

**WATER EFFICIENCY & CONSERVATION  
PROGRAMS:**

**Drinking Water Asset Management Seminar**

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# Why establish a water audit program?

- Over the past several years Michigan water systems have experienced a reduction in demand and revenue due to consumer conservation, losses of manufacturing facilities, and population declines. During the same period, budgets have been reduced.
- What if there was a way to increase your revenue stream under these conditions?
- Do you have untapped water resources that can be recovered in a cost-effective way?

National studies indicate that, on average, 14 percent of the water treated by water systems is lost to leaks. Some water systems have reported water losses exceeding 60 percent. Accounting for water and minimizing water loss are critical functions for any water utility that wants to be sustainable.”

From

[http://water.epa.gov/infrastructure/sustain/wec\\_wp.cfm](http://water.epa.gov/infrastructure/sustain/wec_wp.cfm)

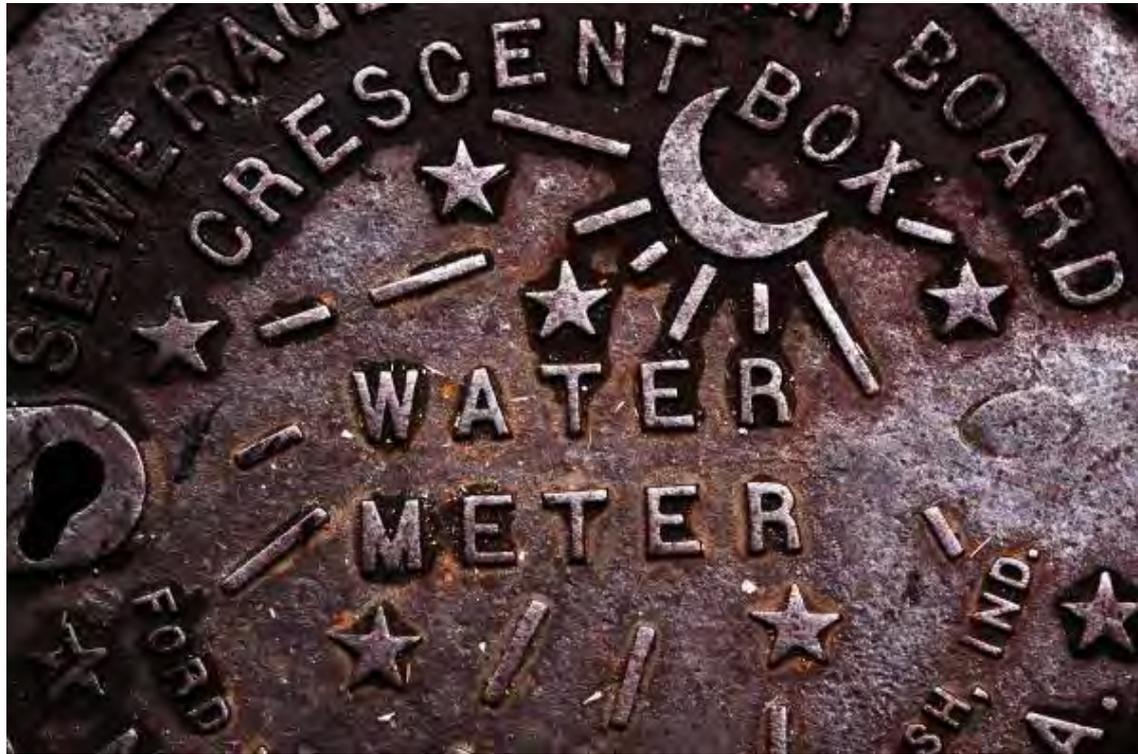


According to the EPA's manual titled  
**CONTROL AND MITIGATION OF DRINKING  
WATER LOSSES IN DISTRIBUTION SYSTEMS**

“Maintaining system infrastructure to deliver clean and safe drinking water to customers is often a significant challenge for the operators of public water systems (PWS).

Much of the estimated **880,000 miles** of drinking water infrastructure in the United States has been in service for decades and can be a significant source of water loss”.

“In addition to physical loss of water from the distribution system, water can be “lost” through unauthorized consumption (theft), administrative errors, data handling errors, and metering inaccuracies or failure.”



“Water is a commodity that is produced by a PWS; therefore, lost or unaccounted-for water can be equated to lost or unaccounted-for revenue.

A water loss control program can help to locate and reduce these water losses and thus maintain or increase revenue.”



# WATER EFFICIENCY & CONSERVATION PROGRAMS:

Where to look:

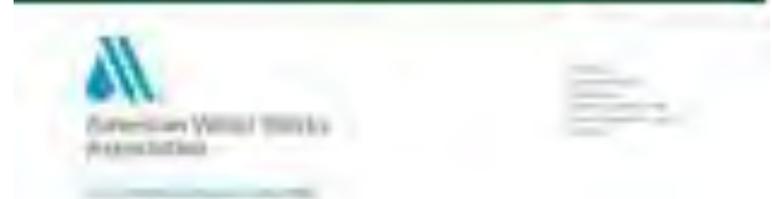
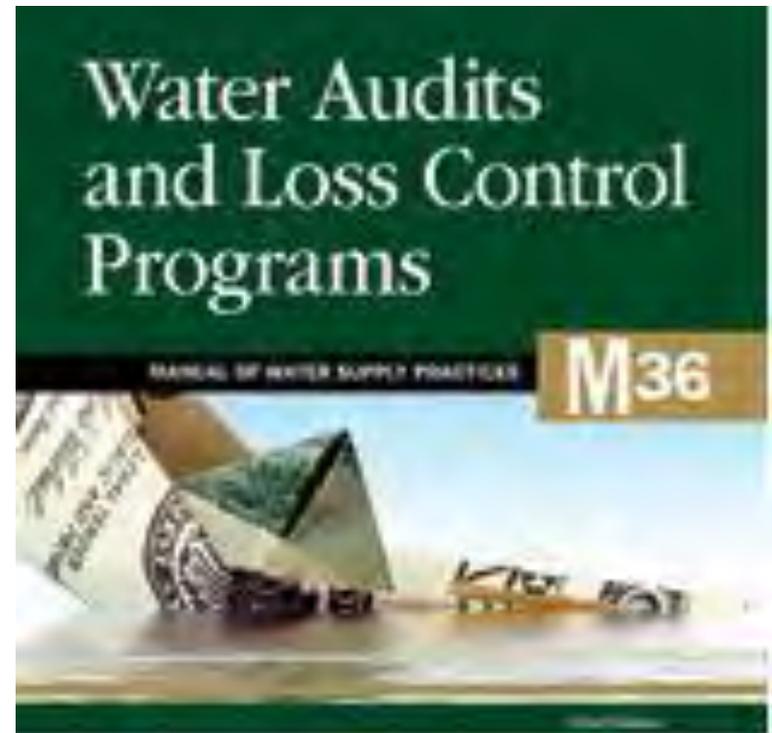
- Meter Inaccuracies
- Systematic Data Handling Errors
- Unauthorized Consumption
- Leakage
- Pressure Management

# Water Audit Tools

## AWWA Manual M36 Water Audits and Loss Control Programs

“This manual explains the AWWA water audit methodology in a user-friendly manner and provides an overview of some of the best loss control techniques that can currently be implemented for a sustainable water loss control program.”

- AWWA Website



# Manual 36 Water Balance Table

System Input Volume (corrected for known errors)	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption  (including water exported)	Revenue  Water	
			Billed Unmetered Consumption		
		Unbilled Authorized Consumption		Unbilled Metered Consumption	Non-Revenue Water  (NRW)
				Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses		Unauthorized Consumption	
				Customer Metering Inaccuracies	
				Data Handling Errors	
		Real Losses		Leakage on Transmission and Distribution Mains	
				Leakage and Overflows at Utility's Storage Tanks	
				Leakage on Service Connections up to point of Customer metering	

AWWA Water Loss Committee offers free water audit software developed to work in conjunction with the M36 manual. The program uses Microsoft Excel and is user friendly.

Available at:

<http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=48511>

# AWWA WLCC Free Water Audit Software: Reporting Worksheet

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WAS v4.2

[Back to Instructions](#)

[?](#) Click to access definition

Water Audit Report for:

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 (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**

## WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources: [?](#)

Master meter error adjustment (enter positive value): [?](#)

Water imported: [?](#)

Water exported: [?](#)

**WATER SUPPLIED:**

## AUTHORIZED CONSUMPTION

Billed metered: [?](#)

Billed unmetered: [?](#)

Unbilled metered: [?](#)

Unbilled unmetered: [?](#)

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

**AUTHORIZED CONSUMPTION:** [?](#)

Click here: [?](#)  
for help using option  
buttons below

Pcnt: Value:

1.25%

Use buttons to select  
percentage of water supplied  
**OR**  
value

## WATER LOSSES (Water Supplied - Authorized Consumption)

### Apparent Losses

Unauthorized consumption: [?](#)

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

Customer metering inaccuracies: [?](#)

Systematic data handling errors: [?](#)

**Apparent Losses:** [?](#)

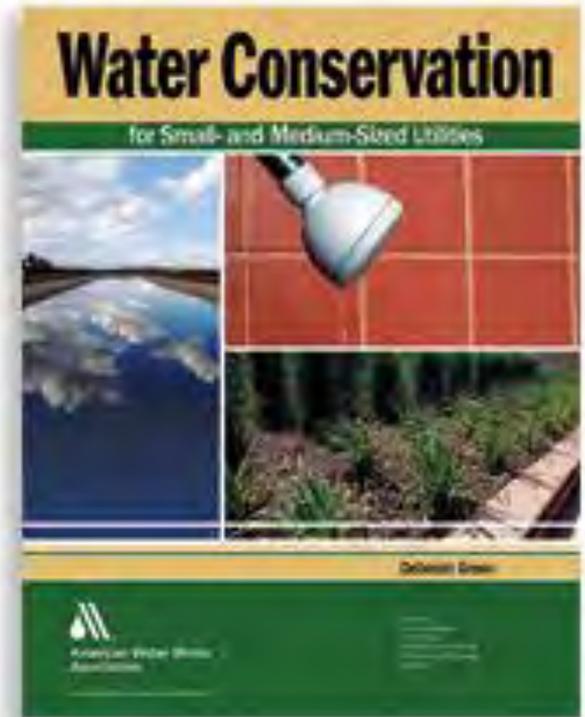
Pcnt: Value:

0.25%

Enter a percentage  
less than 10% in the  
red cell (J42), or select

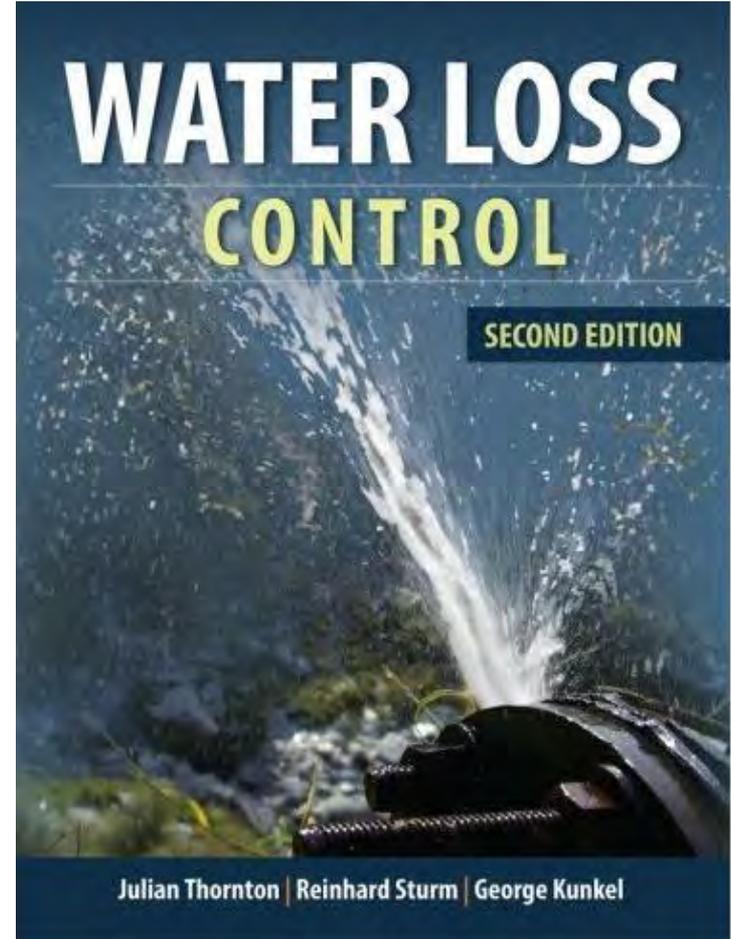
# AWWA Manual M52: Water Conservation Programs

“Provides guidance for municipal water resources managers on developing a citywide or regional water conservation plan... goal setting, water use analysis, potential savings, costs and benefits, conservation techniques and rate setting, responsibilities of stakeholders and outside groups, setting up a program, overcoming public resistance, program implementation, and success measurement.” - AWWA Website



# Another Resource - Water Loss Control by Julian Thornton, Reinhard Sturm and George Kunkel.

**Abstract:** “This comprehensive guide takes you step by step through every stage of the development of a water loss control program—from measuring and auditing water loss, tracking losses to their root cause, to developing a loss control program for future efficiency...and best practices advocated by the American Water Works Association and the International Water Association



**AWWA Manual M36**  
**Water Audits and Loss Control**  
**Programs Case Study**

**Washington County Service Authority**  
**(WCOSA) - Abingdon Virginia**

## Washington County Service Authority (WCSA)

- Located in the Appalachian Mountains in southwest Virginia
- Established in 1910
- Provides both water and waste water service
- Two filtration plants, 1 well, and 1 spring
- Total capacity of 7 mgd
- 27 pumping stations, 39 pressure zones and a maximum operating pressure of 250 psi.

## Washington County Service Authority (WCSA)

- Developed piecemeal with mains ranging from ½ inch to 20 inch in galvanized, cast iron, ductal iron asbestos cement, PVC and stainless steel
- Spread out over a rural area covering over 300 square miles
- 900 miles of pipeline
- 19,000 customers or 240 ft. per customer

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## Washington County Service Authority (WCSA)

- Elevation ranging from 1698 ft. to 5520 ft. above sea level or a range of 3822 ft.
- 27 pumping stations, 39 pressure zones



## Washington County Service Authority (WCSA)

- New General Manger hired in 1996
- 1997 WCSA implemented an operations improvement plan by participating in the AWWA 's QualServe program
- Began to study nonrevenue water with the goal of reducing operational costs and recover lost income

# The Plan

1. Meter Replacement
2. Capital Improvement (CIP)/Water Main Replacement Program
3. System Pressure Modifications
4. Supervisory Control and Data Acquisition (SCADA)
5. District Metered Area Monitoring (DMAM)

# 1. Meter Replacement

- Started with a meter replacement program. In house evaluation determined that most were oversized for the flow range
- Most were over 20 years old and all were manual read. It took 5 employees 2 months to read all the meters. Billing was bi-monthly
- Used in house staff and summer help to replace 18,900 meters. Care was taken to install properly sized radio read meters.

## **2. Capital Improvement (CIP)/Water Main Replacement Program**

- WCSA used a consulting firm to develop a hydraulic model of the distribution system and create a master plan for water infrastructure replacement
- The master plan was then used to create a CIP
- From 1999 to 2009 a total of 33 CIP projects were completed at a cost of \$12.6 million, including \$3.9 million for the meter replacement project

## **2. Capital Improvement (CIP)/Water Main Replacement Program - continued**

- Inventory data was collected by WCSA staff and loaded into a GIS mapping program. Identified over 200 miles of 2" or smaller galvanized pipe
- Repair to galvanized estimated at \$270,000 per year
- Galvanized leakage estimated at \$340,000 per year
- System improvements resulted in the elimination 18 pumping stations, 5 storage tanks and 7 pressure zones

### **3. System Pressure Modifications**

- Elevation changes in the system presented a significant challenge to managing pressure. In 1997 WCSA had 6 pressure reducing valve (PRV) stations, only 2 were operational.
- As of 2009 20 PRV stations have been installed and all are operational.
- WCSA has experienced a significant reduction in water main breaks attributed to reduced pressures

## **4. Supervisory Control and Data Acquisition (SCADA)**

- WCSA installed a SCADA system, which monitors all storage facilities, control valves, and pressure
- Monitored 24/7/365 by operators who respond to sudden changes in flow direction or drops in pressure
- Tank overflows almost entirely eliminated and water quality improved with effective tank turn over

## **5. District Metered Area Monitoring (DMAM)**

- WCSA distribution system divided into districts based primarily on pressure zones
- Mag qmeters installed at points of pressure change such as pump stations or PRV' s
- Volume of water measured entering and leaving each DMAM used to determine losses DMAM's with the highest losses were given priority in the CIP

## **5. District Metered Area Monitoring (DMAM)**

### **- continued**

- In 2003 the entire system loss was 51 million gal/month. At  $51 \text{ mg}/7\text{mg/d} = 7.3$  days or roughly 25 % of operations lost
- Four of the DMA's accounted for a loss of 25 million gal/month
- WCSA plans on metering both static and dynamic fire suppression because it is suspected that this is where a majority of the water is lost

# The Bottom Line

- Improvements made through the QualServe participation has resulted in a 10% reduction in their operating budget which was passed on to customers in the form of minimal rate increases
- A 11% increase in water and waste water revenue attributed to the meter replacement program
- Increased water quality, fewer main breaks

# The Story Behind the Story

- New General Manager in 1996
- By 1997 Operations Improvement Plan in Place
- Focus on Nonrevenue Water
- Meter Replacement = \$
- Meter Replacement = 5 staff
- Hydraulic Model = Master Plan - Infrastructure Replacement
- Master Plan for Infrastructure Replacement = CIP
- CIP + \$ = 33 Completed CIP's
- GIS Software + Staff = Location of 200 miles of 2" pipe
- Complete CIP Projects = Elimination of 18 pumping stations, 5 storage Tanks and 7 pressure zones
- SCADA = Improved Service and Fewer Tank Overflows
- 10% Operating Budget Reduction
- 11% Increase in Revenue

# The Story Behind the Story = Successful Asset Management by

