How Does a Water Audit Work?

By James Piper, P.E.

Water has long been the forgotten utility. It was inexpensive. It was perceived to be plentiful. And there were few incentives for conservation. No more. Population growth, economic development, aging infrastructures and ongoing regional droughts are causing trouble for municipal water systems that are trying to keep up with rising demand. Facility executives are facing rapidly rising rates, water use restrictions or both.

An audit can show how much water efficiency measures can save — and what they will cost

Some water utilities are implementing maximum water-use levels, with economic penalties should a facility exceed the limit. The challenge for facility executives is to find ways to reduce water use without interfering with facility operations.

The good news is those facilities that have implemented a comprehensive water conservation program have found that the return on investment is becoming easier to justify. To achieve savings, what is needed is a program designed to address all aspects of water use within a facility.

Thirty years ago, when energy conservation became an important issue, many facility executives responded by turning down thermostats and removing fluorescent lamps. And while these strategies did produce some savings, they did not fully address the issue of energy conservation. Areas with even greater energy-saving potential went unaddressed simply because they were overlooked or not fully understood. To produce more savings than could be achieved through quick cutbacks, facility executives turned to the energy audit. The energy audit proved to be the most effective tool in helping manage energy use.

An energy audit helps facility executives identify and quantify what steps can be taken to reduce energy use. But even more importantly, it gives facility executives a detailed survey and analysis of how energy is used within their facilities. The same process is needed today to reduce water use.

Water Use Audits

Water use audits, like their energy counterparts, are an important first step toward understanding both a facility's water use and what can be done to reduce it. They trace water use from its point of entry into the facility through its discharge into the sewer. They identify each point of water use within and around the facility and estimate the quantity of water used at each of these points. They identify and quantify unaccountable water losses and possible leaks. They provide facility executives with a road map of potential savings, as well as implementation costs.

In addition to water quantity, water use audits should also take into consideration water quality. Some of the largest potential savings that can be achieved is through the recycling of water or the use of rainwater. Water audits can help identify potential uses for alternative sources of water.

A comprehensive water use audit will examine all the major areas in which a facility uses water, including sanitation, maintenance, mechanical systems, building processes and irrigation. For each of those areas the water use audit will provide a breakdown of the how, when, and where of water use.

Step 1: The Water Use Inventory.

It is important that facility executives develop an understanding of exactly how and where their facility uses water. To do this, an inventory of all water use points in the facility with flow rates must be developed.

Start with a walk through of the facility, identifying every point in which water is used. For items such as toilets and faucets, the inventory should include the item, its location, and its flow rate. If the facility has low-flow fixtures or if flow restrictors have been installed, identify them on the inventory.

Do not overlook building mechanical systems. Mechanical systems account for approximately 25 percent of the total water uses in an average building. For example, cooling towers and boilers are large users of water. Both systems require that a certain quantity of water be bled off and replaced to control the level of solids suspended in the circulating water or steam. Check the blow down system for cooling towers and boilers to determine the rate at which make up water is being added.

Refrigeration units that use once-through cooling systems also can be very large users of water. The inventory should include the type of system installed, its location, its capacity, and the rate at which it uses water for cooling. In some cases, the owner’s manual will identify the water flow rate. However, it may be necessary to use a stopwatch and a bucket to determine the actual water flow rate.

Irrigation systems also can be a significant water user. The inventory should include the number of systems, the number of sprinkler heads attached to each system, the flow rate of the systems and types of controls installed. Note if each system is equipped with ground moisture sensors to prevent activation during or immediately following a rainfall.

In addition to identifying all water use points and flow rates, the inventory should identify if the water being used is hot or cold, or if it undergoes special filtering or treatment. Reducing water use in applications that use hot or treated water will produce savings that go beyond solely the cost of the water.

When completing the inventory, pay attention to any unexplained water flow. As piping systems are modified over the years, it is easy to lose track of what piping serves what equipment. Do not be surprised to find water flowing from equipment that is no longer used or even installed.

Step 2: Metering.

Unfortunately, most facilities only have a single, master water meter. Readings from master meters will provide an indication of how a facility compares to other facilities, but it will not show where to look for areas where water use can be reduced, particularly if the facility is large or complex. Narrowing use down to possible areas where use can be reduced requires submetering.

Where and how submeters are installed depends to a great extent on the design of the water system serving the facility. Ideally, submeters would be installed on individual zones or floors of the facility. Equipment with large water use rates, such as cooling towers and process cooling equipment, would each have separate submeters.

Each meter should be read at least monthly. If there are suspicions that the readings for a particular meter are high, or if the readings for a meter suddenly increase, it will be necessary to read that meter more frequently; even on a daily or twice-daily basis. Meter readings taken while the facility is closed, and processes are shut down is one way to narrow the search for leaks and losses. All meter readings should be logged and reviewed on a regular basis for unexplained changes.

Tracking water meter readings will provide a baseline of water use for the facility. Just as energy use for different types of facilities was tracked on a use-per-square-foot basis to allow comparison between similar facilities, so can water use. However, other measures than square footage will likely be more meaningful. For example, in hotels, use can be tracked on a per-occupied-room basis. For restaurants, it could be on a use per-meal-served basis. Office facilities may use a square-foot basis or per-building-occupant basis.

Again, the key to gaining useful information from submeters is to have the meters read on a regular basis, and as frequently as possible. Frequent readings help to quickly identify and locate leaks.

Step 3: Review Maintenance Practices.

If water conservation has not been a priority in the past, chances are no one individual or group has the overall responsibility for conserving water. And as with many things in the world of facility management, if no one individual has responsibility for an item, then it is not a priority for anyone. As a result, specific water use related problems may have been seen by several people but not really noticed or acted upon.

Preventive maintenance programs have long been recognized as effective tools for improving system performance while reducing overall operating costs. With water use historically being an ignored or low priority item, chances are few preventive maintenance steps have been put in place to specifically address water use. How often are restrooms checked for faucets that do not fully shut off or flush valves that leak or stick on? Does anyone ever test once-through cooling systems to determine that they

are operating at the proper flow rate? How often are cooling towers and boilers checked to see that the make-up water systems are operating properly?

When maintenance issues occur within the facility, there is a system established whereby building occupants can report the problem. Does that process include water-use related issues? Do building occupants even know that they can and should report instances of excessive water use or waste?

Finally, what mechanism is in place to review water using items that are being purchased for use within the facility? For example, refrigeration systems that use once-through water cooling are less expensive and easier to install than closed loop systems. Closed loop systems, however, have minimal water requirements. Is there an established procedure that reviews equipment purchases that addresses the issue of water use?

Step 4: The Water Efficiency Plan.

Once information has been gathered on how water is being used in the facility, an action plan can be established for reducing water use. The plan should identify who will take responsibility for implementation. It should make certain that individual has the authority and support needed to implement the plan.

The plan should set specific water use reduction goals for the facility. Those goals must be measurable, achievable, and realistic. The plan must also identify a mechanism for periodically reviewing the success of the program in meeting those goals.

The water audit should have identified several areas in which water savings can be achieved. The water efficiency plan should set the priorities for implementation based on costs, benefits, and available manpower.

The Benefits

Reducing water use in a facility is a win-win situation. Using less water means lower utility costs. It also means reduced chemical treatment costs in systems such as boilers and cooling towers. Finding and eliminating long-standing leaks can create a better work environment for building occupants, as well as reduce damage to building components.

Reducing water use can also enhance the public image of a facility. Facility executives should publicize the program's successes and give credit to those involved. Even something as simple as installing moisture sensors on an irrigation system can improve the facility's image. Consider how many times you have seen an irrigation system operating in the rain. What impression of the facility did it leave you with?

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