RAIN WATER HARVESTING

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Abstract:- As the world population rises increase demand of water supply have growing industries, expansion of agricultural and Increases for quality drinking water. Surface and ground water are being utilized faster than they can be recharged. Monsoon is still the main hope and the source of our agriculture. Therefore, the water saving became need time. Because Rainwater harvesting is an old techniques to capture rain water at the time of the downpour, store the water above the ground or recharge the underground water and use later. As the groundwater resources are depleting, is the only way the rainwater harvesting to solve the water problem. Rainwater will be useful not only, the demand of water supply, but also help to improve the quantity and quality of water. These paper review the method, design of rainwater harvesting system, and its impact in all parts of world.

Key word: Demand, ground water, monsoon, rainwater harvesting

1. INTRODUCTION

Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the bio diversity depends. The most part of the earth surface i.e. about 71 % is covered by water. Out of total volume of water available on the surface of the earth 97 % is saline water, 2 % water is in the form of ice and glaciers and only 1 % is fresh and potable water. Over the years of the rising population practices the increases demand of water supply have growing industries and expansions of agriculture to fulfil requirement of this increasing population. Rainwater harvesting is the process of collection of rainwater from land to the rain falling, filters and save it be used for multiple purposes. Rain water harvesting is an environmentally sound solution to address issues brought forth by large projects utilizing water management approach. Population growth all over the world is causing similar problems and concerns of how to supply water at all. Water is renewable but finite resources, in the sense the global hydrologically cycle turns through the dynamics evaporation, condensation, and runoff. The hydrological cycle ensures that the same amount of water now as existed when the Earth was formed. Due to increase in population Land pressure rises, cities are growing vertical and in countryside more forest areas are encroached and being used for agriculture. While, Monsoon is still the main hope and the source of our agriculture. But much mount of rainwater is soon lost as surface runoff. So irrigation may be most obvious response to drought, it has proved costly and can only benefit a fortunate few. There is now increasing interest in the low cost alternative generally referred to as Rainwater Harvesting.

A. DEFINITION OF RAINWATER HARVESTING:-

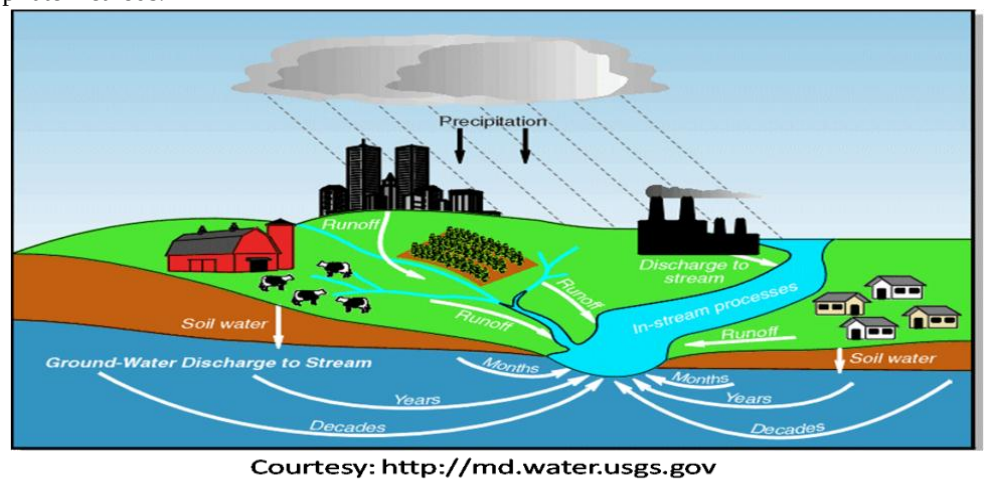
The harvesting of rain water involves the collection of water from surfaces on which rain fall subsequently stores the water for later use. It is accumulation and deposition of rain water for use on site. The harvested water can also be used as drinking water, long term storage and ground water recharge etc.

B. RAIN WATER HARVESTING METHOD:-

It is easy to collect rain water from the building, roofs and many other sources. As long as you are ready and you have everything with a few different items, what it needs, harvest rain water and enjoy naturally delicious, clean and useful water start? Rainwater harvesting systems can be purchased from various home improvement stores completely. The costs of these systems are different. Broadly there are two ways of harvesting rainwater.

(a) Surface runoff harvesting
(b) Roof top rainwater harvesting

(a) Surface runoff harvesting:- In urban area rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.



Courtesy: http://md.water.usgs.gov

Figure 1: surface runoff harvesting

(b) Roof Top rainwater harvesting:-

It is the system collect rainwater, where it is harvest falls. In on the roof is the catchment area and collected rainwater, from roof/ building. It can either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the ground water level of the area.

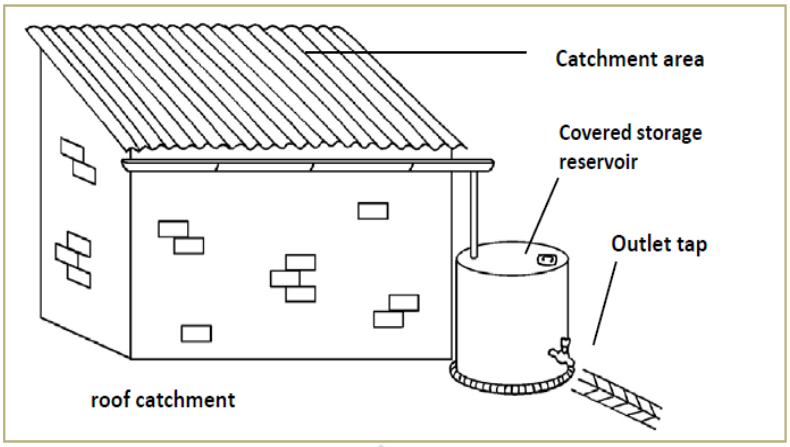


Figure 2:Roof top rainwater harvesting

C. Benefits of rain water harvesting system:

- Rainwater is a comparatively clean and totally free source of water.
- Rainwater is improved for scenery plants and gardens because it is not chlorinated.
- It can supplement other sources of water supply such as groundwater or municipal water connections.
- It lower the water supply cost.
- It can provide an excellent back-up source of water for emergencies.
- It is socially acceptable and environmentally responsible.
- It uses simple technologies that are inexpensive and easy to maintain.
- Reduced flood flows and topsoil loss.
- It is free; the only cost is for collection and use.
- It is used in those areas which face insufficient water resources.
- It is good for laundry use as rainwater is soft and lowers the need for detergents.
- It can be used to recharge groundwater.
- It minimizes the runoff which blocks the storm water drains.

D. Need for Rainwater Harvesting:

- As water is becoming scarce, it is the need of the day to attain self-sufficiency to fulfil the water needs.
- As urban water supply system is under tremendous pressure for supplying water to ever increasing Population.
- Ground water is getting depleted and polluted.
- Soil erosion resulting from the unchecked runoff.
- Health hazards due to consumption of polluted water.

E. Objectives of rainwater harvesting:-

To aid towards the greater objective of water management and conservation and to increasing recharge of groundwater by capturing and storing rainwater, rainwater harvesting from rooftop run-offs and natural waterbodies augment the community development and also use surface water instead of groundwater in daily works like washing, watering land like irrigation and gardening, cooking and canteen cores, it is required to build storing tank to directly collect rainwater and construct pits to collect rooftop run-offs and water from storm water drains etc. and then after proper filtering in settlement tanks and filtration chamber, use the water in daily works.

F. RESCENT TECHNIQUE OF RAIN WATER HARVESTING

There are two main techniques of rain water harvesting:

1. Storage of rain water on surface for future use
2. Recharge to ground water

The storage of rain water on surface is a traditional technique and structures used were Tanks, ponds, check dams; weirs etc. recharge to ground water is a new concept of rain Water harvesting and the structures generally used are:

Pits:- Recharge pits are constructed for recharging the shallow aquifer.

Aquifer:- The aquifer is porous, water saturated layers of sand, gravel or bed rock that can yield significant or usable amount of water. These are constructed 1 to 2 m wide, 1 to 1.5 m deep which are back filled with boulders, gravels, coarse sand.

Trenches:- These are constructed when the permeable rock is available at shallow depth. Trench may be 0.5 to 1 m wide, 1 to 1.5 m deep and 10 to 20 m long depending upon the availability of water. These are back filled with filter materials.

Dug wells:- Existing dug wells may be utilized as recharge structure and water should pass through filter media before putting into dug well.

Hand pumps:- The existing hand pumps may be used for recharging the shallow/deep aquifers, if the availability of water is limited. Water should pass through filter media to avoid chocking of recharge wells.

Recharge wells:- Recharge wells of 100 to 300 mm diameter are generally constructed for recharging the deeper aquifers and water is passed through filter media to avoid Choking of recharge well.

Recharge Shafts:- For recharging the shallow aquifer which is located below clayey surface, recharge shafts of 0.5 to 3 m diameter and 10 to 25 m deep are constructed and back filled with boulders, gravels and coarse sand.

Lateral shafts with bore wells:- For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m wide and 10 to 30 m long depending upon availability of water with one or two bore wells is constructed. The lateral shaft is back filled with boulders, gravels and coarse sand.

II. LITERATURE SURVEY

A. Gitte and Pendke (2002)[1] conducted a study on the water conservation practices, water table fluctuations and ground water recharge in watershed areas. The study revealed that water conservation measures were found to be effective for rising of water table in observation wells, located in the middle and lower reach of the watershed. The overall groundwater recharge due to corresponding rainfall was in the tune of 3.76 to 8.85 cm in the influence of area of soil and water conservation structure.

B. Mondal and Singh (2004)[2] conducted a study of unconfined aquifer response in terms of rise in water level due to precipitation; a rapid and cost-effective procedure is evolved in hard rock terrain. Cross correlation of rise in water level and precipitation is established. The entire area is classified into various zones depending on variability in coefficient of correlation. Thus, most favorable zone for artificial recharge is delineated with the help of correlation coefficients.

C. Chris Solloway et al.(2013)[3] has conducted, focused on the impacts of rainwater harvesting in the areas of water conservation, storm water runoff volume, and pollutant load reduction; code and administration; and cost factors. The review included relevant information for a range of system sizes and complexities from small, passive systems (e.g. rain barrels) to larger systems with fitted pumps, controls, and treatment systems.

D. Konig (2001)[4] states that in the past components such as tanks, pumps and filters were often supplied in kit form and had to be assembled on site, necessitating the use of skilled staff and leading to increases in both installation times and costs. Modern systems tend to be modularized and consist of standardized mass-produced components, usually of high quality. Components such as tanks, pumps and filters are delivered to site as complete units are easier to install and commission than the older types of system and offer a greater degree of design flexibility.

E. Kadirvelu (2002)[5] describe the impact assessment of RWH in madras University-Marina campus. He designed RWH structures on the basis of the in situ soil conditions. It was constructed on the study area. The frequent monitoring of three open wells was carried out. The water levels during the pumping before and after the implementation of RWH are monitored. The water levels and the water quality are compared with the observation well which is situated near the study area and maintained by TWAD. The benefit cost ratio is also analysed on the basis of construction cost of RWH and the population to be served by the harvested rain. Finally, he concluded from the results that the quantity and quality are improved. The benefit cost ratio is also arrived to 2.38. The impact of RWH is positive in the study area in view of improved in quantity, quality and benefit cost.

F. (Mati et al. 2006)[6] conducted a study to determine if RWH technologies can be mapped at continental and country scales. The project utilized a number of GIS data sets including rainfall, land use, land slope, and population density to identify four major commonly adaptable RWH technologies: roof top RWH, surface runoff collection from open surfaces into pans/ponds, flood flow storages and sand/sub-surface dams and in-situ RWH.

G. Ghayoumian .J et .al (2006)[7] paid Special attention to artificial groundwater recharge in water resource management in arid and semi-arid regions. Parameters considered in the selection of Ground water artificial recharge locations were diverse and complex. In their study, factors such as: slope, infiltration rate, depth to ground water, quality of alluvial sediments and land use were considered, to determine the are as most suitable for groundwater recharge in a coastal aquifer in the Gavbandi Drainage Basin in the southern part of Iran.

H. Jain and Thakur (2015)[8] In this study an attempt has been made to study the design of roof top rainwater harvesting tank. The design parameters for the rain water harvesting system have been developed and thus an optimum tank size has been determined which is based on the rainfall and population density data of the year. The yearly rainfall can be harvested to supply a minimum of 20 liters of water per person per day by installing a tank of size 23 m3 in for a catchment area of 50 m2. Thus the rainwater collected in the monsoon season can be used during the dry period and thus minimizing the ground water withdrawal.

I. Samita, jyoti et. al.(2016)[9] has conducted on recharging ground water by using bore wells. The water table level in the locality has increased leading to a substantial increment in the yield of the bore well. The run-off from the surrounding area, which was being wasted in channelized into pond and used to recharge the bore well which can further be put for better use such as gardening etc. The dependence on municipal water supply can be reduced and the cost of water can be saved. The properties of bore well recharge water are within its permissible limit, hence can be used for domestic purposes.

J. Ravikumar et al (2003)[10] describe the roof top rainwater harvesting in Chennai Airport using GIS. They explain the estimation of surface runoff using SCS method and design of rainwater harvesting structures in Chennai Airport Terminal buildings. Thematic maps were digitized in map Info GIS software and roof drainage delineation was done in GIS environment. Based on the topography and lithology of airport. the artificial recharge structures like recharge shaft, recharge well and recharge pit were designed

III. CONCLUSION

water is essential for our life and used in different ways. It is also a part of ecosystem. Most part of earth surface is covered by saline water only 1% fresh and portable water available. Due to increase in population the use of ground water has increased so depletion of ground water level occur thus wells and tube wells dry up. Rain water harvesting is appropriate method to reducing water scarcity and recharge ground water level. Rain water is collected and use in our daily life. It is no denying that sustaining and recharging the groundwater along with judicious use of the limited fresh water resources is the need of the hour. If sufficient measures are not taken up immediately, we will face a crisis which will be detrimental to the very survival of mankind. Efficient management of water resources and education about judicious utilization of water resources along with measures of harnessing, recharging and maintaining the quality of water and water bodies has to be taken up on war footing.

REFERENCES

[1] Pacey, Arnold and Cullis, Adrian, (1989), Rainwater Harvesting: The collection of rainfall and runoff in Rural areas, Intermediate Technology Publications, London.

[2] B.C. Punima, and Jain Ashok, and Jain, Arun Kumar Jain, R.C.C. Designs Book.

[3] Garg, S.K. Table 7.31, Chapter Hydrology and runoff computation, Irrigation Engineering & Hydraulic Structure.
[4] Central Ground Water Board, (2000). Guide on Artificial Recharge on Ground Water, Ministry of Water Resourses, Government of India, New Delhi.
[5] Central Ground Water Board, (1994). Manual of Artificial recharge of Ground Water, Ministry of Water Resourses, Government of India,Faridabad.
[6] Madras Metropolitan Development Authority (1993), Guidelines for Rain Water Harvesting and Recharge Well, Chennai, India.
[7] International Rainwater Catchment Systems Conference (1999). Ed. by. Johann G. Everaldo R. P. Eduardo A.N.Abstracts of the Ninth Conference, July 6-9, Petroline, Brazil.
[8] International Rainwater Catchment Systems Conference (1995). Rainwater Utilization for the World's People, VOL I & II Proceedings of the Seventh Conference, June 21-25, Beijing, China.