

---

# WATER LOSS AUDITS: NATIONAL TRENDS & NJ STATUS



***LARRY LEVINE, SENIOR ATTORNEY  
NATURAL RESOURCES DEFENSE COUNCIL***

Feb. 7, 2017  
Workshop by: Sustainable Jersey, NJLM,  
AEA, Jersey Water Works, Rutgers SEBS

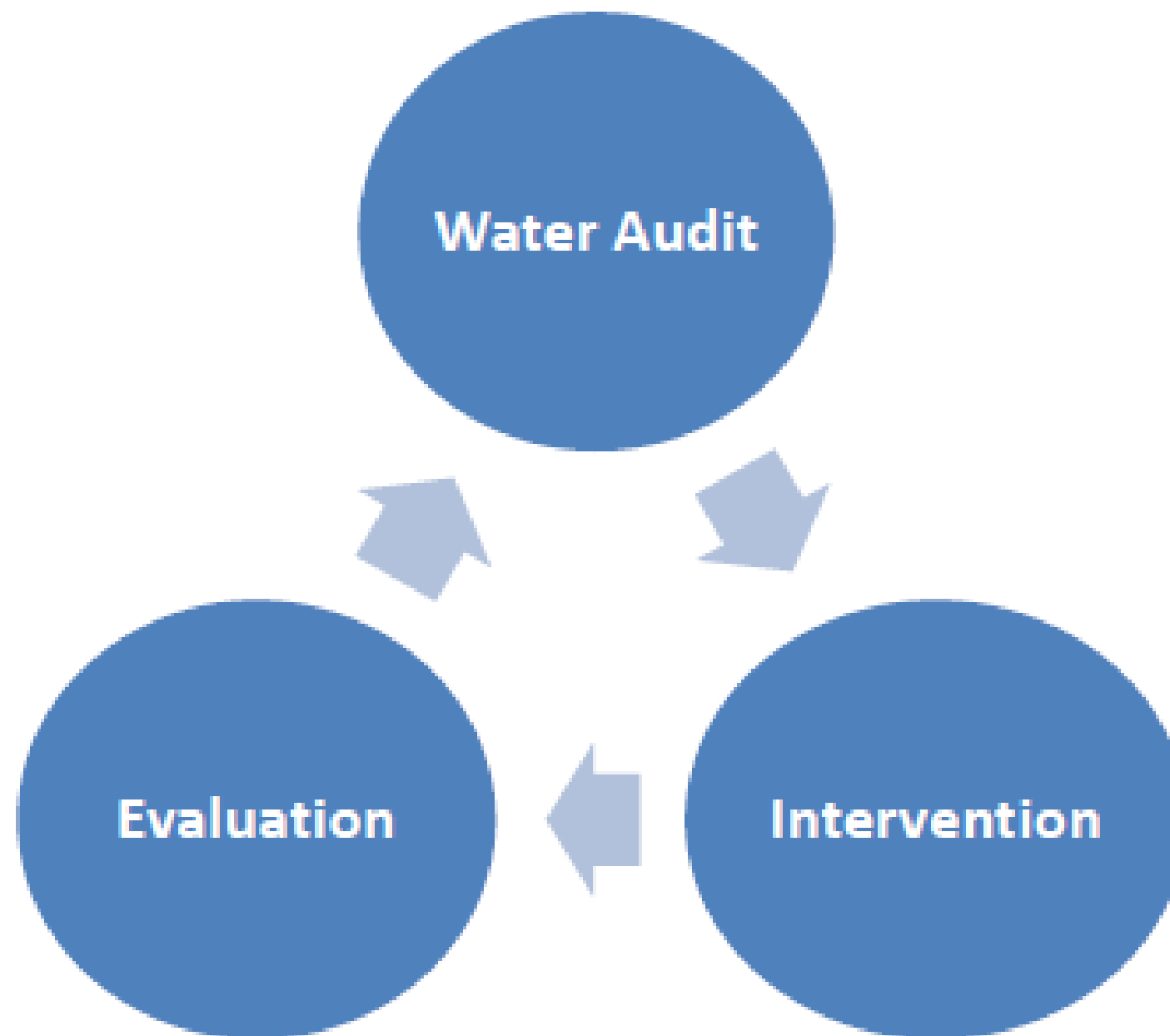
---

---

# Water Loss Control & Water Loss Audits

---

## Components of water loss control:

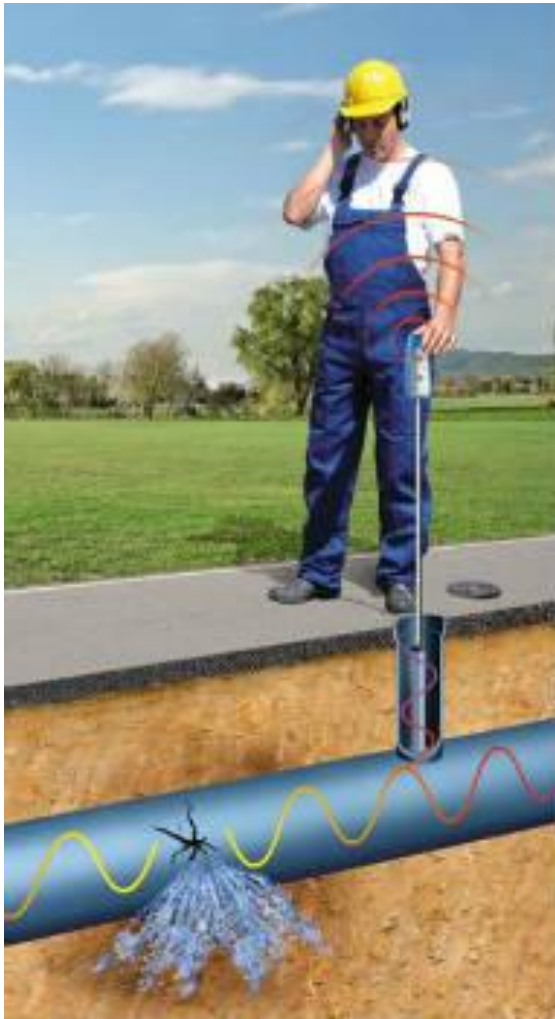


Source: EPA, Water Audits and Water Loss Control for Public Water Systems(2013)

---

# Information to Inform Action

---



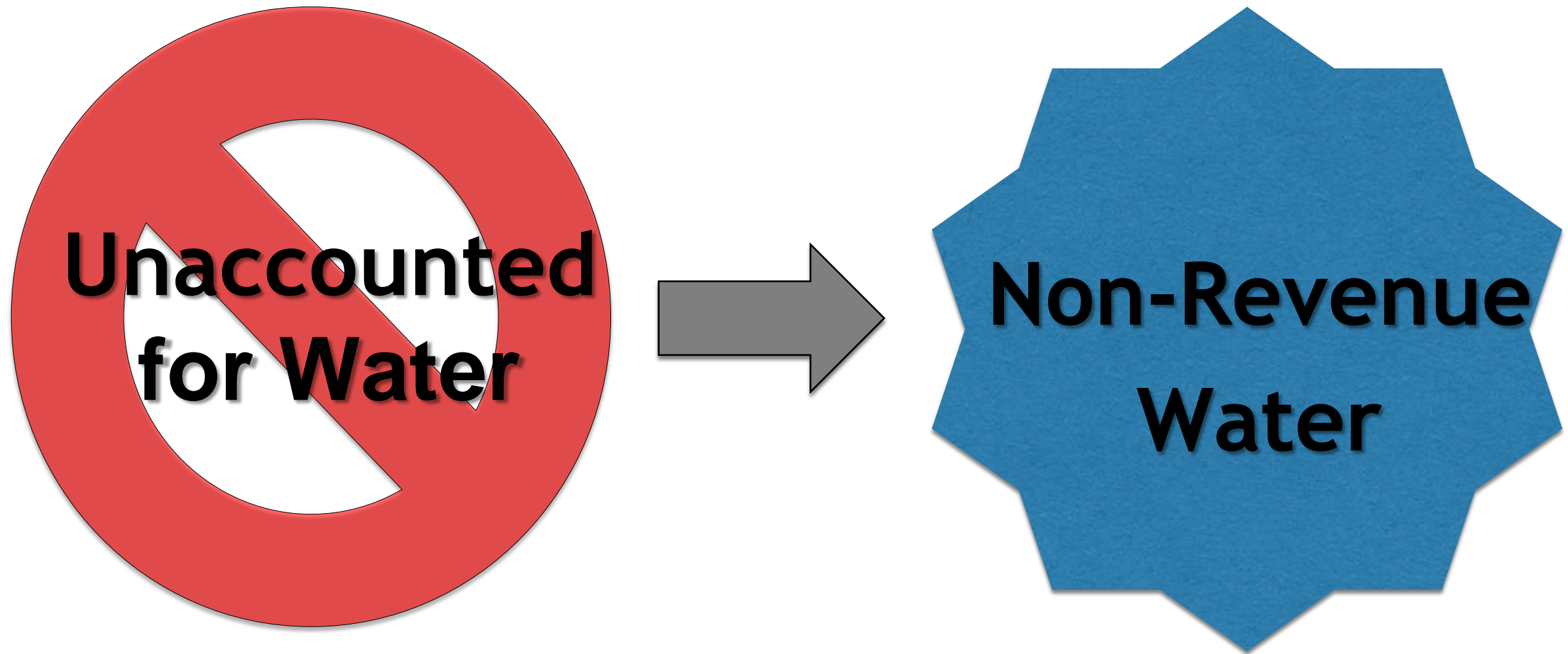
**Eight Questions for every local water utility --**

- 1. How much water does our water system lose each year?**
- 2. How do we actually know how much water we're losing?**
- 3. What do water leaks and water main breaks cost our water system each year?**
- 4. Who pays for all the damages when a water main breaks?**
- 5. How accurate are our water meters?**
- 6. What steps does the utility take to find and repair leaks before they become major breaks?**
- 7. What is the average pressure in our water distribution system, and how is it managed to avoid unnecessarily high pressure?**
- 8. How many miles of water mains are replaced each year, and at that rate, how many years would it take to replace the entire system?**

---

# Water Loss Audits

---



# Where Has All the Water Gone...?

The IWA/AWWA Water Balance						
Volume From Own Sources (corrected for known errors)	System Input Volume	Water Exported (corrected for known errors)	Billed Water Exported			Revenue Water
		Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
Water Losses	Apparent Losses			Unbilled Authorized Consumption	Billed Unmetered Consumption	
		Real Losses	Leakage on Transmission and Distribution Mains	Unbilled Metered Consumption	Unbilled Unmetered Consumption	Non-revenue Water
Leakage and Overflows at Utility's Storage Tanks	Customer Metering Inaccuracies			Unauthorized Consumption		
	Leakage on Service Connections up to the Point of Customer Metering			Systematic Data Handling Errors		
Water Imported (corrected for known errors)						

NOTE: All data in volume for the period of reference, typically one year.

# AWWA Water Loss Audit – Standardized Method & Format

Industry-recognized best practice for water loss control is based on annual water loss audits using a standardized format developed by the American Water Works Association (AWWA).

**AWWA Free Water Audit Software: Reporting Worksheet**  
WAS v5.0  
American Water Works Association, Copyright © 2014, All Rights Reserved.

Water Audit Report for: **Greater Cincinnati Water Works**  
Reporting Year: **2015** 7/2014 - 6/2015

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

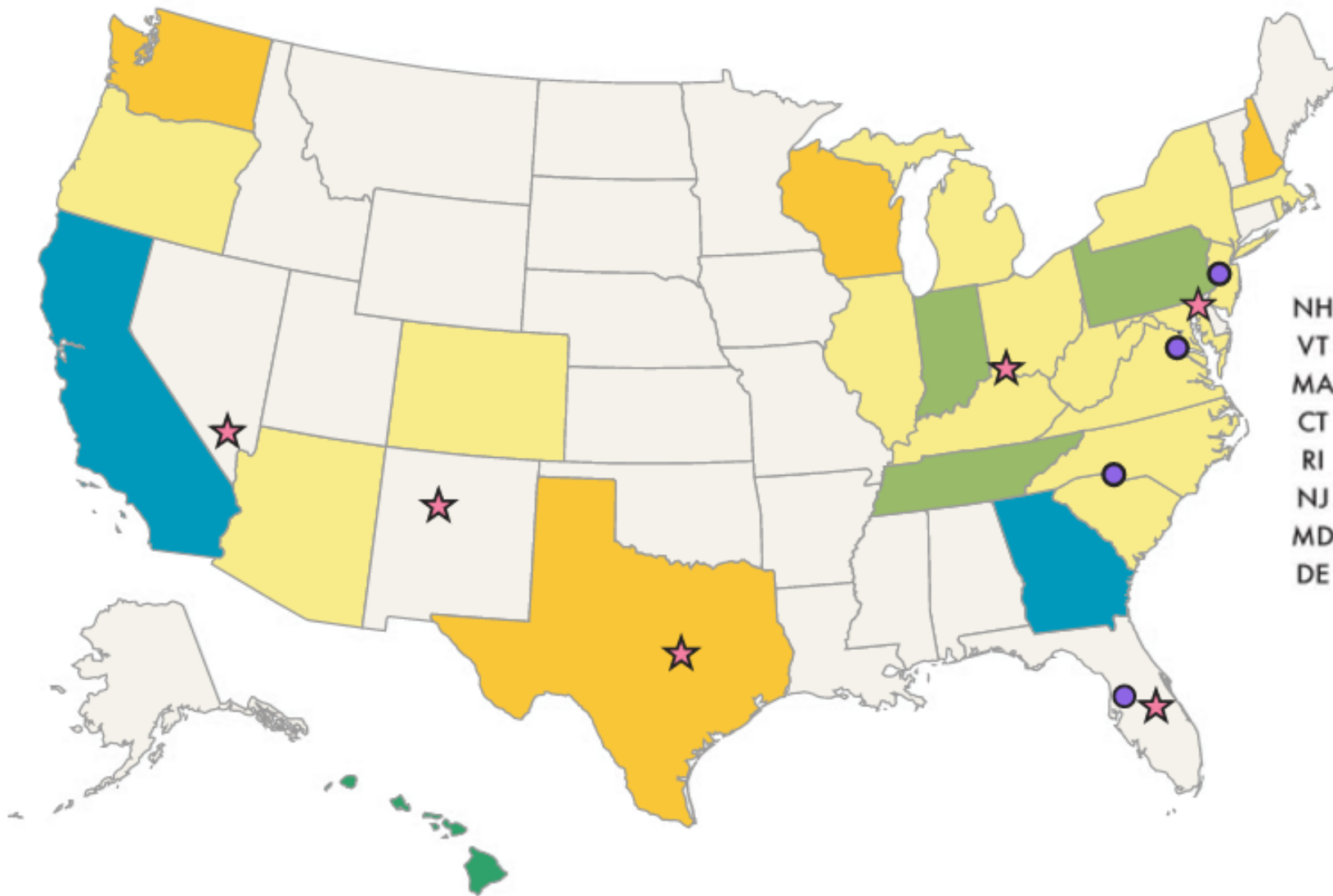
Category	Value	Unit
<b>WATER SUPPLIED</b>	<b>34,133.629</b>	MGYr
Volume from own sources	43,025.000	MGYr
Water imported	0.000	MGYr
Water exported	9,068.000	MGYr
<b>AUTHORIZED CONSUMPTION</b>	<b>26,874.700</b>	MGYr
Billed metered	26,014.000	MGYr
Billed unmetered	28.100	MGYr
Unbilled metered	501.900	MGYr
Unbilled unmetered	330.700	MGYr
<b>WATER LOSSES (Water Supplied - Authorized Consumption)</b>	<b>7,258.929</b>	MGYr
<b>Apparent Losses</b>	<b>418.206</b>	MGYr
Unauthorized consumption	85.334	MGYr
Customer metering inaccuracies	267.837	MGYr
Systematic data handling errors	65.035	MGYr
<b>Real Losses (Current Annual Real Losses or CARL)</b>	<b>6,840.722</b>	MGYr
Real Losses = Water Losses - Apparent Losses	6,840.722	MGYr
<b>NON-REVENUE WATER</b>	<b>8,091.529</b>	MGYr
NON-REVENUE WATER = Water Losses + Unbilled Metered + Unbilled Unmetered	8,091.529	MGYr
<b>SYSTEM DATA</b>		
Length of mains	3,153.0	miles
Number of active AND inactive service connections	248,559	
Service connection density	79	conn./mile main
Average length of customer service line	27.0	ft
Average operating pressure	93.8	psi

## AWWA Free Water Audit Software (version 5.0)

- Can be readily conducted by any water utility
- Low cost -- Excel-based software is free
- Can be performed by existing utility staff
- Forgiving -- Allows entry of estimated or imprecise data
- Generates recommendations for where data quality should be improved
- Most utilities can complete the audit in 1 to 3 days without outside help



# Cutting Our Losses: State-by-State Policies



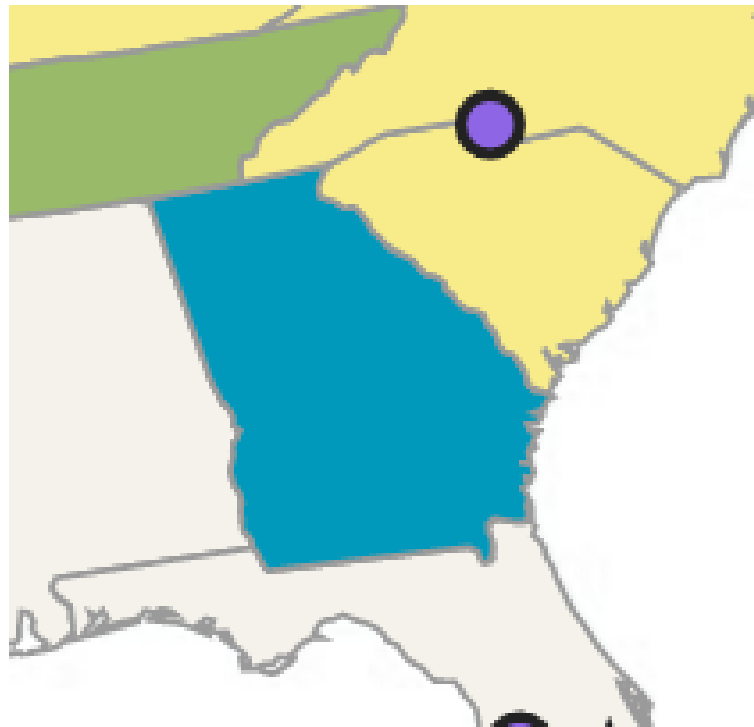
NH  
VT  
MA  
CT  
RI  
NJ  
MD  
DE

- ✓ **Rudimentary Water Loss Reporting** - Some water suppliers are required to make simple estimates of water losses.
  - ✓ **Annual Reporting with Standard Terminology** - Reports of water loss using [industrywide definitions](#) are required each year.
  - ✓ **AWWA Free Water Audit Software** - Utilities are to report water losses in an [electronic format](#) developed and endorsed by the water utility industry.
  - ✓ **Validation of Data** - Third party experts or trained evaluators review the information and data sources used by utilities to prepare water loss audit reports ("Level 1" validation).
  - ✓ **Volume-Based Performance Benchmarks** - Goals or targets are being set to reduce water losses by specific volumes.
- No Action
  - Rudimentary Water Loss reporting is required
  - Annual Water Loss reporting with AWWA standard terminology is required
  - Annual use of AWWA Free Water Audit Software is required
  - Validation of water loss data is required
  - System-specific, volume based performance benchmarking required
- 
- River basin agencies or other regional organizations where water loss reporting is being specifically addressed
  - ★ Water suppliers for which validated water audits are complete and available

---

# Georgia – A Leader in Auditing and Data Validation

---



● System-specific, volume based performance benchmarking required

## Georgia Water Stewardship Act of 2010 (SB 370/HB 1094)

- Requires all public water systems in GA serving more than 3,300 individuals to conduct and file a standardized Water Loss Audit report (AWWA method) each year.
- 226 utilities in GA are subject to the annual reporting requirement
- Level 1 validation is required.
- Validated audit reports are posted by the State.
- **Performance:** Georgia DNR - Environmental Protection Division requires each water supplier to develop and conduct a water loss control program and demonstrate “demonstrable progress” toward improvement of water supply efficiency over time



---

# California

---



## SB 555 (2015)

- Requires annual AWWA water loss audit report by all urban water suppliers (400+ systems)
- Requires Level 1 validation of reports prior to filing
- Requires utilities to identify steps taken in the preceding year to increase the validity of data entered into the final audit and to reduce the volume of apparent and real losses.
- **Performance:** Standards for the volume of losses are to be set by rulemaking in 2019-2020.

● System-specific, volume based performance benchmarking required

---

# NRDC Model State Legislation: Utility Water Loss Audits

---

- Requires public water suppliers to perform a water loss audit each year, using the AWWA standard methodology.
  - **Regulations** issued within 18 months
  - **1st annual audit report due 2 years** after enactment of the bill
  - **“Level 1” validation** required
  - State must make **audit reports available online**
- 2-3 years after first audit cycle, state to set requirements for “data validity” and performance standards to reduce water loss
- Technical assistance to utilities, using available state funds, to support performance and validation of audits, improvement of water loss detection programs.

---

# Model State Legislation – Introduced & Adopted

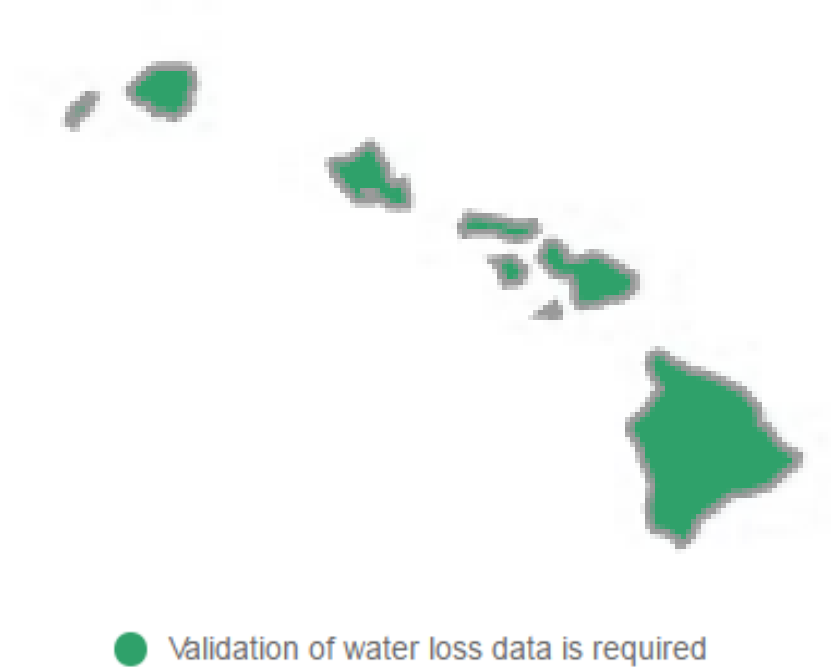
---

- Hawaii - **PASSED**
  - Includes most core elements
- Indiana - **PASSED**
  - Includes limited elements
- **New Jersey - INTRODUCED IN CURRENT SESSION (Dec. 2016)**
  - **S. 2926 & A. 4415**
  - **Includes all core elements of NRDC model bill (except that technical assistance program does not include funding)**
- Colorado - Introduced last session, no committee hearing
  - HB 16-1283 (2016)
  - Includes most core elements

---

# Hawaii – New Law

---



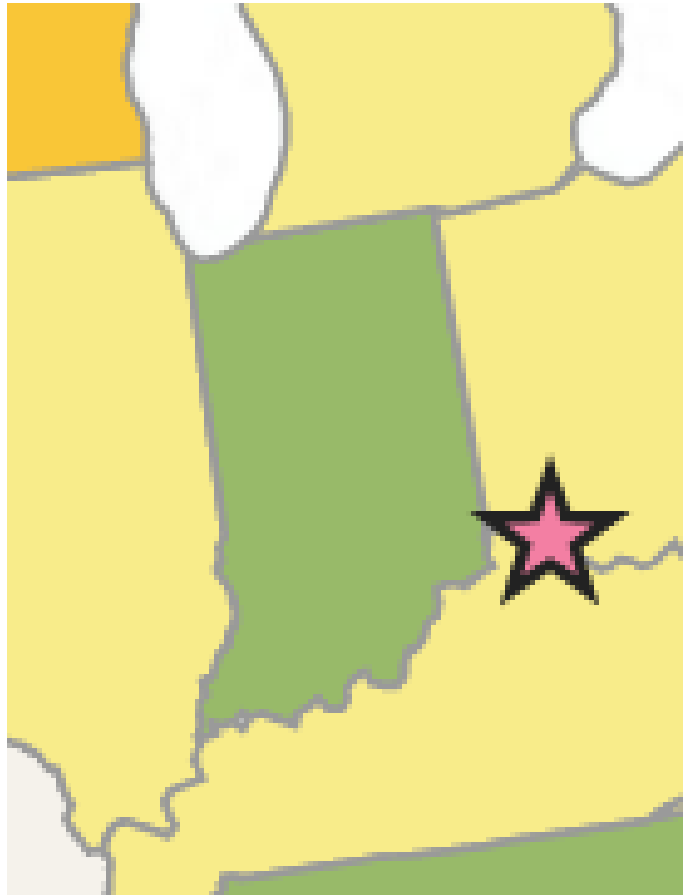
## SB 2645 (2016)

- Requires all county-run water systems (approx. 50 systems) to file an AWWA water audit report annually, starting in 2017.
- All other water suppliers are to begin annual filing in 2019.
- Requires Level 1 validation of reports prior to filing
- Requires utilities to identify steps taken in the preceding year to increase the validity of data entered into the final audit and to reduce the volume of apparent and real losses.
- **Performance:** No provision for setting a performance standard.

---

# Indiana – New Law

---



● Annual use of AWWA Free Water Audit Software is required

## Previous requirement

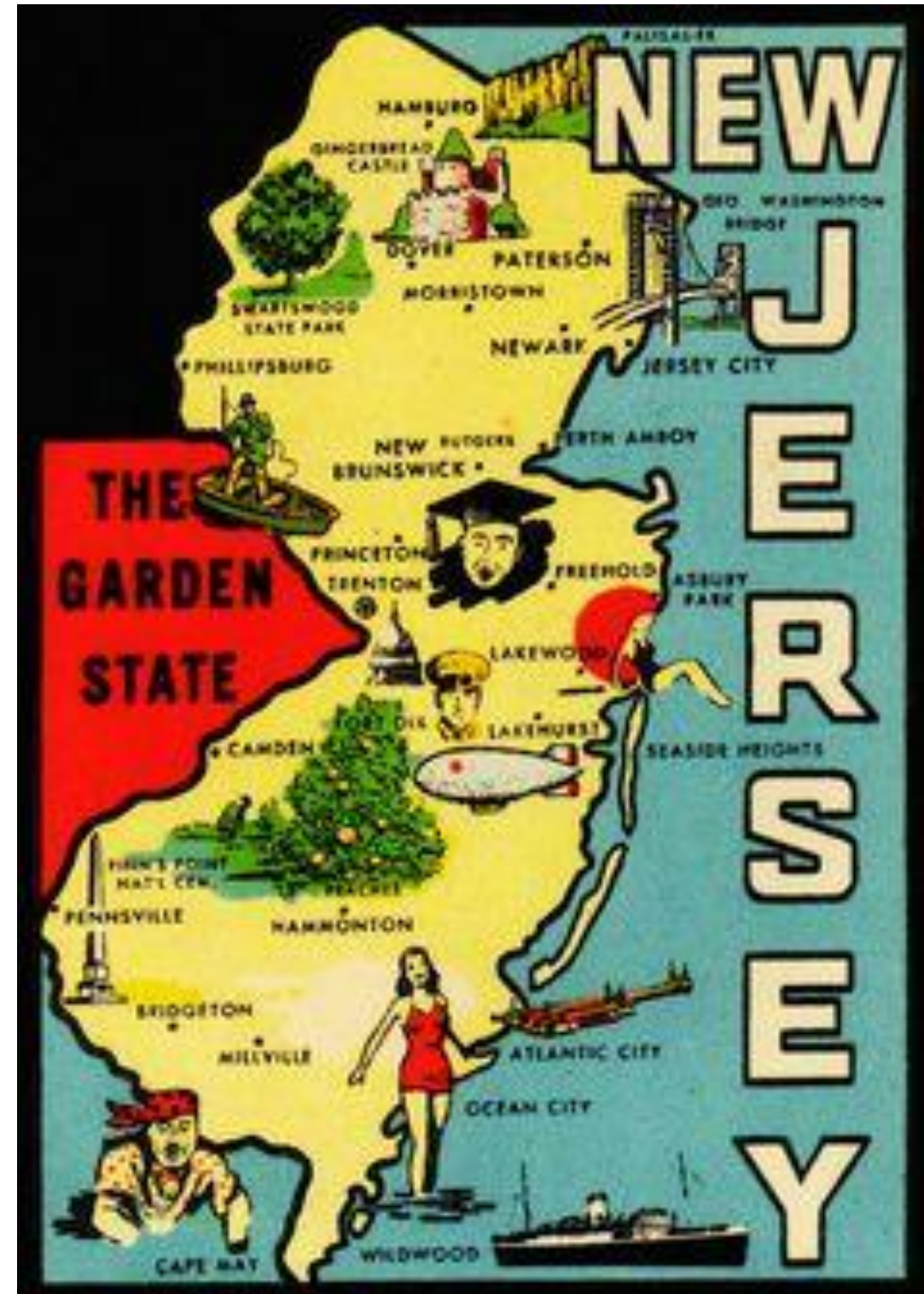
Indiana Dept of Environmental Management requires all public water supply systems to submit annual Public Water System Sanitary Surveys, including an answer of yes, no, or N/A to whether the system has “>25% water loss based on a 1 year average.”

## SB 347 (2016)

- Requires all water utilities to submit a standardized AWWA water loss audit report to the Indiana Finance Authority, along with an infrastructure needs assessment.
- Training provided, but validation not required.
- IFA will review audits and submitted a report to the Governor and legislature in Nov. 2016 (1 year early).

New Jersey: Water Loss Rules & Data

*How about  
New Jersey?*





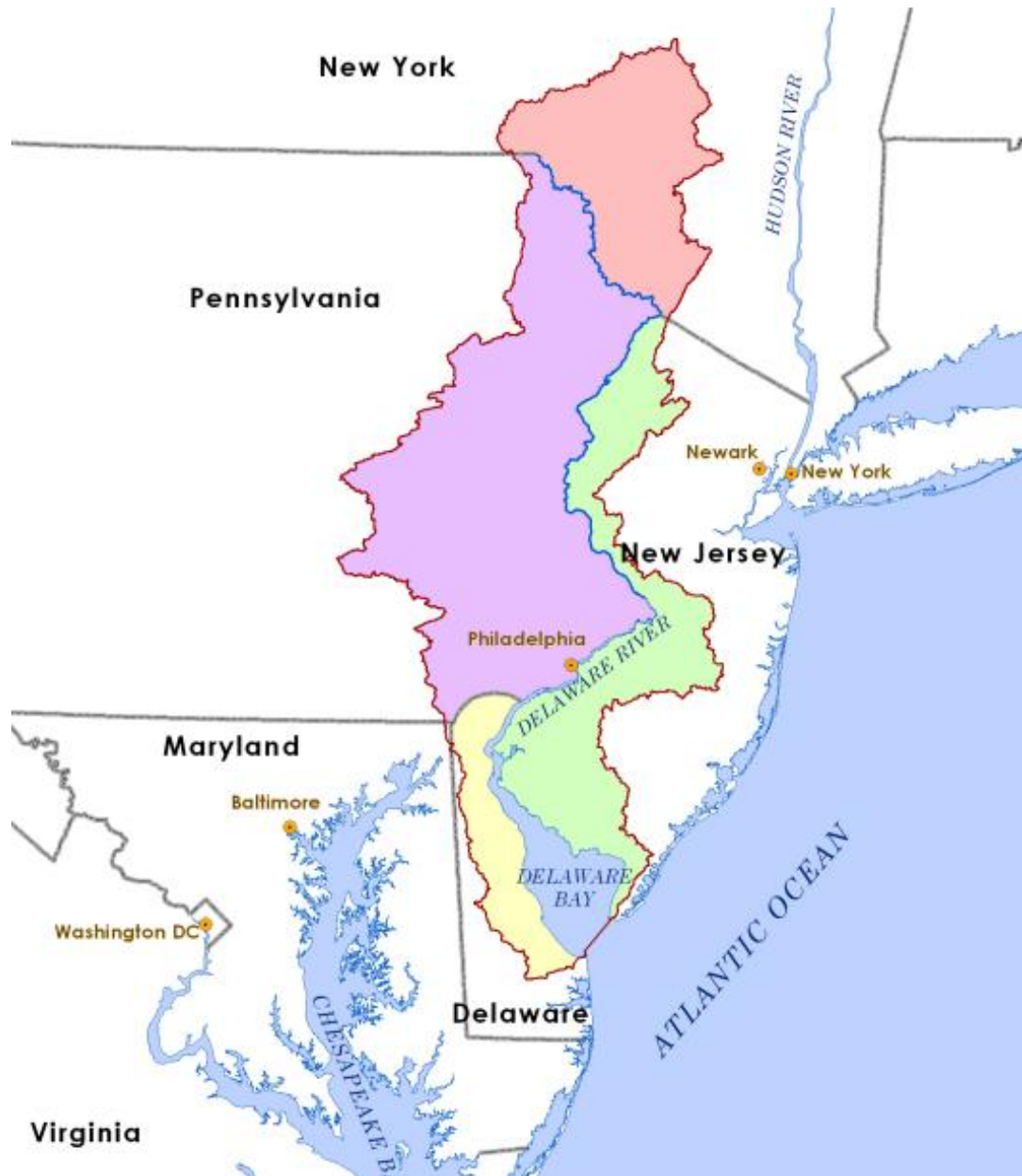
# New Jersey – Current Rules



● Rudimentary Water Loss reporting is required

- ~89% NJ residents served by public water supplies
- >\$7.9 billion need over 20 yrs for drinking water infrastructure (USEPA)
- DEP requires reporting of “Unaccounted-for Water” (UAW) every two years
  - UAW > 15% may trigger compliance actions
  - AWWA audit “optional”
- BPU (which regulates ~100 systems) requires UAW reporting in rate increase applications
- DRBC requirements limited in substance and geography (see next slide)
- ***No statewide requirement for utilities to do AWWA water loss audits***

# Delaware River Basin Commission (DRBC) Rules



Delaware River Basin

- Interstate agency including representatives from DE, NJ, NY, PA, and the U.S. Army Corps of Engineers
- In 2009, DRBC adopted rule that all utilities submit annual water audits, beginning in 2012, using AWWA Free Water Audit Software.
- A good start, but:
  - No public reporting
  - No validation
  - No technical assistance program
  - No performance targets
- Several major NJ water systems, including Trenton, Camden, Pennsauken, Vineland, and New Jersey American Water are covered

---

# Evaluation of Water Audit Data for NJ Water Utilities

(Kunkel Water Efficiency Consulting, for NRDC)

---

**KUNKEL**  
WATER EFFICIENCY CONSULTING

**REPORT ON THE EVALUATION OF  
WATER AUDIT DATA FOR  
NEW JERSEY WATER UTILITIES**

**Prepared by:**  
**Kunkel Water Efficiency Consulting**  
**Philadelphia, Pennsylvania**

**Prepared for:**  
**Natural Resources Defense Council**

**January 10, 2017**

- Highlights largely hidden loss of drinking water in NJ
- Authored by George Kunkel:
  - expert on municipal water loss
  - co-author of AWWA water loss audit manual
  - formerly of Philadelphia Water Dept.
- Reviews 76 audits filed by NJ water utilities in the Delaware Basin.
- Estimates of water losses statewide

# Estimated NJ Statewide Water Loss: Gallons & \$\$\$

**Table 1 Summary of Findings: Evaluation of 2013 Water Audit Data Reported by New Jersey Water Utilities in the Delaware River Basin**

Parameter	Value
Apparent losses reported	790 mg (2.1 mgd)
Estimated economically recoverable apparent losses	287.7 mg (0.79 mgd)
Estimated recoverable annual revenue from economically recoverable apparent losses	\$1,244,507
Real losses reported	5,421 mg (14.8 mgd)
Estimated economically recoverable real losses	2,241 mg (6.14 mgd)
Estimated annual production cost savings from economically recoverable real losses	\$2,311,531

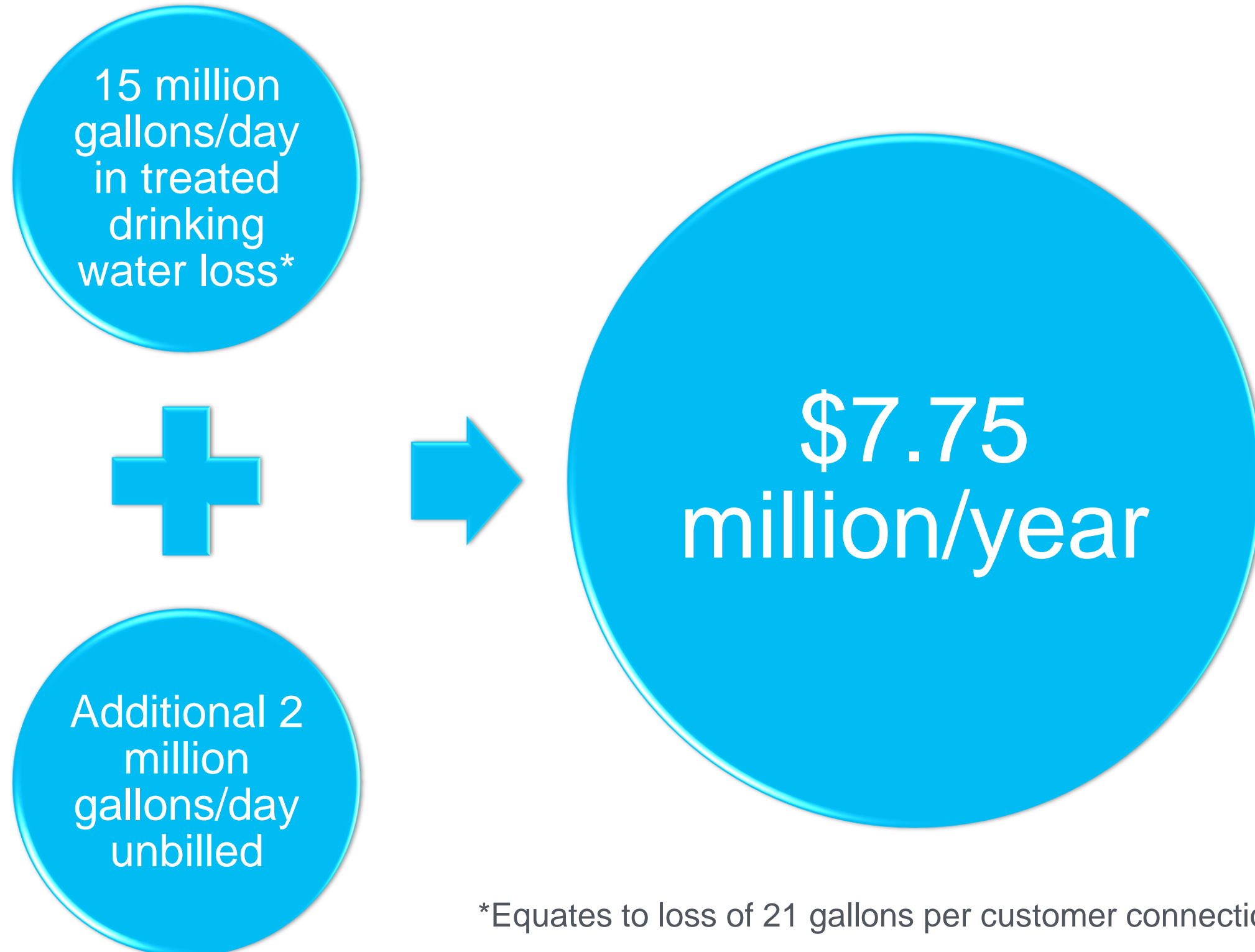
**Table 2 Estimates of Statewide Losses and Potential Savings**

Parameter	Value
Apparent loss estimate	6,898 mg (18.9 mgd)
Estimated economically recoverable apparent losses	2,515.2 mg (6.9 mgd)
Estimated recoverable annual revenue from economically recoverable apparent losses	\$12,576,000
Real losses estimate	47,383 mg (129.8 mgd)
Estimated economically recoverable real losses	19,591 mg (53.7 mgd)
Estimated annual production cost savings from economically recoverable real losses	\$10,128,500

---

# Delaware River Basin – NJ Utilities – Water Loss (2013)

---



\*Equates to loss of 21 gallons per customer connection per day



# NJ Statewide Water Loss Estimates

- ~**130 million gallons** of treated drinking water are lost each day across New Jersey (“real loss”)
- Of this, over **50 million gallons per day** of water losses, valued at **\$10 million per year** (variable production costs), are likely to be cost-effective for utilities to save
- That’s equal to the water use of about **700,000 New Jersey residents**, or a population 2.5 times the size of Newark
- Another **\$12.5 million** per year in lost revenue (“apparent loss”) will be cost-effective for utilities to recover through improved water measurement and billing practices

Water main break in Hoboken, NJ slows traffic on Willow Avenue approaching the Lincoln Tunnel (Dec 1, 2016)  
*Marisa Iati, NJ Advance Media for NJ.com*



Source: Kunkel Water Efficiency Consulting (2017)



---

# Data Validity Scores & Accuracy of Audit Results

---

- NJ utilities' self-reported “**data validity**” scores (DRBC dataset) were **significantly higher** than 3<sup>rd</sup>-party validated audits from a national dataset
  - NJ DRBC median score: 75 (out of 100)
  - National dataset (mostly GA): 63 (out of 100)
- NJ utilities' **reported losses** (DRBC dataset) were about **50% lower** than national dataset and a PA-DRBC dataset
  - Normalized to gallons per service connection
  - This is true for both real losses and apparent losses
  - Suggests problem with data validity
- Many other anomalies in audit data

➤ **Audit training & third-party validation are critical!**

---

**QUESTIONS?**

**LARRY LEVINE**

Senior Attorney  
[llevine@nrdc.org](mailto:llevine@nrdc.org)

**Cutting Our Losses:**

***[www.nrdc.org/resources/cutting-our-losses](http://www.nrdc.org/resources/cutting-our-losses)***

**NJ report at:**

***[www.nrdc.org/experts/ed-osann](http://www.nrdc.org/experts/ed-osann)* (Jan. 17 blog)**

---