

Water Audits

All water utilities experience some level of water losses. These losses happen for a variety of reasons, such as pipe leakage, poor accounting, and inaccurate or unmetered locations. The Department of Environmental Protection's Water Allocation and Chapter 110 Programs characterize these volumetric losses under the general term, "unaccounted-for water" (UAF), usually expressed as a percentage of the overall system. Many water suppliers in Pennsylvania, specifically community water systems, have UAF percentages over the maximum target of 20%, some reaching 50% or more.

The American Water Works Association (AWWA) published a manual, *M36 Water Audits and Loss Control Programs*, Fourth Edition (2016), which offers water utilities a set of tools and approaches to instill accountability and control losses in their systems, including:

- Step-by-step procedures to conduct a water audit to assess the efficiency of the water distribution system and water accounting practices.
- Definitions and implications of apparent (nonphysical) losses and real (physical) losses.
- Specific techniques to identify, measure, and verify all water sources, consumption, and losses.
- Example data inputs and sample calculations for each step of the water audit.
- References to freely available software tools to compile the water audit and plan leakage management activities.
- A roadmap to control apparent losses in metering and billing operations and to recover missed revenues.
- Steps to implement a leakage and pressure management program to control real losses and preserve source water resources.
- Planning steps to assemble the proper resources, information, and equipment to launch and sustain the accountability and loss control program.
- Approaches for the short-term and long-term goal setting for the loss control program.
- Considerations for small water systems.
- Discussions and listings of actual water audit data and descriptions of successful water loss control being applied by North American water utilities.

The water audit process helps reduce the UAF, or more specifically, the nonrevenue water of the distribution system. Figure 1 shows the framework of the system water balance.

This water audit process also helps water suppliers manage their resources to the benefit of their customers and themselves. Water suppliers gain increased knowledge of their distribution, metering, and billing systems throughout the process. Water losses from previously unmetered customers will increase overall revenue that was previously lost. Increased system data and knowledge leads to better water resources management for conservation, long-term planning, drought, and emergency situations.

Several of the largest water suppliers in Pennsylvania use the water audit methodology. The Pennsylvania Public Utility Commission (PUC) issued orders in 2008 and 2012 for all Class A water utilities (over \$1,000,000 in annual revenues) to implement the AWWA water audit methodology and file an annual Water Audit summary with the PUC Secretary. Water suppliers in the Delaware River Basin that distribute in excess of 100,000 gallons per day during any 30-day period are required to utilize the water audit process and report annually as directed by the Delaware River Basin Commission's Resolution No. 2009-1.

For more details, in addition to AWWA's M36 manual (available at www.awwa.org), refer to the United States Environmental Protection Agency's guidance document *Control and Mitigation of Drinking Water Losses in Distribution Systems*, November 2010 (EPA 816-R-10-019 available at www.epa.gov) and the Delaware River Basin Water Code, 18 CFR Part 410 (available at www.state.nj.us/drbc).

Figure 1: Water Balance

Withdrawal volume	Raw Water Consumption and Losses (Consumption includes In-Treatment Plant Use; Losses include raw water meter inaccuracies and pipeline leakage)			Non-Revenue Water	
	Water Sold as Exports	Billed Water Exported			Revenue Water
	Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	
			Billed Unmetered Consumption		
		Unbilled Authorized Consumption	Unbilled Metered		
	Water purchased as Imports	Water Losses	Apparent Losses	Unauthorized Consumption	Non-Revenue Water
				Metering Inaccuracies	
			Real Losses	Leakage in Transmission and/or Distribution Mains	
	Leakage and Overflows at Utility's Storage Tanks				
	Leakage on Service Connections up to the meters point				

AWWA's free water audit software is available for download here: www.awwa.org/Resources-Tools/Resources/Water-Loss-Control.

For more information, visit <http://www.dep.pa.gov/Business/Water/>.