URBAN WATER MANAGEMENT-DEMAND AND SUPPLY-WATER CONSERVATION THROUGH RAIN WATER HARVESTING

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1.0 URBANISATION AND DRINKING WATER SUPPLY

As per UN Study, India's population has already crossed 1 billion mark and it has been assessed that the urban population may reach 50% of the total population by the middle of the next century, as against about 30% at present. Due to rapid urbanization and industrialization in the country, the urban population is increasing steadily from year to year. It is estimated that the urban population in India in future will be as shown in the following Table.

Table 1 : Urban Population in India

Year	Population(million), Based on		Percentage of total population, Based on	
	Past Census	UN Projection	Past Census	UN Projection
1991	217		25.72	
2001	297	303	30	30
2011	378	439	33	35
2021	459	575	37	40
2025	492	630	40	45
2050	695	970	45	48

About 65% of the urban population lives in Class-I cities having population more than 100,000 and about 30% of this population lives in slums and squatter settlements, of which, the major concentration is in metro cities. The balance 35% lives in class-II through class-VI towns.

2.0 WATER SUPPLY SERVICE LEVEL

The per capita water supply service level in some of the metro cities in India and in some other developed countries is given in the following Table. It may be seen that the per capita service level is less than 200 lpcd in the developed countries, while it is more in some Indian cities.

Table 2 : Water Supply Service Levels

S.No	Name of city	Per Capita Water Supply (lpcd)
	India	
1	Bangalore	140
2	Mumbai	260
3	Delhi	270
4	Chennai *	100
5	Calcutta city *	191
6	Pune *	220
	Europe	
1	Austria	155
2	Belgium	140
3	Denmark	160
4	France	150
5	Germany	135
6	Ireland	170
7	England and Wales	175

** Status of urban water supply in cities with population more than 50000, CPHEEO.*
Source : Annual Report, OECD.

This indicates that even the developed countries in Europe etc. have realised the importance of fresh water, especially drinking water, and started reducing the per capita water demand and its conservation.

The CPHEEO, Ministry of Urban Development has recently revised the per capita supply norms as given in Table-3.

Table 3 : Per Capita Supply Norms

S.N	Classification of Towns/Cities	Recommended Maximum Water Supply Levels (lpcd)
1.	Towns provided with piped water but without sewerage system	70
2.	Cities provided with piped water supply where sewerage system is existing/contemplated	135
3.	Metropolitan & Mega cities provided with piped water supply where sewerage system is existing/contemplated	150

Note

a. In urban areas, where water is provided through public stand posts, 40 lpcd should be considered.

b. Figures exclude "Unaccounted for Water(UfW)" which should be limited to 15%.

c. Figures include requirements of water for commercial, institutional and minor industries. However, the bulk supply to such establishments should be assessed separately with proper justification.

In accordance with the above criteria, the future water demand for domestic use in the urban areas would be as detailed in the following Table.

Table 4 : Future Drinking Water Demand

Year	Total water demand *		BCM/year		BCM/year
	Based on Past Census	Based on UN Projection	Based on Past Census	Based on UN Projection	Total water requirement for domestic use for urban & rural +
1991	31465		11.48		
2001	43065	43935	15.72	16.03	
2011	54810	63555	20.00	23.20	42
2021	66555	83375	24.29	30.43	NA
2025	71340	91350	26.04	33.34	55
2050	100755	140650	36.77	51.33	90

* *The water demand has been worked out @170 lpcd for 65% of the urban population presumed to be living in class-I cities and @100 lpcd for balance 35% of the urban population living in class-I cities.*

\+ *Report of the National Commission for Integrated Water Resources Development*

From this Table it can be seen that the future domestic water demand in the urban areas is about 40-47% of the combined domestic demand for both urban and rural areas. The estimation of the future urban water demand as shown in the above Table based on past census includes requirements for minor industries, institutions and system losses etc. but does not include major industrial and institutional requirements, which should be added separately as per local conditions. If the projections of future water demand for urban areas as per the National Commission for Integrated Water Resources Development is considered, then the per capita demand works out more than 200 lpcd, which is very ambitious in view of the fact that the fresh water resources in India are depleting and the need of water for various uses is increasing year after year, necessitating conservation of available water and its economical usage. That means the per capita water supply prescribed in the Manual on Water Supply and Treatment recently published by the CPHEEO, Ministry of Urban Development has to be adopted by various urban local bodies while formulating future water supply schemes. This will not only help in reducing the total fresh water need of the new as well as augmentation schemes, but also reduce the funds requirement for implementation of such schemes.

3.0 WATER CONSERVATION THROUGH RAINWATER HARVESTING

Many of the metropolitan and bigger cities in the country are experiencing acute water shortage especially during summer months due to rapid urbanisation and industrialisation and depletion of available fresh water resources. In the high demand metropolitan areas, overexploitation of ground water has resulted in problems like declining water levels, failures of tube wells, deterioration in ground water quality, saline water intrusion etc. To overcome such problems, it is essential to conserve every drop of rainwater that falls in such cities. Time has come to look into the potentials of storing the rainwater into the underlying sub-surface porous formations to meet the ever-increasing needs of the cities and towns.

4.0 WHY RAINWATER HARVESTING ?

Rainwater harvesting is necessary for the following reasons:

- Rainfall is the source of all fresh water
- Rainfall occurs for few hours and a few days in a year and hence it is important to conserve it so as to use it during the rest of the year.

5.0 RAINWATER HARVESTING IS ESSENTIAL TO MEET THE CHALLENGES OF :

- Rapid urbanisation
- Competing water demand for various uses
- Depleting water resources

6.0 WHAT ARE THE BENEFITS OF RAINWATER HARVESTING ?

The following are the benefits of rainwater harvesting :

- Ground water level will be raised
- Water quality is improved
- Salinity in water is reduced
- Cracks in buildings will be minimised
- Crop yield is enhanced

7.0 METHODS OF RAINWATER HARVESTING

The following are some of the methods of rainwater harvesting:

- Percolation pit method
- Broken brick bed method
- Well cum canal cum percolation pit method and also through,
- Open wells
- Defunct bore wells
- Ponds
- Ditch and furrough storage
- Recharge wells

8.0 OTHER GENERAL METHODS OF RAINWATER HARVESTING

8.1 Rooftop water collection and recharge

- Runoff from rooftops can be connected through a pipe and let into the gravel filled trenches, pits or existing open wells

8.2 Recharge through wells

- This involves direct introduction of rainwater to the aquifer through a settling/filtering pit

The following methods can also be employed for rainwater harvesting :

8.3 Decentralised percolation

- Applicable to houses having large plain areas
- The runoff from the rooftops can be diverted into the bare soil or garden in the premises of the houses

8.4 Centralised percolation

- Pits are dug deeper and away from the foundations, where the soil is more pervious and filled with pebbles gravel etc. for better percolation.
- The pits are to be desilted once in 2 years

8.5 Street Recharge Pits and Trenches

- Rainwater can be diverted to recharge structures in the nearby vacant land, parks, street corners etc.
- Pavements can be utilised for collecting roof runoff
- Infiltration pits can be dug up along street corners

8.6 Recharge Through Shafts

- For Steep Slope areas Shafts of 1m wide, 2m long and 10m depth are recommended

9.0 DESIGN AND COST ASPECTS

The design of rainwater harvesting from the rooftops is given below:

In a 20mm rainy day,

- Volume of rainfall available form individual house of 100 sqm. = 2 cum
- Volume of rainfall available form multi-storied house of 500 sqm. = 10 cum
- Taking 70% of av. rainfall as effective rainfall contributing to recharge, the total recharge is estimated to be = 55 cum for 100 sqm. rooftop areas
- For collecting storing and subsequent recharge of this water 3 times the available water or 6cum for 100 sqm. is needed.
- The approximate cost of construction of 6cum recharge pits is Rs.2000/-
- This will meet the water need of a family of 5 members for about 100 days in a year

Rainwater harvesting is feasible in public buildings, large office complexes, housing complexes etc. having more than 1000 sqm area to start with. The rainwater from the rooftops can be collected and stored in recharge structures such as recharge wells, injection wells, abandoned tubewells, public parks, etc. to increase the groundwater levels. Small checkdams are suitable for ridges. Recharge shafts and trenches are suitable for parks gardens etc. for individual houses, multistoried buildings recharge pits are suitable. To encourage rainwater harvesting in individual premises, information handouts may be issued to the public to make them aware of the importance of rainwater harvesting and water conservation. The local bodies may provide

financial assistance to the public by way of soft loan to build rainwater harvesting structures in their premises.

10.0 ENDEAVOR MADE IN RAINWATER HARVESTING

Successful endeavor in rainwater harvesting have been made by some cities in the country which are given below:

10.1 Chennai

In Chennai, due to the implementation of Ground Water Regulation Act and rainwater harvesting methods being advocated by the Metro Water Board in the City, the groundwater levels has shown an increasing trend every year. It has been assessed that the water levels in the city have increased from 6.6m bgl. in 1987 to 4.55m bgl. in 1998. The Corporation of Chennai has issued circular for implementing measures for conservation of rainwater while sanctioning Planning Permission Applications, Building Applications for ordinary buildings, where the extent of plot is one ground or more with immediate effect. The Chennai Metropolitan development Authority also has passed a resolution explaining the need for conservation of rainwater to improve the groundwater table and the enforcement measures that are essential to achieve this goal. The Chennai Metro Water Board has disseminated handouts for the general public to create awareness on rainwater harvesting.

10.2 Delhi

On experimental basis, roof top rainwater harvesting has been adopted in Delhi for artificial recharge to ground water. In IIT Campus, the roof of Block No.6 is having the roof area of about 1666 sqm. has been selected for conducting the rainwater harvesting experiment. The aim is to inject the storm runoff directly from the roof top to purpose built recharges wells of 2m dia, 95m and 42m deep respectively. The design is for considering rainfall of intensity of 10cm/hr., which will generate about 158 cum of water/hr. During 1998 about 800 cum of rainwater was recharged through the injection wells.

The Delhi Govt. is planning to make it compulsory for all new group-housing societies to tap rainwater in their big complexes. The City Govt. is drafting a bill in this regard, which would be introduced soon in Delhi Assembly. The Union Minister for Urban Development has announced that water harvesting will be implemented in a large scale to prevent water shortage. He indicated that water harvesting may be incorporated in the building bye-laws considering the growing water scarcity.

10.3 Hyderabad

In the scenario of severe water scarcity in twin cities of Hyderabad and Secunderabad, the Govt. of Andhra Pradesh launched a programme of ground water recharge in urban areas during the

monsoon of 1998 involving various Govt. and Non Govt. agencies, builders and the public at large to make the groundwater resource a reliable and sustainable source for supplementing the water supply needs of the twin cities. About 3000 structures implemented by the Hyderabad Metro Water Board, Municipal corporation and other departments, private builders and the people during 1998 are of the nature of pilot projects and indicated possibilities for artificial recharge through collection of rainwater from rooftops, roads, open lands etc into recharge pits, trenches, abandoned wells, parks open lands etc. The Govt. of Andhra Pradesh has made it mandatory for all new construction in urban areas for leaving sufficient open area for groundwater recharge and adopt roof top runoff collection techniques for artificial recharge.

Similar experiments on rainwater harvesting made in some other places of the country are furnished in Annex-I.

11.0 CONCLUSIONS & RECOMMENDATIONS

- The local bodies should plan and implement water supply schemes with the revised guidelines issued in the Manual on Water Supply and Treatment instead of aiming at ambitious per capita demand in the wake of depleting water resources and increasing water demand due to rapid urbanisation and industralisation and also to reduce the fund requirement for implementation of such schemes.
- Water conservation measures should be adopted invariably by all the metropolitan cities and bigger towns; one method of water conservation is rainwater harvesting.
- Rooftop rainwater harvesting and recharge is recommended for big buildings with rooftop area of 1000 sqm.
- Small checkdams are suitable for areas in the ridges
- Recharge shafts, trenches are suitable for gardens, parks etc.
- The local bodies may issue regulations to make rooftop rainwater harvesting as mandatory for the individuals and other public and private buildings
- Forums at the state and district levels may be created for overall water conservation and management
- Individuals may be provided with soft loans to construct rainwater harvesting structures
- Technology support for rainwater harvesting may be provided by the state agencies.