EXECUTIVE SUMMARY

Providing water and sanitation to India's millions is a challenging task. With over 20 million people without access to safe water supply and 100 million without safe sanitation, the sheer numbers indicate the massive effort required to provide these basic services to the people of the country. Just providing access, however, will not solve the problem unless the issues of quality and adequacy are also addressed. The minimum needs should be met and the quality of the services provided should be acceptable.

The present study assesses the status of three basic services - water supply, sanitation and municipal solid waste management. It covers over 300 cities and towns in the country including all metropolitan cities and selected Class I and Class II urban centres. The study covers all the states and union territories including the capitals, excepting Patna and Gandhinagar. The study was commissioned in 1999 and the data collection work took about a year.

The main objectives of the study were to a) assess the status of water supply, sanitation and solid waste management; b) analyse the revenue receipts and revenue expenditure of these services; and c) estimate the additional capital investment requirements for full coverage of population by these services from 1999 to 2022 (at five yearly intervals). The study covers the physical and financial aspects of all the three services selected for the study. A conscious decision was taken in the study to cover only the municipal area of the urban centres and not the areas falling within the jurisdiction of other authorities such as development authorities, cantonment boards, railways etc. This was done due to the time-frame of one year for the study which did not permit data collection from different agencies for the same service. The study gives the status of these services as provided by the public agencies and does not cover private provision.

A study of this magnitude can be successful only with the cooperation of the local agencies, which gave information on various aspects of the selected services. While every effort was made to collect as accurate a data as possible, it was not always possible to check it with the records of the agency. Records are often not computerised or kept properly, making data authentication difficult. However, wherever other data sources were available, attempts were made to cross-check the data collected and verify the authenticity of figures. Despite these problems, the data provided by this study does give a broad picture of the overall situation with respect to these services in the country.

Summary of Findings

Overall, the study confirms the normal notion that the metropolitan cities are better provided for than the other size class of urban centres. The coverage of population with basic services is higher for metropolitan cities than for other size class of urban centres. The investment levels are higher in the metropolitan cities due to large concentration of population in them. This could be one of the reasons for more people flocking to metropolitan cities – due to better provision of basic amenities.

The water supply situation, though much better in metropolitan cities at an aggregate level, is reasonably good in many Class I and Class II urban centres too. The situation with respect to wastewater management is much worse in smaller urban centres than in metropolitan cities. A similar situation is obtained in respect of solid waste management where the metropolitan cities fare much better than the other size class of urban centres. Financially also, the metropolitan and larger urban centres fare much better than the smaller ones. However, there are large variations in the status of individual urban centres with respect to these services. The study found that in some cases the smaller urban centres showed much better service provision than others. These isolated instances would be exceptions than the rule.

Water Supply

The study indicates that the overall water supply situation, when looked at the city level, is reasonably adequate in most cities and towns, the problem in many cases lies in the poor distribution infrastructure. The water crisis is often related to the poor distribution of water than the lack of water at source (e.g. Delhi). However, there are urban centres where water source itself is depleting and is unable to cater to the water requirements of the urban centres (e.g. towns of Tamil Nadu, Andhra Pradesh).

In most cities there are more households than water supply connections, indicating that either there are many shared connections or households depend upon public stand posts. The data indicates that many households have their own sources of water supply while others complement own sources of supply with that of the public agency.

Unaccounted for water (UFW) data have been the most difficult to obtain. UFW is generally an estimate worked out by the technical staff based on their perception of the situation. Most cities do not have bulk meters or meters at all the user's end. This makes the task of calculating UFW very difficult. Therefore, the figures of UFW should be taken as the best estimates that could be made by the technical staff of the water-supplying agency. Smaller size towns that supply water from nearby sources or use ground water source have indicated very small quantity of UFW. Therefore, the study indicates that the larger cities have greater quantity of UFW than smaller size class of cities.

A very small percentage of urban centres have all connections metered (e.g. Bangalore, Pune). About one-third of the urban centres covered do not have any metered connections. In many urban centres a large percentage of domestic connections are unmetered while in a little above one-fourth urban centres all non-domestic connections are also unmetered. This needs to be taken up if tariff structures are to be rationalised and made a deterrent to wastage of water.

Tariff data indicates that uniform volumetric charges and fixed charges (ferrule based etc.) are the most common methods of charging. Incremental block tariff is mostly used in the larger cities, with a few exceptions. In many cities, non-domestic connections are metered while the domestic connections are unmetered. Since meters often do not work, many cities charge fixed tariff for water supply based on the calculated consumption patterns.

Most large cities depend upon surface sources for water supply, supplementing it with ground water sources to meet the demand. However, the share of ground water increases with a decrease in city size, with smaller size class of urban centres showing greater dependence on ground water for water supply. The large investments required to supply water from surface sources could be one reason for this pattern. This also reflects in the existence of water treatment plants. While all metro cities using surface source have water treatment plants, there is a small percentage of urban centres in other size classes that use surface water but do not have water treatment plants.

There are many different types of institutional arrangements for water supply in the urban areas of the country. The most common arrangement is that the capital works are done by a state level agency and the local government does the O&M. However, there are wide variations to this arrangement. These variations range from the state level agency managing the entire water supply system in the entire state (Rajasthan) to the urban local body performing all the tasks related to water supply (Mumbai).

Privatisation or public-private partnerships are still not very common in water supply with less than one-tenth of the urban centres using private participation in this service.

Cost recovery is a major concern in water supply. While it is possible to achieve cost-recovery in water supply, the fact is that almost four-fifths of the urban centres are unable to recover even the O&M cost in this service. This indicates that while theoretically water can be treated as an economic good, there are practical difficulties in implementing decisions on raising water tariff. Water continues to be treated, as a social good and even recovering O&M cost in most cities would require political consensus.

The additional capital investment requirements for covering the entire population with water supply in the years to come is enormous, running into thousands of crores of rupees. While it may be difficult to find resources to finance such large investments, private sector participation could be encouraged. Public-private partnerships could reduce the financial burden of public agencies to some extent and bring in some financial discipline into this sector. While efforts have to be made to improve efficiency of water supply to reduce operating costs, maintenance of existing assets would help in reducing new investment requirements in the near future.

Recommendations

1. Problems of intra-city distribution should be taken up immediately by the local authorities to address the problems of water shortage.

2. Steps should be taken to initiate capacity building in urban centres for estimation of UFW. Financial assistance should also be provided to the water supplying agencies to equip them with instruments for estimating UFW.

3. Metering of connections, both for bulk supply and retail distribution, must be encouraged. Standard meters should be made available, at reasonable cost, to all urban centres for this purpose.

4. Tariff is a major concern in the water sector. Tariff should be increased at certain given intervals, indexed to inflation and power tariff.

5. Getting surface water from distant sources is proving to be very expensive. Ground water depletion can be controlled by undertaking rainwater harvesting in all urban centres. Specific programmes/schemes should be initiated for aquifer re-charge.

6. In line with the provisions of 74th Constitution Amendment Act, the capacity of local governments should be built to manage water supply systems. The local governments should be given sufficient autonomy to decide on increase in water tariff required to cover at least O&M costs.

7. Improving cost recovery should be linked to giving grants. Financial incentives could be given to urban centres showing improved cost recovery. Technical assistance and guidance should also be provided to local authorities to improve financial performance.

8. Private sector participation in this sector should be encouraged, wherever possible. Unbundling of the service would allow private sector to participate in this service and improve efficiency levels.

9. The additional capital investments required to cover the entire urban population with water supply at the required norms will require huge investments that are not possible for the Government to provide. Therefore, public-private participation must be encouraged. New ways of financing for this sector should also be explored.

Sewerage and Sanitation

Wastewater disposal and treatment is a very major problem in most Indian cities. Non-collection of wastewater and discharge of untreated wastewater into low-lying areas or various water bodies causes sever water and land pollution problems. This situation reduces the availability of usable water for water supply.

The study indicates that while all the metropolitan cities have a sewerage system, a third- of the Class I cities and less than one-fifth of the smaller sized urban centres have a sewerage system. However, the coverage of population by the sewerage system is partial in all these urban centres.

Wastewater generation is calculated at a minimum of 80 per cent of water supplied. However, since people use their own sources of water, additional amounts of wastewater may be generated, which have been taken into account in the present study. Wastewater collection in most urban centres with sewerage system usually does not exceed about two-thirds of that generated. However, the wastewater treatment situation is quite alarming. While the smaller sized urban centres with sewerage system treat less than one-fourth of the wastewater generated, even the metropolitan cities treat only about two-fifths of the wastewater generated. Wastewater disposal is done both on land and in water body by most urban centres. Proximity to water body, local conditions and financial constraints determine the place and method of wastewater disposal.

Recycling/reuse of wastewater is practised in very few urban centres and wherever it is done, it is mostly used for agriculture or horticultural purposes. Recycling/reusing wastewater will reduce the demand for fresh water, thereby also postponing the capital investment requirements for water augmentation.

There is no fixed mechanism for charging for wastewater collection and disposal. The charging may be through property tax, a charge on water closet or an additional charge on water supplied.

Wastewater is not charged for in all urban centres, therefore, the cost recovery is generally very low from this service with even the metro cities showing a very small recovery rate. The situation is even worse in urban centres of smaller size. In most cities where the recovery rate has been very good, the reasons have been either due to provision of new connections (connection charges) or due to levying of sewerage/drainage tax.

The additional capital investment required for providing safe sanitation to all in the coming years many is thousands of crores, which would be very difficult to finance. Private sector participation as well as citizen's contribution can help provide some of the additional capital investment requirements.

Recommendations

1. Rehabilitation of sewerage systems must be taken up in all the cities where the sewerage system exists but has become non-functional.

2. Wastewater treatment must be made mandatory for all sizes of urban centres. The smaller urban centres could use less capital-intensive technologies to reduce capital cost as well as maintenance cost of treatment.

3. Pollution of land or water body with untreated wastewater should be made punishable with fine.

4. Recycling/reuse of wastewater must be encouraged. Technical and financial assistance must be provided for this, if required.

5. All agencies dealing with wastewater must prepare plans for cost recovery from this service. Private sector participation could be encouraged in managing this service to reduce public expenditure.

6. Successful examples of people's participation in contributing to the cost of construction of sewerage system (e.g. Alandur) must be examined and adopted in other urban centres of the country.

Solid Waste Management

Municipal solid waste management is an obligatory function of the urban local governments. And this is one service that remains a major problem for urban centres of all sizes.

The per capita waste generation has a positive correlation to the size class of urban centres i.e. the larger the urban centre the more the waste generated.

The collection efficiency of solid waste is much better in larger cities than in smaller urban centres. This could also be due to the motorised transportation vehicles deployed in larger cities. Some of the smaller urban centres still depend on tricycles and animal carts for waste collection. A factor that affects waste collection and transportation is the maintenance of vehicles. Poor maintenance of fleet affects collection and transportation efficiency. Vehicles, especially in smaller urban centres, are often not replaced even when there is a dire need to replace them. Lack of finances for fleet replacement is a major cause of this state of affairs.

The main method of waste disposal continues to be open dumping in most urban centres. While many urban centres have landfill sites, not all dispose their waste in these landfill sites as sometimes the sites are far away from the city and the transportation costs become prohibitive. Therefore, waste is dumped in some low-lying areas or disposed off just outside the city periphery.

Hospital waste, though should be collected separately, is collected in a combined manner in a majority of urban centres, including some of the metropolitan cities.

Solid waste management is a labour intensive activity requiring adequate staff. However, with a few exceptions, most urban centres fall short of staff for this activity. This impacts the quality of service provided.

Privatisation is much more prevalent in this service than in the other two services covered in the study. Many urban centres that have used this arrangement have been able to reduce their expenditure on this service.

Cost recovery from solid waste management is extremely poor and therefore it becomes an expenditure heavy service. Expenditure on establishment is the biggest head of expenditure on this service. Most urban centres spend over three-fourths of their solid waste management budget on establishment.

The additional capital investment requirements worked out for this service in the coming years indicate an investment of a couple of hundred crores per annum. However, these figures will need to be revised taking into account the Hon'ble Supreme Court's directives. As construction of sanitary landfills is very expensive, this would add considerably to the investment requirements.

Recommendations

1. Three 'R's of solid waste management i.e. reduce, reuse and recycle must be adopted by all urban centres. This will help in reducing the quantum of solid waste that the local governments have to deal with.

2. Efficiency of waste collection must be improved in cities by bringing about the necessary changes in the design of equipment used by sanitary staff, manpower management and planning.

3. Transportation fleet needs to be maintained well and needs to be modernised to improve collection and transportation efficiency.

4. Crude/open dumping of waste must be completely discouraged by encouraging controlled tipping.

5. All urban centres should identify landfill sites that are usable. In order to reduce the quantity of waste that goes to landfill sites, waste treatment such as neighbourhood composting and recycling of waste must be encouraged.

6. Separate collection of hospital waste must be ensured in every city and incinerators must be installed to deal with this waste. Landfill sites should apportion an area for the disposal of hazardous waste from hospitals.

7. Private sector participation must continue to be encouraged in this sector to achieve efficiency of operations and cost reduction. However, monitoring of privatised activities should be improved in order to provide better quality of services to the people.

8. Plans to improve cost recovery from this service must be made by every local government. New sources of revenue generation must be thought of.

9. People's participation must be encouraged to keep cities clean and NGOs must be used to do IEC work in communities.

Summary of Key Indicators for Water Supply – 1999				
				(Averages)
Indicators	Metropolitan cities	Class I cities	Class II towns	Total
No. of sampled urban centres	22	164	115	301
Estimated population (1999) in '000	71,429	59,123	10,473	141,025
Population coverage (%)	98	91	89	94
Per capita supply (lpcd)	182	124	83	150
Per capita domestic supply (lpcd)	148	106	69	128
% urban centres with p.c. supply below CPHEEO norm	50	40	52	46
% urban centres with p.c. supply below city norm	68	76	79	77
% supply required to be added to reach city norms	5	25	42	13
Quantity of water required to be added to reach city norms (in mld)	1397	2209	439	4045
Unaccounted for water (%)	24	16	11	21
% connections metered	60	52	39	55
Staff per 1000 connections	14.5	7.9	6.8	10.9
Cost recovery (%)	70	55	44	65
Revenue receipts (Rs.) per kl.	2.16	1.02	1.21	1.73
Revenue expenditure (Rs.) `per kl.	3.09	1.88	2.44	2.66
Deficit per kl. (Rs.)	-0.93	-0.86	-1.23	-0.93
Revenue receipts per capita (Rs. /annum)	149.43	48.65	39.41	100.55
Revenue expenditure per capita (Rs./annum)	214.12	89.40	77.86	153.89
Per capita deficit (Rs./ annum)	-64.69	-40.75	-38.45	-53.34
Additional capital investment requirements* (1999-2022) range between Rs. 32118 and Rs. 35420 crores or between Rs.1396 and Rs. 1540 crores per annum.				
Note: Revenue and expenditure figures are for financial year 1997-98. pc. refers to per capita **These requirements are for covering the entire urban population, in all size classes of urban centres, till the year 2022 and are based on two different per capita estimates used for projection.*				

Summary of Key Indicators for Wastewater Management and Low Cost Sanitation - 1999				
				(Averages)
Indicators	Metropolitan cities	Class I cities	Class II towns	Total Sample
No. of urban centres with sewerage system	22	57	21	100
Population covered by sewerage system (%)	63	48	51	58
% Wastewater treated to generated	41	25	11	37
% Urban centres without STP	4	28	17	49
Wastewater discharged untreated (mld)	6483	2472	185	9140
Cost Recovery (%) – excluding outlyers#	15	14	2	15
Cost Recovery (%) – including outlyers#	146	29	35	127
Low Cost Sanitation (LCS)				
No. of urban centres giving LCS data	18	127	95	240
% population dependent on LCS	25	41	55	34
Additional capital investment requirements* (1999-2022) range between Rs. 52361 and Rs. 86103 crores or between Rs. 2276 and Rs. 3744 crores per annum.				
Note: All data relating to sewerage system and wastewater pertain only to urban centres having sewerage system. *# Cost recovery figures refer to financial year 1997-98. Outlyers are those few urban centres that are showing exceptionally high recovery rate of over 100 per cent. These urban centres include those that are collecting sewage/ drainage tax or cess or those that have generated unusually large revenues from providing new connections in 1997-98.* ** These requirements are for covering the entire urban population, in all size classes of urban centres, till the year 2022 and are based on two different per capita estimates used for projection.*				

Summary of Key Indicators for Solid Waste Management - 1999				
				(Averages)
Indicators	Metropolitan cities	Class I cities	Class II towns	Total Sample
No. of responding urban centres	22	164	112	298
Population coverage (%)	90	95	93	92
Per capita waste generation (grams)	500	377	297	433
Waste collection efficiency (%)	91	85	75	88
Quantity of uncollected waste (MT/ day)	3170	3383	765	7318
Crude dumping of waste (% urban centres)	64	76	79	76
Sanitary workers per 1000 population	2.8	1.9	2.1	2.4
Share of establishment exp. on the service	81	84	81	82
Cost recovery (%)	7	9	5	7
Revenue receipts per capita (Rs. /annum)	12.8	6.66	2.96	10.12
Revenue expenditure per capita (Rs./annum)	189.39	73.12	63.15	140.63
Per capita deficit (Rs./ annum)	176.59	66.46	60.19	130.51
Additional capital investment requirements* (1999-2022) are projected to be about Rs. 3954 crores or Rs. 172 crores per annum.				
Note: Revenue and expenditure figures refer to financial year 1997-98 **These requirements are for covering the entire urban population, in all size classes of urban centres, till the year 2022.*				

CHAPTER I
INTRODUCTION

1.1 BACKGROUND

Over 20 million people without access to safe water supply and over 100 million people without safe sanitation facilities is the present (1999) basic services scenario in the country. Clearly, the task at hand is challenging by any standard. With almost 7 million people being added to urban India every year, the situation is likely to get worse if the problem of basic services is not addressed immediately. Efforts are being made to provide basic services to those deprived of them, yet much more needs to be done to improve the quality of life in urban India.

India's ongoing economic liberalization programme aimed at increasing economic growth along with poverty reduction, needs to be supported by provision of basic infrastructure. Provision of water supply and sanitation will be essential to such growth to ensure sustainability.These services have to not only be provided but should meet minimum standards in terms of quantity, quality and reliability. Constraints and bottlenecks in this sector have to be addressed on a priority basis to keep up the momentum of economic growth.

Urban India is today faced with major problems such as shortage of safe drinking water, inadequate sanitation facilities and poor solid waste management services. With the urban population increasing from 160 million in 1981 to 217 million in 1991, and reaching 285 million in 2001 (Census of India, 2001), the infrastructure in urban areas has reached a breaking point. This situation has arisen because basic infrastructure has not kept pace with demand. In 1991, the urban population of the country was residing in 4689 towns/3768 urban agglomerations, as per the Census of India, 1991. The number of cities and towns has now increased to 5167 (Census, 2001). Increasing attention, therefore, needs to be focused on water supply, sanitation and solid waste management services as these affect the quality of life of citizens and the economic growth of the country.

Despite the importance of this sector, only a broad assessment of these services is available in the country. The Economic Survey, 1998-99[1] showed that while 91.82 per cent of the urban population in the country was covered by water supply, only 49.32 per cent of the urban population was covered by sanitation facilities. The data available with CPHEEO (for end-March, 1997) puts these figures at 90 per cent and 49 per cent respectively. The main data source, widely available, on the status of water supply, waste-water, and solid waste management for Class I and Class II cities and towns in the country is the one published by the Central Pollution Control Board. These data, however, cover only limited aspects of these services. There is almost a complete absence of data on the financial aspects of these services (such as water

tariff, income and expenditure on the service) as well as on the newly emerging aspects such as private sector involvement in municipal services.

Another aspect that is a cause of concern is the neglect of this sector from the standpoint of investments. While "water supply and sanitation sector continued to receive its due importance from the First Plan to the Fifth Plan, from the Sixth Plan onwards, there has been a gradual shift in the priority from urban to rural sector resulting into decreased percentage allocation".[2] This shift has occurred despite the increase in the proportion of urban population to the total population of the country over the years. In the First Five Year Plan, the Plan outlay for urban water supply and sanitation sector was Rs.43 crores and this increased to Rs. 549.44 crores in the Fifth Plan. However, in the Sixth Plan the relative allocation to the urban sector decreased to 1.81% as compared to 2.34% for rural. This downward trend continued in the subsequent Five Year Plans, resulting in inadequate outlays (1.38% of the public sector outlay) for urban sector as compared to 2.47% for the rural in the Eighth Plan. This has had an impact on the coverage of population by these services.

A serious attempt has to be made in the country to assess the financial requirements for this sector. The only estimates available today come from the Rakesh Mohan Committee Report[3] or from the Report of the Working Group on Urban Water Supply and Sanitation Sector for Ninth Five Year Plan (1997-2002). However, the Rakesh Mohan Committee's financial requirement estimates give the investment requirements for these sectors for urban areas as a whole and do not disaggregate them by size class of urban centres. The Working Group's estimates, on the other hand, are grouped into two - Class I and Class II to VI, but have a target year only till the end of the Ninth Plan i.e. till March 2002. There is thus a need to estimate the financial requirements for a longer period of time in a disaggregated manner. This would help in long term planning for the sector.

In the present study an attempt is made to provide the status of water supply, sewerage & low cost sanitation, and solid waste management (for the year 1999) in 300 selected cities and towns in the country including metropolitan cities (Table 1.1).

1.2 OBJECTIVES

The main objective of the present study is to assess the status of water supply, sanitation and solid waste management in selected 300 cities and towns of India and to estimate the requirement of funds for full coverage of population by these services in the urban areas of the country. The detailed objectives of the study are:

- To assess the current status of water supply, sanitation (including on-site sanitation) and solid waste management in the metropolitan cities, Class I and Class II towns of the country using data from a sample of 300 metropolitan, Class I and Class II towns.

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[2] Report of the Working Group on Urban Water Supply and Sanitation Sector for Ninth Five Year Plan (1997-2002), Department of Urban Development, Ministry of Urban Affairs and Employment, Government of India, New Delhi, July 1996.
[3] "The India Infrastructure Report: Policy Imperatives for Growth and Welfare", Expert Group on the Commercialisation of Infrastructure Projects, NCAER, New Delhi, 1996.

- To analyze the revenue receipts and revenue expenditure of the selected services, i.e. water supply, sanitation and solid waste management and also to study the capital investments on these services for the sampled cities and towns.
- To estimate the capital investment requirements for full coverage of population by these services from 1999 to 2022 A.D. (at 5 yearly intervals) for metropolitan cities and for all classes of towns by size class.

The status of water supply broadly covers the following aspects:

(a) institutional arrangements for water supply

(b) the population served and per capita availability of water

(c) sources of water supply and distance to sources

(d) water supply by uses

(e) water losses

(f) water connections and other physical aspects

(g) water treatment

(h) privatisation aspects

(i) staff position

(j) water tariff

(k) revenue and expenditure on water supply

(l) capital works undertaken and proposed to be undertaken and their per capita costs

The status of sewerage and sanitation broadly covers the following aspects:

(a) population coverage by sewerage system

(b) waste water generation and collection

(c) treatment of waste water

(d) recycling and reuse of waste water

(e) revenue and expenditure on the sewerage system

(f) staff position

(g) privatisation aspects

(h) capital works undertaken and proposed to be undertaken and their per capita costs

(i) population covered by septic tanks and low cost sanitation facilities

The status of solid waste management broadly covers the following aspects:

(a) population covered by the service

(b) quantity of waste generated and collected

(c) transportation of waste

(d) waste disposal methods

(e) details of treatment and disposal

(f) staff position

(g) privatisation aspects

(h) revenue and expenditure on solid waste management

(i) capital expenditure incurred and proposed to be incurred and their per capita costs

A further attempt is made in the study to estimate the future investment requirements. This estimate is based on:

(a) population projected for various years

(b) per capita cost of services

(c) backlog population to be covered and additional population to be covered in the years to come

1.3 DATA BASE

The study covers a sample of 300 cities and towns drawn from metropolitan, Class I and Class II population size classes (for a list of selected cities/towns see Table 1.1). The study covers the entire country, i.e., all the 25 States and 7 Union Territories[4]. All state and union territory capitals have also been covered in the study, regardless of their size class, except for, Patna and Gandhinagar, where despite efforts, information could not be obtained from the concerned agencies.

The data for the study has been obtained from the respective urban local bodies, water supplying authorities and agencies doing capital works in the selected sample cities and towns. The data, in the present study, has been organised into three groups – metropolitan cities, Class I cities and Class II towns based on 1991 Census population figures.

The metropolitan cities include 22** cities and urban agglomerations with million plus population (as per Census of India, 1991). However, the population of only the main city in the agglomeration has been taken in the present study. Therefore, six cities in the metropolitan urban agglomerations list, which do not reach the million mark (as per 1991 Census), have been included in the metropolitan cities group (Table 1.2). This has been done in order to keep with the general perception of 23 metropolitan cities in the country.

The Class I cities, in the present study, include cities with a population of between 100,000 and 1,000,000. In all the tables in the report, metropolitan cities have been

[4] At present there are 28 states in the country but at the time of survey there were only 25 states.

*** Patna could not be included in the sample due to lack of response.*

excluded from Class I cities group. This has been done in order to highlight the status of services in the Class I cities, other than the metropolitan cities.

The Class II towns, are towns with a population of between 50,000 and 100,000. However, in the tables in the report, six towns with a population of less than 50,000 have been included in Class II towns. These are the capitals of the relatively small states and union territories (Table 1.1). This has been done to avoid a fourth classification of towns and arriving at extreme results due to the very small number of sample towns in this category. The inclusion of these six towns in Class II category does not alter the major findings of the study.

1.4 METHODOLOGY

As mentioned earlier, the responsibility for providing water supply and sanitation rests with different agencies in different states. Therefore, data in respect of these services has been obtained only from the respective agencies.

1.4.1 Selection of Towns

- Selection of cities/towns has been done on purposive sampling basis. Of the total 305 cities/towns that were selected, the sample was divided amongst the Class I and Class II towns in a 2:1 ratio. This was done purposely in order to give greater representation to Class I cities as these cities form a very large proportion of the total urban centres in the country.

- While selecting the towns from Class I size class, due consideration was given to the towns with population of upto 5 lakhs, between 5 to 10 lakhs and above 10 lakhs.

- All the state and union territory capitals, irrespective of their size class and all the metropolitan cities were included in the sample selected. However, reponse could not be obtained from Patna and Gandhinagar.

- Keeping in mind the time frame for the fieldwork, it was decided to select cities that had relatively better accessibility. Some towns were also selected in clusters in order to facilitate information collection.

- In selecting the sample towns, care was taken to see that there was sufficient geographical coverage within each state. In states where there were very few Class I and II towns, this type of geographical coverage was not possible.

- Urban agglomerations, as agglomerations, have not been included in the sample. In most cases, only the main city/town in urban agglomerations have been included in the list of selected towns. If the population of the main town in the agglomeration fell below Class II level then the town was not selected.

- Only towns with municipal status were selected. Exceptions were only those state/ union territory capitals which had to be selected but did not have a municipal civic status.

- In the selected towns, only the area falling under municipal jurisdiction has been covered. Areas outside municipal jurisdiction have not been covered by the study.

- In the towns without municipal bodies, area within the jurisdiction of the main authority in-charge of providing the selected services have been covered.

- A list of alternate cities/towns was also prepared simultaneously. This list consisted of the remaining Class I and II towns, which were not included in the main list of sample towns. This list was made in order to provide alternate sample towns for survey in case there was a problem in data collection in the selected towns.

- Selection of cities/towns was done in consultation with CPHEEO.

1.4.2 Questionnaires

A specially designed questionnaire was prepared for each service covered in the study i.e., water supply, sanitation and solid waste management for collecting information from the selected cities and towns.

- Based on a questionnaire given by CPHEEO, a specially designed questionnaire was prepared, incorporating many new aspects in order to provide better understanding of the subject.

- The questionnaires were designed keeping in mind the objectives of the study and the clarity required at the field level for filling the questionnaire.

- The size of the questionnaire was also an important consideration while designing the questionnaire as the survey had to be completed within a specified time frame.

- Based on the agencies providing the services covered by the study, the questionnaire was divided into three parts viz., water supply, sewerage and sanitation, and solid waste management.

- The questionnaire was also translated into Hindi in order to facilitate collection of information in the northern states of the country.

- The questionnaires were field tested before finalization. This step helped in refining the questionnaires – both in content and in design (see Annex 1 for the questionnaires used in the survey).

1.4.3 Data Collection

While the institutional arrangements for providing water supply and sewerage in different states and union territories vests with different agencies, at times, even within the same state different towns have different arrangements. In a given state there could be one agency responsible for capital works (i.e. execution of projects)

and another for operation and maintenance. The agencies could be fully government departments, semi-autonomous boards and autonomous boards. Therefore, the study had to obtain data from different public agencies in different states for water supply and sewerage. However, in almost all the states and union territories, the responsibility for solid waste management vests only with the local governments. Exceptions to this are mainly found in small states and union territories.

Data was collected by first mailing the questionnaires and then making personal visits to the selected towns.

a) Mailing

Questionnaires were mailed to different agencies in different towns. The questionnaire pertaining to water supply and sewerage was mailed to the agencies providing these services in the selected towns while the questionnaire pertaining to solid waste management was sent to respective local governments, with some exceptions.

b) Personal visits

Mailing of questionnaires to the selected towns was followed by personal visits to almost all the towns, exceptions being the North-eastern states, Andaman & Nicobar Islands, and Lakshadweep Islands. For personal visits, assistance of six agencies was sought covering different regions of the country (see Annex 2 for the list of collaborating agencies). This was done not only to save time and costs, but also to overcome the language barrier.

1.5 SCOPE AND LIMITATIONS

The study looks at only the public provision of selected services but does not cover private arrangements made by individuals, communities or NGOs. The study focusses on the city as a whole, and does not focus in detail on any specific group such as the community groups or slums. The study does not cover intra-city distribution of services, it only looks at the whole city as one unit.

The present study has not collected time series data but has collected data for one year only. Since the present study's focus is an overview of the status of the selected services in the country, there is no in-depth analysis of problems in the report.

1.6 TIME FRAME

The study had a time frame of one year starting March, 1999. However, due to the all-India nature of the survey, the holding of one General Election during the survey period and the happening of a major natural disaster like the cyclone in Orissa, and other problems like floods in Bihar and so on, and also local level problems in data collection, the study took longer to be completed than anticipated.

The major findings emerging from the survey were presented to the CPHEEO and the draft report with the major findings was submitted in June 2000. A suggestion was

made by the CPHEEO, at this stage, to change the organization of the data in the report so that instead of presenting the data state-wise, it would be presented class-wise. This entailed redoing all the tables and calculations, which further delayed the submission of the final report. A revised draft report, incorporating the suggestions given by the CPHEEO, was submitted to the Ministry of Urban Development (MOUD&PA) in March 2001. The report was scrutinized by the CPHEEO and comments sent to NIUA towards the end of 2001. The present report has incorporated all the comments given by the CPHEEO on the draft reports.

The data in the study pertains to the year 1999, except for the data on revenue and expenditure, which pertains to the financial year 1997-98.

1.7 PROCESSING OF DATA

The entire data collected from the field was processed and tabulated by the Institute's computer unit. This process, included writing of programme for data feeding, coding of data, scrutinizing, preparing tables for the report as well as for the statistical volumes.

1.8 STUDY OUTPUT

The study's outputs are the following:

- Assessment of the current status of water supply, sanitation (including on-site sanitation) and solid waste management in the metropolitan cities and selected Class I cities & Class II towns of the country.

- Analysis of revenue income and revenue expenditure on the selected services, i.e. water supply, sanitation and solid waste management services.

- Estimation of future investment requirements for full coverage of population up to 2022 A.D. at five year intervals, i.e., for 2002, 2007, 2012, 2017 and 2022, for all classes of cities and towns in the country.

1.9 ORGANISATION OF THE REPORT

The present report has been organised into five chapters. Chapter I contains the introduction to the study. Chapters II, III and IV present the status of water supply, sewerage & low cost sanitation, and solid waste management services respectively, along with the additional investment requirements for each service. The final chapter, Chapter V, presents the broad conclusions and summary of results emerging from the study.

The data pertaining to the three services covered in the study have been presented in the appendices. Appendix I gives data on Water Supply and Water Tariff, Appendix II gives data on Wastewater Management and Low Cost Sanitation and Appendix III gives data on Solid Waste Management.

Table – 1.1: List of Sampled Cities and Towns			
Sl. No.	City/town	State	Population 1991 (Census)
	Metropolitan Cities		
1	Ahmedabad M.Corp.	Gujarat	2,876,710
2	Bangalore M. Corp.	Karnataka	2,660,088
3	Bhopal M. Corp.	Madhya Pradesh	1,062,771
4	Calcutta M. Corp.	West Bengal	4,399,819
5	Chennai M. Corp.	Tamil Nadu	3,841,396
6	Coimbatore M.Corp.	Tamil Nadu	816,321
7	Delhi M. Corp.	Delhi	7,206,704
8	Greater Mumbai M.Corp.	Maharashtra	9,925,891
9	Hyderabad M. Corp.	Andhra Pradesh	2,964,638
10	Indore M. Corp.	Madhya Pradesh	1,091,674
11	Jaipur M. Corp.	Rajasthan	1,458,483
12	Kanpur M. Corp.	Uttar Pradesh	1,874,409
13	Kochi M. Corp.	Kerala	564,589
14	Lucknow M. Corp.	Uttar Pradesh	1,619,115
15	Ludhiana M. Corp.	Punjab	1,042,740
16	Madurai M. Corp.	Tamil Nadu	940,989
17	Nagpur M. Corp.	Maharashtra	1,624,752
18	Pune M. Corp.	Maharashtra	1,566,651
19	Surat M. Corp.	Gujarat	1,498,817
20	Vadodara M. Corp.	Gujarat	1,031,346
21	Varanasi M. Corp.	Uttar Pradesh	929,270
22	Visakhapatnam M. Corp.	Andhra Pradesh	752,037
	Class I		
	Andhra Pradesh		
1	Anantapur MCl		174,924
2	Chittoor M		133,462
3	Cuddapah MCl		121,463
4	Eluru M		212,866
5	Guntur MCl		471,051
6	Hindupur M		104,651
7	Kakinada M		279,980
8	Kurnool MCl		236,800
9	Machilipatnam M		159,110

Sl. No.	City/town	Population 1991 (Census)
10	Nandyal MCI	119,813
11	Nellore MCI	316,606
12	Nizamabad M	241,034
13	Ongole MCI	100,836
14	Qutubullapur M	106,591
15	Rajahmundry M. Corp.	324,851
16	Tenali M	143,726
17	Tirupati MCI	174,369
18	Vijayawada M. Corp.	701,827
19	Warangal M. Corp.	447,657
	Bihar	
20	Bihar Sharif M	201,323
21	Chhapra M	136,877
22	Gaya M. Corp.	291,675
23	Katihar M	135,436
24	Munger M	150,112
25	Ranchi M. Corp.	599,306
	Gujarat	
26	Anand M	110,000
27	Bharuch M	133,102
28	Bhavnagar M. Corp	402,338
29	Bhuj M	102,176
30	Jamnagar M. Corp.	341,637
31	Junagadh M	130,484
32	Nadiad M	167,051
33	Navsari M	126,089
34	Porbandar M	116,671
35	Rajkot M. Corp.	559,407
36	Surendranagar M	106,110
	Haryana	
37	Ambala MCI	119,338
38	Faridabad M. Corp.	617,717
39	Gurgaon MCI	121,486
40	Hisar MCI	172,677
41	Karnal MCI	176,131

Sl. No.	City/town	Population 1991 (Census)
42	Rohtak MCI	216,096
	Jammu & Kashmir	
43	Jammu M. Corp.	716,000
	Karnataka	
44	Belgaum M. Corp.	326,399
45	Bellary CMC	245,391
46	Davangere MCI	266,082
47	Gadag-Betigeri CMC	134,051
48	Gulbarga M. Corp.	304,099
49	Hubli-Dharwar M. Corp.	678,298
50	Mandya M	120,265
51	Mangalore M. Corp.	273,304
52	Mysore M. Corp.	480,692
53	Shimoga CMC	179,258
54	Tumkur M	138,903
	Kerala	
55	Alappuzha MC	174,666
56	Kollam MC	139,852
57	Kozhikode M. Corp.	419,831
58	Thalaserry M	103,579
59	Thiruvananthapuram M. Corp.	524,006
	Madhya Pradesh	
60	Bhind M	109,755
61	Burhanpur M. Corp.	172,710
62	Dewas M. Corp.	164,364
63	Guna M	100,490
64	Gwalior M. Corp.	690,765
65	Jabalpur M. Corp.	741,927
66	Khandwa M	145,133
67	Morena M	105,135
68	Murwara (Katni) M. Corp.	163,431
69	Ratlam M. Corp.	183,375
70	Rewa M. Corp.	128,981
71	Satna M. Corp.	156,630
72	Shivpuri M	108,277

Sl. No.	City/town	Population 1991 (Census)
	Maharashtra	
73	Amravati M. Corp.	421,576
74	Aurangabad M. Corp.	573,272
75	Bhusawal MCI	145,143
76	Chandrapur MCI	226,105
77	Dhule MCI	278,317
78	Ichalkaranji MCI	214,950
79	Jalgaon MCI	242,193
80	Kolhapur M. Corp.	406,370
81	Nanded Waghala M. Corp.	275,083
82	Nashik M. Corp.	656,925
83	Parbhani MCI	190,255
84	Solapur M. Corp.	604,215
85	Wardha M	102,985
86	Yavatmal MCI	108,578
	Orissa	
87	Bhubaneswar M. Corp.	411,542
88	Cuttack M. Corp.	403,418
89	Puri M	125,199
90	Rourkela M	140,408
91	Sambalpur M	131,138
	Punjab	
92	Amritsar M. Corp.	708,835
93	Bathinda MCI	159,042
94	Hoshiarpur MCI	122,705
95	Jalandhar M. Corp.	509,510
96	Moga MCI	108,304
97	Pathankot MCI	123,930
98	Patiala M. Corp.	238,368
	Rajasthan	
99	Ajmer MCI	402,700
100	Alwar M	205,086
101	Beawar M	105,363
102	Bhilwara M	183,965
103	Bikaner M	406,289

Sl. No.	City/town	Population 1991 (Census)
104	Jodhpur M. Corp.	666,279
105	Kota M. Corp.	537,371
106	Sriganganagar M	161,482
	Tamil Nadu	
107	Cuddalore M	144,561
108	Dindigul M	182,477
109	Erode M	159,232
110	Kanchipuram M	144,955
111	Kumbakonam M	139,483
112	Nagercoil M	190,084
113	Rajapalayam M	114,202
114	Salem M. Corp.	366,712
115	Thanjavur M	202,013
116	Tiruchirapalli M. Corp.	668,648
117	Tirunelveli M. Corp.	374,050
118	Tiruvannamalai M	109,196
119	Tiruppur M	235,661
120	Tuticorin M	199,854
121	Vellore M	175,061
	Uttar Pradesh	
122	Agra M. Corp.	891,790
123	Aligarh M. Corp.	480,520
124	Allahabad M. Corp.	792,858
125	Bareilly M. Corp.	587,211
126	Etawah MB	124,072
127	Faizabad MB	124,437
128	Firozabad MB	215,128
129	Ghaziabad M. Corp.	454,156
130	Gorakhpur M. Corp.	505,566
131	Haldwani-cum-Kathgodam MB	104,195
132	Hapur MB	146,262
133	Hardwar MB	147,305
134	Jhansi MB	300,850
135	Mathura MB	226,691
136	Meerut M. Corp.	753,778

Sl. No.	City/town	Population 1991 (Census)
137	Mirzapur MB	169,336
138	Moradabad M. Corp.	429,214
139	Muzaffarnagar MB	240,609
140	Rae Bareli MB	129,904
141	Rampur MB	243,742
142	Saharanpur MB	374,945
143	Sitapur MB	121,842
144	Unnao MB	107,425
	West Bengal	
145	Asansol M. Corp.	262,188
146	Baharampore M	115,144
147	Balurghat M	119,796
148	Bankura M	114,876
149	Barasat M	177,097
150	Burdwan M	102,660
151	Halisahar M	114,028
152	Krishnagar M	121,110
153	Midnapore M	125,498
154	North Barrackpore M	100,606
155	Santipur M	109,956
156	Siliguri M. Corp.	338,361
	Small States	
	Assam	
157	Guwahati M. Corp.	584,342
158	Jorhat MB	112,000
	Manipur	
159	Imphal MCl	198,535
	Meghalaya	
160	Shillong MB	131,719
	Mizoram	
161	Aizawl NM	155,240
	Tripura	
162	Agartala MCl	157,358
	Union Territories	
163	Chandigarh M. Corp.	504,094

Sl. No.	City/town	Population 1991 (Census)
164	Pondicherry M	203,065
	Class II	
	Andhra Pradesh	
1	Anakapalle M	84,356
2	Dharmavaram M	78,961
3	Gudur MCI	55,984
4	Kapra M	87,747
5	Kavali MCI	65,910
6	Madanapalle M	73,820
7	Narasaraoper M	88,726
8	Rajendra Nagar MCI	84,520
9	Sangareddy MCI	50,123
10	Srikakulam MCI	88,883
11	Srikalahasti M	61,578
12	Suryapet MCI	60,630
	Bihar	
13	Buxar M	55,753
14	Deoghar M	76,380
15	Hajipur M	87,687
16	Hazaribagh M	97,824
17	Jehanabad M	52,332
18	Madhubani M	54,091
19	Mokama M	59,528
	Gujarat	
20	Amreli M	67,827
21	Ankleswar M	51,739
22	Dabhoi M	50,641
23	Dohad M	66,500
24	Gondal M	80,584
25	Jetpur M	73,560
26	Mehsana M	88,201
27	Palanpur M	80,657
	Haryana	
28	Jind MCI	85,315
29	Kaithal MCI	71,142

Sl. No.	City/town	Population 1991 (Census)
30	Rewari MCI	75,342
31	Thanesar MCI	81,255
	Jammu & Kashmir	
32	Srinagar M. Corp.	N.A.
	Karnataka	
33	Bagalkot CMC	76,903
34	Chikmagalur CMC	60,816
35	Gokak CMC	52,080
36	Hospet CMC	96,322
37	Kolar CMC	83,287
38	Rabkavi-Banhatti CMC	60,609
39	Ramanagaram CMC	50,437
	Kerala	
40	Changanessry MC	52,445
41	Payyanur M	64,032
42	Taliparamba M	60,226
43	Thrissur MC	74,604
	Madhya Pradesh	
44	Hoshangabad M	70,914
45	Itarsi M	77,334
46	Khargone M	66,786
47	Mandsaur M	95,907
48	Nagda M	79,622
49	Neemuch M	86,439
50	Sehore M	71,456
51	Shahdol M	55,508
52	Vidisha M	92,922
	Maharashtra	
53	Amalner MCI	76,442
54	Ballarpur MCI	83,511
55	Bhandara M	71,813
56	Kamptee MCI	78,612
57	Manmad MCI	61,312
58	Ratnagiri MCI	56,529
59	Satara MCI	95,180

Sl. No.	City/town	Population 1991 (Census)
60	Virar MCl	57,600
	Orissa	
61	Balangir M	69,920
62	Bhadrak M	76,435
	Punjab	
63	Firozpur MCl	78,738
64	Kapurthala M	64,567
65	Mansa MCl	55,089
66	Phagwara MCl	83,163
67	Sangrur MCl	56,419
	Rajasthan	
68	Banswara M	66,632
69	Barmer M	68,625
70	Bundi	65,047
71	Churu M	82,464
72	Hanumangarh M	78,525
73	Sawai Madhopur M	72,165
	Tamil Nadu	
74	Ambur M	75,911
75	Arajjiban M	71,928
76	Attur M	55,667
77	Cambam M	52,435
78	Dharmapuri M	59,318
79	Guduivattam M	83,232
80	Nagapattinam M	86,489
81	Pudukkottai M	99,053
82	Sivakasi M	65,593
83	Srivilliputtur M	68,644
84	Tindivanam MC	61,579
85	Udhagamandalam M	81,763
	Uttar Pradesh	
86	Auraiya MB	50,772
87	Balrampur MB	59,619
88	Basti MB	87,371
89	Bhadohi MB	64,010
90	Chandpur MB	55,825

Sl. No.	City/town	Population 1991 (Census)
91	Etah MB	78,458
92	Ghazipur MB	76,547
93	Gonds MB	95,553
94	Lakhimpur MB	79,951
95	Lalitpur MB	79,870
96	Mughalsarai MB	66,529
97	Nawabganj-Barabanki MB	65,582
98	Orai MB	98,716
99	Roorkee MB	80,262
	West Bengal	
100	Bishnupur M	56,128
101	Chakdaha M	74,769
102	Contai M	53,484
103	Cooch Behar M	71,215
104	Darjeeling M	71,470
105	Jalpaiguri M	68,732
106	Jangipur M	55,981
107	Katwa M	55,541
108	Raniganj M	61,997
	Small States	
	Himachal Pradesh	
109	Shimla M.Corp.	82,054
	Nagaland	
110	Kohima TC	51,418
	Union Territories	
111	Port Balir MCI	74,955
	Others (Smaller than Class II towns)	
	Arunachal Pradesh	
112	Itanagar CT	16,545
	Goa	
113	Panaji MCI	43,349
	Sikkim	
114	Gangtok NTAC	25,024
	Union Territories	
115	Daman MCI	26,906
116	Kavarathi NMCT	8,677
117	Silvassa	11,725

Table – 1.2: Population of Metropolitan Urban Agglomerations and Metropolitan Ciies

(as per 1991 Census)

Sl. No.	City	Population of urban agglomeration	Population of the main city in the agglomeration
1	Greater Mumbai	12,596,243	9,925,891
2	Calcutta	11,021,918	4,399,819
3	Delhi	8,419,084	7,206,704
4	Chennai	5,421,985	3,841,396
5	Hyderabad	4,344,437	2,964,638
6	Bangalore	4,130,288	2,660,088
7	Ahmedabad	3,312,216	2,876,710
8	Pune	2,493,987	1,566,651
9	Kanpur	2,029,889	1,874,409
10	Lucknow	1,669,204	1,619,115
11	Nagpur	1,664,006	1,624,752
12	Surat	1,518,950	1,498,817
13	Jaipur	1,518,235	1,458,483
14	Kochi	1,140,605	564,589
15	Vadodara	1,126,824	1,031,346
16	Indore	1,109,056	1,091,674
17	Coimbatore	1,100,746	816,321
18	Patna	1,099,647	917,243
19	Madurai	1,085,914	941,989
20	Bhopal	1,062,771	1,062,771
21	Vishakhapatnam	1,057,118	752,037
22	Ludhiana	1,042,740	1,042,740
23	Varanasi	1,030,863	929,270
	Total	70,996,726	52,667,453

Note: 1. There are 23 million plus cities/urban agglomerations and only 18 million plus cities in country as per 1991Census.

2. Kalyan Municipal Corporation, falling within Greater Mumbai urban agglomeration, has a population of 1,014,557.

This makes Kalyan a metropolitan city, by definition. However, Kalyan has not been included in the above list of metropolitan cities because only the main city of the agglomeration has been considered.

Source: Census of India 1991, Series 1 – India, General Population Tables Part II-A (ii) Towns and Urban Agglomerations 1991 with their Population 1901-1991, Tables A-4, P.42 and p.204

CHAPTER II
STATUS OF WATER SUPPLY

2.1 INTRODUCTION

Indian cities and towns are increasingly facing potable water crisis due to mounting demand and inadequate measures to meet the demand. This situation is the result of an increase in urban population, depletion of nearby water sources, water pollution, inefficient use of water, inefficient management of water supply systems and multiple institutional arrangements. This situation needs to be improved so that water is available to all at a reasonable cost. The present scenario of the public water supply system, thus, needs to be understood well in order to take steps to improve the system.

This chapter presents the status of public water supply system in 301 sampled Class I and Class II urban centres, including most of the metropolitan cities in the country (as per Census of India, 1991). The total population covered by these 301 urban centres is 141.02 million, that is, 71.43 million in 22 metropolitan cities, 59.12 million in 164 Class I cities and 10.47 million in 115 Class II towns (Table A-1 in Appendix I). The chapter covers different aspects of water supply including coverage, quantity supplied, per capita supply, norms for supply, unaccounted for water, water connections, source and storage of water, water treatment, institutional arrangements, staff position, privatisation and financial aspects of water supply. The chapter finally gives the additional capital investment requirements for covering the entire population by water supply till the year 2022.

2.2 COVERAGE OF POPULATION BY WATER SUPPLY

The Approach Paper to the Ninth Plan (1997-2002) estimates that 85 per cent of the country's urban population has access to water supply. The Plan states that 100 per cent of the population should be covered by water supply by the year 2002.

One of the obligatory functions of local bodies is to provide water supply to the residents. Although this function has been taken over by para-statals or city level boards in many urban centers, providing safe water to the entire population remains the duty of the concerned public authority. However, covering the entire population by water supply requires continuous investment in expanding and improving the water supply system. The coverage of population by water supply has improved over the years, however, 100 per cent coverage of urban population will take sometime to achieve.

The average coverage of population by formal water supply in the sampled urban areas is reasonably high with 94 per cent of the population being covered by the service. The coverage is higher in the metropolitan cities (98%) than in Class I cities (91%) and Class II towns (89%). (Table 2.1).

However, the term coverage[5] has to be read with caution as it only indicates the reach of the public water supply system but does not indicate the quantity, quality, and duration of supply or the mode of provision to the covered population.

Table - 2.1: Coverage* by Water Supply (1999)

(no. of cities/towns)

Population covered by the service (%)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 50	0	6	7	13	4
50 to <75	3	21	10	34	11
75 to <100	0	27	25	52	17
100	19	108	72	199	66
Data not available	0	2	1	3	1
No. of cities/towns	22	164	115	301	100
Average coverage (%)	98	91	89	94	
Range (%)	50-100	20-100	12-100	12 - 100	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 1 for details
** Coverage indicates coverage by house service connections, tankers and by public stand posts.*

Most metropolitan cities have 100 per cent of population covered by water supply except for Kanpur, Ludhiana and Varanasi which have reported coverage between 50 and 70 per cent.

Two-thirds of the Class I sampled cities have 100 per cent population covered by the service while in Class II towns about 63 per cent, have reported 100 per cent coverage. Overall, two-thirds of the sampled urban centres have reported 100 per cent coverage of population by the service while about 4 per cent of the sampled urban centres have indicated a coverage of 50 per cent or less.

As mentioned earlier, coverage does not indicate the quality of service to the people. In some of the sampled cities there are no house service connections while in some others water is not available to residents on a daily basis because of acute shortage of water - yet the survey indicates a high coverage of population by the service. Two instances can be cited here:

a) Six sampled urban centres provide only stand-post supply to the residents, as there are no individual house service connections in these towns. These towns are Balurghat, Sanitpur, Chakdaha, Contai and Siliguri in West Bengal, and Kavarathi in Lakshadweep Islands. In two other towns i.e., Katwa (West Bengal) and

[5] *Coverage generally refers to the coverage of areas by pipelines, i.e. if the agency has laid pipelines to service the area, the entire area is considered covered, even if all households in the area have not taken the connection,. In some cities coverage means water provision to the population not only by means of house service connections but also by means of tankers and stand posts. If people are being provided water by the local authority, by any means, they are considered covered. Therefore, coverage has to be read with caution as it only means that the public water supplying agency is serving the people by some mode, not necessarily by household connections. Coverage does not give any indication of the quantity or quality of water provided to consumers. Therefore, a 100% coverage should not be misinterpreted as everyone getting adequate water.*

Payannur (Kerala) the population mainly depends on public stand-posts as there are negligible individual connections. The population in these towns mostly use informal sources of water supply, such as wells, handpumps, rivers, ponds etc. to meet their daily water needs.

b) Twenty two sampled urban centres, despite 100 per cent coverage of population by water supply, are unable to ensure daily water supply to the population. Surendranagar in Gujarat, for example, gets only 30 minutes of water once a week while Gondal in the same state gets 20 minutes supply once in four days. (Table 2.2).

Table - 2.2: Urban Centres with Acute Water Problems – 1999

Sl. No.	State/city/town	Frequency of water supply
	Gujarat	
1	Surendranagar	30 minutes once a week
2	Gondal	20 minutes once in four days
3	Amreli	60 minutes once in three days
4	Jetpur	20 minutes daily
5	Rajkot	30 minutes daily
	Tamil Nadu	
6	Attur	Twice a week
7	Gudivattam	Twice a week
8	Nagercoil	Alternate days
9	Rajapalayam	Alternate days
10	Tiruppur	Alternate days
11	Vellore	Alternate days
12	Sivakasi	Alternate days
13	Srivilliputtur	Alternate days
14	Udagamandalam	Alternate days
	Karnataka	
15	Bangalore	Alternate days
16	Tumkur	Twice a week
17	Hubli – Dharwad	Alternate days
18	Bagalkot	Alternate days
19	Rabkavi-Banahatti	Alternate days
	Rajasthan	
20	Bhilwara	Twice a week
21	Barmer	Twice a week
22	Beawar	Alternate days

(In the above towns of Tamil Nadu, Karnataka and Rajasthan water is supplied for 1 to 3 hours)
See Table A – 2 in Appendix – I for details

2.3 QUANTITY OF WATER SUPPLIED

The total quantity of water supplied to any urban centre depends upon the city size (which determines the demand) and the source of water supply used by the city (which determines the supply). In the sampled urban centres the water supply varies between 2978 mld in Mumbai to 0.04 mld in Kavarathi. The total water supplied by the 22 metropolitan cities amounts to 13014 mld while the 164 Class I cities supply about 7309 mld. The 115 Class II towns supply about 871 mld of water (Table A-2 in Appendix - 1). The present study covers only the supply by the public agencies.

2.3.1 Water Supplied for Domestic and Non-Domestic Uses

The bulk of the water supplied by the public agencies is for domestic purposes, although in terms of revenue generation the non-domestic supply is likely to generate greater revenues due to higher tariff for non-domestic uses. However, supplying water for domestic purposes is the obligatory duty of the public authority. Large industrial and commercial users usually have their own private arrangements for meeting their daily needs of water supply and, in some cases, they supplement it by public supply.

Supply for non-domestic uses exceeds one-fourth of the total supply in only 48 sampled urban centers (Table 2.3). While overall less than one-fifth of water supplied goes for non-domestic uses in the sampled urban centres, a disaggregation of data indicates that there are certain cities where the non-domestic supply is over 50 per cent (e.g. Vishakhapatnam, Qutuballapur and Panaji). In cities with significant non-domestic supply the scope for improving revenues increases.

Table - 2.3: Water Supplied for Domestic and Non-domestic Uses - 1999

(no. of cities/towns)

% Water supplied to total supply	Metropolitan cities		Class I cities		Class II towns		Total	
	Dom.	Non-dom.	Dom.	Non-dom.	Dom.	Non-dom.	Dom.	Non-dom.
<25	0	16	0	98	0	65	0	179
25 - 50	1	5	1	25	3	14	5	44
50 - 75	5	1	23	1	14	3	42	5
75 - 90	16	0	92	0	53	0	161	0
90 - 100	0	0	10	0	12	0	22	0
Break up not available	0	0	36	36	32	32	68	68
Data not available	0	0	2	4	1	1	3	5
No. of cities/towns	22	22	164	164	115	115	301	301
Average (%)	81.5	18.5	80.1	19.5	84.2	15.8	81.2	18.7
Range (%)	40-97	2-59	35-100	0-64	33-100	1-66	33-100	1-66

Note: Dom. refers to domestic and non-dom. refers to non-domestic
Source: NIUA Survey, 1999. See Appendix - I, Table A – 2 for details

2.3.2 Utilization of Production Capacity

Many urban centres have not been able to utilize the production capacity to the full. This could be due to factors such as insufficient water (from source), intermittent supply of electricity, aging pumps etc. The present study indicates that in only about one-third of the sampled urban centres there is full utilization of the installed production capacity. In little above one-third of the sampled urban centres the capacity utilization is between 75 and 99 per cent while in one-fifth it is between 50 and 75. In the remaining urban centres the capacity utilization is less than 50 per cent (Table 2.4). Better utilization of the unused production capacity may help urban centres to improve supplies.

Table – 2.4: Utilization of Installed Production Capacity - 1999

(no. of cities/towns)

Percentage utilization	Metropolitan cities		Class I cities		Class II towns		Total	
	No.	%	No.	%	No.	%	No.	%
> 100	0	0	1	1	3	3	4	1
100	5	23	48	30	36	31	89	30
75 to <100	12	55	60	36	34	29	106	35
50 to <75	2	9	33	20	24	21	59	20
< 50	2	9	13	8	10	9	25	8
Data not available	1	5	9	5	8	7	18	6
Total	22	100	164	100	115	100	301	100

Source: NIUA Survey, 1999. See Appendix - I, Table A – 2 for details

2.3.3 Duration of Supply

In most Indian cities water is supplied only intermittently and in the present survey the duration of supply generally ranges between 1 and 6 hours daily. Thiruvananthapuram, the capital of Kerala, with a per capita supply of 308 lpcd, has 24 hours supply. In the sampled urban centers, 15 per cent have duration of supply of less than one hour while in 42 per cent of the urban centres the duration is between 1 to 4 hours. Only in 13 per cent of the sampled urban centres the duration of supply exceeds 6 hours (Table 2.5).

In some of the sampled urban centres severe water shortages have led to a drought like condition where water supply has been highly rationed. For instance, in Surendranagar, water is supplied for only half-an-hour once in six days while in Gondal water is supplied for 20 minutes once in four days (in 1999). Water shortages have been mainly reported from the states of Gujarat, Tamil Nadu, Karnataka and Rajasthan (see Table AX-2.1at the end of this chapter). The availability of water (and electricity) and the capacity centers, determine the duration of the supply system, rather than the size class of urban of supply.

Table - 2.5: Duration of Supply (1999)					
					(no. of cities/towns)
Duration of supply (hours/ day)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 1	0	2	1	3	1
1 to <2	3	18	20	41	14
2 to < 4	8	50	39	97	32
4 to <6	3	26	17	46	15
6 and above	5	47	19	71	24
Uncertain/ variable/ non-daily	3	21	19	43	14
No. of responding cities/ towns	22	164	115	301	100
Range (hours/day)	1-8	1-24	1-12		
Source: NIUA Survey, 1999. See Appendix - I, Table A – 2 for details					

2.3.4 Water Consumption in Metropolitan Cities

The total water requirement in the urban areas of the country is increasing with urbanization. Larger cities, with higher levels of consumption and huge population base, need more water than other sizes of urban centers. The present study shows that the total water consumed in 22 metropolitan cities is about13014 mld (through formal supply system) for an estimated population of about 70 million (1999). Water supply in the three largest cities Mumbai, Delhi and Calcutta (in municipal area only) is over 6600 mld for an estimated population of about 29 million. As against the per capita supply norm of 150 lpcd recommended for these cities by CPHEEO, the supply is 268 lpcd in Mumbai, 218 lpcd in Delhi and 173 lpcd in Calcutta (Table 2.6). In comparison, the 164 sampled Class I cities consume only 7309 mld of water for an estimated population of about 59 million while the 116 sampled Class II towns consume 871 mld of water for a population of about 11 million. Clearly then, limiting the city size would have a bearing on the water requirement of urban areas. Since it has not been possible to restrict the growth of large cities, distant water sources have to be tapped at high cost to keep the citizens healthy and the economic activities flourishing.

An examination of the ratio of water consumed to population, amongst metropolitan cities, indicates that Pune, Mumbai and Delhi consume a larger proportion of water than the proportion of population residing in them. Pune, with only 3 per cent of the metropolitan population consumes 5 per cent of the water consumed in metropolitan cities (1.56 times the metropolitan average) while Greater Mumbai with 16 per cent of the population consumes 23 per cent of the water (1.48 times the metropolitan average). Delhi with 17 per cent of the population consumes 20 per cent of the water (1.2 times the metropolitan average).

Table - 2.6: Ratio of Water Consumed to Population in Metropolitan Cities –1999							
City	Water supplied (mld)	% consumed to total metropolitan water supply	Estimated total population 1999 ('000)	% population to total metropolitan population	Coefficient of % water consumed to % population	Per capita supply to total population (lpcd)	Per capita supply to served population (lpcd)
Pune	650	4.99	2,300	3.22	1.55	283	283
Greater Mumbai	2978	22.88	11,100	15.54	1.47	268	268
Delhi	2620	20.13	12,000	16.80	1.20	218	218
Varanasi	220	1.69	1,152	1.61	1.05	191	291
Bhopal	270	2.07	1,500	2.10	0.99	180	180
Nagpur	370	2.84	2,100	2.94	0.97	176	176
Calcutta	1035	7.95	6,000	8.40	0.95	173	173
Jaipur	340	2.61	2,000	2.80	0.93	170	170
Vadodara	237	1.82	1,400	1.96	0.93	169	169
Lucknow	410	3.15	2,500	3.50	0.90	164	164
Hyderabad	682	5.24	4,163	5.83	0.90	164	164
Indore	238	1.83	1,600	2.24	0.82	149	149
Bangalore	705	5.42	5,000	7.00	0.77	141	141
Surat	320	2.46	2,300	3.22	0.76	139	139
Ahmedabad	486	3.73	3,500	4.90	0.76	139	139
Visakhapatnam	168	1.29	1,280	1.79	0.72	131	131
Kanpur	310	2.38	2,500	3.50	0.68	124	248
Kochi	84	0.65	680	0.95	0.68	124	124
Ludhiana	234	1.80	2,000	2.80	0.64	117	195
Coimbatore	105	0.81	971	1.36	0.60	108	108
Chennai	461	3.54	4,363	6.11	0.58	106	106
Madurai	90	0.69	1,020	1.43	0.49	88	88
Total	13014	100	71,429	100	1.0	182	189

Source: NIUA Survey, 1999.

2.4 NORMS FOR WATER SUPPLY

Water is basic to survival and well-being and, therefore, adequate quantity of water of potable quality must be provided to all. Water needs may be broadly classified into domestic and non-domestic. Domestic needs include water for drinking, cooking, washing and cleaning (utensils, clothes, house) and for use in water closet. To this, other requirements such as watering plants/garden and washing personal vehicle etc. may be added. Non-domestic use of water would include industrial, commercial and institutional uses, and water used for public purposes such as fire fighting, street washing, watering trees/public gardens etc.

2.4.1 CPHEEO Norms

Norms for water supply suggested by the Central Public Health and Environmental Engineering Organisation (CPHEEO) are given in Table 2.7. These norms are to be followed by Indian cities and towns while designing water supply schemes.

Table – 2.7: Recommended Per Capita Water Supply Levels for Designing Schemes

Sl. No.	Classification of towns/cities	Recommended maximum watersupply levels (lpcd)
1.	Towns provided with piped water supply but without sewerage system	70
2.	Cities provided with piped water supply where sewerage system is existing/contemplated	135
3.	Metropolitan and Mega cities provided with piped water supply where sewerage system is existing/ contemplated	150

Note: i) In urban areas, where water is provided through public stand posts, 40 lpcd should be considered.
Figures exclude "Unaccounted for Water (UFW)" which should be limited to 15%.
Figures include requirements of water for commercial, institutional and minor industries. However, for bulk supply such establishments should be assessed separately with proper justification.
Source: Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation Manual on Water Supply and Treatment, Third Edition – Revised and Updated (May 1999), New Delhi.

2.4.2 Ninth Five Year Plan Norms

The norms for water supply followed by the Eighth Five Year Plan which have also been maintained for the Ninth Five Year Plan are as follows:

- 125 lpcd for urban areas where piped water supply and underground sewerage systems are available.
- 70 lpcd for urban areas provided with piped water supply but without underground sewerage system.
- 40 lpcd for towns with spot-sources/stand posts. One source for 20 families within a maximum walking distance of 100 meters.
- These norms are marginally lower than the norms suggested by CPHEEO.

2.4.3 Norms Determined by the Individual Cities

Apart from the above norms, the cities themselves fix their own norms (Table 2.8). These norms are used by the cities/towns to project their demand for water. The city norms are based on the water needs of the city and on the availability of water there. As per the individual cities, the norms for metropolitan cities vary from 65 lpcd in Vishakhapatnam to 250 lpcd in Lucknow. To what extent should the public water supply system meet these requirements? Since potable water is required for drinking, cooking and washing utensils, the formal water supply system should, at the least, meet these requirements. The non-domestic requirements of water will vary

considerably between city sizes and will depend on the type of economic activities being carried out.

Table - 2.8: Norms for Water Supply given by Metropolitan Cities (1999)	
City	Own norms of cities (lpcd)
Ahmedabad	170
Bangalore	140
Bhopal	150
Calcutta	227
Chennai	110
Coimbatore	150
Delhi	225
Greater Mumbai	240
Hyderabad	160
Indore	200
Jaipur	180
Kanpur	200
Kochi	150
Lucknow	250
Ludhiana	200
Madurai	110
Nagpur	175
Pune	160
Surat	140
Vadodara	180
Varanasi	270
Visakhapatnam	65
Source: NIUA Survey, 1999. See Appendix - I, Table A – 3 for details	

2.5 PER CAPITA WATER SUPPLY AND ITS ADEQUACY

Per capita water supply, a measure of the quantity of water available per head, is an indicator of the water supply situation in an area. However, this indicator is highly sensitive to changes in population, as any change in population figures will directly affect the per capita supply figures.

The per capita supply can be calculated in at least two different ways – one, by dividing the total water supply by the total population, and two, by dividing the total water supply by the population covered by the formal water supply system. Both these methods of calculation can yield different results depending upon the coverage of population by the service (The analysis presented in this report uses the former method of calculation of per capita supply). These per capita calculations only give

the gross availability of water per head in a city but do not indicate the intra-city distribution of water, which in some cities is highly inequitable. It also does not indicate the water availability to domestic consumers as these gross per capita figures include water supplied for all uses, i.e. domestic, industrial, commercial, institutional and public uses (fire fighting, horticultural uses etc.). Dividing the water supplied for domestic purposes by the total population can make a refinement to the calculation and give an indication of the per capita water availability for domestic users. Subtracting the unaccounted for water from the total supply and using only the net water available for the calculation of per capita supply can make a further refinement to the calculations.

Adequacy of supply can be gauged by measuring the actual supply against the norm for supply. Therefore, adequacy of water supply in any city will depend on the norm used. The norms for per capita supply recommended by CPHEEO (Table 2.7) are based on the requirements of water taking into account the existence of sewerage system. The norm for cities provided with piped water supply where sewerage system exists or is contemplated is 150 lpcd for metropolitan and mega cities and 135 lpcd for other size class of urban centres. However, irrespective of the size class, all urban centres provided with piped water supply where no sewerage system exists or is envisaged, the recommended norm is 70 lpcd. The norm for stand-post supply is 40 lpcd. These norms, however, exclude unaccounted for water (UFW) which, as per the CPHEEO manual, should be limited to 15 per cent. The adequacy of per capita supply discussed below, therefore, takes into account these aspects of recommended norms.

While norms recommended by the CPHEEO are the most widely used (by local authorities), each city/ town also often sets its own norm, which may differ from the norm given by the CPHEEO. For instance, while the CPHEEO recommends a norm of 150 lpcd for metropolitan and mega cities having a sewerage system or contemplating one, the present survey indicates that 14 of the 22 metropolitan cities in the sample use norms that are higher than 150 lpcd (Table 2.8). However, the present study uses only the CPHEEO norms for analyzing the adequacy of water supply.

2.5.1 Per Capita Supply

The present survey indicates that the average per capita supply in the sampled urban centres is 150 litres per capita per day (lpcd) with a range of 20 lpcd to 308 lpcd (with a few exceptions of less than 20 lpcd supply, particulary, in urban centers with only stand post supply). The metropolitan cities, with an average per capita supply of 182 lpcd, have almost one-and-a-half times the average supply available in Class I cities (124 lpcd) and over two times the average supply available in Class II towns (83 lpcd) (Table 2.9). When an acceptable level of 15 per cent unaccounted for water is deducted from the supply levels given above, the average per capita figure for the sampled urban centres falls to 127 lpcd, for metropolitan cities it drops to 155 lpcd, while for Class I cities and Class II towns the per capita supply drops to 105 lpcd and 71 lpcd respectively.

Table - 2.9: Per Capita Water Supply (1999)					
					(no. of cities/towns)
Per capita water supply (lpcd)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 40	0	7	22	29	9.6
40 to < 70	0	21	32	53	17.6
70 to <135	7	99	41	147	48.8
135 to <150	4	10	8	22	7.3
150 and above	11	26	12	49	16.3
Data not available	0	1	0	1	0.3
No. of cities/ towns	22	164	115	301	100
Average (lpcd)	182	124	83	150	
Range (lpcd)	88 - 283	23-308	14 - 210	14 –308	

Note: The average excludes outlyers such as 4 lpcd for Tenali and 3 lpcd for Kavarathi
Source: NIUA Survey, 1999. See Appendix - I, Table A – 3 for details

2.5.2 Per Capita Domestic Supply

The per capita domestic supply has been calculated by dividing the total water supplied for domestic purposes by the population.The per capita total supply, calculated by using the total water supplied for all uses, does not give a clear picture with regard to what the domestic consumers get for their use. Therefore, to understand if water supply is adequate for domestic purposes, the per capita domestic supply needs to be looked at. The domestic per capita supply will almost always be less than the total per capita supply, unless an urban centre does not supply any water for non-domestic uses.

The average per capita domestic supply in the sampled urban centers is 128 lpcd with a range of 14 to 258 lpcd. (Table 2.10). The average domestic supply in the

Table - 2.10: Per Capita Domestic Water Supply (1999)					
					(no. of cities/towns)
Per capita water supply (lpcd)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 40	0	9	22	31	10
40 to <70	2	27	25	54	18
70 to <135	12	68	29	109	36
135 to <150	2	9	2	13	5
150 and above	6	12	4	22	7
Data not available	0	39	33	72	24
No. of cities/ towns	22	164	115	301	100
Average (lpcd)	148	106	69	128	
Range (lpcd)	53 - 226	16-258	14-177	14-258	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 4 for details

metropolitan cities is 148 lpcd with only 6 out of 22 metropolitan cities being supplied more than 150 lpcd of water. Similarly the average for Class I cities is 106 lpcd and that for Class II towns is 69 lpcd.

Overall, almost 70 per cent of the sampled urban centers get a domestic supply ranging between 40 to 135 lpcd. It is important to highlight here that there are 31 sampled urban centers, a majority of them being Class II towns, which do not get domestic supply of even 40 lpcd, i.e. their supply level is even below that prescribed for stand posts. When a minimum of 70 lpcd for domestic supply is taken as the minimum supply level then 85 sampled urban centers do not reach this norm.

2.5.3 Exceptions

There are certain towns in the sample where the per capita supply levels are extremely low. These towns are Kavarathi (3 lpcd), Tenali (4 lpcd) and Balurghat, Santipur and Taliparmba (7 lpcd each). The reasons for the low level of supply in these town are: a) low coverage of population by water supply; b) public water supplying agency has been able to provide only a small number of households with domestic connection; and c) dependence of most households on public stand posts and private sources of supply such as open wells, hand pumps etc.

2.6 WATER SHORTAGE

Using the norms recommended by the CPHEEO, which takes into account the needs of sewerage system, the results of the survey indicate that the water supply situation in urban India is distressing with almost 46 per cent the sampled urban centres not getting adequate water supply, that is, getting a per capita supply below the recommended norm. A further disaggregation by size class of urban centers indicates that almost half the metropolitan cities have inadequate water supply while 40 per cent of Class I and and 52 per cent of Class II urban centres have a supply below the recommended norm (Table 2.11 and Table AX- 2.1 at the end of this chapter).

The picture changes considerably when the norms used by the cities themselves are taken into account. As per the city norms, almost 77 per cent of the sampled urban centers do not get adequate water supply, that is, they get water below the norms adopted by them. According to the city norms, 68 per cent of the metropolitan cities, 76 per cent of the sampled Class I cities and 79 per cent of the sampled Class II towns do not get adequate water (Table 2.12).

As a result of urbanization and changing requirements the demand for water is increasing. An estimation of the demand-supply gap in water supply indicates that an additional 1466 mld of water (using CPHEEO norms) would be required to bridge the gap between demand and supply in the 137 urban centers that do not get adequate water. The average gap per metropolitan city works out to 53 mld while those for Class I and Class II cities and towns the gap works out to 11 mld and 3 mld respectively (Table 2.11).

Table - 2.11: Demand – Supply Gap (1999) Using CPHEEO Norms					
Size class of urban centres	Urban centres with supply below norm	Quantity of water supplied (mld)	Demand as per norm (mld)	Demand - Supply Gap (mld)	Average per capita gap (lpcd)
Metropolitan	11	3201.60	3782.10	580.50	23
Class I	66	2154.36	2857.10	702.74	29
Class II	60	286.18	468.98	182.81	33
Total	137	5642.14	7108.18	1466.05	26
Source: NIUA Survey, 1999. See Appendix - I, Table A – 3 for details					

Using the city norms, the demand-supply gap for the 231 urban centers with a supply below norm, works out to 4045 mld. The average gap per metropolitan city works out to 93 mld, while for the Class I and Class II urban centers the gap is 18 and 5 mld respectively (Table 2.12). Amongst the steps needed to bridge the gap between demand and supply are efficiency improvements in the present system and new investments to augment supplies.

Table - 2.12: Demand – Supply Gap (1999) Using City Norms					
Size class of urban centres	Urban centres with supply below norm	Quantity of water supplied (mld)	Demand as per norm (mld)	Demand - Supply Gap (mld)	Average per capita gap (lpcd)
Metropolitan	15	7190.22	8586.90	1396.68	32
Class I	125	4433.08	6642.36	2209.28	52
Class II	91	599.66	1038.38	438.72	52
Total	231	12222.96	16267.64	4044.68	43
Source: NIUA Survey, 1999. See Appendix - I, Table A – 3 for details					

2.7 UNACCOUNTED FOR WATER (UFW)

One of the main problems in the water supply sector today is the high level of unaccounted for water (UFW). UFW includes both physical losses as well as revenue losses (which include theft of water and illegal connections). The UFW in many Indian cities is said to be as high as 40 – 50 per cent while the acceptable level is about 15 per cent (according to CPHEEO norms). Although the problem is huge, many local governments find it difficult to realistically estimate UFW mainly due to lack of knowledge of how to calculate UFW and also lack of equipment for determining UFW. In addition, since meters are not installed on pipelines at the point of origin and at consumers end (not all connections are metered), the estimation of physical leakages as well as revenue losses is difficult.

Lack of reliable data on UFW is giving a somewhat distorted picture, which indicates that in over three-fourths of the responding urban centres the UFW is less than 25 per cent (Table 2.13). In 22 responding metropolitan cities, almost 3007 mld of water is unaccounted for, that is, the water is wasted and/or is unpaid for. While the UFW

in the three largest metropolitan cities (Mumbai, Chennai and Delhi) is between 20-26 per cent of the total supply, in absolute terms the quantity of UFW is over 1400 mld. Just the daily physical losses in these cities would be sufficient to provide at least one and-a-half day's water supply to the 115 sampled Class II towns.

Table - 2.13: Unaccounted for Water (1999)

(no. of cities/towns)

Unaccounted for Water (%)	Metropolitan cities	Class I cities	Class II towns	Total	%
<15	3	95	75	173	57
15– 25	9	44	18	71	24
25 – 30	2	5	9	16	5
30 – 35	5	7	3	15	5
35 – 55	2	5	2	9	3
Data not available	1	8	8	17	6
No. of cities/ towns	22	164	115	301	100
Average (%)	24	16	11	21	
Range (%)	10-55	10-45	10-50	10-55	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 4 for details

2.8 WATER CONNECTIONS

2.8.1 Total Water Connections

It is often recommended that all connections should be metered so as to improve revenues from water supply as also to monitor supplies. Metering will allow charging by the quantity of water consumed and will also allow for leakage detection.

Table - 2.14: Percentage Metered Connections to Total – 1999

(no. of cities/towns)

% Metered connections to total	Metropolitan cities	Class I cities	Class II towns	Total	%
0	2	50	44	96	32
<25	5	31	17	53	18
25 – 50	1	8	6	15	5
50 – 75	4	11	7	22	7
75 – 99	4	27	10	41	14
100	3	23	19	45	15
n.a.	3	12	9	24	8
not applicable	0	2	3	5	2
Total no. of cities/ towns	22	164	115	301	100
Average (%)	60	52	39	55	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 5 for details

Unmetered connections will generally encourage wastage of water, though the amount of water that can be drawn will be determined by the duration of supply.

However, 15% sampled urban centres have reported metering of all connections (domestic and non-domestic). Little less than one- third (32%) of the sampled urban centres do not have any metered connections. Amongst the 19 metropolitan cities (which responded to this question), in only two cities, i.e. Bangalore and Kochi, 100 per cent of the connections are metered, while in Calcutta and Ludhiana none of the connections are metered (Table 2.14).

2.8.2 Metering of Connections

a) Metering of Domestic Connections

Metering of connections does not necessarily imply that the meters are in working order and that the meters are read regularly. In many towns, particularly where the supply is for a very short duration – often for an hour or less a day, metering of domestic connections is not a preferred option because the meters do not function properly and meter reading is not cost effective.

This is reflected in the results of the survey, which shows that in 126 of the sampled urban centres (42%) none of the domestic connections are metered. However, there are 46 cities/ towns (15%) where all the domestic connections are reportedly metered (Table 2.15).

Table – 2.15: Percent Metered Domestic Connections

(no. of cities/towns)

% metered domestic connections	Metropolitan cities	Class I cities	Class II towns	Total	%
0	5	68	53	126	42
<25	2	12	7	21	7
25 – 50	1	6	6	13	4
50 – 75	4	13	7	24	8
75 – 99	4	25	10	39	13
100	3	24	19	46	15
n.a.	3	14	10	27	9
not applicable	0	2	3	5	2
Total no. of cities/ towns	22	164	115	301	100
Average (%)	59	49	38	52	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 5 for details

b) Metering of Non-domestic Connections

Metering of non-domestic connections is a must as the tariff for non-domestic uses is much higher than for domestic use. Therefore, charging non-domestic

users by the quantity of water consumed will increase revenue collection from water charges. However, metering of all non-domestic connections is not practiced in many urban centres.

The present survey indicates that non-domestic connections are metered in only 17 metropolitan cities while in 5 metro cities between 50 and 100 per cent of non-domestic connections are metered. In 86 of the sampled urban centres (i.e. about 29%) none of the non-domestic connections are metered while in 128 urban centres (i.e., about 43%) all the non-domestic connections are metered (Table 2.16). This indicates that metering of non-domestic connections needs to be taken up on a priority basis.

Table - 2.16: Percent Metered Non-Domestic Connections

(no. of cities/towns)

% Metered non-domestic connections	Metropolitan cities	Class I cities	Class II towns	Total	%
0	2	45	39	86	29
<25	0	6	3	9	3
25 – 50	0	3	1	4	1
50 – 75	2	1	2	5	2
75 – 99	3	8	4	15	5
100	12	76	40	128	43
n.a.	3	14	10	27	9
not applicable	0	11	16	27	9
Total no. of cities/towns	22	164	115	301	100
Average (%)	84	81	60	81	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 5 for details

2.9 SOURCE AND STORAGE OF WATER

2.9.1 Dependence on Surface and Ground Water Sources

Urban centers depend on both surface and ground water sources for supplying water. However, the dependence on any source would be based on the availability and the cost factors. While some urban centers may depend entirely on surface sources, such as rivers, lakes and reservoirs, others may use a combination of surface and ground water sources. The result of the present survey indicates that almost two-thirds of the urban centres depend on surface water and one-third on ground water. According to the present survey 43 per cent of the sampled urban centres depend entirely on surface water, 34 per cent depend entirely on ground water while 22 per cent use both surface and ground water sources (Table 2.17).

Metropolitan cities mainly depend on surface water sources with partial dependence on ground water sources. Amongst the 22 metropolitan cities 12 depend entirely on

surface water sources while one city (Ludhiana) depends entirely on ground water. The remaining 9 cities use both surface and ground water sources. In 7 of these cities the share of surface water is more than 50 per cent.

Most of the Class I cities also depend mainly on surface water sources to meet their daily water needs. In sampled Class I cities 43 per cent depend entirely on surface water sources, 33 per cent on only ground water sources while 24 per cent depend on surface and ground water sources. In about 18 per cent of the cities the share of surface water is greater than 50 per cent.

In relative terms, a larger proportion of Class II towns depend on ground water sources to meet their water requirements. Amongst the sampled Class II towns, 43 per cent depend only on surface water sources, 42 per cent depend on only ground water sources and 14 per cent use both surface and ground water sources. In 11 per cent of the towns the share of surface water is greater than 50 per cent.

Table - 2.17: Share of Ground and Surface Water Source - 1999

(no. of cities/towns)

Size class of urban centres	Only Surface Water (SW)		Only Ground Water (GW)		Urban centers with both sources SW & GW				Data not available		Total	
					SW <50%		SW>50%					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Metros	12	55	1	4	2	9	7	32	0	0	22	100
Class I	69	42	54	33	10	6	30	18	1	1	164	100
Class II	49	43	48	42	4	3	13	11	1	1	115	100
Total	130	43	103	34	16	5	50	17	2	1	301	100

Source: NIUA Survey, 1999. See Appendix - I, Table A – 7 for details

A look at the different states in this respect indicates that in sampled urban centres in Maharashtra, Andhra Pradesh, Gujarat, Tamil Nadu and Karnataka surface sources are the main sources for water supply while in Punjab, Uttar Pradesh and West Bengal ground water is also a significant source (see Appendix I, Table A-7).

Based on the quantity of water obtained from ground and surface sources, it is clear that the share of surface water is higher in metropolitan cities and relatively lower in

Table - 2.18: Percentage Water Drawn from Surface and Ground Sources - 1999

(no. of cities/towns)

Size class of urban centres	% Water drawn from	
	Surface source	Ground source
Metropolitan cities	88	12
Class I cities	64	36
Class II towns	52	49
Total	78	22

Source: NIUA Survey, 1999. See Appendix - I, Table A – 7 for details

Class II towns (Table 2.18). Overall, the survey result indicates that as city size decreases the dependence on ground water increases.

Augmentation of water from surface sources, if located at great distances, is an expensive option. However, wherever the option of using ground water is viable, efforts should be made to maintain water tables at reasonable depth by recharging ground water.

2.9.2 Distance to Source of Water Supply

Most settlements initially came up near sources of water, many of them on the banks of rivers. However, rapid growth of many cities has rendered the nearby water sources inadequate and cities have had to go further and further to get water for their citizens. The present survey indicates that in a majority of the sampled cities the source of water is in the city itself or adjoining it (Table 2.19).

Table - 2. 19: Maximum Distance to Surface Sources of Water Supply (1999)

(no. of cities/towns)

Distance (km)	Metropolitan cities	Class I cities	Class II towns	Total	
				No.	%
< 10	4	44	27	75	25
10 - 20	2	32	17	51	17
20 - 30	5	13	8	26	8
30 - 50	3	6	6	15	5
50 - 80	2	7	2	11	4
> 80	3	7	0	10	3
Data not available	3	55	55	113	37
Total	22	164	115	301	100

Source: NIUA Survey, 1999. See Appendix - I, Table A – 7 for details

These are cities that mainly depend on ground water source or nearby surface source. At present some of the Class I cities are bringing water from over 100 kms. In most such cases the source of water is a dam and therefore the distance is large (Table 2.20).

Table - 2.20 : Distance to Present Source of Water for Selected Urban Centres - 1999

Cities	Distance (km.)
Ranchi	292
Thaleserry	280
Gadag-Betigeri	255
Jodhpur	209
Ajmer	140
Jalgaon	140
Solapur	103

Source: NIUA Survey, 1999. See Appendix - I, Table A – 7 for details

Metropolitan cities present a different picture. At present, only Mumbai goes as far as 119 km. for getting water for its citizens. In most other cities the distance to water source is less than 30 kms. However, the future sources of water supply for some metropolitan cities are as far as 400 kms away (Tables 2.21).

Table - 2.21: Distance to Future Sources of Water Supply for Selected Metropolitan Cities - 1999

City	Present source (km.)	Future source (km.)
Mumbai	29 - 119	135 - 150
Delhi	26	320 - 400
Chennai	-	400
Hyderabad	15 -18	60 - 100
Jaipur	25	120
Vishakhapatnam	15 - 73	60 - 150

Source: NIUA Survey, 1999. See Appendix - I, Table A – 7 for details

2.9.3 Storage Capacity of Service Reservoirs

The minimum storage capacity of service reservoirs depends on many factors. The CPHEEO Manual states that "A system supplied by pumps with 100% standby will require less storage capacity than that with less standby provision. Similarly a system divided into interconnected zones will require less storage capacity for all the zones except for the zones at higher elevations"[6]. However, on an average, according to CPHEEO, the storage capacity should be at least 30 per cent of the total water supplied daily.

Table - 2.22 : Storage Capacity of Service Reservoirs - 1999

(no. of cities/towns)

Storage as % of Supply	Metropolitan cities	Class I cities	Class II towns	Total	%
< 10	0	16	13	29	10
10 – <30	7	49	24	80	27
30 – <50	6	40	23	69	23
50 – <75	2	24	22	48	16
75 - <100	2	7	10	19	6
100 & above	0	17	14	31	10
Data not available	5	11	9	25	8
Total	22	164	115	301	100

Note: 37 sampled urban centers did not provide information on this aspect.
Source: NIUA Survey, 1999. See Appendix - I, Table A – 8 for details

[6] *Ministry of Urban Development, 'Manual on Water Supply and Treatment' – Third edition – Revised and updated, CPHEEO, New Delhi, May 1999.*

The results of the present survey show that 109 sampled urban centres (37%) do not have the minimum required storage capacity of service reservoirs. In fact, 29 of these urban centres have a storage capacity of less than 10 per cent. These urban centres are almost equally divided between Class I cities and Class II towns. Amongst metropolitan cities, 7 cities do not have a storage capacity of 31 per cent. These cities are Mumbai, Delhi, Calcutta, Coimbatore, Indore, Kanpur and Vishakhapatnam. The survey has also revealed that 23 urban centres have storage capacity of 100 per cent or more (Table 2.22).

2.10 WATER TREATMENT

2.10.1 Water Treatment Plants

Water treatment plants are required in urban centres that use surface water sources (either fully or partly). Of the metropolitan cities 21 use surface water sources, while amongst the sampled Class I and Class II urban centers 109 and 65 respectively use surface water sources.

The present survey indicates that almost 85 per cent of the sampled urban centres (using surface water sources) have water treatment plants (WTPs). Amongst the metropolitan cities, all the cities with surface water sources have WTPs. However, 12 per cent of Class I cities and 26 per cent of Class II towns do not have WTPs (Table 2.23). Most of the urban centres without WTPs are in the states of Andhra Pradesh and Tamil Nadu. Kavarathi, the capital of Lakshadweep Islands, is the only town in the sample that uses reverse osmosis process to purify water.

Table - 2.23: Water Treatment Plants – 1999

Size class of urban centres	Number of sampled urban centres		
	Using surface water	Without WTPs	% without WTPs
Metropolitan cities	21	0	0
Class I cities	109	13	12
Class II towns	65	17	26
Total	195	30	15

Source: NIUA Survey, 1999. See Appendix - I, Table A – 9 for details

2.10.2 Monitoring Water Quality

Regular monitoring must be undertaken in order to ensure the quality of water. Monitoring is done at various stages of supply such as monitoring of raw water, monitoring at treatment plants and monitoring at distribution network. Water quality monitoring is done at various intervals, which could vary, from a number of times a day to weekly/ fortnightly monitoring. Monitoring is also done at greater intervals than these, but that may affect the quality of water supplied.

The present survey indicates that about one-fourth (24%) of the sampled urban centres monitor raw water quality on a daily basis while almost three-fifths (57%) do

not monitor the quality of raw water at all. Amongst the metropolitan cities, almost 14 cities (64%) monitor raw water quality daily while in Class I cities and Class II towns daily monitoring of raw water is done by 37 cities (23%) and 21 towns (18%) respectively. However, in as many as 7 metropolitan cities raw water quality is not monitored at all. The number of Class I cities not monitoring raw water quality is 93 (57%) while the corresponding figure for Class II towns is 72 (63%) (Table 2.24).

Table - 2.24: Monitoring Raw Water Quality - 1999

(no. of cities/ towns)

Size class of urban centres	Monitoring frequency				
	Nil	Daily	Monthly	Others	Total
Metropolitan cities	7	14	-	1	22
Class I cities	93	37	12	22	164
Class II towns	72	21	6	16	115
Total	172	72	18	39	301
% to total	57	24	6	13	100

Source: NIUA Survey, 1999. See Appendix - I, Table A – 9 for details

At the treatment plant, water quality is not monitored at all in 38 (23%) urban centers with WTPs, while in 14 (9%) it is done on a monthly basis and in 8 (5%) on a weekly basis. In the other sampled urban centres the periodicity of monitoring water quality at the treatment plant varies between alternate days to once in 6 months. In 18 of the 21 metropolitan cities with WTPs, the water quality is tested daily at the treatment plant. In 73 per cent of Class I cities (with WTPs) water quality is tested at the treatment plant daily while the corresponding figure for Class II towns is 65 per cent (see Appendix. I, Table A-9).

At the distribution network, water quality is monitored on a daily basis in 152 sampled urban centres (50%) while it is not monitored at all in 59 urban centres (20%). Water quality is monitored once a week in 20 sampled urban centers while in another 22 it is monitored once a month. In about 40 sampled urban centers monitoring at the distribution network is done at other frequencies (see Table 2.25).

Table - 2.25: Monitoring Water Quality At Distribution Network - 1999

(no. of cities/ towns)

Size class of urban centres	Frequency of monitoring						
	Nil	Daily	Weekly	Monthly	Others	n.a.	Total
Metropolitan cities	1	20	-	-	1	-	22
Class I cities	33	76	12	15	22	6	164
Class II towns	25	56	8	7	17	2	115
Total	59	152	20	22	40	8	301

Source: NIUA Survey,1999. See Appendix - I, Table A – 9 for details

2.10.3 Adequacy of Laboratory Facilities

In order to test water quality, adequate laboratory facilities should be available. Laboratory facilities may be available with the concerned public agency or they may use facilities of other institutions. In any case, laboratory facilities should be adequate for providing potable water to people.

Laboratory facilities for testing water quality are not available in almost 54 per cent of the sampled urban centres. In 5 of the 22 metropolitan cities, the laboratory facilities for testing water quality are not adequate, while in 86 Class I cities and 73 Class II towns these facilities are reported to be inadequate (Table 2.26).

Table - 2.26 : Adequacy of Laboratory Facilities - 1999

(no. of cities/towns)

Adequate (Yes/No)	Metropolitan cities	Class I cities	Class II towns	Total	%
Yes	17	77	41	135	45
No	5	86	73	164	54
n.a.	0	1	1	2	1
Total	22	164	115	301	100

Source: NIUA Survey, 1999. See Appendix - I, Table A – 9 for details

2.11 INSTITUTIONAL ARRANGEMENTS FOR WATER SUPPLY

The responsibility for maintaining public health rests largely with the local governments and falls within the purview of their obligatory functions. Provision of water supply had for long been a function in the municipal domain, and still is in many urban centres in India. At present, this function is divided between at least two bodies in most urban centres - capital works are executed by state level agencies and the operation and maintenance (O&M) function is performed by the local governments. Most large capital works are funded by higher levels of government, which also provide technically qualified manpower for construction purposes. The local government is then handed over charge to maintain the water supply system. However, there are many variations to this arrangement. In different states there exist different arrangements and even within the same state different cities may have varying arrangements.

In some cities, the municipal body is still responsible for providing water supply, while in some others, city level water supply and sewerage boards have been constituted to perform this function (mainly in metropolitan cities). While in still others, state level water supply and sewerage boards are responsible for this function. The common pattern observed in most cities is that a state level agency, such as Public Health Engineering Department/ Division (PHED) or a state level water supply and sewerage board, does the capital works and once the construction is over, hands over the responsibility of O&M to the local government. In some cities the state level agency does the capital works and O&M while the revenue functions are with the local government.

In four of the metropolitan cities in the country viz., Bangalore, Chennai, Hyderbad and Calcutta there are separate metropolitan authorities for water supply and sewerage, which perform all the functions, related to water supply and sewerage. In Delhi there is a city level board that performs these functions. These boards are as follows:

City	Name of city – level board
Delhi	Delhi Jal Board (DJB)
Bangalore	Bangalore Water Supply and Sewerage Board (BWS&SB)
Chennai	Chennai Metropolitan Water Supply and Sewerage Board (CMWS&SB)
Hyderabad	Hyderabad Metropolitan Water Supply and Sewerage Board (HMWS&SB)
Calcutta	Calcutta Metropolitan Water & Sanitation Authority (CMW&SA), since merged with CMDA

States with state-level water supply and sewerage boards or equivalent state-level agencies are as follows:

State	Name of state-level board/agency
Gujarat	Gujarat Water Supply and Sewerage Board (GWS&SB)
Karnataka	Karnataka Urban Water Supply and Drainage Board (KUWS&DB)
Kerala	Kerala Water Authority (KWA)
Maharashtra	Maharashtra Jeevan Pradhikaran (MJP)
Punjab	Punjab Water Supply and Sewerage Board (PWS&SB)
Tamil Nadu	Tamil Nadu Water Supply and Drainage (TWAD) Board
Uttar Pradesh	Jal Nigam

2.11.1 Institutional Arrangements in Major States

In most states the state level agencies do only capital works while in some others they perform other functions too. For instance, KWA in Kerala manages all the functions of water supply throughout the state, KUWS&DB in Karnataka produces water and sells it to most city governments for further distribution and MJP in Maharashtra also performs O&M function in some cities in the state (Table 2.27).

In Rajasthan the entire function of water supply in all urban areas is with the state PHED. Similarly, in Haryana, in all the towns, except in Faridabad where the Corporation is responsible for water supply, it is the PHD that is responsible for provision of water supply.

In Uttar Pradesh there are seven Jal Sansthans, five of which are city level agencies while two are regional level agencies. The cities of Kanpur, Lucknow, Varanasi, Allahabad and Agra have city level Jal Sansthans to manage mainly O&M functions; the two regional agencies are Kumaon Jal Sansthan and Jhansi Jal Sansthan.

Table - 2.27: Institutional Arrangements for Urban Water Supply in Major States

State	Capital works	O & M	Revenue functions
Andhra Pradesh	PHED	Municipal body	Municipal body
Bihar	PHED & Municipal body	PHED & Municipal body	Municipal body
Gujarat	Municipal body & GWS&SB	Municipal body	Municipal body
Haryana	PHD	PHD	PHD
Karnataka	KUWS&DB	Municipal body	Municipal body
Kerala	KWA	KWA	KWA
Madhya Pradesh	Municipal body & PHED	Municipal body & PHED	Municipal body
Maharashtra	MJP & Corporation	Municipal body	Municipal body
Orissa	PHED, Rural Water Supply and Sanitation Department, Housing and Urban Development Deptt.	PHED, Rural Water Supply and Sanitation Department	PHED, Rural Water Supply and Sanitation Department
Punjab	PWS&SB	Municipal body & PWS&SB	Municipal body
Rajasthan	PHED	PHED	PHED
Tamil Nadu	TWAD Board	Municipal body & TWAD Board	Municipal body
Uttar Pradesh	Jal Nigam & Municipal body	Jal Sansthan & Municipal body	Jal Sansthan & Municipal body
West Bengal	PHED & Municipal body	PHED & Municipal body	Municipal body

Source: NIUA Survey,1999. See Appendix - I, Table A – 10 for details

2.11.2 Exceptions

There are exceptions, though, to the above pattern in many states. For instance, in Hindupur and Srikalahasti in Andhra Pradesh, the municipality performs all the above functions. In Kerala, Thrissur Municipal Council does the O&M and revenue related functions in a state where KWA performs all the functions for all towns. In Madhya Pradesh, in the towns of Satna and Rewa, PHED performs the O&M as well as revenue related functions. In Maharashtra, the MJP performs all the functions related to water supply in Amravati, Yavatmal, and Ballarpur.

2.11.3 Institutional Arrangements in Smaller States and Union Territories

In most of the smaller states and union territories the PHED or Public Works Department (PWD) performs all the functions related to water supply. However, there are exceptions to this pattern. For instance, in Port Blair, the Andaman PWD does the capital works while the O&M function is shared between the PWD & the Municipal Council, and the revenue related function is entirely with the Municipal Council. In Agartala only the revenue related functions are with the local body, while O&M and capital works are with PHED. In Chandigarh, the Corporation performs all the functions related to water supply. In Shimla and Shillong the PHED & Irrigation Department are responsible for capital works while O&M functions are performed by the PHED and the municipal body. (Table 2.28).

Table – 2.28: Institutional Arrangements for Urban Water Supply in Smaller States and Union Territories

S.N.	State/ U.T.	City/ town	Capital works	O & M	Revenue functions
State					
1	Arunachal Pradesh	Itanagar	PHED	PHED	PHED
2	Delhi	Delhi	Delhi Jal Board	Delhi Jal Board	Delhi Jal Board
3	Goa	Panjim	PWD	PWD	PWD
4	Jammu & Kashmir	Jammu	PHED	PHED	PHED
5	Himachal Pradesh	Shimla	H.P.Irrigation Deptt. & PHD	Municipal Body & PHD	Municipal Body
6	Manipur	Imphal	PHED	PHED	PHED
7	Meghalaya	Shillong	PHED	PHED & Municipal Body	Municipal Body
8	Mizoram	Aizwal	PHED	PHED	PHED
9	Nagaland	Kohima	PHED	PHED	PHED
10	Sikkim	Gangtok	n.a.	n.a.	n.a.
11	Tripura	Agartala	PHED	PHED	Municipal Body
Union Territory					
1	Andaman and Nicobar Islands	Port Blair	PWD	PWD & Municipal Body	Municipal Body
2	Chandigarh	Chandigarh	Municipal Body	Municipal Body	Municipal Body
3	Dadra & Nagar Haveli	Silvassa	PWD	PWD	PWD
4	Daman and Diu	Daman	PWD	PWD	PWD
5	Lakshadweep	Kavarathi	PWD	PWD	PWD
6	Pondicherry	Pondicherry	PWD	PWD	PWD

Source: NIUA Survey, 1999. See Appendix - I, Table A – 10 for details

2.12 STAFF POSITION

The staff position can be analysed by using indicators such as staff per 1000 connections or staff per km. of distribution lines. However, any attempt to analyse whether the water utilities/ departments are overstaffed/ understaffed or have the right number of staff would require a norm against which this can be judged. In the absence of such norms, only the situation as it exists today can be described. The staff here refers to the total staff, including managerial, technical and O&M staff.

The present study indicates that the average staff per 1000 connections is 10.9 in the sampled urban centres. The metropolitan cities have 14.5 staff per 1000 connections while in the sampled Class I cities, the staff per 1000 connections averages 7.9 while the average for Class II towns is 6.76 (Table 2. 29).

Table - 2.29: Staff Per 1000 Connections (1999)

(no. of cities/ towns)

Staff/1000 connection	Metropolitan cities	Class I cities	Class II towns	Total	%
<5	8	54	32	94	31
5 – 10	1	43	33	77	26
10 – 15	3	20	16	39	13
15 – 20	5	12	6	23	8
20 – 25	4	5	4	13	4
25- 50	1	10	4	15	5
Data not available	0	20	14	34	11
Data not reliable	0	0	6	6	2
Total	22	164	115	301	100
Average	14.5	7.9	6.76	10.9	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 11 for details

Table - 2.30: Staff Per Km. of Distribution Line (1999)

(no. of cities/towns)

Staff/Km. of distribution line	Metropolitan cities	Class I cities	Class II towns	Total	%
< 0.5	5	48	28	81	27
0.5 - < 1.0	6	42	24	72	24
1.0 – 2.0	5	32	23	60	20
2.0 and above	5	22	25	52	17
n.a.	1	20	15	36	12
Total	22	164	115	301	100
Average	1.73	0.80	1.09	1.26	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 11 for details

A disaggregation of these figures indicates that a little less than one-third of the sampled urban centres have a staff of less than 5 per 1000 connections while another little over one-fourth have a staff of between 5 to 10 per 1000 connections.

A look at the staff per kilometer of distribution line indicates that, on an average, there are 1.26 staff per kilometer of distribution line in the sampled urban centers. While metropolitan cities have more staff than this average, Class I and Class II urban centers have less staff than the average (Table 2.30). The present survey indicates that almost half the sampled urban centers have less than one staff per kilometer of distribution line, with 27 per cent have less that 0.5 staff per kilometer of distribution line.

2.13 PRIVATISATION

Involvement of private sector in the provision of water supply does not appear very common in the sampled cities. Only 8 per cent of the cities have used private sector for activities related to water supply. Private sector has been mainly involved in the operation and maintenance of pipelines, treatment plants, tube-wells and pumping stations. Private sector is also involved in billing and revenue collection activities (Table 2.31).

Contracting has been the main mode of privatisation in these cities. While most cities have only been able to give the cost of the activity after privatisation, which is the payment actually being made to the contractor, only a few have calculated the cost of the activity to the water supplying agency before the activity was privatised. This indicates that privatisation in these cities has not been undertaken as a measure of economy and efficiency but for reasons other than these.

Only 24 urban centres have used private sector for activities related to water supply. One-third, that is, 8 of these urban centres are in Rajasthan, and the remaining are in the states of Maharashtra, Karnataka, Gujarat, Uttar Pradesh and Andhra Pradesh. Private sector participation has been used in water supply sector since 1989, though in most of the urban centres it was introduced in 1992 and later.

Most urban centres have not provided information on cost of the activity before and after privatisation. However, for the few cities for which this information is available indicates that privatisation has helped in saving costs. For instance, in Ludhiana maintenance of tube-wells has helped in cost savings of Rs. 5.5 lakhs and in Nashik a cost saving of Rs. 8.45 lakhs has been achieved by giving maintenance of pumping stations to private sector.

Table - 2.31: Details of Privatisation in Water Supply – 1999								
Sl. no.	City/ Town	Activity	Specific aspects/areas	Privatisa-tion mode	No. of contrac-tors	Year privatised	Cost before (Rs. '000)	Cost after (Rs. '000)
Metropolitan cities								
1	Nagpur	O & M	Pumping station	n.a.	1	1994	n.a.	75
		O & M	Treatment plant	n.a.	1	1994	n.a.	105
2	Jaipur	O & M	Pipe lines	Contract	1	n.a.	n.a.	n.a.
3	Ludhiana	O & M	Tubewells	Contract	10	1995	750	200
4	Visakha-patnam	O & M	Pumping station Treatment plant & Pipe lines	Contract	n.a.	1995	n.a.	n.a.
Class I								
1	Agra	O & M	Treatment plant	Contract	1	1997	n.a.	1,182
		O & M	Pumping station	Contract	1	1997	n.a.	150
2	Allahabad	O & M	Tube-wells	Contract	18	1989	180	270
3	Nashik.	O & M	Pumping station	Contract	1	1992	2,800	1,955
4	Jodhpur	Billing	Entire city	Contract	1	1992	n.a.	360
		Revenue collection	Entire city	Contract	1	1992	n.a.	900
5	Bareilly	O & M	Tube-wells	Contract	1	1998	75	40
6	Rajkot	O & M	Pumping station	Contract	2	1998	n.a.	n.a.
7	Kota	O & M	Pipe lines	Contract	1	1996	n.a.	162
		Billing	Entire city	Contract	1	1994	n.a.	1,420
		Revenue collection	Entire city	Contract	1	1994	n.a.	140
Class II								
1	Amravati	O & M	Pipe lines	Contract	7	1998	n.a.	2,000
		Billing	Entire city	Contract	1	1998	n.a.	n.a.
2	Ajmer	O & M	Pipe lines	Contract	2	1996	n.a.	n.a.
		O & M	Pumping station	Contract	2	1996	n.a.	n.a.
3	Gulbarga	O & M	Head Pump	Contract	4	1996	n.a.	n.a.
4	Bhilwara	Billing	Entire city	Contract	1	n.a.	n.a.	n.a.
5	Sriganga-nagar	Billing	Entire city	Contract	1	1995	n.a.	100
		O & M	Pipe lines	Contract	1	1996	n.a.	300
		O & M	Pumping station	Contract	2	1995	n.a.	200
6	Bhusawal	O & M	Pipe lines	Contract	1	1998	600	n.a.
7	Qutubulla-pur	O & M	Pipe line & Bore wells	Contract	1	1994	n.a.	n.a.
8	Hospet	Water distribution	n.a.	n.a.	3	1996	n.a.	n.a.
9	Mahesana	O & M	Pumping station	Contract	1	1992	n.a.	n.a.
10	Bhandara	O & M	Treatment plant	Contract	1	1999	n.a.	613
11	Barmer	Revenue	Entire city	Contract	1	1996	n.a.	54
		Billing	Entire city	Contract	1	1996	n.a.	89
12	Bundi	Billing	Entire city	Contract	1	1994	150	50
13	Virar	O & M	Head work	Contract	1	1997	n.a.	3,000
		O & M	Treatment plant	Contract	1	1998	n.a.	360

Source: NIUA Survey,1999. See Appendix - I, Table A – 12 for details

2.14 WATER TARIFF

2.14.1 Charging for Water

Tariff for water should ideally cover not only the cost of operation and maintenance of the system but also the capital replacement cost. However, in most Indian cities and towns even the operation and maintenance cost is not recovered. Water is considered to be an essential good and therefore, to be either provided at very low rates or even free of cost. The rates fixed are also not revised frequently to reflect the prevailing costs, widening the gap between the cost of production and tariff charged. The present survey, however, reveals that this situation has undergone some change and that many cities and towns have revised their tariff in the 1990s.

Water is charged for in three ways:

- Through consumption based tariff
- Through flat rates
- Through water taxes

Tariff for water supply varies considerably between cities and between states. Water tariff is different for domestic and non-domestic uses. The tariff is generally much higher for industrial and commercial uses than for domestic use.

2.14.2 Types of Water Tariff

Water connections (domestic and non-domestic) can be of two types - metered and unmetered. Water tariff for metered connections is consumption based, i.e. based on the quantity of water consumed. Water tariff for unmetered connections is a flat rate (fixed amount), which is not related to the quantity of water consumed.

a) Metered Rates

Consumption based water rates for metered connections are of two types:

- a uniform volumetric rate per kilo litre (kl i.e.1000 litres) for the entire quantity of water consumed in a month; and
- an increasing block tariff (IBT) or slab based rate with higher rate per kilo litre for higher quantities of water consumed per month, with a minimum monthly fixed charge in some cities.

Uniform volumetric rate is a single rate per kilolitre of water for the entire quantity of water consumed per month through a single connection, applied uniformly to large as well as small consumers. Therefore, the monthly bill, where this rate is used, is directly proportional to the quantity of water consumed.

On the other hand, IBT differentiates between the low end users and the high end users and often cross-subsidises low end users by high end users. In IBT it is

assumed that the poorest would have a consumption, which will generally not exceed the first block, and so they will pay the lowest rates. However, the lowest block, though it generally varies between 10 kl. to 25 kl., can be as high as 50 kl. (e.g. Coimbatore). Most domestic consumers in the last case would fall in the first block itself, while in others they may go upto the second or the third blocks. So IBT needs to be studied in detail to know whether subsidies are being targeted properly.

b) Unmetered Rates

Flat rate for unmetered connections can be grouped into four categories. These categories are:

- based on ferrule size of connection;
- based on the number of taps in a house;
- a fixed flat rate; and
- a variable flat rate based on the annual rateable value (ARV) of property.

Ferrule based rates depend on the ferrule size (i.e. the diameter) of the connection. Most domestic connections are only of half-inch diameter; larger ferrule size connections are generally taken by large consumers such as apartment blocks. Ferrule based rates are common in only a few states.

Tap based rates depend upon the number of taps in a house. Generally, the rate for the first tap is higher than the rate for additional taps. These rates are much less commonly used in the sampled urban centers than the ferrule based rates.

The fixed flat rate, charged either annually or at lesser intervals, is the most common method of charging for water (for unmetered connections). The basis of this flat rate is not explicitly stated but could be based on ferrule size, or the duration of supply or some other basis known to local authorities.

Water tax, charged in a few urban centers in the sample, is a certain percentage of the property tax. This ARV based charge for unmetered connections is not very common in the sampled urban centers. However, the survey reveals that in some urban centres a flat rate is charged but it is called water tax. While in yet other cases, a flat rate, which is actually based on ferrule size but not explicitly stated, so, is called water tax and not a water charge. These variations in the nomenclature used for flat rates sometimes make it difficult to classify them (as water tax or water charge).

Tariff for non-domestic uses, in some cities, are very elaborate. Cities differentiate between different types of non-domestic uses in a fairly detailed manner and charge different water rates for different uses. The schedule of tariff for large cities often follows an elaborate categorisation by uses and the scale of

activity. For instance, the water rates are different for small eating-places, big restaurants and hotels. Domestic tariff is also fairly elaborate in larger cities where there are individual houses as well as large apartment blocks. Tariff is often higher for apartment blocks than for individual houses mainly on account of larger ferrule size of connections. Water rates are also different for treated and untreated water and for supplies within city limits and outside city limits.

Tariff for domestic connections are often significantly lower than those for non-domestic connections, particularly industrial and commercial connections. There is a cross-subsidy within the water sector whereby domestic consumers are subsidised by industrial and commercial consumers. The extent of cross-subsidy varies, though on an average industrial consumers pay between 2 to 10 times higher tariff than domestic consumers. While in many cities in the sample, industrial and commercial users are charged the same rate, institutional users are often charged a different rate which may be the same as domestic rate or a rate that is lower than the industrial and commercial rates.

With a few exceptions, stand posts are supplied water free of charge. In some cities, such as Mumbai and Hyderabad, a system of metering of stand post supplies is being introduced.

c) Water Tax

Water tax, in the sampled urban centres, is levied mainly in the states of Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Maharashtra, and Madhya Pradesh with a few cities of Gujarat and Karnataka also levying water tax. The rate of water tax varies from 3.5 per cent to 25 per cent in the sampled urban centres. Mumbai levies a water tax of 50 per cent of the rateable value of the property.

2.14.3 Water Tariff in Metropolitan Cities

A comparison of tariff used by different metropolitan cities is made somewhat difficult by the non-uniformity of structure. Each city uses a slightly different structure such as different blocks in IBT or different ferrule sizes (see Appendix I) or an entirely different basis of charging, such as property tax based rates. Despite these, a broad overview of the tariff structure and rates is presented below.

a) Domestic Metered Rates

i) Uniform Volumetric Rates

In 12 of the 22 sampled metropolitan cities uniform volumetric rates are charged for metered connections. Most metropolitan cities charge a rate ranging between Rs. 2.00 and Rs. 3.50 per kl. per month. Only two metropolitan cities viz., Madurai and Vishakhapatnam charge Rs. 5.00 per kl. per month from their domestic consumers.

ii) Increasing Block Tariff

Eight metropolitan cities use increasing block tariff (IBT) for metered domestic connections. The number of blocks in IBT generally varies between 3 to 5 in the sampled metropolitan cities. IBT for metered connections vary from Re.0.35 (+ 50% surcharge) (Delhi) to Rs. 5.00 (Chennai) for first 10 kl (Delhi). The IBT is the lowest in Delhi while it is the highest in Chennai. Broadly stated, Chennai's rates are roughly 10 times that levied in Delhi. The ratio of charges (Rs./kl.) in the last to first block is the highest in Chennai (ten times) and the lowest in Nagpur (one-and-a- half times). This means that consumers in the last block pay a much higher rate per kilolitre of water than the consumers in the first block (Table 2.32).

Table - 2.32: Metropolitan Cities with Increasing Block Tariff - 1999

Sl. No.	City	No. of blocks	First block	Rs/kl.in the first block	Last block	Rs/kl. in last block	Minimum payment, if any (Rs.)	Ratio of charges (Rs./kl.) in last to first block
1	Bangalore	5	upto 25 kl.	3.50	above 100 kl.	33.00	65	9.43
2	Chennai	4	upto 10 kl.	2.50	above 25 kl.	25.00	-	10.00
3	Coimbatore	4	upto 50 kl.	2.50	above 200 kl.	4.00	-	1.60
4	Delhi	4	upto 10 kl.	0.35	above 30 kl.	3.00	20	8.57
5	Hyderabad	4	upto 15 kl.	3.70	above500 kl.	14.00	55	3.78
6	Jaipur	3	upto 15 kl.	1.56	above 40 kl.	4.00	-	2.56
7	Nagpur	3	upto 10 kl.	1.00	above 30 kl.	1.50	-	1.50

Source: NIUA Survey, 1999. See Appendix - I, Tables AT-1, AT-4, AT-7, AT-10, AT-11 and AT-14 for details

b) Domestic Unmetered Rates

i) Ferrule Based Rates

Only seven metropolitan cities use ferrule base rates for unmetered connections. Ferrule based rates vary from Rs. 120 (Surat) to Rs. 750 (Pune) per year for a ½" domestic connection and the average payment for ½" ferrule size is approximately Rs. 296 per annum. Larger size ferrule connections pay much higher rates in some cities. For instance, in Jaipur those with one-inch ferrule connection pay 18.5 times the rate paid by those with a half-inch ferrule connection. Whereas in Surat this difference is only 5.4 times (Table 2.33).

ii) Flat Rate

Only eight metropolitan cities charge non-ferrule based flat rates. Flat rates vary from Rs. 240 (Madurai) to Rs. 1680 (Hyderabad) per year with the

Table - 2.33: Metropolitan Cities With Ferrule Based Rates - 1999				
				(in Rs. /year)
Sl. No.	City	Ferrule size		
		1/2" (15mm)	3/4" (20mm)	1" (25mm)
1	Calcutta	120	480	780
2	Jaipur	min. 240	min. 1440	min. 4440
3	Kanpur	min. 360 - 1200	min. 540 - 1800	min. 840 - 2400
4	Nagpur	300	600	-
5	Pune	750	1500	4000
6	Surat	120	252	648
7	Vadodara	180	720	1440
	Average	296	544	1059
Source: NIUA Survey, 1999. See Appendix- I, Tables AT – 2, AT-7, AT-10, AT-12, & AT-13 for details				

average charge working out to approximately Rs. 668 per year (Table 2.34).

Table - 2.34: Meropolitan Cities With Flat Rates - 1999		
Sl. No.	Metro cities	Charges/ year (in Rs.)
1	Bhopal	720
2	Chennai	600
3	Coimbatore	300
4	Hyderabad	1680
5	Indore	720
6	Ludhiana	600
7	Madurai	240
8	Visakhapatnam	480
	Average	**667**
Source: NIUA Survey, 1999. See Appendix - I, Tables AT–1, AT-6, AT-9, AT-11 for details		

c) Non-Domestic Tariff

The non-domestic tariffs are of two types – in some cities all the non-domestic uses are clubbed together under one head "non-domestic ", while in other cities non-domestic uses are broken up into industrial, commercial and institutional uses. In yet other cities, industrial tariff has been separated while tariff for all the other non-domestic uses have been clubbed together.

A strict comparison of rates is difficult, as explained earlier, due to different blocks used by different cities. Broadly though, Coimbatore has the lowest rates for non-domestic supply of Rs. 5.00 per kl. upto 50 kl. per month. Bangalore has the highest rates in this category with the base block rate being Rs. 33 per kl. upto 10 kl.

i) Industrial Tariff

The industrial tariff in the metropolitan cities varies from Rs. 8.00 (Surat) to Rs. 22 per kl. per month (Indore) for metered connections. For unmetered industrial connections the minimum tariff varies from Rs. 5760 per annum (Kanpur) to Rs. 25200 per annum (Vadodara) for a 25 mm connection. Non-ferrule based flat rate for industrial connections vary from Rs. 1200 (Ludhiana) to Rs. 4800 per annum (Chennai). In Ahmedabad, the industrial connections are charged 25-30 per cent of annual rateable value or a minimum of Rs. 720 per annum.

2.14.4 Water Tariff in Major States

a) Andhra Pradesh

In Andhra Pradesh, the tariff for domestic metered connections varies from Rs. 1.50 per kl. in Nellore to Rs. 5.75 per kl. in Vijayawada (Table 2.35). Industrial tariff for metered connections varies between Rs. 10.00 per kl. in Warangal to Rs. 15.00 per kl. in Tirupati. The tariff for metered industrial connections is almost six times higher than the domestic rate in Nellore while it is about two-and-a-half times the domestic rate in Vishakhapatnam. The flat rate tariff for unmetered domestic connections varies from Rs. 360 per annum in Srikakulam to Rs. 720 per annum in Warangal.

The domestic water connection charges mostly range between Rs. 4000 and Rs. 6000, though there are exceptions to this. In Hyderabad the connection charges vary between Rs. 900 to Rs. 40,000 depending on the size of pipe and the size of the plot. Tariff revisions in most of the sampled urban centres were done in 1999 (see Appendix – I, Table AT-1 for details).

Table - 2.35: Domestic and Industrial Tariff in Selected States – 1999

Sl. No.	State	Metered				Unmetered			
		Uniform volumetric rate (in Rs./kl.)				Flat rate (in Rs./ annum)			
		Domestic		Industrial		Domestic		Industrial	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	Andhra Pradesh	1.50	5.75	10.00	15.00	360	720	-	
2	Gujarat	1.50	5.00	8.00	25.00	120	300	360 - 6300 (Fr.)	
3	Haryana	1.00		2.50		125 - 200 (Fr.)		-	
4	Karnataka	1.25	3.50	-		360	540	2160	
5	Madhya Pradesh	0.33	3.00	2.20	22.00	144	720	480	3600
6	Maharashtra	1.00	5.75	8.00	28.00	160	806	213	3576
7	Punjab	1.20		2.50		240	360	360	1200
8	Tamil Nadu	1.00	5.00	3.75	20.00	240	816	480	4800
9	Uttar Pradesh	0.18	3.00	-		-		-	

Note: Fr. refers to ferrule based rates
Source: NIUA Survey, 1999. See Appendix - I, Tables AT– 1,2,3,4,6,7,9,11 & 12 for details

b) Gujarat

In the sampled urban centres of Gujarat, the tariff for domestic metered connections varies from Rs. 1.50 per kl. (Vadodara) to Rs. 5 per kl. (Bharuch). Industiral tariff for metered connections varies between Rs. 8.00 (Surat) to Rs. 25.00 per kl. (Jamnagar) (Table 2.35). The tariff for metered industrial connections is four times the domestic rate in Surat while they are seven times in Vadodara.

The tariff for unmetered connections based on ferrule size varies considerably between cities ranging from Rs. 60 per annum for a ½" domestic connection in Anand to Rs. 360 in Bhuj. The tariff for industrial unmetered ferrule based connections varies between Rs. 360 per annum for a ½" connection in Palanpur to Rs.6300 in Vadodara. The variation between domestic and industrial tariff is as high as 35 times in Vadodara and as low as three times in Palanpur for a ½" connection. The flat rate for unmetered connections (non-ferrule based) varies from Rs. 120 per annum in Mehsana to Rs. 300 in Bhavnagar. The variation between domestic and industrial tariff is as high as 42 times in Bhavnagar while it is as low as two times in Junagadh.

The water connection charges in the state are highly variable with each city charging a different amount. The connection charges in the sampled cities/ towns vary from Rs. 25 to Rs. 400 in Palanpur to Rs. 100 to Rs. 20000 in Ahmedabad for various sizes of connections.

The water tariff was last revised in Surendranagar in 1976 though in most other sampled cities/towns in the state the tariff was revised either in late 1980s or in 1990s (see Appendix – I, Table AT-2 for details).

c) Haryana

Similar to Punjab, Haryana too has a uniform water tariff for most of its cities and towns. The domestic metered water rate is Re. 1.00 per kl. per month in almost all the sampled cities and towns (Table 2.35). Industrial tariff is two-and-a-half times the domestic rate at Rs. 2.50 per kl. per month while the commercial water tariff is Rs. 2.00 per kl. per month. Unmetered domestic connections are charged both by tap rates as well as by ferrule size of connection. The tap rate charges are Rs. 50 per month for one tap and Rs. 80 per month for more taps in Rohtak while the ferrule size based rates vary between Rs. 125 for 15 mm connection and Rs. 200 per year for connections above 20 mm.

The connection rates for all uses are fixed at Rs. 300. The water tariff in the sampled urban centres of the state was revised mostly in 1993 and 1994 (see Appendix – I, Table AT-3 for details).

d) Karnataka

In Karnataka, larger cities have IBTs for water supply while almost all the other sampled urban centres charge a fixed monthly amount for water. The cities with

IBTs include Bangalore, Mysore, Hubli-Dharwad and Mangalore while Belgaum has ferrule-based rates. The minimum rates for domestic metered connections are Rs. 3.50 per kl. in Bangalore, Rs.1.25 in Mysore and Hubli-Dharwad and Rs. 1.40 per kl. in Mangalore. The fixed rates are generally Rs. 360 or Rs. 540 per year (Table 2.35, also see Appendix – I, Table AT-4 for details).

e) Kerala

Kerala uses a block tariff structure for charging for water. However, the charging system in Kerala is different to other states. Kerala charges a fixed amount for each block and not a rate for each block. The lowest block in the state for domestic users starts from 10 kl. with a rate of Rs. 22 and the amount increases for every kilo litre (Table 2.35, also see Appendix – I, Table AT-5 for details).

f) Madhya Pradesh

In the sampled urban centres of Madhya Pradesh, the per kl. rate for domestic metered connections varies between Rs. 0.33 in Satna to Rs. 3.00 in Jabalpur (Table 2.35). The tariff for industrial metered connections varies from Rs. 2.20 per kl. in Satna to Rs. 22.00 per kl. in Jabalpur. The industrial tariff for metered connections is eleven times the domestic rate in Indore while it is less than double in Rewa.

The tariff for unmetered domestic connections varies from Rs. 144 per annum in Rewa to Rs. 720 per annum in Bhopal. Industrial tariff for unmetered connections varies from Rs. 480 per annum in Morena to Rs. 3,600 in Indore.

The water connection charges in Madhya Pradesh vary a great deal ranging from Rs. 61 in Satna to Rs. 3,000 in Gwalior. The water tariff was last revised between 1997 and 1998 in most of the sampled urban centres in the state (see Appendix – I, Table AT-6 for details).

g) Maharashtra

The water tariff for domestic metered connections, in the sampled urban centres of Maharashtra, varies from Rs. 1.50 per kl. in Mumbai to Rs. 5.75 per kl. in Ballarpur. Industrial tariff for metered connections varies between Rs. 8.00 per kl. in Ichalkaranji to Rs. 28.00 per kl. in Ballarpur (Table 2.35). The tariff for metered industrial connections is eight times the domestic tariff in Nanded while it is four times in Ichalkaranji.

The tariff for unmetered domestic connections varies from Rs. 106 per annum in Yavatmal to Rs. 806 per annum in Amalner. The tariff for unmetered industrial connections varies from Rs. 213 per annum in Bhandara to Rs. 3,576 per annum in Ratnagiri.

The water connection charges varied between Rs. 21 in Chandrapur to Rs. 955 in Bhandara. The tariff revisions in the sampled urban centres in the state were mostly done between 1997 and 1999 (see Appendix – I, Table AT-7 for details).

h) Orissa

The water tariff for domestic metered connections, in the sampled urban centres of Orissa, varies from Rs. 1.50 per kl. in Sambalpur to Rs. 2.00 per kl. in Cuttak and Puri. Industrial tariff for metered connections varies between Rs. 3.00 per kl. in Sambalpur to Rs. 4.65 per kl. in Cuttak. The tariff for metered industrial connections is about twice the domestic tariff in sampled urban centres.

The tariff for unmetered domestic connections varies from Rs. 360 per annum for two taps in Sambalpur to Rs. 480 per annum for two taps in Cuttak, Puri and Balangir. While in Bhadrak the tariff for unmetered domestic connections is 10% of ARV.

The water connection charge is uniform for the sampled urban centres. Though within an urban centre water connection charge varies from Rs. 3000 for residential areas to Rs. 5000 for industrial and commercial areas. The tariff revisions in the sampled urban centres in the state were done in 1996 (see Appendix – I, Table AT-8 for details).

i) Punjab

Punjab has a uniform water tariff for most of its urban centres. Amongst the sampled urban centres almost all domestic metered connections are charged Rs. 1.2 per kl. per month (Table 2.35). The industrial and commercial rate is double the domestic rate i.e. Rs. 2.5 per kl. per month. The domestic unmetered rates are by the number of taps in some cities and a fixed amount in some others. The rate for the first tap is Rs. 20, and Rs. 7.5 for a second tap per month. Fixed flat rate for unmetered domestic connections varies between Rs. 240 and Rs. 360 per annum in most sampled urban centres with the exception of Ludhiana where this rate is Rs. 600 per annum.

In Punjab, water connection charges varied from Rs. 15 in Jalandhar to Rs. 800 in Sangrur. The tariff revisions in the sampled urban centres in the state were done between 1992 and 1999 (see Appendix – I, Table AT-9 for details).

j) Rajasthan

The urban centres of Rajasthan have a block tariff structure for domestic and non-domestic connections. The domestic metered rates vary from Rs. 1.56 per kl to Rs. 4 per kl in different blocks while the un-metered rates vary from Rs. 240 to Rs. 1440 per year for ferrule sizes of 15mm and 20 mm. For non-domestic connections the metered rates vary from Rs. 4.68 per kl. to Rs. 11.00 per kl in different blocks while the un-metered rates vary from Rs. 612 to Rs. to Rs. 4440 for ferrule sizes of 15mm to 25 mm (see Appendix – I, Table AT-10 for details).

k) Tamil Nadu

In the sampled urban centres of Tamil Nadu the tariff for domestic metered connections varies from Rs. 1.00 per kl. in Ambur to Rs. 5.00 per kl. in Madurai

(Table 2.35). Industrial tariff for metered connections varies from Rs. 3.75 per kl. in Thiruvannamalai to Rs. 20.00 per kl. in Madurai. The tariff for metered industrial connections is five times the domestic rate in Madurai while it is three times in Thiruvannamalai.

The tariff for unmetered domestic connections varies from Rs. 240 per annum in Madurai to Rs. 816 per annum in Puddukottai. The industrial tariff for unmetered connections varies between Rs. 480 in Tirunelveli to Rs. 4,800 per annum in Chennai.

The water connection charges varied from Rs. 1,000 in Madurai to Rs. 25,000 in Salem. The water tariff was last revised between 1991 and 1999 in the sampled urban centres in the state (see Appendix – I, Table AT-11 for details).

l) Uttar Pradesh

The water tariff in Uttar Pradesh is amongst the lowest in the country. The per kl. rate for domestic metered connections varies from a low Rs. 0.18 in Ghazipur to Rs. 3.00 in Agra (Table 2.35). The variation between domestic and industrial tariff for metered connections varies from less than double in Saharanpur to about eight times in Agra.

Water connection charges vary from Rs. 120 to Rs.5000 depending on size of connection and other charges involved. Tariff revision in some cities has not been done for many decades while in others the revision has been more recent, that is in 1990s (see Appendix – I, Table AT-12 for details).

m) West Bengal

The urban centres of West Bengal have a ferrule based tariff structure for unmetered domestic and non-domestic connections. The tariff ranges from Rs. 120 per annum for a ½" domestic connection in Calcutta to Rs. 360 in Darjeeling. The annual tariff for non-domestic unmetered ferrule based connections in Calcutta varies between Rs. 1560 per annum for a 1/8" connection to Rs.28,800 for 1"connection. The variation between domestic and industrial tariff is as high as 60 times for a ½" connection (see Appendix – I, Table AT-13 for details).

2.15 REVENUE RECEIPTS AND REVENUE EXPENDITURE

Non-uniformity in the method of keeping municipal accounts across states and cities makes the analysis of revenue receipts and revenue expenditure a difficult task. Urban local governments keep accounts in different ways – some keep by departments while others keep by major revenue expenditure heads such as establishment, electricity, consumables and so on. This makes it difficult to segregate revenue expenditure for a particular department. These differences in the methods of keeping accounts have an impact on the analysis of revenue receipts and revenue expenditure presented here.

Another factor which has an impact on the analysis of revenue receipts and revenue expenditure is the fact that the financial data analysed here are not time series data, but pertain to just one year i.e., 1997-98 financial year, which could be an unusual year for some urban centres. However, such a large sample nullifies such differences in the aggregate.

2.15.1 Revenue Receipts

The main sources of revenue receipts for the water supply department are water tax, water charges, connection charges, bulk supply charges and other sources that vary from city to city. Water tax, which is a certain percentage of property tax, is the main source of revenue receipts for some urban centres while for some others water charges are the main source of revenue receipts. Some urban centres levy water tax as well as water charges. Water cess is also a source of revenue receipts for a few urban centres. Water tax is a fixed amount that is recovered from all property tax assessees, regardless of the quantity of water consumed. Water charge, on the other hand, is related to consumption of water. Water charges that are fixed are not directly related to water consumption, though they are fixed on the basis of the water that can be consumed given the duration of supply and the ferrule size of the connection.

Water charge is a more common source of revenue receipts than water tax in the sampled urban centres. A larger percentage (29%) of the sampled urban centres raise revenue through water charges than water tax (20%). However, about a third of the urban centres (31%) raise revenues from both water charge and water tax. In the remaining urban centres other sources of revenue receipts are more significant than water charge and water tax[7].

a) Water Charge

Water charge contributes an average of 69 per cent to the total revenue receipts from this service in the sampled urban centres. The share of water charges to the total revenue receipts from the service reduces with city size indicating that the larger urban centres raise a larger proportion of revenue receipts from water charge than water tax. Water charge is generally consumption based and therefore, a significant share of revenue receipts from water charge is healthy for the water supplying agency. About 74 urban centres that do not raise any revenue receipts on this head (Table 2.36).

b) Water Tax

Water tax, on an average, contributes only about 15 per cent to the total revenue receipts from this service. The share of water tax, to the total revenue receipts, increases as the city size reduces (Table 2.37). This indicates that the smaller size of urban centres rely more on tax than on charge. It is important for these

[7] The analysis of revenue receipts is somewhat hampered by the fact that for some urban centres only aggregate figures of revenue receipts are available and in some certain revenue receipt heads are clubbed together. Disaggregated figures (i.e. by individual revenue heads) are available for only 254 sampled urban centres.

Table - 2.36 : Percentage Revenue Receipts from Water Charges – 1997-98					
					(no. of cities/towns)
% Revenue receipts from water charges	Metropolitan cities	Class I cities	Class II towns	Total	%
0	1	48	25	74	25
1 to <20	2	25	16	43	14
20 to <40	3	10	13	26	9
40 to <60	1	12	9	22	7
60 to <80	3	11	4	18	6
80 and above	8	39	23	70	23
Break up not available	4	9	11	24	8
Data not available	0	10	14	24	8
No. of cities/towns	22	164	115	301	100
Average (%)	74	54	42	69	

Note: The total number of urban centres in the above table are 254 but the urban centres which do not generate revenues from water charges (first row) have been excluded for calculating the average. Therefore, the calculations are based only on 179 urban centres.
Source: NIUA Survey, 1999. See Appendix - I, Table A – 13 for details

urban centres to switch to water charges to increase their revenue receipts from sale of water as water tax is not an elastic source of revenue receipts.

Table - 2.37: Percentage Revenue Receipts from Water Tax - 1997-98					
					(no. of cities and towns)
% Revenue receipts from water tax	Metropolitan cities	Class I cities	Class II towns	Total	%
0	8	61	32	101	34
1 to <20	3	9	7	19	6
20 to <40	3	7	6	16	5
40 to <60	2	18	14	34	12
60 to <80	2	9	8	19	6
80 and above	1	42	23	66	22
Break up not available	3	8	11	22	7
Data not available	0	10	14	24	8
No. of cities/towns	22	164	115	301	100
Average (%)	11	25	37	15	

Note: The total number of urban centres in the above table is 254 but the urban centres which do not generate revenues from water tax (first row) have been excluded for calculating the average. Therefore, the calculations are based only on 152 urban centres.
Source: NIUA Survey, 1999. See Appendix - I, Table A – 13 for details

c) Connection Charges

The share of water connection charges in the total revenue receipts from water

supply averages only about 2 percent in the sampled urban centers (Table 2.38). While some consider connection charges to be a part of revenue receipts, others consider it to be a part of capital receipts. However, while revenue receipts from connections charges is included in the revenue receipts in this study, the overall results do not alter due to its inclusion, as its contribution to the total revenue receipts from this service is insignificant.

Table - 2.38: Percentage Revenue Receipts from Connection Charges – 1997-98

(no. of cities and towns)

% Revenue receipts from connection charges	Metropolitan cities	Class I cities	Class II towns	Total	%
0	10	51	35	96	32
1 to <5	9	72	42	123	41
5 to <10	0	11	1	12	4
10 to <20	0	1	7	8	3
20 to <50	0	3	1	4	1
50 and above	0	8	4	12	4
Break up not available	3	8	11	22	7
Data not available	0	10	14	24	8
No. of cities/towns	22	164	115	301	100
Average (%)	1	7	8	2	

Note: The total number of urban centres in the above table is 254 but the urban centres which do not generate revenues from connection charges (first row) have been excluded for calculating the average. Therefore, the calculations are based only on 158 urban centres.
Source: NIUA Survey,1999. See Appendix - I, Table A – 13 for details

Connection charges are the main source of revenue receipts for some urban centres. For instance, in the sampled urban centres of West Bengal, where water is supplied free of charge in most cities and towns, the main source of revenue receipts is from connection charges.

2.15.2 Revenue Expenditure

Data on revenue expenditure suffers from the same problems explained earlier, i.e. from different methods of keeping accounts. Different heads of revenue expenditure are at times clubbed together[8] or are available for the local body as a whole but not for the water department separately. These have some impact on the revenue expenditure analysis, though broad trends are available with the existing data.

The main heads of revenue expenditure on water supply are establishment, electricity, consumables, repairs and replacements and certain other heads, which vary from one city to the other.

[8] *Disaggregated figures for expenditure on establishment is available for 267 urban centers, while figures for expenditure on electricity, as a separate head, is available for only 130 sampled urban centers.*

a) Establishment

Expenditure on establishment, as a proportion to total revenue expenditure on water supply, is lower than expenditure on O&M. On an average, a little over one-fourth (28%) of the total revenue expenditure on water supply is spent on establishment in the sampled urban areas. While in a majority (37%) of the urban centres between 20 and 40 per cent of the total revenue expenditure on the service is spent on establishment, in about 5 per cent the establishment expenditure exceeds 80 per cent (Table2.39). A larger share of revenue expenditure on establishment considerably reduces the funds available for operation and maintenance of water supply system.

Table - 2.39 : Percentage Revenue Expenditure on Establishment in Water Supply – 1997-98

(no. of cities and towns)

% Revenue expenditure on establishment	Metropolitan cities	Class I cities	Class II towns	Total	%
<20	6	24	12	42	14
20 to <40	11	56	45	112	37
40 to <60	3	36	15	54	18
60 to <80	2	16	15	33	11
80 and above	0	6	9	15	5
Break up not available	0	12	4	16	5
Data not available	0	14	15	29	10
No. of cities/towns	22	164	115	301	100
Average (%)	26	31	33	28	

Source: NIUA Survey,1999. See Appendix - I, Table A – 14 for details

b) Operation and Maintenance (O&M)

Expenditure on electricity, consumables, repairs and replacements and other related expenses together constitute the operation and maintenance head. O&M expenditure would, to a large degree, determine the quality of service provided by the agency. A high O&M expenditure should result in better quality of service.

About half the total revenue expenditure on water supply service is spent on O&M in the sampled urban centers (Table 2.40). While a majority of urban centers spend between 60 to 80 per cent of the total revenue expenditure on the service on O&M, there are some cities (11%), which spend less than 20 per cent of the total revenue expenditure on this head. Low revenue expenditure on O&M would result in poor quality of service. The minimum necessary expenditure on the service must be incurred to ensure good quality of service to the people.

i) Electricity

The expenditure on electricity is often a significant proportion of the total revenue expenditure on water supply due to pumping requirements in this

Table - 2.40: Percentage Revenue Expenditure on Operation and Maintenance – 1997-98					
					(no. of cities and towns)
% Revenue expenditure on O&M (including electricity	Metropolitan cities	Class I cities	Class II towns	Total	%
<20	0	7	12	19	6
20 to <40	5	17	16	38	13
40 to <60	4	43	16	63	21
60 to <80	9	53	43	105	35
80 and above	4	18	9	31	10
Break up not available	0	12	4	16	5
Data not available	0	14	15	29	10
No.of cities/towns	22	164	115	301	100
Average (%)	46	63	52	50	
Source: NIUA Survey, 1999. See Appendix - I, Table A – 14 for details					

service. On an average, the expenditure on electricity forms 36 per cent of the total revenue expenditure on the service in the sampled urban centers (Table 2.41).

Table – 2.41: Percentage Revenue Expenditure on Electricity – 1997-98					
					(no. of cities and towns)
% Revenue expenditure on electricity	Metropolitan cities	Class I cities	Class II towns	Total	%
<20	3	33	32	68	22
20 to <40	7	26	15	48	16
40 to <60	5	36	20	61	21
60 and above	5	12	5	22	7
Break up not available	2	43	28	73	24
Data not available	0	14	15	29	10
No.of cities/towns	22	164	115	301	100
Average (%)	33	45	32	36	
Source: NIUA Survey,1999. See Appendix - I, Table A – 14 for details					

Only 199 urban centers could furnish disaggregated data on this head, the others have given data only in a clubbed manner along with other expenses. Not being able to segregate expenditure on electricity for water supply department from the rest of the departments is one of the reasons for local governments not being able to furnish data on expenditure on electricity. Urban centers that rely on gravity would spend less on electricity as compared to urban centers relying heavy on pumping. High expenditure on electricity considerably increases the cost of production of water. Water tariffs are often kept low for considerations other than cost. Making water

tariff more realistic by indexing it to electricity charges can help reduce the revenue deficit on water supply account.

ii) Consumables and Repairs & Replacements

Consumables, such as bleaching powder, chlorine, alum etc. that are used for treating water, are absolutely essential for making water potable. Therefore, expenditure on consumables will necessarily be incurred by all water supplying departments/ agencies. Repairs and replacements of machinery, pipelines etc. are also essential to keep the water supply running efficiently. Therefore, expenditure on these two heads must be reflected in the water supply accounts, though, often they are clubbed together. Expenditure requirement on these heads will vary from one city to the other, depending on the source of water and other local variations.

Expenditure on consumables and repairs & replacements do not exceed 10 per cent of the total revenue expenditure in little less than one fourth of the sampled urban centers while it lies between 10 to 30 per cent in about one-third of the urban centers (Table 2.42).

Table - 2.42: Percentage Revenue Expenditure on Consumables and Repairs & Replacements – 1997-98

(no. of cities and towns)

% Revenue Expenditure on consumables and repairs & replacements	Metropolitan cities	Class I cities	Class II towns	Total	%
<10	11	31	23	65	22
10 to 20	7	36	9	52	17
20 to 30	1	23	17	41	14
30 to 40	1	8	9	18	6
40 to 50	0	6	8	14	5
> 50	0	3	6	9	3
Break up not available	2	43	28	73	24
Data not available	0	14	15	29	9
No.of cities/towns	22	164	115	301	100
Average (%)	9	13	15	10	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 14 for details

2.15.3 Cost Recovery

Water supply is a service from which cost recovery is possible. However, this would depend on the tariff structure as well as the efficiency of collection of dues in any given city/ town. It is generally true that most water supply accounts show deficit and the service has to be subsidized by higher levels of government to carry on functioning. Yet there are urban centres where water supply accounts show a positive balance with revenue receipts exceeding revenue expenditure.

a) Extent of Cost Recovery

A majority of urban centres (79%) show revenue* deficit on water supply account, that is, the revenue receipts are not sufficient to meet the revenue expenditure on the service. The general pattern of cost recovery indicates that, on an average, only 65 per cent of the cost incurred on providing water supply is recovered. However, the recovery rate is much better in metropolitan cities (70%) than in other Class I (55%) and Class II (44%) urban centers (Table 2.43). The recovery in metropolitan cities could be better due to better efficieny coupled with the fact that some metropolitan cities have city level autonomous boards, which are run more professionally than the departments of local government. These boards also have a much better structured water tariff and have a larger percentage of metered connections. These factors lend themselves to better recovery rate in water supply.

Cost recovery is less than 50 per cent in a little less than half the urban centres (45%). In fact, about a fifth of the sampled urban centres are not able to recover even 25 per cent of the revenue expenditure on the service.

Table 2.43: Revenue Receipts as a Percentage of Revenue Expenditure in Water Supply -1997-98

(no. of cities and towns)

Revenue receipts as a % of revenue expenditure	Metropolitan cities	Class I cities	Class II towns	Total	%
<25	3	37	27	67	22.4
25 to <50	7	40	21	68	22.6
50 to <75	3	22	15	40	14
75 to <100	0	19	15	34	11
100 and above	9	29	17	55	18
Data not available	0	17	20	37	12
No. of cities/towns	22	164	115	301	100
Average (%)	70	55	44	65	

Source: NIUA Survey, 1999. See Appendix - I, Table A – 15 for details

This situation has come about not only because of inefficiency in managing the service but also because charging for water has not been given due attention. While the water tariff itself is very low in many urban centres, charging for water through flat rates or through tax is not a very efficient way of recovering cost. Consumption based tariff should form the basis of charging while flat rates for charging should be discouraged by making flat rates unattractive.

b) Revenue Receipts Surplus

Despite the general deficit scenario, nearly 21 per cent of the urban centres (i.e., 56 cities/ towns) are able to generate revenue surplus on water supply account

** Revenue receipts include connection charges*

(Table A-2.2.). However, this needs to be qualified. Surplus revenue receipts over revenue expenditure could be due to a number of reasons. Positive reasons include improved water tariff, efficient management, efficient revenue collection mechanism, and professional management and private sector participation amongst others. Negative reasons include non-payment of outstanding bills and loans (which do not get reflected in the budget) or low level of revenue expenditure on O&M. Costs are also sometimes understated because of book adjustments between service providers and electricity boards – these do not get reflected in the revenue receipts and expenditure statement for the service. Adjustments made to grants (for outstanding expenditure or loans) also do not get reflected in the revenue receipts and expenditure statement, which could lead to a situation of revenue surplus. However, if all payables and receivables are taken into account

Table - 2.44 : Urban Centres with Revenue Surplus in Water Supply – 1997-98

City/ town	Percentage revenue receipts to revenue expenditure
Metropolitan cities	
Visakhapatnam	274
Chennai	137
Hyderabad	106
Bangalore	103
Class I cities	
Warangal	144
Jamnagar	129
Mangalore	202
Kolhapur	107
Cuddalore	150
Dindigul	122
Erode	102
Kanchipuram	154
Nagercoil	158
Rajapalaiyam	122
Salem	109
Tiruppur	259
Class II towns	
Amalner MCl	166
Ambur M	109
Dharmapuri M	133
Pudukkottai M	104
Tindivanam MC	108
Udhagamandalam M	109

Source: NIUA Survey, 1999. See Appendix - I, Table A – 15 for details

then the revenue surplus situation may change. It must be mentioned here that the above analysis is for the financial year 1997-98 which could be an unusual year for some water supply departments. A time-series data analysis would give a clearer picture of the long-term trends in these urban centres.

However, a refinement can be made in order to understand whether these urban centers are generating surplus after incurring some minimum necessary O&M expenditure. If an O&M expenditure of Re. 1.00 per kilolitre is taken as a cutoff[9] (assuming that this is the minimum amount that should be spent to supply treated water) then only 22 of the 56 urban centres show revenue surplus (Table 2.44).

Of these 22 urban centres, 13 are in Tamil Nadu. The surplus revenue receipts position in water supply in Tamil Nadu could be due to efficient management or non-payment of dues and deferred payments in 1997-98.

c) Revenue Receipts and Revenue Expenditure Per Kilolitre

The average revenue receipts generated per kilolitre (kl.) of water supplied is Rs. 1.73 in the sampled urban centers as compared to the average revenue expenditure of Rs. 2.66 per kl., thus leaving a deficit of Rs. 0.93 per kl. Considering the fact that over 21,000 million litres of water is supplied daily in the sampled urban centers, this deficit will add up to a huge sum. The metropolitan cities spend more and generate more revenue receipts per kl., yet they are in deficit of 0.93 per kl. (Table 2.45 and Table 2.46).

Table - 2.45 : Revenue Receipts Per Kilolitre of Water Supplied - 1997-98

(no. of cities and towns)

Revenue receipts (Rs.)/kl	Metropolitan cities	Class I cities	Class II towns	Total	%
< 0.25	1	25	15	41	13
0.25 - 0.50	2	26	22	50	16.6
0.50 - 0.75	3	34	12	49	16.4
0.75 - 1.00	7	15	12	34	11
1.00 - 2.00	2	32	24	58	19
2.00 - 3.00	2	14	7	23	8
> 3.00	5	8	10	23	8
Data not available	0	10	13	23	8
No. of cities/towns	22	164	115	301	100
Average (Rs./ kl.)	2.16	1.02	1.21	1.73	

Source: NIUA Survey,1999. See Appendix - I, Table A – 15 for details

As compared to the expenditure per kl., the tariff charged is generally low. For instance the average volumetric (per kl.) receipt in metropolitan cities is Rs. 2.16

[9] *If the cutoff is lowered to 0.50 paise per kilolitre then 41 urban centres show surplus revenue over expenditure (see Table-A-2.2).*

per kl. While the expenditure is Rs. 3.09 per kl. Bridging the gap between tariff and expenditure is essential if water-supplying agencies have to break-even and reduce dependence on higher levels of government for providing this basic service.

Table - 2.46: Revenue Expenditure Per Kilolitre of Water Supplied - 1997-98

(no. of cities and towns)

Revenue expenditure (Rs./kl.)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 0.50	0	12	5	17	6
0.50 - 1.00	3	30	19	52	17
1.00 - 2.00	8	49	32	89	30
2.00 - 3.00	6	35	16	57	19
3.00 - 4.00	1	12	12	25	8
> 4.00	4	12	16	32	11
Data not available	0	14	15	29	9
No. of cities/towns	22	164	115	301	100
Average (Rs./ kl.)	3.09	1.88	2.44	2.66	

Source: NIUA Survey,1999. See Appendix - I, Table A – 15 for details

d) Per Capita Revenue Receipts and Revenue Expenditure

As stated earlier, the gap between revenue receipts and revenue expenditure is significant in Indian cities and towns. The average per capita revenue receipts generated from water supply is a low Rs. 100.55 per annum or Rs. 8.38 per month (Table 2.47), as compared to a per capita revenue expenditure of Rs. 153.89 per annum or Rs. 12.82 per month (Table 2.48).

Table - 2.47 : Per capita Revenue Receipts from Water Supply - 1997-98

(no. of cities and towns)

Per capita revenue receipts/annum (Rs.)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 10	1	29	23	53	17
10 - 20	2	29	18	49	16
20 - 30	2	25	18	45	15
30 - 40	1	13	11	25	8
40 - 50	3	17	12	32	11
> 50	13	41	20	74	25
Data not available	0	10	13	23	8
No. of cities/towns	22	164	115	301	100
Average (Rs.)	149.43	48.65	39.41	100.55	

Source: NIUA Survey,1999. See Appendix - I, Table A – 16 for details

Table - 2.48: Per capita Revenue Expenditure on Water Supply					
					(no. of cities and towns)
Per capita revenue expenditure/annum (Rs.)	Metropolitan cities	Class I cities	Class II towns	Total	%
< 25	1	25	20	46	15
25 - 50	2	38	28	68	23
50 - 75	2	30	15	47	16
75 - 100	5	22	14	41	14
100 - 200	7	26	16	49	16
> 200	5	9	7	21	7
Data not available	0	14	15	29	9
No. of cities/ towns	22	164	115	301	100
Average (Rs.)	214.12	89.40	77.86	153.89	
Source: NIUA Survey, 1999. See Appendix - I, Table A–16 for details					

This creates a per capita deficit of Rs. 53.34 per annum or Rs. 4.44 per month (Table 2.49). When the total deficit in these urban centers is put together it adds up to a staggering Rs. 695.62 crores in 1997-98. While improving efficiency will cut down the deficit to some extent, government alone cannot finance such large annual deficits and the burden of bridging this gap must be also passed on to the consumers.

In the metropolitan cities the per capita revenue receipts is Rs. 149.43 per annum or Rs. 12.45 per month, while the per capita revenue expenditure is Rs. 214.12 per annum or Rs. 17.84 per month. The total deficit in just the 22 metropolitan cities is a massive Rs. 443.14 crores in 1997-98.

Table - 2.49: Summary of Revenue Receipts and Revenue Expenditure -1997-98				
				(Average)
Revenue	Size class of urban centres			
	Metropolitan cities	Class I cities	Class II towns	Total sample
% revenue receipts to revenue expenditure	70	55	44	65
Revenue receipts per kl. (Rs.)	2.16	1.02	1.21	1.73
Revenue expenditure per kl. (Rs.)	3.09	1.88	2.44	2.66
Deficit per kl. (Rs.)	-0.93	-0.86	-1.23	-0.93
Revenue receipts per capita (Rs. /annum)	149.43	48.65	39.41	100.55
Revenue expenditure per capita (Rs./ annum)	214.12	89.40	77.86	153.89
Per capita deficit (Rs./annum)	-64.69	-40.75	-38.45	-53.34
Total deficit (Rs. in crores)	443.14	215.36	37.12	695.62
Source: NIUA Survey,1999. See Appendix - I, Table A – 15 &16 for details				

2.16 CAPITAL INVESTMENTS

Improving the present supply of water as well as adding new infrastructure for augmenting supplies requires capital expenditure. Cities incur capital expenditure on source development, adding new infrastructure and upgrading existing systems.

It is important to point out here that most of the water augmentation schemes have a 25 to 30 year life span and, therefore, cities may not incur capital expenditure every year but would be doing so every few years. However, schemes for improving the existing infrastructure may be undertaken more frequently. The present survey looks at the capital expenditure incurred by the sampled cities in the last five years only, i.e. since 1994. The survey indicates that capital expenditure has been incurred on source development, laying new pipelines, adding new treatment plants, pumping stations, and reservoirs, and on digging new tubewells. In the last five years most cities have undertaken capital works on a combination of the above mentioned components and only very few cities have reported expenditure on only one of the above components.

The present survey indicates that only about two-fifths of the sampled cities have undertaken capital works since 1994. The main components of capital expenditure on laying pipelines has been the most common in the sampled cities since 1994 which has been reported by almost one-fifth of the cities. The other major items of capital expenditure have been pumping stations (in 13% of cities), reservoirs (in 11% of cities), tubewells (in 10% of cities), and treatment plants (in 9% of cities). Source development has been reported in only 4 per cent of the sampled cities (Table A-17 in Appendix - I).

Nearly one-third of the sampled cities have plans to undertake capital works in the future. The components of capital works are similar to the above. Again, most cities have indicated multiple components of capital works (Table A-18 in Appendix - I).

The total cost of capital works varies with the component and other technical details of the component. Therefore, the per capita cost of capital works undertaken also has a very wide range. Also many capital works components are not amenable to a per capita cost calculation.

For instance, for capital works on laying down pipelines it is not possible to give a per capita cost figure. Many cities have not given the per capita cost of capital works undertaken. Hence no analysis of capital expenditure has been possible.

2.17 ADDITIONAL INVESTMENT REQUIREMENTS

The coverage of population by public water supply system is 93 per cent in the sampled urban centres. The policy of the government aims at 100 per cent coverage of population by water supply and this requires additional capital investments. The present study gives the additional capital investment requirements for covering 100 per cent of the population by the public water supply system for the years 2002, 2007, 2012, 2017, and 2022 by the different size class of cities.

2.17.1 Projection Methodology

For projecting the additional capital investment requirements the following were required:

a) the total urban population projected till the year 2022 at five year intervals starting 2002 A.D. – for which the Registrar General of India's population projection has been used (Table 2.50);

b) the division of the projected additional urban population by size class of cities for different years (Table 2.51);

c) the present coverage of population by the service by size class of urban centres (Table 2.52);

Table - 2.50: Class-wise Projection of Urban Population* in Different Years

(in million)

Year	Size class of cities and towns							
	Metro	I**	II	III	IV	V	VI	Total
% Urban population (1991)	23.00	33.67	13.33	16.35	9.77	3.43	0.45	100.00
1999	64.10	93.84	37.15	45.57	27.23	9.56	1.25	278.70
2002	69.34	101.51	40.19	49.29	29.45	10.34	1.36	301.48
2007	79.11	115.82	45.85	56.24	33.61	11.80	1.55	343.97
2012	89.58	131.14	51.92	63.68	38.05	13.36	1.75	389.48
2017	101.11	148.02	58.60	71.88	42.95	15.08	1.98	439.61
2022	114.16	167.13	66.17	81.16	48.50	17.03	2.23	496.37

Note: The proportion of population in each size class is for the individual cities and towns and not for urban agglomerations and the proportions are assumed to be constant for the projected period i.e., upto 2022.
Source for proportion of population in each size class - Census of India 1991, Series 1 - India, General Population Tables Part II-A (ii) Towns and Urban Agglomerations 1991 with their Population 1901 - 1991, Statement-3, p.32
Source for size class-wise population distribution - Projections based on Census of India's 'Population Projections for India and States 1996-2016', Registrar General, India, New Delhi, 1996.
** Population as on 1st July of the respective years ** Class I cities exclude metropolitan cities*

Table – 2.51: Additional Population to be Covered in Different Years by Size Class

(in million)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
Backlog 1999	1.92	9.38	4.09	5.01	3.00	1.05	0.14	24.59
1999-2002	5.24	7.67	3.04	3.73	2.22	0.78	0.10	22.79
2002-2007	9.77	14.31	5.66	6.95	4.15	1.46	0.19	42.49
2007-2012	10.47	15.32	6.07	7.44	4.45	1.56	0.20	45.51
2012-2017	11.53	16.88	6.68	8.20	4.90	1.72	0.23	50.13
2017-2022	13.05	19.11	7.57	9.28	5.55	1.95	0.26	56.76
Total	51.98	82.67	33.11	40.61	24.27	8.52	1.12	242.27

d) division of the projected population of population by dependence on surface and ground water sources; and

e) water requirement (in mld) for the projected additional population – for which the norm recommended by CPHEEO has been used (Table 2.53 & 2.54).

Table - 2.52: Coverage of Population by Water Supply - 1999

(used for calculating the backlog)

Size class of cities/ towns	% covered by water supply	% not covered by water supply
Metro	97	3
I	90	10
II	89	11
III	89	11
IV	89	11
V	89	11
VI	89	11

Source: NIUA Survey, 1999

Table - 2.53: Water Supply Norms Recommended By CPHEEO

Size class of cities and towns	Population	Norm in lpcd
Metropolitan	1,000,000 and above	150
Class I	1,00,000 to 9,99,999	135
Class II	50,000 to 99,999	70
Class III	20,000 to 49,999	70
Class IV	10,000 to 19,999	70
Class V	5,000 to 9,999	70
Class VI	Less than 5,000	70

Note: The above norms include 15% leakage
Source: Manual on Water Supply and Treatment, Third Edition, Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation (CPHEEO), May 1999, p.11

Table - 2.54: Additional Water Requirements Using CPHEEO's Norms

(in mld)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
1999*	288.45	1266.79	286.06	350.86	209.66	73.61	9.66	2485.08
2002	786.05	1035.64	212.60	260.76	155.82	54.70	7.18	2512.74
2007	1465.97	1931.45	396.49	486.32	290.60	102.02	13.38	4686.25
2012	1569.99	2068.50	424.63	520.83	311.22	109.26	14.33	5018.76
2017	1729.52	2278.68	467.77	573.75	342.85	120.36	15.79	5528.73
2022	1958.22	2580.00	529.63	649.62	388.18	136.28	17.88	6259.81

**Backlog*

The additional population to be covered in different years by size class has been arrived at by subtracting the latter year's population by the previous one. The backlog population to be covered as in 1999 has been calculated by the population not covered as in 1999, which has been taken from the present survey.

a) **Assumptions made for calculating investment requirements:**

i) The Census of India's publication (1996) titled 'Population projection for India and the states 1996-2016' projects the population till the year 2016. Thereafter, for projecting the population till the year 2022, the annual growth rate of urban population during 2015-2016 (2.46% per annum) has been used as a constant (see Table AX -2.3 at the end of this chapter).

ii) The percentage of population living in different size class of towns has been kept constant at 1991 level for projections till the year 2022. Such an assumption was necessitated due to the absence of any projection of population by size class of towns available from the Registrar General's office.

iii) To calculate the backlog of population not covered by water supply in 1999, the results of the present survey on coverage have been used for metropolitan cities, Class I cities and Class II towns. However, since the study does not cover the other size classes of towns (barring the capital towns) the coverage figures for Class II towns have been used as proxy for classes III to VI.

iv) The proportion of population dependant on surface and ground water, as given by CPHEEO (i.e., 65% on surface water and 35% on ground water), has been assumed to be constant over the various size classes of towns till the year 2022.

v) The norms for water supply used for different size classes of towns have been assumed to be constant till the year 2022.

vi) The projection of investment requirements using Task Forces norms has assumed that the surface water source is river and the ground water source is not in hard rock.

b) **Calculation of Additional Investment Requirements by Using Per Capita Costs**

The calculation of additional investment requirements has been done by using the per capita costs given by the Planning Commission (Task Forces on Housing and Urban Development, 1983), and that given by HUDCO, (2000) (Tables 2.55 and 2.56).

The per capita cost of water supply schemes for metropolitan cities as obtained from the respective cities are presented in Table 2.57. The per capita cost estimates available are by the source of water i.e., surface and ground. Therefore, the additional population projected till the year 2022 has been divided by their dependence on surface and ground water sources. The

Table - 2.55: Task Forces Estimates of Per Capita Cost For Water Supply Schemes			
			(Rs. at 1998-99 prices)
	Population		
	>1 Lakh	50,000-1 Lakh	< 50,000
Surface sources			
Dam	1465.1	1352.4	1210.3
River	1489.6	1283.8	1274.0
Ground sources			
Hard rock	1215.2	1117.2	1082.9
Others	1195.6	1215.2	1190.7
Source: Task Forces on Housing and Urban Development, Vol. II – Financing of Urban Development, Planning Commission, Government of India, New Delhi, December 1983, p. 31 (inflated to 1998-99 prices)			

Table - 2.56: HUDCO Estimates of Per Capita Cost For Water Supply Schemes	
	Rs. at 1998-99 prices
Surface source	1944
Ground source	567
Source: Letter to NIUA dated 20th April, 2000 (deflated to 1998-99 prices)	

CPHEEO average of 65% population's dependence on surface water and 35% population's dependence on ground water has been used to arrive at the number of people to be provided for by surface and ground water. The population dependent on surface water has been multiplied by the per capita cost of providing surface water and the population dependent on ground water has been multiplied by the per capita cost of providing ground water. The investment requirements thus worked out are given in Tables 2.58 and 2.59.

2.17.2 Projected Additional Capital Investment Requirements

In 1999, almost 25 million people were not covered by water supply in the urban areas of the country and between 1999 and 2022 another 217.68 million would be added to the urban population who will need to be covered by water supply (Table 2.50). Therefore, provision for water supply for 242.27 million people has to be made in order to cover the present uncovered population and future additions to the urban population till the year 2022. This requires large financial investments to be made in the water sector.

Estimation of per capita cost* of providing water supply have been made by the Task Forces on Housing and Urban Development set up by the Planning Commission (Table 2.55), HUDCO (Table 2.56), and the Working Group on Urban Water Supply and Sanitation sector for Ninth Five Year Plan (Table 2.60). HUDCO has also

** Information on per capita cost of capital works has been obtained from the metropolitan cities too through the present survey, Table 2.) .however, it has not been possible to use these figures due to the large variations in the responses.*

Table - 2.57: NIUA Survey Estimates of Per Capita Cost of Water Supply Schemes In Metropolitan Cities

(in Rs.)

Sl. No.	City	Past schemes (1994 - 1999)	Future schemes
1	Ahmedabad	312	343
2	Bangalore	533	1400
3	Bhopal	382	521
4	Calcutta	318	399
5	Chennai	400	n.a
6	Coimbatore	564	920
7	Indore	816	816
8	Kanpur - Barrage unit	160	374 - 1233
	Ganga Pollution Control Unit	1000	600
9	Lucknow - Reorganisation scheme		
	a) Tubewell schemes	600 - 1000	720 - 1200
	b) Hilly region	1500 for gravity source with minor treatment works	1800
		4000-5500 for pumping sources with full treatment works	4800 - 6600
10	Ludhiana	650	650
11	Madurai	398	n.a
12	Surat	1154	429
13	Vadodara	380	769
14	Vishakhapatnam	414	577
15	Varanasi	n.a.	1235

Note: The per capita cost of water supply schemes includes water treatment. The information presented in this table has been furnished by the respective cities.
Source: NIUA survey,1999.

estimated the per mld cost of urban water supply (Table 2.62). The present financial requirement estimations are based on the cost estimates of these three sources. All cost figures are at 1998-99 prices.

The additional capital investment required for providing water supply to the uncovered population in 1999 and the additional population from 1999 to 2022 A.D is Rs. 32,117.87 crores (Table 2.58) or Rs. 1338.24 crores per annum using Task Forces per capita costs.

Using HUDCO's per capita cost estimates, the additional capital investment requirement rises to Rs. 35,420.25 crores (Table 2.59) or Rs. 1540 crores per annum for the same period. As against these, if the Ninth Plan's per capita costs are used

Table - 2.58: Additional Capital Investment Requirement Using Task Forces Per Capita Costs

(Rs. in crores at 1998-99 prices)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
1999*	266.66	1301.23	514.81	623.96	372.85	130.90	17.17	3227.58
1999-2002	726.68	1063.79	382.61	463.73	277.10	97.28	12.76	3023.95
2002-2007	1355.24	1983.96	713.57	864.85	516.79	181.43	23.80	5639.65
2007-2012	1451.40	2124.73	764.20	926.21	553.46	194.31	25.49	6039.81
2012-2017	1598.89	2340.63	841.85	1020.33	609.70	214.05	28.08	6653.53
2017-2022	1810.31	2650.14	953.17	1155.25	690.32	242.36	31.80	7533.35
Total	7209.18	11464.48	4170.22	5054.33	3020.23	1060.33	139.11	32117.87

**Backlog* *Rs. 1 crore = Rs. 10,000,000 or Rs. 10 million*

Table - 2.59: Additional Capital Investment Requirement Using HUDCO's Per Capita Costs

(Rs. in crores at 1998-99 prices)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
1999*	281.15	1371.94	597.47	732.83	437.90	153.74	20.17	3595.19
1999-2002	766.17	1121.59	444.04	544.64	325.45	114.26	14.99	3331.14
2002-2007	1428.88	2091.76	828.13	1015.75	606.97	213.09	27.96	6212.54
2007-2012	1530.27	2240.18	886.89	1087.82	650.03	228.21	29.94	6653.35
2012-2017	1685.77	2467.81	977.01	1198.36	716.08	251.40	32.98	7329.42
2017-2022	1908.68	2794.14	1106.20	1356.82	810.77	284.64	37.34	8298.61
Total	7600.91	12087.43	4839.75	5936.22	3547.21	1245.34	163.38	35420.25

**Backlog* *Rs. 1 crore = Rs. 10,000,000 or Rs. 10 million*

Table - 2.60: Ninth Plan Estimates of Per Capita Cost for Water Supply

*(in Rs.)**

	Population		
	>1 Lakh	50,000-1 Lakh	< 50,000
Surface source	1800	1500	1500
Ground source	1800	1500	1500
Rehabilitation/ Augmentation	750	750	750

Source: Report of the Working Group on Urban Water Supply and Sanitation Sector for Ninth Five Year Plan (1997-2002), Department of Urban Development, Ministry of Urban Affairs and Employment, Government of India, New Delhi, July 1996, p. 86-87

** The source does not give the year of prices*

then investment requirements further rise to Rs. 40,379.52 for the same period or Rs. 1682.48 crores per annum, including augmentation and rehabilitation (for those already covered uptil 1999) (Table 2.61).

Table - 2.61: Additional Capital Investment Requirement Using Ninth Plan's Per Capita Costs								
								(Rs. in crores at 1998-99 prices)
Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
1999*	346.14	1689.06	612.98	751.85	449.27	157.73	20.69	4027.71
1999-2002	943.26	1380.85	455.56	558.77	333.9	117.23	15.38	3804.95
2002-2007	1759.17	2575.27	849.63	1042.12	622.72	218.62	28.68	7096.21
2007-2012	1883.99	2758.00	909.91	1116.06	666.91	234.13	30.72	7599.71
2012-2017	2075.43	3038.25	1002.37	1229.47	734.67	257.92	33.84	8371.94
2017-2022	2349.87	3440.00	1134.92	1392.04	831.82	292.03	38.31	9478.99
Total	9357.85	14881.42	4965.37	6090.31	3639.29	1277.66	167.62	40379.52
1999 **	4663.26	6333.97	2479.77	3041.57	1817.50	638.08	83.71	19057.87
Grand Total ***	14021.11	21215.39	7445.14	9131.88	5456.79	1915.74	251.34	59437.39

** Backlog ** Augmentation/ Rehabilitation for those covered till 1999*
**** Grand Total is the sum of Total row and Augmentation/Rehabilitation for those covered till 1999 row*

Using the per mld cost of providing water, (using HUDCO's estimates) (Table 2.62) the requirements vary between Rs. 15825 crores (low estimate) to Rs. 40502 crores (high estimate) during the period 1999-2022 for covering the entire population by water supply (Table 2.63 and 2.64). The per annum investment requirements vary between Rs. 688 crores (low) to Rs. 1761 crores (high) during the period 1999-2022 if the goal of covering 100 per cent of the population with water supply is to be achieved.

Table - 2.62: HUDCO's Estimates of Per mld Cost for Water Supply		
		(at 1998-99 prices)
	Low Estimate Rs./ mld (in crores)	High Estimate Rs./ mld (in crores)
Surface source	0.81	2.03
Ground source	0.20	0.61

Source: Letter to NIUA dated 20th April, 2000 (deflated to 1998-99 prices)

These estimates are based, as stated earlier, on the population projections by the Census of India, the assumptions made regarding size class distribution of population, the division of population by dependence on surface and ground water sources, and the per capita supply norms of the CPHEEO. The estimates do not include the O&M costs of the existing or future systems (except the estimates made using Ninth Plan per capita costs).

A few estimates are available on the additional investment requirements for the urban areas of the country, though they are not strictly comparable with one another as each estimate is based on different sets of assumptions regarding physical specifications, service standards and the population to be covered. However, a

Table - 2.63: Additional Capital Investment Requirement
Using HUDCO's Per mld Costs - Low Estimate

(Rs. in crores at 1998-99 prices)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
1999*	172.31	756.75	170.88	209.60	125.25	43.97	5.77	1484.53
1999-2002	469.57	618.66	127.00	155.77	93.08	32.68	4.29	1501.05
2002-2007	875.74	1153.80	236.85	290.52	173.60	60.95	8.00	2799.45
2007-2012	937.87	1235.67	253.66	311.13	185.92	65.27	8.56	2998.08
2012-2017	1033.17	1361.23	279.44	342.74	204.81	71.90	9.43	3302.73
2017-2022	1169.79	1541.23	316.39	388.07	231.89	81.41	10.68	3739.46
Total	4658.45	6667.34	1384.22	1697.83	1014.54	356.18	46.73	15825.29

** Backlog*

Table - 2.64: Additional Capital Investment Requirement
Using HUDCO's Per mld Costs - High estimate

(Rs. in crores at 1998-99 prices)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
1999*	441.00	1936.77	437.34	536.43	320.54	112.53	14.76	3799.38
1999-2002	1201.77	1583.36	325.04	398.67	238.23	83.64	10.97	3841.67
2002-2007	2241.29	2952.95	606.19	743.52	444.30	155.98	20.46	7164.69
2007-2012	2400.32	3162.47	649.20	796.28	475.82	167.05	21.92	7673.06
2012-2017	2644.22	3483.82	715.17	877.19	524.17	184.02	24.14	8452.74
2017-2022	2993.88	3944.50	809.74	993.19	593.48	208.36	27.34	9570.47
Total	11922.49	17063.87	3542.67	4345.28	2596.54	911.58	119.59	40502.02

** Backlog*

comparison of the present study's estimates with some of the earlier estimations is given below only for a broad comparison.

The India Infrastructure Report* (NCAER, 1996), gives a summary of some of the estimated investment requirements made by various institutions/ committees for urban water supply sector in the country. The additional investment requirement (for 1996-2001 period) estimated by the Planning Commission varies between Rs. 1722 crore to Rs. 2584 crore per annum, while that estimated by ORG varies between Rs. 1131 crore to Rs. 2975 crore per annum.

As against these, the present study estimates that the additional annual investments required for covering the backlog population and additional population till the year

** The India Infrastructure Report: Policy Imperatives for Growth and Welfare, Vol. 3, National Council of Applied Economic Research, New Delhi, 1996, p.9*

2022 with water supply will range between Rs. 1396 crore (Task Forces costs) to Rs. 1540 crore (HUDCO costs) at 1998-99 prices for the period 1999-2022. Adding the cost of augmentation and rehabilitation (as given by the Ninth Plan Working Group) the investment requirements go up to Rs. 59437 crores for the same period. In annual terms, the additional investment requirement is estimated at Rs. 2584 crore till the year 2022.

As per The India Infrastructure Report, the funds required for providing infrastructure (water supply, sanitation and roads) to the urban population for the period 1996-2005 is about Rs. 28,000 crores, the annual requirement being Rs. 2800 crores for this period. As against this the funds available are less than one-fifth of the requirement. The remaining funds will necessarily have to be mobilised from other sources, including the private sector, if the urban population is to be provided with basic infrastructure.

ANNEX TABLES

Table - AX - 2.1: Urban Centres with Water Supply Below Norm and Additional Quantity Required to Reach Norms – 1999

Sl. No.	City/Town	Sewered (S)/ Unsewered (US)	Estimated population 1999 ('000)	Water supply (mld)-1999	Per capita supply (lpcd) - 1999		CPHEEO norm (lpcd)	Demand as per norm (mld)-1999	Additional water required - 1999	
					total pop.	served pop.			mld	lpcd
	Metropolitan Cities									
1	Ahmedabad M.Corp.	S	3,500	486.00	139	139	150	525.00	39.00	11.14
2	Bangalore M.Corp.	S	5,000	705.50	141	141	150	750.00	44.50	8.90
3	Chennai M.Corp.	S	4,363	461.00	106	106	150	654.45	193.45	44.34
4	Coimbatore M.Corp	S	971	105.00	108	108	150	145.65	40.65	41.86
5	Indore M.Corp.	S	1,600	238.00	149	149	150	240.00	2.00	1.25
6	Kanpur M.Corp.	S	2,500	310.10	124	248	150	375.00	64.90	25.96
7	Kochi M.Corp.	S	680	84.00	124	124	150	102.00	18.00	26.47
8	Ludhiana M.Corp.	S	2,000	234.00	117	195	150	300.00	66.00	33.00
9	Madurai M.Corp.	S	1,020	90.00	88	88	150	153.00	63.00	61.76
10	Surat M.Corp.	S	2,300	320.00	139	139	150	345.00	25.00	10.87
11	Visakhapatnam M.Corp.	S	1,280	168.00	131	131	150	192.00	24.00	18.75
	Class I Cities									
1	Anantapur MCl	US	250	14.06	56	56	70	17.50	3.44	13.76
2	Eluru M	S	247	23.71	96	96	135	33.35	9.63	39.00
3	Guntur MCl	S	557	74.90	135	135	135	75.17	0.27	0.49
4	Kakinada M	US	325	21.33	66	88	70	22.75	1.42	4.37
5	Kurnool MCl	US	282	6.50	23	23	70	19.71	13.21	46.91
6	Nandyal MCl	US	150	10.00	67	67	70	10.50	0.50	3.33
7	Nizamabad M	US	285	15.00	53	53	70	19.95	4.95	17.37
8	Tenali M	US	170	0.68	4	20	70	11.90	11.22	65.98
9	Munger M	US	210	10.00	48	80	70	14.70	4.70	22.38
10	Anand M	S	175	11.00	63	63	135	23.63	12.63	72.14
11	Bhavnagar M.Corp.	S	550	70.00	127	127	135	74.25	4.25	7.73
12	Nadiad M	S	300	21.00	70	70	135	40.50	19.50	65.00
13	Navsari M	S	139	16.30	117	117	135	18.77	2.47	17.73
14	Rajkot M.Corp.	S	1,000	106.60	107	107	135	135.00	28.40	28.40
15	Surendranagar M	US	150	5.60	37	37	70	10.50	4.90	32.67
16	Ambala MCl	S	141	16.20	115	120	135	19.04	2.84	20.11
17	Gurgaon MCl	S	175	18.50	106	124	135	23.63	5.13	29.29

Sl. No.	City/Town	Sewered (S)/ Unsewered (US)	Estimated population 1999 ('000)	Water supply (mld)- 1999	Per capita supply (lpcd) - 1999		CPHEEO norm (lpcd)	Demand as per norm (mld)- 1999	Additional water required - 1999	
					total pop.	served pop.			mld	lpcd
18	Hisar MCl	S	250	24.76	99	141	135	33.75	8.99	35.96
19	Rohtak MCl	S	243	32.00	132	147	135	32.81	0.81	3.31
20	Jammu M.Corp.	US	1,051	58.29	55	66	70	73.56	15.27	14.53
21	Belgaum M.Corp.	S	470	36.00	77	77	135	63.45	27.45	58.40
22	Bellary CMC	S	297	30.65	103	103	135	40.10	9.45	31.80
23	Davangere MCl	S	455	31.50	69	70	135	61.43	29.93	65.77
24	Gulbarga M.Corp.	S	450	31.50	70	70	135	60.75	29.25	65.00
25	Hubli-Dharwar M.Corp.	S	850	87.75	103	103	135	114.75	27.00	31.76
26	Mysore M.Corp.	S	1,050	138.47	132	165	135	141.75	3.28	3.12
27	Dhule MCl	S	330	31.00	94	94	135	44.55	13.55	41.06
28	Ichalkaranji MCl	S	250	32.00	128	128	135	33.75	1.75	7.00
29	Nanded Waghala M.Corp.	S	410	39.00	95	95	135	55.35	16.35	39.88
30	Parbhani MCl	US	233	15.00	64	64	70	16.31	1.31	5.62
31	Bhind M	S	175	19.00	109	109	135	23.63	4.63	26.43
32	Dewas M.Corp.	US	200	9.00	45	45	70	14.00	5.00	25.02
33	Morena M	S	125	8.46	68	68	135	16.88	8.42	67.32
34	Satna M.Corp.	US	200	13.50	68	68	70	14.00	0.50	2.50
35	Shivpuri M	S	140	13.00	93	93	135	18.90	5.90	42.14
36	Bathinda MCl	S	174	17.00	98	247	135	23.49	6.49	37.30
37	Pathankot MCl	S	195	17.00	87	87	135	26.33	9.33	47.82
38	Ajmer MCl	S	550	52.00	95	118	135	74.25	22.25	40.45
39	Bhilwara M	US	225	14.00	62	62	70	15.75	1.75	7.78
40	Bikaner M	S	600	68.00	113	113	135	81.00	13.00	21.67
41	Cuddalore M	US	162	4.29	26	26	70	11.34	7.05	43.51
42	Dindigul M	US	214	12.00	56	56	70	14.98	2.98	13.93
43	Kanchipuram M	S	157	16.36	104	104	135	21.15	4.79	30.60
44	Kumbakonam M	S	147	10.60	72	72	135	19.82	9.22	62.81
45	Nagercoil M	US	206	9.00	44	72	70	14.39	5.39	26.20
46	Tiruchirapalli M.Corp.	S	800	88.00	110	110	135	108.00	20.00	25.00
47	Tirunelveli M.Corp.	S	414	34.00	82	82	135	55.89	21.89	52.87
48	Tuticorin M	S	217	16.00	74	74	135	29.25	13.25	61.15
49	Aligarh M.Corp.	S	600	46.50	78	78	135	81.00	34.50	57.50
50	Bareilly M.Corp.	S	750	80.00	107	133	135	101.25	21.25	28.33
51	Firozabad MB	US	250	12.00	48	64	70	17.50	5.50	22.00

Sl. No.	City/Town	Sewered (S)/ Unsewered (US)	Estimated population 1999 ('000)	Water supply (mld)- 1999	Per capita supply (lpcd) - 1999		CPHEEO norm (lpcd)	Demand as per norm (mld)- 1999	Additional water required - 1999	
					total pop.	served pop.			mld	lpcd
52	Ghaziabad M.Corp.	S	887	110.00	124	124	135	119.75	9.75	10.99
53	Gorakhpur M.Corp.	S	600	74.00	123	164	135	81.00	7.00	11.67
54	Hapur MB	S	200	14.00	70	108	135	27.00	13.00	65.00
55	Hardwar MB	S	300	39.00	130	217	135	40.50	1.50	5.00
56	Mathura MB	S	400	26.73	67	103	135	54.00	27.27	68.18
57	Meerut M.Corp.	S	1,250	132.00	106	106	135	168.75	36.75	29.40
58	Mirzapur MB	S	210	25.00	119	183	135	28.35	3.35	15.95
59	Rampur MB	US	317	19.76	62	62	70	22.19	2.43	7.67
60	Balurghat M	US	132	0.86	7	7	70	9.24	8.38	63.50
61	Krishnagar M	US	145	5.97	41	68	70	10.17	4.20	28.94
62	Santipur M	US	134	0.91	7	23	70	9.37	8.47	63.22
63	Silliguri M.Corp.	US	500	17.97	36	36	70	35.00	17.03	34.06
64	Guwahati M.Corp.	US	995	55.00	55	126	70	69.65	14.65	14.72
65	Aizwal NM	US	244	10.80	44	135	70	17.08	6.28	25.74
66	Pondicherry M	S	290	33.35	115	115	135	39.15	5.80	20.00
	Class II Towns									
1	Anakapalle M	US	115	3.64	32	32	70	8.05	4.41	38.35
2	Kapra M	US	120	4.55	38	47	70	8.40	3.85	32.08
3	Kavali MCI	US	85	4.95	58	58	70	5.95	1.00	11.76
4	Narasaraopet M	US	95	4.50	47	47	70	6.65	2.15	22.63
5	Rajendra nagar MCI	US	120	5.10	42	42	70	8.40	3.30	27.53
6	Sangareddy MCI	US	60	3.86	64	64	70	4.20	0.34	5.67
7	Srikakulam MCI	US	100	6.81	68	68	70	7.00	0.19	1.90
8	Buxar M	US	67	3.90	58	71	70	4.68	0.78	11.61
9	Deoghar M	US	100	3.00	30	38	70	7.00	4.00	40.00
10	Hazaribagh M	US	119	7.26	61	73	70	8.33	1.07	9.02
11	Mokama M	US	66	1.96	30	30	70	4.62	2.66	40.30
12	Mahesana M	S	138	14.80	107	107	135	18.63	3.83	27.75
13	Palanpur M	US	117	4.00	34	34	70	8.19	4.19	35.81
14	Kaithal MCI	S	95	10.75	114	142	135	12.76	2.01	21.30
15	Rewari MCI	S	105	11.35	108	108	135	14.18	2.83	26.90
16	Thanesar MCI	S	100	13.22	132	184	135	13.50	0.28	2.80
17	Gokak CMC	US	68	4.55	67	67	70	4.76	0.21	3.09
18	Kolar CMC	S	112	8.00	71	71	135	15.12	7.12	63.57
19	Rabkavi-Banhatti									

Sl. No.	City/Town	Sewered (S)/ Unsewered (US)	Estimated population 1999 ('000)	Water supply (mld)- 1999	Per capita supply (lpcd) - 1999		CPHEEO norm (lpcd)	Demand as per norm (mld)- 1999	Additional water required - 1999	
					total pop.	served pop.			mld	lpcd
	CMC	US	72	4.54	63	63	70	5.04	0.50	6.94
20	Ramanagaram CMC	US	70	4.50	64	64	70	4.90	0.40	5.71
21	Changanessary MC	US	62	4.00	65	65	70	4.34	0.34	5.48
22	Payyanur M	US	71	1.50	21	21	70	4.94	3.44	48.72
23	Taliparamba M	US	52	0.39	7	7	70	3.64	3.26	62.60
24	Ballarpur MCl	US	109	7.00	64	64	70	7.62	0.62	5.72
25	Kamptee MCl	US	95	3.60	38	38	70	6.65	3.05	32.11
26	Itarsi M	US	105	5.86	56	56	70	7.35	1.49	14.19
27	Nagda M	US	100	3.03	30	34	70	7.00	3.98	39.75
28	Neemuch M	US	100	5.90	59	59	70	6.97	1.07	10.71
29	Sehore M	US	100	5.30	53	53	70	7.00	1.70	17.00
30	Shahdol M	US	75	4.67	62	62	70	5.25	0.58	7.73
31	Bhadrak M	US	93	3.00	32	32	70	6.51	3.51	37.74
32	Mansa MCl	S	67	7.95	119	241	135	8.99	1.04	15.57
33	Hanumangarh M	US	125	7.20	58	58	70	8.75	1.55	12.40
34	Ambur M	US	86	5.59	65	65	70	6.00	0.41	4.77
35	Arakkonam M	US	88	4.00	45	45	70	6.16	2.16	24.55
36	Attur M	US	64	2.98	47	47	70	4.48	1.50	23.44
37	Cumbum M	US	54	2.70	50	70	70	3.75	1.05	19.63
38	Dharmapuri M	US	67	3.00	45	45	70	4.66	1.66	24.95
39	Guduivattam M	US	95	5.80	61	61	70	6.66	0.86	9.06
40	Nagapattinam M	S	112	7.80	70	70	135	15.15	7.35	65.48
41	Srivilliputtur M	US	74	3.50	47	47	70	5.17	1.67	22.64
42	Tindivanam MC	US	70	1.90	27	30	70	4.90	3.00	42.86
43	Udhagamandalam M	S	100	4.00	40	40	135	13.50	9.50	95.00
44	Auraiya MB	US	90	4.50	50	50	70	6.30	1.80	20.00
45	Balrampur MB	US	70	2.79	40	186	70	4.90	2.11	30.14
46	Bhadohi MB	US	125	4.00	32	105	70	8.75	4.75	38.00
47	Chandpur MB	US	80	3.24	41	60	70	5.60	2.36	29.50
48	Etah MB	S	135	4.00	30	42	135	18.23	14.23	105.37
49	Mughalsarai MB	US	160	4.00	25	200	70	11.19	7.19	44.97
50	Orai MB	S	170	8.24	48	69	135	22.95	14.71	86.53
51	Bishnupur M	US	67	2.61	39	105	70	4.72	2.11	31.28
52	Chakdaha M	US	90	1.90	21	54	70	6.28	4.38	48.83

Sl. No.	City/Town	Sewered (S)/ Unsewered (US)	Estimated population 1999 ('000)	Water supply (mld)- 1999	Per capita supply (lpcd) - 1999		CPHEEO norm (lpcd)	Demand as per norm (mld)- 1999	Additional water required - 1999	
					total pop.	served pop.			mld	lpcd
53	Contai M	US	114	1.57	14	14	70	7.98	6.41	56.20
54	Darjeeling M	S	150	6.00	40	40	135	20.25	14.25	95.00
55	Jalpaiguri M	US	101	4.91	49	n.a.	70	7.08	2.17	21.43
56	Jangipur M	US	78	3.00	38	71	70	5.47	2.47	31.63
57	Katwa M	US	68	1.50	22	55	70	4.74	3.24	47.83
58	Raniganj M	US	121	5.08	42	79	70	8.47	3.39	28.02
59	Kohima TC	US	103	2.90	28	28	70	7.21	4.31	41.84
60	Kavarathi NMCT	US	11	0.04	3	3	70	0.78	0.74	66.67

Note: CPHEEO norms state that where there is no sewerage system existing or envisaged 70 lpcd supply may be sufficient, irrespective of the size class of town.)
Source: NIUA Survey,1999 Also see Appendix - I, Table A – 3

Table - AX -2.2 : Urban Centres with Surplus Revenue Receipts – 1997-98			
Sl.No.	City/Town	% Revenue receipts to revenue expenditure	O&M expenditure per kl. (Rs.)
	Metropolitan cities		
1	Bangalore	103	3.70
2	Chennai	137	1.28
3	Coimbatore	282	0.24
4	Greater Mumbai	135	0.94
5	Hyderabad	106	2.14
6	Kanpur	118	0.23
7	Kochi	133	0.89
8	Madurai	123	0.53
9	Visakhapatnam	274	1.30
	Class I		
1	Anantapur	143	0.97
2	Nellore	104	0.52
3	Tenali	122	1.98
4	Waranga	144	1.01
5	Gaya	188	break-up n.a.
6	Jamnagar	129	1.06
7	Belgaum	166	0.49
8	Bellary	134	0.52
9	Mangalore	202	1.30
10	Thiruvananthapuram	179	0.30
11	Kolhapur	107	1.94
12	Ratlam	218	0.68
13	Kota	130	0.14
14	Cuddalore	150	1.85
15	Dindigul	122	1.95
16	Erode	102	1.03
17	Kanchipuram	154	1.00
18	Kumbakonam	251	0.40
19	Nagercoil	158	1.81
20	Rajapalaiyam	122	1.35
21	Salem	109	1.20
22	Thanjavur	150	0.54
23	Tirunelveli	104	0.89
24	Tirunvannamalai	115	0.75
25	Tiruppur	259	1.44

Sl.No.	City/Town	% Revenue receipts to revenue expenditure	O&M expenditure per kl. (Rs.)
26	Aligarh	113	0.21
27	Haldwani-cum-Kathgodam	115	0.48
28	Muzaffarnagar	100	0.03
29	Saharanpur	102	0.06
	Class II		
1	Anakapalle	176	0.91
2	Srikakulam	106	0.82
3	Suryapet	116	0.50
4	Gondal	99	0.07
5	Chikmaglur	167	0.29
6	Gokak	168	0.84
7	Amalner	166	2.03
8	Hanumangarh	207	0.58
9	Ambur	109	1.10
10	Attur M	229	0.74
11	Cambam M	122	0.83
12	Dharmapuri M	133	1.53
13	Nagapattinam M	148	0.57
14	Pudukkottai M	104	2.12
15	Tindivanam MC	108	2.03
16	Udhagamandalam M	109	1.81
17	Auraiya	105	0.10
18	Chandpur	177	0.80

Source: NIUA Survey, 1999. See Appendix - I, Table A – 13 & 14 for details

Table - AX-2.3: Year and Class Wise Projection of Urban Population								
								(In million)
Year	Size class of cities and towns							
	Metro cities	I	II	III	IV	V	VI	Total
Proportion of population in different size classes								
% population								
1991	23.00	33.67	13.33	16.35	9.77	3.43	0.45	100.00
1999	64.10	93.84	37.15	45.57	27.23	9.56	1.25	278.70
2000	65.83	96.36	38.15	46.79	27.96	9.82	1.29	286.20
2001	67.57	98.91	39.16	48.03	28.70	10.08	1.32	293.77
2002	69.34	101.51	40.19	49.29	29.45	10.34	1.36	301.48
2003	71.19	104.21	41.26	50.60	30.24	10.62	1.39	309.50
2004	73.09	107.00	42.36	51.96	31.05	10.90	1.43	317.80
2005	75.06	109.88	43.50	53.36	31.88	11.19	1.47	326.35
2006	77.07	112.82	44.67	54.79	32.74	11.49	1.51	335.09
2007	79.11	115.82	45.85	56.24	33.61	11.80	1.55	343.97
2008	81.17	118.83	47.05	57.70	34.48	12.11	1.59	352.93
2009	83.25	121.87	48.25	59.18	35.36	12.42	1.63	361.96
2010	85.35	124.94	49.46	60.67	36.25	12.73	1.67	371.08
2011	87.46	128.03	50.69	62.17	37.15	13.04	1.71	380.24
2012	89.58	131.14	51.92	63.68	38.05	13.36	1.75	389.48
2013	91.76	134.33	53.18	65.23	38.98	13.68	1.80	398.98
2014	94.01	137.62	54.48	66.83	39.93	14.02	1.84	408.74
2015	96.32	141.00	55.82	68.47	40.91	14.36	1.88	418.77
2016	98.68	144.46	57.19	70.15	41.92	14.72	1.93	429.06
2017	101.11	148.02	58.60	71.88	42.95	15.08	1.98	439.61
2018	103.60	151.66	60.04	73.64	44.01	15.45	2.03	450.42
2019	106.14	155.38	61.52	75.45	45.09	15.83	2.08	461.49
2020	108.75	159.20	63.03	77.31	46.20	16.22	2.13	472.83
2021	111.43	163.12	64.58	79.21	47.33	16.62	2.18	484.46
2022	114.16	167.13	66.17	81.16	48.50	17.03	2.23	496.37

CHAPTER III
WASTEWATER COLLECTION, TREATMENT AND DISPOSAL AND LOW COST SANITATION

3.1 BACKGROUND

Wastewater disposal is a major problem in most Indian cities. Only a small percentage of urban centres in the country have a sewerage system and even where the system exists, the coverage of population by the sewerage system is partial. In some cities the system does not function properly or is defunct. Many urban centres with sewerage system do not have sewage treatment plants to treat wastewater. Discharge of untreated sewage into water bodies pollutes the limited water sources near urban centres. Improper collection and treatment of wastewater creates insanitary conditions and results in serious health problems.

3.2 COVERAGE BY SEWERAGE SYSTEM

3.2.1 Urban Centres Covered

Providing most urban centres with a sewerage system requires substantial financial resources and in order to keep the system operational, a minimum required level of water supply has to be ensured. Most Indian cities do not have the funds to construct a sewerage system along with the required treatment facilities. The present survey indicates while all the responding metropolitan cities (22) have a sewerage system, only 57 out of the 164 sampled Class I cities (i.e. 35%) and 21 out of 115 sampled Class II towns (i.e. 18%) have reported having a functioning sewerage system. Overall, only about 34 per cent of the sampled urban centres (i.e., 100 cities/towns) have a sewerage system. (Table 3.1).

Table - 3.1: Sampled Urban Centres with Sewerage System - 1999

(no. of cities/towns)

Sewerage system	Metro cities	Class I	Class II	Total	%
Yes	22	57	21	100	34
Not functional	-	12	2	14	4
No	-	88	86	174	58
n.a.	-	7	6	13	4
Total	22	164	115	301	100

Source: NIUA Survey, 1999

Of the urban centres with a sewerage system, about 38 per cent have a combined system of wastewater collection, i.e., combined with storm water drainage, while 60 per cent centres have a separate system (Table 3.2).

Table - 3.2: Sampled Cities with Type of Sewerage System - 1999					
					(no. of cities/towns)
Type of sewerage system	Metropolitan cities	Class I cities	Class II towns	Total	%
Separate	16	31	13	60	60
Combined with drainage	6	25	7	38	38
n.a.	0	1	1	2	2
Total	22	57	21	100	100

Note: In two Class I cities and one Class II town the sewerage system is not functional, while in two Class I cities the system is under construction. Source: NIUA Survey, 1999 See Appendix - II, Table B –2 for details

3.2.2 Population Covered

The coverage of population by the sewerage system in the sampled urban centres is partial with an average coverage of 45 per cent. Overall, in the metropolitan cities only 63 per cent of the population is covered by the system. The coverage of population by the sewerage system in the sampled Class I cities is a low 26 per cent while the coverage is even lower in the sampled Class II towns with only 11 per cent population covered by the system (Table 3.3). This shows that most Class I and Class II urban centres have only surface drains for carrying wastewater (See Table AX – 3.1 at the end of this chapter).

Table - 3.3: Population Covered by Sewerage System – 1999				
Cities / Towns	No. of urban centres		% population covered	
	Total sample	With sewerage system*	In total sampled urban centres	In urban centres with sewerage system
Metropolitan	22	22	63	63
Class I	164	57	26	48
Class II	115	21	11	51
Total	301	100	45	58

** Sampled urban centers with functional sewerage system.*
Source: NIUA Survey,1999 See Appendix - II, Table B – 1 for details

Even in urban centers with sewerage system, the average coverage of population by the system is only 58 per cent. This indicates that the coverage of population by sewerage system, even in the sewered urban centres, is only partial in most cases. This could be either because the sewerage pipelines do not cover the entire city or that people have not yet connected to the system.

3.3 WASTEWATER GENERATION, COLLECTION AND DISPOSAL

3.3.1 Generation and Collection

The quantity of wastewater generated depends largely on the quantity of water supplied. It is generally accepted that 80 per cent of water supplied goes out as wastewater. However, in urban centres where the formal supply does not cover the

entire population, informal sources of water supply would also contribute to wastewater generation. The wastewater collection system has to, therefore, be designed for at least 80 per cent of the formal water supply.

The present survey indicates that, on an average, only 59 per cent of the wastewater

Table - 3.4: Volume of Wastewater Generated, Collected and Treated – 1999

Waste water volume	Metropolitan cities	Class I cities	Class II towns	Total
Wastewater generated (mld)	10907.0	3298.2	208.3	14413.5
Wastewater collected (mld)	6707.0	1703.7	135.8	8546.6
Wastewater treated (mld)	4424.3	826.1	23.6	5274.0
Wastewater discharged untreated (mld)	6482.7	2472.1	184.7	9139.5
% collected to generated	61	52	65	59
% treated to collected	66	48	17	62
% treated to generated	41	25	11	37
No. of cities/ towns	21	57	21	100

** Excludes Lucknow for which information on quantity of waste water treated was not availale*
Source: NIUA Survey, 1999. See Appendix - II, Table B – 2 for details

generated is collected by the sewerage system in the responding urban centres (having a sewerage system). This indicates that either the sewerage system has only a limited capacity to collect wastewater or that the entire population for which the system has been designed has not obtained connection to the system. The wastewater collection efficiency is not very different in the responding urban centres of different size classes with the percentage wastewater collected ranging between 52 to 65 per cent of the wastewater generated (Table 3.4 & 3.5).

In a little over one-third of the sampled urban centres, having a sewerage system, the wastewater collected amounts to less than half of what is generated daily. In fact, in 16 per cent of these urban centres less than a quarter of the wastewater generated

Table - 3.5: Wastewater Collection Efficiency - 1999

(no. of cities/towns)

% waste water collected to generated	Metropolitan cities	Class I cities	Class II towns	Total	%
≤ 25	2	12	2	16	16
>25 to 50	6	17	2	25	25
>50 to 75	11	17	12	40	40
>75 to 99	3	11	5	19	19
100	0	0	0	0	0
n.a.	0	0	0	0	0
Total no. of urban cetres	22	57	21	100	100
Average (%)	61	52	65	59	

Source: NIUA Survey,1999. See Appendix - II, Table B – 2 for details

is collected daily (Table 3.5). Low coverage of population by sewers, even in the urban centres with a sewerage system, is the reason for the low collection efficiency. There is thus a need to expand the coverage of the sewerage system in order to improve the collection efficiency.

3.3.2 Discharge of Wastewater

Almost 36 per cent of the responding urban centres discharge wastewater only into water body while 22 per discharge only on land. Nearly 41 percent of the urban centres use both land and water body for discharging wastewater. The place of wastewater disposal depends on the option selected by the concerned authority, which may be based on local and financial considerations (Table 3.6).

Table - 3.6: Discharge of Wastewater - 1999

(no. of cities/towns)

Discharge of Wastewater into	Metropolitan cities	Class I cities	Class II towns	Total	%
Land	3	19	0	22	22
Water body	9	20	7	36	36
Land and water body	10	18	13	41	41
n.a.	0	0	1	1	1
Total	22	57	21	100	100

Source: NIUA Survey,1999. See Appendix - II, Table B – 2 for details

3.3.3 Recycling/Reuse of Wastewater

Recycling/ reuse of wastewater is not practiced in many urban centres. The present study indicates that only 44 urban centres in the sample recycle/reuse wastewater for agriculture/ horticultural purposes. In 16 of these urban centres 100 per cent of the wastewater collected is recycled while in 6 urban centres less than ten percent of wastewater is recycled (Table 3.7).

A disaggregation of urban centers that recycle wastewater indicates that 26 per cent of wastewater collected is recycled in the 11 metropolitan cities, 55 percent in the 25 Class I cities and 100 per cent in the 8 Class II towns. This indicates that as the size of the urban centers decrease the greater is the recycling of wastewater (in percentage terms). This could be due to the proximity of agricultural fields allowing the wastewater to be recycled and also the lack of funds to set up water treatment plants. Overall, about 30 per cent of the wastewater collected is recycled.

Recycling of wastewater not only helps reduce pollution of land and water bodies but also has implications for water demand and additional investment requirements in water supply. Recycling/ reuse of wastewater can reduce or postpone the need for developing new sources of water supply and also help improve the environment.

Table - 3.7: Recycling of Wastewater - 1999					
					(no. of cities/towns)
% Recycle/reuse of sewage for agriculture/horticulture	Metropolitan cities	Class I cities	Class II towns	Total	%
<10	4	2	0	6	14
10 – 25	2	1	0	3	7
25 – 50	3	6	0	9	20
>50	2	16	8	26	59
Total	11	25	8	44	100
Average (%)	26	55	100	30	
Source: NIUA Survey, 1999. See Appendix - II, Table B – 4 for details					

3.4 WASTE WATER TREATMENT

3.4.1 Treatment

Disposal of untreated wastewater pollutes water bodies/ land and is a major health hazard. Many urban centres, in the present study, either do not have any treatment facilities or have inadequate treatment facilities. Only 62 per cent of the wastewater collected, in 100 sampled urban centres with functional sewerage system, is given any form of treatment before disposal while the rest is disposed off untreated into land or water body. In actual terms, about 9139 million litres of wastewater is discharged untreated into land or water bodies everyday from just these 100 urban centres in the country. A larger percentage of wastewater collected is treated in the metropolitan cities (66%) than in the Class I cities (48%) and Class II towns (17%). In terms of volume, the quantity of wastewater discharged untreated from the 21 metropolitan cities is 6483 million litres daily (Table 3.4 & 3.8).

The present survey indicates that in 47 per cent of the sampled urban centres, with

Table - 3.8: Wastewater Treated to Collected - 1999					
					(no. of cities/towns)
% waste water treated to collected	Metropolitan cities	Class I cities	Class II towns	Total	%
0	3	29	15	47	47
1 to 25	1	2	1	4	4
25 – 50	2	5	0	7	7
50 - 75	5	5	0	10	10
75 - 99	0	5	0	5	5
100	10	11	5	26	26
n.a.	1	0	0	1	1
Total no. of urban cetres	22	57	21	100	100
Average (%)	66	48	17	62	
Source: NIUA Survey,1999. See Appendix - II, Table B – 2 for details					

sewerage system, the entire wastewater collected is discharged without any treatment. While in almost one-fourth of the urban centres 100 per cent of the wastewater collected is treated before disposal (Table 3.8). A majority of the sampled class II towns and a significant percentage of Class I cities, with sewerage system, do not have wastewater treatment facilities, and hence do not treat the wastewater before discharging. The level of water and land pollution due to untreated wastewater in the relatively smaller urban centres can be gauged by this situation. Efforts will have to be made to provide at least primary wastewater treatment facilities in these towns to reduce the level of pollution created by the discharge of untreated wastewater.

3.4.2 Type of Treatment

In about 19 per cent of the responding urban centres only primary treatment is provided to wastewater before disposal into land or water body, while 38 per cent of urban centres also provide secondary treatment to wastewater before disposal (Table 3.9).

Table - 3.9: Type of Wastewater Treatment - 1999

(no. of cities/towns)

Type of wastewater treatment	Metropolitan cities	Class I cities	Class II towns	Total	%
Primary	9	8	2	19	19
Primary and Secondary	9	24	5	38	38
None	3	26	14	43	43
n.a.	1	1	0	2	2
Total	22	57	21	100	100

Source: NIUA Survey,1999. See Appendix - II, Table B – 3 for details

A larger percentage of metropolitan cities provide secondary treatment to wastewater than the other size class of urban centres. Almost two-fifths of the responding urban centres do not provide any treatment to water before disposal.

3.4.3 Treatment Process

The most commonly used wastewater treatment process in the responding urban centres, with sewerage system, is extended aeration, which is practiced in 33 per cent of the responding urban centres. Activated sludge process is used in 9 per cent and stabilization ponds in 3 per cent of the responding urban centres (Table 3.10).

3.4.4 Sewage Treatment Plants

All urban centres with sewerage system should have STPs to treat wastewater. The present survey shows that STPs are available in only 50 of the 100 urban centres with sewerage system (Table 3.11).

Table - 3.10: Wastewater Treatment Process – 1999					
					(no. of cities/towns)
Wastewater treatment process	Metropolitan cities	Class I cities	Class II towns	Total	%
Extended aeration	10	19	4	33	33
Activated sludge process	4	4	1	9	9
Stabilization pond	1	2	0	3	3
Up-flow anaerobic sludge blanket (UASB)	0	5	0	5	5
Others*	3	0	2	5	5
n.a.	1	1	0	2	2
None	3	26	14	43	43
Total	22	57	21	100	100

Source: NIUA Survey, 1999. See Appendix - II, Table B – 3 for details
** Others include cases where there is a combination of 2 treatment processes or a different process from the choices given.*

Table – 3.11: Sewage Treatment Plants – 1999			
			(no. of cities/towns)
	With Sewage Treatment Plant	Without Sewage Treatment Plant	Total
Metropolitan Cities	18	4	22
Class I Cities	29	28	57
Class II Towns	4	17	21
Total	51	49	100

Source: NIUA Survey, 1999 See Appendix - II, Table B – 3 for details

While most of the metropolitan cities (18 out of 22) have STPs, only 28 of the 57 Class I cities and 4 of the 21 Class II towns with sewerage system have STPs. There is thus a need to construct sewage treatment plants in all the urban centres with sewerage system.

3.5 CHARGING FOR WASTEWATER

Providing sewerage system along with treatment facilities is an expensive proposition. In Indian cities and towns there is no established mechanism for cost recovery from this service. The present survey reveals that charging for wastewater collection and treatment in the sampled urban centres is done by three methods:

- Levying a tax (sewerage/ drainage tax) – this is a percentage of property tax and varies from 1 per cent to 25 per cent of annual rateable value (arv) of property.
- Levying a charge per water closet (WC) – this type of charge is common in most sampled urban centres of Haryana and in some urban centres of Punjab and Andhra Pradesh. The rate charged per water closet varies from Rs. 24 to Rs. 200

per year in the sampled urban centres. This charge, in some cities, is also called tax (and not a charge).

- Levying a surcharge on water – this is practised in only four of the sampled urban centres (Bangalore, Chennai, Hyderabad and Ajmer). The surcharge varies from 20 to 35 per cent of water charges in these cities.

Others methods of charging - In some cities the basis of charging is different to all the other sampled urban centres. Calcutta charges a certain percentage of water tax as sewerage tax while in Mangalore the basis of charging is by area (Table 3.12).

Table - 3.12 : Sources of Revenue for Wastewater Management – 1999

Metropolitan Cities	Rate (percentage of property tax)
Delhi	5% of arv
Greater Mumbai	25% of arv
Jaipur	20% of arv
Kanpur	4 % of arv
Lucknow	3 % of arv
Pune	4% of arv
Other cities	**Rate (percentage of property tax)**
Allahabad	4 % of arv
Bareilly	4 % of arv
Bhind	1.5% to 2.5% on arv
Bhuj	6% of arv
Ghaziabad	2.5 % of arv
Hardwar	2 % of arv
Kolhapur	1.5 to 2.5% of arv
Mirzapur	2.5%of arv
Morena	3% of arv
Navsari	6% of arv
Rajkot	9% of arv
Roorkee	5 % of arv
Solapur	1% of arv
Tiruchirapalli	1.5 % of arv
City	**Rate (per water closet - domestic)**
Ambala	Rs. 60 per wc/ yr.
Bhubaneswar	Rs.120 per wc/yr.
Dhule	Rs. 200 per wc/yr.
Eluru	Rs. 24 per wc/ yr.
Guntur	Rs. 60 per wc/yr. & Rs. 120 per wc/ yr. (non-domestic)
Gurgaon	Rs. 60 per wc/ yr.

Hissar	Rs. 60 per wc/ yr.
Hoshiarpur	Rs.120 per wc/yr.
Kaithal	Rs. 60 per wc/ yr.
Karnal	Rs. 60 per wc/ yr.
Mansa	Rs.120 per wc/yr.
Rewari	Rs. 60 per wc/ yr.
Rohtak	Rs. 60 per wc/ yr.
Sangrur	Rs.120 per wc/yr.
Thanesar	Rs. 60 per wc/ yr.
Vijaywada	Rs. 120 per wc/ yr.& Rs. 192 per wc/ yr.(non-domestic)
City	Rate (charge on water)
Bangalore	30% of water charges
Chennai	25 % of water charges
Hyderabad	35% of water charges
Ajmer	20% of water charges
City	Rate
Calcutta	80 % of water tax (amount fixed based on ferrule size)
Mangalore	Rs. 2 per sq. ft.(dom.) & Rs. 5 per sq. ft. (non-domestic)

Source: NIUA Survey,1999. See Appendix - II, Table B – for details

3.6 REVENUE RECEIPTS AND REVENUE EXPENDITURE

3.6.1 Revenue Receipts

The main sources of revenue for this service are sewerage/drainage tax (as given above) and connection charges. Amongst the sampled urban centres with sewerage facilities, 36

Table – 3.13 : Percentage Revenue Receipts from Sewerage/Drainage Tax – 1997-98

(no. of cities/towns)

% Revenue Receipts	Metropolitan cities	Class I cities	Class II towns	Total	%
<50	2	3	1	6	6
50-90	1	8	0	9	9
90-99	3	8	3	14	14
100	2	5	0	7	7
0	7	17	13	37	37
combined (n.a.)	5	1	1	7	7
n.a.	2	15	3	20	20
Total	22	57	21	100	100
Average	94	82	95	94	

Source: NIUA Survey,1999. See Appendix - II, Table B – 9 for details
'combined (n.a)'. represents those sample cities/towns where data on waste water receipts are combined with water supply receipts

urban centres have indicated revenues from sewage/drainage tax (Table 3.13) while 48 have indicated revenues from connection charges in 1997-98. (Table 3.14).

Only 20 urban centres, with sewerage system, have generated revenues from both sewerage/drainage tax and connection charges in 1997-98. As can be seen from Table 3.13, sewerage/ drainage tax forms a very high percentage of revenues (over 50%) for this service. In 7 sampled urban centres the entire revenue comes only from tax sources.

Revenues from connection charges, forms a relatively smaller proportion of revenues for this service. In a large number of sampled urban centres the revenues from connection charges form less than a quarter of the total revenues from sewerage service. However, there are 18 urban centres whose entire revenue comes only from connection charges (Table 3.14).

Table – 3.14 : Percentage Revenue Receipts from Connection Charges – 1997-98

(no. of cities/towns)

% Revenue Receipts	Metropolitan cities	Class I cities	Class II towns	Total	%
<25	3	13	5	21	21
25 - 50	1	3	1	5	5
50 - 75	1	0	0	1	1
75 - 99	0	2	1	3	3
100	3	7	8	18	18
0	7	16	2	25	25
combined (n.a.)	5	1	1	7	7
n.a.	2	15	3	20	20
Total	22	57	21	100	100
Average	22	27	52	24	

Source: NIUA Survey,1999. See Appendix - II, Table B – 9 for details
'combined (n.a)'. represents those sample cities/towns where data on waste water receipts are combined with water supply receipts

3.6.2 Cost Recovery

Wastewater management is a service from which cost recovery is generally very low and it is often considered an expenditure-dominated service. Although partial cost recovery is observed in some urban centres, the recovery rates are generally very low. There are some urban centres where no revenue is generated from the service. As indicated earlier, the main source of revenue for the service is from tax, though charges per water closet also allows reasonable recovery.

The present survey shows that, despite the general grim scenario, 12* sewered urban centres are able to recover full cost of the service while a majority of urban centres are able to recover only less than 25 per cent of the expenditure on the service.

** These urban centres exclude Chennai, Bangalore and Hyderabad for which water and sewerage accounts are given together. These cities also show excess income over expenditure on water supply and sewerage services.*

Some urban centres (12 in this sample) do not generate any revenue from the service (Table 3.15).

The average cost recovery in the metropolitan cities from this service is a mere 15 per cent if the outlyers are excluded. These outlyers are 4 metro cities (Mumbai, Pune, Madurai and Vadodara), which generate excess revenue to expenditure. If these cities are included in the calculation of average, then the cost recovery from the service, in metropolitan cities, goes up to a staggering 146 per cent. Similarly, the low cost recovery rates in Class I and Class II urban centers also show significant variations when extreme values (recovery of over 100 per cent) are excluded from the calculation of average (Table 3.15).

Table – 3.15 : Percentage Revenue Receipts to Revenue Expenditure – 1997-98

(no. of cities/towns)

% Receipts to Expenditure	Metropolitan cities	Class I cities	Class II towns	Total	%
0	0	11	2	13	13
0-25	6	22	8	36	36
25-50	3	5	2	10	10
50-75	0	4	3	7	7
75-100	2	1	1	4	4
>100	4	7	1	12	12
combined (n.a.)	5	1	1	7	7
n.a.	2	6	3	11	11
Total	22	57	21	100	100
Average (%)*	146	29	35	127	
Average (%)**	15	14	2	15	

Source: NIUA Survey, 1999. See Appendix - II, Table B –11 for details 'combined (n.a)'. represents those sample cities/towns where data on waste water receipts are combined with water supply receipts
** Average with outlyers ** Average without outlyers*

The reasons for a few urban centres generating excess revenue over expenditure in 1997-98 needs to be explained. The present study considers sewerage/drainage tax and connection charges as revenue sources for this service. Some of the urban centres that have shown an excess of revenue over expenditure in this service in 1997-98 have significant tax collections on this head, as is the case in Vadodara, Vijayawada, Bhuj and Mangalore. Mumbai generates substantial revenues from surcharge on measured water supplied, and from sewerage tax and sewerage benefit tax. Pune generates significant revenues from drainage charges, sewerage benefit tax and connection charges. Guntur and Tiruchirapalli have shown unusually high revenues in 1997-98 owing mainly to the underground drainage development charges (which are one time charges). Tiruchirapalli has also given the O&M of the sewerage system to private contractors, the cost of which is not entered in the books on this head. Some of the other reasons for excess revenues over expenditure

is the fact that the expenditure may be very low as is the case in Mehsana and Rae Bareli where no treatment is provided to wastewater – keeping the expenditure low. The sewerage system may also not be functioning properly in some urban centres and so the main expenditure remains only on establishment. Madurai generates significant revenue from connection charges, which allows it to show excess revenue over expenditure. Navasari and Dhule have also shown slight excess revenue over expenditure in 1997-98. While in Navasari, apart from revenues from tax, providing drainage lines to industries has proved to be a significant source of revenue, in Dhule the Maharshtra Jeevan Pradhikaran maintains the sewerage system hence the expenditure on the service is low. Bangalore, Chennai and Hyderabad, which have city level water and sewerage boards, also show excess income over expenditure on combined water and wastewater services.

Cost recovery, therefore, is an important issue and new ways of generating revenues from this service should be considered. Sale of wastewater for specified uses, producing gas from wastewater, sale of manure etc. have to be encouraged to expand the revenue from this service. One way of reducing expenditure and increasing revenues is through public-private partnerships or privatisation.

3.7 PRIVATISATION

Private sector participation in wastewater management has been reported in only 6 sampled urban centres i.e., in Chennai, Hyderabad, Rajkot, Bhavnagar, Nashik and Chandigarh. In all these cities private sector has been involved in the operation and maintenance (O&M) of either the sewage pumping stations or sewage treatment plants since mid 1990s. Privatisation has resulted in substantial cost savings for Chennai, that is, as much as 47 per cent (Table 3.16).

Table - 3.16 : Privatisation in Wastewater Management – 1999

Sl. No.	City/town	Function	Activity privatised	Mode used	Year privat-ised	No. of contrac-tors	Cost before privati-sation (Rs.)	Cost after privati-sation (Rs.)
1	Chennai	O&M	Pumping stations	Contract	1996	3	27,00,000	14,40,000
2	Hyderabad	O&M	STPs	Contract	1999	2	n.a.	n.a.
3	Rajkot	O&M	Pumping stations	Contract	1998	3	n.a.	n.a.
4	Bhavnagar	O&M	n.a.	Contract	1994	1	n.a.	40,000
5	Nashik	O&M	STPs	Contract	1995	1	n.a.	9,52,000
6	Chandigarh	O&M	Pumping stations	n.a.	1999	1	n.a.	n.a.

Source: NIUA Survey,1999. See Appendix - II, Table B – 6 for details

3.8 CAPITAL EXPENDITURE

While a majority of the cities do not have underground drainage systems, only a few unsewered cities have indicated capital investment in sewerage related works. Most of the capital works are Capital expenditure on sewerage related works has been undertaken in only about 21 per cent of the sampled cities. The expenditure has been incurred mainly for augmentation (12% cities), improving existing systems (4% cities) and adding new pipelines (5% cities). The components of expenditure also include treatment plants (3% cities), pumping stations and creating treatment facility such as lagoons. (See Appendix II, Table B-7).

As per the present survey, not too many unsewered urban centres are undertaking capital works in the near future to provide safe sanitation to their population. Only about 10 cities have indicated capital expenditure on sewerage related works of which only two are non-sewered urban centres. There is, thus a need to make additional capital investments to provide safe sanitation to all.

3.9 SEPTIC TANKS AND LOW COST SANITATION

Providing sewerage system in urban centres, though desirable, requires heavy capital investment for construction and requires regular funds for maintenance. However, providing sewerage system to all urban centres may not be feasible or desirable, given the water supply situation and the state of municipal finances (the present survey shows that almost half the sampled urban centres do not get adequate water). Therefore, the urban centres that do not have sewerage system and cannot provide one, can opt for low cost solutions. Septic tanks and low cost sanitation systems are the solutions for providing safe sanitation facilities for such urban centres and even for those that have partial coverage by sewerage system. A section of the population in most urban centres uses community toilets while the remaining resort to open defecation. Dry latrines too are still in existence in some cities. Data on this aspect was very difficult to obtain from local governments. Even where data has been provided by the agency concerned, the data were not found to be very reliable.

Most urban centres have population that depend on septic tanks and low cost sanitation, even in the urban centres that have a sewerage system (Table AX-3.1 at the end of this chapter). The present survey indicates that almost one-third (34%) of the population in the sampled urban centres[10] is covered by septic tanks and low cost sanitation. The percentage of population dependent on low cost sanitation is higher in Class I and Class II urban centres as the population covered by sewerage system in these urban centres is low (Table 3.17).

[10] *Data on low cost sanitation has been furnished only by about 80 per cent of the sampled urban centres.*

Table – 3.17 : Population Dependant on Septic Tanks and LCS					
					(no. of cities/towns)
% Population	Metropolitan cities	Class I cities	Class II towns	Total	%
<25	8	46	15	69	26
25 - 50	10	26	26	62	23
50 - 75	0	27	30	57	22
>75	0	28	24	52	20
Data not available	4	15	5	24	9
Total	22	142	100	264	100
Average (%)	25	41	55	34	
Source: NIUA Survey,1999. See Appendix - II, Table B – 12 for details					

3.10 ADDITIONAL CAPITAL INVESTMENT REQUIREMENTS

A little above 50 per cent of the population is covered by sanitation facilities in urban India at present. Lack of facilities for wastewater management creates insanitary conditions and therefore, there is a need to accord high priority to wastewater management.

The target of the government is to eventually provide safe sanitation facilities to 100 per cent of urban population. However, the target for the immediate future (that is till 2002) is to cover 75 per cent of the population by the service. Achieving these targets requires substantial investments in this sector. The present study has projected the additional investment requirements in this sector to cover 75 per cent of the population by the year 2002 and the entire population with safe sanitation facilities thereafter till 2022.

3.10.1 Projection Methodology

For projecting the additional capital investment requirements the following were required:

a) the total urban population projected till the year 2022 at five year intervals starting 2002 A.D. – for which the Registrar General of India's population projection has been used (Table 3.18).

b) the division of the projected urban population by size class of urban centres for different years (Table 3.19);

c) the present uncovered population by the service by size class of urban centres (Table 3.20).

The backlog population to be covered has been calculated by using the percentage population not covered in 1999, which has been taken from the present survey. The population to be covered in different years, including the backlog till 1999, by size class has been arrived at by using the 9th Plan target of covering 75 per cent of the population till the year 2002 and covering 100 per cent of the population thereafter.

Table – 3.18 : Class-wise Projection of Urban Population* in Different Years

(in million)

Year	Size class of cities and towns							
	Metro	I**	II	III	IV	V	VI	Total
1991(% Population)	23.00	33.67	13.33	16.35	9.77	3.43	0.45	100.00
1999	64.10	93.84	37.15	45.57	27.23	9.56	1.25	278.70
2002	69.34	101.51	40.19	49.29	29.45	10.34	1.36	301.48
2007	79.11	115.82	45.85	56.24	33.61	11.80	1.55	343.97
2012	89.58	131.14	51.92	63.68	38.05	13.36	1.75	389.48
2017	101.11	148.02	58.60	71.88	42.95	15.08	1.98	439.61
2022	114.16	167.13	66.17	81.16	48.50	17.03	2.23	496.37

Note: The proportion of population in each size class is for the individual cities and towns and not for urban agglomerations and the proportions are assumed to be constant for the projected period i.e., upto 2022.
Source for proportion of population in each size class - Census of India 1991, Series 1 - India, General Population Tables Part II-A (ii) Towns and Urban Agglomerations 1991 with their Population 1901 - 1991, Statement-3, p.32
Source for size class-wise population distribution - Projections based on Census of India's 'Population Projections for India and States 1996-2016', Registrar General, India, New Delhi, 1996.
** Population as on 1st July of the respective years. ** Class I cities exclude metropolitan cities.*

Table – 3.19 : Additional Population to be Covered in Different Years by Size Class

(in million)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
Backlog 1999	21.63	52.08	24.80	30.42	18.18	6.38	0.84	154.32
1999-2002	9.34	18.77	8.48	10.40	6.21	2.18	0.29	55.67
2002-2007	12.89	20.56	8.49	10.41	6.22	2.18	0.29	61.05
2007-2012	10.47	15.32	6.07	7.44	4.45	1.56	0.20	45.51
2012-2017	11.53	16.88	6.68	8.20	4.90	1.72	0.23	50.13
2017-2022	13.05	19.11	7.57	9.28	5.55	1.95	0.26	56.76
Total	78.91	142.73	62.08	76.14	45.50	15.97	2.10	423.43

Source: Derived from Table 3.18 Calculations till 2002 are based on 75% coverage of population

Table – 3.20 : Coverage of Population by Safe Sanitation - 1999

(used for calculating the backlog)

Size class of cities/towns	% Population covered	% Population not covered
Metro	59	41
I	70	30
II	65	35
III	50	50
IV	50	50
V	50	50
VI	50	50

Source: NIUA Survey,1999. See Appendix - II, Table B – 12 for details

3.10.2 Assumptions used for Calculating Investment Requirements

The main assumptions for calculating the investment requirement in this sector relate to the choice of technology. For calculating investment requirements the following assumptions were made:

1) All metropolitan cities will be covered by sewerage system
2) In Class I cities, 60 per cent of the population will be covered by sewerage system and of the remaining 40 per cent - 20 per cent will be covered by septic tanks and 20 per cent will be covered by pit latrines.
3) In Class II towns 50 per cent of the population will be covered by septic tanks and 50 per cent by pit latrines.
4) Class III and IV towns follow the same pattern as Class II.
5) In Classes V and VI only low cost sanitation (i.e. pit latrines) will be provided.

3.10.3 Projected Additional Investment Requirements

The calculation of additional investment requirements has been done by using the per capita costs given by the Planning Commission (Task Forces on Housing and Urban Development, 1983) and that given by HUDCO, (2000) (Tables 3.21 and 3.22).

Table – 3.21 : Task Forces' Per Capita Investment Costs for Sanitation

(Estimates at 1998-99 prices) *(in Rs. per capita)*

Type of technology	City size by Population		
	>1 Lakh	50,000-1 Lakh	< 50,000
Sewerage system	1622	1637	1534
Sewage treatment (plant)	240	818	480
Septic tank (household)	995	1103	1107
Pit latrine	647	691	627

Table – 3.22 : HUDCO's Per Capita Investment Costs for Sanitation (HUDCO estimates at 1998-99 prices)

Item	Rs./per capita
Sewerage augmentation	1620
Conventional treatment	162
Septic tank with soak pit	4050
Twin pit without superstructure	
5 users	648
15 users	377.5

The backlog population as well as the additional population till 2022 has been multiplied by the per capita cost of providing sewerage/ septic tanks/ pit latrines. The investment requirements thus worked out are given in Tables 3.23 and 3.24.

In 1999, an estimated 154 million people were not covered by safe sanitation in the urban areas of the country (figure based on the results of the present sample survey).

Table–3.23: Additional Investment Requirements for Providing Safe Sanitation to Population (Using Task Forces per capita cost estimates)

(Rs. in crores - at 1998-99 prices)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
Backlog 1999	4028.19	7528.07	2223.61	2727.38	1629.75	400.20	52.50	18589.71
1999-2002	1738.86	2713.69	760.15	932.37	557.14	136.81	17.95	6856.98
2002-2007	2254.48	2746.51	697.95	856.07	511.55	125.62	16.48	7208.64
2007-2012	1948.88	2214.83	543.95	667.18	398.68	97.90	12.84	5884.25
2012-2017	2146.91	2439.88	599.22	734.97	439.19	107.85	14.15	6482.17
2017-2022	2430.81	2762.51	678.45	832.16	497.26	122.11	16.02	7339.32
Total	14548.14	20405.48	5503.32	6750.14	4033.57	990.48	129.95	52361.07

Table – 3.24: Additional Investment Requirements for Providing Safe Sanitation to Population (Using HUDCO's per capita cost estimates)

(Rs. in crores - at 1998-99 prices)

Year	Size class of cities and towns							
	Metro	I	II	III	IV	V	VI	Total
Backlog								
1999	3855.13	10461.69	5824.97	7144.65	4269.31	413.48	54.25	32023.48
1999-2002	1664.15	3771.19	1991.30	2442.45	1459.49	141.35	18.54	11488.48
2002-2007	2157.61	3816.80	1828.34	2242.57	1340.05	129.78	17.03	11532.18
2007-2012	1865.15	3077.92	1424.92	1747.75	1044.37	101.15	13.27	9274.54
2012-2017	2054.67	3390.68	1569.71	1925.34	1150.50	111.42	14.62	10216.95
2017-2022	2326.37	3839.04	1777.28	2179.94	1302.63	126.16	16.55	11567.96
Total	13923.08	28357.33	14416.53	17682.70	10566.36	1023.33	134.26	86103.59

Note: Rs. 1 crore = Rs. 10,000,000

Between 1999 and 2022 over 200 million would be added to the urban population of the country and this additional population will also have to be covered by safe sanitation. Provision, therefore, has to be made to cover over 400 million people by safe sanitation between 1999 and 2022. This requires huge financial investments to be made in the sanitation sector.

The present financial requirement estimations are based on the per capita cost estimates provided by the Task Forces on Housing and Urban Development and HUDCO. All cost figures are at 1998-99 prices.

The additional capital investment required to cover 75 per cent of the uncovered population upto the year 2002 (i.e. 209.99 million people) is Rs. 25,446.69 crores using Task Forces per capita cost estimates. Using HUDCO's per capita cost estimates, the additional capital investment requirement goes upto Rs. 43,511.96 crores for the same period. Almost three-fourths of this investment will be required

to cover only the backlog population. Between 2002 and 2022 an investment totalling Rs. 26,914.38 crores will be required to be invested to cover the additional population by safe sanitation (using Task Forces per capita cost estimates). For the same period, the total investment required would be Rs. 42,591.63 crores if HUDCO's per capita cost estimates are used.

The total investment required for the period 1999 to 2022 is a whopping Rs. 52, 361.07 crores (using Task Forces per capita cost estimates) or Rs. 86,103.59 crores (using HUDCO's per capita cost estimates). The per annum investment during this period works out to Rs. 2,276.57 crores or Rs. 3,743.63 crores respectively using the above two estimates.

For financing such huge investments, government's resources should be supplemented by mobilizing resources from the private sector and from the people themselves. Mechanisms for charging for wastewater service must be accorded adequate attention to generate additional resources to maintain the infrastructure and assets created.

ANNEX TABLE

Table- AX- 3.1: Population Covered by Sewerage System and Low Cost Sanitation – 1999

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
	Metropolitan Cities							
1	Ahmedabad M.Corp.	3,500,000	2,800,000	80	700000	20	3500000	100
2	Bangalore M.Corp.	5,000,000	3,900,000	78	1100000	22	5000000	100
3	Bhopal M.Corp.	1,500,000	200,000	13	300000	20	500000	33
4	Calcutta M.Corp.	4,870,000	2,200,000	45	1300000	27	3500000	72
5	Chennai M.Corp.	4,363,000	4,100,000	94	n.a.	n.a.	n.a.	n.a.
6	Coimbatore M.Corp.	971,000	270,000	28	388400	40	658400	68
7	Delhi M.Corp.	12,000,000	8,500,000	71	n.a.	n.a.	n.a.	n.a.
8	Greater Mumbai M.Corp.	11,100,000	8,400,000	76	2000000	18	10400000	94
9	Hyderabad M.Corp.	4,163,000	2,350,000	56	n.a.	n.a.	n.a.	n.a.
10	Indore M.Corp.	1,600,000	640,000	40	480000	30	1120000	70
11	Jaipur M.Corp.	2,000,000	1,000,000	50	860000	43	1860000	93
12	Kanpur M.Corp.	2,500,000	1,500,000	60	1000000	40	2500000	100
13	Kochi M.Corp.	680,000	20,000	3	n.a.	n.a.	n.a.	n.a.
14	Lucknow M.Corp.	2,500,000	800,000	32	950000	38	1750000	70
15	Ludhiana M.Corp.	2,000,000	1,200,000	60	37860	2	1237860	62
16	Madurai M.Corp.	1,020,000	350,000	34	26500	3	376500	37
17	Nagpur M.Corp.	2,100,000	1,260,000	60	112222	5	1372222	65
18	Pune M.Corp.	2,300,000	1,732,000	75	500000	22	2232000	97
19	Surat M.Corp.	2,300,000	1,200,000	52	1000000	43	2200000	96
20	Vadodara M.Corp.	1,400,000	875,000	63	375000	27	1250000	89
21	Varanasi M.Corp.	1,152,295	700,000	61	449395	39	1149395	100
22	Visakhapatnam M.Corp.	1,280,000	90,000	7	578000	45	668000	52
	Class I							
	Andhra Pradesh							
1	Anantapur MCl	250,000	0	0	175000	70	175000	70
2	Chittoor M	149,257	0	0	125000	84	125000	84
3	Cuddapah MCl	166,000	0	0	141000	85	141000	85
4	Eluru M	247,000	100,000	40	147000	60	247000	100
5	Guntur MCl	556,820	100,000	18	n.a.	n.a.	n.a.	n.a.
6	Hindupur M	140,000	0	0	28910	21	28910	21

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
7	Kakinada M	325,000	0	0	232750	72	232750	72
8	Kurnool MCl	281,507	30,000	11	24000	9	54000	19
9	Machilipatnam M	200,000	0	0	170000	85	170000	85
10	Nandyal MCl	150,000	0	0	42976	29	42976	29
11	Nellore MCl	404,000	0	0	183000	45	183000	45
12	Nizamabad M	285,000	0	0	26855	9	26855	9
13	Ongole MCl	180,000	0	0	n.a.	n.a.	n.a.	n.a.
14	Qutubullapur M	250,000	0	0	110000	44	110000	44
15	Rajahmundry M.Corp.	380,000	0	0	n.a.	n.a.	n.a.	n.a.
16	Tenali M	250,000	0	0	15710	6	15710	6
17	Tirupati MCl	210,000	0	0	170000	81	170000	81
18	Vijaywada M.Corp.	836,850	292,900	35	543950	65	836850	100
19	Warangal M.Corp.	680,000	0	0	187639	28	187639	28
	Bihar							
20	Bihar Sharif M	250,000	0	0	22000	9	22000	9
21	Chhapra M	200,000	0	0	n.a.	n.a.	n.a.	n.a.
22	Gaya M.Corp.	400,000	0	0	300000	75	300000	75
23	Katihar M	200,000	0	0	20000	10	20000	10
24	Munger M	210,000	0	0	52000	25	52000	25
25	Ranchi M.Corp.	700,000	0	0	n.a.	n.a.	n.a.	n.a.
	Gujarat							
26	Anand M	175,000	105,000	60	60000	34	165000	94
27	Bharuch M	159,000	0	0	30000	19	30000	19
28	Bhavnagar M.Corp.	550,000	300,000	55	125000	23	425000	77
29	Bhuj M	118,000	106,000	90	11000	9	117000	99
30	Jamnagar M.Corp.	500,000	0	0	250000	50	250000	50
31	Junagadh M	165,000	0	0	8000	5	8000	5
32	Nadiad M	300,000	140,000	47	60000	20	200000	67
33	Navsari M	139,000	118,000	85	n.a.	n.a.	n.a.	n.a.
34	Porbandar M	142,000	0	0	90000	63	90000	63
35	Rajkot M.Corp.	1,000,000	550,000	55	64000	6	614000	61
36	Surendranagar M	150,000	0	0	150000	100	150000	100
	Haryana							
37	Ambala MCl	141,000	18,160	13	122470	87	140630	100
38	Faridabad M.Corp.	1,150,000	632,500	55	n.a.	n.a.	n.a.	n.a.

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
39	Gurgaon MCl	175,000	109,000	62	28900	17	137900	79
40	Hissar MCl	250,000	130,000	52	25000	10	155000	62
41	Karnal MCl	220,000	112,000	51	30525	14	142525	65
42	Rohtak MCl	243,000	183,000	75	50000	21	233000	96
	Jammu & Kashmir							
43	Jammu M.Corp.	1050800	0	0	n.a.	n.a.	n.a.	n.a.
	Karnataka							
44	Belgaum M.Corp.	470,000	235,000	50	n.a.	n.a.	n.a.	n.a.
45	Bellary CMC	297,000	129,000	43	30000	10	159000	54
46	Davangere MCl	455,000	318500	70	45500	10	364000	80
47	Gadag-Betigeri CMC	148,353	0	0	65000	44	65000	44
48	Gulbarga M.Corp.	450,000	150,000	33	75000	17	225000	50
49	Hubli-Dharwad M. Corp.	850,000	450,000	53	102000	12	552000	65
50	Mandya M	140,000	0	0	56000	40	56000	40
51	Mangalore M.Corp.	410,000	250,000	61	10230	2	260230	63
52	Mysore M.Corp.	1,050,000	400,000	38	150000	14	550000	52
53	Shimoga CMC	221,860	80,600	36	n.a.	n.a.	n.a.	n.a.
54	Tumkur M	300,000	0	0	49815	17	49815	17
	Kerala							
55	Alappuzha MC	200,000	0	0	150000	75	150000	75
56	Kollam MC	160,000	0	0	112000	70	112000	70
57	Kozhikode M.Corp.	493,000	0	0	450000	91	450000	91
58	Thalaserry M	134,000	0	0	28652	21	28652	21
59	Thiruvananthapuram M.Corp.	585,000	0	0	585000	100	585000	100
	Maharashtra							
60	Amravati M.Corp.	500,000	0	0	350000	70	350000	70
61	Aurangabad M.Corp.	868,000	684,000	79	155000	18	839000	97
62	Bhusawal M.Cl.	200,000	0	0	113460	57	113460	57
63	Chandrapur MCl	295,000	0	0	n.a.	n.a.	n.a.	n.a.
64	Dhule MCl	330,000	150,000	45	105000	32	255000	77
65	Ichalkaranji MCl	250,000	197,500	79	52500	21	250000	100
66	Jalgaon MCl	400,000	0	0	217000	54	217000	54
67	Kolhapur M.Corp.	502,000	200,000	40	n.a.	n.a.	n.a.	n.a.
68	Nanded Waghala M.Corp.	410,000	250,000	61	150000	37	400000	98

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
69	Nashik M.Corp.	838,760	500,000	60	335500	40	835500	100
70	Parbhani MCl	233,000	0	0	28000	12	28000	12
71	Solapur M.Corp.	900,000	810,000	90	n.a.	n.a.	n.a.	n.a.
72	Wardha M	150,000	0	0	10370	7	10370	7
73	Yavatmal MCl	130,000	0	0	43000	33	43000	33
	Madhya Pradesh							
74	Bhind M	175,000	40,000	23	n.a.	n.a.	n.a.	n.a.
75	Burhanpur M.Corp.	210,000	0	0	n.a.	n.a.	n.a.	n.a.
76	Dewas M.Corp.	200,000	0	0	n.a.	n.a.	n.a.	n.a.
77	Guna M	125,000	0	0	75000	60	75000	60
78	Gwalior M.Corp.	900,000	516,000	57	200000	22	716000	80
79	Jabalpur M.Corp.	1,000,000	0	0	900000	90	900000	90
80	Khandwa M	175,000	0	0	n.a.	n.a.	n.a.	n.a.
81	Morena M	125,000	16,000	13	106000	85	122000	98
82	Murwara-Katni M.Corp.	180,000	0	0	n.a.	n.a.	n.a.	n.a.
83	Ratlam M.Corp.	235,000	0	0	188500	80	188500	80
84	Rewa M.Corp.	180,000	0	0	102520	57	102520	57
85	Satna M.Corp.	200,000	0	0	172000	86	172000	86
86	Shivpuri M	140,000	5,000	4	100000	71	105000	75
	Orissa							
87	Bhubaneswar M.Corp.	653,830	200,000	31	n.a.	n.a.	n.a.	n.a.
88	Cuttack M.Corp.	563,346	0	0	400000	71	400000	71
89	Puri M	149,802	0	0	98840	66	98840	66
90	Rourkela M	199,700	0	0	n.a.	n.a.	n.a.	n.a.
91	Sambalpur M	157,040	0	0	n.a.	n.a.	n.a.	n.a.
	Punjab							
92	Amritsar M.Corp.	843,320	505,992	60	190560	23	696552	83
93	Bathinda MCl	174,000	68,848	40	40000	23	108848	63
94	Hoshiarpur MCl	145,000	87,000	60	29500	20	116500	80
95	Jalandhar M. Corp.	738,000	440,000	60	295200	40	735200	100
96	Moga MCl	147,865	99,500	67	30000	20	129500	88
97	Pathankot MCl	195,000	80,000	41	59640	31	139640	72
98	Patiala M.Corp.	328,000	200,000	61	128000	39	328000	100
	Rajasthan							
99	Ajmer MCl	550,000	58,000	11	96000	17	154000	28

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			Number	%	Number	%	Number	%
100	Alwar M	300,000	0	0	150002	50	150002	50
101	Beawar M	141,000	0	0	n.a.	n.a.	n.a.	n.a.
102	Bhilwara M	225,000	0	0	170000	76	170000	76
103	Bikaner M	600,000	126,000	21	330000	55	456000	76
104	Jodhpur M.Corp.	1,000,000	327,000	33	65055	7	392055	39
105	Kota M.Corp.	750,000	0	0	28660	4	28660	4
106	Sriganganagar M	225,000	0	0	64018	28	64018	28
	Tamil Nadu							
107	Cuddalore M	162,000	0	0	140000	86	140000	86
108	Dindigul M	214,000	0	0	85000	40	85000	40
109	Erode M	173,600	0	0	136800	79	136800	79
110	Kanchipuram M	156,700	115,950	74	40750	26	156700	100
111	Kumbakonam M	146,833	38,000	26	94080	64	132080	90
112	Nagercoil M	205,500	0	0	185000	90	185000	90
113	Rajapalaiyam M	123,310	0	0	n.a.	n.a.	n.a.	n.a.
114	Salem M.Corp.	447,388	0	0	n.a.	n.a.	n.a.	n.a.
115	Thanjavur M	216,900	0	0	19275	9	19275	9
116	Tiruchirapalli M.Corp.	800,000	8,000	1	279700	35	287700	36
117	Tirunelveli M.Corp.	414,000	70,000	17	n.a.	n.a.	n.a.	n.a.
118	Tirunvannamalai M	128,500	0	0	6690	5	6690	5
119	Tiruppur M	294,761	0	0	229300	78	229300	78
120	Tuticorin M	216,670	40,000	18	n.a.	n.a.	n.a.	n.a.
121	Vellore M	176,000	0	0	175061	99	175061	99
	Uttar Pradesh							
122	Agra M.Corp.	1,150,000	0	0	n.a.	n.a.	n.a.	n.a.
123	Aligarh M.Corp.	600,000	120,000	20	350000	58	470000	78
124	Allahabad M.Corp.	1,015,000	600,000	59	415000	41	1015000	100
125	Bareilly M.Corp.	750,000	300,000	40	150000	20	450000	60
126	Etawah MB	140,000	0	0	70000	50	70000	50
127	Faizabad MB	170,000	0	0	n.a.	n.a.	n.a.	n.a.
128	Firozabad MB	250,000	0	0	100000	40	100000	40
129	Ghaziabad M.Corp.	887,000	763,193	86	125000	14	888193	100
130	Gorakhpur M.Corp.	600,000	300,000	50	75000	13	375000	63
131	Haldwani-cum-Kathgodam MB	140,612	0	0	27500	20	27500	20

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
132	Hapur MB	200,000	75,000	38	18500	9	93500	47
133	Hardwar MB	300,000	184,000	61	n.a.	n.a.	n.a.	n.a.
134	Jhansi MB	506,600	0	0	230240	45	230240	45
135	Mathura MB	400,000	50,000	13	n.a.	n.a.	n.a.	n.a.
136	Meerut M.Corp.	1,250,000	315,000	25	650000	52	965000	77
137	Mirzapur MB	210,000	153,168	73	56740	27	209908	100
138	Moradabad M.Corp.	670,000	0	0	n.a.	n.a.	n.a.	n.a.
139	Muzaffarnagar MB	325,000	80,000	25	241000	74	321000	99
140	Rae Bareli MB	175,000	70,000	40	105000	60	175000	100
141	Rampur	317,000	0	0	n.a.	n.a.	n.a.	n.a.
142	Saharanpur MB	540,000	360,000	67	178200	33	538200	100
143	Unnao MB	121,000	0	0	33000	27	33000	27
144	Sitapur MB	150,000	0	0	33000	22	33000	22
	West Bengal							
145	Asansol M.Corp.	314,625	36,000	11	183000	58	219000	70
146	Balurghat M	143,000	0	0	130000	91	130000	91
147	Bankura M	132,000	0	0	126035	95	126035	95
148	Barasat M	151,000	0	0	120000	79	120000	79
149	Berhampore M	150,000	0	0	n.a.	n.a.	n.a.	n.a.
150	Burdwan M	323,000	0	0	240000	74	240000	74
151	Halisahar M	149,000	0	0	15700	11	15700	11
152	Krishna Nagar M	145,272	0	0	116216	80	116216	80
153	Midnapur M	158,000	0	0	125000	79	125000	79
154	North Barrackpur M	118,374	0	0	20105	17	20105	17
155	Santipur M	133,911	0	0	65000	49	65000	49
156	Siliguri M.Corp.	500,000	0	0	341000	68	341000	68
	Small States							
157	Agartala MCl	200,000	0	0	176000	88	176000	88
158	Aizwal	244,000	0	0	n.a.	n.a.	n.a.	n.a.
159	Guwahati M.Corp.	995,000	0	0	n.a.	n.a.	n.a.	n.a.
160	Imphal MCl	245,000	0	0	177000	72	177000	72
161	Jorhat MB	170,000	0	0	n.a.	n.a.	n.a.	n.a.
162	Shillong MB	216,732	0	0	209007	96	209007	96
	Union Territories							
163	Chandigarh M.Corp.	850,000	850,000	100				100

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			Number	%	Number	%	Number	%
164	Pondicherry M	290,000	83,000	29	102500	35	185500	64
	CLASS II							
	Andhra Pradesh							
1	Anakapalle M	115,000	0	0	25000	22	25000	22
2	Dharmavaram M	100,000	0	0	10000	10	10000	10
3	Gudur MCl	72,000	0	0	38684	54	38684	54
4	Kapra M	120,000	0	0	98332	82	98332	82
5	Kavali MCl	85,000	0	0	31000	36	31000	36
6	Madanapalle M	100,000	0	0	94000	94	94000	94
7	Narasaraopet M	95,000	0	0	n.a.	n.a.	n.a.	n.a.
8	Rajendra Nagar MCl	120,000	0	0	19600	16	19600	16
9	Sangareddy MCl	60,000	0	0	22000	37	22000	37
10	Srikakulam MCl	100,000	0	0	100000	100	100000	100
11	Srikalahasti M	70,000	0	0	70000	100	70000	100
12	Suryapet MCl	89,000	0	0	45680	51	45680	51
	Bihar							
13	Buxar M	66,790	0	0	55600	83	55600	83
14	Deoghar M	100,000	0	0	40000	40	40000	40
15	Hajipur M	115,000	0	0	2000	2	2000	2
16	Hazaribagh M	119,054	0	0	n.a.	n.a.	n.a.	n.a.
17	Jehanabad M	57,030	0	0	30000	53	30000	53
18	Madhubani M	65,000	0	0	35000	54	35000	54
19	Mokama M	66,000	0	0	n.a.	n.a.	n.a.	n.a.
	Gujarat							
20	Amreli M	85,000	0	0	64000	75	64000	75
21	Ankleswar M	60,000	40,000	67	n.a.	n.a.	n.a.	n.a.
22	Dabhoi M	65,000	7,000	11	32600	50	39600	61
23	Dohad M	78,000	0	0	70000	90	70000	90
24	Gondal M	100,000	0	0	80000	80	80000	80
25	Jetpur M	125,000	0	0	125000	100	125000	100
26	Mahesana M	138,000	100,000	72	20000	14	120000	87
27	Palanpur M	117,000	0	0	100000	85	100000	85
	Haryana							
28	Jind MCl	114,000	72,000	63	41900	37	113900	100
29	Kaithal MCl	94,545	51,000	54	13000	14	64000	68

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
30	Rewari MCl	105,000	65,000	62	40000	38	105000	100
31	Thanesar MCl	100,000	65,000	65	21000	21	86000	86
	Karnataka							
32	Bagalkot CMC	100,000	0	0	32000	32	32000	32
33	Chikmaglur CMC	100,000	60,000	60	40000	40	100000	100
34	Gokak CMC	68,000	0	0	25000	37	25000	37
35	Hospet CMC	114,150	0	0	n.a.	n.a.	n.a.	n.a.
36	Kolar CMC	112,000	7,500	0	n.a.	n.a.	n.a.	n.a.
37	Rabkavi-Banhatti CMC	72,000	0	0	72000	100	72000	100
38	Ramanagaram CMC	70,000	0	0	40000	57	40000	57
	Kerala							
39	Changanessary MC	62,000	0	0	6500	10	6500	10
40	Payyanur M	70,500	0	0	8764	12	8764	12
41	Taliparamba M	52,000	0	0	9000	17	9000	17
42	Thrissur MC	91,000	0	0	54600	60	54600	60
	Maharashtra							
43	Amalner MCl	100,000	0	0	76000	76	76000	76
44	Ballarpur MCl	108,900	0	0	73500	67	73500	67
45	Bhandara M	76,000	0	0	45000	59	45000	59
46	Kamptee MCl	95,000	0	0	11800	12	11800	12
47	Manmad MCl	87,000	0	0	50000	57	50000	57
48	Ratnagiri MCl	70,000	0	0	28000	40	28000	40
49	Satara MCl	100,000	0	0	95180	95	95180	95
50	Virar MCl	100,000	0	0	100000	100	100000	100
	Madhya Pradesh							
51	Hoshangabad M	100,000	0	0	n.a.	n.a.	n.a.	n.a.
52	Itarsi M	105,000	0	0	n.a.	n.a.	n.a.	n.a.
53	Khargone M	80,000	0	0	n.a.	n.a.	n.a.	n.a.
54	Mandsaur M	123,000	0	0	62000	50	62000	50
55	Nagda M	100,000	0	0	n.a.	n.a.	n.a.	n.a.
56	Neemuch M	99,506	0	0	n.a.	n.a.	n.a.	n.a.
57	Sehore M	100,000	0	0	80000	80	80000	80
58	Shahdol M	75,000	0	0	56000	75	56000	75
59	Vidisha M	125,000	0	0	57000	46	57000	46

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
	Orissa							
60	Balangir M	82,600	0	0	n.a.	n.a.	n.a.	n.a.
61	Bhadrak M	93,000	0	0	n.a.	n.a.	n.a.	n.a.
	Punjab							
62	Ferozepur MCl	93,006	76,595	82	16400	18	92995	100
63	Kapurthala M	84,765	53,000	63	n.a.	n.a.	n.a.	n.a.
64	Mansa MCl	66,568	33,000	50	31765	48	64765	97
65	Phagwara MCl	108,472	48,800	45	43070	40	91870	85
66	Sangrur MCl	70,060	65,160	93	4900	7	70060	100
	Rajasthan							
67	Banswara M	110,000	0	0	n.a.	n.a.	n.a.	n.a.
68	Barmer M	84,000	0	0	60000	71	60000	71
69	Bundi M	80,000	0	0	25,000	31	25000	31
70	Churu M	100,250	0	0	n.a.	n.a.	n.a.	n.a.
71	Hanumangarh M	125,000	0	0	50,000	40	50000	40
72	Sawai Madhopur M	89,200	0	0	44,126	49	44126	49
	Tamil Nadu							
73	Ambur M	85,700	0	0	43000	50	43000	50
74	Arakkonam M	88,000	0	0	9750	11	9750	11
75	Attur M	64,000	0	0	56000	88	56000	88
76	Cumbum M	53,600	0	0	33570	63	33570	63
77	Dharmapuri M	66,600	0	0	34000	51	34000	51
78	Gudiyatham M	95,175	0	0	90500	95	90500	95
79	Nagapattinam M	112,200	28,000	25	80000	71	108000	96
80	Pudukkottai M	108,000	0	0	74900	69	74900	69
81	Sivakasi M	70,100	0	0	35000	50	35000	50
82	Srivilliputtur M	73,900	0	0	n.a.	n.a.	n.a.	n.a.
83	Tindivanam M	70,000	0	0	70000	100	70000	100
84	Udhagamandalam M	100,000	51,000	51	3125	3	54125	54
	Uttar Pradesh							
85	Auraiya MB	90,000	2,000	2	45820	51	47820	53
86	Balrampur MB	70,000	0	0	18000	26	18000	26
87	Basti MB	110,000	0	0	65000	59	65000	59
88	Bhadohi MB	125,000	25,000	20	75000	60	100000	80
89	Chandpur MB	80,000	0	0	35700	45	35700	45

Sl. No.	City/ town	Population 1999	Population covered by sewerage system		Population covered by low cost sanitation		Total population covered	
			Number	%	Number	%	Number	%
90	Etah MB	135,000	40,000	30	20000	15	60000	44
91	Ghazipur MB	95,565	0	0	38230	40	38230	40
92	Gonda MB	114,000	0	0	48000	42	48000	42
93	Lakhimpur MB	100,000	0	0	70000	70	70000	70
94	Lalitpur MB	100,000	0	0	89230	89	89230	89
95	Mughalsarai MB	159,804	23,970	15	135,834	85	159804	100
96	Nawabganj-Barabanki MB	90,000	0	0	60000	67	60000	67
97	Orai MB	170,000	0	0	150000	88	150000	88
98	Roorkee MB	100,000	60,000	60	34000	34	94000	94
	West Bengal							
99	Bishnupur M	67,400	0	0	48610	72	48610	72
100	Chakdaha M	89,730	0	0	58900	66	58900	66
101	Contai M	114,000	0	0	90000	79	90000	79
102	Cooch Behar M	99,400	0	0	60000	60	60000	60
103	Darjeeling M	150,000	30,000	20	78000	52	108000	72
104	Jalpaiguri M	101,088	0	0	29677	29	29677	29
105	Jangipur M	78,191	0	0	35780	46	35780	46
106	Katwa M	67,664	0	0	50000	74	50000	74
107	Raniganj M	121,000	0	0	87000	72	87000	72
	Small States							
108	Kohima TC	103,000	0	0	10000	10	10000	10
109	Shimla M.Corp.	111,000	72,000	65	39000	35	111000	100
110	Itanagar NTAC	33,540	0	0	28200	84	28200	84
111	Panaji MCl	57,190	30,000	52	14050	25	44050	77
	Union Territories							
112	Port Blair MCl	105,000	0	0	n.a.	n.a.	n.a.	n.a.
113	Daman MCl	35,000	0	0	n.a.	n.a.	n.a.	n.a.
114	Kavarathi	11,107	0	0	n.a.	n.a.	n.a.	n.a.
115	Silvassa	20,000	0	0	20000	100	20000	100

Source: NIUA Survey,1999. See Appendix - II, Table B – 12

CHAPTER IV
MUNICIPAL SOLID WASTE MANAGEMENT

4.1 BACKGROUND

Generation of solid waste continues to increase in urban India with rapid urbanization, rising incomes, changing consumption patterns and a shift from recycling to a throw-away society. In urban areas the problem of solid waste management (SWM) is very acute due to dense development and congestion. Solid waste management is an obligatory function of urban local bodies (ULBs) in India. Most ULBs are unable to cope with the challenging task of collection, transportation and disposal of solid wastes not only due to rapid urbanization and rising incomes but also due to the non-availability of required open-spaces near urban centres for landfilling. Waste, therefore, often accumulates in open spaces, wasteland, streets, and even stagnant water bodies causing serious health and environmental problems. Accumulation of uncollected wastes pollutes ground water (through leachates) and surface water (due to runoff during rains).

While SWM generally consumes a significant proportion of municipal budgets, revenues from the service are negligible. The ULBs are also often under-staffed and lack adequate number of vehicles to transport waste. Disposal of waste is becoming an even more serious problem in SWM with land availability within accessible distance becoming scarce mainly due to rapid growth of cities and towns. Management of municipal solid waste is a service, which needs efficiency improvements and also substantial financial support in order to bring about significant change in the service.

This chapter presents the status of solid waste management in the country in respect of coverage, generation, collection, transportation, disposal, staffing, privatization efforts, and revenue receipts and expenditure. The chapter also gives the additional investment requirements to improve the service and its coverage.

4.2 COVERAGE BY SOLID WASTE MANAGEMENT

While the municipal governments are obligated to provide this service to the entire population within their jurisdiction, the overall coverage[11] by the service in the sampled cities is 92 per cent (Table 4.1). This indicates that local governments have not been able to extend this service to about 8 per cent of the population in the aggregate. There is no major difference in coverage of population by the service between metropolitan cities, sampled Class I cities and Class II towns. Coverage here does not, however, indicate the quality of service provided i.e., the collection efficiency or frequency of cleaning (which have been dealt with in the following paragraphs). Since solid waste management falls in the domain of public goods, non-

[11] Coverage only means that the local body provides sweeping and collection services in the area. However, the quality of service, frequency of collection and lifting of waste are not indicated by coverage.

provision of this service or provision of poor quality service can creates health risks to not only the population not covered by the service but also for other citizens.

Table - 4.1: Coverage of Population by Solid Waste Management Service - 1999

(no. of cities/towns)

% Coverage	Metropolitan cities	Class I cities	Class II towns	Total	%
<25	0	0	0	0	0
25 - 50	1	2	1	4	1.3
50 - 75	2	10	9	21	7.1
75 - 99	3	26	19	48	16.1
100	16	124	82	222	74.5
n.a.	0	2	1	3	1.0
Total cities/towns	22	164	112	298	100
Average (%)	90	95	93	92	

Source: NIUA Survey,1999. See Appendix - III, Table C – 1 for details

4.3 SOLID WASTE GENERATION

4.3.1 Quantity Generated Per Day

The total quantity of solid waste generated by almost 140.6 million people (1999) in the 298 responding urban centres amounts to over 60,823 MT per day (Table 4.2). In the country's largest cities such as Delhi and Mumbai the daily waste generation is as high as 6,000 metric tonnes (MT) while in some of the other sampled class II cities solid waste generated is as low as 4 MT (Dohad, Sawai Madhopur, Silvasa & Cumbum) and 5 MT (Chandpur in Uttar Pradesh). In over two-thirds (69%) of the sampled urban centres the average daily solid waste generation is less than 100 MT. Overall, the total solid waste generation does not exceed 500 MT in about 92 per cent of the sampled urban centres (Appendix - III, Table C-2). The variations in the quantity of waste generated in cities depends upon the population size of the city, the floating population, the income levels of the population, the economic activities, the cultural habits of people, and so on.

Table - 4.2: Total and Per Capita Waste Generated –1999

(no. of cities/towns)

Size class of city/ town	No. of sampled cities/ towns	Municipal population 1999 (in million)	Quantity of solid waste generated daily (MT)	Per capita waste generated daily (gms.)
Metropolitan	22	70.30	35157	500
Class I	164	59.94	22587	377
Class II	112	10.36	3079	297
Total	298	140.60	60823	433

Source: NIUA Survey,1999. See Appendix - III, Table C – 2 for details

4.3.2 Quantity of Domestic and Non-Domestic Waste

The quantity of waste generated by different sources would depend on the nature of activities in the urban centers. Not all cities have been able to provide the quantity of waste generated by domestic and non-domestic sources – only about three-fourths (77%) of the urban centers have provided data on this aspect. The survey results show that, on an average, about two-thirds (31475 MT & 63%) of the waste generated is from domestic source while about one-third of the waste generated is from non-domestic sources (18130 MT & 37%) (Table 4.3).

Table - 4.3: Waste Generation by Source - 1999

(no. of cities/towns)

Size class of city/ town	Respond-ing cities / towns	Data not available	Waste generated by Source (MT per day)		Waste by source from cities responding (MT per day)	% waste generated	
			Domestic	Non-Domestic		Domestic	Non Domestic
Metropolitan	17	5	19645	10449	30094	65	35
Class I	128	36	10309	6812	17121	60	40
Class II	83	29	1521	869	2390	64	36
Total	228	70	31475	18130	49605	63	37

Source: NIUA Survey, 1999. See Appendix - III, Table C – 2 for details

4.3.3 Hospital Waste

Collection of hospital waste is increasingly becoming an important issue and this aspect needs urgent attention. Hospital/ medical waste, by law, must be collected separately from municipal wastes and major hospitals should have their own incinerators to incinerate such waste. The remnants from incineration and the parts that cannot/ should not be incinerated should be landfilled in a separate zone at the landfill site

However, hospital waste is collected separately in only 66 cities and towns in a sample of 298. In three-fourths of the sampled urban centres the hospital waste is

Table - 4.4: Collection of Hospital Waste - 1999

(no. of cities/towns)

Collection method	Metropolitan cities	Class I cities	Class II towns	Total	%
Combined	6	133	91	230	77
Separate	16	29	21	66	22
n.a.	0	2	0	2	1
Total cities/towns	22	164	112	298	100

n.a. in case of Class I cities are for Halisahar in W. Bengal & Jorhat in Assam
Source: NIUA Survey, 1999. See Appendix - III, Table C – 2 for details

collected along with municipal solid waste (Table 4.4). This poses great health risks to the workers dealing with waste, and more specifically to the rag pickers.

In a majority of the metropolitan cities, 16 out of the responding 22 cities, hospital waste is collect separately though only in 11 of these cities this waste is incinerated (Table 4.5). Overall, incineration of hospital waste is practiced in only 53 per cent of the sampled urban centres where hospital waste is collected separately (see Table - AX-4.1 at the end of this chapter). However, in the absence of proper landfill sites, the remains from incinerators too are landfilled along with other wastes.

Table - 4.5: Treatment of Hospital Waste

(no. of cities/towns)

Method of treatment	Metropolitan cities	Class I cities	Class II towns	Total	%
Incineration	11	18	6	35	53
None	3	5	11	19	29
n.a.	2	6	4	12	18
Total cities/towns	16	29	21	66	100

Source: NIUA Survey,1999. See Appendix - III, Table C – 2 for details

4.3.4 Per Capita Waste Generation

Per capita waste generation is a very sensitive measure, which is affected by the population and the waste generation figures used. In the present study, the per capita waste generation has been calculated using the estimated population of 1999 and the estimated daily waste generation in the urban centers (both as furnished by the local governments). The daily waste generation figure is an average for the year as the waste generated varies considerably between seasons. The daily waste generated is also grossly overstated by many urban centers, as these are estimates provided by the local governments. In the absence of weighbridges, it is not possible for the local governments to estimate the waste generated accurately. These estimated figures of waste generated as well as population projected have affected the per capita waste generation figures in various urban centers.

The daily per capita waste generation in the sampled cities averages 433 grams. In metropolitan cities the average daily per capita waste generated is the highest among the sampled cities, averaging 500 grams, while in the sampled Class I cities it is 377 grams and it is 297 grams in the sampled Class II towns (Table 4.6). While 12 per cent of the of the sampled urban centres have a per capita waste generation of less than 150 grams daily, almost 18 per cent urban centres have a per capita waste generation of over 500 grams daily. Higher per capita waste generation poses a greater burden on local governments to make arrangements for collection, transportation, and disposal of this waste.

Table - 4.6: Per Capita Waste Generation - 1999					
					(no. of cities/towns)
Per capita waste generation (gms./per day)	Metropolitan cities	Class I cities	Class II towns	Total	%
<150	0	14	22	36	12
150 - 250	0	32	28	60	20
250 - 350	2	37	22	61	20
350 - 500	7	40	26	73	25
>500	13	41	14	68	23
Total cities/towns	22	164	112	298	100
Average (gms)	500	377	297	433	
Source: NIUA Survey,1999. See Appendix - III, Table C - 1 & 2 for details					

4.4 SOLID WASTE COLLECTION

4.4.1 Waste Collection Efficiency

The task of collecting the huge quantities of waste generated in urban areas is a daunting task for local governments. It means organising the staff for collection, arranging transportation and finding ways of disposing the waste collected. On an average, only 88 per cent of the solid waste generated is collected daily. In actual terms, of the 60823 MT of solid waste generated per day in the sampled urban centres, only 53505 MT is collected, leaving 7318 MT uncollected daily.

In the 22 metropolitan cities, despite a collection efficiency of 91 per cent, an estimated 3170 MT of waste is left uncollected daily (Table 4.7). Such huge quantities of uncollected waste can be a potential source of major diseases, in addition to being very unpleasant visually.

Table - 4.7: Quantity of Solid Waste Generated and Collected –1999					
Size class of city/town	Sample cities/ towns	Quantity of waste generated daily (MT)	Quantitity of waste collected daily (MT)	Quantity left un-collected daily (MT)	% solid waste collected daily
Metropolitan	22	35157	31987	3170	91
Class I	164	22587	19204	3383	85
Class II	112	3079	2314	765	75
Total	298	60823	53505	7318	88
Source: NIUA Survey,1999. See Appendix - III, Table C –2 for details					

The present survey indicates that 100 per cent collection of waste has been achieved in only about one-third (32%) of the sampled cities. In 5 per cent of the sampled cities less than 50 per cent of waste generated is collected. The waste collection efficiency is better in metropolitan cities, where 91 per cent of the daily waste generated is collected, than in the Class I cities and Class II towns where 85 per cent and 75 per cent respectively of the daily waste generated is collected (Table 4.8).

Table - 4.8: Waste collection efficiency -1999					
					(no. of cities/towns)
% waste collected to generated	Metropolitan cities	Class I cities	Class II towns	Total	%
<50	0	4	9	13	5
50-75	2	28	27	57	19
75-99	13	78	41	132	44
100	7	54	35	96	32
Total cities/towns	22	164	112	298	100
Average	91	85	75	88	
Source: NIUA Survey,1999. See Appendix - III, Table C – 2 for details					

4.4.2 Collection Frequency

In most cities waste is collected once or twice daily i.e., street sweeping and collection. In 57 per cent of the sampled urban centres waste is collected once a day while in about 37 per cent of the sampled urban centres the collection is twice a day. A small percentage of cities have reported lesser frequency of waste collection such as on alternate days, twice weekly and weekly (Table 4.9).

Table - 4.9: Collection frequency - 1999					
					(no. of cities/towns)
Collection frequency	Metropolitan cities	Class I cities	Class II towns	Total	%
Once daily	17	90	64	171	57
Twice daily	4	64	42	110	37
Others	0	7	5	12	4
n.a.	1	3	1	5	2
Total cities/towns	22	164	112	298	100
Note: Other includes alternate days, twice weekly, and weekly *Source: NIUA Survey,1999. See Appendix - III, Table C – 2 for details*					

4.5 SOLID WASTE DISPOSAL

4.5.1 Transportation of Waste

The quantity of waste transported is a function of the number of vehicles of each type, their capacity, and the number of trips they make. For example if a city has 3 trucks with a capacity of 3 tons making two trips a day, the total waste transported would be given as 18 tons. However, the actual waste transported could be 15 tons or any such figure. On the other hand, if the waste is construction waste, then the weight would increase considerably. Also the number of trips is an average for the year. The capacity of the vehicles must also be read with caution. The capacity of each vehicle given by the local government is the designed capacity of the vehicle.

However, the waste that is loaded in each vehicle would vary considerably depending on how the loading is done and whether any compacting takes place after loading. Often the trucks are loaded by head load and there is a lot of air with the material and so the actual load is much less than the designed capacity. Also the domestic waste is more voluminous and so would fill up space much faster than construction waste, so the actual weight transported is just an estimate. In the absence of weighbridges the local governments just give an approximate figure for waste generation and collection. A case in point is Ahmedabad, where after the installation of a weighbridge the actual waste collection and transportation figures fell significantly. This is also the reason why in some cities the figures for waste generation and collection are very high or very low. The transportation vehicles are also often old and may not be able to carry the designed load. Therefore, all the figures of waste generation, collection and transportation must be taken as the best estimates provided by the local governments.

Primary waste collection is generally done by using wheelbarrows and tricycles. The waste collected through street sweepings is heaped at various points and then transferred into dustbins. The waste from the dustbins and intermediate collection centres is transported to the disposal point by waste transportation vehicles. Transportation of waste is generally done by vehicles owned by the local governments or hired from private bodies. These vehicles include trucks, tractor-trolleys, power tillers, dumper placers, compactors etc.

The present survey indicates that in most urban centres only motorised vehicles are used for waste transportation (Table 4.10). However, in some urban centres, particularly those that dump waste anywhere, non-motorised vehicles are also used for waste transportation. These mainly include tri-cycle carts and animal drawn carts. Almost 20 Class I cities and 16 Class II towns in the sample have reported use of non-motorised mode of transport, along with motorized mode, for transporting waste.

Table - 4.10: Transportation of Waste by Motorized Vehicles - 1999

(no. of cities/towns)

No. of vehicles	Metropolitan cities	Class I cities	Class II towns	Total	%
1-3	0	4	42	46	15
4-5	0	29	44	73	25
6-10	0	50	21	71	24
11-20	0	36	2	38	13
21-50	4	39	0	43	14
>50	17	5	0	22	7
Privatised	0	1	1	2	1
n.a.	1	0	2	3	1
Total cities/towns	22	164	112	298	100

Source: NIUA Survey,1999. See Appendix - III, Table C – 3 for details

Transportation vehicles need to be repaired and maintained in good order to be able to transport waste efficiently. However, the present survey indicates that, on an average, about 15 per cent of vehicles are out of order at any given point of time. The percentage of vehicles that are usually out of order in metropolitan cities is 10 per cent while it is 15 per cent for the sampled Class I cities and Class II towns.

Workshop for maintenance of vehicles is available with only about 30 per cent of the urban local governments in the sample (Table 4.11). In the urban centres without a workshop, maintenance of vehicles is done in private workshops.

Table – 4.11: Vehicle Maintenance Workshop - 1999

(no. of cities/towns)

Vehicle Maintenance Workshop	Metropolitan cities	Class I cities	Class II towns	Total	%
Yes	18	51	19	88	30
No	3	112	92	207	69
n.a.	1	1	1	3	1
Total cities/towns	22	164	112	298	100

Source: NIUA Survey,1999. See Appendix - III, Table C – 3 for details

4.5.2 Method of Waste Disposal

The present survey indicates that by far the most universally used method of waste disposal in the urban areas of the country is crude/ open dumping. In almost three-fourths of the sampled cities the main method of solid waste disposal is crude/ open dumping. In about 12 per cent of the sampled urban centres composting has been reported to be the main method of waste treatment/ disposal while in about 11 per cent of the cities landfill is the main method of waste disposal (Table 4.12). The situation with respect to crude/ open dumping varies across the country. There are cities where waste is dumped anywhere, there are other cities where waste is

Table - 4.12: Main Method of Waste Disposal - 1999

(no. of cities/towns)

	Crude/open dumping		Landfill		Composting		Others		Total No.
	No.	%	No.	%	No.	%	No.	%	
Metropolitan Cities	14	64	8	36	0	0	0	0	22
Class I Cities	125	76	16	10	23	14	0	0	164
Class II Towns	88	78.6	10	8.9	13	11.6	1	0.9	112
Total	227	76.2	34	11.4	36	12.1	1	0.3	298

Note : Disposal method is assumed to be main method if waste disposal is equal or greater than 50%
2 cities namely Dewas (Class I) & Kapurthala (Class II) had both Open dumping & Landfill as main method (50% of waste disposed by each method)
2 Class I cities namely Chitoor & Khandwa had 50% of waste disposed by Composting & remaining 50% by combination of Open Dumping & Landfill method)
Source: NIUA Survey,1999. See Appendix - III, Table C – 2 for details

dumped in low-lying areas, and then there are cities where the waste is dumped but at specified sites. Often crudely dumped waste and waste collected in small heaps along street sides are burnt leading to air pollution. Despite having landfill sites, some cities do not make use of them as the sites are far away from the city and transportation costs are high, therefore crude/open dumping is resorted to in such cases (e.g. Jodhpur).

In many urban centres any open site where waste is dumped is called landfill site. The present survey indicates that in 227 sampled cities and towns waste is dumped at specific open sites which are not developed landfill sites - these include 14 metropolitan cities, 125 Class I cities and 88 Class II towns. Overall, while 34 sampled urban centres have indicated having a landfill site at present (8 metropolitan cities, 16 Class I cities and 10 Class II towns), 38 other urban centres have plans for developing landfill sites in the future (4 metropolitan cities, 24 Class I cities and 10 Class II towns). Developing sanitary landfill sites is, thus, a necessity to dispose off waste scientifically and in an environmentally sound manner.

4.6 STAFF POSITION

Solid waste management is a labour intensive service and one of the problems that Urban Local Bodies face in providing this service is shortage of staff. The Report of the Committee on Urban Wastes (1975) had recommended a norm of 2.8 sanitary workers per 1000 population. The present survey indicates that this norm is not met in almost four-fifth (80%) of the sampled urban centres. This could also be partly due to privatisation of the collection and transportation functions in many cities. The average number of sanitary workers per 1000 population in the sampled urban centres is 2.4 i.e., 0.4 short of the norm mentioned above. In the metropolitan cities there are an average of 2.8 sanitary workers per 1000 population whereas this average is 1.9 in Class I cities and 2.1 in Class II towns (Table-4.13). Inadequate number of sanitary workers for the area and population covered affects the collection efficiency and therefore, the quality of service. In order to improve the solid waste management collection efficiency, private contractors and NGOs could be involved, as has been done in many cities.

Table – 4.13: Sanitary Workers Per 1000 Population - 1999

(no. of cities/towns)

Sanitary workers per 1000 population	Metropolitan cities	Class I cities	Class II towns	Total	%
<2	8	89	61	158	53
2 to <3	11	45	33	89	30
3 to <4	2	19	11	32	11
4 – 8	1	5	3	9	3
n.a.	0	6	4	10	3
Total cities/towns	22	164	112	298	100
Average	2.8	1.9	2.1	2.4	

Source: NIUA Survey,1999. See Appendix - III, Table C – 8 for details

4.7 PRIVATISATION

Solid waste management is a service in which private sector involvement is being encouraged by the government. Many cities have already privatised sweeping and collection activities. Transportation of waste is another area where privatisation has taken place. Even at the disposal stage, private sector is being involved in setting up composting plants and waste-to-energy plants (Table-4.14). Privatisation has helped local governments to reduce expenditure and improve the coverage of population by the service.

Table – 4.14: Privatisation of Solid Waste Management Activities – 1999

(no. of cities/towns)

Activity privatized	Metropolitan cities	Class I cities	Class II towns	Total	%
Primary collection	6	16	8	30	46
Transportation	4	5	2	11	17
Disposal	0	2	0	2	3
Composting	1	4	0	5	8
Others*	1	11	5	17	26
Total cities/towns	12	38	15	65	100

** Combinations of activities*
Source: NIUA Survey,1999. See Appendix - III, Table C –9 for details

The present survey indicates that private sector involvement in solid waste management has been found in 65 of the 298 sampled urban centres (i.e., 22%). Almost 46 per cent of these urban centres are using private sector for primary collection activity i.e., sweeping and collection while in 17 per cent of these urban centres the private sector has been involved for transportation of waste. In the remaining 37 per cent of the sampled urban centres private sector has been involved in disposal, composting and drain cleaning etc. (see Table – AX - 4.2 at the end of this chapter).

Private sector involvement is the maximum in the metropolitan cities where 12 of the 22 responding cities are using private sector for mainly primary collection and transportation activities. The use of private sector in SWM is still not very common in the Class I and Class II urban centres as the present survey shows that privatization has taken place in only 38 Class I cities and 15 Class II towns.

Most local governments that have privatized activities under SWM have not furnished information on cost savings due to the involvement of private sector. While a few local governments have given only the cost before privatization, some others have only given the cost of the activity after privatization. Very few local governments have provided information on cost of the activity before and after privatization. In some of these urban centres cost savings between 22 and 51 per cent have been achieved due to privatization.

4.8 REVENUE RECEIPTS AND EXPENDITURE

4.8.1 Revenue Receipts

Solid waste management is a service that is low on revenue generation. The service either generates no revenue or the revenue generated is not very significant. No direct revenue accrues from this service except in a few urban centers. Revenue from the service mainly comes in the form of tax, which is a certain percentage of the property tax. However, only 42 urban centres in the sample have reported revenue from sanitation tax, sanitation cess or conservancy tax. A small number of cities have reported revenue receipts from sale of compost. Nearly 71% of the sampled cities have not reported any revenue receipts from the service (see Appndix III, Table C-10). The expenditure incurred on the service has to, therefore, be met from the general revenues of the local government.

4.8.2 Revenue Expenditure

Analysis of expenditure on solid waste management is made difficult by the method of keeping accounts by various local governments. While expenditure on salary and wages is relatively easy to obtain, expenses on heads such as consumables and vehicle repairs are often clubbed together with other expenses.

Management of municipal solid waste generally consumes a large share of the total municipal expenditure. The share of this service as a percentage of the total municipal budget is known to be as high as 50 per cent. The present survey indicates that the expenditure on solid waste management forms an average of 18 per cent of the total municipal budget of the responding urban centres.

The share of expenditure on establishment is very high on this service as municipal solid waste management is a labour intensive service. On an average, the expenditure on establishment forms over four-fifths of the total expenditure on the service. More than two-thirds (73%) of the responding urban centres spend over 75 per cent of their solid waste management expenditure on establishment (Table 4.15).

Table – 4.15: Per Cent Share of Establishment Expenditure - 1997-98

(no. of cities/towns)

% Expenditure on establishment	Metropolitan cities	Class I cities	Class II towns	Total	%
<25	1	3	0	4	1
25 - 50	0	5	4	9	3
50 - 75	4	18	11	33	11
>75	15	121	80	216	73
bu .n.a.	1	3	3	7	2
n.a.	1	14	14	29	10
Total cities/towns	22	164	112	298	100
Average (%)	81	84	81	82	

bu n.a. breakup not available
Source: NIUA Survey,1999. See Appendix - III, Table C –11 for details

4.8.3 Per Capita Revenue Receipts

Solid waste management is a service from which user charges are not recovered by the local government. The cost recovery, to whatever extent, is based on tax/ cess. Therefore, it should come as no shock that, on an average, only Rs. 10.1 per capita per annum is recovered from the service (Table 4.16). In almost one-third of the responding urban centres the recovery is less than Rs. 0.25 per capita per annum.

Table - 4.16: Per Capita Revenue Receipts from SWM (1997-98)

(no. of cities/towns)

Per capita revenue receipts (Rs./annum)	Metropolitan cities	Class I cities	Class II towns	Total	%
<0.25	2	20	7	29	9.8
0.25 to <1	2	10	4	16	5.4
1 to <5	0	8	6	14	4.7
5 to <7.5	1	3	3	7	2.4
7.5 to <10	0	6	0	6	2.0
10 and above	3	9	2	14	4.7
Total responding cities / towns	8	56	22	86	28.9
n.a.	14	108	90	212	71.1
Total cities/towns	22	164	112	298	100.0
Average (Rs. per annum)	12.8	6.6	2.8	10.1	

Source: NIUA Survey,1999. See Appendix - III, Table C –10 for details

4.8.4 Per Capita Expenditure

In the sampled cities, the average per capita expenditure on the service is Rs. 121 per annum. The average per capita expenditure in metropolitan cities on the service is Rs. 156 per annum while it is Rs. 87 and Rs. 86 in sampled Class I cities and Class II towns respectively (Table 4.17). Since there are no norms available for per capita expenditure on municipal solid waste management, it is difficult to know whether the

Table – 4.17: Per Capita Expenditure on Municipal Solid Waste Management 1997-98

(no. of cities/towns)

Per capita expenditure (Rs/annum)	Metropolitan cities	Class I cities	Class II towns	Total	%
<50	5	37	28	70	23
50 to 100	4	80	43	127	43
100 to 200	10	27	21	58	19
200 to 300	1	3	4	8	3
> 300	1	2	2	5	2
n.a.	1	15	14	30	10
Total cities/towns	22	164	112	299	100
Average (Rs. per annum)	156.06	87.27	85.99	121.21	

Source: NIUA Survey, 1999See Appendix - III, Table C – 11 for details

per capita amount spent by the municipal bodies is sufficient to maintain and improve the service.

4.8.5 Cost Recovery

Solid waste management service, in India, does not generate significant revenues in most urban centers while the expenditure levels are usually very high. The cost recovery in this service is, therefore, very low and averages a low 7 per cent for the sample. The average revenue from solid waste management service is a low Rs. 10.12 per capita per annum while the expenditure on the service averages Rs. 140.63 per capita per annum. Therefore, a deficit of Rs. 130.51 per capita per annum has to be covered by the general revenues of the local governments (Table 4.18).

Table – 4.18: Per Capita Cost Recovery from Solid Waste Management Service (1997-98)

	Metropolitan cities	Class I cities	Class II towns	Total
Per capita revenue receipts (Rs. / annum)	12.80	6.66	2.96	10.12
Per capita expenditure (Rs. / annum)	189.39	73.12	63.15	140.63
Deficit (Rs./ annum)	176.59	66.46	60.19	130.51
Cost recovery (%)	7	9	5	7

Note : Per capita receipts and per capita expenditure are for cities giving information both for receipts and expenditure.
Source: NIUA Survey,1999. See Appendix - III, Table C – 10 & 11 for details

The cost recovery from solid waste management service needs to be improved in order to provide better quality service to the people. Introduction of user charges for door-to-door collection can improve cost recovery from the service. Involving private sector, NGOs and community-based organizations can reduce the expenditure on the service and help improve the finances of the local government.

4.9 ADDITIONAL INVESTMENT REQUIREMENT

The coverage of population by the SWM service in the present survey is 95 per cent in the sampled urban centres. Covering 100 per cent of the population by the service would require extending the service to the presently uncovered population and covering the population that would be added in the coming years. The present study gives the additional capital investment requirements for covering 100 per cent of the population by the SWM service for the years 2002, 2007, 2012, 2017, and 2022 by the different size class of cities.

4.9.1 Projection Methodology

For projecting the additional capital investment requirements the following were required:

a) the total urban population projected till the year 2022 at five year intervals starting 2002 A.D. – for which the Registrar General of India's population projection has been used;

b) the division of projected urban population by size class of cities for different years (Table 4.19);

c) the present coverage of population by the service by size class of urban centres;

Table - 4.19: Year and Class Wise Projection of Urban Population*

Year	Metro	I	II	III	IV	V	VI	Total
1991 (% population)	23.00	33.67	13.33	16.35	9.77	3.43	0.45	100.00
1999	64099850	93836607	37150044	45566633	27228502	9559239	1254128	278695000
2002	69340170	101507979	40187151	49291817	29454498	10340730	1356656	301479000
2007	79113330	115815036	45851334	56239259	33605967	11798205	1547870	343971000
2012	89579940	131137243	51917417	63679653	38052001	13359095	1752651	389478000
2017	101110092	148016382	58599892	71876087	42949808	15078592	1978241	439609094
2022	114164910	167127501	66166011	81156360	48495268	17025463	2233661	496369174

Note: 1991 The proportion of population in each size class is for the individual cities and towns and not for urban agglomerations and the proportions are assumed to be constant for the projected period i.e., upto 2022.
Source for proportion of population in each size class - Census of India 1991, Series 1 - India, General Population Tables Part II-A (ii) Towns and Urban Agglomerations 1991 with their Population 1901 - 1991, Statement-3, p.32
*Source for size class-wise population distribution - Projections based on Census of India's 'Population Projections for India and States 1996-2016', Registrar General, India, New Delhi, 1996. * Population as on 1st July of the given year*

4.9.2 Assumptions Made for Calculating Investment Requirements

The Census of India's publication (1996) titled 'Population projection for India and the states 1996-2016' projects the population till the year 2016. Thereafter, for projecting the population till the year 2022, the annual growth rate of urban population during 2015-2016 (2.46% per annum) has been used as a constant.

The percentage of population living in different size class of towns has been kept constant at 1991 level for projections till the year 2022. Such an assumption was necessitated due to the absence of any projection of population by size class of towns available from the Registrar General's office.

To calculate the backlog of population not covered by SWM service in 1999, the results of the present survey on coverage have been used for metropolitan cities, Class I cities and Class II towns. However, since the study does not cover the other size classes of towns (barring the capital towns) the coverage figures for Class II towns have been used as proxy for classes III to VI.

The additional population to be covered in different years by size class has been arrived at by subtracting the latter year's population by the previous one. The backlog population to be covered in 1999 has been calculated by the population not covered till 1999, which has been taken from the present survey (Table 4.20 and 4.21).

Table – 4.20: Additional Population to be Covered in Different Years by Size Class								
Year	Metro	I	II	III	IV	V	VI	Total
1999*	61535856	89144776	34549540	42376968	25322506	8890092	1166339	262986078
1999-2002	5240320	7671373	3037107	3725184	2225997	781491	102528	22784000
2002-2007	9773160	14307056	5664184	6947442	4151468	1457476	191214	42492000
2007-2012	10466610	15322207	6066083	7440395	4446034	1560890	204782	45507000
2012-2017	11530152	16879139	6682475	8196434	4897808	1719497	225590	50131094
2017-2022	13054818	19111119	7566119	9280273	5545460	1946871	255420	56760080
Total	111600916	162435670	63565508	77966696	46589273	16356316	2145872	
** Backlog*								

Table – 4.21: Population Not Covered by Solid Waste Management – 1999		
Class	Uncovered population (%)	Per capita waste generation (gms)
Metro	4	499
I	5	379
II	7	296
III	7	296
IV	7	296
V	7	296
VI	7	296
Source: NIUA Survey, 1999		

4.9.3 Projected Additional Investment Requirements

The calculation of additional investment requirements has been done by using the per capita costs given by the Planning Commission (Task Forces on Housing and Urban Development, 1983) (Table 4.22). The per capita cost estimates available are for primary collection, transportation and disposal. For calculating the additional investment requirements the total cost of the service covering all the three stages has been taken. For metropolitan cities the costs given for 'Calcutta Corporation'

Table – 4.22: Task Forces Per Capita Investment Costs for Solid Waste Management		
		(Rs. at 1998-99 prices)
	Smaller urban locations	Calcutta Corporation
Primary collection	34.3	49
Transportation :		
Trucks/containers	49	107.8
Workshops	36.75	73.5
Disposal	24.5	24.5
Total 144.55	254.8	
Source: Task Forces on Housing and Urban Development, Vol. II – Financing of Urban Development, Planning Commission, Government of India, New Delhi, December 1983, p. 38 (inflated to 1998-99 prices)		

have been used while for other classes of cities and towns the costs given for 'smaller urban locations' has been used. The backlog population and the additional population to be covered by the service has then been multiplied by this cost figure to arrive at the additional investment requirements for covering 100 per cent population by the service.

Municipal solid waste service at present covers 95 per cent of the population, on an average, in the sampled urban centres. The backlog population to be covered by the service was about 263 million in 1999. In order to extend this service to the presently uncovered population, and to the additional population to be added till the end of 2022, an amount of Rs. 3953.79 crores at 1998-99 prices (based on Task Forces per capita cost estimates) will need to be invested during 1999-2022 period. In annual terms an investment of Rs. 171.90 crores will be needed to cover the uncovered and additional population by the service between 1999 and 2022 (Table 4.23).

Regardless of the method of estimation, financing an investment of this magnitude will require resource mobilization from non-governmental sources. Encouraging private sector participation in waste recovery programmes, mobilizing community based organizations and NGOs to take up primary waste collection activities and finding new revenue sources (such as fines) in this sector will help to reduce the financial burden on the government and improve the delivery of this service.

Table – 4.23: Additional Investment using Task Forces Per Capita Cost Estimates

(Rs. in crores at 1998-99 prices)

Year	Metro	I	II	III	IV	V	VI	Total
Backlog 1999	65.33	67.82	37.59	46.11	27.55	9.67	1.27	255.34
1999-2002	133.52	110.89	43.90	53.85	32.18	11.30	1.48	387.12
2002-2007	249.02	206.81	81.88	100.43	60.01	21.07	2.76	721.97
2007-2012	266.69	221.48	87.69	107.55	64.27	22.56	2.96	773.20
2012-2017	293.79	243.99	96.60	118.48	70.80	24.86	3.26	851.76
2017-2022	332.64	276.25	109.37	134.15	80.16	28.14	3.69	964.40
Total	1340.99	1127.24	457.02	560.56	334.96	117.60	15.43	3953.79

ANNEX TABLES

Table -AX- 4.1: Treatment of Hospital Waste* - 1999	
City/ town	Treatment
Metropolitan cities	
Ahmedabad M.Corp.	Incineration
Bangalore M.Corp.	Incineration
Bhopal M.Corp.	n.a.
Calcutta M.Corp.	n.a.
Chennai M.Corp.	None
Coimbatore M.Corp.	Incineration
Delhi M.Corp.	Incineration
Greater Mumbai M.Corp.	Incineration
Hyderabad M.Corp.	Incineration
Indore M.Corp.	Incineration
Jaipur M.Corp.	Incineration
Madurai M.Corp.	Incineration
Nagpur M.Corp.	Incineration
Surat M.Corp.	None
Vadodara M.Corp.	Incineration
Visakhapatnam M.Corp.	None
Class I cities	
Agartala MCl	n.a.
Alappuzha MC	Incineration
Balurghat M	None
Bhilwara M	n.a.
Chhapra M	Incineration
Cuddalore M	Incineration
Dewas M.Corp.	Incineration
Dindigul M	Incineration
Gulbarga M.Corp.	n.a.
Guwahati M.Corp.	Incineration
Imphal MCl	None
Jodhpur M.Corp.	Incineration
Kanchipuram M	None
Kollam MC	Incineration
Kozhikode M.Corp.	Incineration
Kumbakonam M	Incineration
Mathura MB	Incineration

City/ town	Treatment
Nagercoil M	Incineration
Nandyal MCl	n.a.
Ongole MCl	n.a.
Pondicherry M	Incineration
Rajkot M.Corp.	None
Ratlam M.Corp.	n.a.
Salem M.Corp.	Incineration
Srinagar M.Corp.	Incineration
Thanjavur M	Incineration
Thiruvananthapuram M.Corp.	Incineration
Tiruchirapalli M.Corp.	None
Vijaywada M.Corp.	Incineration
Class II towns	
Ambur M	n.a.
Ankleswar M	None
Ballarpur MCl	Incineration
Contai M	None
Cooch Behar M	None
Dharmapuri M	Incineration
Ghazipur MB	n.a.
Gokak CMC	None
Jalpaiguri M	None
Katwa M	None
Lalitpur MB	n.a.
Mahesana M	None
Nagapattinam M	Incineration
Panaji MCl	Incineration
Port Blair MCl	Incineration
Pudukkottai M	None
Rajendra Nagar MCl	None
Raniganj M	None
Sawai Madhopur M	n.a.
Thrissur MC	Incineration
Tindivanam M	None

** In urban centres collecting hospital waste separately.*
Source: NIUA Survey, 1999 See Appendix - III, Table C – 5 for details

Table – AX- 4.2: Details of Privatisation in Solid Waste Management – 1999

Sl. No.	City/Town	Details of privatisation						
		Aspect privatised	Specific Area covered	Mode used	Year of privatisation	No. of contractors	Cost (Rs.'000) before privatisation	Cost (Rs.'000) after privatisation
Metropolitan Cities								
1	Bangalore M.Corp.	Sweeping	n.a.	Contract	1989	120	n.a.	n.a.
2	Calcutta M.Corp.	Transportation	-	n.a.	n.a.	n.a.	n.a.	n.a.
3	Chennai M.Corp.	Collection	3 Zones	BOO	Starting 2000	1	n.a.	n.a.
4	Delhi M.Corp.	Composting	n.a.	Contract	1999	1	n.a.	n.a.
5	Greater Mumbai M.Corp.	Transportation	n.a.	Contract	n.a.	n.a.	n.a.	n.a.
6	Hyderabad M.Corp.	Sweeping	n.a.	n.a.	1998	122	n.a.	n.a.
7	Jaipur M.Corp.	Transportation	n.a.	n.a.	1990	18	n.a.	n.a.
8	Ludhiana M.Corp.	Sweeping & collection	n.a.	CBO	n.a.	114	2827	n.a.
9	Madurai M.Corp.	Transportation	Commercial	Contract	1998	2	n.a.	n.a.
10	Nagpur M.Corp.	Collection	n.a.	Contract	1997	2	n.a.	n.a.
11	Surat M.Corp.	Collection & transportation	n.a.	n.a.	n.a.	2	n.a.	n.a.
12	Visakhapatnam M.Corp.	Sweeping & collection	n.a.	n.a.	1994	5	n.a.	n.a.
Class I Cities								
	Andhra Pradesh							
1	Anantapur MCl	Sweeping	n.a.	Contract	1997	1	11500	14500
2	Chittoor M	Sweeping & collection	n.a.	Contract	1999	1	n.a.	n.a.
3	Eluru M	Collection & disposal	n.a.	Contract	1998	2	n.a.	1800
4	Guntur MCl	Collection & disposal	n.a.	Contract	1996	3	n.a.	3864
5	Hindupur M	Sweeping & collection	n.a.	Contract	1996	1	n.a.	100
6	Nandyal MCl	Sweeping	n.a.	NGO	1998	1	n.a.	n.a.
7	Nellore MCl	Sweeping	n.a.	Contract	1998	5	23843	27812
8	Qutubullapur M	Sweeping	n.a.	Contract	1997	5	2000	4200
9	Tenali M	Collection & disposal	n.a.	Contract	1998	1	n.a.	144
10	Tirupati MCl	Sweeping & collection	n.a.	Contract	1997	4	n.a.	n.a.
11	Vijaywada M.Corp.	Disposal & treatment	n.a.	n.a.	n.a.	3	n.a.	n.a.
	Bihar							
12	Gaya M.Corp.	Drain cleaning	n.a.	Contract	1999	4	n.a.	740

Sl. No.	City/Town	Details of privatisation						
		Aspect privatised	Specific Area covered	Mode used	Year of privatisa-tion	No. of contrac-tors	Cost (Rs.'000) before priva-tisation	Cost (Rs.'000) after priva-tisation
	Gujarat							
13	Bhuj M	Collection & transportation		-	-	-	-	- -
14	Jamnagar	Primary collection	n.a.	Contract	1987	6	8000	2200
15	Rajkot M.Corp.	Collection & transportation	n.a.	Contract	1990	9	n.a.	7000
	Jammu & Kashmir							
16	Srinagar M.Corp.	Collection	New colonies	Contract	1999	3	n.a.	n.a.
	Karnataka							
17	Belgaum M.Corp.	Transportation	n.a.	Contract	1994	2	n.a.	n.a.
18	Bellary CMC	Sweeping & transportation	n.a.	Contract	1998	2	n.a.	n.a.
19	Davangere MCl	Composting	n.a.	Auction	1996	55	n.a.	n.a.
20	Hubli-Dharwad M.Corp.	Vermi-composting	n.a.	Contract	1998	1	n.a.	n.a.
21	Mysore M.Corp.	Sweeping & transportation	n.a.	Contract	1998	7	n.a.	n.a.
22	Shimoga CMC	Disposal	n.a.	Contract	1994	6	n.a.	n.a.
	Kerala							
23	Alappuzha MC	Disposal	n.a.	Contract	1999	1	n.a.	n.a.
	Madhya Pradesh							
24	Jabalpur M.Corp.	Sweeping	n.a.	Contract	1998	1	1164	770
	Maharashtra							
25	Amravati M.Corp.	Sweeping	n.a.	Contract	1985	2	n.a.	700
26	Aurangabad M.Corp.	Composting	Entire city	Contract	1997	1	n.a.	30000
27	Nanded Waghala M.Corp.	Sweeping	Entire city	Contract	1997	1	n.a.	1000
28	Nashik M.Corp.	Transportation	n.a.	Contract	1997	77	n.a.	26500
29	Parbhani MCl	Transportation	n.a.	Contract	1999	2	n.a.	1205
	Orissa							
30	Bhubaneswar M.Corp.	Collection	n.a.	Contract	n.a.	n.a.	n.a.	n.a.
	Rajasthan							
31	Ajmer MCl	Transportation	Entire city	n.a.	1998	2	n.a.	n.a.
32	Sriganganagar M	Sweeping	Entire city	Contract	1994	3	700	350
	Tamil Nadu							
33	Tiruppur M	Secondary collection	Major roads	Contract	1997	1	n.a.	n.a.
	West Bengal							
34	Asansol M.Corp.	Primary collection & transportation	n.a.	Contract	n.a.	7	n.a.	n.a.

Sl. No.	City/Town	Details of privatisation						
		Aspect privatised	Specific Area covered	Mode used	Year of privatisa-tion	No. of contrac-tors	Cost (Rs.'000) before priva-tisation	Cost (Rs.'000) after priva-tisation
	Assam							
35	Guwahati M.Corp.	Transportation	Entire city	Contract	1988	13	n.a.	n.a.
	Tripura							
38	Agartala MCl	Composting	n.a.	n.a.	1999	n.a.	n.a.	n.a.
	Union Territories							
39	Chandigarh M.Corp.	Sweeping & collection	n.a.	Contract	1996	3	n.a.	2720
40	Pondicherry M	Sweeping & collection	n.a.	Contract	1997	1	n.a.	n.a.
	Class II Towns							
	Andhra Pradesh							
1	Kapra M	Sweeping	n.a.	n.a.	1999	3	4640	2908
2	Madanapalle M	Sweeping & collection	n.a.	Contract	n.a.	2	n.a.	97
3	Narasaraopet M	Collection & disposal	n.a.	Contract	1998	1	n.a.	1248
4	Rajendra Nagar MCl	Sweeping & disposal	n.a.	NGO	1997	1	20	85
5	Srikalahasti M	Sweeping & disposal	n.a.	Contract	1998	n.a.	n.a.	-
6	Suryapet MCl	Sweeping & disposal	n.a.	Contract	1997	2	n.a.	n.a.
	Karnataka							
7	Bagalkot CMC	Sweeping	n.a.	Contract	1999	2	n.a.	n.a.
8	Chikmagalur CMC	Collection & transportation	Entire town	Contract	1997	1	n.a.	n.a.
9	Gokak CMC	Sweeping & transportation	n.a.	n.a.	1999	1	n.a.	n.a.
10	Rabkavi-Banhatti CMC	Transportation	n.a.	Auction	n.a.	n.a.	n.a.	n.a.
	Maharashtra							
11	Bhandara M	Nala cleaning	n.a.	n.a.	1999	1	n.a.	n.a.
12	Kamptee MCl	Sweeping & collection	Commercial	Contract	1999	1	25	18
13	Manmad MCl	Transportation	n.a.	Contract	1999	1	300	147
14	Virar MCl	Sweeping & collection	Entire town	Contract	1999	1	4500	3500
	Goa							
15	Panaji MCl	Collection, transportation & disposal	Restaurants	Contract	1995	2	n.a.	n.a.

Source: NIUA Survey,1999. See Appendix - III, Table C – 9 for details

CHAPTER V
CONCLUSIONS, SUMMARY OF RESULTS AND RECOMMENDATIONS

Water supply, sanitation and solid waste management constitute basic essential services for which the main responsibility lies with the public authorities. Provision of potable water and safe sanitation to all is the ultimate goal of the government. However, achieving this goal and providing services at the desired level have been the main challenge for public authorities concerned with these services. Solid waste management is another essential service, the responsibility for which lies with the local governments. All these basic services have a major impact on the health of the citizens and therefore need to be accorded high priority in planning and implementation. However, in order to understand the magnitude of the problem, an overview of the status of these basic services is necessary.

The present report brings out the status of these three essential services (as in 1999) by looking at the coverage, the service levels, and the investment requirements to achieve 100 per cent coverage at the desired level. The broad conclusions drawn from the study are presented in subsequent paragraphs.

5.1 WATER SUPPLY

5.1.1 Conclusions

Water is essential for survival and is required in adequate quantity to remain healthy. Increasing urbanization, growing water demands, pollution of nearby water sources and depletion of sources due to over exploitation have all contributed to the current crisis of potable water. It is thus time to take stock of the situation and initiate remedial measures to avoid the impending crisis.

Institutional arrangements for providing water supply are complex with multiple agencies being involved in various stages of provision. The general pattern is that the responsibility for carrying out capital works, in most cities, rests with a state level agency and the operation and maintenance function is with the local government. There are many variations to this pattern by states and cities. Multiplicity of agencies has implications for the functioning of the service, as it does not allow the urban local governments to take all decisions regarding the service. This is essential to give autonomy of operations to the urban local governments.

The norms for water need to be made more realistic by basing them on the actual needs. Water requirements change with income levels, economic activities, social habits and technology. Revising norms periodically will make planning for water more realistic. The present survey is an indicator of this, with the norms given by the cities themselves varying considerably from the norms recommended by CPHEEO.

The coverage of population by water supply has improved steadily over the years and in the present survey it has reached 94 per cent (1999). However, it still falls short

of the target of covering 100 per cent of the population by water supply. Coverage by itself is not sufficient to ensure that adequate quantity of water is available to all at the required pressure and for adequate number of hours in a day. Despite full coverage of population by water supply, there are cities/ towns that do not get water daily or get water for only half-an-hour or less per day. Therefore, coverage has to be seen against the quantity of water available, duration of supply and quality of water supplied.

The per capita supply meets the city norms in only one- third of the urban centres. The situation is equally alarming in all size classes of urban centres, the per capita deficiency in relatively smaller urban centres is much worse than large urban centres. To improve the supply, not only are finances required to fund new schemes for water supply, but also efficiency in operations and cost recovery are also required.

Water is supplied only for a limited number of hours daily in almost all the urban centres. A round the clock supply, though desirable, is not possible in many cases due to inadequate water at source and other factors such as limited pumping and treatment capacity.

Unaccounted for water (UFW), which averages 21 per cent in the sampled urban centres, is another major problem that needs to be plugged. The urban local bodies do not have adequate capacity to detect and plug these leakages, be they physical or financial. The estimation of UFW is also very poor in most urban centres, mainly because all connections are not metered in most cities. Almost one-third of the sampled urban centres do not have any metered connections and this makes leakage detection a difficult task. In order to estimate UFW more accurately and reduce losses, leakage detection programmes need to be undertaken in most urban centres. Reducing water losses will effectively increase water availability and will reduce the requirement of funds for future investments.

With cities expanding rapidly, newer sources of water have to be tapped, and these are often further away from the city. Some of the metropolitan cities, which depended on nearby sources of water supply earlier, have to go much further in future to supply water to their population. Delhi, which has its present source at less than 30 km distance, will go as far as 300 to 400 kms in future to provide adequate water to its population.

The demand for water will continue to increase in future due to increasing population and also due to changing non-domestic water requirements. The demand-supply gap in Class I cities is the highest amongst the sampled urban centres and this indicates that an increase in population has not led to a concomitant increase in water supply. To improve the situation, not only are additional finances required but also efficiency of operations needs to improve.

Quality of water supplied also needs improvement. There are still some cities that use surface water but do not have water treatment plants. Laboratory facilities for testing water quality are also inadequate in a large number of urban centres. Water

supplied in urban centres with inadequate testing can result in serious health problems. Monitoring raw water quality is not done at all in a large number of urban centres. This would indicate that the treatment provided to water to make it potable does not have a scientific basis and the treatment may not be adequate.

There is more staff per 1000 connections in metropolitan cities than in other size class of cities. Since norms for staff per 1000 connections are not available for water supply, it is difficult to estimate whether the water utilities/urban local bodies are overstaffed.

Private sector involvement in water supply is not very common yet, with less than one-tenth of the sampled urban centres reporting private sector participation in the service. Wherever private sector has been involved, it has been mainly in operation and maintenance activities. A significant intervention by private sector in water supply has not yet happened though several attempts have been made in this direction. The main advantage of private sector participation in areas such as source development will be that the financial burden on local governments or the existing utilities will reduce considerably. Private sector will also introduce financial discipline, which will help improve the recovery from water supply.

Water rates are still very low in many states and not sufficient to cover the expenditure on the service. Domestic users are heavily subsidized by industrial and commercial users who pay a rate that is, on an average, two to ten times that paid by domestic users. While most urban centres have revised water tariff in early to mid-1990s, the revision in many cases has been marginal and does not reflect the real costs.

Revenue receipts from water supply are unable to meet the expenditure in over two-thirds of the sampled urban centres despite the fact that water supply is amenable to cost recovery. This is an area that needs to be investigated further to accurately pinpoint reasons for losses. Accounting improvements are also necessary in many urban centres to enable accurate assessment of revenues and expenditure on the service.

Additional capital investments in water supply are required to cover the presently uncovered population by water supply and also cover the population that will be added to the urban population between 1999-2022. Annual investment in the range of Rs. 13 to 15 billion (1999- 2002) is not possible to mobilize from the government alone; private sector participation has to be encouraged not only to bring in money but also to cut down costs.

5.1.2 Summary of Results

1. The average coverage of population by public water supply system in the sampled towns is 94 per cent. The coverage is marginally better in metropolitan cities with an average of 98 per cent.
2. In 7 urban centers (4 Class I cities & 2 Class II cities of West Bengal & Kavarathi

U.T.) only stand posts cover the entire population, as there are no individual connections.

3. The per capita supply in the sampled cities is 150 lpcd. This per capita supply is at an acceptable level as per the CPHEEO norms. The average supply in metropolitan cities is 182 lpcd, while in the sampled Class I and Class II urban centres it is 124 lpcd and 83 lpcd respectively.

4. The per capita domestic supply averages 128 lpcd for the sampled urban centres. In metropolitan cities the average domestic supply is 148 lpcd while it is 106 lpcd and 69 lpcd in Class I and Class II urban centres respectively.

5. Unaccounted for water in the sampled urban centers averages 21 per cent. While UFW is 24 per cent in the metropolitan cities, it is 16 per cent in the sampled Class I cities and 11 per cent in the Class II towns.

6. The average quantity of water required to be added to reach the city norms in the sampled urban centres is 4045 mld. In the metropolitan cities the quantity required is 1397 mld while in Class I cities the quantity required is 2209 mld and in Class II towns it is 439 mld.

7. The average percentage of total individual connections that are metered is a low 55 per cent in the sampled urban centers. In 15 per cent of the urban centers all the domestic connections are metered while in 42 per cent of the urban centers none of the domestic connections are metered.

8. Water treatment plants are not available in 30 (out of 195) urban centers using surface water. While all the metropolitan cities using surface water have water treatment plants, the corresponding figure for Class I cities is 96 (out of 109) and 48 (out of 65) for Class II towns.

9. Raw water quality is not monitored at all in 172 sampled urban centers.

10. Average staff per 1000 connections is 10.9 in the sampled urban centers. In metropolitan cities this figure is 14.5 while in Class I cities it is 7.9 and it is 6.8 in Class II towns.

11. Private sector has been involved in the water supply service in only 8 per cent of the sampled cities.

12. The tariff for domestic water supply per kilolitre is largely in the range of Re. 1.00 to Rs. 5.00 per kl. The tariff has been revised in most cities in the 1990s. Water tariff for non-domestic supplies are at least double but go upto 10 times the tariff charged for domestic use. Tariff for domestic water is amongst the lowest in U.P and highest in Kerala.

13. The investment requirements for covering the entire population by water supply by the year 2022 is Rs. 32118 crores at 1998-99 prices (using Task Forces per capita cost estimates) and Rs. 35420 crores (using HUDCO's per capita cost estimates). The per annum investment requirement works out to be Rs.1396 crores during the period 1999-2022 for the former and Rs. 1540 crores for the latter. Using HUDCO's per mld cost estimates, the additional capital investment

requirements vary between Rs. 15825 crores (low estimate) to Rs. 40502 crores (high estimate) for the period 1999-2022 at 1998-99 prices.

5.1.3 Recommendations

1. Problems of intra-city distribution should be taken up immediately by the local authorities to address the problems of water shortage.
2. Steps should be taken to initiate capacity building in urban centres for estimation of UFW. Financial assistance should also be provided to the water supplying agencies to equipping with the instruments for estimating UFW.
3. Metering of connections, both for bulk supply and retail distribution, must be encouraged. Standard meters should be made available, at reasonable cost, to all urban centres for this purpose.
4. Tariff is a major concern in the water sector. Tariff should be increased at certain given intervals, indexed to inflation and power tariff.
5. Getting surface water from distant sources is proving to be very expensive. Ground water depletion can be controlled by undertaking rainwater harvesting in all urban centres. Specific programmes/ schemes should be initiated for aquifer re-charge.
6. In line with the provisions of 74th Constitution Amendment Act, the capacity of local governments should be built to manage water supply systems. The local governments should be given sufficient autonomy to decide on increase in water tariff required to cover at least O&M costs.
7. Improving cost recovery should be linked to giving grants. Financial incentives could be given to urban centres showing improved cost recovery. Technical assistance and guidance should also be provided to local authorities to improve financial performance.
8. Private sector participation in this sector should be encouraged, wherever possible. Unbundling of the service would allow private sector to participate in this service and improve efficiency levels.
9. The additional capital investments required to cover the entire urban population with water supply at the required norms will require huge investments that are not possible for the Government to provide. Therefore, public-private participation must be encouraged. New ways of financing for this sector should also be explored.

5.2 SEWERAGE AND LOW COST SANITATION

5.2.1 Conclusions

The situation with respect to safe sanitation is not very encouraging in the urban areas of the country. Only one-third of the 301 sampled urban centres have sewerage system and the population covered by them is about 45%. Even in urban centres with sewerage system, the coverage of population is only partial (58%).

A significant amount of wastewater generated is not collected in these urban centres. And even where it is collected, a large percentage of wastewater is not treated. In fact, overall close to two-thirds of the wastewater generated is not treated in the sampled urban centres. When this is translated into actual terms, the level of land and water pollution due to discharge of untreated wastewater is huge. Significantly, over half the urban centres, with sewerage system have sewage treatment plants.

Only primary treatment is given to wastewater in a small number of the urban centres while in a larger number waste water is also given secondary treatment.

Recycling of wastewater is not yet very common in the sampled urban centres. Only a small percentage of urban centres recycle wastewater, using it mainly for irrigating agricultural fields.

The main sources of revenue receipts for this service is sewerage/ drainage tax though sewerage benefit tax is also levied in two metropolitan cities, generating substantial revenues on this account. Levying a surcharge on water for managing wastewater is not very common and is used in just a few urban centres. Levying a charge per water closet is common in some of the towns.

Cost recovery from this service is very low in most urban centres.. However, some of the urban centres are able to generate substantial revenues from the service, showing positive balance on the revenue account in this service.

Low cost sanitation covers about one-third of the population in the sampled urban centres. However, a significant percentage of the population is still not covered by safe sanitation and is forced to use open spaces for defecation. Some people still depend on dry latrines, though information on this aspect is not very easy to obtain.

The investment required for providing safe sanitation to all is huge and is difficult for the government alone to finance it. Private sector participation as well as users contribution can ease the financial burden on the government.

5.2.2 Summary of Results

1. Overall, only about one-third of the sampled urban centres (i.e., 100 cities/towns) have a sewerage system.
2. Of the urban centres with a sewerage system, about 38 per cent have a combined system of wastewater collection, i.e., combined with storm water drainage, while 60 per cent centres have a separate system.
3. The coverage of population by sewerage system in the sampled urban centres is partial with an average coverage of 45 per cent.
4. Only 59 per cent of the wastewater generated is collected by the sewerage system in the urban centres having a sewerage system.
5. Low coverage of population by sewerage system is the main reason for the low collection efficiency.

6. In 47 per cent of the sampled urban centres, with sewerage system, the entire wastewater collected is discharged without any treatment.

7. In about 19 per cent of the responding urban centres only primary treatment is provided to wastewater before disposal into land or water body, while 38 per cent of urban centres also provide secondary treatment to wastewater before disposal.

8. The most commonly used wastewater treatment process in the responding urban centres, with sewerage system, is extended aeration.

9. Recycling/ reuse of wastewater is done in only 44 urban centres having a sewerage system.

10. The present survey shows that STPs are available in only 51 of the 100 urban centres with sewerage system.

11. The present survey reveals that charging for wastewater collection and treatment in the sampled urban centres is mainly done in three ways: through taxes, by a surcharge on water, and by a charge per water closet.

12. Amongst the sampled urban centres with sewerage facilities, 36 urban centres have indicated revenues from sewage/drainage tax while 48 have indicated revenues from connection charges in 1997-98.

13. There are 13 urban centres, with sewerage system, where no revenue is generated from the service.

14. The cost recovery from the service is generally low and averages about 27 per cent in non-metropolitan urban centres.

15. The present survey indicates that 34 per cent of the population in the sampled urban centres is covered by septic tanks and low cost sanitation.

16. The additional investment required for covering the entire population by safe sanitation facilities is Rs. 52361 crores for the period 1999-2022 (using Task Forces cost estimates) and Rs. 86103 crores for the same period (using HUDCO's cost estimates).

5.2.3 Recommendations

1. Rehabilitation of sewerage systems must be taken up in all the cities where the sewerage system exists but has become non-functional.

2. Wastewater treatment must be made mandatory for all sizes of urban centres. The smaller urban centres could use less capital-intensive technologies to reduce capital cost as well as maintenance cost of treatment.

3. Pollution of land or water body with untreated wastewater should be made punishable with fine.

4. Recycling/ reuse of wastewater must be encouraged. Technical and financial assistance must be provided for this, if required.

5. All agencies dealing with wastewater must prepare plans for cost recovery from this service. Private sector participation could be encouraged in managing this service to reduce public expenditure.

6. Successful examples of people's participation in contributing to the cost of construction of sewerage system (e.g. Alandur) must be examined and adopted in other urban centres of the country.

5.3 SOLID WASTE MANAGEMENT

5.3.1 Conclusions

The status of solid waste management needs to be improved considerably in urban India. While the coverage by the service, which indicates only the reach of the agency, but not the quality of service delivered, is fairly high at 92 per cent of the total population, the service delivery needs improvement. The waste collection efficiency in smaller cities and towns needs even more improvement as these urban centres lack sufficient staff and waste transportation vehicles. They also lack vehicle maintenance facilities and funds to keep the waste transportation vehicles in good order to lift waste efficiently and regularly.

One of the areas that need immediate and urgent attention is the disposal of waste. With three-fourths of the waste being dumped crudely, the quality of urban environment is deteriorating rapidly. Landfill sites need to be identifed and developed on a priority basis and waste treatment facilities (e.g. composting) need to be developed on scientific lines. Decentralisation of waste management, wherever possible, should be resorted to in order to reduce the quantity of waste that needs to be transported and also the land requirement for waste treatment. Waste segregation at source and recycling of waste should be encouraged. Waste reduction and recycling should be promoted at the household and neighbourhood level.

Hospital waste should not be allowed to be mixed with municipal waste, as is happening in most cities and towns today. The provisions of the Bio-Medical Waste (Management and Handling) Rules, 1998 should be implemented and action taken in case of non-compliance.

Privatisation of activities under solid waste managment must be encouraged. Although only 65 sampled urban centres have involved private sector in waste management, the cost savings have been encouraging in some cities. These experiences must be studied in detail and replicated wherever possible, particularly in cities/towns where there is shortage of staff and the coverage by the service is not full.

Solid waste management is a service that is expenditure heavy with very meager revenues, if at all there is any revenue from the service. Cost recovery from the service, at present, is dismal with only a fraction of the expenditure on the service being recovered. The per capita per day expenditure on the service is only about Rs. 0.33 paise. Expenditure norms, based on performance norms, should be fixed in order to guide the local governments in improving the quality of service provided.

Since there is no separate account maintained for solid waste management, it is difficult to assess the financial condition of the service and suggest improvements. The revenue generated from the service, through taxes, though not very significant, is deposited in the general revenue account of the local body and the expenditure too is made from the general revenue account. Efficiency and cost savings cannot be instituted or financial discipline brought in unless the accounting system is improved. Improving the accounting should also be taken up on a priority basis by local governments to bring about cost savings and revenue improvements in the service. At the same time, new sources of revenue in solid waste management such as fine for littering, user charges for bulk waste generators and other commercial establishments, user charges for domestic waste collection (door-to-door) and levying of tipping fees should be considered by local governments for improving revenue from this service.

Additional funds required for investment in solid waste managment to cover 100 per cent of the population by the service cannot be financed by the government alone. Resource mobilization from private sector and financial institutions must be explored for improving solid waste managment in urban areas of the country.

5.3.2 Summary of results

1. The average coverage of population by solid waste management is 92 per cent in the sampled urban centres.

2. The average per capita waste generation in the sample is 433 grams per day. The per capita waste generation is the highest in metropolitan cities with 500 grams per day followed by Class I cities with 377 and class II towns 297 grams waste generation per capita per day.

3. The total waste generated in the 298 responding cities and towns is 60823 MT per day, of which 7318 MT of waste gets left uncollected daily. This gives a waste collection efficiency of 88 percent. The waste collection efficiency reduces with city size. Metropolitan cities collect an average of 91 per cent of the waste generated daily while the collection efficiency is 85 per cent in Class I cities and 75 per cent in Class II towns.

4. Hospital waste is collected separately in only 22 per cent of the urban centres; in 77 per cent hospital waste is still collected along with municipal waste.

5. Even in urban centres where hospital waste is collected separately, no treatment is given to this waste in about 29 per cent of such cities.

6. The most prevalent method of waste disposal is crude/ open dumping. Almost three-fourths of the urban centres resort to this method for waste disposal. Landfill is the main method of waste disposal in 11 per cent of the urban centres (most common in metropolitan cities) while composting is the main method in 12 per cent of the urban centres.

7. The average staff per 1000 population for solid waste management is 2.4, while the norm for the service is 2.8 workers per 1000 population. Metropolitan cities with 2.8 staff per 1000 population are above the sample average while the other urban centres fall short of this average (1.9 in Class I cities and 2.1 in Class II towns).

8. Private sector involvement in solid waste management has been found in only 22 per cent of the urban centres. Largest involvement of private sector is in primary collection followed by transportation.

9. Revenue receipts from solid waste management is negligible in most urban centres and is generated mainly from taxes.

10. Establishment consumes about four-fifth of the total expenditure on the service. This is not abnormal as this is a labour intensive service and there is very little mechanisation at the primary collection stage.

11. The average per capita revenue from the service is Rs. 10.1 per annum, with metropolitan cities generating Rs. 12.8, Class I cities Rs. 6.6 and Class II towns generating low revenue of Rs. 2.8 per capita per annum.

12. The average per capita expenditure on the service is about 12 times the revenue generated from the service. The per capita expenditure on the service is Rs. 121.21 per annum. The per capita expenditure on the service is higher in metropolitan cities than in other urban centres. Metropolitan cities spend an average of Rs. 156.06 per capita per annum, Class I cities spend Rs. 87.27 and Class II towns spend an average of Rs. 85.99 per capita per annum on solid waste managment.

13. Cost recovery from solid waste managment is a dismal 7 per cent. The average deficit per capita per annum is Rs. 130.51 with the deficit being the highest in metropolitan cities – Rs. 176.59 as compared to Rs. 66.46 in Class I cities and Rs. 60.19 in Class II cities.

14. The additional investment requirement for covering 100 per cent of population by solid waste managment during 1999-2022 period is Rs. 3954 crores at 1998-99 prices (based on Task Forces per capita cost estimates). The investment requirement per annum works out to Rs. 172 crores during this period.

5.3.3 Recommendations

1. Three 'R's of solid waste management i.e. reduce, reuse and recycle must be adopted by all urban centres. This will help in reducing the quantum of solid waste that the local governments have to deal with.

2. Efficiency of waste collection must be improved in cities by bringing about the necessary changes in the design of equipment used by sanitary staff, manpower management and planning.

3. Transportation fleet needs to be maintained well and needs to be modernised to improve collection and transportation efficiency.

4. Crude/open dumping of waste must be completely discouraged by engaging in controlled tipping.

5. All urban centres should identify landfill sites that are usable. In order to reduce the quantity of waste that goes to landfill sites, waste treatment such as neighbourhood composting and recycling of waste must be encouraged.

6. Separate collection of hospital waste must be ensured in every city and incinerators must be installed to deal with this waste. Landfill sites should apportion an area for the disposal of hazardous waste from hospitals.

7. Private sector participation must continue to be encouraged in this sector to achieve efficiency of operations and cost reduction. However, monitoring of privatised activities should be improved in order to provide better quality of services to the people.

8. Plans to improve cost recovery from this service must be made by every local government. New sources of revenue generation must be thought of.

9. People's participation must be encouraged to keep cities clean and NGOs must be used to do information, education and communication work in communities.

APPENDIX I

WATER SUPPLY AND WATER TARIFF

LIST OF TABLES

A-1

POPULATION, AREA, SLUM POPULATION, 1999

A-1: Population, Area, Slum Population, 1999

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
METROPOLITAN CITIES								
1	Ahmedabad M.Corp.	2,877	3,500	100	190.84	190.84	1,179	1,435
2	Bangalore M.Corp.	2,660	5,000	100	445.91	482.00#	399	750
3	Bhopal M.Corp.	1,063	1,500	100	284.09	284.09	n.a.	231
4	Calcutta M.Corp.	4,400	6,000	100	187.33	187.33	2,000	2,290
5	Chennai M.Corp.	3,841	4,363	100	174.00	174.00	n.a.	1,500
6	Coimbatore M.Corp	816	971	100	105.60	105.60	n.a.	n.a.
7	Delhi M.Corp.	7,207	12,000	100	1485.00	1485.00	1,300	3000**
8	Greater Mumbai M.Corp.	9,926	11,100	100	437.71	437.71	4,459	5823~
9	Hyderabad M.Corp.	2,965	4,163	100	172.00	172.00	n.a.	601
10	Indore M.Corp.	1,092	1,600	100	137.17	137.17	264	300
11	Jaipur M.Corp.	1,458	2,000	100	200.40	200.40	214	433
12	Kanpur M.Corp.	1,874	2,500	50	106.00	227.67	200	500
13	Kochi M.Corp.	565	680	100	94.88	94.88	52	70
14	Lucknow M.Corp.	1,619	2,500	100	290.00	310.00	120	200
15	Ludhiana M.Corp.	1,043	2,000	60	134.67	165.00	350	700
16	Madurai M.Corp.	941	1,020	100	51.96	51.96	195	310
17	Nagpur M.Corp.	1,625	2,100	100	217.56	217.56	650	890
18	Pune M.Corp.	1,567	2,300	100	146.00	416.00	628	879
19	Surat M.Corp.	1,499	2,300	100	112.28	112.28	450	750
20	Vadodara M.Corp.	1,031	1,400	100	108.26	108.26	185	250
21	Varanasi M.Corp.	929	1,152	70	73.89	73.89	161	265
22	Visakhapatnam M.Corp.	752	1,280	100	78.33	107.00	n.a.	265
	Total - Metropolitan Cities	*51,749*	*71,429*	*98*	*5,234*	*5,741*		

** Estimated by Water Supplying agencies of respective cities/towns # Area covered by utility ** For entire Delhi not just for M.Corp.*
M.Corp's slum population as per 2001 census is 1854,685 ~ Mumbai's slum population has reduced due to slum redevelopment schemes
Source: Respective urban local governments/relevant agencies, NIUA Survey,

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
	CLASS I							
	Andhra Pradesh							
1	Anantapur MCl	175	250	100	16.00	16.00	55	70
2	Chittoor M	133	149	100	33.57	33.57	41	42
3	Cuddapah MCl	121	166	100	6.84	6.84	25	29
4	Eluru M	213	247	100	14.55	14.55	62	78
5	Guntur MCl	471	557	100	45.79	45.79	n.a.	157
6	Hindupur M	105	140	75	36.18	36.18	n.a.	41
7	Kakinada M	280	325	75	30.51	30.51	62	92
8	Kurnool MCl	237	282	100	15.01	15.01	84	94
9	Machilipatnam M	159	200	100	26.67	26.67	n.a.	13
10	Nandyal MCl	120	150	100	15.42	15.42	30	38
11	Nellore MCl	317	404	100	48.39	48.39	94	119
12	Nizamabad M	241	285	100	30.50	30.50	n.a.	109
13	Ongole MCl	101	180	100	25.89	25.89	24	27
14	Qutubullapur M	107	250	52	46.87	46.87	n.a.	168
15	Rajahmundry M.Corp.	325	380	100	44.50	44.50	52	78
16	Tenali M	144	170	20	15.12	15.12	n.a.	43
17	Tirupati MCl	174	210	100	21.96	24.00	45	54
18	Vijaywada M.Corp.	702	837	100	58.00	58.00	240	300
19	Warangal M.Corp.	448	680	100	68.50	68.50	36	41
	Bihar							
20	Bihar Sharif M	201	250	70	19.43	19.43	82	136
21	Chhapra M	137	200	100	8.00	8.00	n.a.	n.a.
22	Gaya M.Corp.	292	400	100	17.50	17.50	42	n.a.
23	Katihar M	135	200	75	12.00	12.00	n.a.	n.a.
24	Munger M	150	210	60	19.00	19.00	n.a.	n.a.
25	Ranchi M.Corp.	599	700	93	177.19	177.19	n.a.	n.a.

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
	Gujarat							
26	Anand M	110	175	100	21.13	23.14	32	40
27	Bharuch M	133	159	100	18.43	19.93	10	15
28	Bhavnagar M.Corp.	402	550	100	53.40	53.40	48	60
29	Bhuj M	102	118	100	9.45	9.49	15	20
30	Jamnagar M.Corp.	342	500	100	26.40	26.40	90	102
31	Junagadh M	130	165	100	30.00	30.00	n.a.	n.a.
32	Nadiad M	167	300	100	28.48	28.48	25	40
33	Navsari M	126	139	100	8.52	8.55	25	30
34	Porbandar M	117	142	100	12.30	12.30	8	10
35	Rajkot M.Corp.	559	1,000	100	69.00	104.86	90	125
36	Surendranagar M	106	150	100	14.19	36.87	10	n.a.
	Haryana							
37	Ambala MCl	119	141	96	16.94	16.94	12	19
38	Faridabad M.Corp.	618	1,150	100	178.00	208.00	130	150
39	Gurgaon MCl	121	175	85	15.33	16.57	31	38
40	Hisar MCl	173	250	70	45.42	45.42	43	52
41	Karnal MCl	176	220	85	22.10	22.10	41	46
42	Rohtak MCl	216	243	89	20.38	28.38	67	103
	Jammu & Kashmir							
43	Jammu M.Corp.	716	1,051	84	n.a.	130.36	n.a.	n.a.
	Karnataka							
44	Belgaum M.Corp.	326	470	100	141.95	n.a.	100	120
45	Bellary CMC	245	297	100	81.95	81.95	62	95
46	Davangere MCl	266	455	99	31.80	31.80	72	140
47	Gadag-Betigeri CMC	134	148	100	15.36	54.58	7	9
48	Gulbarga M.Corp.	304	450	100	55.00	55.00	48	89
49	Hubli-Dharwar M.Corp.	648	850	100	188.77	188.77	102	270

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
50	Mandya M	120	140	100	17.03	n.a.	n.a.	8
51	Mangalore M.Corp.	273	410	90	74.71	116.77	17	n.a.
52	Mysore M.Corp.	481	1,050	80	64.00	100.00	52	70
53	Shimoga CMC	179	222	100	35.00	50.00	9	42
54	Tumkur M	139	300	60	15.93	45.90	10	23
	Kerala							
55	Alappuzha MC	175	200	100	42.00	42.00	42	53
56	Kollam MC	140	160	100	18.45	18.45	34	45
57	Kozhikode M.Corp.	420	493	100	84.23	84.23	71	73
58	Thalaserry M	104	134	100	15.35	15.35	10	11
59	Thiruvananthapuram M.Corp.	524	585	100	78.40	78.40	20	25
	Madhya Pradesh							
60	Bhind M	110	175	100	17.18	17.18	3	3
61	Burhanpur M.Corp.	173	210	100	24.00	24.00	n.a.	84
62	Dewas M.Corp.	164	200	100	100.22	100.22	n.a.	n.a.
63	Guna M	100	125	70	45.75	45.75	25	39
64	Gwalior M.Corp.	691	900	94	n.a.	166.83	300	270
65	Jabalpur M.Corp.	742	1,000	100	133.99	133.99	n.a.	n.a.
66	Khandwa M	145	175	100	35.77	35.77	n.a.	n.a.
67	Morena M	105	125	100	12.00	12.00	20	25
68	Murwara (Katni) M.Corp.	163	180	100	107.10	107.10	n.a.	n.a.
69	Ratlam M.Corp.	183	235	100	39.00	39.00	62	70
70	Rewa M.Corp.	129	180	70	54.99	54.99	n.a.	n.a.
71	Satna M.Corp.	157	200	100	62.24	62.24	4	5
72	Shivpuri M	108	140	100	81.10	81.10	23	28
	Maharashtra							
73	Amravati M.Corp.	422	500	100	121.00	121.00	100	150
74	Aurangabad M.Corp.	573	868	100	138.00	138.00	170	270

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
75	Bhusawal MCl	145	200	100	13.58	13.58	13	n.a.
76	Chandrapur MCl	226	295	100	45.00	45.00	89	89
77	Dhule MCl	278	330	100	46.46	46.46	35	55
78	Ichalkaranji MCl	215	250	100	29.91	29.91	22	30
79	Jalgaon MCl	242	400	100	65.64	65.64	n.a.	75
80	Kolhapur M.Corp.	406	502	100	66.00	66.00	42	68
81	Nanded Waghala M.Corp.	275	410	100	20.60	46.00	n.a.	71
82	Nashik M.Corp.	657	839	100	259.13	259.13	131	168
83	Parbhani MCl	190	233	100	57.60	57.60	59	125
84	Solapur M.Corp.	604	900	100	180.66	n.a.	130	240
85	Wardha M	103	150	100	9.04	9.04	17	20
86	Yavatmal MCl	109	130	100	10.69	10.69	39	40
	Orissa							
87	Bhubaneswar M.Corp.	412	654	100	124.74	n.a.	n.a.	n.a.
88	Cuttack M.Corp.	403	563	100	80.00	80.00	100	143
89	Puri M	125	150	71	16.84	16.84	38	45
90	Rourkela M	140	200	85	52.00	52.00	21	30
91	Sambalpur M	131	157	100	33.46	33.46	73	n.a.
	Punjab							
92	Amritsar M.Corp.	709	843	60	133.00	133.00	247	253
93	Bathinda MCl	159	174	40	97.00	99.00	24	28
94	Hoshiarpur MCl	123	145	69	35.00	35.00	n.a.	28
95	Jalandhar M.Corp.	510	738	89	98.00	110.00	200	150
96	Moga MCl	108	148	70	18.50	18.50	14	18
97	Pathankot MCl	124	195	100	22.10	22.10	11	11
98	Patiala M.Corp.	238	328	65	41.00	41.00	80	70
	Rajasthan							
99	Ajmer MCl	403	550	80	199.00	220.00	112	150

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
100	Alwar M	205	300	90	58.15	58.15	20	25
101	Beawar M	105	141	100	17.74	17.69	20	21
102	Bhilwara M	184	225	100	69.00	69.00	37	45
103	Bikaner M	416	600	100	175.76	175.76	14	25
104	Jodhpur M.Corp.	666	1,000	94	78.57	78.57	194	281
105	Kota M.Corp.	537	750	100	221.00	221.00	n.a.	n.a.
106	Sriganganagar M	161	225	100	18.00	20.87	9	11
	Tamil Nadu							
107	Cuddalore M	145	162	100	27.62	27.62	28	34
108	Dindigul M	182	214	100	14.01	14.01	22	27
109	Erode M	159	174	100	8.44	8.44	37	40
110	Kanchipuram M	145	157	100	11.60	11.60	n.a.	n.a.
111	Kumbakonam M	139	147	100	12.58	12.58	49	52
112	Nagercoil M	190	206	61	24.27	24.27	11	13
113	Rajapalayam M	114	123	100	11.36	11.36	16	17
114	Salem M.Corp.	367	447	100	91.34	91.34	62	125
115	Thanjavur M	202	217	80	36.31	36.31	38	41
116	Tiruchirapalli M.Corp.	669	800	100	n.a.	146.90	167	312
117	Tirunelveli M.Corp.	374	414	100	108.65	108.65	83	94
118	Tirunvannamalai M	109	129	100	13.64	13.64	21	34
119	Tiruppur M	236	295	100	27.19	27.19	n.a.	63
120	Tuticorin M	200	217	100	13.47	13.47	32	35
121	Vellore M	175	176	100	11.65	11.65	n.a.	66
	Uttar Pradesh							
122	Agra M.Corp.	892	1,150	75	121.57	121.57	n.a.	n.a.
123	Aligarh M.Corp.	481	600	100	62.00	62.00	n.a.	n.a.
124	Allahabad M.Corp.	793	1,015	75	70.05	70.05	83	106
125	Bareilly M.Corp.	587	750	80	106.43	106.43	n.a.	n.a.

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
126	Etawah MB	124	140	100	33.74	33.74	1	3
127	Faizabad MB	124	170	100	16.50	16.50	n.a.	n.a.
128	Firozabad MB	215	250	75	45.00	50.00	n.a.	n.a.
129	Ghaziabad M.Corp.	454	887	100	63.78	200.00	n.a.	n.a.
130	Gorakhpur M.Corp.	506	600	75	119.00	143.00	76	90
131	Haldwani-cum-Kathgodam MB	104	141	100	10.62	10.62	17	n.a.
132	Hapur MB	146	200	65	14.20	14.20	2	2
133	Hardwar MB	147	300	60	11.91	11.91	27	40
134	Jhansi MB	301	507	80	48.00	48.00	120	170
135	Mathura MB	227	400	65	25.23	25.23	n.a.	90
136	Meerut M.Corp.	754	1,250	100	141.94	141.94	n.a.	n.a.
137	Mirzapur MB	169	210	65	30.59	30.59	26	32
138	Moradabad M.Corp.	429	670	100	50.48	50.48	n.a.	n.a.
139	Muzaffarnagar MB	241	325	80	12.00	12.00	43	58
140	Rae Bareli MB	130	175	75	32.69	32.69	15	30
141	Rampur MB	244	317	100	48.00	48.00	n.a.	n.a.
142	Saharanpur MB	375	540	50	25.75	25.75	142	175
143	Sitapur MB	122	150	100	35.00	35.00	n.a.	n.a.
144	Unnao MB	107	121	100	21.50	21.50	10	13
	West Bengal							
145	Asansol M.Corp.	262	315	100	25.02	n.a.	264	n.a.
146	Baharampur M	115	143	100	16.67	15.65	32	56
147	Balurghat M	120	132	100	6.50	8.50	40	52
148	Bankura M	115	151	70	18.13	19.06	25	33
149	Barasat M	103	150	38	20.26	34.50	39	65
150	Burdwan M	245	323	70	34.18	34.18	97	110
151	Halisahar M	114	149	100	8.29	8.29	73	48
152	Krishnagar M	121	145	60	15.96	15.96	51	61

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
153	Midnapore M	125	158	n.a.	14.78	14.78	42	59
154	North Barrackpore M	101	118	100	8.42	12.22	18	23
155	Santipur M	110	134	30	25.88	25.88	60	64
156	Silliguri M.Corp.	338	500	100	15.50	41.90	42	157
	Small States							
	Assam							
157	Guwahati M.Corp.	584	995	44	216.00	216.00	95	105
158	Jorhat MB	112	170	n.a.	9.20	n.a.	n.a.	n.a.
	Manipur							
159	Imphal MCI	199	245	100	33.30	n.a.	n.a.	n.a.
	Meghalaya							
160	Shillong MB	132	217	100	10.36	10.36	n.a.	n.a.
	Mizoram							
161	Aizwal NM	155	244	33	110.00	128.98	n.a.	n.a.
	Tripura							
162	Agartala MCI	157	200	100	16.01	16.01	25	27
	Union Territories							
163	Chandigarh M.Corp.	504	850	100	114.00	114.00	75	120
164	Pondicherry M	203	290	100	20.00	20.00	41	58

Source: Respective urban local governments/relevant agencies, NIUA Survey,1999.

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
CLASS II								
	Andhra Pradesh							
1	Anakapalle M	84	115	100	23.28	23.28	21	22
2	Dharmavaram M	79	100	100	40.45	40.45	46	47
3	Gudur MCl	56	72	100	9.10	9.80	19	21
4	Kapra M	88	120	80	43.90	65.00	24	30
5	Kavali MCl	66	85	100	22.95	22.95	25	30
6	Madanapalle M	74	100	90	7.74	14.20	13	16
7	Narasaraopet M	89	95	100	7.65	7.65	41	45
8	Rajendra nagar MCl	85	120	100	58.00	58.00	24	26
9	Sangareddy MCl	50	60	100	13.69	13.69	23	25
10	Srikakulam MCl	89	100	100	14.10	14.10	37	n.a.
11	Srikalahasti M	62	70	86	12.80	12.80	14	21
12	Suryapet MCl	61	89	80	23.54	23.54	43	49
	Bihar							
13	Buxar M	56	67	82	9.75	9.75	n.a.	14
14	Deoghar M	76	100	80	n.a.	n.a.	n.a.	n.a.
15	Hajipur M	88	115	100	15.00	15.00	n.a.	n.a.
16	Hazaribagh M	98	119	84	19.00	19.00	n.a.	n.a.
17	Jehanabad M	52	57	89	8.00	8.00	9	11
18	Madhubani M	54	65	69	19.00	19.00	n.a.	n.a.
19	Mokama M	60	66	100	10.00	10.00	n.a.	36
	Gujarat							
20	Amreli M	68	85	100	11.44	13.59	n.a.	n.a.
21	Ankleswar M	52	60	100	11.05	11.05	15	16
22	Dabhoi M	51	65	100	23.82	23.82	8	10
23	Dohad M	67	78	100	6.54	7.00	3	7
24	Gondal M	81	100	100	11.00	11.00	15	20

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
25	Jetpur M	74	125	100	6.88	36.00	12	15
26	Mahesana M	88	138	100	12.87	12.87	18	24
27	Palanpur M	81	117	100	23.48	23.48	20	30
	Haryana							
28	Jind MCI	85	114	80	15.30	21.00	15	48
29	Kaithal MCI	71	95	80	3.05	5.05	8	26
30	Rewari MCI	75	105	100	12.58	18.43	23	28
31	Thanesar MCI	81	100	72	32.25	32.25	24	39
	Karnataka							
32	Bagalkot CMC	77	100	85	48.25	48.25	15	24
33	Chikmaglur CMC	61	100	100	27.50	27.50	8	12
34	Gokak CMC	52	68	100	33.05	33.05	10	14
35	Hospet CMC	96	114	100	20.73	50.92	n.a.	33
36	Kolar CMC	83	112	100	12.50	21.47	17	22
37	Rabkavi-Banhatti CMC	61	72	100	8.49	12.00	n.a.	7
38	Ramanagaram CMC	50	70	100	11.60	17.80	8	20
	Kerala							
39	Changanessary MC	52	62	100	13.50	13.50	15	25
40	Payyanur M	64	71	100	54.63	54.63	1	1
41	Taliparamba M	60	52	100	43.36	18.21	n.a.	n.a.
42	Thrissur MC	75	91	100	16.65	16.65	18	21
	Madhya Pradesh							
43	Hoshangabad M	71	100	100	24.26	24.26	n.a.	n.a.
44	Itarsi M	77	105	100	14.07	14.07	n.a.	n.a.
45	Khargone M	67	80	100	10.00	10.00	30	35
46	Mandsaur M	96	123	100	10.36	10.36	n.a.	10
47	Nagda M	80	100	89	23.00	23.00	17	19
48	Neemuch M	86	100	100	13.43	13.43	40	45

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
49	Sehore M	71	100	100	18.00	18.00	11	n.a.
50	Shahdol M	56	75	100	19.92	19.92	12	15
51	Vidisha M	93	125	100	5.83	5.83	23	26
	Maharashtra							
52	Amalner MCl	76	100	100	9.71	9.71	19	25
53	Ballarpur MCl	84	109	100	8.19	9.07	66	n.a.
54	Bhandara M	72	76	79	16.83	16.83	29	38
55	Kamptee MCl	79	95	100	4.27	4.27	69	75
56	Manmad MCl	61	87	100	23.45	23.45	n.a.	n.a.
57	Ratnagiri MCl	57	70	100	10.49	10.49	9	12
58	Satara MCl	95	100	100	8.16	8.16	21	25
59	Virar MCl	58	100	100	19.54	19.54	12	20
	Orissa							
60	Balangir M	70	83	58	n.a.	n.a.	n.a.	n.a.
61	Bhadrak M	76	93	100	80.00	80.00	40	n.a.
	Punjab							
62	Firozpur MCl	79	93	88	11.33	11.33	11	15
63	Kapurthala M	65	85	63	16.00	16.00	8	8
64	Mansa MCl	55	67	50	23.47	23.47	10	11
65	Phagwara MCl	83	108	80	16.00	16.00	10	9
66	Sangrur MCl	56	70	98	10.36	18.00	11	21
	Rajasthan							
67	Banswara M	67	110	100	10.01	10.01	n.a.	n.a.
68	Barmer M	69	84	76	10.29	6.25	13	16
69	Bundi M	65	80	100	22.76	30.00	15	18
70	Churu M	82	100	100	35.00	35.00	6	7
71	Hanumangarh M	79	125	100	13.42	13.42	4	5
72	Sawai Madhopur M	72	89	100	11.50	11.50	12	15

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
	Tamil Nadu							
73	Ambur M	76	86	100	13.97	13.97	23	24
74	Arakkonam M	72	88	100	9.06	9.06	14	15
75	Attur M	56	64	100	27.62	27.62	7	9
76	Cumbum M	52	54	72	n.a.	6.58	n.a.	11
77	Dharmapuri M	59	67	100	11.65	11.65	27	30
78	Guduivattam M	83	95	100	4.71	4.71	16	18
79	Nagapattinam M	86	112	100	14.90	14.90	13	16
80	Pudukkottai M	99	108	100	12.95	12.95	35	38
81	Sivakasi M	66	70	100	6.89	6.89	5	5
82	Srivilliputtur M	69	74	100	5.71	5.71	13	13
83	Tindivanam MC	62	70	91	22.33	22.33	26	30
84	Udhagamandalam M	82	100	100	30.67	30.67	n.a.	13
	Uttar Pradesh							
85	Auraiya MB	51	90	100	4.00	9.00	n.a.	n.a.
86	Balrampur MB	60	70	21	14.25	42.00	10	13
87	Basti MB	87	110	100	19.57	19.57	n.a.	n.a.
88	Bhadohi MB	64	125	30	10.36	8.00	10	15
89	Chandpur MB	56	80	67	3.60	3.60	15	30
90	Etah MB	78	135	70	13.49	27.00	10	25
91	Ghazipur MB	77	96	75	13.45	13.45	31	36
92	Gonda MB	96	114	80	9.00	9.00	10	12
93	Lakhimpur MB	80	100	100	6.99	9.00	5	15
94	Lalitpur MB	80	100	80	15.00	17.30	30	41
95	Mughalsarai MB	67	160	12	16.00	16.00	15	38
96	Nawabganj-Barabanki MB	66	90	76	10.00	11.00	n.a.	n.a.
97	Orai MB	99	170	70	20.00	20.00	20	35
98	Roorkee MB	80	100	89	n.a.	n.a.	n.a.	n.a.

Sl. No	City/Town	Population ('000)		% Population covered by water supply 1999	Area (Sq.km.)		Slum population ('000)	
		1991 (Census)	1999 (Estimated)*		1991 (Census)	1999 (Estimated)*	1991 (Estimated)*	1999 (Estimated)*
	1	2	3	4	5	6	7	8
	West Bengal							
99	Bishnupur M	56	67	37	22.02	22.02	14	19
100	Chakdaha M	75	90	39	15.36	15.36	n.a.	40
101	Contai M	53	114	100	14.25	14.25	26	40
102	Cooch Behar M	71	99	100	8.19	8.19	24	25
103	Darjeeling M	73	93	100	10.60	10.60	n.a.	32
104	Jalpaiguri M	69	101	n.a.	10.80	12.98	n.a.	30
105	Jangipur M	56	78	54	7.70	8.20	n.a.	35
106	Katwa M	56	68	40	7.93	7.93	22	27
107	Raniganj M	62	121	53	24.99	24.99	36	45
	Small States							
	Himachal Pradesh							
108	Shimla M.Corp.	82	111	100	19.55	28.53	-	-
	Nagaland							
109	Kohima TC	51	103	100	36.00	36.00	21	38
	Union Teritories							
110	Port Balir MCI	75	105	89	14.14	16.64	n.a.	10
	Others (Smaller than Class II towns)							
	Small States							
	Arunachal Pradesh							
111	Itanagar CT	17	34	82	11.25	n.a.	5	n.a.
	Goa							
112	Panaji MCI	43	57	100	3.70	3.70	2	2
	Union Territories							
113	Daman MCI	27	35	100	5.60	5.60	3	4
114	Kavarathi NMCT	8.7	11	100	3.63	3.63	n.a.	n.a.
115	Silvassa	12	20	100	2.65	2.65	n.a.	n.a.

Source: Respective urban local governments/relevant agencies, NIUA Survey, 1999.

A-2

QUANTITY OF WATER SUPPLIED BY USE, DURATION AND FREQUENCY OF SUPPLY, 1999

A-2 : Quantity of Water Supplied by Use, Duration and Frequency of Supply, 1999

Sl. No.	City/Town	Total quantity of water supplied (mld)	Quantity of water supplied by uses (mld)		Per-capita supply (lpcd)	Installed production capacity (mld)	% utilization of capacity	Daily supply through tankers ('000 ltrs.)	Average hours of supply per day	Number of times supplied per day
			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	Metropolitan Cities									
1	Ahmedabad M.Corp.	486	467	19.0	139	486	100	on demand	2	two times
2	Bangalore M.Corp.	706	606	99.4	141	724	97	Nil	above 12	alternate day
3	Bhopal M.Corp.	270	204	65.7	180	322	84	540	6	two times
4	Calcutta M.Corp.	1035	906	129.4	173	1090	95	700	10	n.a.
5	Chennai M.Corp.	461	418	43.0	106	461	100	Nil	2	once
6	Coimbatore M.Corp	105	103	2.3	108	232	45	Nil	2	once
7	Delhi M.Corp.	2620	2165	454.9	218	2620	100	12500	4	two times
8	Greater Mumbai M.Corp.	2978	2453	524.7	268	3277	91	Nil	4	once
9	Hyderabad M.Corp.	682	361	321.0	164	744	92	Nil	2	once
10	Indore M.Corp.	238	199	38.7	149	238	100	420	1	once
11	Jaipur M.Corp.	340	332	7.6	170	n.a.	n.a.	on demand	2	two times
12	Kanpur M.Corp.	310	225	85.0	124	350	89	Nil	5	two times
13	Kochi M.Corp.	84	59	25.2	124	190	44	Nil	4	once
14	Lucknow M.Corp.	410	349	61.5	164	455	90	Nil	6	three times
15	Ludhiana M.Corp.	234	200	34.1	117	234	100	Nil	12	three times
16	Madurai M.Corp.	90	67	23.0	88	110	82	Nil	2	once
17	Nagpur M.Corp.	370	211	158.8	176	416	89	100	3	once
18	Pune M.Corp.	650	520	130.0	283	725	90	Nil	8	two times
19	Surat M.Corp.	320	299	21.0	139	476	67	on demand	2	once
20	Vadodara M.Corp.	240	188	52.0	171	298	81	on demand	1	two times
21	Varanasi M.Corp.	220	198	22.0	191	360	61	Nil	8	two times
22	Visakhapatnam M.Corp.	168	68	100.0	131	185	91	500	1	once

Source: Respective urban local government/relevant agencies, NIUA Survey,1999.

Sl. No.	City/Town	Total quantity of water supplied (mld)	Quantity of water supplied by uses (mld)		Per-capita supply (lpcd)	Installed production capacity (mld)	% utilization of capacity	Daily supply through tankers ('000 ltrs.)	Average hours of supply per day	Number of times supplied per day
			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	CLASS I									
	Andhra Pradesh									
1	Anantapur MCl	14	11	2.8	56	14	100	1362	2	once
2	Chittoor M	16	16	0.3	106	20	79	64	2	once
3	Cuddapah MCl	17	15	2	101	n.a.	n.a.	90	5	two times
4	Eluru M	24	23	0.3	96	24	100	60	2	two times
5	Guntur MCl	75	66	9	135	75	100	1	1	once
6	Hindupur M	10	10	0.4	71	20	50	59	1	once
7	Kakinada M	21	21	0.7	66	n.a.	n.a.	60	5	two times
8	Kurnool MCl	7	5	2	23	7	100	1.600	2	once
9	Machilipatnam M	21	11	9	103	24	86	300	4	two times
10	Nandyal MCl	10	7	4	67	10	100	500	2	once
11	Nellore MCl	43	33	10	107	45	97	60	5	two times
12	Nizamabad M	15	11	4	53	28	55	3000	2	once
13	Ongole MCl	16	13	3	90	19	86	40	2	once
14	Qutubullapur M	30	13	17	118	n.a.	n.a.	1816	12	once
15	Rajahmundry M.Corp.	33	32	0.7	86	33	100	15	3	two times
16	Tenali M	0.7	0.7	n.a.	4*	2	43	Nil	4	two times
17	Tirupati MCl	29	23	5	136	29	100	180	1	once
18	Vijaywada M.Corp.	146	143	3	174	160	91	120	4	two times
19	Warangal M.Corp.	68	55	13	100	68	100	18	2	once
	Bihar									
20	Bihar Sharif M	30	Break-up not available		120	32	94	Nil	4	two times
21	Chhapra M	14	Break-up not available		70	18	78	Nil	4	two times
22	Gaya M.Corp.	36	Break-up not available		91	36	100	on demand	4	two times
23	Katihar M	15	Break-up not available		75	20	75	Nil	3	once
24	Munger M	10	Break-up not available		48	10	100	Nil	4	two times

Sl. No.	City/Town	Total quantity of water supplied (mld)	Quantity of water supplied by uses (mld)		Per-capita supply (lpcd)	Installed production capacity (mld)	% utilization of capacity	Daily supply through tankers ('000 ltrs.)	Average hours of supply per day	Number of times supplied per day
			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
25	Ranchi M.Corp.	91	55	36	130	169	54	Nil	4	two times
	Gujarat									
26	Anand M	11	10	1	63	17	65	on demand	4	two times
27	Bharuch M	18	17	1	113	22	82	1	8	two times
28	Bhavnagar M.Corp.	70	Break-up not available		127	72	97	400	1	once
29	Bhuj M	16	14	2	136	16	100	on demand	1	once
30	Jamnagar M.Corp.	85	Break-up not available		170	480	18	on demand	4	two times
31	Junagadh M	12	Break-up not available		75	12	100	Nil	8	once
32	Nadiad M	21	17	4	70	21	100	on demand	4	two times
33	Navsari M	16	15	1	117	n.a.	n.a.	on demand	3	two times
34	Porbandar M	10	8	2	70	n.a.	n.a.	85	1	once
35	Rajkot M.Corp.	107	96	11	107	n.a.	n.a.	15	30 min.	once
36	Surendranagar M	6	Break-up not available		37	20	27	Nil	1/2 hr. in 6 days	weekly
	Haryana									
37	Ambala MCI	16	14	2	115	30	54	Nil	above 12	three times
38	Faridabad M.Corp.	184	133	51	160	184	100	425	3	two times
39	Gurgaon MCI	19	16	2	106	19	100	on demand	3	two times
40	Hisar MCI	25	23	2	99	29	86	100	8	two times
41	Karnal MCI	40	34	6	182	40	100	Nil	12	three times
42	Rohtak MCI	32	31	0.8	132	39	82	Nil	10	two times
	Jammu & Kashmir									
43	Jammu M.Corp.	58	n.a.	n.a.	55	65	89	1	8	alternate day
	Karnataka									
44	Belgaum M.Corp.	36	21	15	77	36	100	Nil	3	once
45	Bellary CMC	31	25	6	103	31	100	Nil	2	once
46	Davangere MCI	32	20	11	69	32	100	on demand	above 12	once
47	Gadag-Betigeri CMC	16	Break-up not available		107	20	79	Nil	10	once

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
48	Gulbarga M.Corp.	32	24	7	70	61	52	Nil	8	once
49	Hubli-Dharwar M.Corp.	88	68	19	103	108	81	on demand	2	alternate day
50	Mandya M	13	11	2	92	14	95	Nil	2	once
51	Mangalore M.Corp.	85	56	29	207	91	93	on demand	6	once
52	Mysore M.Corp.	138	103	35	132	138	100	730	6	once
53	Shimoga CMC	34	32	1	152	34	100	Nil	2	once
54	Tumkur M	22	21	0.6	73	44	50	80	1	twice weekly
	Kerala									
55	Alappuzha MC	15	Break-up not available		75	18	83	Nil	4	once
56	Kollam MC	18	13	5	113	58	31	Nil	5	two times
57	Kozhikode M.Corp.	72	61	11	146	77	94	Nil	above 12	alternate day
58	Thalaserry M	27	20	7	201	27	100	Nil	12	once
59	Thiruvananthapuram M.Corp.	180	151	29	308	260	69	300	24	once
	Madhya Pradesh									
60	Bhind M	19	19	0.05	109	21	90	Nil	6	two times
61	Burhanpur M.Corp.	19	Break-up not available		90	19	100	Nil	1	two times
62	Dewas M.Corp.	9	Break-up not available		45	n.a.	n.a.	260	2	two times
63	Guna M	12	10	2	97	12	100	on demand	8	two times
64	Gwalior M.Corp.	150	124	25	166	159	94	on demand	4	once
65	Jabalpur M.Corp.	109	75	33	109	200	54	5000	2	two times
66	Khandwa M	16	Break-up not available		91	24	68	Nil	1	once
67	Morena M	8	7	1	68	8	100	40	3	two times
68	Murwara (Katni) M.Corp.	13	8	5	71	15	86	8.0	2	two times
69	Ratlam M.Corp.	18	18	0.4	78	27	67	Nil	1	once
70	Rewa M.Corp.	20	Break-up not available		111	27	74	30	3	two times
71	Satna M.Corp.	14	9	5	68	14	100	23	3	two times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
72	Shivpuri M	13	11	2	93	13	100	on demand	2	once
	Maharashtra									
73	Amravati M.Corp.	60	45	15	120	95	63	Nil	above 12	once
74	Aurangabad M.Corp.	168	130	38	194	168	100	2	1	once
75	Bhusawal MCl	22	Break-up not available		110	28	79	50	5	two times
76	Chandrapur MCl	30	29	0.6	102	52	58	300	2	two times
77	Dhule MCl	31	29	2	94	71	44	Nil	above 12	once
78	Ichalkaranji MCl	32	26	6	128	54	59	50	2	once
79	Jalgaon MCl	56	Break-up not available		140	56	100	Nil	1	once
80	Kolhapur M.Corp.	85	70	15	169	85	100	on demand	2	once
81	Nanded Waghala M.Corp.	39	35	4	95	98	40	250	3	two times
82	Nashik M.Corp.	158	136	22	188	158	100	255	5	two times
83	Parbhani MCl	15	15	0.01	64	22	69	1000	1	once
84	Solapur M.Corp.	125	111	14	139	216	58	3000	3	once
85	Wardha M	12	12	0	82	12	100	Nil	1	once
86	Yavatmal MCl	13	11	2	100	16	80	Nil	above 12	alternate day
	Orissa									
87	Bhubaneswar M.Corp.	150	97	53	229	259	58	250	6	two times
88	Cuttack M.Corp.	146	126	20	259	146	100	Nil	10	four times
89	Puri M	24	16	8	160	24	100	Nil	8	two times
90	Rourkela M	18	18	0.4	90	18	100	200	2	two times
91	Sambalpur M	19	15	4	118	19	100	Nil	6	two times
	Punjab									
92	Amritsar M.Corp.	127	89	38	151	180	71	Nil	10	three times
93	Bathinda MCl	17	13	4	98	17	100	Nil	6	two times
94	Hoshiarpur MCl	22	Break-up not available		150	22	100	Nil	12	three times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
95	Jalandhar M.Corp.	175	157	17	237	209	84	Nil	12	three times
96	Moga MCl	20	18	2	135	29	70	Nil	12	three times
97	Pathankot MCl	17	14	3	87	28	60	Nil	12	three times
98	Patiala M.Corp.	60	55	5	183	80	75	Nil	above 12	three times
	Rajasthan									
99	Ajmer MCl	52	Break-up not available		95	146	36	Nil	1	once
100	Alwar M	32	27	6	107	32	100	Nil	5	two times
101	Beawar M	11	10	1	80	23	49	Nil	1	alternate day
102	Bhilwara M	14	Break-up not available		62	32	44	72	2	twice weekly
103	Bikaner M	68	46	22	113	68	100	Nil	2	once
104	Jodhpur M.Corp.	176	Break-up not available		176	316	56	Nil	3	once
105	Kota M.Corp.	160	120	40	213	166	97	Nil	12	once
106	Sriganganagar M	22	20	2	98	32	69	on demand	8	three times
	Tamil Nadu									
107	Cuddalore M	4	4	0.3	26	5	86	Nil	2	once
108	Dindigul M	12	11	1	56	12	100	Nil	1	once
109	Erode M	22	17	5	127	30	74	Nil	3	twice
110	Kanchipuram M	16	14	3	104	22	76	0	2	once
111	Kumbakonam M	11	9	2	72	11	95	Nil	3	twice
112	Nagercoil M	9	8	1	44	11	86	Nil	8	alternate day
113	Rajapalayam M	9	8	0.5	71	43	20	30	2	alternate day
114	Salem M.Corp.	50	45	5	112	53	95	150	1	once
115	Thanjavur M	24	Break-up not available		111	25	97	on demand	3	once
116	Tiruchirapalli M.Corp.	88	79	9	110	88	100	0	30 min.	twice
117	Tirunelveli M.Corp.	34	32	2	82	34	100	Nil	3	once
118	Tirunvannamalai M	14	Break-up not available		105	18	75	Nil	2	once
119	Tiruppur M	29	Break-up not available		97	49	58	1	2	alternate day

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
120	Tuticorin M	16	Break-up not available		74	18	89	Nil	2	once
121	Vellore M	13	10	3	74	21	62	Nil	3	alternate day
	Uttar Pradesh									
122	Agra M.Corp.	250	201	49	217	376	66	16	8	two times
123	Aligarh M.Corp.	47	35	12	78	48	97	39	6	three times
124	Allahabad M.Corp.	210	181	29	207	230	91	on demand	9	three times
125	Bareilly M.Corp.	80	72	8	107	110	73	Nil	8	two times
126	Etawah MB	20	18	1	139	24	81	on demand	10	two times
127	Faizabad MB	22	Break-up not available		127	29	74	on demand	6	three times
128	Firozabad MB	12	Break-up not available		48	15	80	Nil	4	two times
129	Ghaziabad M.Corp.	110	Break-up not available		124	120	92	100	6	two times
130	Gorakhpur M.Corp.	74	58	16	123	82	90	on demand	6	three times
131	Haldwani-cum-Kathgodam MB	19	17	2	132	20	95	60	5	two times
132	Hapur MB	14	Break-up not available		70	14	100	6	4	four times
133	Hardwar MB	39	33	6	130	65	60	Nil	above 12	once
134	Jhansi MB	77	76	1	152	70	110	150	2	two times
135	Mathura MB	27	Break-up not available		67	33	80	60	3	two times
136	Meerut M.Corp.	132	Break-up not available		106	150	88	10	above 12	three times
137	Mirzapur MB	25	24	0.5	119	28	89	Nil	5	two times
138	Moradabad M.Corp.	48	Break-up not available		72	55	87	Nil	8	two times
139	Muzaffarnagar MB	46	36	10	142	48	96	Nil	8	two times
140	Rae Bareli MB	13	11	2	74	15	90	Nil	6	two times
141	Rampur MB	20	Break-up not available		62	20	99	Nil	12	two times
142	Saharanpur MB	49	36	13	91	50	98	10	9	n.a.
143	Sitapur MB	17	Break-up not available		114	22	78	on demand	6	three times
144	Unnao MB	21	21	n.a.	174	24	88	on demand	6	two times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	West Bengal									
145	Asansol M.Corp.	52	50	2	166	54	96	94	12	two times
146	Baharampur M	15	15	0	104	33	46	Nil	8	n.a.
147	Balurghat M	0.9	0.9	0	7*	1	72	26	6	three times
148	Bankura M	11	6	5	72	19	58	17	above 12	two times
149	Barasat M	12	12	0.1	82	16	75	1	6	three times
150	Burdwan M	24	21	2	73	24	96	1	7	three times
151	Halisahar M	20	16	4	134	24	83	10	6	once
152	Krishnagar M	6	6	0	41	9	63	Nil	6	once
153	Midnapore M	15	11	4	95	18	83	1	6	two times
154	North Barrackpore M	13	13	0.9	117	14	100	Nil	8	three times
155	Santipur M	0.9	0.9	0	7*	0.9	100	2	6	three times
156	Silliguri M.Corp.	18	18	0	36	18	100	Nil	5	two times
	Small States									
	Assam									
157	Guwahati M.Corp.	55	Break-up not available		55	80	69	200	3	two times
158	Jorhat MB	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Manipur									
159	Imphal MCl	58	Break-up not available		238	74	79	288	2	once
	Meghalaya									
160	Shillong MB	27	24	3	123	55	48	50	3	two times
	Mizoram									
161	Aizwal NM	11	11	0	44	12	91	Nil	7	once

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	Tripura									
162	Agartala MCI	22	15	7	109	n.a.	n.a.	60	4	two times
	Union Territories									
163	Chandigarh M.Corp.	227	121	106	267	295	77	200	9	two times
164	Pondicherry M	33	29	5	115	33	100	Nil	6	two times

** reasons for low lpcd : a) low coverage of population by water supply, b) public water supply agency has been able to provide only a small number of households with domestic connection, c) dependence of most households on stand posts and private sources of supply*

Source: Respective urban local governments/relevant agencies, NIUA Survey,1999.

Sl. No.	City/Town	Total quantity of water supplied (mld)	Quantity of water supplied by uses (mld)		Per-capita supply (lpcd)	Installed production capacity (mld)	% utilization of capacity	Daily supply through tankers ('000 ltrs.)	Average hours of supply per day	Number of times supplied per day
			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	CLASS II									
	Andhra Pradesh									
1	Anakapalle M	4	2	1	32	4	100	Nil	3	two times
2	Dharmavaram M	8	7	1	79	8	100	60	4	once
3	Gudur MCl	7	7	0.5	99	8	88	360	4	two times
4	Kapra M	5	5	0	38	7	63	500	1	once
5	Kavali MCl	5	5	0	58	n.a.	n.a.	Nil	2	two times
6	Madanapalle M	8	7	0.2	77	9	87	68	above 12	once
7	Narasaraopet M	5	Break-up not available		47	5	100	38	4	two times
8	Rajendra nagar MCl	5	3	2	42	6	91	200	3	two times
9	Sangareddy MCl	4	3	0.4	64	4	100	10	2	once
10	Srikakulam MCl	7	7	0.2	68	7	100	0	3	two times
11	Srikalahasti M	7	7	0.2	97	10	71	23	2	once
12	Suryapet MCl	8	6	2	85	8	100	Nil	2	once
	Bihar									
13	Buxar M	4	4	0	58	8	49	Nil	10	two times
14	Deogha r M	3	Break-up not available		30	3	100	Nil	2	once
15	Hajipur M	11	Break-up not available		96	14	79	Nil	8	three times
16	Hazaribagh M	7	Break-up not available		61	82	9	Nil	4	two times
17	Jehanabad M	8	Break-up not available		140	n.a.	n.a.	Nil	6	two times
18	Madhubani M	8	Break-up not available		123	12	67	Nil	4	two times
19	Mokama M	2	Break-up not available		30	2	100	Nil	above 12	three times
	Gujarat									
20	Amreli M	n.a.	n.a.	n.a.	118	10	100	Nil	1 hr. in 3 days	twice a week
21	Ankleswar M	10	Break-up not available		167	10	100	50	above 12	once
22	Dabhoi M	9	Break-up not available		138	9	100	on demand	2	two times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
23	Dohad M	7	7	0.6	96	10	75	on demand	1	once
24	Gondal M	13	11	2	130	7	182	Nil	20 min. in 4 days	once in 4 days
25	Jetpur M	11	Break-up not available		91	n.a.	n.a.	on demand	20 min.	once
26	Mahesana M	15	Break-up not available		107	n.a.	n.a.	on demand	2	two times
27	Palanpur M	4	Break-up not available		34	n.a.	n.a.	on demand	2	two times
	Haryana									
28	Jind MCI	16	15	0.9	138	16	100	Nil	12	two times
29	Kaithal MCI	11	10	0.7	114	17	63	Nil	8	two times
30	Rewari MCI	11	11	0	108	11	100	50	1	two times
31	Thanesar MCI	13	12	0.9	132	13	100	Nil	above 12	three times
	Karnataka									
32	Bagalkot CMC	12	11	1	122	14	90	Nil	above 12	alternate day
33	Chikmaglur CMC	15	13	3	150	15	100	on demand	2	once
34	Gokak CMC	5	4	0.7	67	5	83	Nil	12	once
35	Hospet CMC	16	12	4	140	16	100	Nil	2	once
36	Kolar CMC	8	7	1	71	9	89	on demand	1	once
37	Rabkavi-Banhatti CMC	5	3	1	63	5	100	Nil	1	alternate day
38	Ramanagaram CMC	5	Break-up not available		64	n.a.	n.a.	Nil	1	once
	Kerala									
39	Changanessary MC	4	3	1	65	6	67	Nil	4	once
40	Payyanur M	1.5	1.5	0.01	21	2	100	Nil	6	two times
41	Taliparamba M	0.4	Break-up not available		7*	0.5	80	Nil	6	two times
42	Thrissur MC	18	12	6	198	51	36	Nil	5	once
	Madhya Pradesh									
43	Hoshangabad M	8	5	4	81	8	100	450	2	two times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
44	Itarsi M	6	4	1	56	6	100	Nil	1	once
45	Khargone M	13	Break-up not available		163	11	122	420	2	two times
46	Mandsaur M	9	9	0.4	73	14	66	Nil	1	once
47	Nagda M	3	Break-up not available		30	3	100	Nil	5	two times
48	Neemuch M	6	Break-up not available		59	7	87	on demand	3	once
49	Sehore M	5	5	0.3	53	12	44	300	1	once
50	Shahdol M	5	Break-up not available		62	7	64	10	2	once
51	Vidisha M	9	9	0.1	72	9	100	Nil	1	two times
	Maharashtra									
52	Amalner MCl	15	Break-up not available		150	16	94	Nil	1	once
53	Ballarpur MCl	7	7	0.4	64	8	92	Nil	3	two times
54	Bhandara M	9	7	2	118	9	100	Nil	4	two times
55	Kamptee MCl	4	3	0.5	38	N. App.	N. App.	Nil	1	once
56	Manmad MCl	7	7	0.5	83	16	46	500	above 12	once
57	Ratnagiri MCl	8	8	0.2	114	17	48	20	1	once
58	Satara MCl	11	9	2	110	12	92	Nil	2	once
59	Virar MCl	9	8	0.8	90	21	43	Nil	2	once
	Orissa									
60	Balangir M	7	2	5	87	18	40	Nil	11	once
61	Bhadrak M	3	1.5	2	32	4	75	on demand	3	three times
	Punjab									
62	Firozpur MCl	20	15	4	210	21	92	Nil	10	three times
63	Kapurthala M	14	13	1	165	18	76	Nil	above 12	once
64	Mansa MCl	8	8	0	119	11	70	Nil	10	two times
65	Phagwara MCl	15	12	3	136	19	80	Nil	12	three times
66	Sangrur MCl	13	12	0.4	181	14	91	Nil	above 12	three times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	Rajasthan									
67	Banswara M	10	Break-up not available		89	10	100	Nil	3	two times
68	Barmer M	7	6	0.03	77	7	100	200	1	twice weekly
69	Bundi M	8	6	2	100	9	89	Nil	2	once
70	Churu M	8	5	2	77	8	95	Nil	above 12	two times
71	Hanumangarh M	7	6	1	58	8	90	Nil	4	two times
72	Sawai Madhopur M	8	7	1	87	8	100	Nil	5	two times
	Tamil Nadu									
73	Ambur M	6	Break-up not available		65	8	75	720	2	once
74	Arakkonam M	4	Break-up not available		45	5	80	Nil	2	once
75	Attur M	3	2	0.6	47	5	60	Nil	1	twice weekly
76	Cumbum M	3	3	0.07	50	n.a.	n.a.	Nil	2	once
77	Dharmapuri M	3	3	0.1	45	3	100	Nil	3	once
78	Guduivattam M	6	Break-up not available		61	8	73	Nil	2	twice weekly
79	Nagapattinam M	8	6	1	70	10	81	Nil	3	once
80	Pudukkottai M	8	8	0.3	73	8	100	Nil	1	once
81	Sivakasi M	5	Break-up not available		74	7	79	Nil	3	alternate day
82	Srivilliputtur M	4	3	0.08	47	4	79	Nil	10	alternate day
83	Tindivanam MC	2	2	0.2	27	1	131	Nil	1	once
84	Udhagamandalam M	4	Break-up not available		40	4	92	400	3	alternate day
	Uttar Pradesh									
85	Auraiya MB	5	4	0.2	50	6	75	on demand	3	three times
86	Balrampur MB	3	Break-up not available		40	4	70	on demand	5	two times
87	Basti MB	10	Break-up not available		91	12	83	on demand	6	two times
88	Bhadohi MB	4	4	0	32	4	100	100	6	three times
89	Chandpur MB	3	3	0.2	41	5	60	Nil	10	n.a.
90	Etah MB	4	4	0	30	4	98	Nil	4	four times

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			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
91	Ghazipur MB	16	14	2	167	16	100	Nil	12	three times
92	Gonda MB	9	Break-up not available		79	9	100	Nil	4	two times
93	Lakhimpur MB	13	Break-up not available		125	19	67	on demand	8	two times
94	Lalitpur MB	9	8	0.09	85	16	53	200	4	two times
95	Mughalsarai MB	4	4	0.3	25	5	89	Nil	11	three times
96	Nawabganj-Barabanki MB	9	Break-up not available		101	12	76	Nil	11	three times
97	Orai MB	8	8	0.3	48	13	64	Nil	9	two times
98	Roorkee MB	19	Break-up not available		188	20	94	Nil	8	three times
	West Bengal									
99	Bishnupur M	3	3	0.07	39	4	64	Nil	2	two times
100	Chakdaha M	2	2	0	21	4	54	42	6	three times
101	Contai M	2	2	0	14	2	64	4	2	two times
102	Cooch Behar M	10	7	3	99	10	100	20	7	three times
103	Darjeeling M	6	4	2	65	11	55	Nil	1	two times
104	Jalpaiguri M	5	4	1.0	49	6	81	20	6	two times
105	Jangipur M	3	3	0.4	38	4	75	2	6	three times
106	Katwa M	2	1.5	0	22	2	100	2	3	three times
107	Raniganj M	5	4	1	42	7	75	40	2	two times
	Small States									
	Himachal Pradesh									
108	Shimla M.Corp.	3	2	0.9	252	33	85	65	above 12	once
	Nagaland									
109	Kohima TC	28	20	8	28	3	100	Nil	3	once
	Union Teritories									
110	Port Balir MCl	15	14	0.9	140	21	69	136	1	once

Sl. No.	City/Town	Total quantity of water supplied (mld)	Quantity of water supplied by uses (mld)		Per-capita supply (lpcd)	Installed production capacity (mld)	% utilization of capacity	Daily supply through tankers ('000 ltrs.)	Average hours of supply per day	Number of times supplied per day
			Domestic	Non-domestic						
	1	2	3	4	6	7	8	9	10	11
	Others (Smaller than Class II towns)									
	Small States									
	Arunachal Pradesh									
111	Itanagar CT	6	5	0.7	164	6	100	50	2	two times
	Goa									
112	Panaji MCI	12	5	6	206	72	16	420	4	once
	Union Territories									
113	Daman MCI	8	Break-up not available		229	16	50	60	5	two times
114	Kavarathi NMCT	0.04	0.04	0	3*	0.1	31	0	1	two times
115	Silvassa	1	1.3	0.1	71	1	100	Nil	2	two times

** reasons for low lpcd : a) low coverage of population by water supply, b) public water supply agency has been able to provide only a small number of households with domestic connection, c) dependence of most households on stand posts and private sources of supply*

Source: Respective urban local governments/relevant agencies, NIUA Survey, 1999

A-3

WATER SUPPLIED, ESTIMATED DEMAND AND SUPPLY DEFICIT USING CPHEEO NORM AND CITY NORM, 1999

A-3 : Water Supplied, Estimated Demand and Supply Deficit using CPHEEO Norm and City Norm 1999

Sl. No.	City/Town	S/US	Population ('000) 1999	Water supplied		CPHEEO norm (lpcd)	Norm adopted by city (lpcd)	Demand for water(mld)		Supply Deficit(mld)	
				mld	lpcd			CPHEEO norm	City norm	CPHEEO norm	City norm
	1	2	3	4	5	6	7	8	9	10	11
	Metropolitan Cities										
1	Ahmedabad M.Corp.	S	3500	486	139	150	170	525	595	39	109.0
2	Bangalore M.Corp.	S	5000	706	141	150	140	750	700	45	0
3	Bhopal M.Corp.	S	1500	270	180	150	150	225	225	0	0
4	Calcutta M.Corp.	S	6000	1035	173	150	227	900	1362	0	327
5	Chennai M.Corp.	S	4363	461	106	150	110	654	480	193	19
6	Coimbatore M.Corp	S	971	105	108	150	150	146	146	41	41
7	Delhi M.Corp.	S	12000	2620	218	150	225	1800	2700	0	80
8	Greater Mumbai M.Corp.	S	11100	2978	268	150	240	1665	2664	0	0
9	Hyderabad M.Corp.	S	4163	682	164	150	160	624	666	0	0
10	Indore M.Corp.	S	1600	238	149	150	200	240	320	2	82
11	Jaipur M.Corp.	S	2000	340	170	150	180	300	360	0	20
12	Kanpur M.Corp.	S	2500	310	124	150	200	375	500	65	190
13	Kochi M.Corp.	S	680	84	124	150	150	102	102	18	18
14	Lucknow M.Corp.	S	2500	410	164	150	250	375	625	0	215
15	Ludhiana M.Corp.	S	2000	234	117	150	200	300	400	66	166
16	Madurai M.Corp.	S	1020	90	88	150	110	153	112	63	22
17	Nagpur M.Corp.	S	2100	370	176	150	175	315	368	0	0
18	Pune M.Corp.	S	2300	650	283	150	160	345	368	0	0
19	Surat M.Corp.	S	2300	320	139	150	140	345	322	25	2
20	Vadodara M.Corp.	S	1400	240	171	150	180	210	252	0	12
21	Varanasi M.Corp.	S	1152	220	191	150	270	173	311	0	91
22	Visakhapatnam M.Corp.	S	1280	168	131	150	65	192	83	24	0

S = having sewerage system US = not having sewerage system

Source: Respective urban local governments/relevant agencies, NIUA Survey, 1999

Sl. No.	City/Town	S/US	Population ('000) 1999	Water supplied		CPHEEO norm (lpcd)	Norm adopted by city (lpcd)	Demand for water(mld)		Supply Deficit(mld)	
				mld	lpcd			CPHEEO norm	City norm	CPHEEO norm	City norm
	1	2	3	4	5	6	7	8	9	10	11
	CLASS I										
	Andhra Pradesh										
1	Anantapur MCl	US	250	14	56	70	100	18	25	3	11
2	Chittoor M	US	149	16	106	70	135	10	20	0	4
3	Cuddapah MCl	US	166	17	101	70	140	12	23	0	6
4	Eluru M	S	247	24	96	135	135	33	33	10	10
5	Guntur MCl	S	557	75	135	135	140	75	78	0.27	3
6	Hindupur M	US	140	10	71	70	135	10	19	0	9
7	Kakinada M	US	325	21	66	70	135	23	44	1.4	23
8	Kurnool MCl	US	282	7	23	70	100	20	28	13	22
9	Machilipatnam M	US	200	21	103	70	135	14	27	0	7
10	Nandyal MCl	US	150	10	67	70	140	11	21	0.50	11
11	Nellore MCl	US	404	43	107	70	150	28	61	0	17
12	Nizamabad M	US	285	15	53	70	100	20	29	5	14
13	Ongole MCl	US	180	16	90	70	110	13	20	0	4
14	Qutubullapur M	US	250	30	118	70	180	18	45	0	15
15	Rajahmundry M.Corp.	US	380	33	86	70	140	27	53	0	21
16	Tenali M	US	170	0.68	4	70	79	12	13	11	13
17	Tirupati MCl	US	210	29	136	70	100	15	21	0	0
18	Vijaywada M.Corp.	S	837	146	174	135	135	113	113	0	0
19	Warangal M.Corp.	US	680	68	100	70	140	48	95	0	27
	Bihar										
20	Bihar Sharif M	US	250	30	120	70	175	18	44	0	14
21	Chhapra M	US	200	14	70	70	175	14	35	0	21
22	Gaya M.Corp.	US	400	36	91	70	180	28	72	0	36
23	Katihar M	US	200	15	75	70	150	14	30	0	15
24	Munger M	US	210	10	48	70	125	15	26	5	16