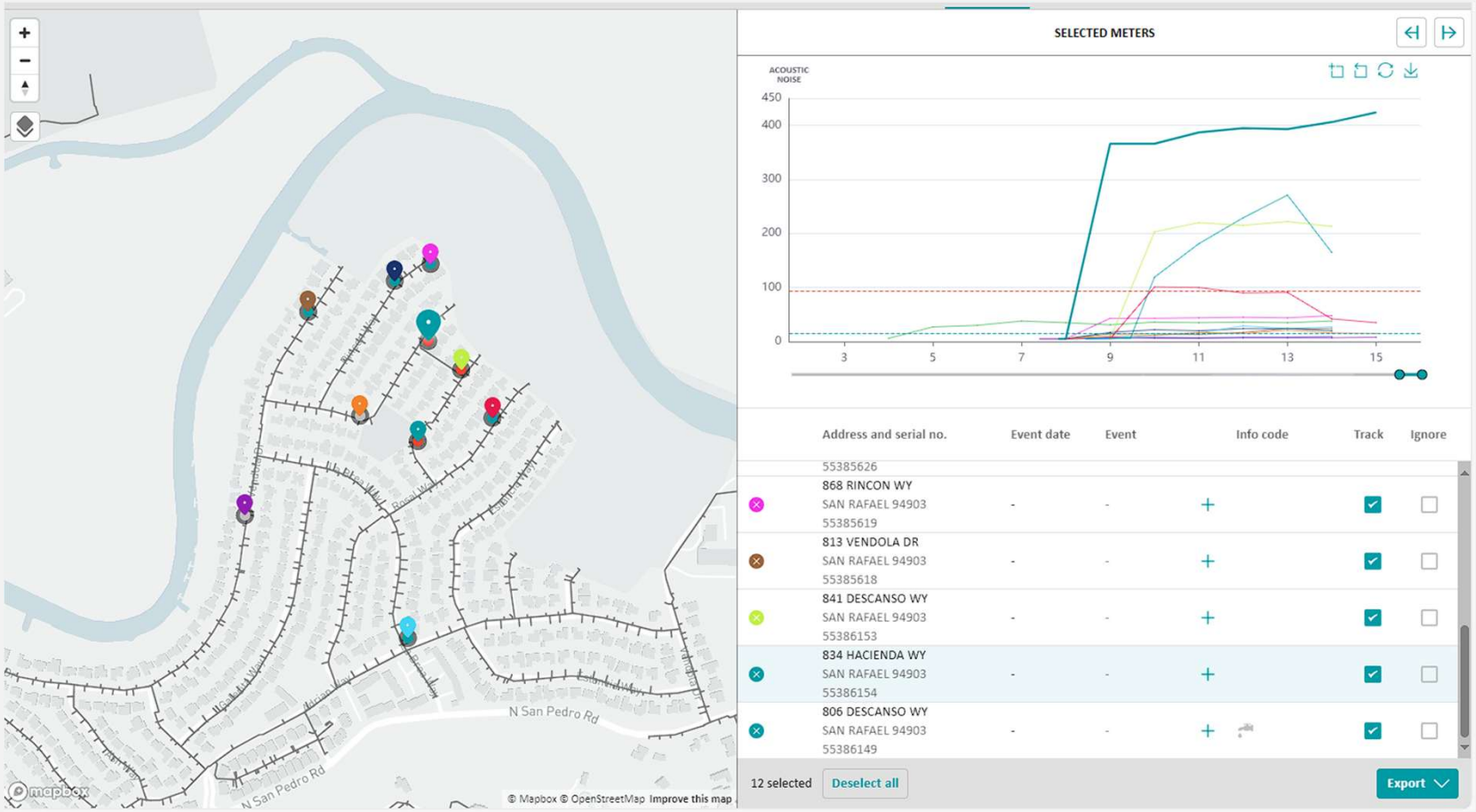
Service & Main Line Coverage



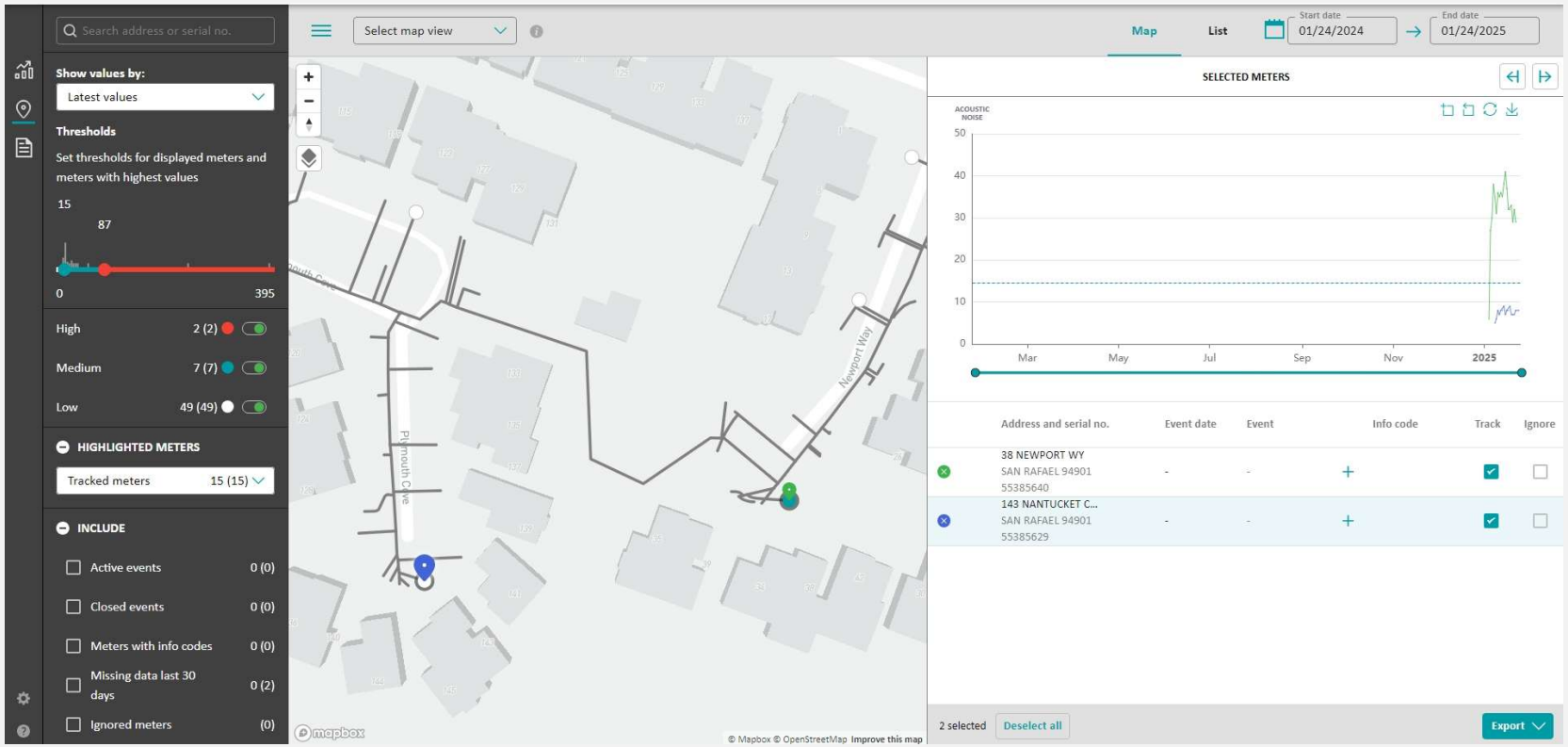
ALD Meters

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

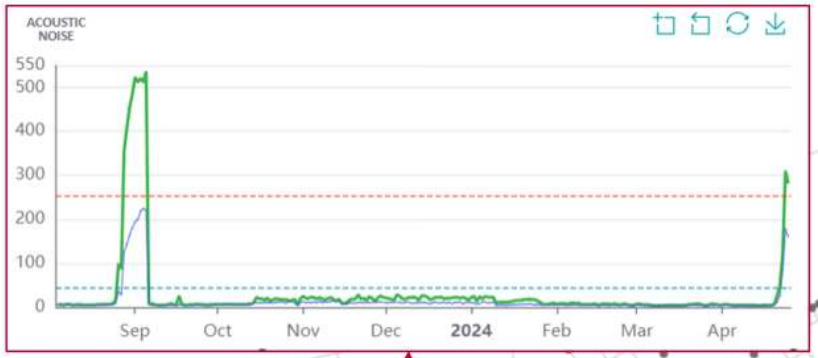


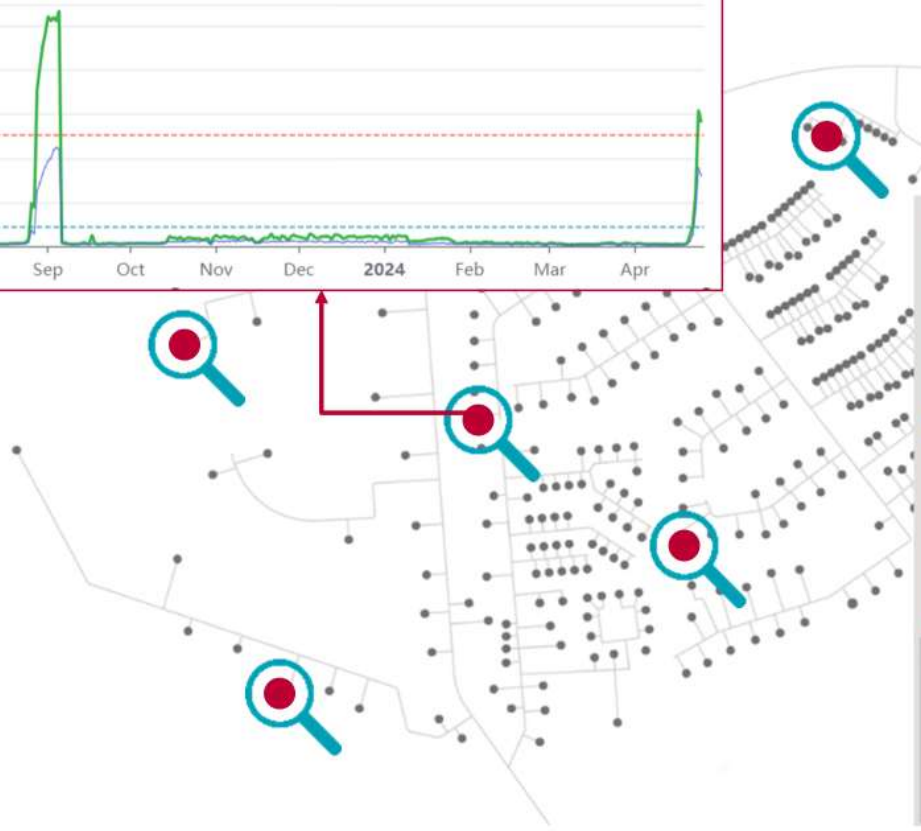
Leak Detection – Minimum Viable Survey Deployment

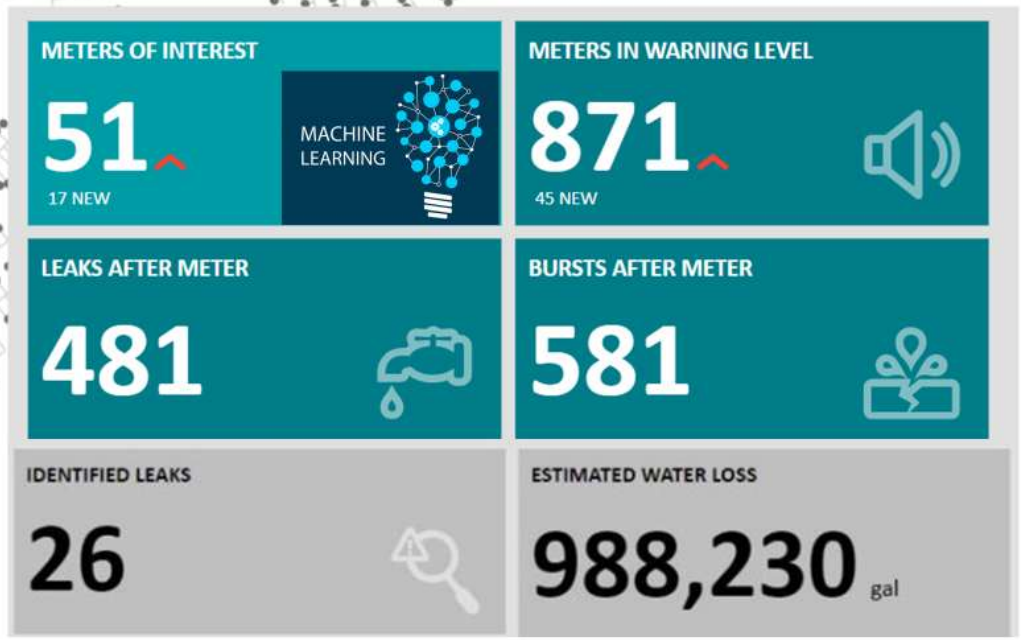


Leak Detection Software

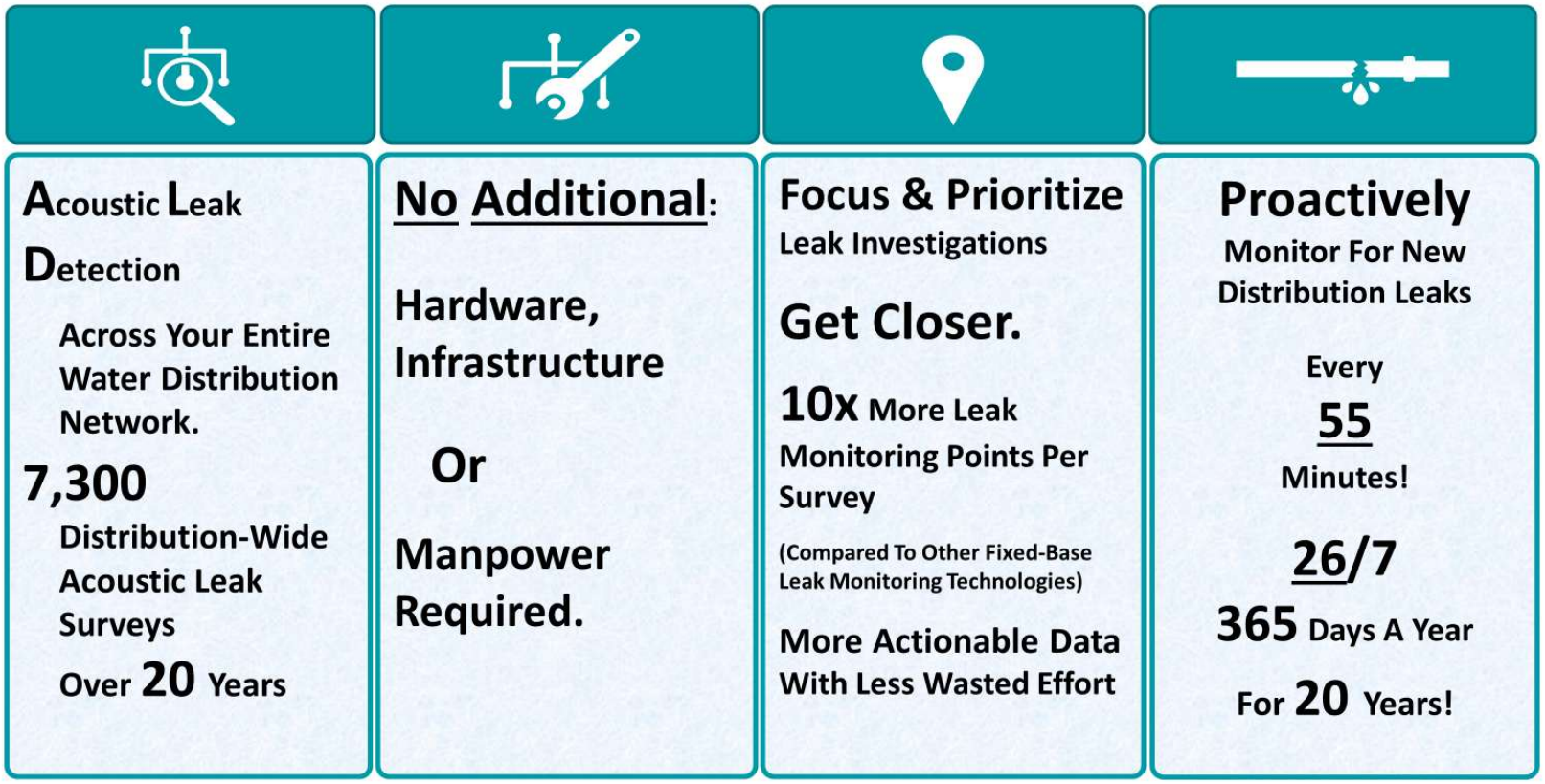
Imagine easily surveying your entire system every day







A Built-In Acoustic Advantage



Case Studies & Testimonials

Mt. Vernon, IL

- Population: 14,600
- 6296 Residential AMI Ultrasonic Water Meters
- 7100 Total Water Meters
- 4 Data Collectors
- System installed Q3 of 2018
- We data logged 354 residential meters to find the approximate value captured in range of 0.04-0.25

Minimum Gal/Min	Maximum Gal/Min	Total for 6.25 Years for 354 meters	Average gal consumed/ Year/meter	Total consumption of all residential meters/ year	Total Consumption over 20 years
0.04	0.09	1,122,341 gal	507 gal/meter/year	507*6296= 3,192,072	3,192,072*20=63,841,440
0.09	0.25	1,284,580 gal	580 gal/meter/year	580*6296= 3,651,680	3,651,680*20=73,033,600
Total		2,406,921 gal		6,843,752	136,875,040 gal over 20 years

Extra Money from Capturing Low Flow

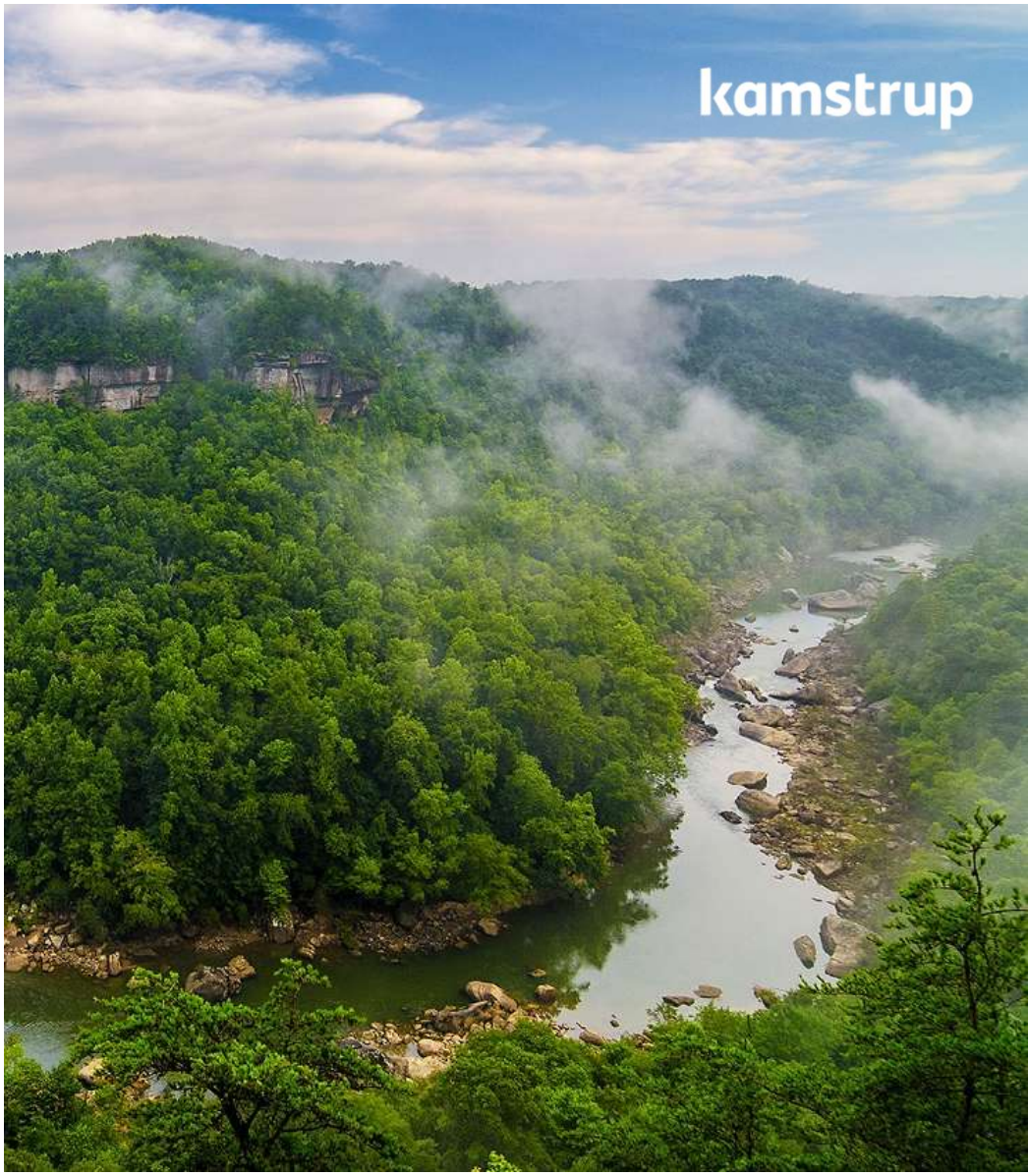
Current water and sewer rates per first 1000 for Mt. Vernon is roughly $19.

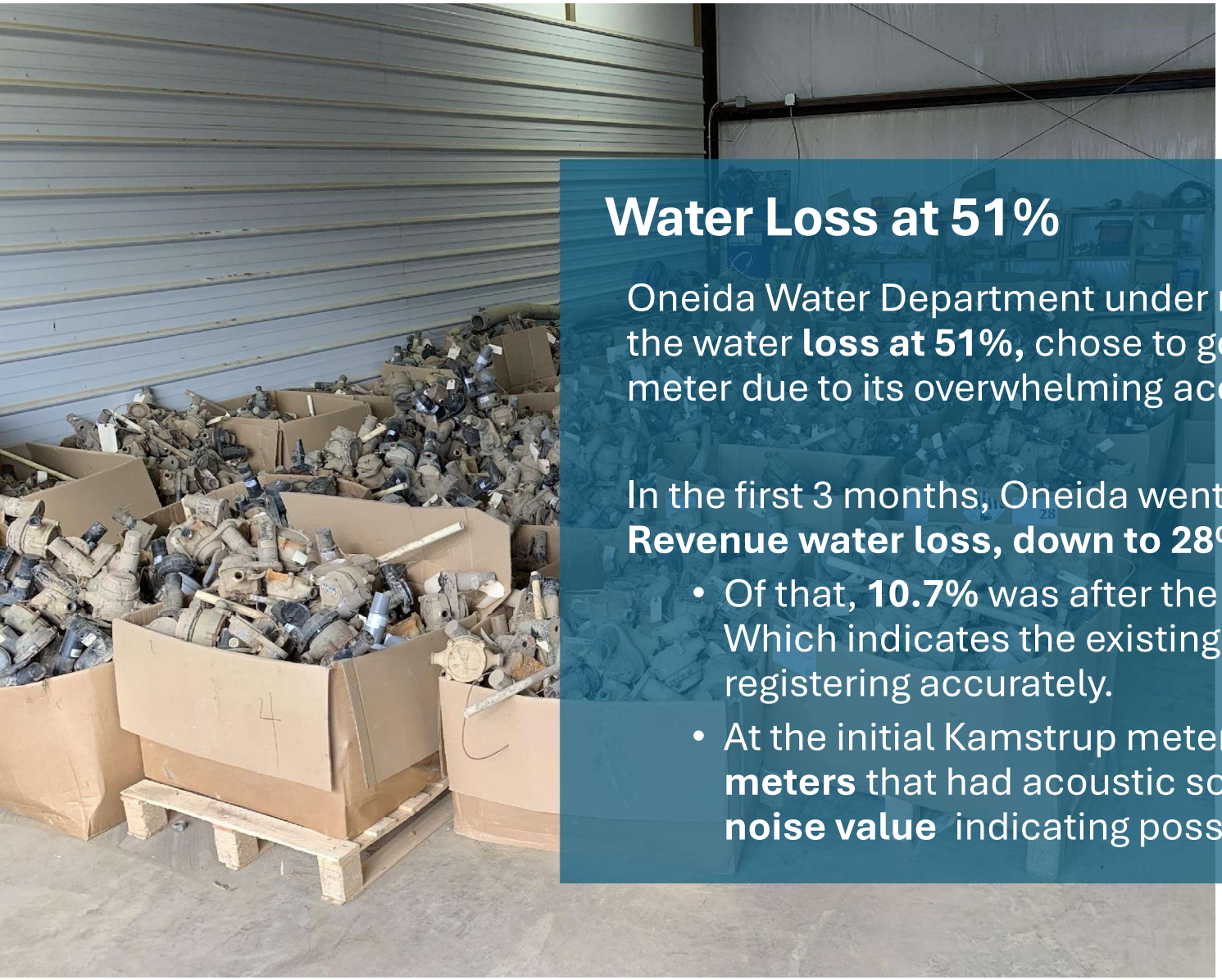
From our data the city will be able to bill an extra $130,031 per year from accurate low flow data.

Over the life of the system which is 20 years, the city will be able to bill an extra $2,600,620

Town of Oneida, TN

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





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.

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.

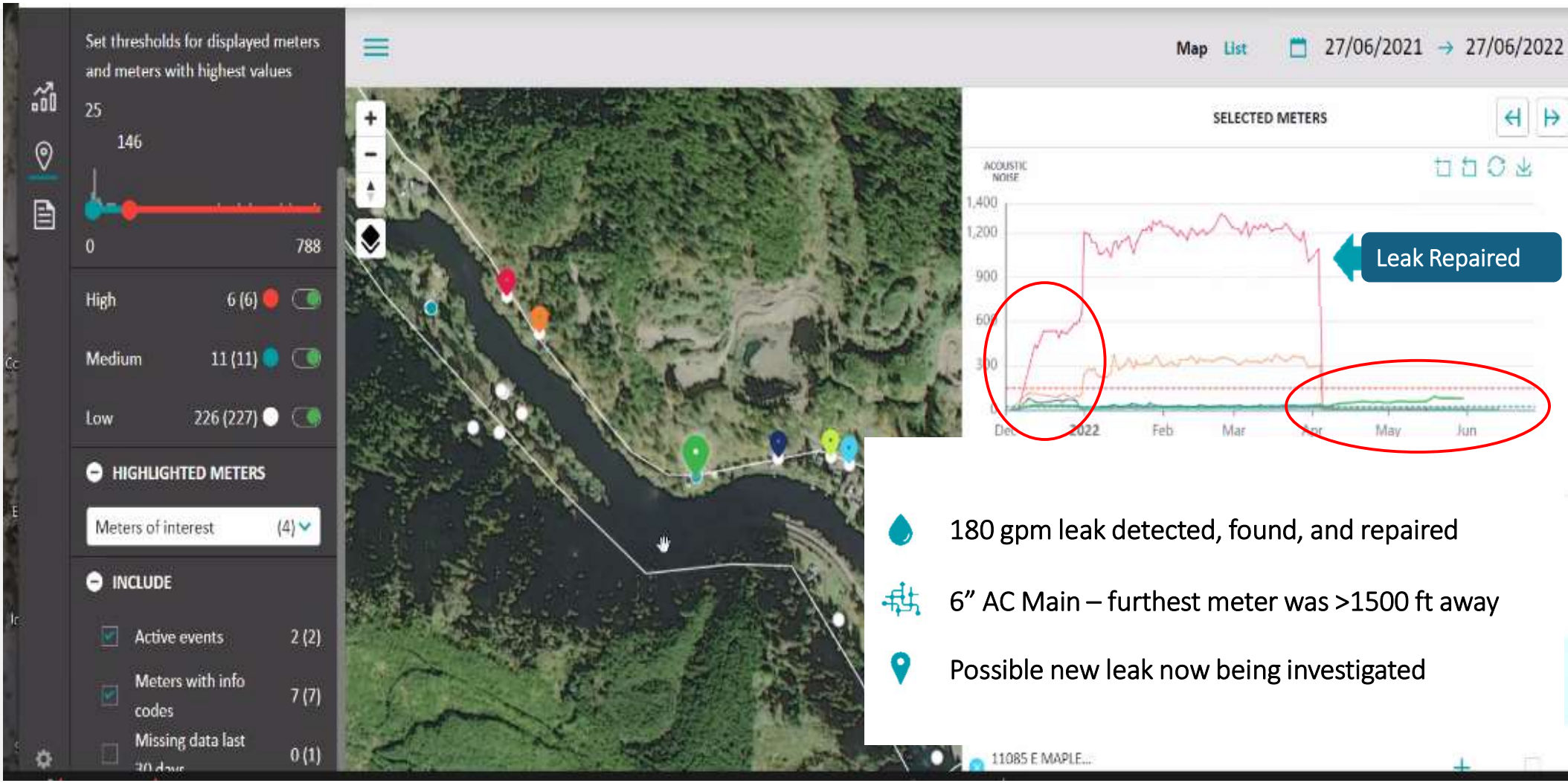
Fun Fact:
A 3 hour per day reduction in water treatment plant runtime equals 1.5 months less runtime (Over 45 WTP Operating Days Saved) in just year one!

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*

*based on TN American Water base rate

Mapleton Water District, OR



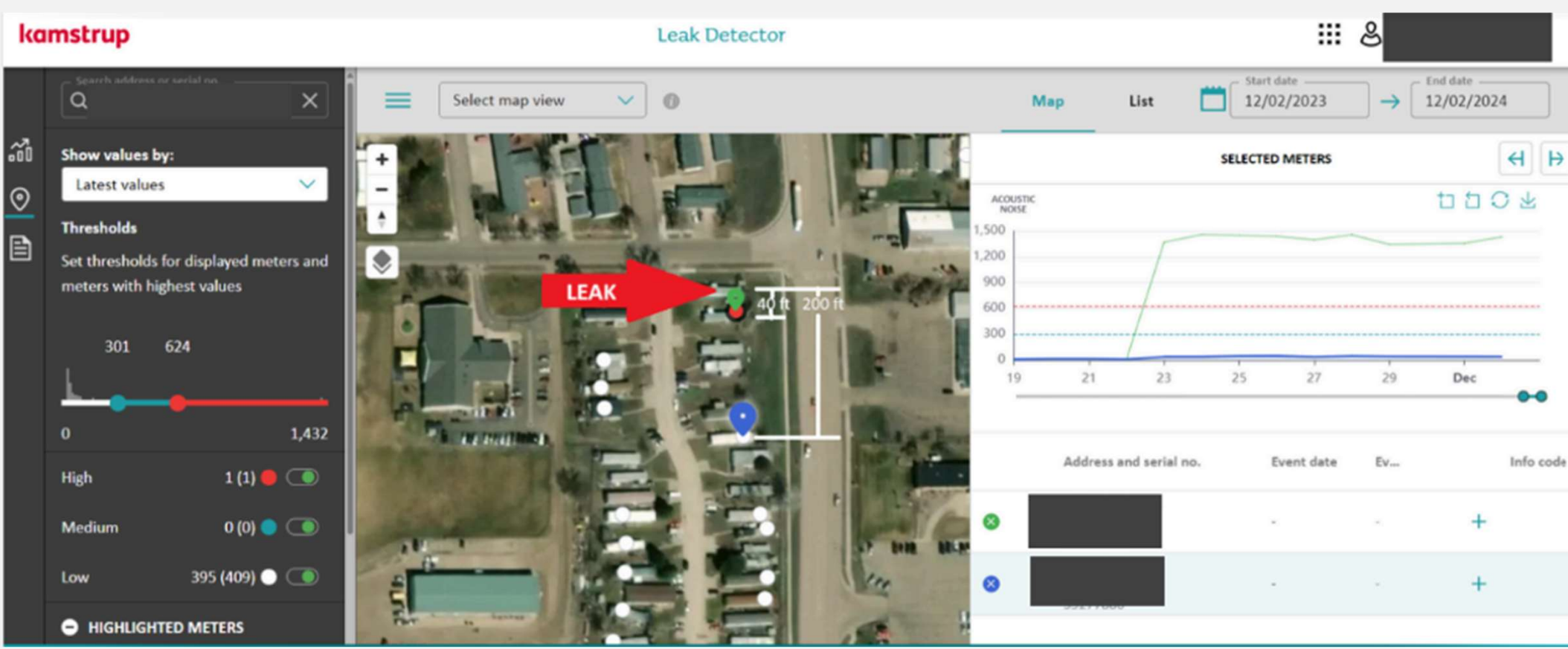
180 gpm leak detected, found, and repaired

6” AC Main – furthest meter was >1500 ft away

Possible new leak now being investigated

Pierre, South Dakota

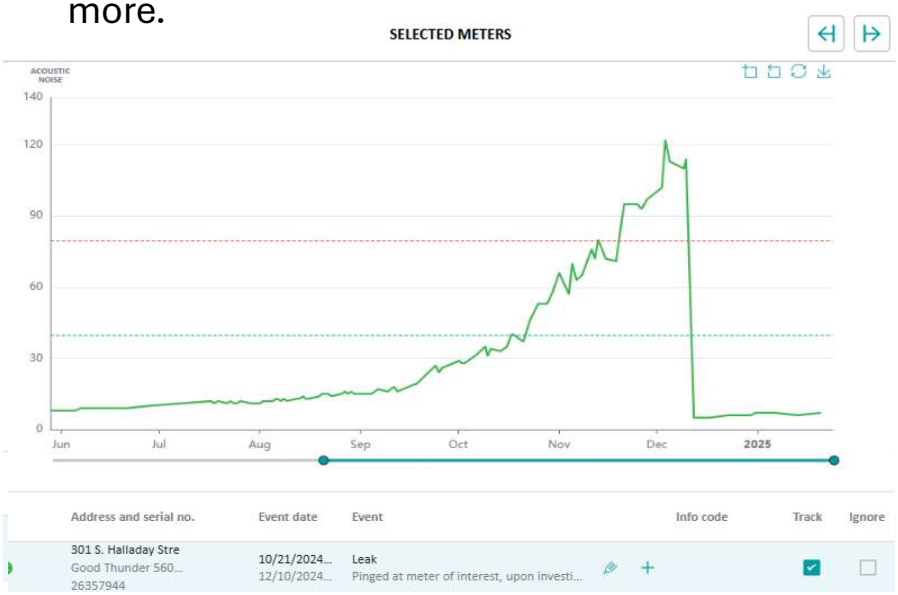
Pierre, South Dakota

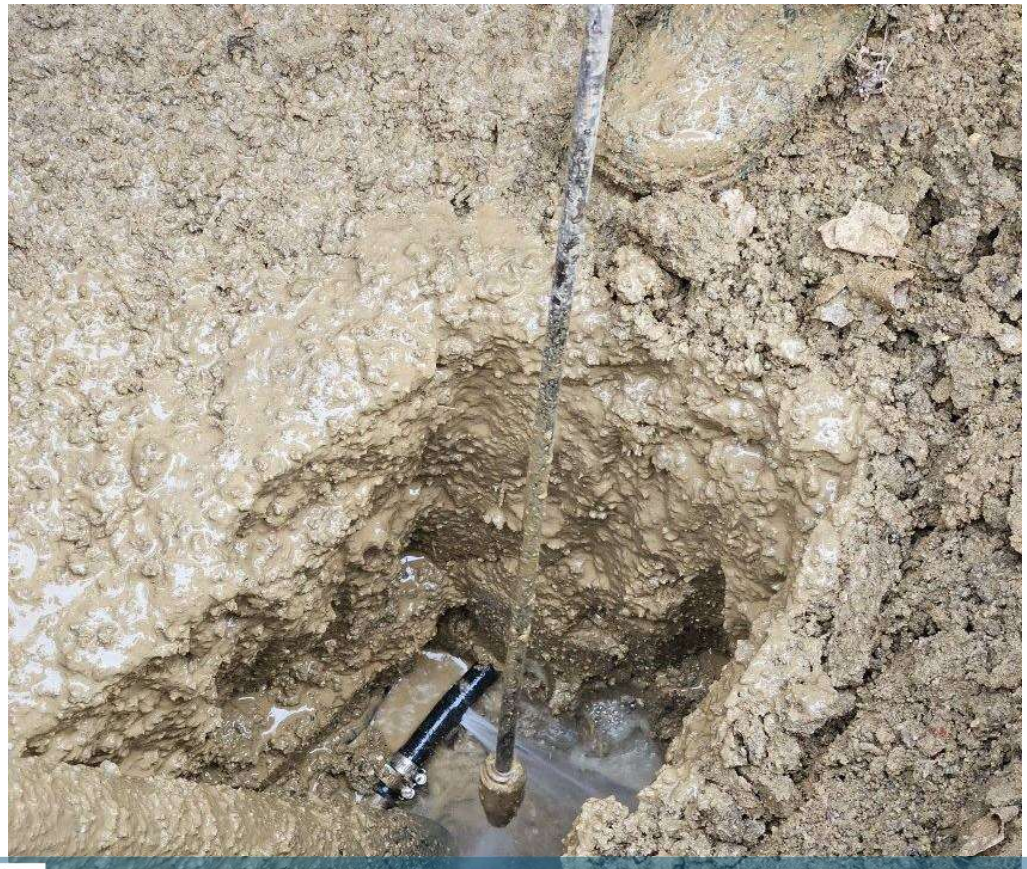


Good Thunder, MN

AMR (Drive-By) with built-in ALD
Non-surfacing utility-side leak identified

- The leak was draining into the sewer, so it did not surface.
- The leak probably would not have surfaced, but rather would have broken the line eventually and the customer would have been out of service in mid to late January.
- If the repair was done as a service emergency in January, it would have cost a minimum of 30% more.





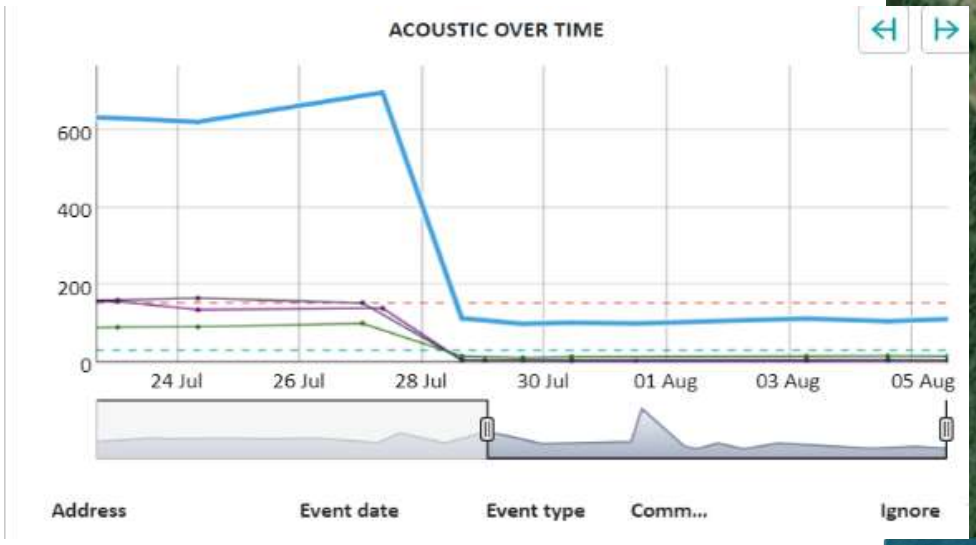
Leak was 2 feet inside the curb stop - 50 ft from the meter.

The leak was draining into the sewer and did not surface.

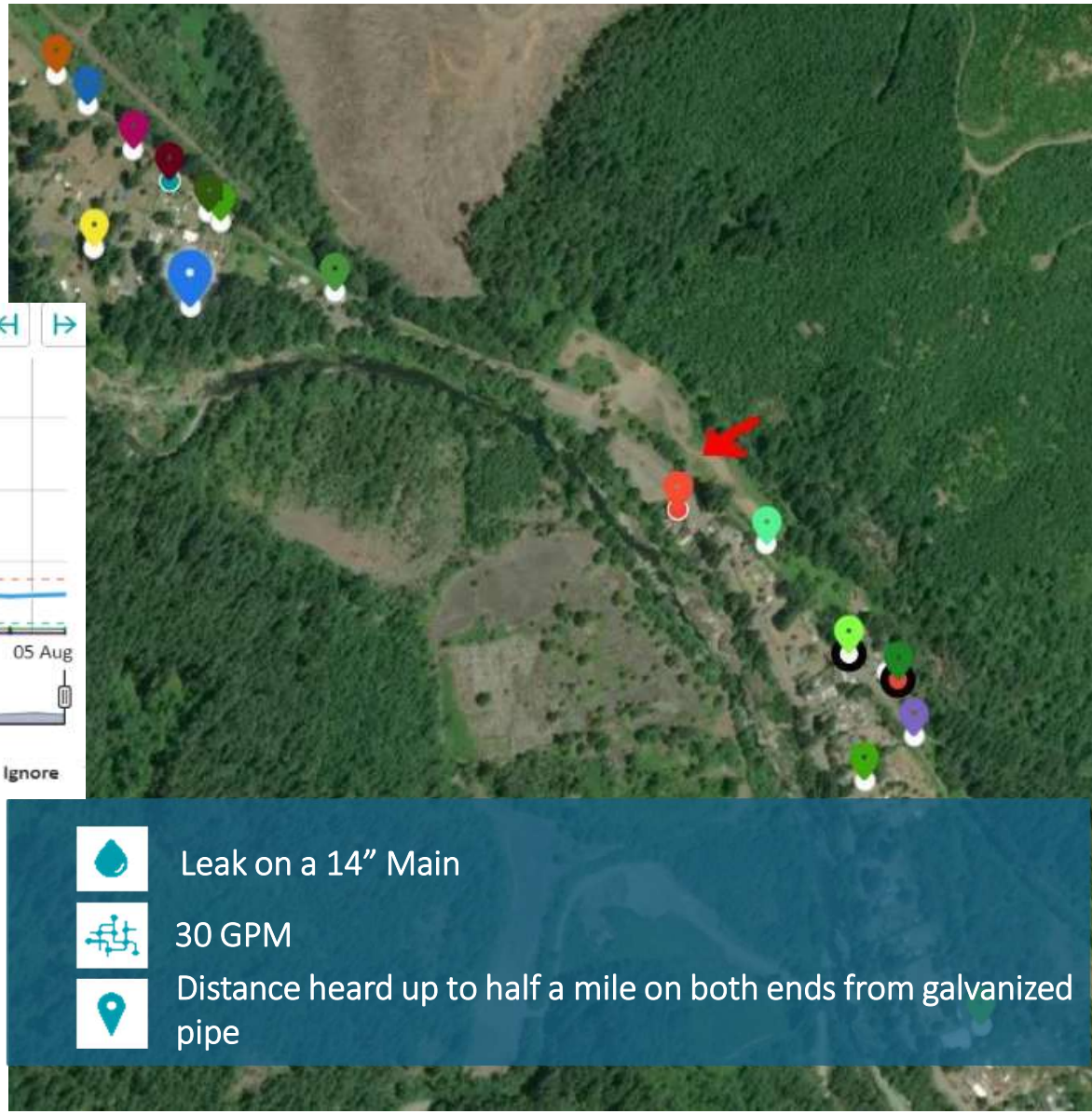
If the repair was done as a service emergency in January, it would have cost a minimum of 30% more.

Row River Valley, OR

- Main line leak found by meters up to ½ mile away!



Address	Event date	Event type	Comm...	Ignore
Dorena, 97434	07/30/2021 08/03/2021	Leak	Fixed 3...	



Leak on a 14” Main

30 GPM

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