FEASIBILITY OF RAIN WATER HARVESTING IN MYSORE

Mysooru R. Yadupathi Putty, *Asstt. Professor,* Chandrashekara Reddy, *Alumnus,*
Ravi Kumar U.N., *Sel. Gr. Lecturer*
The National Institute of Engineering, Mysore - 570008

ABSTRACT

This paper presents results of a study carried out to determine the potential for harvesting rain water from roofs and paved areas in the individual houses in the region of Mysore. Rural and urban areas are dealt with separately. It has been found that rain water harvesting is beneficial, provided provisions are made for storing quantities of the order of 10 to 15m^3 of water, particularly in the new localities of the urban areas.

1. INTRODUCTION

Rain water harvesting (RWH) in the individual residential houses (Kamalamma and Vermaraj, 1992) is gaining popularity in recent years because of the increased needs and a sustained campaign by NGOs for sustainable use of available resources. The present study was taken up to find out the extent to which catching rain at the individual houses would be useful and how far would it be feasible in the urban and the rural areas of Mysore. The study has been carried out considering the data of three rain gauges and an on the field survey of demands in two rural settlements near Mysore and in a newly developing locality in the city of Mysore.

2. THE STUDY AREA

This study pertains to the region of Mysore and Chamarajanagara (Figure 1), the southern most districts of Karnataka (these two districts were parts of the undivided Mysore district till 1997). This region is characterised by an average annual rainfall ranging between 700 and 1000 mm, spread over about 60 to 80 rainy days. Rainfall occurs in three spells – Premonsoon (April-May), South-West Monsoon (called Mungaru in Kannada, June-September) and North-East Monsoon (Hingaru, October-December). While in the western parts of the region SW Monsoon contributes about 60% of the annual rain, in the other parts, all the three seasons contribute almost equal amounts of rain. The pre-monsoon rainfall contributes about 30% every where. Rain-fall seldom occurs on successive days and dry days are a common feature (see Figure 2) during the rainy season also. This is an ideal condition for harvesting rainfall on a micro-micro scale.

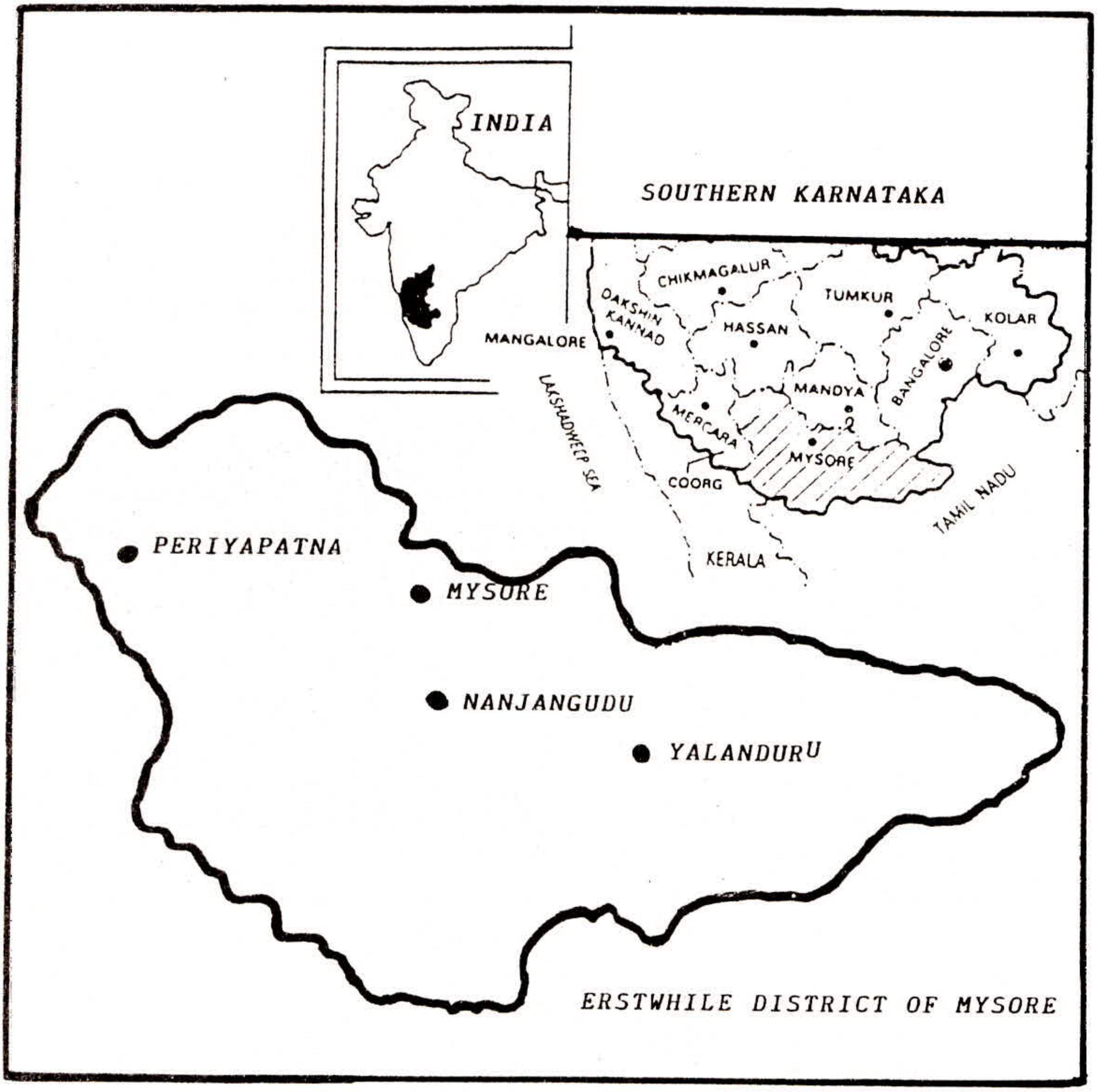

Fig. 1 : The study area and the location of the stations

The rainfall data of three stations namely, Najanagudu, Yalanduru and Piriyapattana have been made use of in the study. The location and other details are shown in Figure 1. In each case daily rainfall data of 20 years have been utilised to generate **the rainfall series of a typical year** (Putty and Prasad, 1997), which is used for the purpose of designing the RWH system.

The feasibility study is carried out based on the data of demand collected form two villages-Devagalli and Lalitadripura near Mysore and the newly developing locality of J.P. Nagara in the Southern tip or Urban Mysore. In the rural areas, the main occupation of the people is either

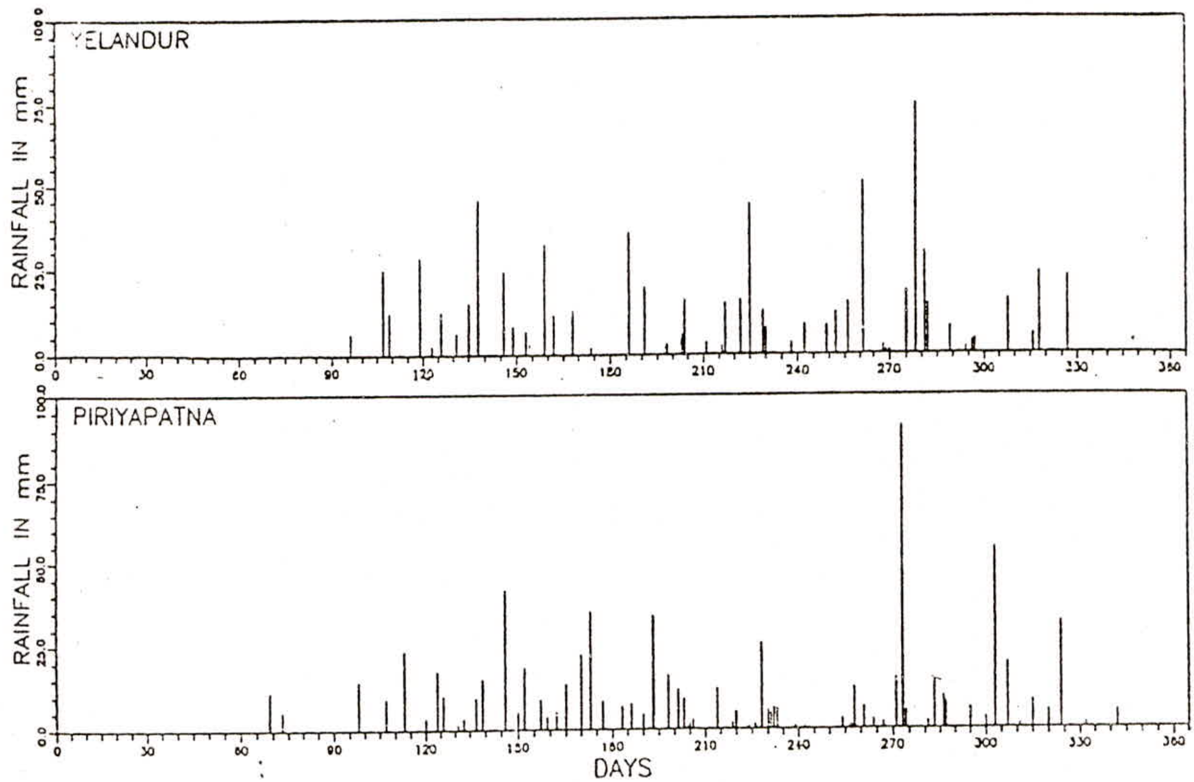

Fig. 2 : Daily rainfall of the typical year for Yalanduru and Piriyapattana.

agriculture or labour in construction sites in Mysore. People (mainly the women folk) are forced to fetch water for daily use from either the community water supply tank or the community wells. Hence, water is used judiciously and obviously the water requirements are low. Daily per capita demand in the villages, as it exists, is not greater than 25 ltr. (averaged over a weak). In the city (Mysore) the centralised water supply system is quite reliable and most newly constructed houses have huge storage tanks. Hence, water is used injudiciously by the people. Yet, a per capita consumption of 80 lpd can be considered a safe value for design purposes. With these consumption rates assumed, analysis is carried out in the present study to find out :

- the extent to which the demands can be met under various roof and land areas available, and
- the tank sizes and the initial cost of such projects.

A discussion of the results follows the analysis.

3. DESIGN FOR THE RURAL AREAS

Considering the least value of annual rainfall among the three stations (in 715 mm), assuming a total initial loss of 75 mm and a conservative value of runoff coefficient of 0.8 uniformaly for all types of roofs (tiled, metal sheet and concrete), the extent to which the roof harvested water can meet the demands in the houses of the two villages of Devagalli and Lalithadripura is shown in Table 1. It can be seen from the table that on an average, about 75% of the families get sufficient water to meet their full requirements. A very interesting aspect is that the well-to-do families get water more than what they are presently using. Hence, RWH, if adopted, certainly helps to improve the quality of living and at the same time relives the community sources of water of quite a lot of load.

The tank capacity required to meet the consumption needs of five people is calculated using the daily data of the typical year and a uniform demand throughout the year. It turns out to be about 22000 ltr., 21000 ltr. and 18000 ltr., respectively for the cases of Nanjanagudu, Yalanduru and Piriyapattana. The construction cost of brick lined subsurface tanks comes to about Rs.15000 for these cases. Even the plastic lined (Collett, 1986) subsurface tanks cost about Rs.8000 for such huge tanks. Hence, it should be noted that while only a few families would be able to afford such initial cost (unless supported by some external funding agency), many would not find even a suitable place within their house to locate such huge tanks. This is the case if RWH is planned to supply water for the complete year, during which five months are completely dry in Mysore. However, since the tendency of the people is always to use water more when it is available and it is advisable to use stored water as early as possible, yet another case of utilising rain water is investigated. Here it is assumed that all the rain water is consumed within the duration from May to November in the year. Then the storage requirement of a family of five members is calculated to be about 12000 1. In the case of Yalanduru.

A third possibility of utilising rain water investigated applies to a family which posses a sufficiently large land area and can afford to invest a substantial amount for installing the RWH system. A typical case from Devagali is illustrated. This particular house has a tiled roof covering about 100m^2. Again, assuming a total initial loss of 75 mm and runoff coefficients of 0.8 and 0.5 respectively for the roof and the open land, water available is found to meet the house hold needs of six people (150 lpd) and of the livestock (80 lpd), with water sufficient to irrigate a small kitchen garden (in about 30m^2) for one season. In this case, a double tank conjunction system (one tank for collecting roof water and the other subsurface tank for collecting the flow from the land surface and excess flow from the roof) is proposed. It is found that water is sufficient to meet the demand of a delta of 450 mm (for the garden crops), with watering of each part of the garden being done once in three days. However, it is necessary that waste water from the house be also led into the garden directly. The total tank capacity required is around 18m^3. With a surface tank of 6m^3 and a subsurface tank of 12 m^3, the total cost of the project would be about Rs.15000.

4. RAIN WATER HARVESTING IN URBAN LOCALITIES

Information available from the planning authorities reveals that in the new localities being developed in the city of Mysore, residential sites of sizes 30' x 40', 40' x 60' and 50' x 80' are distributed in about equal proportion of area. These classes of sites may be denoted respectively by LIG (low income group), MIG and HIG. A survey of a new locality in Mysore has shown that the average number of people living in houses in such sites turns out to be around five in the first two and four in the HIG classes. The survey further reveals that the roofed area in all these classes is over 70%. A very important point to note is that except in the case of HIG sites, where a small portion is usually reserved for developing gardens, the total paved area (including the roof area) in 90% of the houses is greater than 95%. This points to the possibility of RWH having a good potential. It is calculated that in case of both LIG and MIG roof water can be used for seven months to meet the requirements of a family of five at about 40 lpd. Also in case of MIG water harvested from the paved area can be used for the complete year for gardening, cleaning and such other purposes. The tank volume required turns out to be about $10m^3$ for the first case and about $18m^3$ for the later. In case of HIG class of houses, it is found that 80 lpd would be available to be supplied to four persons throughout the year, if a tank of sufficient capacity is provided.

The initial cost of installing a rain water harvesting system with brick masonry tanks covered with RCC slabs, would turn out to be about Rs.15000 and Rs.25000 respectively in the first two cases discussed above. This additional cost for people investing on a new house in the urban areas is a meager amount. Particularly since people usually go in for large subsurface water storage tanks on hand before constructing the house, RWH systems can be installed in urban areas with only a little additional cost. Hence, sincere efforts on the part of the planning authority would help popularising this system in the new localities.

A very important point to be noted is that in the new localities, the paved residential sites form about 70% of the total area and if rain water is to be caught at least from a part of this for being used in the houses, quite a lot of load on the storm water drains and hence on the low lying areas (tanks) can be reduced. Further, public water distribution can be made that much more efficient. Hence, it is necessary that it should be made mandatory by law that people taking up construction in sites 30' x 40' and larger must go in for installation of a RWH system.

5. DISCUSSION AND CONCLUSION

Rain water harvesting has many limitations despite turning out to be a very simple means of reducing load on the centralised distribution system. In addition to the initial cost being unaffordable for many, particularly in rural areas, routine efforts needed-

i. to clean the roof and the tank regularly,

ii. to manage the system duly during rains and

iii. to keep the stored water clean for months etc.

are integral part of the system and hence must be considered its drawbacks. Hence, a feasibility study must necessarily be taken up before installation of a RWH system. In this context, the present study, concerning the region of Mysore, has established the following:

- the system may not be beneficial in small houses in rural areas because of the high initial cost; however, with external financial support, the system would meet a major part of the demand of most houses;

- the system is highly beneficial to large house holds in the rural areas; in many cases it would meet the requirements of the live stock and a small kitchen garden too;
- in urban areas, harvesting rain water may not be advantageous to people in houses on sites smaller than 30' x 40';
- adoption of a RWH system must be made mandatory for people going in for sites larger than 100 m^2.

It may be concluded remarking that rain water harvesting in the individual houses must be considered a very easy way of augmenting water supplies through centralised systems. Hence it must be given due consideration while planning urban localities in areas of the region of Mysore. Rain water harvesting should indeed be an integral component of any development plan underlining sustainability.

Table 1 : Demand – availability analysis for Devagalli (DG) & Lalithadripura (LP)

Roof Area (m^2)	Rain water available (lpd)	No. families		No. families with sufficient area	
		DG	LP(%)	DG	LP(%)
-30	42	13	35	10	22
50-60	92	07	20	04	20
70-80	125	07	25	06	18
90-100	157	05	10	04	10
110-120	190	04	05	03	05
130-140	224	04	05	04	05
20-140	-	66	100	46	80

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