



Using Water Audits and Leak Detection Surveys

In 2000, public water suppliers in Washington produced a total of 1,020 million gallons of drinking water per day to serve 4.9 million customers, or about 83 percent of the state's population, according to the U.S. Geological Survey. Of that total, USGS categorized more than 37 percent as leakage.

One of the most important elements of the Department of Health's Water Use Efficiency Rule (rule) is a new distribution system leakage standard. The rule requires most water systems in the state to meet a leakage standard of 10 percent or less.

What is leakage?

Leakage occurs when the water your system produces leaves the distribution system before it reaches your customers. In the rule, the term "leakage" includes:

- ◆ Physical or "real losses" such as water lost from main breaks and tank overflows.
- ◆ Inaccurate meters, accounting errors and theft. Many people call these losses, "apparent losses."
- ◆ All unauthorized uses and any water you cannot account for.

The rule does not classify any water that enters the distribution system as "unaccounted for." Although many people use that term, there is no standard definition for it. The rule considers all water "accounted for," either as authorized consumption or as distribution system leakage.

How to Calculate Leakage Rate

- ◆ Start with total water produced or purchased.
- ◆ Subtract authorized uses.
- ◆ Divide by total water produced or purchased.

$$\frac{5,000 \text{ gallons} - 3,750 \text{ gallons}}{5,000 \text{ gallons}} = 25\% \text{ leakage rate}$$

Why reduce leakage?

Reducing leaks has many benefits for water systems and customers including greater reliability through an efficient water system, reduced costs for pumping, treating, and transporting water, and preserving water supplies for future use.

A leaky pipe is a natural cross connection that could allow contaminants into the

system. Systems with leaks are more likely to fail bacteria or water quality tests.

Besides the public health risk this creates, re-testing costs extra time and money and, if the results trigger health advisories or other public notification, public confidence could be lost.

Leaks can be a liability to your water system if they cause substantial property damage. Leak prevention reduces your liability by protecting public health, and may postpone or eliminate the need for additional infrastructure to meet customer demands.

Placing a high priority on using water efficiently sends the right message to the community. Whatever a system can do to reduce leaks within the distribution system can improve your image and will encourage customers to reduce their own water use.

How can I find leaks?

Leak detection is a problem-solving process. Don't narrow your search too soon. If you assume where the leak is, you may waste time and miss the leak. To be successful:

- ◆ **Use common sense.** If you know you have a leak, check your hunches first. If you have no idea where the leak is, start by listening to easily accessible pieces of the distribution system, such as fire hydrants.
- ◆ **Have a systematic plan.** Once you hear a leak, try to narrow it down. Begin by using maps to isolate the system into zones. To create zones you may have to shut off valves. You may have to survey late at night when there is little or no usage, typically 2 a.m. to 4 a.m.
- ◆ **Have the ability to isolate the system into sections or zones.** It is easier to test for leaks when you can use a systematic approach, such as block by block, zone by zone, or narrowing your search as you go. Separating your system into zones makes it easier and less expensive to isolate lines for repairs. When you add new lines, make sure you can isolate the line or zone from the rest of the system for testing. When you isolate a section, verify the valves are truly holding. Installing meters at booster pump stations can help you track usage within a certain pressure zone.
- ◆ **Walk the system.** Don't rule out a wet spot or ground disturbance that's been there as long as you can remember.
- ◆ **Listen to your customers and co-workers.** A pressure change or flow interruption can mean a leak.
- ◆ **Look for "ultra green" vegetation.** Excessive plant growth may indicate a leak.
- ◆ **Pay attention to reservoir levels.** An unexpected drop could mean a leak, theft or fire usage.
- ◆ **Know where your lines and valves are.** Keep maps showing valves, line location and size, connections, and other places leaks can occur. This will also help when trying to isolate sections of your system.
- ◆ **Update your records.** Especially after construction changes and leak repairs showing changes in pipe types.
- ◆ **Check the valves.** You may think you have a line leak when in fact the problem is a leaky valve. Confirm the valve is holding before you continue searching for an elusive leak.

Do you have a leak?

Clues

- ◆ Water use jumps suddenly.
- ◆ Customers report low pressure.
- ◆ Customers complain about dirty water.
- ◆ Electricity bill goes up without explanation.
- ◆ A higher than usual volume of unexplained water loss.

Suspects

- ◆ Aging infrastructure.
- ◆ Poor installation and workmanship.
- ◆ Corrosion.
- ◆ Lack of maintenance.
- ◆ External factors, such as earthquakes.

- ◆ **Pay attention to service meters.** Older service meters can mean lost revenue because the longer they work the less they register. That means revenue from every house on an older system may go down even though water use remains constant. The larger the meter, the greater the loss. Remember to check the manufacturer's instructions for calibrating meters.
- ◆ **Have a long-term plan for pipe repair and replacement.** The age and type of pipe material, along with soil type are all factors that can influence leak occurrence and play a role in the life of the distribution system.

How can a water system reduce leakage?

- ◆ Perform a water audit to determine leakage, authorized unmetered use, and water sold to customers.
- ◆ Conduct a leak detection survey in the distribution system to determine specific leaks.
- ◆ Correct data errors. Replace or calibrate inaccurate meters.
- ◆ Meter all service connections.
 - Even if you don't bill consumers, you will know how much water they use.
 - Helps find leaks.
 - If you don't have meters, develop and implement a plan to install them by January 22, 2017.
- ◆ Keep records of water used for system maintenance.
- ◆ Improve record keeping.
- ◆ Reduce unauthorized uses such as theft.
- ◆ Develop and implement a water-loss-control action plan.
- ◆ Identify all pipes over 50 years old.
- ◆ Repair all known leaks.
- ◆ Track and estimate all unmetered authorized consumption.



Mike Carlstrom, Tacoma Water construction inspector, tackles a distribution system leak. *(Tacoma Public Utilities Photo)*

Learn More About the Leakage Standard

[Water Use Efficiency Guidebook 331-375 \(PDF\)](#)

What is the difference between a water audit and a leak detection survey?

A water audit is a management tool used to determine how efficiently a system is operating and where the losses might be. It will help you identify whether the problems are from physical leaks,

inaccurate data, or authorized unmetered use. It can also tell you how much money you are losing through leaks.

A leak detection survey is a physical evaluation of a water system to identify specific leaks. It involves using a listening device to find leaks in pipes or fittings within the distribution system.

Water Audits

A water audit tracks the volume of water entering a system and the volume that leaves the system for authorized uses.

How do I conduct a water audit?

To be successful, you need a team of key players. This team might include the system operator, manager, bookkeeper, field staff, and users.

Steps for Completing a Water Audit

1. Collect records for a specific review period (usually one year).
2. Use source and service meter readings to calculate how much water enters and leaves the system during that period.
3. Track and estimate any unmetered authorized uses. If you don't track and estimate these uses, they are leakage.
4. Test meters for accuracy as recommended by the manufacturer. Calibration and replacement of meters is different for source and service meters. Generally, you should test source meters more often than service meters.
5. Calculate the total amount of leakage.
6. Determine possible reasons for leakage, including physical leaks and unauthorized uses.
7. Analyze results to determine the improvements you may need. They may include better accounting practices, leak survey, or replacing old distribution pipes.

What are the benefits of conducting a water audit?

A water audit will help to tighten the system. This is a good way to find errors in records and meters, and determine how serious the leakage is. In addition, some financial institutions may require the audit as a condition for loans or grants.

A water audit will help the system meet regulatory requirements. Fewer leaks mean better public health protection and a more reliable water supply for the future. The savings may be sufficient to meet the community's need for expansion. And, a natural result of improving service is improved public relations.

A water audit will help the system save money.

- ◆ Reduced wear on equipment, postponing the need for costly pipe replacement.
- ◆ Lower operating costs for treating, pumping, and storing water. You may notice a substantial reduction in the power bill after you repair the leaks.

- ◆ Lower insurance costs and reduced system liability.
- ◆ Delaying capital improvements needed to meet customer demand such as a new storage tank or well.

Leak Detection Surveys

A leak detection survey identifies leaky pipes in the water system. Surveyors use a listening device to find leaks in pipes, valves, and other fittings. Often experienced contractors perform these surveys.

What do you listen for?

Leaks produce a unique sound. There are a lot of noises on the line so it takes a trained ear to distinguish between a leak and other sounds such as electronic humming, birds singing, road noises, or the wind. Some noises sound the same and can get you in trouble. For example, there is a very subtle difference between water traveling toward a leak and water coming out of a leak. This small difference becomes large when you decide to repair the leak where you heard it and discover it's actually someplace else.



Good water management starts with regular and accurate meter reading.

What factors affect leak sounds?

- ◆ **Distance.** The louder the noise, the closer the leak. This can be deceptive, depending on the pipe material.
- ◆ **Pipe material.** Metal pipes conduct sound a block or two away. Plastic and polyurethane lines don't conduct sound, so any sound heard with those materials is nearby.
- ◆ **Depth of the pipe.**
- ◆ **Amount of pressure in the line.** Lower pressure generates less noise.
- ◆ **Available test points, such as valves, hydrants, and meters.** If there is no place available to listen near the leak, the chances of detection are greatly reduced.
- ◆ **Size of the leak.** Smaller leaks under high pressure make more noise than large leaks under low pressure.

When should I do a leak detection survey?

It's best to survey yearly or every other year. This careful, considered, and proactive approach will save you time and money. Waiting until there is a problem results in less careful work because you're under stress and playing catch-up. If a leak gets out of hand, it can harm customer relations and expose you to liability from damages. Finding and repairing leaks quickly reduces public health risk from contamination.

My system needs a leak detection survey. Where do I start?

First, decide whether or not you are going to do the survey yourself. It takes a trained ear and dedicated time to be successful. If you don't have the skills, specialized equipment, or experience, you should consider hiring a leak detection specialist.

Second, decide whether or not you are going to excavate and do the repairs yourself. If so, do you have the resources and expertise to complete the job? Consider what will happen if the job is done incorrectly. If you feel uncomfortable, you should probably hire a contractor.

Third, if you decide to do the survey yourself, follow these steps:

1. Do a preliminary survey to determine obvious leaks and water losses through malfunctioning pumps, valves, and meters.
2. Measure water flows by isolating distribution into zones, then listening for leaks, testing pressures, throttling valves, and watching tank levels and meters to determine leakage.
3. Pinpoint leaks with listening devices. This can be as simple as using a screwdriver to listen for vibrations or using sophisticated electronic listening devices.
4. Use maps to record the location of any leaks you find.
5. Repair the leaks.
6. Record repairs, cause of leaks, amount of water lost and the date of repair.

For More Information

Find more resources on our [Publications and Forms webpage](#).

Contact our nearest regional office from 8 AM to 5 PM, Monday through Friday. Email wue@doh.wa.gov.

[Eastern Region](#), Spokane Valley 509-329-2100.

[Northwest Region](#), Kent 253-395-6750.

[Southwest Region](#), Tumwater 360-236-3030.



To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email doh.information@doh.wa.gov. If in need of translation services, call 1-800-525-0127.