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STUDY OF WATER SUPPLY SYSTEM PROBLEMS & SOLUTIONS IN MUMBAI CITY

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Brief history of Mumbai –

Colaba, Mazgaon, Old Woman's Island (Little Colaba), Wadala, Mahim, Parel, and Worli were the original seven islands that made up city of Mumbai. These island clusters have been connected by an amount of reclamations. There were fishing colonial populations on each of the seven islands that would become Mumbai. The seven islands of Bombay, which were Portuguese possessions off the coast of India in the 16th century, were given to England under this name as part of Catherine of Braganza's dowry when she wed Charles II in 1661. Before the Portuguese took control of the islands in 1534, they had previously been a part of indigenous empires like those of the Silhara dynasty and the Sultan of Gujarat. Charles II leased the islands to the East India Company in 1668 for 10 pounds of gold per year after receiving them as dowry. The islands have been combined into a single continent by 1845 thanks to several land reclamation initiatives.

Mumbai serves as the state of Maharashtra's capital. with a estimated ninth most populated metropolis in the world and the most crowed city in India. With a population of 20.7 million as of 2011. Mumbai Metropolitan Region, beside its nearby parts, is one of greatest populated urban areas in the world and India's second-most populous metropolitan area. Additionally, it has the largest GDP of any city in South, West, or Central Asia. It is the richest city in India.

India's financial, commercial, and entertainment hub is Mumbai. In terms of global financial flow, it is among the top ten commercial hubs in the world, contributing 6.16% of India's GDP, 25% of industrial output, 70% of the country's marine trade (Mumbai Port Trust and JNPT), and 70% of the country's capital transactions.

The Marathi and Hindi (Bollywood) film, television industries are also based in this city. Mumbai is divided into two distinct parts called the Mumbai City district and the Mumbai Suburban district. The city district area is also frequently referred to as South Mumbai or the Island City. Mumbai has a total area of 603.4 km2, of which the island city takes up 67.79 km2 and the suburban district 370 km2, making a total area of 437.71 km2 that is under the control of the Municipal Corporation of Greater Mumbai (MCGM).

Brief history of Mumbai Water Supply System

Source before Independence

- Vehar Lake's impoundment on the river Mithi provided the first piped water supply, and in the year 1860, 32 MLD of water was delivered to the city by a 1200mm > 800mm water main.
- Critical Because of less of water, the Tulsi Scheme was created in 1872. It consisted of a 600 mm diameter pipeline that ran from the Mithi river upstream of Vehar Lake to the Malbar Hill reservoir,
- It was determined to develop Tansa as the following source in 1885. A major water crisis developed in the meantime, prompting the urgent construction of Tulsi Lake on the river Mithi upstream of Vehar Lake.
- Due to inferior quality of the waterfrom this catchment, the 4 MLD water supply was later diverted for Array dairy and industrial use

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Source after Independence

• The creation of new sources was required due to a significant increase in population after independence. The Vaitarna reservoir scheme was developed and put into action under the capable leadership of Municipal Engineer Shri N.V. Modak. Construction of a concrete gravity dam and a steel pipeline with a 2500 mm diameter were part of the programme.

• upto 1972 all sources were gravity supply and the treatment given is disinfection by Chlorine. In 1980 the 1910 MLD treatment plant at Bhandup was commissioned.

Present status of water supply system of Mumbai

1. The major water supply sources Tansa reservoir (455 Mld), Vaitarna reservoir (455 Mld), Upper Vaitarna reservoir (640 Mld) and Bhatsa reservoir (1365 Mld) are l[5]ocated about 100 Kms from City.
2. 10% overloading is used in the water treatment processes at Bhandup (1910 Mld) and Panjrapur (1350 Mld).
3. A very intricate network of tunnels and water mains, with diameters varying from 5500 mm to 1800 mm, is used to transport both raw and treated wate
4. The treated water is conveyed to 27 service reservoirs through two Master Balancing Reservoirs (MBR) at Bhandup (MBR-I 246 + 140 Million Litters) & Yewai (MBR-II 125 Million Litres).

Future augmentation schemes

1.Currently, the slum areas receive 45 lpcd while planned developments receive 150 lpcd. As portion of a campaign to renovate slums, MCGM plans to enhance water supply to around 150 lpcd of slum dwellers, 300 lpcd of planned developments. To accomplish the desired goal, future source development is now underway.

Waste water treatment facilities (WwTF)

1. From 1974 to 1996, MCGM implemented the integrated Water Supply & Sewerage Projects (WSSD) known as Bombay-I, Bombay-II, and Bombay-III. In the meantime, in 1979, MCGM created the first Master Plan for Mumbai's sewage system. According to the topography, this master plan separated all of Mumbai into 7 sewerage zones. Accordingly

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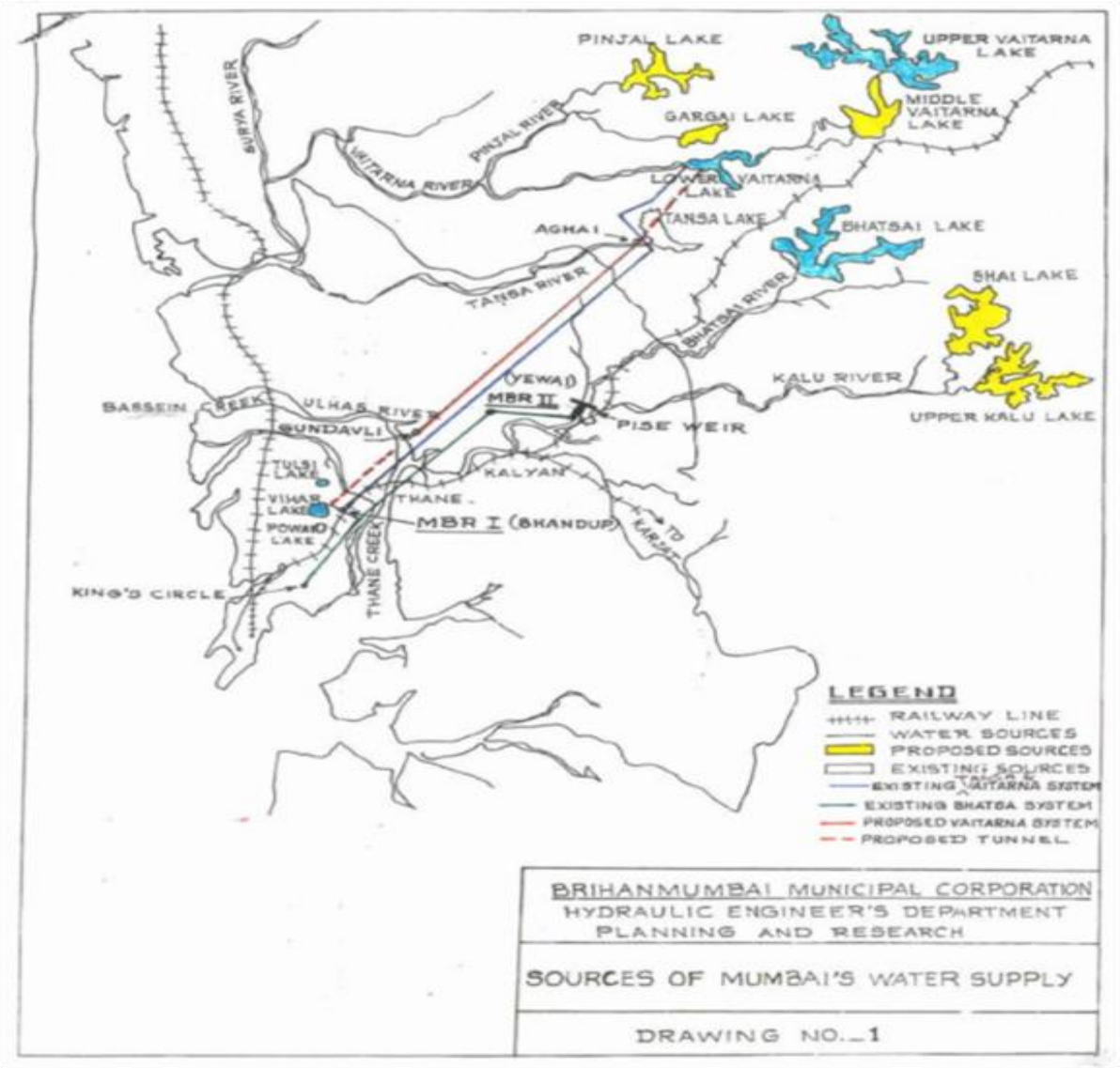
2. Construction on the Colaba WwTF, which will have a 37 MLD capacity andtertiary treatment facilities, has already started. It will be operational by February 2019.

3. At addition to Colaba, MCGM has chosen six more locations for sewage treatment plants at Worli, Ghatkopar, Bandra, Versova, Malad, and Bhandup with the goal of treating and recycling 3000 million litres of wastewater per day (mld) of waste water.



Treatment of water:

1. Before being given to customers, water has undergone thorough treatment, including pre-chlorination, alum dosage, settling, filtration, and post- chlorination. The Bhandup treatment facility generates roughly 45 MLD of backwash, which is dumped into Vihar Lake.

2. Treated water is kept in the master balancing reservoirs (MBRI) at the Bhandup Complex (246 ML) and the MBRI at Yewai (123 ML) before being supplied to 27 service reservoirs dotted across the city by a complicated web of inlet mains that are kept charged throughout the day.

INTRODUCTION OF ADVANCE TECHNOLOGY:

1. SCADA (Supervisory Control And Data Acquisition)

SCADA is introduced about 10-years back (in the year 2000) for monitoring and controlling water supply parameters from source to treatment plant and further to service reservoirs. The real time parameters such as levels, turbidity, residual Chlorine, pressure & flow are predictable to be available for effective and efficient management of the utility.

2. AQUA BILLING

The procedure for billing water delivery has been computerised. The process has been streamlined to better serve customers. Demand and receipt data are now obtainable for any period, category and rate-wise..

3. TUNNELS

The idea of subterranean tunnels / micro tunnels and for rehabilitation / augmentation of ancient pipes is adopted due to the abundance of subsurface utilities and lack of space to build water mains. In 1972, the first Under Creek Kasheli Tunnel (1500M, 3500mm in diameter) was built. Later on Ruparel - Race course-Malbar Hill, Kings‟Circle – Shiwadi, Bhandup – Malad – Charkop tunnels of 3000mm diameter totaling to 30 Km were constructed. Recently Veravali – Versova – Yrai Road (2200mm-6 Km) Tunnel has been commissioned. Currently Malbar –SK Patil – Cross Maidan (2200mm- 5Km), Maroshi – Ruparel (300mm – 12Km), Modak Sagar – Y-Branch (3500mm- 7Km) and Gudavali- Kapur Bawadi – Bhandup (12Km – 5500mm) tunnels are being bored.

The Powai- Veravali (2200mm – 2Km), Powai – Ghatkopar (2200mm – 3Km) and Amar mahal – Trombay (2750mm – 5Km) and TilakNagar – Wadala.

4 METERS

On consumer connections, AMR-capable consumer metres are being fitted. The agreement calls for the reading of metres and their maintenance during a five-year period..

5. FLOW METERS

In command to evaluate the water supply by ward and zone and to relate by billing and revenue collections, flow metres are installed on reservoir outflows and in zones.

6. WATER DISTRIBUTION IMPRIOVEMENT PROGRAMME

T1his is a coordinated effort to develop the system as a whole under the direction of experts in the field, with the goal of implementing contemporary water distribution techniques (SCADA, GIS, MIS), building capacity, and enhancing customer service levels.

Scope of Water Distribution Management & NRW Reduction

- Hydraulic modeling of the entire network.
- Hydraulic model of DMA, each comprising about 1000 connections.
- 100% Consumer metering, Bulk metering and District Metering set-up.
- Water balance and estimation of NRW/UFW
- Leakage detection, Repairs / Rehabilitation / Replacement plan

Solutions to problems of water supply system in Mumbai

1. Primary source of numerous challenges the MCGM Water Utility Department encounters is an insufficient supply of services. In calculation to performing routine maintenance on pipes and responding to frequent breakdowns on a war footing, the planned/unplanned growth and expanding slums necessitate an increased length of distribution networkThe Department is unable to address the citizen complaints. Materials needed for upkeep and repairs are frequently inadequate.

2. The field challenges are significantly more severe, particularly in densely populated slums. In slums, water pipes frequently run in groups through tight spaces and side gutters. Finding the flaw or leakage in these situations is very stimulating, particularly when there's

water contamination involved.. It is also challenging to address contaminant issues in the mains that run beneath the concrete roads. Due to the personnel being threatened, it has also grown to be exceedingly difficult to act even after discovering instances of theft or pilferage.

3. The entire workforce must stop working during the action and focus on the issue. In order for the public to assist and complete their obligation to pay for the services and conserve rare water resources, MCGM authorities expect that they become aware of the difficulties in getting water from 100 km away and distributing it in complex setting. Mumbai is presently dealing with matters by general availability and equitable distribution.

6. Strengthening of Old dams - Some of Mumbai's current DAMS for water delivery have outlived their usefulness. Using Vehar (1880), Tulsi (1892), Tansa (1884), and Modak Sagar (1954) as examples. Despite detail which measures to fortify the dams have been made, due to their age, they may require extensive restoration or reconstruction, necessitating a longer period of source closure.

7. Strengthening Tansa Dam:

The Tansa dam, which holds Bombay's main foundation of water supply, must be fortified as part of Vaitarna-Tansa Scheme. Approximately 20 years ago, it was discovered that this dam, built in 1892 out of lime mortar, was vulnerable to uplift pressure. The combination of large flood along with this pressure was later shown to be a potential threat to the dam's safety.

1.Water supply having 24 x 7 system - According to guidelines from the Ministry of Urban Development, Government of India, all urban local authorities must provide 24 hours a day, 7 days a week of water service in their respective cities. Some additional water is initially needed during the transition phase in order to reach this benchmark and change the intermittent delivery pattern into a 24 x 7 water supply pattern.

2.Rain Water Harvesting & Ground Water Use - In the past, tanks were used to collect rainwater, which served as the primary source of water supply. According to Kisan Mehta, people used to gauge how much water needed to be drawn from the tank to last throughout the year by measuring the height of the rainwater that had been collected. With the advent of piped water supplies, this conventional method of water saving has been forgotten. Numerous tanks, including Mumba Devi, Manamala, Babula, Govalia, Gilder, and Banganga, were blessed in Mumbai. Back ago, water found from these tanks, wells, and lakes.

Desalination - Instead of opting for a complicated process of building dams & reservoirs and supporting that system, Mumbai might make use of the enormous availability of seawater, desalinate it for drinkable water, and therefore expand water supply. Arvind Deshmukh, Chief Engineer at BARC, claims that a desalination plant with a capacity of 10–20 MGD requires an investment of Rs.15 crore as opposed to Rs. 10 crore for a traditional water supply system. However, the amount saved in terms of the environment and human suffering is enormous. Every dam results in the flooding of agricultural area and woodland, which displaces the local population. The success rate of project participants' recovery is well established.

Water Recycling - Wastewater makes for about 80% of distributed water. The expected demand shortfall can be made up if some wastewater is cleaned and reused. Additionally, it can stop people from encroaching on a supply that can be saved for use in other dry regions. At the Central Railway's Chhatrapati Shivaji Terminus, a water recycling facility with a 0.2 million capacity was installed in 1999 at a cost of Rs24 lakh, serving as an example of water recycling. Water Conservation- 71% of the earth's surface is covered in water, however 97% of it is seawater, 2% is frozen in glaciers and polar ice caps, and barely 1% is freshwater. We must therefore conserve every last drop of water. We need to get into the habit of using less water and avoid wasting it on unnecessary luxury.

CONCLUSION:

Not that water is running out is Mumbai's issue. There is water there. The issue is that expanding populations in many places are using less and less water per person due to infrastructure that is collapsing and leaking heavily, poor water management resulting in outrageous waste, and contaminated groundwater.

To conclude, I would say to improve Mumbai‟s water supply system, what is needed is :

1. To fulfil Mumbai's water demand, the Chitale Committee recommended that the Gargai & Pinjal Dams and Damanganaga-Pinjal River Link Project be finished as soon as possible. Government of Maharashtra (GOM) has allotted both sources to Municipal Corporation of Greater Mumbai, and GOM settled endorsement for developing of Pinjal & Gargai Project.

2. Since ten years ago, MCGM has used SCADA to monitor and manage water supply characteristics from the source to the treatment facility and then to the service reservoirs. The MCGM SCADA system is still being developed, though. The full-fledged development and deployment of SKADA are urgently required for effective and efficient management.

- Water distribution to end users must be done in an efficient and equitable manner by any municipal organisation. Concrete actions must be taken if supply and demand management is to be effective. Zone wise flow metre installation at strategic places to enable routine water balance audit analysis, for facilitating equitable water supply and leak detection.

- The leak detection section needs to be strengthened as soon as possible.

- Therefore, it is possible to adapt leak detection to prevent water loss. The leak detection department must be strengthened due to technology improvement. Enhanced staff training and high-tech, international instruments can be used to get over leak detection's obstacles

- Rainwater harvesting. If the old techniques for collecting rainwater are revived, perhaps there won't be a need for water supply plans on river basins in the future. Rainwater collection offers variety of additional advantages.

- There will be upsurge in the groundwater table, an improvement in quality of the water, a decrease in salinity, a reduction in building cracks, etc.

- Cleanliness of existing wells and providing tube wells can be done to develop alternative sources.

- Consumer awareness about the usage of water & adapting technologies for reducing water use.

Scope of future study :

On this world, water is essential for all life. A well-planned long-term future strategy is needed to meet Mumbai's opulent water needs. Hence, there’s tons of room for further research. Government and its many agencies must make extensive efforts, and the general population must as well. It is possible to conduct research into aspects of water quality for the end user, reservoir reinforcement, rehabilitation and replacement of ageing water mains, water distribution system innovation, effective leak detection techniques, innovation and use of contemporary technology, innovation and public awareness to use water efficiently preventing water losses, etc.

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