

This presentation premiered at WaterSmart Innovations

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A Non-Revenue Water Tale of Five Cities

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Ongoing Research & Development:

Performance Indicator Task Force
WRF 4695-Effective WLC Planning

AWWA adopts international standard, abandons Unaccounted For Water

WRF study shows audit validity is a widespread challenge

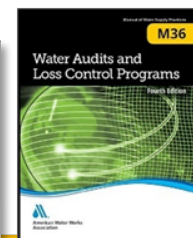
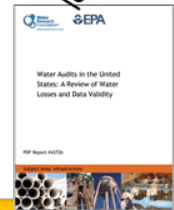
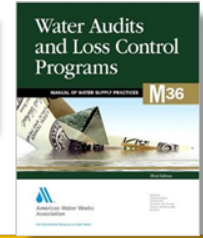
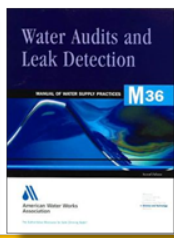
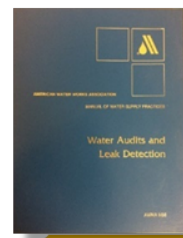
Validation method developed

M36 1st Ed.

M36 2nd Ed.

M36 3rd Ed.

M36 4th Ed.



1991

1999

2003

2006

2009

2010

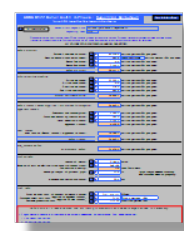
2014

2015

2016

2017

AWWA Audit Software v1

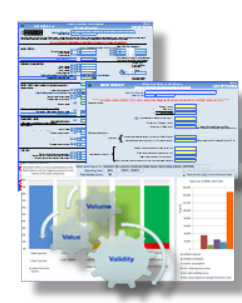


AWWA Audit Software v4



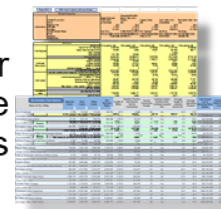
(2,000+ downloads)

AWWA Audit Software v5

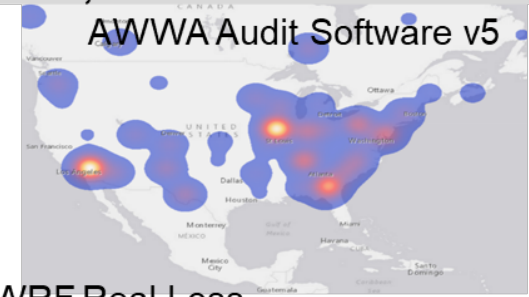


~8,000 downloads to date of AWWA Audit Software v5

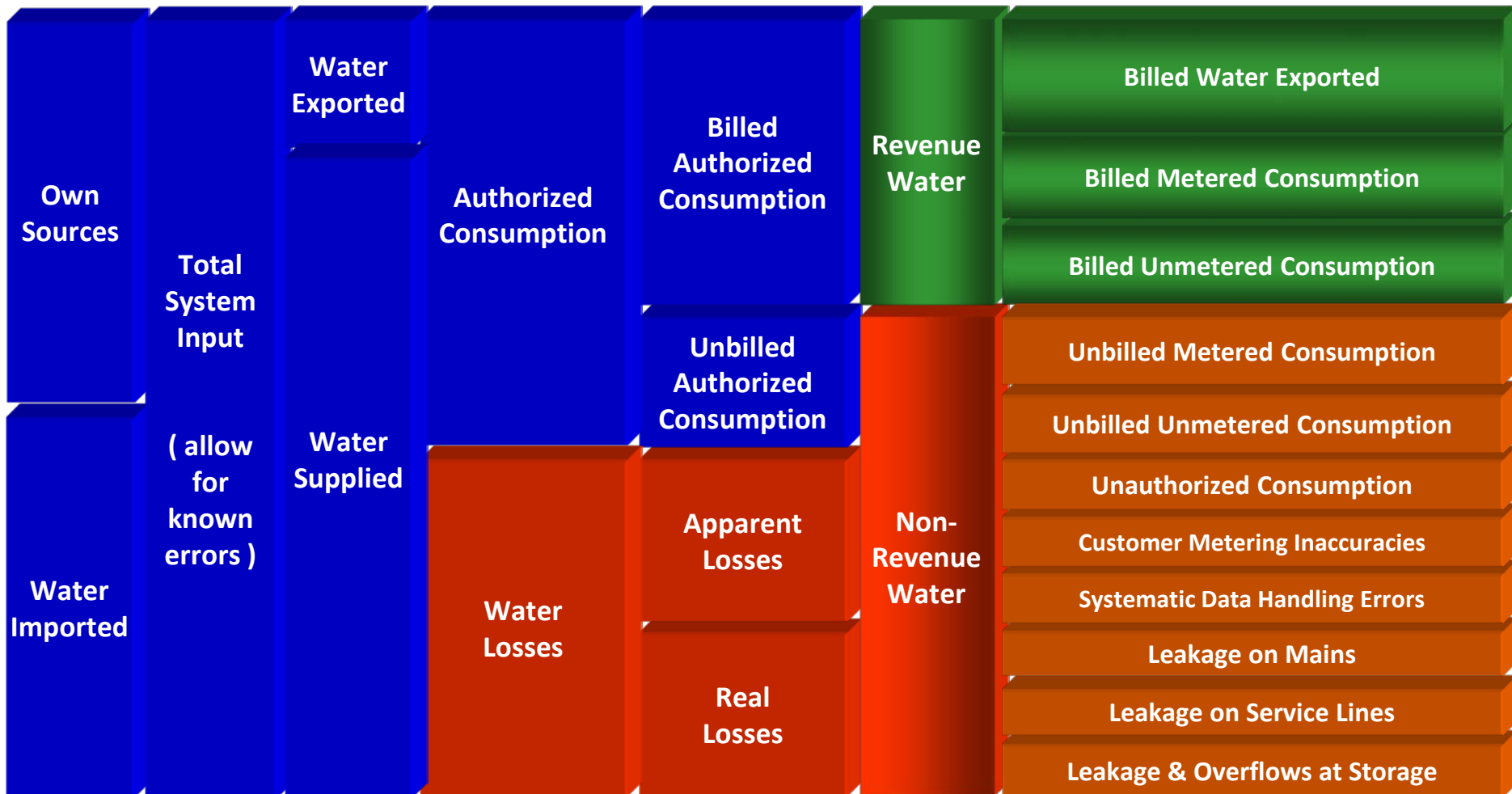
AWWA Compiler developed for large audit sets



WRF Real Loss Component Analysis Model

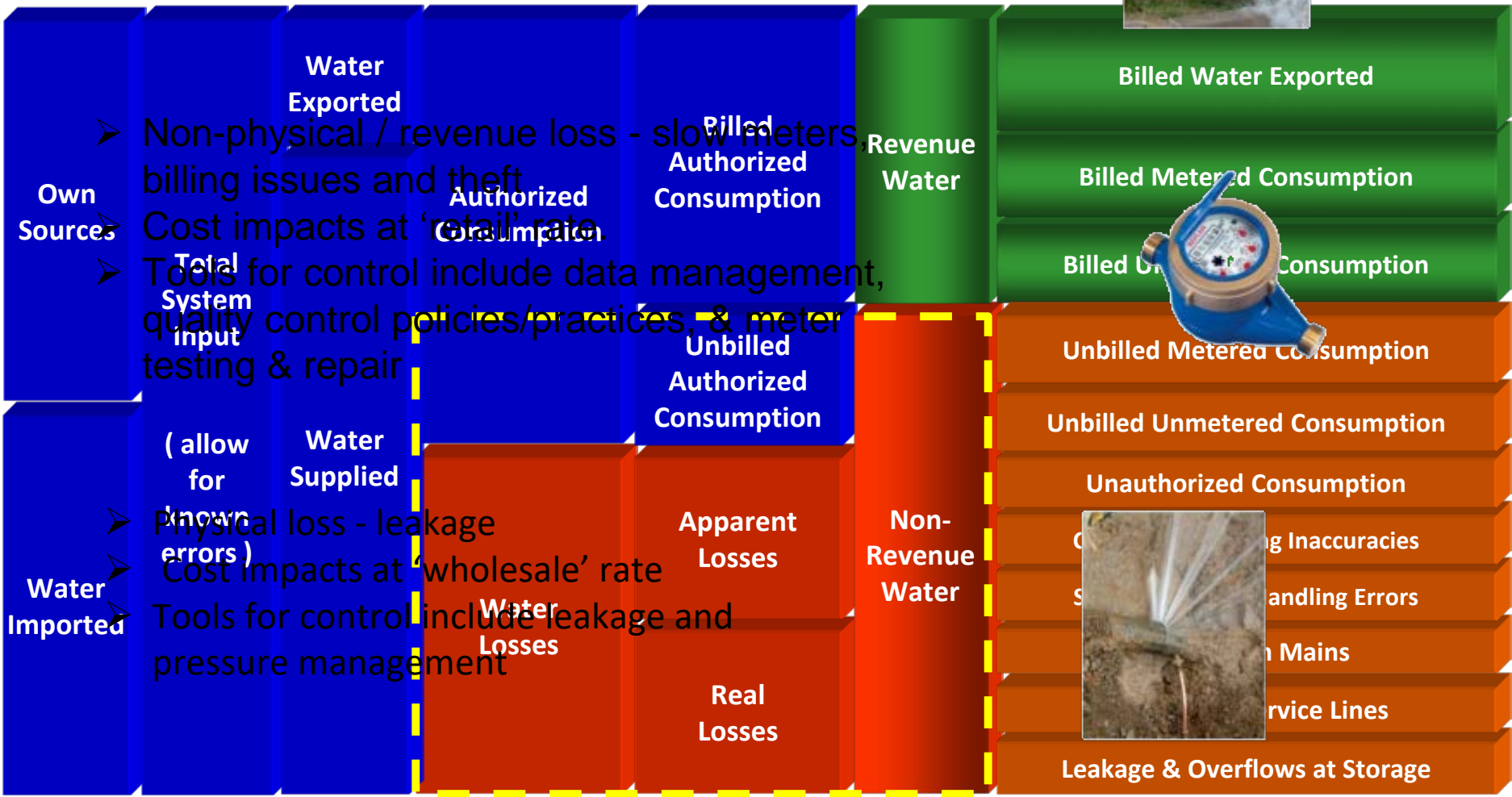


IWA/AWWA Standard Water Balance



Management of NRW

- Fire Dept Usage
- Operational Flushing
- Tools for control include efficient flushing practices and awareness campaigns



Water Efficiency Management

1

Determine Loss Volumes

- AWWA water audit
- Apparent & Real Loss volumes

2

Distinguish Types of Leakage/Losses

- breakdown of types of leakage (Component Analysis Model)
- sources of Apparent Loss

3

Evaluate Economics

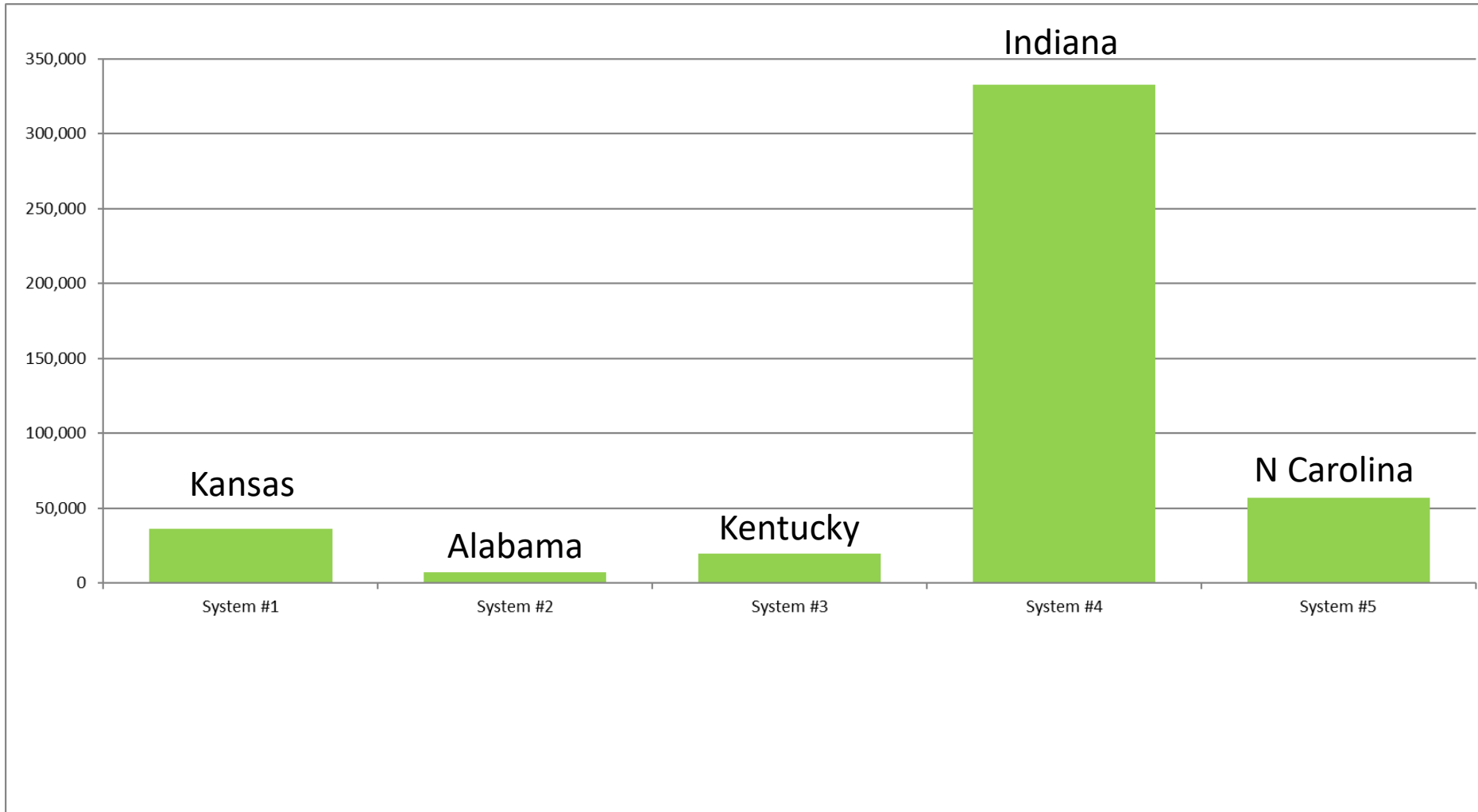
- costs of losses
- costs of intervention strategies

4

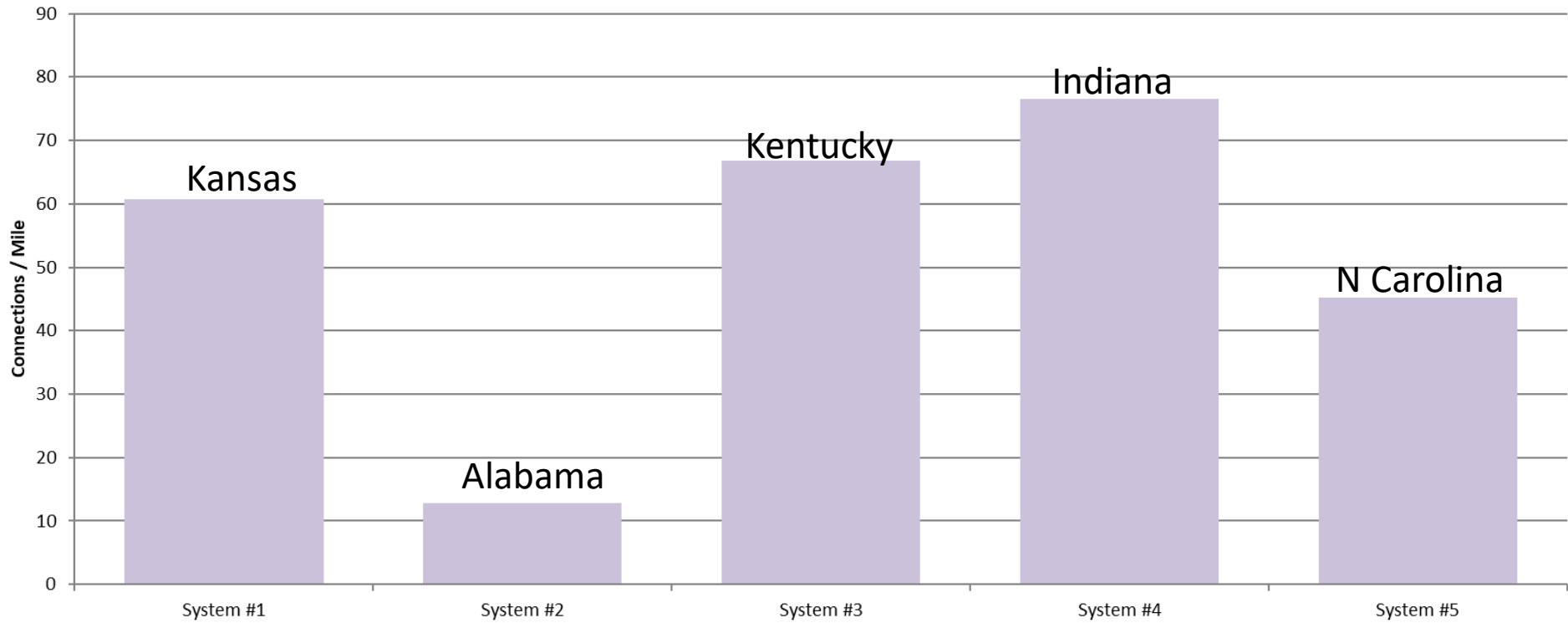
Implement Interventions

- leak detection
- repair time improvement
- pressure management
- cost effective!

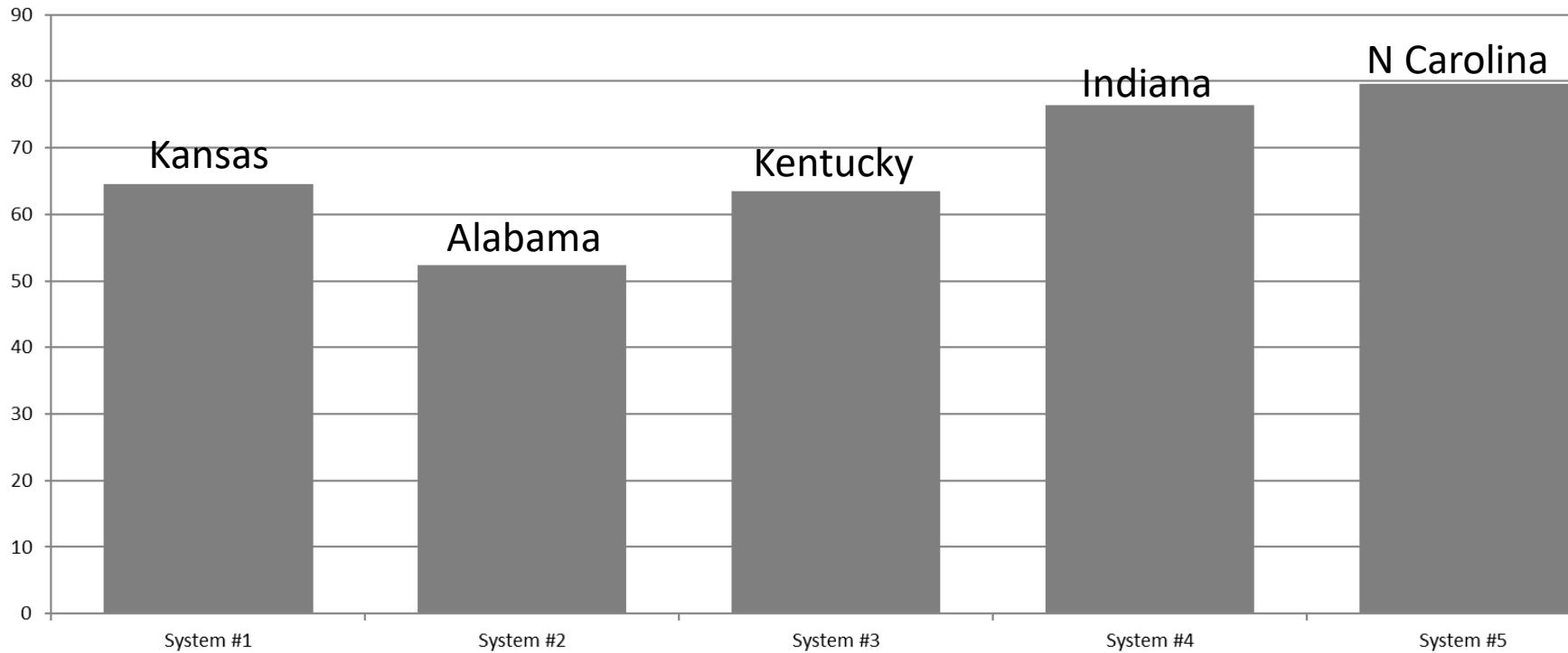
Service Connections



Connection Density



Data Validity Score



System #1 - Kansas

Existing Programs:

- Leak Detection
- Customer Meter Testing

Initial Assessment:

- Unrealistically low ILI – (0.2)

Validation Efforts:

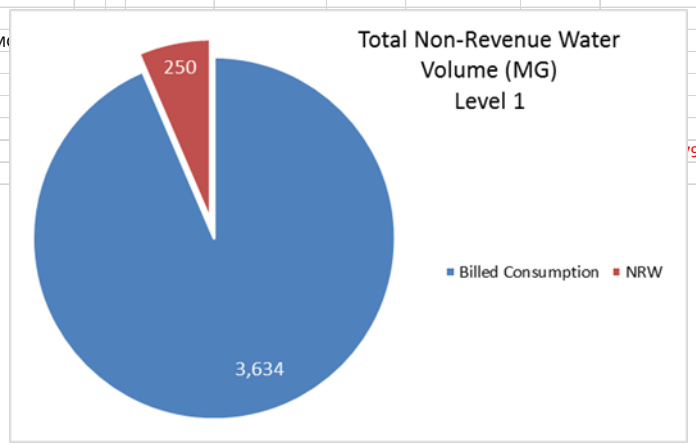
- Finished Water Meter Testing
- Billing Data

Current Program Focus:

- Calendar Year 2016 Audit – ILI solved?
 - Unmetered Interconnection?
- Large Meter Testing Optimization
- Small Meter Testing/Optimum Replacement
- Leak Detection Optimization

Test - Thursday, October 20, 2016							
Low Flow Rate							
	Clearwell		Test Meter		Wetwell		
Starting Level	12.580	feet	Meter Reading:	512.83	Starting Level	18.990	feet
Ending Level	12.327	feet	Time Start:	10:55 AM	Ending Level	18.712	feet
			Pump Flow:	2			
				MGD			
Total Volume	2,523	cubic feet	Time End:	11:10 AM	Total Volume	272	cubic feet
	0.019	MG	Meter Reading:	512.84		0.002	MG
			Meter Volume:	0.016			
				MG			
	Clearwell		Test Meter		Wetwell		
Starting Level	12.327	feet	Meter Reading:	512.84	Starting Level	18.712	feet
Ending Level	12.065	feet	Time Start:	11:10 AM	Ending Level	18.414	feet
			Pump Flow:	2			
				MGD			
Total Volume	2,613	cubic feet	Time End:	11:25 AM	Total Volume	290	cubic feet
	0.020	MG	Meter Reading:	512.87		0.002	MG
			Meter Volume:	0.024			
				MG			
	Clearwell		Test Meter		Wetwell		
Starting Level	12.065	feet	Meter Reading:	512.87	Starting Level	18.414	feet
Ending Level	11.773	feet	Time Start:	11:25 AM	Ending Level	18.136	feet
			Pump Flow:	2			
				MGD			
Total Volume	2,912	cubic feet	Time End:	11:40 AM	Total Volume	272	cubic feet
	0.022	MG	Meter Reading:	512.89		0.002	MG
			Meter Volume:	0.016			
				MG			
	Clearwell		Test Meter		Wetwell		
Starting Level	11.773	feet	Meter Reading:	512.89	Starting Level	18.136	feet
Ending Level	11.500	feet	Time Start:	11:40 AM	Ending Level	17.850	feet
			Pump Flow:	2			
				MGD			
Total Volume	2,722	cubic feet	Time End:	11:55 AM	Total Volume	279	cubic feet
	0.020	MG	Meter Reading:	512.91		0.002	MG
			Meter Volume:	0.025			
				MG			

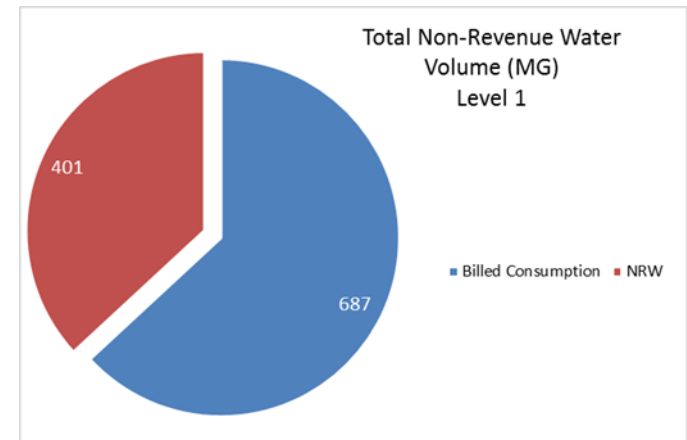
Test Total: 0.081 MG



System #2 - Alabama

- Existing Programs:

- Leak Detection based on High Volumes of perceived leakage
- % Based Performance Indicator
 - Large Industry left → % ↑ → “Water Loss Problem”



- Initial Assessment:

- High Pressure = High UARL = ILI of 2.1

- Validation Efforts:

- Level 1 Water Audit

- Current Program Focus:

- M36 Methodology based tracking & metrics
- Finished Water Meter Testing
- Large Meter Testing Program
- Leak Detection Optimization



System #3 - Kentucky

- Existing Programs:

- Leak Detection based on High Volumes of perceived leakage
- % Based Performance Indicator
- Finished Water Meter Testing
- Master Meter Testing

- Initial Assessment:

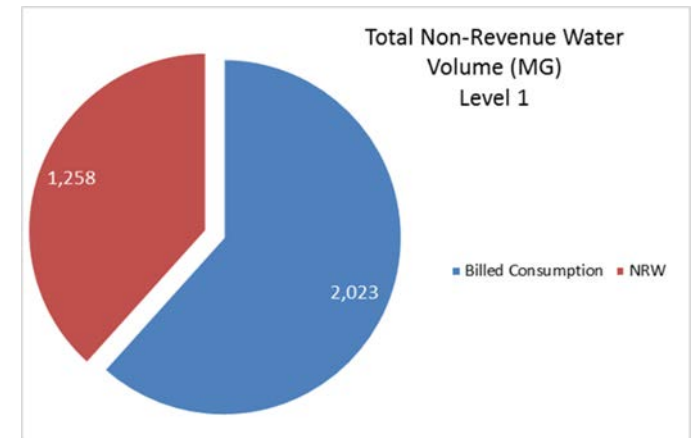
- Very high ILI of 13
 - Preliminary Bottom-up Analysis

- Validation Efforts:

- Level 1 Water Audit

- Current Program Focus:

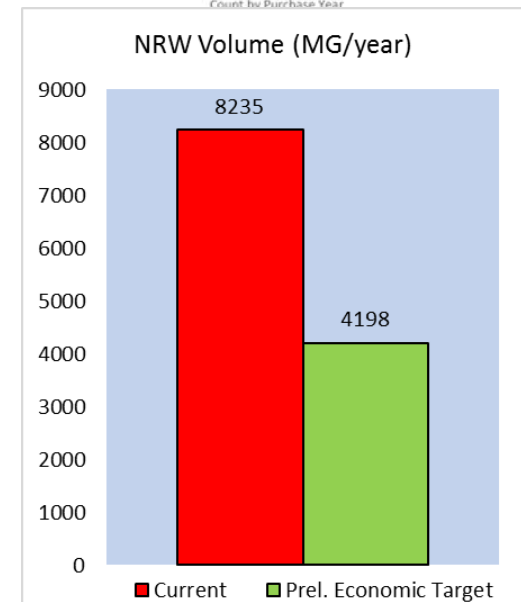
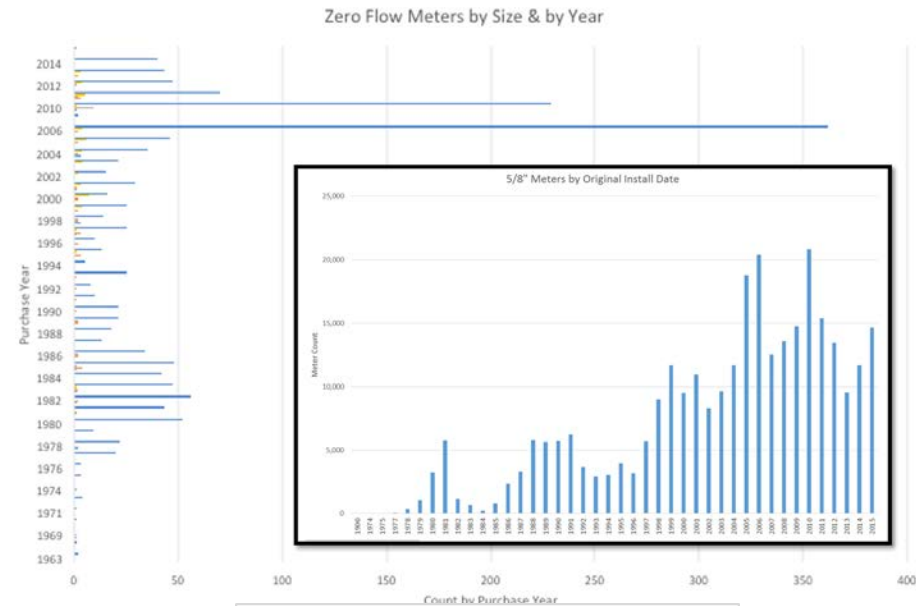
- M36 Methodology based tracking & metrics
- Billed Metered Level 2 Validation
- Large Meter Testing Program
- Leak Detection Optimization



REAL LOSS COMPONENT ANALYSIS RESULTS				
System Component	Background Leakage (MG)	Reported Failures (MG)	Unreported Failures (MG)	Total (MG)
Reservoirs	1.98	-	-	1.98
Mains and Appurtenances	21.07	16.74	174.38	212.19
Service Connections	54.98	4.85	5.51	65.34
Total Annual Real Loss	78.03	21.58	179.89	279.51
<i>Real Losses as Calculated by Water Audit</i>				1,139.70
<i>Hidden Losses/Unreported Leakage Currently Running Undetected</i>				860.20

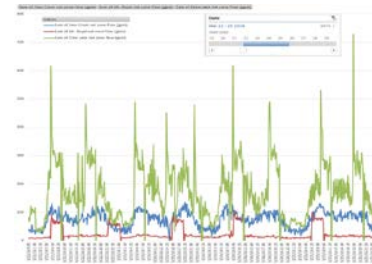
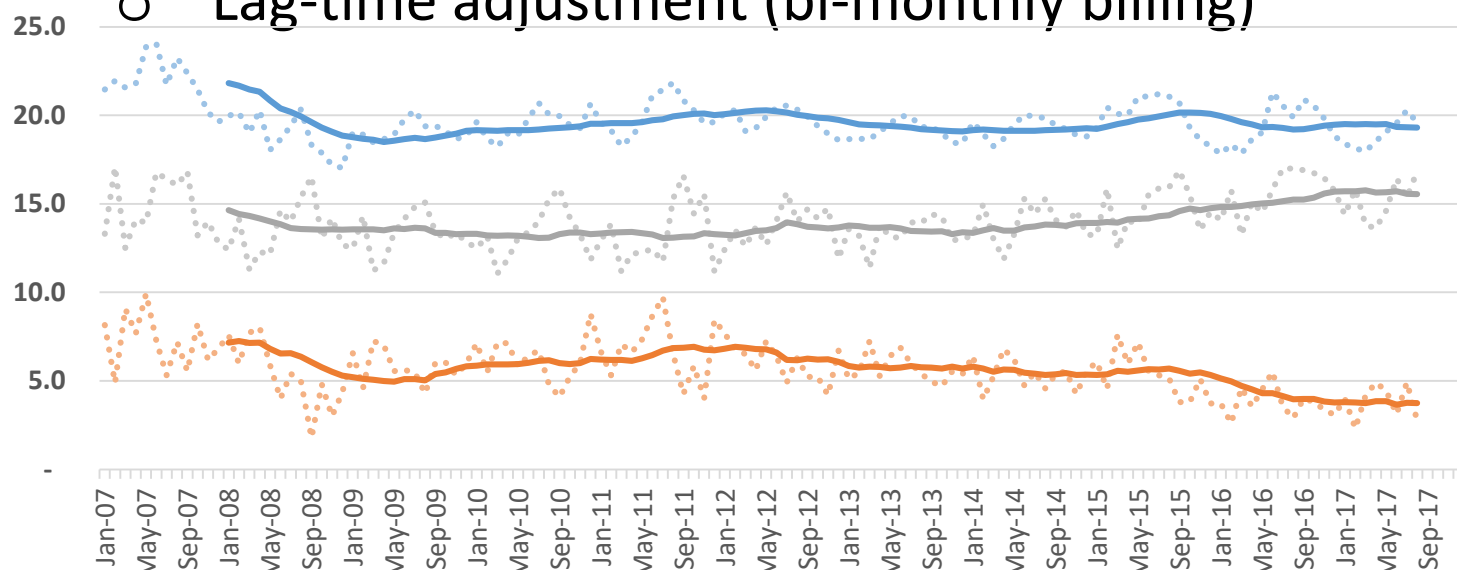
System #4 - Indiana

- Existing Programs:
 - Leak Detection
 - Customer Meter Testing
 - Rolling 12 month auditing
- Initial Assessment:
 - % Metric used as Indicator
- Validation Efforts:
 - Level 1 Water Audit
 - Customer Meter Inaccuracy Analysis
 - Billing Data Analysis
- Current Program Focus:
 - Large Meter Testing Optimization
 - Redistricting/Pressure Reduction
 - Leak Detection Optimization
 - Unmetered Fire Line Analysis
 - Small Meter Testing Analysis

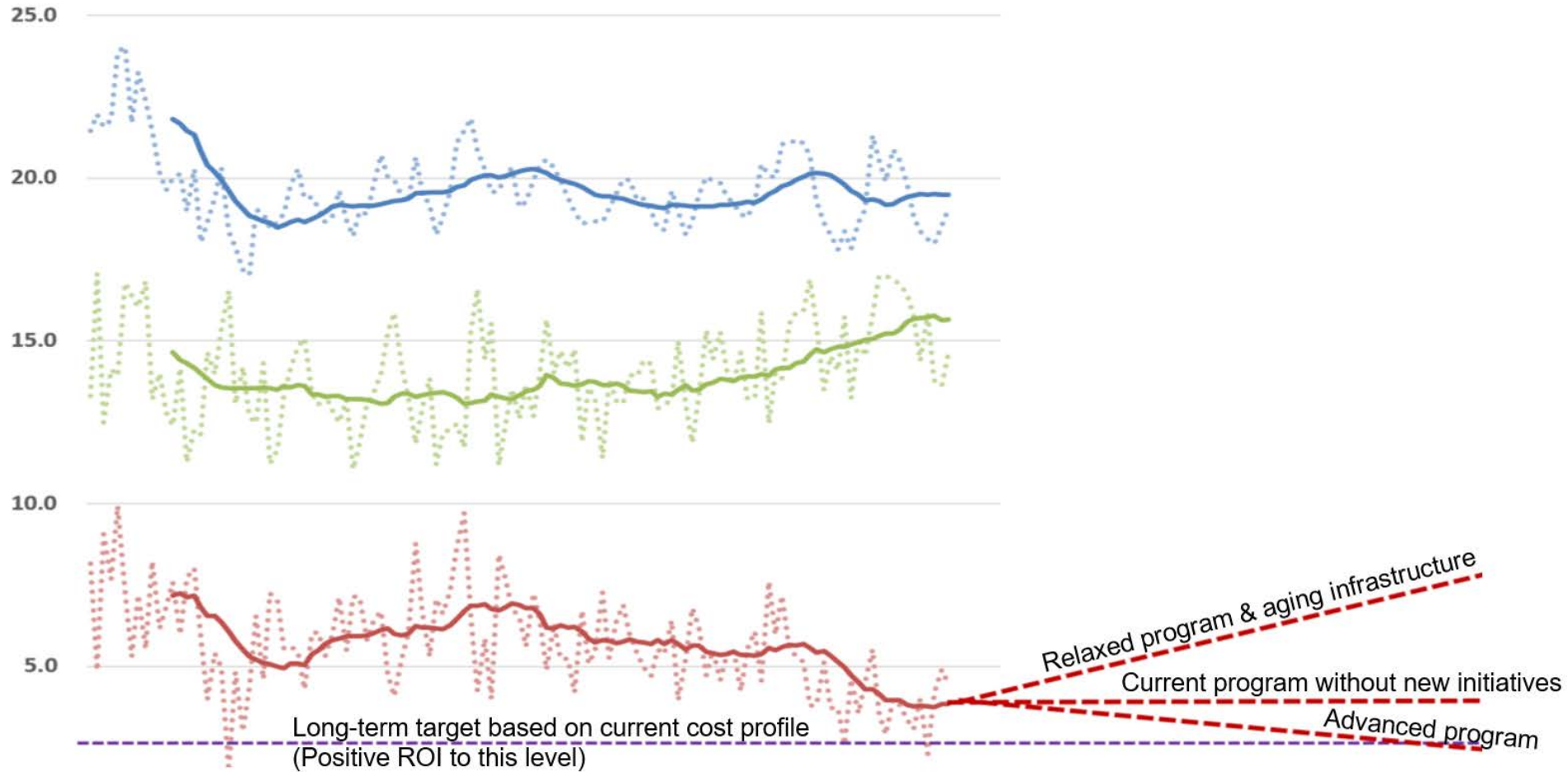


System #5 – North Carolina

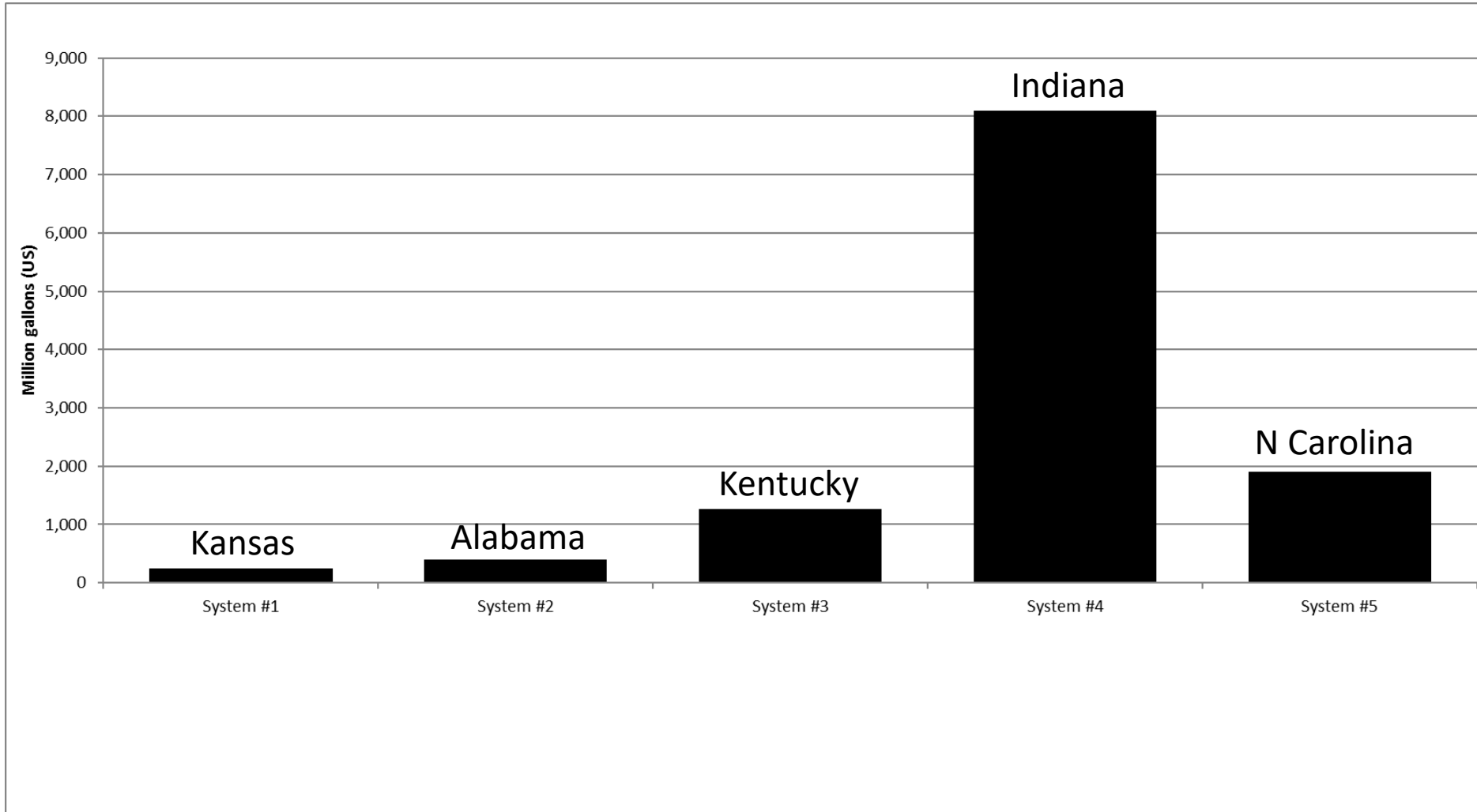
- Existing Programs:
 - Capital based line replacement
- Initial Assessment:
 - High Pressure = High UARL
- Validation Efforts:
 - Level 1 Water Audits
 - Billing Data Analysis
 - Real Loss Component Analysis
 - Lag-time adjustment (bi-monthly billing)
- Current Program Focus:
 - Large Meter Testing
 - Optimization
 - Pressure Optimization
 - District Metered Areas
 - Leak Detection
 - Optimization
 - FWM Testing



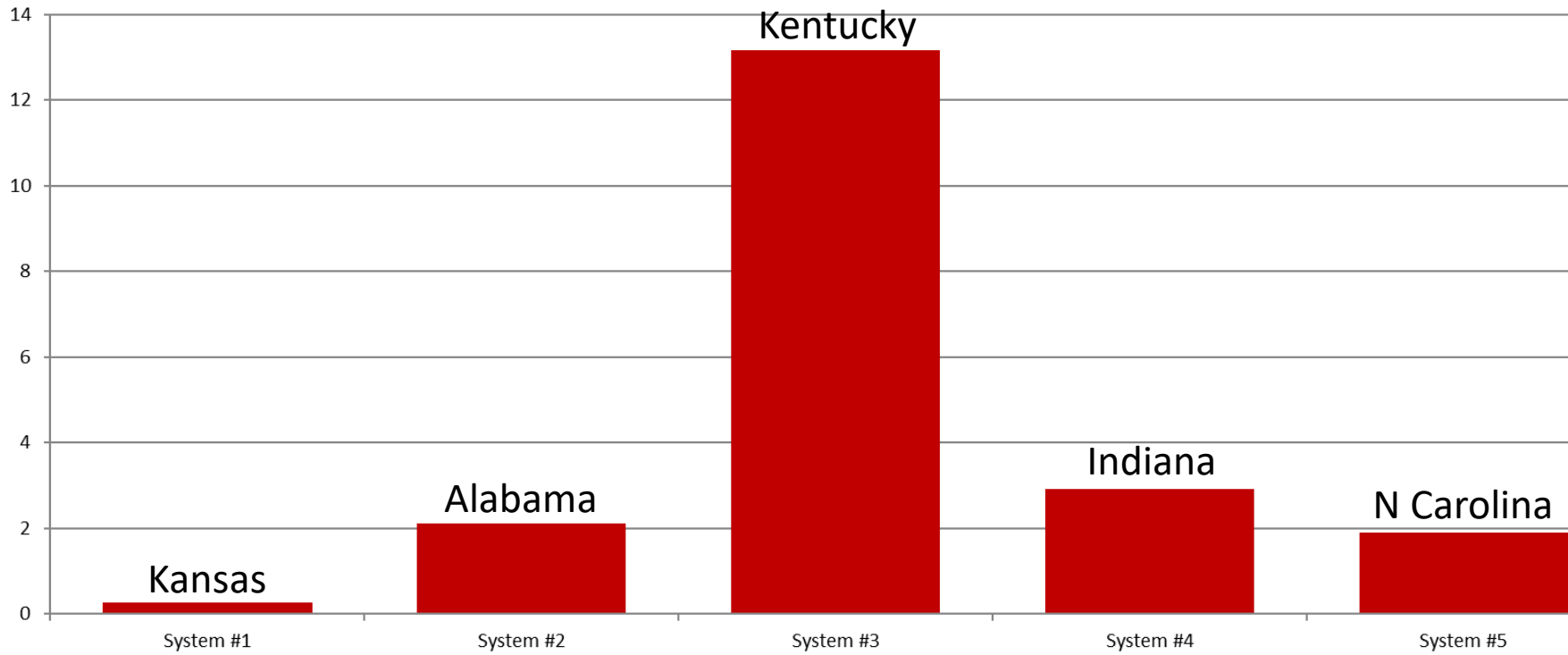
System #5 – North Carolina



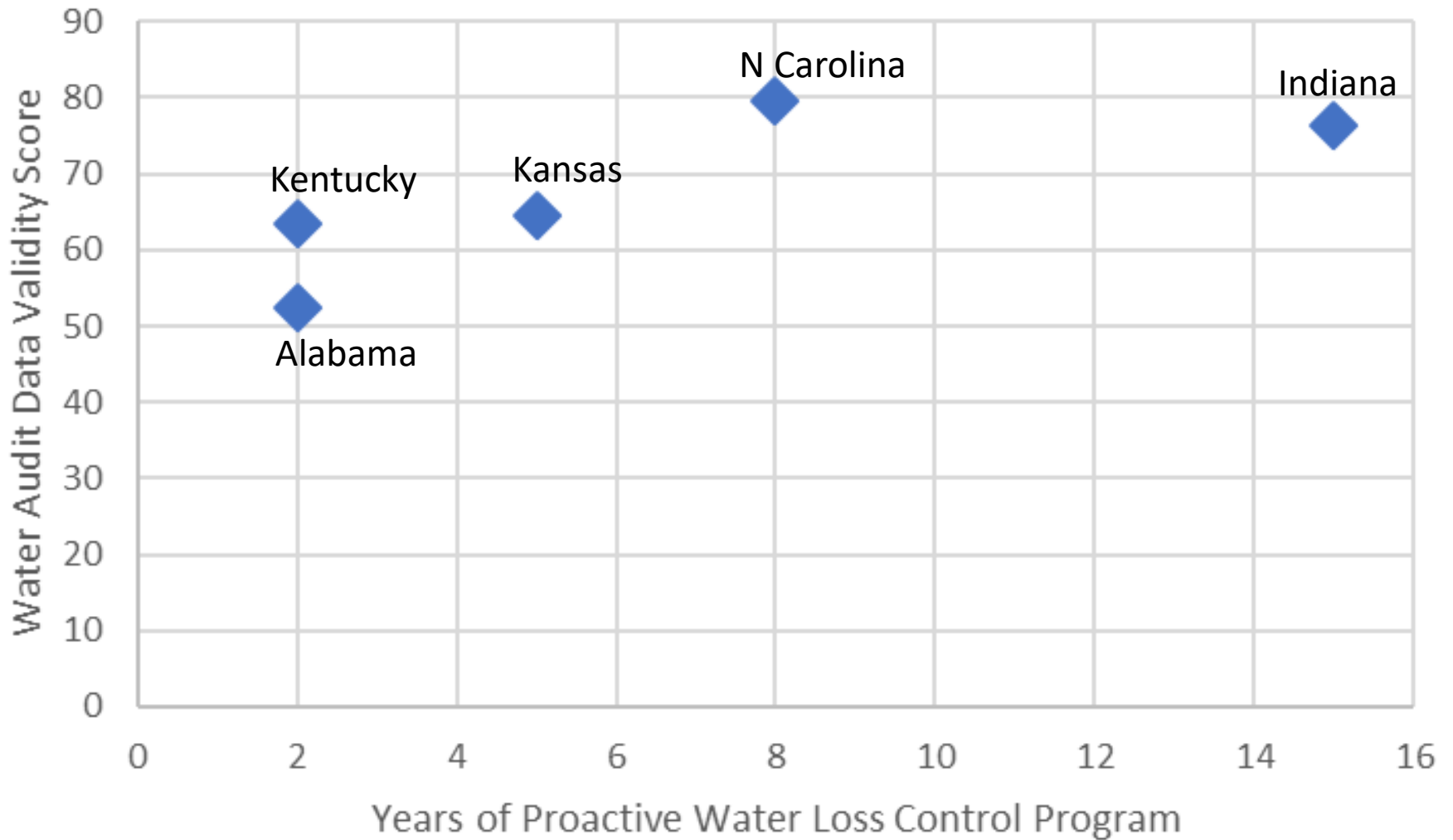
Non Revenue Water



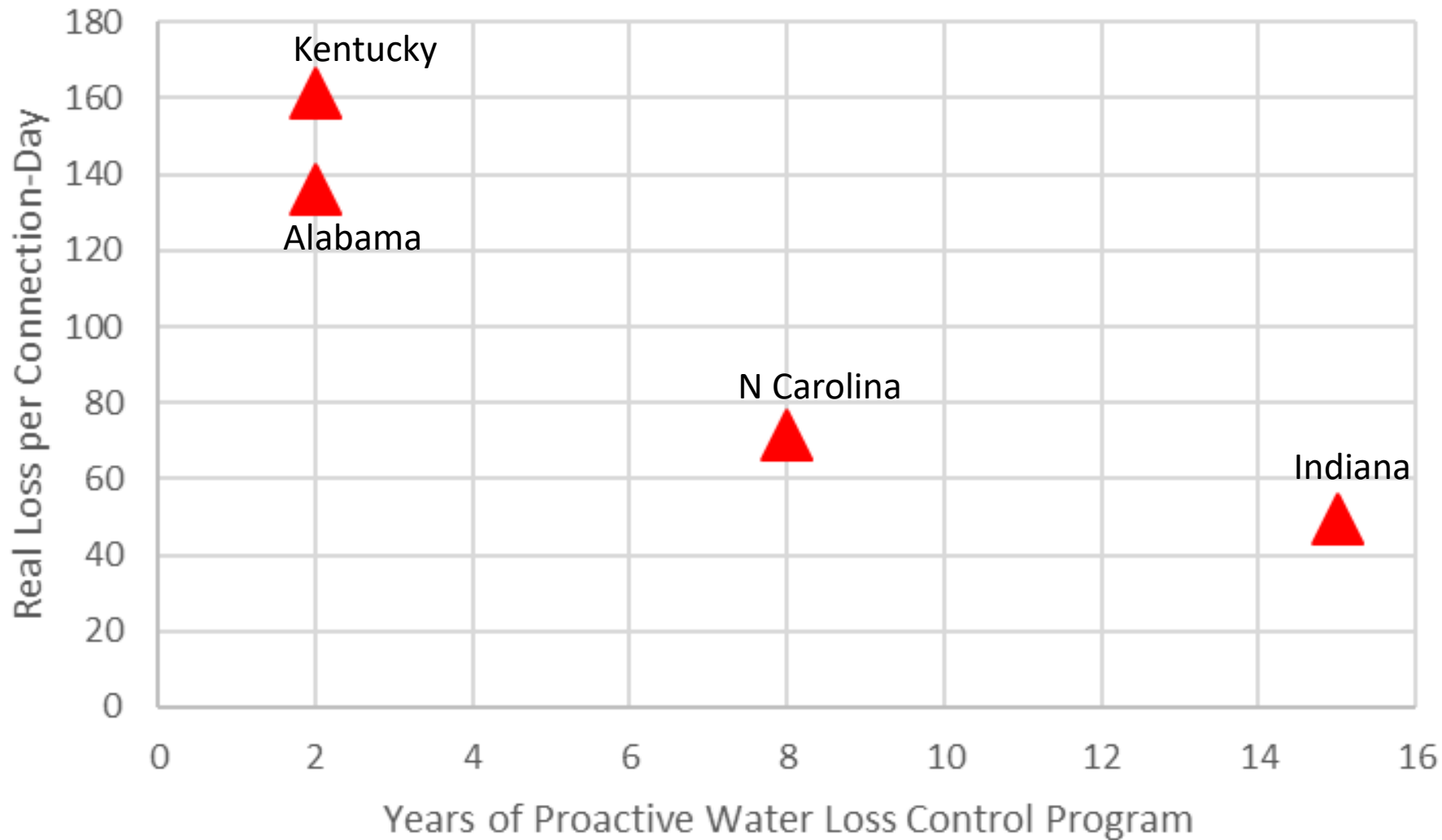
Infrastructure Leakage Index (ILI)



Water Audit Data Validity Score



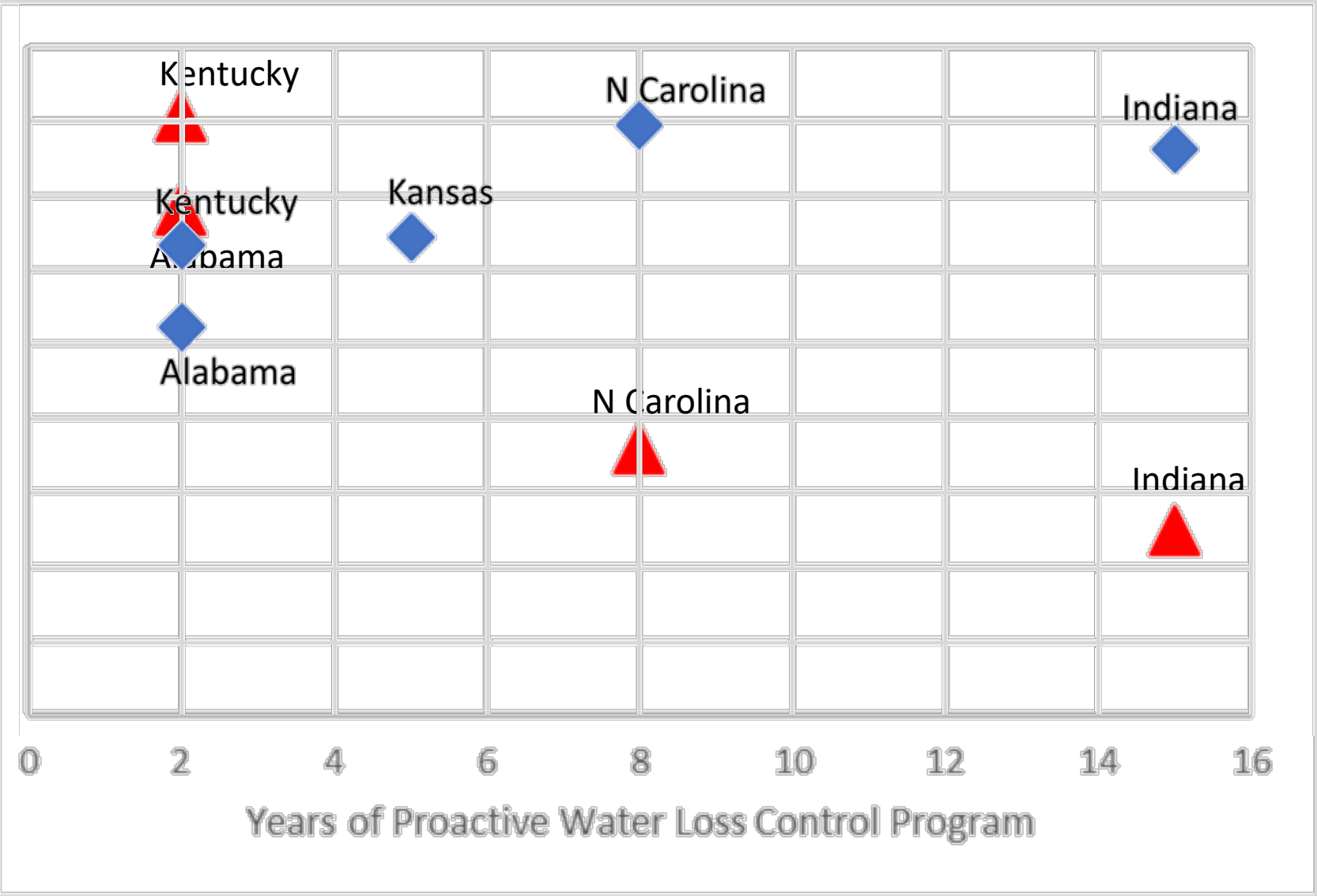
Real Loss: Gallons per Connection per Day



Program Maturity = Higher Validity, Lower Loss

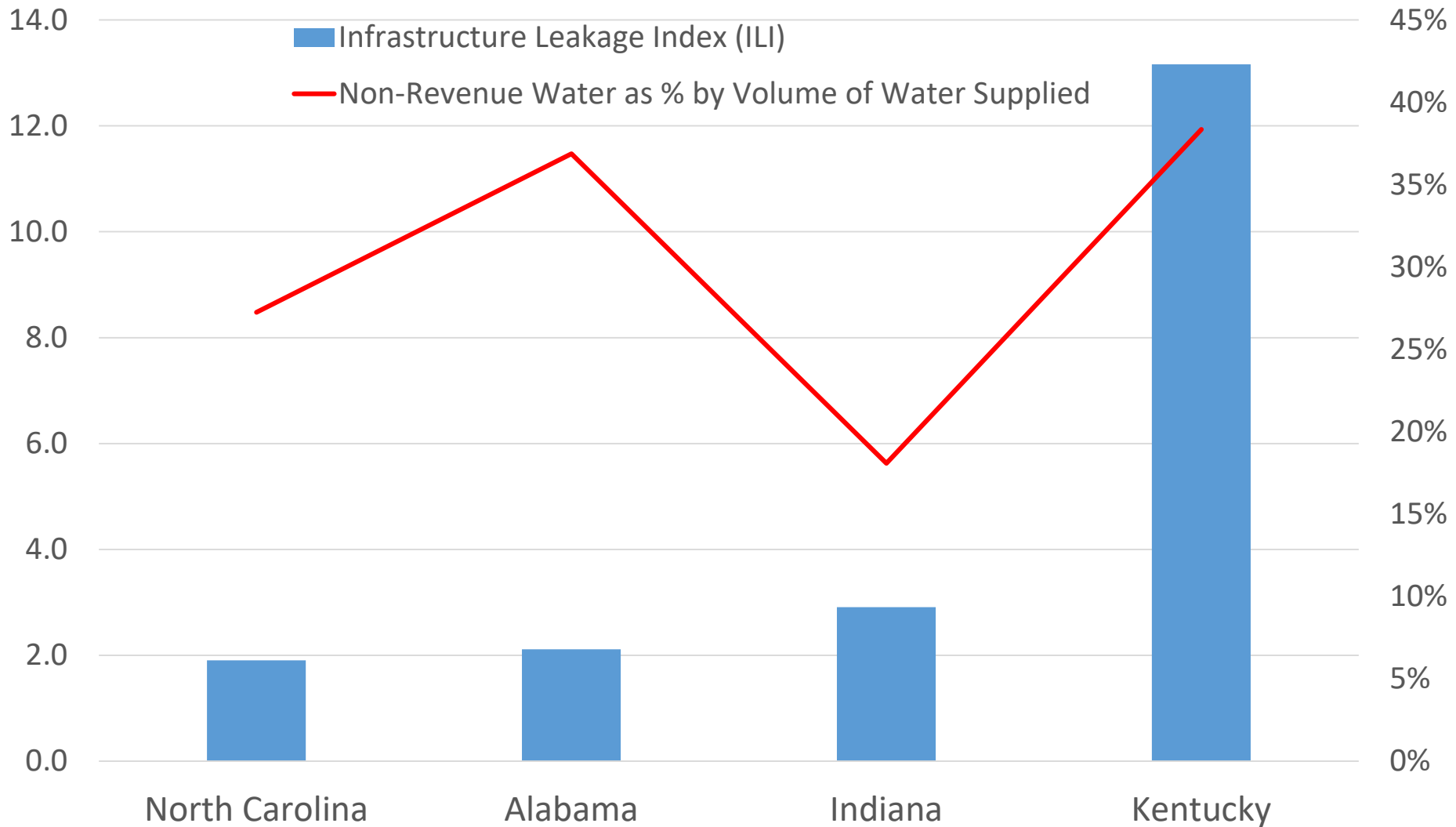
◆ Data Validity

▲ Real Loss



What do Water Loss %s Tell Us?

hint: nothing





SAVE THE DATE

December 3 - 5, 2017

Paradise Point Resort · San Diego, CA

The North American Water Loss Conference (NAWL) will assemble policy and technical experts on non-revenue water management in North America.

Presented by:  American Water Works Association
California-Nevada Section

In cooperation with the American Water Works Association, the Alliance for Water Efficiency and the NAWL 2017 Conference Planning Committee.



Partnering Organizations:



www.northamericanwaterloss.org



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