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Reducing Apparent Losses and Recovering Revenue through Component Analysis of Apparent Losses *Philadelphia Water Department*

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Apparent Losses

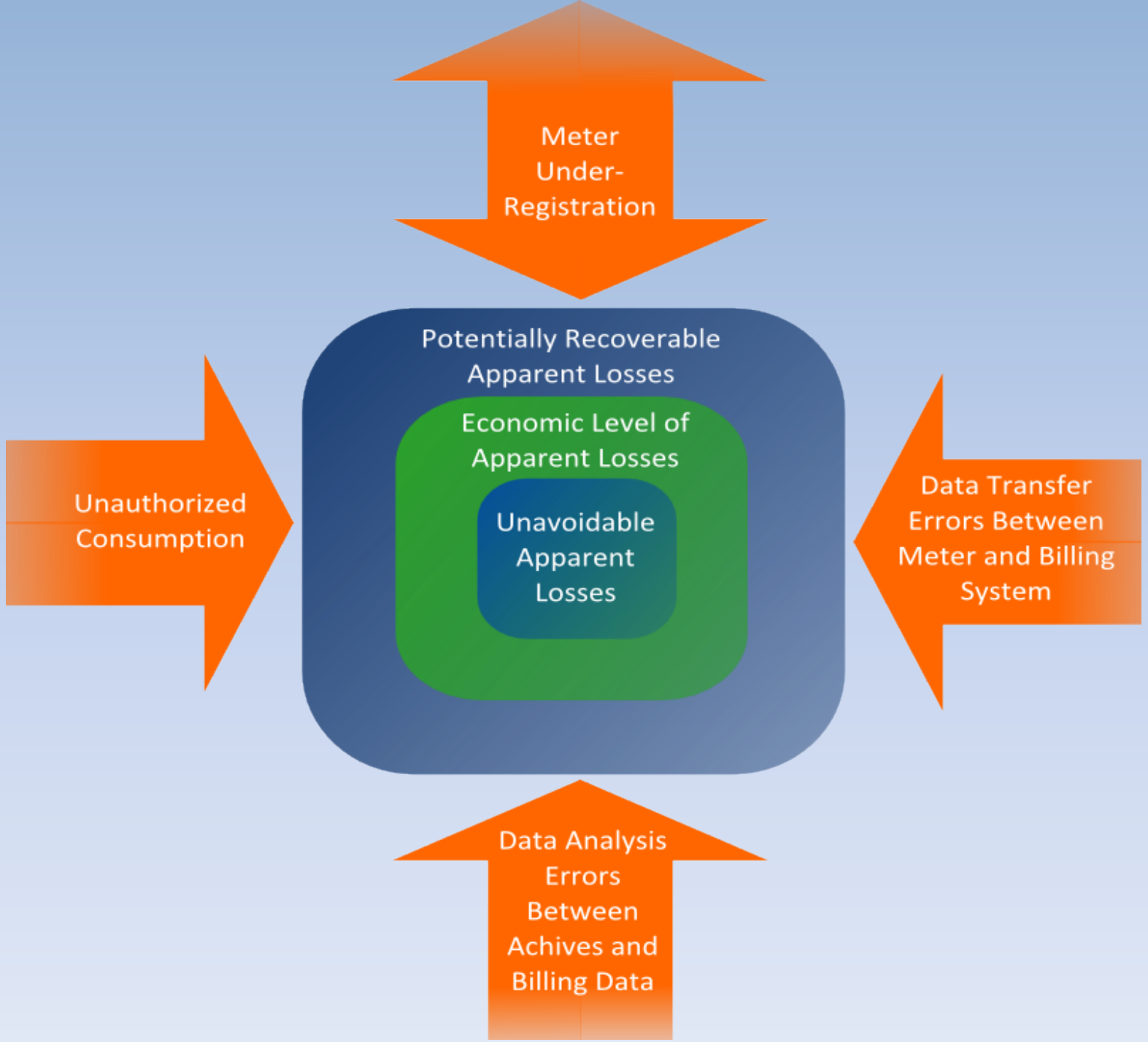
- Are often the most costly losses in a water system, as they are valued at sales $'s

- In many cases generate sufficient new revenue to fund other less attractive but necessary areas of loss control

- Come in several forms and are not limited to simply metering losses

Apparent Losses – Meter Accuracy Errors

- Wear over time, excess volume or abrasive waters
- Environmental problems such as freezing or over heating
- Incorrect installation or lack of maintenance
- Incorrect meter type for the application
- Incorrect meter type for the application
- Incorrect sizing
- Demand type problems such as low flows
- Good installation, selection & sizing practice, routine testing and replacement will resolve these issues


Meter Under-Registration
Potentially Recoverable Apparent Losses
Economic Level of Apparent Losses
Unavoidable Apparent Losses
Unauthorized Consumption
Data Transfer Errors Between Meter and Billing System
Data Analysis Errors Between Achives and Billing Data

AWWA/IWA Water Balance Components

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption
			Billed Un-metered Consumption
		Unbilled Authorized Consumption	Unbilled Metered Consumption
			Unbilled Unmetered Consumption
	Water Loss	Apparent Losses	Customer Meter Inaccuracies
			Unauthorized Consumption
			Systematic Data Handling Error
		Real Losses	Leakage on Distribution and Transmission Mains
			Leakage from Overflows at Storage Tanks
			Leakage on Service Connections up to Point of Customer Meter

Philadelphia's Water Loss Control

- PWD established Water Accountability Committee in 1993
- Since then reduced Non-revenue Water from ~130mgd to ~79mgd
- PWD is a national leader in water loss control

Philadelphia's Water Audit Summary

July 1, 2009 - June 30, 2010 in Million Gallons Per Day (mgd)

Water into Supply -	244.4 mgd
Customer Billed Consumption -	167.8 mgd
Unbilled Water	76.6 mgd

Unbilled Auth. Consumption	2.0 mgd	$ 779,000
Apparent Losses	17.0 mgd	$30,034,000
Real Losses	59.6 mgd	$ 5,868,000
Non-revenue Water	78.6 mgd	$36,522,000

NRW by volume = 78.6 mgd /225.0 mgd = **34.9%**

NRW by cost = $36.5 million/ $224 million = **16.3%**

Apparent Loss indicator = 17 mgd / 553,115 connections = **30.7 gallons/connection/day**

Real Loss indicator = 59.6 mgd / 553,115 connections = **107.7 gallons/connection/day**

Unavoidable Annual Real Losses (UARL) **= 6.0 mgd**

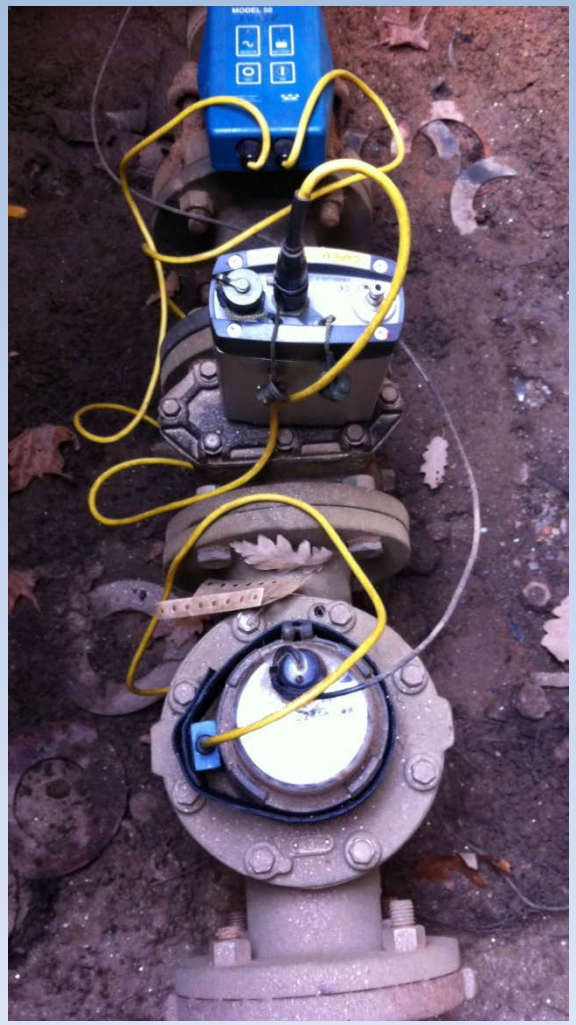
Infrastructure Leakage Index (ILI) = 59.6 / 6.0 = **9.9**

Philadelphia's Water Audit Summary

July 1, 2009 - June 30, 2010 in Million Gallons Per Day (mgd)

- Apparent Losses – 17 mgd with a loss revenue impact of $30,034,000 annually
- Primary Components:
  - Customer metering inaccuracies: 1.9 mgd, $4,110,000
  - Unauthorized consumption: 6.2 mgd, $6,449,000
  - Systematic data handling error: 8.9 mgd $19,475,000
- Customer metering inaccuracies: 77% of losses occur on large meters; PWD has a reliable small meter population
- Project in 2010 continued earlier work to data-log large meters and assess the functionality of the meters. Work also began a pilot of single jet meters in PWD system

Meter Profiling Methodology

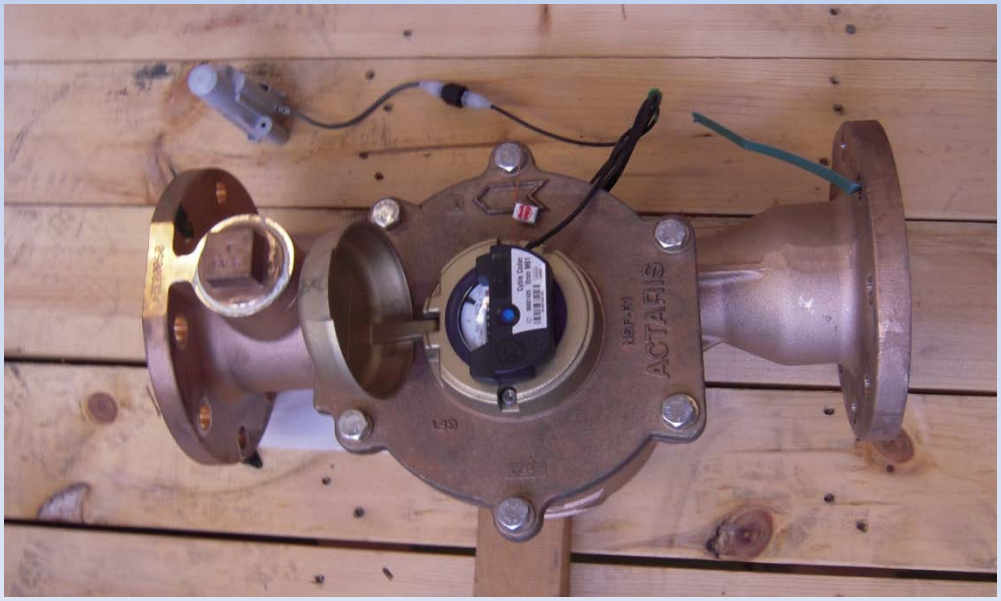


- Determines whether a customer meter is appropriately sized and/or whether the brand/type of meter is suitable for the current demand
- The Flow Meters' magnetic drives were converted to a flow measurement using an F.S. Brainard Meter-Master.

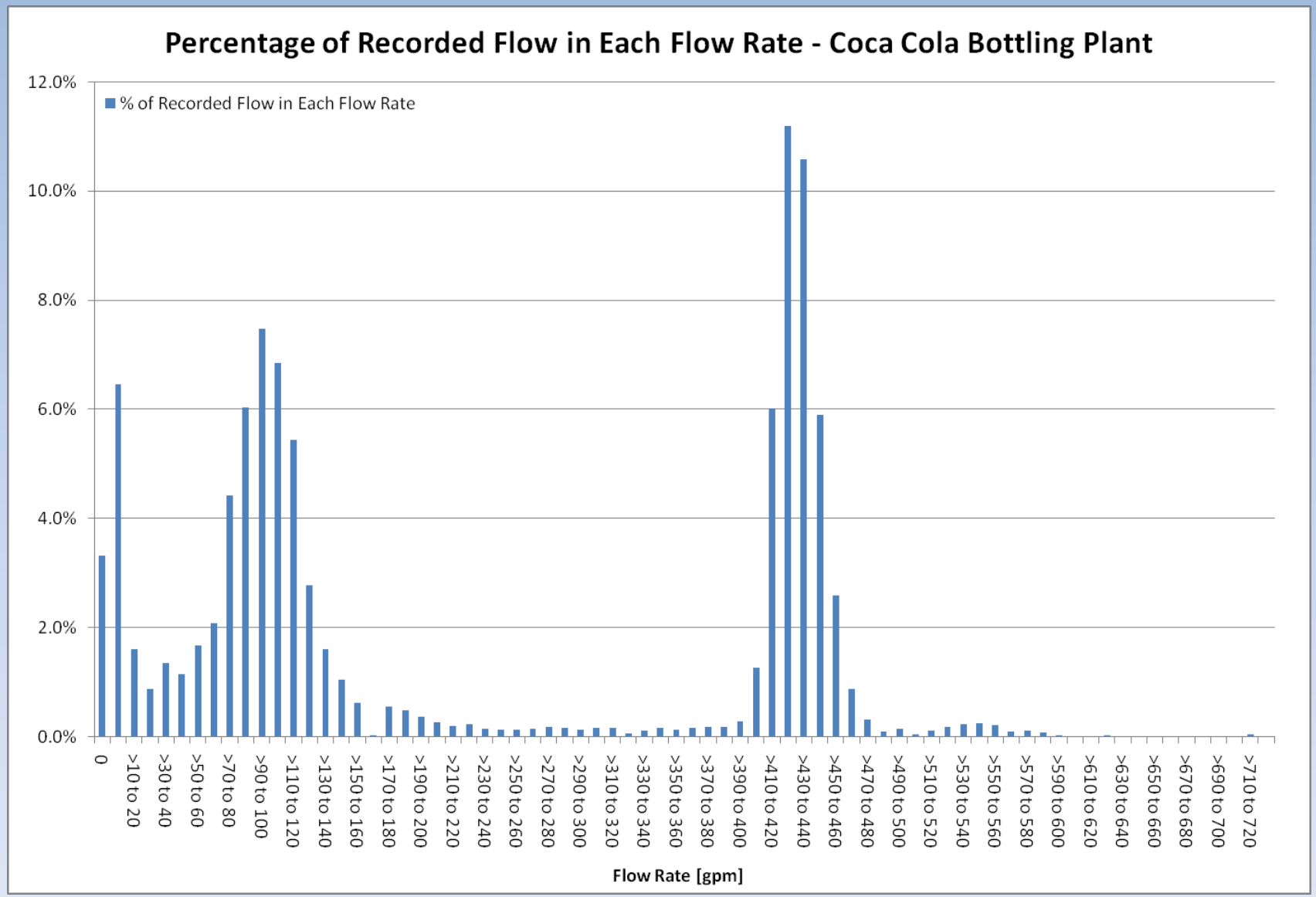
Consumption Analysis and Meter Right Sizing for Commercial and Industrial Customers

- Meters were compared to Actaris (Itron) single jet flow meters which usually demonstrated a 1-1.5% increase in accuracy and additional low flow capture

- Economic feasibility was measured with a payback period of less than 10 years



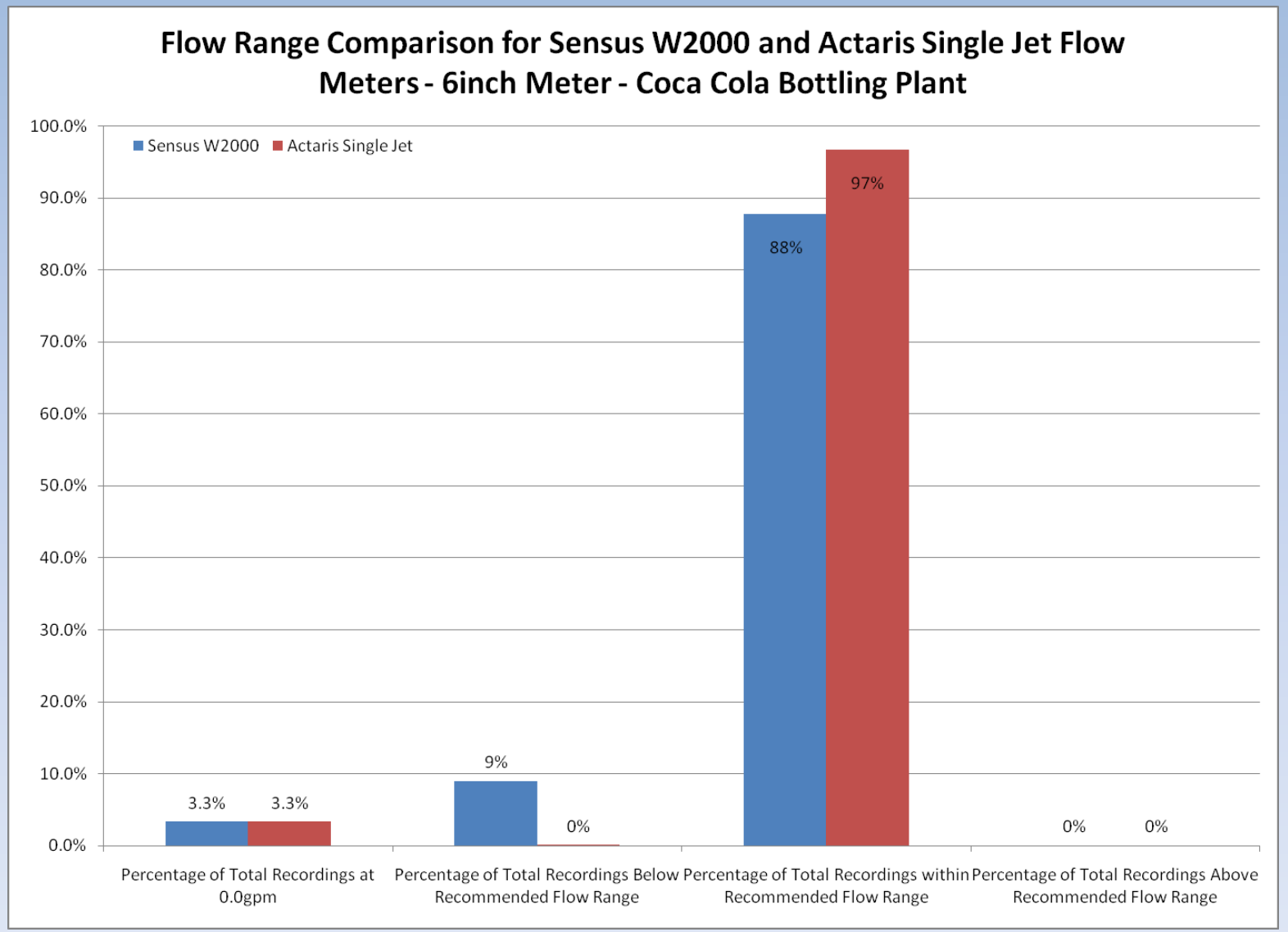
Coca-Cola Bottling Plant 6-inch Meter



Coca-Cola Bottling Plant 6-inch Meter

Meter Type	Rec. Flow Range (gpm)	Accuracy @ Rec. Flow Range	Recorded Avrg. Flow Rate (gpm)	Recorded Max Flow Range (gpm)
Sensus 2000	30 – 2,000	100% +/-1.5%	~260	725
Actaris Single Jet	4 – 1,000	100% +/-0.5%	~260	725

Coca-Cola Bottling Plant 6-inch Meter

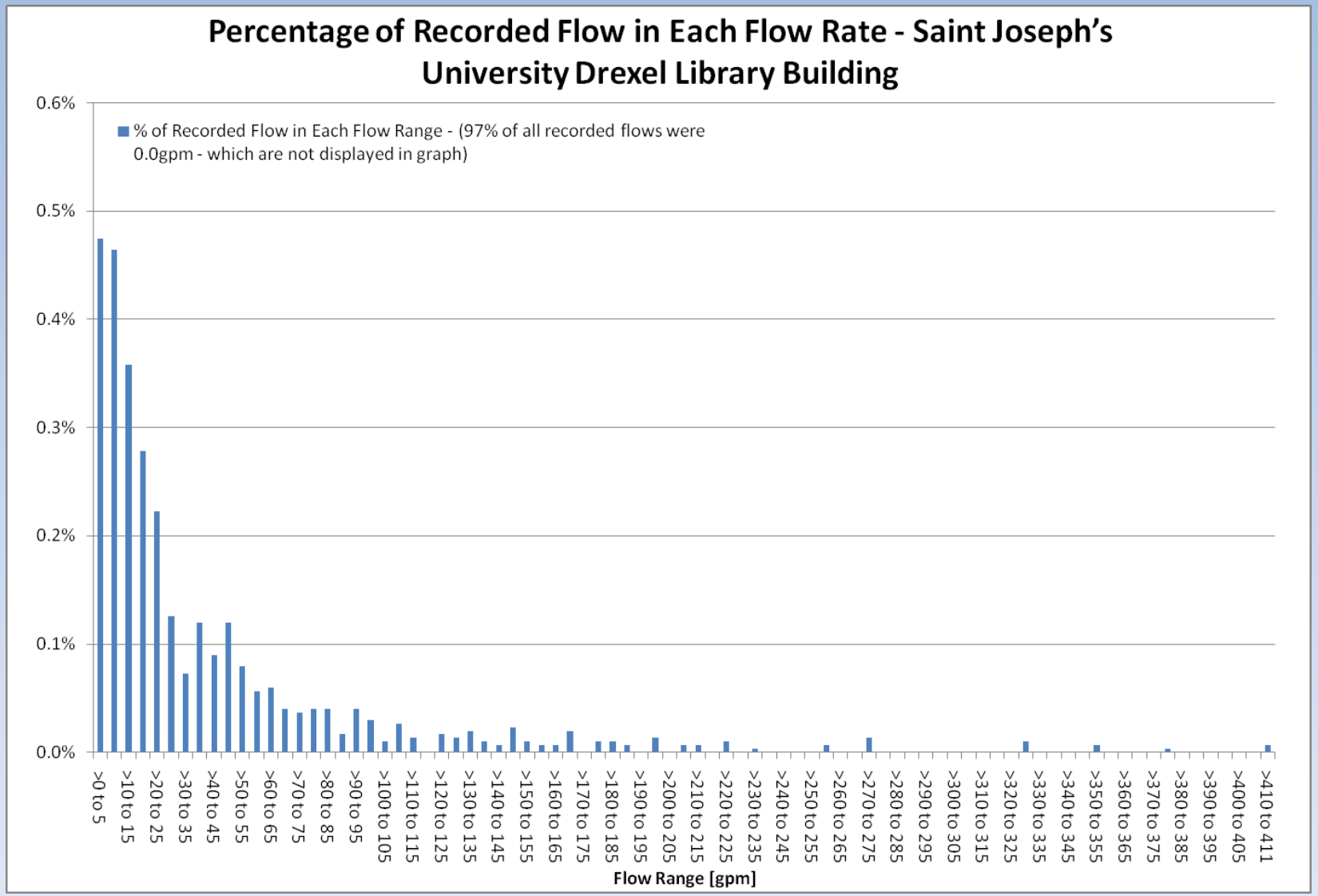


Cost/Benefit – Meter Changeout

	Monetary ($/year)	Volume (kgal/year)
Sensus W2000 Apparent Losses	$10,900	1,870
Actaris Single Jet Apparent Losses	$3,562	611
Switch from Sensus to Actaris	$7,338	1,259

- Approximate Cost of Meter Replacement = $4,050
- Meter replacement payback period = 0.6 years

Saint Joseph's University – Drexel Library 3-inch Meter



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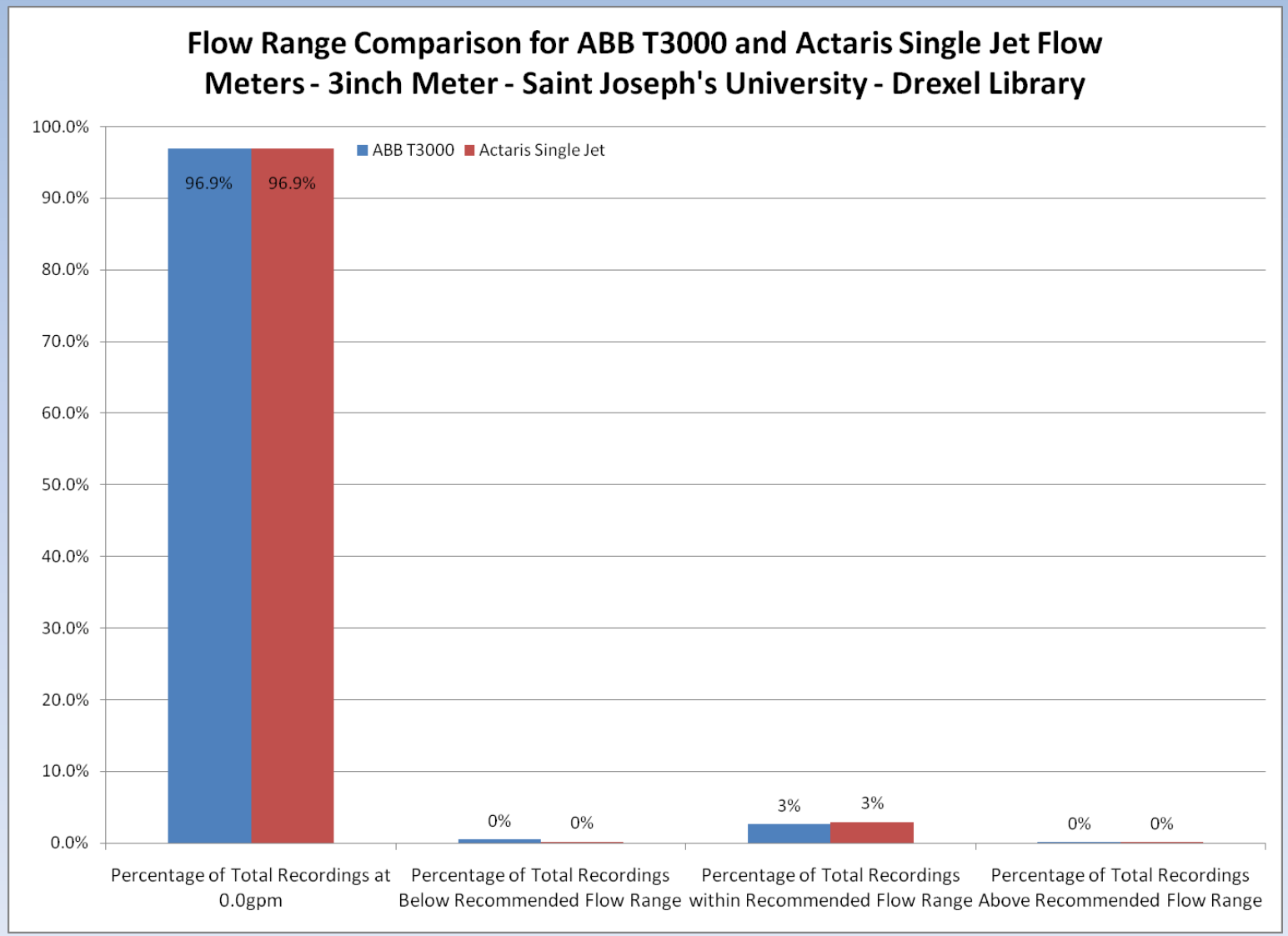

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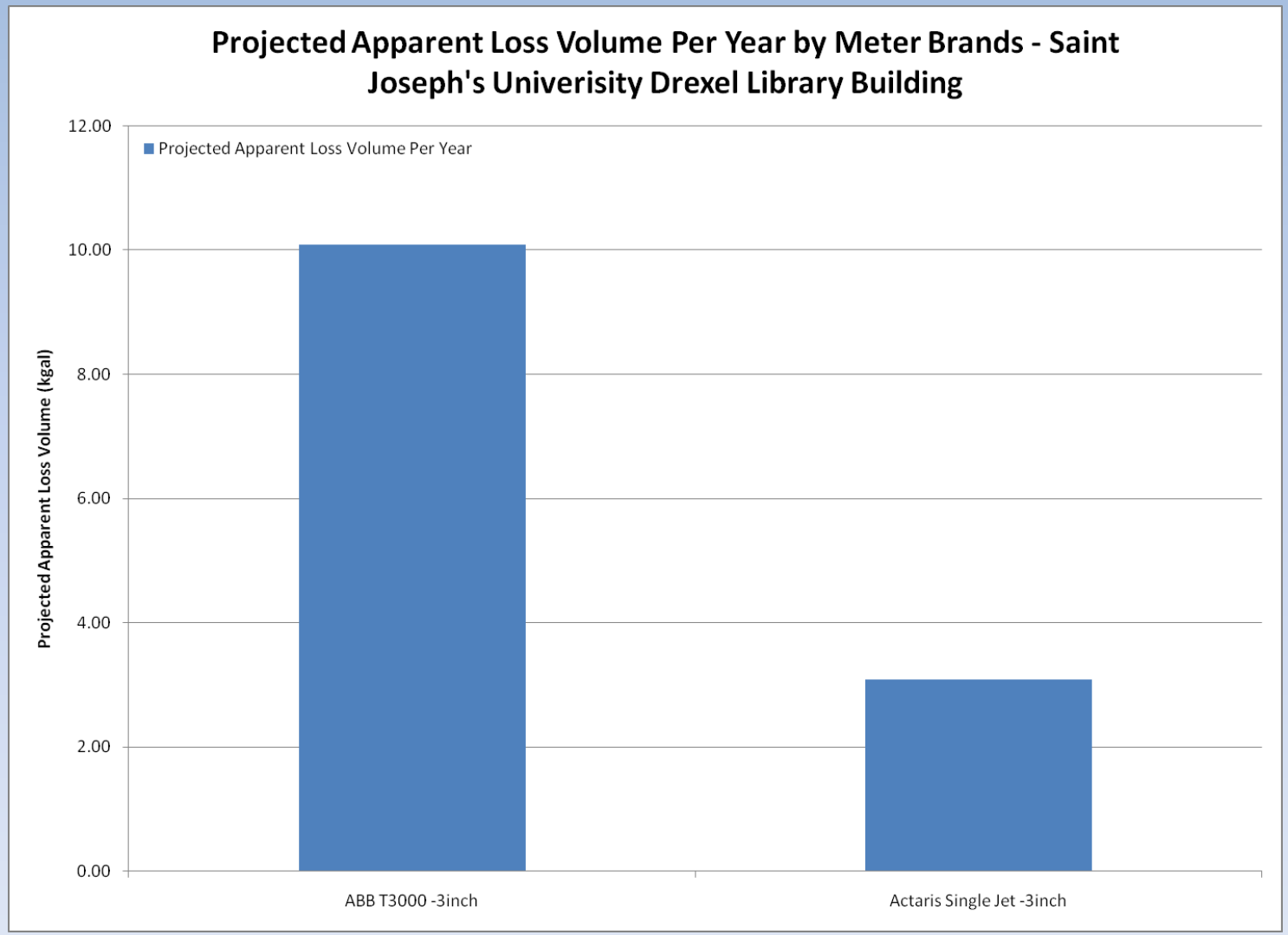

Cost/Benefit – Meter Changeout

	Monetary ($/year)	Volume (kgal/year)
Sensus W2000 Apparent Losses	$63	10
Actaris Single Jet Apparent Losses	$19	3
Switch from Sensus to Actaris	$44	7

- Approximate Cost of Meter Replacement = $2,014
- Meter replacement payback period = 46 years

Results

Findings

- Data-logging continues to find that existing meters are often not the optimum size or type of meter for many applications (this phenomenon is believed to be prevalent throughout the water supply industry)

- The most economic sites to target single jet meter replacements are those with relatively high water consumption

Results

Next Steps

- Analyze billing system for high demand commercial and industrial customers for targeted meter replacement

- Schedule replacement of 13 single jet meters; observe before/after consumption registration & revenue flow

Thank you

Questions?

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