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Research Article

Rain Water Harvesting Using Runoff From National Highway

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Abstract

Water is one of the main resources used by the human for the daily needs. As in the metropolitan region, the daily water is supplied through pipelines from various reservoir to localized areas. We noticed after the rainfall, the water gets evaporated and submerged on roads. So, alternatively we decided to preserve the rainfall water collecting through the drainage system. As the objective of our project is to provide recharge pit for the recharge of ground water table. Our Project evaluated area is 48000 square meter. By using the annual rainfall data, the volume of rainfall is calculated. Based on the Soil type, filter media is designed where rainwater is collected from drainage. The suspended particles are separated in drainage system as the water flows freely into the filter media and thus recharges the ground water. Our estimated costing of this project is around One Lakh Rupees which is more efficient to improve the ground water table by 1m.

Keywords: *Catchment area, Rain water harvesting (RWH), Filter media, Recharge pit*

Introduction

Rainwater harvesting is the technique that is widely used for the storing and collection of rainwater to prevent water scarcity in the summer season. It prevents losses through evaporation and seepage and other hydrological study and interventions in the manner of engineering aspects, aimed for conservation and utilization of limited water endowment. It is also practiced in ancient days to check dams to reduce runoff and improve groundwater recharge and reservoir. The harvested water can be a source of potable water, in different aspects like complementary and non-potable water, where it becomes an unavoidable source of water to attend to the demand in areas of developed and developing countries. It primarily consists of collection, storage, and subsequent use of captured water or as a supplementary source of water.

Sometimes Chennai is referred as the “Gateway to south India”, located on the south-eastern coast of India. Its average elevation is around 6.7 meters and the highest point is 60m. The Cooum river through the center and the Adyar river to the south are the two major rivers that flow through Chennai. Cyclones in the Bay of Bengal may hit the city, where the highest rainfall recorded is 107.8cm in November 2015. Among the two major rivers, one is

extremely polluted which is difficult to balance the water demand of the population. Rainwater harvesting can be efficient practice in the Tiruvallur district.

As water is becoming scarce, it needs of a day to attain sufficient water needs. Provide the technique related to groundwater recharge in aspects of rooftop, runoff, etc.

Objectıve

To provide a filtration tank for recharging the groundwater from rainwater excess from the road.

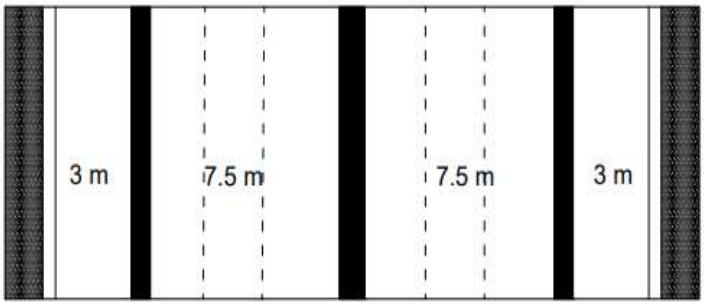
Methods Of Raınwater Harvestıng

There are two methods of rainwater harvesting as given below

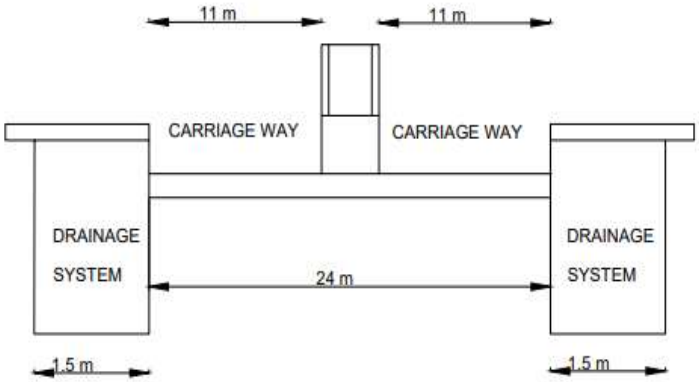
- Recharge the groundwater aquifer, from the ground surface area.
- Recharge the groundwater aquifer, from top of roof.

Study Area

The study location is located in puduvoyal area, Tiruvallur district, Tamilnadu. The study area of road National Highway 16. The road is situated between 13°21’43” N and 80°8’29” E, ends at 13°20’36” N and 80°8’32” E. The road has an area of 48000sqm. The length of the road is 2000m and breadth is 24m.



Plan of the road



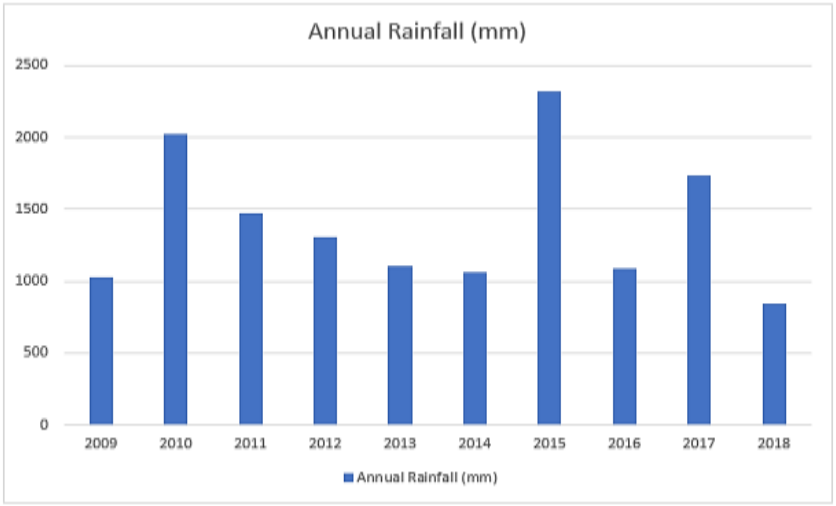
Cross-section of road

Raınfall Data

Monthly average data of puduvoyal area. Receives average rainfall of 1397.94mm. The maximum rainfall recorded on November 2015 (1078mm).

Table 1: Average annual rainfall data

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
2009	2	7	0	0	29	32.9	28.5	96.8	107	72	534	121
2010	7	0	0	0	202	116	238.1	424.5	220	260	229	303
2011	0	31	0	97	0	77	84.6	162.4	160	211.8	525.2	120
2012	34.2	0	0	0	0	116	57	167.8	220.8	384	134.6	186.8
2013	0	0	31.4	0	62	149.8	132	102.2	243	247.2	103	31.5
2014	0	0	0	0	7.2	108.7	76.6	141	127	273	253	73
2015	0	0	0	29	66.6	49	182.5	114	134.5	248	1078	418.7
2016	0	0	0	0	232	157	63	20	253	36	136	188
2017	2	0	0	0	20	60	136	372	150	347	591.5	59
2018	6	0	9	0	0	14	71	79	43	192	281	153
AAR in mm	5.12	3.8	4.04	12.6	61.88	88.04	106.93	167.97	165.83	230.1	386.53	165.4



Mean annual rainfall = 1397.94mm

Volume of water received (m^3) = Area of catchment (m^2) * Intensity of rainfall * Runoff coefficient (K)

Where,

K = 0.5 I = 1.3m A = 48000m^2

V = K*I*A

= 0.5*1.3*48000

= 0.388 m^3/sec

Discharge of rainwater for length of 2km = 0.388 m^3/sec

Methodology

1. Overviewed the road & existing drainage system.
2. Site selection & Collecting rainfall data for past 10years.
3. Calculating the amount of rainwater.
4. Design of filter media.
5. Cost analysis.

Design of recharge pit

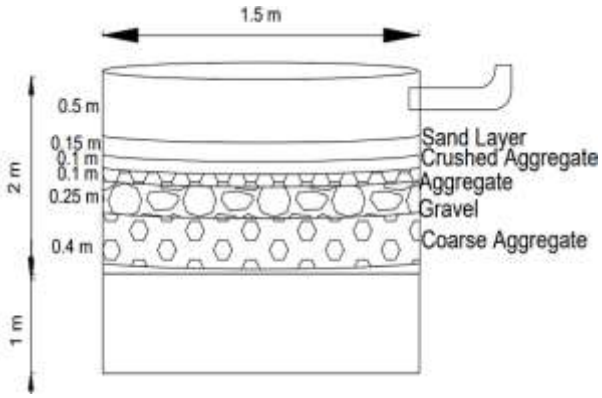


Table 2: Estimation & Costing of filter media

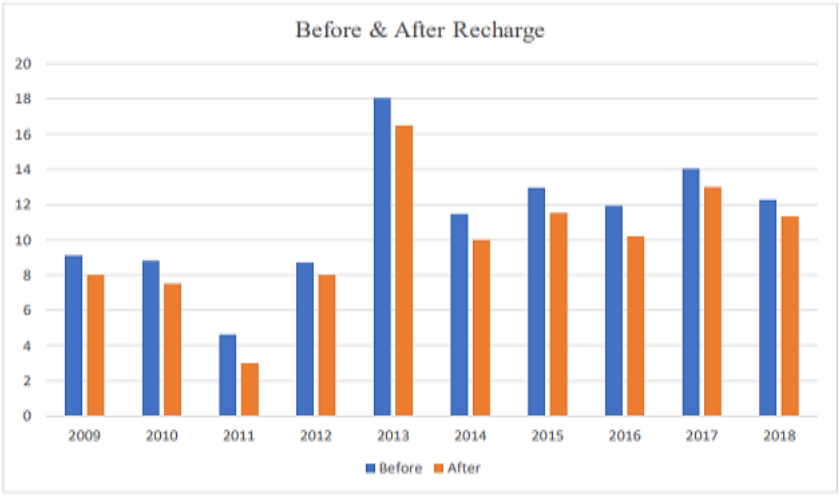
Sr. No	Filter material	Size (mm)	Volume (Cubic meter)	Rate (Cubic/ meter)	Cost (Rs)
1	Sand	-	0.265	1341	355
2	Crushed aggregate	-	0.176	1235	218
3	Aggregate	20	0.176	812.13	142
4	Gravel	-	0.441	423.75	186.84
5	Coarse aggregate	40	0.706	1094.61	772.83
				Total =	1675

Sr. no	Description of work	Volume	Rate	Cost (Rs)
1	Excavation	5.30 m^3	130/Cubicmeter	689
2	Wire mesh	2.25 m^2	215 Sq/meter	483.75
3	P. V. C. pipe	3.04 m	395/meter	1200
			Total =	2373

The total costing of one Recharge pit is Rs. 4048

Conclusion

This paper presented design of rain water harvesting system, we are improved the ground water table by one meter using recharge pit.



Future Scope

By implementing this idea, which is more efficient in irrigation purpose and also increases the ground water table. To increase the production in the field the supply of water is needed in agriculture fields to over come the water scarcity. As this idea is cheap and economical where the village areas can be benefited.

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