CHAPTER 2

THE GORDIAN KNOT

Drainage and Sewerage

With the introduction of Vihar water in 1860, only a part of the Chadwickian sanitary ideology had been implemented in Bombay. His famous principle of “circulation versus stagnation,” that is provision of constant and direct supplies of water and removal of the fouled water¹ still eluded the city. Victorian England, the mother of sanitary ideas, at this time, was governed by the view that the question of sewage and drainage concerned the poor more than the wealthy; primarily on account of overcrowding. According to the contemporary British standards, houses without back doors, windows, privies and internal water supply were ‘ruinous’ and it maintained that “Every dwelling house should have its own convenience.” Water closets were considered indispensable for sanitation. It was also felt that the solids of sewage could be precipitated, but agricultural land was the proper place and use for sewage. Another acknowledged principle of sewage was that fresh sewage, when properly diluted, filtered, disinfected and clarified could be passed into rivers, or into the sea, without causing nuisance or injury to fish as rivers and streams were considered natural outlets for drainage. Although there was a great outcry against the pollution of rivers by sewers and the killing of fish, polluting rivers was considered better than polluting towns and houses.²

Similarly, it was also believed that “social improvement must begin in the upper circles of society that it may descend in precept and be enforced by example.” Since the poor were utterly powerless to help themselves in sanitary matters, and since

sanitary progress was equated with political contentment, commercial prosperity, public health and social comfort. Sanitary laws had to be framed by the State. This necessitated the gathering of evidence, maintenance of reports and giving instructions. Sanitary reform thus, automatically lead to a degree of centralization of powers in the hands of the State, an idea which was unmistakably brought out by British civil engineers in Bombay as well, who categorically stated that aim of establishing a complete sewerage was to establish a complete control over house drainage which could be accomplished by making house drainage and water supply compulsory under the supervision of a properly qualified engineer with full power to execute house drainage where none existed or where it was defective.

This chapter therefore traces the growth of this vital pillar of water management that is drainage and sewerage, with greater emphasis on the latter as it involved managing waste water generated in houses.

FROM CESSPOOLS TO MAIN DRAINAGE

Drainage of the mid nineteenth century Bombay, was a neglected area, and the filth of the town, with its attendant sickness and mortality, was deeply lamented by the people. People commonly believed, that the Government had plenty of money, but was not willing to apply it to proper purposes. From Conybeare’s report the Fort emerges as the cleanest part of the town with a death rate of only 9.9 per 1000, while that of some of the sub-divisions of the Native Town was as high as 60 per 1000. Out of the 6 divisions of Bombay from A to E, the A division, within which the Fort fell, was by far the best drained and consequently the healthiest. On the other hand, the E division, which contained the undrained subdivision of

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3 Ibid. pp 44
5 BTJC . op. cit. 30th Aug 1845. Supply of Water to Bombay. p 572
Kamathipura, was the unhealthiest.\textsuperscript{6} From 1853 onwards an improved system of drainage, elaborated by the experiments of the English Board of Health and sanitary commission, had been adopted.\textsuperscript{7}

There were storm water drains as far as Girgaum and Grant Road. The then suburban sections of the city did not have even these. Drains, situated in the middle of the road, covered with perforated stones, were cleaned by the lowest class of people commonly known as “parvaris”, twice a year, in the principal thoroughfares and streets and once in the lanes. Fevers, which were common, were very often attributed to the decomposed gases emitted from these perforated covers. Beyond the storm water sewers there were open trench like sewers in front of houses mainly in the crowded localities outside the Fort.\textsuperscript{8}

Despite its rising fortunes, a proper drainage and sewerage system, still eluded the city as it was caught in a maze of problems. Having evolved on a trial and error method, that was attributable to the various physical, administrative, financial and political hurdles faced by it, from time to time, the drainage of the city was also influenced by the sanitary ideas of contemporary England. But unfortunately, even in the latter country, these ideas had just begun to take shape after the publication of the Report of the Health of Towns Commission in 1849. Needless to say, their implementation, in Bombay too, entailed a degree of experimentation.

**Initial Challenges**

Morphological changes brought about in the city made the drainage problem a difficult one. Over 40 percent of its land was reclaimed from the sea by filling in of inland lagoons and marginal seas, just at or above sea level. Topographically, the


\textsuperscript{7} GD 1855. Vol. 8. Unpublished Report of Board of Conservancy for 1853-54. p 58

city area was a linear central bowl or depression, with low lines of hills on either side. (Malabar Hill to Worli Hill on the West; Dongri, Mazagaon, Sewri, Antop and Sion on the East). The rain water therefore, gravitated towards the central depression. The building of the Hornby Vellard in 1784 and the Sion Causeway in 1805 and further, the construction of the Mahim (Jamshedji) Causeway in 1845 had worsened the problem of flooding.9

Administrative procrastination further impeded performance in this area. Projects were deferred on account of delays in surveys by the PWD.10 Plans were either not transmitted to the civil architect or were shoddily presented on different scales and ‘unfavourable material’.11 Even climatic conditions were perceived as complicating the question of drainage improvement. As regards sewerage there was a general opinion that it could be solved in a tentative manner only, owing to the features of the island and the difficulty in ascertaining the quantity of water that would ordinarily pass down the sewers. Additionally, its success depended entirely on the general introduction of house drainage for which the time was not yet ripe.12 Strong colonial prejudice against available engineering skills in India prevented the schemes from being designed within the city. Strangely enough, the drainage of the city was projected to be of such importance that Engineers were encouraged to study sanitary works of England and schemes were invariably referred to “some eminent engineer”13 who were not really conversant with the circumstances of the city or who had not studied the subject specially.14

11 Ibid. Letter no. 7337 of 1859 from GD to Lord Elphinstone. 8th November 1859, pp 269-271.
12 On the Surface Drainage of Bombay, Education Society’s Press, Byculla, 1867, Minute by Captain JS Trevor, 12th February 1861, pp 71-74. Hereafter OSDB
13 GD 1859, Vol. 34. Dispatch to her Majesty’s Principal Secretary of State for India, from the Municipal Commissioners, 2nd November 1859, pp 265-268.
14 OSDB op. cit. p 60.
Finally, the energies of the municipal engineers were very often were spent in areas where they lacked expertise. Many had never been to Bombay or did not know the subject well. Therefore, different engineers gave specifications according to their understanding of the issue. This great defect in the engineering branch of the municipal organization was particularly visible during Commissioner Crawford’s time when municipal engineer Russell Aitken, for example, misapplied his time in this area and rushed into endless professional disputes with the Government engineers and prepared plans and submitted reports in an area in which he had no knowledge.\textsuperscript{15}

More surprisingly engineers wavered in their opinions and frequently changed their positions as regards the manner in which the sewerage and drainage of the town was to be dealt with. This was exemplified by Robert Rawlinson, an eminent sanitary engineer of contemporary England, who had never been to Bombay. After initially approving engineer Tracey’s method of dealing with sewage, which was to have been emptied into the harbour at various points, Rawlinson changed his view by 1868, as greater experience on this subject, apparently induced him, to recommend that sewage thrown into the harbour would taint it. He thus suggested its use for irrigation.\textsuperscript{16}

The drainage of Bombay at this time revolved around the main drain, which was originally a nullah, which drained into the sea through the large gap, also known as the Great Breach. The latter, was subsequently closed by the construction at Breach Vellard, and by another gap at Worlee. With the increase of population, an outfall was required nearer the town. Therefore, sluices were constructed at Love Grove in 1842 which, however, should have been constructed the south end of the Vellard to drain the town more effectively. In 1846-47, three outfalls were constructed into the Back Bay in order to drain the western portion of the island and another three to drain the eastern side into the harbour. This work however was not done on a general system, but whenever funds were available. The main sewer of the Native Town


drained into the sluices of Love Grove. The Fort was drained by 8 outfalls into the harbor and a branch in almost every street and alley. Night soil was not allowed to enter the sewers up to this period and the use of cesspools was common.\(^\text{17}\)

Since the old main drain was a nuisance, in 1853, Conybeare proposed a plan for the use of sewage, at a site near Grant Road assuming that the benefits of sewage irrigation would be recognized. But, having proved unsatisfactory, they were discontinued two years later. In the latter part of 1857, Mr. Buist suggested a design which was aimed at substituting the main drain with an enclosed sewer below the Bellasis Road and to accelerate the flow of sewage through that sewer by making use of impounded salt water. But this plan which would only have improved the lower portion of the main drain, and not the general state of the drainage of Bombay, \(^\text{18}\) did not materialize.

Several other schemes were submitted by Lt. Col. Crawford, Mr. Perkes and Lt. Col. Turner and others. The use of salt water for flushing the drains, the cutting of a trench across the island or the use of the eastern foreshore for sewage outfall and the use of sewage manure, the common use of water closets were some features of these schemes. But all of these were rejected on account of their cost, lack of perfection, or simply due to their absurdity. Conybeare too, had commenced a report on the general subject of the Main Drainage of Bombay which was left unfinished on his departure for England.

That drainage and sewerage were not given due consideration, at this time, even by the Government is visible from the fact that despite Conybeare’s suggestion for its provision, along with the Vihar Water Works, as early as 1855, the Governor in Council, Bombay, insisted that the requisite improvement of the drainage of Bombay was already in progress or “in contemplation” under the Board of Conservancy. This could meet the drainage demands of the city, even with an increase in water supply from Vihar, which was deemed “insignificant” thus implying, that Bombay did not

\(^{17}\) OSDB, op. cit. pp 13-14  
\(^{18}\) Ibid. p18
need a “distinct system of drainage with reference to Vihar water works”. On the eve of the Vihar water supply in 1859, the tone changed to one of complete indifference and the expense on drainage came to be regarded as a totally ‘avoidable one’. Consequently nothing was done in this area.

Development and Fate of Schemes: 1860-1877

Till 1860, therefore, there was no further improvement on the issue. In that year Mr. Tracey, the municipal engineer, submitted a comprehensive scheme for the whole of the city. Favouring the eastern foreshore, he suggested, outfalls at Castle, Wari and Carnac Bundars as these would be located at the shortest minimum distance and therefore would not cause a secondary nuisance; nor would the prevailing winds carry the effluvia back to the locality. The western foreshore was rejected as it was the windward side of the island, and any discharge on this side, would be washed back on to the shore. The yearly injury to the Mahim causeway was cited as an additional reason for the unsuitability of the Western shore. It was predicted that any structure created here would be damaged. Therefore the harbour was deemed ideal as it could accommodate an increased amount of sewage as well.

By 1863, when the scheme was referred to Mr. Robert Rawlinson, who countenanced the proposal of the Harbour as the discharge point of the sewerage of Bombay, the city was in the throes of a major physical transformation due to the demolition of the Fort walls and the reclamation schemes launched by the Government. Matters were also complicated by the poor financial status of the Municipality. However, favoured by Rawlinson, Tracey’s scheme, with some modifications, was sanctioned by the Government in 1863 and Tracey was appointed to carry it out with Capt. Trevor as Consulting Engineer. For the execution of the work, a Drainage Department was organized and work was commenced in 1864.

\[19\] GD 1855 Vol. 55, Letter to the Acting Clerk of the Peace from the Government of Bombay, 4th July 1855, pp 269-270

\[20\] OSDB. op. cit. pp 26-32

Nonetheless, the work remained incomplete on account of the customary delay on the part of the contractor against whom legal action had to be taken finally. A year later, and after a sum of Rs.57,493-3-3 had been spent by the Drainage Department, the drainage works of the native town were in a poor state as “official routine” prevented the commencement of the work. Due to the handing over of the Flats to a reclamation company, works did not progress there either. Eventually, the work came to an abrupt conclusion because Tracey’s proposed sewage outfalls on the Harbour, at Carnac and Wari Bunder, placed near the populated parts of the city, raised a controversy.

In 1865, when Arthur Crawford assumed office as the Municipal Commissioner, Bombay had about 25 miles of badly constructed street sewers. The Flats continued to face their problem of submergence during and after the monsoons. Creation of the railway embankments and plots, for the purpose of building, and the works of the Bombay Reclamation Company, whose work ponded up the foul sewage of the whole of Sonapore and Girgaum, between the breakwater and the Esplanade, and endangered the public, worsened the problem. Problems increased as the city’s Drainage Fund, was siphoned off, for the purpose of the beautification of the city by a zealous Crawford. More unfortunately, a large amount of money was simply thrown away by him on drain construction in the Fort area and he jokingly told the Justices that the completion of the Fort “network would give them a large field for experiments”. Despite the incomplete works, generous salaries were sanctioned for the drainage works engineers. But the question of surface drainage and sewage remained unresolved. Only a subsidiary drain was constructed from the native town to Worli, which was a temporary work, on which a lot of money was spent. But the nuisance from the main drain continued however.

The year 1866 saw yet another scheme prepared by Mr. Russel Aitkin, the then engineer to the Municipality. After a careful survey of the harbour and a series of tidal experiments, conducted to the select an outfall for the sewage, Aitken proposed...
three sites. His scheme included the discharge of sewage into a reservoir at Colaba near the Light House and pumped into the sea; combined sewerage for both sewage and storm water as he felt that the separate system was impracticable in Bombay; retention of the main drain, to receive the surplus sewage, when more than 2 inches of rain fell in a day; running the main sewer from Null bazaar to Colaba with large branch sewers from different district. Curiously, Aitkin objected to a “separate system” as he found it impracticable and provided for a combined system. Oddly his main sewer was designed to carry sewage at not more than $2\frac{1}{2}$ feet per second when running full with sewage and storm water, but during the dry weather it was only to be 1 foot or even 9 inches per second. This, he supposed sufficient to prevent deposit in the sewers. The scheme was referred to Mr. Rawlinson, who however, convinced by the float experiments, carried out by engineer Jugganath Sadashiv that a Colaba outfall would contaminate the harbour, rejected it. The natural tendency of the island, he opined, was towards the Flats and Worli. Ironically, two and a half decades later, in 1890, these were to be proved wrong by Mr. Baldwin Latham, an eminent sanitary engineer, who established that arrows, indicating the direction of the floats, were wrongly shown on the plan. They pointed to the north instead of to the south, thus leading to the erroneous conclusion that the current during the ebb tide set into the harbour, instead of flowing into the sea. But since Rawlinson’s opinion held considerable sway in this period his “extraordinary mistake” resulted in Bombay having its outfall on its western foreshore with its entire consequent nuisance.\(^{25}\)

By 1867, Bombay having been condemned as the cholera nest, the drainage issue began to be considered seriously. The gravity of the issue amplified with the Government of India resolution of 21\(^{st}\) September 1867, which put upon the Municipalities the entire onus of the execution of the water supply and drainage schemes. It was expressly stated, that such schemes had to be financially viable. In turn, the Government of Bombay too reiterated the sentiments of the Government of

India. Thus, the Bombay Municipality was left to its own means in the execution of the drainage and water supply schemes, without any financial support.26

A new phase was therefore inaugurated with the drainage scheme of Hector Tulloch in 1868. Convinced about the infallibility of Rawlinson’s principles, Tulloch submitted his report in which he advocated the segregation of sewage from storm water, discharge of night soil into underground sewers and application of sewage on land. His report set the note for an irreversible transformation in the course of the drainage and sewerage of the city.

Tulloch’s scheme clearly brought out the British agenda of segregation of certain areas as European enclaves, preservation of the health of the army and improvement of roads for the sake of commerce. A strong advocate of underground drainage, he reasoned that they would benefit the cause of public health and communication, besides helping the Municipality save lakhs of rupees. As regards the outfall, he argued that since the natural slope of the island was towards the north, irrespective of the application of sewage to land or its discharge into the sea, it should be taken to the west of the city and not towards the Harbour or Colaba. Any discharge in the east was likely to foul the harbour. He therefore recommended the construction of three sluices at Love Grove, Worli and Dharavi.27 This according to him would prove cheaper from an engineering point of view. Besides, he anticipated a rise of the town in that direction.

Yet another scheme, suggested by William Sowerby at the same time, proposed the creation of a canal, on the lines of the Thames, which could serve the twin purpose of draining the island as well as providing means of navigation for the city. Sowerby also favoured underground drainage of Bombay but was against the disposal of the night soil in these.28

26 Pedder’s Proposals, op. cit. p 3
28 Sowerby, op cit. pp 15- 24
Resolution Of The Controversial Issues

The 1860s therefore, saw the drainage problem of Bombay hinged on the most
crucial issues of sewage disposal and the method of sewerage. The three methods of
sewage disposal that were available, at this time were, pumping it into sea,
construction of sewage tanks and sewage irrigation. Of these, the first one had been
popularly recoursed to, uptil this time, as it was believed that running water was
capable of purifying itself. But, by the latter half of this decade, a peculiar situation
had emerged whereby the location of the outfall became a vexed issue, owing to the
magnificent growth of the city.

Till 1868, sewage of the Fort and the neighbouring areas was discharged into the
harbour. By the end of the decade this practice, however, began to be challenged.
With the opening of the Suez Canal, in 1869, which brought Bombay among the
Indian ports closest to Europe, need was felt to relocate the sewage outfall in this
area, which would undoubtedly jeopardize its commercial growth. By this time, the
Fort itself generated sewage of 80,000 people and it was feared that with an increase
in population more sewage would be created. Therefore, the preservation of the
‘magnificent harbour’ of Bombay, which gave the city its importance, emerged as an
overriding concern. Hence the harbour side was out of bounds.

The western foreshore along the Back Bay, on the other hand, was required for open
spaces for the free circulation of air, roads and residential areas. Being the windward
side of the island, valuable properties had developed on this side of the shore. The
Malabar Hill and its roads and the Breach Vellard were regarded the “lungs of
Bombay”. More importantly, the European population chiefly resided on this side.
Wealthy Indians also populated this area. To this was added the need to find
accommodation for the Europeans. House rents had gone up extravagantly.
Migration to less expensive quarters of the natives was not possible for Europeans,
as that part of the town was ill built, ill drained, dirty and very unhealthy. Besides,
they could not live with the peculiar habits of the natives. Further, the rapid
transformation of the Fort into a Central Business District, after the demolition of its

29 Tulloch Drainage, op. cit. p 5
walls, had rendered the area undesirable for residence. \(^{30}\) Shortage of housing was also attributed to the change in the habits of the house owning class of the natives who had started living in the houses which they had formerly rented to the Europeans. Deeply sympathetic towards this problem, the Government decided to reclaim the whole of the foreshore from Walkeshwar to Love Grove and improve the Flats as well. It was felt that a crescent of really good upper storied houses, which would extend from the Mahalaxmi end on the south to the Love Grove end on the north, would prove to be a remunerative scheme. It would also compensate the European population for the loss of one of its healthiest suburbs from the resumption of Colaba by Government.

But the native town, with its three subdivisions viz. the Old town, the Oarts and the New Town, comprising chiefly of the labouring class, came in the way of this construction. Of these, the latter two were required for the above mentioned purposes. \(^{31}\) As per the European town planning norms, it was the standard practice to keep this ‘refuse’ population in the backstreets of the towns, well screened from the main thoroughfares. Moreover, the Back Bay had been a point of deposition of night soil and the sewerage of this section of the population up till now, even though the


\(^{31}\) Oart district, comprised the Police stations of Dhobi Talao, Market and half of Bhooleshwar, and was built on the gentle swell of the littoral concrete, facing the Back Bay. It was densely covered with houses, had no streets and was not properly laid out, without any drainage but well supplied with water. The third, near the Flats, was the Khara Talao, Cammattee Poora, Khetwady and half of Bhooleshwar. These were reclaimed lands built on low water ground below the high water mark; ill supplied with water and had no fall for drainage. Unfit for human habitation, they should never have been built upon, but when the Government cleared the Fort and Esplanade, of houses, it was necessary to resettle the displaced population. Hence they were assigned to natives.
deposition of the night soil had been forbidden in this Bay since 1850.\(^{32}\) It was also maintained that the sewage would be washed back to the shore if disposed off on this side. Thus, the sewage outfall could not be constructed on this side of the shore.

With the city fast assuming importance as a trading centre during this period, roads were also required. There were few thoroughfares in Bombay at this time. But these were altogether narrow and inadequate for the traffic to pass. Most of the streets, with an east west axis, were either too short or too narrow to give the full benefit of the sea breeze. Added to this, was the British aversion to travel through crowded streets in the native town which prompted the desire to reserve roads exclusively for their use.\(^{33}\) Construction of such roads, exclusively for the European population, would help them to maintain the required distance from the locals and at the same time greatly facilitate communication with Malabar and Fort.

Sewage could not be cast at Colaba either; a site clearly favoured in the whole of Bombay and Salsette, by the Sanitary Commissioner in 1867, for barracks of European troops. Evidently therefore, none of these three sites could accommodate the sewage of the city!

The second method of sewage disposal, via sewage tanks, suggested both by Tracey and Aitken was objected to by Rawlinson as, apart from being new to the country, its hot weather and the huge amount of money required for building them, they did not guarantee success.\(^{34}\)


\(^{33}\) L. Michael, op. cit. p 406.

It was the third method of land disposal, the Chadwickian answer to the sewage problem, which aroused much interest. By this method, it was argued, the city would not only get rid of waste, but would also recover the costs of providing its people with sanitary services. Sewage farms therefore came to develop during this period, in England and Europe, generally located on the outskirts of the city where urban sewage was used as irrigator and as manure to grow a variety of crops. Though highly favoured by Nightingale and Rawlinson, opinions on it were vastly divided, in England itself. In Bombay, Conybeare and Tulloch emerged as ardent proponents of the idea. The proposal to apply sewage as manure once again sparked off a hot debate which remained indecisive for a long time to come.

The issue of sewage application proved yet again, the vacillating stand of the ‘experts’, their lack of knowledge of the city’s topography as also the desire to experiment in Bombay. Sewage application for agricultural purposes was, in reality, an old practice. But as mentioned earlier, Rawlinson professed ignorance of it initially when Tracey’s and Aitkin’s schemes were forwarded to him. By 1868, however, he put forth this idea as a ‘new plan’, in order to make way for a new project. Completely converted to the new cause, he now pushed the case vigorously, promoting it as the only answer for Bombay’s sewage disposal problem, even suggesting its trials on a large low lying area to the north of the city. His later report even mentioned that the system had already been tried on a portion of the Flats and that it had failed. This, he ascribed to the want of agricultural skill. Strangely enough, in spite of being aware of its failure in Europe, and in spite of his complete ignorance of the soil or crop type of Bombay, or how the sewage was used, Rawlinson confidently opined on how to use it in this area and showed conviction about its success.

*Forwaded To Her Majesty’s Principal Secretary Of State For India In Council, 12th August 1867. By Robert Rawlinson. London. January 1868. p 2


36 Sowerby. op. cit. pp 4-5.
The idea, found favour with Health Officer Dr. Lumsdaine too, who was confident that all the waste land in the city could be brought under sewage cultivation, without injury to the people or objections from the native cultivator. Tulloch also promoted the use of the northern portions of the city and wanted the people to regard the sewage of the town as a ‘source of wealth’. Since the project of sewage utilization had been temporarily given up in London, at this juncture, due to want of funds, he wanted Bombay to utilize this opportunity to carry out sewage utilization and be the first city in the world, with a population of a million inhabitants, to have utilized her sewage on a systematic plan. In fact, he felt, she would set an example for Europe.37

In England, itself, sewage irrigation had never been found commercially beneficial on a large scale. Many engineers like Tracey, therefore, felt that it was meant to be undertaken as a private venture only. Public funds could not be applied to it.38 Experiments to use the sewage on agriculture made in England as early as 1842 or 43 in the low lying salt batty lands in the north of the country had proved disappointing. The lands to the North of Bombay were also similarly salt batty lands, and it was apprehended that the use of sewage would doubtless stimulate the action of the salt latent in the subsoil. Thus, engineers felt that sewage irrigation could only be tried on an experimental basis and not as a rule. The evidence given by the Report of the International Sanitary Conference of 1866, also established a direct relationship between the spread of cholera and the application of sewage to soil. It strongly cautioned against the use of sewage in the neighbourhood of towns and insisted that when used for agricultural purposes, it was to be applied 500 or 1000 yards away from military cantonment.39 Thus, the threat of cholera prevented the use of sewage, on land, at this stage. However, one cannot ignore the fact that the proposed experiments not only attempted to insulate Colaba, the Harbour and the Backbay zones from the sewage nuisance but also wished to profit from such experiments on lands situated in the proximity of the native locale.

37 Tulloch, Drainage op. cit. pp 39-40
38 OSDB. op. cit, p 26
39 BDWS 1869. op cit. pp 90-91
As regards the type of drains, construction of underground drains was favoured, particularly by the Army Sanitary Commission, which deplored the amount being spent on the Health and the Halalkhore establishments, and pressed for cheaper alternatives. Not only this, the conventional method of sewage disposal resulted in friction between both the Health Officer and the Executive Engineer and was also damaging as, cleaning of the drains for the sake of public health involved constant digging of the roads. Besides, the Commission also strongly recommended against the discharge of the sewage into the harbour where troops, women and children landed from England. It was reasoned, that with the same Halalkhore rates, a complete system of sewerage and drainage could be implemented, instead of continuing with what was termed by Nightingale as the “fetching and carrying” system”.

**Approach- Avoidance Conflict**

But the toughest issue that defied resolution, proved to be that of night soil disposal. With its predominantly traditional system of conservancy, where night soil was collected on a daily basis, Bombay also had a few private cesspools in areas where there were no public drains either open or covered. During the summer season, this night soil was deposited in the pits, dug in the Flats, and in the monsoons, in to Back Bay. The Native Town with a population of 390,000, produced night soil weighing more than 43 tons or 130 cartloads daily. It was apprehended that the night soil of the native town would increase in the near future and it would diminish the value of the Flats, if the pits continued. Complaints made by the residents of Byculla, over this nuisance, the difficulty to manage them due to the increasing population, and later the closure of the Back Bay outlet in 1850, made this issue an important one. Hence, the Love Grove Channel had been suggested by Conybeare, as early as 1855, in favour of the Back Bay. He reasoned that the soil would be dissolved by the sea.

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40 GD 1873, Vol. 73, Memorandum By The Army Sanitary Commission On The Annual Report Of The Municipal Commissioner Of Bombay For The Year 1870. pp 228-229. These establishments cost Rs. 5, 24,863-5-3 and Rs. 1, 96045-8-6 respectively. Hereafter, MASC.
water and only a small population would be inconvenienced by such an act. This channel was also recoursed to in case of the disposal of the night soil of the Fort. The night soil of the latter was otherwise thrown into the sea at Boree Bunder and also on the shore of Mody Bay. But the chief problem with the system, apart from the nuisance it generated, was the blockage of the seaward end of the discharge pipes during monsoons, on account of their siltation. In such instances, it had to be sent to the distant Love Grove sluices which were 6-7 miles from Colaba and 4-5 miles from the native town.

At the international level too, this period witnessed the gradual ascendance of the water carriage system over the conservancy system thus connecting the removal of excreta intimately with water supply. Mounting volumes of urban waste had made the conservancy system uneconomic, as night soil had to be transported to increasingly distant farms. But the real impetus came with the cholera epidemics. To counter these problems, Chadwick strongly advocated a change from the conservancy system to the water carriage one by which night soil could be deposited into water courses through sewers. Sanitary sewers developed both in England and Paris as a result. Water closets, by now, had emerged as a distinguishing feature of the London’s sanitary arrangements.

In Bombay however, the carrying of night soil in underground drains by the water carriage system at this stage, was considered impractical because, such an arrangement would require the rebuilding of the city on an entirely new plan. Besides, if these works were not done thoroughly they would be worse than useless. But the greater deterrents were the apprehended resistance from the natives, who would have had to adapt considerably to their use; the expenditure that such a system demanded and the fear of retrenching a large class of Halalkhores, thereby generating considerable dissatisfaction. Inadequacy of water supply was yet another restraint. The required supply of 30 gallons per diem per head, ideal for the introduction of the water closets, was not available in Bombay at this time. Tulloch.

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41 RSSRB Appendix H. op. cit. pp 24-29
42 MCR 1866. p 11
43 Julie Stauffer. op cit. pp 4-7
However, was not averse to the use of sanitary regulation for their installation among
the natives.41 Moreover, although the Halalkhore cess did not yield enough to pay
their wages or the supplies necessary for the department and despite the British view
of the Halalkhore community as the most troublesome community, a section of the
British medical fraternity, for example Dr. Lumsden, was decidedly in its favour and
against the passage of night soil into the drains, as they feared the gases that would
be generated in the closets, which at this time considered bad from a sanitary point of
view. Hence, it was deemed better to rely on the Halalkhores who, at this time,
served 2/3rd or little more of population mostly in the native town.45

Different methods were therefore suggested for the clearance of the night soil.
William Sowerby, for instance, suggested the system of desiccation of excreta,
which was neither new to the country, where animal excreta was used as a fuel, nor
costly to execute. The same procedure, it was felt, could be adopted for human waste
as well. Others suggested the dry earth system which was in use in Surat. This
system had been used by the Kanpur Municipality in 1866-67, to make a “latrine
poudrette” as manure, to grow sugarcane of an edible kind. Even the Government
report of 27th July 1867 favoured it and suggested ‘the general adoption’ of the dry
earth system of conservancy and the utilization of the resultant compost as manure
for cultivated land, and conveyed that it was to be undoubtedly viewed by all
Municipalities, as a most desirable objective. However, it was expressly pointed out
that, land on which such experiments were conducted had to be far from inhabited
areas, not close to the windward side of the town, or villages or in proximity to
sources of supply of drinking water. It also mentioned the desirability of extending
such projects throughout the country in select areas.46 Another resolution of 14th
November 1867 also clearly approved the establishment of model farms in the
vicinity of cantonments, as a ready means for the disposal of all sorts of refuse in the

41 Tulloch, Drainage, op cit, pp 29-30. Elphinstone circle, in 1869, was the only
place in Bombay with water closets: BDWS 1869, op cit, p 84.
45 BDWS 1869, op. cit. p 88
1868. pp 248-249
best possible way (viz. as manure) and as a source for the supply of wholesome food as highly desirable.  

By the same time, ideas of removal of faecal matter by the pneumatic dry closets, created by Capt. Lieurner, were also being entertained in the city. Captain Tulloch was sent to The Hague to study the new system. One of the greatest advantages offered by the system was that it saved water and utilized the sewage matter in the least offensive form for agriculture.  

After studying the entire matter, the Scoble Commission, appointed to consider and report on the drainage and water supply of Bombay, including a report on Major Tulloch’s scheme, in 1869, concluded however, that rainwater was to be removed to as great an extent as possible, by gravitation, directly either into Back Bay or into the Harbour and that none of this was to be allowed to pass down through the drains on to the Flats near Breach Vellard. Both on sanitary and engineering grounds Tulloch’s report was rejected. Fear of enforcing change on the habits of the natives, inadequacy of water supply and funds led to the rejection of both the water carriage and dry earth systems. Tulloch’s project of sewage utilization for agricultural purposes was not sanctioned either, since it was conceived on a gigantic scale.  

Thus, the existing system of conservancy i.e. an improved surface drainage and Halalkhore system was reinforced. With the execution of the above two it was felt that the sanitary condition of the city could be secured.  

THE WATER CARRIAGE REVOLUTION  

In spite of the decision of the Scoble Commission, the stage was set for the water carriage revolution in the 1870s. In the meanwhile, yet another scheme submitted by Major Tulloch in 1872, suggested the flow of all rainwater into the sea by

47 Ibid. March 1868. p 98
gravitation. Under this, existing sluices at Love Grove were to be enlarged. The sewage of the main sewer was to continue to the north of the island and terminate at a point near Sion, from where it could be pumped across the swamps between the island and Trombay. The idea of sewage irrigation was once again reiterated. For the night soil disposal he suggested that it be carried, by a narrow gauge railway, and disposed off, across the swamps, in the same way. However, the idea of not putting the night soil into sewers was considered an ‘expensive hobby’, by him and he strongly advocated the water closet system once again. In the same period, schemes were also suggested for dealing with night soil by Rienzi Walton, Col. Fuller, and Dr. Hewlett. The depositing points in most of these schemes were Kurla or the swamps of Trombay.\(^5\) None of the schemes took off. In the same year however, based on Walton’s designs, a system of house connections introduced into Sonapore, on an experimental basis, were highly praised by Health Officer Dr. Weir, who described them as the “first and greatest advance made towards scientific sanitation in Bombay”.\(^5\)

**Pedder’s Scheme**

But even now the night soil issue agitated the city. Between 1868-72, the average night soil removed from the city rose by 55 %.\(^5\) To abate the discharge of a large portion of this night soil, which found its way into the Carnac Bunder, the Government had given a notice to the Corporation in 1872. This necessitated the execution of a new sewerage system, based on principle of water carriage. In the absence of the required 30 gallons per head per day and the immense amount of money required for the system, Tulloch’s scheme, of 1872, was modified by Municipal Commissioner Pedder who suggested separation of sewage and storm water with the latter being removed by gravitation; adoption of a system of street and house sewerage by pipe drains leading into 4 main branch sewers, to be adopted as far as Bellasis Bridge; removal of the night soil from the privies by hand and to be carried by carts, to be put into sewers at the collecting depots: from the Bellasis

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\(^5\) PWD Gen. 1868-89, Vol. 424, Appendix B. pp 160-161
\(^5\) MCR 1872, p 17
bridge the main sewer was to pass across the Flats past the Love Grove pumping station to a spot about half a mile north on the foreshore, west of the Worli Hill from where the sewage was to be pumped and defecated. The effluent water could pass into the sea or could be used for irrigation; the sludge matter to be utilized. The basic infrastructure was to be provided by the Municipality, by the Act of 1872. By the new plan, it was felt, the island would be entirely rid of night soil, cleanliness at the Carnac Bunder would be restored, and the annual saving on the night soil removal would be Rs. 70,000. The other advantages, which would apparently accrue from this scheme were that the new pumping and defecating station, which was to be located at Worli, would be positioned in a more remote area. There were only 2 bungalows on top of the Worli Hill, which the Municipality could buy. It seemed that, even raw sewage, which would prove to be the cheapest solution, could be discharged into the sea from this point.\(^{53}\)

In the meantime, experiments were conducted in 1874 to dry the night soil and obtain portable manure. Later, a desiccating machine was also purchased from England for the same purpose. But the move to erect this patent sewage dryer, at Kamathipura, failed as the machine, costing Rs. 15000, ordered from England, was lost in transit.\(^{54}\) Further, there was an extension of Halalkhore service in 1875 which was not welcomed by the Halalkhores themselves, as it meant that they would have to work at half the pay for the Health Department. There existed a nexus, at this time, between the servants of the native houses and the Halalkhores, both of whom wanted the continuation of the private service of the latter community. In striking contrast to the views of the Army Sanitary Commission, the gradual extension of the Municipal Halalkhore services was viewed a must, in the interest of public health by the Health Officer. For this he even considered it necessary to have a ‘firm hold’ on them. Consequently, their move towards English education and other occupations was seen as a threat towards the maintenance of public health.\(^{55}\)

\(^{53}\) Pedder’s Proposals, op. cit. pp 16-25.
\(^{54}\) MCR op. cit. 1875, p 11
\(^{55}\) Ibid, pp 115-117
The Army Sanitary Commission however categorically stated “Whatever is done in the way of sewerage, it’s a sine qua non that Halalkhores must cease” With increasing costs of the system and the fact that these men and women, who were given a ‘starvation pay’, were often fined too in order to ‘secure efficiency’ the Army Sanitary Commission vociferously pressed for water carriage. It strongly felt that the dangers of sewer gas, the other disincentive for the execution of the system, were greatly exaggerated and could be dealt with, by any sanitary engineer. Pedder’s drainage scheme was therefore, vigorously advocated in 1875-76 and the citizens of Bombay were induced to recognize the evils likely to arise from any further prolonging of the execution of these works.56

In 1877, by the time the Hunter Commission was appointed, Bombay was a fearlessly crowded city. Rapid influx of people in the poorest localities in search of employment due to famine, high food prices and acute want of public latrines and grounds saturated with sullage contributed to a high mortality. By this time ground was set by the expansion of the city northwards towards Parel and the Flats, which highlighted the imperfect state of the drainage of the city. A large number of mills here had to pay huge amounts of money for the cleansing of their cesspools: a nuisance which could have been avoided had a proper system of drainage existed.57

The nuisance experienced at Love Grove, was so great at this time, that a suit had been brought against the Municipality by Mr. Varjivandass Madhavdas, a rich Bhatia magnate. The High Court had, therefore, passed an injunction against this outfall. The pumping station was situated at a site which was close to the main road and therefore the smell affected the way farers. The prevailing western winds also carried the smell to the town and the sewage, instead of being carried into the sea was washed into the Bay. The Corporation was thus constrained to pay Mr. Varjivandass Madhowdass Rs. 12,200 up to 1872 and Rs. 300 a month ever afterwards to withhold the suit against the Municipality.58 This gave a further impetus to the idea and the

57 MCR 1877. p 176
58 Acworth. op cit. pp 28-29
Army Sanitary Commission used the opportunity to forcefully argue the case for the immediate drainage of the city on scientific lines.

**The Hunter Commission 1877**

Accepting the dictate of the Commission, within a decade therefore, the Government reversed its earlier stand, that the extension of the drainage could be withheld till the completion of the Tulsi water works. It now declared that the water carriage scheme could no longer be deferred. The suggestion for earmarking the Flats, for residential buildings, for native gentlemen was also duly considered and the move towards the reclamation of the Flats began by 1877, when the Government made over to the Municipality a considerable portion of the area.\(^\text{59}\) The Town Council supported the scheme and it was laid before the Corporation. After keen debates the latter finally capitulated. As a result the Hunter Commission was appointed to look into the matter.

The evidence given before the Commission all over again indicated the acute differences among administrators, engineers and the medical fraternity on the ideas of sewage disposal and the location of the outfall. Only some crucial issues have been examined in the following discussion.

Foremost on the agenda, was the method of the removal of night soil. The Commission had to choose between an increased Scavengering Department, with its concomitant costs, and water carriage. The medical fraternity was divided on this issue. Though Dr. TS Weir favoured the latter, he felt that the cleansing of the

\(^{59}\) L Michael, op. cit, p 258; Interestingly the BMC acquired its first coat of arms also in 1877, with the motto ‘Urbs Prima in Indis’ and depicting a lion representing Great Britain, a leopard symbolizing India and three sailing ships representing Bombay. 78 years later in 1955 a new coat of arms was introduced with four panels representing the Government of India, a geared wheel symbolising industry, 3 sailing ships in outline and a symbolized design of the Corporation building. ‘Urbs Prima in Indis’ was replaced by a motto suggested by the then Chief Minister BG Kher. “Where there is righteousness, there is victory” : BK Karanjia, Life’s Flag is Never Furled. Godrej A Hundred Years 1897-1997. Vol. I. Viking Penguin India. 1997. p 12
closets ought to be under the control of sweepers, outside the house. For this he felt the gullies could serve a good purpose. To Dr. Thomas Blaney, however two issues were crucial to the success of the water carriage system. These were a supply of water at, at least 23 phpd and the habits of the natives. He was convinced that the people of India could not be trusted with the closets. What is noteworthy, however, is the lack of empathy, evinced by him, for the Halalkhores since Blaney found the idea of emptying night soil into the sewers, at all hours, more offensive than the idea of the scavengers carrying night soil baskets on their heads. Blaney was also additionally concerned about the quantities of water as he strongly felt that more amount of water was required in Bombay and India, as natives apparently produced greater faeces.

Water carriage had to be preceded by house connections, which again was a big hurdle since it was difficult to exact the cost of house connections from the house owners. Financially too, the proposal was unviable. People like Blaney opined that the house connections could best be made from the drainage loans, since recovering the cost from the house owners, after the making of such connections, would only result in endless litigations and therefore loss to the city. This had happened with Walton's experiments in 'Sonapore', in the poorest class houses. Eventually, 30% of the houses had to be written off since Pedder's attempts, to recover the cost from the owners, by forcing them to sell of their houses were opposed by the Town Council. Pedder therefore was keen on stricter municipal law. In this, he was supported by Arthur Crawford, former Municipal Commissioner, who favoured compulsory introduction of water closets with people paying for them. But as regards the poor huts he was of the opinion that public latrines were the best for this class.

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61 Ibid. Evidence of Thomas Blaney. 29th November 1877. pp 81- 83.

62 Ibid. Evidence of Mr. Pedder. 20th November, 1877. p 33

63 Ibid. Evidence of Arthur Crawford. 4th December 1877. p 90
Sewage disposal was still an equally problematic area. This aspect, especially, was rendered hazier since engineers contradicted themselves very often. Braham for instance, was against sewage irrigation. Yet, he proposed its use at Love Grove if needed, while at the same time insisting that no soil in Bombay was fit for this purpose. Engineers like Walton, on the other hand, assured that the 6000,000 gallons of sewage, generated in Bombay, could be rendered harmless, and as clear as pure water, at a comparatively small annual outlay viz. Rs. 20,000 via the Hille process and that, the area of land, which would be required to utilize this, was within the easy reach of the proposed pumping station.

Even at this stage, sewage utilization appears to have been a purely speculative matter, since no one had a clear idea as to how much sewage could be disposed off per acre. There seems to have been a difference of opinion even with regard to whether sewage water would be taken or not. Crawford felt it would be taken. While Weir found nothing unusual about it since the Municipality was apparently selling sewage from the drain running across the Race Course in 1876. he wondered if it was advisable at all to run the large amounts across the Flats. Blaney favoured sewage utilisation so long as it was outside the limits of the city; the limits being defined as those within which the effluvia arose from the sewage. Even while favouring it, Pedder claimed that the principle of sewage irrigation was a theoretical one since he had never seen any experiments except very small ones in the cultivation of vegetables. Pedder, in fact, intended the sale of sewage after defecation. But the latter process was to be tried only if, after a year’s trial, raw sewage, deposited into the sea, was found to be a nuisance.

\[^{64}\text{Ibid. Evidence of Mr. Braham, CE. 15\textsuperscript{th} November 1877. p 27}
\[^{65}\text{PWD Gen. 1868-89. Vol. 424, Report on Mr. CB Braham’s Remarks on the Main Drainage of Bombay by Rienzi Walton, EE Municipality. 14\textsuperscript{th} July 1877. printed at the Times of India Steam Press. 1877. pp 24-25}
\[^{66}\text{Hunter Commission, op. cit. Evidences of Crawford. p 88; Weir. p 45 and Blaney p 73.}
\[^{67}\text{Ibid. Evidence of Mr. Pedder. 20\textsuperscript{th} November. 1877. pp 35-37}\]
It is clear therefore that sewage utilization was premised on the idea of its sale to the natives and defecation was to be provided only if the defecating machine could be paid for by the proceeds of such a sale.

**The Battle of the ‘Outfall’**

It was for the sake of sewage utilization that the Worli Outfall was chosen since it promised to be cheap as well as flexible. It offered other advantages as well. Sewage from the entire city could be concentrated here and defecated, if it proved to be nuisance, or diverted to Sion or Kurla if the need was felt. Moreover, the location was considered remote from the point of view of the then city then. 68

Therefore, although it was likely to affect the worshipper’s at the Peer’s tomb on Hajee Haya, the temples of Mahalakshmi and the residents at Sumbhoo Pakhadi, under the new scheme, proposed by Pedder, 158 tons of night soil was to be deposited here. Anticipating trouble, engineers like Braham, warned that the rocky foreshore on the western side was not ideally suited for the discharge of nuisance as compared to the eastern one which was deep, 69 while Ducat insisted that “as Bombay has more than one natural drainage fall, so let it have more than one sewerage system”. 70

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68 Ibid, Evidence of TG Hewlitt, 6th December 1877, p 105
70 Ibid, Report upon the Main Drainage of Bombay by Major Ducat, RE Reprinted from the Times of India, October 1877, p 8
Surprisingly, Pedder himself was not in its favour and did not find the Colaba outfall objectionable, provided it was drained at a sufficient depth and distance. Blaney, who preferred the Kurla outfall, on sanitary grounds, considered the Worli outfall a bad choice too, but he approved of it so long as it came with an abundant supply of water. Nor was it supported by Hewlitt, former Health Officer of the Bombay Municipality, who preferred the Sion and Kurla points. Strangely enough only T.S Weir, at this stage, did not object to the outfall, though he reversed his opinion later. Overwhelming opinion, thus, was in favour of Sion or Kurla as the point of discharge of sewage.

The proposed pumping station was resisted by the village of Worli, with its suburbs or pakhadis too. There were 800 huts here. Villagers apprehended that the nuisance generated by the pumping station would render Worli a hotbed of diseases, utterly destroy the value of their property and further a loss of livelihood. They therefore requested the Government to consider the reports of Gostling and Ducat before enacting any measure. Even the latter two, along with Braham, resisted the site. The former even championed the right of the inhabitants of Worli to protest against the proposed the outfall.

Even as regards subsoil drainage there was virtually no unanimity.

**The Verdict**

Despite the lack of consensus on virtually every issue, the Commission unanimously opined that Pedder's scheme was “the best, safest and most practical outcome of the difficulty of disposal of the sewage of Bombay” and was the “only alternative available”. It favoured the enlargement of sluices at Love Grove, Worli and Dharavi, for the disposal of storm water drainage. Till the lower parts of the town

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71 Hunter Commission, op. cit. p 39
72 Ibid. Evidence of TG Hewlitt, p 103 and p 108
73 Ibid. 20th November, 1877. Evidence of T.S. Weir, p 44.
75 Ibid. Gostling’s First Report on Main Drainage. 6th November 1877. pp 7-8
had been reclaimed, a sufficient area of the Flats would have to act as a reservoir for the holding of storm water, in case of an exceptional rainfall. Entry of night soil was also permitted with only 20 gallons of water phpd. To make up for the inadequacy of water, the need for service reservoirs, as also encouragement to the use of house cisterns was suggested. At the same time, it suggested that work be started on a scheme that would provide for the additional water supply in the near future. Ventilation of sewers was stressed upon, to prevent the dangers of sewer gas. But it admitted that the abolition of the halalkhore system would take some time till the complete system of sewerage came into existence. Subsoil drainage was not considered important by the Commission. Mr. Walton’s system of privies at Sonapur was recommended for the natives and detached public privies for the poor. As for the outfall, Love Grove was favoured, but it was to be about 1/3 mile north from the then outfall. Fort Colaba and Malabar Hill were also to be connected with the general system. Sewage irrigation was however not recommended as it was not financially viable and still debatable across Europe. Even defecating was considered unnecessary. Thus, rapid discharge, within 5 hours of the sewage entering the sewers, was considered the solution to the problem. The new pumping station was however to be erected near the existing one. But only 50 lakhs were sanctioned for the execution of the scheme. 76 The whole sewerage scheme was to be completed in 2 years time.

Under this scheme a main ovoid sewer was to be laid from Carnac Bunder to Love Grove. This would run along Sheikh Memon Street, Bhuleshwar, Khetwadi and the Flats. According to drainage engineer, C.C. James this report marked the commencement of a new era in the drainage history of Bombay. In 1878, the scheme was sanctioned by the

Corporation and in December of the same year the work was commenced under the supervision of Mr. Rienzi Walton, the Executive Engineer on special duty. From 1881, the sewage in Bombay was to travel 4.25 miles before it reached its final destination.\(^7\)

**THE FALLOUT**

Commenting on this episode of sanitary development of the city, Harrison has argued that a reason for the decrease in sanitary expenditure, following the introduction of local self governance, was the resistance to western sanitation on the part of the Hindu Municipal Commissioners and that it was not lack money, as much as indigenous customs that stood in the way of sanitary progress. He points to the prolonged dispute over the drainage question to substantiate his view and says further, that it was only the plague epidemic that provided the impetus for the completion of the underground drainage scheme.\(^7^8\) This statement, however, needs to be reconsidered in the light of the developments in Bombay, following the introduction of the new underground sewerage system.

**Hurdles**

Despite the mandate of the Hunter Commission, the Corporation was not convinced that the sewerage and drainage designed by Mr. Walton’s was the best sanitary scheme that could be devised for the city. Many now alleged that Government, which had considerable property in the Flats, had done nothing to raise the levels of its lands, unlike other property owners, and now wished to make use of public funds for that purpose and make its property saleable.\(^7^9\) This seemed probable, as the Provincial Government, despite its keen desire for implementing the drainage scheme, was not willing to make any pecuniary grant for that purpose. It rejected the Corporation’s requisition for a loan of Rs. 60 lakhs. In fact, the Government was so

\(^7\) CC James, op. cit, pp 248-249

\(^7^8\) Mark Harrison, Public Health in British India, Anglo-Indian Preventive Medicine 1859-1914, Cambridge University Press. New York, 1994, pp 177-78. Hereafter, Harrison

\(^7^9\) Blaney T And Mandlik. The Drainage of Bombay, its History and Prospects, Union Press. Bombay. 1883. pp 7-9. Hereafter, Blaney and Mandlik
slow in responding that the works had to be postponed. In the end, 27 lakhs were raised. In the absence of the requisite finance, it was now considered "inadvisable to undertake the immediate execution of the whole scheme for the drainage and sewerage of Bombay and that, with a view to exercise due caution in the trial of such an experiment."\(^80\)

But the usual lackadaisical approach of the Municipality characterized this work too with delays happening due to debates regarding the contractor as well as the impending monsoon. Hence, work was abandoned at times. Ultimately it was decided, that the work should not be let to a contractor, but executed departmentally.\(^81\) By 1880, the outfall sewer from pumping station to an outlet chamber on the foreshore was completed at a cost of Rs. 2 ½ lakhs. A new pumping station was built at Love Grove in 1884 at a cost of 1 lakh of rupees. The engines installed over here were finally condemned by Mr. Baldwin Latham in 1890 as being extremely inefficient.\(^82\) In 1884, when the night soil sewer outfall, discharging at Carnac Bunder, was diverted to Worli, there were loud protests of 500 house holders.\(^83\)

Sewering the city did not prove to be a trouble-free operation either. Laying of pipes posed a problem as pipe layers refused to accept the English practices. Indian flora such as the Banyan tree, traditionally present on the sides of the road, made the operations additionally difficult as the roots of the trees penetrated even the joints made of cement. Endeavours to solve this difficulty, by sealing the joints with a mixture of tar and cement proved only partially successful. This created a big dilemma for the engineers as they could not decided which type of pipes to be laid for the city. Therefore, the Hassall's or Sutton's patent joint pipes had to be used to overcome the problem.\(^84\) Rocky ground and difficulty of coming to terms with the

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\(^80\) Acworth, op. cit, pp 42-43.
\(^81\) MCR, op. cit, 1879, p 250
\(^82\) CC James, op. cit, p 250.
\(^83\) Acworth, op. cit., pp 65-66
owners of land, for the purpose of pipe laying operations, further increased the difficulties.\textsuperscript{85}

Ventilation of sewers proved to be equally challenging. Experiments to use charcoal on surface manhole ventilators, as a deodorant and disinfectant, a system highly popular in contemporary England, proved a complete failure because of the humid climate of Bombay. As a matter of fact, these ventilators were found to allow surface detritus to enter the sewers in the dry season and water in the monsoon, thus rendering the charcoal completely ineffective. \textsuperscript{86} Incidentally, these had been favoured by Hewlitt, following the example of Rawlinson, but opposed by TS Weir, thus proving once again the experimental nature of the works. \textsuperscript{87} as well as the indecision among the medical fraternity. Ventilation of sewers remained a vexed problem and it was admitted eventually, that the “choice of the best method is a matter of difficulty.”\textsuperscript{88}

‘Outfall’ Reignited

Even the decision regarding the outfall soon proved erroneous. Censure of the new sewerage by C. W. MacRury, Sanitary Commissioner of Bombay, in 1889, led to the reigniting of the outfall issue. The latter reported that the drains laid in the city, in the late 1880s, were without any foundations. As a result, the subsoil, of the most densely populated parts of the city, was loaded with excrement and water. He considered the then state of drainage and sewerage of the city a reproach to the municipal administration of the city. Far from being self cleansing, Bombay drains, at this time were sewers of deposits,\textsuperscript{89} which state resulted in a severe outbreak of cholera in 1889 at Ghorupdeo and Bhorebhat. In the same year, on account of complaints of nuisances being received from Marine Lines, which was then

\textsuperscript{85} MCR 1884-85. pp iv- v
\textsuperscript{86} Oriental Drainage, op cit. 1902, pp 86-87
\textsuperscript{87} Hunter Commission, op. cit. Evidences of TS Weir and TG Hewlitt, p 49 and p114 respectively.
\textsuperscript{88} MCR, op. cit. 1887-88. p xii
\textsuperscript{89} Procs. Corporation. op. cit. 1889-90. Vol. XIII. pp 206- 207
principally occupied by the army, the Government appointed a Committee to inquire into the matter.\(^{90}\)

To deal with these issues, the advice of Mr. Baldwin Latham, an eminent sanitary engineer, was sought. In his report on the sanitation of Bombay, submitted in 1890, Latham condemned, the out fall at Love Grove along with the engines, which caused the problem of silting of the main sewers. Demonstrating the fallacy of the float experiments of civil engineer Mr. Jagannath Sadashiv, he categorically stated that the outfall should have been distinctly to a position to the south of Bombay.\(^ {91}\) But since the main sewers had already been laid with a fall towards Love Grove, he proposed that all sewage should first flow to that place and from there be pumped into a high level gravitating sewer, running from Parel to Colaba, and discharged at the latter place, at ebb tide only, beyond the Prongs Light House. The sewers of Kamathipura were also condemned as antiquated by him. The case of the water carriage and the related completion of the sewerage system were urged therefore.\(^ {92}\)

Latham’s proposals were unexpected. Yet another Commission, appointed to examine them, raised serious objections about the suggested Colaba outfall. Besides the massive cost, which without full allowance for compensation for land, estimated at about Rs.140 lakhs, it was apprehended that sewage would be carried back, to an objectionable extent, into the harbour, and along the Colaba foreshore.\(^ {93}\) Moreover, the presence of the Military at Colaba, apart from the undertaking asked of the Municipality to prevent any nuisance here, and the projection of this site for building purposes, made any discharge of sewage impossible here.

These developments enraged Surgeon Major Mc Rury, who now shot back that he had carried out investigations on this issue “against opposition and difficulties and

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\(^ {90}\) CC James, op. cit, p 252


\(^ {92}\) Ibid, pp 42- 51

\(^ {93}\) PWD General-1890-98. Vol. 1449. Report Of The Colaba Outfall Committee. Proceedings Of Committee Held At Port Trustees’ Board Room On 7\(^ {th}\) November 1890 by G.L.C. Merewether, Chairman, 13\(^ {th}\) November 1890, pp 81- 82.
without sympathy or support from any quarter". For this he was attacked by Mr. Acworth the Municipal Commissioner of Bombay, who not only misrepresented his views and opinions on the general drainage of Bombay city, but deliberately attempted to "damage" his character and "mislead the Corporation and the public at the same time." MacRury alleged, that the Government had followed a policy of concealing the real conditions from the representatives of the rate payers, instead of taking them into confidence on a work so important and so costly. In a separate report, he supported Latham’s proposals.

The Municipality, however, once again found its hands tied down on the question of the outfall as Section 245(c) of the Municipal Act, reserved to the Government the right to veto any proposed new outfall. Since the Government’s interests were closely tied with the Military Department, they were automatically connected with Colaba. Finally, in view of the prohibitive cost of the construction of such an outfall and to ensure the ‘safety of the troops and the public residents at Colaba’, it was resolved that the proposed site was ‘undesirable’. Eventually, Colaba was divided into 5 blocks, and the Shone system was installed here. The latter provided for a population of 28000. Later, it was extended to Mazagaon, Parel, Chinchpokli, the Old Race Course and the Malabar Hill.

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94 Ibid, Letter from Surgeon Major C.W. Mac Rury, Sanitary Commissioner for the Govt. Of Bombay, To The Chief Secretary To Government, General Department, 20th March 1891, pp 29-32,
95 Ibid, Letter from Surgeon Major MacRury, to the Chief Secretary to Government. Bombay, 7th April. 1891, pp 35-38,
96 Ibid, Communication from GD no. 3278. 15th September. 1891. p 107.
Shone’s system was deemed to be better than others, as it could prevent epidemics from spreading. In the event of an epidemic the sewage of an infected district could be cut off completely, thereby preventing it from mixing with that of other districts. Other seeming benefits were its flexibility to cater to increasing populations, and the relief it could afford to the rate payers of the heavy burden of investing for the future as well.\(^98\)

However, despite its theoretical perfection, it discharged sewer gas in enormous quantities and created problems in the city with its tall buildings, which prevented its quick dispersal. Above all, it was expensive as regards installation and efficiency. It is interesting to note that the earliest experiments of this system were made in Rangoon and the defects observed there were rectified in Bombay.\(^99\)

The Disputed Subject of the Subsoil Water

The issue of subsoil water however, continued to rock the city. By 1891, Bombay with a population of 810,000 had only 55.33 miles of sewers but 142.57 miles of public roads.\(^100\) But the Tansa brought in copious amounts of water which rose from 16 ½ million gallons to 29 million gallons a day without attendant increase in drains.\(^101\) Therefore, surcharging of sewers and water logging, continued. The natural rocks, ahead of the outlet channels of the sluices at Love Grove, silting up of the storm water reservoir by the side of the race course, filling up of the Flats, construction of the Causeways, Vellard, and Harbour works\(^102\) prevented the outflow of water.

\(^{97}\) CC James, op. cit. pp 254-255
\(^{98}\) Oriental Drainage, op. cit. p 15
\(^{99}\) Ibid. pp 25-26
\(^{101}\) MCR 1894-95. p 521
The unhealthiness of the city, which was attributed to this increased subsoil water, once again excited much argument. But since it was vague, misunderstood and there was no satisfactory data to go upon, opinions on it were characterized by the usual disagreement, among engineers. Many questioned the very existence of the problem, and the number of drains required to remove this water.

Since 1865, extravagant waste of Vihar water had been held responsible for this state of affairs. Later, engineers like Braham too accepted this. Additionally, underground leakages from defective joints in the water mains, fostered by the new hydraulic system, watering of gardens and so on were considered the prime reasons then. Others like Tulloch and Walton, who did not concur with Braham, ascribed it to storm water accumulation. Drainage engineers like C.C James, on the other hand, felt that it was due to the improper filling of tanks, which often ran deep, and required proper treatment to prevent the entrance of subsoil water. Even Mr. Baldwin Latham, subscribing to the theory of subsoil water and poor health, in his report on the ‘Sanitation of Bombay’ had opined that the filling in of the Flats with ‘kachra’ had blocked the most important channels, by which the underground water could escape, resulting in the rise of the level of the ground water in the lowest parts of the district.

High subsoil waters were held responsible for the grievous mortality rates in Kamathipura in the 1890s. The usual contradictory evidence on this matter muddled the issue, prompting the Corporation, finally, to engage the services of Mr. W. Santo Crimp to report on the whole question.

103 Pherozshah Mehta (Edt.) Chintamani CY. (Edt) Speeches And Writings Of Pherozshah Mehta, Pt. II, Indian Press, Allahbad, 1905. The Second Reading Of The Bombay City Improvement Bill. 28th March 1898, p 544
105 PWD Gen. 1898-1903. Vol. 150. Letter from W L Harvey, Municipal Commissioner for Bombay City, to the Municipal Secretary, Bombay. 24th February 1900, pp 162-163
A leading sanitary engineer, Santo Crimp visited the city in 1899, to advise the Municipality, on the various drainage questions, particularly, that of the disposal of the surface-water of the city, and that of the discharge of the sewers at the Love Grove outfall. Discarding the theory, that the unhealthiness of the city was due to the lack of subsoil drainage, he voiced the possibility of the introduction of Tansa water, without adequate drainage, and advocated that the most important works that were required in the city was the completion of the drainage system. Float observations taken by him showed, that sewage discharged at Love Grove, was carried by the tide towards the coast, in the direction of the Malabar Point. In order to remedy the nuisance, he recommended the extension of the existing outfall to deeper waters; treatment of the sewage, that was discharged during the first four hours of the ebb-tide, with electrolyzed sea water and Permanganate of Potash; and extension of the outfall sewer to Worli Point, discharging at that point, all the sewage during the ebb-tide, and at the Love Grove outfall during the flowing tide. None of these proved financially feasible.

Soon after this, the Worthington engines at Love Grove began to fail on account of silt accumulation. Disagreement among municipal engineers, about the manner in which this problem could be solved, led the Commissioner to refer the question to Major Tulloch once again. However Tulloch’s schemes and designs were rejected on financial grounds, and the executive engineer to the Municipality expressly stated that it was better to incur the heavy recurring expenditure, which experience had shown was necessary, for renewals and repairs, than incur the very heavy expense that Tulloch’s scheme entailed.

Thus, as noted by Drs. Jehangir J. Cursetji, and Dinsha Bomanji Master, by the first decade of the twentieth century the water carriage system had failed dismally to solve the problem of the city. The essential requirements for its success, viz., a sufficient and constant supply of water for flushing of sewers, well laid, water tight sewers with proper ventilation and gradient, a pumping station with adequate
pumping power, and finally properly made house connections, were found missing. 108

**House Connections and Water Closets**

The work of house connections and water closets, essential prerequisites for the completion of the sewerage system, also proved to be demanding, and not merely because of the native resistance to the new system.

Finance happened to be the biggest stumbling block. Often there existed a disproportion between the cost of a building and that of its connections. There were cases, where the cost of the house connection exceeded the value of the building concerned. Initially, it had been collectively decided by the Corporation that, as this system was new to the city; all the houses in one of the wards of the city should be connected at municipal expense. Once the work was carried out, the expert advisers of the Corporation recommended that the system should be applied to the whole of the city. But the Commissioner’s caveat, that defrayal by the Municipality of the cost of house-connections would impose too serious a burden on the municipal treasury, resulted in a division of the house. While one section of Corporators argued, that due to its prohibitive costs and its close connections with the drainage arrangements of a house, the cost should be put upon the house-owners, the other section contended, that the flourishing condition of Municipal finances and the newness of the work required it to be carried out very efficiently, in the interests of the health of the City, and therefore to be carried out by the Municipality. In addition, justice demanded, that as the house-owners of one ward had this work done at Municipal expense, there was no reason why the remainder should be called upon to bear the charge

themselves. As a result the issue, of whether the cost of house connections was to fall on the house owners or the Municipality, remained unsettled for a long time.

This indecisiveness and the fact that an 'abnormally large' pipes imported from England, even at this stage, for house connections, suffered breakage added to the troubles. Stricter rules of water supply, since the introduction of Tulsi water, to curb wastage, compounded the problem. Thus, to meet the requirements of additional water, it was suggested that the ground water of the city be tapped.

The complexity of the system proved to be disadvantageous as well, since it consisted of too many traps and small pipes. In 1892, the Municipality received a petition, signed by 2600 disgruntled people, urging it to look into this system, which they felt, was not suitable for the natives of the city, especially the crowded sections such as Bhuleshwar Mandvi, Parel Girgaum etc. Under this plan, large pipes of the houses were being substituted by those of smaller dimension. It was feared that such small pipes were utterly unfit to carry the sewage of densely populated houses and particularly unsuited to Indian habits. Siphon traps in such an arrangement, often got choked thereby damaging the walls. In fact, it had led to the collapse of a house and the owner had sued the Municipality for this. Additionally, the expenditure on such pipe laying was likely to be a recurring one and therefore resisted by the people.

No doubt there was truth in this argument. All the same, it cannot be ignored that the native habit of scouring their domestic metals utensils with ash, sand or road detritus, contributed in no small measure, to the problem of chokage in the sewers. These substances, when mixed with faecal matter, formed a kind of concrete, which was very difficult to remove.

On account of these problems, in the early 1890s, a large number buildings, remained disconnected with sewers. The situation was so bad, that on the eastern side of the island, the non connection of the houses with the sewers, constructed by

109 BLC Procs. op. cit. 1911. Opinion of Ibrahim Rahimtoola. pp 171-172
110 MCR. op. cit. 1885-86. p 23
111 Blaney and Mandlik. op. cit. pp15-18
the Municipality, forced this quarter to be dependent on old channels for the
clearance of its sewage. It was feared that unless the connections were done urgently
the sewers, as in the case of Kamathipura, would silt up and their position would be
forgotten forever. But the Municipality had little idea of the careful supervision and
for 1896. pp 170-171}

As regards night soil sewerage, based on water closets; the suggestion had received
opposition, right from the beginning, from Dr. Blaney on the grounds of its being
experimental in nature and unsuited for a tropical city. But, it found support among
the Indian members of the Corporation who stoutly defended it. That sewerage
sanitation and especially night soil sewerage, was as yet a new subject in India and
likely to prove defective, was proved by the defective sanitary arrangements at the
Goculdas Hospital, the Secretariat, the High Court, PWD Secretariat, Post Office,
Commissioner. C. Mont, Major On Special Duty. T.D. Mackenzie, Resident Under
Secretary to Government. 29\textsuperscript{th} May 1878. np}

These had been
condemned by the best Sanitary Officers. \footnote{Ibid. Minute by the Honorable J. Gibbs. on the Sanatory condition of the New
Secretariat. 30\textsuperscript{th} March 1878. np.}

Water closets too, only to be found in
well built houses at this time, despite intelligent use, caused trouble and thus did not
meet with general approval. People using them often complained of the deadly
smells and at least two score families had been removed on this count. \footnote{Blaney and Mandlik. op. cit. pp 22-25}

Opposition also stemmed from the fact that water closets were introduced on the
presumption of sufficiency of water and that every user knew how to use a water
closet. It also assumed that an immediate report would be made in case of a
dysfunctional closet and that every house, that was to be sewered, was adapted for a
water closet particularly in crowded areas of the native town. Great anxiety also prevailed with regard to sewer gas.\textsuperscript{117}

Even engineers were unsure on this point of adaptability of the Indian houses to the water closets. While the provision of gullies, in the typical Indian houses, was viewed as a problem for water closets by engineers like CC James, in contrast, Latham strongly appreciated their existence and felt that these could be put to great use for securing ventilation to houses.\textsuperscript{118}

Most importantly, it threw the responsibility of the maintenance of the system on the people for which they were not yet geared up, besides preparing grounds for vexatious visits of the municipal authorities. People therefore, still wanted the Halalkhore system to continue.\textsuperscript{119} Fearful of the fevers, which they linked with the new system the people, wanted this programme to be deferred.\textsuperscript{120} Caste prejudices came in the way of the use of water closets.\textsuperscript{121}

However, the overriding problem as Latham correctly observed was the availability of water. The amount of water required for proper flushing was not available as large quantities of water were being consumed by gardens, streets and mills. This reduced the supply available php\textsuperscript{d} for domestic purposes, in the 1890s to only 12

\textsuperscript{117} Ibid, pp 28-32
\textsuperscript{118} Latham, op. cit, p 60
\textsuperscript{119} Blaney and Mandlik, op. cit, pp 47-52
\textsuperscript{120} Procs. Corporation, op. cit, 1892-93, Vol. XVI Pt. I. Petition by Bomanji Pestonjee Master and about 60 others, 27th June 1892, p 113.
\textsuperscript{121} Oriental Drainage, op. cit. p 119
gallons phpd.\textsuperscript{122} As per the English standards, the amount of water required per head per day was based on the following calculations as shown in the subjoined chart. To the following was added 5 gallons phpd for municipal purposes such as flushing of drains, road watering and fire. Therefore, in England this amounted to 35 gallons phpd. In large cities like Bombay it was calculated that 50 gallons were required, which made an allowance for underground wastage and that caused by the native habit of keeping taps open. \textsuperscript{123} Obviously the greatest water requirement was for the purpose of flushing as is shown in the subjoined chart.

Notwithstanding these problems and the resistance, demands for house connections were renewed from time to time, and action was taken accordingly. In the wake of the sub soil water controversy, the Health Officer, once again strongly, mooted for them although, at this time there were loud and recurring complaints about deficient and poor quality water supply which threatened the very system itself. Leakages from the Malabar Hill Reservoir complicated the problem by making those portions of the city malarious. Consequently, as a part of the anti malarial measures in the city, there was a renewed demand for the conversion of basket privies into water closets, especially in the Malabar Hill region.

To promote the use of closets, law now dictated the use of suitable tanks and cisterns. These, which were expected to solve the problem of insufficiency of water, were to be properly covered and fitted with automatic fittings and not directly connected with the water closet. The size of the tank was calculated at the rate of 5 gallons per head per day for the purpose of water closets exclusively. These cisterns were to be made of iron, slate or zinc.\textsuperscript{124} Regardless of these arrangements many did not get adequate water for the closets. Thus, 350 poor members of the Cutchi Lohanna community, who did not receive water in their storage tanks above their

\begin{table}[h]
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\begin{tabular}{|l|c|}
\hline
\textbf{C.2: Calculations of water expenditure, as per English norms phpd. Turner Sanitation, p 231} \\
\hline
\textbf{Cooking} & .7 gallons \\
\textbf{Drinking} & .3 gallons \\
\textbf{Ablutions} & 5 \\
\textbf{House Cleaning} & 3 \\
\textbf{Laundry} & 3 \\
\textbf{Baths} & 4 \\
\textbf{Water Closets} & 6 \\
\textbf{Waste} & 3 \\
\hline
\end{tabular}
\end{table}

\textsuperscript{122} Latham, op. cit, p 63
\textsuperscript{123} Turner Sanitation, op. cit, pp 231-232
\textsuperscript{124} Turner Sanitation, op. cit pp 188-189
water closets, as a result of which their closets were choked up, threatened to convert them into privies on the basket system, and further to hold the Corporation responsible for any health problem which would arise as a result of the water grievance.¹²⁵ There were yet others who, according to the Commissioner, apparently made illegal connections to the storage tanks of the water closets from plumbers not approved by the Municipality.¹²⁶

But even where water pressure was sufficient, owners were disinclined apparently on sanitary grounds. The Municipality had to often give notice in writing to the people who neither responded nor executed the work.¹²⁷ Resentment towards the domineering attitude of the Corporation in this area, coupled with, insufficiency of space, the incapability of the walls, to bear the weight of the storage tanks, created additional difficulties in the conversion of the basket privies to water closets.¹²⁸

Conversion of privies, however, continued to be resisted throughout as it also involved restructuring of the houses at considerable expense. Joint ownership rights were also violated as a result of the conversion in chawls, where privies were shared by the owners as well as the tenants.¹²⁹ From 1928 onwards, the subvention scheme was set into motion to convert basket privies into water closets. House owners were given notices, calling for conversion of privies on their premises, for which a subvention of Rs. 75, subsequently reduced to Rs. 50, was given for every seat converted, provided the work was done in three months. No subvention was given in case of delay. From 1931 the subvention of Rs. 50 also ceased.¹³⁰ These subsidies were resumed from 1939 onwards. But the shortage of water supply, particularly due

¹²⁵ Procs. SC, January to March 1923. Proceedings 14th March 1923, p 1563
¹²⁶ Ibid. Proceedings, 14th February 1923, p 1440
¹²⁷ Ibid. Proceedings 7th March 1923, p 1539
¹²⁸ Ibid. pp 1620-1622
¹²⁹ Procs SC, op. cit., Jan to June 1925. Letter to the Standing Committee, 10th February 1925, from Mr. Jamnadas Kanji, p 1640
¹³⁰ MCR. op. cit. 1931-32. Ex Health Officer’s Report, p 42
to the enormous congestion and overcrowding came in the way of the success of the schemes as well as the cleanliness of the city.\textsuperscript{131}

**The Halalkhore System and Night Soil**

Notwithstanding the institution of a modern sewerage system, removal of night soil remained a problem. By 1885, it was categorically accepted that the halalkhore service could be maintained in the city so long as halalkhores were found willing to serve.\textsuperscript{132} At the end of the decade, it was found that the sewerage was burdened by around 340 tons of night soil daily. Reversing his earlier stand, Health Officer Surgeon Major T.S Weir, now, emerged as a strong critic of the decision to close the harbour outfall for the disposal of the night soil.\textsuperscript{133}

The halalkhores of the city at this time collected the night soil, mixed it with fresh and sea water, and then flushed it out of tanks into the sewers. It was a disgusting system in which men had to actually enter into the tanks to do the mixing.\textsuperscript{134} The largest night soil depot was located in Kamathipura in 1895.

The Plague further renewed the significance of the halalkhores. But when many struck work, on account of the epidemic, the Commissioner feared that the city with its immense dependence on the Halalkhores would be abandoned in a matter of 10 days. “On their presence or absence, respectively, depends the safety or ruin of this vast city.” But for the presence of these men Bombay would have been reduced to a vast “dunghill”\textsuperscript{135}

\textsuperscript{131} MCR op. cit. 1949, Report of the Health Officer, p 23
\textsuperscript{132} MCR. op. cit. 1885-86. p 22
\textsuperscript{133} Latham, op. cit. Memorandum By Surgeon Major Weir, Medical Officer of Health. Appendix. 6\textsuperscript{th} November 1889, p 95
\textsuperscript{134} Latham, op. cit. pp 61-62
\textsuperscript{135} M.E.Couchman, Account of Plague administration in the Bombay Presidency from September 1896 till May 1897, p 11, Hereafter. Plague Couchman
Thus hand conservancy, remained the primary mode of removal of night soil in the city even at the beginning of the 20th century. In fact, the employment of 500 more haialkhores was recommended by the Health Officer, for this purpose in 1906. It was now calculated that 5488 haialkhores would be required to keep the city adequately clean. By 1909, there were more than 2 dozen night soil depots in the city in the most crowded areas, necessitated by the absence of sufficient water supply and house connections. Indian doctors such as Cursetjee and Masters even recommended the strengthening of the Halalkhore system to improve sanitation.136

The situation did not improve with the passage of time. Cesspools continued to flourish in the F and G wards of the city. Only the financial stringency of 1925 led to a reduction in the number of Halalkhores from 2224 to 2100.137 Yet, this degraded system continued to co-exist with the modern one, due to the failure of the new sewerage, as can be seen from the subjoined chart.

The foregoing narrative therefore, clearly shows that the new system was, undoubtedly, opposed by the people, but not without reason. Indeed, the state of

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136 TBMC, op. cit, Jehangir J Cursetji and Dinsha Bomanji Master, Notes On Some Of The Chief Defects In The Present Modes Of Disposal Of The Sewage And Town Refuse Of The City Of Bombay, Including The Evils Arising From Their Imperfect Working And Their Possible Remedies, pp 447-448.

affairs was chaotic enough to justify their resistance. Consequently, Harrison's argument, that it was this opposition that impeded the sanitary progress of the city, does not sound so convincing. At the same time it must be added that the unconstructive role of the natives, in persisting in some of their indefensible habits, only added to the chaos.

LEGAL AND SPATIAL DEVELOPMENTS

Legal and spatial changes in the city, as well as structure of houses, followed as a natural outcome of these developments. From 1888 onwards, it became necessary for new buildings to be supplied with sufficient water closet or privy accommodation. The Municipal Act of 1888 empowered the Commissioner to make byelaws in any particular, not provided for in the Act, relating to the construction, maintenance and control of drains, ventilation shafts or pipes, cesspools, water closets, privies, latrines, urinals and drainage work of every description, whether belonging to the Corporation or any other person. He could, similarly, regulate all matters and things connected with the supply and use of water. The Bombay Port Trust however continued to ask for concessions even in the matter of drainage.\(^{139}\)

By the beginning of the new century, house owners were expected to construct the house drain until the boundary of their property. It was the task of the Municipality to lay the connecting closed drain. Water closets were however still not popular. Various types of soil pans were designed for the use of the natives. Besides, separate types of urinals existed for exclusively European buildings. The bye-laws of the Bombay Municipality specified that all privies and water closets were to be cut off from any living room by at least a 3 foot air space on all sides. However, since this law was a new one, the older privies continued in their insanitary state. Glass was recommended for the privies so that the faecal matter did not cling to the surface.\(^{140}\)

\(^{138}\) BMC Acts, op. cit. Vol. II. p 328
\(^{139}\) Ibid, p 692
\(^{140}\) CC James, op. cit. pp 126-129
For the purpose of house connections the city was divided into three classes. Class I, consisting of detached houses in compounds; Class II, attached houses without gullies; Class III houses of all other types. These were further subdivided into two classes- Sub Class A with houses where it was desirable to drain the houses with a pipe drain; Sub Class B which were not within 100 feet of a municipal sewer. Although different combinations of open and closed drains were stipulated in all categories of houses, it was a must to lay closed drains below the buildings. No drain could be made without the written permission of the Municipal Commissioner. In sub class B, however, the municipal law could not be imposed on the owners. Thus, such houses continued to rely on cess pools for which again the Municipal law prescribed rules. In many such instances, septic tanks were recommended for the houses.\footnote{Oriental Drainage, op. cit. pp 125-128}

To prevent the committal of public nuisances, public conveniences were erected. In order to promote their use by the natives, a mirror, to satisfy the vanity of the people and a symbol of an outspread hand in red, which was considered auspicious by the Hindus as well as the Muslims, were employed.\footnote{Ibid, p 97} Different types of conveniences were designed for the Europeans and the Natives also reflecting the prejudices of the British.

Faced with difficulties in the matter of enforcing drainage connections, in case where gullies were jointly owned, the Bombay Municipal Act of 1905 introduced further amendments to the Act of 1888. With the completion of the separate sewerage
system in the more densely populated parts of the city it became necessary to connect drains to these house. But since the Act of 1888 did not give the necessary power to the Commissioner to adjust conflicting private interests in a simple manner. The new law, under sections 22-24, therefore, empowered him to enforce the provision of water closets in preference to privies wherever considered desirable, to prevent placing of privies or closets in undesirable positions, to prescribe sites for both and to deal with unhealthy privies. The bill similarly ensured the facility for efficient inspection.  

At the same time, responsibility was thrown upon the owners of premises to maintain and repair drains at their own expense. By section 251 B, people were forbidden from using, as a bathing place or as a place for washing clothes or domestic utensils, any part of any premises which had not been provided with all fittings which were deemed necessary by the Commissioner for the drainage of that area. 

By the end of the first decade of the 20th century, the city contained about 200 miles of underground storm water drains and about 116 miles of sewers. From 1907 an amalgamated Drainage Department consisting of both the special and ordinary branch, under a qualified Deputy executive engineer for drainage, assisted by a full staff comprising two assistant Engineers, a Chief Inspector, several inspectors, a head plumber, a head surveyor and a full clerical staff came into being. The work of cleansing of gullies and waste water pipes was by now undertaken by the Health Department and a special staff was appointed to carry out this work. There were Sanitary Inspectors as well whose duty it was to report on defects in house drainage. Notices were served in case of chokage and the cost of the work was recovered from the landlords. 

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144 Ibid, p 1503
146 Turner, Sanitation op. cit., p 192
SANITARY IMPASSE

Yet the problem of sewerage and drainage was far from solved. Even though it was acknowledged, in principle, towards the end of the 19th century, that the aim of sewage disposal was to get rid of noxious matter, owing to the huge volumes of sewage generated in cities, and that this task could not be left to the running water alone. In Bombay however, nearly 80 million gallons of sewage per day, was being dumped into a minimum depth of 6 feet of water and close to the shore! In contemporary England, on the other hand, in well sewered towns, with a sea outfall, crude sewage was discharged into a depth of water not less than 18 feet and at a great distance from the shore. Prohibitive cost of chemicals, prevented treatment and precipitation of the sewage. The expense of even the cheapest chemical material viz., Chlorine in Bombay came to 26 lakhs of Rupees per annum. The foulness of the sewage was due to the massive discharge of night soil into the sewers. In fact, it was admitted by the drainage engineer that, but for this, the nuisance at Love Grove could be effectively controlled. Hence suggestions were made to press the night soil into sludge cakes which could be either incinerated or disposed of by tipping into some low lying area outside populated districts. But the initial cost of this proposal itself was estimated at Rs. 90,000.

To deal with the problem, experiments of sewage irrigation were also conducted at the Leper Asylum at Matunga (established in 1894), which on account of its position could not be drained into the main sewerage system of the city and had its own sewage disposal system. The crops that were chiefly grown here were jowar, guinea grass and maize, with a rotation crop of pulse and vegetable. Although the farm was financially successful and the results at Matunga were encouraging, repetition of such experiments in the neighbourhood of residential areas was not possible as the

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148 CC James. op. cit. pp 262-264
procedure was offensive. Other sporadic efforts consisted of, for instance, the construction of a Biological Tank, in 1900 at Mody Bay, on land reclaimed by the Port Trust. It was aimed at the disposal of the sewage of Ewart Latham and Company; an oil company.

Sewerage Statistics

By now, the entire sewerage system suffered from major defects, these being; inadequacy of the size of the main and sub branch sewers, which were unable to cope with waste water and night soil discharged, resulting in there being a surcharge. The increased population and the per capita increase in the consumption of water rendered the ejector stations inefficient. Thus, the foreshore at Love Grove continued to suffer nuisance.

Investigations of the sewerage system, after First World War, revealed that though the then Municipal Engineer Rienzi Walton, had designed the main sewer to serve a population of a million and a half, at a rate of 20 gallons per head per day, or for 30 million gallons reaching the pumping station per day, for some unexplained reasons, the original designs were changed and made considerably smaller than intended to. This reduction was responsible for the surcharging of sewers. Similarly, the pumping system was also found to be ineffective and unsuitable for Bombay.

Once again, therefore, a comprehensive drainage scheme for the sewerage and drainage of the city was prepared by executive engineer Mr. Mackinson. This involved the transference of the main outfall to the locality in the North East, as suggested by the Bombay Development Committee. It was proposed to retain the Love Grove outfall as an emergency outfall for use in monsoon. Even the services of

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149 Ibid. p 178
150 L Michael, op. cit. p 369
Mr. John D Watson, CE to the Birmingham and District Board were secured for this.  

But, the report of JD Watson, on the drainage and sewerage of Bombay, suggesting the relocation of the outfall at Kurla was objected to by the BPT.  In 1922, the referee of the Port Trust, Sir Maurice Fitzmaurice proposed the location at Colaba once again, even though he had visited Bombay only once and had no first hand information of the physical features of the island.  Relocation of the outfall at Thana creek was also put forward as a solution to this problem. Further in 1925, experts advised the division of the city into 3 drainage districts, each with their own outfall. However, each sewage outfall was to cost Rs. 2 crores. Obviously, none of these materialized.

Even the Shone system, having been overworked, was found unreliable by now. Similarly, all the ejector stations in the city were found to be dealing with the practically the maximum amount of sewage they were designed for. Likewise, the work of the Development Directorate in the Colaba area, having increased its population there, brought about an attendant increase in the sewage load here which posed a threat to the nearby areas as well.

It was clear by now that, with every addition made to the water supply: the pumping machinery was over used, thereby leading to its frequent wear and tear. Thus, it was anticipated, that with the onset of the greater water supply after the Tansa completion works, more ejector stations would be required. In the 1930s therefore, on account of the increased supply from Tansa and building operations, without a commensurate

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152 MCR 1919-1920 pp 13-14
153 MCR 1921-22, p 13
154 Bombay Pamphlets etc. Vol. 8, Alan Press, 1930, the Drainage of Bombay 11th September 1924, pp 15-16
155 Ibid. J E. Saklatwalla. The Bombay Drainage and the Worlee outfall. The Widening of Thana Creek the only solution, pp 27-31
156 MRRR, op. cit. p 20
157 MCR 1923-24, pp 181-82
enlargement in the drainage and sewerage pipes, the city, was faced with problems once again. Enlargement and remodelling of the city’s system were again re-considered.\(^{158}\)

The acidic nature of the sewage and increasing detritus also emerged as other setbacks. In 1921 the amount of detritus removed from the sewage was 4492 tons daily and the quantity of sewage pumped was 34 ½ million gallons daily. Within a year the figures changed to 4900 tons of detritus and the sewage pumped: 47 ¼ million gallons per day.\(^{159}\)

Sewage disposal operations also turned energy intensive. Mounting coal consumption paved the way for the use of electric energy for the disposal of sewage by 1908.\(^{160}\) By 1923 the electrical energy, for the running of the Love Grove Plant was being supplied by Tata Hydro-electric Plant.\(^{161}\) Simultaneously, the cost of the Drainage Department increased from Rs. 3, 40, 653 in 1913-14 to Rs. 766, 026 in 1924-25. In the same period the cost of cleaning the drains increased from Rs. 5107 to Rs. 24, 500. Increased length of

<table>
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<tr>
<th>C.3: Length Of Pipe And Ovoid Sewers And Growth Of Silt</th>
<th>1915-1924, MRRR, p 103</th>
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<tbody>
<tr>
<td>Year</td>
<td>Pipe sewers</td>
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<tr>
<td>Length</td>
<td>Length</td>
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<tr>
<td>miles</td>
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<td>1915-16</td>
<td>115.70</td>
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<td>1921-22</td>
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<td>1922-23</td>
<td>122.35</td>
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<td>1923-24</td>
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\(^{158}\) MCR, op. cit. 1933-34, Health Officer’s Report, p 46

\(^{159}\) MCR, op cit. 1921-22, p vii and MCR 1922-23, p vi.

\(^{160}\) Ibid. 1908-09, p vi

\(^{161}\) Ibid. 1923-24, p vi
sewers required increased labour. Similarly, the cost of running the Colaba
compressor station increased from Rs. 34,360 in 1913-14 to Rs. 57,657 in 1924-25.
This was mainly due to repairs and maintenance costs. In the same period the
expenses at Love Grove Pumping station increased from Rs. 1,76564 to Rs. 4,18,
294. The most important cost, for this, being, the increase in fuel. Expenses of
maintaining the pumping stations continued to increase with the rise in cost of
labour, materials and spare parts and also the longer working hours.

The Outlying Areas

Right up to 1914, the areas of Dadar, Matunga, Worli, Mahim, Dharavi, Sewri and
Sion remained without sewerage facility. Not being considered important enough for
drainage at this stage, open drains were adopted here. For the village of Dharavi,
with a population of 6000 people mostly employed in Tanneries, it was proposed to
drain the area into the Mahim Bay since the sewage here contained a large
proportion of tannery waste.

But the sewerage of the area, otherwise suffered largely, due to severe differences of
opinion among administrators regarding the outfall of this area. However, this
seriously handicapped the Dadar Matunga scheme of the Improvement Trust. The
continuous discharge of the sewage into the Mahim Creek made the area an
offensive one. The Trust therefore found it difficult to dispose of the lands on this
estate. The inhabitants of the Parsi Colony and the King George V School, which
were a few feet away from the pumping station, complained of the unpleasant smells
of the sewage. In 1929, the use of the Chloronome for the treatment of the sewage
with chlorine abated this nuisance for a while. By 1932, to make these properties
saleable, the sewerage question for this area was finally decided which provided for
an outfall at Dadar for the portions of Dadar, Matunga, Mahim and parts of Sion.

162 MRRR, op. cit, pp 101-107
163 MCR, op. cit, 1946-47, p 137
164 CC James, op. cit, pp 259-260.
165 City of Bombay Improvement Trust, Karnatak Printing Press, Bombay,
Proceedings of the Improvements Committee and the Board, 1929-30. Note of the
Chief Officer, 15th April 1929, pp 63-64. Hereafter, BIT
Sewage was now disposed by first treating it completely by the Activated Sludge Process. The gas generated in the method was used for cooking and heating purposes at KEM hospital. It was proposed that a portion be used for running the Municipal fleet of Lorries and for generating electricity for lighting purposes. The experiment at Dadar thus proved to be a self-paying scheme. 166

Love Grove Once Again

Just before the Second World War, Bombay had a complex sewerage system. To drain the additional quantities of water provided by the Tansa, relief sewers had to be constructed at suitable points. There were 19 ejector stations out of which 5 were in Colaba. The nuisance of the Love Grove outfall still continued. It was hoped that the nuisance would disappear with the extension of the outfall. But this was not realized as the sewage was not discharged deep enough into the sea. 167

Considerable damage to the Love Grove outfall, by the end of the war, forced the Corporation to think of two alternative schemes: to repair the damaged portion or to subject the sewage to preliminary treatment before discharge, without carrying out the repairs. But attempts to extend the outfall at Love Grove, to a length of about 4000 feet, had to be abandoned halfway, after the outfall had been extended to 2000 feet, at the expense of Rs.22.78 lakhs, as further extension was found to be hazardous and risky. Besides, investigations indicated that the work, apart from being extremely expensive, would have to be carried out on a rocky barrier, very much exposed to the action of the sea. Such a structure would not have been a long standing structure. The nuisance at Love Grove thus remained unabated and the problems of the outfall undecided. Even the city engineer NV Modak accepted that the proper solution to the problem of disposal of sewage of the City would have been the construction of a number of outfalls, at suitable points along the foreshore.

166 Modak NV, Municipal Engineering And Other Allied Activities In Bombay 1914-1939, pp 18-20. However, even sewage purification schemes led to displacements. In the above case it led to land acquisition under clause 17 of the Land Acquisition Act in order to aid quicker possession of land: MCR, op. cit. 1934-35, pp 200-201
167 Bombay Municipality, op. cit. pp 61-63
instead of one outfall as at Love Grove. The decision to have a single outfall had led to the construction of very deep sewers. It also turned the sewage sceptic: on account of the long distance it had to travel before its arrival at the point of discharge. In India, with its hot climate, which required sewage to arrive in as fresh a condition as possible for treatment at the disposal works, this was particularly inadvisable. Stale sewage increased the cost of construction and maintenance of the disposal work considerably.\textsuperscript{168}

However, since it was found prohibitively expensive to shift the outfall anywhere else, Love Grove was grudgingly accepted as the outfall of the city. Therefore, the only expedient, to deal with the nuisance, lay in subjecting the sewage to treatment prior to discharge, as in the case of Dadar. With the adoption of these modern methods of disposal the Municipality now claimed to have got both direct and indirect benefits. The direct return was to be had by the utilization of by-products formed in the various stages of treatment. The financial justification of the scheme lay in the fact that by its adoption the Municipality would be able to derive revenue, to meet the interest and sinking fund charges on the loan to be raised for from the scheme, besides the indirect benefits.

As per the calculations made then, the Municipality would derive a surplus of Rs. 33,000 per annum, by the use of sludge gas alone, one of the by-products of digestion. This could be used as a motor fuel, for power, cooking, heating and lighting purposes. An indirect saving of Rs. 36,000 per annum was also expected. This amount would otherwise have been required to be paid to the power companies for running the new machinery in connection with the proposed works. Further, if a market could be derived for the by-products, additional revenues would be generated. Thus, it was decided to maintain the Love Grove outfall only for the central and southern areas of the city. The Dadar outfall was to be extended to meet the additional requirements of the growing population in the north of the island. A third outfall was contemplated at Dharavi as the areas of Sewri, Wadala, Gowari, part of Sion and the whole of Dharavi were fast growing at this time.\textsuperscript{169}

\textsuperscript{168} Modak Municipal Engineering, op. cit, pp 17-20

\textsuperscript{169} MCR, op.cit. 1940-41, Report from the City Engineer's Department No. CESR / 2769, p 195
CONCLUSION

The completion of the Vaitarna scheme worsened the drainage situation of the city. Therefore, a relief sewerage scheme was proposed in 1948. This scheme was designed for a population of 15 lakhs for the City, with the sewers running full. The absorption of the suburbs in 1950 and later in 1957 added to the complications. Even by 1955 the greater portions of the suburbs were undrained and unsewered with a large number of premises with objectionable, inadequate or inefficient sanitary conveniences while some had none at all. Lack of drainage created floods that disrupted suburban lives. Even so there was talk of underground railways in the city. Right up till 1957, the major problem affecting the suburbanites, was lack of underground drainage giving rise to disease and epidemics.

Technology thus failed to solve effectively the problem of drainage and sewerage. The success of this technology depended upon an accurate knowledge of the population, the cost of the system and the connection of the houses, besides the class of people for whom it was to be provided, the geographical configuration of the area and the sewage disposal method. While population data was available the other factors remained largely uncertain right up till the end.

But at the heart of this failure lay the paradox of scarcity and surplus of water. The triumph of the water carriage revolution lay in the sufficiency of water. However, a vicious circle was created in the city, whereby increased consumption, for various purposes including water carriage and wastage on several heads, led to scarcity; the latter leading to a stimulation of the water supply, which could not be absorbed since there was no commensurate increase in the sewerage system. Unplanned growth, increased population and reclamations, added to these afflictions. Further, the dependence on a single outfall increased the problems of operations and maintenance. The city was therefore saddled with an extremely complex, energy intensive sewerage and drainage system, which required to be overhauled, at a huge

170 Bombay Municipal Plan, op. cit. p 24
171 MCR. op. cit. 1955-56, pp 10-11
172 Times of India, 5th September 1956, p 8
173 Ibid. 10th Jan 1957, p 3
expense periodically. The city’s problem of flooding could never be solved as a result. This failure made the city a haven, for the vectors of various diseases which did not respect the sanitary regulations of the Municipality. The next chapter looks at these diseases and the water management policies of the Government in that area.