

# RAINWATER HARVESTING POSSIBILITIES AND CHALLENGES IN BIHAR

**Kundan Kumar**

*IIMT College of Engg. (G. Noida)*

## ABSTRACT

*This paper examines the possibilities and challenges of rainwater harvesting in both rural and urban areas of Bihar. The problems of water shortage in urban areas and the high costs of developing new surface water sources, the scarcity of ground water supplies in arid and semiarid lands (ASALs) and the unmanageable operation and maintenance costs of large piped water supplies are alarming. Therefore the willingness of the people, particularly in arid and semiarid areas, to embrace low cost initiatives like rainwater harvesting. The solutions suggested emanate from the grassroots community projects, the author's experiences in water sector as an engineer and recommendation from household rainwater harvesting workshops.*

## I. INTRODUCTION

Rainwater harvesting technology is an old established art in Bihar, whose abundant knowledge has not been applied to its full potential, especially in urban informal settlements and its neighbourhoods due to various challenges and constraints experienced by community based organisations. Observations in most of our urban centres show that rainwater-harvesting structures are not integrated into the building but are added as an afterthought. This is due to the existing by-laws and lack of awareness by planners, policy makers, beneficiaries and many engineers. The high potential of rainwater harvesting in Bihar lies in three factors namely: -reliable seasonal rainfall, the quality of roofing materials, and the high demand for clean water supplies. The housing quality in Bihar, based on roofing materials is such that about 84.7% of the housing units in central province, 48.1% in Eastern, 33.1% in Western province, 29.3% in coast province and about 12.4% in North Eastern province are made of iron sheet roofs, asbestos cement sheets, concrete or clay tiles. (CBS 1994). This combined with high costs of conventional water sources makes rainwater harvesting a viable alternative water source particularly in developing urban centres and rural areas. The Bihar Rainwater Association (BRA) in conjunction with community based organisations have identified some of the challenges and constraints that commonly affect replicability and sustainability of rainwater harvesting technologies and through group discussions suggest some possible solutions. Modern technologies for obtaining and using water are concerned chiefly with expensive exploitation of river systems and ground water resources by means of wells and boreholes. This is due to supply responsive approaches propagated by External Support Agencies (ESA). Sustainability of most of these projects after the donor withdrawal has been found wanting and unmanageable by the beneficiaries particularly in the rural parts of Bihar. In spite of the great efforts in the area of water resources development, with the construction of large water projects, there is still under-provision of water for domestic use particularly in the rural and slum areas of Bihar, as more than 67% of rural household still have no access to clean and safe drinking water. The problems of irregular water supply due to poor

maintenance, lack of funds, broken facilities and rapid population increase, among other factors, have now reached a critical state.

## II. WATER SUPPLY AND CONSUMPTION LEVELS

Depending on climate and workload, the human body needs about 3-10 litres of water per day. The amount and purpose varies widely, and is greatly influenced by the type and availability of the water supply. In rainwater harvesting large surface areas (catchments) and the storage tank is required to provide sufficient supply for the dry seasons. Cultural habits, pattern and standard of living, methods of withdrawal, cost and quality of water will greatly influence the use of rainwater for domestic purposes. The per capita water consumption in the rural areas of developing countries as given by IRC (1983) is as follows:

**Table 1.0 Typical domestic water supply and usage**

Types of Water supply	Water consumption Litres/person/day	Range in L/person/day
Communal water point (e.g. village well, public standpoint) at a distance more than 1000m	7	5-10
at between 500-1000m	12	10-15
Village well at less than 250m	20	15-25
<i>Communal standpipe at less than 250m</i>	30	20-50
Yard connection with a tap	40	20-80
House connection		
-single tap	50	30-60
-multiple tap	150	70-250

It can be noted that water for drinking purposes range from 3-10 litres per day while for general domestic uses it varies between 5-250 litres depending on distance and type of source or mode of withdrawal. Thus a rainwater tank will be the same as a yard connection with added advantages of extra storage to balance demand vs. supply, hence increasing per capita consumption to the benefit of consumers.

## III. POSSIBILITIES AND CHALLENGES

Various challenges and possibilities in making Rainwater harvesting a viable alternative to conventional water supply sources were identified during the household rainwater harvesting district workshop (HRWH) and could broadly be classified as: - *policy issues, technical challenges and managerial constraints.* (KRA 1998 a)

### 3.1 Policy Issues

In many instances community based organisations, non-governmental organisations, government departments and even some donor agencies lack policy guidelines in support of rainwater harvesting. Those that have are generally inadequate, and unsuitable to the prevailing local conditions. For example the Ministry of Water resources in Bihar have no mechanism of approving the construction of a ferrocement tank or water jar since they do not have design standard drawings. The city council by-laws only allow for effective disposal of rainwater from roofs to avoid dumpiness and drainage problems but not to collect for beneficial purposes. Thus, most of the rainwater harvesting projects, particularly in Central, Eastern, provinces evaluated by the BRA are faced with some of the following challenges:

Inadequate legal advice in projects formation and outlined objectives as per relevant constitutional framework;  
Limited policies and by laws in funds and fundraising strategies to allow for effective project implementation and management;

- Lack of collaboration and networking amongst stakeholders;
- Limited community mobilisation policy for water related activities;
- Low rate of community participation and contribution to project development;
- Inadequate water quality improvement structures, control and usage;
- Limited training and technological transfer in rainwater harvesting at project level;

Lack of operation and maintenance guidelines for rainwater infrastructure such as gutters, tanks catchments and fittings. There is high potential of rainwater harvesting both in rural and developing urban centres particularly in countries like Bihar due to the rapid population growth and the need for alternative water sources that are simple, effective, low cost and environmentally sound. The annual seasonal rainfall patterns in Bihar coupled with adequate roofing materials makes rainwater harvesting a possibility in both urban and rural areas. The current political system of democracy is creating an enabling environment for collaboration and training in community mobilisation and participation. However the new water policy, local council by-laws and various Acts need to be amended to effectively address some of these issues. The community's willingness to participate in RWH is seen as a positive challenge in the development of the water sector policy. Thus with suitable water policy implementation plans and by-laws, rainwater harvesting can be enhanced and improved to overcome the above said challenges in supplementing conventional water supply sources, particularly for isolated homes in ASALs and in upcoming urban centres where water shortage problems are rampant.

### 3.2 Technical Issues

No matter how well designed a rainwater harvesting system, if it is not technically efficient, it will not deliver or perform the anticipated functions. Many projects, particularly in the rural areas, are not sustainable or cannot be replicable due to inadequate technical interventions, e.g. construction of roof catchment system, shallow wells, tanks and VIP latrines requires detailed technical instruction for effective implementation. The absence of such technical instructions at project level implies inadequate technological transfer and poor project management resulting in a high failure rate. A 1998 survey by BRA of 16 community based water projects indicated that lack of technical interventions is the major cause of project failures. Assessment of the infrastructure shows that the communities were not fully involved in the planning and technology selection. The method of fixing gutters,

taps, tank construction valves and operation and maintenance guidelines are not fully understood nor issued to the community on the commissioning of the project. Technology selection by a community means acceptance, implying an understanding and willingness to be associated with it, irrespective of some shortcomings in community participation. Technical challenges facing many local initiatives in rainwater harvesting projects particularly were identified as follows:

- Inadequate construction guidelines for tanks, gutters, filters, etc.
- Inadequate technological transfer to the beneficiaries
- Lack of suitable training programmes in rainwater harvesting
- Poor technical selection and usage of local materials
- Sizing of storage tanks, with respect to rainfall data and costs
- Lack of water quality improvement structures and control
- Inappropriate guttering system in design, construction (support) and maintenance.

Technological challenges in rainwater harvesting could be turned into realities by adopting pragmatic approaches like creating awareness through exposure (CATE), involving other stakeholders, use of appropriate designs in the rainfall data, guttering systems, sizing of storage tanks and use of locally available resources. It is estimated that about 60% of the failures in Kasaye Rainwater Harvesting project are attributed to inappropriate guttering systems. (BRA Report 1999). If rainwater harvesting were considered a supplementary source of water supply in small urban centre and arid and semi-arid lands (ASALs) of Bihar, then accessibility and coverage of safe drinking water would increase to over 74%. Presently it is estimated that only 32.5% of households in rural parts and 93.3% in urban centres of Bihar have access to safe drinking water. But accessibility does not in any way mean availability and reliability, (CBS 1994).

## IV. MANAGERIAL ISSUES

The BRA carried out a preliminary survey in 5 districts (Bhagalpur, Gopalganj, Sitamadhi, Samastipur, Darabhangha) of low cost individual and or small community based water projects i.e. springs, shallow wells and rainwater harvesting. Compared to the existing piped water supply in most in those districts, household community-based water supplies are much more efficient than centrally controlled large piped water schemes. There is a sense of ownership, community participation and contribution in the management of community based water projects unlike in the government projects where the water managers have little or no enthusiasm in the management affairs. The managerial issues of major concerns that were raised included among others:

- Limited use of local resources;
- Inadequate community participation and contribution – due to approaches;
- Inadequate project management skills, by community organisation;
- Poor financial management and bookkeeping resulting in financial loss;
- Lack of proper water usage and control measures;
- Lack of awareness and unwillingness to obtaining legal status due to taxation;
- Donor dependency syndrome
- Political interference within the community projects.

Experience in low-income housing areas show that it is relatively easy to arouse people's interest in rainwater tank construction; since they are perceived as desired improvements to their homesteads and a symbol of status particularly in the rural areas. one criterion used to select a beneficiary for RWH tank construction is to have an iron sheet roofed houses. (BRA, 1999) This has led to the community members improving their housing and consequently improving general community development. New housing schemes in urban areas should be encouraged to incorporate RWH tanks for emergency supply and other general usage of water. The large government owned water projects have a high potential in overcoming managerial challenges of low cost community based water projects. Legally formulated by-laws and registration of self -help water projects, improvement of financial and management skills through local training will enhance effective and proper water usage and control. Solutions to managerial issues as suggested by various communities based organisations included:

- Increased community mobilisation at project levels
- Awareness creation through exchange visits
- Community training in project management
- Use of demand responsive approaches in project initiation and technology selection.

The essence of appropriate technology is that equipment and techniques selected particularly in RWH should be relevant to local resources and needs, feasible to organise and suitable for the local environment and above all more efficient than the one existing.

## V.COMMUNITY WATER SUPPLY –URBAN CASE STUDY

Providing water supply to a community involves tapping all sources of water available, ensuring that it is fit for human consumption and supplying it regularly and in adequate quantities. The per capita quantity of water used by a family varies with physical and socio-economic conditions and consequently, varies widely between and within a neighbourhood. The level of service provided has also been found to have a marked influence on water usage. Where water has to be carried over long distances e.g. in ASAL's district, or when waiting for too long hours at water kiosks especially in developing urban centres before being served, the daily consumption may be as low as 5 litres per person.

## VI. CONCLUSIONS AND RECOMMENDATIONS

Being individual or community-based, the introduction and application of rainwater harvesting technologies would be easy to implement and environmentally friendly for the following reasons:

- It is easily understood with relatively little technical knowledge required;
- It has many advantages over the existing systems, especially in operation performance, it creates jobs through labour-intensive methods particularly in rural areas;
- It relies on locally available resources, personnel and materials;
- It is economically feasible compared to other sources, such as boreholes and river system;
- It is socially acceptable at grassroots levels;
- It improves the drainage and sanitary conditions of the home states
- High sense of ownership improves sustainability of the system

- It can be integrated easily in many development programs such as housing food security, water supply etc.

A major advantage of rainwater collected from roofs is that it is usually free and much cleaner than water from streams, burst pipes and dams. Therefore rainwater offers considerable advantages when used for various domestic purposes such as drinking and cooking. However, it should not be assumed that water from roofs is totally free from contamination. In some case birds' droppings, rotting roofing materials and wind-blown dirt may all contribute to some pollution. Also poorly managed systems may be a source of other problems related to drainage and diseases.

The following guidelines are therefore recommended in rainwater harvesting:

-That water running off the roof during the first 3-5 minutes of a storm should not be used for drinking purposes but discarded or used for crop production. If this is not done the tank should be cleaned out more often as there is every chance that organic matter in the tank will promote the growth of bacteria bad and other organisms, likely to cause contamination. There should be some form of coarse screen between guttering and the delivery pipe, and a finer screen or filter at the point where water enters the tank to improve quality of water harvested.

-Gutters should be free from depressions and bends in which water is left standing, as these points become mosquito-breeding sites. All openings into the tank, such as overflow, water level indicators, and vent pipes should be fitted with fine plastic gauze to prevent entry of insects and rodents. Operation and maintenance of the system fittings such as valves and taps are very important, as this will ensure sustainability and efficiency of water delivery system. Proper design and selection of the guttering system, i.e. shapes size and slope to be adopted, so as to ensure maximum collection and delivery of the rainwater. Programmes should be designed to help low-income groups in water development activities and thus have improve the bad state of the housing, including roofs, should receive adequate support to promote rainwater harvesting. In many parts of Bihar people cannot be expected to improve their current living conditions without adequate water supply. For any development, may it be industrial, commercial or agricultural, water is needed for it to succeed. We cannot be indifferent to these situations; it is up to us, at all levels in society, to do something in our respective fields. Rainwater harvesting is just one of the solutions in the provision of supplementary water sources in the coming millennium. Therefore rainwater harvesting should be introduced as a bylaw in the building guidelines and any new development should be encouraged to explore and apply the rainwater harvesting technologies, not withstanding policy managerial

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