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Rooftop Rainwater Harvesting System at MPCOE Campus

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Abstract: ***Water scarcity is serious problem throughout the world for both urban and rural community. Rainwater harvesting is defined as process of augmenting the natural infiltration of rainwater or surface water into the ground by some artificial methods. 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 recharge pit etc. This method is less expensive and very effective and if implemented properly helps in augmenting the ground water level of the area. The methods of rooftop rainwater harvesting are recharge pit, recharge trenches, storage tanks, abandoned dug wells, bore well. The main source of water is rain and if this rain water is agglomerated and harvested, the scarcity of water in water scarce region can be minimizedeven to the extent of elimination. One of the major panaceas in water scarce area where there is inadequate groundwater supply in terms of quantity and quality can be resolve by the technique of rain water harvesting. In urban areas, rain water available from rooftop ofbuildings and paved road during monsoon goes as a waste. This water can be stored in tank and can be used directly or indirectly by diverting to treatment plant through various ground water tapping arrangements and catchments which in turn can be utilized at the time of need.***

Keywords: RWH, Survey, Catchment, Filter, Recharged

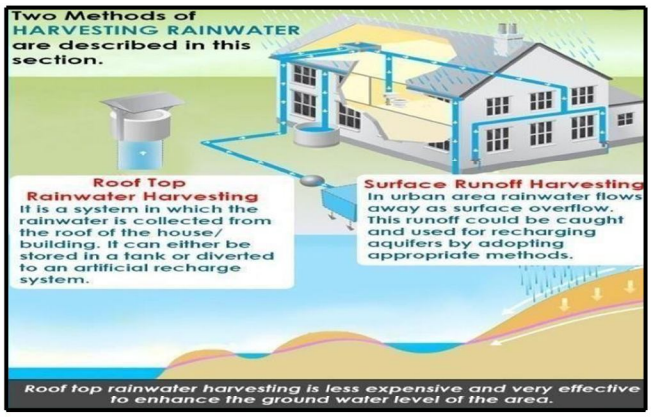
I. INTRODUCTION

Rainwater harvesting (RWH) is the collection andstorage of rain, rather than allowing it to run off. Rainwater is collected from a roof-like surface and redirected to a tank, cistern, deep pit (well, shaft, or borehole), aquifer or a reservoir withpercolation, so that it seeps down and restores the ground water. Dew and fog can also be collected with nets or other tools. Rainwater harvesting differs from storm water harvesting as the runoff is typically collected from roofs and othersurfaces for storage and subsequent reuse. Its usesinclude watering gardens, livestock irrigation domestic use with proper treatment, and domesticheating. The harvested water can also be committed to longer-term storage or groundwater recharge Rainwater harvesting is one of the simplest and oldest methods of self-supply of water for households having been used in South Asia and other countries for many thousands of years.

A Methods of Rainwater Harvesting

Broadly there are two types of RWH

1) Surface run off harvesting
2) Roof top rain water harvesting



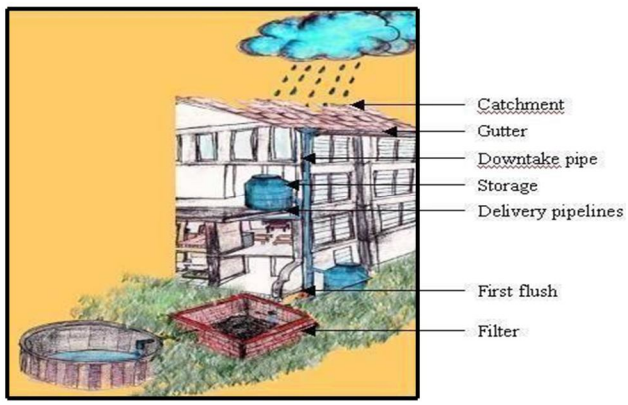
B. Rooftop Rain Water Harvesting

The rain water which is flowing off from rooftops ofresidential, institutional, industrial and various other buildings is collected and stored for further use is termed as rooftop rain water harvesting. RooftopRain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks. The Main Objective of rooftop rain water harvesting is to make water available for future use. The use may be temporary, seasonal or permanent except in years of exceptionally low rainfall. The rain water from the roof may also be used for recharging the ground water through nearby water sources such as open dug wells or bore wells. In terms of economic and human welfare it has a crucial role to play. Rainwater in many cases is most reliable, easiest to access, and least polluted source. It can be collected and controlled by the individual household or community as it is not open to abuse by other users.

Some of the following advantages are

1) Provides self-sufficiency to your water supply.
2) Cost investment for pumping of ground water isreduced.
3) Supply better and safer quality of water.
4) Improves the quality of ground water throughdilution when recharged to groundwater.
5) Soil erosion can be eliminated and flooding inlow lying area is avoided.
6) Comparatively less expensive.
7) Thismethod is simple to adopt for allindividuals.
8) It is easy to construct, operate and maintain.

C. Components of Rainwater Harvesting



1) *Catchment:* The surface that receives rainfall directly is the catchment of rainwater harvesting system. It may be a terrace, courtyard, or paved or unpaved open ground. The terrace may be a flat RCC/stone roof or sloping roof. Therefore the catchment is the area, which actually contributes rainwater to the harvesting system.
2) *Transportation:* Rainwater from the rooftop should be carried through down to take water pipes or drains to the storage/harvesting system. Water pipes should be UV resistant (ISI HDPE/PVC pipes) of the required capacity. Water from sloping roofs could be caught through gutters and down take the pipe. At terraces, the mouth of eachdrain should have wire mesh to restrict floating material.
3) *First Flush:* The first flush is a device used to flushoff the water received in the first shower. The firstshower of rains needs to be flushed-off to avoid contaminating storable/rechargeable water by the probable contaminants of the atmosphere and the catchment roof. It will also help in cleaning of silt and other material deposited on the roof duringdry seasons. Provisions of first rain separators should be made at the outlet of each drain pipe.
4) *Filter:* There is always some skepticism regarding Roof Top Rainwater harvesting since doubts are raised that rainwater may contaminate groundwater. There is a remote possibility of this fear coming true if the proper filter mechanism is not adopted. Secondly, all care must be taken to see that underground sewer drains are not punctured, and no leakage is taking place in close vicinity. Filters are used for the treatment of waterto effectively remove turbidity, color, and microorganisms. After the first

flushing of rainfall, water should pass through filters. A gravel, sand, and 'netlon' mesh filter is designed and placed on top of the storage tank. This filter isvery important in keeping the rainwater in thestorage tank clean. It removes silt, dust, leaves, and other organic matter from entering the storagetank. The filter media should be cleaned daily after every rainfall event. Clogged filters prevent rainwater from easily entering the storage tank and the filter may overflow. The sand or gravel media should be taken out and washed before it is replaced in the filter.

5) *Storage Structures:* Storage structures are provided to store the filtered rain water for various activities. This stored rain water can also be used for recharging groundwater.

D. Aim

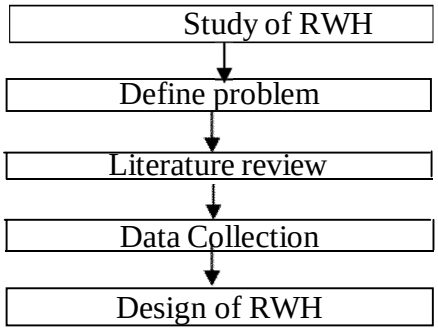
Design of Rainwater Harvesting System at MPCOE Campus

E. Objectives

1) To design roof top of rain water harvestin

2) To meet increase in water demands

II. METHODOLOGY



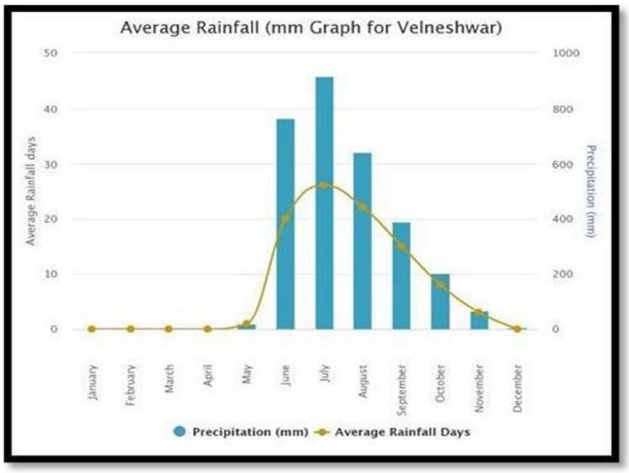
A. Study Area

Location: Vidya Prasarak Mandal Maharshi Parshuram College Of Engineering, Veneshwar Latitude –17^{0}23'NLongitude 73^{0}12'0" E

Google Map of MPCOE Campus

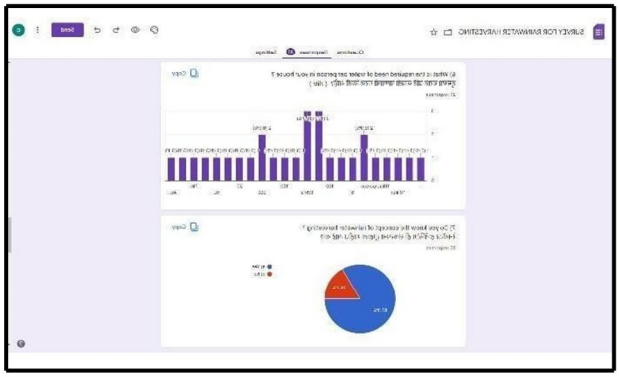
1) Rainfall Data of Velneshwar Area

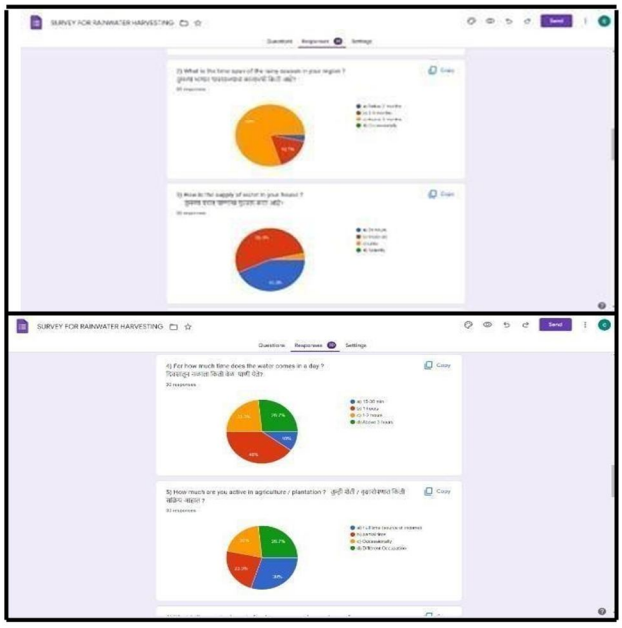
Rainfall Data of Velneshwar since 2010 to October2022.



Average Rainfall (mm Graph for Velneshwar)

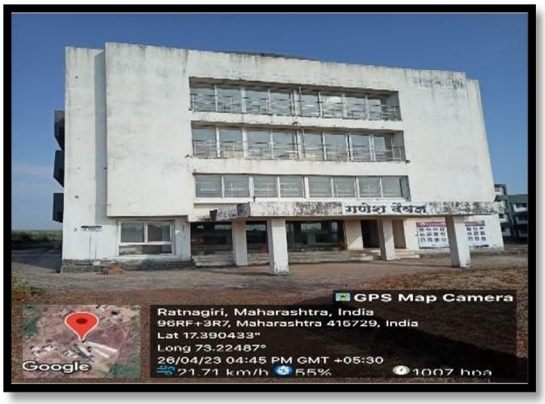
2) Survey Using Google Form





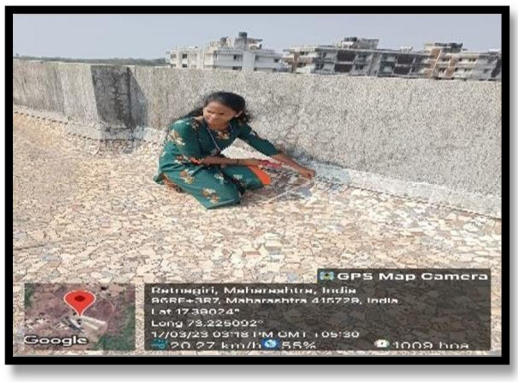
3) Roof Top Measurement

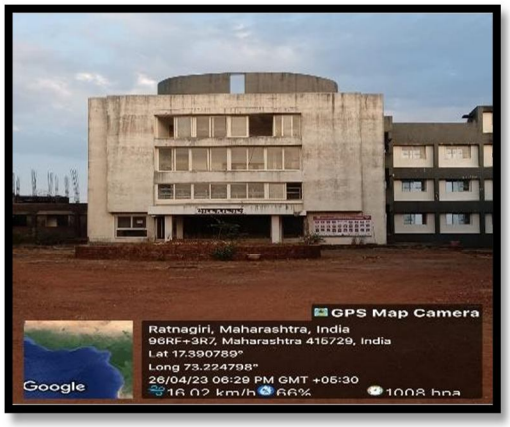
Building 1 – Ganesh Daivadnya BuildingLength = 82.30m
Width = 15 m



Building 2 – Shripati BuildingLength = 82.30m
Width = 15 m

Building 3 – Bhaskaracharya BuildingLength = 82 m
Width = 15.80 m





Building 4 – Girls and Boys ostelNo. of building = 5
Length = 24 m Width = 8.40 m

Building 5 – Teacher QuarterNo. of building = 3
Length = 24.50 mWidth = 11 m

B. Calculation

1) Catchment area of Ganesh Daivadnya building 1

= length x width
= 133.30 x 15.80
= 2106.14 m^2

2) Catchment area of Shripati building 2

= length x width
= 136.8 x 15.80
= 2161.44 m^2

3) Catchment area of teacher quarter

= length x width
= 24.50 x 11
= 269.5 m^2

4) Catchment area of hostel building

= length x width
= 24 x 8.40
= 201.6 m^2

5) Catchment area of hostel building
= length x width
= 82 x 15.80
= 1295.6 m^2

TOTAL AREA = 2106.14+2161.44+1295.6+(3 X 269.5) + (5 X 201.6)

= 7379.68 m^2

Design calculations

AREA = 7379.68 m^2

Discharge = C x I (annual rainfall) x A
= 0.7 X 900X10^{-3} X 7379.68
= 4649.19 m^3/dayVolume = Q X T
= 4649.19 X 1000

Volume = 4949190 litres

Approximate volume = 50,00,000 litre

Estimate Of Rain Water Harvesting

Sr.no	Description	Size	Qty	Rate per Qty	Amount
1	Earthwork excavation for foundation of building,water supply, sanitary lines and electrical conduits either inpits or intrenches 1.5m and above in width, in hard soilnot exceeding 1.5 m. indepth including dressing thebottom andsides of pitsand trenches, stacking theexcavated soil clearfrom edges of excavation with lead upto 50 m.after breaking ofclods complete asper specifications	5297.2cubic feet			Rs 32,000/
2	Aggregate(coarse)	372 cubicfeet		Rs68 Per cubic feet	Rs 25,296/
3	Sand (fine)	186 cubicfeet		Rs53 Per cubic feet	Rs 10,788/
4	Cement	50 kg	124 nos’	Rs 360	Rs 44,640/
5	Steel (primarysteel)		348 6 kg		Rs 1,60,358/
Total					Rs 2,73,082/

III. CALCULATION

1) This project deals with all aspects oferadicating the water scarcity problem in MPCOE campus by implementing ancient old technique Rain Water Harvesting. The rain water collected from the roof is of sufficient quantity and thus, for this quantity the underground water tank capacity has been calculated for which the design can be made.

2) RCC tank is constructed underground in suitable area, so that the land about the above can be beneficial for other purposes. The tankof capacity 100000 litres is to be constructed inthe campus.

3) Hence, it is finally concluded that adopting the Rain Water Harvesting in the campus ofMPCOE will be the best approach towards harvesting rainwater and decrease the overdependence on the ground water**.**

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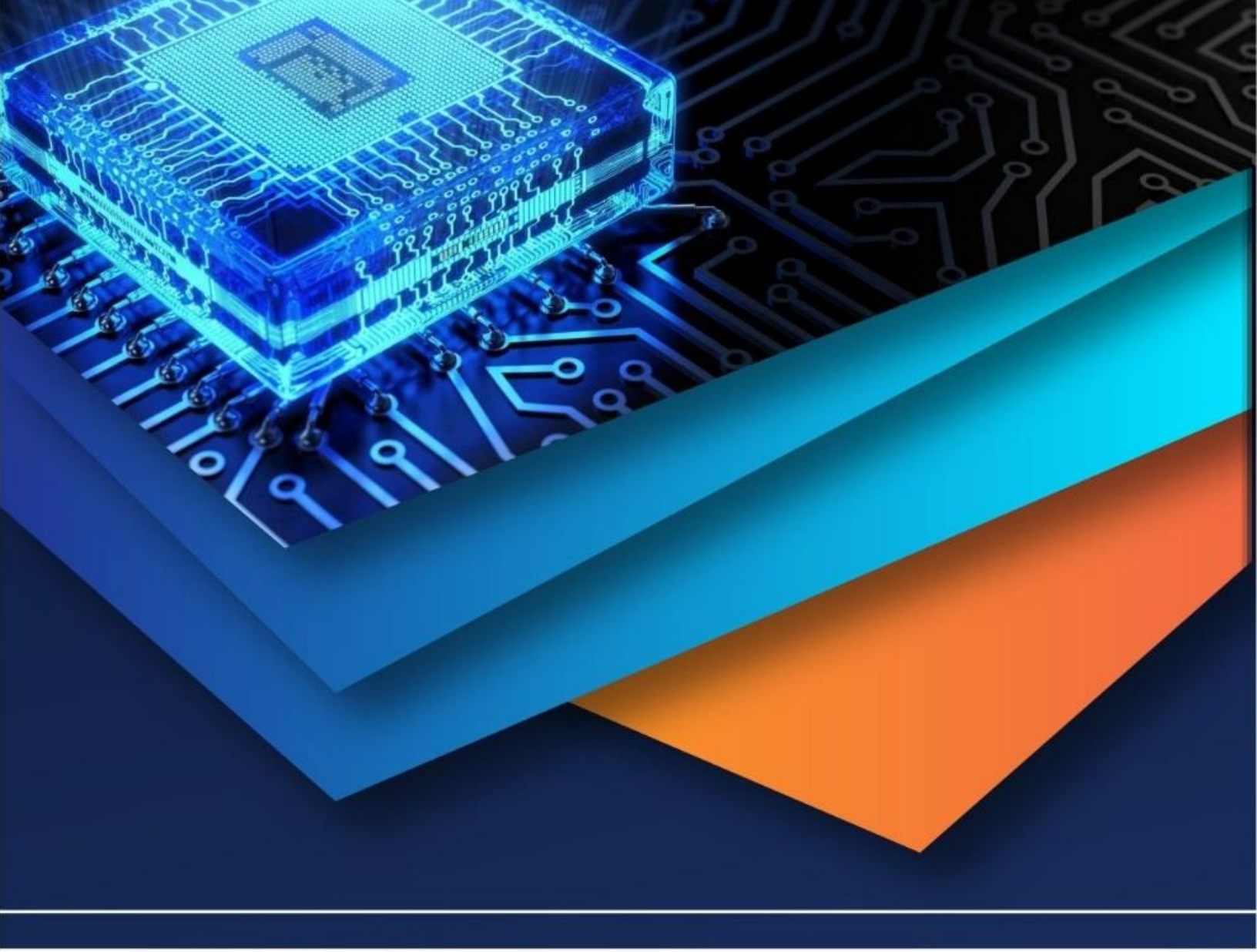

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