

Development of Rainwater Harvesting System for Road Side Rainwater

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Abstract: Water is the most valuable resources on earth. We are need water for the in our daily life. As the population increases day by day the water demand also increases. Due to climate changing, Civilization occurs day by day due the water can't infiltrate in to the ground as the result we meet the problem of scarcity of water. In order to conserve the water we have to think for the alternatively simple technological and cheap cost methods to preserve water. We are trying to save the water it can be use for full fill of daily water requirements. Rainwater harvesting is the best way to full fill the requirement of the daily of water. The water which are falling on the road we are capturing this water for the recharging ground water table. This projects evaluate area is 36210 sq. m. Using the annual rainfall data the volume of rainfall data are calculated for one year. Suitable filter media are design to filter the water and they are installed in recharging well. The suspended particles are separates by the filter media. The well is to be design for the directly infiltration of water to the ground for recharge ground water. With the help of water harvesting, we can save water and it is use in future.

Keywords: Catchment, Rain water harvesting (RWH), Filter, Recharge pit.

1. Introduction

Rainwater harvesting is a process of collecting, storing and using rainwater as a primary or supplementary source. Rainwater harvesting is the storing of rainwater during the monsoon period for the purpose of uses it during periods of water scarcity. It is a perfect technique of catching and holding rainwater where its falls. Either, we can store it in storage tanks for further use and also we can use it to recharge groundwater level depending upon the situation. It is a process used for collecting and storing rainwater for human use. With quickly climatic changes, increases in global temperature and population growth, there is a scarcity of potable water in most of the countries across the world. As the population of world increases the demand for drinking water is more needed. Increase in population growth all over the world which causes water problems and concerns about how to supply quality water to all. Ground water and surface recourses are utilized rapidly than it can be recharge. Rainwater harvesting is the oldest technique which is adopted by many countries.

Water harvesting is very old tradition and has been used

mostly in the dry lands. Water harvesting is collection activity of rainwater and storing it for direct use along with diverts it to an existing well for recharging the ground water. Use of roads for this purpose will ensure two things availability of good roads and recharge of ground water around the roads and as we all know roads are everywhere so this would directly lead to the increase the ground water level. It can be very useful water source in future. Water which is present on earth surface is consist of about 97.5% of salt water, the fresh water quantity is only 2.5% which are found in such a forms as permafrost and glaciers along with surface and atmospheric water as well as groundwater. Rainwater harvesting is a system by which, the rain water that collects on the roofs and the areas around the building is diverted towards the open wells or percolation chamber, constructed for this specific purpose. Rainwater is collected directly or recharge into the ground to improve the ground water storage. Water that is not extracted from ground during rainy days is the water saved. Rainwater harvesting system is economically cheaper in construction as compared to other sources, i.e. canal, well, diversion etc.

2. Scope of the study

As per the Central Ground Water Board, the underground water reservoir will entirely dry up by 2025. The 50% of Indian population is expected to shift to the cities, consequently demand of drinking water anticipated to become scarcer. To overcome the water scarcity potential and to become self-sufficient, best technique water management. Needs to be adopted. Rainwater harvesting is a best technique to solve the water scarcity problems.

3. Objectives

- To study of need of rainwater harvesting system.
- Survey of local ground water level and average annual runoff of rainwater through the roads.
- Development of rainwater harvesting system to percolate the rainwater into the ground to recharge ground water level.
- Providing a filtration tank and infiltration gallery for recharging the ground water from water excess from the road.

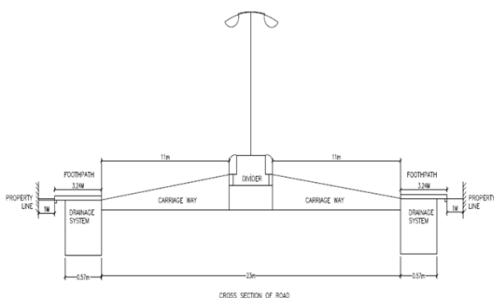
4. Methods of rainwater harvesting

There are two methods of harvesting rain as given below

- Recharging ground water aquifer, from roof the top.
- Recharging ground water aquifer, from ground surface area.

5. Study area

The study location is located in Nagpur city, state of Maharashtra, in India. The study location is Nandanwan, KDK college road, Nagpur. The study area of road is from Jagnade square to crossing between Great Nag, road and Middle ring road. The road is situated between North latitude 21°08' and 21°08' and East latitude 79°07' and 79°08'. The road has an area as a 36210 m². The length of road is 1500 m and breadth is 24.14 m.

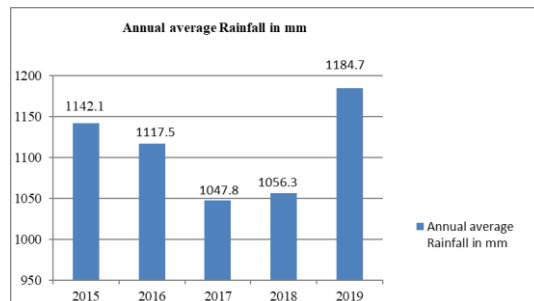


6. Rainfall data

Monthly average data of Nagpur city. It receives average annual rainfall of 1109.68 mm. The maximum intensity of rainfall recorded per day was 187mm/day on date 26th June 2013.

Table 1
Average annual rainfall data

Sr. No.	Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total (mm)
1.	2015	4.7	17.0	44.7	37.8	38.1	430	81.5	319.4	157.9	11.0	0.0	0.0	1142.1
2.	2016	0.0	0.0	6.7	0.0	9.9	171.1	640.6	114.2	100.8	74.2	0.0	0.0	1117.5
3.	2017	0.0	0.0	0.4	0.0	33.8	256.5	255.3	346.6	117.0	38.2	0.0	0.0	1047.8
4.	2018	0.0	14.5	0.5	21.0	37.0	337.6	410.7	158.5	68.5	0.0	0.0	8.0	1056.3
5.	2019	8.1	0.0	3.0	10.4	0.0	134.0	342.0	280.5	341.6	55.6	0.0	9.5	1184.7



Graphical representation of rainfall data

Total average annual rainfall of Nagpur city = 1109.68 mm

Volume of water Received (m³) = Area of Catchment (m²) X

Amount of rainfall (mm) X Runoff coefficient (K)

Where,

$$K = 0.8 \quad I = 1.1 \text{ m} \quad A = 36210 \text{ m}^2$$

$$V = A \times I \times K$$

$$V = 36210 \times 1.1 \times 0.8 \quad \text{Volume of water received} = 31864.8 \text{ m}^3 / \text{year}$$

7. Methodology

1. To survey the length of road and count the number of wells.
2. Collecting rainfall data for about past 10 years.
3. To calculate the amount of rainfall falling on the road.
4. Design of rainwater harvesting system.
5. Cost analysis.

A. Design of filter media and recharging pit

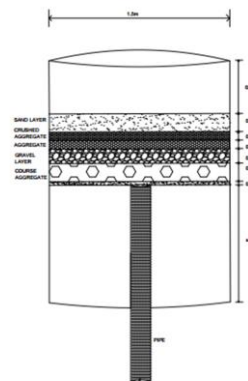


Table 2
Estimate and costing of filter media

Sr. No.	Filter material	Size (mm)	Volume (Cubic Feet)	Rate (Cubic/Feet)	Cost (Rs.)
1.	Sand	-	9.131	38	346.94
2.	Crushed aggregate	-	4.86	17	82.62
3.	Aggregate	20	4.86	23	111.78
4.	Gravel	-	7.98	12	95.76
5.	Coarse aggregate	40	9.73	31	301.63
					Total = 938.73

Sr. No.	Description of work	Volume	Rate	Cost Rs.
1.	Excavation	3.87 m ³	-	1200
2.	Wire mesh	-	30 sq/feet	890
3.	Bore well	130 ft	170 sq/feet	22100
4.	R. C. C. ring	-	700rs/piece	4900
5.	P. V. C. pipe	-	100/feet	262
				Total = 29352

The total costing of one filter unit is Rs. 30,290

8. Conclusion

This paper presented design of rainwater harvesting system, we are improving the lack of water problems in Nandanwan, Nagpur by implementing this technique of recharging the ground water table.

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