The Problem of Water in Madras.

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The settlement of the English at Madras was a haphazard affair. From the first water supply was one of its chief problems; and when after a century rolled by a capital city developed there, the state of things as regards water went on deteriorating for another century until a partial solution was obtained in 1872. It is only in the present year that a final solution can be glimpsed on the horizon.

Alexander Hamilton, a trader in the East Indies writing in 1718 (79 years after the commencement of the English settlement), says "Fort St. George or Chennapatnam is situated in one of the most incommodious places I ever saw. It fronts the sea which continuously rolls impetuously on its shore—more here than in any other place on the coast of Coromandel. The foundation is sand with a salt water river on its back which obstructs all springs of fresh water, so that the Fort has no drinkable water within a mile."

Morphology.—The present city has grown up on a strip of land of very tame topography about 9 miles along the coast and from 3 to 4 miles broad, presenting a uniformly flat appearance, the highest points being only 40′ above sea level in Kilpauk and Mylapore. The bulk of it was at the time of the settlement and for long after, paddy fields irrigated from tanks like the Vyasarpady tank, the Spur tank, and the Long tank (Nungambakkam and Mylapore tanks combined) which could be recognised even now by their stagnating pools in monsoon time menacing the public health. Perambur, Choolai, Purasapakam, Vepery and Basin Bridge as also a part of George Town and the Broadway (where Attapallam or Pedda canal ran to empty itself in the 'Northern River') were all low lying swamps. The principal villages inhabited at the time of the settlement were Madraspatam somewhere north of the Fort and Mylapore on the south. Beyond Mylapore in the south, the ground was again swampy and estuarine.

The geological structure of the town as revealed by the earliest official borings in 1832 on the site of the Land Customs House (the present Museum), and later on by numerous bore wells sunk during successive drought years and by the trenches recently dug for the underground drainage, shows alternating layers of fluviatile sands and clays

to an average depth of 12′. Along the coast Mylapore is on a dune hill and north of the Fort, Peddanaickenpet, Muthialpet, Washermanpet, and Kaladipet are situate on a well-defined dune ridge bifurcated along its north-south axial line by the Broadway. The structure of these shows dune sands intercalated with bog clays. Below 12 feet anywhere there is a stratum, 15 feet thick, of black, stiff buttery clay with recent shells, passing down into coarse marine sands. Gneissic bed rock is struck everywhere at about 57 feet.

The rainfall has been scarcely 40″ on the average. Under the above hydrographic and geological conditions, the obtaining of safe drinking water from the open porous subsoil was obviously out of the question. The location of the English settlement of 1639 cannot therefore be described from the health point as anything but a blind one that has resulted in a perpetual groping for water which has not yet found its goal.

Quest for Water.—The only lure to the English settlers was the thriving indigenous trade in 'Calico' (muslin) at this place. The Fort gave rise to a New Town around it. This was called Chennapatnam which as it grew soon joined itself to the northern Madraspatam and came to be christened 'Black Town' by the settlers. The nearest source of good drinking water to the residents of the 'White Town' (Fort) consisted in wells in the northern part of Peddanaickenpet, the western portion of the New Town. It was sold by water-bearers in pots and by others who brought it on cattle and carts. This water appears to have been relished for its cool and sparkling character and when particularly good, it was compared to 'Mountain Water,' apparently the water of St. Thomas Mount. A pot of water is said to have cost two *duddus* (10 copper cash each). The water was stored for the garrison in cisterns of timber and masonry.

The Fort was captured by the French in 1746 and one effective step taken by the besiegers is said to have been to cut off the water supply. It was restored in 1749 and within a decade we find a Select Committee arranging through an engineer, Mr. Call, for making provision for water storage enough for a garrison of 1500 Europeans, 3000 sepoys and 1000 native non-combatants for 6 months at a ration of ½ a gallon per man per day. But quite within a few years of this time the English supremacy became assured and there was no longer the need for enlarging the cisterns to the magnitude of siege requirements.

The aspect of drinking had been but one—and that a minor one—of the two sides of the need for good water, that had presented itself from the commencement. The East India Company gave employment to a large number of washers, bleachers and dyers of calico, and the Company was driven to the necessity of finding plenty of open space and good water for these men to carry on their business. The first settlement of these workers took place in Peddanaickenpet but soon, it appears, the area proved inadequate. During the time of Governor Collett (1717-20) a complaint was made to him to the effect that the water of the 'Northern River' (portion of the Buckingham Canal west of George Town and south of the General Hospital) had become much spoiled. This was evidently due to the very operations of these men —not to speak of accumulating sewage among an increasing population not alive to their sanitary necessities and having no provision for drainage. Accommodation was then found north of the town where the ground abounded in fresh springs. Even to-day it is so. This new settlement acquired the occupational name of 'Washermenpet.' And about the same time a new petta was encroached on without the consent of the Nawab of Arcot and it was called after the Governor's name as 'Colletpet,'—corrupted into its present name 'Kaladipettai.' Both the places are on the axis of the dune ridge and rich in fresh water. The necessities of these professional men and the limited extensions available, led, in Governor Pitt's time (about 1735), to the founding of a new weavers' settlement at Chintadripet. The Governor is said to have cast 'covetous eyes' on an extensive garden in this area enjoying a good supply of water owned by one Sunkurama, a local merchant, under a *cowle* from Governor Collett. He was ousted without any regard for his *cowle* and the garden was converted into a new weavers' village as, here the people of that calling were alone permitted to settle down. Thus Chintadripet, Washermenpet and Colletpet are clearly seen to have been the necessary accretions of a trading settlement where the principal occupation was the manufacture of calico dependent on a good water supply.

A turn of events.—It is a matter of history how in about two decades from Sunkurama's affair the company rose to sovereign power before which all dangers disappeared. With this turn in their fortunes the calico trade too was abandoned. Madras henceforth became the capital city of a rising state and the cause of its expansion though changed in nature continued to operate with unabated force. In 1792 the defeat of Tippoo removed all internal dangers in South India and about this time we find the municipal affairs entrusted to a separate body. An Act of Parliament of 1793 states the object of municipal administration to be that the streets should be regularly and effectively cleansed, watched and repaired and that scavengers should be appointed for the purpose. Organised drainage came only with the organised water supply to the city in 1872.

The Fort Scheme.—The population estimated in 1639 at 7,000 had considerably increased and in a letter from the 'principal inhabitants'

(apparently to the Company) of 1791 the population was put at 3 lakhs. All estimates from sight have tended on the side of exaggeration and having regard to the fact that the 'Madras Justices' put the population of 'Black Town' at 60,000, we may safely put the population of the city at about three times this figure or say, two lakhs. Long before this time, the drinking water supply to the Fort had become an acute problem and had to be placed on a reasonably satisfactory basis having regard to the new proportions assumed by the Fort. The native population around had from habit paid no heed to the fundamentals of organised sanitation and there was serious danger of contamination of the drinking water. Except perhaps the main roads there must have been a most appalling disregard of sanitary morals. Cholera epidemics broke out in the hot months and there was water scarcity during and after the poor monsoons which were not by any means infrequent. All this had occasioned serious apprehensions in the minds of the military authorities and a scheme was eventually devised and secured their approval. It was executed in 1772 under a contract with Captain Baker. The scheme was called the "Seven Wells Government Waterworks" the wells being situate in an area two miles from the Fort and at a distance of near a mile from the sea, north of Peddanaickenpet.

These wells are situated on the crest of the dune ridge and with the tests then available the water must have appeared particularly good in quality. The wells are ten in number and not seven, 16′ in diameter with varying depths from 23 to 29 feet. Water was raised by picotahs into cisterns and passed through a filter measuring 48′ × 30′ × 6′. From the filter the water was raised into two main cisterns from which it was conveyed by gravitation in 5 to 3½ inches cast iron pipes to the various points of distribution to the military in and outside the Fort. The supply of the wells has been put at 140,000 gallons a day or nearly 10 mil. c.ft. per annum, at an annual cost of about £1200. The number of men for whom the supply was estimated in Baker's contract was substantially the same as that worked out by the 'Select Committee'. During the century that elapsed before Madras came to be served from the Red Hills reservoir, the wells showed no signs of exhaustion, and indeed on one occasion, early in 1885, when a cyclone had breached the Red Hills reservoir, the city had a partial supply for 10 days from these wells in addition to the Red Hills water led in by other means. Between 1783 and 1787 the service was sought to be extended to private houses in and out of the Fort but the proposal did not receive encouragement at the hands of either Europeans or Indians. The Indians appeared to have preferred their accustomed wells for drinking purposes and their own wells for other domestic uses.

An appalling situation.—The Fort having been thus provided for and the surrounding population being contented to move in their own grooves from habit, things went on without a change for nearly a century. But the evils of the situation went on accentuating themselves until they were felt to be intolerable in the sixties of the last century. The city was now an agglomeration of 16 villages with teeming populations loosely knit together and dependent for water on shallow wells among which potable water was a mere chance. Their cohesion was being brought about by the filling up of the vacant spaces in between through the practice of the European administrators, settlers and merchants, who had no need to care for distances, of building carefree 'Garden houses'—a practice which the introduction of a general protected water supply for the city, was to further accentuate. The census of 1871 showed an actual population of very nearly 4 lakhs and the administration report of the Madras Municipality of 1871-72, when the new supply scheme was to place an abundance of good wholesome water within the easy reach of all the inhabitants for a reasonable outlay, describes, the evils under which the city had till then, been suffering. It says that nothing had been done to improve the drainage of the city and that the open porous nature of the sandy soil of the city had hitherto in great measure mitigated the evils arising from damp. The people of the city more especially the poor had been compelled in several localities to drink the water of the tanks and ponds fed by the sewers of the town. Mr. Standish, the executive engineer writes : " it was but very recently that I discovered how excessively filthy are the tanks attached to the several pagodas which were resorted to principally by high caste people. In the Kachaleswara temple, a green fermenting crust had formed on the surface worse than anything I had ever seen in our worst drains and yet there were people who resorted to it for bathing purposes." The report goes on to point out the crying need for a comprehensive drainage scheme as " it cannot be expected that 32 mil c. yds. of water (the quantity proposed to bring into Madras) could be poured year after year over this soil with impunity and it is simply a matter of time when the subsoil water will rise so high as to render the ground floor of houses damp and unwholesome." This gives a tolerably fair idea of the state of water supply and drainage in the century that followed the establishment of the Company as a ruling power.

Organised supply of 1872.—For the first practical step towards meeting the growing menace we have to come down to 1861. It followed up an idea originated six years before for enlarging and combining certain large irrigation tanks, one of which was only eight miles from the town, as part of an extensive irrigation scheme. Mr. Fraser, an engineer who was deputed for the purpose, elaborated a scheme for the enlargement of

the Red Hills and the Cholavaram irrigation tanks both for irrigation and for providing an abundant and wholesome water supply to the city. Fears were also entertained about the quality of the 'Seven Wells' water and a report made by Mr. Meyer and Dr. Wyndow, who had been appointed to analyse the water of the Wells said that the smallest amount of impurity found was double that which 'the authorities at home considered possible' and that the natural and only sound inference from the conditions of the soil was that it would be necessary for Government to look for water beyond this polluted area (the area of the 'Wells'). The scheme submitted by Mr. Fraser secured the consent of the Government of India in 1866 and was executed in the next six years. The essence of it may be said to be that local water was discarded and recourse had to the water of the Kortalayar river i.e., from twenty miles away.

The hopes, whatever they might have been, as to the possibilities of the underground water came to be abandoned in 1885 when careful boring conducted by Government under the advice of Mr. King of the Geological Survey assisted by a French engineer with experience at Pondicherry, upon a site chosen in the People's Park as the most favourable, showed that any artesian supply was a thing not to be hoped for, as granite occurred everywhere at a very shallow depth.

Under the scheme in question, the Kortalayar river was dammed at Tamarapakkam (*vide* map) from which place a supply channel was constructed to divert it to the Cholavaram tank. It intercepts two minor tributaries, Boosikal and Katankal, of the river and absorbs their content. The other supply channel connected the Cholavaram tank with the Red Hills tank, which was to be the immediate water reservoir for the city. The 'Red Hills' are no hills at all but an elevated laterite area. Besides the channel supply, the tanks themselves have a combined catchment area of 34 sq. miles while the intercepted tributaries have a catchment area of 106 sq. miles. The cost of the weir and of the channel as also of the improvements to the tanks by way of enlarging their capacity, coming up to 18 lakhs of rupees, was borne by the Government, and their upkeep and maintenance are the charge of the Public Works Department.

The waterworks necessary for conveying the water of the Red Hills to Madras by gravitation were constructed and maintained by the Corporation. They comprised a 'Valve-house,' situated at the S. E. corner of the tank for drawing up water and an open earth supply channel which had a bottom width of 6 feet and steep sides having a depth of 7½ feet. The channel was 6½ miles long with a gradient of 3 inches per mile. Except for a short length at the upper end, where the channel is in cutting, it was carried upon an embankment. At the Madras end the channel

delivered the water into a circular well 22 feet in diameter and 21 feet deep, from where the cast iron mains of the distribution system ramified. This well with its distributary apparatus, known as the 'Madras Municipal City Waterworks' is situated at the highest available point 44 feet above sea level at Kilpauk. These works have, with reference to later works, been designated the *Old Works*, and their cost as also subsequent expenditure in extending and cleansing the distribution pipes came to Rs. 23 lakhs. The supply scheme was inaugurated by Lord Napier and the first supply to the city was on the 13th May 1872.

Defects disclosed.—It was soon found that the supply system was far from satisfactory in many points and that the works needed considerable remodelling. The Red Hills Lake had been tapped at so high a level that for considerable periods the water surface in the lake went lower and had to be pumped. This always synchronised with a cholera epidemic in the city and a rise in the mortality caused by intestinal troubles which pointed to the pumping as having a fouling effect on the water. The open earth channel caused a serious loss of water through evaporation and percolation. The capacity of the channel itself proved insufficient for the requirements as its maximum capacity proved only about 7 or 8 mil. gallons a day, while the estimated capacity had been more than double the amount. It was liable to contamination on its way by human beings and was continually liable to breaches. There were no filters nor was there any provision in the distribution system for delivery at adequate pressure while it became frequently choked with organic matter.

New Works.—To remedy the above defects New works had to be constructed at a cost of Rs. 62 lakhs between 1907 and 1924 by Mr. Madeley, the Corporation Engineer. He has given a fine description of the New works in a memoir entitled '*Madras City Water Distribution Scheme—Reports and Estimates*' 1911. The bulk of these works was finished by 1914 when they were opened for use by Lord Pentland. Among these may be mentioned (1) [at the tank] an intake tower, located where the water is deep, which by going 10 feet below the intake of the old method added 58 per cent to the water previously available, so that the lake can be almost entirely emptied,—besides a screening chamber and roughing filters, (2) an arched masonry culvert 5 feet wide and 4 feet high which replaced the old open channel and trebled the previous supply besides avoiding pollution in transit, (3) [at Kilpauk] sand filters, filtered water tanks, pressure pumps, and an elevated tank to ensure a steady pressure in the mains and (4) a remodelling and extention of the Distribution System. A chlorinating plant added later on chlorinates the water before it is let into the filters.

But all the same it was soon pronounced that the effluent from the slow sand filters was bad, though 'safe' from an epidemiological point of view. This was due to the fact that though the immediate effluent had no sulphuretted hydrogen, the water contained sufficient organic matter to putrify and produce this gas in the pipes. The matter is still undergoing consideration and remedial measure at the hands of a Government Filtration Committee and Rs. 5 lakhs have been sanctioned for the purpose. Even in 1936 the water was considered to be far from satisfactory in this respect.

Unreckoned factors.—These works were designed and constructed on an estimated basis of rain and population which unfortunately belied the forecasts. Mr. Madeley expected a population of 7 lakhs in 1941 but in 1931 itself it came to 6½ lakhs showing a phenominal boom of 22·8 per cent during the previous decade ; while it was only in the decade 1891 to 1901 that the increase went beyond 10 per cent (with a growth of nearly 13 per cent). The figures for the daily consumption of water show 2½ million gallons in 1878, 10 to 12 mil. gallons in 1910-1915, 12 to 15 mil. gallons in 1915-23, rising year after year by a million gallons except during drought years. At present it is 28 million gallons per day. Besides all this we have to reckon with the fact that the city itself has been growing, of which the most conspicuous instance has been the Mambalam extension. Commerce and industry of various kinds have been taking root in the city with improved railway communications and the erecting of the New harbour ; and the latest sanitary improvements, chief among which has to be mentioned the underground drainage, are vast consumers of water. With the city, its population and the rate of consumption growing side by side, the scarcity of rains that has been the feature of the last two decades has made the fact increasingly evident that we have to look for something to replace the year to year storage beyond which the architects of the present system did not envisage.

The measures so far possible namely, the widening of the supply channels, improvements to the dams etc., did not go beyond the fringe of the matter.

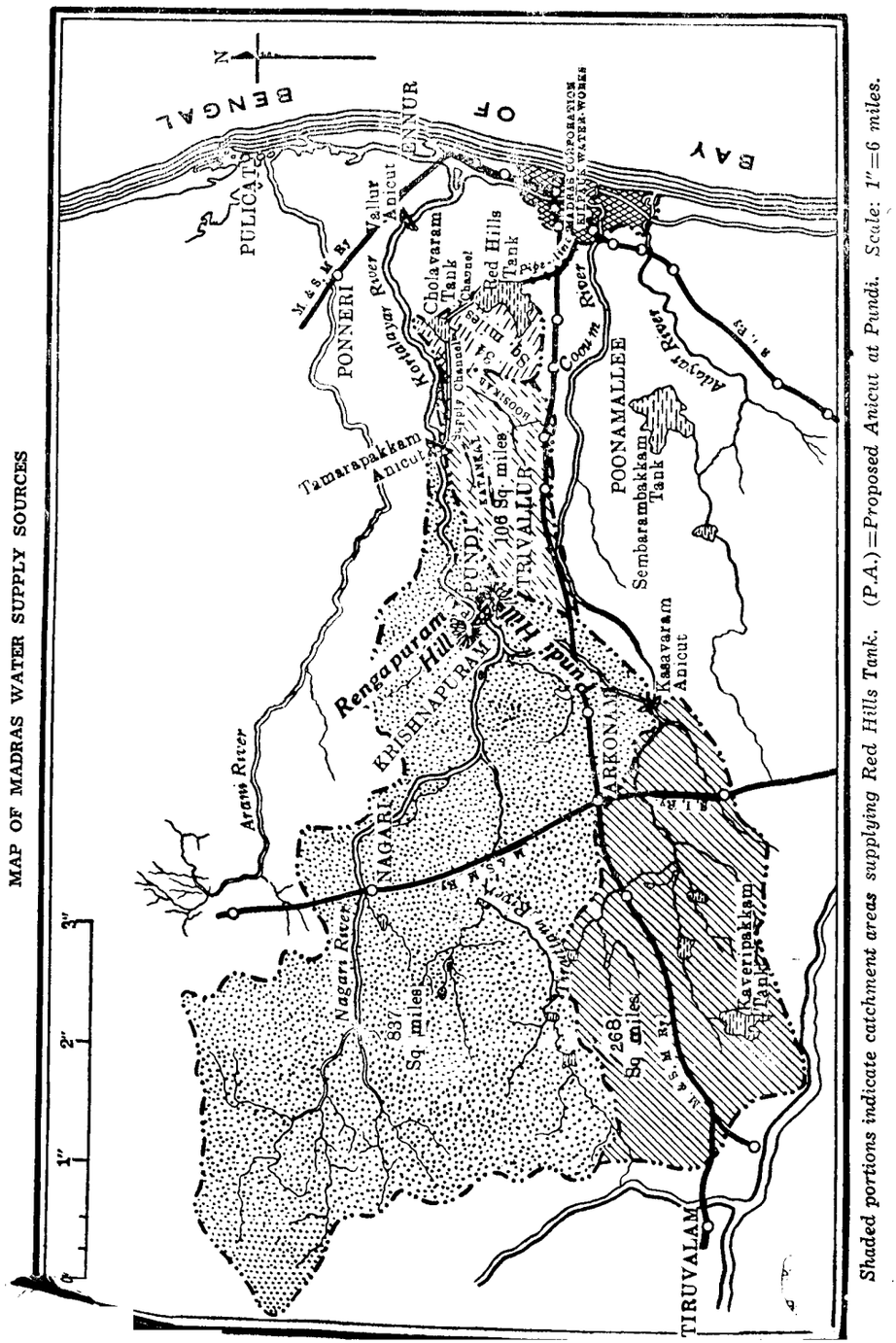
The present water-famine.—The outlook necessary has come as the result of the very acute water famine that has followed the complete failure of the monsoon of last year,—water being now supplied with an intermittency of an unprecedented character and the weir at Tamarapakkam is being raised with mud and turfed over to catch the effects of possible summer showers, and yet it is said that 16 mil. gallons are being consumed per diem in place of the normal 28 mil. gallons. Brains of all sorts of training were set racking as the daily press has made evident. Wells were everywhere getting dry and a campaign that in former years

led to closing down of a large number of wells has again given place to a campaign of self-sufficiency through reopening them. Tube wells and bore wells are becoming the order of the day.

The writer has personally taken logs of a large number of wells and attended the excavations of the new underground drainage scheme, to study the hydrographic character of the strata. In the dune area in the north of George Town there are good underground springs that would give a large yield for local supply, showing that the early move for water that brought into existence Washermanpet and Kaladipet, were moves in the right direction. The new Mambalam extension built on an original tank bed has also some good springs; but they are all, as has to be expected, undergoing deterioration as the result of the numerous wells now coming into being. There has been nowhere any evidence to upset the conclusion of Mr. W. King and after him of Mr. Cornet that no hopes need be entertained of tapping an artesian supply. As a whole it can be safely said that the entirety of the underground sources within the city is a factor only to be ignored in any scheme not proceeding with purely private ends ; so that the only direction in which the question has to be thought out, is storage by leading in surface water, which to all outward appearance has been exploited already.

A bright spot.—In this dilemma, there has occurred a bright spot. So long ago as 1909 Sri. C. Velayudha Mudaliar, a mirasdar of Karikalavakkam near Trivallur suggested to the Government that a dam across the Kortalayar, some 19 miles up the Tamarapakkam weir, where the river was joined by the Nagari river, was likely to vastly improve its irrigational potentialities. The Government investigated this matter for irrigational purposes in 1924 and the reports made thereon suggested a dam at Pundi some 5 miles lower down. After this, in 1927, when the city was suffering acutely from one of its periodic water scarcities, Government appointed a Commission to examine the various possibilities for improving the water supply of the Red Hills tank, but the recommendations made related only to the addition of head sluices and the widening of the supply channel and the like, which has already been referred to. The question of damming up the river has again been before the present Government since the middle of last year. In April last the hon. Mr. Yakub Hassan, Minister for Public Works, visited the Pundi locality and a scheme appears to be occupying the attention of the Government having for its object a solution once for all of the water supply problem of the city.

In all normal years the Kortalayar has been losing a large volume of water to the sea over the last of its anicuts at Vallur, often to a height of 16'. An engineer who happened to see the flow is said to have ex-



claimed ' to impound this water, would be to create a new tank, Red Hills and Cholavaram combined.' The scheme is one for the erection of a dam 40 feet high above the bed level to a length of 2000 feet between the Rengapuram and Pundi hillocks on either side of the river so as to create a large reservoir of 11·8 sq. miles. The entire cost is said to come to 50 lakhs including about 10 lakhs for acquiring the villages that would get submerged. The capacity of the Red Hills and Cholavaram tanks is given at 2700 mil. c. ft. of which annually 2200 is issued, out of which again 900 go to the town and 500 for irrigation and the rest gets lost by evaporation and percolation from tanks. If the capacity of the new reservoir is going to be 2500 mil. c. ft., as estimated, after allowing for the present rights of irrigation lower down, the addition will indeed solve for ever the water problem of the city—which at present consumes only a third of this amount,—whatever the threatening drought and however the city and its population may expand. The bed of the river at the dam site is sandy with lateritic boulder conglomerate resting on Sriperumbudur shales which again rests on granitic gneiss, and it is well adapted for the dam ; the country between Krishnapuram and Pundi is funnel shaped and constricted at the dam and widening out rapidly up the river, the left bank being steeper than the right. With the estimated data the work promises to be of such a character that its benefits would far outstrip the initial cost. The writer's geological work in the area around Pundi and Madras points to the scheme in question as being the only sound one in the circumstances of the city, as it will confer lasting benefit on it by securing for it a perennial supply of water of the quality that it is now enjoying.

It is to be hoped that the year 1939 would by bringing in this benefit prove to be a landmark in the history of the human progress in the city, by solving once for all the problem with which it has started in a rather blind way. One is strongly tempted to think here of the circumstances in which the present harbour in Madras came into being. It was planted on a surf beaten beach as a challenge—so to say—to nature by Sir Francis Spring. It was built in the face of great opposition and prognostics of evil. But it has triumphantly justified itself, and the greatly augmented sea-borne trade of the city bears eloquent testimony to the usefulness of its being. But the scheme in question no way partakes of the utopian character that the harbour presented at its inception. There is no going against nature in this scheme and the blessing it is likely to confer will be many sided in its character and the impetus it will give for the growth of the city will be of that nature that long before its sexcentenary its people will not be able to realise how it had happened that Madras had ever to put up a fight for mere water.

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The following books and reports have been consulted by the author. The writer has to thank the Commissioner of the Madras Corporation for kindly allowing him access to his records and maps among which the last of the undermentioned papers was found. The writer has also to thank the Industrial Engineer of the Department of Industries fof kindly permitting him access to his records.

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