

report of the study
group on
water supply
water pollution
drainage sanitation.

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metropolitan regional
planning board

R E P O R T
O F
THE STUDY GROUP ON
WATER SUPPLY, WATER POLLUTION, DRAINAGE
AND SANITATION

BOMBAY METROPOLITAN REGIONAL
PLANNING BOARD BOMBAY.

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I N D E X

	Page No.s
Section I Introductory.	1
Section II Water Supplv.	2 to 8
Section III Water Pollution.	9 to 14
Section IV Air Pollution.	15 to 16
Section V Drainage & Sanitation.	17 to 18
Section VI Summary and Conclusion.	19 to 21

Section I
Introductory.

The Bombay Metropolitan Regional Planning Board in its meeting held on 3rd July 1968 decided that it was advisable to form a Study Group to evolve some measure of co-ordination in the planning and development of the various water resources in the region and to study water pollution, drainage and sanitation aspects. For this purpose the Board constituted a Study Group consisting of the following members:

1. Shri S.V.Desai, Bombay. Chairman.
2. Shri S.V.Hatu, Chief Engineer,
Public Health, Bombay.
3. Shri N.V.Modak, Ex-Special Engineer,
Bombay Municipal Corporation & ^{Bomb} ~~Drainage~~ Engineering
4. Shri B.G.Yalimbe, Superintending Engineer,
Bombay Public Health Circle, Bombay.
5. Shri N.A.Lentin, Executive Engineer, Field
Unit Division, Bombay.
6. The Hydraulic Engineer, Bombay Municipal
Corporation, Bombay.
7. Dr. Pitchai, Prof. of Public Health
Engineering, V.J.T.I., Bombay.
8. Prof.S.J.Arceivala, Director, Central Public
Health Engineering Research Institute,
Nagpur.
9. Shri V.N.Marathe, President, Thana Municipal
Council, Thana.
10. Shri J.G.Keskar, Town & Country Planner, Bombay.

The Board had prescribed no specific terms of reference for the working of this Group. It had however suggested formation of different sub-groups to consider the question of (1)water supply (2)water pollution and (3)drainage.

The Group held 2 meetings. The first on 30.12.1968 and the second on 30.1.1969. At the first meeting on 30.12.68 the scope of the work to be carried out by the Group was discussed in general and it was decided that as the aspects of water supply, water pollution and drainage were inter-related, no useful purpose would be served by forming sub-groups to study each of these subjects as suggested by the Board. At the second meeting held on 30.1.1969 further detailed discussion was held and at the end it was decided to draft report in the light of the discussions at the two meetings. The report as finalised is now submitted to the Board.

Section II

Water Supply.

The population of the Bombay Metropolitan Region is estimated to reach 124.61 lacs by 1991 according to the medium estimate of the Demography Study Group appointed by the Board. Of this figure, about 11.67 lacs would be the rural population and the rest i.e. 112.94 lacs or about 113 lacs will be urban. If the population grows to this size as estimated, it is necessary to establish in the first instance that a potential for adequate water supply for such a population exists from the water resources available in the region.

Computation of water demand:

The quantum of the water demand will mainly depend upon assumptions about the desirable water supply per capita for domestic use and the allowance to be made to meet the industrial demand. The urban and rural areas will also need to be considered separately.

Urban Area :

(a) Domestic Use :-

Two studies have been made earlier in this respect in regard to the Bombay Metropolitan Region. The first study has been done by Shri R. Bharadwaj, University of Bombay, under his thesis "An econometric analysis of water requirements of the Bombay Region". The other study has been made by M/s Binnie & Partners (India) Ltd. for the Government of Maharashtra and the Firm's Preliminary Report on the water supply in the Bombay Metropolitan Region from Bhatsai river and other sources deals exhaustively with calculation of water demand in the region. This study has also taken into consideration the analysis made by Shri R. Bharadwaj. It would therefore suffice to take into consideration the relevant part of M/s Binnie & Partners' Report only. Their

analysis and findings are briefly as follows :-

1. 1981 population of the Bombay Metropolitan Region will be lacs and 1991 population, 116 lacs.
2. The water demand projections pertain to Greater Bombay and Thana, Kalyan and Bhāwānī talukas only (Bassein, Panvel, Uran and Khaṛapur although forming part of the region are not considered.)
3. It is assured that while the whole of Greater Bombay's population will be supplied with water, only 80% of the population of Thana and Kalyan talukas, 60% of Bhiwānī taluka and 80% of the migrant population will need to be supplied with water on an urban scale. On this basis they have arrived at a population of 83.86 lacs as 1981 population for calculating the water demand. They have also worked out alternative figures for a population of 87.70 lacs allowing for higher migrant population.
4. As regards the rate of supply per capita per day (g.c.d.), they have adopted two alternative figures. The first one allows for 1981, 40 g.c.d. for city, 38 g.c.d. for suburbs, 32 g.c.d. for extended suburbs and 25 g.c.d. for outer areas. The second calculation allows 56 g.c.d. for city, 50 g.c.d. for suburbs, 40 g.c.d. for extended suburbs and 30 g.c.d. for outer areas.

The Group feels that it is very difficult to make any assumptions with a degree of precision in this respect. Probably a supply of 56 g.c.d. for Bombay city, might be found too high an assumption by many. In the opinion of the Group, an average rate of 40 g.c.d. for the urban population of the entire region would be a fair allowance for domestic use.

At 40 g.c.d. the domestic water demand for the 1981 urban population of 113 lacs mentioned earlier would work out to 452 m.g.d. in round figures.

(b) Industrial Use :-

M/s Binnie & Partners have made a detailed analysis in this respect too. The industrial demand allowed for by them in the outer areas outside Greater Bombay is projected from the existing demand of industries in this part of the region and area of land zoned for industry in A.J.D.C. Schemes. They have made two different projections for 1981. One of 213 m.g.d. and a higher one of 241 m.g.d. The latter figure is for the higher population of 87.70 lacs and works out to an equivalent of 27 g.c.d. in terms of population. Without going into any discussion on this issue, we would adopt this figure as a basis for computation of the industrial water demand.

Industrial demand for the 1991 urban population at this rate of 27 g.c.d. would work out to 305 m.g.d.

(c) Other Uses :

Demand in this respect may be taken roughly as 4% (as adopted by M/s Binnie & Partners (India) Ltd.) of the total domestic and industrial demand. For the urban population of the region, this will therefore work out to 30 m.g.d.

$$\left| (452 + 305) \times \frac{4}{100} \text{ m.g.d.} \right|$$

(d) Losses :

These may be taken as 15% of the total of domestic and industrial and other uses demand and will work out to 15% of (452 + 305 + 30) = 118 m.g.d.

The total demand for 1991 for the urban area of the region is therefore likely to be of the order of a + b + c + 905 m.g.d.

Rural Area :-

The 1991 rural population as mentioned earlier is estimated at 11.67 lacs. Currently, the rural areas get a

very low supply of water but as standards of living improve a much higher supply would be needed for these areas also. These rural areas are not expected to have any large industries. In many of the rural areas, local ponds^{and} and underground sources of water like wells, ~~xxxx~~ etc. will continue to be tapped for local consumption. At present even cities like Madras, Bangalore etc. are getting water supply less than 20 to 25 g.c.d. only. Considering all these facts an overall average of 15 g.c.d. (inclusive of losses in the system) would be a reasonable figure for estimating the water demand of the rural part of the region. On this basis, the water demand for 1991 rural population of the region will work out to 17.51 m.g.d.

The combined urban and rural water demand for 1991 will thus work out to 922.51 m.g.d. say 923 m.g.d.

Water Resources :-

Certain water resources are already harnessed. On some others, work is in progress or partly completed. The remaining could be tapped as demand rises. The general position in this respect is as follows

1. Existing sources:		
a. Vaitarna :	108 m.g.d.	
b. Tansa :	822 m.g.d.	
c. Vihar :	20 m.g.d.	
d. Tulsī :	3 m.g.d.	
	---	223 m.g.d.
2. Upper Vaitarna :		120 m.g.d.
3. <u>Bhatsai</u> :		250 m.g.d.
4. <u>Umes.</u> :		50 m.g.d.
5. <u>Harvi.</u> :		100 m.g.d.
6. <u>Kalu.</u> :		200 m.g.d.
7. <u>Pinjal.</u> :		100 m.g.d.
8. <u>Ransai.</u> :		5 m.g.d.
9. Other sources :		200 m.g.d.

Total :		1248 m.g.d.

Work on Uhas is already completed. Work on Upper Vaitarna and Barvi (1st stage) has already commenced. Work on Bhatsai (1st stage) has also been recently commenced.

Some towns in the region have their own water supply sources. Some towns and villages depend on wells. The total water available from such minor sources is comparatively insignificant and is not therefore accounted for in the total water resources.

As the total water demand for the region works out to 923. m.g.d. as stated earlier it is clear that there would be no difficulty about supplying water to 1991 population of the region. It is also evident that a sizeable surplus could be made available for irrigation when all the sources are tapped. If all the surplus water is diverted to irrigation, it could be argued however that water resources of the region would be exhausted by 1991. But it would be logical to presume that by then sufficient technological developments would have taken place such as desalination of sea water on a competing cost basis. Besides in the face of competing demands for water, use of degrittied or partially treated sewage for irrigation on a wide scale in the region is anticipated in near future. Use of tertiary treated sewage water by large industries is another possibility which cannot be overlooked.

Integrating New Development with Availability of Water :-

Contemplated new towns or expansions of existing towns in the region will have to be taken in the order of availability of water in the different locations of the region. The water resources already harnessed supply water to Bombay and towns on the way. However the Bhatsai scheme now taken in hand can supply water also to the northern areas in the region such as Bassein by extending a trunk-main on that side. But until this happens, there is little prospect of enough water being made available for the area north of Greater Bombay. This means that new towns contemplated in the north of the region

new towns contemplated in the portion of the region to the north of Bombay will have to await availability of water from Bhatsai and this might take 3 to 4 years more. As regards the eastern and southern parts of the region, the proposed township in Trans-Thana Creek Area and the proposed metrocentre between Panvel and Uran can be supplied with water in the first instance from the Barvi Scheme of the Maharashtra Industrial Development Corporation.

The Board had desired the Group to work out an integrated water supply scheme in detail for the region. After giving a careful consideration to this issue the Group came to the conclusion that in the ultimate analysis, the various water supply schemes of the Corporation, the Government and the M.I.D.C. will have to function as an integrated grid so that water to any particular area is delivered from the most advantageous sources. What is more important at present is to establish an estimate of the water demand of the region.

Water supply for irrigation :

In paragraphs 1.10 of Chapter I of their preliminary report, M/s Binnie & Partners have given figures for the periodical demand and their 1981 figure is 628 m.g.d. under projection A and 849 m.g.d. under projection B. In paragraph 1.11 of the same chapter, while they observe that any projection beyond 1981 must be regarded as purely tentative, they have indicated a probable maximum demand of 800 m.g.d. under projection A and 1200 m.g.d. under projection B.

All the water resources available in the region are expected to yield 1248 m.g.d. as stated earlier. The Group feels that in planning the water supply for the region, some water must be left surplus for meeting irrigation needs of the rural areas of the region. This could be achieved without difficulty if a periodical watch is kept on the type of industries coming up in the region and

those requiring huge water demand are either discouraged or allowed after due consideration of an integrated assessment of the urban and rural demand with that for irrigation.

Bandharas on Tidal Rivers :

The Rural Planning Study Group is understood to have come to the conclusion that agricultural economy in the rural parts of the region could be substantially improved if water is made available for irrigation. That Group also feels that as making water available for irrigation by impounding rivers with large dams not only involves considerable investment but also takes years for completion of such projects, it would be worthwhile to put up small Bandharas on tidal rivers in the region in order to impound sweet water flowing down the river and separate it from the tidal water during the fair season. This view of the Rural Planning Study Group was examined and it was agreed that while small Bandharas on rivers would make some water available for irrigation, its scope would be limited to that of minor irrigation only. Experience of minor irrigation shows that agriculturists do not come forth readily to use the water and are not prepared to pay water 'duty' which makes such schemes economically non-viable. Such Bandharas would however serve a good purpose if the Zilla Parishads are willing to undertake them by securing prior co-operation of the potential beneficiaries or alternatively without expectation of any return in the first instance. In the opinion of the Group, the Zilla Parishad alone would be the most appropriate authority to cajole the abutting farmers to avail of water from such Bandharas. This Group, therefore, feels that it is not necessary to make any examination at this stage about the suitable locations for such Bandharas.

Section III.

Water Pollution

Water generally occurs in nature in unpolluted form whether it is river water, well water or water beating on the sea shore. It is the various human activities that result in water getting polluted. Human wastes whether carried by an under-ground sewerage system or otherwise can cause health hazards if these wastes are allowed to flow untreated into a water stream from which water is drawn for supply to the community. Effluents from industries particularly those discharging chemical and other wastes also make the receiving waters unfit for human use and vitiate the surroundings on account of odour or un-aesthetic visual appearance of the water. Further pollution of rivers or that of coastal sea can affect fish life if the pollution is of a high order. From all these considerations it is of great importance that water pollution does not go unchecked in the Bombay Metropolitan Region particularly in view of the high density of population in the urban areas of this region.

Extent of Water Pollution in the Region :

A large part of the population in the region lives in Greater Bombay where water is supplied from distant sources after conveying it through conduits. Some other towns in the region are also supplied with water in the same manner. Because of this position, pollution of water for human use is comparatively rare in the cities and towns in the region. In Bombay, there have been instances where contamination has taken place by infiltration of sewage into a leaky water main or service pipes. This sort of contamination of water is purely a matter for local action and improvement.

Pollution of river water is prevalent to some extent in Patalganga and Ulhas rivers. The position in this respect

is not likely to deteriorate even when new towns are established in the region, as all such towns will be provided with a ^{system with proper} treatment and outfall in view of what is stated in the subsequent section on Drainage and Sanitation of this report.

It is the wastes from industries, particularly the liquid effluent wastes that are causing considerable anxiety in the region and their discharge into water sources requires to be curbed and controlled in an effective manner. These industrial effluents when carried along a tidal river like Ulhas affect fish. They stink and emit unpleasant acidic odours and also affect aesthetic quality of environment. Where such pollution is of a high order, the water may even become dangerous to cattle.

Survey of Water Pollution in the Region :-

In view of the alarming position of water pollution by industrial effluents in parts of the region, the Field Unit Division of the Bombay Public Health Circle under the Executive Engineer carried out in 1967 a survey of the Patalganga and Ulhas rivers. The findings in this respect are briefly as follows :-

1. Patalganga :

Sample tests at various places indicated that pollution was high, the B.O.D. (Biochemical Oxygen Demand) ranging from 9 p.p.m. to 33 p.p.m. as against a required value of 3 p.p.m. for river water. At the points of entry of some of the industrial effluents, the river water supply was ~~quite~~ ^{highly} affected. The industrial effluents were either highly acidic or highly toxic or highly phenolic. They had a high B.O.D. and consequently a high potential to pollute streams. Pollution at some places was due to effluent of even septic tanks sited along the river such as those in Khopoli area. This indicates the urgency of tackling properly the sewage waste even

from small towns like Khopoli.

The extent of pollution in Patalganga has highlighted the need of appointment of a Pollution Control Committee with the co-operation of the MIDC and local villages and the municipal authorities.

1. Ulhas River :-

Pollution was found to travel from Lonavala and Khandala due to faecal matter with the result that at Karjat the condition of water in the Ulhas river was such as to give rise to an epidemic if any one were to use the river water for drinking.

While pollution occurred near Bhivpuri power house and near Neral Nalla, the situation improved at Badlapur due to the self-purification of the stream in a length of about 6½ miles. The survey shows that the pollution can be controlled to a considerable extent by providing bunds upstream of the polluting nallas. Sanitary conditions of the villages within the catchment areas need also to be improved.

Pollution in the Creeks.

It is along the two main creeks viz. Ulhas Creek and Thana Creek that industrial effluents give rise to pollution. Particularly in Ulhas Creek pollution has already started affecting the fish. The Thana Creek on the other hand gets flushed by the tides and sufficient dilution is therefore available.

There is no possibility of the saline creek waters being used for cooking or drinking by anyone knowingly or unknowingly. The problem of pollution of Ulhas Creek has therefore a limited significance as regards fish life. In this connection the Group was asked to consider a representation addressed to the Chief Minister dated 20.7.1968 by the Kalyan-Ambernath Manufacturers' Association. The representation pointed out that the industries under ^{reference} were

established in Kalyan-Ambernath area with the concurrence of Government. Their effluents are discharged in a river or Nalla the waters of which were non-potable even before starting of these industries. The Association therefore made out a case that it would not be reasonable to ask the industries to treat their effluents to any high degree because of loss of some marine/aquatic life. It further stated that the cost of treating effluents of these industries which are mainly chemical in this area would come to crores of rupees and that some of the industrial/^{units} may find it absolutely uneconomical to treat their effluents. The Association therefore requested that this aspect should be duly considered and further suggested that before the bill for "Prevention of Water Pollution" is placed on the Assembly agenda, the representatives of these industries may be consulted.

The Group came to the conclusion that while the industries may be called upon to improve their effluents as far as possible, the question will have to be approached from the relative cost of complete treatment of their effluents as against the loss caused to the fishermen's families by danger to fish life. Alternatively, it might be possible to take the effluents of all these industries by constructing a separate channel from downstream of the Mohone weir and carry the said channel by the shortest possible alignment so as to discharge the wastes at a point near the confluence of Ulhas river with Thana Creek. A very tentative alignment for this is indicated in the plan attached to this report. The cost of such a channel should obviously be borne pro-rata by the industries and it is suggested that this proposal may be examined in further details.

There is no doubt that more intelligent operation of the plants by industries themselves would minimise discharge of chemicals ordinarily allowed to run into their effluents. It is suggested that the various industries may be prevailed upon to examine this aspect more

carefully. It is evident that when the bill for "Prevention of Water Pollution" lately introduced by the State Government in the Assembly is enacted, it should be possible to exercise a measure of compulsion on the industries in this respect.

Pollution of wells in the Thana-Belapur Area :-

Villagers in the Thana-Belapur area have been complaining that some of their wells have been polluted by the effluents of the industries that have come up in this area. In this connection it is learnt that industries in the Thana-Belapur area are prepared to carry their effluents right to the Thana creek and that the difficulty is mainly in respect of carrying their drains through the intervening private lands. In this context it is felt necessary that the various municipal and development authorities in the region be vested with powers as in the Bombay Municipal Corporation ^{Act} authorising laying of sewer lines in anybody's property without resort to acquisition of affected land.

Safeguarding pollution of Water Catchment Areas :-

So far as the Regional Plan is concerned, this issue arises only to a limited extent as all the future impounding reservoirs are to be located in the hills outside the region. However, as presently contemplated, waters from Betsai reservoir are intended to be carried along the river channel itself from the dam upto a point near Padgha where a weir will be constructed and water pumped into the trunk mains. In this stretch, the flow along the river will have to be safeguarded from further pollution. In the catchment area of the river in this stretch, establishment of any new towns or further growth of existing towns will therefore need to be discouraged as far as possible. It is not banned completely. It is however understood that an alternative scheme to carry water from the dam by a separate high level canal is being considered, and if this alternative scheme is

: 14 :

ultimately adopted, there will be no necessity to safeguard the river catchment in this stretch.

Section IV

Air Pollution

The extent of Air Pollution in the region is not of a serious order at the moment. Air pollution in respect of the odours is however perceptible from some of the industries. In Kalyan e.g. odours from the industries in the Mohane industrial area are quite perceptible. Similarly in the Trans-Thana Creek area some of the newly set up industries emit the odour. Within Greater Bombay itself, a pungent odour in the Sion-Chembur area was found to persist in recent areas and on investigation it was found that the source was the Fertilizers Corporation of India at Chembur.

It was not possible for the Group to make any intensive studies or analysis to investigate the extent of the problem and suggest remedies. The Director of the Central Public Health Engineering Research Institute, Nagpur, who had recently carried out a study for the Chembur plant of the Fertilizer Corporation of India was requested to state whether his Institute could undertake air pollution studies particularly in respect of the problem areas in the region such as Thana-Belapur area, Kalyan-Ulhasnagar-Ambernath complex and Khopoli and if so furnish an estimate of minimum cost for undertaking this work. The Director was also requested to give an idea about the time and cost involved for establishing the current level of pollution in different areas in Greater Bombay. The Director has in his reply communicated that his Institute could undertake the work at an estimated cost of Rs. 1,53,700. As the Board has no funds available at its disposal, it is suggested that offending industries may be prevailed upon to undertake these studies at their costs in the interests of the people in whose vicinity such industries have come. It is worthwhile mentioning that the Fertilizer Corporation of India Ltd., Trombay, got a study of their Chembur plant made by the Central Public Health Engineering Research Institute at their own cost.

Setting up Monitoring Stations in Great Bombay.:

While studies in respect of air pollution of specific industries may be got done by industries concerned, it is necessary to set up within Greater Bombay a few Monitoring Stations to keep a continuous watch on the level of air pollution. In any metropolis, air can get polluted from several sources. In American cities automobiles play a considerable part in air pollution but the same would not be true of Bombay for years to come. It is however absolutely necessary that Monitoring Stations are set up all-over Greater Bombay so that we know from time to time what is exactly happening to the atmosphere of the city and can take corrective steps before it is too late. The cost of setting up and maintaining such monitoring stations will have to be borne obviously jointly by the Municipal Corporation and industries and other sources responsible for causing air pollution. In any case, the Group feels that this issue should be examined and finalised in much greater detail.

Section V

Drainage and Sanitation.

Drainage involves dealing with storm water as well as spent foul water of the community. The latter is generally known as 'sewerage', although drainage is sometimes taken to connote both storm water drainage and sewerage.

Sewerage :-

In regard to sewerage, apart from Greater Bombay there is no underground sewerage system yet in any of the towns in the region. Some of the towns have already taken in hand preparation of sewerage schemes. In a large town, sanitation and public health can be maintained efficiently and effectively only by extending sewerage to the whole of the town. In the absence of a sewerage system it is customary to resort to aquaprivies or W.C.s connected to septic tanks. These have their own limitations and the Group feels that there is no substitute for a waterborne sewerage system for maintaining proper sanitation of any large community. Even for the new towns proposed in the region, the town project should therefore be based on the conception of tap water supply and full-fledged underground sewerage for the whole of the town. After all, water supply and sewerage will each cost roughly Rs. 100 per capita and if we are going to supply tap water, it would be false economy to get along with anything less than a full-fledged sewerage system.

It is understood that in the new towns it may be necessary to resort to self-help housing to a considerable extent. Even here it is absolutely necessary that for securing attractive and hygienic environment, a flushing W.C. connected to the sewerage system is insisted upon for each house. A W.C.-pan connected to sewer may cost about Rs. 250 or so exclusive of the cost of construction of a cubicle which can be made as cheap as possible as the latter

: 18 :

has no bearing on the sanitation aspect. The cost can be minimised further if necessary by not insisting on a flushing tank.

As planning and designing of a sewerage scheme whether for new towns or existing towns is confined to the town itself and is a part of micro-planning, details thereof could be worked out at an appropriate time. The Group therefore feels it not necessary to devote any consideration to this aspect at this stage.

Storm Water Drainage :-

The region is undulating; with a number of rivers flowing down into the Arabian Sea. Storm water runs easily to the respective outfall points and no particular precautions are required to be taken in this respect while planning the region. It only requires to be seen that any proposed new development does not block natural flow of water unless an alternative adequate and properly designed flow-channel is provided for.

Local flooding in some of the towns in Monsoon does occur but this is essentially a local problem and did not call for any study from the Group.

Section VI

Summary and Conclusion

Water Supply :-

1. The total requirement of water for the estimated population of 124 lacs by 1991 in the Bombay Metropolitan Region, would be of the order of 923 m.g.d. for meeting domestic and industrial demand including minor other users and losses .
2. If all the available water resources in the Bombay Metropolitan Region are harnessed by the year 1991, then total available quantity of water would be 1248 m.g.d. indicating that the 1991 water demand can be met leaving a good surplus for irrigation purpose.
3. For any further growth beyond 1991, technological advances in desalination of water at competitive cost and anticipated use of degrittied or partially treated sewage for irrigation on a wide scale in the region and also the use of tertiary treated sewage water by large industries may provide the answer.
4. Development of new towns in the region will need to be taken in order of availability of water in respective parts of the region.
5. In Planning the water supply for the region, some water must be left surplus for meeting irrigation needs. Industries requiring huge water demand may therefore require to be discouraged or allowed after due consideration of an integrated periodical assessment of the urban and rural demand with that for irrigation.
6. Bandharas on tidal rivers will doubtless provide some water for minor irrigation but Zilla Parishads will be the most appropriate authority to plan them and undertake their construction.

Water Pollution :-

7. Though the problem of water pollution in the Bombay Metropolitan Region is not very serious, the water pollution in respect of rivers Ulhas and Patalganga does deserve due attention. Setting up of a Pollution Control Committee with the Co-operation of M.I.D.C., local villages and municipal authorities may help in checking the pollution of these rivers.

8. Ulhas creek is polluted to a considerable extent by effluents of Shahad, Atale, and Ambernath industries and this has affected fish life. While the industries may be called upon to improve their effluents as far as possible, the question will have to be approached from the relative cost of complete treatment of their effluents as against the loss caused to the fishermen's families by danger to fish life. Alternatively, it might be possible to take the effluents of all these industries by constructing a separate channel from downstream of the Mohone weir and carry the said channel by the shortest possible alignment so as to discharge the wastes at a point near the confluence of Ulhas river with Thana creek.

9. In order to enable industries in Thana-Belapur area to carry their effluent drains right to Thana Creek through private lands, the local authorities in the area should be vested with powers as in the Bombay Municipal Corporation Act authorising laying of drains through anybody's property.

10. For preventing pollution of waters flowing down the Bhatsai river from the proposed dam to the weir near Padgha, new towns or further growths of existing ones in the river catchment in this stretch should be discouraged if not, banned.

Air Pollution :-

11. Extent of air pollution in the region is confined to some locations only mainly affected by industrial odours. The problem industries in these areas should be got studied

by the Central Public Health Engineering Research Institute at the cost of respective industries.

12. Some Monitoring Stations to keep a continuous watch on level of air pollution in Greater Bombay must be set up to watch the atmosphere and enable timely corrective action.

Drainage and Sanitation :

13. Water borne sewerage is a must for any town old or new and it will be a false economy to get along with any thing less than such a sewerage system when it is intended to extend piped water supply to all towns.

14. In self-help housing, a separate W.C. connected to the sewer should be insisted upon for each house. The cubicle of the W.C. may be flimsy and cheap and flushing tank may not be insisted upon if cost is to be minimised.

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