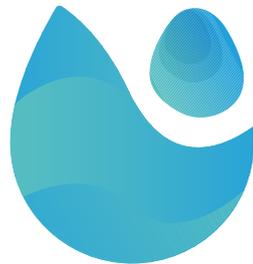




**URBAN
THINKERS
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THE CITY WE NEED



Making
Chennai
Water Positive

NOVEMBER 8th & 9th 2019

BACKGROUND NOTE



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MAKING CHENNAI WATER-POSITIVE: A BACKGROUND PAPER

Introduction

There has been a phenomenal growth in urbanization worldwide. According to the UN-Habitat, six out of ten people are expected to reside in urban areas by 2030. India is also witnessing the same pattern of growth. It is estimated that around 34% of India's population resides in urban areas, up from 28.53% in 2001. The growth in cities is mainly due to population expansion and migration. This puts pressure on city land and infrastructure, especially on water supply systems.

In India, Tamil Nadu is the most urbanized state among the major states, with around 48.4% of the population living in urban areas. Chennai, the capital of Tamil Nadu, is the fourth largest metropolis in India. It is a key administrative centre, and also a much sought-after travel and investment destination for industry, commerce, finance, education, tourism and others.

The Chennai city area economy is India's fourth largest, with a GDP per capita growth that was the highest in India during 2000-2014. The World Bank has ranked Chennai ninth among Asia-Pacific super-rich cities. Major drivers of growth are both the traditional manufacturing sector, and its 'new economy' comprising the IT and IT-Enabled Services (ITES) sectors, fintech etc. The manufacturing sector is made up of large industries in the automobile, electrical, oil refining, chemical petrochemical sectors and many others. Due to a large number of automobile and related ancillary industries, Chennai is known as the Detroit of India. Chennai also has two ports and an international airport. A large number of multinational companies have their operations in Chennai. The large industries are supported by small and medium enterprises (SMEs) located in various industrial estates in and around Chennai.

At the same time, the city's geography combined with rapid growth and impact of climate change, has created severe water stress over the years resulting in floods, storms, tsunamis and droughts. Be it the periodic water shortages right from the 1970s, or more recently, the floods of 2015, cyclone Vardah of 2016 or the severe drought of 2019, the people of Chennai across different segments have suffered through them all. Chennai seems to be in the grip of a perennial water crisis, adversely affecting city tap-water supply-both of quantity and of quality. In the absence of adequate piped water supply, households, offices and other establishments are forced to depend on private water supplies. This has not only increased the cost of living for the citizens, but has also affected productive man hours as was evident from our survey which we undertook in May 2019 to assess the impact of water shortage this summer.

Chennai gets most of its annual rainfall during the North-East monsoon in the period October-December. This year the monsoon has commenced in mid-October. According to a report in The Hindu dated November 6, 2019, the combined full storage capacity of the four city reservoirs at Poondi, Cholavaram, Red Hills and Chembarambakkam is 11250 million cubic feet (mc feet). The actual storage as of November 5, 2019 was recorded at 2982 mc feet (i.e.) 26.5%. According to Metro water sources, this is sufficient for six months. If further rain is not received, again Chennai would face water scarcity in the summer of 2020. Water supply in Chennai is therefore much dependent on the vagaries of the monsoon. Chennai also has the lowest per-capita water availability among India's large cities. The Central Public Health Engineering Organization (CPHEEO) guidelines of the Government of India state that per capita water availability should be 135 litres/day but in Chennai the amount is 90 litres/capita/day and 25 litres/capita/day to slum areas.

The World Resources Institute (WRI), the international institution with authoritative expertise in water resources and climate change impact, has produced an atlas of water-stressed areas. In this atlas, Chennai is identified as an area of extreme high stress in which at least 80% of all water resources is used up by municipal and industrial demand. Hence, if there is a 15-20 % shortfall due to deficient rainfall the city faces water stress immediately.

There is an urgent need for a comprehensive long-term solution to the severe water crisis facing Chennai. Adequate water at affordable cost must be made available to all consumers, be them industries, commercial establishments, Institutions and residents. This has to be implemented in a comprehensive manner if Chennai wants to realize its target of becoming a smart city, a livable city and a globally competitive city.

An overview of the following would throw some light on the current status and what needs to be done for Chennai to become a Water Positive city.

Current Estimated demand

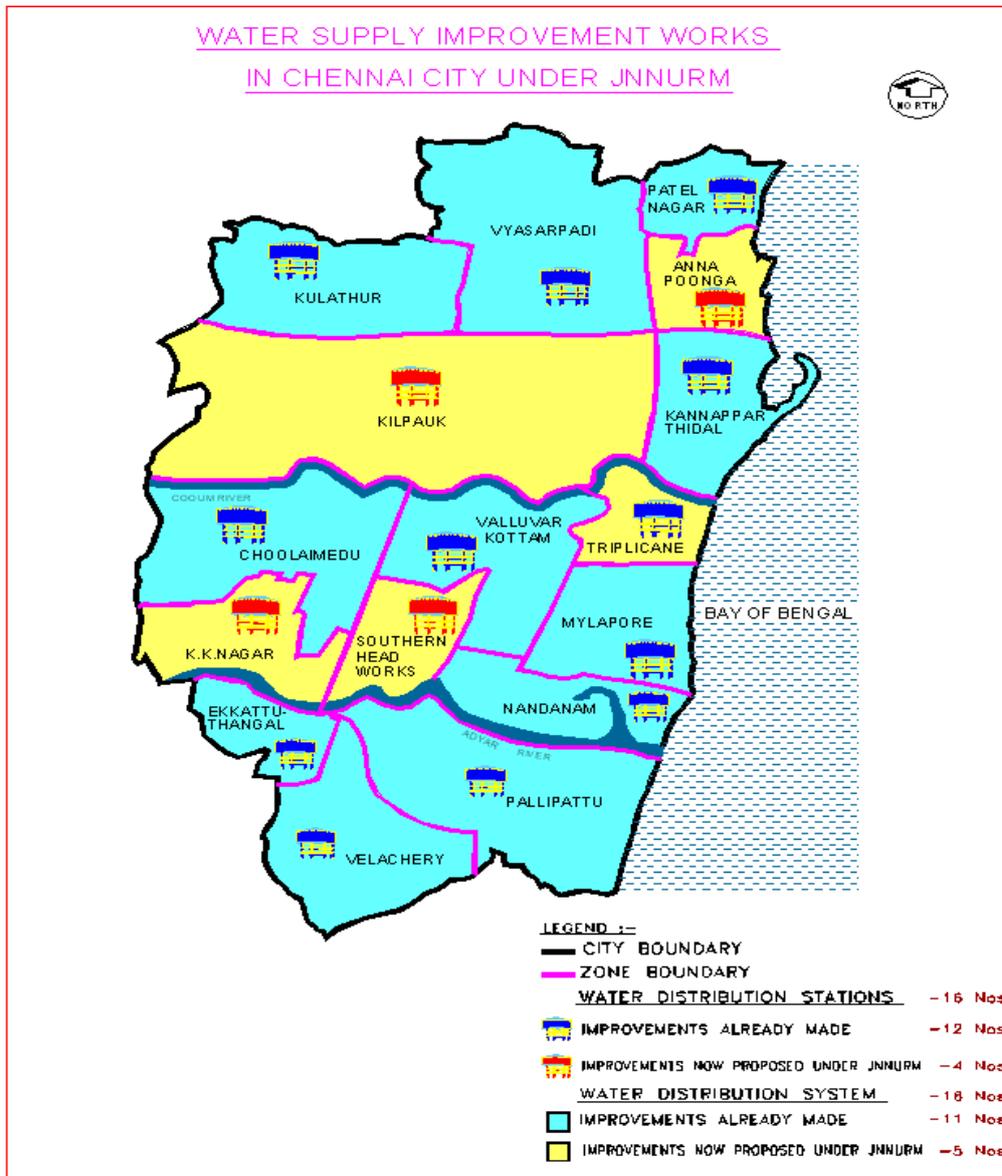
The area covered by Chennai city and surrounding urbanized areas is 426 sq km. The population of Chennai city and surrounding urbanized areas is recorded as around 8.6 million according to the 2011 census. The population of Chennai and surrounding urbanized areas nearly doubled during the two decades preceding 2011 due to migration and other factors. Today, the population of the Chennai region would stand at around 10 million. Anecdotally, a popular belief in Tamilnadu is that Tamilnadu has ten crore population out of which about one crore lives and works in Chennai. CPHEEO norms state that per capita water availability should be at least 135 litres/capita/day. By this requirement, a rough estimate shows a water demand of around 1350 million litres/day (MLD) for a population of ten million. To be added is the demand from industries.

To corroborate the above, reference was made to Metro water data. According to the Metro water website, the water requirement for Chennai region including Chennai city and the adjacent and distant urbanized areas projected for 2021 is 1650 MLD and the industries demand is 330 MLD. Therefore, the total consolidated water demand for the year 2021 is 1980 MLD. Since 2021 is not too far off, we may consider 1980 MLD as a reliable estimate for the water demand for Chennai, for the purpose of this note.

Snapshot of Chennai water supply as of March 2018*

A map of Chennai showing the water supply zones is given below.

*Source: Website of Metrowater (<https://chennaietrowater.tn.gov.in>)



The following are the key information about the Chennai water supply system:

- Operational area 426 Sq km
- Population 86 lakhs
- Water produced (normal years) 830 MLD
- Area covered with piped supply 99%
- Treatment capacity 1494 MLD
- Length of water mains 6697 km
- Number of consumers 876,891
- Major distribution stations 16
- Capacity of major reservoirs 11.25 tmc ft
- (Redhills, Poondi, Chembarambakkam, Cholavaram)
- A full storage of 11.25 tmc feet would yield, about 1140 MLD for 365 days

Actual supply

The normal Metro water supply is reportedly 830 MLD during years with normal monsoon and adequate water availability. Out of this, approximately 180 MLD is provided by the two desalination plants at Nemmeli and Minjur. The remaining is from the Red hills and other lakes, Veeranam and from Krishna water supply. Hence, even in the best of days when the estimated demand is 1980 MLD and supply is 830 MLD, the consequence is that most residents get water only intermittently once in two or three days.

In 2019 the water supply was further reduced to an average of 500 MLD. This again includes 180 MLD from the two desalination plants. Consumers would have received water once in three or four days if at all. Many tail-end areas went without water for weeks at a stretch. Due to empty pipes, and the proximity of sewer lines, there is a real possibility of sewage water entering empty drinking water lines, leading to public health hazard and risk of epidemics due to the spread of water-borne diseases.

Bridging the shortfall

With the shortfall in availability of fresh water, and the additional uncertainties introduced into the water cycle due to climate change, there is no option but to utilize degraded or hitherto unacceptable sources of water, such as sea water, brackish water, treated sewage and industrial effluent. Reuse of treated sewage and industrial effluent frees up fresh water supplies which could be used to augment municipal drinking water supply.

Geographical setting and Enhancement of Chennai's natural resources

Chennai is situated in the Chennai river basin. This river basin is defined by three rivers: Kosasthalaiyar, Cooum and Adyar. All three flow from west to east in different sections of the Chennai metropolitan area. The Kosasthalaiyar is a primary supplier of water to Chennai reservoirs. The four main reservoirs of Chennai are Red Hills, Cholavaram, Poondi and Chembarambakkam. All are rain-fed by the seasonal flow of the river mainly during the north-east monsoon.

The Cooum and Adyar are polluted by municipal sewage and dumping of solid waste, and serve as drainage channels. Additionally the Buckingham Canal flows from north to south parallel to the coastline. This was a navigation canal during the British era. However, it is polluted today by domestic and industrial effluent. The water in these watercourses is unfit for drinking or recreation purposes (boating, swimming).

Action has been taken to remedy this situation through ecological restoration of the rivers. The Cooum and Adyar rivers are being restored by the Chennai Rivers Restoration Trust, a Trust formed by Government of Tamilnadu. They have successfully restored the Adyar Creek and Estuary areas by creation of the Adyar Eco-Park extending 58 acres, also known as Adyar Poonga. They are now implementing the Cooum River Restoration project.

Apart from the above, an estimated 320 tanks and lakes populate the Chennai region. These are interconnected natural and manmade water bodies. However, over the years many of these water bodies have been converted into residential areas (one such area is known as 'Eri scheme', Eri in Tamil meaning lake). Such construction activity in lake beds and interconnecting channels prevents the drainage of excess water during periods of heavy rainfall, and was a reason for aggravating the flood situation of 2015.

Chennai receives an average rainfall of 1300 mm a year. While, this is higher than the Tamil Nadu state average of 940mm, there is a wide variation in the actual rainfall received every year. In the period 1985-2016, the annual rainfall varied from 624mm to 2570mm. Since the Chennai basin does not have perennial rivers, the city water supply is mostly dependent on the monsoon rain.

A judicious mix of augmentation of surface water sources, seawater desalination and sewage reuse along with improvements in the distribution system, would go a long way in improving Chennai's water security and removing the chronic water shortages. A look at the water use pattern of Chennai would show that out of 1980 MLD, 330 MLD is for industries and the remaining 1650 MLD is for municipal domestic use.

The planned desalination capacity is 750 MLD as explained below. If industries can survive on reuse water (say 300 MLD out of 330 MLD) then there is about 900 MLD remaining which would have to be met from surface sources (Veeranam and Krishna water).

Emerging trend in technologies:

Proven technologies that can be deployed to give Chennai a cost-effective and continuous water supply are readily available. These are briefly enumerated below:

Seawater desalination

Chennai is blessed with a long coastline. Seawater desalination has been successfully used to partially ameliorate Chennai's water crisis. Two plants each 100 MLD are operating in Nemmeli and Minjur. One more plant of 150 MLD is under construction. A fourth plant of 400 MLD is under planning and development. The total desalination capacity is therefore planned at 750 MLD.

Sewage reuse

Reuse of municipal sewage is widely established worldwide. In Singapore, municipal sewage is recycled and treated to drinking water quality. In Chennai, a plant of 45 MLD was recently commissioned in Kodungaiyur for tertiary treatment of municipal sewage and reuse the water for industry.

Water distribution improvement and 24x7 water supply

Cities in Europe, the US, and Asia (Singapore, Tokyo) have 24x7 water supply with state-of-the-art metering, energy-efficient pumping and distribution networks, supported by advanced instrumentation, IT and efficient customer relations management (CRM). Implementing improvements in Chennai's distribution system would significantly improve the operating efficiencies and reduce water losses. Improvements in the distribution system are further discussed below.

Trenchless technology

Trenchless technology is used to lay pipelines without cutting of roads and without disrupting traffic. It is used worldwide and introduced in Indian cities in the last one or two decades. This technology speeds up pipe laying and can be adopted in Chennai.

Improvements in the water distribution system

The distribution system comprising of a large network of pipes covering around 6697 km usually escapes our attention since the pipes are buried underground. Yet it is through these pipes that much precious water is lost. Upgradation and strengthening of the water distribution network is essential to reduce water losses. The distribution network of reservoirs, pumping stations, pipelines and associated infrastructure in most of our cities is very old and most of them are corroded. The pipe network in Chennai is around 6697 km. Additionally, in Chennai there are around eight lakh water supply connections. House service connections are mostly made in an unauthorized and non-standardized manner. Maintenance has been neglected. The result is that at least 40% of the water is lost in transit in many Indian cities. Data is not available for Chennai, but we may assume that distribution losses are significant. Additionally, in Chennai the payment to Metro water is through a flat rate paid annually. Water meters are not installed in houses and apartments. There is no measurement or record of water consumption. A water balance is therefore unable to be developed. Areas of leakage and irregular consumption patterns are not able to be detected and remedied. While electricity metering has been the norm for several years, and the community pays electricity bills in time, water supply has not been favored with the same disciplined consumer behavior.

Improved consumer behavior may be expected from a water supply system which supplies water more-or-less continuously. Efforts must be made on priority to rehabilitate the distribution system. The present intermittent water supply must be converted to continuous water supply. Leakage of desalinated water, the most expensive grade of water, should be minimized.

Policy and Governance

India has a National Water Policy. This policy was notified in 2012, and encourages a shift away from groundwater to surface water sources. Further, in order of priority, water is first to be allocated for drinking purposes, and then only for other purposes such as irrigation and industry. This policy direction is relevant for us since ground water is extensively used in Chennai. In line with the National Water Policy, surface water should be used to meet the entire demand. Groundwater salinity intrusion is also an issue in many areas. Groundwater regulation is becoming increasingly regulated. Groundwater may be treated as a reserve, to be used only in the case of emergencies.

Institutional arrangements-present governance set-up

The key statutory government body tasked with the planning, implementation and management of the city's water supply is the Chennai Water Supply and Sewerage Board (CMWSSB). The CMWSSB is under the administrative charge of the Commissionerate of Municipal Administration (CMA), Government of Tamil Nadu. Storm water management is the responsibility of the Greater Chennai Corporation (GCC). City planning is the responsibility of Chennai Metropolitan Development Authority (CMDA). In addition to the above, the Government of India is implementing AMRUT and Smart Cities Mission with the purpose of accelerated development and modernization of city infrastructure. Chennai is selected as one of the smart cities. Chennai's water managers have helped the city to successfully overcome the challenges caused by various water crises over the years.

Dimensions to be considered

From the above, it is clear that several issues need to be considered in order to ensure adequate water security for Chennai and make Chennai water positive in a cost-effective manner with long-term sustainability. These issues include:

1. Augmenting surface water sources
2. Cost effective seawater Desalination plants
3. Reuse of sewage and industrial effluent
4. Rain-water harvesting

5. Storm-water management
6. Reducing water losses in the water supply distribution system
7. Project development and Project Finance
8. Private sector participation
9. Operations and maintenance of the water assets
10. Climate change, and climate-proofing of water infrastructure
11. Conservation of lakes and wetlands
12. Conservation of groundwater and reduction of salinity ingress
13. Institutional and regulatory arrangements for implementing and maintaining upgraded water supply system
14. Affordable Tariff structure
15. Public outreach campaigns
16. Environmental and social issues
17. IT and customer relations management (CRM)

Especially, after the summer of 2019, it would not be difficult to convince water users about the advantages and cost-effectiveness of assured continuous water supply against a monthly or two-monthly water bill in a transparent manner based on metered water consumption, at a tariff that is more affordable than the combination of tanker supply and use of bubble-top cans, and at the same time helps the water utility to recover the costs incurred to bring water reliably to the consumer's tap.

For MCCI members there is a strong business case in promoting technologies that employ a smaller and smaller water footprint. In the case of the power sector, thermal power plants are a major consumer of water for use as the cooling medium in surface condensers. Since Tamil Nadu is a water-stressed area, many small and medium thermal power plants in Tamil Nadu have installed air-cooled condensers instead of conventional water-cooled condensers. This eliminates the use of make-up water for power plants. Such demand for water-saving process equipment and systems has made manufacturers of air-cooled condenser systems very successful.

Business opportunities would also be available in areas including but not limited to:

- Technologies which produce reliably drinking or industrial-grade water from degraded water sources (sewage, industrial wastewater, sea or brackish water) especially when incorporated with energy-saving devices e.g. solar-powered booster pumps for desalination units
- Supply and operation of modular ship-mounted (or truck-mounted) desalination plants. These can be hired out on lease basis or pay-per-use basis.
- Private sector investment and participation in water supply projects (as per Govt policy and regulations for public-private-partnerships (PPP))
- Industrial effluent treatment and zero liquid discharge (ZLD)
- Performance-based Operations and Maintenance (O&M)
- Supply of pipes, valves, instrumentation and control systems
- IT systems and software
- Supply of equipment and spares, chemicals and consumables
- Energy and water audit
- Asset condition assessment and rehabilitation

Conference deliberations

The conference is designated an Urban Thinkers Campus (UTC) under the umbrella of the United Nations-World Urban Campaign Secretariat. This event is organized by MCCI in partnership with IIT Madras and National Institute of Urban Affairs (NIUA), e-Konnect Knowledge Foundation and Care Earth Trust. The MCCI is one of the premier industrial promotional organization in southern India and is currently into its 184th year of service to trade and industry. The MCCI has launched the Sustainable Chennai Forum (SCF) in November 2011 with the aim of assisting and promoting a business case for sustainable development and evolving a congenial policy and an action-oriented environment for the all-round development of the Chennai Metropolitan Region.

The issue of water shortage in Chennai has various dimensions-technical, financial, institutional, economic, environmental and social. All these dimensions will be touched upon during the conference. The event brings together business leaders, government

entities, academics, entrepreneurs, NGOs, technology providers, water conservation experts and civic society to discuss the current challenges and issues and finding ways to move forward to make Chennai water-positive. The conference is for two days. A wide range of topics will be discussed and deliberated upon.

Next steps

It is expected that the conference will encourage a lively exchange of ideas, dissemination of information and best practices, knowledge sharing and insights into finding sustainable means of making Chennai water-positive and water secure.

A detailed compendium of the suggestions arising out of the conference will be prepared and shared with the Government and other stake holders.

The Chamber will continue to work involving the member companies of the Chamber and along with the State Government towards this mission.
