

Delaware River Basin Commission

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DRBC Water Audit Program: Status and Trends

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June 21, 2018

Water Management Advisory Committee



Photo: David B. Soete



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DRBC Water Audit Program: Status and Trends

Today's talk will cover...

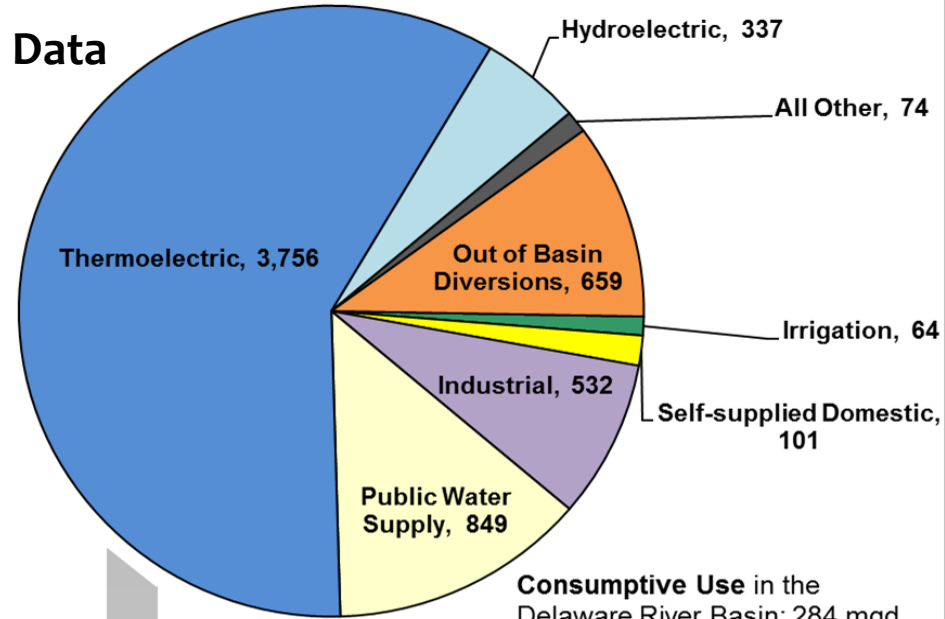
- Overview of Water Use Trends in the Delaware River Basin
- The DRBC water audit program
 - Brief history
 - Program Results from CY2016 Audits
 - Status and trends

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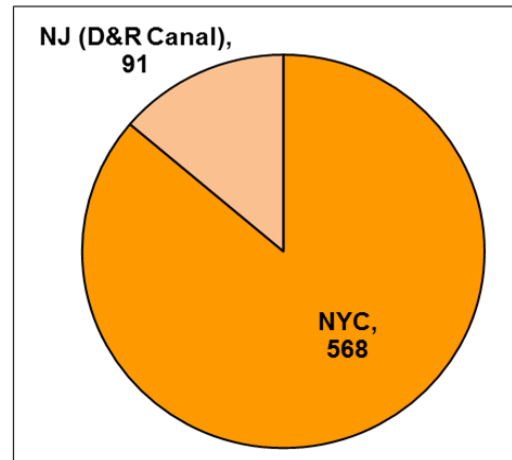
Total Water Withdrawals (ground and surface) from the Delaware River Basin: 6,372 mgd

2014 Data

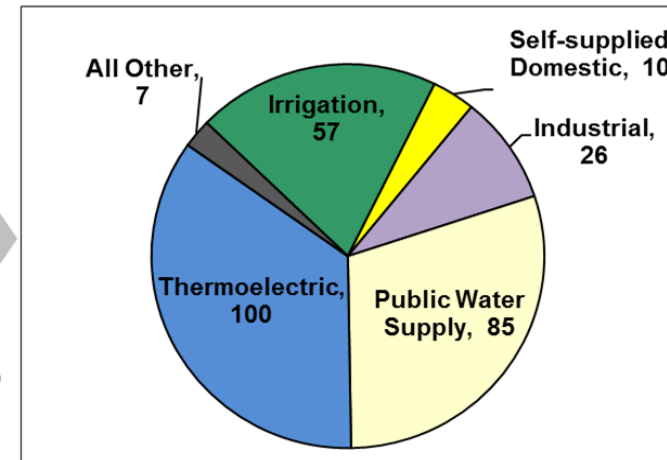
- Irrigation
- Self-supplied Domestic
- Industrial
- Public Water Supply
- Thermoelectric
- Hydroelectric
- All Other
- Out of Basin Diversions



Major Exports from the Delaware River Basin: 659 mgd



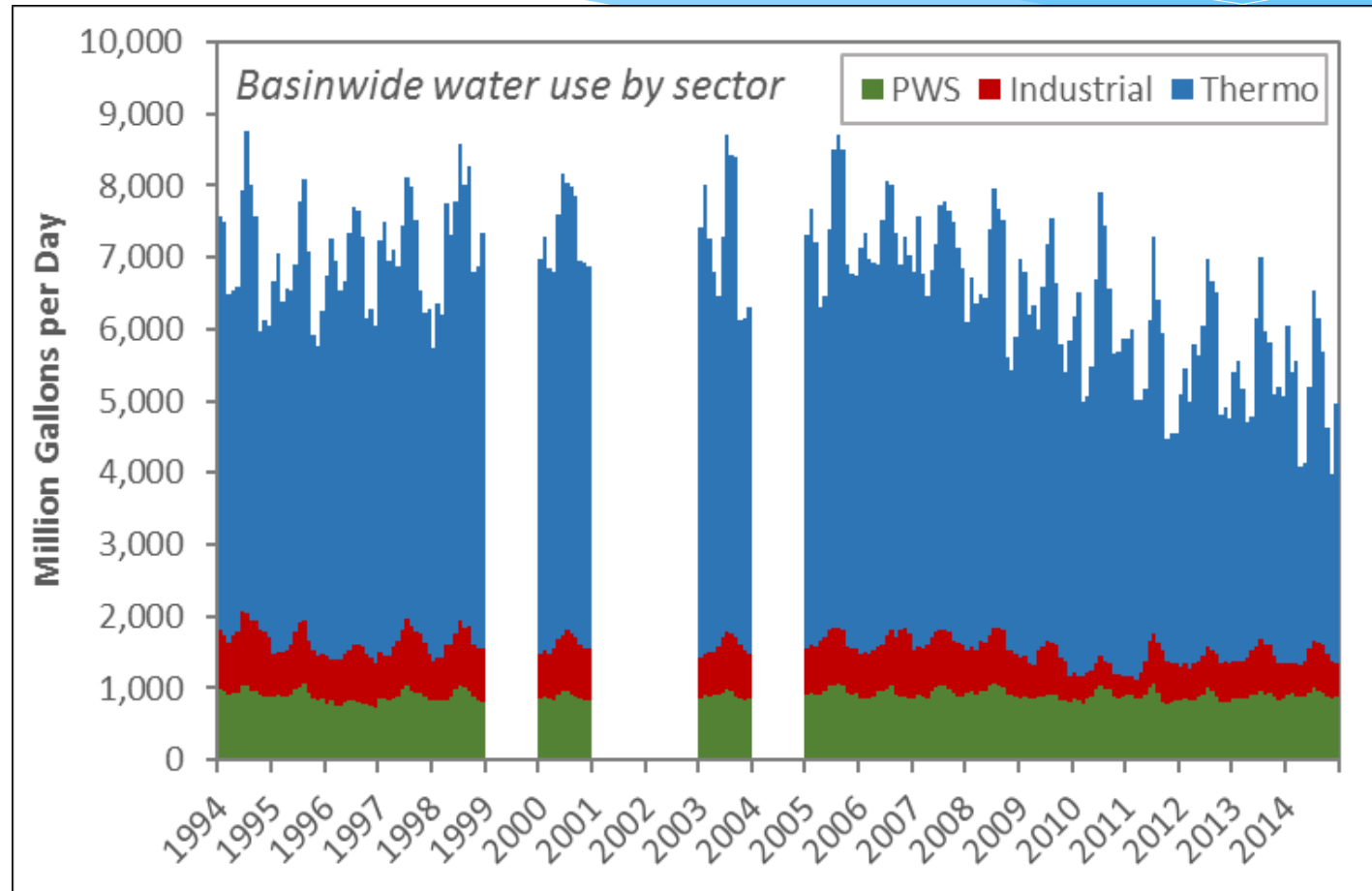
Consumptive Use in the Delaware River Basin: 284 mgd



Pie chart values in mgd (million gallons per day)

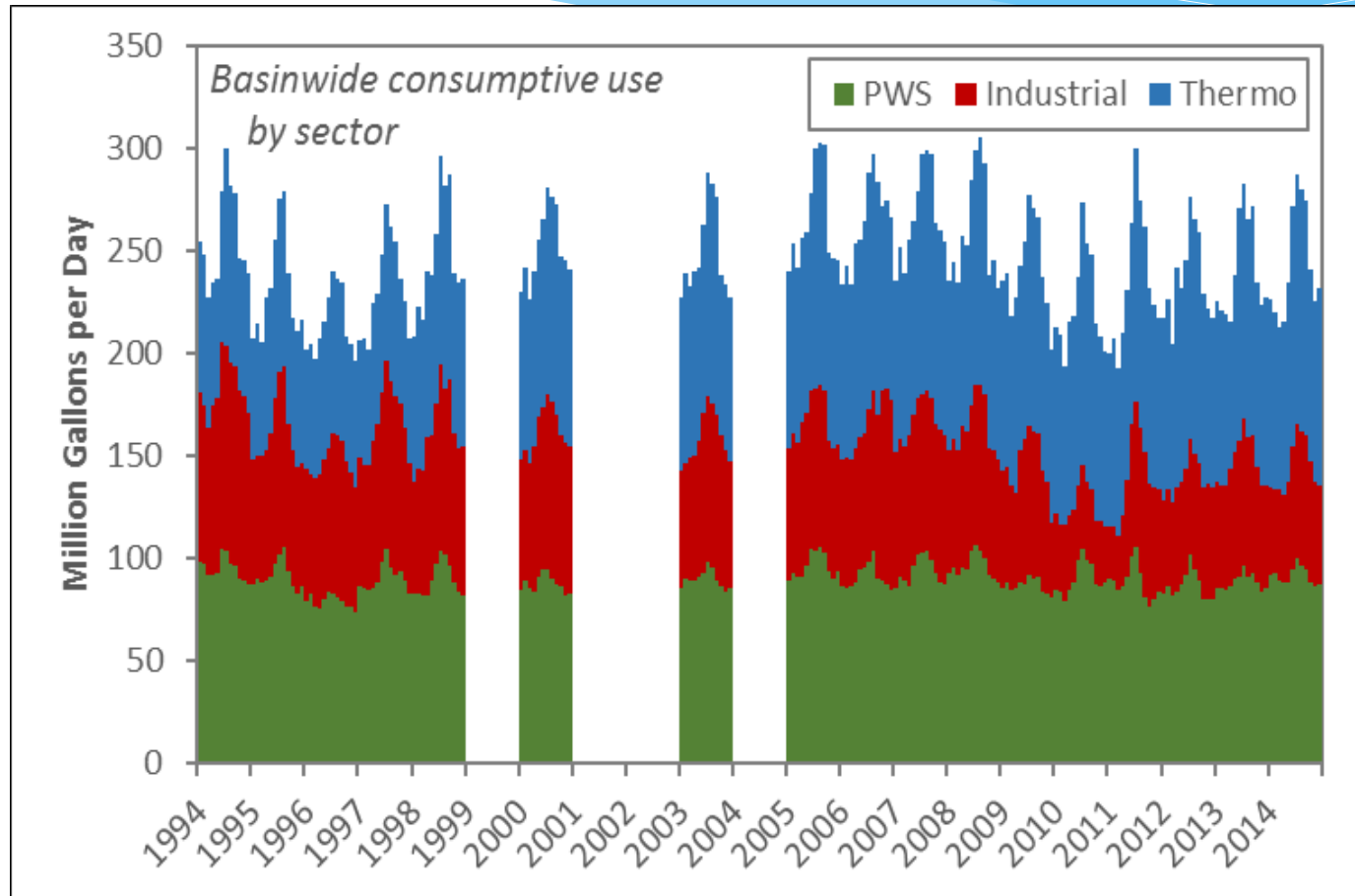
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Monthly Total Water Withdrawals for Three Key Sectors in the Delaware River Basin



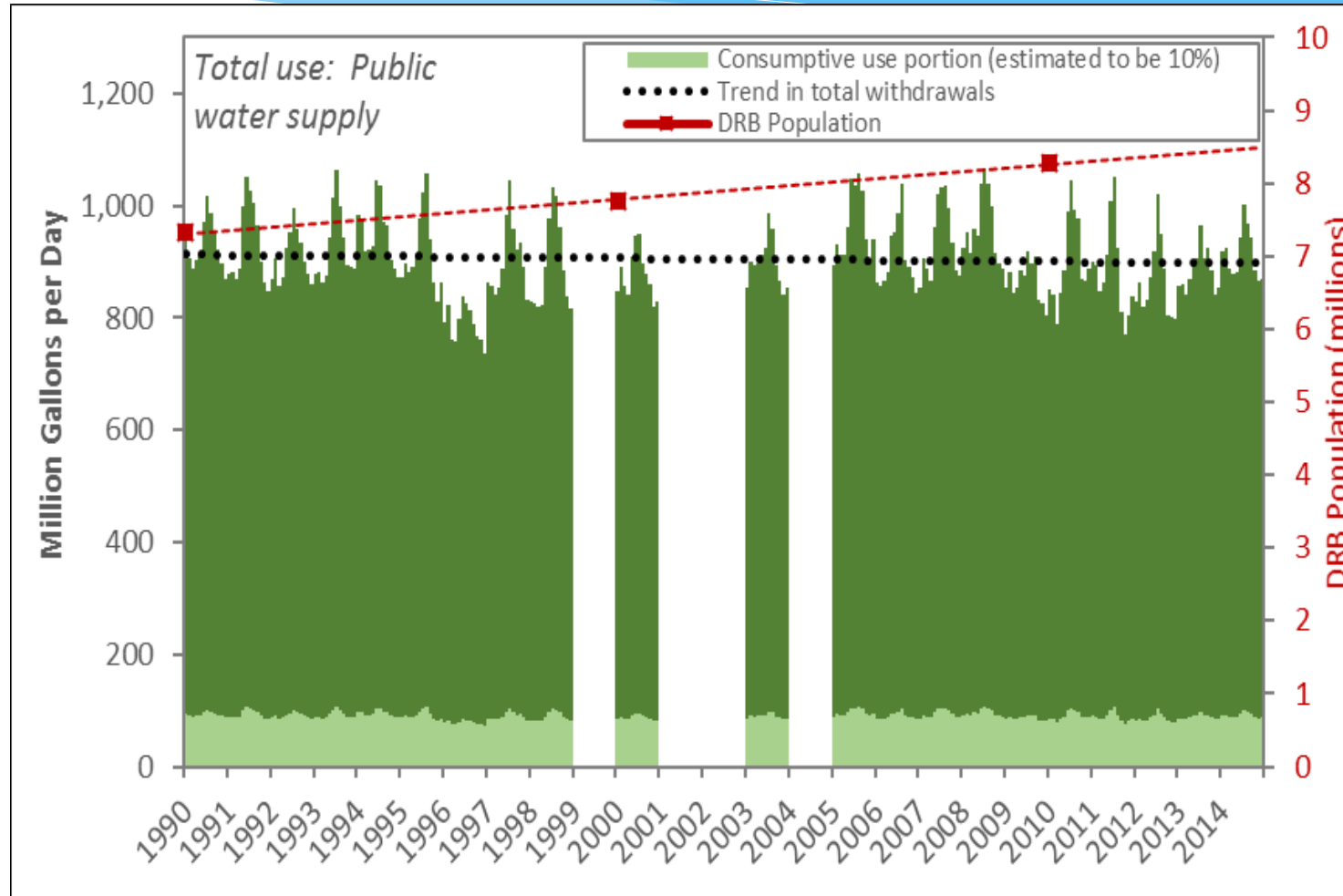
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Monthly Consumptive Water Use for Three Key Sectors in the Delaware River Basin



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Monthly withdrawals of Public Water Systems in the Basin 1990-2014



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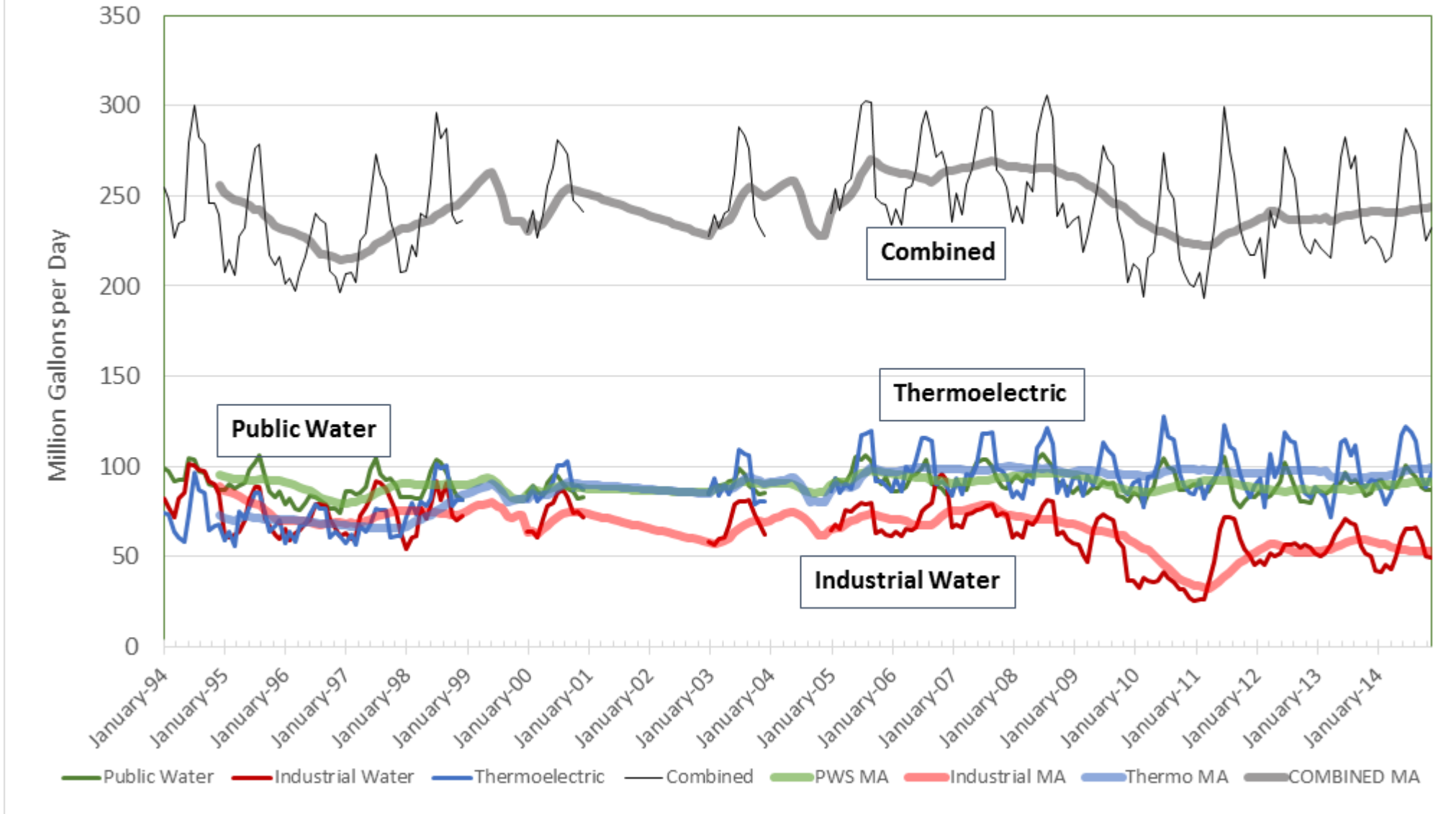


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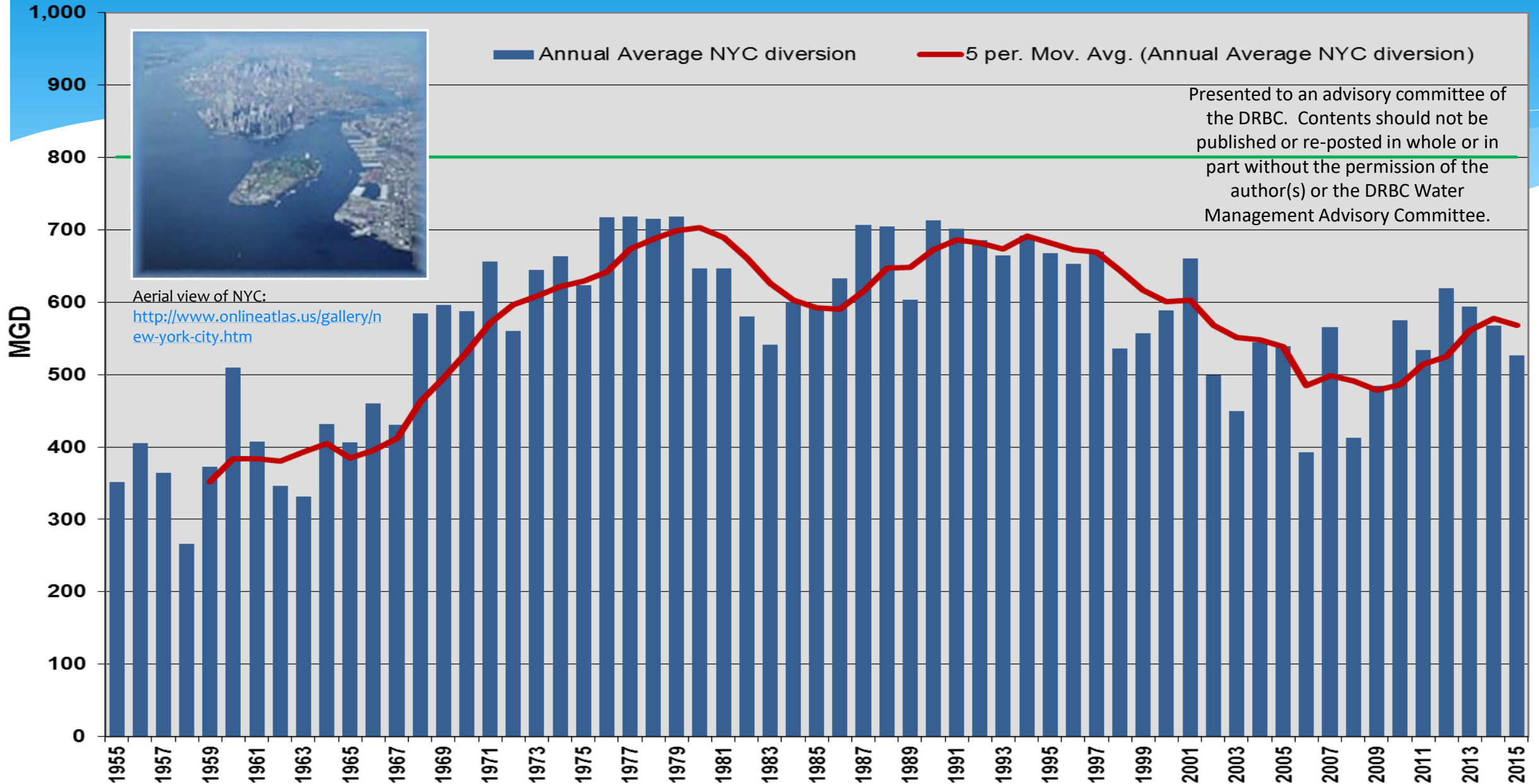
Consumptive Use Trends 1994 – 2014

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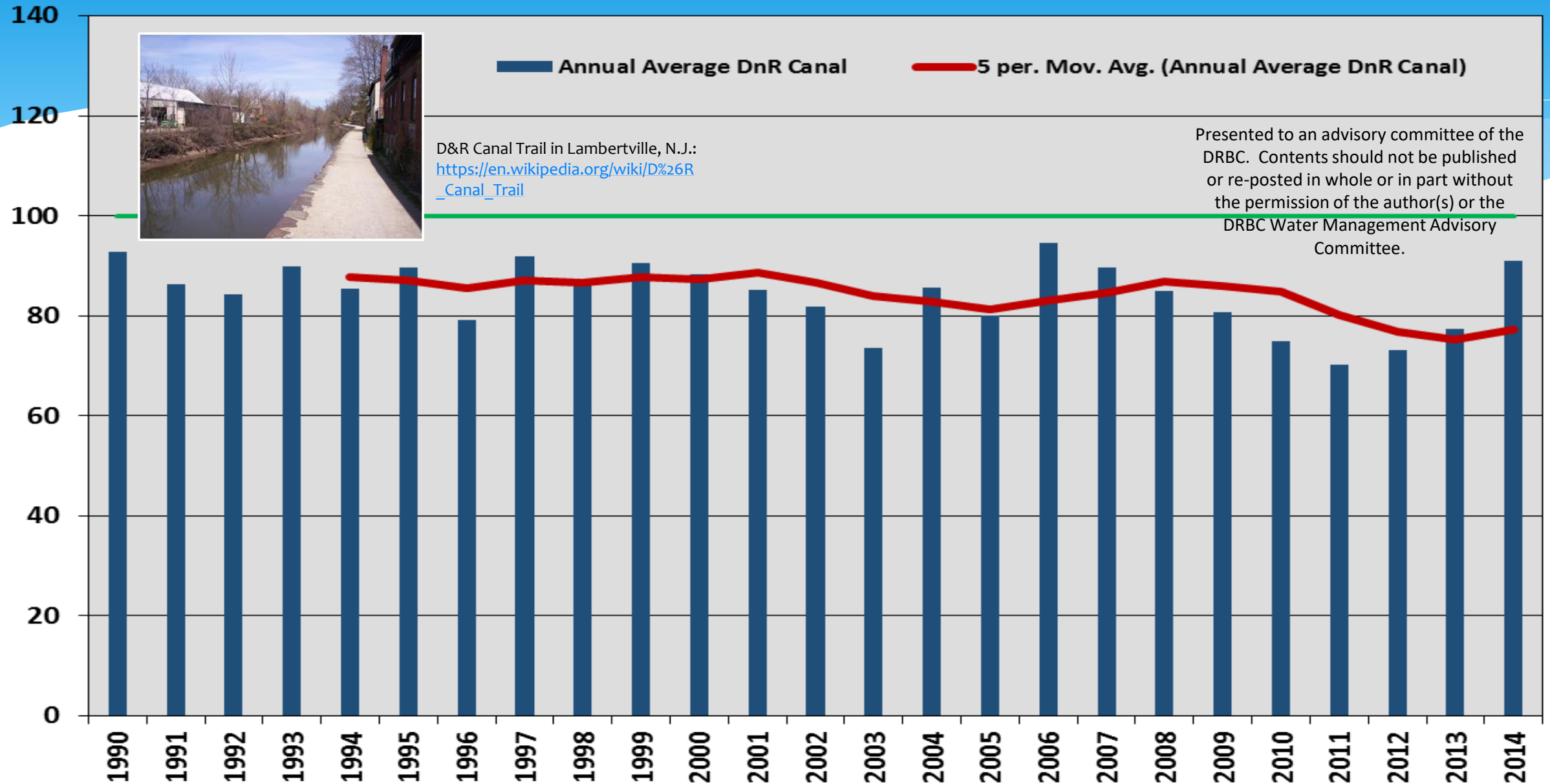
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Water Exported to New York City from Delaware River Basin 1955 - 2015 (Annual Data)



Water Exported via D & R Canal from Delaware River Basin 1990 - 2014 (Annual Data)



What do these trends tell us?



- **Overall:** Relatively flat demand w/localized demand pressures
- **Power:**
 - Trend is away from Once Through Cooling to Evaporative Cooling , which results in much less total water use but increases in consumptive use
- **Industry:**
 - Decreased water use over time, sensitive to loss of large facilities
- **PWS:**
 - Conservation efforts are offsetting population growth, a trend that is likely to continue
 - Implementation of **Water Auditing** could continue this trend

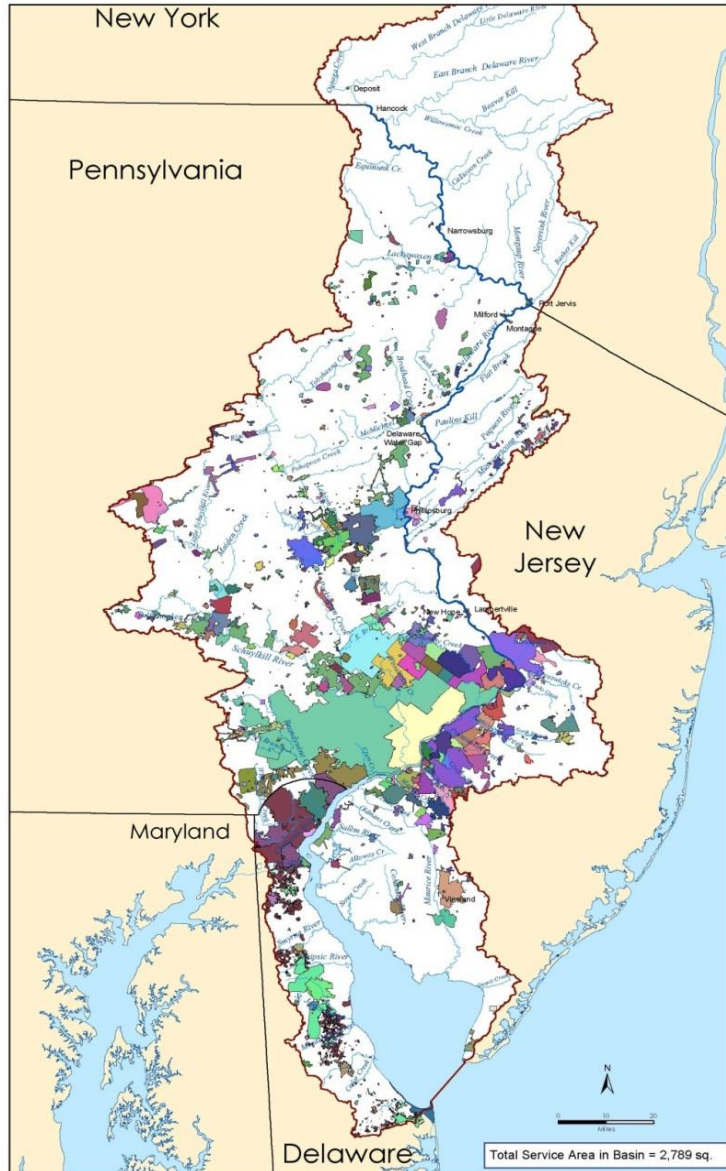
DRBC Water Audit Program: What is it?

The purpose of DRBC's water audit program is to track how ***efficiently*** water is moved from its source to the customer (within a public water supply system) and to ensure that systems quantify and are accountable for water losses.

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Public Water Supply Service Area in the Delaware River Basin

Water Service Areas in the Delaware River Basin



- Total PWS withdrawals:
~849 MGD (2014 data)
- 2nd largest water use sector in the Basin
- Approx. 21% of Basin covered by service area (**see map**)
- Serve 6.7 million customers (80% of basin residents)
- Approx. 300 systems subject to Water Audit Requirement

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History of DRBC Water Conservation Regulations

- 1986:** Source & Service Metering
- 1987:** Leak Detection & Repair (UFW)
- 1988:** Conservation Plumbing Standards
- 1992:** Water Conservation Pricing
- 2006-9:** Water Loss Accountability (Committee)
- 2009-11:** “Water Audit” Rule/Outreach
- 2012:** First year for new water audit format
- 2013:** First water audit reports due

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DRBC Rule change

~~Unaccounted for water (UFW)~~

IWA/AWWA Water Audit
Methodology

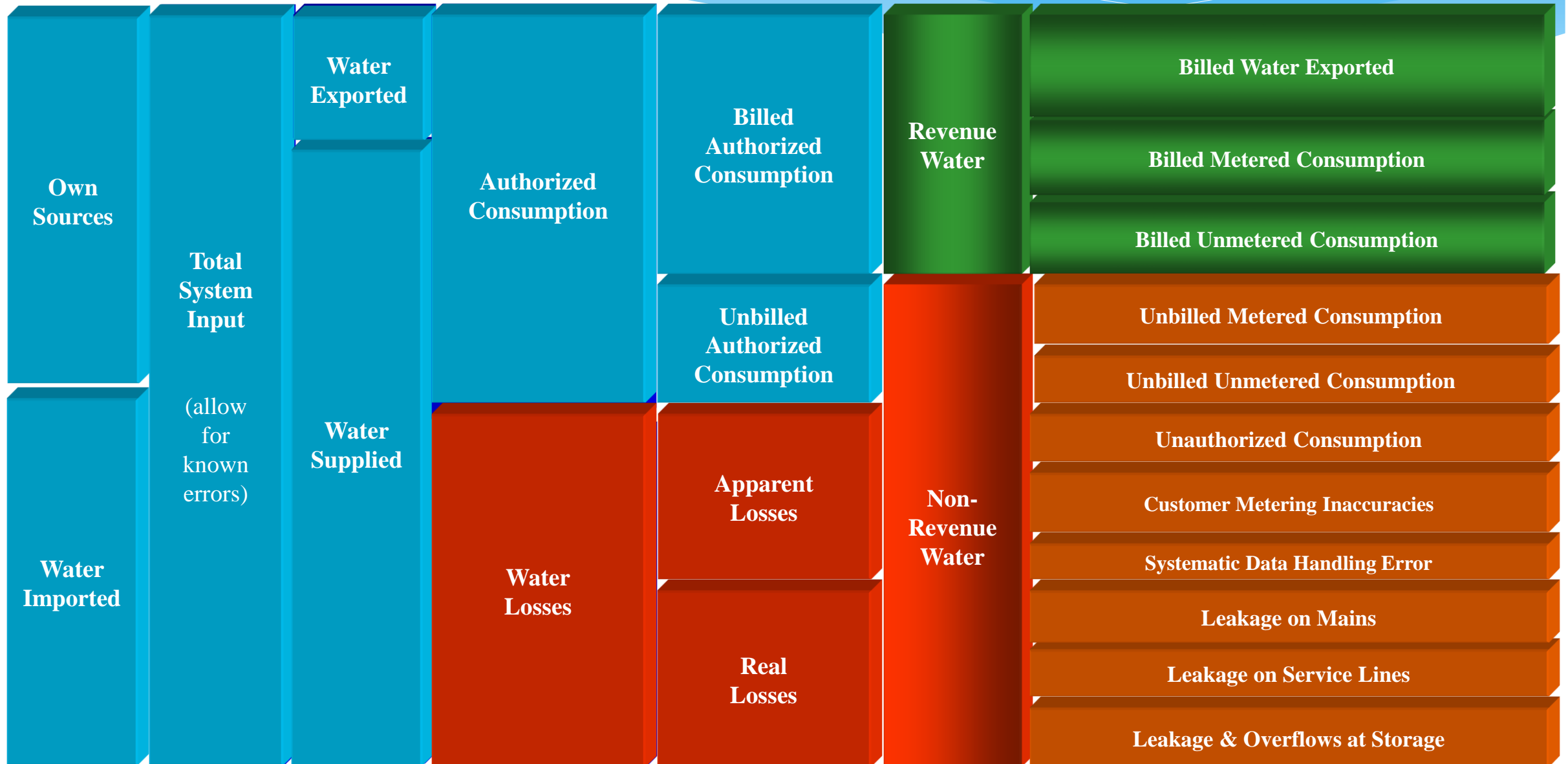


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IWA/AWWA Water Audit Components

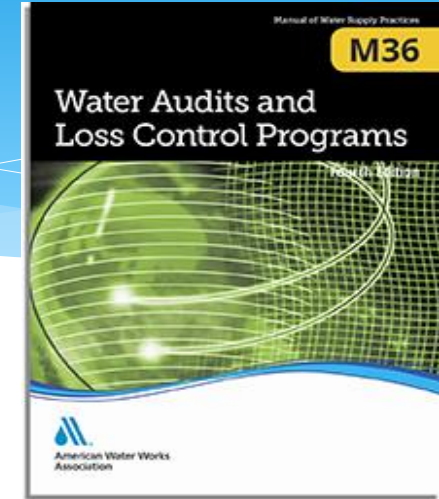


Benefits of the IWA/AWWA Water Audit Methodology

- UFW:
 - Vague / inconsistent definitions / value
 - Negative UFW values reported!?
- AWWA Method:
 - **Best Practice** Approach
 - Standardized definitions / terminology
 - Meaningful indicators (ILI, gpd/conn)
 - Real losses vs apparent losses
- Better Indicators = better water management

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AWWA Resources / Software



- M36 Water Audit manual
- Free interactive audit software available
- DRBC provided a key role in software design and development
- Data grading capability assesses the validity of the input data
- Instructions, definitions provided in software

www.awwa.org

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

Water Audit Report for: **Philadelphia Water Department**
 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 (na 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.

WATER SUPPLIED

Volume from own sources	7	87,417.500	MG/Yr	Master Meter Error Adjustments	Value:	1,304,420	MG/Yr
Water imported	na	0.000	MG/Yr				
Water exported	10	5,402.000	MG/Yr			-82,580	MG/Yr
WATER SUPPLIED:		80,628.500	MG/Yr				

AUTHORIZED CONSUMPTION

Billed metered	7	49,907.000	MG/Yr	Master Meter Error Adjustments Value: 1,959,000 MG/Yr
Billed unmetered	na	0.000	MG/Yr	
Unbilled metered	na	0.000	MG/Yr	
Unbilled unmetered	8	1,959.000	MG/Yr	
AUTHORIZED CONSUMPTION:		51,866.000	MG/Yr	

Unbilled Unmetered volume entered is greater than the recommended default value

WATER LOSSES (Water Supplied - Authorized Consumption) **28,762.500** MG/Yr

Apparent Losses

Unauthorized consumption:	8	2,425.500	MG/Yr	Value: 2,425.500 MG/Yr
---------------------------	---	-----------	-------	------------------------

Unauthorized consumption volume entered is greater than the recommended default value

Instructions | Reporting Worksheet | Performance Indicators | Comments | Water Balance | Dashboard | Grading Matrix | Service Connection Diagram | Definitions | Loss Control Planning | Exit

Collecting the Data

AWWA Free Water Audit Software Reporting Worksheet (Top Portion)

The Reporting Worksheet is the primary Data Input Worksheet. Input data on this portion of the Reporting Worksheet include:

- Volumes of supply
- Consumption
- Apparent Loss
- Real Loss is calculated
- Data Gradings

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

Water Audit Report for: << Please enter system details and contact information on the Instructions tab
Reporting Year: _____

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

PLEASE CHOOSE REPORTING UNITS FROM THE INSTRUCTIONS SHEET BEFORE ENTERING DATA

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.

WATER SUPPLIED <----- Enter grading in column 'E' and 'J' -----> Master Meter and Supply Error Adjustments

Volume from own sources: + ?					
Water imported: + ?					
Water exported: + ?					
WATER SUPPLIED:			0.000		

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

AUTHORIZED CONSUMPTION

Billed metered: + ?					
Billed unmetered: + ?					
Unbilled metered: + ?					
Unbilled unmetered: + ?					0.000
AUTHORIZED CONSUMPTION:			0.000		

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

WATER LOSSES (Water Supplied - Authorized Consumption) **0.000**

Apparent Losses

Unauthorized consumption: + ?					
Customer metering inaccuracies: + ?					0.000
Systematic data handling errors: + ?					0.000
Apparent Losses:			0.000		

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

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:					
WATER LOSSES:			0.000		

NON-REVENUE WATER **0.000**

= Water Losses + Unbilled Metered + Unbilled Unmetered


Click here: ? for help using option buttons below

Use buttons to select percentage of water supplied OR value

Pont: 1.25% Value: []

Pont: 0.25% Value: []

Pont: 0.25% Value: []



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Collecting the Data

AWWA Free Water Audit Software Reporting Worksheet (Bottom Portion)

Inputs on this portion of the Reporting Worksheet include:

- System Data
- Cost Data
 - System Operating Cost
 - Customer Unit Retail Cost
 - Variable Production Cost
- Data Gradings

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SYSTEM DATA

Length of mains: miles
Number of active AND inactive service connections:
Service connection density: conn./mile main

Are customer meters typically located at the curbside or property line? (length of service line, beyond the property boundary, that is the responsibility of the utility)
Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)
Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: psi

COST DATA

Total annual cost of operating water system: \$/Year
Customer retail unit cost (applied to Apparent Losses): \$/1000 gallons (US)
Variable production cost (applied to Real Losses): \$/Million gallons Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 80 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: Customer metering inaccuracies
- 3: Total annual cost of operating water system

Water Audit Data Quality & Validation Levels

- * The Data Validation Process includes five levels of data quality which are defined below:
 - **Self-reported** – data have been collected, but not been subject to any in-depth review
 - **Filtered** - have been checked for technical plausibility by employing a screening criteria, such as ILI < 1.0 or > 20.0
- * Data validation conducts in-depth review of the data sources and practices of the water utility
 - **Level 1 validated** - focuses primarily on the suitability of the data gradings assigned to the various inputs, with scrutiny on the data inputs to flag gross or egregious errors
 - **level 2 validated** - in-depth investigation of various input data and information of one or more components of the water audit. This is still largely a desk-top activity.
 - **level 3 validated** - Bottom-up review and investigation into a single component or sub-component that collects new or additional data at a field/source level, and provides detailed analysis

How to Assess Water Loss and Its Impacts

Three “V”s...



Volume

MG per Year
Gal/connection/day
Infrastructure Leakage Index

Value

\$ per Year
Economic Loss
Real and Apparent

Validity

Data Input Grading
Water Audit Data Validity
Score

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How to Assess Water Loss and Its Impact

➤ Volume

- Apparent Losses, annual volume
- Normalized apparent losses, gallons/service connection/day
- Real Losses, annual volume
- Normalized real losses, gallons/service connection/day
- Normalized real losses, gallons/mile of pipeline/day (for low density systems)
- Infrastructure Leakage Index (ILI) = Real Loss volume/Unavoidable Annual Real Losses (the UARL is a calculated reference value that includes system specific data: length of mains, # of service connections, average pressure, and length of service lines owned by customers)

➤ Value

- Customer Unit Retail Costs and Apparent Loss Costs
- Variable Production Costs and Real Loss Costs
- Non-revenue Water percent by cost

➤ Validity

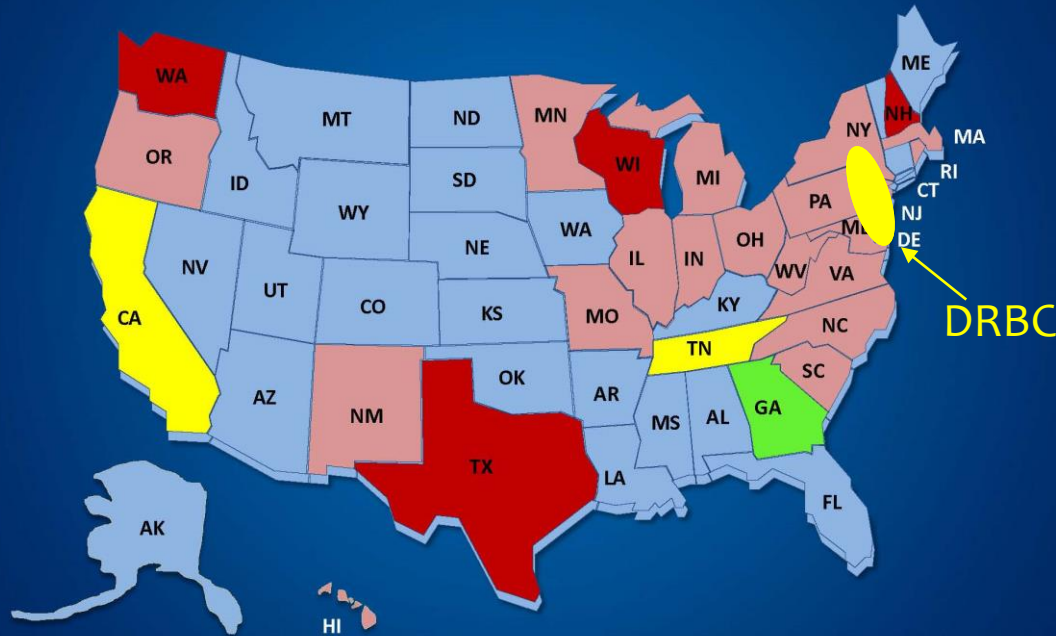
- Data Validity Score

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Water Loss – National Perspective

Landscape of Varying Levels of Water Loss Management Policy



Landscape of Varying Levels of Water Loss Management Policy

-  No Policy for Water Loss Management
-  Basic Water Loss Reporting
-  Annual Water Loss Reporting with AWWA M36 Terminology
-  Annual Water Loss Reporting with AWWA Free Water Audit Software
-  Annual Water Loss Reporting with AWWA Free Water Audit Software with Validation of Audits Submitted

State By State Water Loss Policy Map. American Water Works Association, 2015. Web. 5 Feb. 2016.

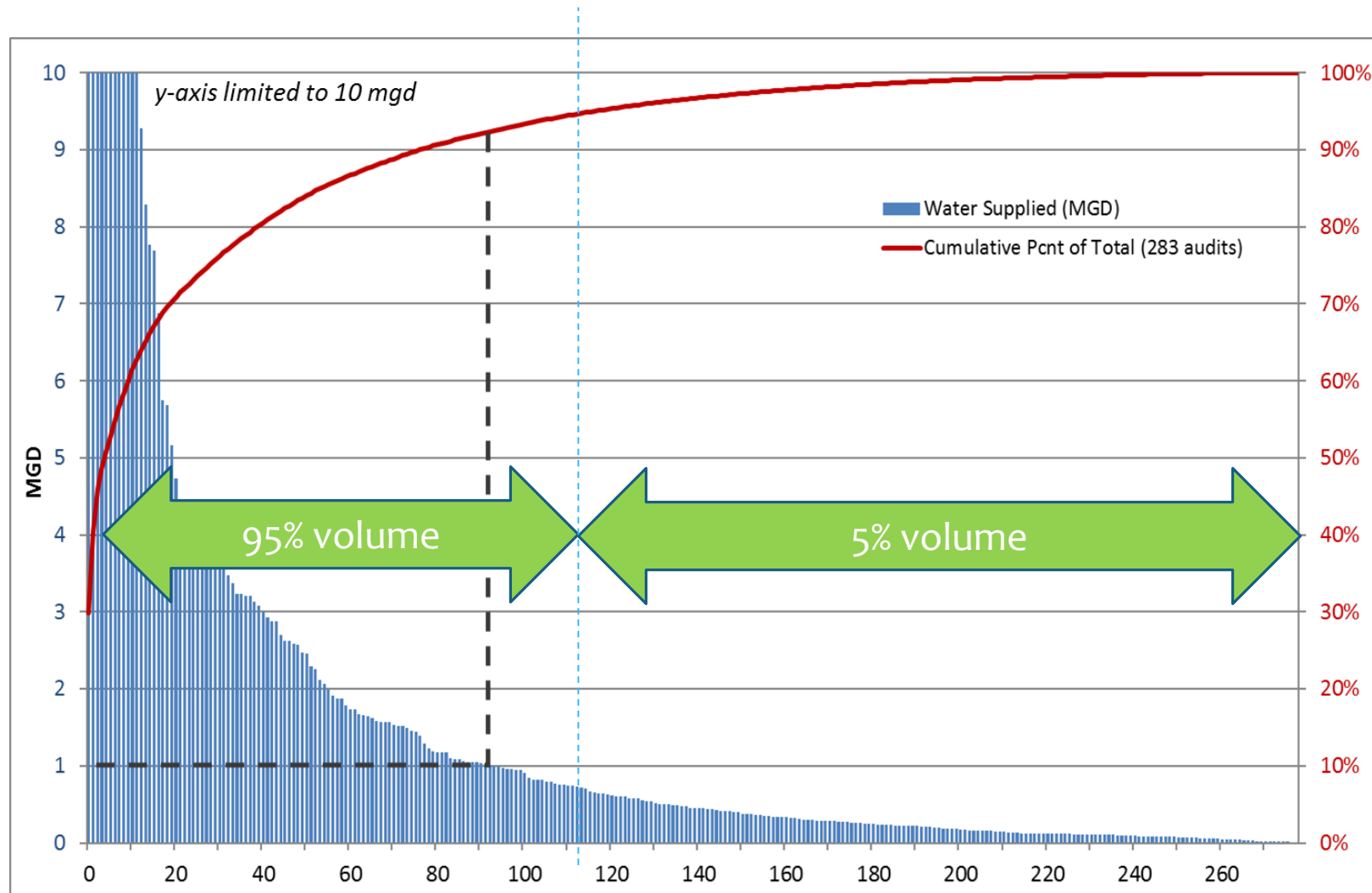
https://www.awwa.org/Portals/0/files/resources/water%20knowledge/water%20loss%20control/state%20of%20the%20states_Apr2016.pdf.

Water Audit Data Analysis: CY2016 Results for the Delaware River Basin...



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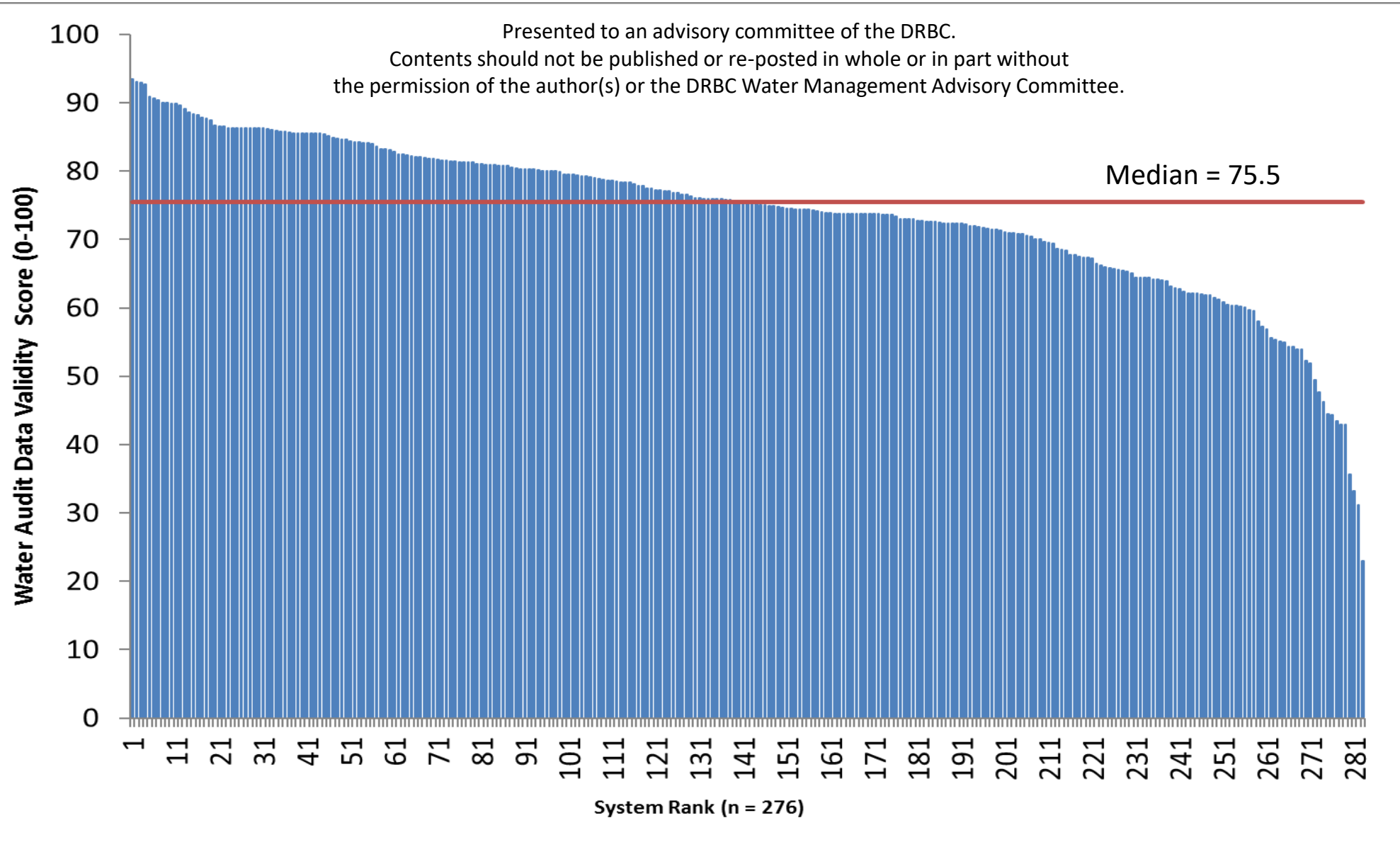
Water Supplied in CY2016 (MGD) - DRB



Water Audit Data Validity Score

CY2016 - DRB

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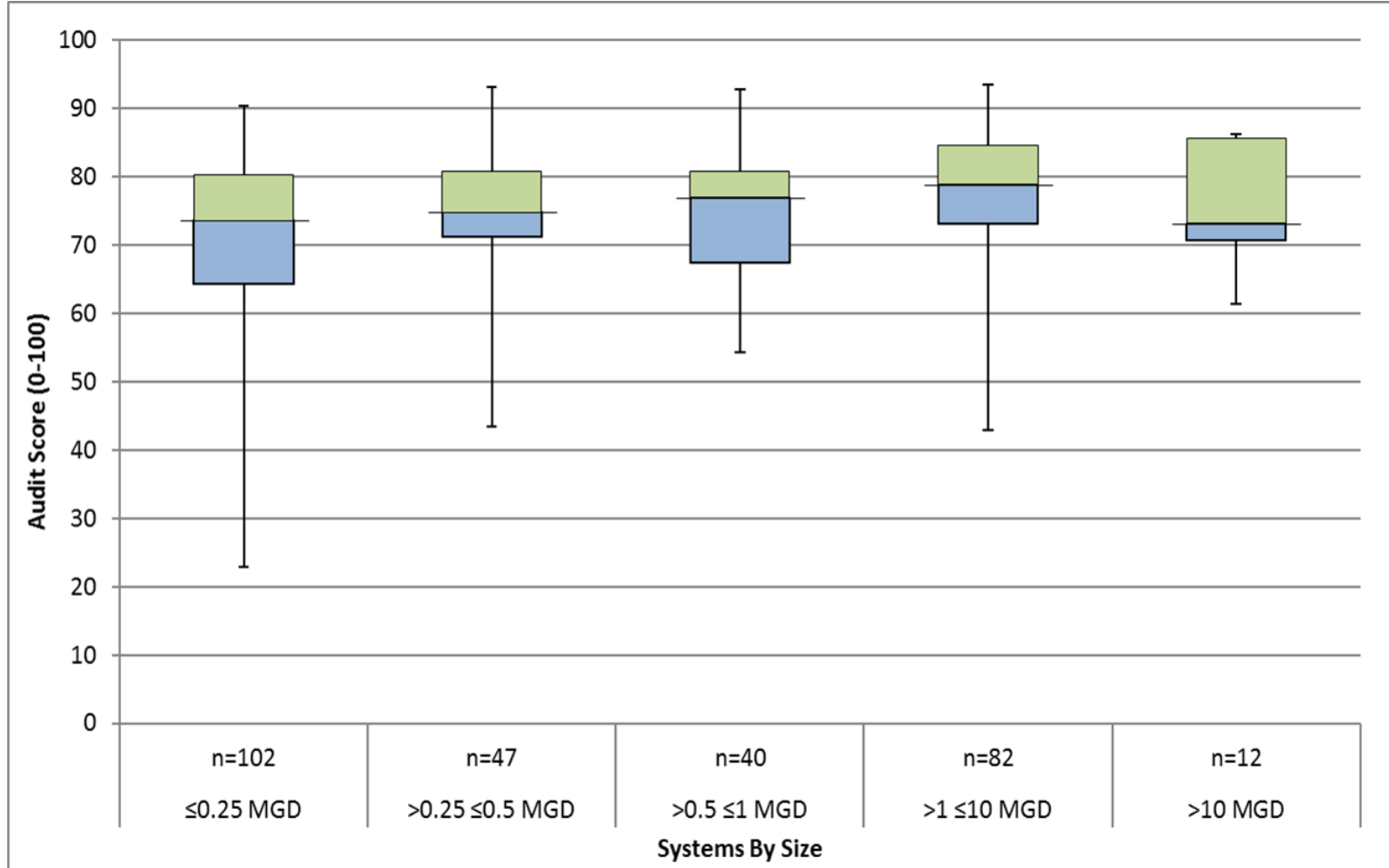




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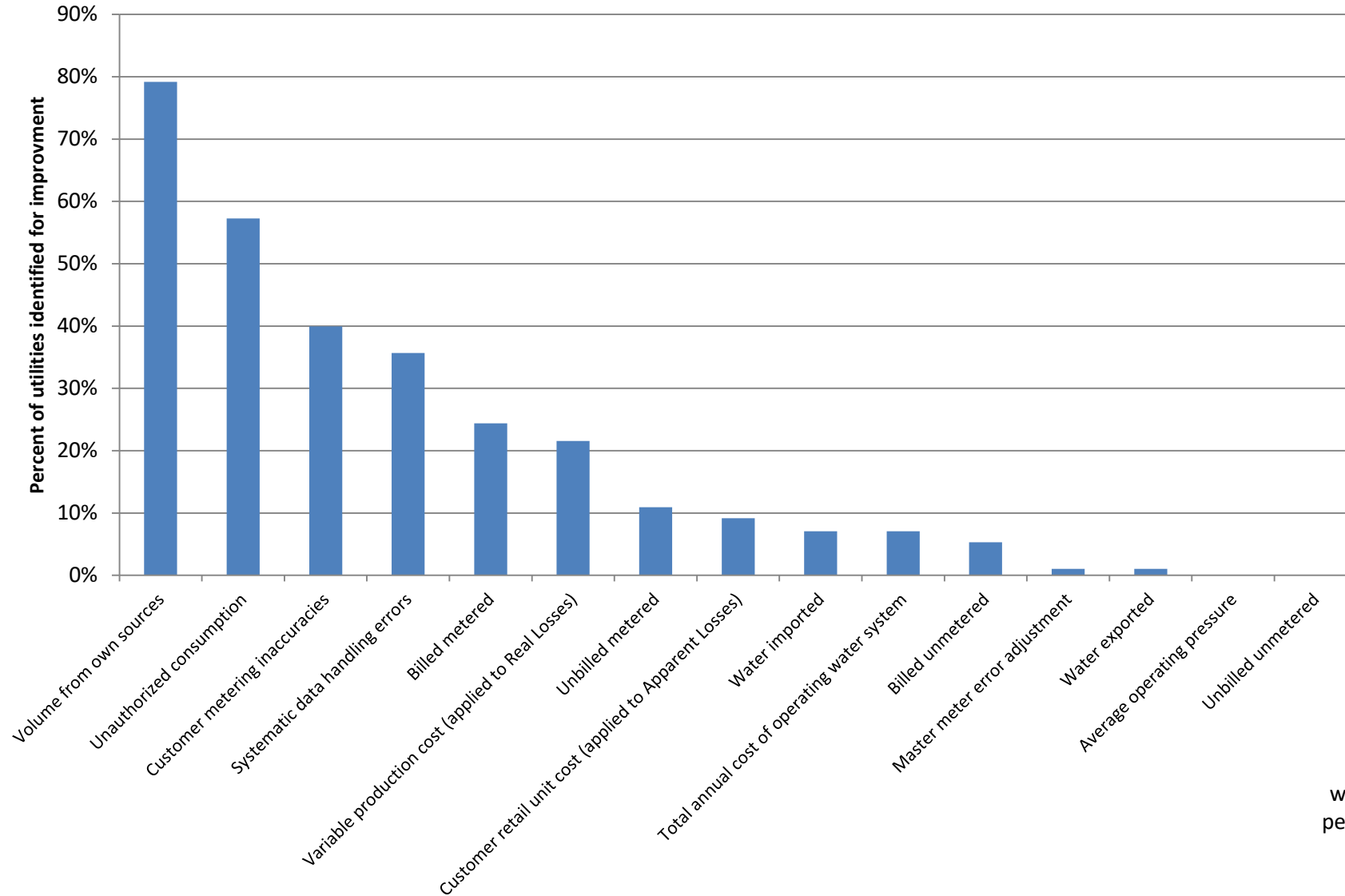
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Water Audit Data Validity Score CY2016 - DRB



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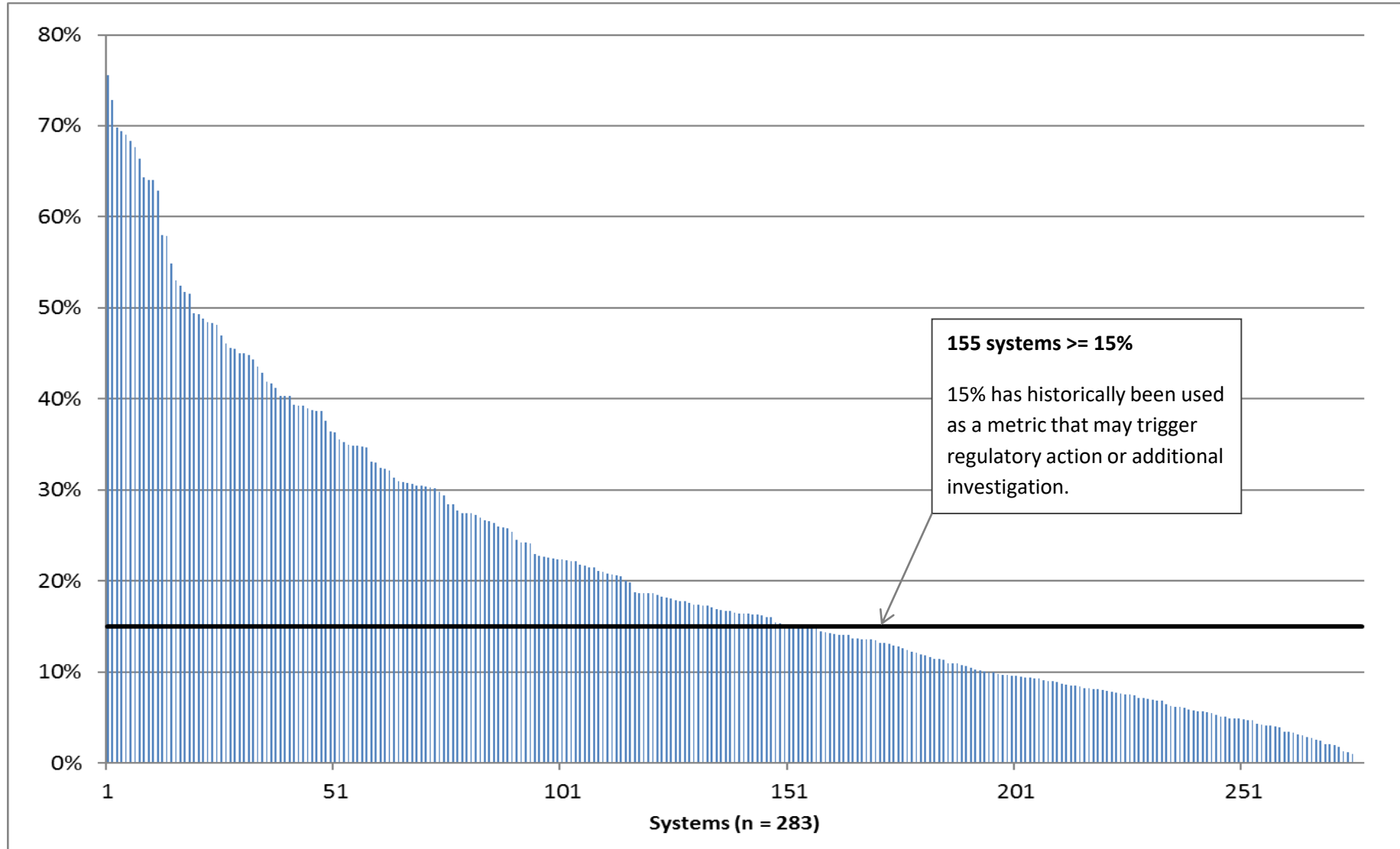
Priority Areas to Improve Grading Score CY2016 - DRB



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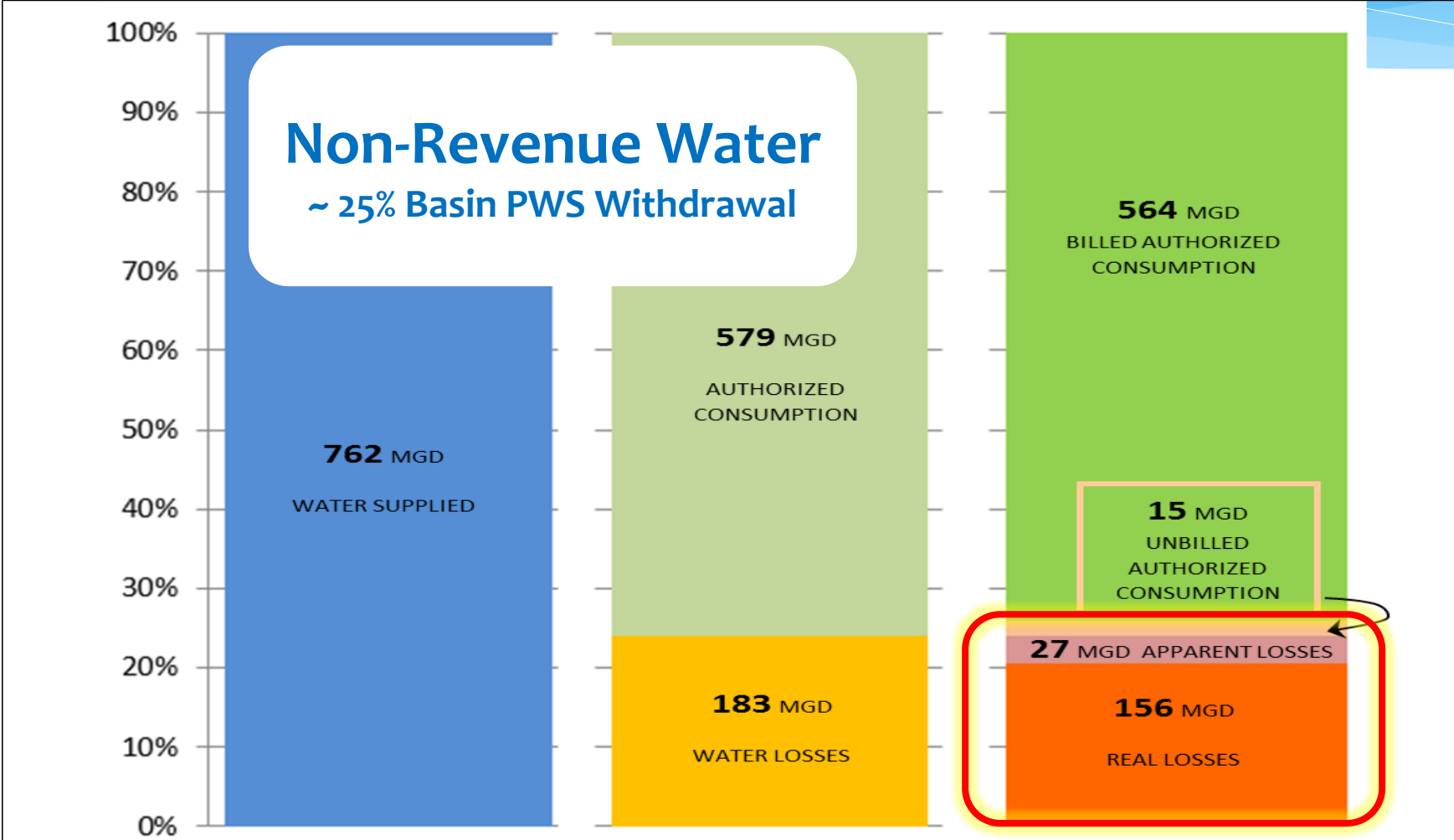


Non-Revenue Water as % of Water Supplied CY2016 - DRB



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DRBC water audit program summary (CY2016)



Billed authorized: All consumption that is billed to customers of the utility; this includes metered and unmetered connections.

Unbilled Authorized: All consumption that is unbilled but is still authorized by the utility. This is likely to include water used in activities such as firefighting, flushing of mains and sewers, street cleaning and fire flow tests. It may also include water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic or institutions free of charge.

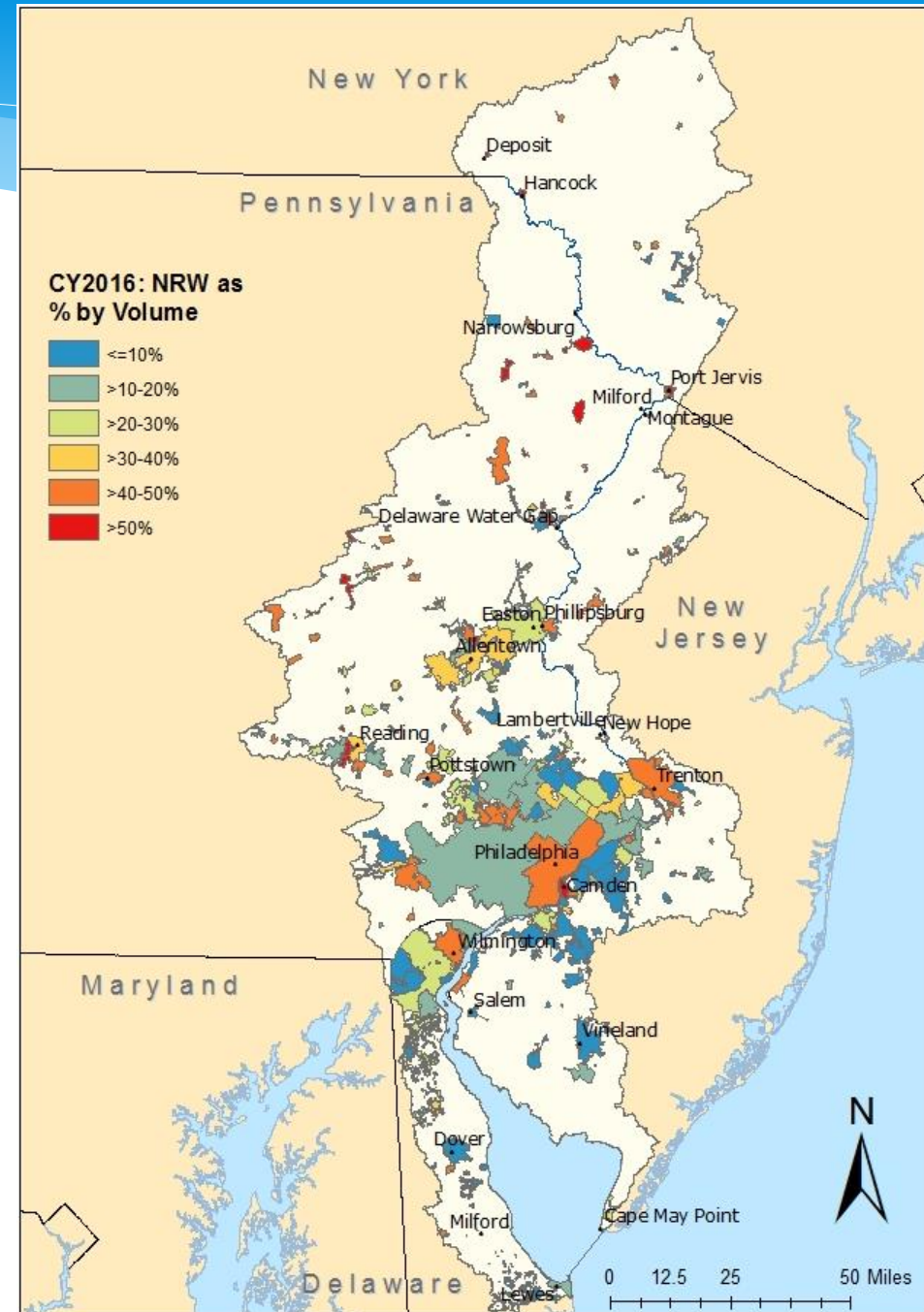
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Water System Map of Non-Revenue Water (NRW) Percent by Volume



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Status / Lessons Learned

- No. of PWS in the basin reporting (100,000 gpd threshold)
- Compliance/trends
- Lessons learned

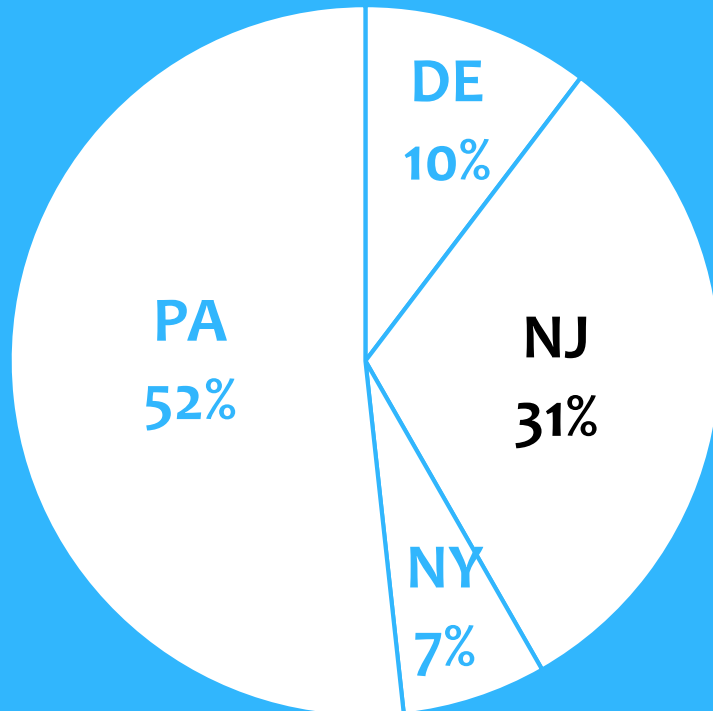
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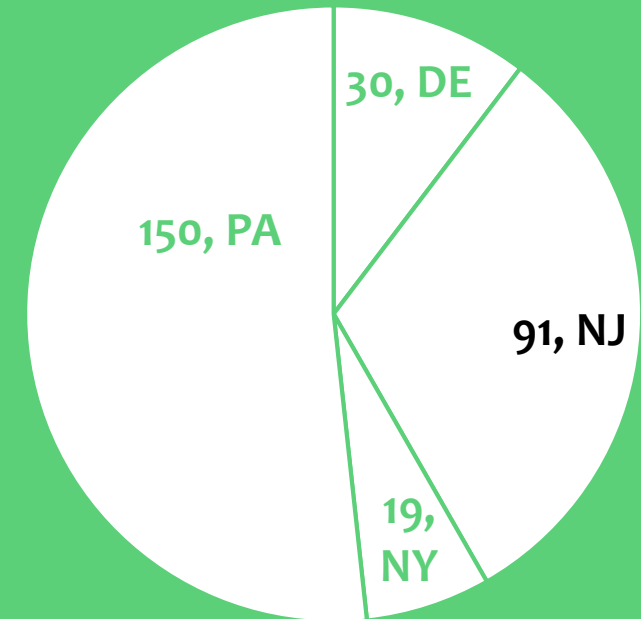
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CY2016 WATER AUDITS DUE

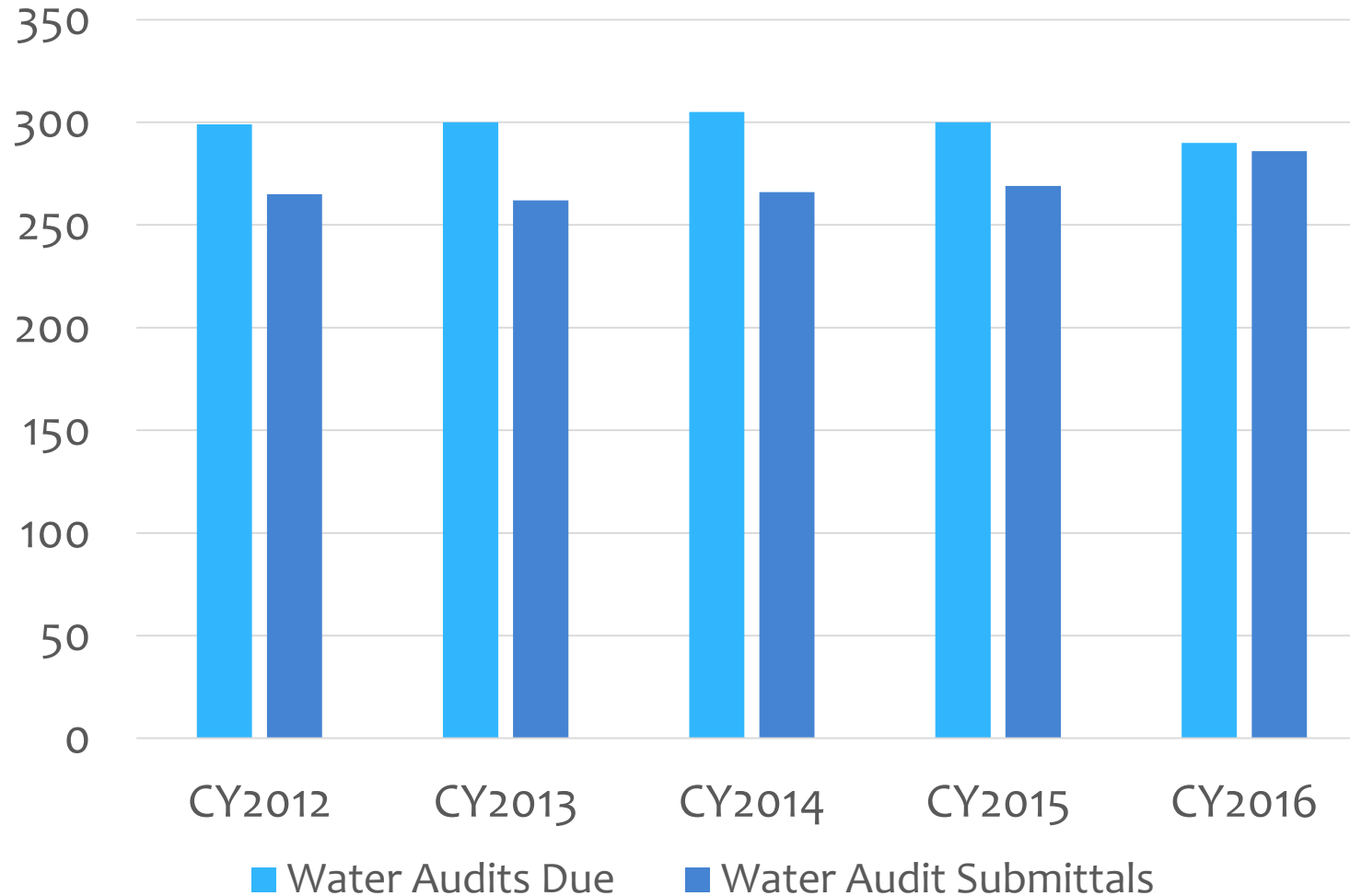


290 CY2016 WATER AUDITS DUE



Status / Lessons Learned

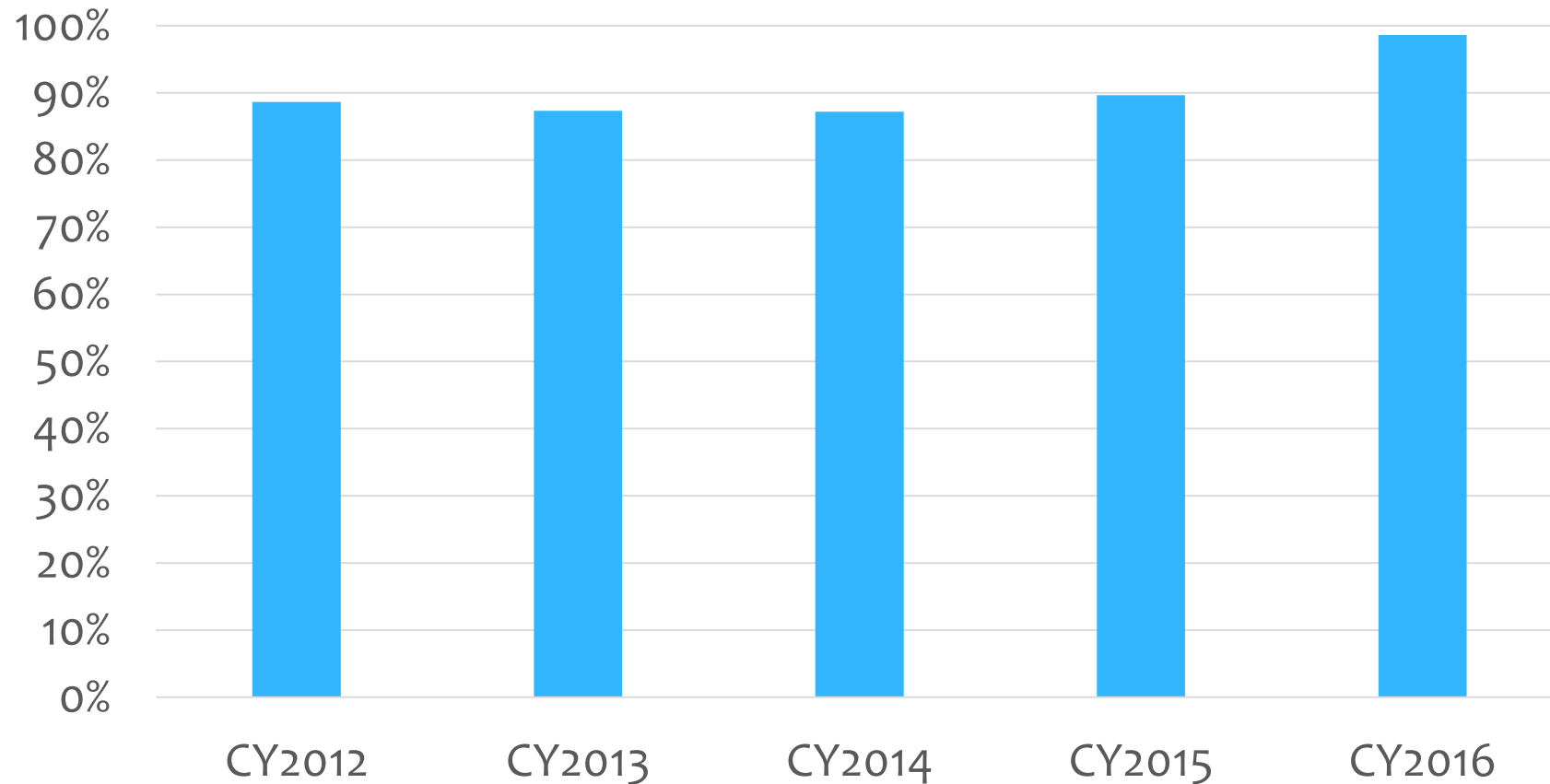
Water Audit Submittals for Calendar Years 2012 - 2016



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Status / Lessons Learned

Water Audit Reporting Percentage for Calendar Years 2012 - 2016



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Status / Lessons Learned

- **Lessons learned**
 - Education & outreach to small utilities
 - Beneficial program for water efficiency and utility function/costs
 - Patience & persistence & a “stick”

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Conclusions / Next Steps

- **Water Use Trends:** basin export trends relatively flat while consumptive use trends vary for the 3 major sectors
- **Water Audit:**
 - Raising awareness of best practice & trends in conservation
 - Asset Management Tool
 - DRBC leadership in Water Auditing: Training / Support / QA/QC
 - DRBC involvement in AWWA Performance Indicators Task Force
 - Future indicators (ILI, gal/conn)for water management
 - Training:
 - NJ: August 8 (half-day), Rutgers, New Brunswick, NJ
 - PA: DRBC Hosting Training Series (9/27, 10/23, 11/28), BCCC, Newtown, PA



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*Managing Our Shared Water
Resources since 1961*

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