

Current Scenario of Rain Water Harvesting System in Residential and Industrial Buildings in Jaipur City

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Abstract:- Jaipur is one of the semiarid zonal cities in India. Depending on precipitation intensity, rainwater constitutes potential source of drinking water. Rainwater harvesting is the technology where surface runoff is effectively collected and stored. Harvested rainwater can then be used for drinking or for ground water recharge. Unless a proper water storage technique is used the rainwater harvesting may not be prominent. This paper deals with a case study of rain water harvesting system in residential societies in Jaipur city of Rajasthan state.

Keywords – Rainwater harvesting, runoff, aquifer

I. INTRODUCTION

The reality of water crisis cannot be ignored. Jaipur has been notorious of being poor in its management of water resources. The demand for water is already more than the supply [1]. Majority of the population in Jaipur today are groundwater dependent. Other than municipal water supply, people use private tube wells to fulfill their daily water needs. As a result, the groundwater table is falling at an alarming rate. Extraction of groundwater is being done so uncontrollably that this has resulted in Hydrological Imbalance. Harvesting is an age-old system of collection of rainwater for future use. But systematic collection and recharging of ground water, is a recent development and most common practice as one of the most feasible and easy to implement remedy to restore the ground water and prevent major water scarcity related issues. Water harvesting means a system that collects rainwater from rainfall without allowing it to drain away. It includes the water collection from roofs and catchments of the buildings. There are several ways through which water can be harvested such as collecting run-off water from rooftops, collecting run-off water from local catchments and collecting flood water from local streams. Water harvesting systems developed by local communities and households can reduce the pressure on the state to provide the water and other resources needed for water supply. In addition, involving people will help them in collecting the water and burden on government funds got reduced.

The enormous need of water in Jaipur is a well-known fact. In spite of higher average annual rainfall in Jaipur (676 mm, 24 inches) as compared to the global average (800 mm,

32 inches) it does not have sufficient water [2]. From overall rain falling on the surface flows away rapidly, leaving very little water for the recharge of groundwater. Due to this, many parts in India do not possess sufficient water even for domestic uses. Surface water sources fail to meet the very high demands of water supply in urban areas; groundwater reserves are being tapped and over-exploited resulting into reduction in groundwater levels and reduction in groundwater quality. This precarious situation needs to be solved by fast recharging the damaged 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.

Water harvesting is the deliberate collection and storage of rainwater that runs off on catchment areas which can be natural or can be manmade. Catchment includes rooftops, compounds, hill slopes or artificial land surface for collection of rain water [3]. The amount of water collected is dependent on the total frequency and intensity of the rainfall in that particular area, catchment characteristics, water demands and how much runoff occurs and how fast or easy the water can infiltrate through the subsoil and can percolate down to recharge the aquifers [4]. In urban areas, sufficient space for storage of rain water on surfaces is not available, water levels are very deep so that for recharging the aquifer we need extra rainwater, rooftop and runoff rainwater harvesting is ideal solution to solve the water supply problems.

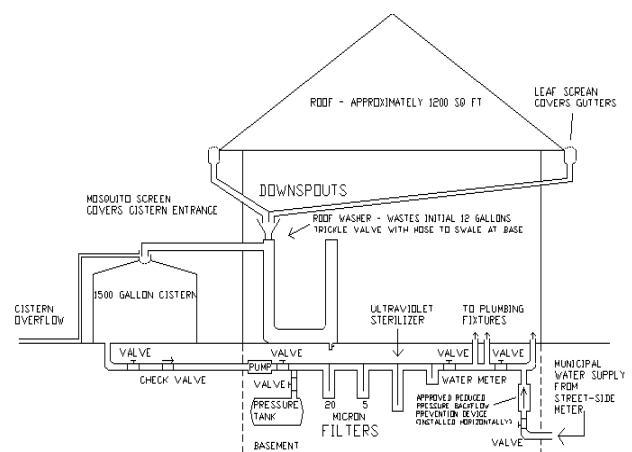


Fig 1. Basic Layout of Roof Top harvesting

II. STUDY AREA

Study area selected for the assessment of research is Jaipur urban. Some areas of Jaipur city such as Jagatpura, Sitapura, Mansarovar, Kukas, Bhankrota etc are assessed because there are numerous residential buildings available and there is huge need of rain water.

III. METHODOLOGY

A. ESTIMATION OF RUNOFF

The runoff can be estimated by following formula:
 Runoff= Catchment Area × Runoff Coefficient× Rainfall
 Runoff coefficient plays an important role in assessing the runoff availability. General values are tabulated below (Table 1) which may be utilized for assessing the runoff availability.

TABLE – 1 RUNOFF COEFFICIENT WITH CATCHMENT TYPE

Type of catchment	Runoff coefficient
Roof top	0.75 – 0.95
Paved area	0.50 – 0.85
Bare ground	0.10 – 0.20
Green area	0.05 – 0.10

In this study water collected on rooftop is considered as the water collection is totally depend upon type of the residential and industrial buildings.

Calculations are on the basis of average rainfall per year in Jaipur city is as follows:-

Average rainfall per annum = 676mm (0.6m)

Let area of roof = 100 sq. meter

Volume of water collected = $100 \times 0.6 = 60$ cumecs
 = 60,000 litres

Evaporation loses = 0.80

Coefficient of roof catchment = 0.85

Water collected after loses = $60,000 \times 0.80 \times 0.85$
 = 40,800 litres

This water is collected from a 100 sq. meter rooftop which is enough for 10 persons throughout the year for drinking purposes. The average consumption of water per person per day is 135 liters. Thus tanks of 50-80 liters per person per day capacity are mandatory in residential societies and industries of Jaipur city.

B. COST ANALYSIS

Cost of a Rainwater harvesting system designed as an integrated component of a new construction project is considered very less. Cost of designing a rain water harvesting system in already existed building is high because it needs extra efforts in components of building such as Roofs and Gutters. For minimizing the cost the storage capacity is to be maximized and water use through conservation is to be minimized and reuse factors which we have to keep in mind while construction.

The cost of a rainwater system can be minimized by careful planning and designing of system. Water harvesting to recharge the groundwater increases the availability of groundwater at an specific place and time and thus assures a

fix and easy access to groundwater. To minimize groundwater pollution and to enhance the quality of groundwater through dilution when recharged to groundwater thereby providing good quality water, which should be soft and has fewer amounts of minerals.

IV. CONCLUSION

In scientific terms, water harvesting refers to collection and storage of rainwater and also other activities such as harvesting surface and groundwater for domestic use, prevention of water losses through evaporation of surface water and seepage and all other hydrological studies and engineering creations, which helps conservation and efficient use of the limited water endowment of physiographic unit known as watershed. It is no denying that sustaining and recharging the groundwater along with proper use of the limited fresh water resources is the main need of our country. If some important measures are not taken up immediately then we will face a crisis due which survival of living being becomes critical. Prominent management of water resources and education about proper utilization of water resources along with measures of recharging and maintaining the quality of water is much needed in current scenario.

One of the most effective steps towards this goal would be acknowledging the importance of rainwater harvesting. This should not only emphasis rooftop rainwater harvesting through rooftops but also storm water harvesting systems. Storm water is not acknowledged yet as a better alternative over rooftop water harvesting. One of the major troubles in storm water harvesting is the backward condition of storm water drain systems in India. A planned approach is hence needed for completely utilizing the potential of rainwater to adequately meet our water requirements. Hence, an same and positive emphasis is must in developing both the types of water harvesting systems. We have to catch water where ever it falls in the every possible ways we have.

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