\NEED AND RELEVANCE OF RAINWATER HARVESTING AND GREY WATER RECYCLING IN URBAN AREAS: THE CHENNAI EXPERIENCE

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The importance of water can never be over-emphasized. From the Rig Veda to the Sangam Literature of the south, water is glorified and exalted as divine life giving element of nature.

There are only two primary sourcesfor fresh water found on land -Melting of ice and precipitation. Harvesting rain is crucial for sustaining both surface and sub-soil water sources. That this has been historically well understood throughout rural India is evident from numerous traditional water harvesting systems put in place severaldecades ago which are still in operation like the eri systems of South India.

60% of India is expected to be living in towns and cities by 2025. Municipal authorities are finding it increasingly difficult to meet the water needs of this bourgeoning urban population. Urban India has not only taken water for granted but has exhibited little interest in rainwater harvesting (RWH), despite its potential to help sustain groundwater sources.

A classic example is the coastal city of Chennai in Tamil Nadu. Inadequate supply of municipal water over the last two decades has forced the populace to relentlessly tap groundwater for its needs. This over-exploitation has resulted in the sharp depletion of the groundwater table and deterioration of its quality as well. Seawater has already intruded into the coastal aquifers, rendering groundwater quite saline.Many other citiesare facing a similar situation or heading towards it.

RAINWATER HARVESTING BASICS

Most places in India receive moderate to good rainfall. But this rainfall occurs in short spells of high intensity. Because of this most of the rain falling on the surface either floods the area or flows away rapidly resulting in very little or no infiltration into the soil. One of the best ways to prevent rain water from getting wasted is to harvest it at source.

Types of Rainwater harvesting

Rainwater harvesting can broadly be divided into 3 categories based on the types of usage, the area in which harvesting is carried out and the people involved.

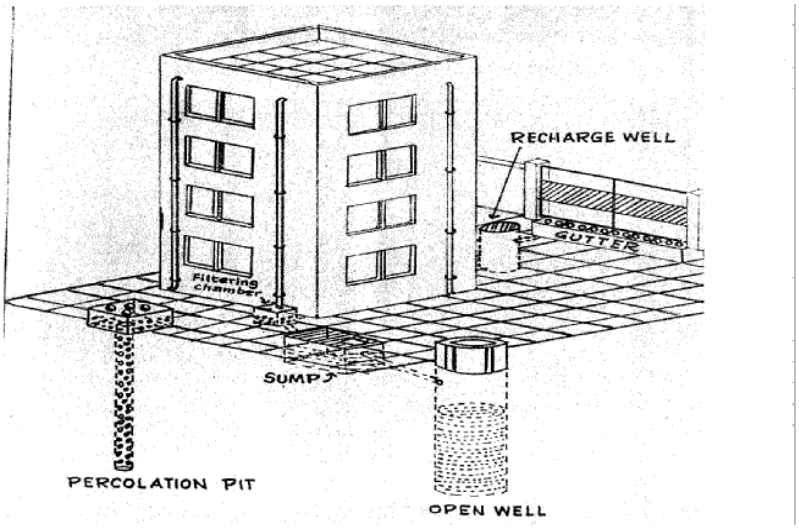
- **(i)** **Storage or Recharge -** Based on the type of usage, structures can either be used to store the collected water for direct use or to recharge groundwater.
- **(ii)** **The Urban-Rural Difference -** Urbanization has resulted in the shrinking of open spaces as well as unpaved areas. This has resulted not only in flooding of cities but has also caused water scarcity due to groundwater depletion in general and saline intrusion in coastal cities. While rural harvesting is mostly traditional and is carried out in surface storage bodies like rivers, tanks, ponds, lakes etc., urban harvesting, due to lack of open space for capturing the runoff, is mostly in sub-soil storage as groundwater recharge.
- **(iii)** **Rooftop and Drive-Way Harvesting -** When we say rainwater harvesting, the first thing that comes to our mind is the terrace. This greatly restricts the scope of rainwater harvesting as a considerable amount of water that falls around the built up area is let out of the building as run-off. Driveway run-off water should not be

led into a sump for immediate use or to a source well, but itcan very well be directed into recharge wells.

Rooftop Rainwater Harvesting - Methodology

Rooftop rainwater is of good quality providedthe terraces are kept clean. This is brought down by the drainpipes called rooftop pipes.

i. Direct at least one or more of these pipes located close to the existing below-ground-level masonry tank (also called sump) into it through a first-flush arrangement or a filter or both.The first-flush is an arrangement to remove the first rainwater from the terrace that may be contaminated with debris using a diversion pipe that fills up with the first water. The collected water should then be let outof the pipe using a valve set up for the purpose.
ii. Any overflow from the sump can be led into an open/dug well, if any, within the premises for groundwater recharge purposes. Pipes not directed to the sump can also be led into the well.
iii. In the absence of an open well, a percolation or recharge well could be dug within the premises to inject rooftop water into it for groundwater recharge.
iv. In houses or flat complexes where there is not enough space around the built-up area to dig a recharge well, a percolation/recharge pit could be made for the purpose of putting rooftop water into it for groundwater recharge.
v. Percolation or Recharge wells can be constructed using cement rings readily available in the market. The depth depends on the nature of the soil and the diameter of the well should be decided based on the amount of water expected to flow into it.



Driveway Runoff Harvesting – Methodology

Water falling in areas surrounding the built up space can be harvested by intercepting it with the help of a shallow gutter (covered with a perforated reinforced cementconcreteslab) or a bump (which will be a cheaper alternative to the gutter) near the gate(s) and directed to a recharge well(s) for recharging the groundwater.

However, such driveway runoff should not be led into a recharge pit since the runoff will contain large amounts of silt and will lead to clogging of the pit.

Characteristics of a good groundwater recharge system

The RWH system must ensure that not a drop of rainwater falling within the premises is let into the sewerage or wasted as runoff. This can be achieved only if the method adopted within the premises satisfies the following criteria:

- **Completeness** -Both rooftop and driveway runoff water to be harvested.
- **Apportioning of water**–To avoid overload of any one system, leading to overflow and loss.
- **Proper design** - Volume of water likely to flow through and the nature of the soil in the area should be considered.
- **Maintainability** - Design should incorporate features allowing for periodic maintenance of the structure.

GREY-WATER RECYCLING

The 2003 ordinance that made the implementation of RWH systems compulsory in all existing buildings in Tamil Nadu also mandates that "waste water from the bath and wash basin shall be treated by organic or mechanical recycling and taken to a sump for onward pumping to an exclusive overhead tank for use in toilet flushing. Any excess shall be connected to the rainwater harvesting structures for groundwater recharge."

Recycling of grey water i.e. bath and kitchen water is essential to maintain the cyclical flow of water in a household. It may not be possible to use this water for potable purposes, but it very much possible for it to be re-used for non-potable uses such as toilet flushing and gardening.

Simply diverting the grey water into a bed of water loving plants such as Canna, popularly known as *kal-vazhai* in Tamil, Cyperus(umbrella plant) or Heliconium is the most cost effective way of treating it. The organic as well as the inorganic material in the grey water actas nutrients for the plants. The plants along with the soil microbes take care of polishing the greywater as it moves down through the soil. The treated water can then be diverted into storage tanks and used for flushing of toilets and gardening.

Bath and kitchen refuse water account for close to 50% of the daily water usage at homes. Greywater recycling therefore should go hand in hand with rainwater harvesting inindividual homes as well as apartment complexes to reach a considerable level ofdecentralization in terms of water supply.

THE CHENNAI EXPERIENCE

Unlike most of the cities in India, Chennai is not located close to any perennial river and is completely dependent on rainwater harvested in traditional surface storage bodies called *eris* and sub-soil water, which is also sustained by rainwater through infiltration

Chennai city, like most of the other large metropolitan areas in India, is water-starved but not rain-starved. The annual average rainfall in Chennai city is 1300 mm and around 60% is from the North-East monsoon and 35% from the South-West monsoon.

Individual and organizations' efforts

Realizing the fact that the problems faced by urban residents are essentially due to lack of awareness regarding the importance of water, Dr. SekharRaghavan undertook a door to door campaign in two of Chennai's coastal suburbs, Besant Nagar and Valmiki Nagar in the late 90s.

A few like-minded people got together to formthe Akash Ganga Trust in 2001. In August 2002, the Trust launched Chennai's Rain Centre, the first of its kind in the country, inaugurated by the Honorable Chief Minister of Tamil Nadu. The Centre is a one-stop information and assistance center on rainwater harvesting.

In addition to Akash Ganga Trust, a few other NGOs like Rotary Clubs, Lions Clubs and INTACH (Indian National Trust for Art and Cultural Heritage) have also been playing an active role in promoting RWH in Chennai. Particular mention must be made of the efforts of Rotary International District 3230 in renovating and reviving seven temple tanks for use in artificial recharge of the harvested rainwater, besides creating awareness among its members.

Surveys and Effectiveness Studies

The Centre surveyed a local residential colony to ascertain the adequacy of the RWH structures that had been installed to comply with the law, described in more detail below, enacted by the Tamil Nadu government making RWH compulsory. The survey revealed that only 30% of the residents had done well and another 20% satisfactorily. The remaining 50% had done it without any involvement and realization of the benefits of RWH.

Government efforts

The Tamil Nadu government enacted a law in October 2002, followed with an ordinance in June 2003, making the implementation of RWH systems compulsory in all existing buildings in the entire state of Tamil Nadu by October 11, 2003. The law mandates that "waste water from the bath and wash basin shall be treated by organic or mechanical recycling and taken to a sump for onward pumping to an exclusive overhead tank for use in toilet flushing. Any excess shall be connected to the rainwater harvesting structures for groundwater recharge."

To show that it not only preaches but also practices, the government also issued orders to all its departments to implement RWH in buildings belonging to them. The Chennai Corporation has implemented RWH in public places like roads that get flooded during monsoon, schools, parks and their staff quarters.

Community-Government Synergy

The coming together of the society and the state is one of the main reasons for the success of implementing rainwater harvesting in Chennai. Individual efforts complemented the initiative of the state and the state in turn supported the efforts of the community.

From awareness creation to technical support, the efforts of the community and the state were properly aligned to avoid conflict.The initiative and leadershipof both the bureaucracy as well as the electedofficialsof the government is greatly appreciated by many. Between 2001 and 2002, the Municipal Administration and Water Supply Secretary held regular meetings at her office and monitored the progress closely.Campaigns were scheduled at regular intervals and the implementation was monitored closely.

NGOs used their people friendliness to get the idea across. The Rain Centre along with several other organizations played a very important role in taking the movement from just theory to practice.

Even ten years after the law came into force, the government has not lost sight of this synergy. Realizing the importance of third party monitoring, the present government has proposed to carry out an audit of the RWH implementation in the city with the help of local NGOs.

The mutual faith shown by both parties in each other was one of the high points of the exercise a decade and it is heartening to note that it still remains so. Unless this coupling happens, it is very difficult to put in place measures on such a massive scale.

Benefits of implementing Rainwater Harvesting

Benefits are both direct and indirect. One of the more apparent and direct benefits of rainwater harvesting in cities is that of flood mitigation. Appropriately designed recharge structures in open public spaces – be it storm water drains or recharge pits – will help keep the roads from flooding. When water is not allowed to leave the premises, the chances of it choking up the roads are minimal.

There is a marked improvement of both the quantity as well as the quality of the groundwater in areas which have implemented rainwater harvesting. The city of Chennai is probably the best example to second this statement. In a survey conducted by the Rain Centre after the 2006 monsoons, it was found that the water table had risen by 6 metres after the rainwater harvesting drive in the city.

CONCLUSION

Cities across India could benefit from Chennai's learning. If it is possible to get the community together and implement something on such a scale in one city, it is very much possible to replicate this elsewhere.

New designs have to be developed for the urban context, particularly for RWH systems that are concerned with aquifer recharge. Progress made to date in Chennai indicates that such changes are indeed feasible, cost-effective, and potentially quite effective for other similar urban locations.

About the authors

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