Best Management Practices Help

# Control Water Loss

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Photos by Julie Black

There may have been a time when having a substantial amount of lost or unaccounted-for water was acceptable to water utilities. The North American water supply was taken for granted because it was abundant in many areas. Finding and plugging leaks might not have seemed cost effective for a typical water system: the perceived cost of detection and repair outweighed the perceived benefits of saving water. Many water systems also didn't meter or charge for certain kinds of uses.

Now, growing populations, drought, and water shortages are straining our finite water supply. Water utilities are under increasing pressure to find new water resources, which often are difficult and costly to develop. Water and revenue loss recovery stands as one of the most promising resource initiatives in North America.

## Losses Aren't Small

According to U.S. Geological Survey water loss data from 1995, of 40 billion gallons of water withdrawn each day by U.S. water utilities, a full six billion gallons per day is categorized as "public use/loss." This is more than enough to meet the water needs of the 10 largest U.S. cities.

Water conservation has become an issue in recent years, but most water conservation efforts have focused on the consumer. Even with significant drought occurring in many areas of the U.S. since 2001, relatively little emphasis has been placed by water suppliers on quantifying and controlling water loss. It only makes sense to recover lost water to mitigate the effects of drought and water shortages. Utilities need a more accurate picture of the existing water supply before developing new sources and expensive infrastructure.

Recovering lost water offers several benefits:

- As a rule, this water is already treated to prevailing standards and ready for consumer use.
- It is pressurized to reach the consumer.
- It often is sufficient to meet the community's need for expansion.
- It can generate additional revenue if it has inadvertently been provided free to consumers.

Water loss management can offer energy conservation benefits as well. Collectively, water utilities are the single largest user of electricity in the U.S., according to a 2001 American Water Works Association (AWWA) Research Foundation update. It is possible that five to 10 billion kilowatts of power generated in the U.S. are expended each year on water that is either not paid for or leaked away.

# Tips for Controlling Loss

There are several steps utilities can take to control losses, both while the audit process is underway and as part of an ongoing resource management program.

### Leakage

Leakage can be managed by component analysis, zone flow analysis, and using improved leak detection technology. Examples include geophones, computer correlators, and leak noise loggers. Leakage recovery is the best source of new water resources for systems facing water supply shortages.

### Pressure Management

Many systems are over pressured, which can lead to higher break frequencies and volume loss. Pressure reduction is a simple and effective way to aid conservation, reduce transients and overflows, and increase safety of emergency flows.

### Rehabilitation and Replacement

Many water systems are reaching the end of their useful life and becoming corroded and inefficient. Pipe cleaning and relining, network replacement, service replacement, and valve and hydrant maintenance are just a few of the ways that rehabilitation and replacement can be improved. Applying a sound, comprehensive asset management approach to the distribution system can minimize water loss and optimize the life of the system.

### Leak Repair Time

Not all leakage is repaired as efficiently as possible. Leaks are classified as either reported or unreported. Each category has a run time. Reducing the run time can save significant volumes of lost water.

### Meter Accuracy

Meters fail for a number of reasons, including wear over time, excess volume or abrasive waters, incorrect installation or lack of maintenance, incorrect sizing or meter type, or environmental problems, such as freezing or overheating. Good installation, selection, and sizing practices, along with routine testing and regularly scheduled replacement, can resolve these issues.

### Data Transfer Errors

In many situations, data is recorded correctly by the meter but is transferred incorrectly. Errors occur because of scaling problems, problems with zeros, pulse or factor problems, meter reader error in manual reads, or poor customer accountability. Auditing, inspections, standardization, and a good data trail resolve many of these problems.

### Data Analysis Errors

Once data arrives at the utility office, it can be used incorrectly. Volumes may be inferred from generated estimates or from rebates. Customers may be lost or temporarily transferred to other accounting systems. These problems can be resolved through routine audits, operator education, and having clear operating guidelines.

### Theft

Unreported connections, bypasses, meter tampering, and misusing hydrants for other activities are some examples of illegal consumption. Routine inspections, prepay schemes, flow and pressure control, and legal action when warranted resolve these problems.

Though water loss is often defined as leakage, it actually consists of three components:

1. *Terminology*—There have not been standardized definitions of water and revenue losses.
2. *Technical*—Not all water supplied by a water utility actually reaches the customer.
3. *Financial*—Not all water reaching the customer is properly measured or paid for.

## Establishing Best Practices

The water utility community is taking steps to get the lost water situation under control. The International Water Association and AWWA have been working to develop a set of best management practices for the emerging discipline of water loss control. The result is a set of tools to provide reliable water-use tracking and to control unnecessary water and revenue loss.

One of the key components of North American research was the AWWA States Survey Project, conducted in 2001. It gathered data from 46 jurisdictions, including 43 state agencies and three regional agencies. It assessed 10 current practices, including:

1. Water loss policy
2. Definition of water loss
3. Accounting and reporting
4. Standards and benchmarks
5. Goals and targets
6. Planning requirements
7. Compilation and publication
8. Technical assistance
9. Performance incentives
10. Auditing and enforcement

The survey concluded that, although there is a fair amount of state and regional policy activity to address lost water, there are no imposed consequences through incentives or enforcement mechanisms. Additionally, there is a need for refined definitions, measures and standards for evaluating water losses, as well as a need for an established uniform method of accounting and collecting valid and reliable data. Proper management of any resource must include accurate measurement of the resource throughout its life cycle.

Having a reliable water audit is the foundation of proper resource management for drinking water utilities. Just as a bank provides statements of money flowing into and out of accounts, the water audit displays how quantities of water flow into and out of the distribution system to the consumer.

All losses and potential losses are broken down into two types: real and apparent. Real losses are physical losses such as leakage and tank overflows. Apparent losses are "paper" losses resulting in lost revenue; these include errors in meter accuracy, data transfer, data analysis, and theft or illegal consumption.

The financial distinction between each type of loss is important. Real losses are usually valued at the short-term marginal treatment/production costs or the price to purchase bulk water. Apparent losses exert an impact according to the retail sales cost. Because most systems charge more in retail costs, apparent losses are usually more costly than real losses. However, it is appropriate for real losses to include more than just the marginal production costs. Social, environmental, or political costs should be built into the real loss cost analysis, particularly when source water is scarce or infrastructure development is contentious. Significant leakage recovery can extend the capacity of existing infrastructure.

Analyzing the separate components of water loss helps model where losses are occurring and what impact they have on annual loss. The analysis also makes it easier to identify and deploy appropriate intervention methods.

## Developing the Water Audit

The mechanics for developing a good water audit are twofold: an initial top-down approach with gradual bottom-up refinements. The top-down approach is largely a desktop exercise. The auditor compiles information from available documentation, including water system input, customer billing summaries, leak repair summaries, average pressure, meter accuracy tests, fire hydrant permits, and other records, that shows how water was used and lost. This information provides an initial basic audit that relies on a considerable number of estimates. While approximate in nature, it provides a baseline that can be assembled quickly and provides a good starting point for water utilities compiling their first water audit.

The bottom-up approach includes performing comprehensive field investigations. Using nightflow analysis to obtain leakage measurements is an example of using actual field measurements to replace rough estimates in the initial baseline audit. Nightflow, as the term implies, is the measured minimum flow at night compared to the average daily flow. If the ratio is above 25 percent, it could signal high potential leakage in that area.

Because research and field data gathering is time consuming, it may be best for water utility managers to incorporate these bottom-up methods in increments. Over several years, a reliable water audit will begin to take shape. As the water audit develops with added data, it becomes a normal part of a utility's operational and planning tool kit. Several researchers have begun developing statistical methods to improve the accuracy of the top-down water audit in reflecting actual supply conditions in order to shorten the time between the initiation of the audit process and the existence of a water audit function that is reliable for planning purposes.

## Conclusion

The AWWA States Survey Project confirmed what many in the industry long suspected: weak and inconsistent water accounting structures exist in drinking water supply systems throughout North America. Water loss, manifested as both real (physical) and apparent (paper) losses, constitutes a major inefficiency in water supplies as precious water and energy resources are wasted, revenue isn't fully recovered, and the integrity of water use and loss data is compromised. The emerging discipline of water loss control offers great potential as a resource and revenue recovery opportunity for North American water suppliers.


For more information about water loss, see the articles "On the Trail of the Elusive Water Leak" and "You'd Be Surprised Who's Stealing Your Water" on the National Environmental Services Center Web site at *www.nesc.wvu.edu*.

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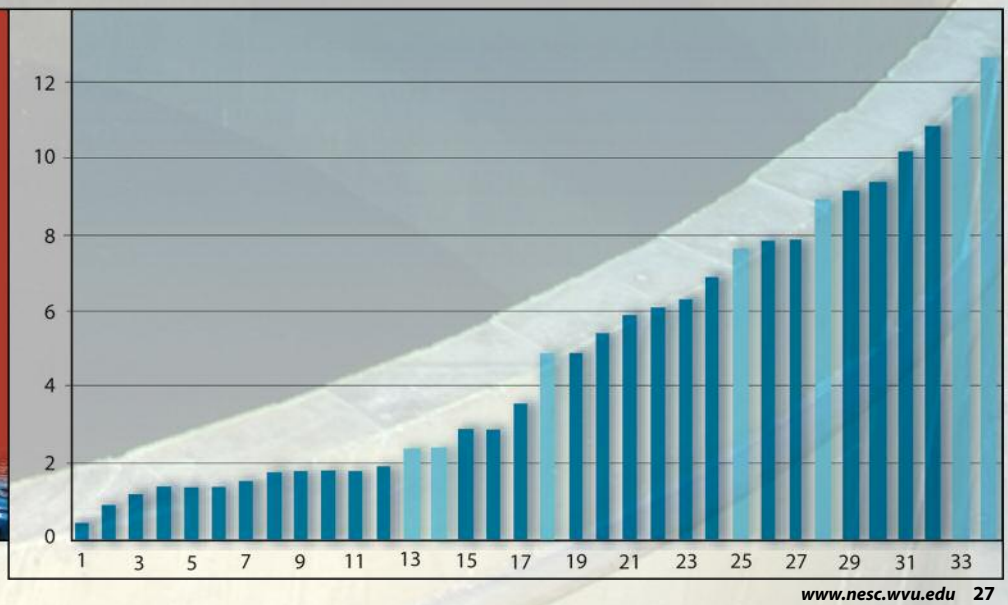


**ILI ratings shown for 34 water systems around the world with North American systems in lighter blue.** Twelve operate with an ILI less than 2, a level of leakage that is less than twice the technically achievable low. Seven of the systems have ILI values greater than 8, or leakage more than eight times the technically achievable low. (Source: AWWA Water Loss Control Committee Report, 2002)