CASE STUDY OF RAIN WATER HARVESTING AT EASTERN PERIPHERAL EXPRESSWAY & A NEW PROPOSAL FOR NH-58

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ABSTRACT

Water scarcity is a serious problem throughout the world for both urban and rural community. Urbanization, industrial development and increase in agricultural fields and production has resulted in overexploitation of groundwater and surface water resources and resultant deterioration in water quality. The conventional water sources namely well, river and reservoirs etc are inadequate to fulfill the water demand due to the unbalanced rainfall. While rainwater harvesting system investigate a new source. The aim of the present study is to use rainwater and thus taking close to the concept of natural conservation. In this study, the rainwater harvesting system is analysed as a alternative source of water at NH-58. The developed system will help in recharging the groundwater in the region of Muradnagar which has fallen from 0.7m to 3.2m by 2015. This can be implemented in the region by considering almost all the technical aspects.

Keywords: *Catchment, Rainwater Harvesting, Recharge pit.*

INTRODUCTION

Around 113,000 cu. km. of new water is created every year by the worldwide hydrological cycle, out of which 72,000 cu. km. is lost to vanishing, leaving just 41,000 cu. km accessible for utilize.
India has an aggregate yearly accessibility of inexhaustible new water of 2.085 million m3, lower than Brazil (6.949), Russia (9.465), Indonesia (2.530), the USA (2.478) and China (2.427). The conservative utilization of water must be advanced both in the created and the creating social orders. Horticulture represents 80 percent of all water use in the creating social orders.
India's per capita water accessibility in 2004 was 2000 m3 contrasted and 110,000 for Canada, 9900 for US and 4400 for Japan. These nations have possessed the capacity to outfit vast parts of their water assets through legitimate administration. Shockingly, we have not possessed the capacity to make legitimate use of our water assets prompting enormous water worry in numerous parts of India. Starting today, the nation is encountering perpetual water deficiencies, and the influenced region is probably going to increment essentially by 2025. We can't stand to ignore the bona fide requirement for ideal usage of water assets. Legitimate administration and usage of water assets have turned into a noteworthy worldwide issue with huge ramifications for populace arranging, welfare, social solidness and peace.
Today because of rising populace and temperate development rate, requests for the surface water is expanding exponentially. Because of this reality the wellsprings of water are being abused; which will eventually bring about water deficiency all around the globe. Here is a pictorial investigation indicating locales influenced by water lack in year 1990 and those which will be influenced by the water deficiency by year 2025.

EA Water Pvt Ltd has launched a unique Rainwater Harvester, which filters runoff water from roads, which generally contains oil and grease. This system has been installed in the Gymkhana club, Sector-15, Faridabad, Haryana. Rajit Malohtra, project in charge, of this company explained that the water harvesting system installed at the club has a sand filter, which filters silt from runoff harvested from roof, lawns and parking area. The cost of the filter is around Rs 60,000.

Acqua Sure, a consortium of three specialist Netherlands-based companies, has developed a system for the conversion of rainwater to drinking water in the form of a Rainwater Purification Centre (Rain PC).

Rain PC is developed by scaling down the multi-staged water treatment method (MST), which involves screening, flocculation sedimentation and filtration and incorporating existing technologies like upward flow fine filtration, absorption and ion exchange. Coming in a small compact 26 kg unit, the Rain PC offers an affordable solution by converting rainwater into drinking water.
Rain PC is made of ultra violet resistant poly-ethylene housing and cover, stainless steel rods and bolts, a nickel-brass valve and an adapter for maintaining constant volume. Xenotex-A and activated carbon catridges along with ultra membrane filtration or micro-membrane filtration modules incorporated in the Rain PC has the capacity to deal with E-coli and the potential of meeting the Dutch as well as World Health Organisations (WHO) water regulation standards. The components can also be transported individually to be assembled at the site. Three product types are available based on their microbial contaminant removal capacity. This technology is ideally suited for virtually any situation and is a blessing particularly for those who have little or no access to regular safe drinking water.

The salient features of Rain PC are:

- Simple straight-forward installation
- Easy to operate and maintain
- Needs no power and operates at low gravity pressure (0.1 bar upward).
- The system is capable of providing a constant flow of about 40 liters of rainwater per hour, enough for a family of five for drinking, cooking and bathing purposes.
- Maintains nearly constant volume irrespective of water pressure.
- The Xenotex-A and activated carbon cartridge processes up to 20,000 liters and can be regenerated up to 10 times.
- Cost per 1000 liters is as low as US$ 2 to 3.

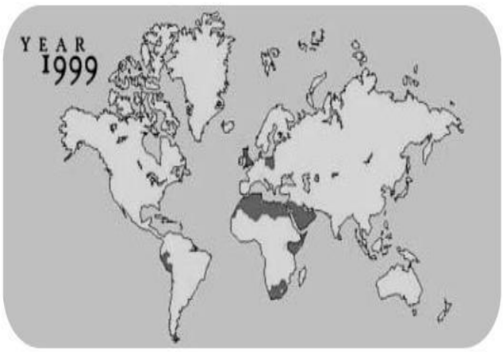

Figure 2: About 450 million people in 31 countries (shaded) face a serious water shortage

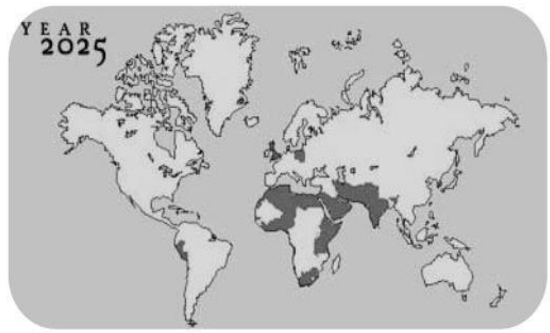

Figure 3:About 2.8 billion people in 48 countries (shaded), including India, are expected to face water shortages

LITERATURE REVIEW

Kahinda (2008) defined rainwater harvesting as the collection, storage and use of rainwater for small scale productive purposes. Crotchety (1991) defined it as the collection of run off for productive use. Venkateswara rao (1996) in his article has reviewed the importance of artificial recharge of rainfall water for Hyderabad city water supply. Rainfall water from roof tops of the buildings recharged through specially designed recharge pits in order to augment the ground water resources in city. He finally suggests, that wherever natural tanks are not existing, community recharge pits are to be constructed at hydro geologiocally suitable location.

Ravikumar (2003) describes the roof top rainwater harvesting in Chennai airport using GIS. They explain the estimation of surface runoff using SCS method & design of rainwater structures.

Patel (2002) evaluated the various hydrological and hydro-chemical aspects of recharge systems such as percolation tanks, check dams and dug well recharge in three different geological settings, namely, miliolite limestone, gaj limestone and weathered basalt rock. The different hydrological aspects of artificial recharge system studies were development and decay of the recharge plume, recharge rates and radius of influence of recharge structures. The hydrochemical aspects were changes in total dissolved solids and fluoride content of groundwater. The study involved actual measurements of some parameters governing the physical impacts of recharge structures.

The study found that the rate of development and decay of recharge varied according to variations in geological settings. It also established that the recharge rates were far higher in the case of percolation tanks and check dams which were periodically de- silted than those not de-silted. The recharge rate estimated for a normal percolation tank was 7.87 mm day–1 while that for a de-silted percolation tank was 20.4 mm day–1. Accordingly, the recharge-evaporation ratio was found to be much higher for the de-silted percolation tank (4.2) against 1.83 for the normal percolation tank. Further, the radius of influence of percolation tank was found to vary across geological formations. Though the study is about the local hydrological impacts of recharge schemes, it supports the argument made in this paper that it may not be appropriate to use thumb rules to assess the size of benefits from recharge structures.

Palanisamy and others evaluated the economic impact of ten percolation tanks from Coimbatore and Avinashi districts of Tamil Nadu. It was found that only 14% of the wells in the vicinity were benefited by the tanks, with a total area of 14.4 ha and average additional income at tank catchment ranging from Rs.1323 ha–1 to Rs.2736 ha–1. The analysis did not involve the cost of the tank structures and was based on one year of data. The study attributed the poor economic performance of the tanks to inadequate rainfall in that particular year and improper tank location (Palanisamy and Kandaswamy (1990) as cited in Muralidharan and Athawale, 1998). These findings corroborate to a great extent the arguments made earlier in this paper, with regard to limited physical impact of RWH structures and uncertain benefits.

Badiger (2002) made a quick evaluation of the variety of physical and socioeconomic impacts of the *pal* systems built by PRADAN in northeastern Rajasthan on the basis of studies carried out in four micro catchments. These catchments fell within the large basin of Mewan in Mewat region of Alwar.

2. INDENTATIONS AND EQUATIONS

2.1 WATER CONTENT DETERMINATION

$w = W_w / W_s \times 100$

Where w= water content in percent

Ww = Weight of water

W_s = Weight of soil

2.2 SPECIFIC GRAVITY DETERMINATION BY PYCNOMETER METHOD

$G = M2 - M1/((M2 - M1) - (M3 - M4))$

Where M1=mass of empty Pycnometer,

M2= mass of the Pycnometer with dry soil

M3= mass of the Pycnometer and soil and water,

M4 = mass of Pycnometer filled with water only.

G= Specific gravity of soil

2.3 OPTIMUM MOISTURE CONTENT AND MAXIMUM DRY DENSITY

$\gamma = W/V$

$\gamma d = \gamma /(1 + w)$

Where γ= bulk density

W= weight of soil

V= volume of soil specimen

w = water content

γd = Dry density

Collected data

1. Catchment area
2. Average rainfall intensity
3. Runoff coefficient
4. Storm duration

Using rational formula

Q = CIA/360

Total runoff volume= peak runoff rate x storm duration

% water obstructed = volume of recharge pit /total runoff x 100

Soil testing

METHODOLOGY

Case study on eastern peripheral expressway is to be performed. First of all the collection of rainfall data is be collected. estimation of the rainwater should be performed in 1km length of the highway to generalize for rest of the highway. This will help us in designing the storage tank of the particular area. After that various soil index and engineering properties are estimated by performing various soil tests. Design of the pipe is then to be made. Finally a better proposal for NH-58 is to be performed.

EXPECTED CONCLUSION

Recharge of ground water table is a gradual process, we can not suddenly increase the ground water table by constructing any type of recharge structure but we can give our contribution in aquifer recharge. This will help to rejuvenate the depleting ground water resourses. Also help to save the amount of rainwater which used to drain away from many years. Thus it is concluded that implementation of rain water harvesting system on NH-58 would result in the form of the best approach to deal with present scenario of water scarcity and storing huge amount of water in a year.

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