

Sustainable fresh water supply for chennai city

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Sustainable Fresh Water Supply for Chennai city, Tamil Nadu, India A Status Update Joseph Thomas, ChiefTechnologyOfficer, Villgro, Chennai, India 3H, IIT Madras Research Park, Kanagam Road, Taramani, Chennai, Tamil Nadu India 600113. Telephone +91 44 6663 0400, email:org, mobile +91 98840 49116 Key Words: Rain water harvesting, Sustainable water supply, Urban fresh water. Abstract Chennai city, one of the major metropolises of India, is situated at the northern coastal edge of the State of Tamil Nadu. The city is more well-known by its older name of Madras.

Currently, Chennai is inhabited by more than 7 million people in an area of 176 sq km. Water supply for this population is maintained by tapping a combination of surface storage reservoirs and aquifers. The Chennai Municipal Water Supply and Sewerage Board (CMWSSB), a statutory body established in 1978, is responsible for water supply and sewerage services in the Chennai Metropolitan Area. The main sources of public water supply in the city are the three reservoirs — Poondi, Redhills and Cholavaram — with an aggregate storage capacity of 175 million cubic metres (MCM).

The other major resource is groundwater from the well-fields in the Araniar-Kortaliyar basin and the southern coastal aquifer, and also a large number of wells and tube-wells spread all across the city (Figure 1). Over-extraction of groundwater resulted in a rapid ingress of seawater, which extended from 3 km inshore in 1969 to 7 km in 1983 and 9 km in 1987[[i]]. Groundwater levels within the city also fell and brackish water began to appear, even in localities which earlier had good quality groundwater sources.

The CMWSSB calculates water availability based on surface and aquifer contributions under its direct control. Since it perceived reservoirs and other

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surface supply as more significant for a long time, very little attention was paid to subsurface storage or ground water recharge. As an outcome of research, done by several agencies the CMWSSB embarked on a campaign to create ground water recharge facilities in the city, and later throughout the State. This led to significant changes in ground water levels and to the quantum of water available to the population of a growing metropolis.

pic]Figure 1. Introduction The Chennai Municipal Water Supply and Sewerage Board (CMWSSB) is solely responsible for providing drinking water and sewerage services to the residents of Chennai. One of India's major metropolises, Chennai is situated at the northern coastal edge of the State of Tamil Nadu. The city is more well-known by its older name of Madras. Currently, Chennai is inhabited by more than 7 million people in an area of 176 sq km. The CMWSSB depends on surface reservoirs and ground water sources to maintain water supply to the residents.

Supply is maintained through multiple means. Since Chennai is essentially low-lying and water supply is intermittent, most residents build underground sumps that store the water. Subsequently, the water is pumped up to an overhead tank. In other cases, water tankers are dispatched by CMWSSB to various localities and the sumps are filled from the tankers. In other localities, CMWSSB has put in place above-ground water tanks and these are filled by the water tankers.

In yet other places, residents collect water directly from the tanker, see Figure 2. [pic] Figure 2: Drinking water collection from tankers directly by residents. Despite the seemingly abundant sources of water, Chennai suffers continuously from water stress since the entire basin is dependent on rainfall.

The annual rainfall in Chennai is 1200 mm [[ii]]. This quantum is, given the size of the Chennai basin, sufficient to meet the needs of the population. The problem is with the distribution of the rainfall.

There are two rainy seasons in Chennai. The first is the Southwest monsoon, which has patchy rains and contributes about 25% of the total rain and falls between May and September. This does not do much for ground water recharge. However, the Northwest Monsoon (Oct to Dec) is usually characterized by a series of storms that brings the remaining 75% of total rain in extremely short bursts. During this time, Chennai is prone to flooding and, before 2003, a large part of this water would have been lost as run-off into the sea.

CMWSSB traditionally focused its attention on increasing surface storage, transporting fresh water from long distances. Like the Telugu Ganga project - probably one of the longest canals built for water supply to the city that failed to ease the water problem. Another attempt was to divert water from Chembarabakkam and Veeranam tanks whereby the water rights of the agrarian community were infringed. Drilling of borewells in the Cuddalore belt and installation of turbine pumps to tap 100mld whereby the groundwater which again supports the local agriculture community was depleted.

None of these solutions were sustainable in the long run and yet CMWWSSB paid very little attention to ground water recharge that had that potential. In 1997, at the Shri AMM Murugappa Chettiar Research Centre (MCRC), Chennai, [[iii]] a study was conducted to understand the user experience. The study surveyed 10, 000 households in 155 corporation wards of Chennai.

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The focus was on how residents get their water needs met and how the water is utilised. Raw data from this study was further analyzed by Dr. A Vaidyanathan and J. Saravanan [[iv]].

These studies clearly established that the contribution of ground water could be as high as 80% in some cases. The next section will take up a quick summary of the research and the subsequent sections will deal with the steps taken by CMWSSB and other civil society organisations to get rain water harvesting introduced. The final section will describe the results of these efforts on the ground water table. The research and changes The survey conducted by MCRC was across 10, 000 households, representing a roughly 1 percent sample.

Another 2500 surveys across, business, educational, institutional, governmental and industrial establishments were undertaken between September, 1995 and January, 1996. The analysis phase took up another year. The main recommendations of the study were to a) encourage public participation in water conservation and ground water recharge b) promote and propagate water saving/replacement technologies in the domestic sector c) use surface water to reduce ground water usage d) encourage ground water recharge by adoption of low-cost water harvesting systems, cleaning of water-ways and renovation of existing recharge structures, such as temple tanks. In 1999 a National Water Harvesters' Network was set up by the Centre for Science and Environment (CSE) water harvesters' advisory committee in New Delhi. Members suggested that a regional network be initiated in Tamil Nadu to promote rainwater harvesting in Chennai [[v]].

Professor M. S. Swaminathan, provided office space for the network unit in Chennai and Prof. A. Vaidyanathan agreed to chair the group.

The Tamil Nadu unit of the national water-harvesting network was launched in April 1999. The network was meant to: (i) provide an opportunity for individuals and institutions actively engaged in water harvesting, in Chennai, to share their knowledge and experience and promote free and open interaction among them; and (ii) to reach out to a wider public in the city and outside to propagate the role of urban rainwater harvesting in terms of technology, experience and its potential contribution in meeting urban water needs. It was Prof.

Vaidyanathan who then asked for the raw data from the MCRC study and did his own assertion of the data and analysis. In the background paper that came out of the analysis [3] the following was stated: “ The present paper is meant to give an overview of the present and future needs of the city, the limited and expensive scope for augmenting surface supplies, the need for a two-pronged strategy of conservation/recycling and Rain Water Harvesting (RWH) to increase ground water recharge. ” This confirmed the results of the MCRC study.

Both the MCRC study and the CSE study highlighted the dependence of people on multiple sources for their water consumption rather than just CMWSSB and the heavy dependence on groundwater by both. Thus the RWH campaign was backed up by strong research results of MCRC and CSE. These studies were necessary to convince the public and the policy makers. It should be mentioned here that the then Chairman and Managing Director of CMWSSB, Ms. Shanta Sheela Nair understood these results and backed the

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RWH movement fully. In a 2006 publication [[vi]] Prof. Vaidyanathan and his colleague, J.

Saravanan summarized the action of the government as follows: “ In Chennai, the capital of Tamil Nadu, the growing dependence on groundwater since the 1970s is evident in the sinking of increasing numbers of open wells and deep bore wells. This trend, a symptom of the increasing water scarcity in the city, led to a progressive decline in groundwater levels as well as seawater intrusion in coastal aquifers. Faced with this crisis, the State government passed the Chennai Groundwater Regulation Act in 1987, which sought mainly to curb the commercial groundwater exploitation within the city limits.

In 2001, rainwater harvesting (RWH) became mandatory in multi-storeyed buildings. The unprecedented and severe droughts in the ensuing two years intensified the groundwater crisis to such a degree that, in August 2003, the government passed an ordinance making RWH mandatory for all buildings (existing and new) in the city and throughout the State. It further set a deadline of October 31, 2003 for this process to be completed. A vigorous publicity drive convinced the public that the government was serious about implementing the programme and providing technical advice and help in the design and construction of RWH structures.

This led to unprecedented activity across the towns and cities of the State, especially Chennai city, and the programme was seen as successful. In this endeavour, however, very few turned to the municipal corporation, private consultants or NGOs with the relevant expertise for assistance in designing and building their RWH structures. Most relied on plumbers or their own

expertise. Independent experts pointed out several problems with the programme, noting that) the time given for the implementation of this ordinance was too short; b) there were far too few professionals with the knowledge and experience needed to design appropriate systems for the widely varying conditions; c) the supply of trained and skilled labour to implement the works was also inadequate to cope with the scale and speed of the programme; d) the availability of quality materials for implementation was also inadequate; and e) there was hardly any systematic follow-up to check the quality of the works reported to be completed.

There were widespread but unverified reports that, simply in order to meet the stipulations, grossly inadequate RWH structures had been put in place; the capacity as well as quality of design and implementation leaving much to be desired. This was an instance of decentralisation that, despite the presence of a “ felt need”, occurred without adequate consultation. The legislation in regard of RWH was welcome but the actual programme was poorly implemented and monitored. Although the programme applied to all classes of housing, it ignored those living in informal settlements such as slums within the city limits.

These areas could have benefited from RWH in public building and public spaces — an aspect that received very little attention. Moreover, no steps were taken under this programme to reclaim tanks and wetlands in the city that, in the past, not only functioned as recharge structures but were also used as sources of domestic water by communities. ” The Government has since 2009 been working towards cleaning up the waterways of Chennai. This effort has seen the government draw on municipal corporation, private

consultants and NGOs with the relevant expertise to work on this massive effort.

There is a project with an outlay of Rs 1, 400 crore (approx US \$300 million) to make the city flood-free[[vii]]. In March 2010 the Chennai Metropolitan Development Authority held a Seminar on Waterways in Chennai. The proceedings [[viii]] contain a list of 36 recommendations and some of them are re-produced here: 1. The sequence of actions to tackle the problem may be - (a) flood alleviation (b) prevention of pollution to the waterways (c) cleaning up of the waterways by removing encroachments & obstructions (d) restoration / improvements to the waterways and its continued maintenance. . Floods are opportunities to augment ground water recharge to be facilitated by construction of check dams, filter wells, and underground tunnels/storage reservoirs, if the soil conditions and slopes permit. 3. Flood plains should be developed along the waterways in the areas outside the towns and cities, adopting the retention model, as a solution against flood hazards; these flood plains could be developed as parks or green belts for recreation such as camp sites. 4. Eco-engineering should also be adopted as a solution to bring nature back and rejuvenate the rivers. 5.

It is recommended that corporate sector participation, and general public participation, in planning and improvement of lakes and rivers should be encouraged. Cleaning up of rivers and conservation of water bodies should be thought of as a movement with the participation of all stakeholders including the general public. 6. Adequate public awareness about the hazards of pollution of water bodies and the remedial measures has to be created by organizing community education campaigns. Getting the citizens

involved is important, ' Saving Waterways' should become a people's movement. . Use of sewage for power generation and recycling of waste water should be encouraged. 8. Area development plans prepared at micro level, such as Detailed Development Plans, should contain plans for ground water recharge, at least in large premises such as schools and public places. Sustainability measures should form part of the Integrated River Restoration Plans. What is evident here is that the outcomes of studies take time to percolate down to the agencies mandated to make the changes required for sustainability. It also requires a good amount of political will.

Much of the change of attitude of governmental institutions can also be traced backed to strong political thrust to implement the changes. Results Data on change in groundwater quantity and quality has to be presented here, mostly based on media stories. Some researchers feel that the effects of rain water harvesting and subsequent ground water recharge are so noticeable that quantifying is not a priority. The Table below (Figure 3) shows the number of rain water harvesting structures built by the Corporation of Chennai, as reported on its website. Rain Water Harvesting done by Corporation of Chennai Corporation owned buildings | 1344 Structures | | Flyovers and Bridges | 29 Structures | | Open low-lying areas | 242 Structures | | Road Margins | 945 Structures | | Corporation Streets | 2698 Structures | | Corporation pond | 1 No. | | Temple Tanks | 16 Nos. | | Residential / Commercial / Institution Buildings | 329959 Buildings | Figure 3[[ix]] An article published in a leading daily in Chennai, The Hindu, dated January, 31 2009 had many interesting points to make about the results of RWH and ground-water recharge. [x]] " The CMWSSB study of 759 RWH observatory

wells shows that ever since the installation of RWH structures in about 500,000 of its consumer households was made mandatory in 2004, there has been a 50 per cent rise in the water level. According to the CMWSSB officials, over the last five years, the water level across the city has gone up by three to six metres. Similarly, the water quality in several areas has also showed improvement. The sustained normal rainfall since 2004 and the proper maintenance of RWH structures in most households have been the principal reasons. Following the drought period in 2003, when Chennai received only about 690 mm of rainfall as against its normal of 1,200 mm, the water table had receded and, on an average, was at 7-8 metres below ground. In many places it was at 10 m depth and, in some, it was at 10 m.

Following a good monsoon (2,064 mm) in 2005 and rainwater harvesting, the ground water table saw an appreciable rise in several areas and the water table reached 1 m depth below ground. The total dissolved solids (TDS), which were earlier as high as 4,900 parts per million (ppm) in some areas, dropped to permissible levels of 500 ppm, greatly improving the quality of water (see Figure 4). [pic] Figure 4[10] “ Before the onset of every monsoon, Metrowater officials conduct a random check of the RWH structures for their maintenance and create awareness about the need to keep these in good shape. Harnessing of rainwater that gets collected in storm water drain network would help reduce the inundation on roads and large volumes of water draining into sea every year.....

Unless rainwater runoff in both public and private spaces in the city is harnessed, Chennai may lose out on the precious resource and may end up with water problems during the summer months,” note rain-water harvesting

experts. Conclusions This presentation has tried to show that it takes many years of persistent effort to address a problem in civil society. In Chennai, and indeed the whole of Tamil Nadu, the problem was one of water stress. Research showed that the available rainfall could help people cope but fresh water from the rain was being lost to the sea. Based on this, a proposal was made that ground water recharge was a viable, low-cost solution. This proposal had to be championed. Prof. Vaidyanathan and the then Chairman of CMWSSB, Shanta Sheela Nair, did just that.

They showed with great determination and several pilot studies that rain water harvesting would be viable and worthwhile. They managed to convince the government of this, and RWH became a statutory requirement for all buildings in the state. Monitoring the quantity and quality of the ground water has shown the significant changes this legislation has brought in. As a side-effect a greater understanding of the need to clean, preserve and secure all types of fresh water bodies has prevailed among the political circles, bureaucracy, NGOs and civil society. The people have also shown great resolve in implementing the solution since it directly affects their lives.

The type of study conducted by MCRC and CSE can be a methodology to assess the water sources, consumption pattern, per capita availability and requirement particularly in developing countries. This way the water supply system can be better planned and implemented to be sustainable.

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