Sustaining the Hydraulic Empire: Vihar and the Saga of Piped Water Supply Management in Bombay City (1845- 1957)

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Abstract

This article comes in the wake of the water crisis faced by Mumbai city (formerly Bombay) this year. It describes the disputed genesis and controversial growth of the hydraulic water supply system in Mumbai right from the colonial to the post independence period. The water crisis of 1845, which eventually led to the inauguration of the Vihar Lake, that brought water to the city via the island of Salsette, established a hydraulic kingdom, which hegemonised the traditional water supply methods under the name of sanitation and development. Envisioned and engineered by Henry Conybeare, with an eye towards the city's commercial expansion, it has always been glorified as a modern and scientific arrangement that brought indescribable benefits to the city. This article questions the modernity and the sustainability of the model created by Vihar. It argues that apart from leaving huge socio-political, ecological and economic footprints and fashioning hydrological dystopias it has also failed to satisfy the city's thirst. Yet it continues to grow.

Key words: Hydraulic, Vihar, Tulsi, Powai, Tansa, sustainability, engineering, dystopias

1. Introduction

The city of Mumbai has the oldest and the most extensive water supply network in the country. But even with six far flung lakes and 3,500 million litres of daily water supply at its disposal, the city continues to face water woes in the 21st century. This is so as nearly 700 million litres are being either lost to leakages or stolen while contamination and low pressure continue to bog the system. Consequently, last year the city sought to implement the ambitious WIDP (Water Distribution Improvement Programme) for the equitable distribution and effective

management of water in the city. WIDP involves the use of even more sophisticated technology for leak detection, GIS mapping of the existing water supply network, reducing water contamination and a 24/7 customer helpline.[1] Even in the current year the city is faced with a grievous water crisis. This paper therefore aims at understanding the nature of water management in the city of Bombay from 1845, the year which saw a two member committee attend to the water problem in the island city, right up to1957, the year which saw the merger of the suburban area up to Dahisar and Mulund into the municipal limits of the Bombay Municipal Corporation.

2. Hypothesis and methodology

The genesis of the hydraulic water supply system of Mumbai in 1860 was touted as one of the most modern and scientific developments of the colonial administration, which subsequently provided the model of urban sanitary development everywhere in the country. Naturally, it spawned much literature, which however has proved to be only an eulogistic examination of its modernizing effect on the city. This paper posits that the spirit of modernization, which in reality is 'based on advanced technology and the spirit of science, on a rational view of life, a secular approach to social relations, a feeling for justice in public affairs'[2], cannot be associated with Vihar and the later works as the city's distribution system was, and continues to be, extremely faulty. Further it questions the dubious role of engineering in urban water management, as the latter proved to be experimental in nature. Therefore, it strongly argues that the hydraulic kingdom of the city was an engineer's vision; expensive, unsustainable and ill executed it created a system which was capable of infinite expansion without satiating the needs of the city while at the same time bringing about drastic changes in the urban spatial and political administration. At the same time it stresses that the legacy of corruption and mismanagement inherited during the execution of the first water supply system endures till date.

[1] The Indian Express, Mumbai News line, 2nd January 2014, p 2.

[2] David Arnold (2000), The New Cambridge History of India III · 5 Science, Technology and Medicine in Colonial India, UK, Cambridge University Press, pp 16-17

For the purpose of this study I have used several unpublished and published primary sources of the Maharashtra State Archives (MSA) Mumbai as well as secondary literature.

3. Understanding scarcity and needs

The traditional water management systems in Bombay city consisted of tanks and wells; many of which were constructed by its wealthy residents of various creeds. Rainwater harvesting was also not uncommon. Such was the importance of these water bodies that many streets were named after them. In times of scarcity right, tanks and wells were preserved and improved upon.

In the 19th century, even though scarcity was acknowledged in the city and need was felt to augment water supply, there were no clear indications of how much and for which purposes water was required. Perceptions regarding the means and the agency, which would aid in this work, also varied. While the local inhabitants considered the provision of a permanent supply of good water as the imperative duty of the Government of Bombay, the Provincial Government on the other hand desired water supply from elevated reservoirs, for their 'remunerative capacity'. [3] A constant supply of water was also required to fight fires, which were so frequent. Matters were however seen differently by Henry Conybeare (Superintendent of Repairs), the future architect of Vihar. Although an engineer by profession Conybeare, an ardent subscriber of the Chadwickian sanitary reform, linked an ample supply of water with the hygiene of the city and the productivity of labour as also its commercial prospects.

The water crisis of 1845 proved to be just the opportune moment for the intervention of the engineer as it forced the Government to invite their suggestions to deal with it. The initial proposals by engineers such as Rivett, Jervis and Turner aimed at augmenting the city's traditional sources, since they unanimously agreed that water shortage was faced only in the three months of the summer. Hence they suggested elevated reservoirs to collect rainwater from where it could be transported to the existing supply systems in the city. But to no avail.

[3] MSA, General Department 1847, Vol.36, op cit. Minute of the Honourable Governor in Council, 10th May 1847, pp 13-14. Hereafter MSA GD

The move to go beyond the city and explore Vihar in the region of Salsette, from where the construction of an elevated reservoir which could feed the existing tanks, originated with Captain JHG Crawford (Acting Superintendent of Repairs). In spite of his agreement with the other engineers that except for three months of the year Bombay had sufficient water, his schema changed with the entry of Henry Conybeare, who, considering the potential of the city as a centre of commerce and trade, interpreted scarcity in the light of Bombay's future growth and suggested a bigger venture which would supply copius amounts of water. Even though he accepted that some districts of the island were well supplied he defined the need of the city on the basis of what 'ought to be'.[4]

Thus, scarcity came to be calculated on the basis of the future needs of the city.[5] Conybeare's idea of the Goper valley in Salsette was adopted by the Bombay Government and selected as its engineer, to design and execute the works, he was sent to England, to make further preparations. The Vihar project thus changed its nature. Instead of being an undertaking to supplement the existing sources, it emerged as an independent enterprise that would supply the city irrespective of its traditional systems.

4. A controversial structure

However, the gestation and execution of the scheme were mired in controversy right from the beginning. It was begun untimely in the absence of Conybeare under a surveyor and in the very next year of its initiation, the country was shaken up by the Mutiny. Stricken, the Government directed that all further works on Vihar be deferred. By this time 14 lacs had already been spent![6] When finally resumed in 1857, it was executed under an unscrupulous Resident Engineer, Heneage Walker, and equally deceitful contractors from England. On account of Walker's 'mismanagement of the works' a large percentage was

[4] Frederic Graber, Inventing Needs: Expertise And Water Supply In Late Eighteenth –And Early Nineteenth Century Paris, British Journal for the History of Science; September 2007; 40, 146, p 316. Hereafter, Graber

[5] Graber, op. cit.; scarcity of water was a concept created by the eighteenth century scientists, engineers and entrepreneurs who tried to convince the government that there was a lack of water. The idea of need was invented by these technicians. Ibid pp 315-316.

[6] MSA, GD 1858, Vol. 83, Letter, 30th November 1857, p 109.

allowed to the contractors, amounting to 50 % on the estimated cost of the original work, for material that was never used.[7] Eventually, the Municipality accusing Walker of "an evident leaning towards the interests of the Contractors" [8] dismissed him on grounds of misconduct.

4.1 Engineering inconsistencies

The process of technology transfer from Victorian England to India was also complex. Technology too, was not without its flaws. It was used in a rather theoretical than practical manner which caused frequent failures, since it was simply implanted in the city in a stereotype mould, with constant reference to English models rather than the needs of the changed location. The soil of Bombay proved unfavourable and many pipes, having been placed underground on the British model, corroded very soon, due to the action of saline water. Their poor quality also resulted in frequent bursts [9] due to which the town had to go without water for hours together. In addition the reservoir surfaced as an arena of problems since intense tropical sun led to rapid growth of plant life in it. To add to the woes, the works at Vihar were not finished in a workman like manner. Thus, Bombay was saddled with a defective but modern supply system with immense leakages[10].

The structure was disputed on engineering grounds too. The controversies revolved around the type of dam that was built. Engineers, such as Captain Hector Tulloch, regarded an earth embankment dam, an innovation in engineering then, as wasteful of material, and probably costly and difficult to build without skilled masons. It was further opined, that masonry dams were better suited for the Konkan region because good clay for puddle, the essential part of every earthen dam, was not to be found here, as it had vegetable matter. On the other hand, good stone was available. Lastly, earthen dams with leaks were liable to destruction, sometimes to a very sudden one, whereas masonry dams with leaks

[7] MSA, GD 1859 Vol.64, Letter, 26th April 1859, pp35-36

[8] MSA, GD 1858 Vol. 84, Compilation number 657, pp 144-159

[9] MSA, GD 1859, Vol. 65, Letter, 6th August 1859, pp 93-95

[10]MSA, GD 1860, Vol. 44, Report, 1st February 1860, pp 340-44

were always safe against sudden destruction, and never likely to be washed away bodily at all.[11]

4.2 Professional rivalry

But the most enduring feature that characterized the entire construction of the water works was the intra professional rivalry displayed by the engineers which severely impacted its quality. Caught between two professionals, Conybeare, a civil and Capt. Crawford a military engineer, Vihar also epitomized the contemporary divide between the civil and military engineers and threw light on the disparity in their status as well. Civil engineers who had begun to be appointed from 1853 onwards to the PWD, a highly neglected department, were regarded with great contempt by the military engineers who drew better salaries.[12] Unwilling to shoulder the responsibility of the gross mismanagement at Vihar, both Crawford and Conybeare blamed it on each other's professional backgrounds with the latter concluding that some jealousy existed between the military and the civil branches of the engineering profession[13] and he charged the military officers, who were expressly appointed to oversee the Resident Engineer, of incompetence in discharging the civil engineering functions, with which they were entrusted.

4.3 Local plight

The water works proved troublesome to the locals too. Water pipes, laid through their private property, in the town, rendered them unfit for use for any other purpose. Inadequate compensation,[14] haphazardly laid or unconnected pipes inconvenienced the public while poor communication between the various civic bodies, and lack of clarity regarding the terms of the contract between the

[11]Hector Tulloch, The Water Supply of Bombay Being a Report Submitted to the Bench of Justices of that City, printed by WJ Johnson, London, 1872, pp 73-74. London 1872, pp 86-89. Hereafter, Hector Tulloch Water Report

[12] Bombay Builder An Illustrated Journal Of Engineering, Architecture Science And Art, Published By The Mechanics Institute.1866-67, Vol. IV, 5th October 1868, p 119.

[13] Bombay Times and Journal of Commerce, 1859 'Conybeare vs. Crawford', 5th December 1859, p 2301. Hereafter BTJC

[14] MSA,GD 1858, Vol. 84, Letter, 22nd March 1858, p 47

Government and the contractors and the neglect of a systematic supervision added to the confusion.[15] But neither the Government nor the local authorities showed willingness to take the responsibility.[16]

To add salt to the wounds, Vihar imposed a huge debt on the fledgling Municipality. Although a distinct understanding had been arrived at with regard to the expenditure of the Vihar water works, that it would not exceed Rs. 25 lakhs, the final expenditure amounted, with interest, to the large sum of 65 ½ lakhs of rupees. The Municipality was expected to defray the charges.[17]

5. Hydraulic hegemony

In the post mutiny years the needs for safety and security gave a further impetus to the proliferation and ascendency of the new water supply system. In this period sanitation emerged as the buzz word and became the new instrument to control the traditional systems. Commercial considerations and technology combined with the sanitary sword to create a hydraulic empire which completely changed the shape of the city. Thus, tanks and wells were rapidly shut, an act which was decried by the natives and grounds thus created were used as open spaces or for other commercial purposes.

5.1 Hydraulic dystopia

The 'modernity' of the piped water supply, however, evaded the locals who were to be supplied by standpipes fixed on the roads or for whose supply the Government relied on the charity of the rich natives. Thus, Cursetjee Furdoonjee, a well known merchant, offered to erect a drinking fountain, to be maintained by the Municipality, in the memory of Sir Jamshetjee Jeejeebhoy[18] while Sir Cowasji Jehangir, a prominent Parsi leader, provided 40 drinking fountains to be placed in the various parts of the city.[19]

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[15] BTJC, op. cit, Letter, 24th September 1859, p1812

[16] MSA,GD 1857, Vol. 92, Letter, 9th September 1857, p 205

[17] Hector Tulloch Report, op cit, pp30-31

[18] Bombay Gazette, 18th November 1861, p 1103

[19] RP Masani, Evolution of Local Self Government in Bombay, Oxford University Press, Madras, 1929, p 182. Hereafter, Masani LSG

Nor could the supply system ensure a common minimum supply to all. As a matter of fact there existed no unanimity among the colonial planners and sanitarians on the most vital issue of water supply viz. the minimum amount of water required per head per day (phpd). In 1864, for instance, Dr. Andrew Leith (Deputy Inspector General of Hospitals) calculated it to be only 5 gallons,[20] while Dr. Thomas Blaney, a medical practitioner, claimed it to be only 2 gallons of water phpd for the largest proportion of the population since they had to travel long distances; sometimes as much as a quarter of a mile.[21] Disease and death therefore continued to ravage the city.

But with all its flaws Vihar set the blueprint for all subsequent waterworks which continued to manifest controversial beginnings, long gestation periods and negligent supervision. Most were executed under poor financial conditions which however did not preclude repetition of mistakes by the Municipality in the form of ambiguous specifications in letting of contracts, incompetent supervision and non imposition of severe penalties for shoddy performance and shirking of work.

Technological glitches, corruption, besides the tardy working of the Government machinery, which took agonizingly long periods of time for decision making, contributed no less, to this failure. All subsequent works proved the defects of the preceding technology, thus showing that engineers learnt from their failures and that though the cheapness of the project was the guiding factor, the end costs exceeded the original estimates. The Tulsi dam construction which came up on the heels of Vihar, for instance, was held up for 7 long years for want of financial support and decision regarding the nature of the dam itself, which severely impacted its water quality. While the Bhandarwada service reservoir proved to be a 'grave' failure, since the whole structure was not constructed in conformity with the original specifications due to the carelessness of R. Walton, the engineer in charge, thus forcing the Corporation to embark on remedial measures within 4 years of its completion. The storage basin intended to hold 30 feet of water, leaked so much that, in practice it could hold only 25 ½ feet of

[20] Selections from the Records of the Bombay Government, No. L XXX, Leith's Report, p23.Hereafter Leith.

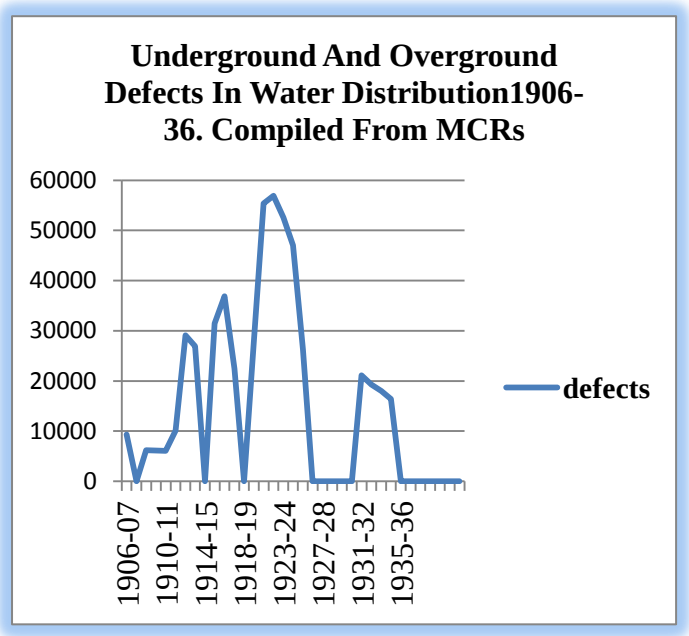
[21] MSA Public Works Department (General) 1868-89, Vol. 423, p55. Hereafter MSA PWD General.

water in it. Besides this, leakages at both the Bhandarwada and the Malabar Hill reservoirs in the city proved to be a fruitful source of malarial fevers in the city.

Further, in the implementation of all these works the British were guided by the firm belief of the superiority of the English engineering skill over that available in India. Hence, for a long time the works came to be supervised by the Engineers brought from abroad. Consequently costs escalated and native engineering skills were conspicuously ignored.

5.2 Combating waste

Leakages and wastage of water during its supply, distribution and consumption completed the chaotic scenario. Vihar dams leaked right from the beginning. Although repaired in 1865, they were seen leaking in 1870 once again.



Waste of water, therefore, assumed a new shape under the new water supply system. From now on water was taken for granted by those who got it from taps. This kind of easy access to water changed the habits of the people giving rise to new expectations and behaviour.[22] It was therefore put to profligate use.

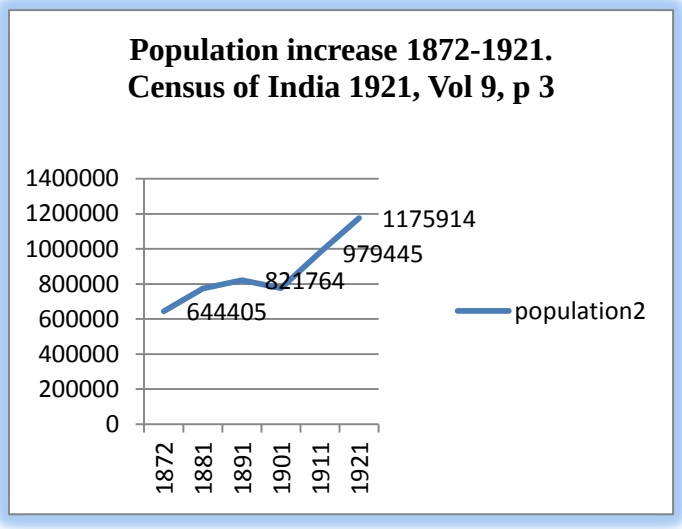
Street watering, which was believed to be conducive for health, however emerged as one of the important causes of waste. By the turn of the century waste of water stood at 15-16 million gallons or 43-44 % of the water supplied. This resulted in the overworking of the pumps at Love Grove, water logging of the

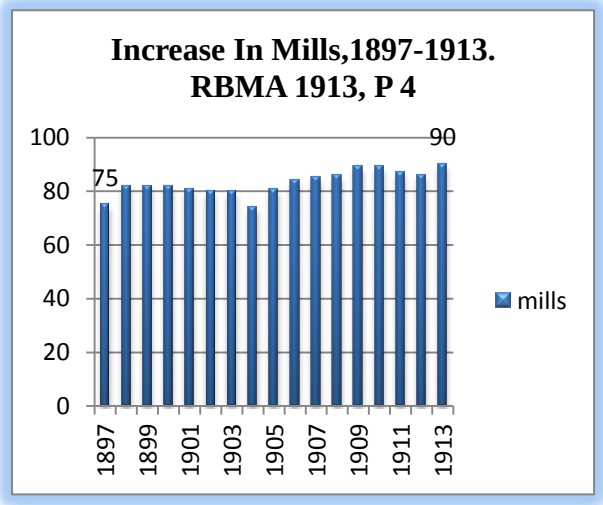
[22] Frank Trentmann and Vanessa Taylor, From Users to Consumers, Water Politics in Nineteenth-Century London In The Making Of The Consumer: Knowledge, Power And Identity In The Modern World; Edited By Frank Trentmann. Oxford: Berg Publishers, 2005, p 69.

soil etc. But for this waste, there could have constant supply at full pressure, without additional delivery mains and could have, apparently, kept Tansa duplication at bay.

5.3 Myopic planning

Rapid demographic and commercial growth of the city increased water consumption phenomenally. Ironically, water works such as Tulsi, Tansa and the service reservoirs, which provided employment opportunities, actually contributed to the growth of the city. Therefore, the Municipality was constrained to create Tulsi, Pawai and Tansa within the next 97 years in quick succession.





But all the works showed haphazardness of planning and knee jerk response. Even before the Tansa water could be brought into the city, Powai had to be considered in 1889, as a water famine stared the city in the face. The works were created and abandoned in no time although the suburbs had to bear the cost of this policy.

Tansa too followed the established trend in the water works engineering of the city. It proved to be more expensive than Government works of the same category. In its first phase transportation of materials from considerable distances and the unfavourable situation of the site, added to the cost[23].Extravagant

[23] MSA PWD General op. cit, 1890-98, Vol. 1549, Report, 4th March 1892, pp 15-16

claims made by the contractors Messrs. Glover and Co.,[24] escalated the cost from 123 lakhs to a crore.[25]

Despite Tansa, at the beginning of the 19th century, water famines continued and the city had to consider innovative means to alleviate these problems, which ranged from opening up of closed wells to considering boring operations[26] and seeking services of water diviners. As an experimental measure 12 tube wells were sunk in the city in 1941. [27] Improper regional planning in the post independence period added to the problems. With the addition of the suburban regions in 1950 and 1957 and the consequent increase in the area and the population of the city, provision of water supply emerged as an intractable dilemma. The city now looked ahead to colonize even more distant rivers of Bhatsa and Kalu.

5.4 Urban transformation

Unfortunately however, since the needs of the army, the factories and the richer people, who could afford water, were the prime concern, the supply system developed in a lopsided manner with an orientation towards the southernmost tip of the Island. The other areas, especially the northern parts of the island, therefore were constantly starved of water. As the city grew this defect became increasingly obvious.

Further, since hydraulic projects required thorough investigations regarding source, quantity, quality, methods of distribution of storage and water supply, they marked the beginning of surveying techniques in the urban areas thereby allowing the government to establish a thorough hold over the city and the adjacent forest areas. Additionally, the use of scientific formulae to conduct water into the city, from distant sources, gave it greater power to control the traditional water sources which not only brought into prominence the role of the engineer but also led to the centralization of water supply systems in the hands of the municipality.

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[24] Record, Procs. Corporation, op. cit, 1891-92 (Pt. I) Vol. XV, Minute, 24th March 1892, pp 602-603

[25] Ibid, Speech of Mr. Acworth, Municipal Commissioner, 31st March 1892, p 617

[26] Indian Municipal Journal, February 3rd 1901, Artesian Wells in Bombay, p 74

[27] Administration Report of the Municipal Commissioner for the City of Bombay, The Times of India Press, Bombay, 1941-42, p 278

Conclusion

It can therefore be concluded from the foregoing narrative that water supply to the city was a future oriented engineering driven activity driven by commercial and not philanthropic concerns. This gave a new meaning to the word scarcity. It therefore, set into motion a system of water supply that was self perpetuating in nature. Exclusive in its distribution policy, it further manifested technical flaws and a want of thoroughness in the process of execution. Increased water supply augmented the growth of the city as a result of which more such costly projects had to be executed, at regular intervals. Added to this was the rapid and unplanned spatial, demographic and industrial expansion of the city, during their long periods of gestation, which nullified the effects of an increase in supply. Want of water literacy and waste worsened the problem. Thus, they failed to quench its water demands. Small wonder, that after more than 150 years of its development the city continues to face water shortages.