

Saving Water in Residential Plumbing Systems

The home of the future will use water-efficient plumbing technologies that really work and require less maintenance than today's plumbing systems. However, to most people's surprise, these fixtures are already available.

Before designing water-efficient plumbing systems it is important to know how much water the typical home currently uses. The American Water Works Association provides some interesting statistics that are used in this article.

For instance, if all U.S. households installed water-saving features, water use would decrease by 30 percent, saving an estimated 5.4 billion gallons per day (see Figure 1). This would result in dollar-volume savings of \$11.3 million per day, or more than \$4 billion per year.

These statistics are based on the water-saving features mandated by the Energy Policy Act of 1992 (1.6-gallon-per-flush [gpf] water closets and 2.5-gallon-per-minute [gpm] showerheads). They do not take into account the new ultra-low-flow fixtures now on the market. This article discusses how water-efficient plumbing fixtures can drastically reduce the amount of water used in a typical home.

IRRIGATION

Let's review what's happened in our industry by looking at an undisturbed project site. In the natural biospheric system, a large percentage of the rain that falls on the site is absorbed into the ground, where some of the water is used by vegetation and the remainder enters the natural groundwater system. Contrast this with a developed site, covered by a building and parking lot, where rainwater does not absorb back into the ground.

When urban sprawl began, most houses had downspouts that emptied onto a splash block, and rainwater was dispersed into the lawn. Open storm water ditches in lawns were common. The end result was that large amounts of water were returned back into the ground.

Figure 1 How water-saving features can reduce water use

Daily indoor per capita water use in the typical single-family home with no water-conserving fixtures is 74 gallons. Here is how it breaks down:

Use	Gallons per Capita	Percentage of Total Daily Use
Showers	12.6	17.3%
Clothes washers	15.1	20.9%
Dishwashers	1.0	1.3%
Toilets	20.1	27.7%
Baths	1.2	2.1%
Leaks	10.0	13.8%
Faucets	11.1	15.3%
Other domestic uses	1.5	2.1%

By installing more efficient water fixtures and regularly checking for leaks, households can reduce daily per capita water use by about 30 percent to about 51.9 gallons per day. Here's how it breaks down for households using conservation measures:

Use	Gallons per Capita	Percentage of Total Daily Use
Showers	10.0	20.1%
Clothes washers	10.6	21.4%
Dishwashers	1.0	2.0%
Toilets	9.6	19.3%
Baths	1.2	2.4%
Leaks	5.0	10.1%
Faucets	10.8	21.9%
Other domestic uses	1.5	3.1%

If all U.S. households installed water-saving features, water use would decrease by 30 percent, saving an estimated 5.4 billion gallons per day. This would result in dollar-volume savings of \$11.3 million per day, or more than \$4 billion per year.

Source: American Water Works Association



Photo: David Ropinski

Inexpensive, simple rain barrels such as this one can decrease reliance on expensive municipal water for irrigation while reducing flooding.

Over time our industry has developed a new theme for rainwater: Move it away as fast as possible. Buildings are designed with rainwater systems that quickly remove water from roofs. This water is discharged into municipal sewer systems and ultimately into rivers and streams. Modern river systems have levee systems designed with the same theme: Move the rainwater away as fast as possible. Problems arise when large communities follow this theme and create flooding in areas during small rain events.

The plumbing industry needs to stop and look at what it has created. Plumbing systems move rainwater miles away in expensive municipal storm water systems. Then we take the water out of rivers, treat it to drinking water standards, and pump it via expensive municipal water systems back to the houses where it can be sprayed on the ground on which it first fell from the sky. Is this an efficient way to handle rainwater? Aren't we spending too much money designing systems that work against the natural biospheric system?

Two very inexpensive ways to handle rainwater work with and not against the natural biospheric system. One is to design landscaping native to the area that does not require large amounts of irrigation. The second way to handle rainwater is to install an inexpensive rain barrel that collects rainwater to be used between rain events for irrigation needs. These rain barrels can be inexpensive and attractive, as those shown on the U.S. Environmental Protection Agency Web site at www.epa.gov/reg3esd1/garden/stormwater.htm.

These methods reduce the amount of rainwater entering municipal systems, which can reduce flooding and save both homeowners and municipalities money.

TOILET FIXTURES

A typical home with water closets using more than 1.6 gpf uses 20.1 gallons of water per day per person. In comparison, a household using 1.6-gpf water closets uses 9.6 gallons of water per day per person. A simple updating of fixtures saves almost 10 gallons of water per day per person.

Today homeowners have an added choice with the introduction of ultra-low-flow water closets that use approximately 1 gallon of water per flush or less. If a homeowner wants to retain the option to use a full 1.6 gallons of water per flush,

dual-flush water closets are available. The user can chose to use a full 1.6-gallon flush to remove solids from the bowl, or the user can chose to flush less water to remove liquids.

As an added bonus, both ultra-low-flow fixtures and dual-flush fixtures are competitively priced with the standard 1.6-gpf water closets.

SHOWERS

Compared to a typical home that uses 12.6 gallons of water per person per day,

a home with the 2.5-gpm showerhead uses 10 gallons per person per day. These fixtures have been available for several years, and there are very few user complaints.

It is interesting to note that most of the major plumbing manufacturers now offer ultra-low-flow showerheads that use less than 2.5 gpm. These showerheads can use 20 percent less water than the standard head and reduce the amount of water used per person per day from 10

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gallons to 8 gallons. A well designed and quality built ultra-low-flow showerhead can be installed in most homes with few problems.

Combining an ultra-low-flow handheld showerhead with a fixed ultra-low-flow showerhead creates a great combination for the user while saving water. The amount of hot water used in a shower also is reduced, which results in an added energy saving bonus.

An important simple maintenance item that often is overlooked is the strainers and aerators on showerheads and faucets. Over time small rocks, sand, and other debris collect in these strainers, resulting in low flow or an uneven water spray. Some of this sediment can be removed with no tools in a couple minutes. The end result is a strong, even spray, the one the manufacturer intended.

LEAKS

In the average house, 10 gallons a day are lost due to leaks in the plumbing system. This is a shocking statistic because leaks should be repaired quickly; however, in reality they seldom are. Leaks most often come from old water closet flush valves that were poorly designed and made with inferior materials. (We all know the trick of jiggling the water closet flush handle to get it to stop running.)

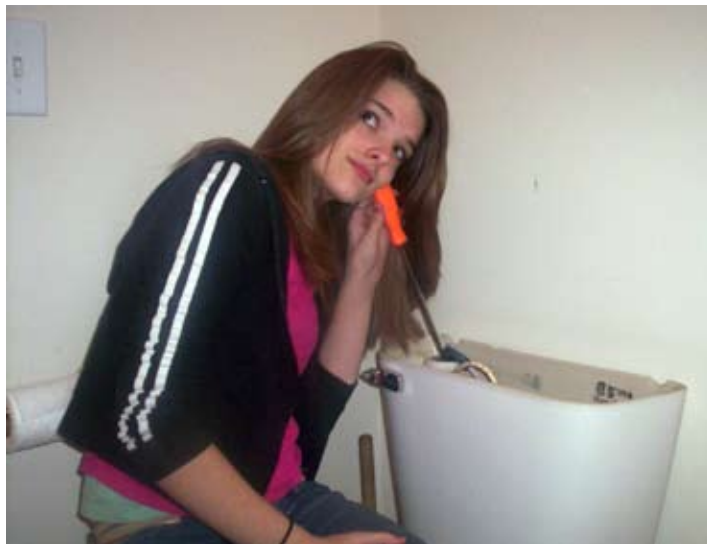
Other leaks come from old leaking faucets, bathtub mixing valves, and leaking fittings under the house. An added problem is that leaks on the hot water system

result in costly energy bills as well as costly water bills. Leaks also can cause more serious problems such as rotting of the house structure or creating a place for dangerous mold to grow.

One inexpensive way to check the piping system for leaks is by using the plumber's stethoscope. This is done by removing the lid of the water closet and placing one end of a screwdriver on the water valve and the other end tight to your ear. If there is a water leak, the sound of water flowing through the pipe is transmitted through the piping to the screwdriver.

Another way to check for leaks is to note the indicator needle on the water meter and not use any water in the house. (It is important to shut off all automatic water systems, such as automatic ice makers, during this time.) After a few hours, check the meter to see if the needle has moved. A leak-free system would not use any water during the test time.

When replacing items such as water closets and faucets, it is important to purchase high-quality, well designed fixtures made of the best materials because



A plumber's stethoscope is an old-school plumber method for checking leaks in a home's plumbing system. Holding a screwdriver tight to the water valve and ear will transmit the sound of running water through the screwdriver into the ear.

a dollar saved at purchase could cost many times more in operation. When high-water-use plumbing fixtures are in a house, it may be worthwhile to update them to new ultra-low-flow fixtures. While initially more expensive, these fixtures can help homeowners save water and energy costs in the home. **PSD**

RESOURCES

"Stats on Tap." American Water Works Association.

"25 Facts About Water." American Water Works Association.

WATER USE FACTS

- Approximately 4,776 gallons of water are needed to raise a Christmas tree. For the 35 million Christmas trees that U.S. families enjoy each year, a total of 167 billion gallons is required.
- If mothers refresh their floral arrangements and flowering plants after Mother's Day, they will use 2.8 million gallons of water. That's equivalent to the amount needed to supply a week's worth of water to 1,157 households.
- One inch of rainfall drops 7,000 gallons, or nearly 30 tons of water, on a 60-foot-by-180-foot plot of land.
- On average, 50–70 percent of residential water is used outdoors for watering lawns and gardens.
- After a typical Thanksgiving dinner, 16.4 million Americans watch football. At halftime, American toilets flush 16.4 million times and use 48.5 million gallons of water. Using water-efficient toilets would save 22.3 million gallons of water, or the same amount of water needed to fill 1,476 swimming pools.
- The average five-minute shower uses 15–25 gallons of water.

Source: American Water Works Association

WINSTON HUFF, CPD, LEED AP, is a project manager, plumbing fire protection designer, and LEED facilitator with Smith Seckman Reid Consulting Engineers in Nashville, Tenn. He received the 2005 Apex award for Technical Writing for the article "Sustainable Plumbing System Technologies for Space and Earth" printed in the September/October

2004 issue of *Plumbing Systems & Design*. He was the founding editor of *Life Support and Biosphere Science* and has served as its editor-in-chief. He is president of Science Interactive, an organization promoting biosphere science. For more information or to comment on this article, e-mail articles@psdmagazine.org.

