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Rain Water Harvesting Potential of Block B of MIET College, Jammu

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Abstract—— There has been continuously rising of gap between water demand and supply. This has led to increased emphasis on the optimal management of the available water resources. Management and planning of water resources is need of hour for long term sustainable water resource development throughout globe. Hence rainwater harvesting is the best engineering solution for urban area regarding water conservation especially in water scarcity areas. In order to apply concept of rain water harvesting, a part of the MIET Jammu college campus is taken as study area to evaluate rainwater potential.

Keywords— Rain water, harvesting,Runoff

I. INTRODUCTION

Water is an important Resource for survival of human for different purposes. However we are continuously facing scarcity of water throughout globe in our daily life. The water needs are on a rapidly and continuously rise but less attention is paid for its conservation and utilization of water. Rainwater is important source of water and if it is efficiently harvest, we can reduce water scarcity to a very great extent. Rain water is bacteriologically pure, free from organic matter and soft in nature. So rainwater harvesting (RWH) is an effective alternative for conservation of water. The term refers to storing and collecting run off rainwater and used for various specific purposes. An attempt of calculating Water demand of one specific block, BLOCK B, of Model Institute of Engineering and Technology, Jammu has been done in this study.

II. OBJECTIVES

Following are the main objectives of our work:-

1) Analysis of total strength of people in the block.
2) Analysis of availability of water resources in the block.
3) Computation of water demand of the block.
4) Computation of rooftop area of the block.
5) Observation of average rainfall in the area.
6) Calculation of runoff
7) Interpretation of the results obtained.

III. DESCRIPTION OF STUDY AREA (BLOCK B)

Model Institute of Engineering and Technology is a leading technical institution located in Jammu, Jammu and Kashmir, India. College campus is located in kotbalwal area of jammu city. The total calculated area of the rooftop of block B is 1172.281 m^2The study makes an attempt to estimate the quantity of rainwater harvested to enable the same to be utilized for recharging the ground water level.

A. Population of Block B of MIET

Year	Population	Increase in population	Incremental increase
2016	210		
		29	
2017	239		66
		95	
2018	334		
Total		124	66
Average per year		$\bar{x} = 62$	$\bar{y} = 66$

B. Water Demand as per Standards:

Water demand is estimated by adopting the standards for various consumption units. Water is being utilized by people for various purposes such as drinking, sanitation, cleaning, gardening, fire accidents, etc.

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Year	Population $P_n = P_0 + n\bar{x} + \frac{n\cdot(n+1)}{2}\cdot\bar{y}$	Water Demand @ 10 lpcd (in lpd)
2018	334	3340
2019	462	4620
2020	656	6560
2021	916	9160
2022	1242	12420

Annual water demand = 3340 × 220 = 734800 litres/year = 734.800 m^3/year (for 2018)

C. Years with average rainfalls (in mm)

1990	1117.386
1991	596.427
1992	855.512
1993	600.342
1994	711.693
1995	1082.202
1996	1049.243

1997	1167.789
1998	618.065
1999	608.636
2000	558.578
2001	699.125
2002	605.702
2003	1030.000

2004	1098.900
2005	1112.400
2006	1235.800
2007	1294.100
2008	1339.400
2009	799.900
2010	1343.800

2011	1478.000
2012	1396.800
2013	1716.200
2014	1182.270
2015	1581.800
2016	1312.500
2017	1144.600

Therefore the annual average total depth of rainfall at the end of the year is 1028.470 mm.

IV. RUNOFF ESTIMATION

Computation of runoff volume is used to design recharge pits and storage volume. Amount of discharge coming from surface runoff can be computed by the following expression.

$Q = C \times I \times A$

Q = surface runoff in m^3/s

I = Intensity of rainfall in m/s

C = runoff co-efficient

A = catchment area

Runoff volume (m^3) = $C \times A \times$ *annual average depth*

From the above formula the volume of water received to harvest is (0.7 × 1172.281 × 1.028470) = 843.959 m^3 = 843959 litres

Where runoff coefficient for concrete (C)= 0.7

Also, I = Intensity of rainfall in m/s = (1.028470) ÷ (365 × 24 × 60 × 60) = 3.261257×10^{-8}

Thus, Q = surface runoff in m^3/s = $0.7 \times 3.261257 \times 10^{-8} \times 1172.281 = 2.676177 \times 10^{-5}$

V. CONCLUSION

The rain water harvesting is used to overcome the problems faced due to water scarcity and it is one of the cost effective measure as well. This approach computes the water potential of rainwater which is based upon the annual average rainfall ,catchment area characteristics. The water demand can be assessed by working out the catchment area water supply and the actual demand of water.

The results of this study are as follows:

- Average annual rainfall is 1028.470 mm.
- Total surface runoff is 843.959 m^3.
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From the above information it is concluded that surface runoff from rainwater is sufficient for the demand of population of block B of MIET, Jammu.

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