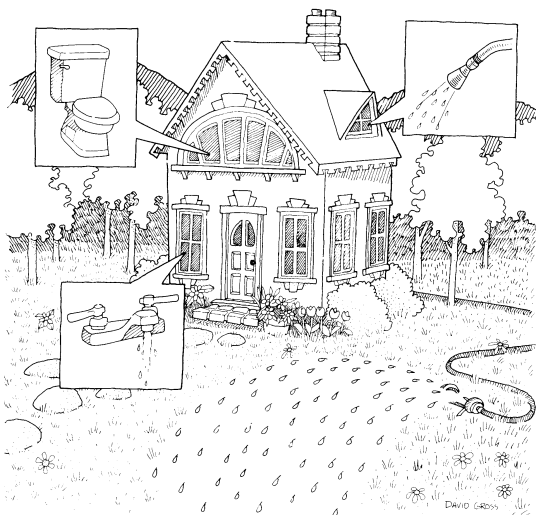


Water Efficiency

FOR YOUR HOME

**Products and advice which
save water, energy, and money**



**Third Edition
Rocky Mountain Institute**

Water Efficiency for Your Home:

**Products and Advice Which Save
Water, Energy, and Money**

Third Edition

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Pinkham, and Scott Chaplin



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Foreword

This booklet is published by Rocky Mountain Institute to help individuals improve the water and energy efficiency of their homes and save money in the process. New products and techniques allow today's households to use a third less water than those of a decade ago, without sacrificing comfort or changing lifestyles.

Although this booklet is designed for home owners and tenants, the ideas it advances can be applied on a larger scale: your neighbors, community, and water utility can all take advantage of the broad benefits that efficiency provides. The Commonwealth of Massachusetts, City of Los Angeles, and communities and utilities across the country now encourage water-efficient products and practices. Your community can do the same.



Rocky Mountain Institute's resource-efficient headquarters in Old Snowmass, Colorado.

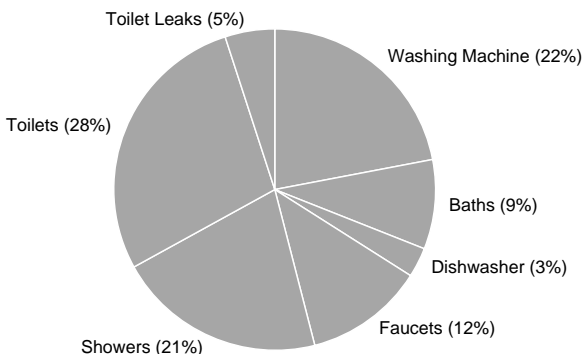
The Wider Benefits of Efficiency in Water Use

You can save a lot of water, energy, and money by using water efficiently. Today's state-of-the-art efficient fixtures provide service equal or superior to their old, inefficient counterparts, but don't have to cost any more. By facilitating efficient water use, the advice and devices mentioned in this booklet can:

- Cut your water and sewage fees by 35% or more.
- Improve the quality of your shower, and allow twice as many people to get a shower before the hot water runs out.
- Cut your annual water-heating bill by \$20–40 (up to three times this amount if you heat water with electricity).
- Reduce or eliminate the problem of an overflowing cesspool or septic tank (or the ultimate headache, a backflowing toilet), potentially saving the hundreds of dollars it would cost to build or expand a leachfield.
- In new construction, enable you to install a much smaller septic leachfield than you would otherwise have to install, with hundreds of dollars in savings.
- In new construction, allow you to save money by installing a smaller water heater (if you had planned to install a 50-gallon heater, a 30-gallon heater may be more than large enough if you use efficient fixtures).
- Protect the environment. Water not consumed can save a river from a dam and wetlands from destruction, while water not heated with fossil fuel means oil or gas not depleted, coal not burned, carbon not released to cause global warming, and sulfur not deposited as acid rain.

Here's Where Your Residential Water Goes

Typical inefficient indoor use:
80 gallons per person per day



U.S. indoor residential water use is estimated to average 80 gallons per person per day in homes without efficient fixtures. Outdoor use varies tremendously: your use could be insignificant or, if you have a large lawn which requires watering, it could be more than 200 gallons per person per day. To be certain, compare your winter and summer water bills.

Save Water, Painlessly

If your water use is anywhere near the national average, you can probably save a third or more of the water you now use at home. The easy program described in this booklet will show you how. Replacing your water-wasting fixtures with efficient state-of-the-art products will be an easy, money-saving project. Redesigning your landscape with colorful, durable, native, and drought-resistant plants will be equally rewarding.

Start your retrofit program with your showerhead. The money saved on your water-heating

bill, in addition to the savings on your water and sewer bills, will repay your investment in less than a year. The money you save on reduced energy use can in turn finance the rest of your retrofit program.

To learn where you can save more water, read on.

Showerheads: Save Water and Energy, Too

For less than \$20, you can cut the water use of your conventional showerhead by 25–75% without sacrificing the quality of your shower. If you're using a conventional showerhead with an optional washer or flow restrictor to limit its delivery, you can still save more water and substantially improve the quality of your shower by removing that device and using a high-performance showerhead instead.

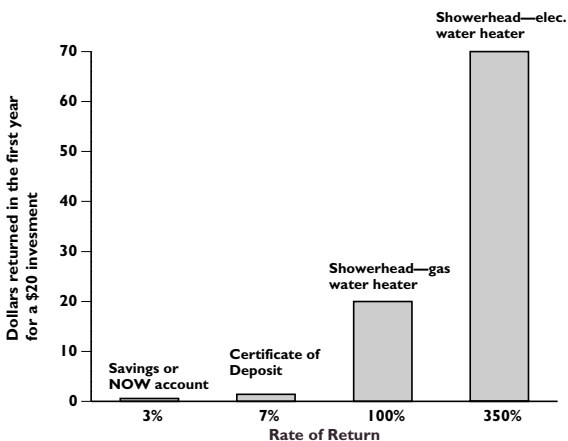
To check the flow rate of your existing showerhead, turn the shower on all the way and see how long it takes to fill a one-gallon plastic jug. (You may have to cut a piece of the neck off the jug so it will fit over the showerhead.)

Time to Fill Jug (sec)	Flow (gpm)
10	6.0
15	4.0
20	3.0
24	2.5
30	2.0

If your showerhead fills a one-gallon jug in fewer than 24 seconds, it's using more than 2.5 gallons per minute (gpm) and should be replaced with a more efficient model. If the jug takes more than 24 seconds to fill, you already have an effi-

cient showerhead.

The flow rate of your old showerhead, the number of people taking showers, the length of those showers, and the price you pay for energy and water all will affect your financial savings. Annual savings of \$20–40 are common for a family of three people—your savings may be twice or three times this amount if you heat your water with electricity, which is more expensive than natural gas.



It makes good economic sense to invest in a water-efficient showerhead.

Those savings make a \$20 low-flow, high-performance showerhead an excellent financial investment: \$20 in a 7% certificate of deposit takes 10 years to return \$20 in interest, while a savings account takes more than 20 years to do so. In 10 years, your efficient showerhead will easily return 10–40 times its cost in saved energy alone, not counting the value of the saved water.

There are many excellent showerheads on the market, but not all are as efficient as those described here. When buying a showerhead, be sure that it delivers no more than 2.5 gallons per minute; 1.5–2.0 gpm will save you even more. The

“feel” of the shower—misty, pounding, etc.—varies widely with brand and model (some have a needle-like spray that may drive you out of the shower!). Some models have a fingertip valve so you can reduce the flow while soaping up without changing the temperature.

Your hardware or plumbing-supply store should carry water-efficient showerheads, or you can purchase them by mail. If you order a showerhead directly from a manufacturer, be sure to contact the manufacturer first—prices and models change.

Installation is usually not difficult for a handy individual. Unscrew your old showerhead with a wrench, smear some pipe goop on the shower arm threads (or use Teflon tape from your local hardware or plumbing-supply store), and screw the new showerhead into place. (Some showerheads have a rubber washer, which eliminates the need for pipe goop or Teflon tape.) You may need two wrenches—the second to prevent the shower arm from twisting out of its fitting as you remove the showerhead—and possibly penetrating oil or some other lubricant to help release the threads.

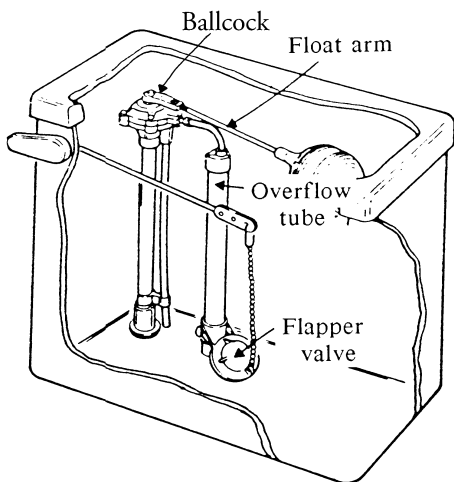
After removing your old showerhead, you may find that the shower arm ends in a ball rather than in threads. If you can't unscrew the ball from the arm, you will need to install an adapter from your local hardware or plumbing-supply store before installing the new showerhead. An alternative is to replace the shower arm with a threaded arm from your local supplier—a \$3–5 item. Unscrew the arm from the wall and replace it with a new one. Be sure to use pipe goop or Teflon tape on the threads.

Leaky Toilets

Toilets that leak water from the tank into the bowl waste 5% of all indoor residential water use.

That number is an estimated national average: if you have a leaky toilet, it may be wasting up to 50% of your indoor water. It's worth fixing.

To check for a leak, lift the lid off the tank.



If water is flowing down the overflow tube, try bending the float arm (which closes the ballcock) downwards. If the water level is below the top of the overflow tube but still runs into the bowl, the flapper valve is probably worn and needs replacement.

Without disturbing the float or flapper valve, put a few drops of dark food coloring in the tank and wait a few minutes. If the colored water shows up in the bowl, your toilet needs some work.

Take another look in the tank. If water is flowing into the overflow tube, the ballcock (the float-controlled valve that lets water into the tank) isn't closing properly—it's either worn out or needs adjustment. Try bending the float arm down. If the ballcock still doesn't close before water runs down the tube, it will need replacement.

If the ballcock isn't the problem, the flapper valve is probably worn out. First check to make sure there is no scale or grit preventing the flapper from closing properly. If the flapper is in fact

worn out, replace it with another from a local supplier, or better yet, replace the toilet with an efficient model.

Buying an Efficient Toilet

Unless your house was built in the past few years under a 3.5-gallon-per-flush building code, it most likely has a toilet which uses 5 or more gallons per flush (gpf). If so, a 1.0–1.6 gpf toilet can cut your indoor water use by 20–25%, with a corresponding reduction in wastewater flow. Even if you now use 3.5-gallon toilets, you can expect a reduction of more than 15% in total indoor water use if you switch to 1.0-gallon toilets.

For the average household, switching to efficient toilets will save approximately 15,000 gallons of water—and \$25—annually. If you were to replace three toilets at a cost of \$100 each, the savings would translate into an 8.3% annual rate of return—the toilets would pay for themselves in 8 1/2 years, and keep on saving year after year. If you can't afford to replace all your toilets immediately, start with the one that is used the most. Your local utility may offer substantial rebates, which would make these toilets an even better buy.

For those with overflowing septic system problems, ultra-low-flush toilets may cure the problems for a lot less than the cost of improving the septic system. A new home with efficient plumbing fixtures may realize extra financial savings from a smaller leachfield or lower sewage hook-up fee. Check with your local building inspector. In addition, you will reap the continuing financial benefits which accrue through reduced water use.

If you're concerned that an ultra-low-flush toilet might not do its job properly, remember that these toilets are specially designed to operate on

1.6 gallons or less. Conventional toilets modified with displacement bags, dams, or bricks may require double-flushing, but engineering studies and our own years of experience show that many 1.0–1.6 gpf toilets work as well as or better than their conventional counterparts. Rather than sloshing lots of water around in the bowl for a long time to little purpose, they use a forceful pulse of water to complete each flush quickly and cleanly.

Removal of old toilets and installation of new ones is easier than it sounds. Before removing a toilet, be sure to turn off the water supply to it and flush all the water out of the cistern. Replace the wax seal under the base of the toilet with a new one. If you have any doubts about the job, a plumber should be able to do it in a half hour or less. When choosing a toilet, be sure it has the same rough-in size (distance between the wall and the center of the discharge pipe) as your current toilet. This shouldn't be a major issue; most U.S. toilets have a 12" rough-in.

Efficient Faucets Save A Lot

Inexpensive but efficient replacement faucets can reduce your total indoor residential water use by 3–5%. That may not sound like much, but your energy savings through reduced hot-water use will repay the cost of the faucet in less than a year. In most cases, all that needs to be replaced is the tip of the faucet.

Installation is usually very easy: just unscrew your old faucet and replace it with an efficient new one. If it's corroded and won't come out easily, a pair of pliers will help.

To determine the right size:

- Remove the existing faucet.
- If the threads are on the inside, it has "female" threads. If the threads are on the



A water-efficient faucet will pay for itself in less than a year.

outside, they're "male."

- If a nickel fits snugly into the threaded end, it's a "regular" faucet ($15/16$ " male or $55/64$ " female threads).
- If a nickel doesn't fit into it but a dime does, it's a "small" faucet ($13/16$ " male or $3/4$ " female threads).
- If your faucet is missing from the start, your best bet is to choose a regular faucet with dual (both male and female) threads: it will probably fit.

A bathroom faucet which delivers 0.75–1.5 gallons per minute (instead of the usual 2.0–4.0 gpm) will work fine for toothbrushing, washing, or

shaving. You'll need a higher flow in the kitchen sink to fill pots and pans: 2.0–2.5 gpm is generally plenty. A shutoff lever in the faucet will allow you to slow the flow temporarily without losing the temperature setting—a convenient, water-saving feature.

Efficient faucets are widely available through hardware and plumbing-supply stores. Stores that sell them often have a display to help you find the right size. Be sure to determine the desired flow rate before you buy. If a faucet doesn't mention flow rate, it probably isn't an efficient model.

Washing Machines

Replacing a typical home washing machine, which spins on a vertical axis, with a new “horizontal-axis” machine can reduce your wash water needs by 30–60%. These new efficient washers are available in front- and top-loading models. You will not only save water, but also detergent and energy—and your clothes will get cleaner. An average household can save nearly 7,000 gallons of water a year with such a machine.

If you're in the market for a new machine, an efficient horizontal-axis model would be a good investment. However, it is probably not cost-effective to replace your conventional machine if it still has a few years left in it.

Lawn Watering

Proper watering practices can typically cut lawn water consumption by 20–50% while maintaining or even improving the health of your lawn. Most lawns are bluegrass, which, while being a fairly water-demanding species, doesn't need watering as frequently as many people think. It grows best when watered evenly, deeply,

infrequently, and only when it needs it—no more often than once every three days in any climate.

You can tell when your lawn needs watering simply by walking across it. If the grass springs back up after you lift your foot, it's not time to water yet; if it stays flat, however, it's time to water again. When only a few dry spots are present, watering them by hand can save water and make the color of your lawn more even.

Water for as long as it takes to irrigate the full 4–6-inch root zone—check the depth of watering periodically with a screwdriver; in a sufficiently watered lawn, it should be easy to push in to a depth of about 6 inches. Remember, water deeply, but only when needed. Of course, if it's raining or has recently rained, you can reduce the amount of water you apply accordingly. Your local water conservation office may be able to provide information on lawn watering requirements for your climate.

Water in the early morning or in the evening, when wasteful evaporation will generally be lowest. If you live in a humid climate, it's better to water in the early morning to avoid mold problems.

Use a sprinkler timer, which can irrigate in pulses of 10–20 minutes with 15 or more minutes in between, allowing the water to soak in properly. If the soil doesn't absorb water as fast as the sprinkler applies it, it will accumulate in puddles or run off your lawn; both are wasteful and may harm your lawn (not to mention your driveway, sidewalk, and house). To increase the rate at which water is absorbed, you can poke holes in the soil with an aerator from your local nursery.

If you have an automatic sprinkler system, place empty cans or rain gauges around your lawn, run the sprinkler for 15–20 minutes, and check to see that your sprinkler is distributing water evenly. You may be surprised to see that

some parts of your lawn get two to three times as much water as other parts. If so, readjust the sprinkler heads and try again. To avoid puddles or run-off, set your system to run for no more than 20 minutes at a time. To keep your automatic sprinkler operating efficiently, adjust it at least once a month during the watering season. The amount you water in May should be far less than the amount you water in July; water only enough to keep your lawn healthy.

Remaking Your Landscape

Even when it's watered efficiently, bluegrass still requires a lot of water. You can remake your bluegrass lawn into a colorful, durable, drought-resistant landscape and save yourself most of the money and effort you put into maintaining it.

Regardless of where you live, follow these general guidelines when remaking your landscape:

- Make sure your soil has plenty of organic matter to hold water. If it doesn't, use compost to improve the soil before you lay down grass. Also use organic matter when planting shrubs.
- Keep your lawn small, and put it on a flat, level area where the water won't run off.
- Circular or rectangular lawns are easiest to water efficiently, without overspray. Narrow strips and odd shapes, especially when they border on driveways, walkways, or buildings, are difficult to water efficiently; use wood chips and low-water-use plants and, if necessary, drip irrigation in those areas.
- Choose a sprinkler pattern that matches your lawn.
- Use a drip-irrigation system or "micro-sprinkler" for your shrubs and flower beds if they require watering. A properly



A properly installed drip-irrigation system can reduce both water use and maintenance.

designed and installed system can substantially reduce both water use and maintenance.

- Instead of bluegrass, use a low-water-use grass or other water-efficient plants. Your local water company or cooperative extension office may be able to provide a list of low-water-use plants suitable for your area. Remember that the less water your plants require, the smaller will be your weed problem too, and the easier it will be to maintain your landscape.

Graywater Use

If you're building a new house or renovating an existing one and would like to make an extra effort to improve your water efficiency, you may wish to consider a graywater system.

Graywater is soapy water from bathroom sinks, showers, and washing machines. A graywater system filters and reuses this wastewater to flush toilets, which obviously don't need drinking-quality water for the job they do. (Graywater systems normally don't reuse kitchen sink water

because of its high grease and other organic content.) If you install such a system, you might wish to arrange it so you can also use some of the filtered water to irrigate your garden. Either way, be sure to have your plan approved by your local building inspector or health department.

Except in California, graywater systems are not yet widely used. While there are a few commercially manufactured graywater systems, you can also assemble one from plumbing parts. An assembled system including a tank, filters, and pump costs about \$600–800. By reusing your washwater, a graywater system can reduce your indoor water use by about 30%, and cut outdoor water use as well.

Composting Toilets

Composting toilets need no sewer hookup, septic system, or plumbing. While requiring more space than conventional toilets, they may be the best option for certain applications. Like graywater systems, composting toilets can reduce indoor water consumption by about 30%, and also provide the user with a small amount of high-quality fertilizer once a year.

Rainwater Collection Systems

Rainwater collection systems, once common in the United States, can supply a significant amount of water, even in dry regions. Most systems rely on rooftops to collect rain, which is then stored in barrels or cisterns. Typically they are homemade using regular gutters and other easily obtainable parts. Metal or tile collecting surfaces are best, so as to avoid contamination from asphalt and other roofing materials. The primary

cost for a system is for storage, which generally runs 25–75¢ per gallon.

Some rainwater collection systems can be used in conjunction with graywater systems. Depending on the catchment area, storage capacity, and annual rainfall, such a system can meet some (if not all) of a household's non-potable water needs, and in some cases it may provide potable water too.

Congratulations

Whether you've refitted your whole house or just replaced a showerhead, your efforts have saved you money and made a real contribution to the cause of improved resource efficiency. You can take your success further by promoting efficient water use by your local water supplier and local and state governments. More information is available from the organizations and publications listed below.

Additional Resources

Selected RMI Publications

(When ordering, refer to the publication code in parentheses; all prices are postpaid in the United States)

The Water Efficiency Revolution. An overview of how water efficiency can help the environment, reprinted from *Calypso Log Magazine*. 2 pp, \$1.50. (#W93-5)

Water Efficiency Sampler. Briefly overviews 15 case studies of projects ranging from hookup fee incentives to composting toilets. 2 pp, free. (#W92-1)

Graywater Systems, Composting Toilets, and Rainwater Collection Systems: A Resource List. Lists dozens of manufacturers and other organizations involved with these technologies, and includes an extensive annotated bibliography. 14 pp, \$7. (#W93-18)

Let's Tap Water Efficiency Before Spending on

Treatment. Notes that water efficiency is cheaper than new treatment plants; reprinted from the Christian Science Monitor. 1 p, \$1.50. (#W94-24)

Water Efficiency Publications. A complete list of more than two dozen publications related to water use. 2 pp, free. (Water pubs list)

Organizations and Publications Which Encourage Water-Efficient Landscapes

National Wildflower Research Center, 2600 FM 973 North, Austin, Texas 78725. Publishes fact sheets, including recommended species lists, source lists, gardening and landscaping tips, and bibliographies, available on a state-by-state basis for \$2. Members, who contribute \$25 to the nonprofit center, can receive these sheets at no charge. Be sure to include a stamped, self-addressed envelope.

The Wildflower Meadow Book: a Gardener's Guide, by Laura C. Martin, available from Globe Pequot Press, Box Q, Chester, CT 06412 (800/243-0495; in CT, 800/962-0973). A thorough description of the design, planting, and maintenance of wildflower meadows in each of seven regions of the country. Topics covered include naturally occurring plant communities, noxious weeds, meadow plants for various purposes, and other useful organizations and books. 300 pp, \$16.95, plus \$2 postage.

Plants for Dry Climates: How to Select, Grow, and Enjoy, by Rose Duffield and Warren D. Jones, available in paperback from Price Stern Sloan, Inc., 360 North Cienega Blvd., Los Angeles, CA 90048. A well-illustrated and colorful manual of plants which do well in arid parts of the country. Topics covered include lawns, gardens, annuals, perennials, and planting and plant care. 175 pp, \$12.95 plus \$1 shipping.

Water Wiser: The Water Efficiency Clearinghouse. American Water Works Association (800/559-9855). Provides information on community-wide water-efficiency efforts, primarily to water utilities, governments, and community planners.

Energy Efficiency and Renewable Energy Clearinghouse. U.S. Dept. of Energy (800/428-2525).

Provides information to citizens on a wide range of issues including energy efficiency, appropriate technologies, and alternative water technologies such as composting toilets and graywater systems.

National Drinking Water Clearinghouse. National Small Flows Clearinghouse (800/624-8301). A government organization that provides information on water quality issues as well as on technologies suitable for individual and small-scale water systems, including artificial wetland water treatment, solar aquatics, and successful water-efficiency programs.

In addition, state and local water conservation offices and cooperative extension agents may be able to furnish useful information on water efficiency.



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