



Bureau of Safe Drinking Water



Conducting AWWA Water Audits in the Pennsylvania Department of Environmental Protection Outreach Assistance Program: Initial Findings and Progress

**SRBC Public Water Supply Assistance Program
Fall 2018 Workshop - Harrisburg, PA**

**George Kunkel, P.E.
PA DEP Public Services Institute Instructor
Principal, Kunkel Water Efficiency Consulting**

October 18, 2018



Presentation Outline

- **Compiling and Leveraging AWWA Water Audits in the DEP Outreach Assistance (OAP) and Capability Enhancement Programs (CEP)**
 - DEP and AWWA Method Overview
 - Results to date
 - Looking forward

Current State of NRW Assessments in DEP

DEP employs **Unaccounted-For Water** reporting in several reports.



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF SAFE DRINKING WATER

WATER ALLOCATION PERMIT COMPLIANCE REPORT

Permit No.: **WA-**____-____ Report Year: _____
 Permittee: _____
 Address: _____

20% UFW, or a Metered Water Ratio < 80% (billed water), is DEP's threshold for utility action

3. Please calculate the metered ratio and daily per capita water use. Indicate if data used in calculations was taken from the current year Primary Facility Report, or quarterly meter records. If quarterly meter records are used, please indicate which quarter _____ and provide water use by type of connection. Sources include all Surface and Groundwater including Purchased Water.

A. Metered Ratio

1. Metered Ratio (MR) = Water Metered at Service Connections ÷ Total Water Withdrawn from All Sources x 100

$$(MR) = \frac{\quad}{\quad} \div \frac{\quad}{\quad} \times 100 = \quad \%$$

2. If the MR is less than 80% please explain the reason why, if known.



The Problem with “UFW” – Example from a DEP OAP Water Audit

“Unaccounted-for” water percentage is 52.8%

- What actions should be taken?
 - 1.
 - 2.
 - 3.
- Will these actions be successful in reducing losses? Will they be cost-effective? How will you know?

Why water loss percentages just don't work!

“unaccounted-for” percentages exist in the form of:

$$\frac{\text{Volume of Water Supplied minus Volume of Customer Billed Water}}{\text{Volume of Water Supplied}}$$

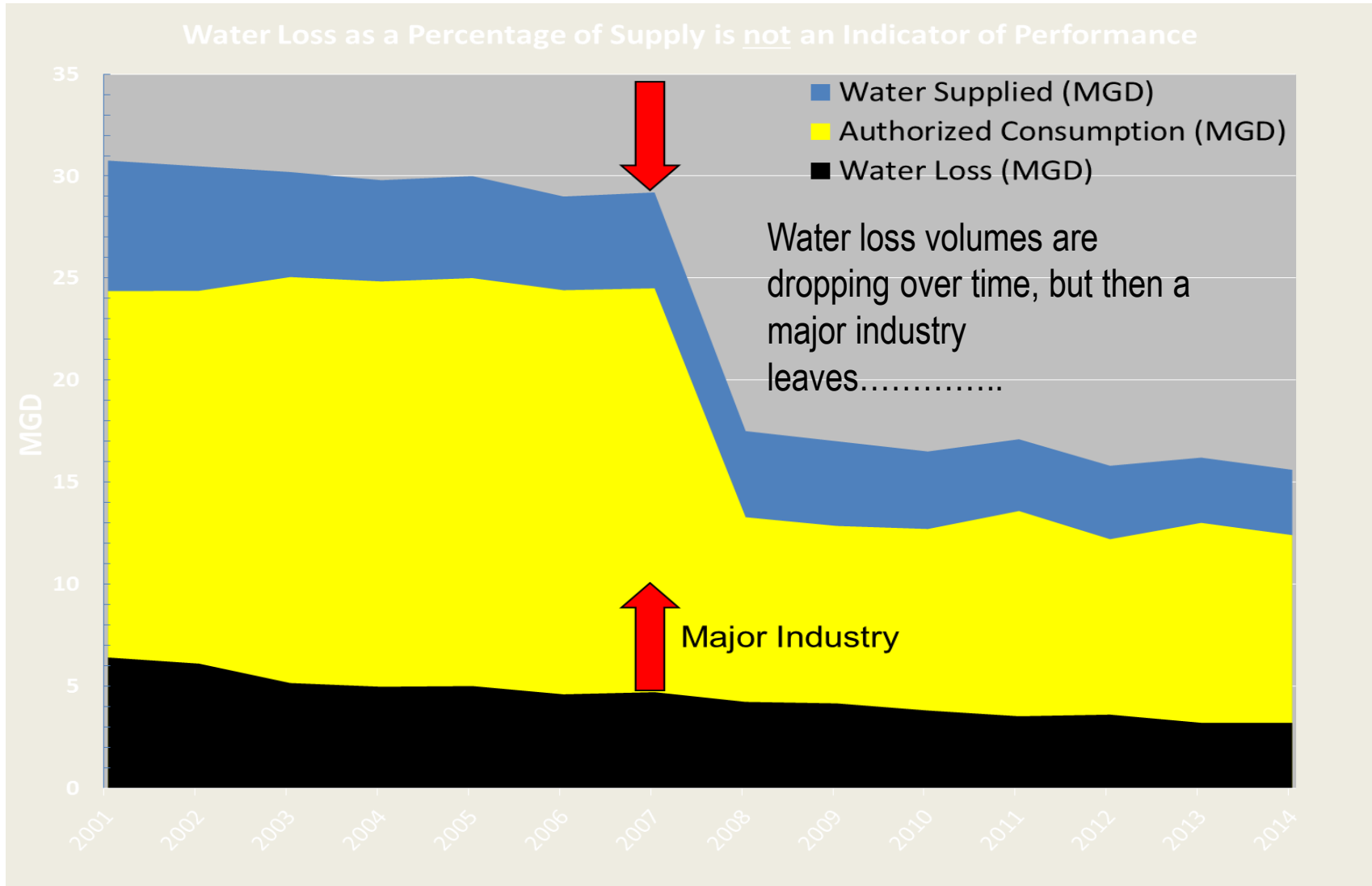
Or

$$\text{Metered water ratio} = \frac{\text{Volume of Customer Billed Water}}{\text{Volume of Water Supplied}}$$

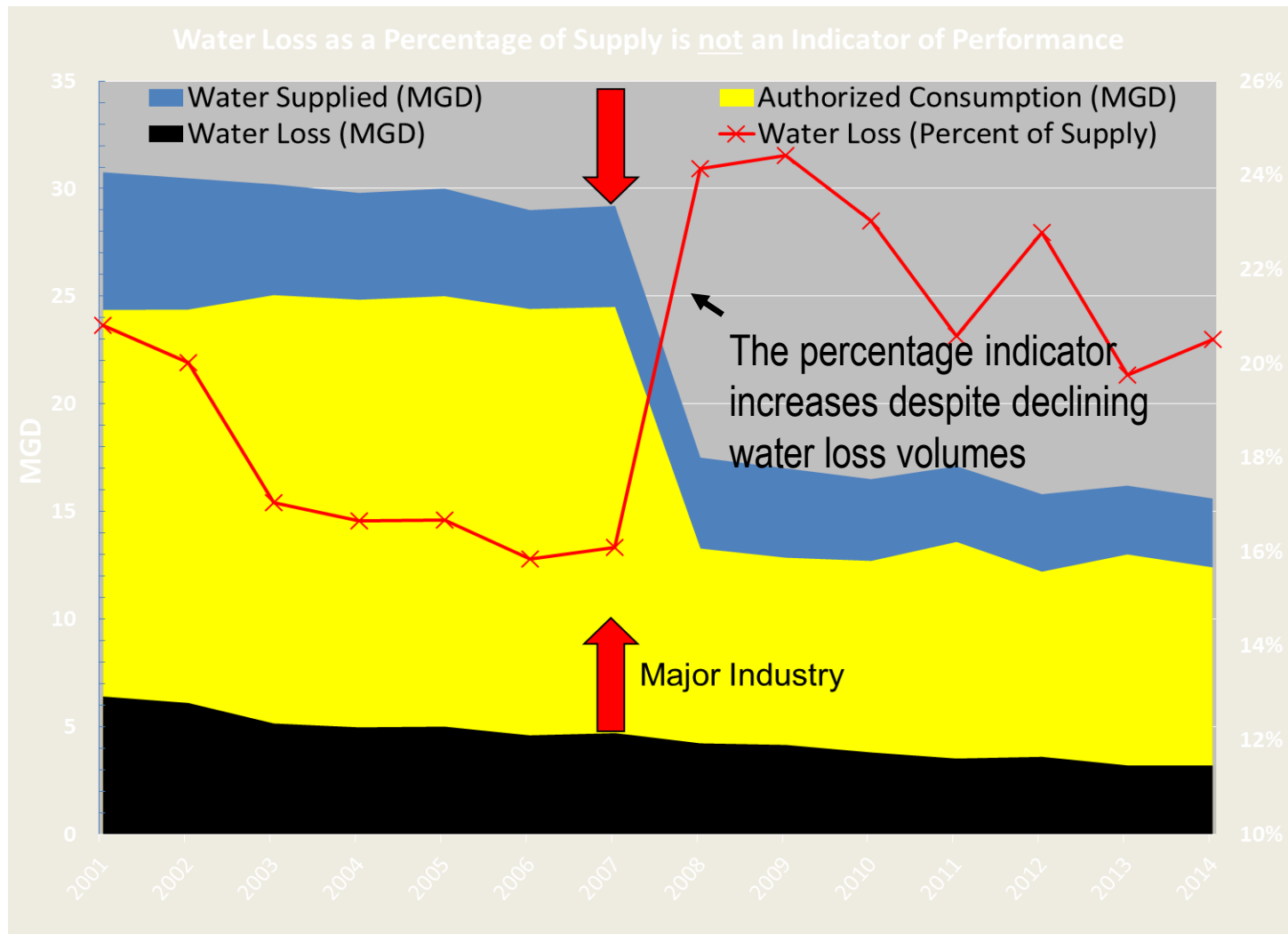
Percentages are misleading because:

- *They are mathematically skewed by variations in customer consumption*
- *They don't reveal the individual components of NRW: apparent (customer) losses and real (leakage) losses*
- *They reveal nothing about water volumes and costs*

Why water loss percentages just don't work!



Why water loss percentages just don't work!



? Click to access definition
+ Click to add a comment

Water Audit Report for: **County Water Company**
Reporting Year: **2013** **1/2013 - 12/2013**

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter and Supply Error Adjustments

WATER SUPPLIED

<----- Enter grading in column 'E' and 'J' ----->

Volume from own sources:	+	?	5	3,481.590	MG/Yr
Water imported:	+	?	10	779.762	MG/Yr
Water exported:	+	?	n/a	0.000	MG/Yr

Pont:	4	Value:	-136.890	MG/Yr
Pont:	10	Value:	-0.50%	MG/Yr
Pont:		Value:		MG/Yr

WATER SUPPLIED: **4,402.160** MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Billed metered:	+	?	7	3,258.200	MG/Yr
Billed unmetered:	+	?	n/a	0.000	MG/Yr
Unbilled metered:	+	?	3	15.420	MG/Yr
Unbilled unmetered:	+	?	8	183.820	MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

AUTHORIZED CONSUMPTION: **3,457.440** MG/Yr

Click here: ?
for help using option buttons below

Pont:		Value:	183.820	MG/Yr
-------	--	--------	---------	-------

Use buttons to select percentage of water supplied OR value

Pont:	0.25%	Value:		MG/Yr
-------	-------	--------	--	-------

WATER LOSSES (Water Supplied - Authorized Consumption) **944.720** MG/Yr

Apparent Losses

Unauthorized consumption: **11.005** MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	+	?	3	164.300	MG/Yr
Systematic data handling errors:	+	?	6	32.920	MG/Yr

Apparent Losses: **208.225** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **736.495** MG/Yr

WATER LOSSES: **944.720** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **1,143.960** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

AWWA Water Audit Method – provides better information for utilities to make more informed decisions and stretch limited resources



SYSTEM DATA

Length of mains:	+	?	4	256.3	miles
Number of <u>active AND inactive</u> service connections:	+	?	4	12,196	
Service connection density:		?		48	conn./mile main
Are customer meters typically located at the curbstops or property line?				No	(length of service line, beyond the property boundary, that is the responsibility of the utility)
<u>Average</u> length of customer service line:	+	?	5	18.0	ft
Average operating pressure:	+	?	3	65.0	psi

COST DATA

Total annual cost of operating water system:	+	?	9	\$9,600,000	\$/Year
Customer retail unit cost (applied to Apparent Losses):	+	?	10	\$3.95	\$/1000 gallons (US)
Variable production cost (applied to Real Losses):	+	?	9	\$190.00	\$/Million gallons <input type="checkbox"/> Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 62 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources

2: Unbilled metered

3: Customer metering inaccuracies



AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.
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Water Audit Report for: **County Water Company**
Reporting Year: **2013** | **1/2013 - 12/2013**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 62 out of 100 ***

System Attributes:

Apparent Losses:	208.225	MG/Yr
+ Real Losses:	736.495	MG/Yr
= Water Losses:	944.720	MG/Yr

? Unavoidable Annual Real Losses (UARL): 83.69 MG/Yr

Annual cost of Apparent Losses: \$821,449

Annual cost of Real Losses: \$139,934 Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial: {
 Non-revenue water as percent by volume of Water Supplied: 26.0%
 Non-revenue water as percent by cost of operating system: 10.4% Real Losses valued at Variable Production Cost

Operational Efficiency: {
 Apparent Losses per service connection per day: 46.78 gallons/connection/day
 Real Losses per service connection per day: 165.45 gallons/connection/day
 Real Losses per length of main per day*: N/A
 Real Losses per service connection per day per psi pressure: 2.55 gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL): 736.49 million gallons/year

? Infrastructure Leakage Index (ILI) [CARL/UARL]: 8.80

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

This worksheet includes:

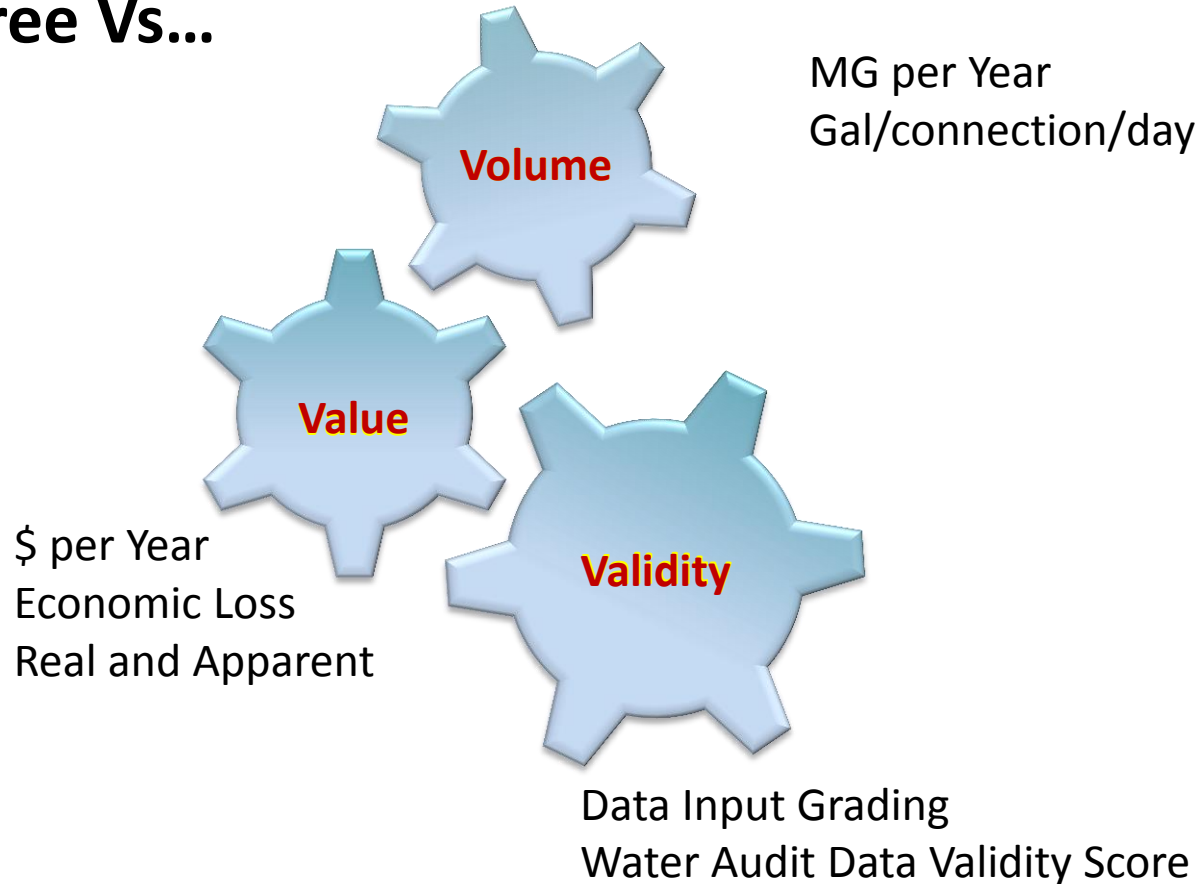
- **System Attributes**
- **Performance Indicators**
 - Financial
 - Operational Efficiency

Two primary uses:

- **Performance Tracking** – measuring the performance of a utility year-by-year
- **Benchmarking** – comparing with other water utilities and defining levels of best practice

AWWA Advices to Assess Water Loss Via the.....

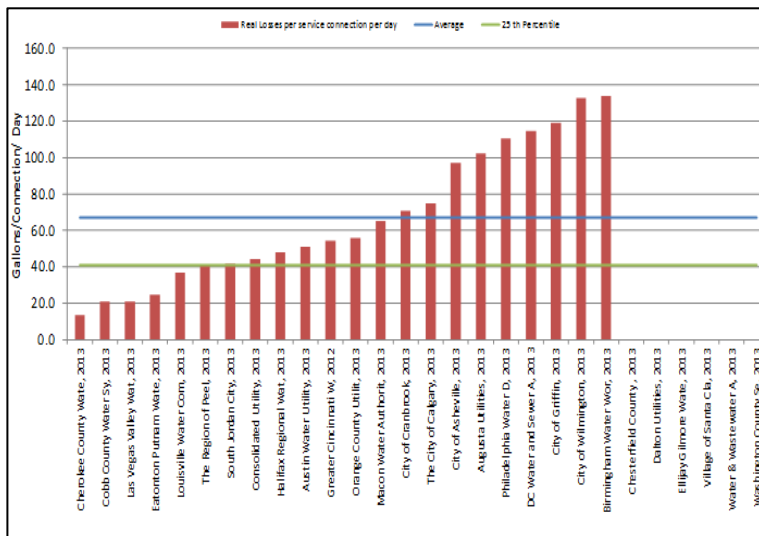
Three Vs...



AWWA Compiler Software

AWWA Compiler Software – Easily assembles completed audit reports from multiple water audits into one spreadsheet that generates charts

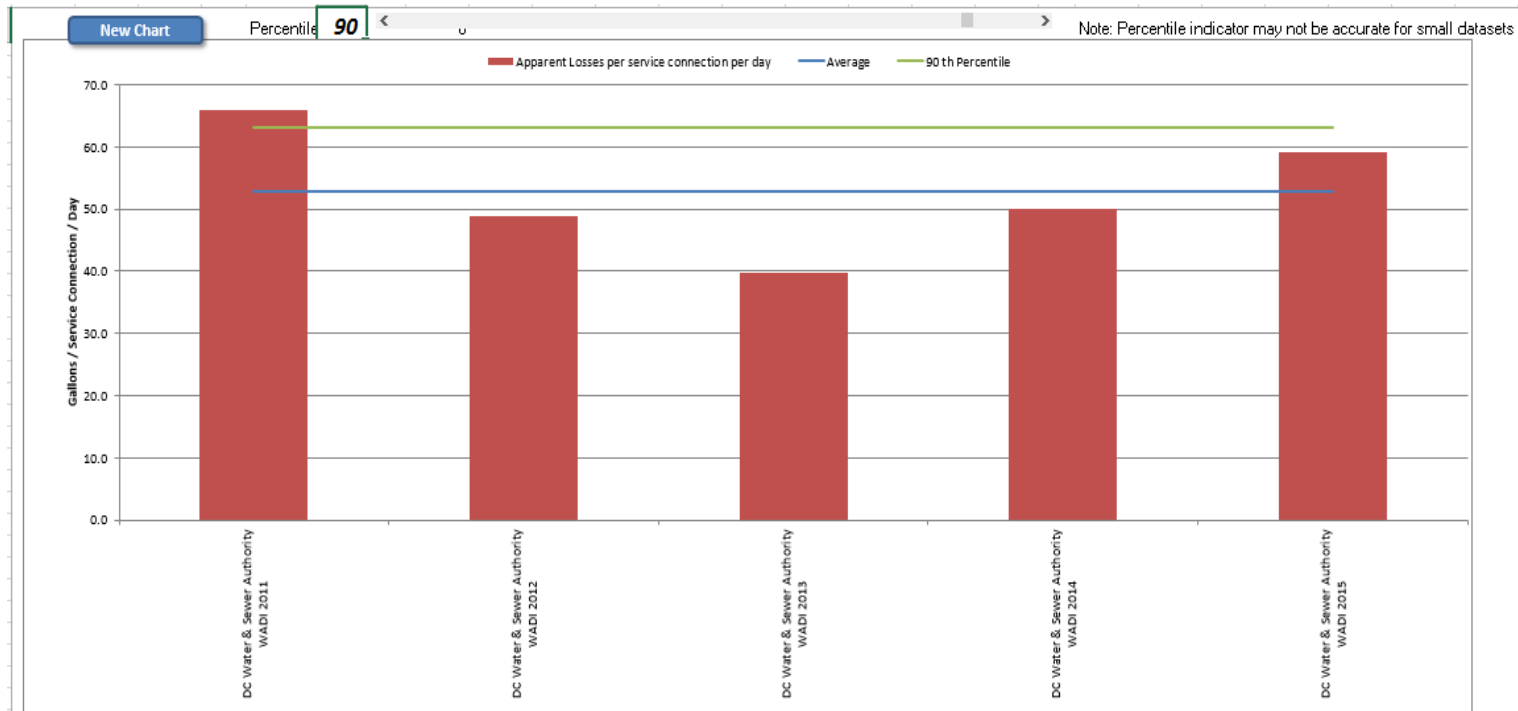
Charts can reveal notable trends



Include on Chart	Run Compiler / View Options	Name of City / Utility:	Customer Metering Inaccuracies	Systematic Data Handling Errors	Systematic Data Handling Errors Default Use	Apparent Losses	Real Losses	Water Losses2	Non Revenue Water	Length of Mains	Number of Active and Inactive Service Connection
Yes		City of Asheville	111.220	11.956	Yes	140.844	1,958.789	2,099.633	2,285.180	1236.5	55,256
Yes		Augusta Utilities	202.735	71.603	No	307.087	2,694.886	3,001.973	3,552.620	1213.3	72,235
Yes		Austin Water Utility	828.761	0.001	No	945.924	4,024.607	4,970.531	5,095.921	3707.0	215,960
Yes		Birmingham Water Works Board	557.467	0.001	No	645.000	11,242.159	11,887.159	12,339.569	3941.0	230,018
Yes		The City of Calgary	334.291	82.627	Yes	525.552	8,526.084	9,051.636	9,476.994	3072.7	312,075
Yes		Chesterfield County Rural Water Co., Inc.	6.456	1.598	Yes	9.978	115.171	125.149	130.422	732.0	8,243
Yes		Greater Cincinnati Water Works	308.039	696.500	No	1,096.716	4,873.730	5,970.446	6,972.146	3135.8	246,044
Yes		Consolidated Utility District	17.943	0.300	No	27.152	813.118	840.270	902.268	1301.0	50,510
Yes		City of Cranbrook	0.000	0.000	No	2.798	172.402	175.201	189.193	101.5	6,696
Yes		Cobb County Water System	341.584	16.730	No	404.568	1,347.804	1,752.372	1,764.294	3150.0	178,130
Yes		Dalton Utilities	195.846	15.831	Yes	231.343	1,204.651	1,435.995	1,534.328	1251.0	37,023
Yes		DC Water and Sewer Authority	527.700	1789.500	No	2,449.800	5,621.951	8,071.751	8,748.651	1350.0	134,284
Yes		Elizaj Gilmore Water & Sewer Authority	11.638	1.000	No	15.169	218.215	233.384	283.102	227.0	5,527
Yes		Eatonton Putnam Water and Sewer Authority	2.281	0.511	Yes	5.792	74.506	80.298	101.609	145.0	8,350
Yes		City of Griffin	18.795	1.798	Yes	23.769	510.230	533.999	551.539	212.7	11,733
Yes		Halifax Regional Water Commission	129.981	0.264	No	158.629	1,504.514	1,663.143	1,763.626	1017.2	85,957
Yes		Las Vegas Valley Water District	2638.000	100.000	No	2,998.997	3,025.078	6,024.075	6,030.775	4515.0	397,526
Yes		Louisville Water Company	973.100	150.000	No	1,123.200	4,123.662	5,246.862	7,839.099	4156.0	306,079
Yes		Macon Water Authority	119.744	6.252	No	132.247	1,551.136	1,683.383	1,779.733	1400.0	65,200
Yes		Orange County Utilities Department	104.165	32.920	No	191.107	1,841.418	2,032.525	2,144.747	1745.5	90,402
Yes		Philadelphia Water Department	1490.200	3579.300	No	7,495.000	21,267.500	28,762.500	30,721.500	3178.0	527,205
Yes		The Region of Peel	725.152	1.321	No	855.072	4,717.505	5,572.577	6,079.497	2793.9	315,617
Yes		Village of Santa Clara	1.254	0.250	No	1.740	20.613	22.353	24.947	25.0	752
Yes		South Jordan City	63.709	9.664	Yes	84.822	289.389	374.211	714.143	333.0	19,074
Yes		City of Wilmington	171.726	500.000	No	701.726	1,832.707	2,534.433	2,631.175	410.0	37,751
Yes		Water & Wastewater Authority of Wilson County	5.228	0.020	No	6.170	58.944	65.114	66.494	326.5	7,052
Yes		Washington County Service Authority	14.449	3.485	Yes	24.269	1,047.489	1,071.758	1,139.856	852.5	22,500
Yes		Cherokee County Water & Sewerage Authority	87.701	4.162	Yes	103.643	310.021	413.664	549.551	1234.2	62,708

AWWA Compiler Software

Charting multi-year water audit data for a utility is good for checking for trends (good or bad) in utility data from year-to-year. Below the Annual Cost of Operating the System for DC Water is plotted over 5 years



Current State of NRW Assessments in DEP

2017

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF SAFE DRINKING WATER
PLANNING AND CONSERVATION DIVISION

Page 1

Primary Facility Report for [REDACTED]
REPORT FOR CALENDAR YEAR JAN 1 TO DEC 31, 2017

Client: [REDACTED]

PRIMARY FACILITY NAME AND MAILING ADDRESS

Name and Address: [REDACTED]
Contact Information: [REDACTED]
Phone: [REDACTED]
Fax: [REDACTED]
Facility e-mail: [REDACTED]

PEAK DAY WATER USE FOR REPORT YEAR 2017

Date: 12/31/2017 (mm/dd/yyyy)
Gallons Per Day: 505,178

MINIMUM DAY WATER USE FOR REPORT YEAR 2017

Date: 01/06/2017 (mm/dd/yyyy)
Gallons Per Day: 30,531

POPULATION SERVED

Population Served: 3,224

AVERAGE DAILY WATER USE

Type	Metered Connections		Unmetered Connections	
	Number	Water Use (GPD)	Number	Water Use (GPD)
Domestic	1,401	130,414	0	0
Commercial	27	11,436	0	0
Industrial	3	1,841	0	0
Institutional	17	29,557	0	0
Bulk Sales to other PWS	0	0	0	0
Oil and Gas	0	0	0	0
Other	0	0	0	0
Water Losses				50,672
Total	1,448	173,248	0	50,672

Explain 'Other' Connections:

BREAKDOWN OF WATER LOSSES FOR THE SYSTEM

Type	Water Use (GPD)
Apparent Losses	2,375
Real Losses	48,297
Total Water Losses	50,672

In 2018 DEP provided for optional entry of AWWA water audit components on the Annual Water Supply Report.

BREAKDOWN OF WATER LOSSES FOR THE SYSTEM

Type	Water Use (GPD)
Apparent Losses	2,375
Real Losses	48,297
Total Water Losses	50,672

In 2017 DEP launched use of AWWA water audit for utilities working with the OAP.

Benefits of AWWA Approach – Example OAP Utility

AWWA Water Balance Summary

Water supplied volume:	135.582 mg
Authorized consumption (billed and unbilled):	<u>66.119 mg</u>
Water Losses:	69.463 mg
Real (leakage) losses:	38.364 mg
Apparent (customer) losses:	31.099 mg

- What actions should be taken?
 - 1.
 - 2.
 - 3.

Benefits of AWWA Approach – Example OAP Utility

AWWA Performance Indicators

- Apparent Loss Rate **43.86** gal/conn/day (highest in PA dataset)
 - Apparent Loss Costs **\$533,346**
 - Real (leakage) Loss Rate **1,401.4** gal/mile of pipeline/day (mid-range of PA Data)
 - Real (leakage) Costs **\$12,929**
- History – good leakage control, many old customer meters
 - What actions should be taken?
 - 1.
 - 2.
 - 3.

▶ PA DEP Water Audit Program Development

- Launched in January 2017 – 14 audits to date
- Standard deliverables
 - Validated water audit (in AWWA Free Water Audit Software)
 - Detailed notes available to utility manager
 - Summarized results and recommendations for utility manager, board, engineers, etc
- Growing utility interest: ~ one utility per month
- A second DEP assistance provider in training

Dennis Harney, OAP Coordinator

dharney@pa.gov

717-705-4913

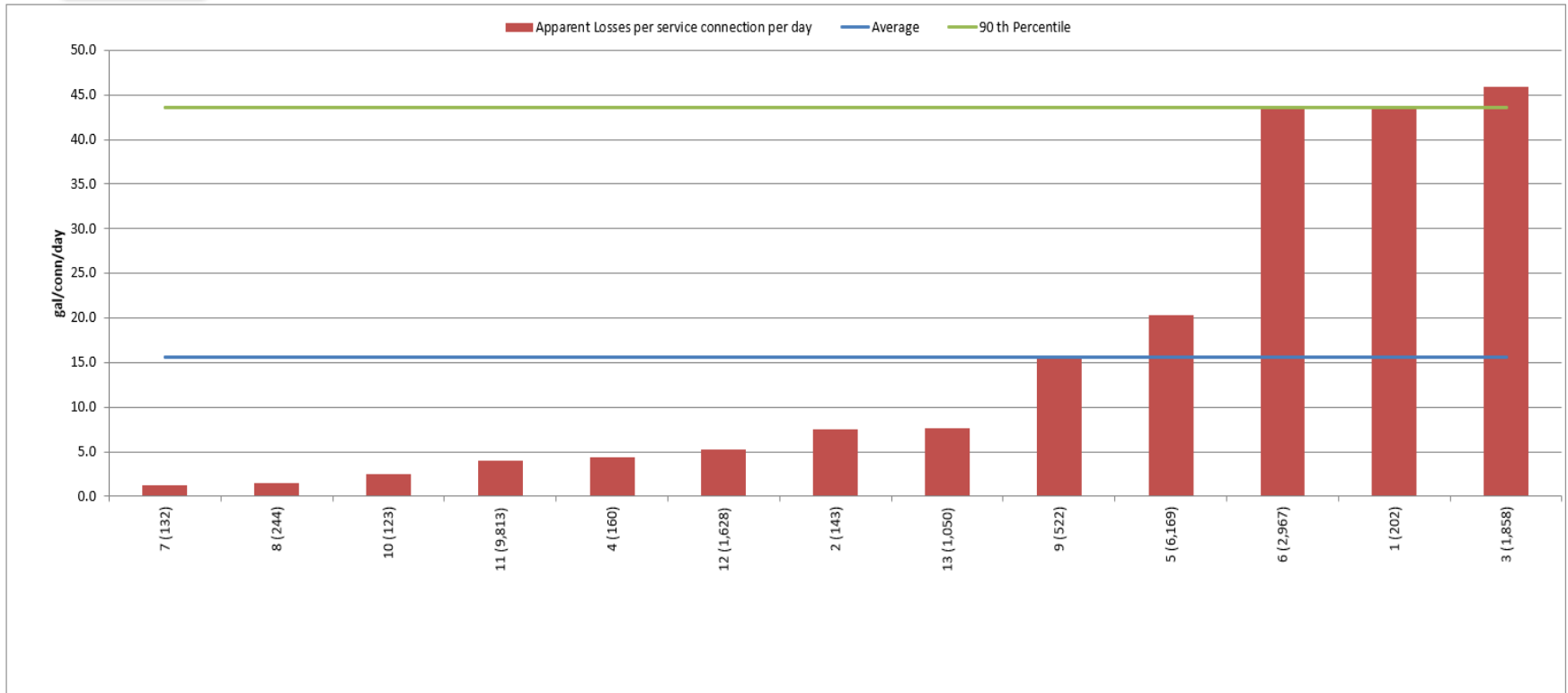
Some Notable Observations

- All utilities have provided an annual *financial* audit/statement.
 - Costs from the financial audit are used in the water audit
 - All utilities are capable of obtaining a financial audit
- All utilities have shown strong motivation to assess losses and make improvements
- The AWWA water audit method/software has proven useful and effective with all utilities, with the smallest utility at 123 customer service connections

Comparing PA Water Utilities with the North American Dataset

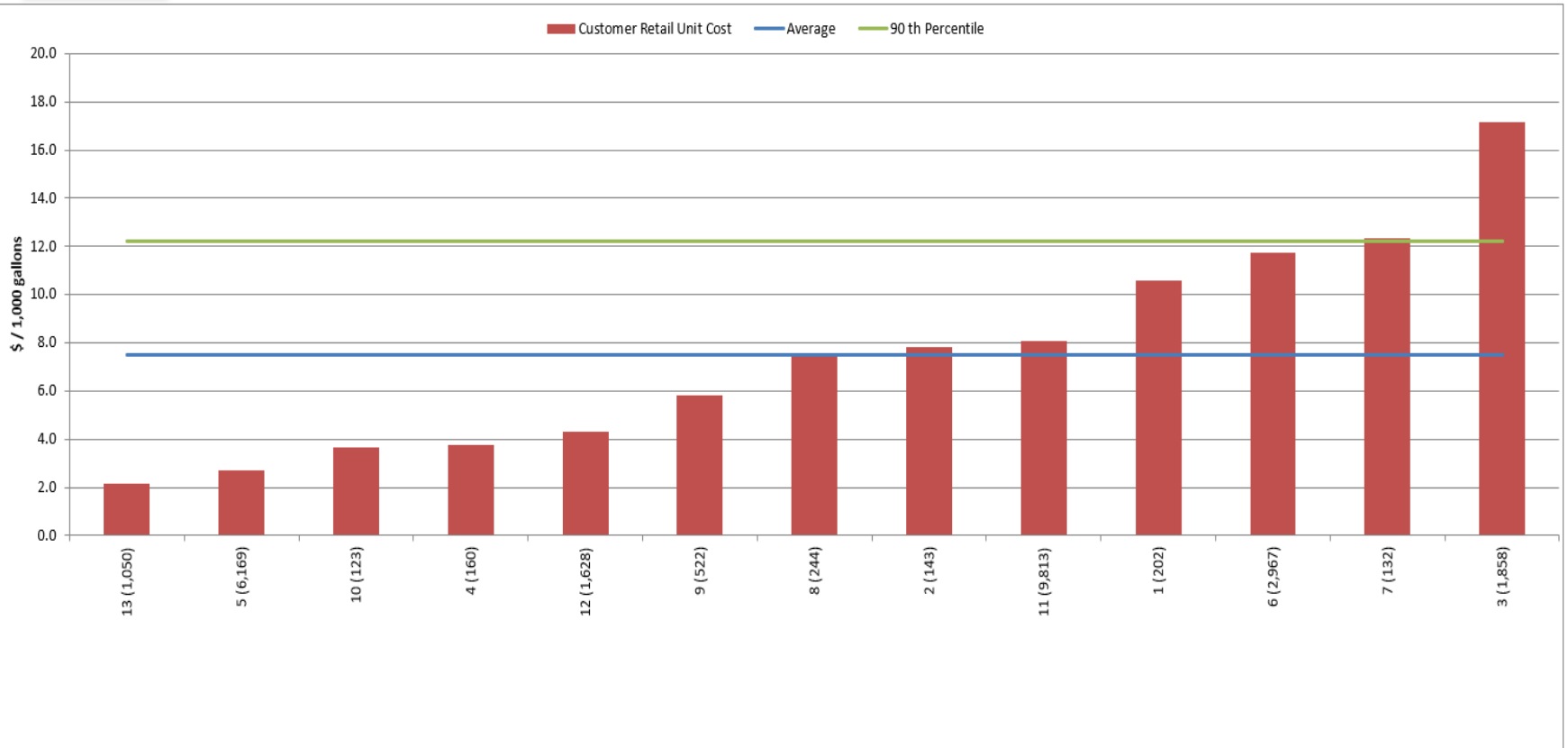
- How do PA Utilities stack up against systems across the USA and Canada?
- The following compare PA water audit data (unvalidated) with a North American dataset (validated)
- Data sources:
 - PA: DRBC and PA PUC data
 - North American: State of Georgia and two dozen US and Canadian utilities

DEP OAP Water Audits: Apparent Loss Rate, g/c/day



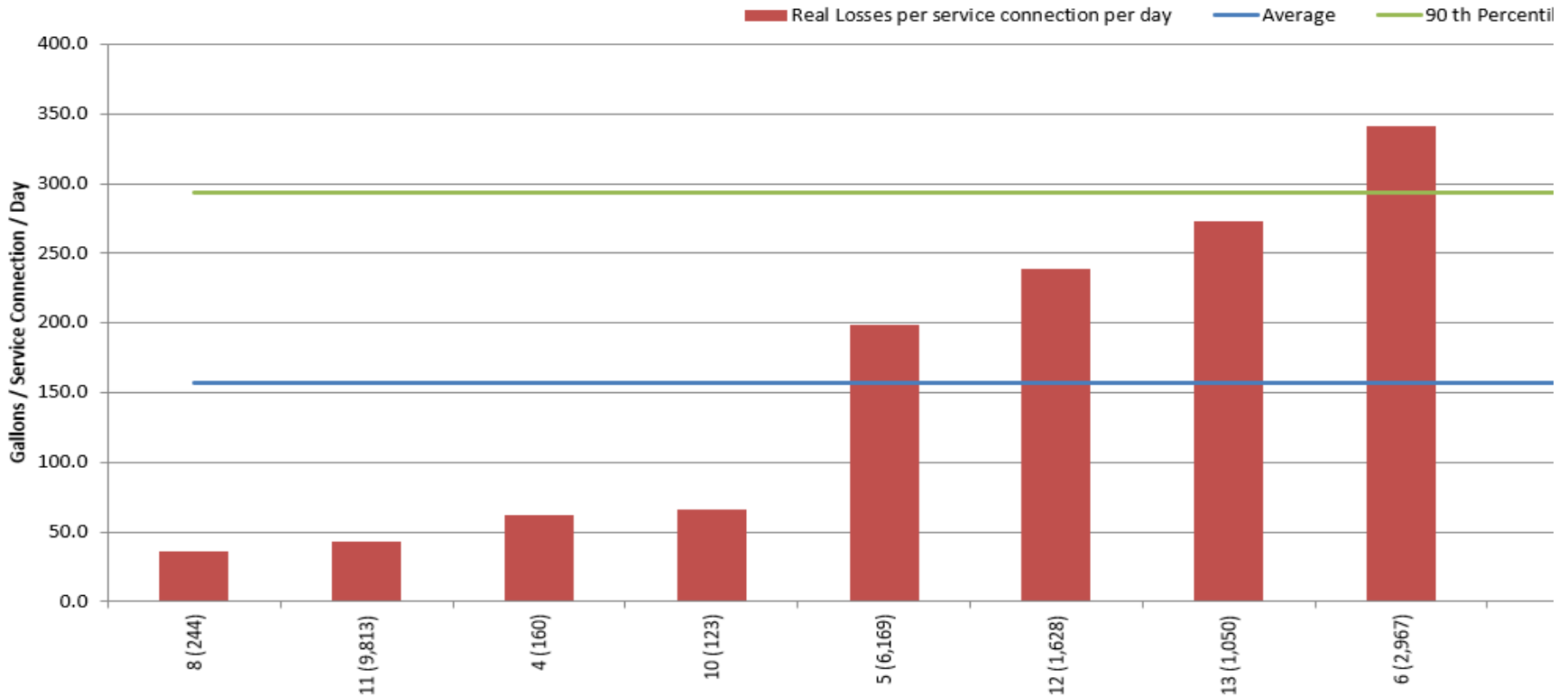
Data Source	Median (g/c/day)	Max (g/c/day)
PA DEP OAP audits	7.58	45.86
PA Dataset	4.58	39.72
NA Dataset	5.77	49.85

DEP OAP Water Audits: Customer Retail Unit Cost (CRUC), \$/1,000 gal



Data Source	Median (\$/1,000 gal)	Max (\$/1,000 gal)
PA DEP OAP audits	7.48	17.15
PA Dataset	7.66	37.67
NA Dataset	4.16	13.32

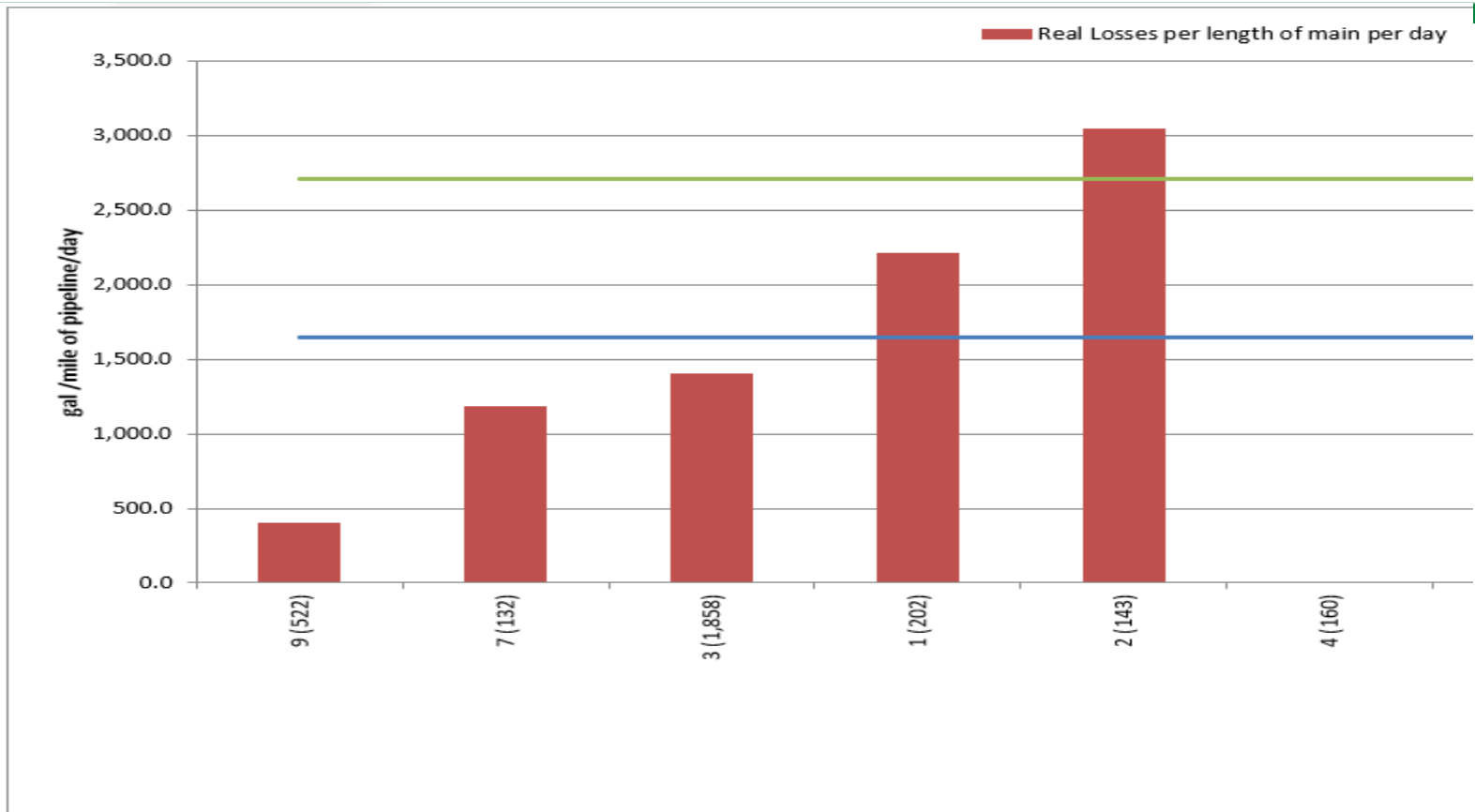
DEP OAP Water Audits: Real Loss Rate, gal/conn/day



Data Source	Median (g/c/day)	Max (g/c/day)
PA DEP OAP audits	132.54	340.83
PA Dataset	35.71	202.33
NA Dataset	43.40	249.35

These are typical service connection density systems

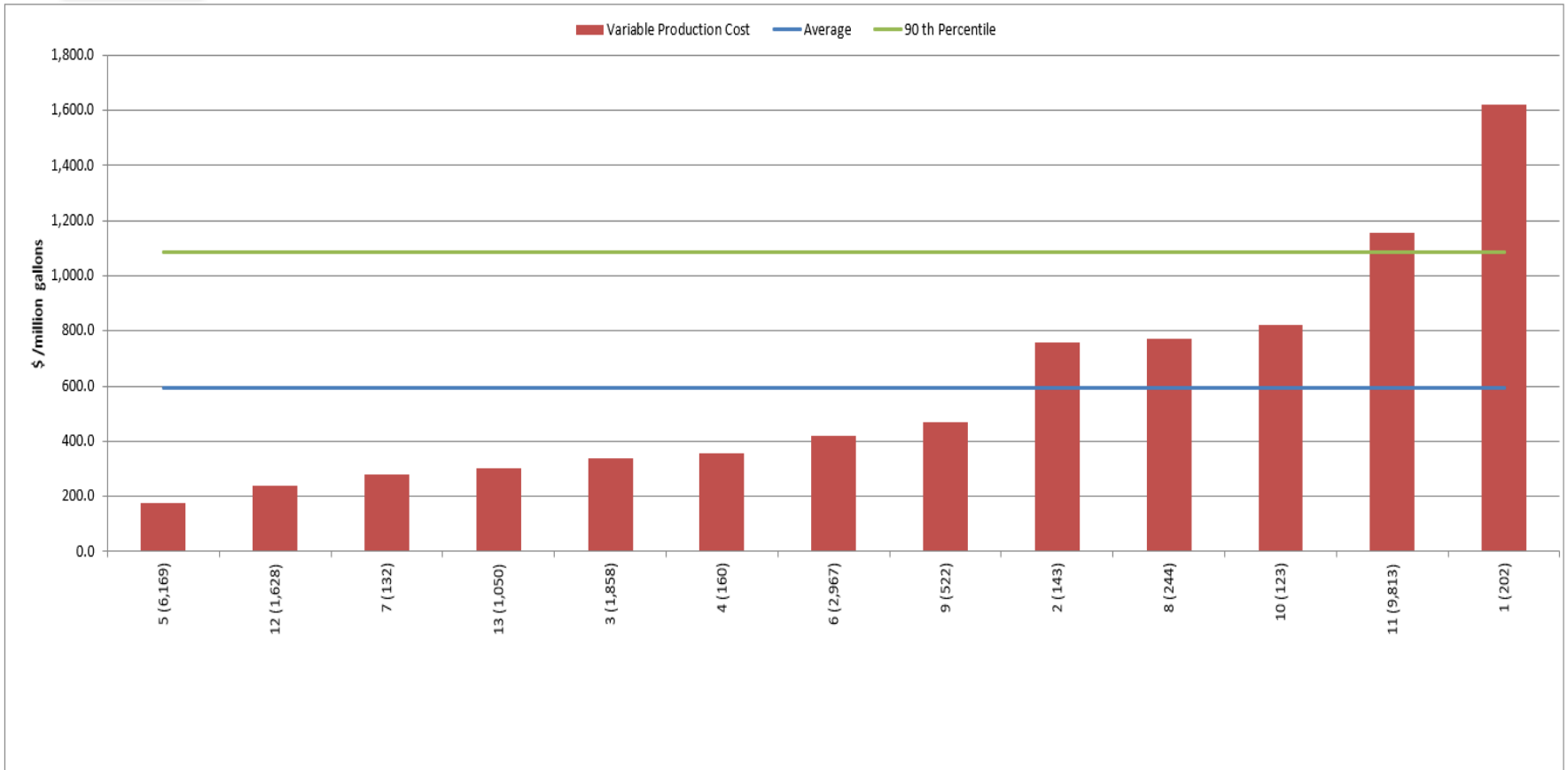
DEP OAP Water Audits: Real (leakage) Loss Rate (gal/mile of pipeline/day)



Data Source	Median (g/mile/day)	Max (g/mile/day)
PA DEP OAP audits	1,401.42	3,042.71
PA Dataset	2,292.20	3,823.67
NA Dataset	1,091.50	6,992.73

These are low service connection density utilities

DEP OAP Water Audits: Variable Production Cost (VPC), \$/million gallons



Data Source	Median (\$/mil gal)	Max (\$/mil gal)
PA DEP OAP audits	419.84	1,623.00
PA Dataset	520.00	4,712.30
NA Dataset	425.60	5,060.90

Utility	# of Connections	General Findings
1	202	Treatment issues, high production costs , PVC pipe is a challenge for acoustic leak detection
2	143	Double-counting production flows , treated water reservoir overflows constantly, PVC pipe
3	1,858	Old customer meters /high apparent loss, high water rates , high pressure but good leakage control
4	6,169	Poor flow regulation, low costs, old customer meters , particularly large ones.
5	160	Well problems, old customer meters , pressure level unknown
6	2,967	Billing system challenges, high debt, old customer meters
7	132	Source/treatment issues, unmetered customers Individual leaks stress distribution system capacity.
8	244	Strained sources, esp. in summer; an emergency interconnection is planned. Leaks stress the system.
9	522	High wholesale water demand & leaks strain the system. Planning PENNVEST customer meter replacement.
10	123	Replaced customer meters & created GIS mapping. PVC pipe defies leak detection ; can try DMAs.
11	9,318	Moderate leakage, but costly imported water . Proactive. Consider progressive leakage management.
12	1,628	Very high leakage with early vintage plastic piping. Planning pipe replacement. DEP arranged for leak detection in summer 2018. Three pressure zones can act as DMAs.
13	1,050	65% of customers are unmetered. Very high leakage. A gate valve likely skews production flows.
14	1,448	Distribution system water quality issues. Older cast iron pipe.

General Findings

- Issues
 - Poor production flowmeter management
 - Old customer water meters
 - Some systems are unmetered
 - Lack of knowledge on piping and pressures
 - High water pressure is common
 - PVC piping is difficult for acoustic leak detection

Poor Production Flowmeter Management

- Design – flowmeters need space and most engineers don't design for this
- Utility maintenance/testing is limited
- Many flowmeters are very old with no plan to replace



Partially closed butterfly valve

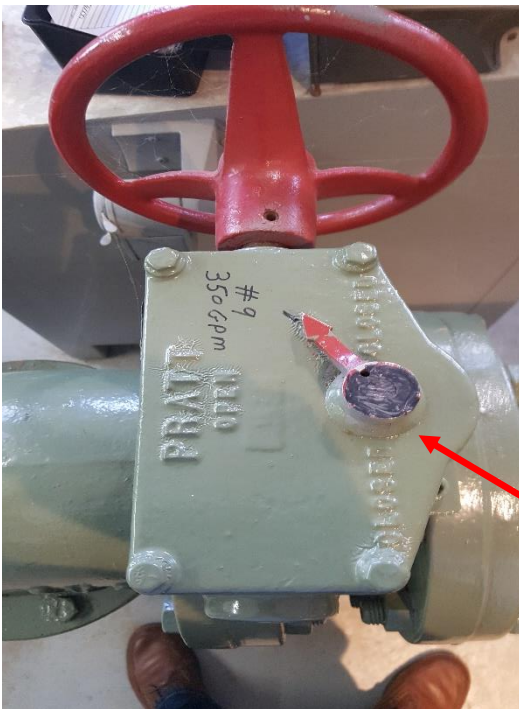


Venturi flowmeter

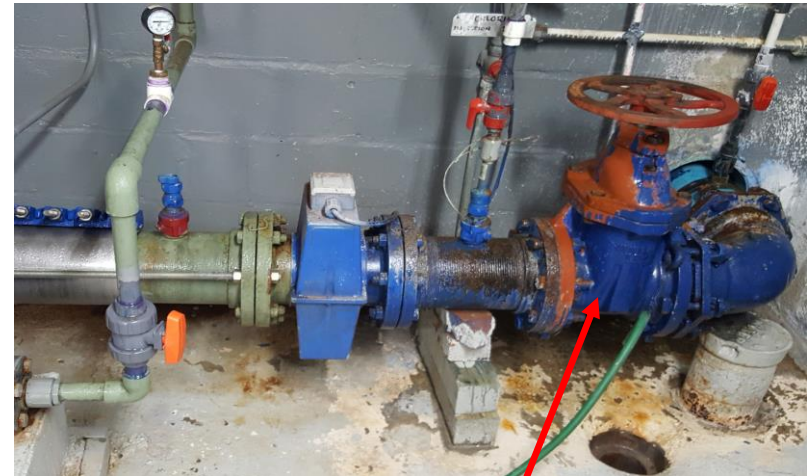
A utility was double-counting production water volumes – adding readings from 2 output devices from the same meter. This greatly inflates the loss level (ghost losses!)

Poor Production Flowmeter Management

- Water utility with three production flowmeters at wells
- At two of the three sites, valves just upstream of the flowmeters are throttled partially closed, likely skewing the reading.



Partially closed butterfly valve



Partially closed gate valve

Poor Production Flowmeter Management

- Utility maintenance/testing practices are limited in most cases
- Flowmeter accuracy testing appears to be rarely conducted
- **Clearwell/tank drop test:** low cost, reliable means of testing production flowmeter accuracy: recommended for several utilities under OAP



The storage tank/flowmeter configuration at this utility allows for a drop test

Customer Metering

- Most systems employ customer meters
- One utility is unmetered, one 2/3 unmetered
- Most systems have aging meter populations, but two have recently replaced their meters, with another soon executing replacement

Leakage Management

- High leakage believed to exist in most systems
- PVC pipe exists in half of systems. Difficult to conduct acoustic leak detection on this piping.
- Good potential exists to implement leakage monitoring via the District Metered Area (DMA) method in several systems.
- Good potential to better manage high pressures in several systems.
- None of the utilities has an ongoing leakage management program

General Findings

- Opportunities
 - Water audit reveals cost impacts – may help convince utility Boards act to fund upgrades
 - Low cost operational improvements can be identified
 - May be able to conduct a *Reservoir Drop Test* as low cost means to test production flowmeters
 - Small size grids are good to operate as District Metered Areas (DMA) for leakage monitoring
 - Advanced Metering Infrastructure (AMI) could create dramatic operational and cost-efficiencies

Additional DEP Resources provided to Utilities

- Fire Hydrant Flushing Form
- Tank Drop Test procedure/form
- Leakage tracking spreadsheets
- Info on Advanced Metering Infrastructure

3910-FM-BSDW0563-4/2018		COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF SAFE DRINKING WATER								
		HYDRANT SAMPLING LOG								
Utility Name:		Date:		Conducted By:						
Reason:		Zone Flushed:								
				A	B	A x B				
Hydrant No.	Hydrant Location	Static Pressure	Start Time	End Time	Total Time Flushed (min)	Est. Flow (gpm)	Volume Flushed (gal)	Disinfect Residual Start (mg/L)	Disinfect Residual End (mg/L)	Comments

Continuation of Water Auditing

- Capability Enhancement Program identifies water utilities with specific issues that include perceived high water loss
- G. Kunkel conducting water audits as requested
- Mary Roland soon starting in OAP and is training on the water audit process
- Opportunity to coordinate with other PA water programs

DEP Approved Trainings

Water Loss Management: a Three-Part Instructional Series

Susquehanna River Basin Commission

April 11, 2017

July 12, 2017

August 16, 2017

SRBC Registration Workshop Overview Previous Workshops ▾ Contact

Workshop Overview

Water Loss Management Instructional Series

The Susquehanna River Basin Commission (Commission) is continuing its [Public Water Supply Assistance Program \(PWSAP\)](#) by partnering with the Pennsylvania Department of Environmental Protection (PADEP) Operator Outreach Assistance Program to present this three-part instructional series.

Description: Many public water suppliers in Pennsylvania deliver water to customers through aging distribution systems. Water systems may be withdrawing, treating, and supplying water for which they may not be fully receiving revenue because of apparent losses (metering and billing inaccuracies) or real losses (leakage). To help public water suppliers conserve water resources and improve operations, the Commission and PADEP are offering a series of three workshops:

Session 2	Wednesday, July 12, 2017	8:30 am to 3:30 pm	5.5 Water Contact Hours
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Controlling Water Utility Apparent Losses in Metering and Billing Operations:

- Learn why metering and billing operations are an important component of your water loss control program.
- Learn ways to estimate apparent losses and recover lost revenue through accurate metering and billing.

Session 3	Wednesday, August 16, 2017	8:30 am to 3:30 pm	5.5 Water Contact Hours
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Fundamentals of Leakage and Pressure Management for Water Utilities:

- Learn about tools you can use to analyze system leakage.
- Learn about the importance of system pressure in leakage reduction.
- Learn how to systematically reduce water loss through leakage reduction and pressure management.

Instructor: George Kunkel, P.E., PA DEP Public Services Institute Instructor

Mr. Kunkel was the former water loss control program manager for the City of Philadelphia and a co-author of the American Water Works Association (AWWA) Free Water Audit Software. He has served, or is serving, on various AWWA water loss control committees and is currently Principal of Kunkel Water Efficiency Consulting.

Water Loss Control: 3-day Series presented in Erie (2016), Harrisburg/SRBC (2017) and Newtown (fall 2018).

– ***Series will be presented each year: Southwestern PA in 2019?***

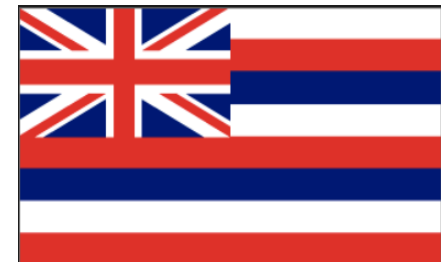
PA Regulatory Agency NRW Assessments

Agency	Collect AWWA Audits?	Data Validation Effort	Use UAF?
PA DEP	No	N/A	Yes (mixed)
PA PUC	Yes	Self-reported (no validation)	No
DRBC	Yes	Filtered, with biennial summary analysis	No
SRBC	No	N/A	Yes

- *A number of PA water utilities are seeking consistency in NRW assessments across all PA agencies*

Progressive Regulatory Agency Developments

- State of Georgia (*best in class*)
 - Conducts training, data validation
 - Pilot projects
 - Use State Revolving Fund Set-asides
- State of California
 - Similar to Georgia – twice as many systems
 - First audits released in 2018
 - Setting initial loss targets by 2020
- State of Hawaii
 - Collecting initial data in 2018



Summary

- PA DEP is assisting small utilities in water loss control by:
 - Providing regular training
 - Compiling the standard AWWA water audit and providing recommendations for utilities in the OAP
- Opportunity exists to more fully integrate the AWWA Water Audit methodology in PA DEP reporting structures

George Kunkel, P.E.

kunkelwaterefficiency@gmail.com