

Rainwater harvesting in Ancient Times and its Sustainable Modern techniques

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ABSTRACT

In India water harvesting has been practised since time immemorial. References of this practice are found in ancient religions texts and history. Archaeological evidence of elaborate water storage and supply systems are found for periods dating back to the Indus Valley Civilization (3000-1500 B.C.) to as recent as 19th century A.D. During the last about 100 years, the objectives and focus of water harvesting have undergone considerable change through the basic techniques of design and construction have remained almost the same. At present most water harvesting structures are built under the holistic programme of watershed development which addresses the key issues of domestic water supply for individual households and small communities in remote areas, improving agricultural production in rain fed areas, reclamation of degraded lands, rejuvenating defunct local streams, soil conservation, improving biomass and providing more livelihood options for the poor especially women. Beneficiaries and the local community organizations are fully involved in planning, design, construction and management of watershed development projects.

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1. INTRODUCTION

India is a country with very deep historical roots and strong cultural traditions. These are reflected in its social fabric and institutions of community life. Some of the traditions, evolved and developed thousands of years ago have played an important role in different spheres of life. One of the important among these is the tradition of collecting, storing and preserving water for various uses. As the population increased, settlements developed into towns and cities and agriculture expanded, techniques were developed to augment water availability by collecting and storing rain water, tapping hill and underground springs and water from snow and glacier melt etc. Water came to be regarded as precious and its conservation and preservation was sanctified by religion. Various religious, cultural and social rituals prescribed, interalia, purification and cleansing with water. Water itself had many applications in different rituals. Development of reliable sources of water like, storage reservoirs, ponds, lakes, irrigation canals etc. came to be regarded as an essential part of good governance. Emperors and Kings not only built various water bodies but also encouraged the village communities and individuals to build these on their own. Wide-ranging laws were made to regulate their construction, maintenance and for conservation and preservation of water and its proper distribution and use.

2. MYTHOLOGY AND FOLKLORE

Ancient Indian religious texts and epics give a good insight into the water storage and conservation systems prevailing in those days. For instance the sage Narad during his visits to different kingdoms would invariably enquire about the state of the ponds and other water bodies and whether these had enough water for the population. In the epic Ramayana, the beauty and grandeur of the kingdom of Lanka is described interalia, in terms of its well-maintained lakes, ponds, wells, gardens, orchards and forests.

3. HISTORICAL PERSPECTIVE

In India, the first major human settlements came up in the Indus Valley (3000 - 1500 B.C.) in the north and western India. Evidence of water systems is found in different writings of this period. There are archaeological evidence of irrigation and drinking water supply systems from a large number of wells with brick lining. Dholavira, an important site of Indus Valley had several reservoirs to collect rain water. Similar evidences are found at Mohanjodaro and Harappa. In Lothal (Gujarat) and Inamgaon (Maharashtra) and other places in north and western India small bunds were built by the local people to store rain water for irrigation and drinking.

The Arthashastra of Kautilya gives an extensive account of dams and bunds that were built for irrigation during the period of the Mauryan Empire. (321–185 B.C.)The water supply systems were well managed within the framework of strict rules and regulations. Different types of taxes were collected from the cultivators depending upon the nature of irrigation. The tax rate was 25% of the produce in respect of water drawn from natural sources like rivers, tanks and springs. For water drawn from storages built by the King the tax rate varied according to the method of drawing water. For instance, it was 20% of the produce for water drawn manually, 25% for water drawn by bullocks and 33% for that diverted through channels. Exemptions from payment of water rates were given for building or improving irrigation facilities. The period of exemption was 5 years for new tanks and bunds, 4 years for renovating old works and 3 years for clearing the works over-grown with weeds. Water bodies like reservoirs, bunds and tanks were also privately owned and the owner was free to sell or mortgage them. The owner could also sell water to others in return for a share of the produce. In the absence of the owner, the water bodies were to be maintained by the people of the village. A set of punishments were prescribed for various violations of water laws like:

- Causing damage to another's ploughed or sown field by letting water overflow from a tank/reservoir.
- Causing damage to gardens, parks and bunds.
- Owner of the higher tank preventing the filling of the lower tank.
- Failure to maintain the water body.
- Out-of-turn drawing of water from a tank.
- Building a well or a tank on someone else's land.
- Selling or mortgaging a water body meant for charitable purposes.
- Death penalty was prescribed for breaking a reservoir or tank full of water.

Satvahanas (1st Century B.C. – 2nd Century A.D.) introduced the brick and ring wells. Lake and well irrigation was developed on a large scale during the time of Pandya, Chera and Chola dynasties in south India (1st – 3rd Century A.D.) and large structures were built across Cauvery and Vaigai rivers. Irrigation tanks were built, many of these by developing large natural depressions. Water resources development on a large scale took place during the Gupta era (300-500 A.D.). In the south, the Pallavas expanded the irrigation system in the 7th Century A.D. The famous Cauvery anicut was built during this period. Large-scale construction of tanks (Tataka) for tapping rain water was also done in Tamil Nadu. The Chola period (985-1205 A.D.) witnessed the introduction of quite advanced irrigation systems, which brought about prosperity in the Deccan region. This included not only weirs across rivers and streams but also chain-tanks i.e. a number of tanks with connecting channels. This new system was more reliable in terms of water availability and provided better flexibility in water distribution.

In the Medieval period, Mohammad Bin Tughlaq (1325-1351 A.D.) encouraged the farmers to build their own rain water harvesting systems and wells. The Vijaynagar Kingdom (1336-1546 A.D.) in the south took keen interest in building rain water harvesting structures in the form of large and small storage tanks.

4. WATER HARVESTING FOR DOMESTIC USE

Though the large number of reservoirs and tanks built in different times by the Kings, village communities and individuals were mainly for irrigation, these also provided water for the cattle and domestic use either directly or indirectly through charging of wells. In fact, wells were invariably built close to the tanks, lakes, canals etc. In the arid and semi-arid areas of northwest India. Rain water was collected in underground storage tanks called Tanka, Kunds or Kundis. However, the first known construction of a Kund was in 1607 in village Vadi-Ka-Melan. In 1755, Maharaja Udai Singh built a large Kund in his fort at Jodhpur. Subsequently, during the famine of 1895-96 construction of such storage structures was taken up on a large scale.

The city of Delhi, founded in the early eleventh century used to get its water supply from Suraj Kund, which was built to impound rain water from the Aravalli hills. During the Sultanate period that followed, several cities were built in the vicinity of the Aravallis and all these had elaborate rain water harvesting systems to meet the domestic water requirements. The prominent among these is the Hauz-e-Sultani built by Sultan Iltutmish (1210-1236 A.D.).

In 1615, during the Mughal rule, Abdul Rahim Khan built a unique water supply system for the Burhanpur town (Madhya Pradesh). The system involved construction of long lines of underground tunnels with vertical airshafts to tap the underground water flow from the nearby Satpura hill ranges to the Tapti River lower down. The system is still functioning well and is adequate to meet the entire water requirements of the town.

In the hills near Daulatabad town two water harvesting structures were built by the Hindu Kings to meet the water requirements of the town. Similar structures were built in Palanpur, Ahmedabad, Bharuch, Surat and Vadodara areas of Gujarat during the 15th Century for both irrigation and drinking water.

5. WATER HARVESTING FOR FORTS AND PLACES OF WORSHIP

All forts, built in different terrains and climatic conditions, had elaborate arrangements for drinking water. Those built on hilltops or in rocky terrain depended mainly on rain water harvested from surrounding hills. The Amber Fort near Jaipur built about three centuries ago is a classic example of such a system. It has an automatic arrangement for desilting and aeration of harvested rain water before its entry into a large storage tank. The Jodhpur fort in western Rajasthan had water harvesting arrangements to tap both rain water and groundwater. The Panhala Fort of Maharaj Shivaji built on a hillock near Kolhapur in Maharashtra had step wells to tap underground springs originating in nearby higher hill slopes. The fort at Chittor on top of a hill has a large reservoir formed from the harvested waters of springs. At the Buddhist site of Sanchi (Madhya Pradesh) dating back to the 3rd Century B.C., there are three ancient tanks to store rain water from the hill slopes.

Most of the old temples in south India built centuries ago have large tanks in their premises. These tanks are either fed by harvested rain water or by tapping underground springs. In Tamil Nadu alone there are 39 temple tanks with areas varying from 0.25 to 3 hectares. These are all fed by rain water. Though these were used mainly for bathing and religious purposes, these also recharged the drinking water wells.

6. ROLE OF COMMUNITIES AND INDIVIDUALS

In those days, centuries ago, the state built only large storages essentially for irrigation and water supply for the capital cities and important towns. These were obviously not enough and therefore the village communities and individuals were encouraged to build their own water harvesting devices to meet their basic domestic requirement of water. The communities being closely knit had a strong culture of providing voluntary labour and material contributions for building these facilities for the common good. The social norms for civilized behaviour, inter alia, enjoined on the community members to maintain these facilities, conserve and protect water from pollution and ensure its equitable and fair distribution.

7. MODERN APPROACH FOR SUSTAINABILITY OF WATER HARVESTING PROGRAMME

At present most water harvesting structures are built under the holistic programme of watershed development which addresses the following main concerns/issues:

- i. Roof top rainwater harvesting for domestic use of individual households and small communities in remote areas.
- ii. Creating surface water storages in the form of check dams, dug ponds etc. for irrigation and drinking water for cattle.
- iii. Recharging ground water through check dams, percolation tanks, sub-surface dykes etc. to augment drinking water availability in wells, tube wells, hand pumps etc.
- iv. Soil conservation through;
 - ✓ Afforestation
 - ✓ Gully plugging
 - ✓ Contour cropping
 - ✓ Control and regulation of grazing
- v. Soil moisture conservation especially in rainfed hilly areas, through
 - ✓ Bench terracing
 - ✓ Contour bunding

- vi. Improving cropping pattern, crop calendar etc. for enhancing farm incomes
- vii. Improving marketing facilities for farm produce
- viii. Providing additional livelihood options such as:
 - ✓ Dairy farming
 - ✓ Poultry farming
 - ✓ Bee keeping
 - ✓ Sericulture etc.
- ix. Promoting social forestry to meet the fuel wood requirement where alternative sources of fuel are not feasible.

The watershed development and management programme is carried out from concept of commissioning with whole hearted participation of beneficiary communities for which detailed guidelines have been issued by the Government of India

The benefits of watershed development schemes are evaluated in terms of;

- i. Increase in discharge of local streams and rejuvenation defunct local streams
- ii. Increase in water availability in village wells, hand pumps etc.
- iii. Increase in biomass
- iv. Increase in rain fed area and irrigated area
- v. Increase in productivity of rain fed and irrigated areas
- vi. Reclamation of degraded lands
- vii. Improvement in socio-economic condition of people especially women

7.1. WATER HARVESTING IN URBAN AREAS

In large cities and towns, the urban local bodies have made it mandatory to provide roof top rainwater harvesting devices in all government buildings, housing and industrial complexes with arrangement for recharging of ground water aquifers. Rejuvenation of natural lakes in and around urban centers is being taken up on a large scale under the National Lake Conservation Programme of the Union Ministry of Environment and Forests. Sustainability of these programmes is ensured through regular maintenance and monitoring of the benefits by various institutions including NGO's and community based organizations.

8. CONCLUSION

Rainwater harvesting as part of the broad based watershed development programme is useful in augmenting water availability for domestic use and agriculture in diverse geo-climatic conditions, reclamation of degraded lands, increasing biomass rejuvenating defunct local streams, providing additional livelihood options etc. thereby improving the socio-economic condition of the people with environmental safeguards. Recharging of groundwater with rainwater harvested from roof tops in urban areas an important measure to address the problem of declining ground water levels.

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