

A vertical downspout pipe is mounted on a wall with a light-colored, pebbled stone texture. The pipe is white and has a decorative, ribbed section near the bottom. In the foreground, there is a concrete base and some green grass. The background is a continuation of the stone wall.

Rainwater Harvesting

Moderate Investment Can Yield Big Results

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Editor's note: This article, an overview about rainwater harvesting, is the first in a two-part series. In the fall *On Tap*, the second installment will review rainwater harvesting regulations around the country.

Maybe you've heard something about rainwater harvesting and you're intrigued. Or maybe you've already decided to invest in a rainwater harvesting system. What do you need to know before you start? Where can you go for more information? What questions do you need to answer before harvesting rainwater? Let's start at the beginning.

Why should I harvest the rain?

If you live in a rural area or an area where drilling a well is prohibitively expensive, rainwater catchment may be the only real option. Even in locations where wells or municipal water hookups already exist, there's a growing list of other reasons to consider rainwater harvesting. For example, a new building development or fear of declining water quality may lead you to consider adding a rainwater harvesting system. Concerns about the impending impact of global warming may be another reason to consider a system. Global warming is expected to increase the severity of storms, potentially increasing runoff, and causing local wells and aquifers to run dry faster. Also, rainwater is lower in "hardness" (i.e., has a lower mineral content) than normal tap or well water, meaning less soap and detergent is required, scale build-up in appliances is reduced, and no water softener is needed. Harvesting rainwater saves money and is good for the environment.

How much does it cost?

If you are going to have an entire rainwater system professionally designed and installed, plan on spending two to three dollars per gallon stored. The storage tank is the single most expensive item of a system. Overall costs can be reduced significantly if you are willing to do some of the work yourself or if you have some of the infrastructure already in place (e.g., gutters, downspouts, or an irrigation system).

A professionally installed system with a high-end filtration unit may run as high as \$30,000. However, most systems will cost \$10,000 or less. You can recover this investment in 10 to 12 years at today's water rates.

How much rain can I capture?

The amount of rain you can capture is calculated by multiplying the square footage of the roof times the annual rainfall in your area times .632 (the number of gallons of rain per square foot). Rainfall information for your area is generally available from the local weather station, newspaper, or on the Internet.

In arid Santa Fe, New Mexico, which receives an average of about 14 inches of rain a year, the maximum amount of rainwater that you could



capture from a 2,000 square foot roof is slightly less than 17,700 gallons (2,000 x 14 x .632). The population there is growing and water prices are rising, so, even though it does not rain much, capturing rainwater makes sense. In fact, Santa Fe County requires rainwater harvesting as part of any new development plan.

Now, let's look at rainy Atlanta, Georgia, which receives an average of 50 inches of rain a year. The maximum amount of rainwater that you could capture from a 2,000 square foot roof is slightly more than 63,000 gallons (2,000 x 50 x .632). Although this area usually receives substantial rain, the recent drought has greatly increased the interest in rainwater harvesting. It provides an alternative irrigation water source for a growing number of homes in this part of the country.

The examples above show the amount of rain that could be theoretically harvested off the roof. However, catching 100 percent is not possible due to many different factors, including roofing materials that absorb some of the rain, light rainfalls when the rain evaporates in place, or heavy rains in which the rain overflows the system design.

The catchment rate is usually about 80 to 90 percent, depending on gutters, rainfall conditions and the efficiency of roofing material. Assuming that the 2,000 square foot roof is made of galvanized steel, which has a 90 percent catchment efficiency, the total likely amount of rain that could be captured in the Santa Fe example is about 15,900 gallons (2,000 x 14 x .632 x 90 percent) a year and in Atlanta, approximately 56,700 gallons (2,000 x 50 x .632 x 90 percent).

What can I do with the rainwater?

Normally, rainwater is used for irrigation and, therefore, greatly reduces potable water used for this purpose. In the summer, this can save 30 to 50 percent of the water used by an average household, depending on where you live.

Is it safe to drink?

Rainwater must be purified before it is consumed. Rain will collect debris as it falls on the roof, and this needs to be removed through gutter screens and filters. Additionally, it may become contaminated with potentially harmful pathogens and should be treated by some type of purification system prior to being used as potable water.

Home purification systems usually have three components: 1) a cartridge filter, 2) a carbon filter, and 3) an ultraviolet (UV) light. The cartridge filter removes particles as small as five microns, the carbon filter removes minerals and heavy metals, and the UV light kills bacteria. These purification systems normally include a small holding tank (20 to 35 gallons) to store water after it has been treated and is ready for household consumption.

Other home water treatment options include reverse osmosis or distillation systems. Both of these options produce purer water, but they are not typically required for rainwater, and are more costly and less energy- and water-efficient.

Do I need approval?

Approval requirements vary depending on where you live. In Colorado, for example, it is currently illegal to harvest rainwater. (Under existing Colorado law, all rainwater is supposed to be allowed to flow into streams to be used by water-rights holders. The fear is that wide spread use of rainwater harvesting will diminish flows into streams and rivers.) Other locales require little to no permitting if the water is to be used for irrigation.



If the water is going to be used for drinking, a permit will usually be required. In all cases, you should check with your local water utility or municipality to see if local permits are required. Rainwater harvesting is currently experiencing tremendous growth in the U.S., and many cities are updating their building and permitting processes to make it easier to install catchment systems.

Where do I start?

First, examine your water use and then install water-conserving devices. These will usually pay for themselves in just a few years through savings of water and electricity. Check with your local water municipality, as many cities and counties are offering rebate programs to promote water conservation.

By installing low-flow fixtures and appliances like WaterSense®-approved shower heads,

faucets, and toilets, and Energy Star®-rated dishwashers and clothes washers, along with drip-irrigation systems for outdoor watering, your water usage can often be cut by as much 40 to 50 percent. These savings require little in the way of lifestyle changes, but can greatly reduce the size and, consequently, the costs, of a rainwater harvesting system.

What is the biggest thing I should be aware of?

With municipal water, you turn over all control to the utility company, including maintaining the pipes and the water filtration system. As the owner of your own system, you are responsible for its maintenance. Gutters need to be cleaned at least annually. Tanks and exposed pipes should be inspected at regular intervals. If a filtration system is included, the filters need to be inspected and changed following the manufacturer's recommendations. Trees surrounding the roof, gutters, and tanks need to be trimmed periodically to keep them away from the system components. This maintenance is essential, although usually not time consuming.

Why are some communities offering rebates for installing a system?

Green, sustainable building is catching on through programs like LEED [Leadership in Energy and Environmental Design]. Additionally, some cities and water companies are starting to manage water demand, not just supply. These factors and others are driving local initiatives to conserve the use of potable water. Rainwater harvesting is one way to meet LEED green building requirements as well as conserve water. According to Ashley Katz, communications coordinator for the U.S. Green Building Council, "Buildings use 12.2 percent of all potable water, or 15 trillion gallons per year. Water efficiency measures in green buildings can easily reduce water usage by 40 percent. Reusing captured rainwater is a methodology that's commonly used to reduce water usage, and is growing in popularity."

Do these systems affect groundwater supplies?

The impact of rainwater harvesting on groundwater is an area where additional field research needs to be conducted. However, it is critical to remember rainwater systems do not

remove water from the hydrological cycle; they merely slow down rain runoff and allow it to be used and to infiltrate locally. Some areas of the country are actively promoting rainwater harvesting to reduce the volume of runoff and lessen the impact of non-point pollution.

What are some resources I can use to find out more about rainwater harvesting? The Environmental Protection Agency (EPA) does not regulate rainwater-harvesting systems but publishes information pertaining to water conservation and water quality.

Visit EPA's Water Sense Program, at www.epa.gov/watersense/ and their Drinking Water Standards at www.epa.gov/safewater/standards.html for more information.

NSF International Rainwater Catchment System Testing Program reviews products such as gutters, roofing materials, and coating products to ensure they do not impart contaminants into the water at levels that exceed EPA health guidelines. Go to www.nsf.org/consumer/rainwater_collection/index.asp?program=Rainwater_Col to learn more.

For overviews of rainwater harvesting, refer to these manuals:

- The Texas Manual on Rainwater Harvesting www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf.
- City of Tucson Rainwater Harvesting Guidance Manual <http://dot.ci.tucson.az.us/stormwater/downloads/2006WaterHarvesting.pdf>.
- Guidelines for Rainwater Catchment Systems in Hawaii www.ctabr.hawaii.edu/oc/freepubs/pdf/RM-12.pdf.

Check with your state to see if similar manuals exist.

Brad Lancaster's book *Rainwater Harvesting for Drylands* may be purchased at the author's web site at www.harvestingrainwater.com or through online bookstores.

The U.S. Green Building Council is a non-profit organization committed to expanding sustainable building practices and is the certification organization behind LEED. Visit their site at www.usgbc.org. 💧

Doug Pushard founded *HarvestH2O.com* as a personal expression of his interest in the subject of water conservation. His writing has appeared in several publications, including the *New York Times*, *Home Power*, *Smart HomeOwner*, *SUN Monthly*, and *Water Today*.