



2015

STRATEGIC ACTION PLAN FOR
INTEGRATING DISASTER RISK REDUCTION AND CLIMATE
CHANGE ADAPTATION INTO SECTORAL PLAN OF SOLID
WASTE MANAGEMENT AT NAVI MUMBAI
MAHARASHTRA

*Govt. of India - UNDP project on
Climate Risk Management in Navi
Mumbai, through disaster
preparedness and mitigation.*

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**Strategic Action Plan For
Integrating Disaster Risk Reduction and Climate Change Adaptation into sectoral plan of Solid
Waste Management at Navi Mumbai
Maharashtra**

Introduction:

Govt. of India - UNDP project on Climate Risk Management is being implemented in Navi Mumbai, through disaster preparedness and mitigation. One of the prime deliverables of the project is to integrate disaster risk reduction and climate change adaptation under the various on-going development programmes of sectors namely education, solid waste management, public health, infrastructure, housing, environment, etc through the consultative process with different stakeholders.

Most cities in India have deficient infrastructure and weak institutional capacities for governance. This is especially true for management of city waste streams especially solid wastes. The quantities of solid waste are increasing each year and the waste characteristics are getting complex by the day. The city of Pune in India, with its fast growing population and economic activity faces severe problems in terms of solid waste management. Like most other Indian urban agglomerations, the city is faced with challenges of managing its wastes. It is therefore the right time for Navi Mumbai city to develop an Integrated Solid Waste Management Plan.

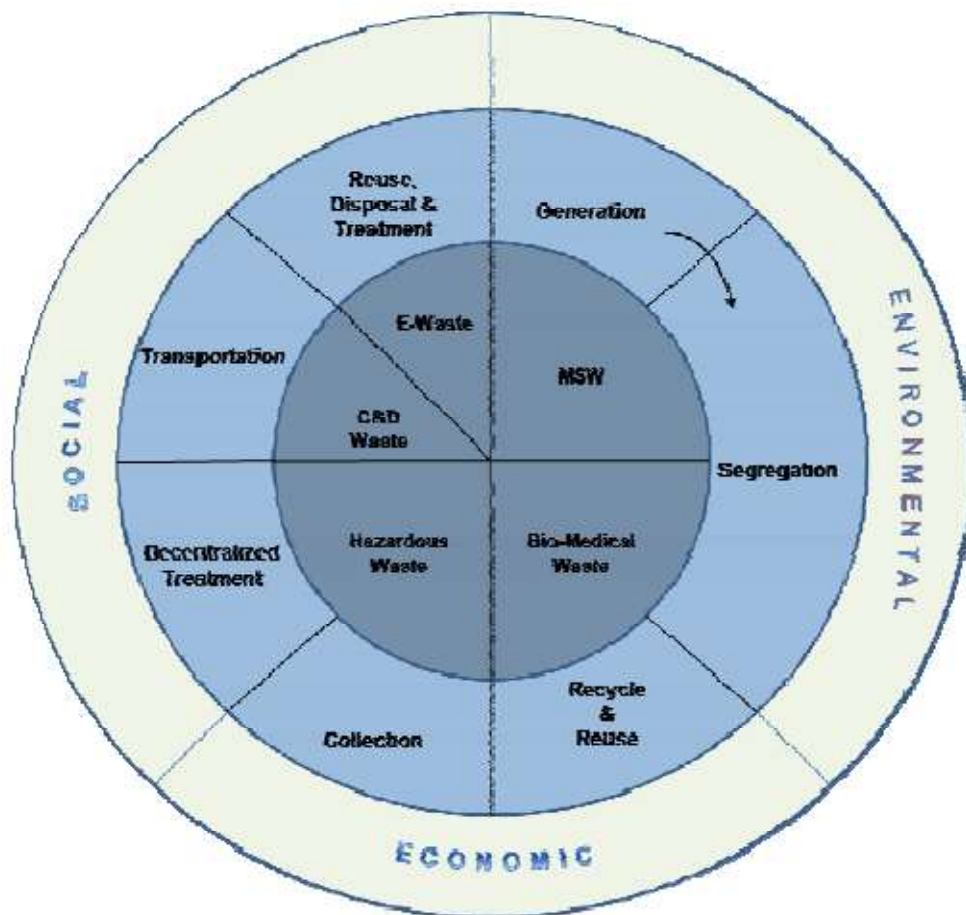


Figure explains Integrated Solid Waste Management Concept

Recognizing this aspect, the Navi Mumbai Municipal Corporation (NMMC) and the United Nations Development Programme (UNDP) is developing comprehensive framework for developing ISWM Action Plan for Navi Mumbai. In this regard the series of consultations, deliberations will be planned with various stakeholders to develop comprehensive plan for ISWM. The ISWM Plan will take a comprehensive approach across all the waste streams including Municipal Solid Waste (MSW) and Plastic Waste, Biomedical Waste (BMW), Hazardous Waste, Electronic Waste (E-Waste) and Construction and Demolition Waste (C&D Waste).

This Action Plan is aims to develop following strategic planning process emphasizing Reduction, Reuse and Recovery (3R) principle across the Life Cycle of waste streams. The scope of the ISWM includes an assessment of the prevailing condition of the Solid Waste Management in the city including gap identification, followed by the formulation of Vision, Mission, Goals and Objectives. These key elements will be developed through a consultative process with a Working Group that represented diverse stakeholders. The overall methodology of Integrated Solid Waste Management plan will be developed from following consultative processes.

- **Step I:** For the **Municipal Solid Waste Management** workshop will be organised for various SWM officials of NMMC, Contractors, NGOs and other agencies working in the area of door to door collection along with institutions specializing in waste processing. The second workshop on municipal solid waste management will be organised with diverse technology providers for centralized as well as decentralized treatment.
- **Step II:** The **E-waste** workshop will be organised by involving the Software Technology Parks of India (STPI) that represents Ministry of Communication and Information Technology, Government of India and other concern agencies representing the Navi Mumbai based stakeholders from IT sector.
- **Step III:** Consultation workshop on **construction and demolition** waste will be planned with the various Promoters and Builders Associations at Navi Mumbai.
- **Step IV:** The workshop for **Biomedical Waste Management** will be organised involving the Indian Medical Association, Navi Mumbai Chapter, hospital association and various health care facilities.

An initial rapid assessment strongly points out the significance of disaster risk reduction and climate change adaptation centric in the waste management arena. Taking into consideration the fast changing characteristics of waste and the uncertainties surrounding the quantification of waste streams coupled with inter play amongst multiple stake-holders makes municipal solid waste the key focal point to be addressed while ensuring the disaster risk reduction in the city of Navi Mumbai.

Sector Background - Existing status of physical infrastructure in Navi Mumbai:

Navi Mumbai is world's largest planned city with a horizon of 344sqkms. It includes an area of 95 villages in it, having a coastal stretch of 34.2 kms along Thane and Panvel creeks. To avoid the haphazard spill over of Mumbai, Plan for Mumbai Metropolitan Region (MMRP) was prepared under the provision of Maharashtra Regional and Town Planning act 1966, which was sanctioned by Govt in 1973. One of the most important propositions of the sanctioned MMRP was to develop a new metro

international airport is also planned in Navi Mumbai region.

Geology: The rock formation in the region is derived mainly from Deccan Basalt and also from granites, gneisses and laterite. The gently sloping coastal low lands are observed in patches and are covered with moderately shallow to deep soils, mostly lateritic in nature, sometimes oxidised to yellow murrum.

Topography: To part of Western Konkan coast is a narrow coastal strip along the western part of Sahyadris. It is bound on the eastern side by hillocks of height of 50-200 mt. and on the west side by Thane creek.

Climate: This area has sub-tropical monsoonal climate of humid-per-humid to semi-arid and sub humid type. Overall climate is equable with high rainfall days and very few days of extreme temperatures.

Temperature: The mean annual temperature ranges from 25°C to 28°C. The mean maximum temperature of the hottest month in this area varies from 30°C - 33°C in April-May while mean minimum temperature of coldest month varies from 16°C to 20°C. Extremes of temperatures, like 38°- 39°C in summer and 11°-14°C in winter, may be experienced for a day or two in respective season.

Rainfall: The rainy season is mostly confined to south-west monsoon with 80 percent of the rainfall received during June to October (60-70 days). This area, on an average, receives 2500 to 3500 mm rainfall.

Humidity: The area has marine humid per humid climate with more humidity and less daily variations. Relative humidity varies from 41 to 97%. Driest days being in winter and wettest ones are experienced in July.

Wind: Features such a presence of large water body (the creek), presence of hill ridges etc. influence the local wind patterns to some extent. No significant micro-climatic variation is noticeable in the region.

Soil: The soil of this area is highly saline in the vicinity of creeks and non-saline at other places. They are calcareous, neutral to alkaline in reaction (pH 7.5 to 8.5), clayey, with high amount of bases and have high water holding capacity (200-250 mm/m). The soils located on moderately sloping residual hills are lateritic in nature and show intensively leached surfaces. They are loamy and slight to moderately acidic (pH 5-6.5) with moderate base status (< 75%)

Populations: As per provisional reports of Census India, population of Navi Mumbai in 2011 is 1,119,477; out of which males and females are 611,501 and 507,976 respectively. Although Navi Mumbai city has population of 1,119,477; its urban / metropolitan population is 18,414,288 of which 9,894,088 are males and 8,520,200 are females.

Based on various assumptions, NMMC has projected Navi Mumbai population as per the following:

Year	Total Population	Source
2006	925346	UHP Projection
2011	1293987	Projected
2021	1879274	Projected
2031	2388082	Projected
2042	2911032	Projected

Municipal Solid Waste: Wherever people live and work they will generate waste and that too in increasing quantities with the progress of economy and change in life style. Currently Nation-wide every urban citizen is generating 400 to 500 gm solid waste per day which is still 1/3 to 1/4th as compared to developed countries. Arbitrary disposal of solid waste as open dumping has been the most wide spread form of waste management in every city of India. This practice has thrived because of the mistaken belief that it is the easiest and cheapest method of waste disposal.

During the last few decades, deposition of waste along road side, on river banks, in marsh lands has proved highly detrimental to the ground water and living environment. The physical, chemical and biological contaminants in solid waste have been choking drainage and water flows in several part of city, building up of toxic heavy metals and poisonous substances in the surrounding lands. This is also assuring ideal breeding ground for pathogens, flies, mosquitoes, rodents, vulture thereby, causing new disease epidemics.

Background and legal aspects: In the last decade of the 20th century municipal solid waste drew country wide attention of Citizen Forums, Judiciary, some of the Bureaucrats and Democrats of Urban Local Bodies, Planning Commission and Officials of Central Government.

The subject got real high level of attention from the incidence of heavy rains in Sept 1994 in the city of Surat. Where Solid waste and rain water created so-called plague situation. (Unfortunately similar incidences again happened in several cities during July 05 and August 2006). Combined action from the multiple agencies cited above resulted in framing and enactment of: Specific rules and regulations on this subject: These are: Municipal Solid Waste [Management and Handling] Rules 2000 from the Ministry of Environment and Forest (MOEF) Govt. of India Final notification of these rules was done under the Gazette of India No. 648 Extra Ordinary Part II-Section3-Subsection (ii) of 3rd October 2000.

Compliance of these rules (brief called MSW Rules 2000) has become mandatory for every Urban Local Body that includes Municipal Corporation, Municipality, Nagar Palika, Nagar Nigam, Nagar Panchayat, Municipal Council and Notified Area Committee. Under these MSW rules all Municipal Authorities have to follow prescribed norms for collection, segregation, storage, transportation, processing and disposal of Municipal solid waste generated in their respective jurisdiction.

Following aspects of Municipal Solid Waste Management are in place at NMMC;

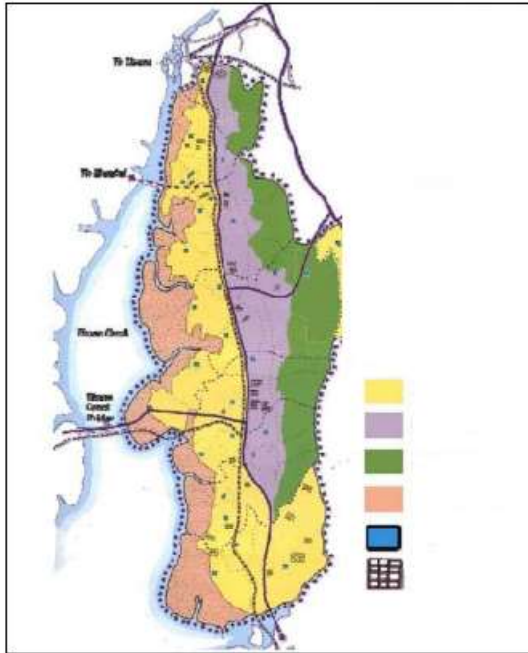
- Set up of waste processing and disposal facilities.

- Monitoring the performance of waste processing and disposal facilities.
- Improved existing landfill sites as per provisions of these rules.
- Identification of landfill sites for future use and making sites ready for operation.

Details of MSW Generation TPD:

MSW Generation TPD	:	643.00 TPD [2008]
- Per capita MSW Generation	:	450.00gm/cap
- Additional feature	:	
Bulk generation of Mumbai's Whole sale mkt (APMC) + MIDC canteens	:	151.72MT/day (included in 643TPD)
- Land Area for MSW at Turbhe	:	26.32 Ha
- Biomedical waste	:	7579 Kg. (Total per Annum)
- Disposal of BMW	:	
Auto Calving	:	3257 Kg
Incineration	:	4322 Kg.
- Common facility for Hazardous & BMW waste at Taloja	:	
- Public garden	:	134 Nos
Spread in	:	5.47lac Sq.m area
- No. of Trees	:	45945 + Planned 45000(2008-09)
- Welfare center	:	46
- Gymnasium	:	24
- Libraries	:	18
- Stage/function grounds	:	24
- Education Institutions	:	356
- Slum Pockets	:	48
- Rainfall	:	Heavy monsoon zone with
- Lakes & ponds	:	2500 to 3200 mm during June-Oct 26 Nos. Area 99806 Sq.m
Properties		
- Households Registered	:	164691
- Commercial	:	49781
- MIDC area	:	4086
- Sub Total	:	210558
- No. of Industrial Units(MIDC area)	:	3000

NODCS IN NMMC AREA



Area Distribution in NMMC area

Sr. No.	Type of area	Area in Sqkm
1	Urban area (CIDCO Demarketed)	79.44
2	MIDC area	24.69
3	Village-adivali Bhusavali	4.508

Out of total developed area of 108.63 sq.km, 50.79% area is used for urban commercial, industrial, administrative areas and infrastructure such as crematorium, water supply and sewage disposal, roads, railways. 19.92 sq.km area is undeveloped. Forest area of 26.55sqkm, 0.52 sq.km garden area, and 0.52 sq.km lake area and 34.2 km creek length within NMMC limits.

(Detail Ward wise land use plans are annexed.)

NMMC has projected MSW quantities as per Population Projection (2007–2040) and in process to develop plans. These projections are as per the following details;

Sr.No.	Year	Population	MSW gms/cap/day	MSW TPD	Sr.No.	Year	Population	MSW gms/cap/day	MSW TPD
1	2001	703947	450	316.8	16	2022	1930154.8	450	868.6
2	2008	1092957	450	491.8	17	2023	1981035.6	450	891.5
3	2009	1187826	450	534.5	18	2024	2031916.4	450	914.4
4	2010	1200929	450	540.4	19	2025	2082797.2	450	937.3
5	2011	1293987	450	582.3	20	2026	2133678	450	960.2
6	2012	1352515.7	450	608.6	21	2027	2184558.8	450	983.1
7	2013	1411044.4	450	635.0	22	2028	2235439.6	450	1005.9
8	2014	1469573.1	450	661.3	23	2029	2286320.4	450	1028.8
9	2015	1528101.8	450	687.6	24	2030	2337201.2	450	1051.7
10	2016	1586630.5	450	714.0	25	2031	2388082	450	1074.6
11	2017	1645159.2	450	740.3	26	2032	2440377	450	1098.2
12	2018	1703687.9	450	766.7	27	2033	2492672	450	1121.7
13	2019	1762216.6	450	793.0	28	2034	2544967	450	1145.2
14	2020	1820745.3	450	819.3	29	2035	2597262	450	1168.8
15	2021	1879274	450	845.7	30	2036	2649557	450	1192.3
					31	2037	2701852	450	1215.8
					32	2038	2754147	450	1239.4
					33	2039	2806442	450	1262.9
					34	2040	2858737	450	1286.4
					35	2041	2911032	450	1310.0

Since the waste from APMC and MIDC canteens varies due to weekly holidays, this factor is considered and instead of 643.55 TPD, the current waste quantity is taken as 600.00 TPD.

Based on the need and aforesaid projection integration of disaster risk reduction and climate change adaptation into the solid waste management plan becomes more crucial. The Navi Mumbai Municipal Corporation supported by UNDP will be undertaking series of consultative processes to upgrade solid waste management plan through DRR and CCA lenses.

Following strategic action plan is suggested after reviewing the existing SWM mechanisms at Navi Mumbai;

Priorities for Action	Indicators for the Solid Waste Management Sector
<p>Review and up gradation of City level Solid Waste Management Plan through DRR and CCA lenses</p>	<ul style="list-style-type: none"> • Municipal Solid Waste Management workshop will be organised for various SWM officials of NMMC, Contractors, NGOs and other agencies working in the area of door to door collection along with institutions specializing in waste processing. The second workshop on municipal solid waste management will be organised with diverse technology providers for centralized as well as decentralized treatment. • The E-waste workshop will be organised by involving the Software Technology Parks of India (STPI) that represents Ministry of Communication and Information Technology, Government of India and other concern agencies representing the Navi Mumbai based stakeholders from IT sector. • Consultation workshop on construction and demolition waste will be planned with the various Promoters and Builders Associations at Navi Mumbai. • The workshop for Biomedical Waste Management will be organised involving the Indian Medical Association, Navi Mumbai Chapter, hospital association and various health care facilities.
<p>Reviewing the classification of the city waste</p>	<ul style="list-style-type: none"> • Updation of Waste Characterization Study <ul style="list-style-type: none"> - Physical Analysis - Chemical Analysis - Heavy Metal Analysis - Calorific Value Analysis • Assessment of primary collection, storage, transportation and identification of gap areas • Decentralized sampling and analysis of waste in NMMC area

<p>wet and dry waste</p>	<p>source has to be achieved through awareness programme. Joint efforts of ULB, citizen forums, NGOs and peoples representative are required.</p> <ul style="list-style-type: none"> • Four such spots as transfer stations to be developed in the city limits where above activity can be performed. • System of Door-to-Door Collection for receiving the wet waste from residential area will be enforced. • Commercial waste generators will be provided large size metallic bins at appropriate locations where they can deposit wet and dry wastes separately. <p>(Already in place at Navi Mumbai)</p>
<p>Reviewing the plans for handling other waste</p>	<ul style="list-style-type: none"> • Construction debris • Drainage silt • Garden waste / Horticulture waste • Waste from Restaurant and Bars • Institutional waste • Wood and Construction/Demolition Material
<p>Analysing the Transportation during monsoon</p>	<ul style="list-style-type: none"> • Wide gap between generation of waste, its storage, collection and transportation. • During past few years monsoon - onset period, the uncollected garbage especially in low-lying areas, drains, canals, roadsides has plagued the cities and perturbed the city administrations. This may lead towards the filthy conditions and spread of several diseases like leptospirosis, dengue, chicken guinea, rhino viruses, fevers and respiratory disorders.
<p>To ensure the strategic planning for recycling programme development</p>	<ul style="list-style-type: none"> • Assess Markets and Market Development Strategies for Recyclables. The ultimate success of recycling depends on stable, reliable markets for recyclables. Securing stable, reliable markets requires <ul style="list-style-type: none"> ○ Basing marketing decisions on a clear understanding of the recyclables market system, ○ Sharing decision making among recycling program planners, government officials, the public, and the private sector.
<p>Education Strategies</p>	<ul style="list-style-type: none"> • Education is one of the most vital components to help foster market development among the public and private sectors. Educational programs must involve every sector of the population, including government officials; industry representatives; collectors, haulers and processors of recyclables; and the general public.

	<ul style="list-style-type: none"> • Government officials responsible for setting solid waste policy at the local levels must be educated to understand the impact of policy decisions. • Industry officials need to be made aware of the importance of recycling at their facilities and of using recycled products. Perhaps even more important, industry managers should be provided with information regarding local legislation, available supplies of recyclables, developing recycling technologies, and funding sources. • Creating a working group including industry and government officials is an important mechanism to facilitate such information sharing.
Environment and Education	<ul style="list-style-type: none"> • Assessing the SWM impact in climate • Designing a hands-on course curriculum. This will acquaint the student and communities with the actual practice of environmental management. • Specialised trainings to SWM staff at one of the laboratories/institutions involved with environmental management. • Localized collaboration between institutions like the Environmental Club of India with educational institutions.

This concerted effort on the skill building and awareness generation will help immensely to the students, localmunicipal bodies, communities so the further environment degradation can be restricted if not totally avoided.

Conclusion: In nutshell, the reference of action plan on integrating disaster risk reduction and climate change adaptation will help in developing disaster resilience integrated plan for Solid Waste Management. This plan aims to build the capacity of municipal staff, technical teams, ground staff, students, communities, practitioners and policy makers for assessing the current waste management system and practices covering all the stages of waste management chain viz.: primarygeneration and disposal, collection and transportation, sorting and material recovery for recycling, treatment and resource recovery, and final disposal.

The key objective of action plan was to facilitate identification of important aspects of waste management system and gaps therein with reference to regulations, institutional arrangements, financial mechanisms, technology and infrastructure, and roles and responsibilities of various stakeholders in the current system. This will further provide methodology to conduct various aforesaid studies leading to collection and analysis of the information.
