AIM Network
2019 Asset Management Conference

A Comprehensive Approach to Non-Revenue Water

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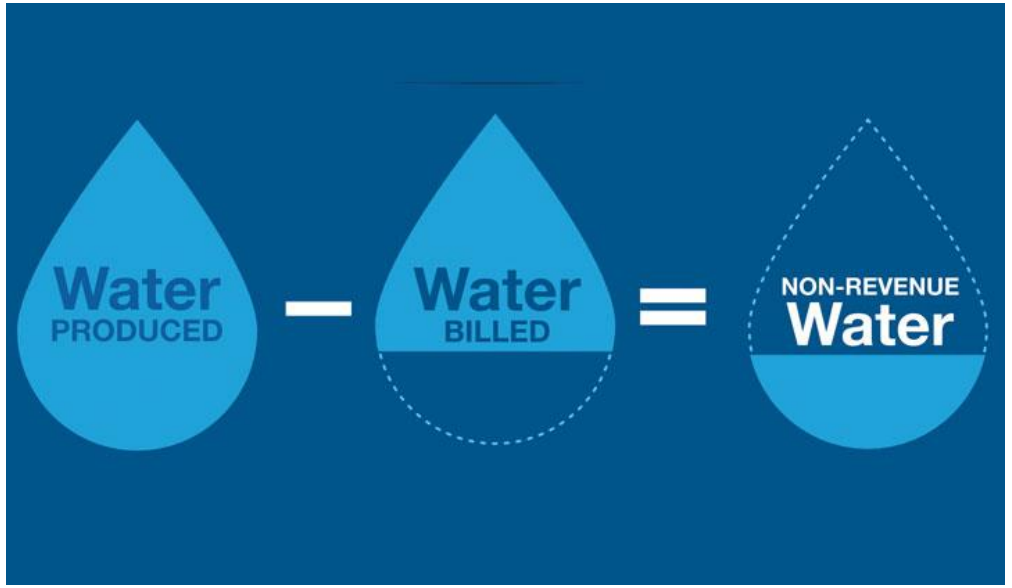
Agenda

- Non-Revenue Water
  - 101
  - Real vs Apparent Loss
  - Volume & Value
- Solutions for Real Loss
  - Transmission Mains
  - Distribution System Monitoring
- Solutions for Apparent Loss
  - Clayton County Water Authority, Georgia Case Study

Non-Revenue Water 101

Water that has been produced and is ‘lost’ for before it reaches the customer.

- Estimated 32 billion m^3 lost each year annually
- Half of which occurs in developing countries
- Real versus apparent loss



Non-Revenue Water – Real Loss

Real Loss:

- Physical losses
- Leakage
- Storage overflows

Unreported Leaks (not surfacing)

Reported Leaks (surfacing)

Non-Revenue Water – Apparent Loss

Apparent Loss:

- Non physical losses
- Customer meter inaccuracies
- Systematic data handing errors in billing systems
- Unauthorized consumption

Real Water Losses and Costs

Water Supplied Per Day (m3 / day)	Water Supplied Per Year (m3 / year)	Water Loss Per Year (12% of Water Supplied) (m3 / year)	Variable Cost ($ / m3)	Value of Water Loss Per Year ($ / year)
125,000	45,625,000	5,475,000	$0.75	$4,110,000
75,000	27,375,000	3,285,000	$0.75	$2,460,000
50,000	18,250,000	2,190,000	$0.75	$1,640,000
20,000	7,300,000	876,000	$0.75	$660,000
10,000	3,650,000	438,000	$0.75	$330,000
5,000	1,825,000	219,000	$0.75	$160,000
2,500	912,500	109,500	$0.75	$80,000

Apparent Loss - Under Registering Customer Meters

Water Supplied Per Year (m3 / year)	Customer Meter Under-Registration (%)	Water Sold To Customers Per Year (15% NRW) (m3 / year)	Water and Sewer Rate ($ / m3)	Revenue Loss Per Year ($ / year)
45,625,000	3%	38,780,000	$2.25	$2,620,000
27,375,000	3%	23,270,000	$2.25	$1,570,000
18,250,000	3%	15,510,000	$2.25	$1,050,000
7,300,000	3%	6,210,000	$2.25	$420,000
3,650,000	3%	3,100,000	$2.25	$210,000
1,825,000	3%	1,550,000	$2.25	$100,000
912,500	3%	780,000	$2.25	$50,000

Total NRW 15% - Leakage 12% and Customer Meters 3%

Real and Apparent Losses Total

Water Supplied Per Year (m3 / year)	Real Losses (Water Loss) ($ / year)	Apparent Losses (Revenue Loss) ($ / year)	Total Losses ($ / year)
45,625,000	$4,110,000	$2,620,000	$6,730,000
27,375,000	$2,460,000	$1,570,000	$4,030,000
18,250,000	$1,640,000	$1,050,000	$2,690,000
7,300,000	$660,000	$420,000	$1,080,000
3,650,000	$330,000	$210,000	$540,000
1,825,000	$160,000	$100,000	$260,000
912,500	$80,000	$50,000	$130,000

Solutions for Real Loss – Transmission Main Leaks
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Why do pipelines fail?

27%

Internal Corrosion

19%

External Corrosion

19%

3rd Party Damage

15%

Joint leakage

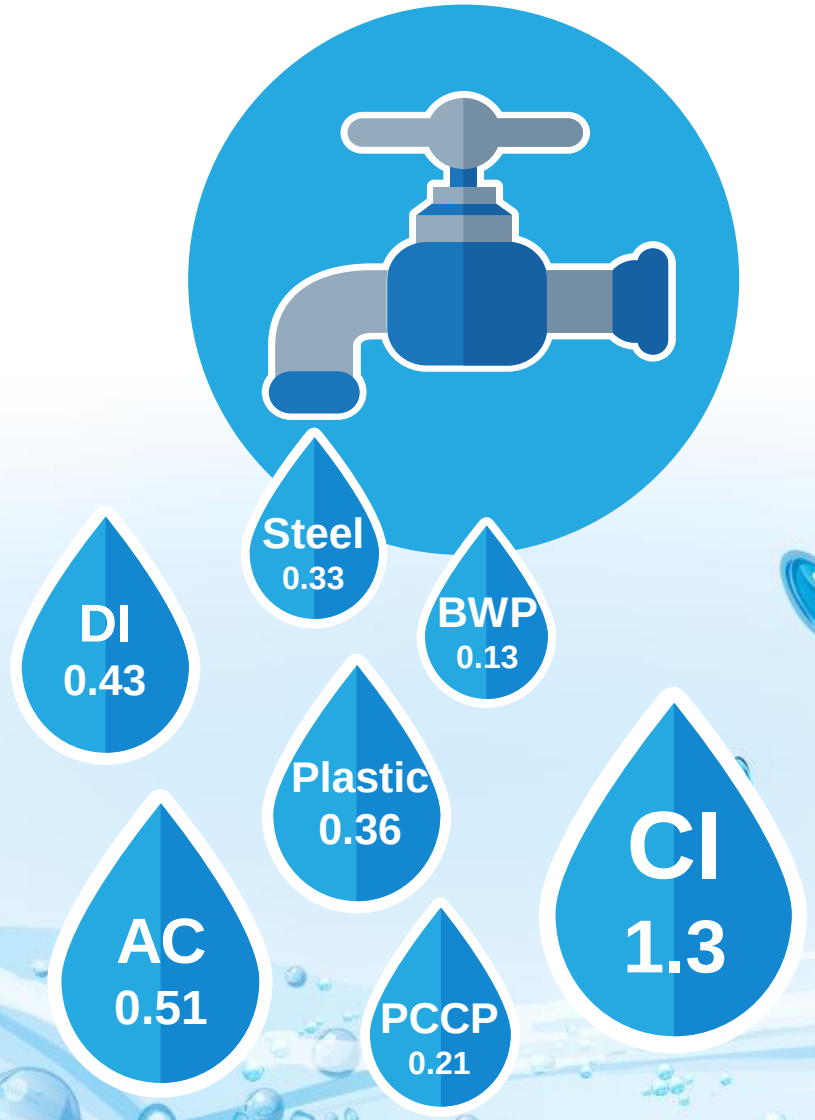
10%

Surge pressure

10%

Capacity

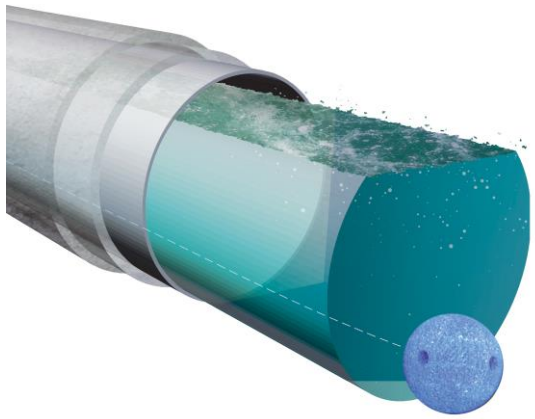
Leaks by Pipe Type



Leaks per kilometer

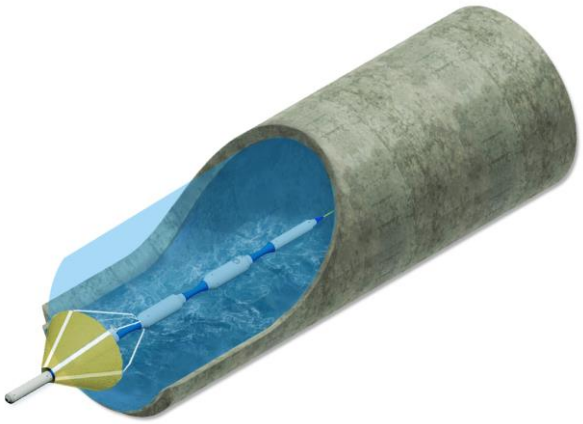
Inline Acoustic Leak & Gas Pocket Detection Technologies

SmartBall®



Free swimming
All pipe materials
150mm diameter and greater
+/- 1.5 m location accuracy
100mm insertion
Inspection length up to 20 km
Pipeline mapping available

Sahara®



Tethered
All pipe materials
150mm diameter and greater
+/- 0.5 m location accuracy
50mm insertion
Inspection length up to 1.5 km
Pipeline mapping not available

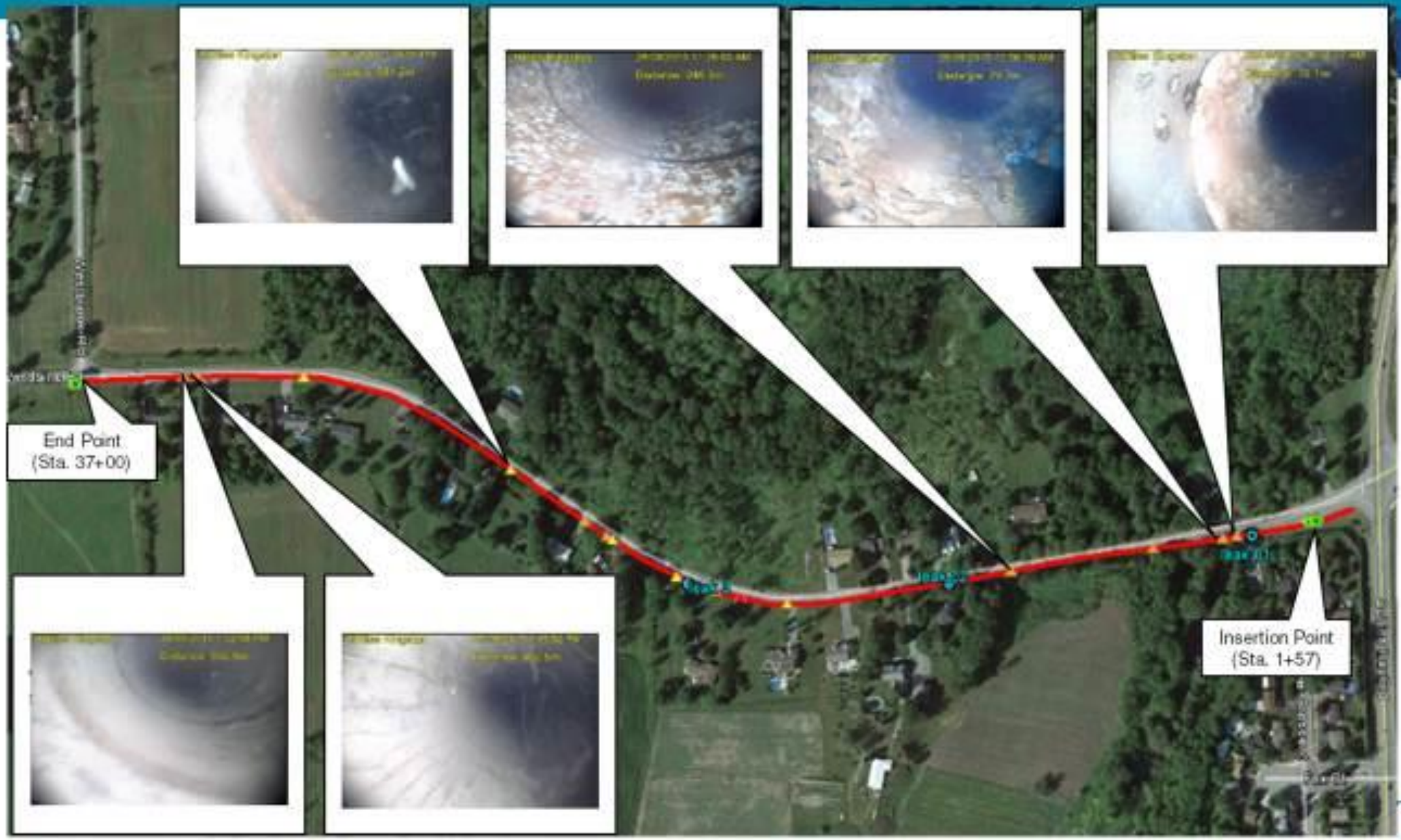
SmartBall - Summary

- SmartBall is a free-swimming acoustic leak detection tool that can detect and locate very small leaks and gas pockets with high accuracy
- Applicable in pressure pipelines over 150mm and in all pipe materials including PCCP, metallic, and PVC
- Applicable in water and wastewater networks
- Mapping, Temperature, Pressure

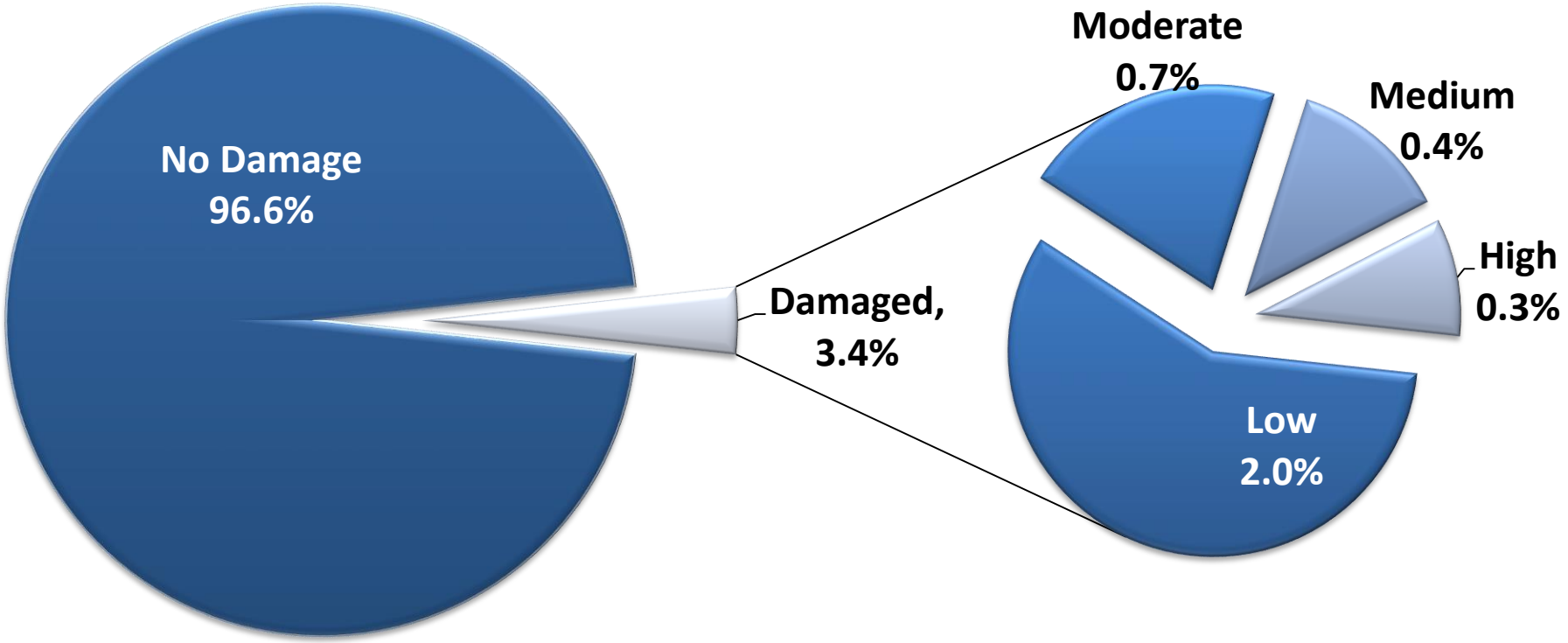
Sahara – Summary

- Sahara is an inline leak and air pocket detection platform with CCTV and sub-meter mapping technology for all pipe materials
- No disruption to service
- Used in pipelines 150mm in diameter or larger
- 50mm or larger tap (any orientation) required for insertion
- Same day results
- Ideal in complex and urban systems

CCTV



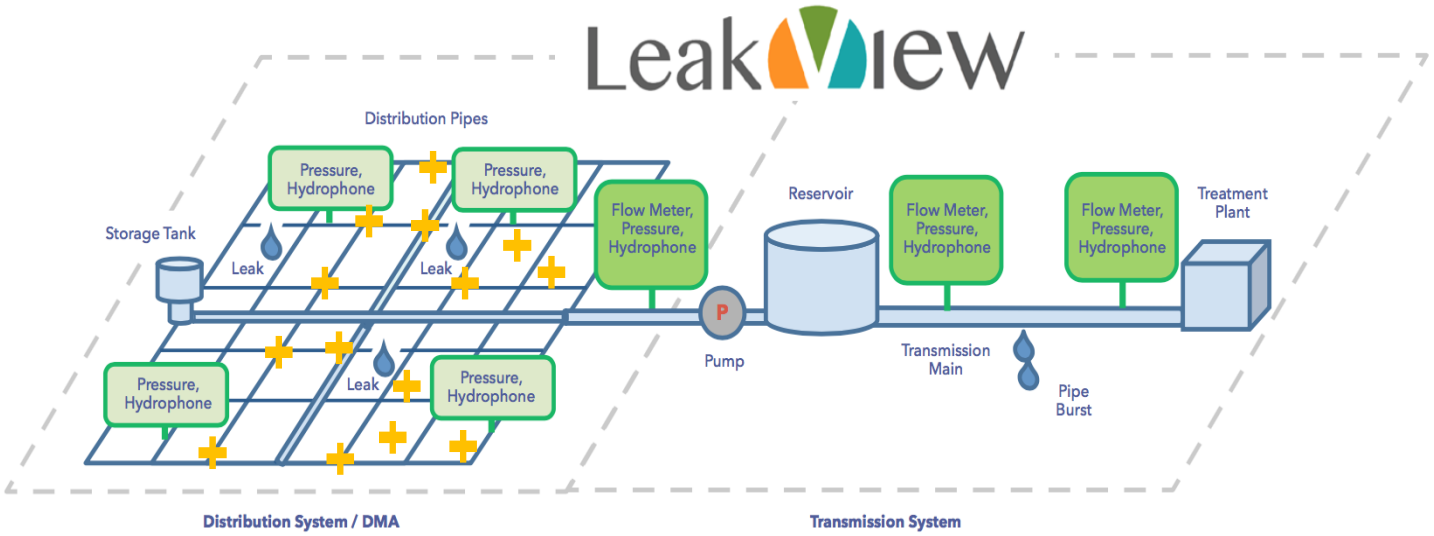
Typical Inspection Results



Solutions for Real Loss – Distribution System Monitoring
Visenti, A Xylem Brand

Distributed Sensors & Smart Networks

Leak detection, localization, and notification



Hydrophones

Detect slow growing leaks

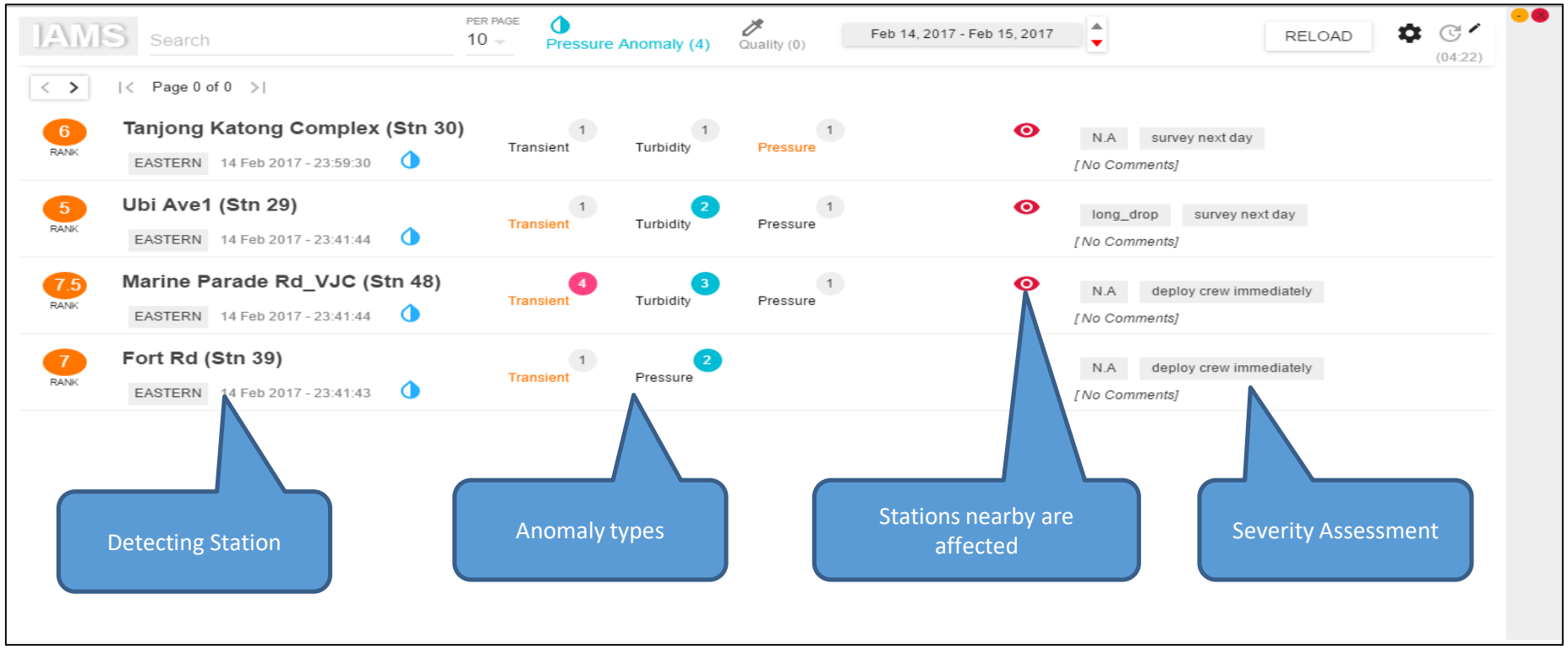
Pressure Sensors

Detect and localize bursts

Meters

Provides NRW calculations

LeakView Interface



Pressure transient-hydrophone sensors providing extensive pipeline coverage, and 24/7 alerts allow cost effective large-scale pipe failure detection on critical parts of the network.

24/7 365

Real-time Alarms sent to a 24/7 control room help monitor the pipe network, prevent false alerts and improve response time.

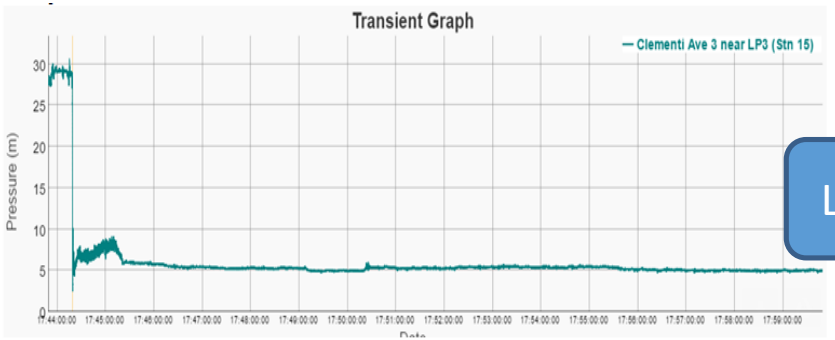
AIM network

Atlantic Infrastructure Management Network

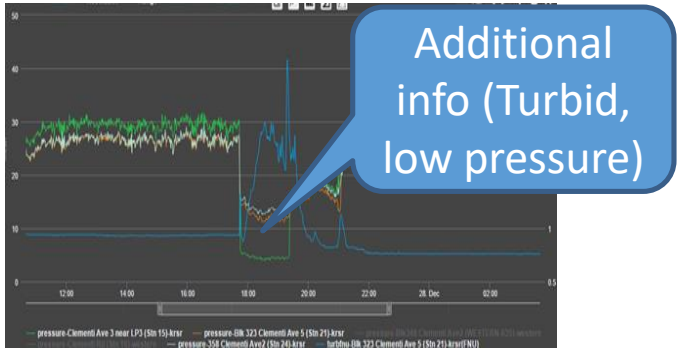
LeakView – Burst example

Transients occurs when pipe breaks at 5:44 PM followed by acoustic noise & turbidity spike:

Acoustic noise due to the leak was picked up on at 6:00PM

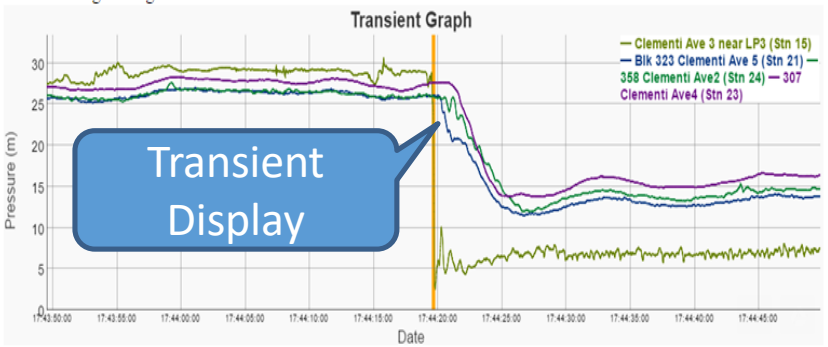


Location info

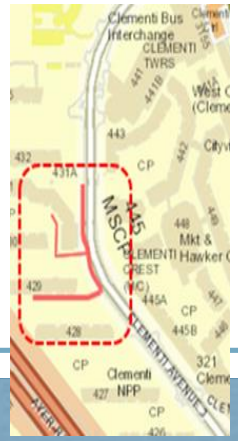


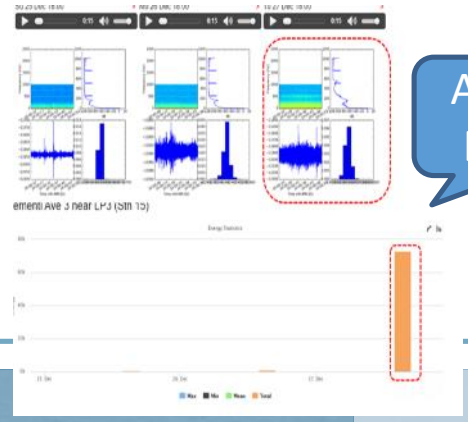
Additional info (Turbid, low pressure)

Plot with neighboring sites:



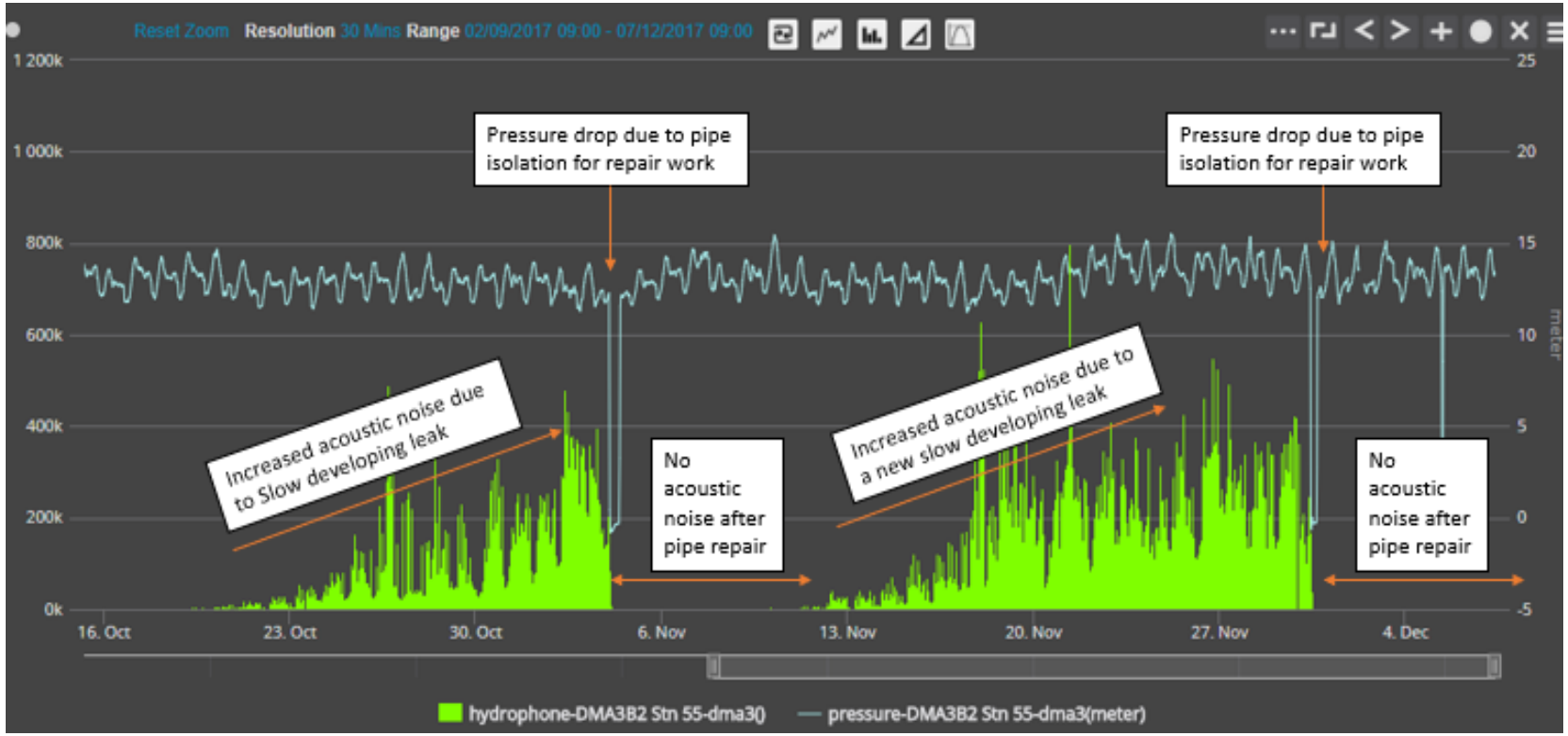
Transient Display



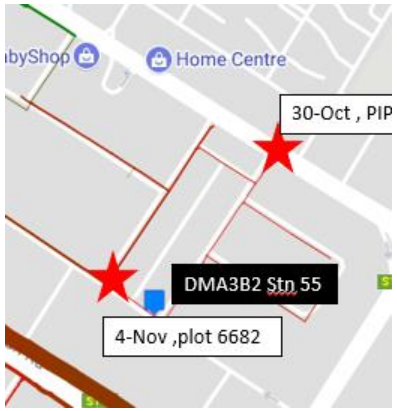


Acoustic Display

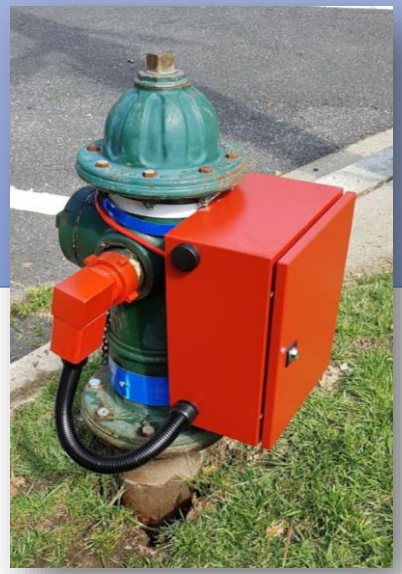
LeakView – Example of slow growing leak



The system has detected increased acoustic noise within a range of 500m from the sensor location due to a slow developing leak. After the pipe has been repaired the acoustic energy has been significantly reduced until a new leak has been detected due to acoustic energy increase. When the second leak has been repaired the acoustic energy has been significantly reduced again meaning that there are no other leaks after the pipe repair



Hardware deployments are flexible



Hydrant deployment

- Temporary
- Flexible
- 10 minutes to install

Vault deployment

- Permanent
- Weather independent
- Better data
- Solar panel to increase battery life

Solutions for Apparent Loss
Valor, A Xylem Brand

Revolutionizing How Water Utilities Work

Using **machine learning** and **analytics** to inform **operational interventions** to transform how water utilities operate.

Data Inputs

Historic and current meter and billing data

Machine learning/AI

Data analytics powered by machine learning, to produce informed decisions, recover revenue, reduce costs

Industry Intelligence

Insights driven by industry expertise including knowledge of consumption patterns, AWWA specs, weather impacts, hardware specs & anomalous use

Intuitive Dashboards

Actionable insights are displayed over the web via intuitive dashboards. Analytics are relevant and allow for revenue recovery

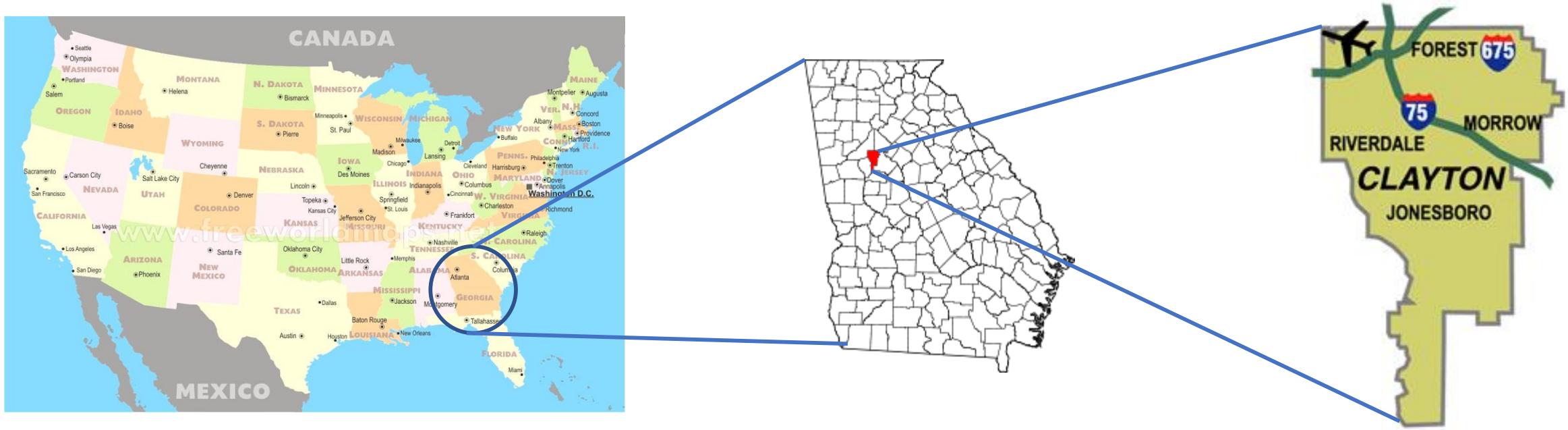
Operational Interventions

Predictive alerts and prioritized operational schedules for repair and replacement, field inspections, validation reporting, and 3rd party testing

Outputs

- Revenue Recovery
- Operational Efficiency
- Informed Operators
- Happy Customers

Clayton County Water Authority (CCWA), Georgia



Clayton County Water Authority (CCWA), Georgia

- One Water Utility (Water, Sewer, & Stormwater)
- ~80,000 accounts
- $110M in revenue, $24M capital/year
- “Utilizing innovation to provide industry leading service to our community”
- Metering and Billing
  - 80,000 meters, mostly mechanical
  - AMR
  - Predominantly residential customers

CCWA – NRW Progression

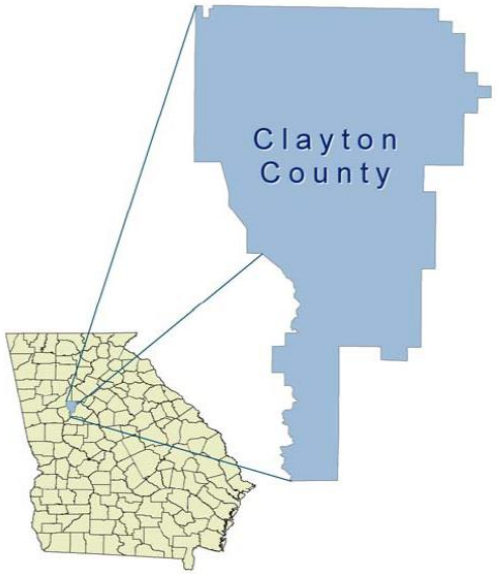
- Challenges
  - Need timely and trusted data insights
  - No structured meter replacement program

- Trial proactive apparent water loss management
  - Identify revenue enhancement opportunities
  - Identify improvement opportunities

CCWA – NRW Program Phase 1

- Phase 1: May – October 2016
  - Determine current state of system
  - Historical data analyzed for past 4 years
  - ~76,000 meters identified as available for apparent loss over 8 categories
  - CCWA gained a high level understanding of key problem areas

CCWA – Phase 1 Results



Meter Under-Registration: Residential Results

	Meter Size (Inches)	No. Discrete Flags (6 month total)	Estimated Revenue Loss (4 Years)
Residential	0.625	2,000	$ 446,341
	0.75	208	$ 3,085
	1	107	$ 5,853
	4	20	$ 107
Total		**2,335**	**$ 455,386**
Percentage of residential meters		**3.3%**	
Average $ value per meter		**$ 6.37**	

CCWA – Phase 1 Results Con't

Clayton County Water Authority

Meter Under-Registration: Non-Residential Results

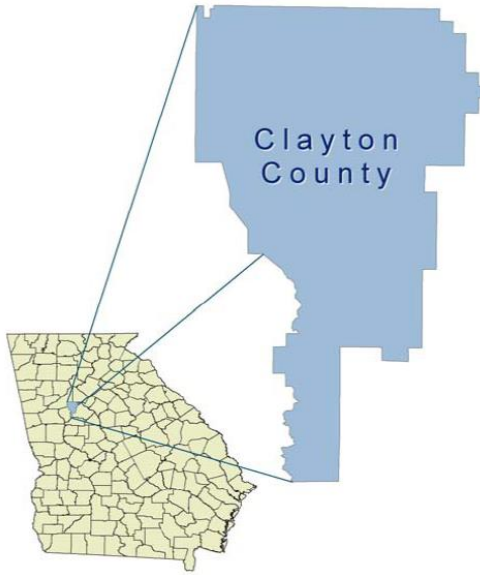
	Meter Size (Inches)	No. Discrete Flags (6 month total)	Estimated Revenue Loss (4 Years)
Non Residential	0.625	148	$ 7,484
	0.75	74	$ 2,590
	1	83	$ 5,908
	1.5	111	$ 45,000
	2	101	$ 141,000
	3	30	$ 3,524
	4	23	$ 2,114
	6	46	$ 86,023
	8	35	$ 4,374
	10	5	$ 622
Total		**656**	**$ 298,639**
Percentage of non residential meters		**14.8%**	
Average $ value per meter		**$ 67.60**	

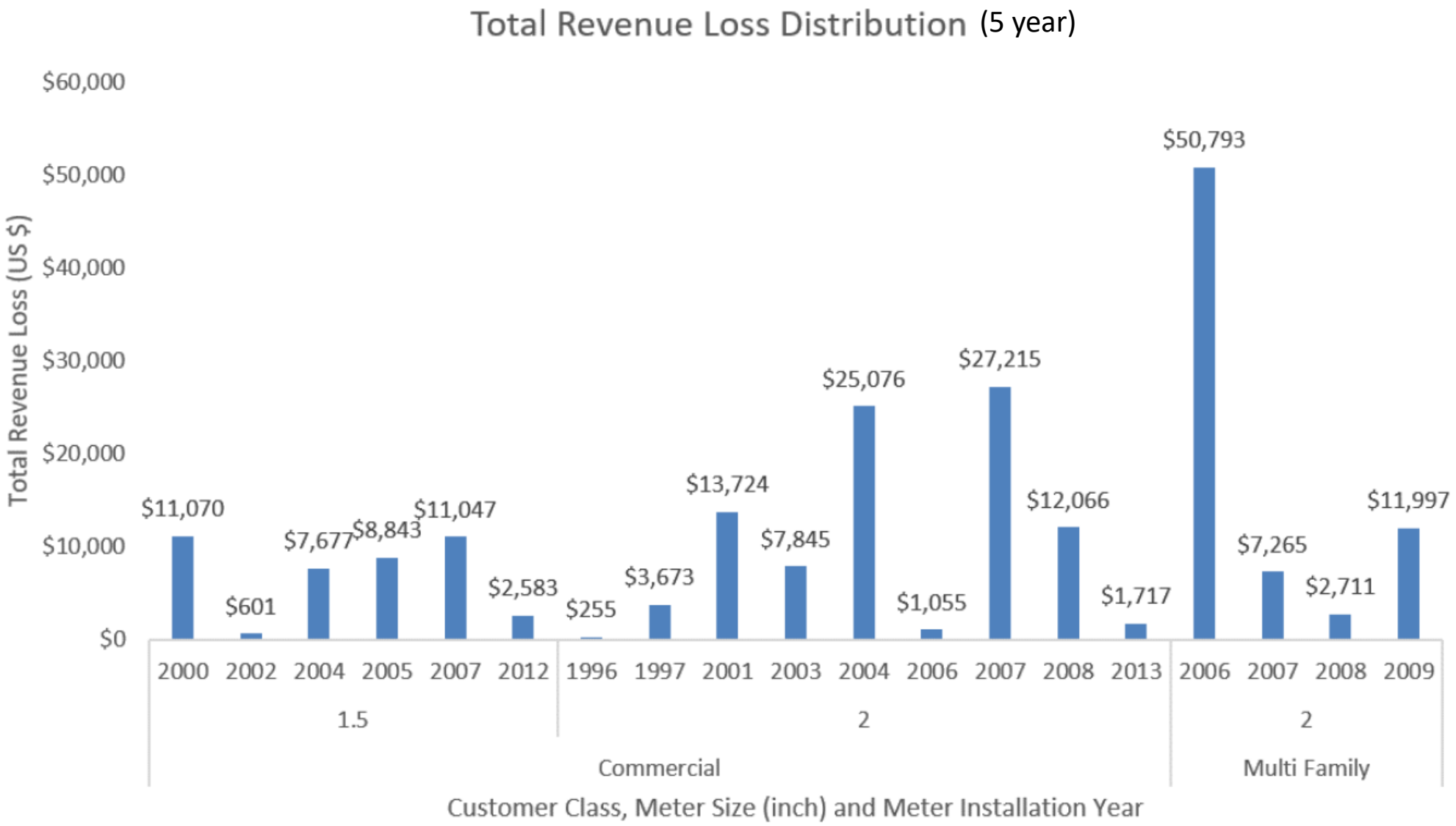
CCWA – NRW Program Phase 2

- Phase 2: March – August 2017
  - Focused on category with highest number of flags: Meter Under Registration
  - 1.5 & 2” meters only
  - Top 100 meters flagged, 72 tested in the field, 28 flagged as under registering
  - 39% hit rate compared to CCWA’s previous 6-10%

CCWA – Phase 2 Results

CLAYTON COUNTY Water AUTHORITY





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CCWA Key Learnings

- Staff programs adequately
- For greater short-term gains, focus on non-residential meters
- Data-science approach enhances the quality of outcomes
- Rethink meter replacement programs
  - Leverage your data!

Thank you!
Questions?