

RAINWATER HARVESTING

WHAT IS RAINWATER HARVESTING?

People have been harvesting rainwater for thousands of years. Folded banana leaves or rocky outcrops where water poured off during rains created plentiful opportunities to collect water.

More recently, roofs have acted as efficient catchment systems for people to collect rainwater for domestic use. By building simple rainwater catchment systems, houses, schools and municipal buildings can harvest rainwater from their roofs and gutters to store for drinking and cleaning as well as for use in times of emergency and to supplement unreliable water sources.

WHY USE RAINWATER?

- Rainwater offers an alternative water source when water runs out or is unreliable.
- Water can be stored in bottles and purified for drinking or stored in jugs for washing hands, watering gardens and cleaning.
- Taking responsibility for clean water and water conservation provides a model for the community.

IS ROOF WATER HARVESTING RIGHT FOR ME?

Roof water harvesting is the act of collecting rainwater from roofs for storage. Rainwater is some of the cleanest and purest water available. When constructed and maintained correctly, roof water harvesting systems can provide clean, affordable water for consumption and hygiene.



Before beginning a roof water harvesting project consult the following checklist:

- Is current water unreliable, inadequate or expensive?
- Is there space to build a roof water harvesting system?
- Is the roof made of hard and non-toxic materials (e.g., metal sheeting or tiles and NO LEAD PAINT)?
- Are there people who will be responsible for cleaning and maintaining the system?



Rainwater Harvesting Components

- Roof (catchment area)
- Pipes and gutters (conveyance system)
- Tank with a secure cover (storage)
- Overflow pipe
- First flush system (method to let the first flow of dirty water off the roof bypass the storage tank)
- Tap or pump to access water (distribution system)
- Draining area to prevent puddles near tank and to drain tank of dirty water at bottom

What is a First Flush System?

Dirt, pollution, bird feces and other contaminants on a roof are washed away during the first part of the water runoff. This water should be diverted away from the storage tank in a process called “first flush.” After the initial runoff, water quality improves significantly. There are several designs for a First Flush System but systems that do not require a person to be present to divert the water are recommended.



Materials

Catchment area

- Hard roof of tile or corrugated metal (no lead paint)

Conveyance System

- Gutters to catch rainwater, such as 22-gauge galvanized mild steel sheeting or large bamboo
- Galvanized wire or wood (to attach gutter to roof)
- Pipes to carry water from gutters to tank (PVC works well with the First Flush System)

Storage

- Holding tank: polypropylene, metal drums or ferrocement
- Tanks should be fully enclosed to prevent contamination
- Tanks should be easy to access to clean out

First Flush System

- Screens for end of gutters and downpipes to prevent debris from entering tank
- Extra PVC with a stopper and small hole on the end
- A small tank/container with a stopper (optional)
- A rubber ball (optional)
- An alternate First Flush System could contain a large box or container with screens and layered gravel, sand, charcoal and pea gravel for filtering debris and pollutants

Costs

- The tank (70 to 80 percent of the cost but worth investing in properly)
- Other materials
- Labor (save money by having parents and other volunteers build the system)

BUILDING A ROOF WATER HARVESTING SYSTEM

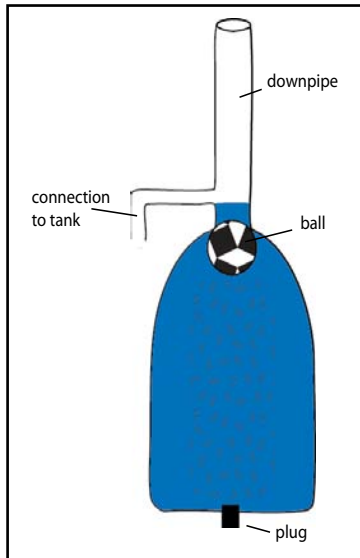
The steps below are meant as a general overview of building a rainwater harvesting system. Please consult with a local organization that can help build a system that meets the needs of the home, school or community center where it will be used.

1. Make sure you have a hard roof that has not been finished with lead paint. Roofs without branches overhead are best to prevent excess debris and animal nesting.
2. Purchase or build a tank approximately 5,000L to 20,000L in size. Be sure the tank has a tap for accessing the water collected and a small, screened pipe outlet at the top of the tank to allow overflow water to leave the tank (called the overflow pipe).
3. Make a gutter around the eaves of the roof. You can make a gutter out of 22-gauge galvanized metal sheeting, large semi-circular plastic pipes or large bamboo cut lengthwise.
 - For metal sheeting, bend the metal sheeting into a V in a clamp. To strengthen the edges, bend them in a 90-degree clamp then hammer flat.
4. Attach the gutter to roof using either galvanized wire thread through the metal and roof, wood triangle supports attached to the building or plastic pipe supports. Wires or supports should be spaced regularly and evenly across the roof. Be sure that the gutter is angled downward so that the flow of water runs toward the storage tank.
5. Attach a downpipe directly to the end of the gutter. The pipe may be of PVC or metal. You may either cut a hole toward the end of the gutter for the downpipe or attach it to the end of the gutter. The downpipe should attach tightly to prevent additional contamination from entering the downpipe. Use caulking or a tar compound to seal the downpipe connection.
6. Fix a screen to the entrance of the downpipe to prevent leaves and debris from entering the downpipe. The screen should be large enough to allow water to flow freely but small enough to block leaves and debris.
7. How you connect the downpipes to the tank will depend on which method of First Flush System you choose to employ.
8. The tank will need to have some way to retrieve water such as a tap or pump. *****Be sure to clean the tank regularly and maintain the First Flush System so as not contaminate the water.*****



FIRST FLUSH SYSTEMS

Using a Cistern System



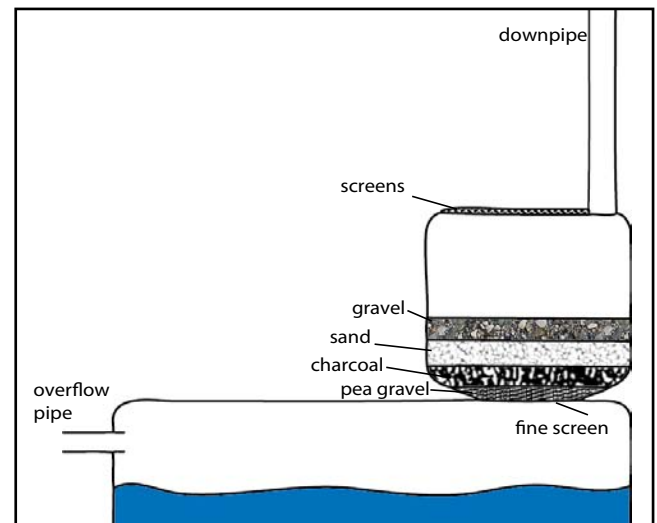
This system is easy to build, easy to clean and prevents roof contaminants from overflowing into the tank through the use of a ball as a stopper.

- Get a large jug, small cistern or small tank.
- Make a hole in the bottom of the cistern and plug it with a stopper.
- Place a rubber ball large enough to block a connection with the downpipe inside the cistern.
- Connect additional piping off the downpipe toward the tank.
- Connect the downpipe to a small tank, jug or cistern.
- Connect the additional piping to the tank. The pipe should attach tightly to the tank to prevent contamination from entering the downpipe. Use caulking or a tar compound to seal the downpipe connection.
- Someone will need to empty the cistern by unplugging the stopper during dry spells so as to continue the first flush system when rains come.

Using a Filter Box System

This system is advantageous because no one needs to be present to divert the water or dump the dirty water.

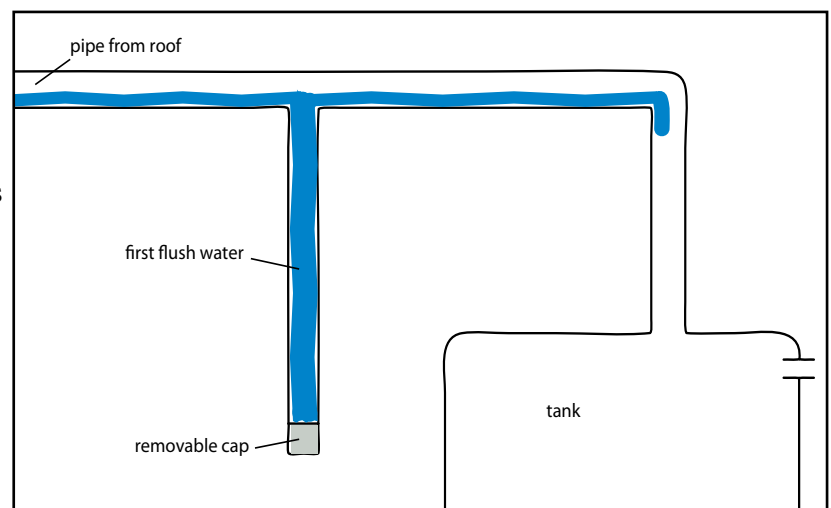
- A filter box system can be made from gravel, sands and charcoal.
- The filter will need to be changed occasionally.



Using a PVC Pipe System

This is the easiest system to build but potentially the most problematic for filtering roof waste.

- Using PVC pipes extend a pipe from the gutter(s) toward the tank.
- Attach a long PVC pipe as a down pipe to the pipe from the roof before it reaches the tank.
- At the bottom of this downpipe place a cover over the pipe with a small hole. The hole should be big enough to allow the dirty water to drain but not so big that water runs quickly through it and prevents the tank from filling.
- Extend the pipe from the roof so that it attaches to the tank. The attachment should be tight so as to prevent contaminants from entering the tank. Use caulking or a tar compound to seal the connection. You may also want to place a screen at the entrance of the tank to be sure no further debris enters the tank.



If you are considering a rainwater harvesting project in your community we suggest you consult with an organization that specializes in building water catchment systems. The organizations listed in the **Resources** are good contacts for more information.

RESOURCES

Water Aid. Rainwater Harvesting

http://www.wateraid.org/international/what_we_do/sustainable_technologies/technology_notes/2055.asp

WELL

<http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/drh.htm>

Rainwaterharvesting.org

<http://www.rainwaterharvesting.org/>

International Rainwater Catchment Systems Association

<http://www.ircsa.org/>

United Nations Environmental Programme

<http://www.unep.or.jp/Ietc/Publications/Urban/UrbanEnv-2/index.asp>

Pan African Conservation Education Project

<http://www.paceproject.net/Water-g.asp>

T.H. Thomas and D.B. Martinson. 2007. *Roofwater Harvesting: A Handbook for Practitioners*.

Resource available at <http://www.irc.nl/page/37471>

<http://www2.warwick.ac.uk/fac/sci/eng/research/civil/crg/dtu/rwh/>

UNEP. *Source Book of Alternative Technologies for Freshwater Augmentation in Latin America and the Caribbean*

<http://www.oas.org/DSD/publications/Unit/oea59e/ch10.htm>

Lifewater International

www.lifewater.org

