

Environmental Management

12.1 Introduction

12.1.1 The concentration of population and economic activities in Greater Mumbai and their continuing growth in the rest of the MMR have, over the years, given rise to complex problems of environmental management. They include, high level of air and water pollution, unsatisfactory solid waste management, exploitation of wetlands and countryside and risk of industrial disasters. Growth projections made elsewhere in this report imply an addition of 7.81 million people in MMR in the next two decades. These projections also imply to increased pace of development activities relating to housing, industry and recreational facilities, urban infrastructure and transport. The environmental impact of future growth together with backlog of environmental neglect of the past presents a formidable challenge for environmental management. It calls not merely for more stringent environmental regulations and other enforcement measures, but also consideration of the whole gamut of issues relating to environmental planning and management.

12.2 Review of the Past Efforts

12.2.1 The Regional Plan for MMR - 1973, prepared in the late 1960s, did not deal specifically with the environmental issues. However, the prevailing environmental concerns were reflected in the decentralisation policies that aimed at reducing congestion and overcrowding in Mumbai, improving its infrastructure and thereby improving the conditions of living and working. The Plan also aimed at achieving distribution of industries in a way that would avoid problems of air and water pollution. It suggested reduction of land allocation for industries in South Mumbai and Thane and proposed new industrial areas in the northern part of the Region to achieve better spatial distribution. The Plan also sought to ensure conservation of the countryside through provision of Green Zone and Forest Zone and confining of urban development to well defined urban centres.

These proposals of the Regional Plan were prompted more by traditional town planning concerns than by any conscious concern for environment. This is evident from the fact that no study on the state of the Region's environment was carried out while preparing the Regional Plan.

12.2.2 The Regional Plan for Extended MMR, 1985 reflected greater environmental consciousness than the Regional Plan, 1973. This was, firstly, because of the increased awareness and understanding of the environmental issues worldwide, and secondly, because the extended MMR, with its very low level of urbanisation, its beautiful coastline and its vast stretches of wetlands was considered as a conservation area. Some of the Plan's main objectives were:

1. To preserve places of scenic beauty and to see that the degradation of environment does not set in as a concomitant of development; and
2. To suggest measures for preserving ecological balance.

The Plan therefore designated most of the area of extended MMR as 'G' Zone. In order

to protect beautiful beaches, plantation areas and traditional village settlements along the coast from the inroads of urbanisation and indiscriminate tourist activities, a belt of 500 m. from the coast from Alibag to Rewas and along the banks of Amba and Patalganga rivers was designated as Recreational Zone-I (R-I), with severe restrictions on any new developments. Between Alibag and Rewas, the next 500 m. belt was designated as Recreational Zone-II (R-II) to permit only a limited range of activities.

12.2.3 Apart from the two foregoing Regional Plans, a number of planning and policy measures were taken in the past two decades to achieve environmental objectives. They are summarised as follows :

1. In 1971, CIDCO rejected a proposal to locate a major fertilizer complex near the site of proposed Nhava-Sheva Port in Navi Mumbai on the grounds of pollution, though the complex was seen as one of the major port-related activities to justify the building of the port.
2. In view of the pollution from industries in Thane-Belapur industrial area, the Development Plan of Navi Mumbai avoided any urban development alongside the industrial area and, instead, earmarked that land for regional park, though this was reversed a few years later. The Plan also proposed woodland corridors running east to west from Thane-Belapur industrial area to other areas of Navi Mumbai. The Development Plan of Navi Mumbai also provided for a special green belt around Jawaharlal Nehru Port (Nhava-Sheva Port).
3. The Industrial Location Policy (ILP) for MMR introduced in August, 1977, permitted renovation and modernisation of medium and large scale industries in Zone I and II (Greater Mumbai, Thane and Mira-Bhayander area) subject to strict enforcement of pollution control measures. In the revised ILP of 1984, units in Zone I and II were allowed additional built-up area and power to enable them to install pollution control equipment.
4. In 1986, the Development Plan of Navi Mumbai was amended to prohibit expansion of chemical industries in Thane-Belapur industrial area. The prohibition was, however, withdrawn a few years later.
5. In order to prevent pollution of drinking water source, in December, 1987, the State Government placed a ban on any new development within 3 km. on the either side of Bhatsa river, and decided to convert the area into a Protected Forest.
6. Since 1982, in accordance with the Prime Minister's directive, any development within 500 m. from the high tide line along beaches and sea-coast was prohibited. In February, 1991, this was formalised and made more comprehensive through a notification issued under the Environment (Protection) Act, 1986. The notification envisaged designation of areas between low tide and high tide and an area upto 500 m. from the high tide line along the coast as Coastal Regulation Zone and imposed severe restrictions on the developments within the Zone.
7. In view of the existence of some highly polluting and hazardous industries in the industrial areas in Thane, a Safety Zone of 1 km. was proposed around these industries in 1989. As an interim measure, new residential developments in the Safety Zone were prohibited. With some modifications, this Safety Zone has now become a

part of the revised Draft Development Plan of Thane. Since 1988, the State Government has made it mandatory for polluting industries to obtain environmental clearance under the Environment (Protection) Act, 1986 either for locating new units in MMR or carrying out extensions at the existing locations.

8. The planning proposal for Bandra-Kurla Complex, prepared by the MMRDA in May, 1979, provided for channelisation of highly polluted Mithi River to improve its flow, preservation of 184 ha. of mangrove areas including a bird sanctuary, and development of 15 ha. nature park.
9. The Development Plan for Greater Mumbai sanctioned during 1990-93 has earmarked as No Development Zone (NDZ) vast areas of wetlands along the sea coast on the west and along the Thane creek on the east. The Development Control Regulations sanctioned in February, 1991, have provided for severe restrictions of developments within 200 m. from high tide line.

12.3 Major Environmental Initiatives

12.3.1 In the 1970s and 1980s, a number of environment related studies and projects were undertaken in the Region. They include -

Rs. 216 cr. Mumbai Water Supply and Sewerage Project (MWSSP)-I (1974);

Rs. 1541 cr. MWSSP-II (1979-84);

Rs. 800 cr. MWSSP-III (currently under implementation);

Rs. 162 cr. MWSSP-I for 6 municipalities and 104 villages in the Region.

Although these projects and related studies have contributed significantly to the cause of environmental improvement, they were primarily infrastructure projects intended to improve water supply and waste disposal systems for Greater Mumbai and other major urban centres in the Region. While such infrastructure related projects and studies have continued, the last couple of years have witnessed new studies and projects focused primarily on environment. They are given below.

12.3.2 Study of Quarrying in MMR

The MMRDA commissioned through consultants a study on quarrying activities in MMR in 1990 (MMRDA and Kirloskar Consultants, 1991). The study was prompted by the environmental damage caused by indiscriminate quarrying for construction material practiced in the Region. The objectives of the study were :

1. to identify quarry sites for the future requirement of the construction materials in MMR;
2. to suggest methodology for scientific quarrying;
3. to suggest measures for minimising environmental damage caused by quarrying activity; and
4. to suggest measures for the restoration and rehabilitation of ravaged quarry sites.

Dealing comprehensively with the subject the study estimated construction material requirement for a period upto 2011, carried out engineering and geological investigations, assessed environmental factors and identified existing quarry sites that could be continued

and the new sites where quarrying could be permitted. The study recommended guidelines for safe scientific and environmentally desirable methods of quarrying. It also emphasised the need to restore and rehabilitate abandoned quarry sites and demonstrated the technique through case studies. The study also dealt with legal, procedural and institutional aspects of the quarrying activities and made useful recommendations.

12.3.3 Metropolitan Environmental Improvement Programme (MEIP)

In response to the rapidly growing environmental problems in the urban areas in Asia, the World Bank initiated in 1990 a Metropolitan Environmental Improvement Programme in 5 major Asian cities including Mumbai. The programme recognised the inadequacy of traditional sectoral programmes and policies in addressing the environmental problems and adopted cross-sectoral and region-wide approach in planning, policy making and regulations for ensuring more effective environmental management. The programme was designed to improve environmental quality in MMR by assisting the Government to prepare and implement environmental management strategy and identify high priority investment projects in the Region. In the first phase of the programme, following studies were undertaken :

1. Environmental Management Strategy and Action Plan for MMR.
2. Integrated Urban Environmental Management in Chembur and Thane-Belapur industrial areas.
3. Municipal Solid Waste Management in Greater Mumbai and in peripheral municipality.

In June, 1994, the Study on Environmental Management Strategy and Action Plan was completed and other studies were in progress. The study has presented the state of MMR's environment covering 14 sectors and has examined institutional, financial and legal aspects of environmental management in the Region (GOM, Coopers & Lybrand and AIC, 1994). The study has made detailed recommendations on different aspects of the environmental management in the Region. It has also recommended Action Plan and has defined priorities. One of the more significant aspects of the study is its elaboration and guidance on the strategic environmental planning and its linkage with the revision of Regional Plan.

12.3.4 URBAIR

The Urban Air Quality Management Strategy and Action Plan (URBAIR), which is an extension of MEIP efforts, aims at improving air quality management in 4 Asian cities including Greater Mumbai (GOM et. al., 1994). The study has assembled and analysed information on sources and quantity of emissions and has provided overall assessment of Greater Mumbai's air quality. This assessment points to TPS and PM 10 as the most critical pollutants for Greater Mumbai. The study has also estimated economic cost of damage caused by air pollution, attempted pollution forecast for the year 2010, and examined the present institutional framework for air quality management. Based on this comprehensive assessment, the study has recommended abatement measures for transport, industrial, municipal and domestic sectors, and has indicated their costs time-frame and priorities. Finally, it has proposed an Action Plan which consists of technical and other measures for pollution abatement and improvement in data base, and regulatory and institutional framework for air quality management in Greater Mumbai.

12.4 Environmental Status

12.4.1 The quality of MMR's environment is largely determined by the quality of water bodies, ambient air, and the standard of solid waste collection and disposal. The overall quality of the environment is perceived to be very unsatisfactory. This is on account of the pollution of creeks and coastal waters from domestic and industrial effluent, air pollution from industries and automobiles and poor standard of refuse collection and disposal, especially, in the urban areas. Brief outline of the MMR's current environmental status as obtained from the study of Environmental Management Strategy and Action Plan for MMR (GOM, Coopers & Lybrand and AIC, 1994) and other environmental studies is as follows :

12.4.2 Water

Of the 9 major rivers in MMR, Tansa, Bhatsa and Barvi rivers are used for drinking water purposes, whereas Panvel, Bhogeshwari and Amba rivers are used for discharging effluents. Ulhas and Patalganga are used for both purposes: drinking water in the upper reaches and effluent discharge in the lower reaches. There is a wide variation in the quality of waters in these rivers. The water quality parameters in these rivers are given in Table-12.1.

The coastal water system in MMR consists of coastal waters along its coast line and 6 major creeks, namely, Vasai, Manori, Malad, Mahim, Thane and Dharamtar creek. It receives 2181 mld/day of domestic waste with a total BOD load of 425 t/day, and 243 mld/day of industrial waste with BOD load of 24.3 t/day. The bulk of this is either untreated or only partially treated. The sewage pollution from Greater Mumbai has affected coastal water and made it unfit for any recreational purpose, such as, swimming or sailing. The National Institute of Oceanography (NIO) has been monitoring the quality of coastal waters since 1986. This indicates that the quality as judged by some critical parameters, such as, salinity, dissolved oxygen (DO), biochemical oxygen demand (BOD), nitrate,

Water Quality of Rivers in MMR									
	Yearly Averages ⁷ in mg/l								
	PH	D.O.	B.O.D.	Total Alkalinity	Total Hardness	Nitrates	Chlorides	PO ₄	SO ₄
Patalganga river									
Khopoli (Upstream)	7.56	10.05	6.91	67.61	86.61	0.16	24.00	0.21	14.06
Kharpada Bridge (Downstream)	7.32	5.74	5.04	53.71	246.29	0.37	1636.57	0.30	157.52
Ulhas river									
Upstream of NRC Bund	7.70	6.50	3.91	48.42	67.71	0.13	41.42	0.18	11.53
Bhayander Station (Downstream)	7.40	6.60	4.96	100.00	126.78	0.15	12167.00	1.45	99.01
Kalu river	7.20	6.32	9.64	87.00	0.36	1.73	539.00	0.38	135.40
Bhatsa river	7.55	6.16	6.40	76.00	127.60	1.30	695.30	0.62	67.40

Source : Current Status Report - April, 1993; Study on Environmental Management Strategy and Action Plan for MMR. (GOM-Coopers&Lybrand-AIC 1993)

Table-12.1

and phosphates has been worsening. The comparative picture of the quality of water in different coastal areas is as given in Table-12.2

Presence of heavy metals (Zn, Mn, Sr, Cu, Pb, Ni, Co, Cd and Cr) pollution is observed in some water bodies in MMR. Studies indicate that Ulhas River, with its tributaries Kalu and Waldhuni, Patalganga river, Thane Creek and Mumbai Harbour receive effluent discharges that contain heavy metals. The presence of heavy metals is noted in the water, sediments, suspended particles and fish, but their impact is localised around discharge points and where their presence is studied for long time, like in Mumbai Harbour, the levels of concentration do not indicate increasing trend. The assessment of water quality of Thane Creek carried out as a part of the study on Integrated Urban Environmental Management in Chembur and Thane-Belapur Industrial Area (IUEM) indicates that heavy

Comparison of Physico-chemical Parameters as recorded in different Coastal Regions of MMR during 1986 and 1991						
Stations	Year	Salinity (ppt)	BOD mg/l	DO mg/l	NO3/N mg/l	PO4-P mg/l
Mumbai (Colaba)	1986	36.30	0.49	5.61	12.87	42.16
	1991	37.80	0.91	4.80	644.00	239.00
Thane Creek	1986	35.84	0.66	4.45	10.25	64.45
	1991	36.41	3.20	3.90	781.00	306.00
Mahim Bay	1986	36.10	1.70	4.10	30.00	189.00
	1991	36.89	3.10	3.70	325.00	148.00
Versova Creek	1986	30.91	1.10	2.89	59.00	632.00
	1991	32.90	2.80	1.90	136.00	547.00
Vasai Creek	1986	35.74	1.00	3.70	42.00	11.69
	1991	36.00	1.98	2.16	630.00	39.00

Table-12.2

Source : NIO Studies 1986 and 1991 quoted in the Current Status Report, April, 1993, Study on Environmental Management Strategy and Action Plan for MMR

metal concentrations are well below the source-based limits for discharge to marine waters prescribed by MEF. Mercury, for which ambient standards exist, is found to be below ISI-recommended limits of 0.0003 mg/l. for bathing and recreational waters (GOM, Ecology and Environment, 1993).

The water quality in MMR is monitored by a number of organisations, namely, MPCB, MCGM, MWSSB and MIDC. The MPCB has classified the water bodies in MMR into following categories :

River Waters	Suitable for unfiltered public water
Class A I	supply with approved disinfectants.
River Waters	Suitable for public water supply with
Class A II	approved treatment equal to coagulation, sedimentation and disinfection.
Saline Waters	Suitable for commercial fishing and
(Estuaries &	recreation (non-contact).
Coastal Waters) SW II	

The MPCB monitors water quality in Ulhas, Kalu, Bhatsa and Patalganga rivers and MCGM monitors water quality in Bhatsa and Tansa rivers, and Vihar and Tulsi lakes. All drinking water sources are monitored, but not all water bodies used for effluent discharge

are monitored. The water quality in Amba, Bhogeshwari and Powai lakes is not monitored.

Ground water does not make a significant contribution to the overall water supply in the Region. It is used as an important supplementary source in certain parts of the Region, such as, Vasai-Virar, Bhiwandi, Kalyan, Ulhasnagar, Thane, Alibag, Pen and Panvel areas. The coastal area of Vasai-Virar region has large number of wells which supply water for domestic as well as irrigation purpose. The rapid growth of urban development in this region and inadequacy of piped water supply have led to over abstraction of water from these wells. This has resulted in the intrusion of sea water into the underground reservoir affecting the quality of the well water. Apart from this, ground water in certain parts of the region is polluted on account of microbial contamination and excess concentration of nitrates. The parameters like TDS, Fe and F exceed the drinking water standards prescribed by the Health Ministry.

12.4.3 Ambient Air

The ambient air quality in MMR is adversely affected by air pollution from domestic, industrial, power, and transport sectors. The major pollutants are SO₂, NO₂, SPM, HC and CO. The emission inventory given in the Table-12.3 indicates that, in MMR, 2085 t/day of pollutants are emitted from these sources. Of these, 1511 t/day or 72.47% is from sources in Greater Mumbai.

The measurement of the concentration of individual pollutants indicates that in 1992 the annual averages of SO₂, NO₂, and SPM in Greater Mumbai were within the minimum standards prescribed by the Central Pollution Control Board (CPCB), though maximum values at times were exceeded (Table-12.4).

The geographical variation of pollution concentration in Greater Mumbai is indicated in Figure-12.1, 12.2 and 12.3 through Iso-lines of air pollution. These Iso-lines are derived from the pollution data regularly collected by the MCGM from the 22 air sampling stations in Greater Mumbai. The peak values of Iso-lines at sampling stations represent mean values of maximum daily pollution level over a three months period following monsoon, which is generally considered to be a worst period for the pollution.

The trend analysis over a period of time indicates that the air quality in Greater Mumbai has improved in terms of SO₂ largely on account of change of fuel used in industries. Coal is no longer used, except partially in a thermal power plant. Many industries either use LSHS oil or natural gas.

The NO₂ levels however are rising. The annual average of NO₂ which was 11 mg/cu.m. in 1978 in Greater Mumbai has increased to 45 mg/cu.m. in 1991. These levels are still far below the CPCB's standard of 120 mg/cu.m. The consistent rise in the NO₂ level is because of the increase in pollution from auto-vehicles.

The SPM values which are generally below the prescribed standard of 500 mg/cu.m. exceed the standard more frequently than permitted by CPCB (i.e. more than 5% of the time). In Parel, Sion and Maravali-Mahul area it has exceeded the CPCB standard 15 to 35% of the time. Besides the industrial and transport sources, the SPM is contributed by smoke from wood and from fuel used for cooking in slum areas, open air burning of garbage and variety of construction activities. The SPM from the transport source is mainly from diesel

Emission Inventory of Air Pollutants for MCGM and MMR															
Sector	MCGM					MMR Other than MCGM					Total MMR				
	Pollutants emitted t/day					Pollutants emitted t/day					Pollutants emitted t/day				
	SO ₂	NO ₂	SPM	HC	CO	SO ₂	NO ₂	SPM	HC	CO	SO ₂	NO ₂	SPM	HC	CO
Domestic Sector	7.36	3.53	0.45	1.04	1.44	4.90	2.35	0.30	0.71	0.97	12.26	5.88	0.75	1.75	2.41
Industrial& Commercial Sector															
Fuel Burning	142.16	41.73	10.81	0.89	2.36	115.79	28.42	5.74	0.73	1.65	257.95	70.15	16.55	1.62	4.01
Process emission	3.20	3.80	27.00	-	-	6.00	2.20	26.50	-	-	9.20	6.00	53.50	-	-
Sub-Total	145.36	45.53	37.81	0.89	2.36	121.79	30.62	32.24	0.73	1.65	267.14	76.15	70.05	1.62	4.01
Power	12.24	45.50	2.94	0.30	2.50	3.70	22.18	0.65	0.42	0.72	15.94	67.68	3.59	0.72	3.22
Transport	14.78	170.64	48.34	196.72	770.51	4.11	41.23	13.99	57.20	234.69	18.89	211.87	62.33	253.92	1005.20
Total	179.74	265.52	89.54	198.95	776.81	134.50	96.44	47.18	59.06	238.03	314.23	361.58	136.72	258.01	1014.84
Total emission of all pollutants tonnes/day			1511.00					575.00				2085.00			

Emissions of chlorine from chlo-alkali industries in MMR is about 0.55 tonnes/day

Emissions of Ammonia from fertilizer plants in MMR is about 8 tonnes/day.

Table-12.3

NO ₂ , SO ₂ and SPM Concentration at different Air Quality Monitoring Stations in Greater Mumbai 1992-93 (in mg/m ³)														
Pollutant	AQM Station	Location	Period			Period			Period			Period		
			March-May (Summer)			June-September (Monsoon)			October-November (Post Monsoon)			December-February (Winter)		
			Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
NO ₂	A1	Colaba	98	19	44	60	11	25	87	34	53	79	43	67
	A3	Worli	85	24	59	50	18	32	130	54	85	126	49	90
	A4	Dadar	65	15	46	66	19	31	85	42	58	144	47	90
	A5	Parel	81	34	58	90	25	43	114	81	96	129	58	99
	A6	Sewree	78	33	54	59	8	35	95	37	70	104	104	104
	A7	Sion	131	42	86	72	67	70	130	54	85	164	40	115
	A10	Andheri	72	18	46	47	8	28	100	41	70	89	27	66
	A11	Saikinaka	98	13	43	76	23	41	91	46	63	86	76	82
	A12	Jogeswari	70	22	45	37	5	18	69	25	44	68	56	61
	A13	Ghatkopar	—	—	—	40	12	24	69	42	59	92	92	92
	A14	Bhandup	—	—	—	37	7	22	74	29	49	75	52	64
	A15	Mulund	70	14	38	44	4	26	54	31	43	100	26	52
	A16	Borivali	48	9	31	20	6	13	41	28	36	79	25	46
	A18	Chemb-urnaka	124	47	71	78	32	49	124	38	62	75	54	65
	A19	Marivali	116	42	82	90	31	54	103	45	68	89	63	75
	A20	Aniknagar	84	20	45	33	12	24	68	22	45	73	73	73
	A21	Mahul	16	16	16	35	10	22	19	19	19	—	—	—
	A22	Mankhurd	—	—	—	28	6	17	53	36	43	—	—	—
SO ₂	A1	Colaba	34	6	19	7	4	6	12	4	8	30	6	23
	A3	Worli	52	9	24	52	6	12	72	11	45	91	22	46
	A4	Dadar	46	6	15	37	6	16	28	6	18	67	14	38
	A5	Parel	49	18	30	76	7	36	32	20	25	50	12	30
	A6	Sewree	99	40	58	180	6	53	65	29	47	65	65	65
	A7	Sion	48	6	22	8	6	7	—	—	—	47	19	33
	A10	Andheri	60	7	31	44	6	13	101	25	57	83	18	18
	A11	Saikinaka	28	6	14	11	6	8	34	8	26	53	17	38
	A12	Jogeswari	33	6	12	10	3	6	19	6	11	34	20	27
	A13	Ghatkopar	—	—	—	8	6	6	66	8	39	40	40	40
	A14	Bhandup	—	—	—	75	6	22	60	54	56	149	38	97
	A15	Mulund	78	6	33	16	6	10	64	6	35	110	6	54
	A16	Borivali	9	6	7	6	6	6	8	6	7	41	4	11
	A18	Chemb-urnaka	22	7	14	19	6	10	36	15	28	63	42	53
	A19	Marivali	33	6	16	45	4	10	25	6	14	26	12	19
	A20	Aniknagar	62	6	24	33	8	14	37	16	25	40	37	39
	A21	Mahul	10	10	10	22	7	12	6	6	6	—	—	—
	A22	Mankhurd	—	—	—	8	6	6	19	6	10	—	—	—
SPM	A1	Colaba	225	99	138	241	68	130	191	126	157	255	88	185
	A3	Worli	257	132	206	266	87	161	317	121	226	370	222	294
	A4	Dadar	285	154	199	342	55	146	303	303	205	543	237	349
	A5	Parel	474	205	324	330	74	173	411	210	337	460	306	374
	A6	Sewree	223	77	147	362	64	194	229	86	148	191	191	191
	A7	Sion	416	168	285	306	240	273	—	—	—	449	248	343
	A10	Andheri	364	160	231	335	83	169	390	128	270	665	238	343
	A11	Saikinaka	330	160	244	319	74	171	296	178	226	302	241	272
	A12	Jogeswari	471	156	276	321	58	185	412	163	256	505	396	435
	A13	Ghatkopar	—	—	—	275	82	149	250	200	230	362	362	362
	A14	Bhandup	—	—	—	483	58	178	277	196	231	351	229	301
	A15	Mulund	343	133	229	283	59	151	256	136	196	506	223	324
	A16	Borivali	342	156	211	200	39	115	238	172	197	775	37	318
	A18	Chemb-urnaka	434	175	301	519	98	216	238	172	197	425	276	350
	A19	Marivali	600	282	409	624	77	252	396	217	271	447	402	429
	A20	Aniknagar	496	158	260	304	56	142	248	149	149	276	276	276
	A21	Mahul	203	203	203	123	72	96	98	98	98	—	—	—
	A22	Mankhurd	—	—	—	136	43	69	269	152	219	—	—	—

Source : Municipal Corporation of Greater Mumbai.

Note : Data for Stations namely; A2-Baultank, A8-Khar, A9-Santacruz and A17-Tilaknagar are not available.

Table-12.4

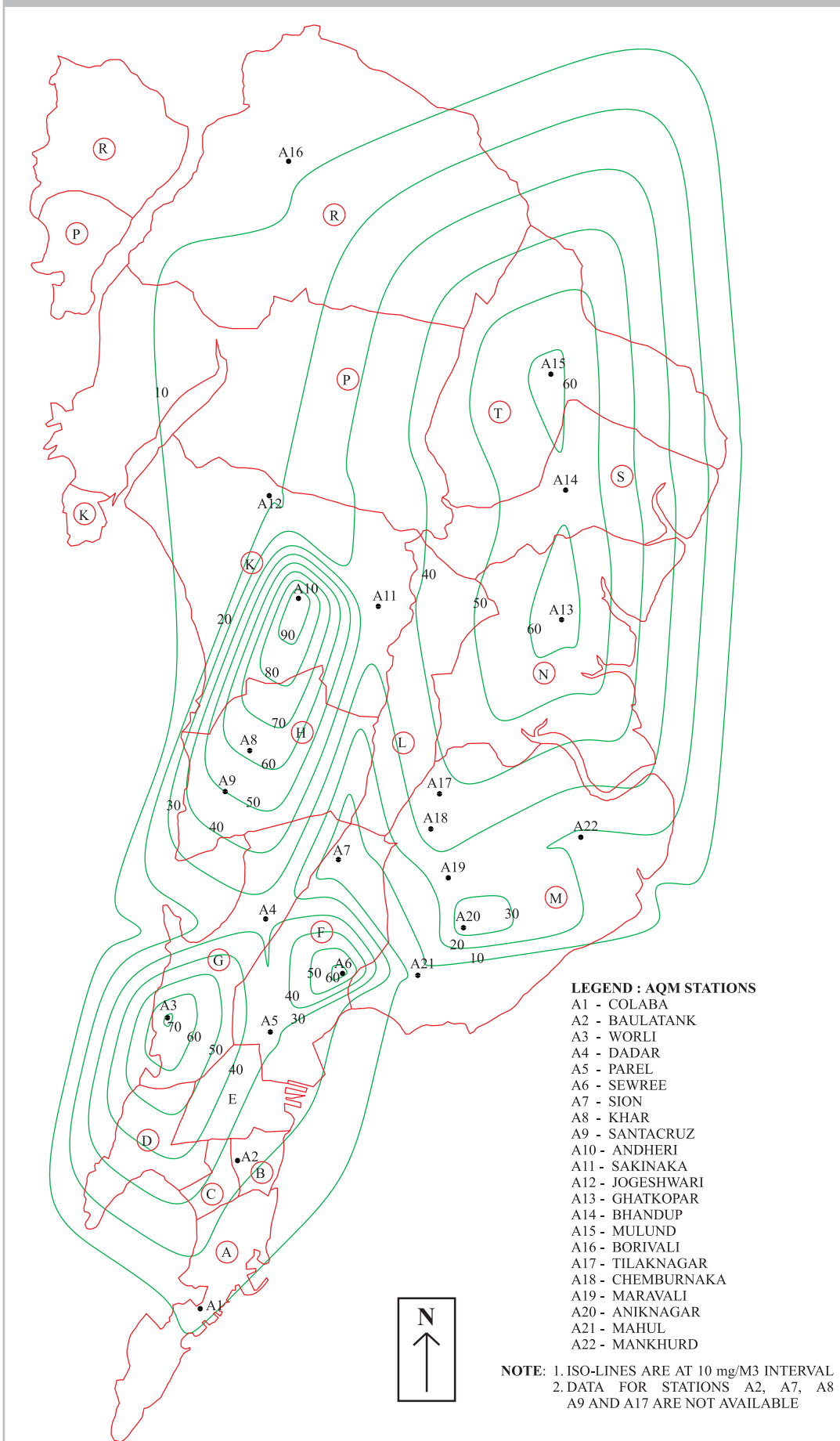
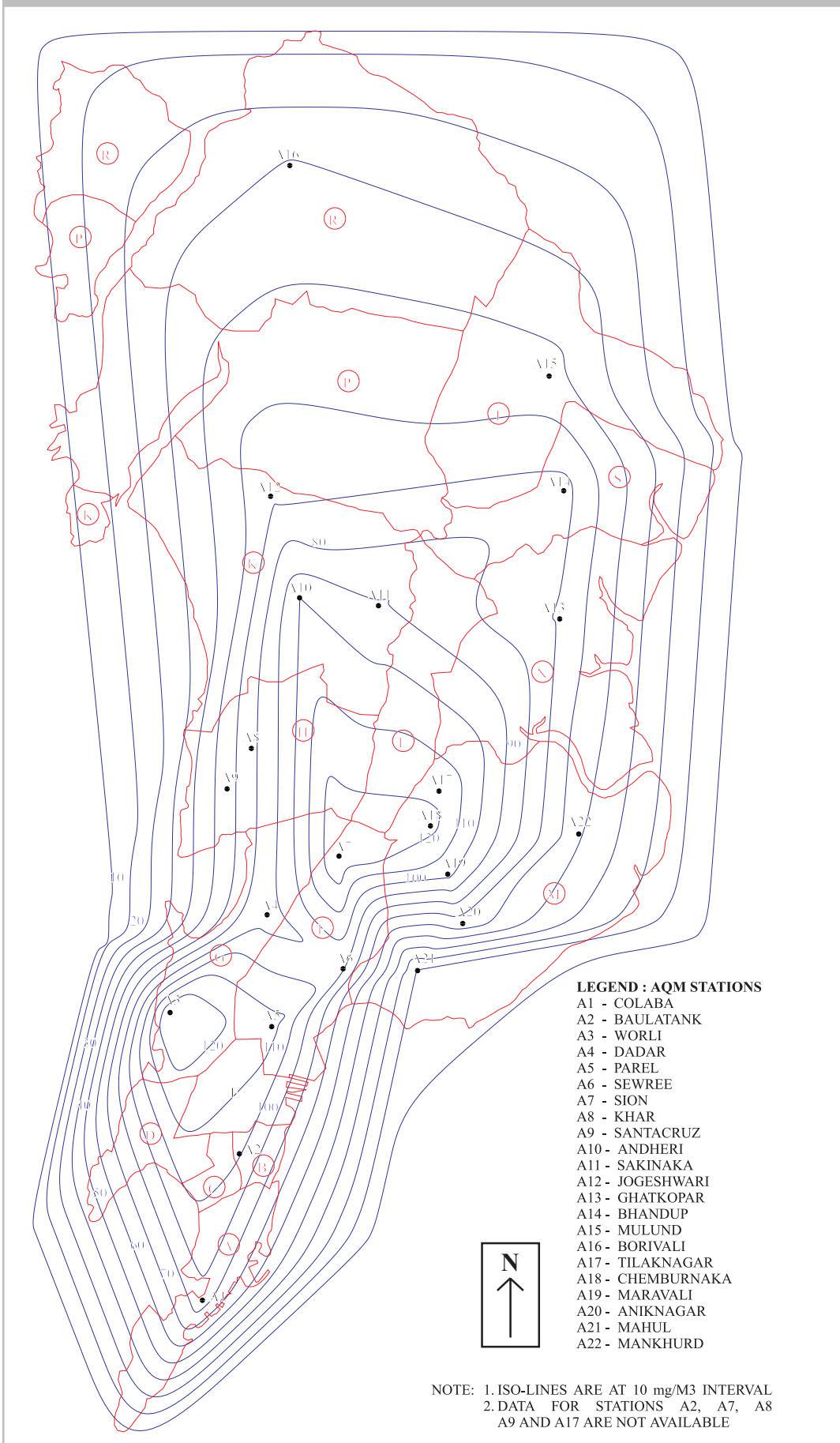
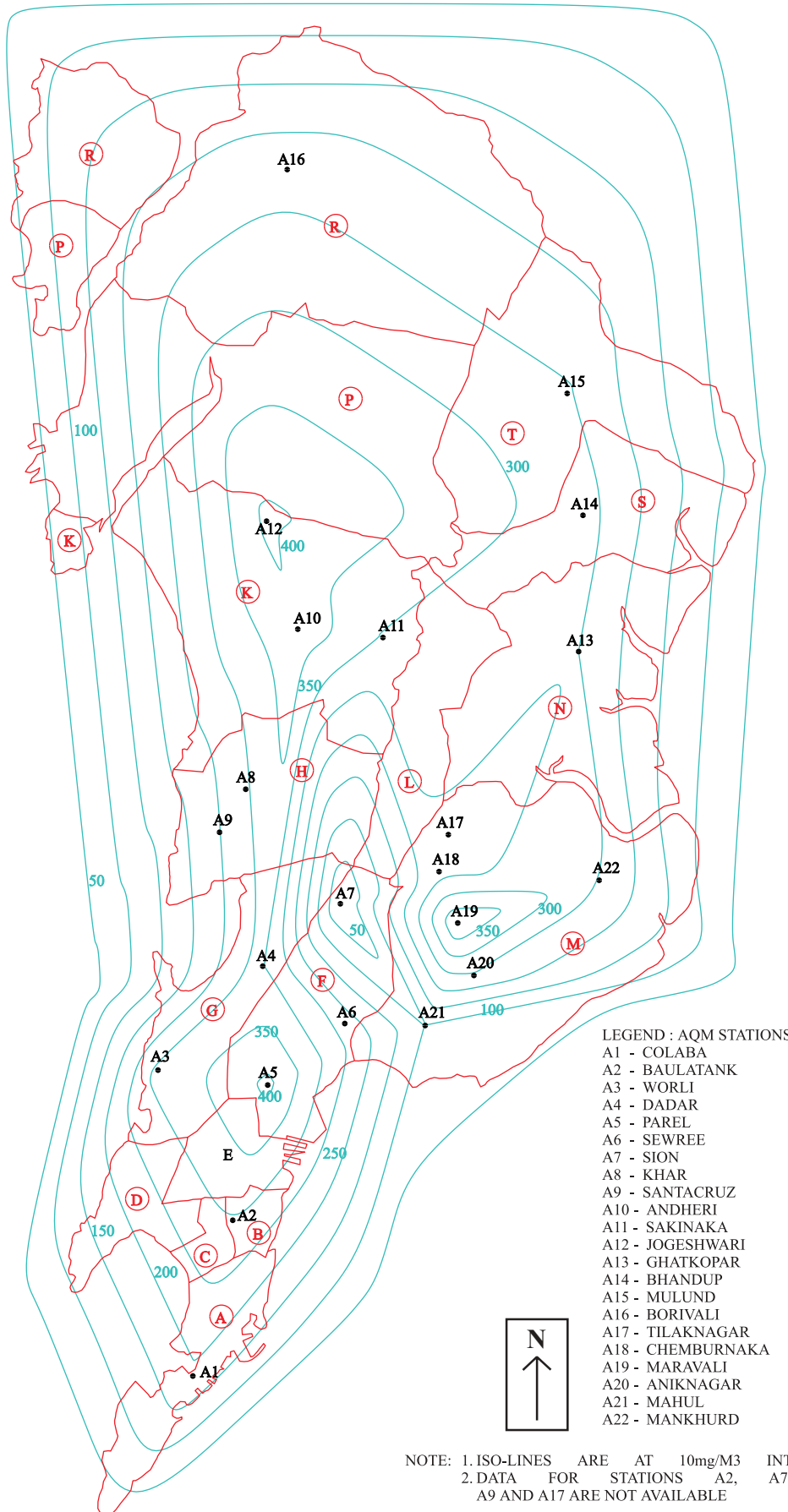
Greater Mumbai

Figure-12.1

Greater Mumbai**Figure-12.2**

Greater Mumbai**Figure-12.3**

trucks and buses, and from two-stroke engines of auto-rickshaws and scooters. Measurement of air pollutants at some road junctions in Greater Mumbai performed as a part of the URBAIR Study reveals very high level of SPM at Mahim Junction (3170 mg/cu.m.), Maheshwari Udyan (1653 mg/cu.m.) and Sion Junction (1094 mg/cu.m.) (Table-12.5). The combination of smoke, dust, heat, humidity and gases create oppressive conditions which are responsible for Mumbai being perceived as a highly polluted city. Thane and Kalyan are also equally, and at times, even more polluted than Greater Mumbai (Table-12.3).

12.4.4 Solid Waste

Greater Mumbai, Thane, Kalyan, Navi Mumbai, and other municipal towns in MMR generate 4305 t/day of solid waste and 2485 t/day of debris and silt. Of this 74.87% or 4002 t/day is generated in Greater Mumbai alone (Table-12.6). Generally, refuse is collected from the common road-side collection points and is transported in trucks to the dumping ground. Inadequate collection frequency, inaccessibility of certain areas, such as, slums, throwing of refuse in open drains, gutters, and storm water channels and scavenging at collection bins by animals and waste-pickers result in very insanitary conditions.

Results of Ambient air monitoring at different traffic junctions in Greater Mumbai

(mg/m ³)								
No.	Site	Monitoring period	SO ₂			NO ₂		
			N	AVG	MAX	N	AVG	MAX
1	C.S.T.	2.12.91 6.12.91	12	89	127	12	175	296
2	Nana Chowk	9.12.91 13.12.91	12	60	104	12	124	162
3	Maheshwari Udyan	20.01.92 24.01.92	12	117	162	12	156	210
4	Mahim	24.03.92 26.03.92	8	43	120	8	90	107
5	Worli Naka	22.04.92 25.04.92	9	38	80	9	56	83
6	Sion Circle	27.04.92 30.04.92	9	90	125	9	117	167
No.	Site	Monitoring period	SPM			Co-ppm		
			N	AVG	MAX	N	AVG	MAX
1	C.S.T.	2.12.91 6.12.91	12	651	1072	15	11.1	13.3
2	Nana Chowk	9.12.91 13.12.91	12	480	555	23	6.5	7
3	Maheshwari Udyan	20.01.92 24.01.92	12	1309	1653	39	7.5	9.7
4	Mahim	24.03.92 26.03.92	8	1144	3170	31	6.2	15.6
5	Worli Naka	22.04.92 25.04.92	9	542	668	30	5.1	9.6
6	Sion Circle	27.04.92 30.04.92	9	708	1094	30	5.8	9.7

Table-12.5

Large quantity of solid waste is also generated by the industries in MMR. It is estimated that the large, medium and small industrial units numbering 8858 generate 508 t/day of solid waste (Table-12.7). Non-salvageable industrial waste is collected by the municipal trucks and disposed of along with municipal waste.

Industries in MMR produce variety of toxic and hazardous waste. The disposal of such waste is regulated under Hazardous Waste (Management & Handling) Rules, 1989, framed under the Environment (Protection) Act, 1986. So far, 49 industrial units in the Region have sought MPCB's permission for disposal of 4397 tons per year of toxic and hazardous waste generated by them. Since no specific disposal site has been identified

Municipal Solid Waste in MMR			
Area	Quantity of Refuse		Quantity of Silt, Debris Tons/Day
	Tons/Day	Kg/Capita/Day	
Greater Mumbai	4500	0.4 - 0.5	1500
Thane	400	0.4 - 0.5	200
Kalyan	260	0.4 - 0.5	25
Navi Mumbai	163	0.3 - 0.4	N.A.
Other Towns	500	0.3 - 0.35	N.A.

Source: 1. For Gr.Mumbai: Phase I Report on Solid Waste Management in Greater Mumbai (GOM - NEERI 1994) **Table-12.6**
 2. For Others: Current Status Report April 1993, Study on Environmental Management Strategy and Action Plan for MMR (GOM - Coopers&Lybrand-AIC,1993)

by the MPCB, these units have been permitted different methods of disposal, such as, on-site land filling, off-site land filling, sale of waste or incineration.

The disposal of the municipal waste, which includes industrial waste also, is carried out by open dumping and not by sanitary land-fill method. Although authorised dumping

Estimated Industrial Solid Waste Production				
Area	Size of Industry	Number of Industries	Estimated Solid Waste Average Tons/Day	Estimated Solid Waste Produced Tons/Day
Greater Mumbai	Large	59	1.00	59
	Medium	430	0.30	129
	Small	4050	0.02	81
Thane	Large	17	1.00	17
	Medium	83	0.30	25
	Small	404	0.02	8
Kalyan	Large	23	1.00	23
	Medium	46	0.30	14
	Small	1192	0.02	24
Navi Mumbai	Large	31	1.00	31
	Medium	95	0.30	29
	Small	1260	0.02	25
Other Towns	Large	10	1.00	10
	Medium	34	0.30	10
	Small	1124	0.02	23
Total		8858	6.60	508

SOURCE : Same as Table 12.1

Table-12.7

sites are identified in Greater Mumbai, Thane, Kalyan and Navi Mumbai, unauthorised dumping, especially of debris and industrial waste, occurs at many places. Authorised dumping sites are poorly managed.

In Greater Mumbai, the dumping sites, namely, Deonar, Mulund, Malad and Gorai are located along the creeklets. At these sites, the waste is deposited below high tide level without any soil cover. The creek water gets polluted on account of direct contact with refuse and on account of leachates. The refuse is not properly compacted; with the result, the space is not optimally utilised and the refuse does not get decomposed even after 3 years. Strangely, one of the worst problems faced at these sites, particularly, at Deonar, the biggest of the 4 sites, is of air pollution. This arises from daily burning of refuse by the waste-pickers to separate recyclable material from the refuse. The study of Solid Waste Management in Greater Mumbai (GOM and NEERI, 1994) indicates that every day 6.3 tons of pollutants, namely, SPM, SO₂, NO₂ and CO are emitted in the air from these sites. Apart from this, the poor sanitary conditions at these sites encourage proliferation of flies, mosquitoes, rodents and vermin. This causes great nuisance and health hazards to the nearby residential localities and to the waste-pickers working on these sites.

12.4.5 Noise

Increasing traffic on the roads, railways and at the airports is a major cause of noise pollution in Mumbai. Noise pollution in Mumbai is also caused by industrial and commercial activities and by a number of public activities like processions, festivals, political meetings, etc. Some indication of the level of noise pollution prevalent in Mumbai can be obtained from the following observation recorded in 1987 (Table-12.8).

The survey of two busy traffic junctions in Mumbai, Worli Naka and Sion Hospital, carried out by MMRDA in August, 1989 indicates that maximum noise levels of 90 to 94 dB has been occasionally experienced. These levels are much higher than the standards prescribed by the Central Pollution Control Board. Areas outside Mumbai, particularly Thane and Kalyan are also perceived to be similarly noisy, primarily on account of rickshaws and commercial vehicles.

12.4.6 Coastal Areas

The MMR has 167 km long coastline that is highly indented with creeks, estuaries and bays. While the western coastline exposed to the Arabian Sea consists of sandy beaches, exposed rocks, cliffs and sea walls and structures in South Mumbai, the interior coastline, along creeks and rivers, consists of mud flats, marshes, mangroves, salt-pans, exposed

Noise levels in Mumbai (1987)		
	Areas	Noise Level in dB (A)
1.	Major Traffic Junctions	77 - 88
2.	Areas around Airport	92 - 94
3.	Residential with Traffic	60 - 80
4.	Industrial areas with Traffic	70 - 85

Source : Current Status Report- April 1993. Study on Environmental Management Strategy and Action Plan for BMR (GOM-Coopers & Lybrand-AIC, 1993)

Table-12.8

rocks, pebbled beaches, etc. The coastline has undergone extensive changes over the last several decades on account of land reclamation. This has interfered with the natural erosion process and is believed to have caused intense erosion that is witnessed in some parts of the Region, such as, Versova.

MMR does not have any designated wetlands of national importance, but its wetlands have rich ecological diversity. Wetlands are considered to be highly productive and valuable eco-systems performing many useful functions, such as, flood control, shoreline stabilisation, providing habitat to flora and fauna, retention of sediments, nutrients and toxicants and providing food chain support.

The wetlands in the Region are being reclaimed on large scale for accommodating growing urban population and economic activity. The wetlands are also converted into agricultural lands through khar-land development programme. Apart from this, wetlands are used for production of salt, fisheries and for dumping of solid waste.

According to the existing land use map of MMR, the wetlands account for 360.03 sq.km. area of the Region. Although some land use analysis using earlier satellite imageries indicate wetland area in 1985 to be 235.8 sq.km. (SAC and MMRDA, 1992), it would be erroneous to conclude that the wetlands in the Region have increased between 1985 and 1993. The smaller figure recorded for 1985 is probably on account of low resolution of earlier satellite imageries i.e. 80 m. resolution as against the high resolution i.e. 20 m. of the later imageries which permits a more accurate delineation of wetlands. In fact, the wetlands have reduced significantly in the last two decades on account of reclamation. In Navi Mumbai alone, after 1985, over 69.8 sq.km. of wetlands have been reclaimed for urban development.

Large tracks of the coastal wetlands in the Region are covered with mangroves. The better amongst them can be seen in Mahim creek (along Mithi River, sea coast of Mumbai between Ghatkopar and Mulund, Thane-Diva area, northern banks of Ulhas river and some parts of Navi Mumbai and Alibag. While in most parts of Greater Mumbai, mangroves have reached a height of about 4 to 5 m., mangroves with a height of 10 m. and more can be seen on some parts of bank of Ulhas river.

Mangrove forest provides shelter to variety of birds and fish life. It includes egrets, herons, ibis, kingfisher, tesus and sea-eagles. Mangroves also help breeding of prawns, lobsters, shrimps and crabs. Despite its great usefulness, mangroves are facing destruction in many places, either because of land reclamation or because of periodic cutting by local fishermen who use them as cheap firewood.

Some stretches of MMR's coastline have beautiful plantations. Areas of Vasai to Arnala in the north are famous for coconut plantations and horticultural farms of bananas and vegetables and flowers. Alibag to Mandwa stretch is equally beautiful and is lined with palm, coconut, betel-nut, causirina and bamboo plantations. Areas of Manori, Aksa and Gorai in Greater Mumbai have also good plantations along the coast. These plantations are interspersed with small village settlements which are characteristic of west coast development. These coastal areas need to be preserved for their extraordinary environmental quality.

Although a number of agencies and Government Departments are concerned with one or other aspects of management of coastal areas, no agency except the Revenue Department, to some extent, is responsible for monitoring development in the coastal areas. With effect from 19th February, 1991, the Ministry of Environment and Forests, Government of India, by a Notification issued under the Environment (Protection) Act, 1986, has declared all areas upto 500 m. from the high tide line as Coastal Regulation Zone. The notification requires the State Government to prepare Coastal Zone Management Plan. All coastal developments in future will be regulated in accordance with the Coastal Zone Management Plan and the notification. Despite this notification, no monitoring agency has yet been designated to regulate development in coastal areas.

12.4.7 Hilly Areas

Like wetlands, hills are a prominent landscape feature of the Region. They are unique in their charm and aesthetic quality and offer challenge and opportunity to nature lovers, hikers, picnickers and those in search of out-door recreation. Though remote hills have largely remained unaffected by development activities, those in the vicinity of urban areas have suffered. The most visible impact has been through quarrying activities for stone and earth. Indiscriminate and unscientific quarrying has ruined the landscape of the area and created problems of air quality and noise pollution and have endangered the safety of those living and working in the vicinity of quarries. Exhausted quarries are abandoned leaving behind ugly and unsightly landscape. No attempt is made to restore or rehabilitate the quarry sites.

Monitoring of the quarrying activities is done nominally through the permissions issued under Mumbai Minor Mineral Extraction Rules, 1955, permissions under Explosives Rules 1983 and lease conditions for Government land granted by the Revenue Department. Where crusher is installed at quarry sites, consent from MPCB is also required. The Environment Department has also stipulated guidelines subject to which quarry permissions are granted but there is no agency which is responsible for monitoring the implementation of these guidelines.

12.5 Issues in Environmental Management

12.5.1 The foregoing review of the state of the Region's environment and the more exhaustive assessment carried out in the series of studies under MEIP and URBAIR between 1991-94 raise a wide range of issues in environmental management in the Region. They can be broadly grouped as follows:

1. Technical issues relating different sectors.
2. Environmental planning issues.
3. Legal and institutional issues.
4. Issues relating to data-base.

While consideration of all these issues is necessary for achieving the overall objective of environmental improvement in the Region, in the context of the revision of the Regional Plan, it would be appropriate to focus only on the environmental planning issues. Other issues have been considered at length, and after wide consultation, detailed recommendations have been made.

As mentioned in para 12.2.1, the environmental considerations were largely absent in the Regional Plan-1973. Although in the Regional Plan for Extended MMR-1985 and the plans and policies introduced thereafter greater attention was paid to the environmental issues, there has not been much effort to consider land use planning and environmental protection in an integrated manner. Such efforts are central to environmental planning that is widely recognised as an important tool in environmental management. The revision of the Regional Plan is seen as opportunity to pioneer environmental planning in the region and provide framework through policies, regulations and guidelines to ensure consideration of environmental concerns in the future land use changes and development projects. In this regard, some of the specific environmental issues that need attention are as follows.

Loss of wetlands on account of reclamation, their contamination through dumping of solid waste and proliferation of slums, and destruction of mangroves are the critical problems related to wetlands. The EMS study has called for a wetlands policy for MMR to prevent their further degradation. The MEF notification of 19 th Feb. 1991 on Coastal Regulation Zone (CRZ) is, in fact, a national level policy framework within which Coastal Zone Management Plans (CZMP) for coastal areas including wetlands are to be prepared to serve as local level policies and plans.

However, the pervasive definition of CRZ covering even minor creeks and backwater extending several kilometers in the land, and stringent control of activities prescribed by the notification have complicated the task of evolving an implementable CZMP. The problem is further compounded by the lack of base maps indicating high tide line that would satisfy the exacting definition given in the notification. The notification has placed total ban on any construction activity in the wetlands and their reclamation. While this is a welcome measure to protect wetlands from indiscriminate exploitation, it needs to be tempered in the light of special problems of the Region.

Greater Mumbai owes much of its existence to wetlands reclamation process spanning over three centuries. Its peculiar geography, i.e., a narrow wedge-shaped land mass surrounded by sea on three sides, and the existence of vast wetlands, make it impossible to avoid infringing upon the wetlands in the process of its development. The typical conflict is experienced in projects, such as,

1. Construction of treatment plant, lagoon, etc. for Municipal sewage treatment;
2. Municipal solid waste disposal;
3. Construction of bridges, approaches for off-shore roads;
4. Slum upgradation or rehabilitation, and housing for urban poor;
5. Construction of sea-wall and waterfront beatification e.g. in Backbay Reclamation Scheme.

Most of these projects are location-specific; hence other locations either cannot be considered, or are not available. For instance, in Greater Mumbai, no land, except low-lying area along the creeks, are available for disposal of solid waste; and no other method of disposal is economically feasible. It is important to recognise that though these projects

affect wetlands, substantial environmental benefit will accrue and permitting them will result in positive trade-off.

Wetlands are also required to be used for urban uses in Navi Mumbai, Thane, Mira-Bhayander, and Vasai-Virar areas. Future projects, such as, 2nd International Airport at Mandwa, Trans-harbour links will also face major difficulties if wetlands policy remains as rigid as it is made out to be by the MEF's notification.

Large areas of wetlands in Greater Mumbai and in the rest of the Region are occupied by salt pans. Urban expansion of the past few decades have brought many of them into proximity of urban centres, consequently increasing their potential value. Salt manufacturers are also facing difficulties on account of pollution of creeks and coastal waters. The MPCB's classification for these waters is SW II, which makes them unfit for salt manufacturing. In these circumstances, it will be appropriate to allow salt-pans which anyway are not wetlands in their natural state to be used for some of the critical urban uses mentioned in the foregoing.

The MEF notification stipulates that in the CRZ III, a belt of 200 m. width measured from the high tide line should be designated as a 'no development zone'. No construction work, except repairs of the existing structures is to be permitted in this zone. This provision will cause hardship to residents of village settlements along the coastal areas of Vasai-Arnala, Alibag-Mandwa and some other areas. Even beyond this belt, but within the 500-metre CRZ, the notification has placed stringent restrictions on construction. Unless these restrictions are rationalised on the line of the traditional building practices in these settlements, they can hardly be implemented.

12.5.4

Conservation of Regional Landscape

Designation of vast areas beyond the identified urban centres as G-Zone has been the main strategy of the Regional Plan, 1973 to prevent urban sprawl and conserve the countryside. Little could be accomplished through this, as development pressures and high land values in the urban centres kept pushing the urban growth well into the countryside, especially along the transport lines. Today, space-extensive activities, such as, large institutions have been seeking countryside locations because of low land prices. There are other activities that cannot be easily accommodated in an urban setting, such as, modern recreational activities like amusement parks, theme parks, race courses, golf courses, racing tracks for motorbikes etc. Countryside is also seen as a good location for special uses like film shooting sites and camping sites. Holiday homes, week-end houses, and tourist resorts are dotting the landscape. With growing income and car ownership, demand for recreational opportunity is increasing rapidly. In the name of environment protection, the demand for countryside locations should not be suppressed through idealistic development control provisions for the G-zone and their zealous enforcement. On the contrary, it should be recognised as legitimate recreational need of the urban population, and channelised to appropriate locations after ensuring environmental safeguards.

The greatest damage to the regional landscape perhaps is being caused by the thoughtless quarrying activity going on all over the Region. Although the study on quarrying in MMR (MMRDA and Kirloskar Consultants, 1991) has recommended environmentally sound methods of quarrying, including restoration and rehabilitation of quarry sites, there has

not been any improvement in the quarrying practices. This is largely on account of the failure to create a mechanism to monitor the quarrying activities that requires coordination between a number of agencies, such as, District Collector, Environment Dept., Geological Survey of India, and the concerned Planning Authority. Part of the problem also lies in the lack of adequate expertise either with the applicant in formulating plans for quarrying or with authorities in appraising them.

12.6 Environmental Consideration of the Revised Plan

12.6.1 Environmental Planning

The study on Environmental Management Strategy and Action Plan for MMR (EMS Study) has emphasised the need for strategic environmental planning as a tool for environmental management of MMR, and has identified MMRDA as the agency to perform this task. The EMS Study has defined environmental planning as a systematic approach achieving simultaneous consideration of environmental matters with land use issues within the overall context of planning.' In specific terms, the environmental planning approach enables a) preparation of land use plans incorporating environmental considerations, and b) assessment of environmental implications of future development projects.

The EMS Study has suggested a procedure for arriving at a land use plan after considering environmental concerns of particular land uses, evaluating alternative locations and establishing where different activities could be located subject to environmental guidelines and standards. The procedure requires information on

1. environmental profile (land, air and water quality, biota, ecology);
2. environmental concerns against particular land use; and
3. environmental characteristics (air, noise, water, waste, ecology).

The EMS Study has identified environmental concerns related to specific land uses or activities. (Annexure-12.A.1). They are rated at 3 levels of significance, namely,

- Type I : Requiring attention;
Type II : Potential to cause concern, and
Type III : Likely to give rise to significant concerns.

This framework could be used to choose the degree of environmental investigations and analysis that a particular land use proposal will require.

The land use plan forming part of the revised Regional Plan is not prepared following this procedure. However, some of the specific land use proposals, such as, new growth centres can be subjected to such procedure before they are taken up for development. In this context, as observed in the EMS Study, it is important to recognise that the environmental measures need to be adopted as a regular and consistent activity at each stage of the development i.e. preparation of plans, assessment of development applications, design of the project or scheme, construction and operation, rather than one-off exercise to achieve environmentally sound development.

In order to ensure that the environmental considerations are consistently applied to the future plans and projects, EMS Study has recommended that Environmental Impact Assessment (EIA) should be conducted for plans and projects that are likely to give rise to significant environmental concerns. The MEF, by its notification dated 27th January, 1994 issued under the Environment (Protection) Act, 1986, has made it mandatory for certain types of development projects to obtain environmental clearance from the Impact Assessment Agency (MEF for the time being). The notification requires a project proponent to submit a project report incorporating EIA. The list of projects which requires such environmental clearance include, mining, thermal power stations, hydro-power projects, irrigation projects, ports and harbours, exploration and production of oil and gas, highly polluting industries, highway projects and tourism projects. The environmental clearance is not required for projects in some categories where investment is not more than Rs. 50 crores, or in the case of small scale units, more than Rs. 1 crore.

The list of projects recommended in the EMS Study as requiring EIA is similar to the ones stipulated by the MEF in its notification. However, EMS Study has suggested that apart from the mandatory list of projects requiring EIA, environmental assessment should be conducted for a number of other projects which give rise to significant environmental effects, such as, a large manufacturing unit, large scale housing development, developments near ecologically sensitive locations or projects giving rise to particular complex and adverse effects, such as obnoxious or hazardous installations. For such supplementary list of projects, to be called discretionary projects, the EIA should be conducted only if preliminary environmental screening reveals need for a detailed EIA.

The EMS Study's recommendations about the EIA are in tune with MMRDA's current thinking about reorienting the development control process whereby the proponents of new developments will be required to be more responsive to environmental imperatives. The EIA is therefore being incorporated as an important feature of the revised Development Control Regulations for MMR. These regulations also contain a list of discretionary projects for which MMRDA or the concerned Planning Authority will have a right to call for a detailed EIA based on preliminary screening.

As an aid to environmental assessment of projects, the EMS Study has recommended certain guidelines for land uses or activities. Although these guidelines cannot be rigidly followed, they provide a broad framework for examining the appropriateness of the proposed land uses. (Annexure-A.12.2).

Apart from the adoption of environmental planning procedure and EIA as recommended by EMS Study, there are other specific policies and proposals that deserve attention in the revised Regional Plan. They are as follows :

1. As a general policy, wetlands should be preserved in their pristine state and should not be reclaimed by filling or bunding. They should be used only in accordance with the MEF notification of 19th February, 1991. In the exceptional circumstances, they may be used for setting up waste treatment and disposal

Matrix Showing Environmental Concerns for MMR

Land Use Activity	Assured availability of water	Air Emissions			Waste Generation			Noise Generation	Congestion	Traffic Generation	Sensitivity To			
		Particulate	Gases	Odours	Liquid Effluent	Solid Waste	Toxic & Hazardous Waste				Air Pollution	Ground/Surface Water Pollution	Solid Pollution	Noise
1. COMMUNITY FACILITIES														
a. Residential Areas	●				●	●			●		●	●	●	●
b. Wholesale Fruit Markets	●			●	●	●		●	●	●				
c. Hospitals / Clinics/Health Care Centres	●				●	●	●			●	●	○		●
d. Auditoria / Theatres etc.	●				○	○			○	●	●			●
e. Schools/Educational Institutions	●				○	○				○	●			●
f. Petrol Pumps			○	○			○	○		○				
g. Car Parking Areas			○					○	●	○				
h. Crematoria	○		○	●	●	○				○				
i. Abattoirs	●			●	●	●		●		●				
j. Refuse Transfer Stations		○		●	○	●	○	○		●				
k. Solid Waste Dumping Ground		●	●	●	●		●	●		●				
l. Incinerators		●	●	●				○		●			●	
m. Sewage Treatment Works	○			●	●	●				●		●	●	
n. Fishing Landing Areas	○			●	○	●								
o. Parks, Spot Grounds, etc	●										●	●		●
2. TRANSPORT														
a. Roads/Highways		●	●		○	○		●		●				
b. Public Transport Depots/Rickshaw and Taxi Stands	○	●	●		○	●		●	●	●				

Annexure-A.12.1 (Contd.)

Matrix Showing Environmental Concerns for MMR															
Land Use Activity	Assured availability Water	Air Emissions			Waste Generation			Noise Generation	Congestion/Crowding	Traffic Generation	Sensitivity To				
		Particulate smoke	Gases	Odours	Liquid Effluent	Solid Waste	Toxic & Hazardous Waste				Air Pollution	Ground/Surface Water Pollution	Soil/Land Pollution	Noise	
c. Railway Lines		○				○		●							
d. Railway Stations and Yards	○				●	●		●	●	●					
e. Airport	○		●		●	●		●		○					
f. Jetters			○		●	●		●	●	●					
3. INDUSTRY/MANUFACTURING Polluting And Hazardoos Industries															
a. Manufacture and Retining of Sugar	●	○	○	●	●	●									
b. Hydrogenated Oils and Edible Oils Manufacture	○			●	●	●									
c. Distilling, Rectifying and Blending of Spirit	●	○	○	●	●					●					
d. Manufacture of Pulp and Paper	●	○	●	●	●			○							
e. Tannery and Leather Finishing	●		○	●	●	●				●					
f. Petroleum and Coal Product Works	○	●	●	○	●	○		●		●					
g. Chemical and Chemical Products Manufacturing	●	○	●	○	●	○		●		●					
h. Cement Manufacturing	●	●	○					●		●					
i. Basic Metals and Alloys Industries	○	●	●		●	●		●		●					
j. Thermal Power Stations	●	●	●		○			○		○					
k. Asbestors and Asbestors Products	●	●	●					●		○					
l. Oil Storage			○	○	○					○					

Annexure-A.12.1 (Contd.)

Matrix Showing Environmental Concerns for MMR															
Land Use Activity	Assured Availability	Air Emissions			Waste Generation			Noise Generation	Congestion/ Crowding	Traffic Generation	Sensitivity To				
		Particulate/ Smoke	Gases	Odours	Liquid Effluent	Solid Waste	Toxic & Hazardous Waste				Air Pollution	Ground/ Surface Water Pollution	Soil/Land Pollution	Noise	
Non-Polluting Industries															
a. Electronics	○				○	●	●			○					
b. White Goods	○		○			●				○					
c. Plastic Goods	○		○	○		●				○					
d. Textile Products texcluding Dyeing and Processing	○	●			●	○		●		○					
e. Paper Products,Printing and Publishing (excluding manufacture of Paper)	○		○	○	○	○		●		○					
f. Watches and Clocks	○					○		○		●					
4. SPECIAL USES															
a. Bathing Areas														○	
b. Continer Terminals													●		
c. Livestock Yards	●		●		●	●		●							
d. Water Catchment Areas													●	●	
e. Quarries	○	●						●		○		●	●		
													Annexure-A.12.1 (Concl'd.)		

Legend : Type I : ○ requires attention
Type II : ● potential to cause concern
Type III : ● Likely to cause significant concern

Source : Working Paper 3, Study on Environmental Management Strategy and Action Plan for BMR (GOM, Coopers & Lybrand, A/C, 1994

facilities, slum upgradation, rehabilitation and new housing for urban poor, and brackish water fish farming. Similarly, wetlands may also be used for critical infrastructure works, such as, pipelines, approach roads, bridges, etc. Reclamation of wetlands may also be allowed for beautification and protection of waterfront. In all such cases, however, compulsion to use wetlands should be clearly established and environmental assessment conducted.

2. In view of the large scale destruction of mangroves, areas with good mangrove forests, such as, along Ulhas river, should be declared as Reserved Forest and handed over to the Forests Department for protection as has been done for mangroves along Mithi River in Bandra-Kurla Complex. As stated in the report on Current Environmental Status in MMR (GOM, Coopers & Lybrand and AIC, 1994), in about 30 sq.km. area of wetlands in MMR root stock of mangrove species is available. These areas should be rehabilitated through re-stocking.
3. Salt-Pan lands in Mira-Bhayander, Vasai-Virar, Navi Mumbai, Khopta and Vadkhal, having acquired urban potential, may be used for urban development. Other wetlands in the vicinity should be protected.
4. Since the greatest aesthetical and environmental damage to the regional landscape is caused by the indiscriminate quarrying activities, they should be permitted only in the specific areas and the quarrying operations should be planned and conducted systematically in accordance with the environmental guidelines. Quarry Zones should be specifically marked in the revised Land use Plan of MMR.
5. In order to reconcile the pressure of development activities on the existing 'G' Zone lands with the environmental objective of preserving the fragile eco-system, the EMS study has suggested reorganising the existing 'G' Zone into following Sub-Zones.

- Sub-Zone (i) : Lands having future urban development potential, particularly in the proximity of urban centres with transport facility.
- Sub-Zone (ii) : Predominantly agricultural lands in which following activities are permitted : activities allied to agriculture and limited non-agricultural developments, such as, gaothans and their expansions, large institutions, recreational activities, etc.
- Sub-Zone (iii) : Fragile eco-systems and areas of high environmental sensitivity, such as, wetlands, mangroves, coastal areas, steep slopes, reserved and protected forests.
- Sub-Zone (iv) : Lands in which future development should be restricted or totally prohibited, such as, lands within 300 m. on either side of rivers, areas prone to frequent flooding, areas liable to inversion phenomenon and areas in close proximity of drinking water sources.

In view of the zoning system proposed for the revised Land Use Plan, the foregoing recommendation can be accepted with slight modification as stated in the following :

- Sub Zone I & II : These Zones coincide with U2 and G Zone respectively of the revised Land Use Plan.

- Sub-Zone III : No separate sub zone as suggested is necessary as most of the wetlands and mangroves are outside the purview of any use zones. Hence, they are virtually in no development zone. Separate zone for reserved and protected forest is proposed in the revised Land use Plan as 'F' Zone. Development in coastal belt would be regulated in accordance with MEF Notification and CZMPs.
- Sub-Zone IV : This would form part of the 'G' Zone. Added restrictions could be stipulated in the revised Development Control Regulations to ensure that no development is permitted within environmentally sensitive areas.

12.7 Legislative Changes

- 12.7.1** In order to ensure that the environmental planning becomes an integral part of the town planning activity conducted under the MR&TP Act, 1966, the EMS study has recommended that the MR&TP Act, 1966, may be modified to reflect the importance of environmental considerations in the preparation of Development Plan and its implementation. The amendment to the Act should also enable inclusion of EIA as a feature of the Development Control Regulations and also permit the Planning Authorities to stipulate conditions while granting Development Permissions to ensure adequate environmental safeguards for effecting land use changes or implementing development projects.

12.8 Information System

- 12.8.1** The environmental planning procedure and the new Development Control mechanism involving EIA and environmental screening would be effective if it is backed by comprehensive information system covering land use changes and environmental parameters of the Region. The EMS Study has recommended that such information system should be established in MMRDA. It has suggested that information on environmental parameters, generated and collected by various organisations, should be regularly supplied to MMRDA who should then compile it to produce environmental status report for the MMR annually.

MMRDA has been developing and maintaining a regional information system for the past few years, and since 1991 has been developing GIS capabilities to integrate spatial and non-spatial data. This information system, which also covers environmental parameters, is being used extensively in planning, policy making and project formulation and for various environmental studies. As recommended by the EMS study, the information system can be extended to cover new environmental parameters on regular basis. (the issues related to development of information system for MMR are discussed in greater detail in Chapter-16).

The regional information system should enable MMRDA to prepare annually an environmental status report for MMR as recommended by the EMS Study. The information system could also be used in assisting various local authorities in the Region to produce their annual environmental reports which they are required to prepare every year as a consequence of the amendment to various municipal laws introduced on 31st May, 1994.

The EMS Study has made a number of recommendations regarding institutional arrangements for environmental planning and co-ordination in MMR. The important amongst them are as follows :

1. MR&TP Act should be suitably modified to make MMRDA as a statutory consultee in the approval of the Development Plans.
2. MMRDA should monitor implementation of the Development Plans.
3. An Environmental Cell should be established in MMRDA to have overall responsibility for strategic environmental planning for MMR. In the long run, this Cell should be manned by professionally trained environmental planners and environmental information specialists. The Environmental Cell should also be created within municipalities. For smaller municipalities, MMRDA should provide technical assistance and supporting infrastructure.
4. The Executive Committee of MMRDA should be expanded to include Secretary, Environment as a member.
5. MMRDA should be represented in the State Appraisal Committee under the Environment Department and participate in the environmental assessment of projects within MMR.

All the foregoing recommendations are unexceptionable and should be implemented as soon as possible. In fact, MMRDA has already initiated action towards creation of an Environmental Cell. It is important that actions on other recommendations are also initiated. This will go a long way in enabling MMRDA to play its rightful role as an effective strategic environmental planning body for the Region.

Environmental Planning Guidelines for Different Land uses in MMR

Environmental Parameters	Land Use				
	Residential	Mixed Use	Non-Polluting, High-tech or High value added industries (Schedule I)	High Polluting, Hazardous or Obnoxious Industries (Schedule II)	Other Industries (Schedule III)
1. General Comments	Residential areas are quiet neighbourhoods with relatively low traffic density and noise. Air, water and solid waste emissions are domestic in character. These areas will also include schools and hospitals	Mixed use areas may have residential Fight and wholesale commerical areas alongwith service industries. Schedule I and III industries may be allowed on a case by case basis.	Schedule I includes - Electronics, Software, date Processing - Watches - Jewellery - Paper Products, Printing - Leather and Fur products - Plastic Products - Textile Products - Wood Products - Laboratories	Schedule II includes manufactures of Sugar, distilleries, oil, pulp and Paper, Tranning, Petroleum and coal products, chemicals and chemical products. Cement, asbestos products, basic metals and alloys, thermal power plants.	Schedule III includes those industries which are not included in Schedule I and II, such as engineering industries, pharmaceuticals, spinning and weaving.
2 Enviornmental Screening and/or EIA requirements for new development proposals	Screen procedures required for residential developments spread over more than 10 ha. (See matrix for environmental concerns of different types of developments)			EIA required for the general area earmarked for industrial use and only screening required for individual units.	
3 Topography Land Slopes Depressions	Avoid areas with 1:10 or steeper slopes for all development Avoid water logged and flood plans areas				
4 Wetlands	Comply with Coastal Regulation Zone (CRZ) Rules				
5 Availability of assured water supply	Public for Private supplies necessary in meet the expected scale of development proposed.				
6 Meteriology	—	—	—	Avoid air polluting industries in Khopoli area because of inversions and limited dispersio. In general avoid location of new industries, upwind of residential areas.	

Annexure-A.12.2 (Contd.)

Environmental Planning Guidelines for Different Land uses in MMR

Environmental Parameters	Land Use				Other Industries (Schedule III)
	Residential	Mixed Use	Non-Polluting, High-tech or High value added industries (Schedule I)	High Polluting, Hazardous or Obnoxious Industries (Schedule II)	
7. Minimum Distance between new developments planned in MMR and the following types of areas :					
(i) Major settlements of 3,00,000 or more populations				Subjects to EIA but minimum 1.0 km for Offensive Odours and 0.5 k.m for Hazardous Industries. The separation zone to be kept as 'G' Zone.	
(ii) Coastal areas / Wetlands / flood plains	0.5km Subject to CRZ	0.5km Subject to CRZ	0.5km Subject to CRZ	0.5km Subject to CRZ	0.5km Subject to CRZ
(iii) Quarries	0.5	0.5	—	—	
(iv) Highways/Railways	50 m from near boundary of the road subject to requirements of air pollution, noise and safety being met.		0.5 km. (wide MOEF)	0.5 km. (wide MOEF)	0.5 km. (wide MOEF)
(v) Settlements of 3000 population or above	—	—		Subjects to EIA but minimum 1.0 km. for Offensive Odours and 0.5 km. for Hazardous Industries. The separation zone to be kept as 'G' Zone.	
(vi) Forests	Can abut forest areas with boundary wall for separation		0.2 k.m. subject to environmental screening or EIA. Separation zone to be kept free of vegetation and any development		
(vii) Sanctuaries / National Parks	1 km. (relaxable to 0.5 km. with justification)	1 km. (relaxable to 0.5 km. with justification)	1 km. (relaxable to 0.5 km. with justification)	5 km.	5 km
(viii) Lakes for drinking water suppliers	Minimum 3 km. upstream of high water line	Minimum 3 km. upstream of high water line	Minimum 3 km. upstream of high water line	Minimum 10 km or upto water shed line whichever is closer, upstream of high water line	Minimum 3 km upstream of high water line.

Annexure-A.12.2 (Contd.)

Environmental Planning Guidelines for Different Land uses in MMR

Environmental Parameters	Land Use				
	Residential	Mixed Use	Non-Polluting, High-tech or High value added industries (Schedule I)	High Polluting, Hazardous or Obnoxious Industries (Schedule II)	Other Industries (Schedule III)
(ix) Religious / Historic / Archaeological	0.5 km.	0.5 km. (relaxable to 0.1 km for tourist amenities)	1 km.	5 km	3 km.
(xi) Airports	3 km	3 km	5 km	7-10 km	5 km
(xii) Endangered Flora / Fauna	Special precautions to be taken when endangered or rare species identified				
8 Area marked for public parks and gardens and playground (minimum)	0.4 ha per 1000 Poulation	0.4 ha per 1000 Poulation	10 % of gross area plus 5% to be left open for parking or similar uses	10 % of gross area plus 5% to be left open for parking or similar uses	10 % of gross area plus 5% to be left open for parking or similar uses
9 Traffic generations potential truck light commercial, passenger)	No generation of heavy truck traffic. light commercial vehicles permitted during certain hours only. Passenger cars, buses allowable.	Light commercial vehicles, passenger cars, buses allowable. Heavy truck traffic permitted during certain hours only	All types of traffic permitted		
10 Widths of arterial and sub-arterial roads	To be based on traffic projections and provision made for future widening				
11 (a) Noise generation from all sources within the premises	Not to exceed : Day Time : 65 dB(A) Night : 50 dB(A)	Not to exceed 70 dB(A)	Not to exceed 90 dB(A)	Not to exceed 90 dB(A)	Not to exceed 90 dB(A)
(b) Ambient noise has per CPCB Standards	Day Time : 65 dB(A) Night : 45 dB(A)	Day Time : 65 dB(A) Night : 55 dB(A)	Day Time : 75 dB(A) Night : 70 dB(A)	Day Time : 75 dB(A) Night : 70 dB(A)	Day Time : 75 dB(A) Night : 70 dB(A)
(c) Construction Noise	Construction activity permitted during daytime only. Noise not to exceed 85 dB(A). Night activity may be allowed with special permission		—	—	—
(d) Aircraft noise	Exclude airport approaches in developing residential and mixed use areas		—	—	—

Annexure-A.12.2 (Contd.)

Environmental Planning Guidelines for Different Land uses in MMR

Environmental Parameters	Land Use				Other Industries (Schedule III)
	Residential	Mixed Use	Non-Polluting, High-tech or High value added industries (Schedule I)	High Polluting, Hazardous or Obnoxious Industries (Schedule II)	
12. Solid Wastes generation and disposal	only of domestic or light commercial type which can be disposed along with town refuge. No toxic or hazardous solid wastes nor radioactive in nature. (hospital wastes to be treated separately).	No toxic or hazardous solid wastes nor radioactive in nature. For other solid wastes, licensed disposal facilities should be available.	To conform with all regulations for disposal of toxic and hazardous wastes, Industries to participate in separate collection and transport of non-hazardous and hazardous wastes to designated disposal sites subject to approval of MPCB.	No toxic or hazardous solid wastes, nor radioactive in nature. For other solid wastes, licenced disposal facilities should be available.	
13. Provision of specifically designated sites for : (i) Municipal refuse dumps / Sanitary land fills (ii) Hazardous wastes landfills (iii) Abattoirs (iv) Cremetoria (v) Sewage Treatment Plants	Minimum 1 km. from residential and mixed use areas and 10 km. from airports (to guard against bird hits). Also ensure against ground water pollution from leachates. Located preferably near industrial areas. Minimum 3 km from residential and mixed use areas and 10 km. from airports. Land fill sites to be of secure, leachate proof construction to control ground water pollution. Minimum 1 km. from residential and mixed use areas and 10 km. from airports preferably upwind of residential and commerical areas. 0.1-0.25 km. from residential and mixed use areas. The separation distance should be wooded. Minimum 1 km from residential and mixed use areas. Location must benefit from topography so as to avoid pumping as far as possible and enable reuse in industries or in crop irrigation.				
14. 1) Storage / stocking of goods 2) Storage of Hazardous substances	None except temporary storage of building materials Not Permitted	None in open areas except with protection against washout in rains Not Permitted	None in open areas except with protection against washout in rains Not Permitted	None in open areas except with protection against washout in rains Storage of hazardous substances allowed subject to risk assessment and approval by DISH/MPCB	None in open areas except with protection against washout in rains Not Permitted
15. Liquid effluents and excretas disposal	Only of domestic origin or similar which can be discharged to a public sewer for treatment and off site disposal or to a septic tank followed by soakage system or pit latrines for on-site disposal. Ensure that potential ground water resources are not polluted	Only of domestic origin or similar which can be discharged to a public sewer for treatment and off site disposal or to a septic tank followed by soakage system or pit latrines for on-site disposal. Ensure that potential ground water resources are not polluted.	Effluents and sludges will be subject to control of MPCB consent conditions and preferably discharge to a common effluent treatment plant and disposal site	Every industry shall obtain Consent/ NOC from MPCB	Effluents and sludges will be subject to control of MPCB consent conditions and preferably discharge to a common effluent treatment plant and disposal site

Annexure-A.12.2 (Contd.)

Environmental Planning Guidelines for Different Land uses in MMR

Environmental Parameters	Land Use			
	Residential	Mixed Use	Non-Polluting, High-tech or High value added industries (Schedule I)	High Polluting, Hazardous or Obnoxious Industries (Schedule II)
16 Ambient air quality based on tentative CPCB standards :				
Annual average SPM mg/cu.m.	400	500	500	500
Annual average SO ₂ mg/cu.m.	80	120	120	120
Annual average NO ₂ ug/cu.m.	100	120	120	120
24 hours value SPM mg/cum not more often than 20% of time in every year	800	800	800	800
24 hour value SO ₂ mg/cu.m	130	130	130	130
24 hour value SO ₂ mg/cu.m	200	200	200	200
				500
				120
				120
				800
				130
				200

Source : Working Paper 3, Study on Environmental Management Strategy and Action Plan for MMR (GOM, Coopers & Lybrand, AIC 1994)

Annexure-A.12.2 (Contd.)