

To Prepare for Learning about Rainwater Harvesting

Dr. Ram Bajaj^{1*}

^{1*}RNB Global University-Bikaner

***Corresponding Author:** Dr. Ram Bajaj

*RNB Global University-Bikaner

Abstract

Rainwater Harvesting involves the collection and storage of rainwater for various purposes before it infiltrates the aquifer. It has been utilized for supplying drinking water, watering livestock, irrigation, and other common water uses. Rainwater collected from rooftops, tents, and local establishments can significantly contribute to the accessibility of potable water. Stormwater harvesting involves collecting water from the ground, often from designated areas, for similar purposes. In some instances, rainwater might be the sole available or cost-effective water source for drinking. Rainwater harvesting systems can be constructed using simple methods and inexpensive local materials, proving to be effective in most inhabitable regions.

Introduction

Rainwater collected from rooftops can often be of high quality and may not necessitate treatment prior to consumption. While certain roofing materials might produce rainwater that could be harmful to humans, it can still serve various purposes such as flushing toilets, laundry, gardening, and car washing. These applications alone can significantly reduce the water usage in a typical household. Implementing rainwater catchment systems at home is suitable in regions with an average annual rainfall exceeding 200 mm (7.9 in) and lacking other accessible water sources (Skinner and Cotton, 1992). Furthermore, excess water from rainwater harvesting tanks can be directed towards replenishing aquifers, a process known as groundwater recharge. However, it's important to note that this is a distinct process from rainwater harvesting and should not be confused with it.

Basic Configuration

Rainwater harvesting systems channel rainwater that falls on to a roof into storage via a system of gutters and pipes. The first flush of rainwater after a dry season should be allowed to run to waste as it will be contaminated with dust, bird droppings etc. Roof gutters should have sufficient incline to avoid standing water. They must be strong enough, and large enough to carry peak flows. Storage tanks should be covered to prevent mosquito breeding and to reduce evaporation losses, contamination and algal growth. Rainwater harvesting systems require regular maintenance and cleaning to keep the system hygienic. Around the world Currently in China and Brazil, rooftop rainwater harvesting is being practiced for providing drinking water, domestic water, water for livestock, water for small irrigation and a way to replenish ground water levels. Gansu province in China and semi-arid north east Brazil have the largest rooftop rainwater harvesting projects ongoing. In Rajasthan, India rainwater harvesting has traditionally been practiced by the people of the Thar Desert. In Bermuda, the law requires all new construction to include rainwater harvesting adequate for the residents. The U.S. Virgin Islands have a similar law. In the Indus Valley Civilization, Elephanta Caves and Kanheri Caves in Mumbai rainwater harvesting alone has been used to supply in their water requirements.

In Senegal and Guinea-Bissau, the houses of the Diola -people are frequently equipped with homebrew rainwater harvesters made from local, organic materials. In the United Kingdom water butts are often found in domestic gardens to collect rainwater which is then used to water the garden. However, the British government's Code for Sustainable Homes encourages fitting large underground tanks to new-build homes to collect rainwater for flushing toilets, washing clothes, watering the garden and washing cars. This reduces by 50% the amount of mains water used by the home. In the Myanmar, the groundwater is saline and communities rely on mud-lined rainwater ponds to meet their drinking water needs throughout the dry season. Some of these ponds are centuries old and are treated with great reverence and respect.

Until 2009 in Colorado, water rights laws almost completely restricted rainwater harvesting; a property owner who captured rainwater was deemed to be stealing it from those who have rights to take water from the watershed. Now, residential well owners that meet certain criteria may obtain a permit to install a rooftop precipitation collection system. Up to 10 large scale pilot studies may also be permitted). The main factor in persuading the Colorado Legislature to change the law was a 2007 study that found that in an average year, 97% of the precipitation that fell in Douglas County, in the southern suburbs of Denver, never reached a stream-it was used by plants or evaporated on the ground. In Colorado you cannot even drill water well unless you have at least 35 acres. In New Mexico, rainwater catchment is mandatory for new dwellings in Santa Fe. In Australia rainwater harvesting is typically used to supplement the reticulated mains supply.

NEED FOR WATER HARVESTING

Water is an important natural resource and is the very basis of our life. We use water for drinking, irrigation, industry, transport and for the production of hydro-electricity. Water is a cyclic resource which can be used again and again after cleaning. The best way to conserve water is its judicious use. Rain water harvesting is one of the most effective methods of water management and water conservation. It is the term used to indicate the collection and storage of rain water used for human, animals and plant needs. It involves collection and storage of rain water at surface or in sub-surface aquifer, before it is lost as surface run off. The augmented resource can be harvested in the time of need. The collected water is stored and pumped in a separate pipe distribution. This is a very useful method for a developing country like India in reducing the cost and the demand of treated water and also economising the treatment plants operation, maintenance and distribution costs.

The scarcity of water is a well-known fact. In spite of higher average annual rainfall in India (1,170 mm, 46 inches) as compared to the global average (800 mm, 32 inches) it does not have sufficient water. Most of the rain falling on the surface tends to flow away rapidly, leaving very little for the recharge of groundwater. As a result, most parts of India experience lack of water even for domestic uses. Surface water sources fail to meet the rising demands of water supply in urban areas; groundwater reserves are being tapped and over-exploited resulting into decline in groundwater levels and deterioration of groundwater quality. This precarious situation needs to be rectified by immediately recharging the depleted aquifers. Hence, the need for implementation of measures to ensure that rain falling over a region is tapped as fully as possible through water harvesting, either by recharging it into the groundwater aquifers or storing it for direct use.

SCIENCE OF WATER HARVESTING

In scientific terms, water harvesting refers to collection and storage of rainwater and also other activities aimed at harvesting surface and groundwater, prevention of losses through evaporation and seepage and all other hydrological studies and engineering inventions, aimed at conservation and efficient utilization of the limited water endowment of physiographic unit such as a watershed. Rain is a primary source of water for all of us.

There are two main techniques of rainwater harvesting:

Recharge to groundwater.

Directly collected rainwater can be stored for direct use or can be recharged into the groundwater.

All the secondary sources of water like rivers, lakes and groundwater are entirely dependent on rain as a primary source.

The term water harvesting is understood to encompass a wide range of concerns, including rainwater collection with both rooftop and surface runoff catchment, rainwater storage in small tanks and large-scale artificial reservoirs, groundwater recharge, and also protection of water sources against pollution. The objective of water harvesting in India differs between urban and rural areas. In urban areas, emphasis is put on increasing groundwater recharge and managing storm water. On the other hand, in rural areas securing water is more crucial. There the aim is to provide water for drinking and farming, especially for life-saving irrigation, and to increase groundwater recharge.

Methods of Rainwater Harvesting

Broadly there are two ways of harvesting rainwater Surface runoff harvesting Roof top rainwater harvesting Rainwater harvesting is the collection and storage of rainwater for reuse on-site, rather than allowing it to run off. These stored waters are used for various purposes such as gardening, irrigation etc. Various methods of rainwater harvesting are described in this section.

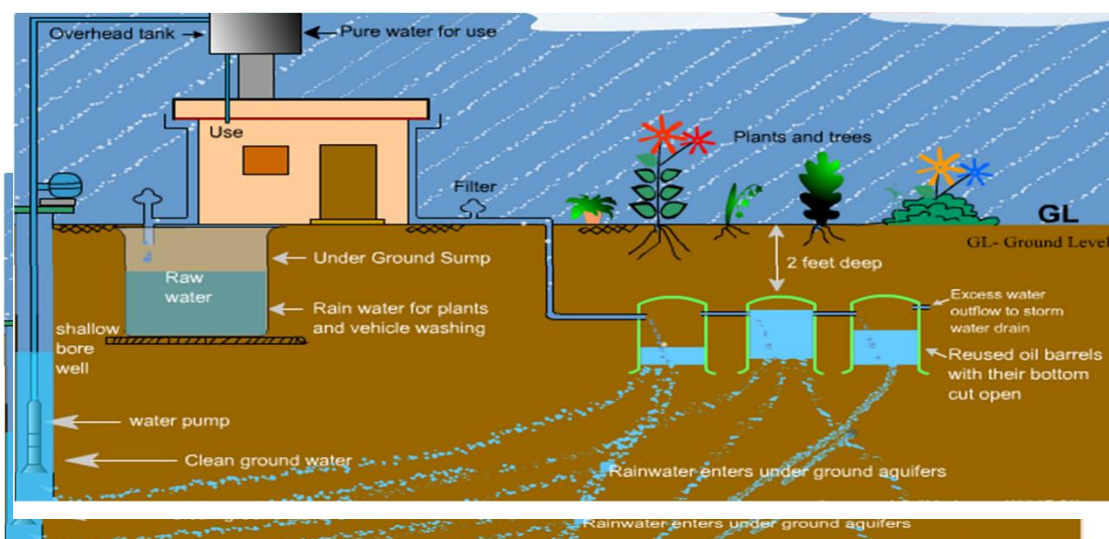
Surface runoff harvesting In urban area rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.

Rooftop rainwater harvesting

It is a system of catching rainwater where it falls. In rooftop harvesting, the roof becomes the catchments, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the groundwater level of the area.

ROOFTOP / RUNOFF RAINWATER HARVESTING FOR ARTIFICIAL RECHARGE TO GROUND WATER

Water harvesting is the deliberate collection and storage of rainwater that runs off on natural or manmade catchment areas. Catchment includes rooftops, compounds, rocky surface or hill slopes or artificially prepared impervious/ semi-pervious land surface. The amount of water harvested depends on the frequency and intensity of rainfall, catchment characteristics, water demands and how much runoff occurs and how quickly or how easy it is for the water to infiltrate through the subsoil and percolate down to recharge the aquifers. Moreover, in urban areas, adequate space for surface storage is not available, water levels are deep enough to accommodate additional rainwater to recharge the aquifers, rooftop and runoff rainwater harvesting is ideal solution to solve the water supply problems



POTENTIAL AREAS

- Where ground water levels are declining on regular basis.
- Where substantial amount of aquifer has been de-saturated.
- Where availability of ground water is inadequate in lean months.
- Where due to rapid urbanization, infiltration of rain water into subsoil has decreased drastically and recharging of groundwater has diminished

ADVANTAGES OF RAINWATER HARVESTING

- To meet the ever increasing demand for water. Water harvesting to recharge the groundwater enhances the availability of groundwater at specific place and time and thus assures a continuous and reliable access to groundwater.
- To reduce the runoff which chokes storm drains and to avoid flooding of roads.
- To reduce groundwater pollution and to improve the quality of groundwater through dilution when recharged to groundwater thereby providing high quality water, soft and low in minerals.
- Provides self-sufficiency to your water supply and to supplement domestic water requirement during summer and drought conditions.
- It reduces the rate of power consumption for pumping of groundwater. For every 1 m rise in water level, there is a saving of 0.4 KWH of electricity.
- Reduces soil erosion in urban areas
- The rooftop rainwater harvesting is less expensive, easy to construct, operate and maintain.
- In saline or coastal areas, rainwater provides good quality water and when recharged to ground water, it reduces salinity and helps in maintaining balance between the fresh-saline water interfaces
- In Islands, due to limited extent of fresh water aquifers, rainwater harvesting is the most preferred source of water for domestic use.
- In desert, where rainfall is low, rainwater harvesting has been providing relief to people.

CONCLUSION

The water harvesting technique increases farmer's income and it is very popular. The system is fragile and crop failure cannot be prevented without outside assistance in very dry years. A wider hydrological research is necessary to see how resilient the ground water system is. The technology is well known by the local population but training is necessary for the younger generations to make them aware of the wider setting. Rainwater harvesting is a viable option to supplement city water for non-potable human uses, such as irrigation. The overall efficiency of a rainwater harvesting system to supplement city water increases as area increases. The system would be highly effective in high commercial regions where there are warehouses and large buildings. These areas also contain less lawn area, so that the water can be used for uses beyond irrigation

Reference

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