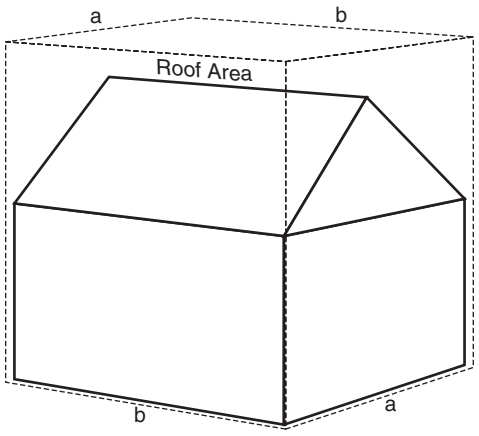
Simple Rainwater Harvesting System in Five Easy Steps

Step One:
Sizing your system.

The size of a rainwater collection system depends on the size of the roof, the amount of rainfall, and the water demands from the system.

1. Assess the landscape. How often and for how long do you water your lawn and garden a week? What do you use to water the landscape?
2. Calculate the water demand during the driest four months of the year (June-September). Keep in mind the following:
   - A sprinkler uses 480 gallons/hour
   - A regular hose uses 480 to 720 gallons/hour (Average is 600 gallons/hour)
   - A drip hose uses 1 gallon/hour for every 100 feet of hosing
3. Determine the average rainfall for your area (obtain this number from a local TV station or visit www.weather.com). This number will be needed to determine how much water will be caught.
4. Determine the size of the catchment area. Any roof of sufficient size with a gutter system can act as the catchment area as long as the water is used for non-potable uses. The above figure illustrates how to determine the area of the roof and calculate how much rain the roof will catch. The area is the length of the roof's gutter system multiplied by its width.



The catchment area of the roof is a simple calculation of width x length of the house. To find how much rain will be collected, take the area of the roof, multiply by the annual rainfall amount, then multiply by .5618 to arrive at the average number of gallons yearly.

Example: A house in Atlanta with a 1500 square foot roof. The lawn is watered with 4 sprinklers, three hours a week. The plants are watered with one sprinkler, two hours a week and with a hose for an hour a week.

- It rains 51 inches in Atlanta therefore the roof will catch 42,978 gallons. (Number of gallons caught derived from the following formula: square feet X .5618 X inches of rainfall.)
- Sprinklers: 4 sprinklers for 3 hours—12 hours X 480 gallons/hour = **5,760** gallons
- 1 sprinkler for 2 hours—2 hours X 480 gallons/hour = **960** gallons
- Hoses: 1 hour X 480 gallons/hour = **480** gallons
- **5760 + 960 + 480** = 7200 gallons/week X 16 weeks = **115,200** gallons of water demanded during the dry season.
- If this house utilized 500 feet of drip hoses for 14 hours a week instead of sprinklers only 1120 gallons of water would be needed.

Step Two:
Choose the right cistern.

The size of the cistern depends on the amount of water to be collected and cost restraints. Choose a cistern that fits the needs of the water harvesting system. Collecting a small volume of water is better than collecting none. All cisterns should be watertight, durable, and have a clean, smooth interior. The cover

Cistern Type	Advantages	Disadvantages
fiberglass tanks	prevents algae growth and evaporation, rust resistant, durable	higher initial costs, degradable, requires exterior coating
polyethylene tanks	various sizes, shapes, alterable, inexpensive, movable	can deteriorate over time if not treated for UV radiation
plastic garbage can	available, inexpensive	use only new cans
barrels	attractive, alterable, great for small systems	hard to find, small
55 gallon steel drums	available, durable, great for small systems, moveable	prone to corrosion, rust and/or toxins
galvanized tanks	inexpensive, attractive, moveable, alterable	can rust, higher long term costs
plaster cisterns	low profile, inexpensive, can alter color	large footprint, unalterable, immovable
concrete tank-ferrocement, stone, or concrete block	durable, permanent	potential to crack, difficult to maintain

needs to be tight fitting to prevent evaporation. A cistern with a lid allows for easy access to attach a faucet and to occasionally clean inside. It is best to place the cistern out of direct sunlight to prevent algae and bacteria growth, which can clog the system. The use of two or more smaller cisterns enables service on one unit at a time without disrupting the entire system.

Step Three:

Placement of the cistern.

- Place the cistern at a high point on the lot and elevate approximately 3 to 4 feet on a sturdy, load-bearing foundation or structure. This will create enough pressure to use gravity for running the water through a hose, soaker hose, or drip irrigation system to the landscape. Foundations can be made of bricks, concrete, or a wood frame. A full 55-gallon cistern will weigh around 500 pounds.
- Above ground cisterns are less expensive than a below ground cistern and easier to maintain. With this system it is easy to take advantage of gravity to guide water throughout the irrigation system.
- Below ground cisterns are good for colder climates. Storing water below ground can have aesthetic appeal while keeping the water out of the sun. Underground systems require a more complicated design and a pump to achieve gravity irrigation. Below ground systems tend to be used primarily in commercial sites due to the additional cost of pumping.

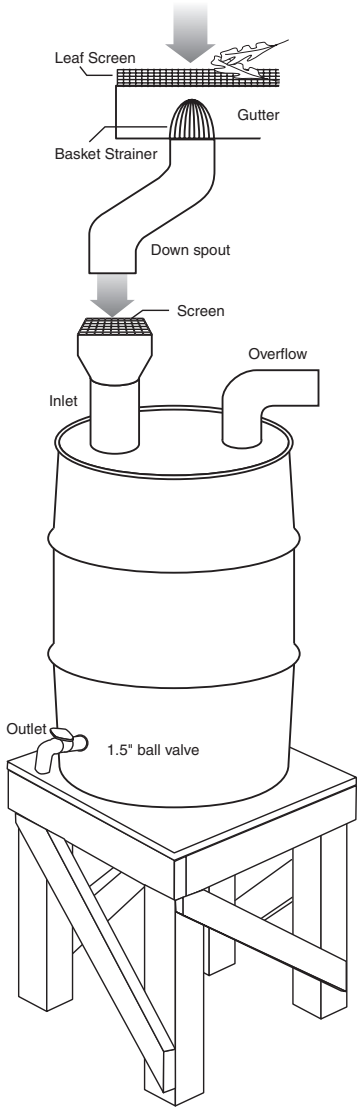
Step Four:

Set up a conveyance system with a large particle filter between gutters and cistern.

- Install continuous leaf screens, made of ¼-inch wire mesh in a metal frame, above the gutters to prevent debris from entering the system.
- Place a basket strainer (e.g. a screen or wire basket) at the top of the downspouts (optional). Make the downspout out of 4-inch diameter Schedule 40 PVC pipe or comparable piping. Angle bends should not exceed 45 degrees. Slope the piping at ¼-inch slope per foot minimum.
- Adapt the gutter to PVC piping with a downspout adapter.
- Place pantyhose or other filtering system before the head of the cistern to filter out debris from the roof.

Rainwater Catchment

Sample diagram



Step Five:

Set up a distribution system to remove water from the cistern to the landscape.

Place a faucet near the bottom of the cistern with a hose connection. Do not place at the very bottom because sediment will build up here. Drill a hole into the cistern for the connection and install a ball valve. Seal the area completely around the hole with aqua or water resistant sealant. (Sealant can be purchased at a hardware or pond supply store). Enough pressure is generated to run soaker hoses and drip irrigation systems from a cistern that is elevated 4 feet. A pump may be needed to create enough pressure to run sprinklers, which require a higher amount of pressure.

Troubleshooting Rainwater Harvesting Systems

Algae growth in the cistern.

- Water with algae growth is still usable for landscape watering. To reduce algae growth, which could clog up the system or slow down water flow, clean the system on a regular basis. Placing the cistern in the shade or underground or using dark barrels will help discourage algae growth.

Leaves on the roof or in gutters.

- Obstructions and leaves caught in the gutters can reduce the amount of rain captured. Clean gutters on a regular basis for maximum collection.

Finding a cistern.

- A variety of containers can be found at farm supply stores, local hardware stores, or on the Internet. Contact Southface Energy Institute for suggestions on where to purchase used drums.

Generating enough pressure to run a sprinkler.

- Water gains 1 psi of pressure for every 2.31 feet the cistern is elevated. A sprinkler requires at least 20 psi. An auxiliary pump may need to be installed to generate enough pressure. Solar powered pumps work well. Or use a drip irrigation system, which uses less power and water.

Xeriscaping–*Water Efficient Landscaping*

By using xeriscape and permaculture landscaping techniques, outdoor water use can be reduced by 50 percent without compromising the aesthetic qualities of the landscape.

Xeriscaping incorporates seven steps for developing and maintaining a water-wise landscape.

Step 1: Planning and Design
Divide the landscape into water-use zones. Incorporate shade and native/drought tolerant plants into the design.

Step 2: Soil Analysis
Determine what improvements need to be made to the existing soil. Soil testing can be done by your local extension service.

Step 3: Appropriate Plant Selection
Choose non-invasion, native plants that are appropriate for the soil and sun exposure. These plants will be drought tolerant and low maintenance.

Step 4: Practical Turf Areas
Choose drought tolerant turf and limit the use of turf to areas of play.

Step 5: Efficient Irrigation
Set up an efficient design for the irrigation system based on the water-use zones. Water only when necessary and early morning watering is best. Try to keep every drop of water on site to prevent run-off use. Use a drip irrigation system set to a timer for efficient watering.

Step 6: Use of Mulches
Mulch traps moisture into the ground and insulates plants from the harsh seasonal air temperatures.

Step 7: Appropriate Maintenance
Use slow release, natural fertilizers. Mow lawns less during droughts to strengthen root structure. Increase height of the mowing blades by 33 percent. Thin plants rather than shear them.

Other ways to save water

- Install low-flow shower heads.
- Install a water efficient toilet. Do not use your toilet as a trash can.
- Use water and energy efficient appliances like horizontal axis laundry washers. Always look for the Energy Star logo.
- Fix leaky water pipes and faucets. A leak of one drop per second wastes 192 gallons per month.
- Turn the faucet off while brushing one's teeth and shaving.
- Greywater reuse—check with the local Health Department for legalities.
- Take showers rather than baths.
- Compost food waste instead of using a garbage disposal.

References

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