Water Audits and Loss Control Programs

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American Water Works Association

MANUAL OF WATER SUPPLY PRACTICES — M36, Third Edition

Water Audits and Loss Control Programs

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Preface

Accountable Water Management—Progressive Thinking and Solutions

North American water utilities have been highly successful in providing safe, reliable water supplies that have been a foundation for growth and prosperity. Benefiting from abundant natural resources, suppliers have succeeded in establishing high expectations for quality water service. The closing years of the 20th century, however, began to witness changes not seen before on the continent. The fastest growing cities in the United States are now located in sunbelt areas—even centered in deserts, such as Las Vegas and Phoenix. Limited water resources exist in these areas, therefore supplies must be developed and conveyed from distant water sources.

Multiyear periods of drought have begun to plague many areas of the United States. Water restrictions and shortages have become routine in many areas as a result of these circumstances, sometimes coupled with poor infrastructure reliability of individual water systems. For many water systems in the older parts of North America, aging infrastructure is exerting a toll as failures and high leakage rates compromise system efficiency and disrupt the reliable provision of services. Enhanced water quality and environmental protections along with funding constraints make development of new water resources more difficult, costlier, and less attractive than in prior eras.

In North America a growing focus on *water conservation* has evolved to address these challenges. Conservation efforts have been successful in stemming customer water demand via the use of water efficiency measures such as low flow toilets and showerheads. It is essential that these successful efforts continue because all water users have a responsibility to use water wisely. In the broader context of *demand management*, water suppliers also have a responsibility to wisely manage the valuable water resources under their purview. This tenet—*the accountable and efficient management of water supplies by utilities*—is the central focus of this manual.

While successfully delivering quality water supplies for up to two centuries, the North American water industry has often done so with uncertain accountability controls and high losses of both treated drinking water, mostly from leakage, and revenue caused by inaccurate metering, billing, and unauthorized consumption. Because the seemingly endless water resources of yesteryear are no longer available in many regions, water suppliers must manage water resources with a greater sense of stewardship and efficiency than in the past.

The first edition of this manual was published in 1991 and detailed the water audit method advocated by the California Department of Water Resources and adopted by the California-Nevada Section of the American Water Works Association (AWWA). The second edition was published in 1999, and provided relatively minor updates to the first edition. Perhaps the greatest strength of this manual has been the clear step-by-step instructions for data gathering to compile the water audit. This feature is retained in this third edition. However, the third edition includes a major advancement in water audit methodology, giving water utilities greater guidance in improving accountability and economically controlling water and revenue losses.

Historically, standard methods to audit water supplies and control losses were lacking throughout most of the world. In 2001, a survey of United States state and

regional water oversight agencies revealed that inconsistent definitions for water loss (most using the imprecise label "unaccounted-for" water) abound with few reliable water auditing or loss control measures in place. Regulatory requirements are unusually sparse on this issue in the United States more recently. Reliable data is being collected and along with many case study and anecdotal accounts, suggest that the occurrence of high loss water supplies is widespread.

Improvement in this state of affairs emerged in the 1990s. The United Kingdom's *National Leakage Initiative* brought forth valuable research findings that were applied in new policies and practices leading to significant leakage reductions. From 1997–2000, AWWA participated on the Water Loss Task Force organized by the International Water Association (IWA). The Water Loss Task Force drew on the best practices included in the various water audit methods in use worldwide, including the United States, to assemble a *best management practice* methodology that features a set of rational terms and definitions, and an array of robust performance indicators that allows an objective gauging of loss levels. In 2003, AWWA's Water Loss Control Committee published the report "Applying Worldwide Best Management Practices in Water Loss Control" in *Journal AWWA*. In this report, AWWA advocates the use of the IWA/AWWA method and performance indicators.

This manual explains the IWA/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. Chapter 1 provides a brief introduction while Chapter 2 gives detailed instruction on the water audit process. Chapter 3 describes ways to recoup missing revenues by controlling apparent (nonphysical) losses. Chapters 4 and 5 discuss the impacts of real (physical) losses which are largely leakage, and methods to control these losses. Chapter 6 gives guidance on the organizational steps a water utility can take to manage and sustain the water loss control program, while Chapter 7 offers valuable insights for small systems in managing their losses. A glossary of terms and definitions is also provided. Appendices include blank worksheets and forms, water resources considerations, a description of AWWA Water Loss Control Committee's free Water Audit Software, and useful case study accounts from a spectrum of North American water utilities. For water utilities just getting started, the free Water Audit Software can be downloaded directly from the AWWA Web site and used to obtain a preliminary quantity of losses and their costs. This can be followed up by field measurements and investigations to gradually enhance and validate the water audit, steps well-described throughout this manual. Examples are included throughout the manual for the fictitious County Water Company, illustrating the means to compile the water audit and initiate control of both apparent and real losses.

Water utilities now have effective tools and methods to promote accountability and efficiency in their supply operations. Water utility managers will be called on to assess their inefficiencies and take corrective action, and the methods contained in this manual will help them do it.

Acknowledgments

This 3rd edition of the manual is a substantial revision of the previous M36 publications. It details significant developments and methods on water accountability and proactive loss control. This edition presents innovations being diligently forwarded by the American Water Works Association (AWWA) Water Loss Control Committee in cooperation with the Water Loss Task Force of the International Water Association (IWA).

This edition was written through the persistent, dedicated work of a standing subcommittee. Members of this subcommittee included

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In Memoriam

This 3rd edition of *Water Audits and Loss Control Programs* is dedicated to Louis F. Aiello III of West Virginia American Water, Charleston, W.V., who passed away shortly before the Water Loss Control Committee completed the final draft. We thank Lou for his work on the committee and recognize his commitment to his family and profession, and his contributions to this publication.

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Chapter 1

Introduction: Auditing Water Supply Operations and Controlling Losses

Community drinking water supply systems around the world have been instrumental in improving the human condition by providing essential water to promote public health and safety and good hygiene, and to serve as a basis for economic development. For hundreds of years, societies have constructed infrastructure to withdraw water from available sources, to treat it to an acceptable standard, and to distribute it to communities, typically through buried piping distribution systems. Yet, for all their success in quenching human needs, many drinking water utilities operate with considerable inefficiencies in terms of water and revenue losses. As the world grapples with the dilemma of a growing population but a finite amount of water, these inefficiencies need to be brought under a reasonable level of control. This manual offers water utilities a set of tools and approaches to instill accountability and control losses, including

- Step-by-step procedures to conduct a water audit to assess the efficiency of the water distribution system and water accounting practices
- Worksheets and sample calculations for each step of the water audit
- Definitions and implications of apparent (nonphysical) losses and real (physical) losses
- Specific techniques to identify, measure, and verify all water sources, consumption, and losses
- 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