# Experimental Study on Rain Water Harvesting in JIT, MBA Block

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***Abstract:*** **Rain water harvesting is a suitable technique for water conservation for future motive, moreover it allows to recharge the ground water. Rainwater harvesting is an historical exercise being carried out through many Nations for the motive of water. Nowadays international populace is will increase and worrying water is greater for industries enlargement of agriculture choppy distribution rainfall it outcomes on water call for. JIT, MBA Block Davanagere placed in Karnataka nation of India, rain water harvesting is handiest the manner to solve the water difficult it additionally allows to enhance the great and amount of the water. out of the viable catchment areas, the constructing turned into specific because the viable catchment region for rainwater harvesting. RWH device can solve the water shortage hassle throughout non-monsoon season through storing a water. This paper opinions the approach of designing rainwater harvesting device, boom the water deliver for lawn and additionally assist in synthetic recharge of floor water as a result inspiring each floor and floor water resource.**

***Keyword: Roof rainwater harvesting, ground water recharge, water scarcity in monsoon.***

## I. INTRODUCTION

The manner of gathering and storing rainwater in medical and managed way for destiny use is known as rain water harvesting. Ground water is getting polluted, Rain water is a relatively smooth and absolutely loose supply of water. It lowers the supply cost, reduces flood flows. It is used in the phase of insufficient water resources. It meets the raising demand of water needs and the water can be stored and it can be used for the irrigation purpose. And it reduces the water invoice in city areas, the harvesting rain aquatic is active for maintainable water saving machine for each rural and concrete region.

The most of the earth surface covered 71% of water, the water available on earth is 97% in that saline water 2%, and 1% of fresh water available from ice and glaciers. Now growing hobby withinside the low value alternative-typically refferred to as 'Rain Water Harvesting' (RWH)

## II. MATERIALS, FACILITIES AND METHODOLOGY

The materials and facilities used for rain water harvesting are;

1. Catchments

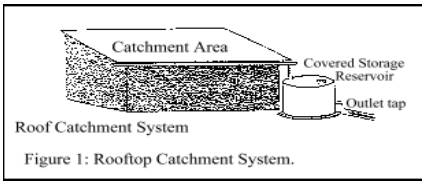
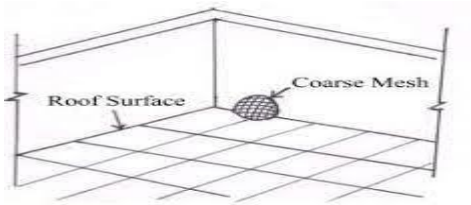
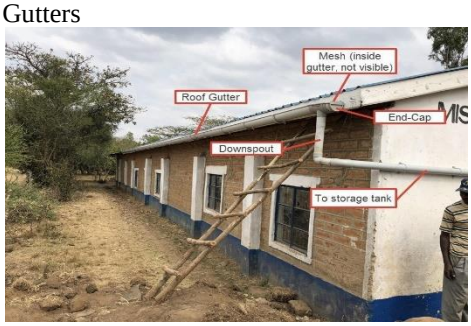



Figure 1: Rooftop Catchment System.

2. Coarse mesh




3. Gutters




4. Catchment


5. Filters


6. Storage facility


## III. METHODOLOGY

The methodology that will be followed for the economic social as well as long term benefits of rainwater harvesting in the JIT, MBA block Davanagere as followed


Fig 1: Study area of Jain Institute of Technology, MBA Block Davanagere
(Source: www.googlemap.com)

1: Design of the site suitability map
2: The areas of interest
i.Rainfall data collection
Statement showing year and annual rainfall

Table 1. Rainfall data collected

| Year | Davangere |
|---|---|
| Normal rain fall (mm) | 698 |
| 2010 | 805 |
| 2011 | 465 |
| 2012 | 483 |
| 2013 | 679 |
| 2014 | 937 |
| 2015 | 659 |
| 2016 | 504 |
| 2017 | 855 |
| 2018 | 605 |
| 2019 | 645 |
| 2020 | 907 |

**Calculation of catchment area**

The roof pinnacle floor region is not anything however the catchment region which gets rainfall. Catchment area of MBA block building is measured. This size changed into completed manually with the assist of "Measuring tape" that is handiest approach recognised as "Tape survey". Before the usage of the tape, changed into checked for 0 mistakes and additionally period of the tape changed into additionally cautiously checked to its accuracy. Those locations which region now no longer available to land, measured through the usage of the ruler from device container of google earth. Roof catchment capacity = annual rainfall(mm)*roof surface area(mm).

**Analysis for selection of catchment**

**Hydrological analysis**

The overall quantity of water this is acquired from rainfall over a place is known as the rain water legacy of that area. Volume of water [$m^3$] =Area of catchment[$m^2$] *Amount of rainfall[mm]*coefficient runoff

**Coefficient runoff:**

Coefficient runoff debts for losses due to the various reason for example spillage, leakage, infiltration, catchment ground wetting and evaporation, as a manner to all make contributions to decreasing the amount of runoff.

Runoff coefficient of different surfaces:

Table 2. runoff co-efficient for different surfaces

| TYPE OF SURFACE | RF COEFFICIENT |
|---|---|
| Roof inclines | 0.95-0.85 |
| Roof conventional | 0.8-0.70 |
| Brick paving | 0.8 |
| Gravel | 0.7-0.5 |
| Concrete/ kota paving | 0.7-0.6 |

Table 3. Run off co-efficient for different types of area

| TYPE OF AREA | RF COEFFICIENT (K) |
|---|---|
| Residential | 0.5-0.3 |
| Road surfaces | 0.8-0.9 |
| Commercial and industrial | 0.9 |
| Parks and farms | 0.03-0.05 |
| Asphalt/concrete paving | 0.9 |
| Forests | 0.2-0.5 |

a) Calculation of discharge

To find the pipe diameter for rainwater down be directed to calculate first discharge.

$$Q = A \times I \times C \quad (1)$$

Where,
Q= Rain fall discharge from roofs ($m^3/s$)
C= The ratio taken for runoff co efficient is 0.7 for this case
I= Rain off intensity that is 20mm/hr.
A= Catchment area (997.45)
Q= C x I x A
Q= 0.7 x 20/3600000 x 997.45
Q= 0.0002660237 $m^3/s$
Volume of water received ($m^3$) = Area of catchment ($m^2$) x Amount of rainfall (mm)x runoff co-efficient
Amount of rainfall
805+465+483+679+937+659+504+855+605+645+907/11
V= 997.45 x 0.6858
V = 478.835

b) Calculation of rainwater pipes to be installed.

Consider rainwater pipe diameter 100 mm.

Formulae used: - Q=AIC

$$= n \times d^2 \times v \times \pi/4$$

(2)

Where;
Q = discharge.
I= rainfall intensity.
A= Area
N= minimum pipes to be provide

D= diameter of rainwater pipe
V= Velocity of water getting into the flat 0 – 2% slope so;
V= 0.1m/s so, no. of pipes is calculated as;
$N = Q / (0.785d^2x0.1) = 3.389$
Main Building
$n=0.002660237 / (0.785\times0.1^2\times0.1) = 3.389$
For its convenience approximate no. of pipes installed = 15pipes
Calculate the diameter of the discharge pipe:
The Newton's regulation of movement taking water to waft beneath Neath the motion of gravity simplest with an acceleration of 9.81$m^2$/sec.
As it is known $U^2+2AS=V^2$ (3)
Where; V= Velocity of water entering the horizontal discharge
pipe = ?
U = Velocity in which Rainwater enters in R.W.P.=0.15m/sec.
S= Elevation building = 11m.
a = Acceleration due to gravity.
g = 9.81$m^2$/sec
we get equation,
V= 14.69 m/sec.
Recognise to design the Discharge pipe for worse condition.
Q = 0.002660237 $m^3$ /sec.
velocity of water = 3.389 m/sec.
Therefore $\pi/4\times d^2xV=Q$ we get the value;
D= 31.6mm which will no accessible in standard sizes.
100mm diameter pipes we provide.

**Design of the of storage tank**

The amount of water saved in a harvesting gadget relies upon on length of the catchment region and the dimensions of the garage tanks.
Basic Data

- Annual average rainfall
- Catchment size
- Requirements of drinking water

Calculate the maximum amount of rain fall harvested from roof top.
Annual Rf 2014 = 937+989+916+981+784+/5 = 921.4
Area of roof top = 997.45
Average annual rain fall =921.4mm
Run off Co- efficient for concrete surface (typical case) = 0.85 Co- efficient for evaporation, spillage and first flush etc. = 0.80 annual water Flush etc. annual water harvesting potential from
997.45sqm roof top = {Area of rooftop x annual rain fall in meter x Runoff co-efficient x Constant co - efficient}
= 977.45 x0.9214 x 0.85 x 0.80 = 612.42cum = 612,423 litters
The ability tank must be designed for dry length. Among the length of consecutive wet season. 245 days has been considered in dry in season monsoon extending over 4 months.
Mechanical teaching staff = 13
Total no. of scholar = 160
Non-teaching staff = 10
MBA teaching staff = 07
Total no. of scholar = 120
Total = 310
Drinking water requirement for scholar and staff for dry season 245 x 310 x 5 = 75,955 l
The tank should be built 20% larger than required for its safety i.e. 91146 lts = (1.2 x 75955)
This tank can meet garden or any construction purpose water requirement of a scholar and staff for the dry period.

**Design parameters of settle tank**

Settlement tanks to provide remove silt and different floating waste impurities form.
agreement tank like a regular field having provision for in go with the drift, out go with the drift and over go with the drift. Settlement tank could have an unpaved backside floor to permit status water to percolate into the soil.
For designing the optimal potential of tank following factors need to be considered:

a. Catchment area size
b. Rainfall intensity
c. Recharge rate

The following data is available
Roof top catchment surface area (A) = 997.45 sqm
High rainfall in 15 min(r) = 25 m
co- efficient runoff(C) = 0.85
The capacity of tank = A x r x c = 997.45 x 0.025 x 0.85 = 21.19 cum 21,195 lts.

## IV. CONCLUSION

This observe turned into aimed for designing and amassing a rooftop rainwater harvesting shape in JIT, MBA block campus. This technique will assist in synthetic recharge of floor water and enjoyable water shortage conditions. The MBA block constructing turned into decided on as the specified catchment vicinity for rain water harvesting thinking about the water call for in campus and the deliver. Further unique elements of RWH machine turned into designed primarily based totally on general guidelines. It turned into determined from the evaluation that implementation of RWH in JIT campus can remedy the water shortage troubles at some stage in non-monsoon season. This inventiveness can boom the water deliver for production work, gardening and will also assist in synthetic recharge of floor water as a result enriching each the floor and the floor water resources.

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