Promoting Non-revenue Water Management in the United States: A 30-year Journey

Background Information

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Interdisciplinary Webinar

Reducing Leakage in a City's Water Supply System

The University of Hong Kong
October 30, 2020

KUNKEL
WATER EFFICIENCY CONSULTING

Water Supply in the USA: Success – but Challenges!

Great Success in building water supply infrastructure!

- Monumental and extensive water supply infrastructure promoted growth and economic prosperity

Great Challenges!

- High Non-revenue water (NRW) in many systems
- Aging and declining water supply infrastructure, but insufficient renewal investment
- No national policy on efficiency of the water supply
- Over 200 state and regional regulatory agencies set policy for over 50,000 water systems: a fragmented system
  - No water loss reduction regulations
  - The State of California will set targets for some systems in 2021

Hoover Dam, Colorado River, Arizona
Source: viator.com

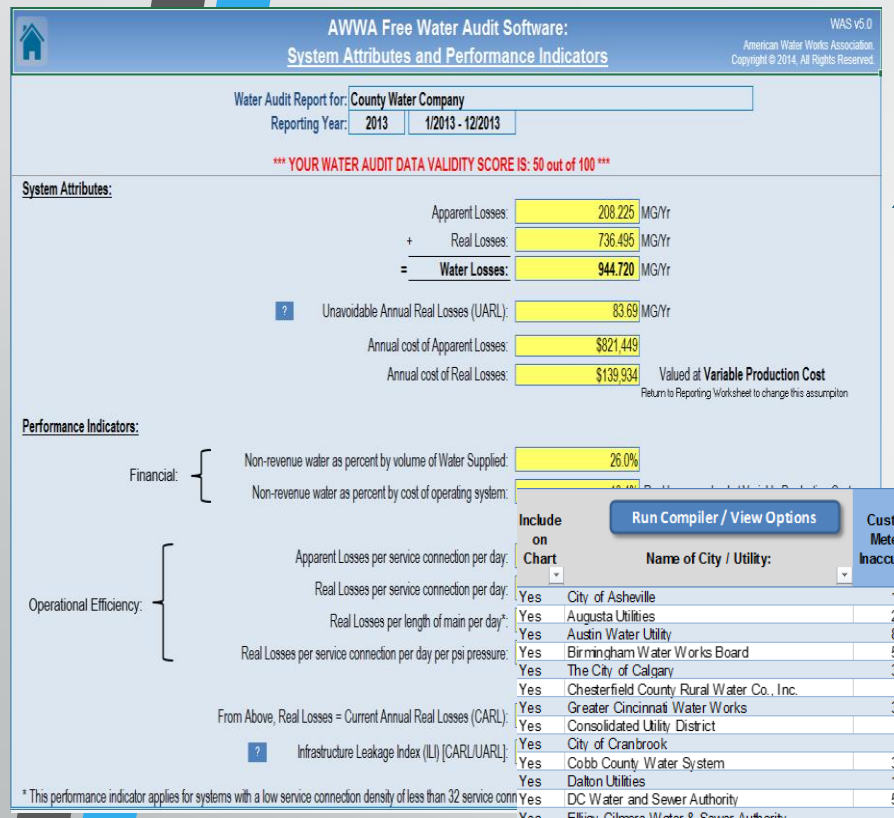
Successful Non-revenue Water Assessment and Management since 1990

- American Water Works Association (AWWA) Water Audit method and tools
- Water Research Foundation (WRF) research projects
- Innovative technologies
- Progressive regulatory structures in several US states

American Water Works Association
Dedicated to the World's Most Important Resource®

THE Water Research FOUNDATION

AWWA's methods and tools have assisted water systems for many years


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: 50 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 assumpiton

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:

Operational Efficiency:
- Apparent Losses per service connection per day:
- Real Losses per service connection per day:
- Real Losses per length of main per day*:
- Real Losses per service connection per day per psi pressure:

From Above, Real Losses = Current Annual Real Losses (CARL):

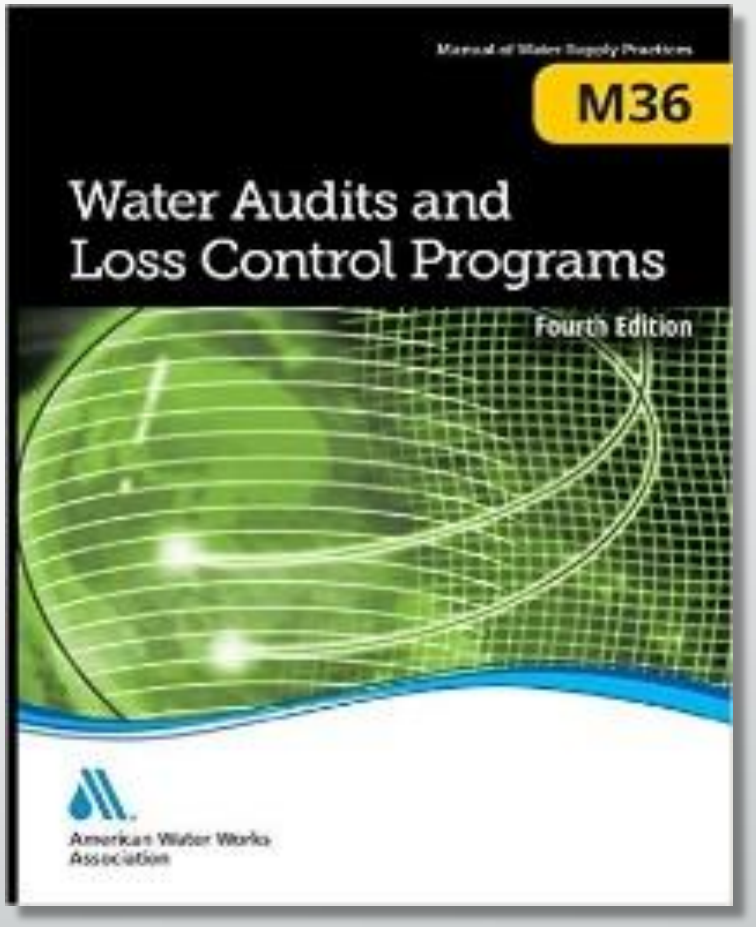
? Infrastructure Leakage Index (ILI) [CARL/UARL]:

* This performance indicator applies for systems with a low service connection density of less than 32 service conn

AWWA Free Water Audit Software and **Compiler Tool** (data aggregator) since 2006

Run Compiler / View Options

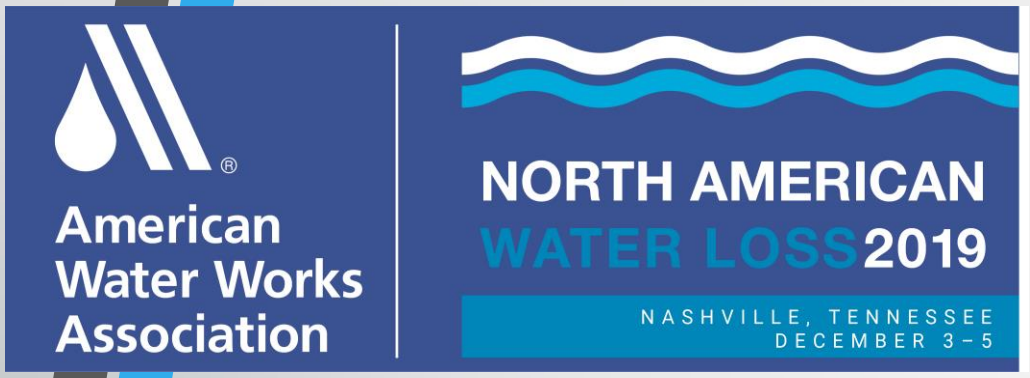
Include on Chart	Name of City / Utility:	Customer Metering Inaccuracies	Systematic Data Handling Errors	Systematic Data Handling Errors Default Use	Apparent Losses	Real Losses	Water Losses2	Non Revenue Water	Length of Mains	Number of Active and Inactive Service Connection
Yes	City of Asheville	111.220	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	Ellijay 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 Guidance Manual, M36 Water Audits and Loss Control Programs, 4th Edition (2016)

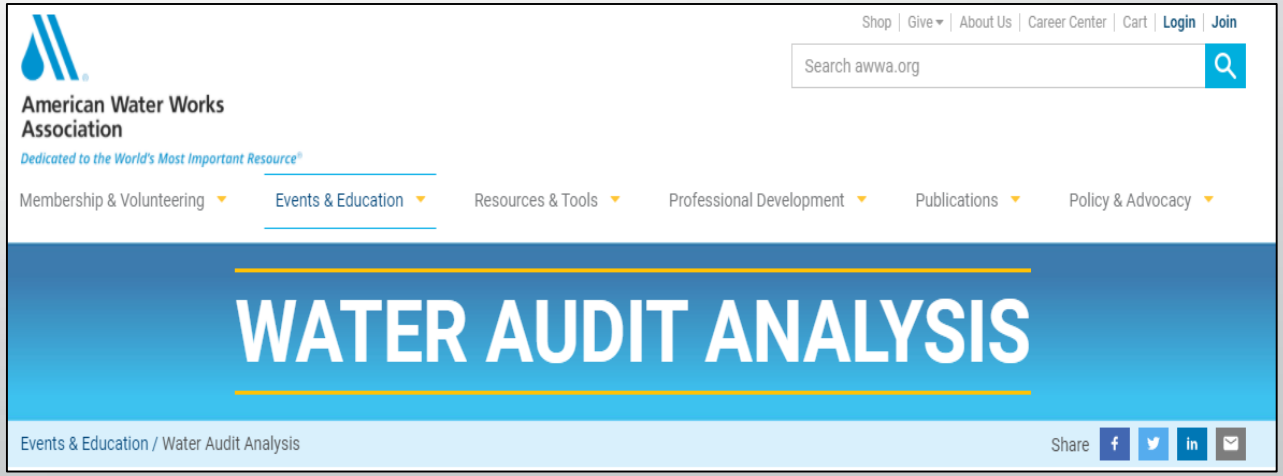
providing strong guidance since 1991

AWWA Conferences and Training Seminars on Non-revenue Water Management



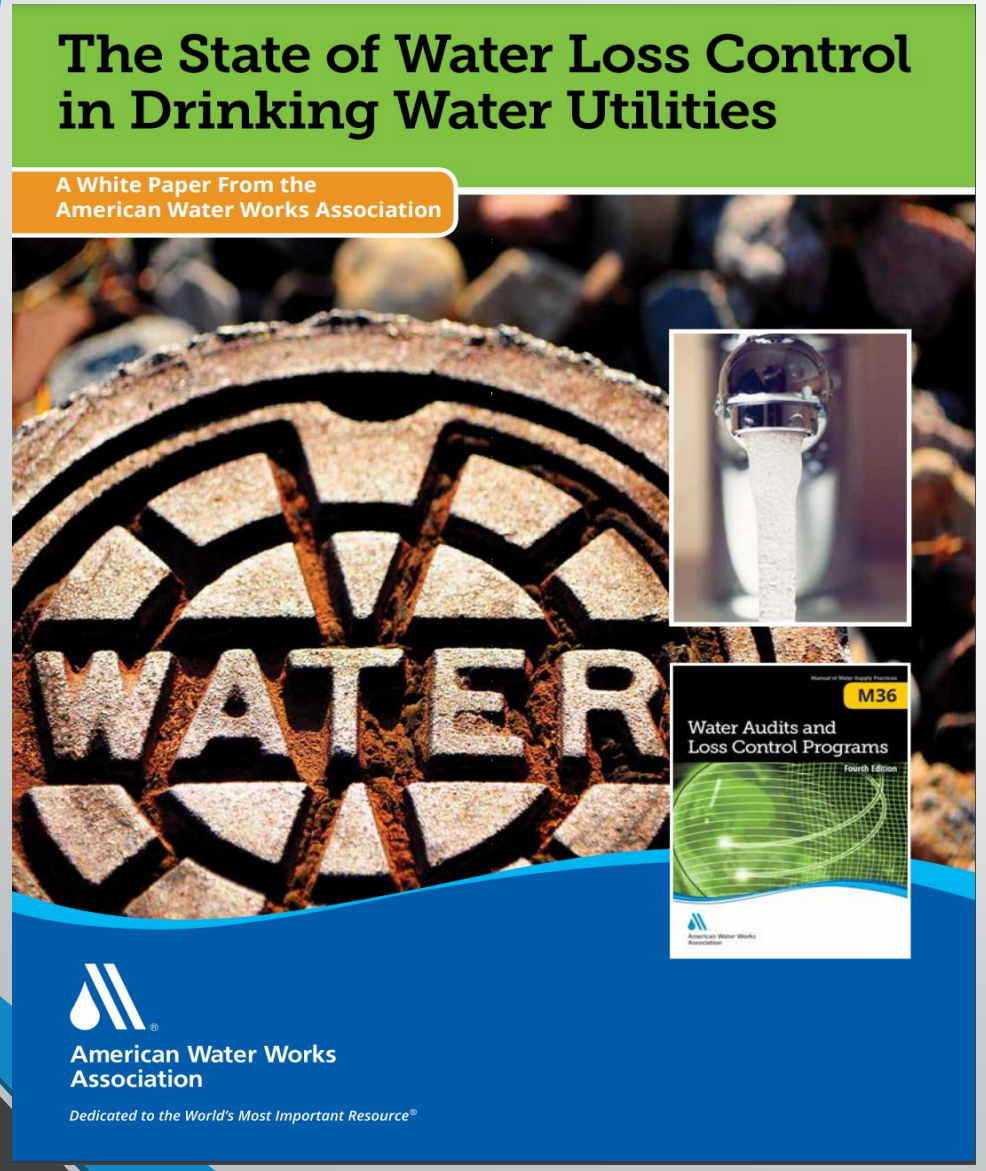
- **Conference**
  - North American Water Loss Conference – biennial event
  - Next: December 2021 Austin, TX, USA

- **Training Seminar***
  - Water Audit Analysis – two day in-person seminar
  - Presented twice annually in different North American cities



*currently suspended due to Covid19 pandemic

AWWA Advocacy for Non-revenue Water Management

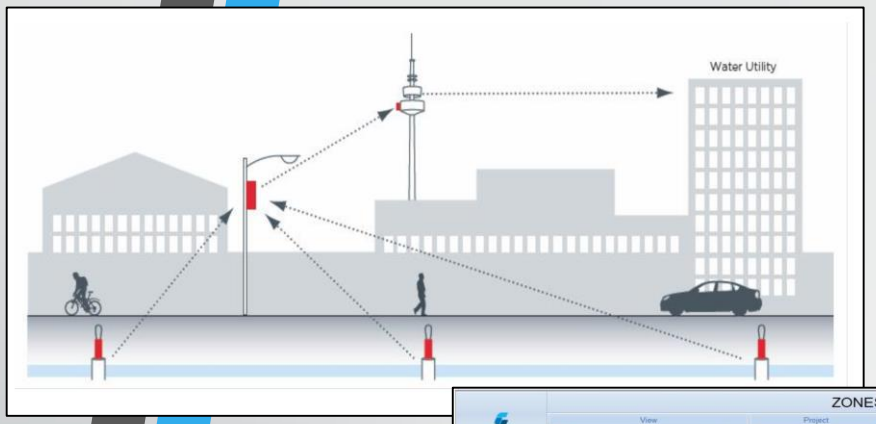


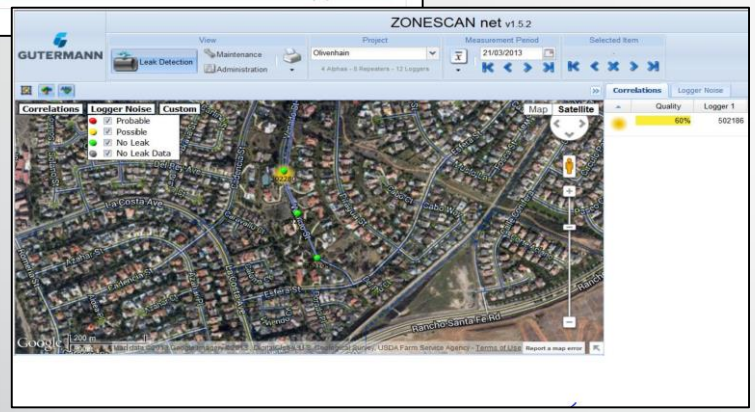
- **State of Water Loss Control Report (2016)**
  - White Paper report detailing current status of water loss control efforts and regulatory trends in North America
  - Several case studies of successful North American water systems are included

The Water Research Foundation
Funding Research into Successful NRW Management

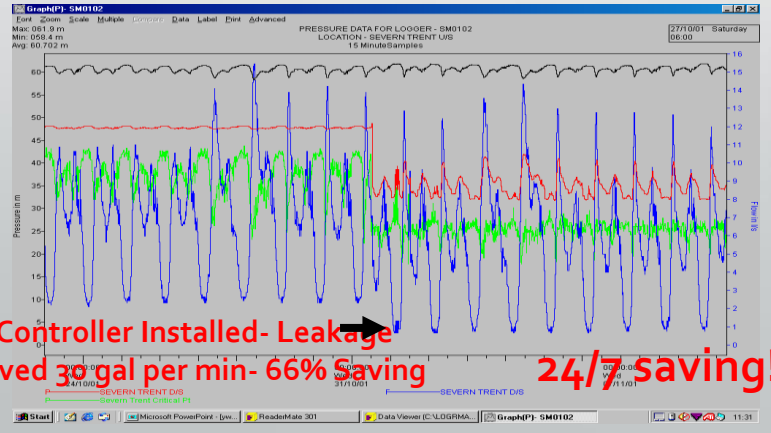
- Numerous projects totaling over US$2M in research funding since 2004
  - Occurrence of NRW, water audit process, and data validation
  - Leakage and pressure management
  - Advanced Metering Infrastructure and apparent loss control
  - NRW management business case planning

Innovative Technologies





- Innovative technology continues to be developed and implemented by forward-thinking North America water systems, Including:
  - Leakage Management
  - Pressure Management
  - Advanced Metering Infrastructure



Controller Installed- Leakage saved 30 gal per min- 66% Saving

24/7 saving!!

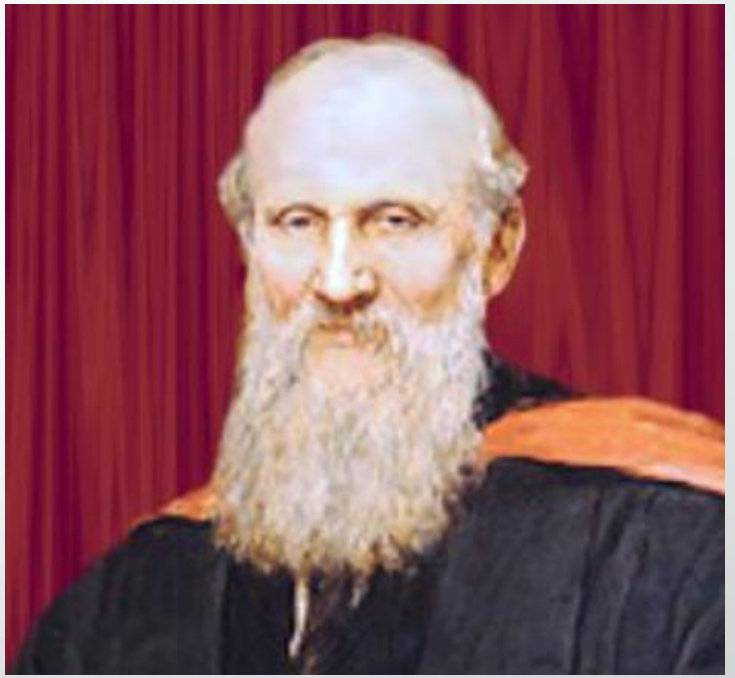
Source: Badger Meter

Progressive Regulatory Structures in North America

- Robust NRW auditing & loss control requirements:
  - State of Georgia, USA
  - State of California, USA
  - Province of Quebec, Canada
- Regulatory programs:
  - Annual compilation and submittal of AWWA water audits
  - Training for water system staff in use of the AWWA Free Water Audit Software
  - Level 1 Validation of the water audits upon submittal (three levels of validation are defined by the Water Research Foundation)

Water Audit Data Collection: Primary Focus for NRW Management in the USA at this time

- The **Water Audit**: collects data on volumes and costs of Water Supplied and Water Billed to Customers
- Non-revenue water cannot be successfully managed unless it is first **quantified** and reliably **analyzed**



"You can't manage it if you don't measure it"

- Lord Kelvin, eminent 19th century British physicist

This presentation continues by describing recent recommendations made by the American Water Works Association ……