ISSN:2348-2079

Volume-8 Issue-3

International Journal of Intellectual Advancements and Research in Engineering Computations

Simulation of storm water collecting systems in K.S.R. Educational Institutions (South Side)

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ABSTRACT

Monte Carlo Simulation is that generates random variables for modeling risk or uncertainty of a certain system. The random variables or inputs are modeled on the basis of probability distributions such as normal, log normal, etc. Water scarcity is serious problem throughout the world for both urban & rural community. Urbanization, industrial development & increase in agricultural field & production have resulted in overexploitation of groundwater & surface water resources and resultant deterioration in water quality. The conventional water sources namely well, river and reservoirs, etc. are inadequate to fulfill water demand due to unbalanced rainfall. While the rain water harvesting system investigate a new water source. The aim of the present study is to use rainwater and thus taking close to the concept of nature conservation. In this study, the rain water harvesting (RWH) system is analyses as an alternative source of water at campus. K.S.R. Educational Institutions, Tiruchengode at the State of Tamilnadu, India. The expected outcome of the study is the development of rainwater harvesting system for catchment area of campus from IT Block, IET Mech Block, B.Ed. Block, PC Block, Academic Block, CE "A" Block, CE "B" Block, CE "C" Block, CE "D" Block, CE, and "E" Block, CE "F" Block, Women's Block, and CE Boys Hostel, Parking area. The result analysis shows that the present RWH system is having the storage 53, 96, 816 liters/year and is reasonably well in comparison with conventional water sources. The developed system satisfies the social requirements and can be implemented in rural areas by considering almost all the technical aspect.

Keywords: Storm water carriage system, Geosynthetic rain water filtration, Rainwater guttering systems

INTRODUCTION

Water is the most common or major substance on earth, it covers 3/4th space of the planet's surface. All living things can live only with water facility. Not at all living things but also non-living things also utilized and maintained by using water. It can have most important to human beings such that our body needs water for smooth living and then non-living things such as hills/rocks, soil etc., Of course, in India the total volume of water, 2% i.e. 28,000,000 Km^3 is portable water which can be utilized for drinking as well as for agriculture. Each and every utilization fulfilled by water conservation only. In our country water scarcity is tackled by doing storm water collecting in lakes, Dams and Canals. From olden days they aware about people water demand as well as seasonal scarcity. All the persons should conserve water by using economical way i.e. our storm water collecting systems. 25,000 persons are used water in this institution, so we analyses and recommend best water conservation system to win water scarcity problems in summer seasons. Installations of storm water harvesting systematic steps are taken into considerations and procedure was framed ethically [1]. Technical advice was followed to do storm water carriage system implementations [2]. Standard cover guide lines are referred to make sustainable establishments [3]. Ground water quality was also recommended

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in ISO water quality manual; it will be considered while doing storm water carriage systems [4]. Water crisis can be blamed and solved by using traditional and innovative rainwater harvesting plans [5]. Dry land can be fulfilled by efficient nearby storm water harvesting system to tackle water scarcity [6]. Rainwater harvesting procedures with its drawbacks are followed to frame systematic approach of groundwater collections [7]. Geographic Informatics System was used to identify ground water quality and then assessments are done to establish permanent well points [8]. Evaluating impacts are concluded by this case study and it will be implemented at the moderate rainfall areas [9]. Rain water trends are updated by using systematic approach for natural water prone areas [10]. High fluoride ground water contamination was highlighted and it was taken into account while using storm collection system ground water [11]. Ground water flow models are referred and concluded design criteria to establishing storm collecting arrangements [12]. Recommendations of water quality standards are cross checked by using WHO water quality standards conditions [13]. Ground water assessment implications are tackled by referring those case studies and its conclusions [14]. Sustainable water development and its managing systems are utilized to do storm water harvesting systems [15]. Catch water point development was studied and taken into consideration to finalize location and orientation of the design layouts [16]. Cost efficiency is also considered in this project to attain optimum of harvesting [17]. Rain water harvesting design criteria was taken into account while deciding diameter of well points and well point counts [18]. Natural Resources Conservation Service (NRCS) methodology is referred to formulate this efficient system [19]. River basin systems carry over to establishing open drains laying [20]. Precipitation measurement system was followed [21].

METHODS OF HARVESTING RAIN WATER

There are three methods of harvesting rain water as given below:

- Storing rain water for direct use (Fig. 1.1)
- Recharging ground water aquifers, from roof top run off (Fig. 1.2)
- Recharging ground water aquifers with runoff from ground area (Fig. 1.3)

Storing rain water for direct use

In this case water tanks are used for home use and lakes are used for irrigation purposes. From Fig.1.1 huge volume of storage tanks would have to be provided for water storages to manage water demands. 135litres/p/day is code recommended quantity of water for each person. This quantity can be fulfilled by using these storm water carriage systems. If we fulfill ground water in each and every home it will help increasing of ground water level in that area. Appropriate size of storm water carriage system must be established by using readymade storm water carriage system as well as standard storm water carriage systems. Direct use can be possible while using this rainwater harvesting systems. Contamination should be avoided while storing storm water with help of water filter fabric. This fabric available in stainless steel and plastics. Stainless steel is most preferable material for life long usage because there is no corrosion.

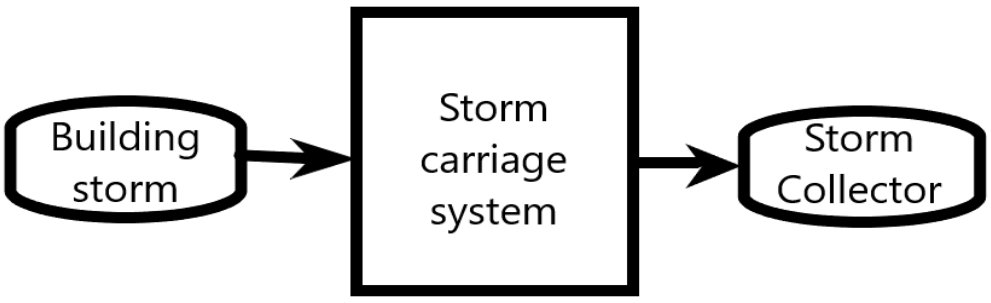


Fig.1.1 Rainwater Harvesting

From top of roof water is collected and diverted by drain pipes to filtration tanks such as bore well, settlement tank etc., This is economical method of collecting storm water and converted as a ground water table. Rain water roof guttering is very cheap plan to collect total storm water from roof and Rain water down pipe used to drain water from gutters. This second system combined used with first system of storm water collection, thus we can economically save water and it will help in increasing ground water table. Each and every drop which entered in roof can be collected and saved as ground water.

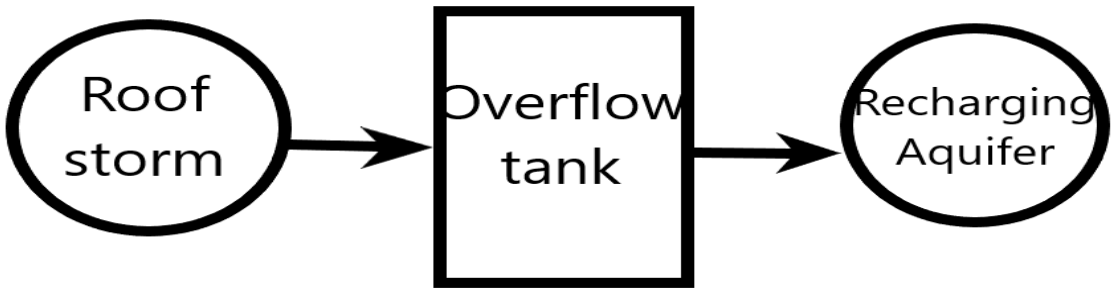


Fig1.2 Recharging ground water aquifers from roof top run off

By using well system, storm water can be saved and it can be directly used for drinking and irrigation purpose. Location of well point is very important for collecting and storing storm water. This is traditional system which can fulfill our water demand in summer season also. Nearby ground areas have more storm water while rainy season at that time storm water can be collected in well point and storing naturally, it will give pure water to us. Many precautionary steps must be taken to do this well establishment because of soil erosions. Self- jetting nozzle will help to percolate water into ground areas.

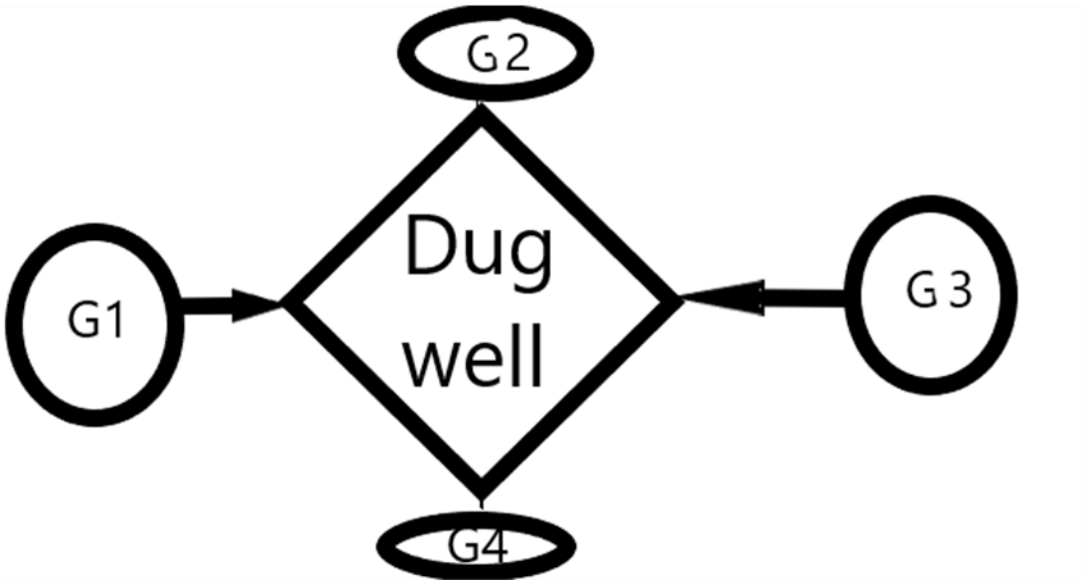


Fig.1.3 Recharging ground water aquifers with runoff from ground areas.

The below formula is used to get storm water or rain water endowment. In rainy season all areas split into various zones such as heavy rainfall G1, moderate rainfall G2, low rainfall G3 and poor

rainfall G4. Third system must be recommended to heavy and moderate rainfall ground areas only.

Area of catchment x Amount of rainfall = rain water endowment

Each and every dweller should implement that type of systems and store water as a ground water. Diameter of well points depends upon quantity of rainfall. Single well point system and multiple well point systems are decided according to rainfall only.

Based on the above factors, the water harvesting potential of site could be estimated using the following equation:

Rain Water harvesting potential = Amount of Rainfall x area of catchment x Runoff coefficient

The calculation for runoff can be illustrated using the following example:

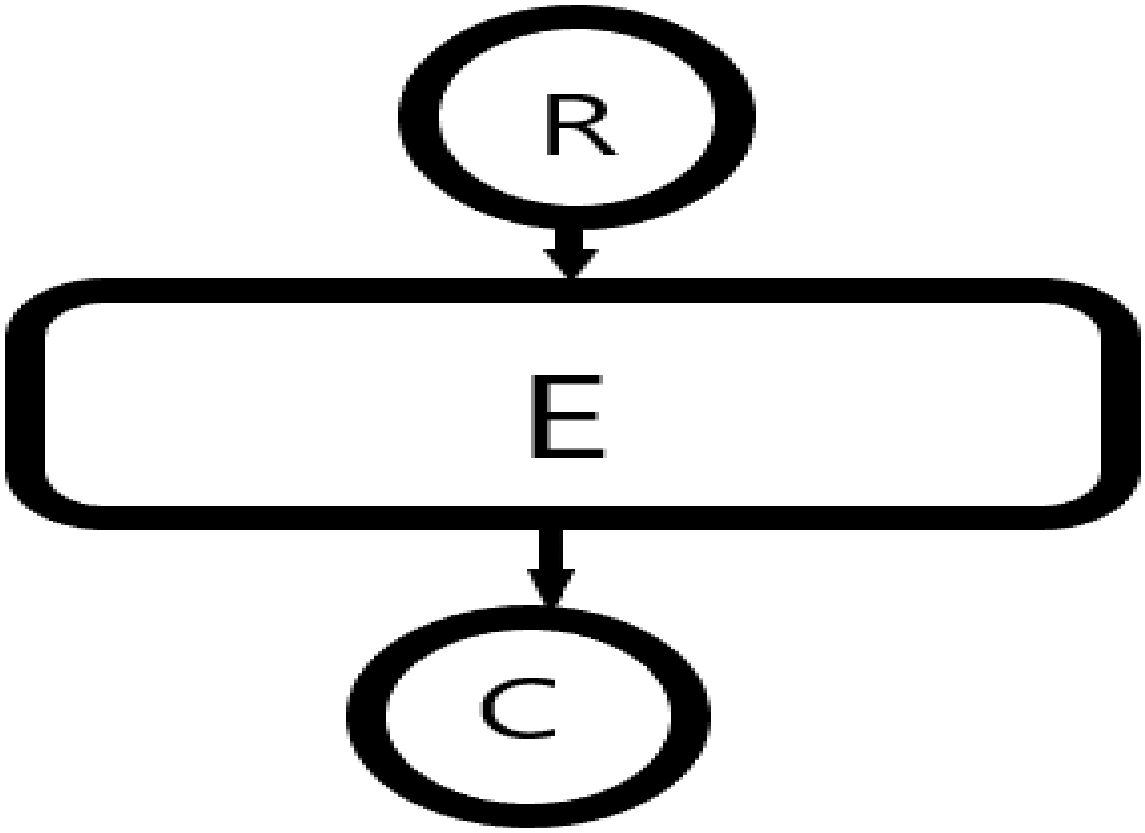
Consider a building with flat terrace area

- 100 sqm located in Tiruchengode. The average annual rainfall
- In Tiruchengode is approximately 611mm. The runoff coefficient
- For a flat terrace may be considered as 0.85.

Annual water harvesting potential from 100 m2 roof
= A x R x C
= 100 x 0.611 x 0.85
= 51.935 cum i.e. 51, 935 liters

Each block storm water collected by open drains and stored in closed type of multiple well point systems. Thus, storm water can be utilized broadly by storing in rainy seasons. Summer water scarcity can be intelligently tackled by this type of storm water carriage systems. Especially geosynthetic pipes, filters and mesh are used to do constructions.

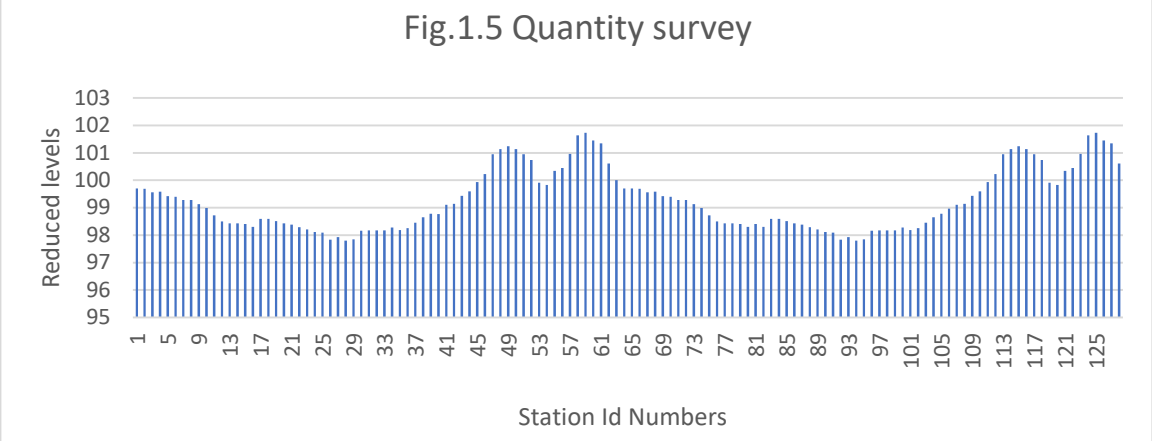
METHODOLOGY



R = Reconnaissance survey; E= Establishing open drains; C= Collecting storm

RESULTS AND DISCUSSIONS

In this project Monte Carlo simulation was used as a methodology to do process of rainwater harvesting modeling. For the randomness assessment, here leveling survey was done by using Dumpy level. That mathematical model procedure could be followed to finish that type of data processing Fig.1.5 in x-axis station Id and in Y-axis RL is used to plot those survey data. As usual procedure will be followed to laying pipes at that spot and checking assessment done by using Hardy-cross methods. Probably there is no clogging will come because Leveling is done at the same time cross checking also done to lay the pipe lines.



CONCLUSION

Rainwater / Storm water harvesting is a viable option to supplement city water for non-portable human uses, such as irrigation. The overall efficiency of a rainwater harvesting system to supplement city water increases as area increases. The system would be highly effective in high commercial regions where there are warehouses and large buildings. These areas also contain less lawn area, so that the water can be used for uses beyond irrigation. In order to display the potential of the rainwater harvesting project for a heavy commercial area. Result in the form of the best approach to deal with present scenario of water scarcity and storing huge quantity of 53, 96, 816 liters in a year in college campus.

REFERENCES

[1]. Texas Guide on rain water harvesting
[2]. “A Water Harvesting Manual for urban areas” issued by Centre. For Science and Environment
[3]. “Indian Standard Guidelines for Rain Water Harvesting in hilly areas by roof water collection system” IS 14961:2001
[4]. Indian Standard “Drinking Water Specifications” IS 10500: 1991.
[5]. www.rainwaterharvesting.org
[6]. www.aboutrainwaterharvesting.com
[7]. Paper on “Rain Water Harvesting” written by Sri. Kaushal Kishore, Materials Engineer, Rooked published in CE&CR, 2004.
[8]. Andrade R Sustainable groundwater development and quality management in Algona District – Andhra Pradesh through integrated geohydrological and artificial recharge approach. PhD Thesis, Osmania University, India, 2009, 180.

[9]. Glendenning, CJ evaluating the impacts of Rainwater harvesting (RWH) in a case study catchment: The Arvari River, Rajasthan, India. PhD thesis, Faculty of Agriculture, Food and Natural Resources, The University of Sydney, 2009.
[10]. Ground Water Department Jodhpur Ground water resources Banganga River Basin. Jaipur, Government of Rajasthan, 1999.
[11]. Sharma SK High fluoride in groundwater cripple's life in parts of India. Diffuse Pollution Conference Dublin 2003.
[12]. Todd DK, Mays LW Groundwater hydrology. Wiley, New York, 2005.
[13]. WHO (World Health Organization). Guidelines for drinking-water quality. Recommendations. Geneva, 1(3), 2006, ISBN 92 4 154696.
[14]. Villholth, K. "Groundwater assessment and management: implications and opportunities of globalization". Hydrogeology Journal, 14, 2006, 330-339.
[15]. Jyotiba B. Gurav and D.G. Regulwar "Rainwater Harvesting – A Case Study", Sustainable Water Resources Development and Management, 2013, 179-183.
[16]. S.N. Kalia "Rainwater Harvesting – A Case Study Catch Water where it Falls", Sustainable Water Resources Development and Management, 2013, 153-159.
[17]. Ranjit Kumar Sharma, Rainwater Harvesting at N.I.T. Rourkela , Department Of Civil Engineering, National Institute of Technology, Rourkela, 2010.
[18]. Rain Water Harvesting, CAMTECH/2004/C/RWH/1.0, Ministry of Railways, Government of India, August 2004.
[19]. Computing Storm water Runoff Rates and Volumes, New Jersey Storm water Best Management Practices Manual, 5, 2004.
[20]. Kenoyer G. J. and Bowser C. J, "Groundwater Chemical Evolution in a Sandy Silicate Aquifer in Northern Wis-consin: Patterns and Rates of Change", Water Resources Research, 28, 1992, 579–589.
[21]. Kumar B, Rai S P, Saravana Kumar U, Verma S K, Garg P, Vijaya Kumar S V, Jaiswal R, Purendra B K, Kumar S R and Pande N G (2010). Isotopic characteristics of Indian precipitation; Water Resource. 46, 2010, W12548. Doi: 10.1029/2009WR008532.