ANNEXURE 5

RAINWATER HARVESTING

Eco-housing Assessment Criteria - Version II

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1. INTRODUCTION

Rainwater harvesting is a way to capture water when it rains, and either store that water above ground or recharge it underground for later use. Rainwater harvesting is useful for supplementing water needs locally, recharging bore wells and reducing dependence on external sources of water.

To plan the appropriate rainwater harvesting mechanisms, study site features such as incident rainfall, subsurface strata and their storage characteristics, and design suitable storage or recharge structures accordingly.

Rainwater Harvesting has the following advantages and benefits

- Helps to conserve ground water
- Allows use of rainwater for potable and non potable purposes
- Inexpensive and simple technology
- Saves money and energy
- Minimizes urban flooding

2. ESTIMATION OF RAIN WATER HARVESTING POTENTIAL

The total amount of water that is received in the form of rainfall over an area is called the rainwater endowment of that area. Out of this, the amount that can be effectively harvested is called the water harvesting potential.

The example below illustrates the rain water harvesting potential for a roof area of 100 m^2 in Delhi[1]

Area of the Catchment (A) = 100 m^2

Average Annual Rainfall (R) = 611 mm (0.61m)

Run-off Coefficient[2] (C) = 0.85

Therefore, the annual water harvesting potential

= A x R x C

=100 x 0.6 x 0.85

= 51 m^3

1 A Water Harvesting Manual for Urban Areas, Case studies from Delhi, © 2000, Centre for Science and Environment

[2] Run off coefficient is the factor which accounts for the fact that all the rainwater falling on a catchment cannot be collected. Some rainfall will be lost from the catchment by evaporation and retention on the surface itself. Refer table 1 for run-off coefficients of different surfaces.

***Table 1** – Run-off Coefficients of different surfaces*

Surface type	**Runoff coefficient**
Roofs conventional	0.70 to 0.80
Roofs inclined	0.85 to 0.95
Concrete/Kota Paving	0.60 to 0.70
Gravel	0.50 to 0.60
Brick Paving	0.75
Vegetation	
1%–3%	0.20
3%–10%	0.15
> 10% (more the vegetation cover – less the runoff coefficient)	0.10
Turf slopes	
0%–1%	0.25
1%–3%	0.35
3%–10%	0.40
> 10%	0.45

3. METHODOLOGY FOR RAINWATER HARVESTING

At a broad level, there are two methodologies which are followed for harvesting rainwater

1. Harvesting for direct storage and use
2. Harvesting for indirect use through ground water recharge

The above two methodologies have been described in brief in sections 3.1 and 3.2 below.

3.1 Harvesting for direct storage and use

When rainwater is harvested for direct storage and use, the rain water is stored in tanks after some priliminary filtering. Most often it is used for non-potable purposes. If it is to be used for drinking purpose, then more extensive filtering needs to be done.

A first flush device must always be installed to ensure that runoff from the first spell of rain does not enter the system. This needs to be done since the first spell of rain carries with it a relatively larger amount of pollutants from the air and the catchment surface. The first-flush device can be a simple valve that diverts the first spell of rain away from the storage tank.

Generally, run off from only paved surfaces are used for storing, since it is relatively free of bacteriological contamination.

Figure 1. *Roof Top Rain Water Harvesting for direct storage and use (Non Potable use)*

The storage tank capacity has to be designed taking into account the rainwater harvesting potential, water requirement of the population that it serves, the duration of the dry months , space availability and economic feasibility.

As a general thumb rule, the volume of the storage tank can be designed using the following formula [3]

$$V = (T \times N \times Q) + Et$$

Where,

V= volume of the tank (litres)

T= length of the dry season (days)

N= number of people using the tank

Q= consumption per capita per day (litres)

Et= evaporation loss during dry period (which may be ignored in case of closed storage tanks)

[3] Ministry of Rural Development, GOI, 2004

3.2 Harvesting for indirect use through ground water recharge

When rainwater harvesting is done for ground water recharge, the connection between ground water and surface water is made through conduits, which are broad at their mouth and enclosed by a brick tank at ground.

First, the water is collected into the tank, which is filled with porous media like pebbles, boulders or brick bats below the ground level, which filters the water as it passes through it. The filtered water then reaches the slotted conduits through which it recharges the ground water (Refer **Fig.2**).

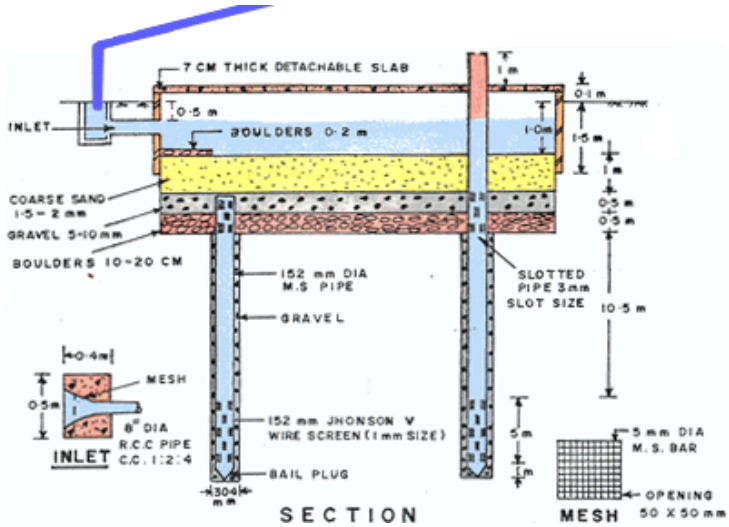

Figure 2. *Rain water harvesting for ground water recharge using a trench with recharge well, Source - Central Ground Water Board, www.cgwb.gov.in*

The design of the rainwater harvesting system for recharge of ground water is dependent on the run -off coefficient of the ground surface and on the rate of recharge of the ground. Since the rate of recharge may not be comparable with the run-off coefficient, the capacity of the tank/trench should be enough to retain the runoff occurring from conditions of peak rainfall intensity.

However, since accurate recharge rates are not available without detailed hydro-geological studies, the rates have to be assumed. Generally, the recharge tank is designed to retain run-off from at least 15 minutes rainfall of peak intensity.

The example below illustrates the design of a recharge tank[4]

Area of the Catchment (A) = 100 m^2

Peak Rainfall in 15 minutes (r) = 25 mm (0.25m)

Run-off Coefficient (C) = 0.85

Voids Ratio[5] (D) = 0.5 (assumed)

Required Capacity of recharge tank

= (A x r x C)/ D

= (100 x 0.025 x 0.85)/0.5

= 4.25 m^3 (4,250 litres)

4. PRECAUTIONS TO BE TAKEN DURING HARVESTING RAINWATER

- Adopt measures and precautions as per given by Central Ground Water Board (CGWB)
- Operation and maintenance - Cleaning at the beginning of summer and winter rainfalls and filtering of foreign material through appropriate measures
- Filtering and distribution system -Filtration is essential to prevent entry of contaminants. In case of recharge trench/shaft, preferred height of the distribution line should be one foot above the bottom

5. REFERENCES, WEB LINKS AND RESOURCES ON RAIN WATER HARVESTING

1. A Water Harvesting Manual for Urban Areas, Case studies from Delhi, © 2000, Centre for Science and Environment
2. www.tide-india.org
3. www.rainwaterharvesting.org
4. www.rainwaterclub.org
5. www.indiawaterportal.org
6. www.cgwb.gov.in/download.htm
7. www.cseindia.org

[4] A Water Harvesting Manual for Urban Areas, Case studies from Delhi, © 2000, Centre for Science and Environment

[5] Voids Ratio – The water holding capacity of a recharge trench is less than its gross volume, because it is filled with porous material. A factor of loose density(voids ratio) of the media has to be applied to the equation