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Surface Runoff Rainwater Harvesting

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Abstract :

Water consumption is likely to increase substantially in the future on account of rising population, economic growth, and social development. Rapid urbanization and population growth of Akurdi city, has necessitated thinking about the declination in ground water level as well as supply of sufficient quantity of water for future either for drinking purpose or other purposes. Nowadays, the world is full of surprises and could hardly predict what could happen in the future. Therefore, it is crucial to be well prepared at all time to face any emergency that might happen. So, having an alternative rainwater harvesting system would be very useful to the surroundings during the emergency and non-emergency situation. To achieve that, this study has been conducted to determine the surface runoff on the paved and unpaved area. The aim of this study is to utilize the surface runoff for the campus needs. In order to maintain adequate supplies for the anticipated growth and development in this campus area, additional water sources must be obtained. This study represents an attempt to determine the characteristics and parameters of surface runoff on the paved and unpaved area during the rainy season in the university-campus . In the present study, attempt has been made to propose a surface rainwater system to meet the water requirements in the college by treating the surface runoff water during the monsoon period efficiently by using proper engineering for the collection, storage and supply of water. The data for rainfall, groundwater depth, etc. is collected from the meteorological department and emphasis is been made for recharging ground aquifers by proposing suitable pits, trenches, etc.

1.INTRODUCTION

1.1 Explaination

Rainwater harvesting is the technology used for collecting and storing rainwater from rooftops, land surfaces or other types of catchment areas.Over the years, rising population, growing industrialization and expanding agriculture have pushed up the demand for water. Monsoon is still the main hope of our water .Water conservation has become the need of the day. Rainwater harvesting is a way to capture the rainwater at the time of downpour, store that water above the ground or charge the underground water and use it later. This happens in open areas as well as in congested cities through the installation of required equipment. The collection and storage of rainwater from run-off areas such as roofs and other surfaces has been practiced since ancient times in India.

1.2 Problem of Statement

Pimpri-Chinchwad is one of the fastest growing cities in India and thus the water demand is very high. The water sources are

limiting and the municipal corporation supply is also limited. Thus, water requirements such as for drinking can be fulfilled by the municipality but other requirements are quite high and depends on the groundwater reserves or from other places through transportation on which a lot of funds have to be spend. The ground water depth is also going deeper and deeper because of using groundwater reserves without recharging. Study is focused on utilizing the rainwater and recharging the ground reserves to face the water scarcity.

1.3 Studies carried out in India

Today, only 2.5 per cent of the entire world"s water is fresh, which is fit for human consumption, agriculture and industry. In several parts of the world, however, water is being used at a much faster rate than can be refilled by rainfall. In 2025, the per capita water availability in India will be reduced to 1500 cubic meters from 5000 in 1950[7]. The United Nations warns that this shortage of freshwater could be the most serious obstacle to producing enough food for a growing world population, reducing poverty and protecting the environment. Hence the water scarcity is going to be a critical problem if it is not treated now in its peanut stage. Contrasting figures of water scarcity in world between two timeline (1999 & 2025) are shown in the fig. 2 & fig 3. Some of the major city where rainwater harvesting has already implemented is Delhi (Centre for Science and Environment's (CSE) designs sixteen model projects in Delhi to setup rainwater harvesting structures in different colonies and institutions), Bangalore (Rainwater harvesting at Escorts Mahle-Goetze, Designed by S Vishwanath, Rainwater club, http://www.rainwaterharvesting.org/People/innovators-urban.htm#svis), Indore (Indore Municipal Corporation (IMC) has announced a rebate of 6 per cent on property tax for those who have implemented the rainwater harvesting work in their house/bungalow/building). Source: The above photographs was the result shown in the **website: http://www.rainwaterharvesting.org/crisis/Crisis_Scarcity.htm**

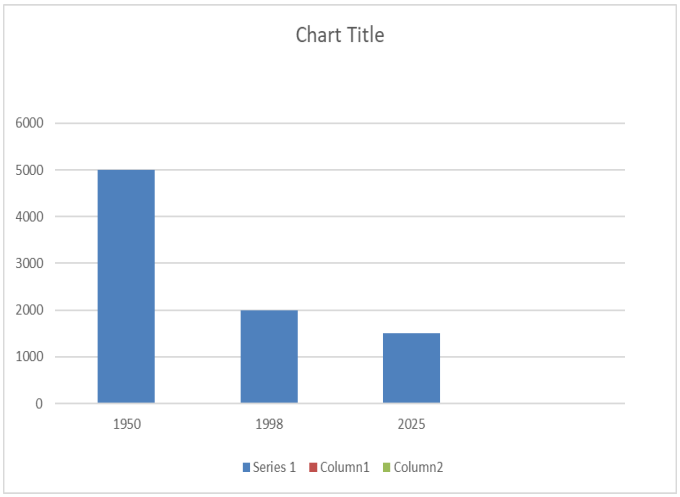


Figure 1.1 - Per capita water availability

2. Literature Review

2.1 General

This chapter reviews the literature relevant to the objective of the study, i.e., Rainwater harvesting system in the campus of Engineering Institute, DYPCOE Akurdi as well as the information on development of its components. A brief review on complete analysis & designing of the different component of this system has also been included. A discussion on the purpose of rainwater harvesting i.e. storing harvested water in tank after different available way of filtration and different component & ways of recharging underground aquifer for increasing the water table level. Rainwater harvesting is a yearlong ancient technique studied by many scientists for different purposes e.g. for storing the harvested water in some storage tank.

2.2 Guozhen, Z. H. A. N. G., Y. A. N. G. Yuanchao, L. I. U. Xiaodong, and Z. H. A. O. Weina. "Research and application of harvested rainwater in the villages and towns of China Loess Plateau region." ***Energy Procedia*** **5 (2011): 307-313.**In this paper, According to the quality characteristics of drinking water in China's western rural catchment area, they choose Qingyang City in Gansu Province as the typical demonstration region to study the construction technology, protection technology of the harvested rainwater source, the water treatment technology of harvested rainwater and the water supply safety technology; to form three technology systems of harvested rainwater source protection, construction and treatment; to set up technology regulations of harvested rainwater protection and pollution control in China northwest region.

2.3 Reitano, Raffaella. "Water harvesting and water collection systems in Mediterranean area. The case of Malta." ***Procedia Engineering*** **21 (2011): 81-88.** systems of water collection and water harvesting, developing appropriate solutions to meet the specific needs of their ancient and present-day inhabitants by using traditional knowledge, building skills, and local resources, leading to solutions that to different extents, fit into the existing environment. This research helps to understand the different approaches in each country, resulting from climatic, geographical, socio-economic, and cultural conditions, as well as those related to spatial planning and urban development. Malta's case can be seen as a particular approach to this problem, which has led to a new source of water harvesting for common use. Malta has always been characterized by underground and rainwater shortages due to the intense but short rainfalls

2.4 Julius, J. R., R. Angeline Prabhavathy, and G. Ravikumar. "Rainwater Harvesting (RWH)-A Review." ***International journal of Innovative research and Development*** **2, no. 5 (2013).** This paper reviews the methods, design of rainwater harvesting systems, and its impacts adopted in all parts of the world. As water harvesting is an ancient tradition and has been used for millennia in most dry lands of the world, many different techniques have been developed. Gitte and Pendke (2002) conducted a study on the water conservation practices, water table fluctuations and ground water recharge in watershed areas.

2.5 Zeleňáková, M., G. Markovič, D. Kaposztásová, and Z. Vranayová. "Rainwater management in compliance with sustainable design of buildings." ***Procedia Engineering*** **89 (2014): 1515-1521.**In this paper, Continuous growth of population and consequent growing need for drinking water is a global problem. Effective use of rainwater for toilet flushing, laundry, gardening or washing thus saving about 50% of drink water. Overall, urban drainage presents a classic set of modern environmental challenges: the need for cost-effective and socially acceptable technical improvements in existing systems, the need for assessment of the

impact of those systems, and the need to search for sustainable solutions. The paper describes comprehensive rainwater management approaches and contains an overview of the source control techniques as well as practical examples of rainwater use for non-potable purposes.

2.6 Yadav, Manisha, and Baldev Setia. "Conceptualization and Design of an Efficient Groundwater Recharge System for NIT Kurukshetra." ***Procedia Technology*** **25 (2016): 138-145.** NIT Kurukshetra is a large campus institute, Due to lack of an efficient drainage system, the campus turns into a system of pools at important locations. This accumulation of water for long durations creates an unhealthy environment for the inhabitants besides damaging the roads, pavement and foundation of buildings. Hence, keeping in view all the above problems and status of the campus, rainwater harvesting can be considered as one of the solutions for addressing the problem of accumulated rainwater in the NIT Kurukshetra. In this paper they have done detailed design of the components of rainwater harvesting through artificial recharge i.e. filter gallery, recharge well, recharge pit, inspection pit etc. are provided. It is expected that the result of the study if implemented will certainly fulfill the dual objective of addressing the menace of water logging in the campus besides enriching the groundwater aquifer.

3. Methodology

1) Topographical survey
2) Catchment area
3) Marking point of elevation
4) Average annual rainfall
5) Water harvesting potential
6) Design of tank
7) Filteration unit
8) Further treatment
9) Estimation of project
10) Use and supply

3.1 Components of rainwater harvesting

A rainwater harvesting system comprises of components for - transporting rainwater through pipes or drains, filtration, and tanks for storage of harvested water. The common components of a rainwater harvesting system are:

- **Catchment:**

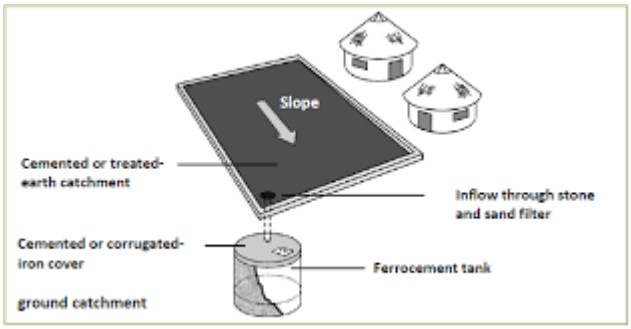
The surface which directly receives the rainfall and provides water to the system is called catchment area. It can be a paved area like a terrace or courtyard of a building, or an unpaved area like a lawn or open ground.

- **Gravity Sand Filter:**

The filter is used to remove suspended pollutants from rainwater collected from surface water. The Various types of filters g enerally used for commercial purpose are Charcoal water filter, Sand filters,

- **Storage Facility:**

There are various options available for the construction of these tanks with respect to the shape, size, material of construction and the position of tank Horizontal roughing filter and slow sand filter.



Catchment area system

4.CONCLUSIONS

Recharge of ground water table is a gradual process, we can not suddenly increase the ground water table after constructing recharge structures, by constructing any type of recharge structure, and we can give our contribution in aquifer recharge. This will help to rejuvenate the depleting ground water resources. Also help to save the little amount of rain water which used to drain away from many years. Thus it is concluded that implementation of RWH system of Dr.D Y Patil College Of Engineerig,Akurdi campus would result in the form of the best approach to deal with present scenario of water scarcity and storing huge quantity of water.

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