RAIN WATER HARVESTING FOR DOMESTIC USE IN WATER POLICY

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Sri Lanka is striving to achieve the goal of "water for all" by the year 2010. Surface water and water from aquifer are under pressure due to urbanisation, deforestation and pollution. To meet the growing demand on water supplies, new types of water sources need to be developed. Rain water has been collected for domestic use in Asia and around the world for many centuries. In recent years many of these traditional techniques have been obsolete due to conventional water supply schemes. Rain water harvesting has attracted considerable attention in recent years at least-by a small, enthusiastic group of researchers, practitioners and decision makers.

Despite several successful domestic rainwater harvesting schemes in Sri Lanka and around the world, governments continue to ignore the technology and consider it an option of last resort. However, in rural areas collecting rain water often remains the only option, specially in areas of high elevation, where surface water is absent, or ground water is mineralised.

In modern mega cities utilising rain water offers many advantages. The benefits includes fewer flooding problems, reduced water bills, restoring the urban hydrology cycle and reducing the 'urban-island effect' caused by the heating of tarmac and concrete by collecting to small pools to cause cooling by evaporation.. It can also reduce the cost provision of infrastructure on storm drainage, use in thermal power plants and in fire fighting. With pollution and reduction of the ground water supplies, due to industries and over population, rain water would be a cheaper and cleaner option to a population that is not served with treated pipe borne water.

The greater attraction of the rain water harvesting system is the low cost, simple design and construction technology, independence of central system, accessible and easily maintained at household. In Sri Lanka, rain water harvesting remains neglected due to lack of awareness on the technology as well as on operation and maintenance. The Lanka Rain Water Harvesting Forum formed in 1996, aims to foster, disseminate and research into the potential of utilising rain water as an option for domestic water supply in Sri Lanka.

This paper will discuss the traditional rain water harvesting systems in Sri Lanka and current status of rain water harvesting in the country. Furthermore, it will give an overview on the design of the available system components, costs, water quality issues, and the advantages and disadvantages of rain water harvesting. In conclusion, it will give recommendation for including rain water harvesting in the water policy of Sri Lanka.

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Introduction

In Sri Lanka the National Water Board has started a programme to provide the entire nation with safe drinking water by the year 2010. However the authorities finds it a challenging task with reducing water resources, pollution, growing conflicts among the users and increase demand on the water. To meet the growing demand on water supplies new types of water sources need to be developed.

Rain water harvesting for domestic use has been developed and tested in many centuries in parts of the world. For example in Sri Lanka in the 5th Century Sigiriya fortress complex the sophisticated rain water-cum-reservoir systems. In recent years many of these rain water collection skills have become obsolete due to introduction of pipe supplies, boreholes or protected wells or springs. However the pressures of increasing population and competition for resources in the second half of the 20th century have forced people to settle in areas that have less water resources. In certain part of the dry zone, the coastal belt, with salt water intrusion into the ground water, and some uphill localities in the wet zone, rain water harvesting remains an important, and sometimes the sole, source of water. In the last 10 year there has been revival of rain water harvesting and many research were conducted to improve the technology. It is time for these technology to pass from the researchers and enthusiasts into normal commercial and public practice.

What is rain water Harvesting?.

It is to catch the rain, store and use. In rain water harvesting reliability of the supply depend on the size of the catchment area, (often the roof), the volume of the storage tank and the management of daily consumption, all in relation to the local rainfall pattern. In our country where the annual average rain is relatively high rain water harvesting is technically feasible any where.

It is been estimated that it is the best water supply option available for about 30% of the house holds in Sri Lanka. However many people do not appreciate the potential of rain water harvesting for domestic use. Thus this technology remain undervalued.

Traditional Rain water harvesting in Sri Lanka

Rain water has been collected in many part of the country Kandy, Badulla, Matara and Galle by different individuals for different purposes with varying technology. Basically three types of traditional rain water harvesting technologies have been identified.

1. Using different techniques to harvest rain water from tree trunks
2. Open air catchment techniques using a plastic/cloth sheet
3. Roof catchment using indigenous, temporary gutter and brick build tanks.

Many of these traditional rain water collecting techniques lack adequate storage capacity and collect water during the rainy season only.

Current status of rain water harvesting in Sri Lanka

Community Water Supply and Sanitation Project (CWSSP)

CWSSP is implemented by the Ministry of Housing and Public Utilities and it is a joint initiative of the Government of Sri Lanka and the World Bank. CWSSP Operate on 3 districts Badulla, Matara and Ratnapura. Since January 1994, 158 schemes of gravity water supply schemes with stand posts and house connections, shallow dug wells, tube wells with hand pumps and motorized pumps schemes were in operation. However, at the end of 1994 the project implementers realized that that several communities living in hilly areas could not be served with the available technical options. Rain water harvesting was seen as possible option to provide a service to these uphill settlements. Thus, a pilot program was initiated at village called Dematwelihinna in Badulla.

Lanka Rain Water Harvesting Forum (LRWHF)

Following the interest shown by the general public small group of interested people established the LRWHForum in 1996. They are from a range of government and non-government institutions, including the National Water Supply and Drainage Board (NWSDB), Water Supply and Sanitation Decade Service, Intermediate Technology Sri Lanka, Community Water Supply and Sanitation Project (CWSSP), Church of Ceylon Board of Women, Agrarian Research and Training Institute (ARTI) and the Open University of Sri Lanka, who are all convinced of the potential of rain water harvesting to contribute to improve domestic water supply.

- identifying identify existing rain water harvesting practices in the country
- developing further techniques for the collection of rain water
- promoting the application of rain water for domestic purposes through information, communication, awareness raising and further study.

Technical option

CWSSP project designed a 5 m^3 volume tanks taking in to account the size of the catchment, frequency and intensity of rain fall and domestic consumption's. On the basis that a family of 5

should have a minimum of 20 l a day for a period of 50 days (dry period). Thus 5 x 20 x 50 = 5000 l or 5 m^3. Following some trials two options were offered: an underground brick tank modeled after the Chinese biogas digester and a free standing ferrocement tank. The brick tank could be constructed within the subsidy that CWSSP offers per household with un-skilled labor provided by the householder, while the ferrocement tank required an household contribution additional to the 20% obligatory household contribution.

Cost of CWSSP rain water harvesting system

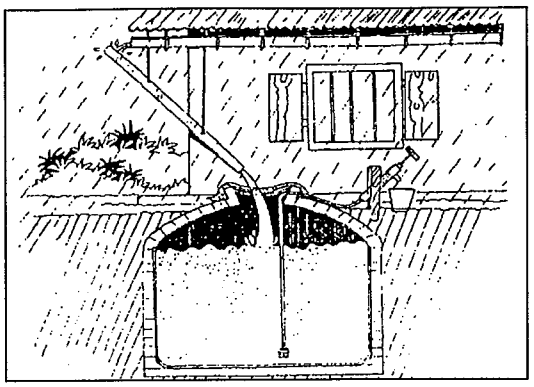
Table 1: Cost Estimates for Brick and Ferrocement Tanks (H. Heijnen and U Mansur (1998)

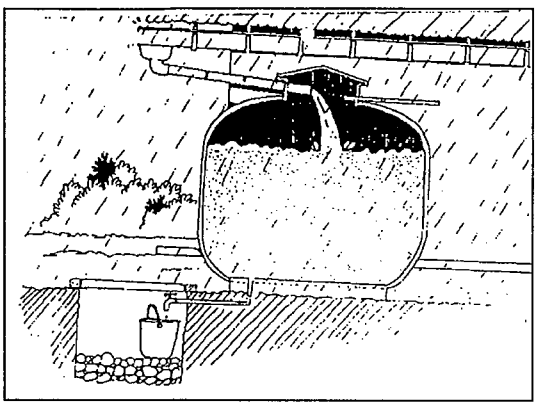
Description	Unit	Rate	Brick Tank		Ferrocement Tank	
			Quantity	Total in Rs.	Quantity	Total in Rs.
Cement	Bags	310	8.5	2635	8.0	2480
Sand	Cubes	1700	0.4	680	0.6	1020
¾ " Metal	Cubes	4000	0.1	400	0.06	240
Brick	Nos.	2/10	800	1680		
Padlo Cement	Kg.	100	0.5	50	0.5	50
Chicken Wire	Sq.m.	40			40	2200
Binding Wire	Kg.	85			1	85
Skilled Labour	Days	250	4	1000	8	2000
Total Rs.				**6445**		**8075**
Unskilled labour	Days	150	12	1800	14	2100
Total				**8245**		**10175**

* costing are inclusive of transport

At current prices the brick tank is within the CWSSP subsidy limit whist, the ferrocement tank requires a additional Rs. 1,500 from the household. To build the brick dome tank a few pieces of bamboo and some brick planks are needed and, while the a metal frame is used to give the ferrocement tank the required rigidity before the plastering can start. The frame can be reused to construct 100 tanks.

Underground Brick Dome tank





Above Ground Ferrocement Tank

Social Aspect

When rain water system was first introduced to Dematawelhina as demonstration project in August 1995 there has been lot of protest and scepticism from the people. However during the next 2 year more and more rain water systems were requested and by at the end of 1997 a total of over 3000 systems were approved in Badulla distinct with some 2000 already completed and functioning. Similarly, Matara has 2000 systems approved and 800 completed.

Women interviewed in Dematawelhina village expression satisfaction of the level of service received by the rain water systems and the convince of having water at the homestead. They claim that they have more time to devote other social and economical matters. Many of them have started poultry projects and mushroom cultivation and home gardening.

Water quality

Quality of rain water collected depend on the cleanliness of the atmosphere, material used for the catchment surface, gutters and down pipe the storage tank and the water extraction device.

Acid rain has been recorded in the hill country and north central province and high nitrate levels in the rain water has been recorded from the western province (Ileperuma, 1998). However acid rain is still not thought to be a serious problem in Sri Lanka compared to other industrialised countries in the region.

Good quality rain can be collected from non- toxic clean roof. Water collected from thatched roof are turbid and unsatisfactory for drinking without treatment. The best surface for catchemnt is the G.I. sheet roofs. Clay tiles and asbestos roof are also satisfactory.

Gutters and down pipes made up of PVC and G.I. Sheets are popularly used . First flush device to take out first rain is recommended and there are various devices with varying complexity in use. Storage tank should be always covered to prevent mosquito breeding and to prevent sunlight entering to form algae. Water should be extracted from the tank by means of a gravity pipe or a pump and not a bucket to prevent contamination.

Preliminary water quality analysis conducted in Badulla and Kandy (H. Heijinen & U Mansur 1988, Padmasiri 1998) indicate that colour and turbidity is still higher than expected and algae growth and mosquito breeding has been a problem. Most of these problems can be avoided by the first flush device or simple filter, keeping the gutters cleaned and tank covered.

Bacteriological analysis indicating faecal pollution was zero in the CWSSP, however some contamination has been recorded from the rain water harvesting systems in Kandy. This could be attributed to inadequate extracting devices. However, this water can be used for drinking after boiling since most pathogenic organisms can not survive at a temperature of 100 ° C.

Advantage and Disadvantage of rain water

Advantages

1. Water is available at household, time and energy is saved on collecting water
2. Simple technology and easy to maintain
3. System is independent and can be managed at household level.
4. Local material and skills can be used for construction of the system.
5. Water collected can be kept high quality and safe with simple precaution.

Disadvantages

1. The high initial cost of building the permanent storage facilities
2. Water is mineral-free and has a flat taste and not popular for drinking.
3. The quantity of available water depends on the rainfall catchment area storage capacity.
4. The user must learn to ration the use of water during the dry season.
5. Inadequate management and maintenance can lead to contamination.

Conclusion

In Sri Lanka existing potential of RWH has not been tapped to meet the need. Experience with the CWSSP project in Badulla with the participation of the people and the popularity of the designed tanks among rural communities suggested that there is scope for expansion into dry and intermediate zone of the country. However in Sri Lanka rain water harvesting remains neglected due to lack of awareness and recognition by the policy makers on the technology. The government, NGO's and the private sector should be encouraged to promote rain water harvesting through advertising and marketing appropriate technical solution.

Initial cost of building the tank is still too high for the low income group, a government subsidiary or credit facility scheme should be developed to encourage these groups. In the urban areas water collected can be used to supplement the central water supply schemes, specially for non-drinking uses. Rain water harvesting systems should be integrated into the newly proposed housing schemes and public buildings. More research should be conducted to develop area specific demand based rain water harvesting systems.

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