

Impacts of Pressure Monitoring and Leak Detection on Non-Revenue Water Loss



FCS

The Sound Choice
for Leak Detection.™

National Amounts

Water Networks

Wastewater



2.2 Million

Miles of underground pipes



250K to 300K

Breaks per year



10 to 37

Leaks per 100 miles of pipe



>148K

Active drinking water systems



6 Billion

Gallons of treated water lost
each day



2 Minutes

Amount of time between
water main breaks

Water Loss

MGD Treated and Distributed	DAILY Loss at 24%					YEARLY Loss at 24%				
	Treatment and Distribution Cost per 1,000 Gallons					Treatment and Distribution Cost per 1,000 Gallons				
	\$1	\$2	\$3	\$4	\$5	\$1	\$2	\$3	\$4	\$5
0.1	\$24	\$48	\$72	\$96	\$120	\$8,760	\$17,520	\$26,280	\$35,040	\$43,800
0.5	\$120	\$240	\$360	\$480	\$600	\$43,800	\$87,600	\$131,400	\$175,200	\$219,000
1	\$240	\$480	\$720	\$960	\$1,200	\$87,600	\$175,200	\$262,800	\$350,400	\$438,000
5	\$1,200	\$2,400	\$3,600	\$4,800	\$6,000	\$438,000	\$876,000	\$1,314,000	\$1,752,000	\$2,190,000
10	\$2,400	\$4,800	\$7,200	\$9,600	\$12,000	\$876,000	\$1,752,000	\$2,628,000	\$3,504,000	\$4,380,000
50	\$12,000	\$24,000	\$36,000	\$48,000	\$60,000	\$4,380,000	\$8,760,000	\$13,140,000	\$17,520,000	\$21,900,000
100	\$24,000	\$48,000	\$72,000	\$96,000	\$120,000	\$8,760,000	\$17,520,000	\$26,280,000	\$35,040,000	\$43,800,000

MGD = Million Gallons per Day

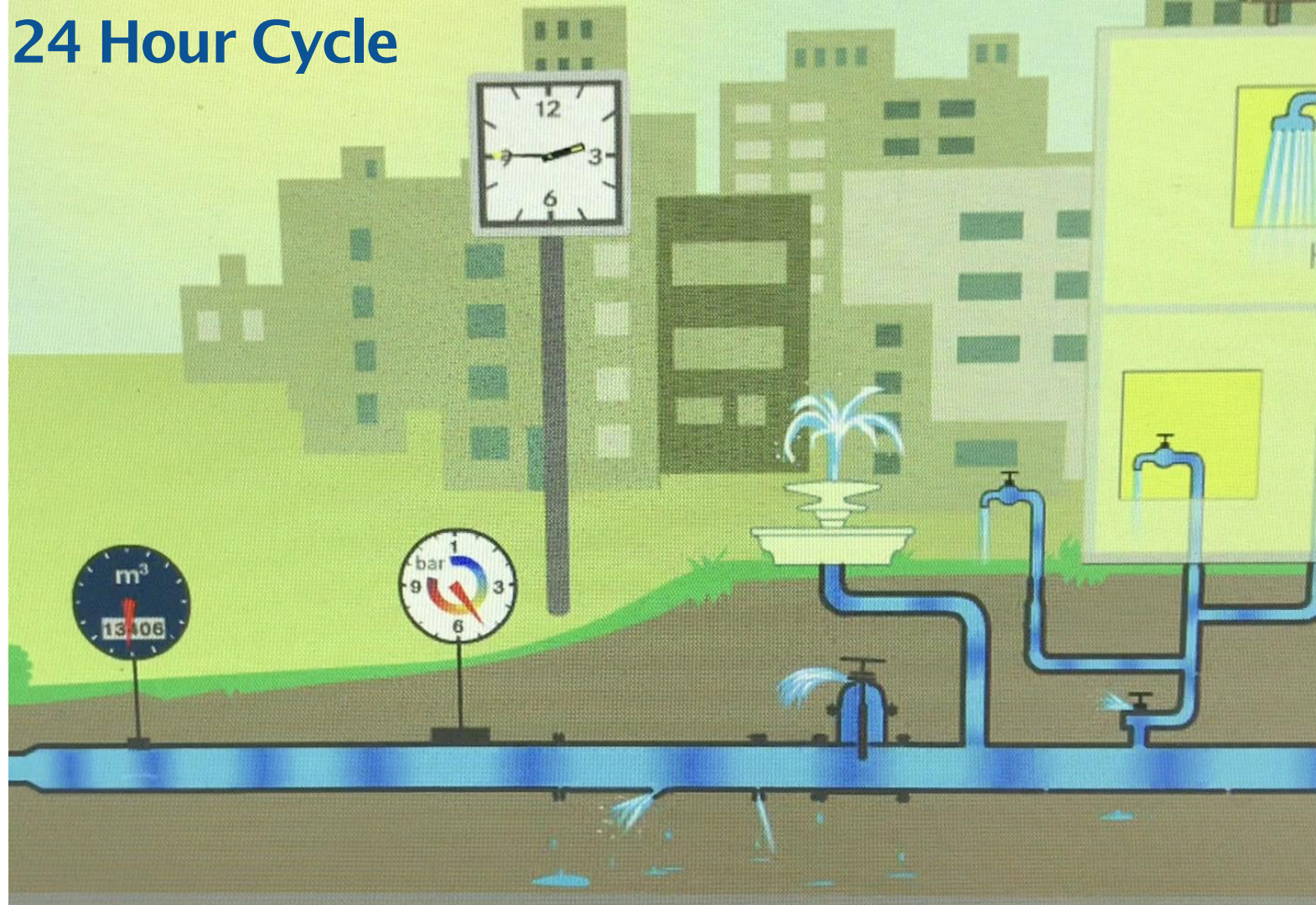
Leaks that Surface



Leaks that Do Not Surface



24 Hour Cycle



Non-Revenue Water Loss Tools

Methods to Stopping the Loss

1. Pressure Modulation (PRV Remote Control)

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- 1. Pressure Modulation (PRV Remote Control)**
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- 3. Localizing (Network Coverage – Acoustic)**
- 4. Locating (Pinpoint / Survey – Ground Mics / Correlators)**

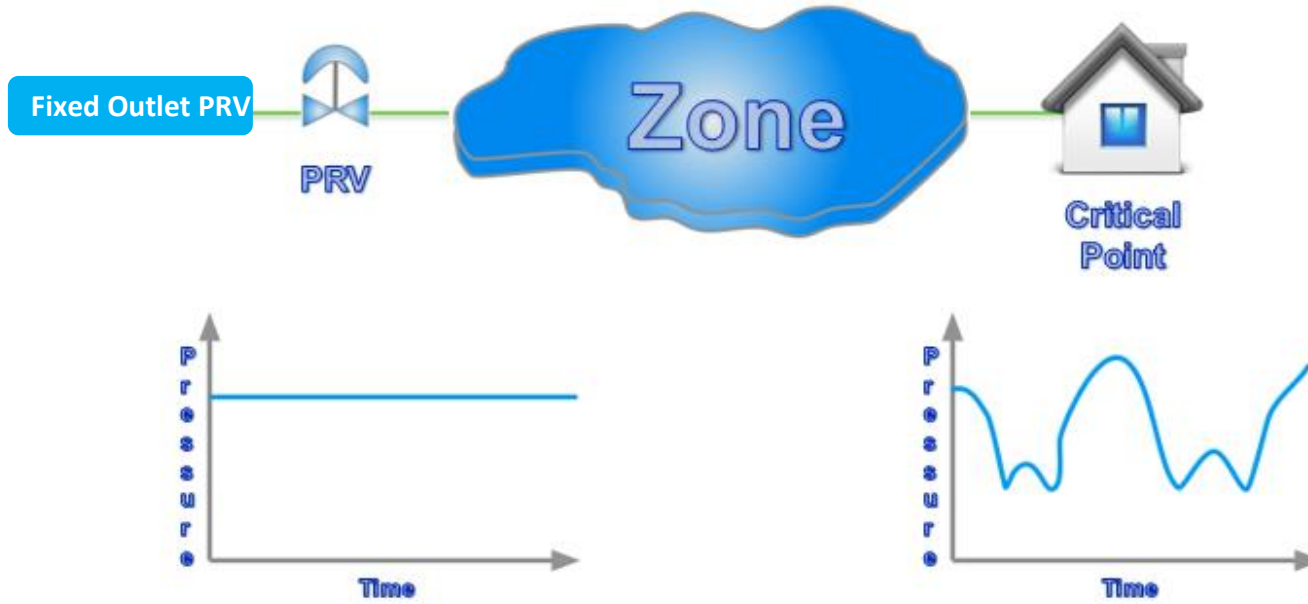
Pressure

Pressure Modulation Device

Modulation

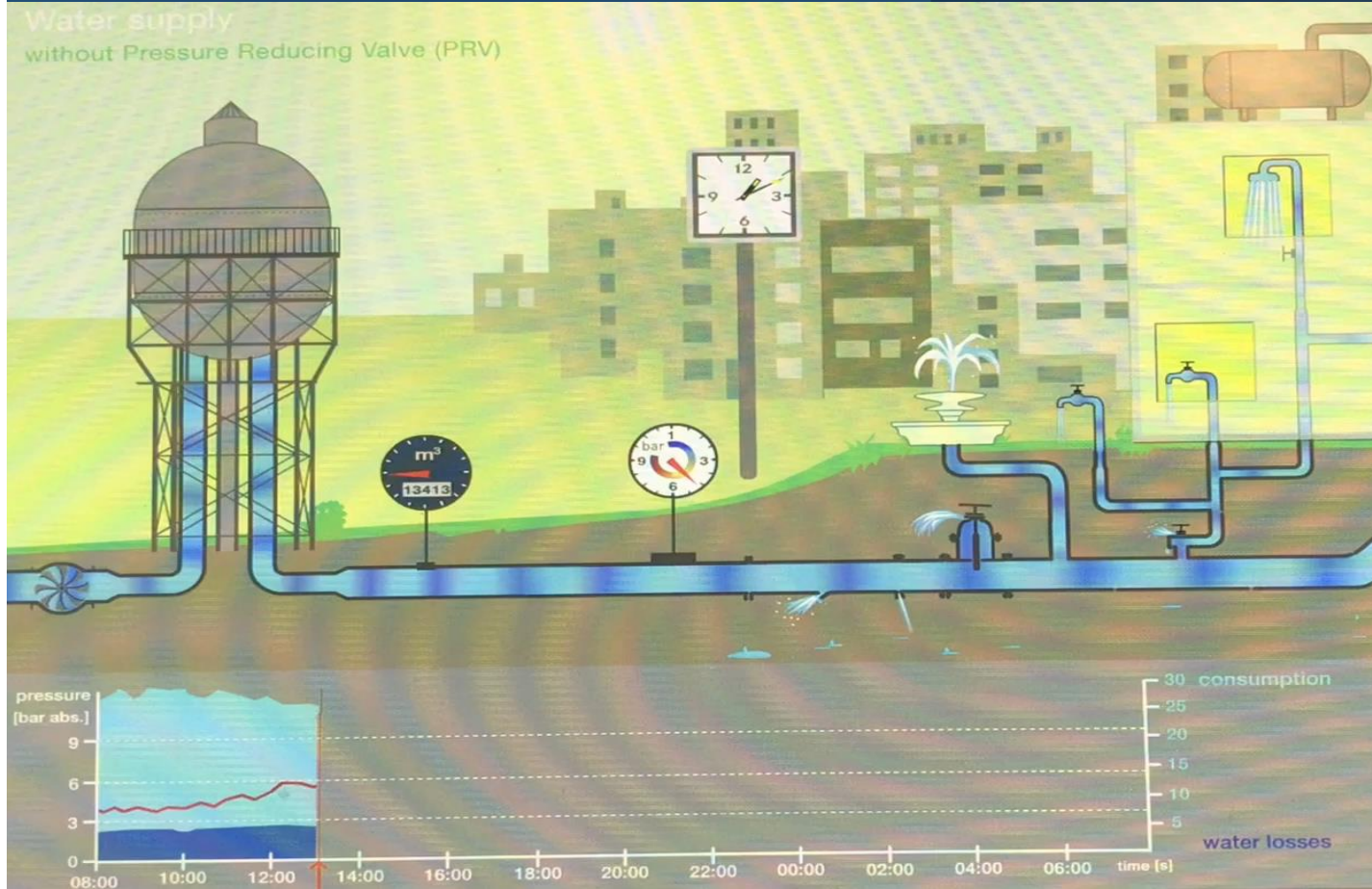


Normal PRV Operations



No Pressure Control

Water supply
without Pressure Reducing Valve (PRV)



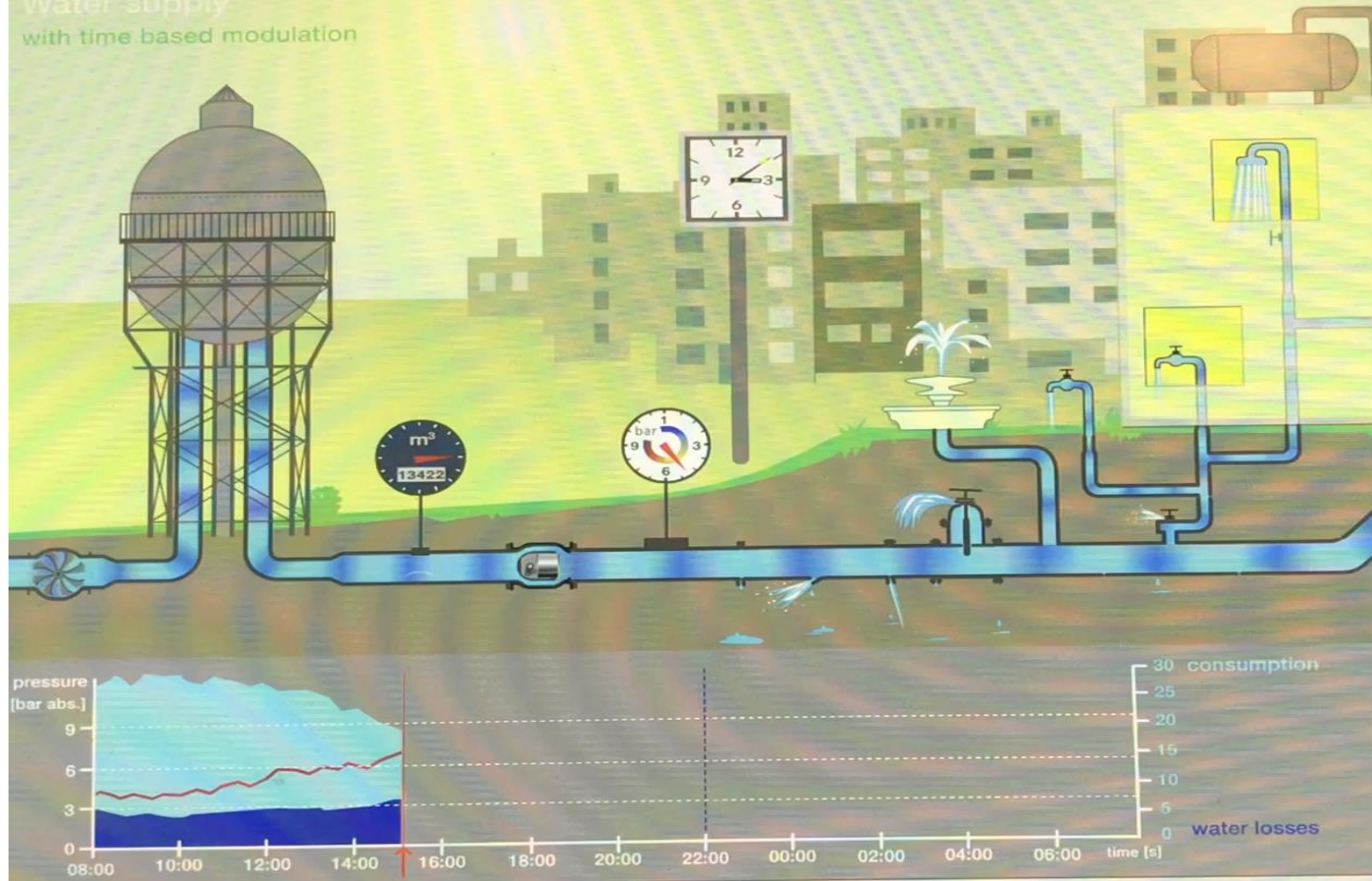
Modulated Control Options

To combat **Critical Point** issues and get greater savings simply add a controller in either of the following modes:

- ☐ **Night/Day (Timed)**
- ☐ **Flow Modulated- Flow Meter**
- ☐ **Critical Point Control**

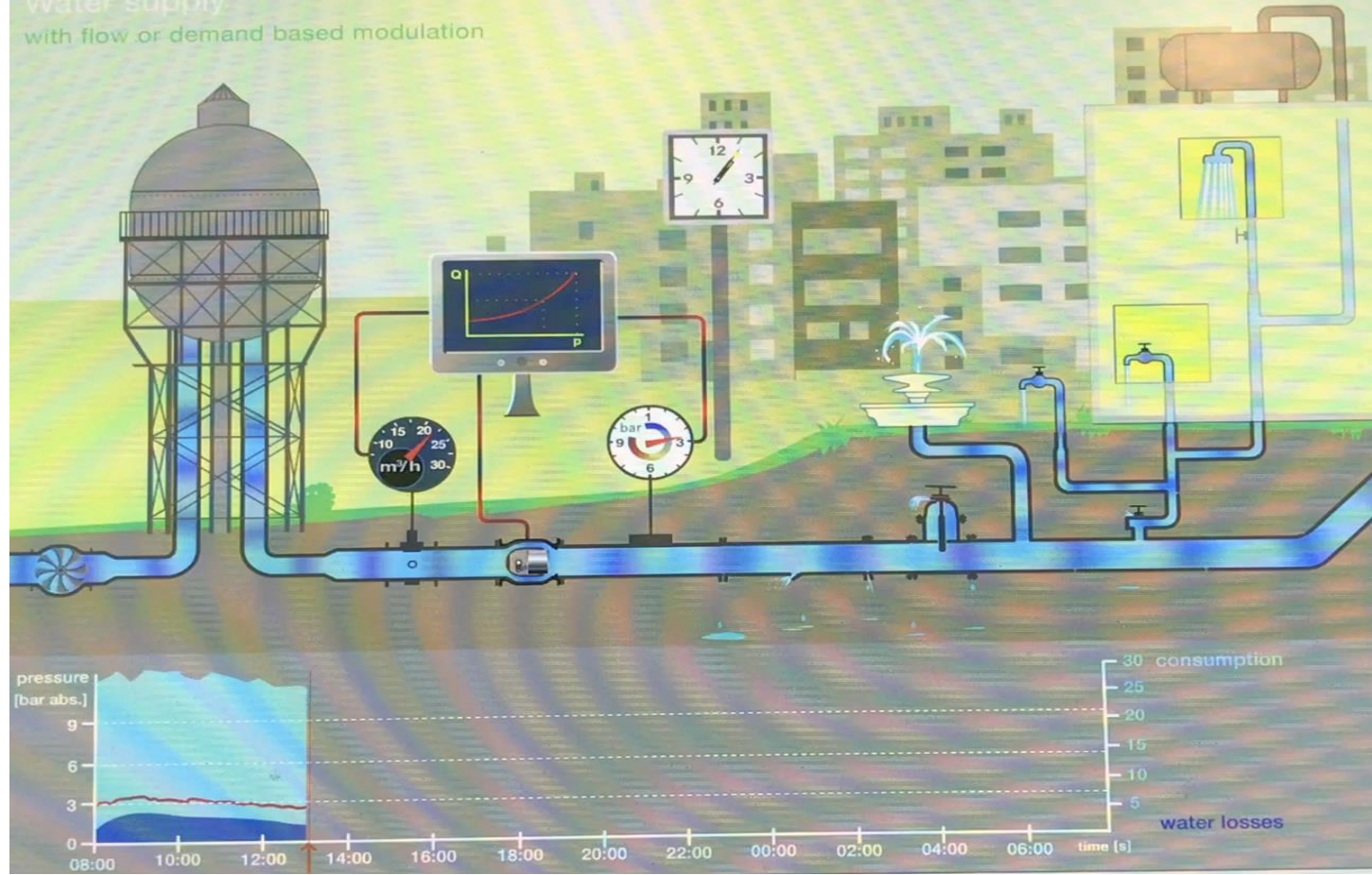
Timed Control

Water supply
with time based modulation



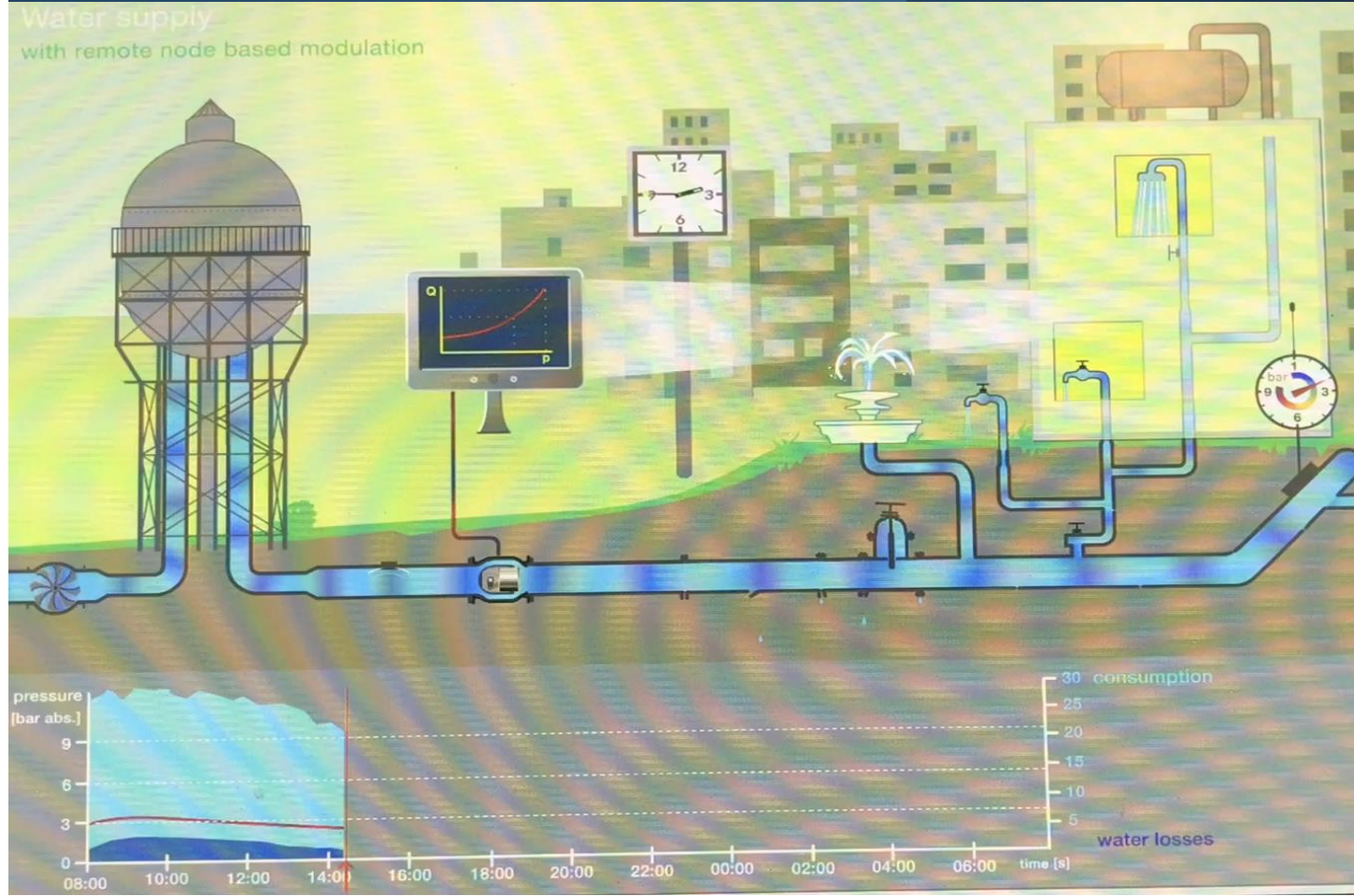
Modulated Flow Control

Water supply
with flow or demand based modulation

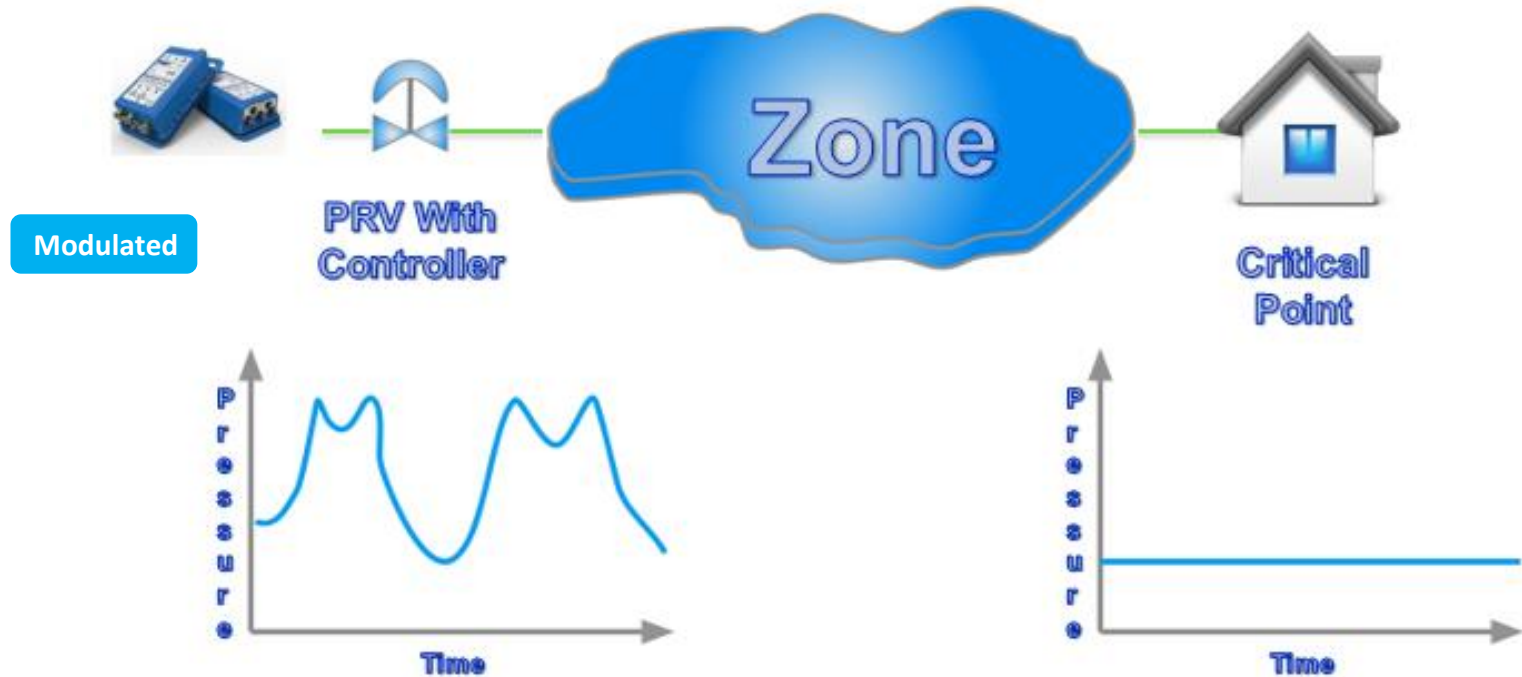


Critical Point Control

Water supply
with remote node based modulation



Modulated Pressure Management

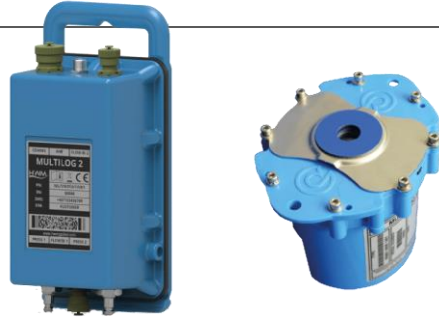


Savings and Reductions of Application

- 74% Reduction of pipe burst
- 18% Savings in chemical cost
- 17% Reduction on labor cost
- 15% Reduction in Energy cost

Pressure Monitoring Devices

Remote
Pressure



Water
Quality



Pressure
Transient



Flow Rod



Localization Inside the Pipe

Hydrophone plus Pressure Transducer

- Continuous logging
- Multiple alarm profiles
- Audio & correlation on leak alarm



PLASTIC PIPE!!!



Acoustic Leak Detection

Active Leak Detection

Localize



Acoustic Noise Logging
For Leak Localization



Ground Microphones
For Leak Surveying
Locate



Correlators For
Leak Pinpointing
Locate



The 5 factors that affect leak sound transmission:

1.Type of Pipe

2.Size of Pipe

3.Pressure

4.Size of Leak

5.Soil Conditions

Noise Sources

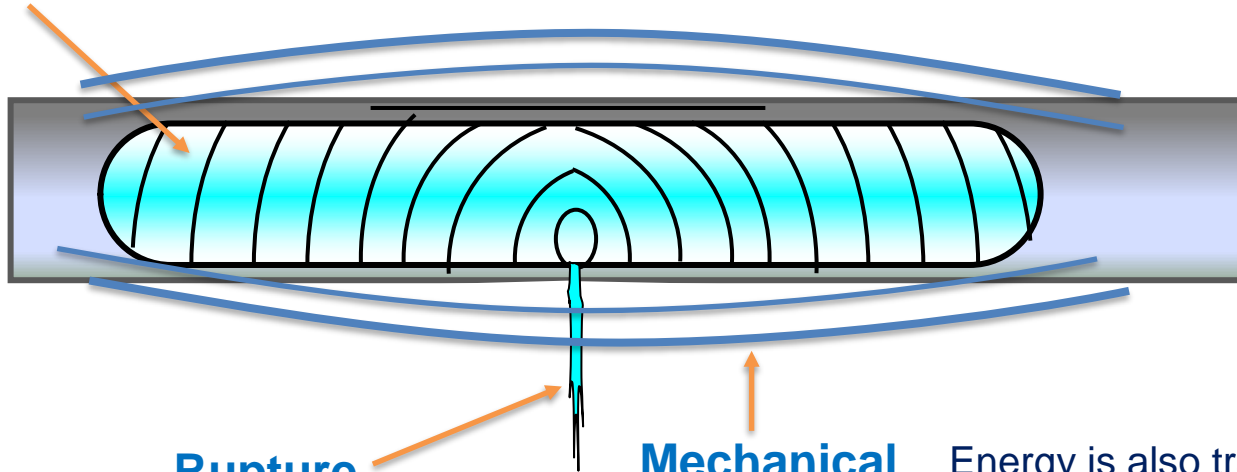
- Leaks
- Partial obstructions
- Customer use
- Pressure reducing valves (PRV's)
- Partially closed valves
- Proximity to sewer/culvert pipe
- Changes in diameter
- Pumps
- Transformers

Only a trained human ear can differentiate leak noise from other sources of noise.

Acoustic Noise Transfer

**Pressure
Wave**

Energy generated from the leak is transmitted through the water

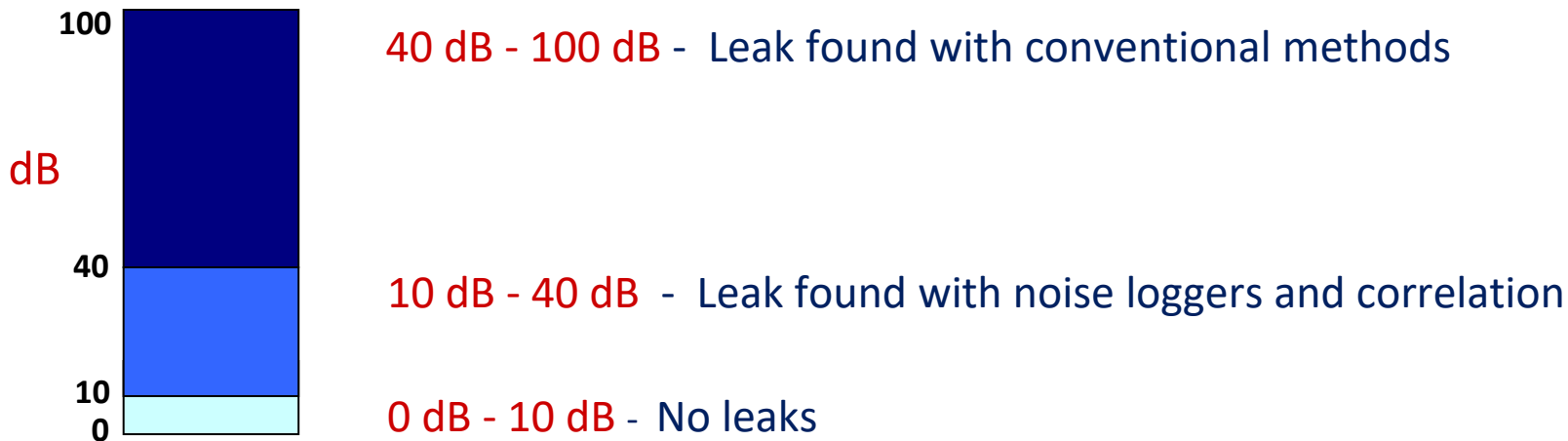


Rupture

**Mechanical
Vibration**

Energy is also transmitted through the pipe wall

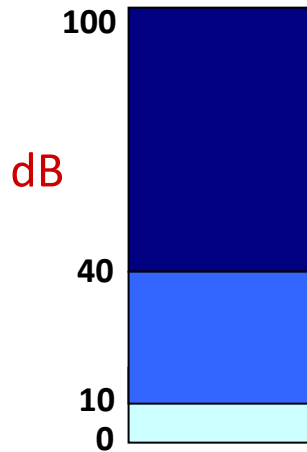
Decibel Ranges



Leaks on plastic pipes are often found at intensities of 20-40dB

Decibel Ranges

Leaks on plastic pipes are often found at intensities of 20-40 dB.



40 dB - 100 dB - Leak found with conventional methods

10 dB - 40 dB - Leak found with noise loggers and correlation

0 dB - 10 dB - No leaks

95-110dB	Motorcycle
90dB	Subway train
80dB	Alarm clock, blender
70-80 dB	Coffee grinder
70dB	Washing machine, TV
60-95 dB	Hairdryer
60dB	Normal conversation noise
50dB	Refrigerator humming, office environment
40dB	A babbling brook, birds chirping
30dB	Whispering nearby
20dB	Leaves rustling in a tree
10dB	Normal breathing

Network Tools

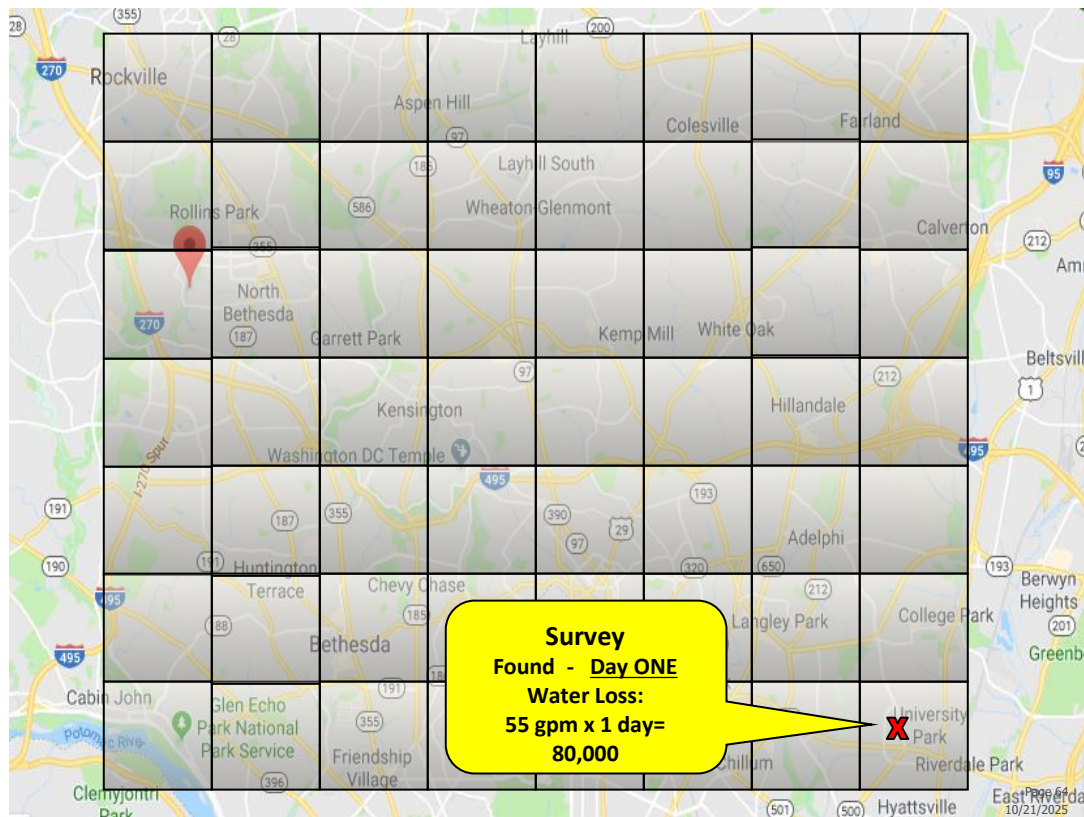
Acoustic Monitoring



Cellular

RF Drive-By

Network Monitoring versus a Survey







FCS 2004 presentation v010H

System Integration


- Integrated sensor and electronics
- Bluetooth connection
- Deployment app
- Auto-correlation
- GIS imports
- Tilt detection







4:22   


HWM Deployment App 


SITE DETAILS


Installation type 


 SMS Number 

 GPS Coordinates 

Site Address 

Site ID 





Zone/DMA 

Site Notes 

PIPE AND CHAMBER

Pipe Material N/A

SAVE

 Install  Swap  Database  Options

System View

Filter Sites

Hide Filters

Mode ▼

Show ▼

Active ▼

Associated with ... ▼

Search by Address, ID, Serial or SMS ▼

Called in

★ Show selected sites

Clear filters



The Grazing Board

Legend ▼

- No leak
- Quiet
- Investigation Ongoing
- Awaiting Repair
- Investigation Cleared
- Customer Side Leak
- ▲ Confirmed Noise Source
- Bad Sensor

Red border or fill indicates leak

Sites on the map: 530

Map

Satellite

DMA Summary ▼

Adams St

Gunders Ave



Site Details ☆

Edit

More

Back

Accounts List

Site ID:

14-060



Create Job Pack ⁱ

Easy ID:

Address:

545 Gunderson Ave, Oak Park, IL 60304, USA

Secondary Address:

GPS:



41.877961408471 , -87.7869189834368

Open in maps

System View

Filter Sites

Hide Filters

Mode ▼

Show ▼

Active ▼

Associated with ... ▼

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Map

Satellite

DMA Summary ▼

Adams St

Gundersen Ave



Site Details ☆

Edit

More

Back

Accounts List

Sms Number:

311270025836005

Deactivate Site

Serial Number:

142701

Status:

Leak

Battery:

3.6 V

CSQ:

12

Last called in:

08/05/2025 6:22 AM

Level:

24

Spread:

3

Last data received:

08/05/2025 3:30 AM

System View

Filter Sites

Hide Filters

Mode ▼

Show ▼

Active ▼

Associated with ... ▼

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Clear filters



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Sites on the map: 530

Map

Satellite

DMA Summary ▼

Adams St

Gunders Ave

PTS Local Res

Site Details ☆

Edit

More

Back

Accounts List

Orientation:

OK(Vertical)

Last Note From Permanent:

Leak on Service 12-5-24 Detected by ATS/Jack

Installation note:

Owner:

Oak Park IL

Logger mode:

Awaiting Repair

Threshold:

15

System View

Filter Sites

Hide Filters

Mode ▼

Show ▼

Active ▼

Associated with ... ▼

Search by Address, ID, Serial or SMS ▼

Called in



Show selected sites

Clear filters



Map

Satellite

DMA Summary ▼

The Grazing Board

Legend ▼

- No leak
- Quiet
- Investigation Ongoing
- Awaiting Repair
- Investigation Cleared
- Customer Side Leak
- ▲ Confirmed Noise Source
- Bad Sensor

Red border or fill indicates leak

Sites on the map: 530

Site Details ☆

Edit

Threshold:

Last Recording:

00:00



Account Associations

Oak Park IL

Oak Park IL - Installed

Correlations

History

Notes History

Gallery

Histogram

DataView

Logger Programming

CSQ

Signal - RSRP, RSRQ

LNS

Audio

Audio List

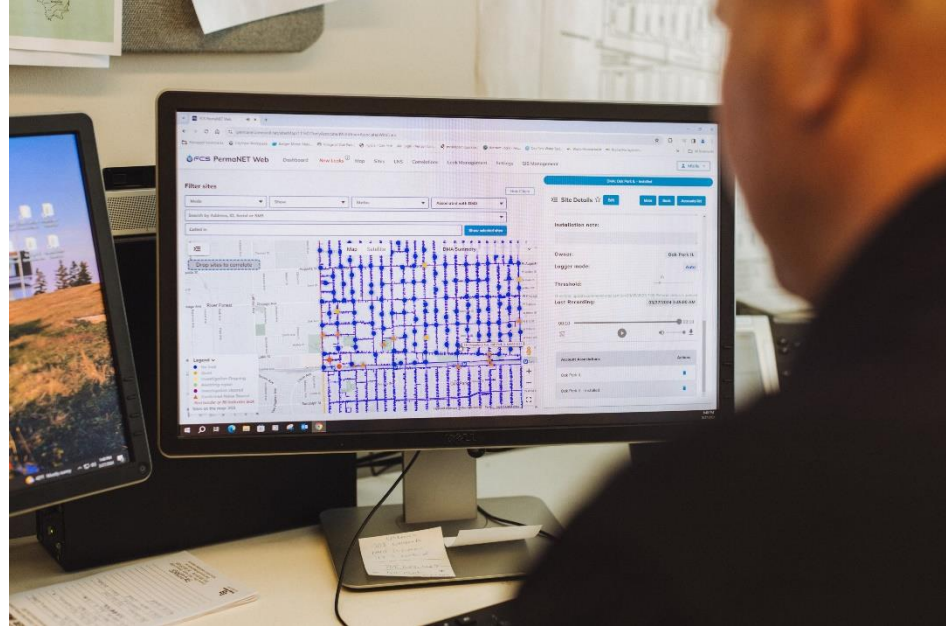
Add Leak

Lid Installation for Northern Climates



Monitoring and Data Analytics

Is monitoring and data analytics offered?

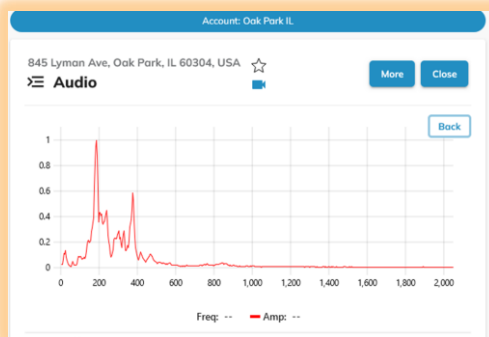


Secondary Validation

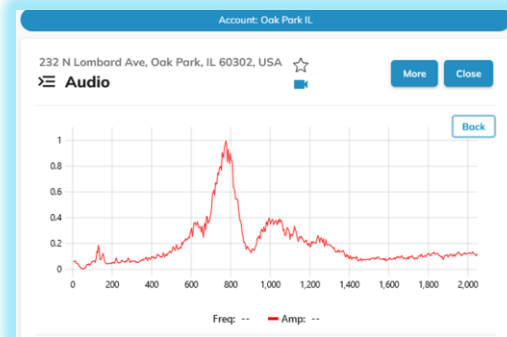
- ***Audio Files*** – Listen to the leak from anywhere.
- ***Histograms*** – Detail the noise level, the spread and the peak percentage of the noise levels.
- ***Correlation*** – Calculate leak location distance from multiple sensors with the audio files.

Audio Files

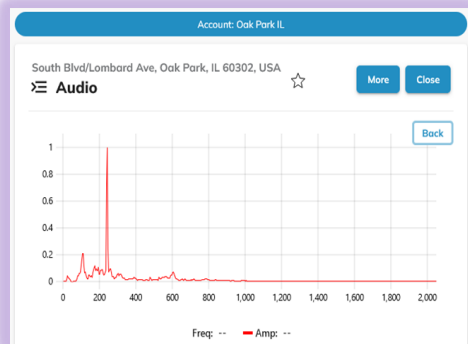
Amplitude by Frequency



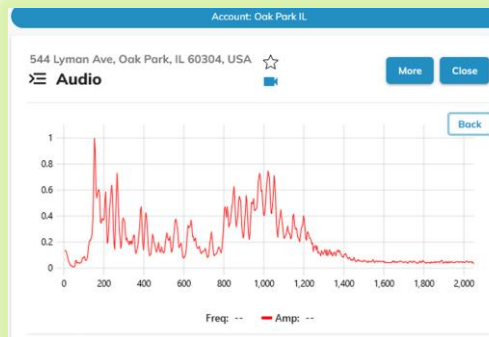
Large OD Pipe Leak



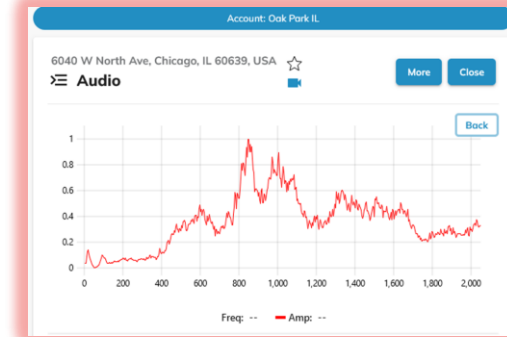
Packing Leak



Electrical

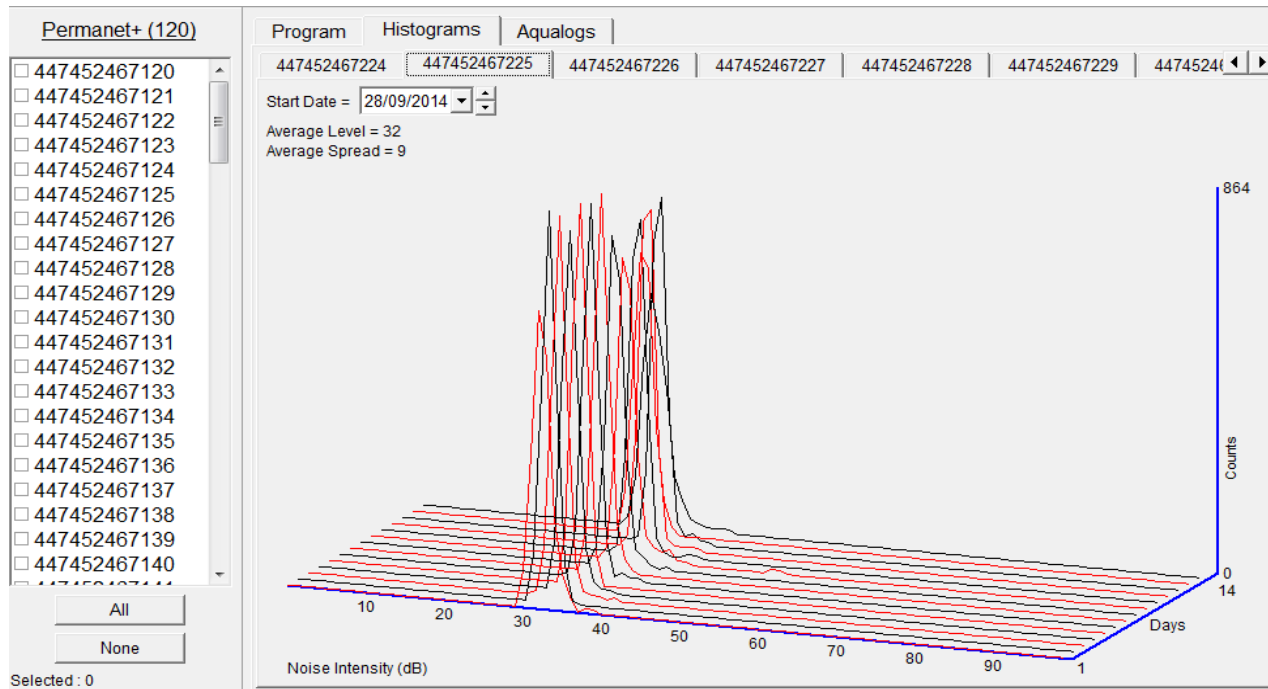


Small OD Pipe Leak

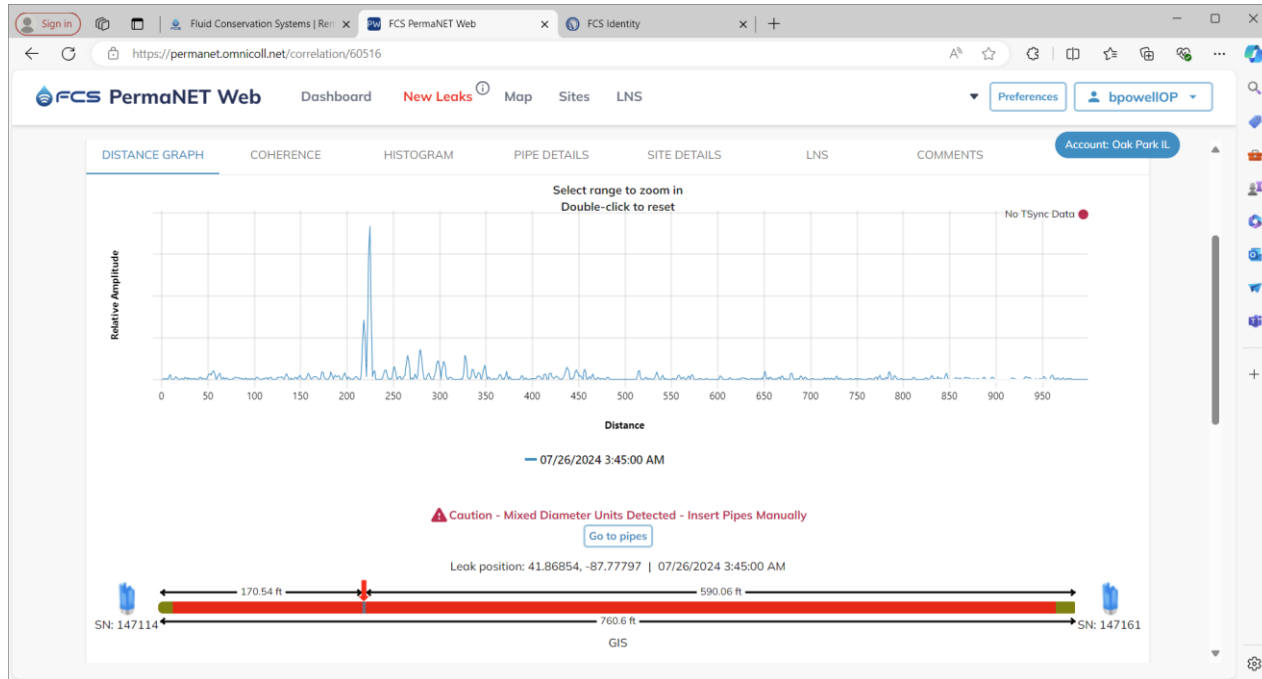


Hydrant Leak

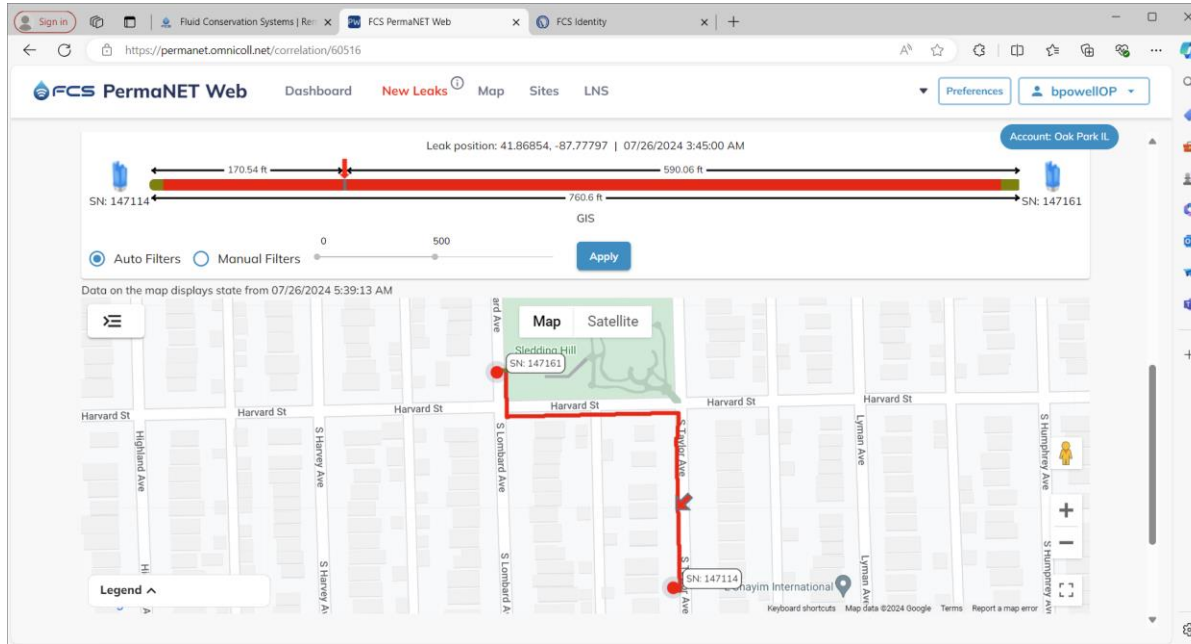
Histograms



Correlation



Correlation Location



Leak Detection Pilot Program

Ask the manufactures to be able to pilot any loggers.

- **How many loggers do you get in the pilot?**
- **How long does the pilot last?**
- **Is analysis provided during the pilot?**
- **Who will deploy the pilot?**
- **Can the loggers be moved during the pilot?**
- **How much does the pilot cost?**
- **Do I get any sort of credit at the end of the pilot?**



The Sound Choice
for Leak Detection.™

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