Pune Municipal Corparation

Towards Sustainable City...

Environment Status Report 2006 - 2007

It gives me great pleasure to present the Environment Status Report for year 2006-07 to the citizens of Pune. Pune has been blessed with a variety of resources not only by nature but also by the virtue of individuals residing in the city.

The city of Pune has been a centre of development and attracting lot of populations all across the globe for their livelihood probably encompassing its environmental capacity in recent times. Pune Municipal Corporation realizes its role for effective management of resources and thereby enormous efforts have been made to cater to the need of its citizens.

This report will help guide the much aware citizens of Pune to quantitatively assess the resources, its availability, trends, projections, need of future and the efforts of PMC in line with the need of time.

I hope that our efforts towards sustainability will be supported by every Punekar and we shall achieve our goal of sustainable city in the near future so as to be recognized as a guiding Corporation for the entire world.

Smt. Rajlaxmi Bhosale
Hon'ble Mayor
Pune Municipal Corporation

Environment Status Report
Pune Municipal Corporation

"Air, water, food… the three basic essentials of mankind", but how much do we need it?

It is very surprising to note that we require approximately 6 liters of water daily, may be around 1kg of food at a maximum but when it comes to air, we require 10,000 liters yet we tend to forget the importance of all these many a times and our priorities are just aligned with lifestyles and creating assets. The establishment of Air Quality Management Cell of PMC was Municipal Corporations first initiative towards its commitment to provide every Punekar their right to clean air and one of its kinds in the entire country. AQM Cell of PMC is a collaborative effort of all the leading organizations, scientists, regulators and policy makers of PMC and is supposed to provide decision support system to the policy makers of Pune who have a vision and willingness to create a sustainable Pune.

I am really grateful on behalf of the AQM Cell of PMC to the Hon'ble Mayor, Corporation and its officials as well as all Cooperators who have given us this opportunity to prepare the Environment Status Report for the year 2006 - 07. The experience of interacting with people, understanding the working of PMC, collecting information from various departments and wards though was tedious and run of the mill and at times even led to real test of our patience but finally has surely added so much of flavor to our working culture at AQM Cell and has enriched our instincts to work under immense pressures and limited resources and time.

I would like to mention a special thanks to Sakal Social Forum for their valuable support in making of the report.

I would like to take this opportunity to thank Dr. D. B. Pardeshi, Mr. Mangesh Dighe, Mr. Rahul Mali & Mrs. Archana for their technical support in making of ESR.

My sincere thanks to all my team members Utkarsh Mukkannawar, Harshala Ghodke, Jaymala Pawar, Manisha Ghule, Piyush Mahore, Vidya jadhav, Pradeep Kadam, who have worked day and night in preparation of report.

Dr. Ajay Ojha
Manager
AQM Cell of Pune Municipal Corporation

Thriving Towards Sustainable City
Pune Municipal Corporation

Pune, the city of education, of Information, of Biotechnology of resources, of scientists, and soon to be the city of Animation and world recognized for its culture, gardens, institutions and people. It is a great pleasure to be a part of this multifaceted city and support the presentation of Environment Status Report for the year 2006-07.

The ESR though usually thought to be a compilation of very important information of the whole city has usually failed to be a part of decision support system. The objective of this years ESR was to make it scientifically sound enough so as to help guiding the PMC on its developmental plans and to evaluate various projects in each department through impact assessment presented in this report.

I feel overwhelmed with responsibilities to understand Pune's share towards global issues and bring to the citizens of Pune a unique feature of this ESR which enumerates not only the usual statistics of Pune city profile in terms of its infrastructure, departments, developments, environment but also the features of global issues such as Green House Gas and Global Warming and thereby appeal to the citizens of Pune to contribute and support PMC in its initiatives to curb down our share of potential global warming and make our city a “Carbon Neutral Pune” for a better living and sustainable future.

Pravegh Pardeshi

Shri. Pravin Singh Pardeshi

Municipal Commissioner

Pune Municipal Corporation

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Introduction

A combined aggregate of **Population X Affluence X Technology** is the main reason for the increasing volume and variety of pollution. Recent trends of urbanization, civilization, unplanned development, and mixed land use pattern have completely altered the characteristics of pollution parameters to such an extent that many a times neither recycling nor reuse nor conventional treatment methodologies seem to be a feasible option either cost-wise or technically.

Pune Municipal Corporation is not away spared from this trend. However, PMC has geared up way back and provided at least the mechanism of proactive disclosure of its environmental status to the citizens through the Environment Status Report thereby committing towards its efforts to achieve best environment in terms of pleasing aesthetics and technical sustainability.

It has been conceptualized till the recent years that the main objective of the ESR is to appraise the local people residing in Pune area about the present status of the corporation including the various corporate sectoral planning, inter departmental activities, pollution status and management practices that the municipal corporation, so that the locals could interact to the scenario. However, the ESR 06 -07 is a step ahead to integrate database of environmental parameters with an approach to prepare science based policy for effective, acceptable and sustainable management.

1.0 Background

Information regarding the Class I cities of India are available with most of the Municipal Corporations especially after the 74th amendment of the Indian Constitution making it mandatory on behalf of each Municipal Corporation to prepare and present its Environmental Status Report (ESR). However, this information is not restricted to the environment only as it includes almost all the sectors such as education, amenities, poverty, housing, culture, waste management, pollution and the city profile as a whole. The central dogma of ESR lies with comparison of the city from previous years to the next. But the most neglected part of any of these is the sustainability issues and indicators that could be measured and evaluated for the very status of developed and sustainable city.

1.1 The Concept

Information availability and disclosure is one of the steps taken up by most of the Municipal Corporations including PMC and other such agencies as proactive schemes for better outreach and constructive management. However, the driving force for environmental management strategies and policy is often restricted to political will wherein PMC is blessed with the best leaders through ages. However, the feeders to decision making process are often led by few personalities who do not belong to the technical fraternity. PMC has identified this limitation and has appointed environment experts for preparing the Environment Status Report (ESR) since more than last 10 years.

Though ESR seems to be compilation of information, there is a need for identifying and evaluating indicators for sustainability not only in terms of quality but also quantity. Though there are indicators for sustainable cities which many of the organizations have been listing from time to time, there is still a need for evaluating them in terms of measurable entity. For instance, air quality standards stipulated by the State or Central Pollution Control Board may be an indicator of sustainable or good air quality that is measurable, but a unit measure above the standard may not actually mean that the air quality is bad or worst and may not need immediate concern. The flaws in such indicators are actually not communicated in the effective manner and hence often misleading.

The other dilemma that exists in the use of sustainable indicators is their qualitative nature i.e. effective or efficient public transport is a sustainable development however the number of buses per unit population is not quantified for particular city. Similar would be the case with water supply or literacy or even for green cover in the city. Therefore it is equally important to convert the data into an understandable and communicable form for the layman.

Identifying and evaluating status of environment, its impact analysis on resources, infrastructure availability and need, identification and evaluation of quantitative sustainable parameters and placing them into hierarchical structure following their interlinking for development of science based decision support system is the main objective of this years ESR 2007.

1.2 The Approach and Methodology

Air Quality Management Cell of Pune Municipal Corporation (AQM Cell of PMC) has been awarded the contract for preparing the ESR 2006 07. The approach adopted in the present ESR is to collect, compile & evaluate the environment parameters in various regimes of Pune including departmental & ward database. Further, impact analysis of each activity of the departments in PMC through evaluating them on the basis of a simple matrix considering different aspects of environment has been also carried out. The status and compilations of data was submitted to each of the departments as well as wards for their approval just after one month of allotment of the work to AQM Cell. The same accompanied a request for submitting departmental action plans with time schedules vis a vis problem identification, limitations and priority in line with the impact assessment and status represented in the draft ESR so that these could be evaluated every year and would help in improving the environment of Pune.

1.3 Organization of Report

A detailed description of each aspect of environment and the city profile as a whole is delineated in each chapter and an attempt is being made to provide an insight of developments, limitations, databases and management plans through graphical and pictorial representations. An outline of the organization of this report is discussed in the following section.

Chapter II City Profile

This chapter deals with the overall city development and its features. An introduction about its name through ages and appearance of it on Martian Crater is the highlight of this chapter. It outlines growth of the city and its beauty specifying geographical extents i.e. 18° 31' 22.45" North 73° 52' 32.69" East near the western margin of the Deccan Plateau, 559 mts above sea level. It has an equally soothing climate representative of India with three distinct seasons and having an average rainfall of 722 mm. Pune known for its culture and the chapter includes brief history and scenario of various festivals of Pune such as Ganesh, Sawaai Gandharv Music Festival and others. The chapter includes a note on the peths (general name for a locality) in Pune and attempts to reflect the perspectives of heir names. The demography section reflects Pune to be the 8th largest city in India. As far as communication and Media are concerned, the city is blessed with multilingual modes and the harbours the most effective and popular communication medias and press.

Pune is well-connected by road, rail, and air to most major cities in India such as Mumbai, Hyderabad, Bangalore, Delhi, Kolkatta, Ahmedabad, Indore and Chennai Public transport in Pune has three main forms: buses, auto rickshaws and private cabs. The Pune Municipal Transportation operates a fleet of about 850 buses on 184 routes has in running condition every day. Pune will be one of the first cities in India to implement a Bus Rapid Transit (BRT) system, along the Hadapsar Swargate Katraj corridor, a total of 12.2 km at cost of 62 crores. The total area served by the road network in PMC was about 139 sq km, with road length per sq km equal to 1.95 km.

Pune has got natural good climatic conditions for flora and fauna. The environment around Pune is pleasant for all kind of conditions, as a result it has rich natural resources, it lies between ranges & hills, some rivers ,lakes, jungles & forest, as a result it has good natural resources.

Growth in Pune city has been phenomenal that is driven by various industry segments that are vibrant in Pune today, notably the auto, auto processing activities, & of course service industries like IT & IT Enabled services. Pune boasts of a number of established large businesses in every segment. The IT sector has grown from about Rs. 250 crores to over Rs. 6500 crores in the last 8 years.

The University of Pune was established in 1948. Engineering colleges in Pune graduate up to 10,000 engineers in various disciplines every year, especially serving the burgeoning software and IT industry. The COEP, established in 1854, is one of the oldest college in Asia. The famous Film and Television Institute of India and National Film Archives are also located in Pune on Law College road.

The city is famous for the various medical facilities available here. In the city there are many hospitals which provide the latest medical facilities.

A salient feature of the chapter is introduction to various eminent personalities of the past who have glorified the existence of Pune on the global front.

Chapter III Demography

One of the very important chapters defining the population growth over decades, projections & its comparison with the Indian age groups as well as the change in age pyramid of Pune city. A brief note on population dynamics encircling population density, spatial distribution (ward-wise), literacy rate and others forms the salient features of this chapter.

The population of Pune was about 25 lakhs as per 2001 census and grown 5 times in last 50 years. The projected population of Pune is 3,401,797 with an annual growth rate of 34% as per the Ministry of Home Affairs as given in **Table 1**. In Pune, the 25-34 age group forms a larger proportion of the total population compared to that prevailing at the national level. The city has a population density of 10,412 per square kilometer as per the 2001

Table 1 Annual growth of population in Pune

Census Year	Population Total	Change	Growth rate (%)
1951	488,419		
1961	606,777	118,358	24.23
1971	856,105	249,328	41.09
1981	1,203,363	347,258	40.56
1991	1,691,430	488,067	40.56
2001	2,538,473	847,043	50.08
2006	3,239,806	701,333	27.63
2007	3,401,797	863,324	34.01
2011	4,134,905	1,596,432	62.89

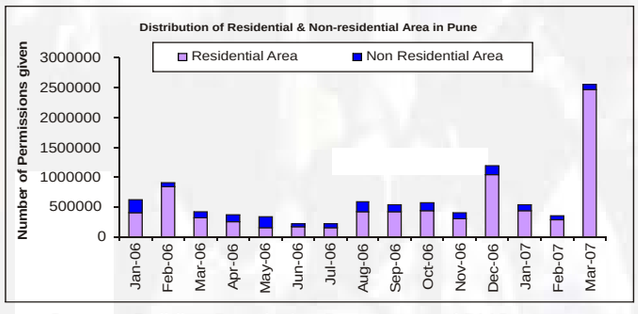
Source: *Population Projection for India and States 1996-2016, General, Ministry of Home Affairs. Registrar*

Chapter IV Housing and Slums

An important aspect of sustainability and growth, the chapter delineates important aspects of housing and its distribution of residential & non residential areas as given in **Figure 1**.

A special note on eco housing concept including environmental performance parameter such as site planning, energy efficiency building materials, water conservation and others weighted to a total of 1000 points for evaluation and PMC's initiative towards being selected as demonstration city for this project is highlighted as given in **Table 2**.

Figure 1 Distribution of Residential & Non Residential Area in Pune



Source: *Building Permission Department of PMC*

Slums being an integral part of Pune covering almost 40% of the total population has been dealt in detail covering aspects such as poverty definitions, growth rates, ward-wise analysis of slums considering area covered, declared And undeclared slums, densities, etc. This year a note defining the status of slums in terms of employment, housing type and access to basic facilities have been added.

Table 2 Eco Housing Criteria

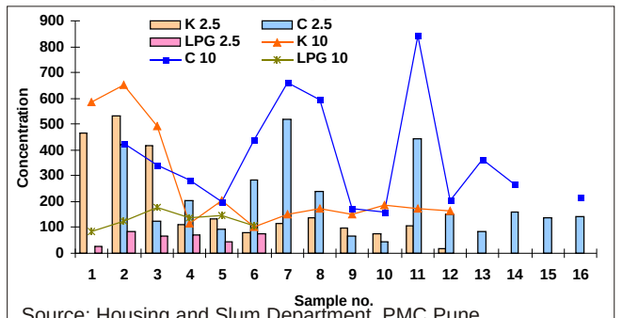
Focus areas	Points
Site planning	260
Environment Architecture	80
Efficient Building Materials	200
Energy efficient lighting	50
Solar water heater	50
Water conservation	200
Segregation of waste	80
Other innovative technologies	80
Total Number of Points	1000

Source: *Development of Eco-housing Criteria for PMC*

It is observed that 27 percent of the city's population resides in declared slums and they occupy only 4 percent of the total city area. In 2001 there were 503 slums pockets in Pune City, 40 % of the total population of Pune City was living in slums, 340 were declared or recognized slums and 132 were undeclared or unrecognized slums. Median age of slum and non-slum population is 24 and 28 years respectively.

The salient feature of this chapter is the major concerning issues of slums and a detailed study on indoor air pollution related to particulate pollution through burning of cooking fuel and its health impacts is highlighted. It shows a very high particulate pollution levels in all slums houses ranging from Unprocessed Biomass Fuel > Kerosene stove > Liquefied Petroleum Gas (LPG). All the values are higher than the standards laid by World Health Organization (WHO) as given in **Figure 2.**

Figure 2 Concentration of PM10 and PM2.5 among the different types of fuel



Source: Housing and Slum Department, PMC Pune

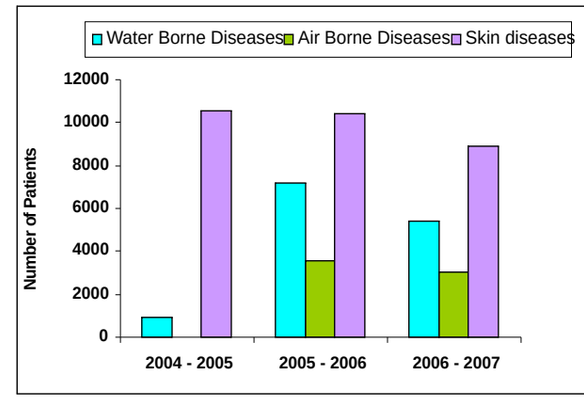
Chapter V **Health**

The most applicable social indicator of development being health, this chapter deals with relevant databases on health facilities which has increased substantially since 2004, Mortality rates for infants is the critical measure of human development and that in Pune is found to be highest in the months of July and August i.e. 118 & 130 per thousand babies born.

The salient feature of this chapter is the notable annual comparative database on communicable diseases in all sectors such as airborne reducing from 3589 to 3024, waterborne reducing from 7178 to 5429, skin diseases reducing from to 8930 & those communicated through mosquitoes sexually transmitted have also been reduced to a great extent as shown in **Figure 3**.

A step towards family welfare programs such as Jalad Sulabh Mofat Nasabandi Yojana, Savitribai Phule Yojana, Janani Suraksha Yojana, Reproductive & Child Health Programme and proposed projects such as healthy city for better life' project of the World Health Organization, a super specialty hospital dedicated to women and children to be set up in the city

Figure 3 Year wise Distribution of Communicable Diseases



Source: *Health Department of PMC*

Chapter VI **Garden**

This chapter describes the importance of open spaces and gardens within a city and discusses the efforts of PMC to reach to a green city status which is further recognized by the awards it received for establishing the most number of gardens. The chapter entails a detailed history of development of gardens and also enlists the river, Nalla (**Table 3)** and road divider beautification projects completed and in progress.

Pune Municipal Corporation has already developed 75 gardens in the city and is in the process of taking many such initiatives in near future including development of 35 gardens, Heritage Park, Palm Park, Joint Forest Management (JFM) project on Forest Land and others.

The most interesting amongst all is JFM Project, where PMC and Forest Development with the participation of local stake holders is approved and in the first phase forest area at Bhamburda, Warje and Pachgaon Parvati will be taken for the development.

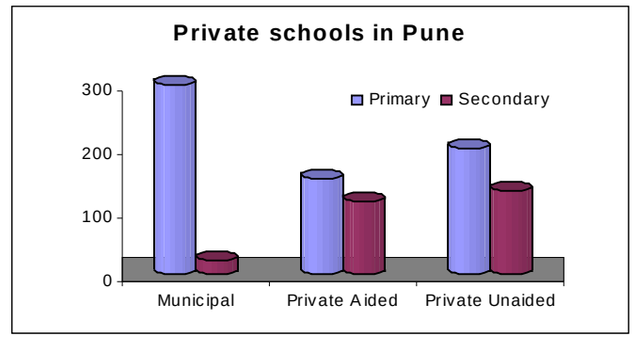
Chapter VII **Heritage**

Pune is blessed with many monuments and historic structures. PMC felt it necessary to highlight the existence of these in this years ESR and thus this chapter discloses the history of such monuments such as Shaniwar wada, Agakhan's palace, Lal Mahal and others. The special feature of this chapter is the description of restoration programs for the heritage structures of the city taken up by PMC. The salient feature is the description of an interesting effort of PMC to create a Guided Heritage Walk project for understanding and preserving our historical and cultural places.

Chapter VIII **Education**

Pune was named "Oxford of the East" by Shri Jawaharlal Nehru ji and now the educational capital of Maharashtra. In fact many of the educational institutes in Pune are much older than the University itself and thereby always been an attraction to a variety of students from all across the globe including approximately 1,70,000 students every year. This chapter details distribution of schools on basis of primary and secondary under the purview of Municipal Corporation and / or aided and non-aided as given in **Figure 4**.

Figure 4 Category wise distribution of Pune schools



Source: *Education dept, PMC*

Chapter IX **Transportation**

Salient feature of this chapter is the survey on vehicular counts at 34 major junctions in Pune carried out by AQM Cell of PMC to evaluate the emissions from various vehicular category that shows the particulate pollution from these are found to be approximately 16% whereas that from resuspended dust is approximately 56%. The total number of vehicles ranges between 40,000 at Golibar Maidan to 1,80,000 at Wadia College. Other emissions such as street sweeping, commercial cooking, cooking in slums and generators contribute to marginal extent. The likely age distribution of vehicles in Pune as from RTO, Pune is given in **Table 3**.

Table 4 Likely percentage age distribution of vehicles plying in Pune

Age (Yrs)	2W	3W	Cars	Tempo/ Other	Bus/ Truck
1-5	66.93	66.28	68.33	7.73	50.60
5-10	26.30	28.13	26.41	55.42	48.13
10-15	6.77	5.59	5.26	36.85	1.27

Source: *Pune RTO*

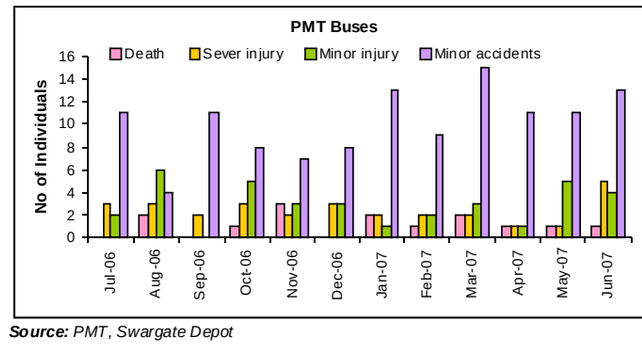
Table 4 Present status of PMT

1	**Average age of PMT buses**	**8 Years 3 month 3 days**
2	TATA & Ashok Leyland make buses	960
3	No. of BRT buses	10
4	Rental buses	149
5	No of Depots	7
6	Average vehicles on road	85 to 90% daily
7	Average vehicle Km covered daily	215
8	Daily Kms covered	1,39,399
9	Cancellation of Kms due to Traffic Congestion, Accident, Breakdown etc	9.1% (12778 Km)
10	Daily Passenger traveled	5,67,978
11	Break down rate	0.43 for 10000 Km
12	Kilometer per liter of diesel	3.38
13	Kilometer per liter Engine of	885 km
14	Bus Staff ratio	9.95
15	Workshop Staff	1.01 (Whereas CIRT norms 1.71 per bus)
16	Earning per km	Rs.22.26
17	whereas cost of bus operation	Rs. 30.58 per km
18	Semi low floor buses	15 (TATA make)
19	Semi luxury buses	11 (TATA make)
20	Pune Sight seeing luxury buses	2 Buses TATA make

Source: *PMT, Swargate Depot*

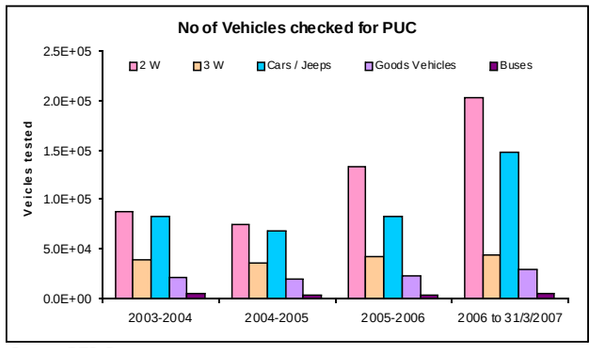
A special note on Bus Rapid Transit, its features, history in other parts of Asia, future plans for implementation of the schemes under JUNNURM forms part of this chapter. A study conducted by AQM Cell of PMC for understanding the changes in air quality and health benefits that Puneites will be availing from the pilot study forms the salient feature of this part of the chapter. A simulation of modal shift of 10% to 30% and equivalent air quality changes of about 20 to 35% and thereby the health benefits have been computed and presented.

Figure 5 Comparative Statistics of Accidents and fatalities by PMT buses



Source: *PMT, Swargate Depot*

Figure 7 PUC checks for various categories of vehicles during last 4 yrs



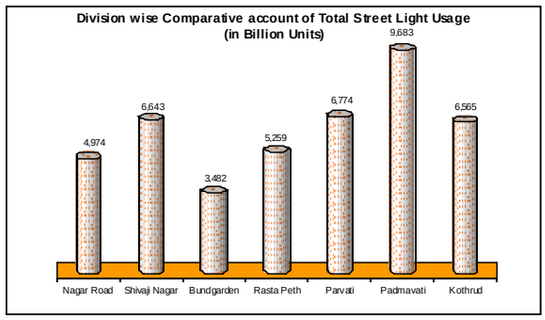
Source: *RTO, Pune*

Chapter X **Electricity**

Pune thrives to be a city with absolutely no power cuts due to the enormous efforts of various captive power projects and minimal loses during transmission. This chapter enlists the daily, monthly and annual sectoral electricity consumption that is found to be on an average 3.26, 6.63 and 1.14 million units/day for Domestic, Industrial and commercial respectively. vis a vis bill collection efficiency in Pune which is almost more than 90%.

The salient feature of this chapter is the electricity consumption for street lighting (**Figure 8**) and power saving mechanisms adopted by PMC in the recent past.

Figure 8 Division Wise Consumption by Street Light usage for the Year 2006-2007



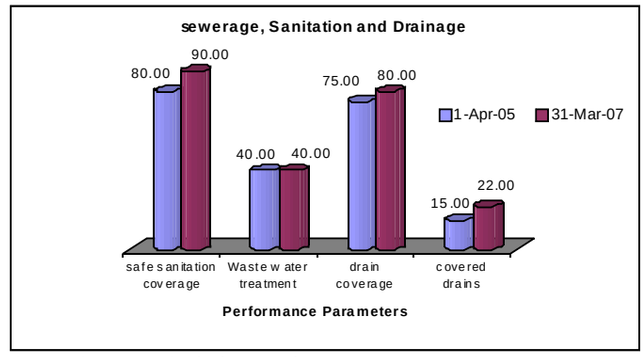
Source: *Electricity Dept, PMC*

Chapter XI **Sewerage**

This chapter deals with the history of sewerage systems in Pune since its inception in 1928 following the sewage collection and treatment in different facilities developed by PMC.

The sewage collection efficiency for Pune city that accounts for about 1500 kms sewer length covering 95% of area with newly emerged villages.

Figure 9 Performance Evaluation of Sewerage, Sanitation & Drainage



Source: Sewerage, Sanitation & Drainage Department, PMC, Pune

The special feature of this chapter is the performance evaluation of sewage collection and treatment based on various indicators such as collection coverage, efficiency of sewage treatment as represented in **Figure 9**, detailed mechanisms at each of the STP and proposed STP with its brief technology description.

Table 6 Existing Sewage Treatment Plants

Name	Capacity MLD	Existing load MLD	Total population benefited (approx)	Method of treatment	Area Km^2
Bhairoba	130	130	812500	Activated sludge process followed by anaerobic digestion	57
Erandwane	50	50	312500	Activated sludge process followed by aerobic digestion	26
Tanajiwadi	17	17	106250	Two stage biological process	18
Bopodi	18	18	112500	Extended aeration process	15
Naidu Hospital	90	90	562500	Activated sludge process followed by Anaerobic digestion	40
Total	**305**		**1906250**		**156**

Source: *sewerage project PMC, Pune*

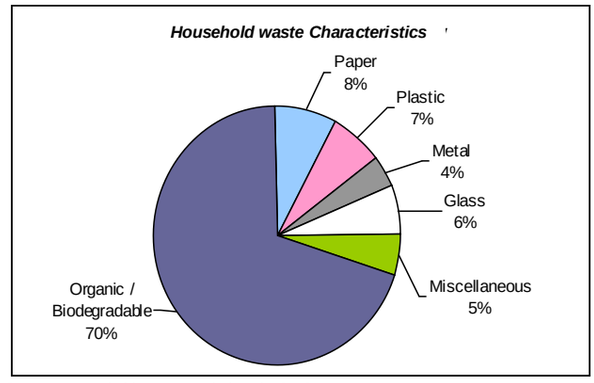
Chapter XII Solid Waste Management

Economic development, urbanization and improved living standards have led to increase in solid waste generation and varying characteristics of it. SWM had always been a challenge in itself to almost all the Class I cities of India and this chapter highlights the salient features of SWM in Pune.

Pune city generates about 1000 Metric Tons of municipal solid waste (MSW) with per day per capita generation found to be 0.450 kg. **Figure 10** gives the characteristics of the MSW, where 70% of total waste is Organic or Biodegradable. Other parameters fall in the range of 4-8%, the Plastics contribute 7%.

Currently Pune city is generating approximately 1000 to 1250 metric tons solid waste per day, which is collected, transported & disposed at a sanitary landfill site which is about 20 km away from Pune, viz at Devachi Urali. The total costs for collection, transportation & disposal is about

Figure 10 General Characteristics of household waste in Pune City

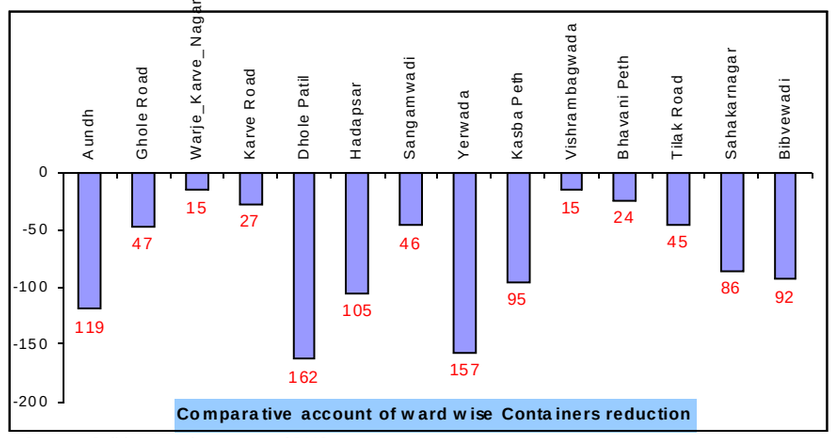


Source: *Household survey carried out by PMC*

Rs.60 crores per year & nearly about Rs. 20 to 25 crores are spent for transportation & equipments used at the sanitary landfill site.

Role of rag pickers association, waste segregation status, waste collection, infrastructure availability and waste generation projections forms the major part of this chapter.

Figure 11 Comparative account of ward wise container reduction in Year 2006-07



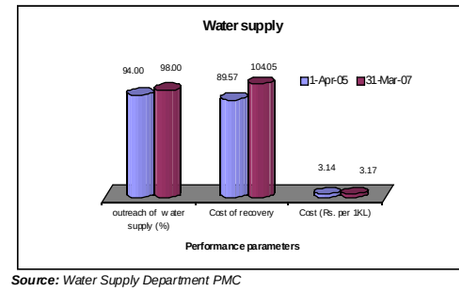
Source: *Solid Waste department of PMC*

Chapter XIII **Water Supply**

Water being the most essential commodity on this earth a special emphasis is given on the availability, supply and quality of water to the Punekars which amounts to be about 195 lit/person, which is approximately 1.5 times the normal per capita availability in other cities. A detail description of water supply status in the city including distinctive note on water treatment plants forms the salient feature of this chapter.

Pune gets its water supply from khadakwasla dam about 12 kms from the city through right bank canal and a closed pipeline. Three more dams i.e. Panshet, Warasgaon and Temghar have been constructed on the same river, upstream of khadakwasla. The storage capacity of these 3 dams is 900 MM^3 whereas the present annual requirement of city is about 200 MM^3. PMC serves a water supply of 195 lit/ capita/ day against standard of 135 lit/ capita/ day. Details of water purification plants are given in **Table 7**.

Figure 12 Comparative accounts of performance parameters for citywide outreach of Water Supply



Source: *Water Supply Department PMC*

Table 7 Water Purification Plants

STP	Location	Capacity (MLD)	Treatment Method	Commissioning Year
Parvati Water works	Sinhagad Rd.	470	Conventional	1969
Cantonment water works	Cantonment	273	Conventional	1893
Holkar Water works	Holkar Bridge	22	Conventional	1919
Old Warje water works	Warje	5	Conventional	1999
Wagholi Water works	Wagholi	23	Conventional	2000
New Warje Water Works	Near Kakde City	100	Non-Conventional	2006

Source: *Water Supply Department PMC*

Chapter XIV **Environment**

City of Pune is in limelight not only for being an IT BT centre but also for reasons that are not very entertaining and liked by many. It has been declared as the 13th most polluted city of India due to high levels of air pollution in the city as well as NGO's in the city have been after the Corporation due to the pollution of surface water bodies since many years.

This chapter forms the heart of the report and details of air quality status in the city in the first section compared to the National Standards. Efforts of PMC and its commitment for providing better air to the Puneites is reflected through the establishment of Air Quality Management Cell of PMC and the awards that it has won for proactive approach for AQM in the city. A thorough description of emissions inventory **Figure 13**, source apportionment, dispersion modeling and cost benefit analysis approaches of AQM Cell forms the major highlights of this section.

Figure 13 Emissions Inventory for Pune

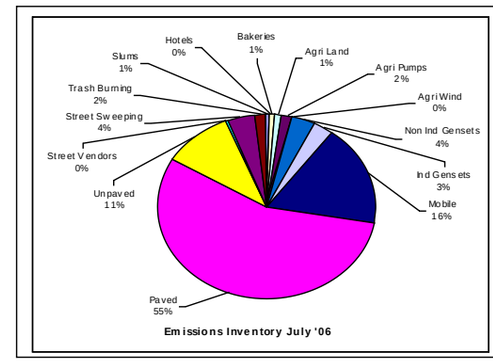
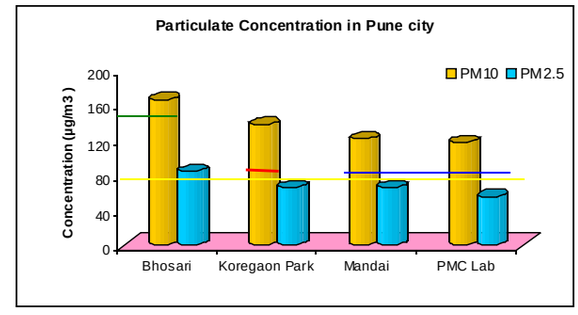


Figure 14 Particulate concentrations in Pune City



Note: - *CPCB Standards*
Industrial
Sensitive
Residential
US Standard
PM 2.5

Figure 15 Comparative monthly trends for Chemical oxygen Demand (COD)

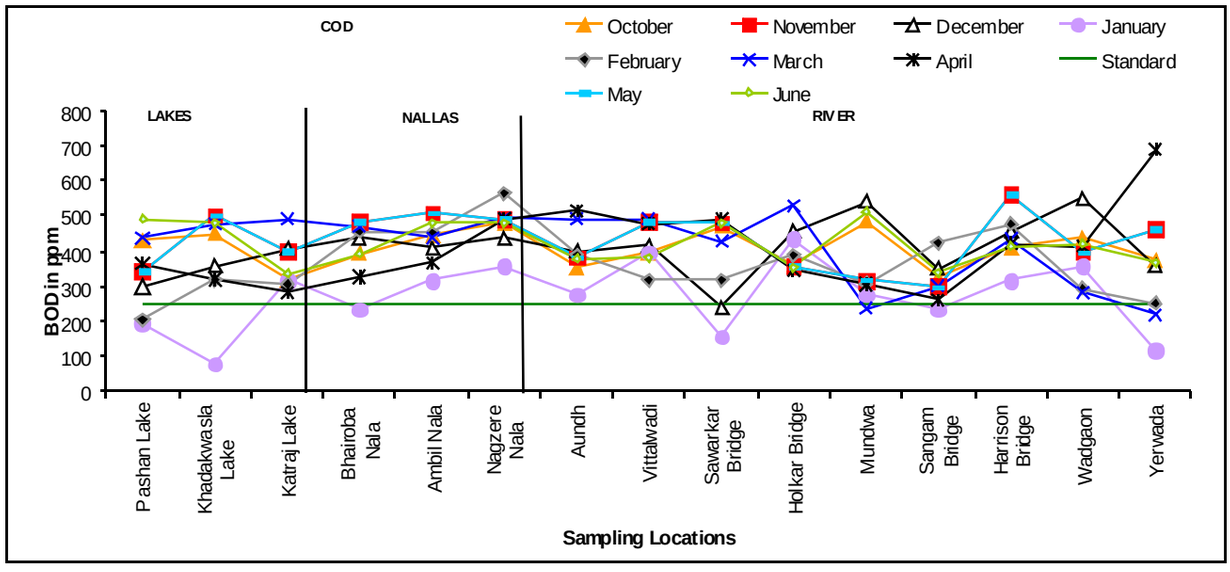
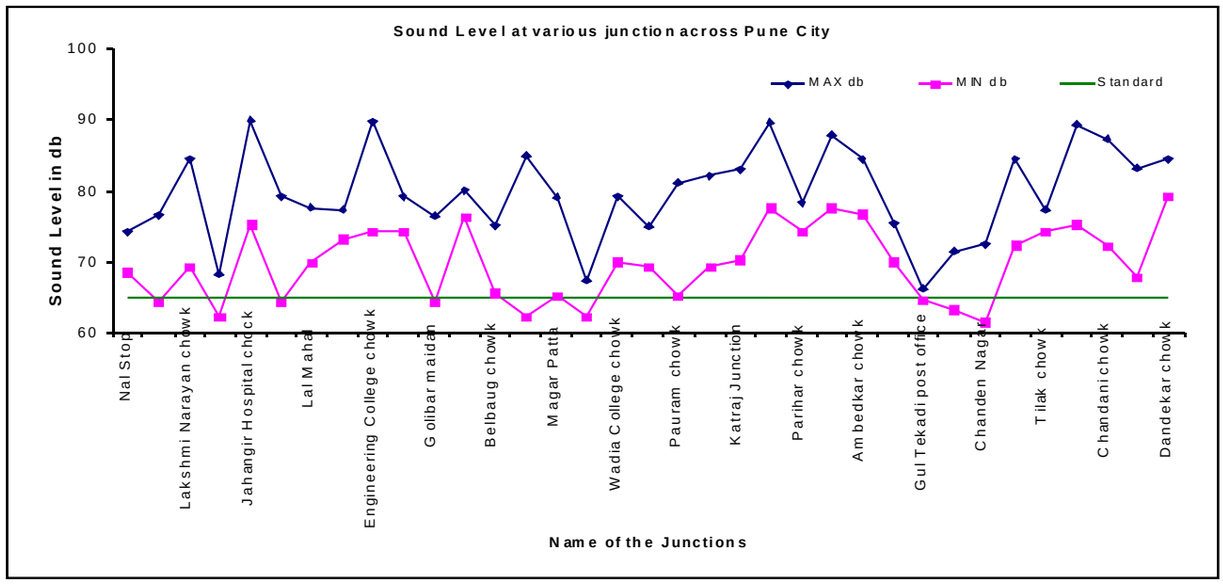


Figure 16 Comparative monthly trends for Noise (dB)



Chapter XV Latest Developments

Problems cannot be solved over night and especially when they are of extensive scale like Pune city it takes a lot of time and plan to implement effective management options for management. This has been recognized in time by PMC and this chapter takes a ride through the various efforts of Pune Municipal Corporation to mitigate problems of citizens and providing them with a developed and sustainable city.

A distinctive note on PMC's extraordinary and uniqueness featuring its decisions to come up with Citizens Environmental Forum and Indradhanushya (Environment Museum - A space for citizenship and environmental education) and Biodiversity park as a Clean Development Mechanism option for Carbon Trade in international market forms the salient feature of this chapter

Particulars	Amount In Crores
Bus Rapid Transit (Brt) Corridors (Pilot 12.5 Km And Phase 1 80 Km)	538.32
Commonwealth youth games city infrastructure (road, terminals and junctions)	268.65
Preservation of Lakes and Nulahs	97.78
River Improvement	99.96
Augmentation of Sewage system	86.13
Rehabilitation of Urban Poor (5 slums relocation from environmentally fragile zones, street vendors rehab and dormitory for migrants)	390.64
Total	**1481.48**

Chapter XVI Global Warming

"The subject of global warming definitely makes headlines in the media and is a topic of much debate". Everyday we hear about this topic yet most of the common man finds it difficult to correlate global issues with themselves.

The Intergovernmental Panel on Climate Change (IPCC) predicts that, based on a range of scenarios, by the end of the 21st century climate change will result in:

?

A probable temperature rise between 1.8°C and 4°C, with a possible temperature rise between 1.1°C and 6.4°C.

- ? A sea level rise most likely to be 28-43cm
- ? Arctic summer sea ice disappearing in second half of century
- ? An increase in heat waves being very likely
- ? A likely increase in tropical storm intensity.

The Air Quality Management Cell of PMC attempts through this ESR to estimate the total amount of GHG emissions from major sectors / activities in Pune as given in **Table 8**

Table 8 GHG Sectoral emissions from Pune

Category	GHG Gases	Activity	Emission Factor	Emissions (Tons/year)*
Transportation	CO_2	Kilometers traveled	*Transport Fuel Quality for 2005, CPCB*	657,445
	HC			55,375
Electricity (Thermal) – residential, commercial & industrial	CO_2	Coal burned	www.osc.edu/research/pcrm/emissions/thermalemissions.shtml	4,927
Solid Waste	CH_4	SW / capita	IPCC, 2005	65,80,000
Agriculture	CH_4	Total cultivation	GHG Inventory in Asia: by Center for Global Environmental Research	11,364
Industries and non industrial generators	CO_2	No of gensets, emissions of processes	AP-42	5,22,475
Sewage	CH_4	450 MLD generated	EMEP / CORINAIR (1996)	10,07,721
Total	All			**79,50,358**

**** All emissions are converted in CO_2 equivalent***

Total amounting to be **79,50,358 Tons of CO_2 /year** from Pune through major sources. Considering the rates of emissions per capita as published by the study mentioned earlier, the estimates for carbon emissions from Pune is represented in **Table 9**.The most out of the dictionary efforts of this ESR is reproduction of published work on Trees which serve as mitigation media for global warming as well as quantifying the reduction potential from each individual through simple methods of changes in lifestyle as represented in **Table 10**.

Table 9 Carbon emissions from Pune

Category	Population	Per capita Carbon emissions (kg C/year)*	Emissions (Kg C / year)
High Income Group	4,80,000	914.7	439056000
Middle Income Group	16,00,000	279.4	447040000
Low Income Group	11,20,000	122.5	137200000
Total	**32,00,000**	**476.4**	**1,023,296,000**

**** Per capita emission estimates derived for 2010 from RANWA study***

Table 10 Quantitative reductions of GHG through Individual efforts

Lifestyle event	Possible Emissions Reduction (CO_2)	Alternative practice
Less packaging	104 kgs/year	Use of recyclable materials for packaging
Washing machine with low energy and low water usage	447 kgs/year	Use of cold water instead of hot water for washing machines
Water heater thermostat to work at 120^{0}C	227 kgs/year	Required only 60^{0}C warm water for bathing
Lights in the house	99280 kgs/day	100 watts incandescent light bulb for 6 hours uses 82 kgs of coal. Use of CFL lamps
Water Heating	1500 kgs/year	Use of Solar water heater. Annual electricity bill saving of Rs. 2400 per house
	454 kgs/year	Wrapping of water heater in insulator
Newspapers, glass, materials, cardboard at home	385 kgs/year	Recycle all of these
Local Travel	721 kgs/year	Leave your car just for two days at home and use public transport
Electronic devices at home	1000's of kgs/year	Unplug all electronic devices once not in use. It would save lot of emissions and money for each home
In office	1000's of Kgs/year	Use of car pools
		Recycling of papers / prints on both sides of paper, inventorizing misuse

Chapter XVII Environment Impact Assessment and Sustainable Pune Indicators

PMC has identified the importance of impact identification to be carried out before the project is taken up for implementation and thereby through this chapter it attempts to define the boundaries for each activity in the individual departments so that effective, communicable and acceptable management plans could be formulated and implemented for each of these activities. The first section of this chapter delineated a matrix of activities in each department and its potential qualitative impacts on various components of environment including social, cultural and economic.

The second section of this chapter exclusively describes quantitative sustainable indicators encircling the five E's of sustainability i.e. economy, ecology, equity, education and evaluation.

The most impressive part of this chapter is its attempt to gather some of the essential indicators through reported literature for its effectiveness in comparing with the state of Pune city so as to identify the gaps between standard resource and/or infrastructure requirements and that available in Pune to help the policy / decision makers to take necessary steps for bridging this gap and taking Pune towards sustainability which essentially was the basic objective of this years Environment Status Report.

The status of Pune at a glance is represented in **Table 11**.

Parameter	Description
Population	
Total area of PMC limit	243.84 Sq.km
No. Of administrative wards	14
Population 2001	2538473 (census 2001)
Population-Estimated (2007)	3401797
Adult - literacy rate	77%
Higher density ward (Estimated)	Bhawani Peth
Lower density ward (Estimated)	Yerwada
Birth Registration (Pune Municipal Corporation) (Per Year)	47320
Infant mortality rate (2001 State Govt. Records)	57.34 per 1000 infants born
Child mortality rate (2001 State Govt. Records)	4.13 per 1000 infants born
Housing	
Total number of households (2001 census)	555771 households
Household Size (As per census 2001)	4.57 persons
Slum	
Slum Population (2001 census)	1025000
Education	
No. of Municipal schools	318
No of students in Primary Schools	173818
No of Secondary Students	153250
Garden	
No. of Gardens	Developed - 75
Total Area	359.35 sq. km
Traffic and Transportation	
Pune RTO total registration vehicles (March)	1445364
No. Of 2 wheelers (March)	1123898
Total Buses	10273
PMT Buses (Including hired buses)	960

Parameter	Description
Water	
Average PMC supply for all purpose	195 lit per capita per day
Residential water supply	70 to 195 lits per capita per day
Total Water Supply	874 MLD
Waste Water	
Generated waste water	451 MLD
Treated waste water	305 MLD
Existing number of treatment plants	5
Solid Waste Management	
Per capita waste generation	450 gm/capita/day
Disposal Site	Devachi Urali 17.2 Ha
New site for waste disposal	Devachi Urali / Yelawadi
CDM Benefits (Carbon trading potential)	21,00,000 tons CO_2 reduction
Electricity	
Electricity (yearly Consumption)	11.03 Million Units / day
Street Lights Electircity Consumption (yearly Consumption)	43.39 Million units / day
Global Warming	
Total emission from Human sources	10,23,296 Tons CO_2
Anthropogrnic contributions from major sources	79,50,358 Tons CO_2
Environment	
1) Air Quality	Approximately 10,000 tones/year
2) Water	
BOD (30 mg/lit)	Most of the times above standards
COD (100mg/lit)	All values above standards
DO (4 mg/lit)	Nallas have negligible values, lakes have sufficient DO whereas rivers have varying DO levels
3) Noise level	All found readings to be above the standards

Pune City Profile

2.1 Pune City Profile

Pune earlier famous as Poona is one of the most important cities of Western India. Aptly called as the `Queen of Deccan' after it's elevated position atop the Deccan Plateau, it's salubrious climate and surrounding hills. The city is nicknamed variously such as `Pensioner's Paradise', the `Oxford of East', `Detroit of India', the cultural capital of Maharashtra', once the `Cycle city ' and now the `Scooter city ' of India and upcoming 'IT-BT' capital of India. Most importantly Pune has grown so much to be reaching as far as Planet “MARS”… and it is true Pune is one of the Indian cities which has a **Martian Crater** named after it.

2.2 Introduction

Pune is the eighth largest city in the Indian state of Maharashtra. (World Gazetteer: India- Metropolitian Area 2007 Calculation) The city derives it name from Punya Nagari, which means 'the city of virtuous deeds, Pune is spread over the banks of five rivers- a cornucopia of different cultures. Pune used to be at the center of the Maratha Empire in the old days. It is a cultural center of the state of Maharashtra that wears a rich historical legacy characterized with the glorious period of Marathas. Located in the Sahayadri Hills, near the west coast of India, Pune city has been developed into a Pune metropolitan area, just equal in area to that of Greater Mumbai. It is located 192 km (by rail) and 160 km (by road) from Mumbai and is 559 metres above the mean sea level.

A triangular portion of India, Pune situated on the Deccan Plateau has a temperate climate. It is surrounded by beautiful hills of the Sahyadri ranges and Sinhagad fort .

Water, which is plentiful, is supplied to the city from Panshet, Khadakvasla and Varasgaon dams, all are located about thirty kilometres from Pune. It is among the greenest urban areas in the country with more than 40 % of its area under green cover.

Equally interesting to note that Pune finds mention in some of the Puranas and research evidences show human civilization that existed 100,000 years along the Mutha River which is one of the major rivers originating from the Sahyadris.

Pune contributed significantly to the freedom movement and produced heroes like Lokmanya Bal Gangadhar Tilak, Sane Guruji and the Chapekar brothers. Pune comprises a cosmopolitan community and a broad range of economic and social populace. One of the biggest industrial towns of Maharashtra and known as the Automobile City as many big auto mobile companies have their head quarters here. It is also famous for education and OSHO Communes in the Rajnish Ashram located here.

In Pune, the past meets the present. It is one of those rare cities with a twin image: that of a tradition-bound place generally considered the quintessence of Maharashtrian culture and that of a modern industrial metropolis. The oldest extant structure in the city is the rock-cut temple of Pataleshwar.

2.3 Geography

- Pune is located at 18° 31' 22.45" North 73° 52' 32.69" East (See satellite view), near the western margin of the Deccan Plateau.
- Recently upgraded to Zone IV 2nd most dangerous Seismic zone in India
- Pune lies on the leeward side of the Sahyadri ranges and Western Ghats, 560 m (1837 ft) above the sea level, at the confluence of Mula and Mutha rivers, which are tributaries of the Bhima.

- Pune's only building in the **Palladian** architectural style GPO (1873-74)

2.4 Climate

Pune experiences three distinct seasons: summer, monsoon and winter. Typical summer months are from March to May, with maximum temperatures ranging from 35 to 39 °C (95 to 102 °F)

With high diurnal variations in temperature

- Annual average rainfall of 722 mm
- Temperature during winters drops to 5-6 C

Table 2.1:- Average values for Pre-monsoon from 2002-2007

Year	W.DIR	AW	VP	RH	EVP.	SSH	RF	DRN	TEMP	WAT
2002-3	0	5	17	53	6	8	22.3	0	26	25
2003-4	0	6	18	57	7	9	2.6	0	28	27
2004-5	27	5	19	54	7	8	66.0	1	28	26
2005-6	0	5	18	49	7	9	70.1	1	36	27
2006-7	27	7	19	50	7	8	76.7	0	28	27

Table 2.2:- Average values for monsoon from 2002-2006

Year	W.DIR	AW	VP	RH	EVP.	SSH	RF	DRN	TEMP.	WAT
2002	27	6	23	73	4	6	338.0	1	25	26
2003	27	5	24	80	4	5	428.8	1	25	26
2004	27	5	24	80	4	6	684.0	2	25	26
2005	27	4	25	82	3	4	1179.5	4	28	26
2006	27	6	25	82	3	4	1088.1	3	25	26

Table 2.3:- Average values for winter from 2002-2006

Year	W.DIR	AW	VP	RH	EVP.	SSH	RF	DRN	TEMP.	WAT
2002	0	2	15	57	4	9	0.0	0	22	22
2003	0	2	13	57	4	9	3.6	0	22	22
2004	0	2	15	61	4	9	10.0	0	26	21
2005	0	2	13	56	4	9	0.0	0	26	21
2006	0	2	17	54	3	8	0.0	0	22	22

Source: Indian Meteorological Department, Pune

Key:

W.DIR- Wind Direction, AW- Wind speed in m/s, **VP**- Vapour Pressure in Hpa., **RH**- Relative Humidity in % , EVP- Evaporation in mm., **SSH**- Sunshine in hrs., RF- Rainfall in mm., **DRN**- Duration of rainfall in hrs., TEMP-Air Temperature in ^{0}C, **WAT**-Water Temperature in ^{0}C.,

2.5 Culture

Pune is Maharashtra's cultural capital and the form of Marathi spoken in Pune is considered to be the standard form of the language. Pune is a vibrant cultural city and people from multiple religions and speaking different regional languages reside here. It also hosts various national festivals and cultural events throughout the year.

People of Pune have wide interests in various Arts, Literature, Music, Spiritualism and Food. In recent years it has also been a leader in Trance and Techno movements, alongside Goa and Mumbai.

2.5.1 Ganapati (Ganesha) Festival

It was in Pune in 1894 that Lokmanya Tilak initiated the concept of the "Sarvajanik Ganeshotsav" to bring people together for interaction and information sharing. This festival usually held around late August-early September during Ganesh Chaturthi, is very popular. During this time, the Maharashtra Tourism Development Corporation organizes the month-long Pune Festival which hosts classical dance, folk dance and music recitals, a film and drama festival, automobile rallies and some traditional sports like bullock cart races and wrestling.

2.5.2 Sawaai Gandharva Music Festival

In December Pune hosts the Sawai Gandharva Music Festival. It is dedicated to the classical forms of music both Hindustani and Carnatic

2.5.3 Wari

Close to Pune City are the villages of **Alandi** and **Dehu** where **Sant Dnyaneshwar** and **Sant Tukaram** belong. Each year thousands of pilgrims from all over Maharashtra gather here and start 'Wari' which is the procession carrying 'palkhi's of Sant Dnyaneshwar and Sant Tukaram to Pandharpur which is the home to Lord Vitthal. Pandharpur is about 300 km from Pune. All pilgrims walk this distance to reach Pandharpur on the auspicious day of 'Aashadhi Ekadasshi' when the 'Wari' ends.

2.5.4 Osho International Meditation Resort

Osho resided and taught in Pune for much of 1970's and 1980's decade. The lush green Osho International Resort is one of the world's largestPlaces dedicated to meditation and personal development. Located in the Koregaon Park are, it attracts a large number of national and international audience to the city.

2.6 The Mystery of Peths

Peth is the general name for a locality in old Pune. Peths are an important part of Pune culture and were important ingredients of ancient city planning. Businesses in many of these localities used to be open for business only once a week. Hence these localities are named according to the day they were open for business: Raviwar (Sunday) Peth, Somwar (Monday) Peth, Mangalwar (Tuesday) Peth, Budhwar Peth (Wednesday), Guruwar (Thursday)Peth, Shukrawar (Friday) Peth, and Shaniwar (Saturday) Peth.

Some peths have been named after a major temple located within their boundaries, such as Kasba Peth, Ganesh Peth, Bhawani Peth and Ganj Peth. Other peths have been named after certain notable Maratha and Peshwa rulers and generals, such as Sadashiv Peth for Sadashivrao Bhau, Nana Peth for Nanasaheb Peshwe, Narayan Peth for Narayanrao Peshwe, Ghorpade Peth for Santaji Ghorpade and Rasta Peth for Sardar Raste. The last peth is the Navi (New) Peth. After Navi Peth, the localities are named as "Nagar" such as Sahakarnagar, Shikshaknagar, Vimannagar, Lokmanyanagar and so on.

2.7 Demographics

As estimated from 2001 census, the urban agglomeration around Pune is expected to have population of 3,401,797 in 2007. This figure includes the population of the city of Pimpri-Chinchwad, which is the industrial twin of Pune. Of late, the city has witnessed a sizeable investment in the software and automobile sectors, resulting in an influx of skilled labor from all over India. Notably, even though Pune is the eighth largest city in India, it has the sixth largest metropolitan economy and the highest per capita income in India, with the least income disparity between the rich and poor (MCCIA).

2.7.1 Communication

Residents of Pune are referred to as Puneites, or as Punekars in the local language Marathi.Marathi is spoken extensively while English is popular amidst the college-goers, white-collar professions and other cosmopolitan populace. Hindi is also widely spoken and understood.

2.7.2 Media and Communication

Marathi newspapers such as Sakal, Loksatta, Lokmat, Kesari, Prabhat and Pudhari are popular. English dailies such as the Indian Express, Sakal Herald, The Times of India and fortnightly VivaWest have editions based out of Pune, with additional local supplements.

Zee Marathi, Doordarshan Sahyadri and ETV Marathi are popular television channels. Many English, Hindi entertainment and news channels are watched as well. Pune has few FM Radio services as well running for last few years. Though, Radio Mirchi (98.3 MHz) tops the popularity rating, AIR FM (101. MHz) and Vidyavaani (Pune Universities' own FM Channel) have their presence felt.

2.8 Transport

Pune is well-connected by road, rail, and air to most major cities in India such as Mumbai, Hyderabad, Bangalore, Delhi, Kolkatta, Ahmedabad, Indore and Chennai. Pune Airport previously had only domestic flights, but has become an international hub with flights connecting to Singapore and Dubai.

The city has two main railway stations, Pune Station and Shivajinagar; most long-distance trains hault at Pune Station. Road travel between Pune and Mumbai has improved significantly with the construction of the Mumbai-Pune Expressway and it now only takes approximately three hours to reach Mumbai

.

2.8.1 Public Transport

Public transport in Pune has three main forms: buses, auto rickshaws and private cabs. The Pune Municipal Transportation operates a fleet of about 850 buses on 184 routes in running condition every day. Pune is one of the first cities in India to implement a Bus Rapid Transit (BRT) system, along the Hadapsar, Swargate, Katraj corridor, a total of 13.6 km at cost of Rs. 62 crores.

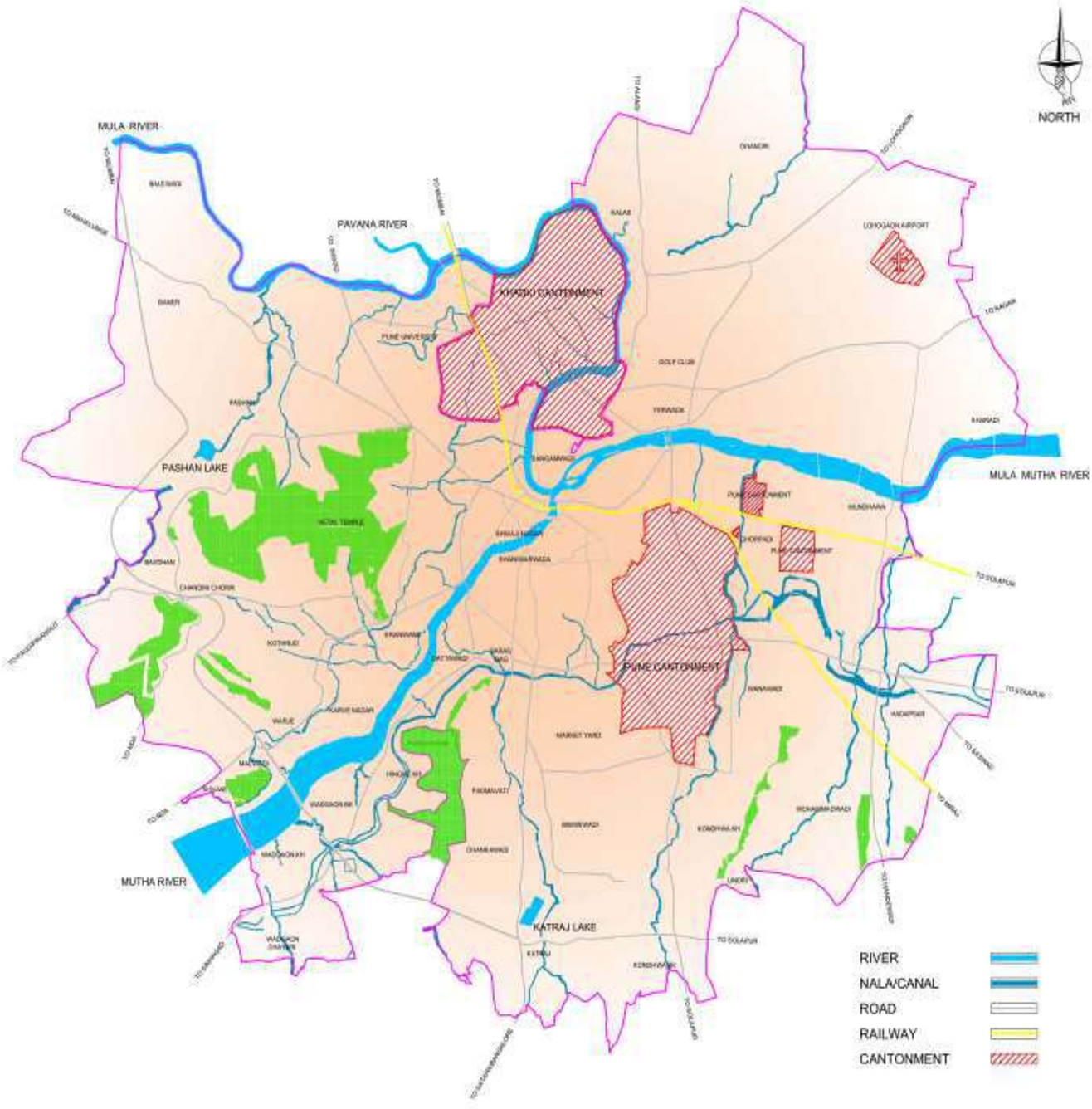
2.8.2 Road

The total area served by the road network in PMC was about 139 sq km, with road length per sq km equal to 1.95 km. About 88 km are within the congested parts of PMC. The estimated land area consumed by the road network is hardly 10.4 sq.km, mainly on account of narrow widths (SPAN Report, 2003-04).

2.8.3 Air

Airport is situated in the Lohagaon area, about 12-km from the city. Indian Airlines, Jet Airways, and many

Map showing extent of Pune City



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2.8.4 Rail

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2.9 Biodiversity

Pune has got good natural climatic conditions for flora and fauna. The environment around Pune is pleasant for all kind of conditions such as ranges & hills, some rivers ,lakes, jungles & forest, as a result of which it has rich natural resources.

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2.10 Civic Administration

Pune Urban Agglomeration comprises of 5 civic bodies, namely

1. Pune Municipal Corporation
2. Pimpri-Chinchwad Municipal Corporation (PCMC)
3. Khadki (Also called Kirkee) Cantonment Board (KCB)
4. Pune Cantonment Board (PCB)
5. Dehu Road Cantonment Board

2.11 Economy

The importance of the Pune region to the state economy of Maharashtra has been increasing. This increase in the regional turnover can be attributed to the phenomenal increase in the manufacturing, IT-BT as well as other service industries in Pune. The growth of Pune city district over the past few years has been really phenomenal. This growth is being driven by various industry segments that are vibrant in Pune today, notably the auto, auto processing activities, & of course service industries like IT & IT Enabled services. Pune boasts of a number of established large business in every segment.

2.12 I.T.Park

InfoTech Park has emerged as the leading IT centre not just in Pune, but the entire country. Presence of huge campuses of the leading IT companies like Wipro, Infosys, Geometric, bears testimony to the success of this park. The sector has grown from about Rs. 250 crores to over Rs. 6500 crores in the last 8 years.

2.13 Shopping Centers

The shopping areas in Pune reflect the booming economy of the city. The Deccan Gymkhana is a triangular area packed with shops. Another famous are is the Laxmi Road which is know for fine traditional Indian saris and jewellery. Some beautiful shopping malls are located in Pune to cater the shopping lover people. Few of those are Nucleus, Pune Central, Mega Mart, Vishal Mega Mart, and KK Bazar.

2.14 Education

"The University stands for humanism and tolerance, for reason, for adventure of ideas and for the search of truth. It stands for the forward march of the human race towards even higher objectives. If the universities discharge their duties adequately then it is well with the nation and the people."

All colleges in Pune are affiliated to the University of Pune, one of the largest universities in the world in terms of matriculation. The University of Pune was established in 1948. Engineering colleges in Pune graduate up to 10,000 engineers in various disciplines every year, especially serving the burgeoning software and IT industry. The COEP established in 1854, is one of the oldest college in Asia. The famous Film and Television Institute of India and National Film Archives are also located in Pune on Law College road.

A number of educational institutes also came up here: the Deccan College (one of the oldest in western India), Engineering College (second oldest in the Subcontinent), Fergusson College (amongst ten most reputed in India), Agricultural College (one of the earliest in the country) to name a few

2.15 Persons

P. L. Deshpande is an integrated part of Marathi Literature. Acharya Pralhad Keshav Atre, G. D. Madagulkar the renowned literature has a massive

contribution to Marathi literature. Sharad Talwalkar an extremely talented and versatile actor ruled the Marathi Film Industry and Theatre for many years. Pandit Bhimsen Joshi, Dhanraj Pillay, Hrishikesh Kanitkar, Manisha Sathe, Rohini Bhide.

2.16 Health

Pune city is famous for the various medical facilities available here. In the city there are many hospitals which provides the latest medical facilities. The hospitals in the city such as Ruby, Sancheti, etc are famous worldwide. These hospitals provide the various facilities regarding the diseases such as cancer, heart attacks, skin diseases, etc.

Demography

3.1 Population Growth Trends

The population of Pune city as per Census 2001 is close to 25 lakhs. In the last 50 years, the city's population has grown by more than five times (**Table 3.1**). The growth in population testifies to the vibrancy of its economic activity and development in the recent past.

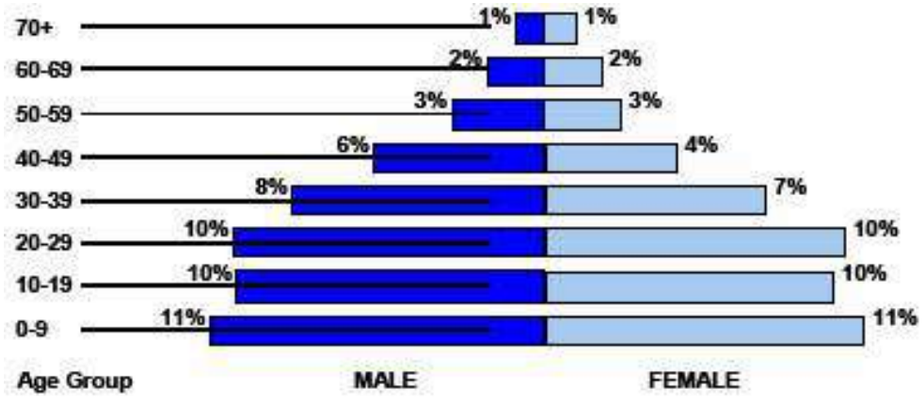
India has a very young population with a median population age of 24 years; about 65% of the total population is less than 35 years old (**Figure No. 3.1**). Pune is also reflective of this demographic characteristic with the median age being closer to the national level. But, 62 percent of the total population is under the age of 30 years. In Pune, the 25-34 age group forms a larger proportion of the total population compared to that prevailing at the national level. It would not be incorrect to say that the tendency to migrate will probably be the highest within this age bracket. It is estimated that about 50 percent of the population increase is on account of In-migration. This probably explains Pune's relatively larger share of population in the 25-34 age groups as far as the area under the jurisdiction of PMC only has been considered.

Table No. 3.1 Decadal change in Population

Census Year	Population Total	Change	Growth rate (%)
1951	488,419		
1961	606,777	118,358	24.23
1971	856,105	249,328	41.09
1981	1,203,363	347,258	40.56
1991	1,691,430	488,067	40.56
2001	2,538,473	847,043	50.08
2006	3,239,806	701,333	27.63
2007	3,401,797	863,324	34.01
2011	4,134,905	1,596,432	62.89

Source: *Population Projection for India and States 1996-2016, General, Ministry of Home Affairs. Registrar*

However, the economic activity on the outskirts of the city, particularly in the Pimpri-Chinchwad region has a direct impact on the city of Pune. To understand the population dynamics of Pune city, it is essential to have an understanding of the situation in the outskirts of the city. The Pune urban area or agglomeration as defined by the Census includes areas under Pune, Pimpri-Chinchwad, and the three cantonments of Pune, Dehu Road and Khadki and a few semi-urbanised villages on the periphery.



3.2 Municipal Area

The size of the Pune municipal area is about 244 square kilometers as per Census 2001. Over the years, Pune has grown considerably to reach this size. In 1961, the Pune municipal area was just over 138 square kilometers.

3.3 Population Density

Pune city has a population density of 10,412 per square kilometer as per the 2001 census. However, Pune has a lower gross population density when compared to other peer group cities like Ahmedabad, Chennai, Bangalore and Hyderabad (**Table No.3.2**). Thus, there is scope for development within the available area when compared to these cities.

Table 3.2 Population Density in Pune and Other Cities

PMC			Other Cities	
Year	Area Km^2	Density / Km^2	City	Density / Km^2
1961	138.94	5,204	Ahmedabad	18,424
1971	139.79	7,154	Bangalore	19,027
1981	147.66	9,346	Chennai	24,231
1991	166.11	10,445	Hyderabad	21,207

Source: *ESR 2004-05 and Census*

3.4 Spatial Distribution of Population

The spatial distribution of population has been examined based on the ward densities in PMC. The average ward population is 1,92,642, varying from 1,00,059 in Dhole Patil Ward to 2,51,100 in Bibwewadi Ward (**Table No.3.3**). The densities seem to be high in the core city.

Table 3.3 Spatial Distribution of Population

Ward Name	*Area (Sq Km)*	Population	*Density / Hectare*
Aundh	40.67	152863	37.58
Karve Rd	16.30	147064	90.22
Ghole Rd	12.79	184228	14.40
Warje Karvenagar	15.25	168094	11.02
Dhole Patil Rd.	14.61	143483	98.21
Hadapsar	24.84	188244	75.78
Yeravda	29.20	153257	52.49
Sangamwadi	29.05	190379	65.53
Bhawani Peth	2.90	201315	69.42
Kasba – Vishrambag Wada	5.00	209044	41.81
Sahakar Nagar	9.20	187543	20.39
Tilak Rd.	14.75	162041	10.99
Bibvewadi	18.38	154516	84.07
Dhankavdi	10.90	143070	13.13
Total	***243.84***	***2385141***	***97.82***

Source: *ESR 2004-05 and Census Data' 2001*

The central area of the city, primarily old city limits, is densely populated. The Bhavani Peth ward located right in the centre of the city has the highest density followed by its two neighbouring wards Vishrambagh Wada and Kasaba Peth. This area includes Laxmi road which is the hub of the city. Tulsibagh, a major market, is also located in this area.

The city appears to be growing in the southeast and southwest directions. As per the 2007 population estimates, the Tilak Road ward on the southwest side of the city is experiencing a rapid growth of 50%. The Karve Road is also growing at a rate of 32%. In the southeast direction, the Bibwewadi ward with its proximity to the Solapur bypass is growing at a rate of 38 % followed by Hadapsar at 26 %.

The dynamic process of population growth is beyond the control of the authorities; it is actually a function of land prices and ease of accessibility to work place and availability of basic services. As a result, extensive population growth is being witnessed in the fringe areas of the city and just outside the PMC limits, especially in the southwest direction.

3.5 Other Demographic Indicators

Pune city has a literacy rate of 77% as per the last Census, details of which is represented in **Table No.3.4**. Higher literacy rate of 81.4% is found in males as compared to 72.2 % in females. It is equally interesting to note that the gap between literacy rates for males and females has narrowed down, compared to that prevailing in 1991. It has been estimated that 50% of the population growth has been on account of migration. This probably has had an adverse effect on the city's sex ratio. Pune has 916 females for every 1000 males as per Census 2001. This ratio was 928 females per 1000 males as per the 1991 Census.

Table 3.4 Literacy Rate

Population	1991 Census				2001 Census			
	Total	%	Literate	%	Total	%	Literate	%
	15,66,651	100.0	10,86,147	69.3	25,38,473	100.0	19,56,956	77.0
Male	8,12,523	51.9	6,10,011	75.1	13,25,694	52.2	10,79,575	81.4
Female	7,54,128	48.1	4,76,136	63.1	12,14,395	47.8	8,77,381	72.2

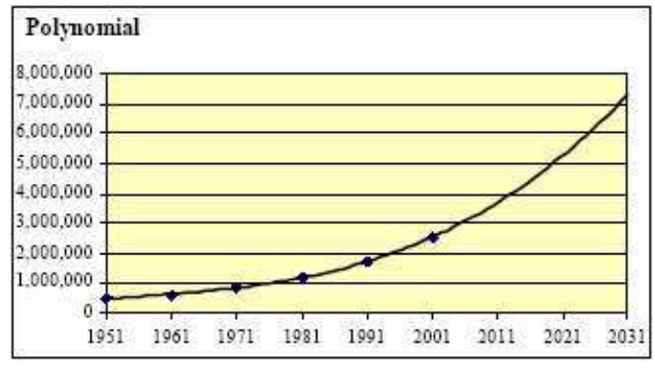
Source: *Census 2001*

3.6 Population Projection

With the trends in decadal growth rate being very high, it is projected that the population of Pune city will reach 56.57 lakhs by the time of the 2031 census. As of 2005, it is estimated that the total population is around 29.46 lakhs. This implies that the population density for Pune will be over 23,000 per square kilometers by the year 2031 compared to just over 12,000 in 2005. This may not look far-fetched as about 90% of the population is below the age of 50 and the city has a very young population with the median age being close to 24 years. A combination of the population pyramid tending to take the shape of a pillar and a large proportion of the current younger generation expected to start families within the next decade and half will probably result in the population figure reaching the projected level.

3.7 Key Issues

Based on the above review, the following issues have emerged with regard to the demographic characteristic of Pune. The population of Pune during the last four decades grew at an average annual rate of over 3.64% against the national average of 2.1 percent and state average of about 3.3 percent.



Source: *City Development Plan (CDP)*

Considering this trend and the growing economic activity in the Pune region, Pune is bound to attract a lot of migrants. It is also observed that during the last decade, 50% of growth has been due to in migration. The migrant population is likely to increase the demand for housing, particularly for EWS/low income groups (LIG). Slums are likely to proliferate, if housing for these groups is not planned. The positive feature of Pune is that large parcels of vacant lands are available and currently the densities are low, except in the core old city. Hence, there are no immediate constraints of land availability, but the affordability is an area of concern. The growth in population is also likely to stress the already stressed modes of public transport and will impact other services; hence, planned efforts are required to direct the growth in the right direction

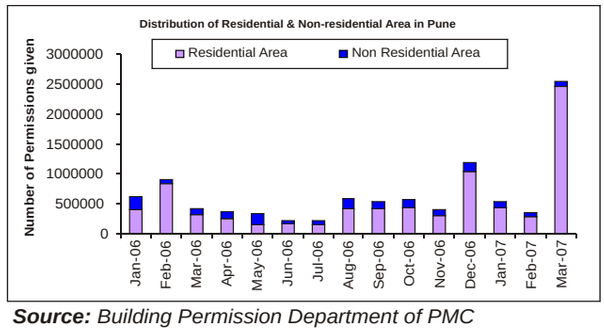
Housing & Slums

4.1 Housing

Housing industry of India is growing at a tremendous speed. Number of housing development companies / contractors are coming up and investing in residential property. Investment in residential and commercial projects is bringing huge profits to these housing companies.

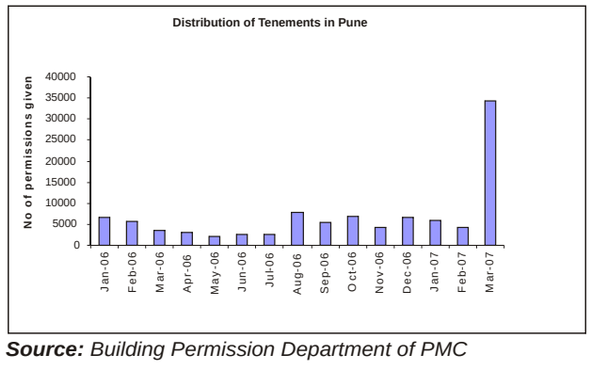
Non-residential area is much lesser than the residential area. Maximum permissions are given for construction of residential area(**Figure 4.1**). In March, 2007 highest number of permissions has been allotted to Tenements (**Figure 4.2**). Number of shops **are** more than other commercial units such as Offices (**Figure 4.3**).

Figure 4.1 Distribution of residential and non-residential areas



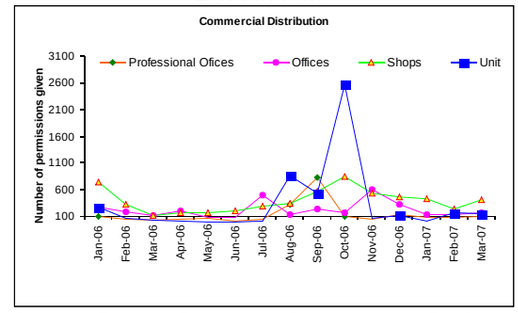
Source: *Building Permission Department of PMC*

Figure No.4.2: Distribution of Tenements in Pune



Source: *Building Permission Department of PMC*

Figure 4.3: Commercial Distribution of Land in Pune



Source: *Building Permission Department of PMC*

4.2 Eco Housing

Eco-Housing represents eco-friendly, energy efficient buildings, sustainable construction practices, and a healthy and productive indoor environment with lowered use of natural resource. Eco-housing structures are designed, built, renovated and operated in an ecological and resource efficient manner.

The Eco-housing program was designed to scale up adoption of energy efficient technologies by the developer community and help create a market for eco-friendly products and services. Program interventions included the development of Eco-Housing performance assessment tool, integration of Eco-Housing policy and fiscal incentives, demonstration projects, capacity building and the development of a sustainable institutional mechanism to mainstream energy efficient housing practices.

4.2.1 Development of Eco Housing Criteria for Pune Municipal Corporation

India has been witnessing very rapid & country wide urbanization. It is high time that we recognize this as a positive social force, which needs to be planned & monitored imaginatively. The

Jawaharlal Nehru National Urban Renewal Mission is a major initiative by the government to restore, rebuild & renew our cities to make global gateways. Initiative like Eco housing is essential ingredients of such initiative.

Pune Municipal Corporation is the first urban local body in the country to take up implementation of eco housing program under technical assistance provided by United State Agency for International Development (USAID). In the last year PMC has closely worked with the international institute for energy conservation (ILEC), global not- profit NGO in developing eco- housing assessment criteria & rating system. These assessment criteria focused on various resource conservation measures. The eco-housing assessment criteria & rating system, developed after studying other National & International Green rating systems are mainly applicable to residential development at large

.

4.2.2 Overview

The voluntary rating system incorporates global best practices to help the developers & architects design & evaluate the green quotient of new residential projects. To determine environmental performance of a building, the eco housing criteria are divided into following eight broad categories, with each individual category describes a set of measures that need to be fulfilled.

Every measure has been assigned points depending on its impact on environment & its relevance to local conditions

Table No.4.1 Focus areas

Focus areas	Points
Site planning	260
Environment Architecture	80
Efficient Building Materials	200
Energy efficient lighting	50
Solar water heater	50
Water conservation	200
Segregation of waste	80
Other innovative technologies	80
Total Number of Points	1000

Source: *Development of Eco-housing Criteria for PMC*

4.2.3 Using the Eco housing assessment criteria

These criteria include both voluntary & mandatory measures. Each measure have been assign points depending on environment impact. Points can be earned by meeting the performance goal of thecriteria. While all the 27 mandatory measures have to be complied with, there is a choice as to the implementation of voluntary measures. The maximum achievable points are 1000 & the project has to get a minimum of 5000 points to qualify for eco housing rating.

Table No.4.2 Eco housing Rating

Points	Eco housing rating
500	*
501 - 600	**
601 – 700	***
701 – 800	****
> 800	*****

Source: *Development of Eco-housing Criteria for PMC*

4.2.4 Benefits of Eco-housing

Eco housing will benefit both the end users as well as urban local bodies. It offers several financial, environmental, infrastructure & health benefits as compared to conventional building. For the consumers it means reduced electricity & water charges, reduction in monthly maintenance charges as well as a higher life cycle for plumbing & electrical equipment.for the corporation an increase in eco housing projects will mean reduced expences on water pumping, sewage pumping & treatment & solid waste management.

4.2.5 Benefits to PMC

With urban population projected to increase by almost 25% over the next decade, the demand for basic infrastructure services is also set to grow proportionally. In this scenario, Eco housing will help reduce the stress on urban infrastructure. For urban local bodies like PMC this will translate into

lower costs for services like water pumping, sewage pumping & treatment & solid waste management. In order to demonstrate the benefits of Eco housing, a reduction in demand for water & waste generation have been calculated using various scenarios. BAU denotes 'Business As Usual', or continuation of current scenario, where environment friendly practices are not being followed. Three scenarios are created around the adoption of eco-housing practices, by 10%, 25% & 50% of the population of pune over the years.

Construction that provides habitat for human beings tends to destroy the habitat of the fauna of the region. A truly eco-friendly housing has to try to find a balance between sustaining both the faunal habitats and the human habitats.

4.3 Slum

Slum people are mostly the underprivileged, weakest section of our society. They are usually deprived of the minimum basic amenities like housing, water supply, drainage and sanitation, wherein women and children are the worst victims. Physically, mentally and emotionally they are most susceptible for impacts from slums. Poor quality of life and poverty go hand in hand, one perpetuating the other.

The slums experience a heavy influx of migrants, majority of them in the prime working age groups. Median age of slum and non-slum population is 24 and 28 years respectively. This indicates that non-slum population is showing the signs of aging.

The most comprehensive legal protocol for slum dwellers and their rehabilitation is the Maharashtra Slum Areas (Improvement, Clearance and Redevelopment) Act of 1971 wherein a slum is loosely defined as a congested, unhygienic area or buildings that are public hazards. Slums are also defined as illegal housing with unsanitary and unhygienic conditions.

In the Pune city 90% slums are on private lands and 10 % are on government lands. As it happened else where in early seventies, initially it authorizes stressed at eviction slum. Pune Municipal Corporation also had 'Galichh Vasti Nirmulan Khate' - a separate department for eviction of the slums.

4.3.1 Defining and Measuring Poverty

Poverty in a city is complex to define - a large number of indicators are involved, like health and well being, as well as income. There are a number of ways to define poverty and measure it in a population. The simplest definition of poverty is to describe it as the lack of specific consumptions (i.e., not enough to eat).

A broader definition defines poverty as the lack of command over commodities exercised by a population. Another, more sophisticated definition is based on the capability of poor to function in society. Access to basic services, especially adequate and safe water, health and sanitation, and education are now increasingly being recognized as an important indicator of poverty. Buildings that are public hazards. Slums are also defined as illegal housing with unsanitary and unhygienic conditions.

There are several standard, widely accepted representations of poverty - for example, the Head Count Index (HCI) signifies the percentage of people below poverty line, while Poverty Gap (PG) measures the depth of poverty (in statistical terms, this stands for the mean distance below the poverty line as per cent of the poverty line).

The urban poor population (slum population) in Pune is estimated at about 30-35 per cent of the total population of the city; the rapid growth of slums has largely an outcome of economic activity and job creation capacity of the city. The non- availability of EWS/LIG housing and inadequate service levels in some pockets of the slums has led to deteriorating environmental problems in the urban areas.

Table 4.3 Growth in Slum Population

Year	Total Population	Slum Population	Slum Population	City	Slum Population
	No.		% of Total	Annual Growth- %	
1961	606,777	92,101	15.18	2.19	9.63
1971	856,105	239,701	28.00	3.50	10.04
1981	1,203,363	377,000	31.33	3.46	4.63
1991	1,691,430	569,000	33.64	3.46	4.20
2001	2,538,473	1,025,000	40.38	4.14	6.06

Source: *Census of India*

Table 4.4 Ward wise Analysis of declared Slums in the City

Ward	Area of ward (sq. km)	Ward wise population (2001)	Declared slums	Declared slum population	Population living in slums (%)	Area of declared slums (sq. km)	Area occupied by slums (sq. km)	Slum density per sq. km	Density of City per sq. km
Yerawada	29.20	1,53,257	9	31,699	20.53	1.57	5.10	202	50
Tilak Road	14.75	1,62,041	49	72,855	34.51	3.23	17.83	225	116
Sangamwadi	29.05	1,90,379	21	93,621	43.81	2.03	9.35	461	98
Karve Road	16.30	1,47,064	43	53,100	25.99	0.81	8.06	656	203
Sahakarnagar	9.20	1,87,543	24	41,505	25.67	0.36	3.66	1,143	163
Aundh	40.67	1,52,863	28	39,665	22.05	0.34	0.76	1,171	40
Bibwewadi	18.38	1,54,516	20	51,600	21.54	0.31	1.38	1,662	107
Ghole Road	12.79	1,84,228	29	39,150	19.43	0.21	1.67	1,835	158
Hadapsar	24.84	1,88,244	35	61,000	29.75	0.31	1.10	1,986	73
Bhavani Peth	2.90	2,01,315	29	45,845	21.00	0.17	7.41	2,667	941
Dhole Patil Road	14.61	1,43,483	25	50,000	49.97	0.11	1.30	4,545	118
Kasba Vishrambag wada	5.00	2,09,044	38	99,980	41.58	0.14	4.94	12,226	1551
Dhankavdi	10.90	1,43,070	NA	NA	NA	NA	NA	NA	NA
Warje-Karvenagar	15.25	1,68,094	3	40,200	34.36	0.02	0.14	23,509	97
Total	**243.84**	**23,85,141**	**353**	**7,20,220**	**26.70**	**9.62**	**4.22**	**749**	**118**

Source: *Slum Improvement Department in PMC*

The majority of slums are located on private lands. A glaring fact is that the total declared slum population of Pune occupies only 4 percent of the city's total area. The density in slums (person/sq. km.) is about 6 times that of the overall density prevailing in the rest of the city. A high density also indicates high health and social costs. It is also observed that 27 percent of the city's population resides in declared slums and they occupy only 4 percent of the total city area. As represented in **Table 4.4 Table 4.5** analyses the status of slums in Pune in terms of location, concentration of slum population, land ownership, tenure status and access to basic urban services. It collates secondary information collected from the declared slums in the city and presents a picture of the urban poor in the city of Pune.occupy only 4 percent of the total city area. As represented in **Table 4.4**. **Table 4.5** analyses the status of slums in Pune in terms of location, concentration of slum population, land ownership, tenure status and access to basic urban services. It collates secondary information collected from the declared slums in the city and presents a picture of the urban poor in the city of Pune.

Table 4.5 Status of slums in Pune

Employment	The working population in slums comprises of skilled construction workers (fitters, electricians, painters), unskilled construction workers (bigaris), unskilled workers, vendors (food and vegetable), private job holders (factory workers), skilled workers (drivers) and domestic maid (females). Very few slum dwellers are professional workers and government servants.
Housing Type	Most slum houses in the kuccha category are built of patras. As per the shelters survey in the year 2000 for Sangam ward, it was observed that 52% of the houses are kuccha houses, 33% are pucca houses and 12 % semi pucca houses. All the declared and non-declared slums have access to water supply, sanitation facilities, street lights and other social infrastructural facilities like schools, primary health care facilities, etc.
Location	As indicated earlier, the majority of the slums of Pune are located on private lands. Table 18 presents the location details for slums surveyed by Shelter Associates.
Access to Basis services	Most of the slum households either have direct access to services or access them through community or common facilities. The figures indicated in Table 20 are based on a survey of 211 declared slums. They reveal that over 58 per cent of the households have individual water supply connections. The rest are dependent on public stand post (PSP) and the ratio per PSP is also reasonably good at 8.5 families per PSP. In terms of sanitation facilities, person dependent on each seat is around 84; at overall level, the service level is marginally poor. However, it varies from slum to slum. Access to electricity connections is fairly good. 93 percent of households have access to some form of electricity connection.

The figures presented in **Table 4.6** and **Table 4.7** for 447 slums indicate that about 38% of the slum tenements (58,928) are in critical locations which need to be relocated to safer areas in order to develop these locations and also in the interests of the safety of slums dwellers.

Table 4.6 Location of Slums as per land tenure

Occupying land on	No. of slums
Defence	3
Forests	3
Government Land	135
Government and Private land	16
Irrigation	13
Private	233
Railway	21
Not recorded	23

Source: Shelter association Pune

Table 4.7 Location of Slums as per land use

Occupancy area	Number of houses	% of Houses	Population
Water bodies	27,847	17.67	1,42,161
Hill slopes	31,081	19.72	15,30,31
Flat area	94,558	59.99	4,99,886
Not recorded	4,139	2.63	20,389
Total	**1,57,625**	**100.00**	**8,15,467**

Source: *Shelter association Pune*

4.3.2 The Major Concerning Issues

Pune is blessed with an ample water supply. However, water is not provided equitably to all areas in the city. Where water is supplied by gravity, those at the tail end receive less water due to consumption at the front end. Where water is pumped, areas at higher elevations receive water at extremely low pressure. At present, the inner area of Pune gets abundant water, while the surrounding areas receive a less than adequate supply. Some slums (82) located on private land and others on government land. Some settlements have been “declared” by the government as slums under the Slum Areas Act (with some responsibility for providing basic services), and others have not. Each of these aspects also has implications for access to water and sanitation

1. Structure of the dwelling place
2. Source of drinking water
3. Electricity Supply and Energy needs
4. Water logging in slums during monsoons
5. Latrine facility
6. Drainage and sewage system
7. Garbage disposal system
8. Access to primary health care
9 Poverty

4.3.3 Education in slum

Health Institute Pachod conducted a project related to various aspects of slums. According to their study, the literacy rates among males of age 7 years and above in recognized, unrecognized and non-slum areas are 82, 78 and 93 percent respectively. The same for females are 62, 56 and 79 percent. Thus in all areas of Group 6-14 are attending school in unrecognized slums. In non-slum areas 95 percent of boys and girls are attending school.

4.3.4 Slums and Environment

The analysis of factors related to the environment of the slums such as, source of lighting, drinking water, drinking water in summer, fuel for cooking, sanitation facility, type of house and crowding (number of persons per room) indicates that in general the situation in unrecognized slums is worse than that in the recognized slum and non-slum areas enjoy a cleaner environment. Health status is a key indicator of human well-being. The health of people does not depend only on the number of doctors and hospitals, but also on a clean and safe environment. Environmental pollution affects human health in many ways and contributes to a wide variety of diseases.

Community participation in improvement of urban environment is imperative. People of slums, particularly women know exactly the problems they

They would be in a better position to come out with effective solutions. The simultaneous involvement of the local community, NGOs, and Municipal Corporation, can help in better provision of basic civic services such as water supply, public bathing, washing, toilet facilities, solid waste disposal, water logging during monsoon, rain harvesting etc.

4.3.5 Indoor Air Quality in Slums

Most often the slums are the areas neglected for most of the utilities as well as resources. However, one of the most neglected areas amongst slum is the air quality of their households. Several studies have shown that indoor air pollution can trigger asthma attacks and can be detrimental to respiratory health status. According to the WHO bulletin 2002, indoor air pollution contains a range of health damaging air pollutants ranging from particulate matter to carbon monoxide. Cooking fuels are the major sources of indoor air pollution. Air Quality Management Cell of Pune Municipal Corporation took a step towards understanding this issue to a greater depth and carried out an air quality monitoring program in the areas of Hadapsar and Manjri and areas around them. 502 households were surveyed from these areas and were characterized by their effective populations, distance from the mainland city, total area covered under slums, legal status, etc. One of the most differentiating factors that came out of the survey is that most of the houses used mixed fuels i.e. a combination of different fuel options available within the area of Pune city. This resulted into a great deal of differentiation between the earlier assumptions of Simple ratio of three types of fuel to be used all across the cities although it might not have added much of a difference in the overall estimation but it reflects the importance of ground survey and authentification of database for future use. The mixed usage of fuel is depicted in **Table 4.9**

Though database has been gathered for various fuel types being used in each home and though it is obvious that most of the homes in slum areas of Pune depend upon various fuel sources for the sake of convenience of understanding not making too much confusion in the overall emissions calculations whereby making it easier for distribution in the grids only three basic types of fuel i.e. Fuel wood, Kerosene and LPG in the ratio of 0.196 : 0.405 : 0.317 should be considered. This ratio of fuel usage as well as per capita consumption is the weighted average fractions calculated through individual and mixed usage of fuels. Also, as a part of AQM Cell's strategy for highlighting the issues of urban air quality management and since approximately 30 - 35% of the Pune population belongs to slum, it was thought essential to conduct air quality monitoring in representative houses of the urban slums. It is very important to know that the particulate matter Concentrations in these houses have been found to be extensively high when compared to the various standards of indoor air quality and seems to be a major area of concern which is often neglected. Along with the air quality of the houses some of the other parameters which are known to account for exposure other than fuel face

Table 4.8 Represents the details of the fuel usage in slums from 6 different areas of Pune

Parameter	LPG	Kerosene	Wood
Per capita/year consumption (Kg)	33.16	56.03	175.71
Fraction of the houses using individual fuel	14.34	14.34	2.79
Fraction from mixed usage of different fuels	17.36	26.23	16.77

Table4.9 Mixed fuel usage in the slum areas of Pune city

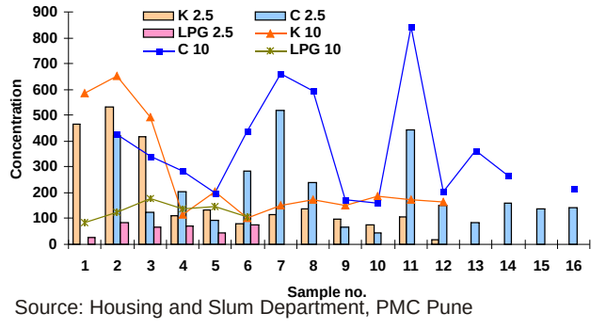
Parameter	L / K	L /W	K / W	K / C	L / K / W	L / K / W / C
Per capita/month	4.52	9.19	11.12	6.56	8.80	9.75
Fraction using mixed fuel (%)	21.12	3.98	19.92	1.79	12.35	2.79
Weighted Average (%)	10.56	1.99	9.96	0.90	4.12	0.70

All units converted into Kgs L -LPG ,K- Kerosene, W-Wood , C-Coal

and burning which are area of the house, cooking medium, cooking time, quantity of fuel used, number of persons in home, additional sources such as mosquito coils, tobacco smoke, others & health effects through administering a questionnaire with the help of Chest Research Foundation, Pune.

Figure 4.4 shows the concentrations of PM10 and PM2.5 among different types of fuel. It is important to note that the contribution of PM2.5 which are very small particles and causing more harm to the health are very high The Particulate Matter (PM10 and PM2.5) concentration is very high in case of biomass fuel and it is decreases for kerosene and LPG. The relation between Particulate concentration and type of fuel used are as follows:

Figure 4.4 Concentration of PM10 and PM2.5 among the different types of fuel



Source: Housing and Slum Department, PMC Pune

Unprocessed Biomass Fuel > Kerosene stove > Liquefied Petroleum Gas (LPG)

Though the use of LPG and Kerosene releases lesser overall PM but emits more than 70% of PM2.5 and may seem to be more harmful from the health point of view.

The health survey associated with the monitoring of air quality revealed that the women in slums are highly prone to harmful effects of Particulate emissions from cooking and shall be made aware of this fact. Pune Municipal Corporation needs to also rethink of its policies for Slum rehabilitation considering the point Of view of indoor air quality and its health effects which has been over looked throughout.

4.3.6 Slum Rehabilitation Schemes

To improve the housing stock and civic infrastructure facilities for slum dwellers, a number of schemes are being implemented with support from the PMC and GoI / GoM. These schemes are listed below, but their impact on living conditions and the environment needs to be assessed.

4.3.6.1 Slum Rehabilitation Authority (SRA)

To develop housing stock and improve the infrastructure at a faster pace, GoM has created the Slum Rehabilitation Authority (SRA) covering Pune Corporation and PCMC area including areas of MIDC. Here are the salient features of the scheme.

1. This scheme is applicable only to private lands. The SRA is purely a public private initiative with only 10% contribution from beneficiaries, the owner of the land is allowed to develop the land along with the registered developer under SRA in accordance with SRA guidelines.
2. In order to develop the slum under this scheme the consent of slum dwellers is not required, if the rehabilitation is within the prescribed limits.
3. Each beneficiary needs to contribute Rs.10, 000 to the authority by way of availing loan against the allotted property.
4. The developer is permitted to utilize FSI up to a maximum of three or as permitted. In case of higher FSI, the difference of 3 FSI will be made available in the form of TDR.
5. The minimum and maximum permissible density is 360 and 1080 person per hectare.
6. The schemes shall provide residential tenements with a built-up area of 270 sq. ft. Including a toilet and balcony.

4.3.6.2 Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

Maharashtra welcomes the cluster approach under JNNURM. Under the basic services to the urban poor sub-component of JNNURM, Government of India has already approved the housing projects for

Pune, Pimpri-Chinchwad, Thane, Nagpur and Nashik for constructing more than 68,000 tenements for families residing in slums. Under IHSDP component of JN NURM, slum redevelopment plans of 29 cities are under active consideration of Government of India.

The objective of slum-free cities is laudable and needs to be pursued vigorously. Government of Maharashtra has signed MoU for reforms in urban governance. Eight cities that have joined JN NURM, five of them namely Mumbai, Pune, Nagpur, Nanded and Nashik have already signed MoUs. These projects are mainly for roads, water supply, sewerage, solid waste management. Projects worth Rs. 844 crore have already been approved and projects worth another Rs. 3,000 crore are under active consideration of Government of India.

Source: Planning Commission on Annual Plan for 2006-2007 of the State of Maharashtra

4.3.6.3 Walmiki Ambedkar Awas Yojna

According to this scheme slum dwellers below poverty line benefited by 50 - 50% subsidy from central govt. and State govt. For Metro city the slum dwellers whose name are in 1/1/95 electoral list and who are residing in that slum and also who are bellow poverty lines are applicable to get Rs 50000/- subsidy for the area of house 225 sq.ft according to availability of land. Nodal agency is at Hadapsar. At this place on 2.48 ha area for the construction of in-situ houses Rs 5.02 Total subsidy is 50% by State Govt and 50% by CentralGovt and for implementation of this scheme According to this scheme, in Pune City work on total 800 houses are running in the different slums and also near Hadapsar for construction of 1200 houses Total Rs 648 crores proposal has submitted by the MHADA to the State government.

Table No 4.9 Distribution of residential and non-residential areas

Sl No	Sl No and Year	Name of the scheme	Developer	Area of scheme	Total tenements	Number of beneficiaries	Tenements needs to be given to PMC	Rehabilitated beneficiaries	Tenements already given to PMC	Remark
1	21/1995	S. N 207 Parvati	Saket Construction	603.70	36	35 Residential + 1 Non Residential=36	Nil	36	Nil	Scheme completed
2	28/1996	S.N 82/2B/1/1A Parvati	Chavan-Khivasara	3435037		16R+4NR = 20	6	20	6	Scheme completed
3	35/1996	S.N. 129 A, Plot no 578	Mas Builders	4492.98	77	66	11	66	11	Scheme completed
4	50/1998	S.N. 135 Kothrud Paud Road	R.B. Kunkalol	2400.00	120	71R +23NR = 94	26	94	26	Scheme completed
5	42/1998	S.N. 42A/1A/2A/1V 42 A/1A/2/2 Erandwane	Deshpande Builders	4000.00	91	50	41	50	41	Scheme completed
6	41/1998	Plot no 61 Kavadevasti	S.R. Kulkarni	53	40	40	Nil	40	Nil	Scheme completed
7	15/1996	S.N. 106 Hingane No 9 Hadpsar	Pawar Enterprises	2000.00	37	16R	21	16	Nil	21 PMC Tenements - Bhumi Jindgi process ongoing
Total				17485.05	497	322	105	322	84	

Health

5.0 Background

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments.

A changing food regime has been identified as one of the major causative factors of most of the diseases prevalent today. Health risks caused because of this cultural shift can be minimized if safer options like Organic/ Ethnic Foods are explored. This has an added advantage of lowering the environmental stresses as organically grown crops do not pollute soil or water, do not kill soil microbes or micro fauna or pests-predator insects/ birds, and no chemical fertilizers/ pesticides are required. Increasing demand for traditional crop varieties and ethnic foods and recipes would conserve those, satisfying consumers' taste; unlike unhealthy fast food/ drinks like Pizza and Coke. The other options in the same series for eco lifestyle to better the ecosystem health and human health could be the use of Handloom Clothes which are not only good for skin health but also causes less pollution than synthetic clothes cause due to petroleum products used. Shifting to biomass-based furniture will reduce the carbon emissions at the source thereby improving overall environment health.

5.1 Proposed Projects

The University of Pune's School of Health Sciences has taken up the task of pushing Pune's case to become eligible for the `healthy city for better life', project of the World Health Organization (WHO). The ambitious project, launched by the WHO in 1996, envisages the creation of a network of `healthy cities' in the world, which qualify for the status on the basis of the initiative and commitment for environment protection of their respective governments. The `healthy city' status, once granted, will not only open floodgates for a series of internationally standardized environment preservation programme but at the same time will also facilitate link up with other healthy cities for technical collaborations and exchange of knowledge programmes.

Pune will once again come on the global map, this time for its healthcare. Perhaps for the first time in the country, a super specialty hospital dedicated to women and children will be set up in the city.

5.2 Health Care Facilities in PMC Area

The development of city and increased population has demanded equally vibrant and effective health care facilities which PMC has been trying to avail for its people. Number of private hospitals registered with PMC and welfare centers has increased since 2004 (**Table 5.1**).

Table No. 5.1 Health Facilities in PMC area

Description of Facilities	2004 – 2005	2005 – 2006	2006 – 2007
No. of private Hospitals	501	513	528
Registered with PMC	501	513	528
Aurvedic	NA	1	2
Homeopathic	NA	NA	1
Family planning centre	19	7	7
Mertnity home	14	15	14
Vaccination centre	1+ 60	1+ 60	1+ 60
Family Welfare Center	7	19	19
Matabal Sangopan Center	5	7	7
I.C.D.S.	2 + 5	2 + 5	2 + 5
O.P.D.	29	29	29
Hospitals (PMC)	2	NA	2

5.3 Infant Mortality Rate

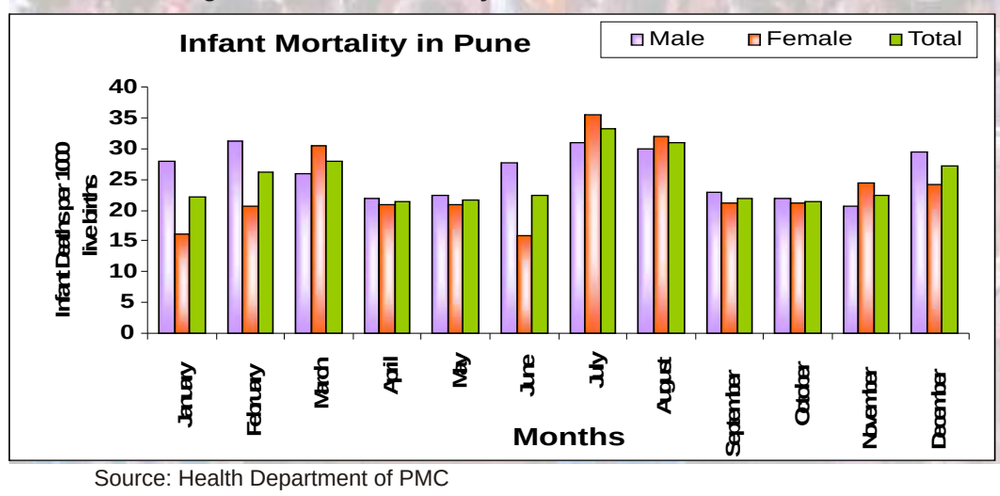
The number of infants that die within a year for every 1,000 babies born alive is a critical measure of level of human development. In India Orrisa shows Highest Female Infant Mortality rate. In Pune Female infant mortality rate is highest in July month (**Figure 5.1**).

Total infant mortality rate shows similar trend in all the months except July & August recorded highest infant deaths i.e. 118 & 130 deaths respectively as depicted in **Table 5.2**.

5.4 Maternal Mortality Rate

Is defined as the numbers of women dying from pregnancy-related causes during childbirth and within 40 days of delivery, and is calculated on the basis of every 100,000 live births. According to the Sample Registration System, India's maternal mortality rate in 1998 was 407 deaths per 100,000 live births.

Figure 5.1: Infant Mortality Rate in 2006 in Pune



Source: Health Department of PMC

Table No.5.2 Number of Births/Deaths/Infant Deaths in the 2006

Month	Birth			Death			Infant Death			Still birth			Maternal Death
	M	F	T	M	F	T	M	F	T	M	F	T	
January	2008	1812	3820	1197	823	2020	56	29	85	44	43	87	1
February	1766	1559	3325	1043	710	1753	55	32	87	54	37	91	1
March	2120	1805	3925	1057	695	1752	55	55	110	40	52	92	3
April	2146	1780	3926	959	656	1615	47	37	84	63	36	99	1
May	2096	1770	3866	1079	734	1813	47	37	84	37	46	83	5
June	1876	1574	3450	1021	667	1388	52	25	77	60	40	100	NA
July	1871	1689	3560	1115	778	1893	58	60	118	60	42	102	5
August	2197	2011	4208	1183	888	2071	66	64	130	48	43	91	3
September	2281	2088	4369	1161	811	1972	52	44	96	51	45	96	3
October	2286	1951	4237	1142	720	1862	50	41	91	51	38	89	1
November	2519	2124	4643	1149	770	1919	52	52	104	63	44	107	4
December	2166	1825	3991	1173	863	2036	64	44	108	63	43	106	2
Total	**25332**	**21988**	**47320**	**13279**	**9115**	**22394**	**654**	**520**	**1174**	**634**	**502**	**1143**	**29**

Source: Birth/ Death Census Department PMC

5.5 Communicable Diseases

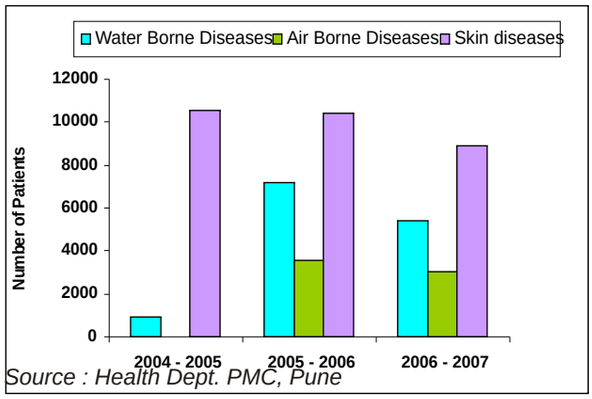
Illnesses caused by microorganisms and transmitted from an infected person or animal to another person or animal. Some diseases are passed on by direct or indirect contact with infected persons or with their excretions. Most diseases are spread through contact or close proximity because the causative bacteria or viruses are airborne; i.e., they can be expelled from the nose and mouth of the infected person and inhaled by anyone in the vicinity. Such diseases include diphtheria, scarlet fever, measles, mumps, whooping cough, influenza, and smallpox. The infectious agents are called pathogens, & are spread by air, water, food body fluids, some insects (such as mosquitoes, flies, & ticks), animals (such as rodents & monkeys) & other non-human carriers called vectors. Depending on mode of transmission Communicable diseases are categorized into Water borne & Air borne Diseases

a) Water Borne Diseases

Disease acquired by drinking water contaminated at its source or in the distribution system, or by direct contact with environmental and recreational waters.

Water-borne disease results from infection with pathogenic microorganisms or chemical poisoning. Number of patients suffering from water borne diseases has reduced from the last year's number (**Figure 5.2**). But from last 2 years the number of patients suffering from Gastroenteritis is more than other communicable diseases (**Table No.5.3**). These diseases pattern indicates that drinking water quality of Pune was poor but it is improving from the last year. During the floods in 2006 various measures have been taken to control various water borne diseases by Pune Municipal Corporation. As a results of this transmission of disease have restricted

Figure 5.2: Year wise Distribution of Communicable Diseases



Source : Health Dept. PMC, Pune

b) Air Borne Diseases

Diseases of respiratory tract are transmitted through air. Pathogens may be inhaled by a person through nose due to physical movement or Air current e.g. some skin diseases. Number of Airborne diseases has reduced since 2006. The details of the occurrences of communicable diseases, as given by the PMC are given in the **Table 5.3**

c) Skin Diseases

Skin diseases are primarily due to fungal growth, which is favored in moist & polluted environment. Number of patients suffering from skin diseases has reduced since last year. (**Figure 5.3**)

Figure 5.3: Skin Diseases

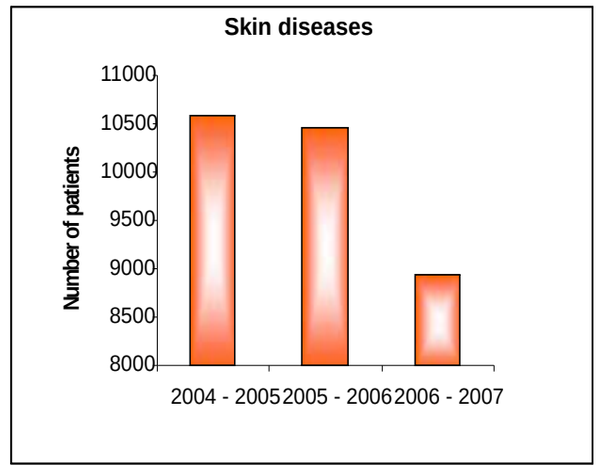


Table No.5.4.1 Year wise Distribution of Communicable Diseases

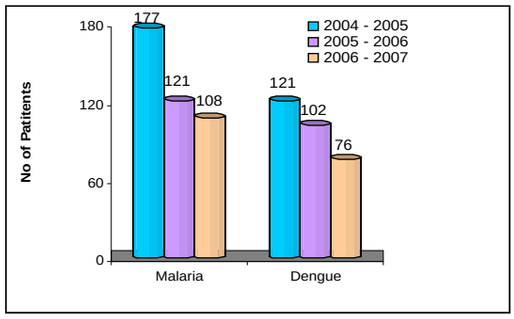
Communicable Diseases		2004 - 2005	2005 - 2006	2006 - 2007
Waterborne Diseases	Gastroenteritis	831	5156	4005
	Cholera	8	98	26
	Jaundice 63	44	841	570
	Typhoid	8	1070	815
	Polio	Nil	Nil	Nil
	Diphtheria	6	13	4
	Tetanus	9	--	9
	Total	**906**	**7178**	**5429**
Airborne Diseases		**Nil**	**3589**	**3024**
Skin Diseases		**10580**	**10450**	**8930**

Source: *Health Department of PMC*

5.5 Diseases transmitted through Mosquitoes

Malaria is also a type of communicable diseases, which uses female mosquito as a vector. Unprecedented population growth, mostly in developing tropical countries, has resulted in enormous urban sprawl, and unsanitary housing, water, sewage and waste systems. The result has been more mosquitoes living closer to more people. In Pune number of cases of Malaria & Dengue has been reduced from 2004 (**Figure 5.4**).

Figure 5.4: Diseases due to Mosquitoes



Source: *Health Department of PMC*

The principal vector of Dengue is *Aedes aegypti*. Once infected, a mosquito remains infective for life. The viruses are transmitted via the bite of various day-feeding mosquitoes of the subgenus *Stegomyi*a. Infected humans circulate the virus in their blood, mosquitoes ingest these viruses when feeding on the infective individual. Humans serve as an amplifying host, though some monkeys may also serve as a source of the virus.

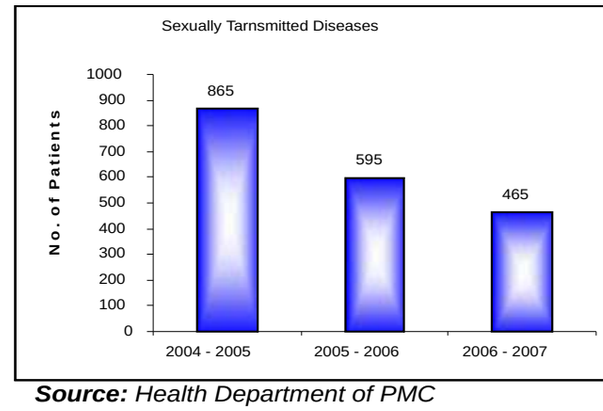
Infants and youths often experience an undifferentiated febrile disease with rash. Older children and adults may have a mild febrile syndrome but more typically experience high fever, severe headache, pain behind the eyes, muscle and joint pains and rash.

Typically, a person will develop dengue fever as a result of initial exposure to one serotype. Upon recovery, a patient develops immunity to this single serotype. Upon second infection with a different serotype, the patient stands a greater risk of developing dengue hemorrhagic fever (DHF), a more serious and potentially fatal disease.

5.6 Sexually Transmitted Diseases

In Pune number of STD cases has shown decrease from year 2004. In this year the number has decreased to 465. (**Figure 5.5**)

Figure 5.5: Sexually Transmitted Diseases



Source: *Health Department of PMC*

5.7 Family Welfare Programme

Pune Municipal Corporation's Health Department is implementing the Family Welfare Programme through city Family Welfare Bureau (CFWB) implements this through the 19 family welfare centers, PMC's maternity hospitals & dispensaries. The activities carried out in this programme include: Family planning, Immunization, Care of childhood diseases, Institutional Deliveries, antenatal care, postnatal care, etc.

For helping in the implementation of this program, there are schemes implemented by the Government & by PMC, like the following

1. Jalad Sulabh Mofat Nasabandi Yojana

An Innovative scheme by Health Department of PMC, NGO Nirdhar & Pariwar Mangal Trust, since December 2001. Under this scheme if a patient wants to undergo sterilization surgery, he or she just has to make a phone call (No. is 25655360). The date of the surgery is given on the phone & a vehicle is also provided to the patient for coming to the hospital. Till now more than 2000 sterilization surgeries are carried out & 100 male sterilizations have been carried out.-

2. Savitribai Phule Yojana

This Yojana is started by state Govt. for motivation of sterilization surgeries in couples having one or two girl children.

3. Janani Suraksha Yojana

This scheme is for motivating women to register early in pregnancy in hospitals antenatal Clinics for which she will receive incentive of Rs. 500 & for having Institutional delivery Rs. 100 /-

4. Reproductive & Child Health Programm

RCH programme phase II is being implemented by PMC which includes a lot of activities for health from COOMB to TOMB.

The Programme implementation plan includes

? Fertility Planning Services

? Mother and Child health services.

? Adolescent Health

? After age 40 care

? Behavior change communication Activities

? Starting of similar new health posts in PMC area.

? Strengthining of Aganwadis.

? Meetings at Aganwadi level which include

- 0 Dada Dadi Melawas
- 0 Newly married couple meeting
- 0 Anemia management

Garden

6.0 Introduction

Public Garden have acquired place of immense importance in the city life. Due to ever-increasing population cities are growing congested with time citizens need open spaces for relaxing and entertainment, in the evening after day's hard work. Open spaces provide them open air, which is important not only for their physical health but also for reviving them mentally. Public Gardens are truly the lungs of the city. Urbanization has got impetus in our country. Thus importance of public gardens is growing with urbanization and industrialization.

Growth of gardens in Pune is mainly observed in the last century. The number of gardens gone up after Pune came under British Rule. There were some Gardens in Pune under Rule of Peshwas. But not many public Gardens were developed in that period. It is evident that modem Gardens were developed only under British Rule.

Pune Municipal Corporation has undertaken various garden and urban aforestation programs in the city. The Garden Department has developed 75 gardens on 359.35 Acres, and 35 new gardens are proposed on 267-Acre area. Pune Municipal Corporation has also developed 5 Nalla parks.

Garden Department of Pune Municipal Corporation has also under taken the road beautification and road side plantation projects on various roads and locations of about 20 Km length and at various locations in the city. Annually the Tree Authority conducts a campaign for tree plantation in monsoon season between 15th June to 15th August.

The citizens are also encouraged to plant more trees in their own premises. Pune Municipal Corporation offers plants and saplings at subsidized rates, and offers the technical supports with this regards. Pune Municipal Corporation has undertaken the extra special task of upgrading and beautifying the existing gardens and forestation projects in various areas, thus working extensively on its slogan of “Green City”. The Corporation had greatly achieved its goal of developing and beautifying many a gardens and parks in the city.

6.1 Awards and Recognition

Pune Municipal Corporation has won various awards and has been recognized all across the world for its gardens

6.1.1 Maharashtra Rajya Vanashree Puraskar

Pune Municipal Corporation has been awarded with this Puraskar in 1991 for its contribution towards trees plantation, Preservation and to create awareness among the citizen for the protection of the Environment. This award consist of Rs. 10,000/- & citation. (In Year**:**1991)

6.1.2 Indira Priyadarshani Vrikasha Mitra Puraskar

Indira Priyadarshani Vriksha Mitra Puraskar 2004 was awarded to Pune Municipal Corporation for outstanding contribution made in the field of aforestation and wasteland development. This award consists of 1, 25,000/- & citation. (Dated: 5th June 2007)

6.2 History of Gardens

6.2.1 Bund Garden

This garden was developed some distance downstream of confluence of Mula-Mutha Rivers. The garden was open to public in year 1869. It is 180 Yards north-south. In olden days Military Band was played here twice/thrice a week. The Garden was under supervision of “Agri-Horticultural Society of Western India”. Now it is being maintained by PMC.

6.2.2 Empress Garden

This garden was developed to the East of race-course. The Garden was known as “Soldiers' Garden” as the Garden was initially meant only for Soldiers. Later in year 1892 Agree-Horticultural Society of western India undertook the supervision of this garden. Trees and flowers of different varieties are abundant here. Seeds saplings of floral plants and flowers etc are sold here at resonable rates.

6.3 New Gardens and Houses in Pune

With establishment of Pune Municipal Corporation (PMC) in year 1950 new era was started growth in population of city was observed. With the increased need following gardens were developed after year 1950.

6.3.1 Sambhaji garden

Aquarium: At Sambhaji Park a building was initially constructed for starting a Restaurant. A hotel named Tajmahal was operational in this building for some period but soon ceased to operate due to financial loss & the owner vacated the building. In 1952 committee was proposed for suggesting use of this place. After visiting Mumbai for Jahangir Art Gallery, Taraporwala Aquarium etc. It was decided to have Aquarium in this vacant building. On 1st August, 1953 Pune Municipal Corporation started it's own F.W. Tropical fish Public Aquarium. It has 14 tanks with different varieties of fishes like Pirhana, Oscar, Alligator gar, Discus, Showelnose catfish, Goldfish, Angels, Arowana, Koi carps, Barbs, Tetras, fresh water Prawns, Red ear terrapins etc. & aquatic plants.

6.3.2 Peshwe Park

PMC & Maharashtra Energy Develomnet Association (MEDA) jointly developed this park. Main objective of this park is to educate public at large and children in scientific about the use of non-conventional energy sources in our day to day life. About Rs. 2.40 Crores. have been spent to this project out of which about 95 lakhs is contributed by Central Government. Phoolrani and various play equipments driven on solar and wind energy are established in the park. This park is open to the public between 10 am to 5.30 pm and closed on Wednesday. This park is being maintained by MEDA.

● Phoolrani (Children Mini-train)

The attraction point in Peshve Park is children mini train Phoolrani. Phoolrani runs from artificial hill, which is located in the left side of the entrance gate. PMC Garden Department has shown a great interest for building this mini train for children. Phoolrani is very famous amongst the children of Pune. India's first mini train ‘Phoolrani’ started in Pune City.

Dr. Dhondo Keshav Karve flagged this train on 8th April 1956. Pune Radio Station transmitted the program. The specialty of this train is all parts of the train are built in Municipal Workshop

● ENERGY PARK, Pune

Pune Municipal Corporation and Maharashtra Enegry Development Agency has jointly decided to establish a state level energy park in Peshawe Park, Pune. Pune Municipal Corporation has agreed to provide 2.5 - 3 acres of land is Peshwe Park for establishment of Energy Park. This will be a joint collaborative project between Pune Municipal Corporation and Maharashtra Energy Development Agency.

6.3.3 Erandawana Udyan (Kamla Nehru Park)

In the year 1952, 4 Acres land in the area of Erandawan was reserved for development of this garden. To avoid soil erosion the retaining wall was constructed around the garden premises. In 1954, large lawn bed with artificial fountain was prepared in the garden with mercury lamp.

6.3.4 Ghorpade Udyan

In rainy season, due to collection of rainwater in a pit and remaining stagnant for long period posed threat to the construction of this garden. Hence a stonewall was constructed to avoid the stagnation of water along with the channel for water flow.

In 1953-54, the two-lawn bed, lotus pond & fountain have been prepared. Out of 4-Acre land 2.5 Acre was used for Garden & remaining was used for the primary school.

6.3.5 Jijamata Udyan

For ladies & children a small garden was prepared in the heart of the city on the east side of Historical Shaniwar Wada, near to the Lal Mahal. On the remembrance of Rajmata Jijabai the garden named Jijamata baug. The garden is having heavy rush due to central location of this garden. In year 1952, the garden became smaller; some area of the garden was lost in Road Widening operation.

6.3.6 Chhatrapati Shahu Udyan

In the year 1950, Pune Municipal Corporation started the garden preparation for the public convenience on the west side of the city in Somwar Peth area. The garden was inaugurated by mayor Mr. Baburao Sanas on 15th Feb, 1953 & named as Shahu Udyan. Daily near 5000 people visit garden.

6.3.7 Late Jayantrao Tilak Rose Garden (Sahakarnagar No.2, Pune.)

A joint Venture of PMC & Rose Society develops a Rose Garden in Sahakarnagar. It is new project in Maharashtra. Late Jayantrao Tilak was nature lover man. He loved shevanti, gladiola, orchid, and rose. He was the founder of Rose Society. Rose Garden is dream of Late Mr. Jayantrao Tilak.

Rose Garden has two acres of land. Before developing a garden there was a Nalla & Encroachment of huts. Colour, height, type of the plant is considered while planning the garden. There are nearly 200 types of flowers and 1700 plants in the garden. Mr. Ramrao Japtap of Ram Rose Nursery provided rose plant for the garden.

6.3.8 Late Shri. Rajiv Gandhi Zoo and Wild Life Research Center

The Katraj Snake Park in Pune is well known Conservation Park in Pune. Situated at a mere distance of 8 kms from the main city of Pune, the park is an excellent place to visit. Mr. Neelam Kumar Khaire set it up in 1986. Later on in 1999, the park was incorporated in the Rajiv Gandhi Zoo and wildlife research center, Katraj. The park houses more than 160 species of snakes, some of the rare animal species like white tiger, rare eagle species, king vulture, etc.

The Pune Municipal Corporation in 1951 set up the Peshwe Park Zoo near Sarasbaug grade on an area covering about 7 acres of land. This Zoo was entertainment. Gradually it became quite a favorite place amongst the public of Pune. Accordingly PMC set up a proposal for the shifting of the animals from this zoo to Katraj in an area of 165 acres of land.

6.4.9 Dr. Shamaprasad Mukherji Udyan

This garden is developed on 2.5 acre of land at Patwardhan baug, Erandawana, Pune. A big lawn, decorative & rare plants, fountains & play equipments for the children & Virungula Centre for senior citizen are the main features of this garden.

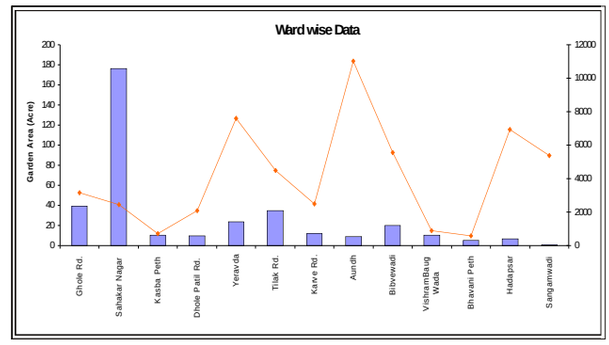
6.4.10 Pu. La. Deshpande Garden

The Pu. La. Deshpande garden on Sinhagad Road that's already dripping charm with its Japanese landscaping will get more attractive once the heritage village comes up. The civic administration has already earmarked 1.5 hectares to develop this first-of-its-kind village in Maharashtra. Moreover, the project has an in-principle nod from last municipal commissioner Nitin Kareer and it is expected to be completed by 2008.

6.5 Beautification of Nala Garden

Nalla Development and beautification works are also being undertaken at Vishrantwadi Kondwa Senapati Bapat road. Nala development is being proposed by using the treated wastewater from the sewage treatment plant. Beautification proposals have also been suggested along Mutha River from the Sangam Bridge to Mhatre bridge stretch. Five playgrounds are also being developed at various locations in the city.

Figure 6.1 Ward Wise Garden area



Source: *Garden Department 2007, PMC*

Table 6.1 Rare Species found in Pune City

Sr. No.	Scientific Names	Local Name
1	Calophyllum Inophyllum	Undi
2	Alstonia scholaris	Satvin
3	Elaeocarpus ganitrus	Rudraksha
4	Ochna squarrosa	Kanakchampa
5	Salix tetrasperma	Walunj
6	Populus sp.	Populer
7	Lagerstroemia flos-reginae	Tamhan
8	Ougeinia oojeinensis	Tiwas
9	Mammea suriga	Surangi
10	Pterospermum acerifolium	Muchkund
11	Bauhinia retusa	Kanchan
12	Pinus longifolia	Pine
13	Acrocarpus fraxinifolius	Red Sedar
14	Saraca asoaca	Sita Ashok
15	Adansonia digitata	GorakhChinch
16	Anthocephallus Kadamba	Kadam
17	Prosopis specigera	Sami
18	Bauhinia blackeana	Kanchanraj
19	Citharexylum subserratum	Sitaranjan
20	Bombax ellipticum	Gulabi Savar

Source: *Garden Department 2007, PMC*

6.6 JOINT FOREST MANAGEMENT PROJECT (P.M.C. & Forest Department)

Pune Municipal Corporation have granted Rs. 1 Cr for development of Forest area on Bhamburda, Vetal tekdi Sr.No. 81, 94 to 97 covering area of 100 Hectare& Warje Sr.No. 34,35,36 covering area of 45 Hectare in collaboration with forest department.

For Joint Forest Management Project on Warje Sr.No. 34, 35, 36 covering area of 45 Hectare, Pune Municipal Corporation have sanctioned Rs.50 lakhs. For this project MoU between PMC & forest department have signed on 13th Feb 2007.

6.6.1 Ongoing Work of Vetal tekdi Sr.No. 81, 94 to 97 covering area of 100 Hectare

1. Construction of wall around 4300 sq. m. of Plant forest.
2. Construction of cement wall.
3. Development of Nursery.
   - A. For monsoon season 10,000 local species of plants, are ready for plantation.
   - B. 30000 cultured plants are prepared for plantation in next year.
4. Preparation of Pits for plantation. In this monsoon 10,000 pits of size 2'X 2'X2' are ready for plantation.
5. Soil & Water conservation
   - a. Local species of plants are planted on10, 500 sq.m area.
   - b. Out of 350 loose bolder structures 187 are completed.
   - c. 500 r.m. Gabion dams are constructed on hill slope area.
   - d. Construction of 20 stone check dams was proposed out of which 2 are completed.
   - e. Preparation of gully plugging on small water courses.

All the above mentioned works are on the verge of completion as per the target period.

6.6.2 Ongoing Work of Warje Sr.No. 34, 35, 36 covering area of 45 Hectare

For this project Rs. 50 Lakhs have given to the Forest department. In this project proposal is made for construction of wall around the forest area. Tender notices are invited from forest department for the same & soon the work will be initiated.

6.7 Biodiversity Park

Revenue department had given 218.61 hectare land to P. M. C. for the development of Biodiversity Park. This is a hilly area & not in use. this area is located in the rapidly developing areas like Baner, Pashan, Hadapsar, Kondhawa, Mohammadwadi, Sutarwadi. Considering the rapid urbanization, there is growing need of forestation on the hills of this area. The detailed list of villages that are given to P.M.C. for the development of Biodiversity Park is given below.

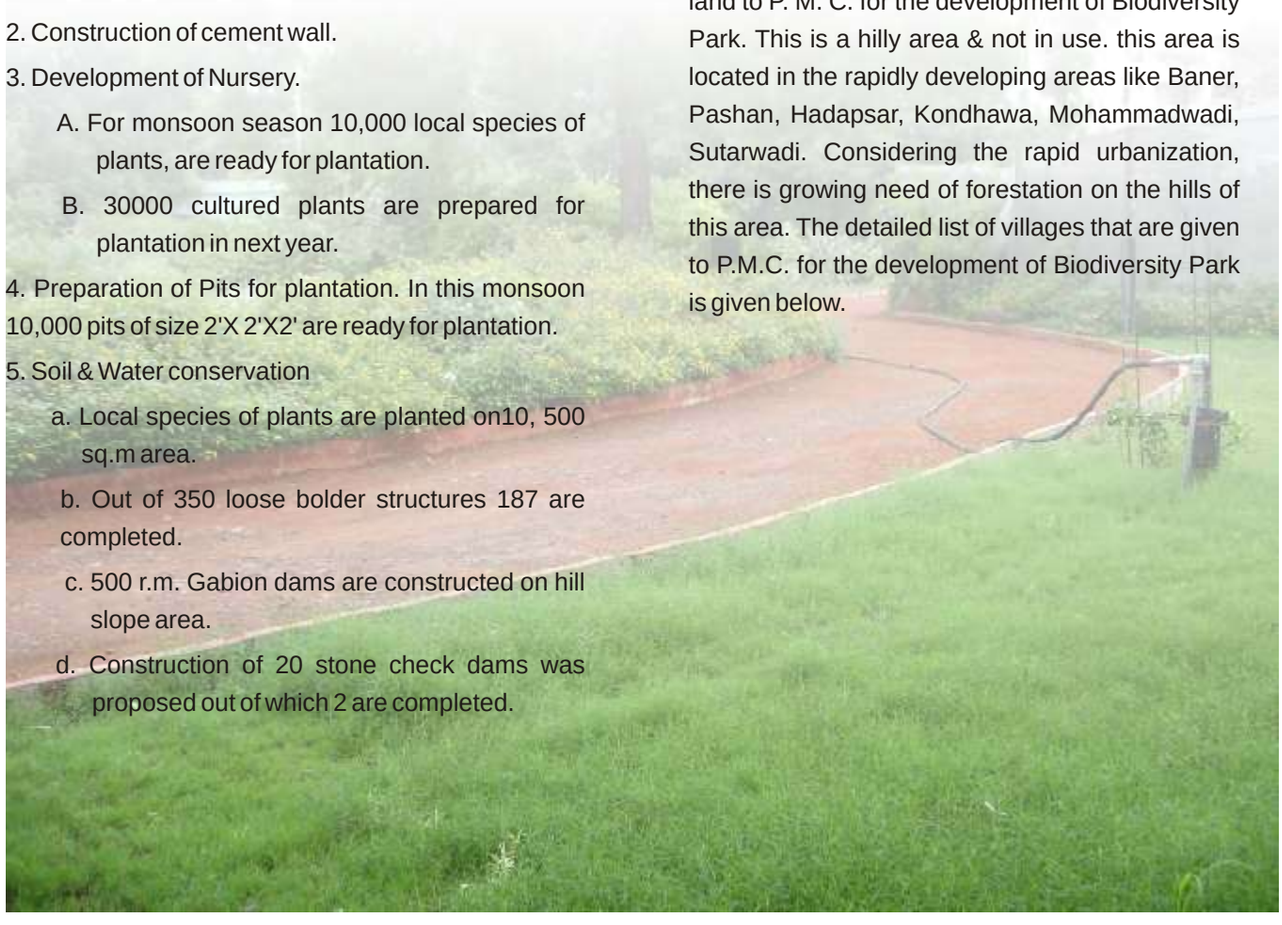
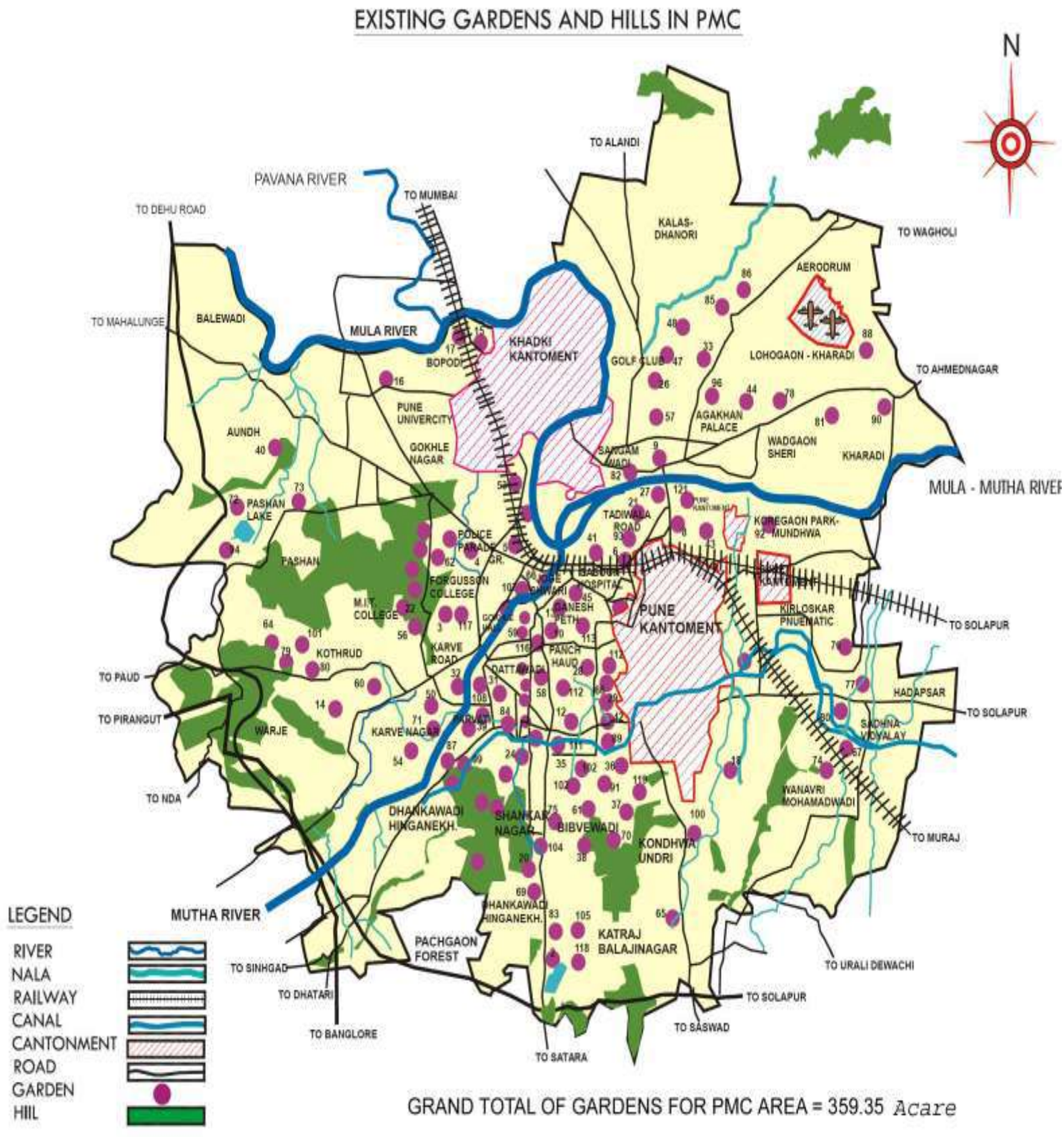


Table 6.2 Biodiversity Park

Village Name	Sr. No.	Area (Hectare R)	Type	Status of Land
Baner	7	56.96	Hill Slope Area	For this land a case is filed against Chinchawad Devasthan Trust by PMC in District Civil Court. The stay order, given by Honorable P.M.C. Court is released by Honorable District Civil Court on 28th June 2007.
	49/1	15.44	Hill Slope Area	For this land a case is filed against Chinchawad Devasthan Trust by PMC in District Civil Court.
Pashan (Near Baner)	133	44.27	Hilly Terrain	Plantation can be done on vacant places.
	Total	116.67		
Pashan (Panchavati)	38	38.01	Hilly Terrain	Plantation can be done on vacant places
	39/1	3.83	Hilly Terrain	Plantation can be done on vacant places
	39/2	6.47	Hilly Terrain	Plantation can be done on vacant places
	Total	48.31		
Sutarwadi	7/1	4.87	Hill Slope Area	Plantation can be done on vacant places
	18/1	0.80	Hill Slope Area	Plantation can be done on vacant places
	23/1	15.25	Hill Slope Area	Plantation can be done on vacant places
	24	3.80		
	Total	24.72		
Hadapsar (In front of the school)	39/A	8.29		Schools, Toilets, Temple – Encroachment
Tukai Tekdi	34/2 A	5.20		Encroachment of 5-6 Temples


EXISTING GARDENS AND HILLS IN PMC
N
TO ALANDI
PAVANA RIVER
TO MUMBAI
TO DEHU ROAD
KALAS-DHANORI
TO WAGHOLI
AERODRUM
TO MAHALUNGE
BALEWADI
MULA RIVER
KHADKI KANTOMENT
BOPODI
GOLF CLUB
LOHOGAON - KHARADI
TO AHMEDNAGAR
PUNE UNIVERCITY
AGAKHAN PALACE
AUNDH
GOKHLE NAGAR
SANGAM WADI
WADGAON SHERI
KHARADI
MULA - MUTHA RIVER
PASHAN LAKE
TADIWALA ROAD
KOREGAON PARK-MUNDHWA
POLICE PARADE GR.
PASHAN
FORGUSSON COLLEGE
M.I.T. COLLEGE
GANESH PETH
PUNE KANTOMENT
KIRLOSKAR PNUEMATIC
TO SOLAPUR
KOTHRUD
KARVE ROAD
PANCH HAUD
TO PAUD
HADAPSAR
TO PIRANGUT
WARJE
KARVE NAGAR
SADHNA VIDYALAY
TO NDA
DHANKAWADI HINGANEKH.
SHANKAR NAGAR
BIBVEWADI
KONDHWA UNDRI
WANAVRI MOHAMADWADI
TO MURAJ
MUTHA RIVER
PACHGAON FOREST
KATRAJ BALAJINAGAR
TO URALI DEWACHI
TO SINHGAD
TO DHATARI
TO SOLAPUR
TO BANGLORE
TO SASWAD
TO SATARA
LEGEND
RIVER
NALA
RAILWAY
CANAL
CANTONMENT
ROAD
GARDEN
HIIL
GRAND TOTAL OF GARDENS FOR PMC AREA = 359.35 Acare

Heritage

7.0 Historical Places in Pune

Pune is blessed with many monuments and historic structures that enhance the beauty of this place .

7.1 Shaniwar Wada

The influence of Moghul design and the hallmark of the Maratha craftsmanship, a timeless masterpiece, Shaniwar Wada in all its glory and moments of its eventful existence. Though all that's left are ruins, Shaniwar Wada is definitely not dead. Somewhere amongst the rubble, Shaniwar Wada still breathes.This palace was build by Bajirao 1st in the 18th century.

Shaniwar Wada was a double storied structure with two square courtyards on each side. Many changes have been made in this structure. The seven Peshwas restructured to what it is today. Nana Saheb Peshwa in 1752 after taking over the empire gave Shaniwar Wada its own personal touch in the form of Ganesh Durwaza and Ganpati Rangmahal where he held an audience with the people of Pune. While the fires ravaged Shaniwar Wada and assaulted its splendid structure, its walls still hide old intrigues, buried treasures, power games and love stories of an old era...

7.2 Aga Khan's Palace

The Aga Khan Palace, Pune was built in 1892 by Sultan Mohammad Shah, Aga Khan III, as an act of charity to provide employment for people hit by famine in the neighboring regions.

The Aga Khan Palace is closely related to Gandhi's life and his contribution to India's freedom struggle. Gandhi's wife, Kasturba and his long time aide Mahadev Desai breathed their last in this house. Charles Correa built their samadhis (memorials) in the outlying grounds. Gandhi's ashes are also interred at this location. Today, this mansion is also known as the Kasturba Gandhi Memorial or, *Kasturba Samadhi*.

7.3 Lal Mahal

In Pune, Dadoji built a palace 'Lal Mahal', for Chattrapati Shivaji and his mother Jijabai. It is a red brick structure standing very prominently in the heart of the city. There is a statue of "Jijamata" (Shivaji's Mother). There is the impressive representation, showing young Shivaji ploughing the land with a golden plough, with mother Jijabai and Guru Dadoji Kondev looking at him. This place is just next to Shaniwarwada. Four Umbrellas on terrace is the attraction of the Mahal. This is the same place where Chattrapati Shivaji Maharaj cut Shaistekhan's fingers when he was trying to run away from one of the windows of the Lal Mahal. Pictorial representation of incidents from Chattrapati Shivaji Maharaja's life could be seen on the walls of this palace. Jijamata Garden has also been made in this place. Kids, senior citizens spend their evenings happily here.

7.4 Kelkar's Museum

Kelkar Museum was established in 1962 by Baba Dinkar Kelkar and was donated to the Maharashtra government in 1975. The museum has 20,000 different articles, all personally collected by Baba Kelkar from all over the world. When his son died at the age of seven, he decided to do something in his

remembrance and that is how the idea of building this museum was conceived.

The museum houses the entire collection of Baba Kelkar, a recreation of the famous Mastani Mahal, research and storage facilities and the Institute of Musicology and fine arts. It is a resting place for Dr. Kelkar's obsession to create a centre for artistic endeavors. This museum on Bajirao Road is a marvel and a must see for tourists. It comprises of rare exhibits and artifacts from all over the country and dates back to the Mughal and the Maratha periods. Paintings, nut crackers, Ganpati's guns, carved palace doors, pottery and a number of musical instruments.

7.5 Scindia's Chatri

The building built in the memory of Mahadji Shinde who was great Maratha noble man. It is about 4kms away from Pune camp and 2kms away from the race course in a place called Wanowri. The carving and beauty of the temple is worth a look. The building is a great architectural achievement which combines imposing austerity with beauty. This place is considered to be a perfect example of Vastushastra.

7.6 Vishram Baug Wada

This is a three storied building famous for its entrance which is surrounded by balcony. 300 years back Bajirao Peshwa (II) built this place. The carved woodwork of the balcony which surrounds the entrance of this building is the example of the fine work of ancient Peshwa Art. The wood used is pure processed Saag. It is 23 meter wide and 66 meters long. After Peshwas this place was used as a jail. Pune Municipal Corporation is soon changing this place as museum. It is a 3 floor building in the heart of the city on Bajirao road, next to Laxmi road the huge market for clothing. About 1 lacks of Rupees were spent to built this building at that time. The entire construction is of bricks and wood work.

7.7 Restoration & maintenance of 200 Years old Heritage Buildings (Heritage Cell)

In 1995 Government of Maharashtra given an order to establish heritage committee. Heritage committee classified, Historical building into grade I, II and III. According to this list in Pune city there are about 200 heritage properties. From this 15 to 20 important Nana Wada, Kasba Ganpati etc. present in much crowed area.building like Shaniwar Wada, Vishrambag Wada, Pune city has been developed into a Pune metropolitan area, hence it is very necessary to know all people, tourists and new generation regarding our Pune's historic cultural and all about old Pune. Hence Heritage cell has establish for conservation work.

7.7.1 Restoration of Vishram Baug Wada

The first phase of restoration & maintenance of Vishram Baug wada, situated in the busy crowdy area of PMC, near Bajirao Road & Kumthekar road has been completed by the Heritage cell of PMC. Considering its Historical importance the damaged & collapsed part of the wada is repaired according to old construction. The destroyed part of the wada is reconstructed & the wada is decorated with some fountains to create a surrounding that resembles to Peshawa's era. The first phase of this project was inaugurated in October 2006. PMC has spent Rs. 1.5 crore for this project. PMC has done a great work of restoring cultural & historical values of Pune city.

The second phase of this project has started. In this phase the gate side of the wada near Bajirao Road & the first chowk will be decorated & repaired. This project requires approx. Rs. 1 crore & a year for completion.

7.7.2 Restoration of Nanawada historic building (vastu)

Nana Wada is historic grade I Peshwa kalin building (vaastu) present on Shivaji road have a composite attributes of Maratha architecture and Gothic architecture. Majestic balcony with a dome shaped ceiling is almost crumbling .The carved wooden arches, the pillars the intricate carvings on the ceiling.

The first phase of restoration & maintenance of Nana Wada has been started by heritage cell. Under this, conservation of majestic balcony, carved wooden arches and pillars were decorated & repaired.

7.7.3 Heritage Walk

In various main cities in India “Guided Heritage walk” project was initiated for understanding the importance of our Historical & cultural places. Similar type of project is initiated in Pune. Shaniwar wada & Vishram Baug wada were renovated. This year under this project Nana wada, Phule Mandai, Kasba Ganpati & the main roads of nearby area are to be renovated. . If these buildings get renewed with all development work like presence of railing, footpath along with lightening then in future heritage walks will be started at an evening time.

In the crowded area of the city there are about 15 - 20 historical places. The length of the road that comes under this project is about 3 km. the road that connects Shaniwar wada & Vishram Baug wada is considered for the “Heritage Walk”. For Signage control a survey was carried out. As heritage walk is for a people and also depends upon their response to the project changes may takes place.

HERITAGE CELL , CITY ENGINEER OFFICE
PUNE MUNICIPAL CORPORATION
20th oct. 2006

Education

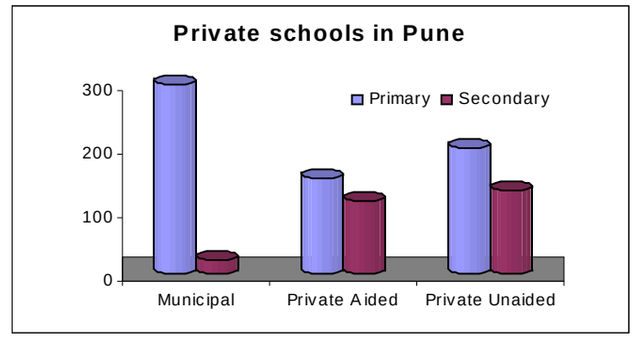
8.0 Introduction

After Indian independence (1947), Pune's reputation as an educational and research node grew with the establishment of the University of Pune, the National Defence Academy (NDA), National Chemical Laboratory and other such institutes. However, certain schools and colleges, such as Fergusson College have exceeded the reputation of the city's far-known educational status from the late 1800's.

Pune was also called "The Oxford of the east" by Jawaharlal Nehru, India's first Prime Minister; as Pune attracts students from every nook and corner of the world. Foreign students find Pune very peaceful and safe compared to other educational cities of India. The weather of Pune is also very good for health. Schools in Pune are either run by the PMC, in which case they are called public schools, or privately by trusts and individuals. Private schools have been preferred by a majority of city residents because of better facilities and the use of English language as the medium of instruction. All private schools are affiliated either with the Maharashtra state SSC board or the all-India Indian Certificate of Secondary Education (ICSE) and CBSE boards.

Figure 8.1 gives category wise distribution of Schools of Pune, the data is provided by education department of PMC. Number of Primary schools is more in each category. The ratio of Primary to Secondary is more in case of Municipal Schools and difference is 87%. Where in case of Private schools is 14% and 20% for Aided and Unaided respectively.

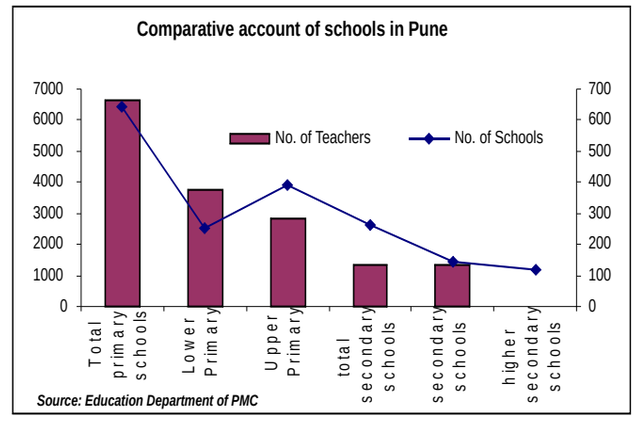
Figure 8.1 Category wise distribution of Pune schools



Source: *Education dept, PMC*

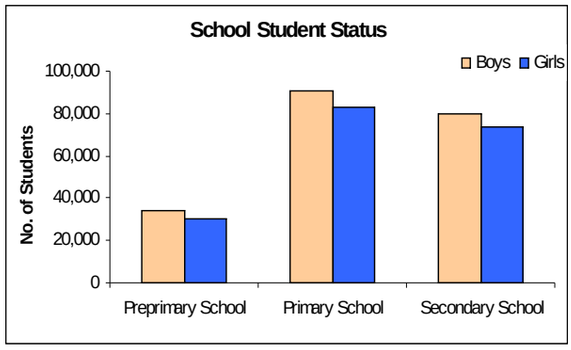
According to studies conducted by the education department of PMC, there are 645 total primary schools with 173818 students & 6628 teachers. Of these primary school, the no of schools of lower primary & upper primary are 254 & 391 respectively. City lists 264 total secondary schools with 153250 students & 1322 teachers. Of these total secondary schools, the no of schools of secondary & higher secondary are 144 & 120 respectively as given in **Figure 8.2**.

Figure 8.2 Comparative accounts of number of Teachers and Schools in Pune



The data provided by education department of PMC suggests that there are more number of boys in pre-primary schools & the percentage of boys is 5% greater than girls. But percentage of boys & girls do not vary so much as per the educational landmark, this suggest that passing percentage of girls are more than boys (**Figure 8.3**)

Figure 8.3 Comparative account of Student Status in Pune schools



8.1 Number of Schools in Different Mediums in the City

As per the latest information given by education department of PMC, number of Marathi medium schools are decreasing. In year 2007, the decreased percentage of Marathi medium schools is 16%. At the same time number of English medium schools are increasing & the increased percentage of English medium schools in year 2007 is 3%. Rapid urbanization can be a cause for increase in number of English medium schools as compared to Marathi medium schools. And there is no change in school number of other medium schools likewise Urdu, Gujrathi, Kannad, Tamil etc as represented in **Figure 8.4 and 8.5**. The schools are as age-old.

Figure 8.4 Comparative account of Schools as per the teaching medium (Basic)

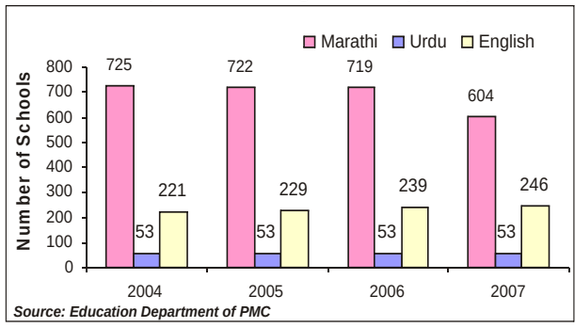
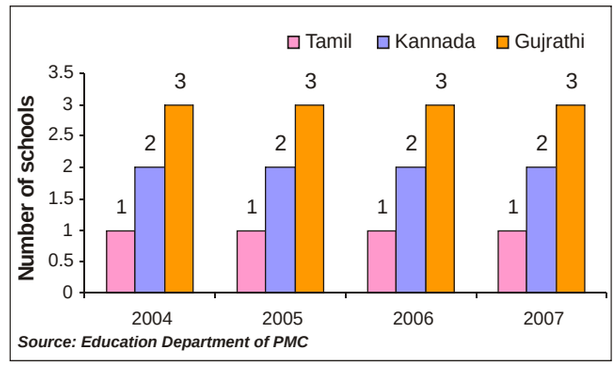


Table 8.5 Comparative account of Schools as per the teaching medium (Regional Language)



Almost all the colleges in Pune are affiliated to the University of Pune. The Government College of Engineering, Pune, is one of India's premier engineering universities, and the SNDT Women's University, open to women only, are the other universities in Pune. In addition to the statutory universities, Pune boasts 5 Deemed Universities that specialize in specific areas of research and training

1. Bharati Vidyapeeth Deemed University
2. Dr. D.Y. Patil Vidyapeeth (Deemed University)
3. Institute of Armament Technology (Deemed University)
4. Symbiosis International Educational Centre (Deemed University)
5. Tilak Maharashtra Vidyapeeth (Deemed University)

The University of Pune (formerly the University of Poona) is a university located in northwest Pune. It has a 400 acre (1.6 km²) campus. It was established on February 10,1949 and is home to 46 academic departments.

Initially the university had a jurisdiction extending over 12 districts of western Maharashtra. However, with the establishment of Shivaji University in Kolhapur in 1964, the jurisdiction of the university was restricted to 5 districts, namely Pune, Ahmednagar, Nasik, Dhule and Jalgaon. Out of these, two districts -- Dhule and Jalgaon -- are attached to the North Maharashtra University established in August 1990.

In 1949, there were only 18 colleges affiliated to the university, with an enrollment of over 8000 students. Thereafter, the number of colleges increased, and in 2004, the university had 46 graduate departments, 269 affiliated colleges and 118 recognized research institutions, with an enrollment of 1,70,000 students for both the undergraduate and graduate courses in different faculties.

National Defence Academy (NDA), which trains officers of India's armed forces, is located at Khadakwasla, on the outskirts of Pune. Students from all over India and the world come to Pune for higher education, particularly in engineering and management. Pune is also rapidly becoming a major centre for Information Technology (IT) in India.

Electricity

10.0 Introduction

Pune city is soon expected to be one of the few cities in the country that will have days without any power cuts. This is mainly due to an initiative by the manufacturing companies based in Pune, and endorsed by Maharashtra's power sector regulator. It could well be a model for other cities, especially those with a concentration of industries that have captive power generation plants and where minimal power is lost during transmission.

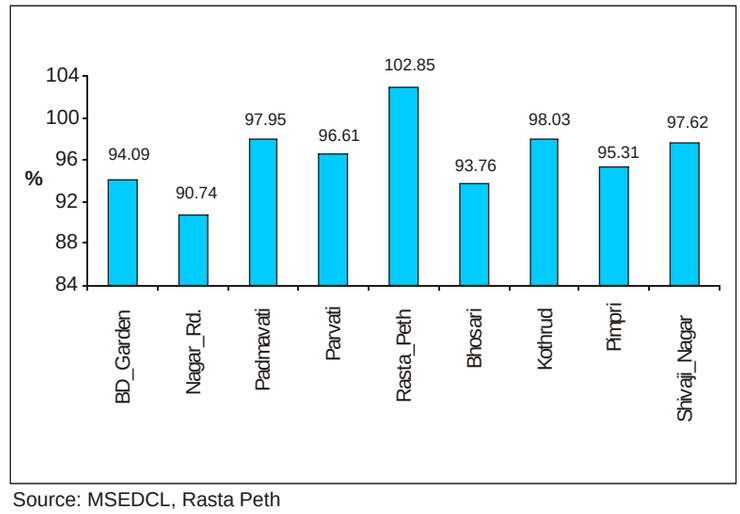
Other towns in Maharashtra, such as Nagpur and Kolhapur, are trying to replicate the Pune model and some from other States too are seeing whether they too can see the summer through without power outages. States are facing crippling power shortages and their utilities resort to load-shedding switching off power for certain time to match supply with demand both announced and unannounced to tide over the crisis.

The Pune urban circle faced a power shortage of about 90 MW, which would have resulted in the distribution utility, Maharashtra State Electricity Distribution Co Ltd (MSEDCL), switching off power for about three hours daily. But this has been avoided thanks to an initiative of the local chapter of the Confederation of Indian Industry. (Business Daily from THE HINDU group of publications, Thursday, April 12, 2007)

Rapid urbanization, population growth and growing economy and industry of the region have placed an enormous strain on the city's infrastructure. This has led to the usual problems of a developing metropolis such deteriorating electricity.

The data provided by MSEDCL, Rasta Peth represents that, Bill Collection Efficiency of different divisions is excellent & all divisions having efficiency greater than 90%. (**Figure 10.1**)

Figure 10.1 Division Wise Collection Efficiency for the Year 2006-2007



Source: MSEDCL, Rasta Peth

10.1 Sector Wise Consumption

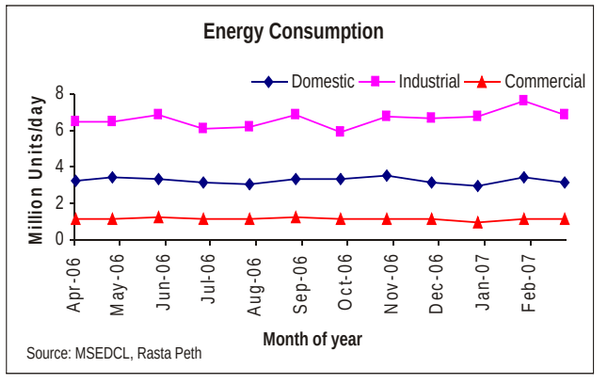
As per the data given by MSEDCL, Rasta Peth shows that maximum unit consumption in industrial sector. Average energy consumption is observed 3.26, 6.63 and 1.14 million units/day for Domestic, Industrial and commercial respectively. Electricity consumption varies marginally as 0.06 for Commercial followed by 0.17 and 0.44 for Domestic and Industrial respectively.

Table 10.1 Electricity Consumption Data

Parameter	Domestic	Industrial	Commercial
SD	0.17	0.44	0.06
Minimum	2.97	5.88	0.99
Maximum	3.49	7.59	1.24
Average	3.26	6.63	1.14

Note: *SD - Standard Deviation All units in Million units per day*

Figure 10.2 Sector Wise Electricity Consumption for the Year 2006-2007



10.2 Monthly Consumption

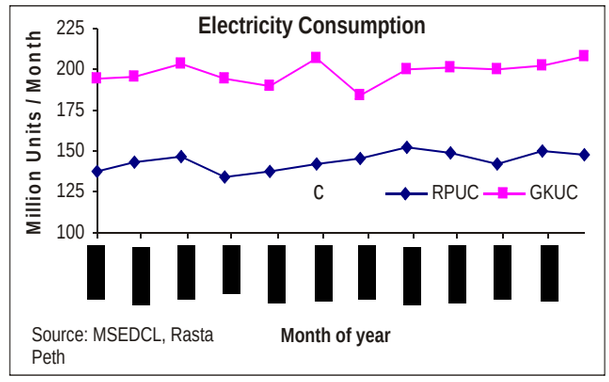
As per the data given by MSEDCL, Ganesh Khind Urban Circle shows that maximum unit consumption of 207.93 in March '07. Average energy consumption observed in both RPUC and GKUC is 143.87 and 198.37 million units/month respectively. Electricity consumption similar variation was observed of 5.5 and 6.97 for both urban circles Rasta Peth and Ganesh Khind respectively.

Table 10.2 Average energy consumption Data

Parameter	RPUC	GKUC
Standard Deviation (SD)	5.50	6.97
Minimum	134.04	184.48
Maximum	151.77	207.93
Average	143.87	198.34

Note: RPUC: Rasta Peth Urban Circle
GKUC: Ganesh Khind Urban Circle
All units in Million units per month

Figure 10.3Monthly Electricity Consumption for the Year 2006-2007



10.3 Daily Consumption

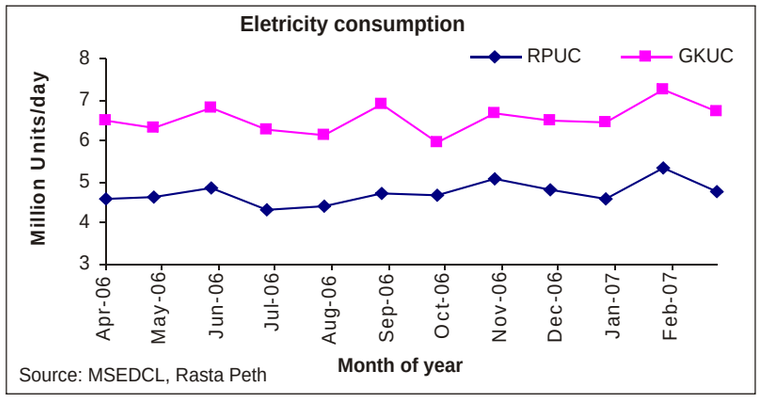
As per the data given by MSEDCL, Ganesh Khind Urban Circle shows that maximum daily unit consumption of 7.24 in February '07. Average energy consumption observed in both RPUC and GKUC is 4.74 and 6.53 million units/day respectively. Electricity consumption similar variation was observed of 0.27 and 6.53 for both urban circles Rasta Peth and Ganesh Khind respectively.

Table 10.3 Average daily energy consumption

Parameter	RPUC	GKUC
Standard Deviation (SD)	0.27	0.35
Minimum	4.32	5.95
Maximum	5.34	7.24
Average	4.74	6.53

Note: RPUC: Rasta Peth Urban Circle
GKUC: Ganesh Khind Urban Circle
All units in Million units per month

Figure 10.4 Daily Electricity Consumption for the Year 2006-2007



Source: MSEDCL, Rasta Peth

10.4 Street lighting

The provision and maintenance of streetlights is an obligatory function of the Electricity Department of PMC and is responsible for installation, replacement, repairs, operation and maintenance of streetlights in the city. There are about 1,00,200 street light poles in Pune city.For a total road length of about 1,800 km. in the PMC limits, the average spacing of streetlight poles works out to about 18 meters, which is fairly good in comparison to the standard norm of 30 meters. The majorities (99%) of the streetlights are 70W, 150W and 250 W sodium vapour lamps; only 1% of streetlights are high mast lights.

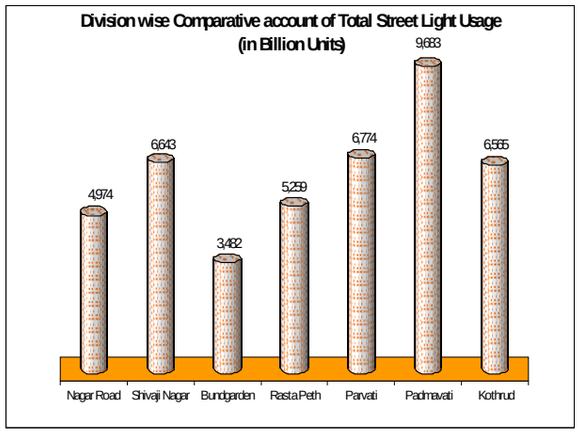
The division wise electricity consumption data is represented in **Figure 10.5**. The maximum yearly total electricity consumption of 9,683 Billion Units was observed at Padmavati, where as minimum total yearly electricity consumption of 3,482 Billion Units was observed at Bundgarden. Comparative account of all available data for the year 2006-2007 suggest maximum monthly usage of 22,831 billion units at Parvati division in November '06 and minimum monthly usage of 232 billion units at Rasta Peth Division in July '06.

Table 10.4 Power Consumption for Street Light Usage In Year 2006-2007

Month	Division Name						
	Nagar Road	Shivaji Nagar	Bundgarden	Rasta Peth	Parvati	Padmavati	Kothrud
Apr-06	420685	555359	302668	445339	425588	659593	608733
May-06	401984	526948	314256	434222	624394	672402	428725
Jun-06	473713	694652	305393	407507	416451	533044	494928
Jul-06	410421	515242	306258	232158	267736	661383	472933
Aug-06	360442	499270	294837	632923	272734	1096620	352441
Sep-06	401745	506111	257397	479483	263667	821597	583402
Oct-06	410902	500888	271203	438438	428283	1048246	432555
Nov-06	411324	574044	292697	358254	2283721	1094374	964524
Dec-06	385762	508679	290477	526038	550290	843492	486859
Jan-07	401468	697491	270048	446913	447990	844295	444910
Feb-07	427412	552549	284754	453435	372516	758260	639777
Mar-07	468207	511489	292468	404719	420132	650169	654776
Total	**4974065**	**6642722**	**3482456**	**5259429**	**6773502**	**9683475**	**6564563**

Source: *Electricity Dept. PMC*

Figure 10.5 Division Wise Consumption by Street Light usage for the Year 2006-2007



10.5 Accelerated Power Development & Reforms Programme (APRDP)

Power is a critical infrastructure for economic growth. The economic acceleration would greatly depend upon a commercially viable power sector that is able to attract fresh investments. However, the financial health of State Electricity Boards (SEBs) become a matter of grave concern considering that their losses have reached an alarming level of Rs.26,000 crores during 2000-01,which was equivalent to about 1.5% of GDP. Accelerated Power Development Programme (APDP) had been undertaken from the year 2000-01 as a last means for restoring the commercial viability of the Distribution Sector.

Since incentive financing is proposed to be integrated with the existing investment programme to achieve commercial viability of SEBs / Utilities and link it to the reform process, the original APDP was rechristened to Accelerated Power Development & Reforms Programme (APDRP) during 2002-03.

10.5.1 The main objectives of APDRP

1. Improving financial viability
2. Reduction of T&D losses to around 10%
3. Improving customer satisfaction
4. Increasing reliability of power supply
5. Improving quality of supply
6. Adopting systems approach with MIS
7. Bringing Transparency through computerization

The success of the Accelerated Power Development Reforms Programme in establishing that financial viability of the distribution system can be improved, would be dependent upon the choice of elements to be funded under the scheme, speed of execution, organizational commitment and public, political as well as administrative support. The number of circles to be covered under APDRP would be increased gradually every year until all the circles in the country are covered.

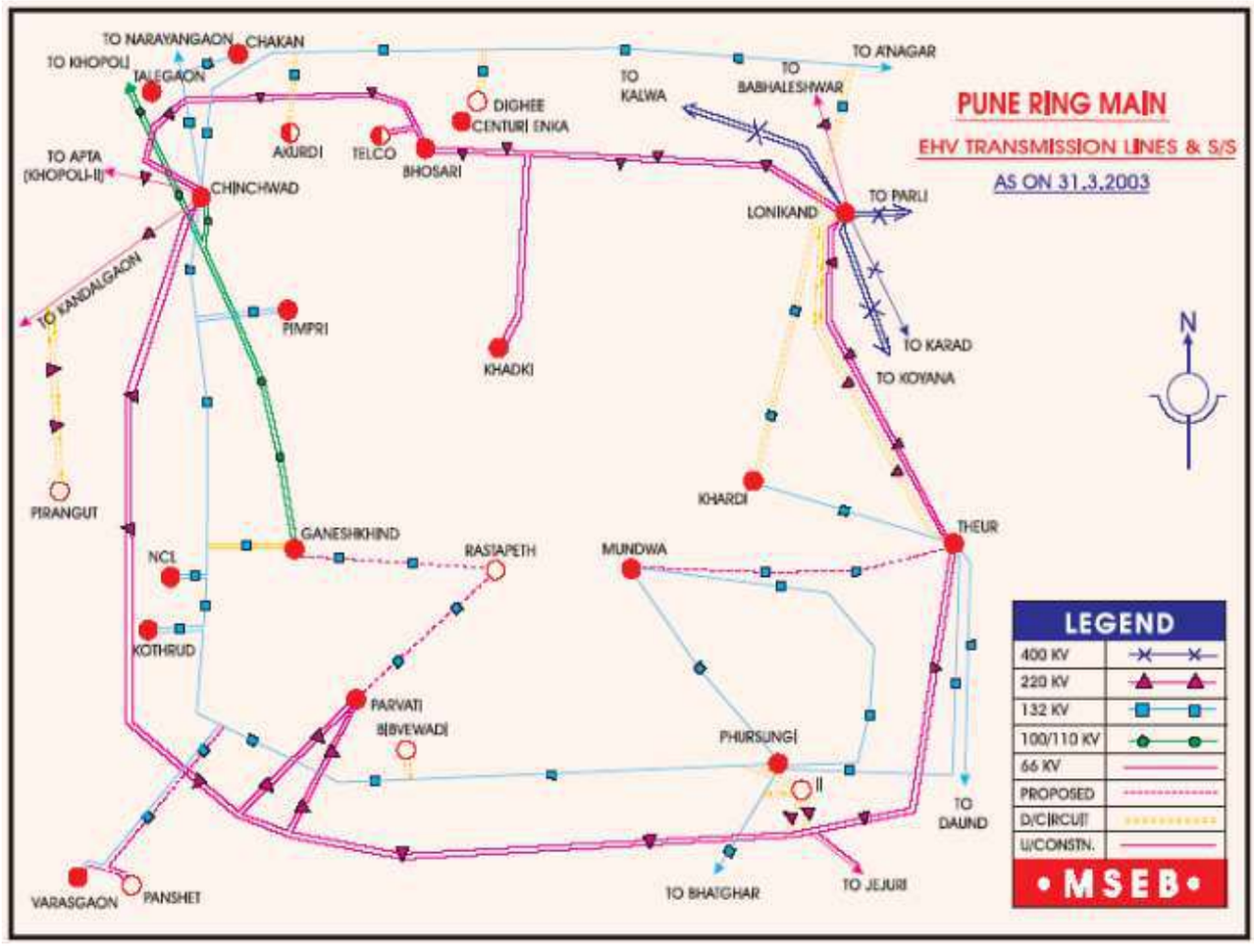
10.6 Some Published facts (News Papers)

The work of improving the power supply system in Pune and Pimpri-Chinchwad, under the Rs 128-crore accelerated power development and reforms programme of the Union government, is likely to commence here in the first week of July.

The Maharashtra State Electricity Board's (MSEB) head office has given its approval to the plan prepared by the Pune urban zone. The first tender for work under the APDRP was published in newspapers on March 15, to signal commencement of the project, according to Gajanan Sunnapwar, chief engineer of Pune urban zone. Sunnapwar said the project will be completed in one-and-a-half year. Rs 100 crore will be spent in Pune and Rs 28 crore in Pimpri-Chinchwad.

Speaking about the works which will be undertaken on priority, Sunnapwar said 2.48 lakh single-phase meters will be installed in Pune, while 1.47 lakh units would be fitted in Pimpri-Chinchwad. Three-phase static meters will be fitted at 4,037 industrial units. Four new sub-stations will be constructed near Alankar theatre and in Karvenagar, Wakdewadi and Bopodi areas, while a new switching station will be installed at Nigdi. The detail of the transmission lines for Pune region is represented in **Figure 10.6**.

Figure 10.6Electricity Transmission lines network for une region (By MSEB)



Sewerage

11.0 Pune scenario

The first sewerage system for Pune city was designed in year of 1928 including only preliminary treatment such as screening & grit removal at Bhairoba Nalla. The treated sewage was then used for irrigation purposes by pumping to 17 1/2 Nalla canal areas. The designed capacity was 31.8 MLD to cater the ultimate design capacity for population of 0.26 million in year of 1951.

In the year of 1981 a complete collection & disposal system was planned considering future population growth and a 90 MLD sewage treatment plant was constructed at Dr. Naidu hospital. One Intermediate pumping station at kasba peth of 90 MLD capacity was provided to pump sewage to pumping station.

Up to year 1997 main sewer length was approximately 146.83 km. Dr. Naidu STP with full fledged primary & secondary treatment facility, was treating 90 MLD sewage & Bhairoba STP with primary treatment facility was treating 32 MLD sewage. The details of STP are given in **Table 11.1**.

11.1 Sewage collection

For newly emerged villages, the sewage network is not yet reached in such areas. Therefore PMC has laid sewage network in this added areas to improve collection of wastewater. Total length of sewer is about 1500 kms, which covers 95% of area with newly emerged villages.

The criteria wastewater parameters like BOD, COD, suspended solids, residual chlorine shown in **Table 11.2**, are well within limits as per specified by CPCB

Table 11.2 CPCB sewage water discharge Limits

Parameters	Sewage quality
BOD5	Less than 20 mg/l
COD	Less than 30 mg/l
Oil & grease	Less than 10 mg/l
Residual Cl2	Less than 1 mg/l
TSS	Less than 30 mg/l

Source: *CPCB standards*

Table 11.1 Existing Sewage Treatment Plants

Name	Capacity MLD	Existing load MLD	Total population benefited (approx)	Method of treatment	Area Km^2
Bhairoba	130	130	812500	Activated sludge process followed by anaerobic digestion	57
Erandwane	50	50	312500	Activated sludge process followed by aerobic digestion	26
Tanajiwadi	17	17	106250	Two stage biological process	18
Bopodi	18	18	112500	Extended aeration process	15
Naidu Hospital	90	90	562500	Activated sludge process followed by Anaerobic digestion	40
Total	**305**		**1906250**		**156**

Source: *sewerage project PMC, Pune*

Table 11.3 Efficiency of wastewater treatment plants

Parameter	Treatment	Bhairoba	Erandwane	Tanajiwadi	Bopodi	Naidu Hospital
BOD (mg/l)	Pre	175-225	175-225	175-225	175-225	175-225
	Post	< 20	< 20	< 20	< 20	< 20
COD (mg/l)	Pre	200-350	200-350	200-350	200-350	200-350
	Post	< 100	< 100	< 100	< 100	< 100
Suspended solids (mg/l)	Pre	200-350	200-350	200-350	200-350	200-350
	Post	< 200	< 200	< 200	< 200	< 200
Oil & Grease (mg/l)	Pre	Nil	Nil	Nil	Nil	Nil
	Post	Nil	Nil	Nil	Nil	Nil
Residual Chlorine (mg/l)	Pre	0.5	0.5	0.5	0.5	0.5
	Post	< 1	< 1	< 1	< 1	< 1

Source: *sewerage project PMC, Pune*

The treatment plants are well equipped with latest technologies and the operation and maintenance of the same is tendered to professional contractors. The efficiencies of the STP's is represented in **Table 11.**3.Sewage wastewater generated in the PMC area is accounted to be 451 million liters per day (MLD); however the exiting facilities can treat only 305 MLD out of the total sewage generated following its discharge into Mula & Mutha River. PMC has planned to augment its sewage treatment facilities through constructing STP's at different locations as given in **Table 11.4**

Table 11.4 PROPOSED STP'S

Proposed STP	Capacity (MLD)
Vitthalwadi	32
Naidu	115
Mundwa	45
Baner	40

11.2 Existing Sewage Treatment Plants

The following discussions gives details of some of the specialized sewage treatment plant with its area served , process, salient features and cost.

11.2.1 STP at Erandwane

The plant capacity is 50 MLD & process used is modified Activated sludge process followed by aerobic digestion. The salient features are that aeration is done with the help of diffusers & settling with the help of inclined tube settlers. Total area served is about 26.15 sq. km. The cost of project was 11.12 crores and plant is functioning since Dec 2004.

11.2.2 STP at Tanajiwadi

The plant capacity is 17 MLD consisting of two stage biological processes i.e. Bio-towers & aeration. Aeration is assisted by using diffused aeration system

Table 11.5 Expected sewage generation in the next 20 years

Phase No	Projected Population (Lakhs)	Year	Expected Water Supply (MLD)	Treated water (MLD)
1	34	2005	791	451
2	47	2015	1074	622
3	66	2025	1506	875

Source: *sewerage project PMC, Pune*

with 102 in numbers of diffusers. The filter media used in Bio-tower is of FRP material i.e. higher plastics. The Bio-tower is designed to reduce 70% BOD load. The total area served is 18 sq. km. The cost of project was 7.43 crores & the plant is functioning since April 2004.

11.2.3 STP at Bopodi

Plant is located near Harris Bridge and is of 18 MLD capacity. Sewage generated from Aundh ITI, Aundhgaon, Sindh colony, Bopodi, and Bopodi gaothan, NCl, Raj bhavan etc are treated here. The treated wastewater is discharged in Mula River. The area served is about 15 sq. km. Cost of project was Rs. 5.69 crores & the plant is functioning since June 2003.

11.2.4 STP at Naidu hospital

The plant is located near Naidu hospital having a capacity of 90 MLD. The sewage generated from central part of city is collected at kasba pumping station & then treated in this plant using Activated sludge process followed by anaerobic digestion.

11.2.5 STP at Bhairoba

Plant located near Koregaon Park with capacity of 130 MLD. The main process used is Activated sludge process followed by anaerobic digestion. The gas generated is used for power generation & treated water is used for irrigation purposes. Total area served is about 82.00 sq. km. The cost is 37.50 crores and the plant is functioning since July 2003.

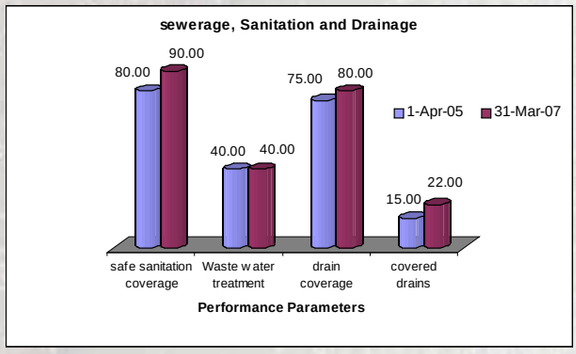
it is equally important for the Municipal Corporation to estimate the sewage generation potential in the city limits especially with the way Pune is expanding. To understand the future needs of the City, **Table 11.5** depicts expected sewage generation for the next 20 years.

11.3 Performance Indicators in sewerage, Sanitation and Drainage system

Performance indicators are used for evaluating the performance efficiency of various aspects of Urban Local Body. These indicators are usually being applied considering the limited time and financial resources available with the organization. The first and foremost indicator is mostly oriented toward aspects of safe sanitation coverage; direct service connection for sewerage services and Safe sanitation disposal techniques like septic tanks and soak pits for percentage of total population. Citywide sewerage and safe sanitation coverage was increased by 10% in last two years.

Coverage then follows the Extent of wastewater treatment in MLD as percentage to wastewater generated in MLD (at least primary treatment). This was about 40% and it followed similar trend as in the 2004-05 financial year. Thereafter, it should have about 5% increase in total pucca roadside drains in comparison to the total Pucca road length in urban area. Covered storm water drain length is observed nearly 7% more as compared to total Pucca drain length. The performance of PMC wastewater treatment is represented In **Figure 11.1**.

Figure 11.1 Comparative account of performance Parameters



11.4 Storm Water Management

With the uneven and untimely patterns of rains in the city, Pune Municipal Corporation has taken a step to understand the watersheds and storm water issues through contracting a well appreciated project of Design & planning for the management of watersheds & storm water in Pune Municipal Corporation area Primove Infrastructure Development Consultant Pvt. Ltd. this year.

11.4.1 Aim & type of work

- Collection of all the information about geographical nature of Pune city, which includes Actual survey, editing the available information in PMC, photos taken by GIS etc.
- Distribution of Pune city into different storm water regions.
- Study from the above data, how much quantity of rainwater is carried through each storm water region
- To carry rainwater, underground drainage system as well as for all Nallas planning & design is required.
- Prepare unit rate for different sized drains.
- Represent all the above information by use of GIS technique into well format.

11.4.2 Scope of work

Prepare base map for Pune city.

Distribute Pune city area into different water shades so; Pune is divided into 23 watersheds.

Evaluation of information collected about rainwater from IMD for last 35 years.

Plan to carry water from each watershed region.

Carry out topographic survey for watershed. In that measure roads & all Nallas.

Design drains of suitable size to carry Estimated Runoff.

11.4.3 Present condition of work

Survey work of all roads & Nallas is completed.

Out of 23 watersheds, planning & designing of 14 watersheds is completed. (Work of 200 sq km out of 240 sq km is completed)

Some important points

Some natural Nallas has been encroached.

There are some manmade underground drains have been made by filling the natural Nallas.

Some Nallas have been closed & diverted.

On most of the roads there are no storm water drains.

Drains are incapable to handle water quantity.

11.4.4 Some challenges

Systematic solid waste management.

Carry all wastewater from Nallas.

Protect all Nallas from Encroachment.

11.4.5 Information revealed from work

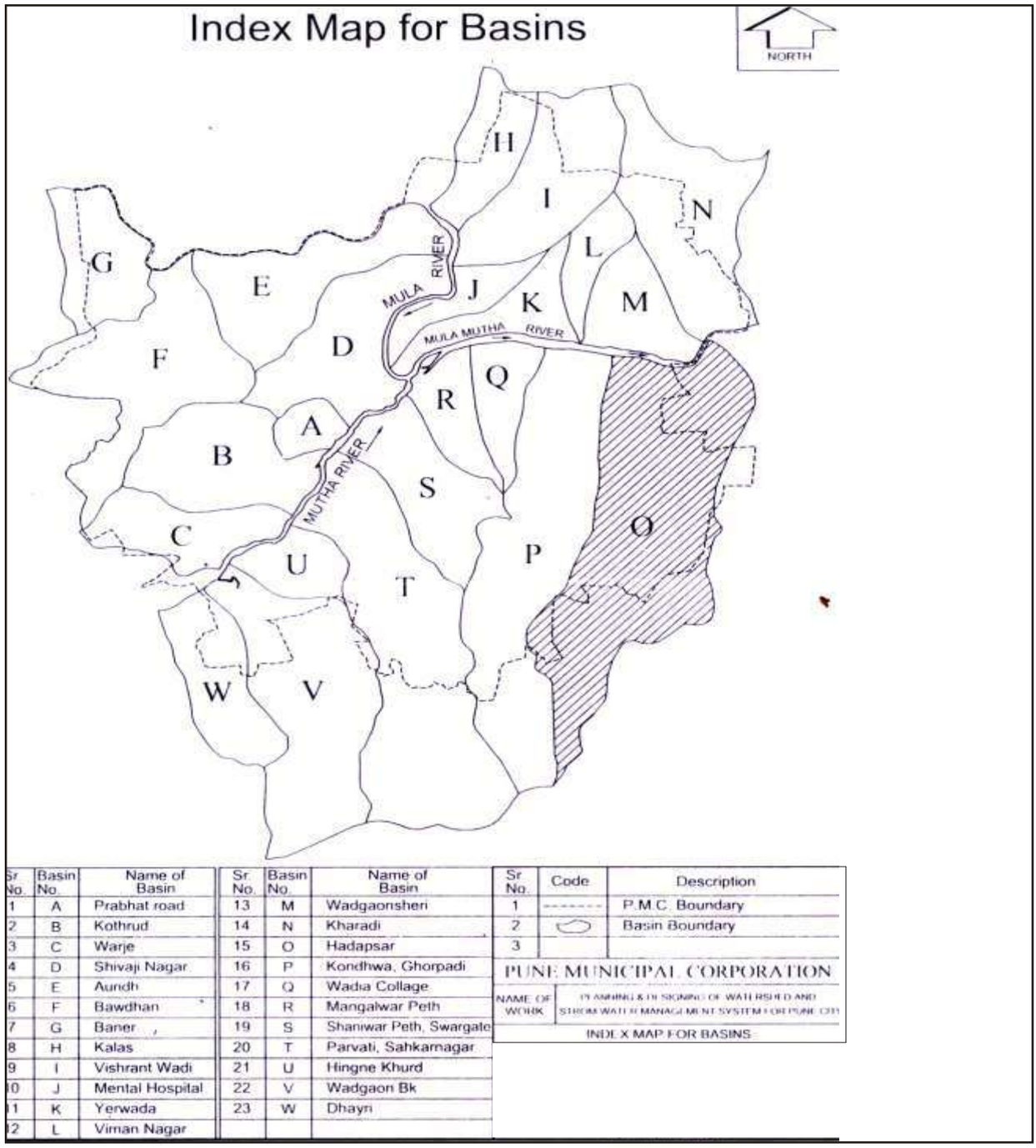
Contour map of 1-meter interval for Pune city is ready.

Information about 800 km roads & 250 km Nallas is available.

All information required for Flood control & water distribution is edited.

Length of Nalla for entire Pune city is nearly 380 km.

Cost for storm water management Tender 81,41,438 Rs. 25 paise.



Sr No.	Basin No.	Name of Basin	Sr No.	Basin No.	Name of Basin
1	A	Prabhat road	13	M	Wadgaonsheri
2	B	Kothrud	14	N	Kharadi
3	C	Warje	15	O	Hadapsar
4	D	Shivaji Nagar	16	P	Kondhwa, Ghorpadi
5	E	Aundh	17	Q	Wadia Collage
6	F	Bawdhan	18	R	Mangalwar Peth
7	G	Baner	19	S	Shaniwar Peth, Swargate
8	H	Kalas	20	T	Parvati, Sahkarnagar
9	I	Vishrant Wadi	21	U	Hingne Khurd
10	J	Mental Hospital	22	V	Wadgaon Bk
11	K	Yerwada	23	W	Dhayri
12	L	Viman Nagar			

Sr No.	Code	Description
1	-------	P.M.C. Boundary
2		Basin Boundary
3		

PUNE MUNICIPAL CORPORATION

NAME OF WORK: PLANNING & DESIGNING OF WATERSHED AND STORM WATER MANAGEMENT SYSTEM FOR PUNE CITY

INDEX MAP FOR BASINS

Solid Waste

12.0 Background

Economic development, urbanization and improving living standards in cities, have led to increase in the quantity and complexity of generated waste. Management of Municipal Solid Waste (MSW) resulting out of rapid urbanization has become a serious concern for government departments, pollution control agencies, regulatory bodies and also public in most of the developing countries. Rapid growth of population and industrialization degrades urban environment and places serious stress on natural resources, which undermines equitable and sustainable development. Inefficient management and disposal of solid waste is an obvious cause for degradation of environment in most cities of the developing world. Improper disposal of this waste leads to spread of communicable diseases, causes obnoxious conditions and spoils biosphere as a whole. Cleanliness is a major factor that influences development of any nation, which is otherwise hampered due to improper disposal of solid waste.

Major problems due to poor solid waste management are loss/under utilization of resourceful material and is social cost due to health impact on rag pickers, community living in dump site surroundings and general public suffering from improper or no collection of waste from streets resulting in nuisance and spread of diseases. Present municipal solid waste management in India has severe problems. Very high rate of urban growth is a major reason for the increased solid waste management problems. This problem of SWM is intensified in urban areas as 217 millions out of 844 million people of India (25.72%) live in urban cities (1991 Census). The only difference amongst various areas is in the management of wastes. An effective, efficient and sustainable waste management system is still rare in India.

Per capita waste generation of many fast developing cities like Pune is among the highest in Indian cities with 0.450 kg of waste being generated per capita. Though it is not comparable with developed countries whose per capita waste generation goes over 2.5 kg, it is considerably high when compared with many cities in developing countries. The wastes are in the form of garbage, debris, silt removed from drains and nallahs, cow dung and also waste matter removed from common house gullies or inaccessible narrow lanes between old buildings. The waste comprises of construction waste and silt, mix waste (Biodegradable and Recyclable) and biodegradable waste.

The City of Pune is a historical city & well known for its educational importance. Today the city is also an IT Hub. The area of Pune city today is 244 sq. km with a vast population of 35 lakhs. It is still developing & expanding & by 2015 the population will rise up to 50 lakhs, & by 2025 it is expected to go up to 65 lakhs.

Principles of solid waste management:

1. Focus on the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property.
2. Segregation, recycling and recovery of value added products from waste.
3. Focus on waste processing by the best available technology (BAT), conservation, recovery, reuse, rather than disposal of material as waste.
4. Focus on decentralized waste processing and disposal facilities.

Pune city generates about 1100 Metric Tons of municipal solid waste (MSW) per day. As per the SWM Department of PMC, 70% of total waste is Organic or Biodegradable. Other parameters fall in the range of 4-8%, the Plastics contribute 7%.

12.1 Present scenario

Currently Pune city is generating approximately 1100 metric tons solid waste per day, which is collected, transported & disposed at a sanitary landfill site which is about 20 km away from Pune, viz at Devachi Urali. The total costs for collection, transportation & disposal is about Rs.60 crores per year & nearly about Rs. 20 to 25 crores are spent for transportation & equipments used at the sanitary landfill site.

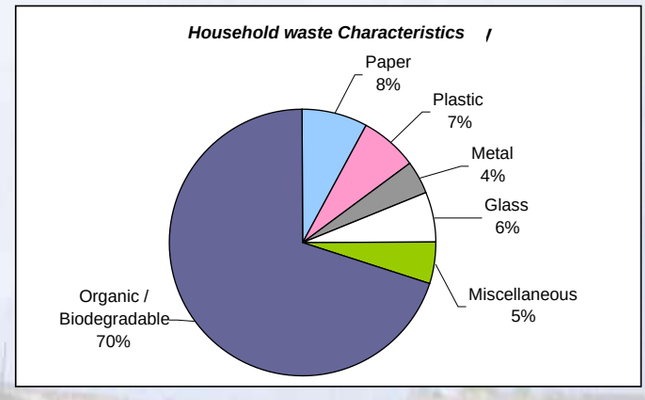
12.2 Initiative taken by PMC

PMC have done substantial work in creating awareness amongst citizens of Pune city in terms of segregation of wet & dry waste & waste processing practices. PMC have created various CD's, posters, banners, leaglets, and pamphlets for creating awareness. PMC has also established mission 'Chakachak' in which various school children, sr. citizens, N.G.O's, laughing clubs are involved & they are voluntarily extending their participation in segregation & waste processing practices.

Implementation of BMW & handling rules is done by PMC since December 2000. The facility is central & there are three incinerators working presently covering all the hospitals, Nursing home, Lab., Blood banks & some dispensaries. This facility is outsourced & run by NGO, which has authorization from MPCB for transport & disposal.

12.2.1 Carcass utilization plant

PMC has also set up carcass utilization plant for the disposal of dead animals in the city. This facility is also out sourceed.



12.2.2 Modern slaughter house

PMC is setting up modern slaughter house plant as per norms of MPCB, at Kondhava the work of which is near completion.

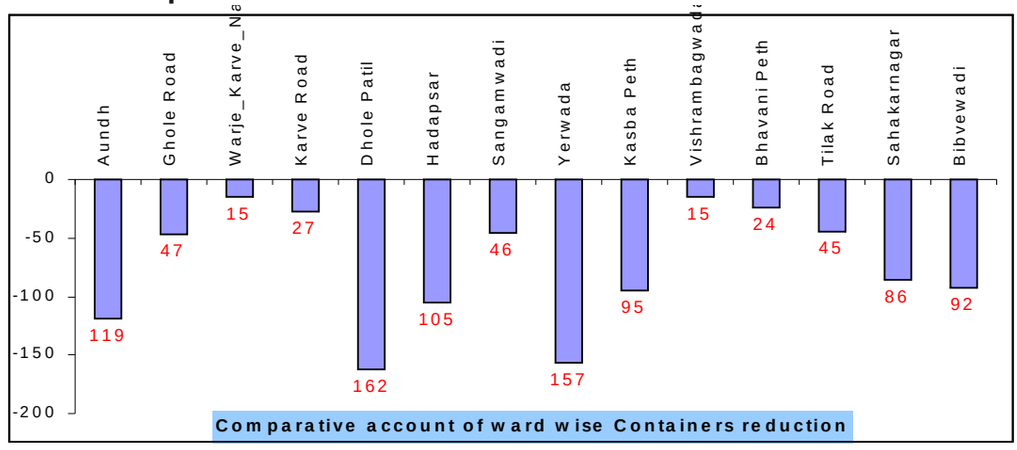
12.2.3 Role of waste pickers

In the limits of Pune Municipal Corporation there are about 4000 waste pickers working for SWM. They are engaged in house to house collection of waste. Pune Municipal Corporation provides them assistance in terms of medical insurance, PMC has also provided them identity cards.

PMC is playing a positive role in house to house collection of waste by deploying vehicular fleet as follows

1. Nearly 450 cycle rickshaws are operating in various parts of the city by PMC employees & ragpickers.
2. 50 cycle rickshaws are operating in various parts of the city by PMC employees & ragpickers.

Figure 12.1 Comparative account of ward wise container reduction in Year 2006-07



Source: *SWM Dept, PMC*

Table 12.1 Ward wise container distribution during last two years

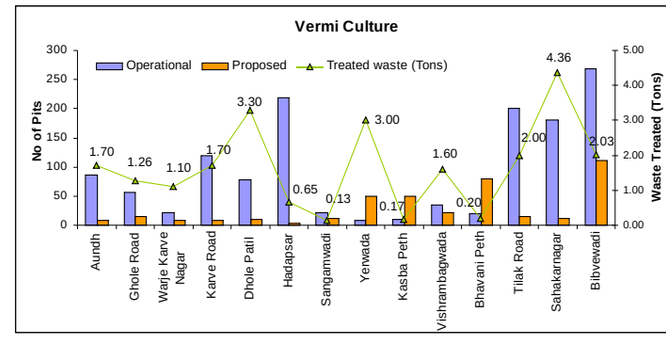
Name of Ward	2005	2006
Aundh	244	125
Ghole Road	180	133
Warje Karve Nagar	88	73
Karve Road	115	88
Dhole Patil	176	14
Hadapsar	310	205
Sangamwadi	171	125
Yerwada	221	64
Kasba Peth	141	46
Vishrambagwada	161	146
Bhavani Peth	72	48
Tilak Road	175	130
Sahakarnagar	213	127
Bibvewadi	288	196
Total	**2555**	**1520**

Source: *Solid Waste department of PMC*

3. 65 Ghanta Trucks being deployed for house to house waste collection. As a result of which PMC is reaching to more than 60 % of properties in doorsteps services.
4. PMC has also set up separate system for collection of Hotel waste with the help of 20 trucks. PMC is planning to out source Hotel waste collection in the near future.
5. Due to augmented doorstep collection services, PMC could achieve in making container free areas by reducing more than 300 containers of 3.8 Cu.mt capacity & similar number of compacter buckets.

Figure 12.2 gives the detailed ward wise comparative account of no. of containers reduced since last year i.e. 2006-2007. Dhole Patil ward office

Figure 12.2 Ward wise scenario of Vermiculture



Source: *SWM Dept, PMC*

Has reduced considerably by 162 containers; Followed by Yerwada by 157 containers. Lowest of 15 container removal was observed in Visrambag wada and Warje-Karve Nagar ward offices.

12.3 VERMICULTURE

The foremost option in conversion of the biodegradable waste is Vermiculture Biotechnology. Vermiculture helps in bioconversion and the end product obtained is rich manure. Vermiculture is used for conversion of solid wastes in to a nutrient-rich material. 'Vermi' Means worms (earthworms) and 'culture' means farming; thus, Vermiculture is a farming of earthworms. In this process, earthworms are harnessed as versatile natural bioreactors, which convert the organic solid waste into a valuable by-product.

Vermiculture provides an amicable solution in the field of solid waste management. Bioconversion and the by-products obtained do not disturb the ecological balance. The manure obtained can replace the chemicals, which affects the soil as well as the water system. The pollution load on the environment can be reduced considerably by adopting this Eco friendly method of bio conversion Vermiculture.

12.4 Biomethanation / Anaerobic Digestion

Though this is an old technology, however, has been proven for utilization of pure waste streams such as cattle dung, poultry dropping, fruit pulp, vegetable market waste, slaughter house waste, sewage sludge etc. The biogas methane is generated under closed reactor system in the absence of oxygen which is useable directly for burning or electricity production.

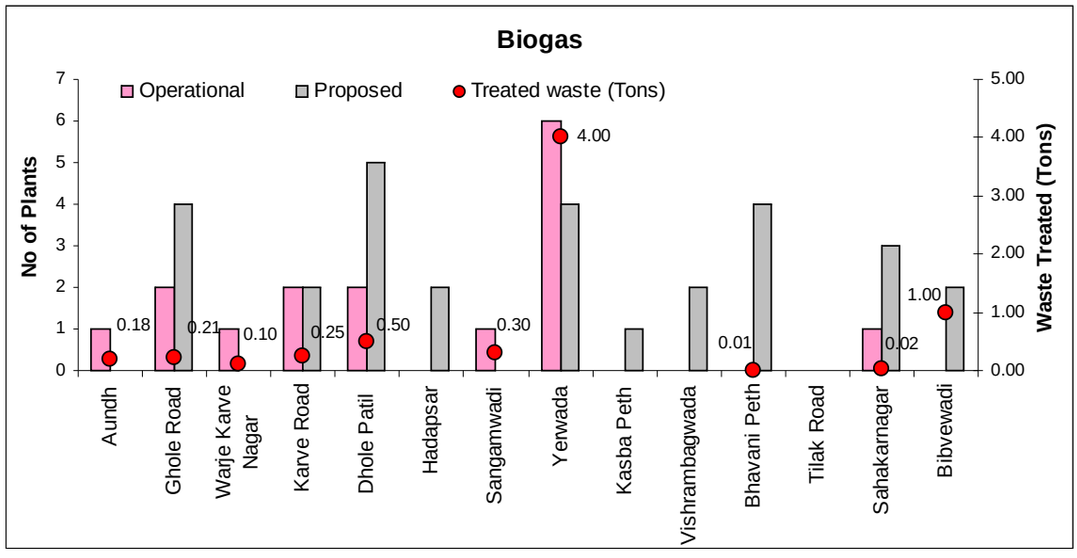
For its success, one of the most important aspects is **source segregation of short-term biodegradable wastes free from sand-silt and contamination**.

Although MSW rules mandate segregation of waste at source by through education, awareness and NGO action, citizen participation programmes, the success rate as of the date is very low. In view of this biomethanation technology can only be tried out at small scale level in the institutional campuses, sewage treatment facilities and slaughter house, where biogas can be used directly and post biomethanation slurry can be used in plantations.

12.4.1 Features of Biomethanation / Anaerobic Digestion

1. MSW should have 70% soft succulent wet waste comprising of food residues, fruit-vegetable market waste, lawn pruning etc.
2. The volatile solid content (specially the labile component) should not be less than 50% in the above waste; desirable level is 75% to produce methane gas at a faster rate.
3. The waste should not be older than 24 hours otherwise there is escape of methane gas due to high temp conditions.
4. The waste should be virtually free of sand, silt, and clay.
5. Large quantity of potable quality water should be available to make slurry of 12 to 15% strength (1 MT waste:8000 lit water)
6. Biomass from de-watered slurry has to be composted through aerobic windrow technology with supplementation of carbohydrate protein rich waste such as blood meal.
7. While methane gas can be converted into electricity and readily sold, compost requires similar marketing efforts as that of a composting project.
8. These projects cannot be established on reclaimed dumpsite due to very heavy structure of methanation towers.
9. High capital cost.
10. Does not reduce burden of sanitary land fill due to several discards (like silt, earth, fibrous materials).

Figure 12.3 Ward wise scenarios of Biogas Units



Source: *SWM Dept, PMC*

11. Highly complicated repair & maintenance specially de-silting, sand traps & feeder lines.
12. The composting of post biomethanation residue again requires extra land space as that of normal composting, hence the process is not space efficient in any way.
13. Supplementation of vegetable waste with slaughter house waste, cattle dung etc. is required for high speed biomethanation.

Solid waste management includes all activities that seek to minimise the health, environmental and aesthetic impacts of solid wastes. There are different types of solid waste depending on their source. On an average about 1000 metric tons of solid waste is generated daily in Pune City, which amounts to about 400 to 500 gm of solid waste per day/per capita. The waste generated is of mixed in nature. It contains both dry and wet waste.

Solid waste management is the most important and obligatory function of urban local bodies in India.Insufficient solid waste management of by local bodies have resulted in problem of health, sanitation and environmental degradation.

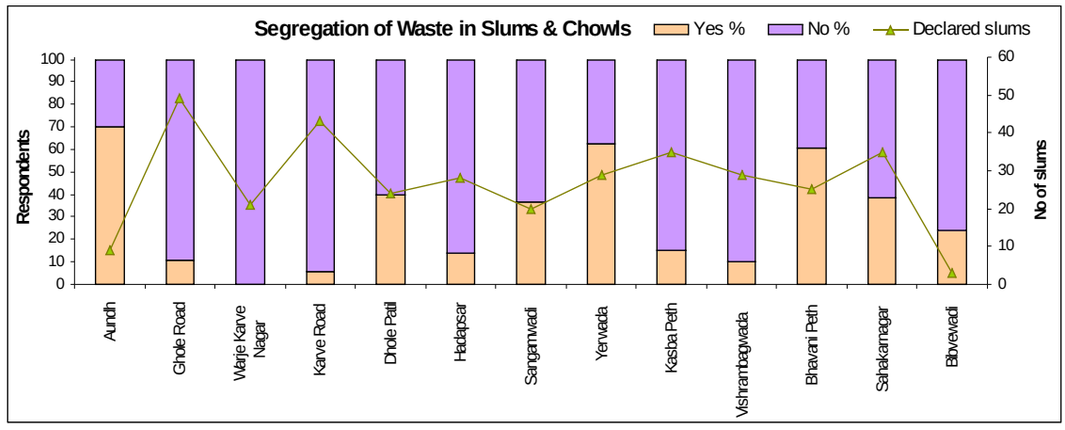
The PMC is responsible for providing necessary infrastructure for collection, storage, segregation, transportation, processing and disposal of municipal solid waste.

12.5 Waste Segregation

Segregation at source (garbage generating point) is the most important step in waste management and is done in two major categories: dry waste and wet garbage The recyclable material that is separated is sent for recycling, thus preventing loss to natural resources, energy and labor which goes into its manufacturing. It also makes the job of rag pickers easy, besides providing them employment. The wet garbage is composted through Vermiculture. Segregation at source (garbage generating point) is the most important step in waste management

Wet waste- means bio degradable solid waste and it includes residential waste of all kinds, cooked and uncooked, including vegetable waste, eggshells, and bones, hairballs, flower and fruit waste including juice peels, soiled paper, sanitary towels, disposable diapers and incontinence pads, house plants waste, house sweeping and waste from slaughters house, meat and fish markets, fruits, and vegetable markets and ashes etc.

Figure 12.4 Ward wise solid waste segregation scenarios in slums



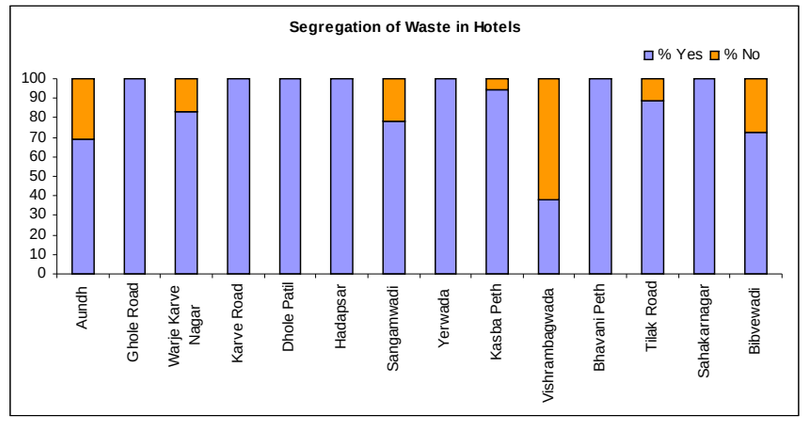
Source: *SWM Dept, PMC*

Dry waste- means recyclable solid waste, which does not, comes under definition of wet waste and includes paper and plastic of all kind, cardboard and cartons, containers of all kinds excluding those containing hazardous material, packaging of all kinds, glass of all kinds, metals of all kinds, rang, rubber, wood, foils, wrappings, paunches, sachets, and tetra packs, discarded clothing, furniture and equipments, etc. As per the directions of Hon. Supreme court and Govt. of India Gazette dated 3 Oct 2001 and Municipal Solid Waste Management and Handling Rules 2000, all the citizens are directed to segregate the garbage at its source. 1 July 2005 was the last date to the residents for non segregation waste collection; from here onward corporation has started collection of only segregated waste, and residents are forced to segregate the waste.

Pune Municipal Corporation has done Ground Truthing in 14 wards regarding solid waste segregation practice in 8 categorized places namely Societies, Bungalows, Slums & Chowls, Hotels Restaurants Juice bar, Wadding halls, Hostels, Slaughter houses and Shops. **Figure 12.5** gives ward wise solid waste segregation scenario in slums and Chowls, where Aundh ward shows maximum segregation of waste in slums & Chowls. There is no segregation of waste in Warje Karve Nagar slum area

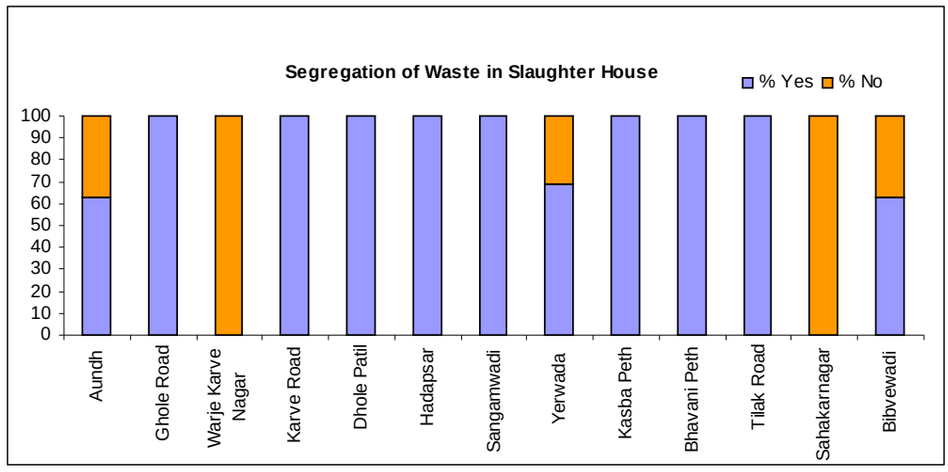
Hotels in Karve road, Ghole Road, Dhole Patil road, Hadapsar, Yerwada & Bhavani peth ward area segregate all the wastes. 50% of wards segregate hotel waste as dry & wet waste (Figure 12.6). Solid waste is not segregated in slaughter houses of Warje Karve Nagar & Sahakar Nagar.

Figure 12.5 Ward wise solid waste segregation scenarios in Hotels



Source: *SWM Dept, PMC*

Figure 12.6 Ward wise solid waste segregation scenarios in Slaughter houses



Source: *SWM Dept, PMC*

12.6 Waste Segregation on the Ghantagadis

The income from the sale of scrap collected from the ghantagadis is their earnings. As a matter of fact in these wards they have free paid municipal labor that have been redeployed for road sweeping and other works. It is also possible to introduce registered ragpickers on all ghantatrucks and ghantagadis at no cost to Pune Municipal Corporation. Door to door collection by registered ragpickers on full cost recovery basis.

12.7 Waste collection

For waste collection and transportation, Pune Municipal Corporation has set up six different ramps at strategic location in the city. The solid waste from each collection point is brought to these ramps, by dumper placers or other transportation equipments. Before sending the waste to the disposal site at Devachi Urli, the entire waste is send to transfer stations for weighing, and a computerized record is maintained by Pune Municipal Corporation. In all the 14 Administrative ward offices the collection route map is prepared, and waste is collected accordingly.

Table 12.2 Approximately daily ward wise generation of solid waste

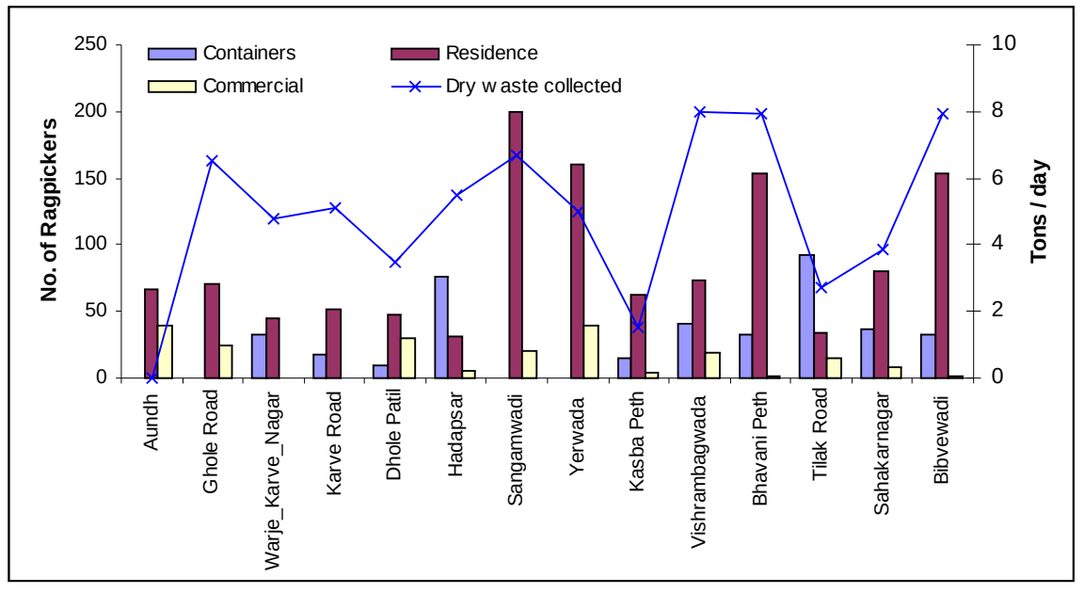
Source: *SWM Dept, PMC*

Table 12.2 Ward Wise Number of collection & transportation Vehicles

SR. NO	Ward Office	Open body Truck	Tipper Truck	Dumper placer	Compactor Vehicle	Tricycle	Community bin container 3.8m^3	Community bin container 1.5m^3
1	Aundh	3	5	3	-	42	57	42
2	Karve Road	-	-	-	-	-	-	-
3	Ghole Road	3	3	4	1	60	118	-
4	Warje-Karvenagar	-	-	-	-	-	-	-
5	Yeravada	-	-	-	-	-	-	-
6	Dhole Patil Road	5	3	6	1	38	53	07
7	Hadapsar	-	-	3	2	86	118* (4.5)	56* (3.5)
8	Sangamwadi	-	-	-	-	-	-	-
9	Vishrambag Wada	6	-	4	2	44	120	-
10	Bhawani Peth	-	-	-	-	-	-	-
11	Tilak Road	-	-	4	5	21	-	-
12	Sahakarnagar	-	-	5	5	43	119	45
13	Bibvewadi	1	-	4	2	26	67	60
	Total	**18**	**11**	**33**	**18**	**360**	**652**	**210**

Source: *SWM Dept, PMC*

Figure 12.7 No Ragpickers categorized as per the containers placed and waste collected per day



Source: *SWM Dept, PMC*

12.8 Bio-medical Waste Management

Medical waste is all waste materials generated at health care facilities, such as hospitals, clinics, physician's offices, dental practices, blood banks, and veterinary hospitals/clinics, as well as medical research facilities and laboratories.

The Medical Waste tracking Act of 1988 defines medical waste as "any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals." This definition includes, but is not limited to:

1. Blood-soaked bandages
2. culture dishes and other glassware
3. discarded surgical gloves
4. discarded surgical instruments
5. discarded needles used to give shots or draw blood
6. cultures, stocks, swabs used to inoculate cultures
7. removed body organs (e.g., tonsils, appendices, limbs)
8. discarded lancets

Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of biomedial waste in any establishment.

Pune municipal corporation has provided site for central incineration facility for the disposal of Biomedical waste and installation of three incinerator in the campus of Kailash Crematorium After the proper awareness campaign and series of meetings with Private Hospital owners, pathologists and the authorities of Blood Bank, Indian Medical Association, NGOs and Pune Municipal Corporation have decided the modus operandi of collection transportation and disposal of Hospital waste and also segregation of non Biodegradable hospital owner to disinfect mutilate or destroy the plastic and metallic instrument and dispose them off giving for recyling.

For the collection and transportation of biodegradable incineration waste, PMC has allotted this work to M/s Lango India on pay and use basis w.e.f. 15 December 2000. All Hospital authorities are instructed a for the segregate of non-biodegradable hospital wastes i.e. plastic and non-incineration material .

Construction and demolition (C&D) debris consists of the materials generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D debris often contains bulky, heavy materials that include:

1. concrete
2. wood (from buildings)
3. asphalt (from roads and roofing shingles)
4. gypsum (the main component of drywall)
5. metals
6. bricks
7. glass
8. plastics
9. salvaged building components (doors, windows, and plumbing fixtures), and
10. Trees, stumps, earth, and rock from clearing sites

Reducing and recycling C&D debris conserves landfill space, reduces the environmental impact of producing new materials, creates jobs, and can reduce overall building project expenses through avoided purchase/disposal costs.

2.9 Chakachak Toli

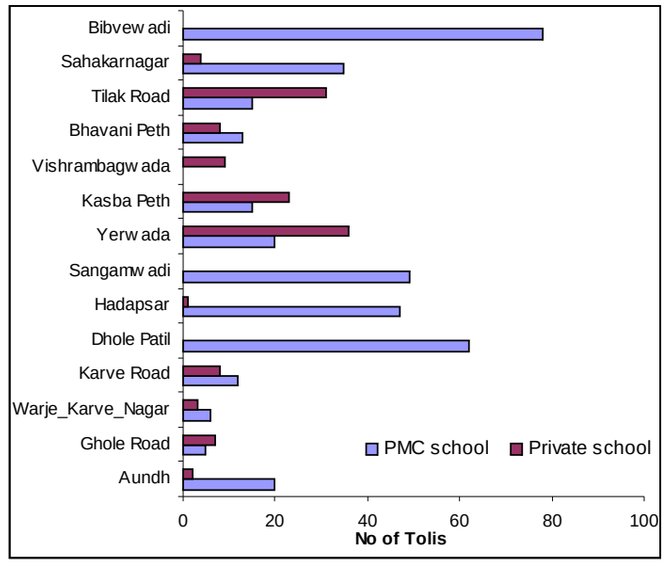
Clean and Beautiful Pune City is the dream of every citizen of Pune. To bring this dream in to existence Pune Municipal Corporation is taking special efforts through various solid waste management programs. For increasing the efficiency in solid waste management, mechanization of process or increasing human resource or privatization are the easy alternatives, but they might prove expensive.

Pune Municipal Corporation has adopted the system of public awareness and active public participation in reduction and disposal of solid waste. This approach of corporation in solid waste management is very time consuming for achieving the goals, but this is the only sustainable approach. Pune Municipal Corporation has involved various NGOs, community groups, clubs, institutes, consultants and students for efficient implementation of program. Students under the guidance of senior citizens and Ward officers are considered at center.

Public Awareness and Participation Program Publications

1. The public appeals or hand bills and the information papers and leaflets, has been distributed, providing the information about the separation of Bio degradable (Wet refuse) and non degradable waste (dry refuse) and disposal for the same.
2. Advertisement hoarding of 20' x 20' size are displayed at various spaces within the city.
3. Public awareness through picture slides in cinema theaters.
4. ChakaChak offices are opened in all zonal office, computers and the telephones are make available to the team member and citizens (Figure 12.9).
5. Information papers for ChakaChak Team in both Marathi and English languages has been distributed.
6. The web site www.chakachakpune.com has launched and the communication access is provided with the same for the citizens and students for public awareness.
7. With the help of all zonal offices with the medical offices, the information about waste disposal, bio gas plant, vermi-culture is provided to all housing societies and developers.
8. Major Vermiculture projects in Pune City are executed at Bhusari colony, near Katraj Lake, Hadapsar ramp, Kalyani nagar. Due to these kind of projects the wet refuse generated is disposed nearby instate of going to the disposal site, and it reduces the transportation cost.

Figure 12.8 Comparative account of No. of CHAKACHAK Tolis in Pune wards



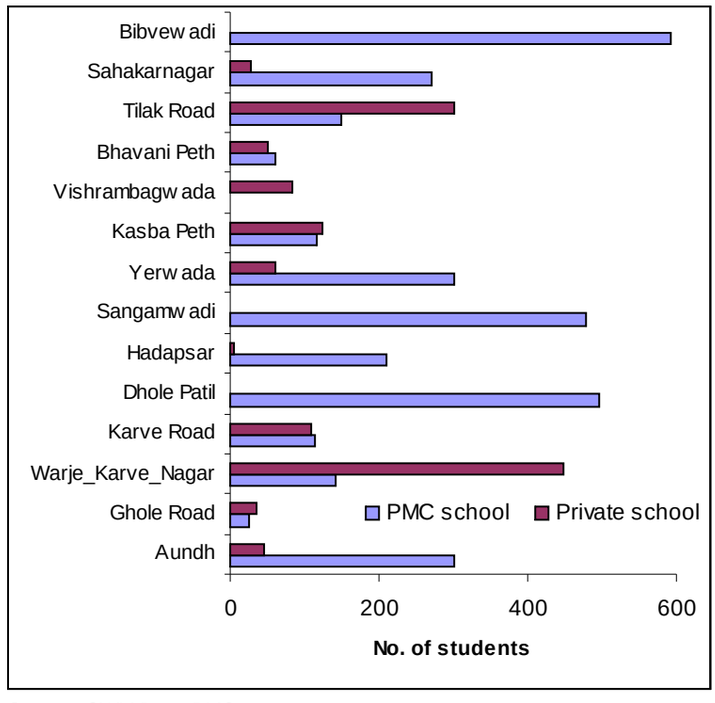
Source: *SWM Dept, PMC*

Table 12.4 Ward wise status of number of ChakaChak Tolies and no. of students campaigning

Sr. No.	Ward Name	No. of chakachak tolis			No. of students		
		PMC school	Private school	Total	PMC school	Private school	Total
1	Aundh	20	2	22	300	45	345
2	Ghole Road	5	7	12	25	35	60
3	Warje_Karve_Nagar	6	3	9	142	448	590
4	Karve Road	12	8	20	115	108	223
5	Dhole Patil	62		62	496		496
6	Hadapsar	47	1	48	210	5	215
7	Sangamwadi	49		49	479		479
8	Yerwada	20	36	56	301	60	361
9	Kasba Peth	15	23	38	116	123	239
10	Vishrambagwada		9	9		83	83
11	Bhavani Peth	13	8	80	60	50	110
12	Tilak Road	15	31	46	150	300	450
13	Sahakarnagar	35	4	39	270	28	291
14	Bibvewadi	78		78	592		592
	Total	**377**	**132**	**568**	**3256**	**1285**	**4534**

Source: *SWM Dept, PMC*

Figure 12.9 Comparative account of No of students campaigning in each ward



Source: *SWM Dept, PMC*

12.10 Projects which are coming up in near future

1. Setting up biogas/ WTE plant on BOT basis which will be taking care of nearly 50 MTD of wet waste in decentralized manner. This project is in pipe line & will be set up near Mundhava.
2. Project coming up at landfill site which is completely funded by central Government consist of 150 MTD of Vermi Culture & nearly 500 MTD of mechanical composting.
3. Also in vessel compost plant near Kalyani Nagar on 1 acre land so that waste collected from house to house will be composted in this plant.

As per the present rate of the waste generation that is 400 gm/capita/day the total amount of waste generated in the city is represented in **Table 12.5**.

Table 12.5 Estimated waste generations in Pune City

Year	Expected Population Growth	Waste Generation
2011	45 lakhs	1800 MTD
2021	60 lakhs	2400 MTD
2025	65 lakhs	2600 MTD

Source: *SWM Dept, PMC*

As per the zero garbage survey conducted in 2000-2001 when population in Pune was 25 lakhs the generation was 1000 MTD. This shows the rate of waste is 400gms/capita/day.

With the inception of MSW (M&H) 2000 rules & after following various methods such as Recycle, Reduce, Reuse at source, house to house collection practices & undertaking various awareness drives & Vermi composting , Bio-gas practices the total amount of waste coming to land fill site is 850 MTD. This indicates people are becoming amenable to various types of waste management practices there by decreasing burden on landfill site.

Even if Pune becomes more commercialized & the waste generation goes to 650 to 700gms/capita/day.Accordingly the waste generation will be 4500 MTD.

Table No.12.6 Estimated Waste generation with Estimated cost

Year	Estimated cost	Estimated Waste generation
2011	45 Lakhs	3150 MTD
2021	60 Lakhs	4200 MTD
2025	65 Lakhs	4550 MTD

Source: *SWM Dept, PMC*

PMC has taken up the job to handle the increase in waste generation by adopting following measures:-

1) Adopting a policy of reduction & segregation of waste at source to be fully augmented with the help of NGO's, various ragpickers organization, public private partnership etc.

2) Adopting eco-friendly practices such as:

   a) Vermi composting at source & by decentralized mechanism & systems.

   b) Setting up Bio-gas plants in societies & townships came up in Pune.

   c) Adoption of waste to energy plants for multiplexes graded hotels & restaurant & in big townships etc.

   d) Legal framework: To set up & incorporate the rules & regulations in Development & control plan. For setting up waste composting & WTE plants for compliance with MSW rule 2000.

   e) Eco-housing concepts to be developed at every household level.

3) Develop job opportunities among all sections of the community. The above practices will go a long way in reducing the cost expenditure in transportation & disposal of waste. Will help in improving the quality of life & environment of Pune. It will boost in the development & economy of Pune city.

4) Last but not the least facilities to be developed to manage the remaining waste after all the above measures at taken at proper waste processing facility.

12.11 Setting up of scientific & decentralized waste processing facilities at:

1. Devachi Uruli

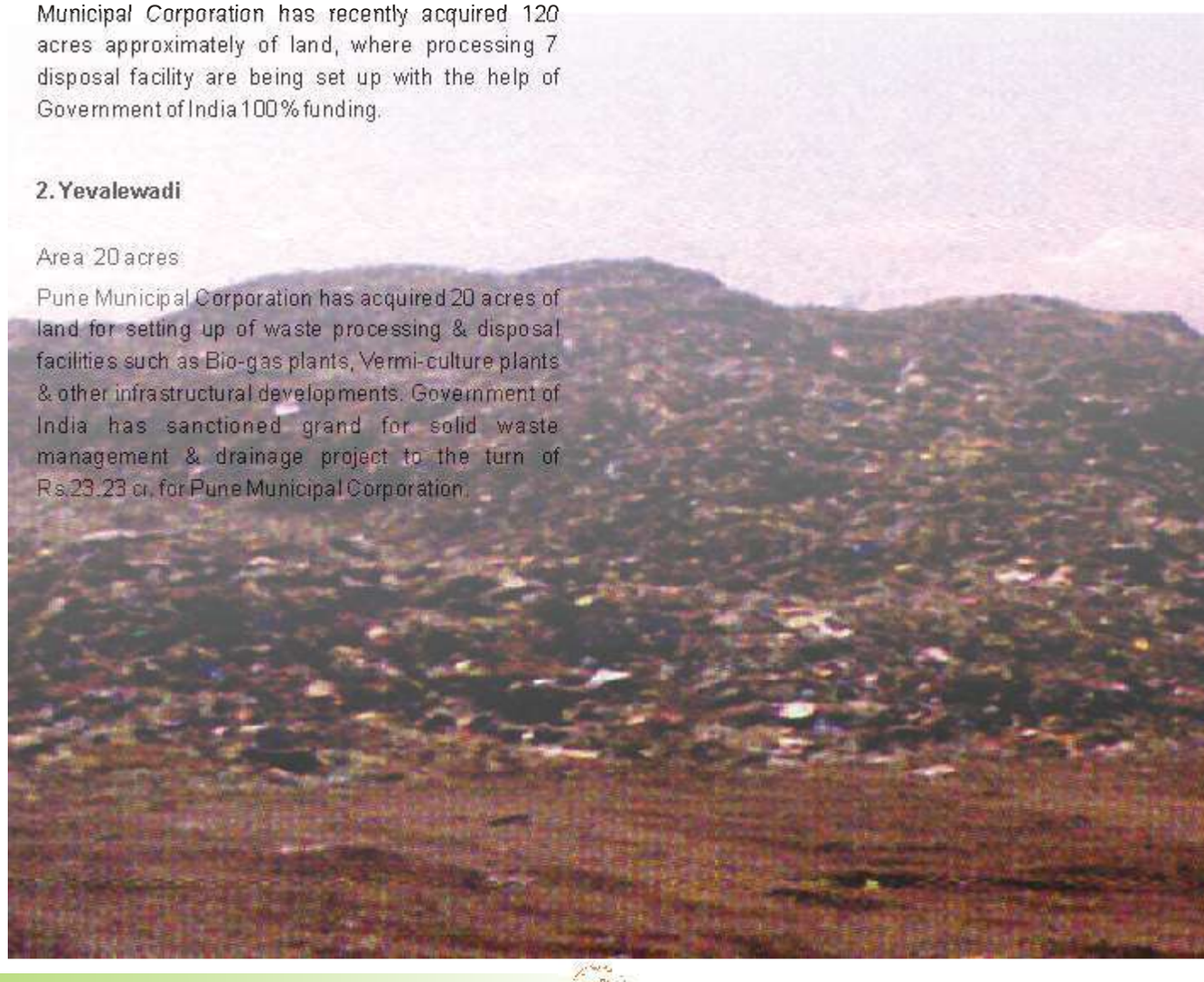
Area 43 acres Existing since 199

Out of 43 acres (40,000sq meters) i.e. 10.75 acres has been scientifically capped & developed at a cost of Rs.2 corers & another one corer for other developmental works. A cement concrete platform has been developed with an impervious layers on 7 acres of land costing Rs. 3.84 corers in the year 2005-06 & also adjacent to the existing land fill site, Pune Municipal Corporation has recently acquired 120 acres approximately of land, where processing 7 disposal facility are being set up with the help of Government of India 100% funding.

2. Yevalewadi

Area 20 acres

Pune Municipal Corporation has acquired 20 acres of land for setting up of waste processing & disposal facilities such as Bio-gas plants, Vermi-culture plants & other infrastructural developments. Government of India has sanctioned grand for solid waste management & drainage project to the turn of Rs.23.23 cr. for Pune Municipal Corporation.



Water Supply

13.1 Introduction

Looking at water, one might think that it's the simplest thing around. Pure water is colorless, odorless, and tasteless. But it's not at all simple and plain and it is vital for all life on Earth. Where there is water there is life, and where water is scarce, life has to struggle or just "throw in the towel."

Water is the most essential commodity for the very existence of human life next to air. The unjustified use of water is one of the major reasons for excessive pollution of the rivers, lakes and other surface water bodies in Pune. Pune is blessed with good quality and huge amount of per capita availability of water, which amounts to be about 195 lit/person, which is approximately one and a half times the normal per capita availability in other cities.

13.2 History

Two important rivers viz. Mutha & its tributary river Amba pass through city. A small dam was constructed on river Amba near Katraj in year 1750 from which water was supplied to the city through a pipeline.

13.3 Present water supply for Pune city

At present Pune gets its water supply from khadakwasla dam about 12 kms from the city through right bank canal and a closed pipeline. Three more dams i.e. Panshet, Warasgaon and Temghar have been constructed on the same river, upstream of khadakwasla. The storage capacity of these 3 dams is 900 MM^3 whereas the present annual requirement of city is about 200 MM^3. PMC serves a water supply of 195 lit/ capita/ day against standard of 135 lit/ capita/ day. The water purification plants & annual water supply service status of Pune city is represented in **Table 13.1 & 13.2** respectively . The future expansion of water works is expected according to the Kirloskar report for taking up the Phase II project for cantonment board and Holkar water works. Water conservation programmes have been taken up by the water supply department under the banner of "LOKSANWAD".

Pune has two major water work systems i.e. Parvati water works & cantonment water works. In addition to these Pune has three minor water works (22 MLD), warje water works (9 MLD) and wagholi water works (23 MLD).

Table 13.1 Water purification plants

Water works	Location	Capacity (MLD)	Treatment Method	Commissioning Year
Parvati Water works	Sinhagad Rd.	470	Conventional	1969
Cantonment water works	Cantonment	273	Conventional	1893
Holkar Water works	Holkar Bridge	22	Conventional	1919
Old Warje water works	Warje	5	Conventional	1999
Wagholi Water works	Wagholi	23	Conventional	2000
New Warje Water Works	Near Kakde City	100	Non-Conventional	2006

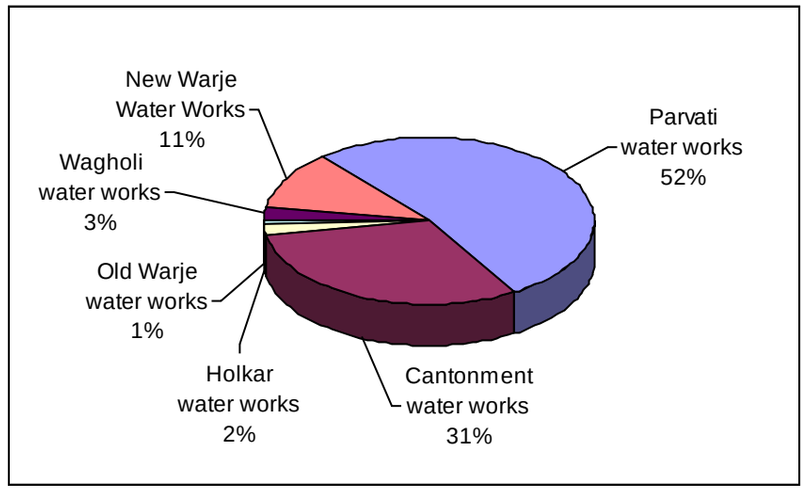
Source: *Water Supply Department PMC*

Table 13.2 Yearly water supply service status of Pune city

Services	Details (year wise)		
	2005	2006	2007
Amount of water supplied for Pune city	797	874	874
ESR/GSR	39	43	44
Storage capacity of ESR/GSR (in ML)	220.924	234.934	248.93
Total length of water supply lines Approx (80mm to 1200mm lines)	N.A	800km	830km
Chlorinators	9	10	10
Types of water connections	29032	32005	34155
Domestic metered	18290	19376	19253
Institutional / Commercial metered	14157	12629	14902
Domestic un metered – Approx		105000	
Total	**137447**	**32005**	**34155**
Norms adopted for water supply		IS 10500-1991	
Hours of water supply per day (Approx)		7	
Staff strength	1240	1337	1346
Wastage of water through leakages from pipelines (Un-accumulated Water in %)		35%	

Source:*Water Supply Dept, PMC*

Figure 13.1Comparative account of each of the Water treatment plants



Source: *Water Supply Department PMC*

Table 13.3 Existing Reservoirs in Pune

Reservoir Name	Capacity MLD	FSL (RLM)	LDL	Dst. (Km)	Area covered
Parvati WTP sump1	4.5	566.93	562.23	0	SNDT, Parvati, HLR, MLR, LLR
Parvati WTP sump2	4.5	566.93	562.23	0	Same as above
Parvati WTP sump3	9	566.93	562.23	0	SNDT, Parvati HLR
Chandani chawk ESR	8	665	N.A.	5.5	Bhusari colony, Bavadhan, Pt. Pashan, Baner, Pt. Kothrud
Gandhi Bhavan ESR	6	N.A.	N.A.	N.A.	Warje, Pt. Karvenagar, Mahatma Soc.
SNDT MLR sump	1.81	595.95	590.4	2.4	SNDT MLR, Chatushringi sump
SNDT MLR	11.35	596.83	591.33	2.4	Erandawane, Prabhat rd., Pt. Karvenagar, Dhahanukr, Karve statue area (east)
SNDT HLR	13.16	625.46	620	2.9	Kothrud up to Vanaz, Shivajinagar, Gokhalenagar, Janawadi, Law college Road.Bapat rd., Deccan Edu.
Chatushringi (old)	4.5	608.38	604.38	5.2	Aundh, Bopodi, Baner, Pt.Kothrud, Raj Bhavan
Chatushringi (new)	8.4	608.38	604.38	5.2	Pashan, SUS rd., ARDE
SUS	4.5	657	653	N.A.	SUS gaothan, Sutarwadi, Balewadi
Bopodi ESR	2.27	N.A.	N.A.	N.A.	Khadaki Cantonment area
Parvati HLR	4.5	627.28	622.1	0.4	Padmavati, Sahakar nagar 1&2, Laxminagar
Parvati HLR 1 (Sq.)	4.5	627.28	621.28	0.4	Same as above
Parvati HLR 2 (Ci)	4.5	627.28	621.28	0.4	Padmavati, Padmavati sump
Parvati MLR	13.16	598.35	593.17	0.7	Mukund, Velankar nagar, Pt. Nana peth, Bhavani Peth, Lohiya nagar, Ghorpadi peth, Kasarwadi, Subhashnagar, Pt.Gurwar peth, Rajiv Gandhi slum
Parvati LLR	31.78	580.9	576	0..8	City area, Pt. Shivajinagar, Tofkhana, Pulachiwadi, pt. Deccan, Navi peth, Jaidev
Padmavati sump	9	598.93	595.88	2.7	Dhanakavadi, Taljai, Katraj, Bibwewadi, Indiranagar
Katraj-Taljai HLR	6.26	669.91	665.91	2.1	Sambhajinagar, Upper Indiranagar, Balajinagar, Chintamaninagar 1 &2
Dhankawadi MLR-1	3.4	657.73	654.13	N.A.	Katraj, Pt. Balajinagar, Sndeban, Rajesh soc., Chaitraban
Dhankawadi MLR-2	3.4	657.73	654.13	N.A.	Dhankavadi Gaothan
Bibwewadi MLR-1	N.A.	N.A.	N.A.	3.7	Kenjalengr., Marketyard,Bibwewadi gaothan, Jedhengr.,Rajesh soc.
Bibwewadi MLR-2	N.A.	N.A.	N.A.	3.7	Same as above
Indiranagar sump	0.45	614.68	611.25	N.A.	Indira nagar Upper, Supper, Indira nagar
Indiranagar Upper	0.45	704.65	700.18	N.A.	Same as above

Source: *Water Supply Department PMC*

13.4 Water Tariff

The Pune municipal corporation has a made correction from 01.04.2000 using water charging in the form of water tax, instead of water meters for the residential & the mixed properties. E.g. schools, colleges, temples & for individual connection they are charging CESS as per residential connection. However, the meter system continues for rental properties besides commercial, industrial connections.

The details of water tariffs, metering system and revenue vis a vis expenses is given in **Tables 13.4, 13.5, 13.6 & 13.7** respectively

Table 13.4 Water Tariff Break up

Water Tax levied (Rs.)	
Annual Retable value (Rs.)	
a) Residential Properties	900
✓ Up to 1000	1000
✓ 1001-3000	1100
✓ 3001-5000	25% or 2500/-
✓ 5000-Above	Whichever is minimum
b) Commercial Properties	
✓ F6666661-10000	500
✓ 10000 and above	1000

Source: *Water Department PMC*

Table 13.5 Water meter system

Connection Type	PMC area	Out of PMC area (Khadki & cantonment):
Residential	Rs. 3.00 per KL	Rs. 5.00 per KL
Commercial	Rs. 21.00 per KL	Rs. 21.00 per KL

Source: *Water Department PMC*

Table 13.6 Revenue and water supply operation & maintenance costs

Particulars		Water Supply
2003-04	Provision	2668.50
	Expenses	1466.53
2004-05	Provision	3128.50
	Expenses	2008.28
2005-06	Provision	2395.18
	Expenses	1602.00
2006-07	Provision	3479.98
	Expenses	1857.03
2007-08	Provision	3637.64
	Expenses	0.00

Source: *Addln. City Engg. (Water Supply Dept.) As on 30-3-07*

3.5 Wrapping Up

With excessive water availability in the city of Pune, the conjunctive water use relevance is as follows;

1. It is realized and accepted that in the face of increasing water demands and increasing population pressures, the **1**business-as-usual situation of excessive water supply and use will not be sustainable in the long run. Therefore, sustainable Options like conjunctive water use have to be explored in earnest.

2. In addition to the sustainability issue, there are other pressing concerns like litigations filed by the Irrigation Department and the Maharashtra Pollution Control Board regarding excessive water use and water pollution. These litigations underline the Severity of the problem, making conjunctive and wise water use relevant and important.

3. It is expected that awareness generation will also help in promotion of conjunctive water use

Table 13.7 Comparative account of Revenue Provision and Expenses done

Particulars		Ele. Used	Water Cost	Water Treatment	O & M	Other	Labour	Total
2003-04	Provision	3580.00	1480.00	197.00	340.78	74.00	1425.21	7096.99
	Expenses	2585.85	1184.93	184.41	267.34	64.05	1173.10	5459.68
2004-05	Provision	3580.00	1375.00	2120.00	3665.00	74.00	1367.52	12181.52
	Expenses	3062.00	1372.00	2072.00	2535.00	71.00	1263.65	10375.65
2005-06	Provision	3105.00	1300.00	2710.00	4385.00	74.00	1407.54	12981.54
	Expenses	3101.00	1297.00	2567.00	3452.00	72.00	1345.01	11834.01
2006-07	Provision	3025.00	1465.00	369.00	452.00	73.00	1640.00	7024.00
	Expenses	3025.00	1465.00	364.00	278.00	63.00	0.00	5195.00

Source: *Addln. City Engg (Water Supply Dept.) - As on 30-3-07*

13.6 Actions Plans

Following are the steps taken to adequate water supply for growing population of the city. Rs. 350 crores of costing Successful implementation on ambitious water supply and sewage treatment

aspects that affect water deliveries; either with direct Service connection or within 200m of a stand post or Served by other sources of potable water provided by the utility e.g. deep bore hand pumps as percentage to total ULB population. Then followed by, the total operating costs (including establishment expenditure) divided by total quantity of water

Table 13.8 Details of the Pumping Stations

Area	Type	Installed	No.	Operated	No.	Water Supplied To Areas
Wadgaon	Raw Water	560 KW	4	560KW	2	Wadgaon, Katraj, Dhankawdi
	Pure Water	448 KW	4	448KW	2	Ambegaon. Part Of Sinhdad Road
Srihari Society	NA	45KW	2	45 KW	1	Wadgaon, Katraj, Dhankawdi Ambegaon. Part Of Sinhdad Road
Kedareshwar	NA	500 KW	4	500 KW	1	Katraj
Aagam Mandir	NA	100 HP	2	100 HP	1	Katraj Ambegaon

Source: *Water Department PMC*

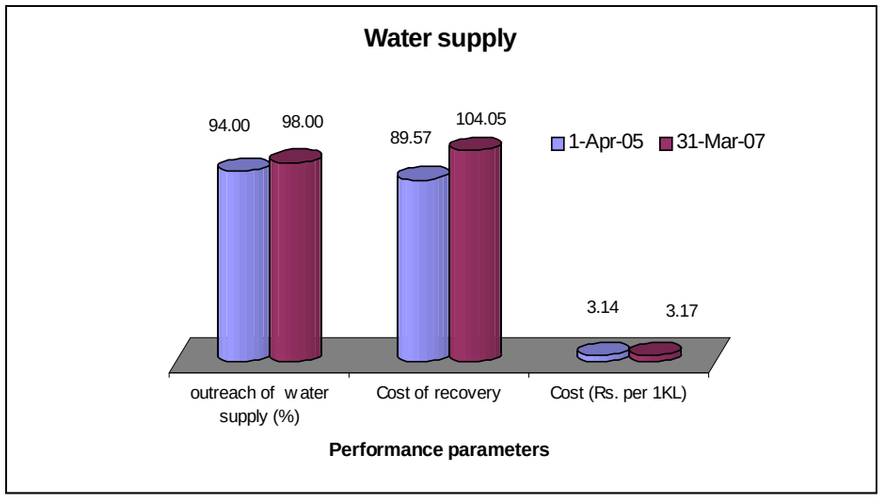
Scheme. Water requirements of Pune city up to 2011, now taken care of and planning already underway for the same for the next 10 years i.e. up to 2021.

13.7 Performance Indicators in water supply system

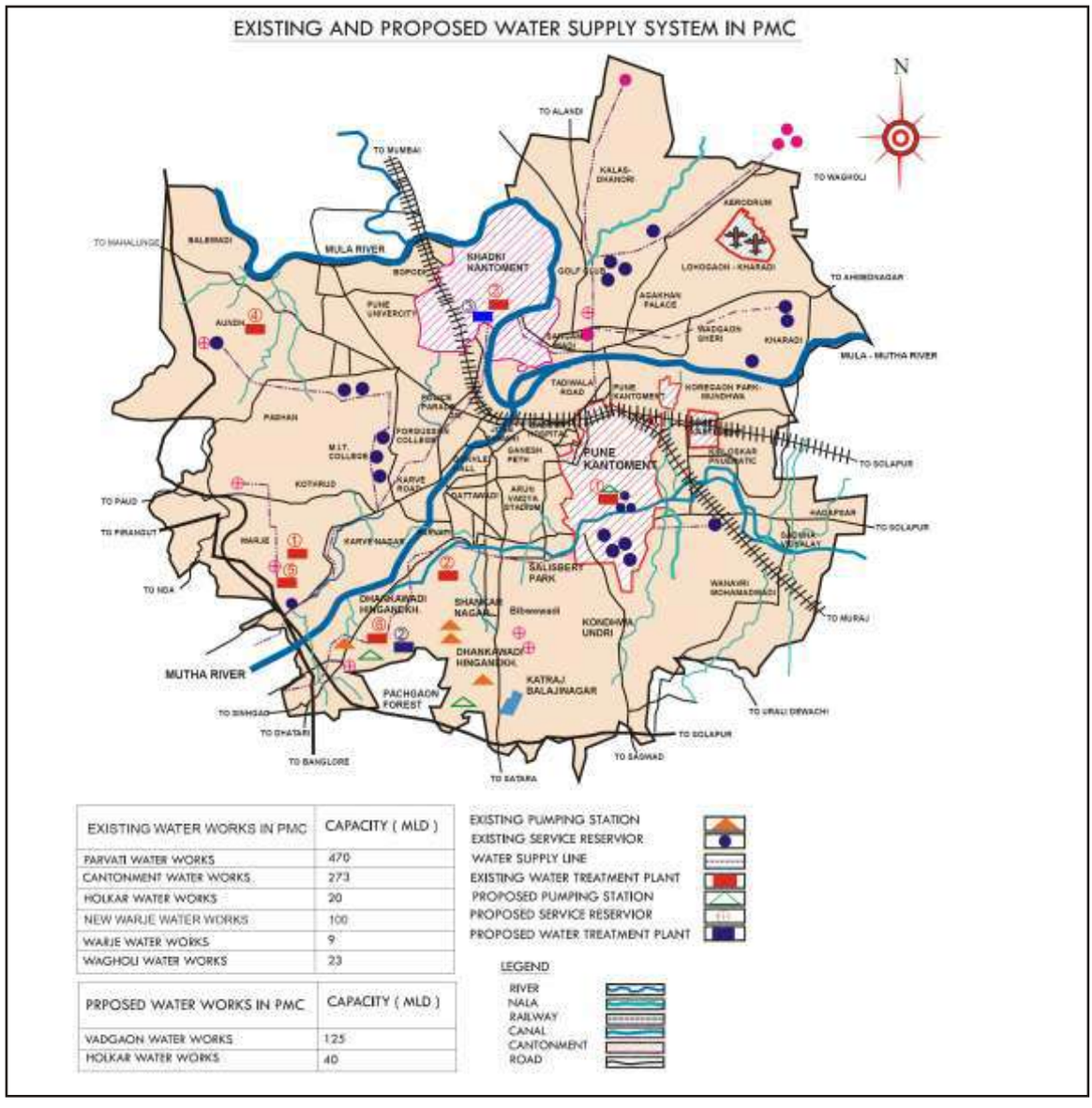
As discussed in the Sewerage section, performance indicators for water supply is mostly oriented towards

Produced and Total revenue from water as a Percentage to total O&M costs for water supply (Including related salary costs). The Increase in number of direct service connections over the last two years is 4% as on April '05. Unrestricted water supply is continued since last two years through out the week with the increase from 2-4 Hrs. to 4-6 hours in a day.

Figure 13.2 Comparative accounts of performance parameters for citywide outreach of Water Supply



Source: *Water Supply Department PMC*



Latest Developments

15.1 Area Traffic Control system (ATC)

Pune municipal Corporation (PMC) is planning to for Area Traffic Control system (ATCS). This will help in managing road traffic in Pune more efficiently and reduce frequent stops and delays. Reduction in stops and delays is having a direct impact on the level of pollution crated by the average citizen and reduction of idle time vehicle is other indirect advantages of the system.

The city is poised for rapid growth in future. As the city size expends the travel demand is bound to rise to higher levels due to increase in trip lengths per capita trip rate and increased use of personalized modes of transport. For catering to be increasing transport needs of the future in a systematic manner it is necessary to undertake effective and state of the art Traffic improvement plans ATCS for Pune city.

The ATCS is a new concept in India on the efficient management of Road Traffic Network form a central computer. The ATCS is a fully adaptive traffic signal control system that use data from vehicle detectors and optimize traffic signal in an area to reduce vehicle delays & stops.

15.1.1 Benefits

1. Reduction in vehicle operation cost due to reduction in delays
2. Reduction in traffic congestion along with increase in capacity of roads and intersections resulting in improvement in level of service of the road system
3. Reduction in environmental pollution with reduced emissions at intersections
4. Reduction in noise levels

15.2 City Development Plan (CDP)

15.2.1 Objectives

The City Development Plan (CDP) is the municipal corporation's strategy that identifies the vision and mission of a desired future for the city and details how the Corporation, together with other stakeholders, intends to work towards achieving this long-term vision. The CDP involves the translation of the vision into missions, missions into actions and actions into outcomes. The CDP process involves:

1. Defining the vision and mission for the city
2. Identifying priority actions to achieve missions
3. Assessing feasibility for projects and scheduling investments

As per the 2001 census, the urban population of India stood at 285.35 million, which is about27.8 per cent of the country's total population; by 2021, the urban population is estimated to account for above 40 per cent of India's population. Thus, cities and towns are expected to play a vital role in India's socio-economic transformation and change.

The current state of affairs in most of our urban areas is unsatisfactory on all Parameters of urban governance like planned growth, share of slum population, reliability of civic infrastructure and financial resources.

Given the current state of affairs of our cities, their incompatibility with the country's socio economic objectives and India's growing role in the world economy, the Government of India launched the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in FY 2005-06. This mission will be in place for the next seven years; it aims at creating economically productive, efficient, equitable and responsive cities. The Jawaharlal Nehru National Urban Renewal Mission focuses on:

1. Improving and augmenting the economic and social infrastructure of cities.
2. Ensuring basic services to the urban poor including security of tenure
3. Initiating wide-ranging urban sector reforms whose primary aim is to eliminate the Legal, institutional and financial constraints that have impeded investment in urban Infrastructure and services

15.2.2 CDP Process Adopted By Pune

The formulation of the CDP for Pune was divided into three phases and involved the Following tasks and activities. The entire process is also presented in the chart below.

15.3 Pune Redevelopment Project

In Pune Redevelopment Project various issues related to Development of Pune including River Beautification, Public Transportation Improvement, Environmental Improvement, and Traffic Improvement are addressed in some details with budgeted cost estimates.

15.3.1 Features of project

1. Attempt to reduce the load of heavy vehicles which need not pass through Pimpri Chinchwad and Pune cities.
2. Attempt to increase the inclination of people to use public vehicles.
3. Reduction in peak traffic volume at critical intersections
4. Reduction in road accidents due to congestion.
5. To reduce vehicular emissions and subsequent impacts of air pollution
6. To promote use of clean fuel like CNG, Bio-diesel and use of pollution under control vehicles in the city areas
7. To reduce social tensions and improvement in overall health of people and the city.

15.3.2 Objective of TProjecthe

1. To plan for alternative mass transport system through the city
2. To assess impact of the project on environment
3. To achieve ecological balance & cater to pollution by planning for river front development
4. To conserve heritage monuments of historic importance
5. To encourage tourism through this monument conservation

15.3.2 Focus Of The Project

1. Riverfront Development: Revitalization of the river and its surroundings

a) Bunds in the river to ensure water throughout the year

b) Beautification of river bank

2. Mass Transportation System: Cost effective, feasible, scalable, non-fossil fuel based transportation system.
   a) E Buses
   b) Alternative Transportation corridors along canals and river
   c) Tunnels
   d) Transportation hubs: Four New locations for Transport hub
3. Afforestation of identified forest reserves & hill top, hill slopes: Tree plantation to be done for 8605 Acres of forest land available
4. Cultural Tourism Of Pune.
   a) Religious Places
   b) Forts
   C) Lakes

15.4 Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

Mission Statement: The aim is to encourage reforms and fast track planned development of identified cities. Focus is to be on efficiency in urban infrastructure and service delivery mechanisms, community Participation, and accountability of ULBs / Parastatal agencies towards citizens.

15.4.1 Objectives of the Mission

A. Focused attention to integrated development of infrastructure services in cities covered under the Mission;

b. Establishment of linkages between asset-creation and asset-management through a slew of reforms for long-term project sustainability;.

C. Ensuring adequate funds to meet the deficiencies in urban infrastructural services.

d. Planned development of identified cities including peri-urban areas, outgrowths and urban corridors leading to dispersed urbanization;

e. Special focus on urban renewal Programme for the old city areas to reduce congestion;

15.4.3 Sewage Treatment Plants

To carry out Augmentation/Up gradation of Sewage Conveyance, Treatment and Recycle system for Pune for Year 2015 under JNNURM.

The City of Pune is facing an increase in population and demographic pressure on the infrastructure services due to the recent spurt in IT related industry. PMC has initiated a Master Plan to set up a Sewerage infrastructure for the projected population of the year 2015.

Pune Municipal Corporation had approached the GOI in 2006 for funding under JNNURM scheme for the following projects;

- ✓ Construction of STPs at Naidu, Mundhwa, Baner, Kharadi and Vitthalwadi.
- ✓ Construction of Pumping station and rising main at New Kasba
- ✓ Construction of Pumping station and rising main at Tophkana

Table 15.1 Various Components Approved under JNNURM

Particulars	Amount In Crores
Bus Rapid Transit (Brt) Corridors (Pilot 12.5 Km And Phase 1 80 Km)	538.32
Commonwealth youth games city infrastructure (road, terminals and junctions)	268.65
Preservation of Lakes and Nulahs	97.78
River Improvement	99.96
Augmentation of Sewage system	86.13
Rehabilitation of Urban Poor (5 slums relocation from environmentally fragile zones, street vendors rehab and dormitory for migrants)	390.64
Total	**1481.48**

The above projects were approved and an amount of Rs. 86.13 crores was sanctioned under JNNURM scheme vides Central Govt. Finance Ministry no. FN44 (1)/PF-1/2006-32 dated 8th June, 2006.

PMC has now formulated proposal for conveyance and treatment of sewage that were not covered in the earlier proposal. The present proposal is for setting up STPs at Bhairoba, Malgalwar peth, Kalyani Nagar, Warje, Tanajiwadi and Bopodi and for providing gravity mains at Bhairoba Nala and Mangalwar peth (Manik Nala).

As per an agreement with the Irrigation Department, PMC has to recycle 6.5 TMC of treated sewage to ensure continuous supply of drinking water for Pune. With the installation of STPs for complete treatment of sewage generated in Pune, a proposal has now been made for recycle of 500 MLD of treated sewage.

The total estimated cost as per the present proposal is **Rs. 232.35 Crores.**

15.5 Indradhanushya *(A space for citizenship and environmental education)*

The Pune Municipal Corporation is setting up Indradhanushya as an activity centre for citizenship education for children, and citizens of Pune. Indradhanushya is coming up at Dattawadi, near Mhatre Bridge. This site was a derelict piece of land, next to the Ambil Odha, used for dumping debris and garbage. Over the last four years or so, through a combination of efforts of various groups this place is being transformed.

Indradhanushya activities will be developed and conducted on the basis of management protocols developed by the Centre for Environment Education (CEE) and the Pune Municipal Corporation by Indradhanushya staff trained under the CEE. The CEE shall develop activity manuals for Indradhanushya staff and teachers for orientation purpose. A set of activities for students based on the school curriculum and proactive citizenship will be developed and documented by the Indradhanushya staff.

15.5.1 Objectives of Indradhanushya

- To provide a facility for children and others to explore and understand the urban environment
- To instill concern and a sense of responsibility towards urban environmental management
- To develop a site which itself demonstrates urban environmental best practices to the extent possible

15.5.2 Indradhanushya Themes

The life of our city and all of us citizens depends on the systems and services we have set up through our municipal corporation for meeting our daily needs. Through 3 D exhibits, panels, activities, films etc Indradhanushya explains the systems for water, sanitation, waste, and traffic in our city, as well as the role of citizens in helping civic systems to function well.

15.5.3 Outdoor and Indoor Exhibits

Through 'live' exhibits, the Indradhanushya campus will demonstrate composting, greening, water harvesting etc. The Dattawadi kothi office of Vishrambaug administrative ward office of PMC is at the campus of Indradhanushya and citizens can interact with the municipal staff here to understand the functions of the civic administration.

15.5.4 School visits

It is envisaged that students from a selected level (probably the 7th standard) from all schools would be able to visit the centre once a year according to a pre planned schedule. Since the themes of Indradhanushya are related to civics, science, geography etc, teachers can expect to take up a range of curricular and extra curricular activities and projects in partnership with Indradhanushya. The orientation would help teachers understand what to expect from the visit, and how Indradhanushya can help the schools take up activities and projects through the school year, on the themes of the centre.

15.5.5 Citizen Workshops

Sessions on topics like composting, bird watching, nature education, energy conservation, water quality, and theatre for children are planned on weekends and vacations. NGOs and citizens can also offer their own expertise and ideas for conducting workshops. The objective of the workshops is to learn about and discuss our own roles as citizens, and acquire skills and knowledge to participate in civic activities.

15.6 River Development

The project is implemented under the name of "Augmentation and up gradation of Sewage Treatment Plant and Pumping Station - 567 MLD treated 305 MLD: reach 100% by next year for river natural flow"

Particulars	Amount In Crores Rs.
Approved cost:	86.13
No. of packages envisaged	9
Value of packages under tendering	8
No. of Packages awarded –	8
Total value of packages awarded -	Rs. 108.29
Physical Progress: Out of 9 works 7 works have already commenced. Other 2 Sites are under acquisition.	
Expected Project completion *(month / year)*	2008 - 09

Project name: Augmentation of weirs, restoration of lakes, bioremediation and landscaping of nalla and rivers

Particulars	Amount In Crores Rs.
Approved cost:	Rs. 97.78 Crs.
CSMC approval date:	08/09/2006
No. of packages envisaged	4
Value of packages under tendering	Rs. 97.78
No. of Packages awarded –	1
Total value of packages awarded -	Rs. 9.95
Physical Progress: Machinery has been already mobilized for commencing the work. Nulla bio mediation parks , small scale on all the major 17 nallahs	
Expected Project completion *(month / year)*	2008 - 09

Source: *JNNURM, CDP*

Project name: Environmental Restoration / preservation of Mula Mutha river ecosystems in Pune.

Particulars	Amount In Crores Rs.
Approved cost:	Rs. 99.96 Crs.
CSMC approval date:	08/09/2006
No. of packages envisaged	3
Value of packages under tendering	3
No. of Packages awarded –	From all three some packages have been awarded
Total value of packages awarded -	Rs.28.82
Physical Progress: Dredging work in Mutha river is in progress and Retaining walls are constructed in some parts along the bank of river Mulla - Mutha	
Expected Project completion *(month / year)*	2008 -09

Source: *JNNURM, CDP*

15.7 LPG kits for Pre '91 Auto rickshaws

The Pune Municipal Corporation has agreed to provide 25% subsidy on the LPG kits to be retrofitted on the pre-1991 auto rickshaws in Pune. However, some of the issues that need to be resolved are as follows:

- ✓ There are various LPG kit suppliers approved by ARAI having differences in the cost
- ✓ The total number of auto rickshaws to be retrofitted is approximately 8000 9000
- ✓ The list of these auto rickshaws is not yet available
- ✓ Payment mode for the LPG kit Retrofitment can be either to the bank or individual
- ✓ There are about 1200 auto rickshaws already retrofitted by individuals through financial burden on them
- ✓ PMC to centralize the procurement of LPG kits or any other such method for ease of conduct
- ✓ Monitoring for the retrofitted vehicles and finances

Following are some steps taken by PMC that could be helpful for effective implementation of the Retrofitment program and financial transactions justifying each of them, which are delineated as follows:

1. Call open techno-financial tender for procurement of 2000-3000 kits valid for a period of 6 months initially so that competitive best quotes for mass procurement would help in fixing minimum prices and best quality.
2. The list of such pre-1991 auto rickshaws to be procured from RTO and their RC books to be attached for identification of same
3. A Format for monitoring of the retrofitted vehicles has been prepared and attached herewith which could be approved by RTO also.
4. The already fitted vehicles can be reimbursed for the fixed price attained through tender process so as to avoid disparity in payments to individuals
5. The payments for new Retrofitment can be made directly to the LPG kit dealers / manufacturers through PMC on verification and submission of relevant documents (format attached) also processed and verified through RTO.

The status of applications received and processed till date is as follows

No of applications received till 9th July 2007	**1026**
No of applications submitted to RTO for verification	**00**
No of applications received from RTO after verification	**950**
No of applications submitted to the PMC for approval	**199**
Total no of cheques received by AQM Cell of PMC	**745**
No of cheques issued from PMC till date	**570**
No of cheques pending to be collected	**175**

Source: *AQM Cell of PMC*

15.8 Pune India's First Wi-Fi (Wireless Fidelity) City

Pune becomes India's first Wi-Fi city. Pune will have a high-speed wireless internet network even before the central government of India announces its Spectrum policy. This will enable people to access the internet from anywhere in Pune city, wirelessly through their Laptops and PDAs. The project “Unwiring Pune” was jointly announced by global chipmaker Intel Corp and Pune Municipal Corporation in March 2006 and is starting operation from this month of April, 2007. Intel, along with Chennai-based Micro sense, will establish infrastructure for a wireless communication network covering the entire 280 km of Pune within the next couple of years.

The initial phases of the project will Wi-Fi areas of Sambhaiji Garden, jangali Maharaj Road and the premises of the civic body. The next in the phase will include that of Aundh, Baner and Balewadi. Users will have to pay a very minimal amount of Rs. 250 (~ $5.6) per month.

"Mysore, Bangalore and Ahmedabad are all trying to be 100 per cent unwired city and they are planning to float a tender document soon. But Pune will be the first city to set up the infrastructure and provide these facilities to the citizens",

This is for the first time that the Wi-Fi (Wireless Fidelity) and Wi-Max (Worldwide interoperability for microwave access) will be executed on a vast area, spreading 400 sq km includes Pune, Pimpri-Chinchwad and the area coming under the Rajeev Gandhi InfoTech Park at Hinjewadi. The total area of Pune, including the 23 fringe villages, is 243 sq km.

15.9 Bio-Diversity Park

The Pune Bio-Diversity Park (BDP) is a unique and encompassing vision. Not only will it create a sanctuary for ecological species diversity, it will also satisfy the needs of literally every resident in Pune by providing clean air and numerous other benefits. Regardless of economic status, social status, or residential location, every person in Pune must breathe the city air as they work for their daily livelihoods. The fact that air pollution in Pune threatens health and well-being proves beyond reasonable doubt that trees are essential for life as we know it.

The United Nations recommends at least 12 sq. meters of green area per person in order for there to be an adequate environment for physical and mental health.

The BDP plan includes planting 1,000 - 2,000 trees (generic forest species will be selected) per hectare and allowing the land to regenerate itself to a natural sanctuary. The total hillside area of the Pune Biodiversity Park is 1,647.74 hectares, and will provide13.7 Lakh (1.37 million) people with fresh, clean air. Therefore this forest will be quite literally a life-sustaining investment for the people living in this area.

15.9.1 BDP Reforestation Benefits

1. Trees produce oxygen, and act as giant filter which clean the air we breathe.
2. Trees clean the soil by filtering sewage, farm chemicals, roadside spills, and clean water runoff into streams.
3. Trees control noise pollution by dampening urban noise almost as efficiently as stone walls.
4. Trees slow storm water runoff and underground water-holding aquifers are recharged with the slowing down of water runoff.
5. Trees are “carbon sinks” that absorb carbon dioxide, and prevent global warming. One hectare of trees absorbs the carbon dioxide produced by a car that travels 40,000 kilometers.
6. Trees clean the air by intercepting airborne particles, reducing heat, and absorbing such pollutants as carbon monoxide, Sulphur dioxide, and nitrogen dioxide, and lower air temperature through respiration. Trees also absorb 50 tons of dust for every hectare. Therefore the 1,646.74 hectares of BDP would absorb up to 82,337 tons of dust.
7. Trees shade and cool, which reduces the need for air conditioners, easing the strain on the city's energy resources. Studies show that cities areas without cooling shade from trees can literally be “heat islands” with temperatures as much as four degrees Celsius higher than surrounding areas.
8. Trees act as windbreaks which reduce the drying effect on soil and vegetation and keep precious topsoil in place, which prevents hillside erosion and slides.
9. Trees fight soil erosion, conserve rain water, and reduce water runoff and sediment deposit after storms or heavy rains, thus preventing mudslides which threaten residents.
10. Trees increase the value of lands in the city, making it a place both locals and visitors want to inhabit by virtue of beauty of green space. The more green space, the more desirable the existing residential become, and thus Pune city benefits from increased property value.

15.10 Bhurelal committee

The review meeting on of EPCA under the chairmanship of Shri Bhurelal on Pune and Solapur Action Plans was held in January 2007.

Pune Municipal Corporation has been directed then to carryout several compliances with regards to the action plan being discussed over the past few months. The following table delineates present status and milestones agreed upon by the PMC towards compliance of the same.

Global Warming

"The subject of global warming definitely makes headlines in the media and is a topic of much debate". Though the subject is in the discussions for long but individuals always seem to neglect it since for two major reasons. Firstly, most of us are unaware of the exact fact and mechanism of global warming as well as we are not sure about the reasons and the local impacts that each of us will be facing soon from the same. Secondly and mot importantly most of us think that as an individual probably we may not probably do anything about it.

The Environment Status Report, this year is attempting to put forth and discuss this issue of global warming, its impacts, Pune's share towards global warming and individual efforts to save our Pune or at least mitigate our share of impacts towards the global killer.

16.0 Introduction

Melting ice in Himalayas, the recent melting of SHIV LING in Amarnath, heavy downpours in Mumbai and Pune, changing temperatures all across India, changing climate and wind patterns all over India, Floods in Mozambique, Forest fires in Indonesia, Hurricanes in Florida, Storms in the UK, and many many more such issues. These are thought to be the effects of global warming and believe it or not it is all come to every individual just every individual of us whether we understand the science or not, whether we think about it or not and whether we take steps to reduce it or not.

So, Pune Municipal Corporation through this ESR attempts to sensitize the puneites of this global killer thought to be known to affect each of us very soon.

16.1 Definition

Climate change or global warming is caused by increased levels of carbon dioxide ($C0_2$) and other polluting gases in our atmosphere.

The gases trap heat by forming a blanket around the Earth - like the glass of a greenhouse. Once released the greenhouse gases stay in the atmosphere for many years. As they build up, the planet's temperature rises. Greenhouse gases are released by burning fossil fuels - coal, oil and gas, individual lifestyle and luxuries and by cutting down forests.

(a)Heat from the Sun
(b)is trapped by the gases in our atmosphere

16.2 The Chemistry

The chemistry of global warming says that the ultra violet rays from sun that's falls on the earth are short waves. The earth's surface is already heated and therefore these rays, due to the temperature of earth now get transformed into Infra Red rays that are of larger wavelength. Certain gases in the atmosphere such as carbon dioxide (CO_2), water vapour (H_2O), methane (CH_4), sulphur hexafluoride (SF_6), and hydrocarbons (HC's / VOC's) have inherent property to absorb the Infra Red rays reflected from the earth thereby not allowing the rays to be dispersed out of the atmosphere just like the GREEN HOUSE we see in the some of the plant nursery.

Table 16.1 Sources, concentrations and share of gases towards global warming

Greenhouse gas	Concentration 1800s - 2000	Man made sources	GWP	Proportion of total effect (approximate)
Carbon dioxide	280 - 370 ppm	fossil fuel burning, deforestation	1	60%
Methane	0.75 - 1.75 ppm	agriculture, fuel leakage	21	20%
Halocarbons	0 - 0.7 ppb	refrigerants	3400+	14%
Nitrous oxide	275 - 310 ppb	agriculture, combustion	310	6%
Ozone	15 - 20-30 ppb	urban pollution		

Note: GWP stands for green house gas ability of a gas to produce global warming effect as the related to CO_2 which is considered to be 1.ppm parts per millionppb parts per billion

This trapping of the earths reflected rays in the atmosphere by certain gases leads to the increase in temperature that is known as “Global Warming”. The share of each of these gases towards global warming, their concentrations and sources are represented in **Table 16.1**.

There is clear evidence of changes in the composition of the greenhouse gases in the lower atmosphere. Ice core samples show that both carbon dioxide and methane levels are higher than at any time in the past 160,000 years.

Estimates of the individual contribution of particular gases to the greenhouse effect, - their Global Warming Potential (GWP), are broadly agreed (relative to carbon dioxide = 1). Such estimates depend on the physical behaviour of each kind of molecule and its lifetime in the atmosphere, as well as the gas's concentration. Both direct and indirect effects due to interaction with other gases and radicals must be taken into account and some of the latter remain uncertain.

16.3 The Impacts

Al Gore's, a well-known scientist who brought global warming known to most of us through his well watched and appreciated documentary "Inconvenient Truth" predicts a Biblical-style event that contradicts one of evolution's most fundamental assumptions.

Mr. Gore predicts a global-warming catastrophe featuring massive flooding, with major portions of the earth under as much as twenty feet of water, together with increased frequency and intensity of huge storms, wildfires, and droughts. Great numbers of species, Mr. Gore tells us, we will perish and the world as we have known it will cease to exist within ten years if we don't ratify the Kyoto treaty. ***(Kyoto protocol / treaty is an international convention on reducing green house gas emissions by developing countries by setting up individual targets through technology, process, sharing green house gas releases by countries)***

16.3.1 The Facts

In 2007 the Intergovernmental Panel on Climate Change (IPCC) is publishing the results of their Fourth Assessment Report. This is being published in three parts. The first, which was published in February, details the physical scientific basis for climate change. The second, published in April covered the impacts of climate change, the options for adaptation and identified where people and the environment are most vulnerable. The third part of the report, published in May, identifies options for mitigation of climate change. A synthesis of all three reports, including a Summary For Policy Makers, will be published in November.

The first part of the Fourth Assessment report on the **science relating to climate change** concluded that the evidence that human-derived greenhouse gas emissions had already had an impact on the climate had strengthened. Furthermore, there was greater confidence in predictions of the impacts of future greenhouse gas emissions.

Among the findings were:

- Eleven of the last twelve years (1995-2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850).
- Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* (90%+ probability) due to the observed increase in anthropogenic greenhouse gas concentrations.
- The average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been absorbing more than 80% of the heat added to the climate system. Such warming causes seawater to expand, contributing to sea level rise.
- Mountain glaciers and snow cover have declined on average in both hemispheres. Widespread decreases in glaciers and ice caps have contributed to sea level rise
- Global average sea level rose at an average rate of 1.8 mm per year over 1961 to 2003. The rate was faster over 1993 to 2003, about 3.1 mm per year.
- Average Arctic temperatures increased at almost twice the global average rate in the past 100 years.
- More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics.
- Widespread changes in extreme temperatures have been observed over the last 50 years. Cold days, cold nights and frost have become less frequent, while hot days, hot nights, and heat waves have become more frequent
- The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice cores.
- The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land use change providing another significant but smaller contribution. Annual fossil carbon dioxide emissions increased from an average of 23.5 Giga tons (Gt) CO_2 per year in the 1990s, to 26.4 Gt CO_2 per year in 2000-2005.
- The global atmospheric concentration of methane has increased from a pre-industrial value of about 715 ppb to 1732 ppb in the early 1990s, and is 1774 ppb in 2005.
- The combined radiative forcing due to increases in carbon dioxide, methane, and nitrous oxide is +2.30 Watts/m^2, and its rate of increase during the industrial era is very likely to have been unprecedented in more than 10,000 years.

The IPCC predicts that, based on a range of scenarios, by the end of the 21st century climate change will result in:

- A probable temperature rise between 1.8°C and 4°C, with a possible temperature rise between 1.1°C and 6.4°C.
- A sea level rise most likely to be 28-43cm
- Arctic summer sea ice disappearing in second half of century
- An increase in heat waves being very likely
- A likely increase in tropical storm intensity.

If these predictions are true then imagine the entire coast of India will be drowned in water (1 m rise in sea level will displace 7 million people in India), the changing agricultural patterns, draught, flooding, heavy precipitation, heat waves, tropical cyclones, shifts in organisms and diseases, people will start migrating towards the central part of India and increasing resource pressures on regions especially growing cities like Pune, Bangalore and others. The rise in temperatures will harbour many such organisms leading to innumerable unknown diseases. As an example, certain mosquito larvae needs higher temperature for their hatching like Dengue and with increase in temperature the growth will be enhanced many folds and cause even more damage to humans.

The Gangotri glaciers are melting at a speed of 30 mts per year and would be further enhanced due to global warming.

A perspective of photographers view on the global impact is represented in **Figure 16.1**.

Figure 16.1Photographic views of the melting glaciers

Table 16.2 Sectoral emissions of CO_2 in Terra grams

Table 12
Multigas emission trends for India over 1985–2005 in Tg

Emissions	1985	1990	1995	2000	2005	CAGR % (1985–2005)
CO_2	440	615	849	1032	1229	5.3
CH_4	17.21	17.92	18.85	19.61	20.08	0.8
N_2O	0.134	0.158	0.185	0.217	0.253	3.2
PFC (CO_2 Eq.)	3	5	6	7	9	5.5
HFC (CO_2 Eq.)	—	1	2	5	11	18.6
SF_6 (CO_2 Eq.)	—	—	—	0.1	2	88.7
GHG (CO_2 Eq.)[a]	846	1046	1310	1523	1751	3.7
SO_2	2.39	2.85	3.66	4.26	4.80	3.5
NO_X	2.11	2.64	3.46	4.31	5.02	4.4
CO	33.7	35.1	37.2	40.3	41.7	1.1
TSP	8.1	9.2	10.1	9.1	8.7	0.4

[a]Includes CO_2, CH_4, N_2O, PFC, HFC and SF_6. Global warming potentials of 1, 21 and 310 are used for CO_2, CH_4 and N_2O, respectively.

16.4 Pune's Share to Global Warming

Many researchers have estimated Indian emission inventories of different gases and years. India has submitted the Initial National Communication (INC) to United Nations Federation Convention on Climate Change (UNFCCC) in June 2004 including inventory of CO_2, methane and N_2O using many domestic emission factors (INC, 2004). The reporting year is 1994 and this inventory is used as a benchmark for greenhouse gases (GHG's) for the all other studies. The sectoral trends of contributions of GHG's from India are represented in **Table 16.2**. Further deteriorating it to an irreversible damage.

The major contributions are seen to be coming from electricity, vehicles and industries. Thus it is very clear that most of our lifestyle through use of vehicles electricity is responsible for the overall share of global warming. However, there are many more events such as cutting of trees, excessive packaging, excessive use of plastics, use and throw culture, wastage of resources like water, energy, fuel, and others that add whooping concentrations of these gases to the atmosphere

Pune has not been left out far from its contribution to the total global warming. The Air Quality Management Cell of PMC attempts through this ESR to estimate the total amount of GHG emissions from major sectors / activities in Pune as given in **Table 16.3**. However, these are preliminary estimates done by the authors and shall not be considered as perfect as there are certain assumptions which might not be agreed upon by some scientists / individuals.

Table 16.3 GHG Sectoral emissions from Pune

Category	GHG Gases	Activity	Emission Factor	Emissions (Tons/year)*
Transportation	CO_2 HC	Kilometers traveled	*Transport Fuel Quality for 2005, CPCB*	657,445 55,375
Electricity (Thermal) – residential, commercial & industrial	CO_2	Coal burned	www.osc.edu/research/pcrm/emissions/thermalemissions.shtml	4,927
Solid Waste	CH_4	SW / capita	IPCC, 2005	65,80,000
Agriculture	CH_4	Total cultivation	GHG Inventory in Asia: by Center for Global Environmental Research	11,364
Industries and non industrial generators	CO_2	No of gensets, emissions of processes	AP-42	5,22,475
Sewage	CH_4	450 MLD generated	EMEP / CORINAIR (1996)	10,07,721
Total	All			**79,50,358**

* All emissions are converted in CO_2 equivalent

Total amounting to be **79,50,358 Tons of CO_2 /year** from Pune through major sources.

16.5 Per Capita Share of Punekar

The estimation of carbon dioxide emission of the city was calculated on the basis of a case study of India, done by Parekh *et al.* (1994) and further used by RANWA an eco organization of Pune. This study dealt with the environmental implications of consumption patterns across income classes in India. The analysis was based on the input-output model using consumption, expenditure distribution data from various sources. The rich have a more carbon intensive lifestyle than the middle class and the poor communities. In fact, the per capita direct and indirect emission level of the urban rich was calculated to be about 15 times that of the rural poor.

The direct or indirect consumption of each resource including food items, manufactured goods, energy, transport, durable goods, fuel etc. was converted to the carbon emitted during the production and consumption of that resource.

The population of Pune for the year 2007 as estimated is rounded off approximately to be 33 lakhs for calculation purpose with a density as stated in the earlier chapters using the population projection ratios is approximately 12000/km^2. It is assumed that approximately 35% of the population falls in the low income group (annual income of less than Rs. 50,000) and 50% (annual income of Rs. 50,000 to Rs. 5,00,000) in the middle income group based on some of the earlier reports for Pune City. The remaining population of 15% is assumed to be in the high income group having annual income of more than Rs. 5,00,000.

Considering the rates of emissions per capita as published by the study mentioned earlier, the estimates for carbon emissions from Pune is represented in **Table 16.4**.

Table 16.4 Carbon emissions from Pune

Category	Population	Per capita Carbon emissions (kg C/year)*	Emissions (Kg C / year)
High Income Group	4,80,000	914.7	439056000
Middle Income Group	16,00,000	279.4	447040000
Low Income Group	11,20,000	122.5	137200000
Total	**32,00,000**	**476.4**	**1,023,296,000**

* Per capita emission estimates derived for 2010 from RANWA study

The total estimated carbon emissions for the Pune city are **10,23,296 tons/year** which seems to be alarming. However, there are no such standard emissions for any city thereby making it difficult to be compared and rated. However, after knowing the impacts of global warming every kilogram of carbon emitted will lead to a disaster of mankind and shall always be borne in mind.

In short, we face a repetition of the Bible's account of the great flood which Noah survived in the ark. God saved Noah; Lets hope we ourselves save the humanity.

16.6 Trees as sinks for Pune (Carbon Sequestration)

The most known sink of CO_2 are the trees; however there is another way through which CO_2 gets locked and that is through the interface of surface water like the lakes, rivers and sea although this fraction seems to be negligible as far as Pune city is concerned. Trees absorb CO_2 for the process of photosynthesis through which they prepare their own food and we all have learnt it right from our childhood. Continuing the positive properties of trees other than aesthetics, cooling, greening, controlling soil erosion and others CO_2 sequestration is one of the most important characteristics of trees which is in the limelight and also very much required by Punekars.

Terrestrially, carbon is stored in vegetation and in the soil. Plants store carbon for as long as they live, in terms of live biomass. Once they die, the biomass becomes a part of the food chain and eventually enters the soil as soil carbon. If the biomass is incinerated, the carbon is re-emitted into the atmosphere and is free to move in the carbon cycle. The role of forests in carbon sequestration is probably best understood and appears to offer the greatest near-term potential for human management as a sink. Unlike many plants and most crops, which have short lives or release much of their carbon at the end of each season, forest biomass accumulates carbon over decades and centuries. Furthermore, carbon accumulation potential in forests is large enough that forests offer the possibility of sequestering significant amounts of additional carbon in relatively short periods decades (***www.ranwa.org***).

Thus, the only possible way for the administration of Pune to manage its CO_2 emissions is to grow more trees other than the individual efforts of changing lifestyles as discussed in the next section.

The ESR this year attempts to roughly estimate the carbon sequestration potential of greenery in Pune and also estimates the total green cover required if Pune has to manage the overall emissions of the city. A simple but effective method of calculating the total CO_2 sequestered by green part of Pune is being discussed hereunder. The total standing biomass for Pune city is being adopted from the study carried out by RANWA which is an NGO based in Pune and have been working the field of ecology and conservation since last several years. The study was carried out in 2000 and may need further assessment as on date. However, it forms a very good base for Pune to understand its sinks available in the city for cleaning the global warming gas CO_2. This study was conducted by Ms. Archana Warran and Dr. Ankur Patwardhan of the RANWA group and is highly appreciated for their efforts to understand the CO_2 sinks of Pune.

Five different locations (Ghera Sinhgad, Katraj, Parvati-Pachgaon, Vetal Hill, Pune University and Sambhaji Garden) were studied for Biomass estimations using height, girth at breast level, tree density. Thereby the total carbon stored in the biomass was calculated. Thus the total biomass estimated through the process amounted to be 1554307 tons. Considering the carbon sequestrations potential of biomass to be 1% of the total, the total Carbon sequestered is expected to be 15 lakh tons. However, with the increasing greenery in the city through the efforts of Garden Department, it is expected that the potential storage of carbon in the biomass would have been increased significantly.

v16.6 Mitigation Efforts

International treaties and events have been happening to combat global warming since more than a decade now. However, nothing much has really happened effective enough to result into a real change in any of the scenarios leading to global climate change and the ill effects of global warming. These efforts may not yield successful results since each of these are brought through government efforts. The only way through which global warming could be either mitigated or at least stopped from increasing according to the authors of this years Environmental Status Report is INDIVIDUAL efforts. It has been rightly pointed out that no machine in this world could actually reduce the increased amounts of these GHG's, not even the efforts through changes in land use, greenery or production capacities. Expected changes in the global warming scenarios through application of pollution control devices and policies have already failed to great extent. Thus the only option to combat this killer is our own efforts and the Pune Municipal Corporation through the ESR '07 appeals to Punekars to adopt simple techniques for reducing their share of global warming contributions. The theme is to adopt Moderate Living & High Thinking thereby making our families "LOW CARBON DIET FAMILY".

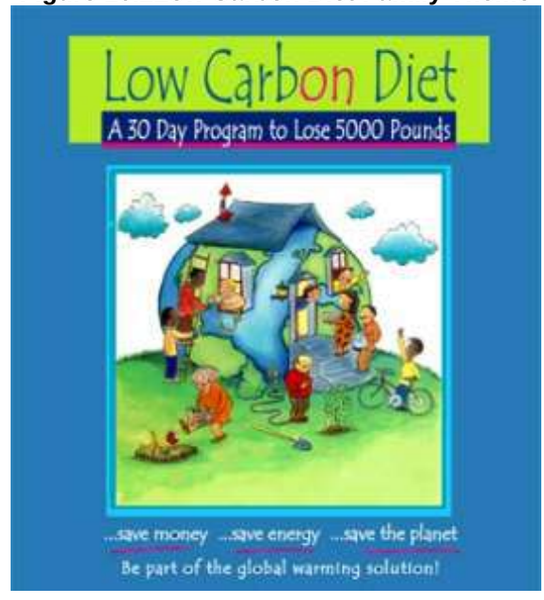
The concept is to understand our lifestyles and thereby monitor GHG emissions in to the environment. On an average every Indian is responsible for 10 tons / year of direct emissions of GHG including our home, travel, etc. However, we add a whooping 24 tons/year extra through shopping, food, using roads, and all other emissions throughout the economy. It is this extra emissions of GHG that the PMC appeals reduce to all the Punekars so as to become a Carbon Neutral Pune. Some of the examples for quantitative and effective reductions that could be achieved are represented in **Table 16.5**.

Table 16.5Quantitative reductions of GHG through individual efforts

Lifestyle event	Possible Emissions Reduction (CO_2)	Alternative practice
Less packaging	104 kgs/year	Use of recyclable materials for packaging
Washing machine with low energy and low water usage	447 kgs/year	Use of cold water instead of hot water for washing machines
Water heater thermostat to work at 120^0C	227 kgs/year	Required only 60^0C warm water for bathing
Lights in the house	99280 kgs/day	100 watts incandescent light bulb for 6 hours uses 82 kgs of coal. Use of CFL lamps
Water Heating	1500 kgs/year 454 kgs/year	Use of Solar water heater. Annual electricity bill saving of Rs. 2400 per house Wrapping of water heater in insulator
Newspapers, glass, materials, cardboard at home	385 kgs/year	Recycle all of these
Local Travel	721 kgs/year	Leave your car just for two days at home and use public transport
Electronic devices at home	1000's of kgs/year	Unplug all electronic devices once not in use. It would save lot of emissions and money for each home
In office	1000's of Kgs/year	Use of car pools Recycling of papers / prints on both sides of paper, inventorizing misuse

Thus, by adopting simple lifestyle changes every individual can help reduce GHG emissions and in a nut shell making each Punekar family a Low Carbon Diet Family ultimately achieving the goals of becoming carbon neutral by setting our own targets of emissions reductions since it will not only help the global cause but will also help save a lot of money for every individual. Figure 16.2 represents our theme for Low Carbon Diet Family.

Figure 16.2Low Carbon Diet Family Theme



Sustainability Indicators

17.0 Introduction

Environmental Impact Assessment (EIA) is a study to identify, predict, evaluate and communicate information about the impacts on the environment of a proposed project and to detail out the mitigating measures prior to project approval and implementation.

EIA is essentially a preventive process. It seeks to avoid costly mistakes in project planning and development, mistakes that can be environmentally or economically costly.

"**Environmental impact**" is any alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration.

The chapter aims in identifying environmental impacts through qualitative approach using simple Impact Matrix for each of the department of PMC so that the departments could consider these essential aspects of impacts before implementation of any projects under their purview. It is essential to borne in mind that this chapter is only indicative of the impacts and does not bear any direct resemblance to any specific project and shall not be considered as rigid. It attempts only to provide guidelines for the departments to consider the basic fundamentals of impact assessment and evaluate each of their projects in these lines and quantify environmental impacts to be taken care and mitigated before the onset of the proposed project.

17.1 Impact Matrix

Any developmental activity is definitely supposed to have impacts either positive or negative on certain parameters of the environment. Identification of the possible impacts, in the form of disruption, inconvenience and post project conveniences, etc.and considering peoples perception of these potential impacts by means of interactive sessions with different social groups are usually carried out to envisage the impacts of the proposed project.

The project impacts addressed here include environmental issues relating to - air, water, noise, land, natural hydrology, human health, aesthetics, culture, socio-economics, and others.

The project impacts have been defined in details with respect to - construction and operational phases. For the construction phase, emphasis has been given to the details regarding handling of earthwork, and use of material from quarries and borrow areas and their rehabilitation etc, Information related to construction management plans (e.g. haul roads, temporary accesses etc.); temporary impacts on land and people during construction is also represented. A matrix of identified environmental impacts due to ongoing developmental activity and post-project activities is prepared to represent the nature and extent of the impacts.

The impact matrix shows the various environmental and social issues in the rows whereas different onsite activities in the columns. The impact matrix is represented in **Tables 17.1 to 17.10** for various departments of PMC**.** The various impacts envisaged due to the proposed project are discussed in the following sections.

These impacts are considered to be temporary or permanent depending upon whether it is during the construction phase of operations phase of the

activity. Similarly it is also considered as significant, minor or insignificant depending up on the intensity of impacts. For e.g. if quarrying is to be carried out, it would definitely have significant impact on air quality whereas a building construction if managed properly might have only minor significant impact. However, there is one more indicator of impact used in the matrix i.e. positive or negative depending up on the impacts to be harmful or good on the environmental parameter of interest.

For better understanding an example case of green belt development or garden development, is considered. During the construction phase, the land clearance, earth movement, material and equipment movement, etc. will have ***temporary, minor significant & negative*** impacts on the environmental parameters such as water, air, waste, aesthetics and others whereas it may have certain impacts on utilities like telephone lines, water or drainage lines if they pass through the area of application. On the other hand once the garden is developed and functional, it will have a ***permanent, significant and positive*** impact on air quality, aesthetics, economy, and overall environment. Thus one project may have negative impacts during construction and positive impacts during operation.

The fundamental of having such a matrix is to provide the policy makers and planning / implementing agencies to at least know the potential impacts of their projects so that they could plan essential steps to combat the same during the course of its actual implementation.

Table 17.1 Environmental Impact Matrix for Road Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio - Economic	Aesthetics
1.	Cleaning	P/S -ve	P/S -ve	-	-	T/S -ve	T/M -ve	T/M-ve	T/M -ve	T/M-ve	May be	May be	T/M-ve	T/M-ve	T/M +ve	May be
2.	Cutting of vegetation	P/S - ve	P/S -ve	P/M-ve	-	P/M -ve	T/M –ve	T/M - ve	T /M -ve	P/M -ve	May be	May be	P/S +ve	T/S -ve	T/M+ve	T/S -ve
3.	Leveling of Road	-	-	T/M -ve	T/M -ve	-	T/M -ve	T/S-ve	T/M-ve	-	May be	May be	T/M-ve	-	-	-
4.	Area Required for resting of materials	T/M -ve	-	-	-	T/M-ve	-	-	-	-	-	-	T/M-ve	-	-	-
5.	Melting of tar	-	-	-	-	-	T/M-ve	-	-	-	-	-	-	-	-	-
6.	Mixing of tar & stones	-	-	T/M -ve	-	-	T/M -ve	T/M-ve	T/M -ve	-	-	May be	T/M -ve	T/M-ve	-	-
7.	Application of tar & stone mixture	-	-	-	-	-	T/M -ve	T/M - ve	-	-	-	May Be	T/M -ve	May be	-	-
8.	Rolling	-	-	T/M -ve	May be	-	-	T/S - ve	T/M -ve	-	-	May be	T/M -ve	-	-	-
9.	Disposal of waste	P/M -ve	May be	T/M -ve	-	T/M -ve	T/M -ve	-	-	May be	May be	May Be	-	-	-	-
10.	Percolation of water	-	-	P/S -ve	-	P/M -ve	-	-	-	T/M -ve	May be	-	-	-	-	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.2 Environmental Impact Matrix for Power Supply Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio - Economic	Aesthetics
1.	Construction of Pole	P/M -ve	T/M -ve	May be	T/M -ve	T/M -ve	-	T/M -ve	T/M -ve	-	May be	May be	-	-	T/M -ve	-
2.	Connection of power supply wires	-	T/S -ve	-	-	-	-	T/M-ve	-	-	May be	-	T/M -ve	-	-	-
3.	Construction of transformers	P/S -ve	P/S -ve	May be	T/M -ve	T/M -ve	-	T/M -ve	-	-	May be	-	-	-	P/S +ve	-
4.	Meter connection	-	-	-	-	-	-	T/M -ve	-	-	-	-	-	-	T/M +ve	-
5.	Maintenance	T/M -ve	T/M -ve	-	-	May be	-	T/M -ve	-	-	-	-	May be	-	T/M -ve	-
6.	Disposal of electricity waste material	P/S -ve	P/S -ve	T/M -ve	-	T/M -ve	-	-	-	May be	-	-	-	May be	T/M-ve	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.3 Environmental Impact Matrix for Sewage Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Generation of Sewage	-	-	T/M-ve	-	-	-	-	-	-	May be	May be	-	-	-	-
2.	Storage	P/S -ve	-	T/M-ve	T/M –ve	-	T/M-ve	-	-	-	-	May be	-	T/M-ve	-	-
3.	Collection	-	-	-	-	-	T/S-ve	-	-	-	-	May be	T/M-ve	-	-	-
4.	Transportation	-	-	-	-	-	T/M -ve	T/M -ve	-	-	-	T/M-ve	T/M-ve	-	-	-
5.	Treatment Method	T/M-ve	May be	T/S-ve	-	-	T/M-ve	T/M-ve	-	T/S -ve	-	May be	-	May be	T/M+ve	T/M+ ve
6.	Use of Sludge	-	-	-	-	P/S+ ve	-	-	-	-	-	-	-	-	P/M+ve	-
7.	Disposal Method	T/M+ve	T/M+ve	May be	-	-	-	-	-	-	-	-	-	-	-	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.4 Environmental Impact Matrix for Slum Area

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Sanitation	P/M -ve	T/M-ve	T/M –ve	-	T/S +ve	T/M -ve	-	-	T/M-ve	-	T/S-ve	T/M-ve	T/S-ve	-	-
2.	Cooking Methods	-	-	T/S-ve	-	-	T/M-ve	-	-	-	-	-	-	-	-	-
3.	Uncontrolled Use of natural resources	-	-	P/M-ve	-	-	T/M-ve	-	-	P/M-ve	-	-	P/S-ve	P/S-ve	P/S -ve	P/S-ve
4.	Drainage System	P/M-ve	T/M-ve	-	-	P/M-ve	T/M-ve	-	-	T/M-ve	-	May be	T/M-ve	T/S-ve	T/M-ve	T/M-ve
5.	Disposal of solid waste	P/S-ve	T/M -ve	T/S –ve	May be	P/S-ve	T/M-ve	-	-	T/M –ve	May be	May be	T/M -ve	P/S-ve	P/S-ve	T/S -ve
6.	Washing methods	T/M -ve	-	P/S –ve	-	T/M-ve	-	T/M -ve	-	T/M-ve	-	-	-	P/S-ve	-	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.5 Environmental Impact Matrix for Education Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Construction of Schools & Colleges	P/S -ve	P/S-ve	T/M –ve	T/M -ve	T/M -ve	T/M -ve	T/M -ve	T/M -ve	May be	May be	May be	T/M-ve	-	P/S+ve	P/S +ve
2.	Provision of education Services	-	-	P/M –ve	May be	-	-	T/M-ve	-	-	May be	May be	-	-	P/S +ve	P/S +ve
3.	Maintenance of education centers	-	-	T/M –ve	-	-	-	T/M-ve	-	-	-	May be	-	-	P/S +ve	P/S +ve
4.	General & Laboratory waste mgt.	-	-	T/M –ve	-	P/M -ve	P/M -ve	T/M -ve	-	May be	May be	May be	T/M -ve	T/M -ve	P/S +ve	P/S -ve

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.6 Environmental Impact Matrix for Gardening Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Construction	P/S -ve	P/S +ve	T/M –ve	T/M -ve	T/M -ve	-	T/M -ve	T/M -ve	T/M -ve	May be	May be	-	-	T/M +ve	-
2.	Plantation	P/S +ve	-	T/M –ve	May be	T/ M +ve	P/S +ve	-	-	P/S +ve	May be	-	-	-	-	P/S +ve
3.	Availability of Resources(water, electricity, etc)	T/M -ve-	T/M -ve	P/S –ve	-	P/S +ve	-	T/M -ve	-	May be	May be	-	-	-	P/S +ve	-
4.	Maintenance	T/M -ve	T/M -ve	T/M-ve	T/M -ve	-	-	T/M -ve	T/M -ve	May be	-	-	-	-	T/M+ve	-
5.	Waste Generation	-	-	-	-	May be	-	-	-	-	-	-	-	May be	-	T/M- ve
6.	Treatment	May Be	May be	-	-	T/M +ve	T/M -ve	May be	May be	-	-	May be	-	-	T/M-ve	-
7.	Disposal of treated waste	May be	May be	May be	-	T/M +ve	T/M-ve	-	-	-	-	May be	-	May be	T/M -ve	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.7 Environmental Impact Matrix for Health Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Construction of Health Centers	P/S +ve	P/S+ve	T/M -ve	T/M –ve	T/M -ve	T/M -ve	T/M -ve	T/M -ve	May be	May be	May be	T/M-ve	-	T/M +ve	-
2.	Provision of Health Services	-	-	P/M -ve	May be	-	-	T/M-ve	-	-	May be	May be	-	P/S +ve	P/S +ve	-
3.	Hygienic conditions maintained in premises	-	-	T/M -ve	T/M –ve	-	-	T/M-ve	-	T/M +ve	-	P/S +ve	-	P/S +ve	P/S +ve	P/S +ve
4.	Collection of waste	-	-	-	-	-	T/M -ve	T/M -ve	-	-	May be	May be	T/M -ve	May be	P/S +ve	P/S +ve
5.	Hospital waste mgt.	P/S +ve	P/S +ve	T/M - ve	T/M – ve	T/M -ve	T/S -ve	T/M -ve	-	T/M -ve	May be	May be	-	T/M -ve	P/S +ve	P/S +ve

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.8 Environmental Impact Matrix for Heritage Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Heritage preservation	T/M +ve	-	T/M -ve	May be	-	-	May be	-	-	P/S +ve	-	-	-	P/S+ve	P/S+ve
2.	Tourist attraction	T/S -ve	May be	T/M-ve	-	-	T/M -ve	T/M -ve	-	T/M -ve	T/S +ve	May be	T/S -ve	-	P/S +Ve	P/S +ve
3.	Unhygienic condition	T/M -ve	T/M -ve	T/M -ve	May be	-	T/M -ve	-	-	T/M -Ve	May be	May be	-	T/S -Ve	T/M -Ve	-
4.	Demand for resources (water & food items)	T/M-ve	May be	T/S -Ve	May be	-	-	-	-	T/M -Ve	May be	-	T/M-ve	-	T/S +ve	-
5.	Demand for open space	T/M-ve	T/M -ve	-	-	-	-	-	-	T/S -ve	May be	-	-	-	-	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.9 Environmental Impact Matrix for Traffic & Transport Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Road Construction	P/S -ve	P/S -ve	T/M -ve	T/M -ve	T/M -ve	T/M -ve	T/M -ve	T/M -ve	-	May be	May be	T/M-ve	-	T/M +ve	-
2.	Pedestrian Paths	P/S +ve	-	T/M -ve	T/M -ve	T/M -ve	-	T/M-ve	-	-	May be	-	T/M -ve	-	T/M +ve	P/S/ +ve
3.	Check Post	P/S +ve	-	T/M -ve	T/M -ve	T/M -ve	-	T/M -ve	-	-	May be	-	-	-	P/S +ve	-
4.	Traffic Signal	P/S +ve	-	T/M -ve	-	-	T/M +ve	T/M +ve	-	-	May be	May be	P/S +ve	T/M +ve	T/M +ve	-
5.	Mgt. of traffic	-	-	-	-	-	T/S +ve	T/M +ve	-	-	May be	May be	T/M +ve	T/M +ve	T/M +ve	-

Note:

P Permanent Duration M Minor Significant Impact - ve Negative Impact
+ ve _ Positive Impact T Temporary Duration S Significant Impact
I Insignificant Impact

Table 17.10 Environmental Impact Matrix for Water Supply Department

No.	Project Activity	Land use	Terrain	Water	Drainage	Soil	Air	Noise	Vibration	Ecology	Cultural property	Sensitive Receptors	Transport and traffic	Health	Socio-Economic	Aesthetics
1.	Construction of pipeline	P/S -ve	P/S -ve	T/M/ -ve	T/M -ve	T/M -ve	T/M/ -ve	T/M - ve	T/M -ve	May be	May be	May be	T/M-ve	-	T/M +ve	-
2.	Construction of common tap for community	P/S -ve	-	T/M/ -ve	T/M -ve	-	T/M/ -ve	T/M- ve	-	May be	May be	May be	-	-	P/S +ve	-
3.	Maintenance	-	-	T/M/ -ve	T/M -ve	-	T/M/ -ve	T/M - ve	-	-	May be	-	T/M -ve	-	T/M - ve	T/I/ -ve
4.	Construction of pretreatment plant for water supply	P/S -ve	P/S -ve	T/M/ -ve	T/M-ve	T/M -ve	T/M/ -ve	T/M - ve	T/M/ -ve	-	May be	May be	-	P/S +ve	P/S +ve	P/S +ve
5.	Construction of wastewater treatment plant	P/S -ve	P/S -ve	T/M/ -ve	T/M - ve	T/M -ve	T/M/ -ve	T/M - ve	T/M/ -ve	P/S +ve	May be	May be	-	T/M +ve	T/M +ve	P/S +ve
6.	During Operation	-	-	P/S/ +ve	P/S/ +ve	-	-	-	-	-	-	-	-	P/S/ +ve	-	-

Note:

P Permanent Duration
M Minor Significant Impact
- ve Negative Impact
+ ve _ Positive Impact
T Temporary Duration
S Significant Impact
I Insignificant Impact

17.2 Quantitative Sustainable Indicators

This chapter essentially considers sustainability aspects of Pune city in terms of certain important indicators. CEROI has published many such indicators of sustainability including 196 of them for social, economic, environmental and others. However, it is important and worthwhile to note that all of those indicators which are available for sustainability are qualitative and do not resemble any such standards to which comparisons can be made and sustainability of a city could then be quantified. But in case of environmental parameters such as air, water and others standards have been laid down by various national and international institutions and government bodies which could be compared for safe and sustainable quality of life (with regards to environment).

The authors of ESR attempt to quantify some of these indicators of sustainability through cross references across the world and compare Pune towards sustainability.

17.2.1 Indicators in details

An indicator is something that helps us understand where we are, which way we are going and how far we are from where we want to be. A good indicator alerts us to a problem before it gets too bad and helps us recognize what needs to be done to fix the problem. Indicators of a sustainable community point to areas where the links between the economy, environment and society are weak. They allow us to see where the problem areas are and help show the way to fix those problems ***(Maureen Hart, Sustainable Measures)***.

In the context of a state-of-environment (SoE) report, indicators are representative, concise and easy-to-interpret parameters used to illustrate the main features of an urban environment, as well as their development over time and space. As per the United Nations Environmental Program (UNEP), the purpose of indicators is to collect useful information about urban conditions and trends. Urban indicators can function as important policy- and decision-making instruments. The main purpose of a SoE report or ESR is to present, in a user-friendly form, an aggregate overview a city's state to a non-professional audience - such as politicians, decision-makers, educational institutions and the general public.

17.2.2 The five E's of sustainability

? **ECONOMY - Compatible with Nature** considering economic development plans that protect and/or enhance natural resources through improvements in management practices, technology, efficiency, and changes in life-style.

? **ECOLOGY - Natural Ecosystem Capacity** understanding natural system processes of landscapes and watersheds to guide the design of sound economic development strategies.

? **EQUITY - Societal Well-Being for All People** guaranteeing equal access to jobs, education, natural resources, and services for all people -- balancing the playing field.

• **EDUCATION - Life-long Learning, Awareness, & Training** citizens and organizations obtaining adequate and comprehensive information in creating authentic choices for action intended to affect sustainability; developing interdisciplinary curriculum to train students for careers in sustainable development.

• **EVALUATION - Measuring the making of a Difference** identifying key sustainability indicators that measure the direction and extent of impact from economic and social activities on natural and human systems; providing feedback to allow for corrections in ongoing work toward sustainability.

17.3 Status of Pune compared to sustainability

It is not possible for obtaining or formulating quantitative sustainable indicators but the authors of ESR have made an attempt this year to gather some of the essential indicators through reported literature for its effectiveness in comparing with the state of Pune city so as to identify the gaps between standard resource and/or infrastructure requirements and that available in Pune as represented in **Table 17.11** to Help the policy / decision makers to take necessary steps for bridging this gap and taking Pune towards sustainability.

Thus, in comparison to the standard quantitative sustainable indicators, Pune falls short of many of the parameters and administration as well the citizens should work hand in hand to bring up the city to a sustainable nature. Each of the department has submitted their action plans based on priorities and budgetary requirements for solving major problems faced by the city. This is one of its kind attempts by the Pune Municipal Corporation this year that each department has been asked to prepare their own action plans to be published in this public document so that it could be reviewed every year for successful implementation and accountability of each department towards sustainability of the city.

Table 17.11Comparative account of Pune status in terms of its sustainability

Indicator	Quantification (Standard)		Status in Pune	Reference
Green Cover	33% of the total area		35%	Indian Forest Department
Trees to be planted / M^2	For House sites	2 trees/222 sq mt. 3 trees / 222 to 892 sq mt. 4 trees / 892 sq mt or < 892sq mt.	NA	Karnataka Preservation of trees Act, 1976 (Section 7) www.karnatakaforest.gov.in
	For Vacant land	25 trees per hectare	NA	
Health Care	Community health center	7415 / 1 lac population	NA	Prime Ministers Council on trade & industry
	Rural health sub center	1 / 4000 population	NA	
	Public health center	1 / 25000 population	NA	
	Urban health & family welfare post	1 / 12000 population	NA	www.indiaimage.nic.in
	Urban health & family welfare center	1 / 100000 population	0.56 / 100000 population	
	Hospital beds required	2.4 % / 1000 population	NA	
	Doctors required	1600700 / 1 crore population	NA	
	Physicians required	51 / 1000 population	NA	www.youandaids.org according to UNDP HDR & census of India 2001
Floor area required	20 sq ft. / person		NA	www.wisconsin.gov.in
Energy consumption	12.82 kWh per person of primary energy is required		34.96 kWh per person	www.wakeupcall.org.in
Waste production	200 gms / person/ day As per CPCB 400 gms of garbage generated / person/ Day		323.53 gms / person/ day	www.pon.nic.in (state govt. news 2005)
Public transport	40 buses required / lacs of people 1200 buses for good services		2.82 buses / lacs of people	www.better-punetripod.com
Public safety	1 police station / 10,000 residents		0.06 police station / 10,000 residents	www.infoforhealth.org
Air Quality (Annual Avg $\mu g/m^3$)	SPM	140	232	National Ambient Air Quality Standards (NAAQS)
	RSPM (PM10)	60	119	
	SO_2	60	23	
	NOx	60	42	
Noise Levels (dB(A) L eq.)	Daytime	55	30% above standards	Noise Pollution (Regulation & Control) Rules, 2000
	Nighttime	45		

Action Plan - Water Supply Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
Leakage Detection Studies	30 – 40 % leakages are observed at individual tapping points	Study of leakages & propose remedial measures.	Next 6 months
Meterisation	Wastage of Water	To study & suggest proper metering system. Every consumer would be brought under meterisation. Proposed meters would be of automatic reading system & remote sensing.	Next 6 months
24/7 Water supply	Insufficient water supply	Based on the results of pilot study PMC will implement the scheme throughout the city.	Pilot study will start on 15th August
Equitable distribution of water supply	Water supply in all areas of the city is unevenly distributed	Identification of new sources of water supply & study the feasibility.	Next 12 months

Action Plan - Traffic Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
Traffic Management	1. Extensive vehicles in Pune city leading to unmanageable traffic. 2. Junction Improvements 3. Pedestrian Movement 4. Increase in number of accidents while crossing the road.	Integration of Private & Public modes BRT System ATC Signal system Footpaths will be constructed. Construction of Road dividers & beautification of the dividers.	
Parking places	Parking is the major issue in Crowded places.	Parking places will be increased as per the requirement	

Action Plan - Environment Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
Air Monitoring	High concentration of Particulate matter	Regular updates of emissions inventory, source apportionment, dispersion modeling	Annually
		Awareness programme in different Educational Institutes. (Materials for study and small projects for data gathering)	Fortnightly
	Pollution during Festival season	Assessment and Evaluation for management programs during festivals	Annually
Integration of all departments and Environment to be centre for communication	Increase in number of Environmental Problems	Recognition of Environmental Department All projects in PMC limits shall require NOC from Environmental Department before implementation of any project for solving Environmental issues.	2008 end
Laboratory Recognition through Central Govt.	Laboratory results to match the best quality and developing confidence in PMC results	Revenue generation and self-financed status of Environment Department as well as recognition all across the city	2008 June

Action Plan - Road Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
Condition of roads During Monsoon	Water logging, repeated potholes	Water logging areas have been identified & suitable action for redevelopment is being taken up by, appointing agencies for instant relief. 24 hours complaint center 21 Agencies are appointed for receiving complaints directly. 200 % increased budgetary allocations for pothole repairs/ maintenance. No digging permissions for all utilities accorded except for the emergencies with the prior approval of the Additional Municipal Commissioner. Better materials/ technologies & equipment for maintenance are introduced Maintenance of roads e.g. sealing of cracks, application of liquid seal coat for cracked surfaces of roads Lanes on either side of central divider had to be resurfaced for free & easy flow of traffic.	6 – Months (Short term measures)
Establishment of STAC (Standing Technical Advisory Committee)	Functioning of Road department	Review of specifications, detailed engineering practices, costing, tendering & project management practices adopted by PMC & suggest suitable amendments.	
Strom Water Management System		A D.P.R. has been prepared as a pre requisite to wipe out all the backlog of strom water management system.	5 Years
Engineering Cell	Due to daily maintenance activity, long term measures are ignored	Establishment of Engineering cell for capital intensive project with complete isolation from daily maintenance activity. Periodic interface with other stake holders such as NGO's, the active citizens, consultants, professionals to ensure common envisioning of road department.	Implemented
Quality of Roads	Quality of roads has been questionable since long	Construction of cross ducts by RCC hume pipes on every road work along with the construction of water tables on the side of the road. M/s EIL has also been asked to carry out quality control tests at the refineries for ensuring better quality of roads. Appropriate training will be given in consultation with STAC & CRII Deputy Director, Delhi.	Being Implemented

Action Plan - Health Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
Outreach Activity	Limited awareness amongst people leading to health problems	Creating inventory of all pregnant women in Aanganwadis	Annually
Vaccination	Repeated appearance of diseases	85 to 90% vaccination	Annually
Health Check ups and providing medicines		HIV counseling and testing Counseling for Family planning and providing free contraceptives For school children from 1st to 4th standard – 100% checkup	Annually
TB & Leprosy drive		WHO guided DOT medical facility for TB & Free checkups and medicines	Annually

Action Plan - Solid Waste Management Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
100% House to House collection	40% Coverage done	Ghanta truck, cycle rikshaws for total coverage of existing properties	Dec 2007
Cycle Rikshaw	Slum and lower middle class garbage segregation and collection	Total House to House collection, segregation processing and disposal	June 2008
Wheel Barrow	In-sufficient wheel barrow to the sweepers to collect the sweeping	Distribute about 1000 single / double barrows to all sweepers for cleanliness of roads	Dec 2007
Litre Bins for litre free Pune	Litres in city roads around	Set up litre bins in 1500 spots	June 2008
Bio Mining – a BOT Project	Existing waste lying deposited on 14 acres has left the landfill site unusable	To exavate and create original space for further use	50% of 14 acres, 25% to be cleaned by June 2008
Solid Waste Management Plan	Scientific Processing unit for waste disposal of garbage is the need of the moment	Composting, Vermi Composting, Sanitary Landfill Site and other basic infrastructure	June 2008 to August 2008
Bye – laws prepared as per MSW – 2000 Rules	City is not totally garbage free	To make it implementable for action	June 2008

Action Plan - Garden Department

Category / Project	Issues/ Problems	Proposed Action Plan	Priority / Target Date
Garden/ BDP	Some of the parts of the city mainly villages needs Gardens.	The development plan of this area is not yet approved, therefore there are some problems in acquiring land. But new gardens are planned by acquiring Government land.	Process of developing Biodiversity Park at Baner, Pashan is going on.
Garden	Some part of the city have less gardens	PMC is planning to develop new gardens by acquiring Government Land, open spaces.	New 35 gardens are also at developing stage.
Tree Plantation	Increasing level of Pollution in the city	Planning of city forest development to minimize pollution levels in the city	Joint Forest Management Programme is ongoing at Baner & Pashan.
River/ Nalla/ Lake	Pollution / Encroachment	Various River & nalla development projects are proposed to minimize pollution.	The project of removing the debris, cleaning of river bank & conserve the area near Katraj, Pashan lake & other main nallas in city is going on.

Sources

Environmental Status Report 2002, 2003, 2004, 2005, and 2006

Central Tax Department

Indian Metrological Department

Agarkar Research Institute

Census of India 2001

National Sample Survey Organization

Central Institute of Road Transport

Regional Transport Authority

Maharashtra State Road Transport Corporation

Maharashtra State Road Development Corporation

Pune Municipal Transport

Maharashtra Pollution Control Board

Maharashtra Chamber Of Commerce Industries and Agriculture

Non-Governmental Organization

All Departments of Pune Municipal Corporation