|| Volume 5 || Issue 5 || May 2020 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

DESIGN OF RAINWATER HARVESTING SYSTEM OF ADYPU CAMPUS

Divya Deepak[1], Rohit Hajare[2], Prashant Ughade[3], Shriram Somwashe[4]
Under Graduate Student. Dept. of Civil Engineering Dr. D Y Patil School of Engineering, Lohegaon, Pune[1,2,3,4]

Prof. Swapnil Bijwe[5]
Asst. Professor, Dr. D Y Patil School of Engineering, Lohegaon Pune, India[5]

Abstract: -In the present study, an attempt has been made to examine the present status of water requirement and proposed rooftop rainwater harvesting potential in the college campus. Building and campus of ADYPU campus located in Lohegaon, Pune and the average annual rainfall in the study area are 763 mm is taken under the present study. The proposed study is entirely based on primary data collected from fieldwork and secondary data such as Socio-Economic Review, District Statistical Abstract of Pune and various published and unpublished thesis, article books, etc. The per capita daily water requirement is calculated as number of person x 2 litres.

ADYPU campus comprises a total area of 100 acres and rooftop surface area of 18172 m2. The Campus serves an approximate population of about 10,000 including students, teaching and non-teaching staff, and daily visitors. The analysis revealed that 20,000 l/d water is required for drinking. At present college has already 15 water storage tanks of 10 lakh litres capacity and excess demand of water meet with recharge of bore well. Rooftop rainwater harvesting estimated is about 14170160 L. Thus the rooftop rainwater harvesting would be a solution for drinking and domestic water sustainability of college to some extent. Results obtained from the present study suggested that the rooftop rainwater harvesting method is more applicable in college campuses located in the drought-prone zone of Maharashtra which would enable to solve the problem of water scarcity up to a certain extent.

Keywords- *Rainwater harvesting, Rooftop rainwater harvesting, Sustainability.*

I INTRODUCTION

Water is one of the most important resources for the survival of human beings as much as food, air, etc are. But very little attention is given to its economical use and conservation of this precious resource. Due to the over-pumping of groundwater, the water table is going down abnormally and if the problem is not given a serious look, then the future generations may have to face severe scarcity of water. Rainfall is the prime source of water and if the rainwater is harvested, the scarcity of water can be eliminated altogether. This is an ideal solution to overcome water problems where surface water sources are insufficient and inadequate groundwater supply quantitatively and qualitatively. Rainwater harvesting is the technique through which rainwater is captured from the roof catchments and stored in reservoirs. Rooftop rainwater harvesting is essential for making water available for future use. This method is particularly important in drought-prone, hilly, urban, and coastal areas.

In fact, India and Maharashtra are blessed with adequate rainfall as a whole, yet there are large swathes of dry and drought-prone areas. In many places the quality of groundwater is not good. Some areas having quite even rainfall but there is also a problem of severe scarcity of drinking water. This is because we have rainfall in short spells of high intensity. Due to this intensity and short duration of heavy rain, most of the rain falling on the surface tends to flow away rapidly and leaving very little for the recharge of ground. Therefore, it is necessary for users to collect and store rainwater. Rainwater harvesting through rooftops is an optimistic method of water conservation and the Indian government has mounted this as a part of the watershed management program. Surface water is inadequate to meet our requirements hence we have to make use of groundwater. Due to the overuse of groundwater, the

underground water level has been declining in such areas rainwater harvesting is an ideal solution in the near future. Therefore, an attempt has been made here to examine the present status of water requirement and proposed rooftop rainwater harvesting potential at micro level.

The Study Region:

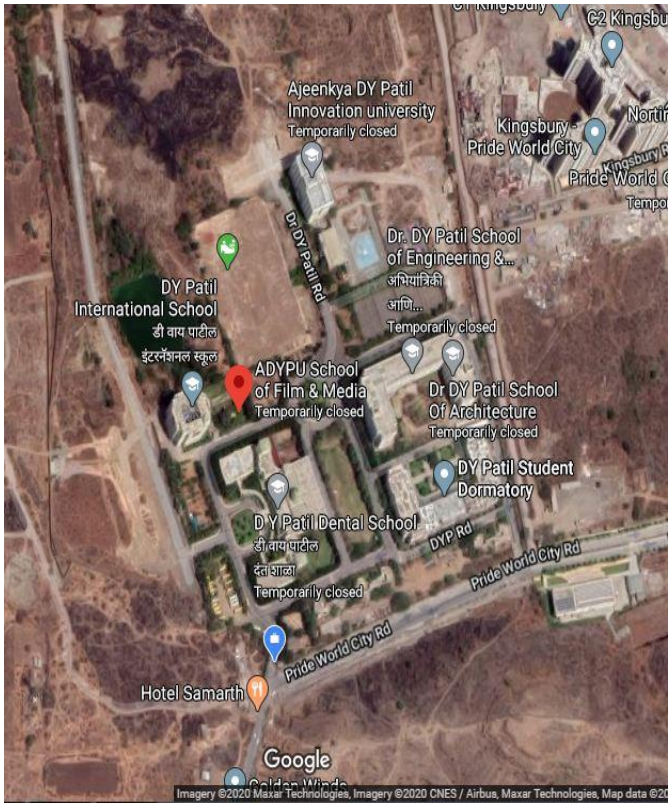

Figure 1: Location Map of ADYPU campus.

Building and campus of ADYPU located in Lohegaon of Pune district of Maharashtra have been taken for the present investigation. It lies between 18’ 35’ 50.6256” North latitude and 73’ 54’ 56.9484” East longitude. The average annual rainfall in the study area is 763mm.

Objectives:

1. To examine the present status of water requirement and enrich the ground water level of the campus.
2. To analyze the proposed rooftop rainwater harvesting potential in the college campus.

II DATABASE AND METHODOLOGY

The proposed study is entirely based on primary and secondary data. Primary data collected from field survey and secondary data collected from college records, Socio-Economic Review and District Statistical Abstract of Lohegaon, Pune. And also data has been collected from a various published thesis, articles, books, etc. Rooftop rainwater harvesting method is used in the present study. The per capita daily water requirement is calculated as number of persons x 2 liters. The daily, annual, and dry day’s water requirement has been calculated in liters. Runoff Coefficient and Annual rainwater harvesting potential (ARHP) of the study region is estimated by using the formula given by (Pecey, et.al; 1989).

Annual Rainwater Harvesting Potential (ARHP) = R x AC x RC

Where, R - Rainfall (in metre)

AC - Area of catchment (in square metre)

RC - Runoff coefficient

Figure 2: SOE and Arch Building

III RESULTS AND DISCUSSION

There are several estimates in the world regarding total water requirement for a human being and also for drinking purposes. According to the United States, it is estimated that 50 l/p/d drinking and domestic water is essential for rural communities in developing countries (Bansil, 1998). According to the World Health Organization, it is estimated that an average of 2.5-liter daily water intake per capita per day is required. According to the U.S. Environmental Protection Agency, average daily water intake 2.0 l/p/d is required.

National Academy of Sciences also estimated daily 2.0 litres water requirement per person. For the present investigation, it is assumed that an average water requirement is 2.0 l/p/d.

The total population of the college is about 10,000 including all students, teaching and non-teaching staff, and daily visitors. The analysis revealed that 20,000 liters water is required for daily and 7300000 liters for drinking purpose per annum. Estimated daily domestic water demand of the college is about 3 lakh liters per day and 109500000 litres per annum. Water required for vegetation is approximately 70000 to 90000 liters per day.

It is investigated that average 360000 litres daily and 131400000 litres annually, groundwater is extracted from 3 bore wells present inside the college campus for the purpose of drinking and domestic use. Drinking water demand is totally fulfilled through groundwater extraction. But, present investigation shows that total demand and supply gap is 40000L daily and 14600000L annually. This gets increased to a range of 50000L to 70000L per day during summer season, which leads to severe problem of water scarcity. College has fulfilled total water demand, especially domestic water demand, through water tankers during every summer season.

Table 1: Estimated water demand and supply gap of ADYPU Campus

Population of the College (Students + Staff + Guests)		**Estimated water requirement in litres (Drinking + Domestic)**		**Estimated ground water extracted in litres (through 3 bore wells)**		**Estimated water demand and supply gap in litres**	
Daily	**Annual**	**Daily**	**Annual**	**Daily**	**Annual**	**Daily**	**Annual**
1	2	3	4	5	6	5-3	6-4
10000	3650000	320000	116800000	280000	102200000	-40000	-14600000

Table 2: Building wise Design

Bldg No.	**Building Name**	**Rooftop Area in m^2**	**Annual Rooftop RWH Potential**		**Cost in Rs.**
			Cu. m.	litres	
1	SOE + SOET + Management	3721	2902.38	2902380	207100
2	Hostel + Canteen	3721	2902.38	2902380	207100
3	Dental School	3273	2552.94	2552940	196130
4	International School	2526	1970.28	1970280	193490
5	DYPDC Bldg-1	1936	1510.08	1510080	85890
6	DYPDC Bldg-2	2995	2336.1	2336100	173385
					1063095 + 300000 (Miscellaneous)
	Total	**18172**	**14170.160**	**14170160**	**1363095**

Figure 3: Dental School

IV CONCLUSION

Present study shows that the quantity of water available depends on the intensity of rainfall and the surface of the roof, and additional sources of water are always needed. For long periods of drought, it is necessary to store excessively large volumes of water. In areas with significant variations in the annual rainfall pattern, the matching of water supply and water demand may be difficult. However, the institution has a crucial role to play. Rainwater in many cases is the easiest way to access, most reliable, and least polluted source, especially in drought-prone areas or where the groundwater is saline. Rooftop rainwater harvesting is the only sustainable alternative for ensuring continued access to safe drinking water. Thus, the Rooftop rainwater harvesting would be a solution for drinking and domestic water sustainability of the college to some extent. Results obtained from the present study suggested that the Rooftop rainwater harvesting method is more applicable in the college campus which is located in drought-prone zones of Maharashtra that would enable to solve the problem of water scarcity to a certain extent.

REFERENCES

1. Pandurang D.Jankar, Maheshkumar M. Bhanuse, PG Student Department of Civil Engineering, Rajaram Bapu Institute of Technology Rajaramnagar, Islampur Dist Sangali.

2. Yashodhan Arvind Jagtap, MTECH Construction Management, MIT College of Management, Pune.

3. C.J.Khilare, S. N. Pawar Dahiwadi College, Dist Satara, Maharashtra.

4. Mohammad Sahil Choudhari, Suresh Savaram Choudhary, TECT Mumbai.

5. Dutta, B. N.R.C.C. Designs.

6. Athavale. R. N, Water Harvesting and Sustainable supply in India; Ravat Publication Jaipur.

7. Datar, R. (2006) Designing and implementing Rainwater Harvesting System for Campus.

8. Jyotiba. B. Gurav and D.G, Regulwar (2013)"Rainwater harvesting – Case Study, Sustainable Water Resources Development and Management, pp 179-183.

9. Ranjeet Kumar Sharma, Rainwater Harvesting at NIT Rourkela department of Civil Engineering, National Institute of Technology, Rourkela 2010.