Dollars Down the Drain: Saving Water, Energy, and Money in the Home

Using household water more efficiently-to cut utility bills, stretch the useful capacity of a weak well, or relieve an overloaded septic system— can result in surprising savings. This publication describes several simple methods for improving water use efficiency.

Saving Water Saves Money

A home in town or in the country can be modified to save energy and money by using less water.

If a household averages three 5-minute showers per day, nearly $60 per year can be cut off the gas water-heating bill by using a water-efficient showerhead. With electric water heating, the savings would be nearly $150.*

As shown in the example on page 5, three simple plumbing fixture modifications that cost less than $10 can cut indoor water use for a four-member household by 70 gallons per day. In a community where combined water and sewer charges average $2.50 per 1,000 gallons, using 70 gallons less water per day saves $64 per year.

Although most rural home owners do not pay monthly water and sewer bills, many have private water supplies and septic systems that do not meet their needs. Weak wells or overloaded wastewater disposal facilities can cause great inconvenience and require major investments of time and money if replacement or expansion is necessary. Improved water use efficiency reduces demands on wells and septic systems and can minimize or even eliminate the need for more costly modifications

Ways To Improve Water Use Efficiency

There are many ways to cut water use in the home, but improving water use efficiency is the easiest. Improvements in efficiency focus on reducing waste, not on using less water than is needed. Many conventional (nonwater-saving) plumbing fixtures and appliances are not water efficient. However, they can be improved by using the methods presented in this publication.

The methods presented here were selected on the basis of high potential for long-term savings of water, energy, and money. They are easily accomplished by most home owners at reasonable cost and, once implemented, have little or no impact on the life-style of water users.

Daily in-home water use usually ranges between 50 and 75 gallons per person (about 250 gallons a day for a family of four). Table 1 shows the typical distribution of water use in a home. Nearly 70 percent of household water is used in the bathroom. Some major savings in water and energy use can be made there.

Toilet

A nonwater-saving toilet uses 5 to 7 gallons of water per flush. For a family of four this totals 36,500 to 51,000 gallons per year just to flush the toilet.

Water-conserving, shallow-trap models use about 3 1/2 gallons per flush. Most new toilets now on the market are the shallow-trap type and cost no more than the water-wasting designs. When planning new or remodeled bathrooms, be sure to specify a shallow-trap model .

***Cost saving estimates** for the examples in this **section are based** on marginal unit costs of $0.45 per **100 cubic feet** for natural gas $0.06 per **kilowatt hour** for electricity. and a combined charge of $2 50 per 1,000 gal gallons for water and sewer service. Consult with your local utilities to determine if your costs differ significantly Annual savings will vary in different locations.

Table 1. Typical household water use.

Type of use	Daily use, gallons per person	Approximate proportion of total use, percent
Toilet flushing	25	40
Bathing	20	30
Laundry and dishes	13	20
Drinking and cooking	4	5
Other	3	5
Total	65	100

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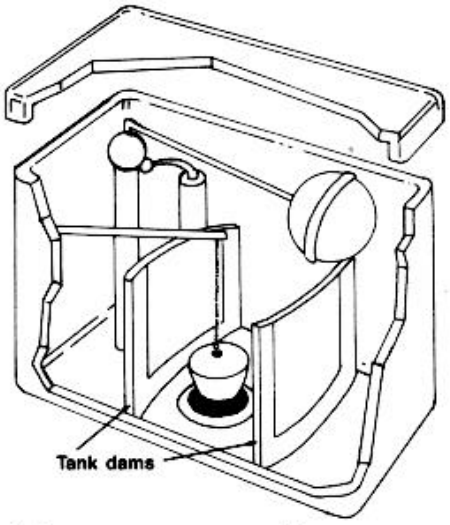
If a new toilet is not needed, try modifying the old one to make it more efficient. Commercially manufactured or homemade toilet tank inserts can be installed to reduce the volume of each flush by 1/2 to 1 1/2 gallons.

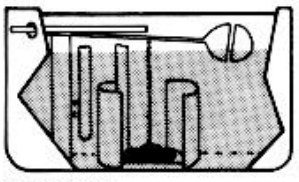
Tank dams, like those in figure 1, can be bought from plumbing supply houses for about $8. They will retain 1 to 1 1/2 gallons per flush. Plastic bottles, like the milk container and the soap bottle shown in figure 2, make effective homemade tank inserts. Trim to a suitable height if necessary, place in the tank, and allow to fill with water. Add a few small stones or some sand to prevent movement during toilet flushing. The volume of each flush will be reduced by the amount of water retained inside the bottles (usually 1/2 to 1 gallon).

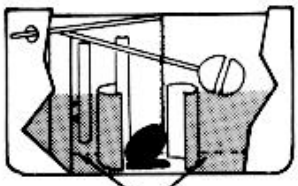
Bricks **are not** good inserts because they flake off inside the tank and interfere with proper sealing of the flush valve. If accidentally dropped while being inserted, a brick can break the tank.

Bending the float arm (identified in figure 3) to lower the water level in the tank is not a good water-saving method. This reduces the pressure and velocity of the flushing action and may adversely affect performance. The filled tank level should be about 1/2 inch below the overflow tube for good performance.

Figure 1. Tank dams can make a toilet more water efficient.







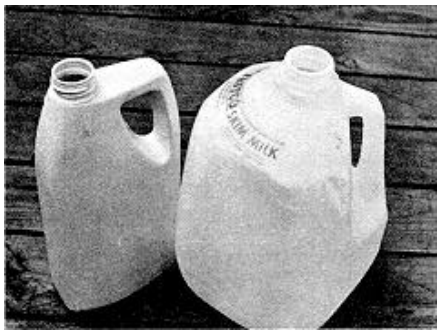


Figure 2a. Plastic bottles make good toilet tank inserts.

Figure 2b. Trim containers to suitable height and add sand or stones for ballast.

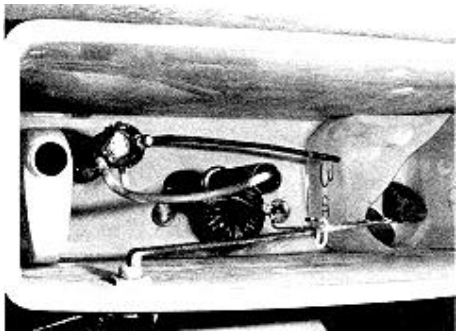


Figure 2c. The float ball can be temporarily unthreaded from the float arm for placement of a large container.

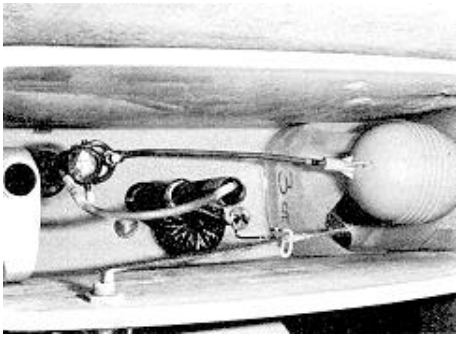


Figure 2d. The float ball is reinstalled and inserts are ready for use.

Shower
Nonconserving shower heads commonly deliver 5 to 6 gallons per minute (gpm). Some have maximum flow rates as high as 10 to 12 gpm. Water conserving models are designed to provide a pleasant, well dispersed spray pattern at normal household pressures using only 2 to 3 gpm.

In many cases, a conventional showerhead can be made more efficient by installing a flow restrictor in the line ahead of the fixture. Figure 4 shows three types of flow restrictors.

The gasketed brass orifice (lower left, figure 4) was installed ahead of the shower fixture shown in figure 5, reducing the delivery rate from 6 gpm to less than 3 gpm. Installation took less than 15 minutes and the insert cost less than $2.

While performance of this showerhead was not greatly affected, some models require a high flow rate to provide a well dispersed spray pattern. Show showerheads that do not perform well with a flow restrictor usually can be replaced with an inexpensive, water-saving model.

With the flow restrictor installed, a 5-minute shower that previously required 30 gallons of hot water now requires less than 15 gallons. This means that a family of four averaging three 5-minute showers a day would save approximately 16,400 gallons of **hot** water per year.

Using an energy-efficient gas water heater, it costs about $60 to heat this amount of water to bathing temperature. Electric heating would cost about $150. Few other improvements in home energy efficiency can be made as easily and yield the substantial savings obtained by conserving hot water.

Leaks
A steady drip from a leaking faucet can waste 300 gallons of water a month. A leaking hot water tap also wastes costly

Figure 5. Installing a shower flow restrictor.

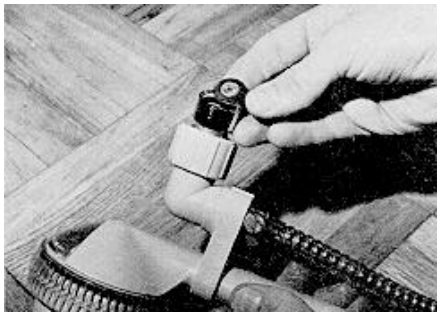


Figure 5a. Restrictor is pressed into threaded collar of showerhead.

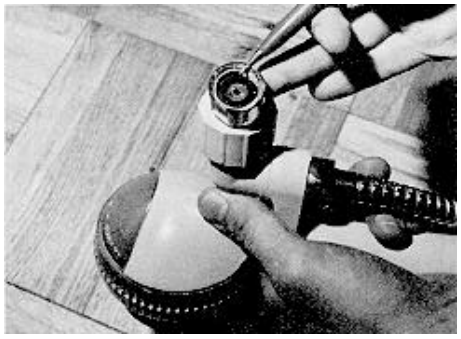


Figure 5b. Flow restrictor in place.

Figure 5c. Showerhead in operation at 3 gallons per minute.

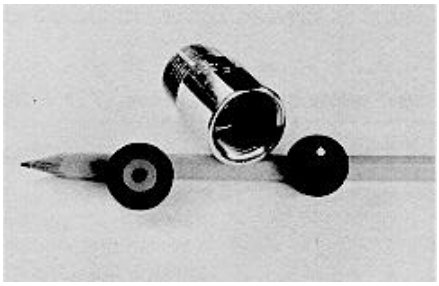


Figure 4. Three types of shower flow restrictors. Lower left: gasketed brass orifice insert. Center: external restrictor (installed ahead of showerhead). Lower right: rubber insert.

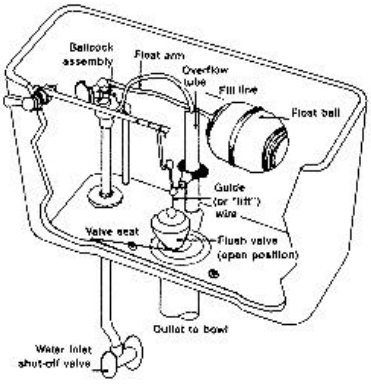


Figure 3. Toilet tank flush and fill mechanisms.

energy. Faucet leaks usually are caused by worn washers-a problem that most do-it-yourselfers can remedy quite cheaply.

One of the largest water leaks in the home may go unnoticed because it is hidden inside the toilet tank where a misaligned or worn flush valve (figure 6) can let 100 gallons a day (36,500 gallons a year) or more seep undetected, through the trap, and down the drain.

If you listen carefully, you may hear a trickling sound as water leaks into the toilet trap or as the float-controlled ballcock replenishes the water supply inside the tank. Because this leakage can occur almost noiselessly, dye testing is a more reliable means of . detecting internal leakage.

To dye test your toilet, remove the tank cover and add several drops of food coloring to the water (figure 7). Wait 10 to 15 minutes. If color appears in the trap, the flush valve is leaking. Check the flush valve seat for corrosion or scale and make sure the flush valve ball is aligned with the valve seat. If this does not help, the valve probably is worn and should be replaced (see figure 8). Valves are available at most hardware stores.

While you have the tank cover off, be sure to check the high water level. The float-controlled ballcock should fill the tank to about 1/2 inch below the top of the overflow tube (internal parts are identified in figure 3). Tremendous quantities of water can be wasted if the water level reaches the top of the overflow tube. The fill level can be lowered by gently bending the float arm.

The ballcock assembly occasionally becomes worn or fouled with scale, preventing shut-off of the water supply at the desired level. Replacement units can be purchased for $10 or less.

Figure 6. A leaking flush valve permits hidden internal toilet leakage.

Figure 7. Dye testing procedure for internal toilet leakage.

Figure 7a. Place food coloring in toilet tank.

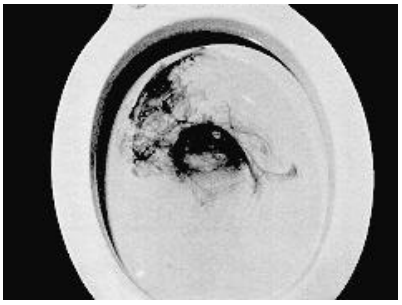


Figure 7b. Wait 15 minutes. Color appearing in toilet trap signals a leak.

Estimating Your Savings

A few dollars invested in improved water efficiency can yield substantial annual savings. Tables 3 and 4 can help in estimating potential savings. The following example shows how.

Example

The Splashers, a family of four, used 270 gallons of water a day before making some water-saving improvements. After improvements, daily water savings amounted to 70 gallons per day with 50 gallons of this being heated water (table 2).

Using two plastic bottles as toilet tank inserts, the Splashers reduced their

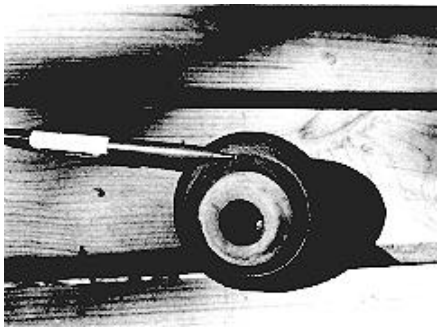


Figure 8. Worn flush valve (note wear ring at pencil point) can cause internal toilet leakage.

toilet flush volume from 5 gallons to 4 gallons per flush.

A flow restrictor installed in their showerhead cut the flow from 6 gallons to 3 gallons per minute.

The Splashers also discovered a leaking hot water faucet in the basement that wasted 5 gallons per day.

Natural gas costs $0.45 per 100 cubic feet in the Splashers' home town and the combined water and sewer charge is about $2.50 per 1,000 gallons.

From table 3, saving 70 gallons of water per day reduced the Splashers' annual sewer and water costs by $64 per year (indicated in bold type).

The 50 gallons per day savings of heated **water cut the Splashers' annual energy bill for natural gas by $65, as shown in table 4 (indicated in bold type).**

Other Publications

The following publications that may be of interest are available from county extension offices in lowa or from Publications Distribution Center/ Printing and Publications Building, lowa State University, Ames, lowa 50011:

Pm-840 *Good Wells for Safe Water*
Pm-899 *Shock-Chlorinating Small Water Systems*
Pm-938 *Home Sewage Treatment—Conventional Methods and Equipment* Pm-986 *On-site Wastewater Treatment Using Mound-Type Systems*
Pm-1328 *Plugging Abandoned Wells*
Pm-1329 *Coping with Contaminated Wells*
Pm-1335 *Sampling Your Drinking Water* Pm-1334i Is Your *Drinking Water Safe?* Pm-1334j *Abandoned Wells: Open Threat to Your Health and Safety*

Table 2. Daily household water use for the Splasher family.

Type of use	Water used before improvements, gallons	Water used after improvements, gallons
Toilet, 20 flushes per day	100 (5 gal. per flush)	80 (4 gal. per flush)
Shower, three 5-minute showers per day	90 (6 gal. per minute)	45 (3 gal. per minute)
Laundry and dishes	52	52
Drinking and cooking	16	16
Other	12 (5 gal. due to leaking faucet)	7
Total	270	200

Table 3. Estimated annual savings on water and sewer bills (rounded to nearest dollar)

Average daily water savings, gallons	Combined water and sewer service charge in dollars per 1,000 gallons			
	$2.00	$2.50	$3.00	$3.50
10	$7	$9	$11	$13
20	15	18	22	26
30	22	27	33	38
40	29	37	44	51
50	37	46	55	64
60	44	55	66	77
70	51	64	77	89
80	58	73	88	102
90	66	82	99	115
100	73	91	110	128

Table 4. Estimated annual energy savings from improved hot water efficiency in the home. (rounded to nearest dollar)

Gallons of hot water saved daily	Natural Gas Price cents per 100 cubic			Electricity Price cents per kilowatt-hour				
	45	55	65	4.0	5.0	6.0	7.0	8.0
5	$6	$8	$9	$11	$14	$16	$19	$22
10	13	16	19	22	27	33	38	44
15	19	24	28	33	41	49	57	65
20	26	32	37	44	55	65	76	87
30	39	47	56	65	82	98	115	131
40	52	63	75	87	109	131	153	175
50	65	79	94	109	136	164	191	218
60	78	95	112	131	164	196	229	262
70	91	111	131	153	191	229	267	306

The appropriate unit price for natural gas or electricity will depend on the pricing schedule of your energy supplier and your normal energy use during the billing.

Energy savings increase with the temperature of the water saved. With the exception of automatic dishwashers, which operate near 140°F, most warm water uses are between 100 and 110°F Typical shower temperature is 107°F The table is based on a water temperature of 107 F Dollar savings will be greater for savings of water with temperatures greater than 107°F

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Prepared by Tom Glanville, extension agricultural engineer.