Rainwater Harvesting

Rainwater harvesting into a barrel or cistern can supplement a water supply or be used as an independent water supply. If you just want a rainwater harvesting system to offset water use, a small system usually can be designed very inexpensively. If you want a system that can meet the daily water consumption for an extended period of time, you will need to determine the size of the catchment area needed to provide water and the size of cistern or tank to hold the water.

Rainwater Harvesting System

Rainwater harvesting systems can be as simple as directing gutters to a lidded garbage can or as complex as a concrete cistern, roof washer and filtration system. Deciding how much water you plan to use and for what reason will help you decide on the size to build and the components of the complete system.

Conserve Water First

The average American uses about 100 gallons of water per day for showers, toilet flushing, clothes washing, cooking and lawn watering. By simply switching to low flush, 1.6-gallon toilets, low-flow showerheads and faucets, horizontal-axis washers and other water-saving appliances, you may be able to reduce your water use by half or more. Conserving water means that you will need less storage capacity, making it possible to buy a smaller (and more inexpensive) cistern. Similarly, if you live in an area that receives a steady supply of rainfall throughout the year, you may only need to size your cistern for a few weeks' worth of water. With water-conserving plumbing fixtures and little or no outside watering, per-person usage can range from 55 to 75 gallons per day.

Capturing Rainwater

All rainwater catchment systems have basics components, which include a catchment surface, conveyance system, storage, distribution, and depending on the use of the water, treatment.

Catchment

The catchment area is the first point of contact for rainfall. For the vast majority of tank-based rainwater harvesting systems, the catchment area is the roof surface. The size of the catchment area or roof will determine how much rainwater you can harvest. The area is based on the “footprint” of the roof, which can be calculated by finding the area of the building. The best roofing material for rainwater catchment is uncoated stainless steel or factory-enameled galvanized steel with a baked-enamel, certified lead-free finish. Any existing metal roof being used for a potable water catchment system should be tested for lead and other heavy metals. Some roofing materials are more likely to support the growth of mold, algae, bacteria and moss, which can potentially contaminate water supplies. A porous or rough roof surface holds back some of the water that would otherwise make it into the cistern. Asphalt roofing has a "collection efficiency" of about 85 percent while enameled steel has a collection efficiency of more than 95 percent. With asphalt roofing, more of the rainwater stays on the

roof in a typical rainstorm (i.e., the roof stays wet), though the actual percentage will depend on the duration of the storm.

To be most effective, the roof should be fully exposed and away from overhanging tree branches. This reduces the risk of contamination from rotting leaves or droppings from birds and insects in the trees. If possible, avoid using roofs of buildings that rely on wood heat, as the smoke particles and soot deposited on the roof may contain polynuclear aromatic hydrocarbons and other hazardous materials.

Sizing Your Water System

Once you have decided how much water and for what purpose you need the water you will need to determine if the rainfall and catchment area will provide you with the water you need. Second, determine rainwater availability in your area. A quick estimate of rainwater collection can be made based on your region's annual rainfall, but more thorough calculations will examine average, minimum and maximum rainfall on a per month basis. This information should be available from the National Weather Service or a local meteorological station. Actual collection calculations are made based on the available roof area (the catchment area) and an "efficiency coefficient," which accounts for the fact that not all the rainwater falling on the roof gets into the cistern. This is partially determined by the type of roof material has been used. On average only about 66% of all water landing on the catchment area will be able to be utilized. A rough estimate is 0.6 gallons of water for every inch of rain per sqft of catchment area.

To determine how much water you may get, follow these steps:
Estimate the square footage of the catchment roof, determine the square footage of drainage area for each downspout you are collecting from.
Estimate the normal annual precipitation for your area.
Multiply these numbers together and take it times 0.6 gallons per sqft of catchment area. This will give you an estimate of how much water is available.
Example: The roof area of a catchment roof is 2000 sqft. There are four downspouts that drain equal parts of the roof. You are only catching runoff water from two of four downspouts (or 1,000 sqft.). Your area averages 30 inches of rain per year. Multiply the number of sqft of the catchment area (1000 sqft) by the amount of yearly rainfall (30 inches) and take it times 0.6 gallons/sqft/inch to determine how much runoff water is available.

Available runoff water for the cistern or storage area:
1,000 sqft catchment area X 30 inches yearly rainfall X 0.6 gallons/sqft/inch of rain = 18,000 gallons per year that will be routed from two downspouts.

The storage container (cistern, tank) is often the most visible or recognizable component of a RWH system. It is where the captured rainwater is diverted to and stored for later use. The main goal of the storage tank is water storage but the most important component of the tank is safety. It should store water that is safe to use, and it should be secure so that children or animals cannot access the tank.

Water Harvesting Operation

To keep a rainwater harvesting system functioning properly, periodic maintenance is required. This is particularly important with systems used for potable water. Gutters and downspouts need to be kept free of leaves and other detritus. Roof-wash water may need draining after each storm. The cistern may need periodic cleaning or repairs if cracks or leaks develop. Filters and LTV lamps need to be replaced on a regular schedule. Pumps and ozonation systems may need occasional servicing. All piping and connections should be inspected periodically. Finally, occasional testing should be considered to ensure that suitable water quality is being achieve