9. MUNICIPAL SERVICES

9.1 INTRODUCTION

In Kanpur, steep growth (35 percent) in population from 1991-2001 has put tremendous pressure on urban infrastructure such as water supply, sewerage, solid waste etc. The primary responsibility of providing water supply and sanitation rests with state government and more specifically with municipal government. Kanpur Jal Sansthan (KJS) deals with water supply and sewerage system while Kanpur Nagar Nigam deals with social infrastructure such as Education, Health and Medical services. This chapter deals with present status, gaps and future requirement for basic civic services and focuses on strategies and investment required by different agencies to meet the gap.

9.2 KANPUR WATER SUPPLY SYSTEM

Kanpur is the biggest and most important industrial city of Uttar Pradesh (India). It is situated on the right bank of river Ganga and relatively flat alluvial plain. It is biggest water supply system of Uttar Pradesh. The capital works are carried out by U.P. Jal Nigam (UPJN) whereas the operation and maintenance is carried out by Kanpur Jal Sansthan (KJS).

9.2.1 Kanpur Jal Sansthan

In 1975, Kanpur Jal Sansthan (KJS) was constituted as a specialized body under the U.P. Water Supply & Sewerage Act and entrusted with the work of operation and maintenance of water supply and sewerage system. Prior to the creation of KJS, Water supply and sewerage services were looked after by Municipal Corporation.

The working of Jal Sansthan is de-centralised. The entire city has been divided into four service districts namely city service, west service, south service and east service district for the management of water supply system. There are 6 Zones to manage the water supply. Each zone is headed by an Executive Engineer who vested with drawing and disbursing power, is responsible for Water Supply and Sewerage and also for revenue collection.

9.2.2 Salient Features of Kanpur Water Supply

The piped water supply of Kanpur City was started in 1892. The Kanpur water works which is more than a hundred year old serves the city service district and part of south service district. Water works was established with a designed capacity of 4 million gall1ons per day to serve about 2 lakh population. It was started with three Settling Tanks, five Slow Sand Filters, two Clear Water Reservoirs (1.14 million gallons each) with steam operated filtered water pumping plants at Benajhabar. Distribution system was served by two balancing tanks of 3 lakh gallons capacity each. The source of intake was river Ganga and the Ganga water was pumped from Bhaironghat Raw Water Pumping Station which was about two kilometers away from

Benajhabar Treatment Works.

River Ganga started receding towards Unnao due to which raw water supply started reducing. To meet the water demand, Kutcha Nala (5.4 Km.) was constructed from lower Ganga canal as raw water channel in 1920. Electrification of Kanpur Water Works was done in 1927. Major re-organisation works were carried out in 1937-42, 1951-56, 1977-81 and 1986-97.

After construction of Ganga Barrage, a permanent and reliable source for the water supply is available to provide 1600 mld raw water. This is sufficient to cater the needs of the town upto 2031.

9.2.3 Water Purifications Measures

Conventional methods of water purification, viz, coagulation, filtration and, disinfection are used to treat surface water from the river Ganga and Lower Ganga Canal. In coagulation, raw water is treated with Alumina Ferric so that the colloidal impurities are precipitated, settled down and finally drained out in the form of sludge. There are 16 Slow Sand and 30 Rapid Gravity Filters in KJS.

Rate of filtration in slow sand filters is comparatively very low. In the beginning, it was 9-11 litres per square foot per hour, which has gradually decreased with the increase in head loss. After attaining a head loss of normally 36 inches, the filter is closed. Periodical recouping of sand is done. These filters are not functioning due to need for rehabilitation.

In Rapid Gravity Filters, filtration rate is much higher as compared to slow sand filters. Conventionally, 400-550 litres per square foot per hour rate are met. However, two conventional Rapid Gravity Filters have been converted into bituminous coal-sand dual media filter in which the rate of filtration was four times of the conventional rate. After filtration process, water becomes apparently very clear but it may contain pathogenic impurities. To remove these impurities, chlorine is used

9.2.4 Current Scenario

9.2.4.1 Source of Supply

The main source of surface water in the city is from the catchment of following:

- Ganga River
- Pandu River

The water flow in the Ganga varies between a mean minimum of 72.6 m^3/s and a mean maximum of 8.860 m^3/s. After tapping water from upper and lower Ganga canals, minimum water flow of 6m^3/s is maintained in the river Ganga near Kanpur. The quality of water intake point has been satisfactory between the year 1997 and 2001 with DO ranging from 7.5 mg/l to 9.1 mg/l. In 2006, quality of water intake point is DO ranging from 4.5 mg/l to 7.0 mg/l

9.2.4.2 *Service Coverage*

The total water supply requirement is 600 mld but only 385 mld of potable water is being supplied. The total supply from treatment plants is about 255 mld water (210 mld raw water from Bhaironghat pumping station and 45 mld from Lower Ganga Canal) and approximately 130 mld water is drawn from groundwater comprising of 80 mld from tube wells (about 135) and 50 mld from hand pumps (about 9830), thereby making a total present water supply of 385 mld. In addition, there are large number of private bore wells in residential and industrial areas which are unaccounted.

The present status of water supply source and capacity of KJS is given in table 9.1.

Table 9.1 Source and Supply of Water

1. Source of Raw Water	Installed Capacity (mld)	Actual Supply in mld.	Remarks
Ganga Channel at Bhaironghat	310	210	Contaminated; needs treatment.
Lower Ganga canal	130	45	Contaminated; needs treatment.
2. Other Sources			
Tube-wells – 135	110	80	Good for use
Hand pumps – 9830	50	50	Good for use
Total	**600 mld.**	**385 mld.**	

Source: Data collected from U.P. Jal Nigam

9.2.4.3 *House connections*

As mentioned earlier, there are 2.84 lakh assesses and 4.2 lakh properties in Kanpur city. However, the coverage of KJS is only 1.8 lakh connections. This is woefully inadequate, specially considering that the distribution network covers 80% of the city area. The total metered residential connections are 1,77,009 whereas un-metered residential/commercial/ industrial connections are 1500.

9.2.4.4 *Existing Distribution and Storage Capacities*

The supply of surface water from different intakes is being treated at the Benajhabar Treatment Works from where it is supplied to 28 zonal pumping stations. From these Zonal Pumping Stations water is further distributed to the different localities of the town. Benajhabar facility has been augmented by two new intake units. Ganga Barrage, main unit was commissioned in 2005. Thus there is an installed treatment capacity/ storage capacity (OHT) of 540 mld of surface water, besides the tube wells and hand pumps. However, against installed capacity of 540 mld, presently only 255 mld of water is treated and supplied.

Table 9.2 Treatment Capacity

Location	Installed capacity	Running capacity
Benajhaber	310 mld.	210 mld.
Gujaini (established in 2005) Ganga Barrage (established in 2005)	30 mld. 200 mld.	20 mld. 25 mld.
Total	**540 mld.**	**255 mld.**

Source: Data collected from U.P. Jal Nigam

The water treatment plant at Barrage unit is presently operated and maintained by U.P. Jal Nigam. Its capacity utilization will increase when more households and industries falling within its supply zone will take connections.

At the site of Barrage, 1600 mld raw water is available whereas present installed capacity is 200 mld of water treatment. For the next five years, this provides sufficient intake and treatment capacity. Keeping the potential for increasing the capacity up to 1600 mld, another 7 units of 200 mld can be added.

9.2.4.5 *Service Levels (Unaccounted – for – water (UFW)*

The supply per capita is 92 litres per capita per day (lpcd) with an estimated current population of 27 lakhs. This is less than the prescribed per capita consumption of 150 lpcd.

The leakage (UFW - unaccounted-for water) from Benajhaber works is estimated to be 30 percent due to old and leaky pipelines. The most significant drawback of Kanpur water supply is the huge amount of water wastage and negligible revenue collection from public utilities (for example parks and fire fighting etc.) and stand posts which takes away about 10 percent of water.

Table 9.3 Future Requirement and strategies

Year	2006	2016	2031
Estimated Population in Lakhs	27.00	34.00	50.00
Demand for Water Supply mld	464	585	860

9.2.5 Stakeholder's Consultations

Our discussions with stakeholders reveal that the water supply in inner core area may be much less than the 92 lpcd, as the pipes there are leaky and often supply contaminated water. It is not unusual to find water supply in these areas being augmented by local community based tubewells or hand pumps. Many MLA and corporators have spent their discretionary funds to set up such localized schemes.

Secondly there is unequal distribution of available water in the city. The assessment of consumers as assessed by KNN and KJS is 2.84 Lakhs of which only 1.8 lakhs are currently connected. Water meters are either not installed or not working. Hence the total water supply cannot be measured at user's point.

Thirdly, the water pressure is not maintained adequately all over the city. This is both because of old and leaky pipes and due to ad hoc style of working in giving connections from water main lines without first checking feasibility and availability of water.

The existing three water treatment plant locations are not inter-connected and as such, there is disparity in supply/demand position in various localities.

The clear water reservoirs at Benajhaber have storage capacity of 35 ml (million litres) and this water is pumped to 28 zonal pumping stations spread all over the city. The water supply is provided for 4 to 5 hours per day, which is not adequate as compared to the requirement of water supply round the clock.

The citizens also complain of unreliability of supply hours, which often become erratic because of erratic water supply. This forces consumers to depend on their own sources of water i.e. tube wells or hand pumps. The tube wells and Hand pumps also cater to those areas, which are not covered by water distribution lines from water works.

9.2.6 Key issues

- The service level in the city is around 90 lpcd. The water supply indicators suggest that the service level is well below the minimum prescribed norm of 172 lpcd (150 +15% waste). This is so, even though there is sufficient intake and treatment capacity in the city.

- The water supply system in inner core area is very old. This has resulted in water scarcity in core areas such as Chamanganj, Baeongamjek etc. from where KJS is facing complaints quite often. It is estimated that 30 percent of water is lost in the distribution due to old system. This needs to be rehabilitated in inner core areas.

- There are frequent complaints of consumers getting dirty water and contaminated water. As a result many do not consider this water safe for drinking.

- The gross per capita supply is 135 lpcd; however equitable distribution is an issue to be examined and corrective measures need to be taken to rectify the situation.

- If the installed capacity of 540 mld is fully utilized, the supply from water works alone could give service level of 199 lpcd, which is well

above the minimum prescribed level.

- It is observed that the supply is limited to 5 hours per day due to in-adequate storage and pressure.

- In earlier years, there used to shortage of water at intake at Bhaironghat and dredging was carried out to bring flow of Ganges towards city. Now with the construction of Barrage, the priorities have changed and to maintain water level at Barrage, down flow of river gets reduced, thereby all pumps do not work at Bhaironghat.

- The shortage of water at Bha ironghat will reduce the water supply at Behajhaber water works, which needs to be supplemented from Lower Ganges Canal, which can supply up to 130 mld.

- In order to get better quality raw water, pipe line of proper size is suggested to be laid for drawing water from lower Ganga Canal at Armapore estate. Bejahaber water works will keep on functioning if proper provisions are made to draw raw water from both Bhaironghat pumping station as well as lower Ganga Canal. Laying raw water pipe will also stop pollution of raw water, which flows in open canal through city area, wherein rubbish is thrown in the incoming water stream.

9.2.7 Strategy F or Improving Water Supply

9.2.7.1 *Intake and treatment*

- Additional units of 200 mld may need to constructed and commissioned with enhancement in water supply to meet the demand after 2016.

- The 200 mld treatment plant at Ganga Barrage is under utilised to the extent of 175 mld. On the other hand the core area of Kanpur inner city is experiencing shortage of water. To meet this shortage, water mains need to be laid from Barrage site to Benajhaber. An estimate for laying the conduit pipe line with a pumping station at Armapore estate needs to be drawn.

9.2.7.2 *Transmission and distribution*

- The three water treatment units should be connected, so that shortage in one system can be made up from surplus of the other system. Such a plan for interconnection has been prepared.

- The old and leaky pipes, especially in the old inner city which have outlived their useful life need to be replaced. This will improve pressure, reduce losses and hence reduce pumping costs and most importantly reduce contamination

- The reliability of water supply needs to be improved by either arranging direct electricity connections to the zonal pumping stations or by providing standby diesel generating sets.

- There is a need for KJS to improve its image by being more responsive to complaints and by setting up an efficient grievance handling cell. Such image makeover will help it in getting more consumers to opt for water connections.
- KJS should experiment with introduction of metering of water. With the availability of new smart meters, their reliability and life has gone up many fold, and they provide a viable method of metering even where the supply is intermittent. Other cities like Hyderabad, Bangalore etc. have switched to metering
- Since billing by metering differentiates between a heavy and lighter user, experience in other cities have shown that it encourages poor and slum dwellers to take to piped water supply, thereby improving both the basic services to the poor as also improving the viability of the service provider.

9.2.7.3 *Improving viability of KJS*

- One of the problems of KJS is overstaffing. It has more staff than other comparable cities like Allahabad etc. As the system has inertia, drastic changes are not possible due to resistance from staff and unions. Private participation can be experimented by giving O & M for certain zones initially and then if found successful, it could be extended to the entire area.
- KJS has an advantage of possessing prime land in the heart of city. The existing slow sand filters are out of use and it is not economically viable to renovate and rejuvenate them. As such, this land can be better utilised in view of the fact that no further treatment plants are likely to be constructed in Benajhaber area. KJS can have a good source of by leveraging this land or could even use it as an incentive for P-P-P.

9.3 SEWERAGE SYSTEM OF KANPUR CITY

Sewerage network was laid in the year 1904 by providing the facility in a limited area. In 1920, it was extended to cover more areas by providing trunk, main and branch sewers. In 1952, Kanpur development Board implemented complete reorganization of sewerage system for a population of 9.5 lakh which was designed to carry sewer at the rate of 180 lpcd.

At present, total length of main and trunk sewers is 74 kms whereas branch sewer lines are 875 kms. Only 60 percent of town is covered with sewerage system. The sewerage system is being administered under five different zones. There are total 13 sewage pumping stations and 30,000 manholes. Sewer lines are presently cleaned by sewer jetting machines, sewer clearing machines and also manually as per requirement. Total numbers of regular employees are 517 whereas 178 are on daily wages basis.

The central zone of Kanpur city has the oldest brick sewers. Brick sewers, being quite old, have lived out and are in worn out state. They have also

become under size due to increase in population. In densely populated area, it has become too difficult to repair these lines. Such areas are chamanganj, Beconganj, Talak Mahal, Pech Bagh, Rizvi Road, Fahimabad, Cooli Bazar, Dhankutti, Ram Narayan Bazar, Moti Mahal, Gadariyan Purwa, Circular Road, Sisamau, Nawabganj, Khalasi Line, Kalyanpur etc.

Beside South of Kanpur Town, other newly developed areas such as Kalyanpur, Indra Nagar, Vikas Nagar are also facing sewer problems. In these areas, the system is not up to the mark and proper arrangements for out fall are not there.

9.3.1 Source of Sewerage

The source of sewer is mostly from domestic households but the waste generated from industries also flow into sewers. The present arrangements segregate industrial effluents from domestic sewerage for sewerage treatment plants. The industrial units in Panki and Dada Nagar industrial area also discharge industrial effluents, which finally flows in River Pandu through three Nalas, flowing north to South in South of Kanpur city. In Jajmau area, cluster of tanneries are discharging effluents, which has been tapped for treatment under Ganga Action Plan Phase-I. Except for primary treatment plants, which the industries in the Jajmau areas claim to have installed, the sewage flowing in three Nalas (Ganda Nala, Halwa Khanda Nala and COD Nala) gets discharged in Pandu River without any treatment, whatsoever.

Average BOD load in domestic sewerage has increased manifold from 1993 to 2006. This is due to growth in population density and adoption of more and more chemicals/ detergents due to a changed life style.

9.3.2 Sewerage Generation

In 1997, total amount of waste water measured in drains and at the STPs was about 360 mld of which 160 mld was intercepted under GAP-1. At present inflow of treatment plants is 63 mld and only 17 percent of the total waste water generated.

The major zone i.e. City Drainage District with its underground sewerage system covers around 15 lakh population and generates 260 mld of waste water with its outfall into river Ganga at Jajmau. In the 'South Drainage District' only some pockets are covered under the sewerage system and rest is disposed into open drains. The industrial effluent from Panki area meets the river Pandu separately through industrial drains. The West Drainage District has no sewerage facilities and the waste water flows in to Pandu River through open drains. The 'East Drainage District' which is primarily comprises of developing areas has no sewerage network.

9.3.3 Sewerage Treatment Plants and their Capacity

Three sewerage treatments (STP) are in operation in Kanpur. All three plants are located in area near Jajmau, on the eastern side of the city. In Jajmau,

main sewage pumping station and treatment plants for 171 mld capacity have been commissioned in the last decade. The details of treatment plants at Jajmau are as below:-

- **5 MLD UASB Sewerage Treatment Plant (STP)**
  A pilot STP based on new technology "Upflow Anaerobic Sludge Blanket" was constructed and commissioned in 1989. This plant was designed for treatment of 5mld of domestic wastewater. The plant functions at full capacity but in the past it has received tannery effluent which has to be discontinued since it has adverse effects on the UASB process and on the quality of the sludge which is used in agriculture. The dried sludge is sold to farmers and final effluent flows into a nala and subsequently into the Ganga.

- **36 MILD UASB Sewerage Treatment Plant (STP)**
  The 36 mld wastewater treatment plant for the treatment of waste from 175 tanneries (presently 354 tanneries) was constructed and commissioned in 1994 after evaluating the performance of pilot plant. For further treatment of tannery wastewater after UASB reactors, a conventional treatment plant was constructed in 1996. The plant is designed for treatment of 36mld mixed tannery and domestic wastewater.

- **130 MLD ASP Sewerage Treatment Plant (STP)**
  This plant, based on activated sludge process, was constructed and commissioned in January 1999. This planned is designed for treatment of 130 mld of domestic wastewater. Since its commission, illegal discharge from tanneries and industrial wastewater from various industries situated in city areas is being discharged regularly to 90 outfall sewers reaching the main pumping station from where sewerage is pumped to this plant. The tannery waste water and industrial wastewater contains leather flushing, chromium sulphides and other toxic elements for which the STP has not been designed. Consequently the components of the equipment are corroded. The plant is now running at 1/3rd of its capacity.

  The treated effluent from two STPs (36 MLD and 130 MLD) is pumped into a channel that transports water to the sewerage farm with a total area of about 2,200 hectare. From the channel, irrigation water is fed to the farm lands.

  With even 100 percent efficiency in system, there is surplus sewage, which gets discharged in Pandu or Ganges River without treatment.

9.3.4 Financial Situation

The financial resources of KJS are based on receipts from water tax, sewer tax, water and sewer user charges levied on properties and on users. At per present tariff, rates of domestic and non-domestic water supply are Rs. 2.90 and Rs. 4.00 to Rs. 5.90 per KL respectively depending on the nature and quantity of use.

The cost of operation and maintenance of water supply and sewerage is met through revenue generated from Water Tax, Sewer Tax, Minimum charges & user charges of water. The Water Tax & Sewer Tax is levied on the basis of Annual Rental Value (ARV) (assessed by KNN) of properties @ 12.5% & 4% respectively.

The main revision of Tariff was carried out in the year 1994 on the basis of MV & size of water connection with a provision of annual enhancement of rate @ 7.5%. The revision of tariff resulted in revenue enhancement as shown in table 9.4.

Table 9.4 Collection of Water and Sewerage Tax by KJS (in Lakhs)

Particulars	Year				
	2001–02	2002–03	2003–04	2004–05	2005–06
Water Tax	697.21	744.29	898.78	814.95	1005.16
Sewer Tax	270.92	301.27	289.78	258.38	270.81
Minimum Charges of Water /Sewer	1209.04	1222.48	1240.63	1647.41	1735.66
Others	83.45	88.18	101.12	100.08	67.17
Total	**2260.62**	**2356.22**	**2530.45**	**2820.82**	**3078.80**

Source: Data collected from Kanpur Jal Sansthan 2006

The maintenance of water supply and sewerage system is carried out by self generated income. However, 70 percent of the income is utilized to meet the establishment cost. The establishment expenditure, post retirement benefit of employees, procurement of chemical, maintenance expenditure has to be paid regularly. This leaves very little surplus to undertake any capital works. Under such circumstances, it is only possible to carry out expenditure related to break down maintenance or emergency works such as replacement of pumping set, sewer lines, pipe-lines, machine etc.

9.3.5 Issues

- The effluent quality of 5 mld UASB STP is not meeting the standard parameters for land application due to present characteristics of sewerage reaching to treatment plat and also due to illegal discharge of tannery waste water into domestic sewers. The tannery waste water contains high sulphide contents in the range of 30 to 50 mg/l which affects the performance of the STP.
- The 36 mld UASB STP was designed for 175 tanneries whereas now 354 tanneries are in operation. Most of the tanneries have adopted chrome tanning process due to which the concentration of chrome and sulphides has increased which affects the process of UASB reactors. Secondly, discharge at intermediate pumping stations has increased due to increase in number of tanneries whereas their pumping capacity is inadequate.

- The industrial effluents from tanneries have a high BOD level of 3000 to 4000 mg/1 under Ganga Action, this effluent from tannery has been tapped and is being taken to sewerage treatment plant at Jajmau. But still most of primary treatment plants, though installed by tanneries, are not functional and effluents from tanneries go to STP without any primary treatment plant.
- Because of improper outfall arrangements and lack of treatment of all effluents, the sewer and industrial wastewater, flowing and discharging into Pandu River is highly polluted and the pollution levels are high.
- With the growing Industrialization and Urbanization the pollution load on the river Ganga at Kanpur is increasing day by day. Pollution is observed here both at the source due to the discharge of industrial effluents and sewage as well as the distribution system through cross contamination.
- The old sewers are choked and broken and are a cause of contamination of ground water and also of contamination of drinking water. These are a serious health hazard and urgent repairs are required.
- At several places the choked or overflowing sewers have been broken and connected to the drains resulting in serious contamination in the drains as well.
- In several new colonies, the sewer branch lines are not connected to the trunk sewer lines and the sewer is either flowing into open fields or into drains. This is once again a serious health hazard.

9.3.6 Remedies and Future Strategies

- The capacity of existing sewerage treatment plants should be increased as well as new STPs should be constructed. With the construction and commissioning of 200 mld STP at the bank of Pandu river and diversion of Sisamau Nala from discharge in Ganga to discharge in Pandu river, the treatment capacity will be increased to 371 mld against the present recorded discharge of 360 mld. With the increase in water supply in years to come, the generation of sewerage and waste water will also increase (estimated at 70 percent of the water supply). Hence there is sufficient capacity as of now but there is a need to plan for additional treatment plants in the period 2012 onwards.
- As U.P. Housing Board has planned to have provision for smaller capacity 25 to 40 mld STP for each new colony, the same can be adopted by KDA or even big builders like Sahara and others. The treated water can even be given to nearby farmers for agriculture purposes, on payment basis.
- UP Jal Nigam has a plan to spend considerable money on sewerage in the next 25 years (nearly Rs 3500 cr). It is suggested that money for providing branch connections to the houses be recovered from the house owners as a connection charge. Similarly instead of laying long trunk

lines, it is better to design small decentralized units like those planned by UP Housing Board. This will reduce both operating and maintenance costs.

- The renovation of sewers in the inner core areas should be done using latest trench less technologies, as the inner core area is very congested and it is not practical to dig up the narrow roads for renovation or for laying new sewers
- Similarly, other new technologies such as lining of old sewers, filling of joints with modern jointing material etc. can also be resorted to as at times it may be more economical and practical to rehabilitate existing sewers than to lay new sewers.

The immediate need is to cover the following works under the JNNURM scheme:-

- Renovation/replacement of existing drains, which are old and in lived out stage.
- Renovation / repair / supplement of existing and old pumping stations including Mechanical and Electrical items like motors, starters and switchgear.
- Regular sewer cleaning by adopting suitable methodology, depending location and condition of Nalas and drains.
- In densely populated areas, nalas need to be replaced by RCC conduit pipes for the purpose of security, hygiene and pollution control.
- Proper solid waste disposal is required otherwise this will find its way into drains, especially in rainy season.
- Operation and maintenance of existing STP's at Jajmau is not proper and other STP plants are also not functioning properly due to shortage of power and finance. This situation can be improved through Public Private Participation (PPP) which can be more effective by way of giving annual operation and maintenance contracts.

9.4 STORM WATER DRAINAGE SYSTEM

Kanpur city is habituated between two rivers Ganges on north and Pandu River on south. Out of 17 nalas, 14 are discharging wastewater in Ganga over a stretch of 20 KM from Bithoor downstream to Jajmau. Out of all Nala, Sisamau Nala has the biggest catchments area of 1985 hectares. The details of various Nalas discharging waste in Ganga towards North are as under:-

Table 9.5 Discharge and length of different drains

S.NO	Name of Nala	Quantity (mld)	Length KM
A) Nala's Discharging in Ganga River towards North			
1	Sisamau Nala	138.33	16.30
2	Nawabganj Nala	1.66	2.22
3	Guptar ghat Nala	2.29	1.30
4	Jageshwar Nala	0.92	0.70
5	Jewra Nala	0.79	1.50
6	Ranighat Nala	0.32	1.40

7	Parmat ghat Nala	0.43	2.18
8	Muir Mill Nala	4.91	2.00
9	Police Line Nala	0.79	0.12
10	Jail Nala/ Sarsaiya Nala	1.22	0.80
11	Golf Nala I & II	1.66	2.50
12	Kesa Colony Nala	0.16	
13	Roadways Colony Nala	0.40	0.60
14	Parmiya Purwa & Kheora Nala	0.14	2.00
	Sub Total (A)	**154.02**	**34.82**
B) Nala's discharging in Pandu river towards South:-			
1	Ganda Nala	55.09	13.50
2	Halwa Kheda Nala	11.44	6.70
3	C.O.D. Nala	8.81	6.20
	Sub Total (B)	**75.34**	**26.40**
C) Drainage from sewerage channel			
	Sub Total (C)	**129.50**	
	Total	**358.86**	

Source: GPCU Kanpur

All the Nalas, discharging in Ganga River have been tapped except Sisamau Under the GAP (Ganga Action Plan) Phase-II, Sisamau nala, the largest nala in Kanpur City, presently carrying a flow of around 138 mld will be diverted for treatment. Out of 138 mld, 80-100 mld will be tapped upstream and diverted to Binagawan STP. The remaining 30-50 mld will be tapped down stream at Parmat pumping station and diverted to Jajmau STP. Thus this flow from Sisamau nala has to be considered while finalising the capacity of the Parmat pumping station. It is also proposed to change the course of Sisamau Nala to South (discharging in Pandu River) instead of present flow towards north in Ganges.

With diversion of Sisamau Nala and three Nalas already discharging into Pandu river, 200 mld sewage treatment pant is being proposed. With 171 mld treatment capacity STP at Jajmau and 200 mld STP at the bank of Pandu river, water will be served to the Jajmau farms with a total area of about 2,200 Hectares.

9.5 SOLID WASTE MANAGEMENT

9.5.1 Solid Waste Generation

The quantity of solid waste generated in a city depends on the following factors:-

i. Population
ii. Socio-status of population
iii. Number of commercial, industrial and institutional establishments

According to KNN officials, at present waste generation in the city is around 1500 MT presently.

9.5.2 Composition of Waste

For Kanpur, organic waste constitutes largest component followed by inert material such as building material and debris etc. in overall composition of waste i.e. waste generated from households, commercial establishments and institutions in Kanpur (Table 9.6).

Table 9.6 Waste Composition in Kanpur (in %)

Waste Components	ICDP	NEERI
Organic	47.27	56.67
Paper	3.58	3.18
Rubber, Leather and Synthetics	2.72	0.48
Plastics	4.5	-
Rags	3.97	-
Glass	-	0.48
Metal	0.24	0.59
Inert Material	38.82	40.07

Source: Studies conducted by ICDP and NEERI

Apart from solid waste generated by Households, commercial establishments and institutions, Kanpur also has a number of industries and other businesses that generate different type of waste as mentioned below:

- Bio-medical waste generated by Hospitals and Nursing Homes
- Sludge, buffing and other waste produced by tanneries in Jajmau area
- Industrial waste produced by textile, rubber and other industries operating in the city
- Dung, waste straw and other waste from dairies (Parag)
- Silt from Nalas and drains
- Coal ash and fly ash from Panki Thermal Power Station.

9.5.3 Waste Generated from Industries

Some of the major industries located within the Nagar Nigam Limits are LML Industries, Cerulin Chemicals, Rajendra Steel &A, Kanpur Pesticides & Chemical Tube, Hindustan Aeronautics, Hindustan vegetable Oil and ICI-Nickel and Small Arms Factory (cyanide)/Chromium. As informed by officials from KNN, total hazardous waste generated from the Industries is about 18 tons per day. Out of total industrial waste, the generation of hazardous waste containing chromium is bout 10-15 MT per day. The site for disposal of the hazardous waste has been identified at Rooma, about 12-15 km away from the sewage treatment plants and the work is under progress. The site has been scientifically designed with liners etc. to avoid any leaching and contamination of ground water.

9.5.4 Waste Generated from Hospital and nursing-home

At present, Kanpur city has about 9 Government, 33 private Hospitals and about 600 clinics. Some of the major hospitals are LLR Medical College Hospital, ESI Hospital, Hallet Hospital, R.K. Devi Hospital, Swaroop Nagar etc.

The estimated quantity of bio-medical waste generated in Kanpur is about 6750 Kg per day. To manage the bio-medical waste generated from these hospitals & clinics, a Central Bio Medical Waste Treatment Plan Facility has been established at Kanpur. The facility is being operated by an NGO, named Medical Pollution Control Committee (MPCC). The facility has an incinerator, Thermoclave, Shredder, Destructor, Chemical treatment Plant and Laboratory. The facility was installed in year 2001 and the incinerator has the capacity to incinerate about 1000 kg of waste.

The bio-medical waste is to be managed according to the Bio-medical Waste (Management & Handling) Rules, 1998. Though as per these rules, it is the responsibility of the respective health care establishment & Uttar Pradesh Pollution Control Board to see that the bio-medical wastes are managed property, its poor implementation affects KNN as these wastes get mixed with the Municipal solid waste posing serious threat to sanitary workers as well as general public. Hence measures need to be taken to prevent the mixing of bio-medical wastes with municipal solid waste.

Out of total bio-waste generated, only 1350 Kg (about 20 %) is sent to the centralized bio-medical waste management facility. Some estimate that about 30 per cent of bio-medical waste is getting mixed up with other type of waste.

9.5.5 Hotel and Restaurants Wastes

Kanpur is a commercial town and therefore has hundreds of small and medium size hotels and restaurants. Some of the important hotels are: Land Mark Hotel, Hotel Gee, Hotel Gaurav, Hotel Akash, Delhi darbar and Data Restaurant etc. In most of the hotels, the wastes generated are collected in drums (300 litre) within the premises and as the drum gets filled it is taken to the nearest waste storage depot and emptied.

The floating population in the city is about 75,000 to 1,00,000 and considering waste generation rate of a modest 0.2 kg/ capita/ day), total waste generation from floating population can be estimated to be 15-20 T / day.

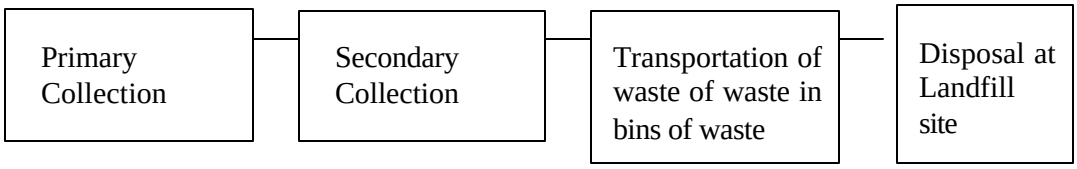
9.5.6 Present System for Solid Waste Disposal

- Kanpur Nagar Nigam (KNN) is responsible for collection, transportation and disposal of municipal solid waste.
- The handling and treatment of bio-medical waste is governed by the Bio-medical waste (Management and Handling) Rules1998.
- The responsibility of safe disposal of bio-medical waste is on individual hospitals and nursing homes.
- The industrial waste should be treated and disposed according to

guidelines of Central Pollution Control Board and State Pollution Control Board. It is the responsibility of the concerned industry to ensure safe treatment and disposal of industrial effluents as per norms and standards.

- KNN has already given a contract for developing a facility at Rooma for safe disposal of 22,000 MT of hazardous waste from tanneries at Jajmau.
- KNN has signed MOU with IL & FS (Infrastructure Leasing & Financial Services Ltd) for Waste to Energy Project Plant at Jajmau wherein the transport of solid waste to the site will be provided by KNN and KNN will receive 5 percent of the revenues / power generated.

The primary responsibility for solid waste management is with KNN. The various stages involved in the disposal of solid waste are as under:-



It has been noticed from the discussion with KNN officials that the waste collected by the sweepers is deposited in the following type of rubbish dumps/depots:

Table 9.7 Type of Waste Storage Depots

S.NO	Type of waste storage Depot	No. of Depots
A. Open points where waste is dumped		
1	Open points-existing	126
2	Open points-not meant as disposal points	36
3	Disputed land	01
4	Built–up CC & Brickwork	01
5	Under shifting	01
		265
B. Modern waste depots in place lode ones:		
1	Solid waste depots, built already	73
2	Existing depots, wherein adequate space is not available	14
3	Disputed locations	02
4	Modern waste depot, built already	02
5	Modern waste depot under constructions	03
6	Proposed under Infrastructure fund	03
7	Proposed modern waste depots	49
8	Waste depots 12m x 6 m x 4.3m size	22
9	Waste depots 8m x 4m x size	27
		195

Source: Data received from Solid Waste Department, Kanpur Nagar Nigam

9.5.7 Future Waste Generation

The total quantity of solid waste generated in a city is estimated by taking an average quantity generated per capita per day (pcpd). According to the 2001 census, the population of Kanpur was 25.51 lakhs. The estimates given by NEERI i.e. 350 gms pcpd the quantum of waste generated in Kanpur will go up as shown in the Table no. 9.8.

Table 9.8 Projected Waste Generation

Year	2006	2011	2016	2021	2031
Population in Lakh	25.51	29.00	32.97	37.49	48.46
Waste generated as day in MT	893	1015	1155	1315	1696

9.5.8 Issues

The issues confronting primary and secondary collection of garbage at Kanpur are as under:-

- The dumping grounds, by roadside and elsewhere, are unhygienic and have deplorable look.
- Disposal of waste into drains leads to choking of drains
- Rains washed out part of garbage from these depots into drains and Nalas which leads to silting.
- Mixing of Bio-medical and other forms of waste with municipal waste is a serious health hazard.
- Lack of segregation of bio-degradable and non-degradable waste at source
- Large scale public littering leading to inattentiveness of street sweeping and cleaning activities.
- Shortage of staff and lack of motivation amongst the existing staff.
- Presently there is no waste processing plant at Kanpur and the total waste is taken to disposal size.

9.5.9 Strategies

- Door to door collection is being experimented and with implementation of source segregation the processing of waste could also be undertaken.
- It is necessary to modernize and replace the ageing solid waste equipment being used by KNN for Solid Waste Management (SWM). A study has already been conducted by NPC suggesting a three tier waste handling system with transfer stations. Such a system will not only improve the SWM but will also reduce the running of the transport vehicles and thereby reduce the cost of operation of SW Management. It is suggested that this change to a modern SW handling system should also be included in JNNURM proposals by KNN.
- SWM is an area amenable for P-P-P and introduction of user charge. KNN should experiment outsourcing in a few wards together with responsibility for user charge collection by the private operator. However, this can be successful only if it is combined with a strong and vigorous community mobilization effort which is best undertaken by

commissioning a good NGO for the purpose.

- The P-P-P experiment in a few areas can also be given to the CDS formed in slum areas. This will provide employment and also strengthen the CDS to undertake other community oriented works.
- Public sector participation (PSP) should be invited for establishing suitable waste processing plant that could be either composting or waste to energy.
- The waste generated from the processing plant and non-recyclable and other waste should be disposed off in sanitary landfill facility. Immediate steps need to be taken for developing such sanitary landfill facility.
- KNN has been allotted the Transport Nagar site which is 46 Hectares for development as a sanitary landfill site. It is estimated that this area will last for 10 years. The entire area has been allotted along the bank of river Pandu and leaving a safe distance of 200 m along 1500 m long bank nearly 30 Hectare will fall under safe distance area. KNN should try to get more land allotted in the same area. This site should be developed after carrying out the environment impact assessment.
- It is further recommended that Panki Thermal Power Station should make its own arrangement to collect and slurry before discharging in Pandu River. The downstream of the river is black with fly ash slurry. The usual sewerage treatment plants do not treat this type of effluent and as such, this job should be undertaken by Panki Thermal Power Station itself.

9.6 STREET LIGHTING

The operation and maintenance of City Street Lighting is being done by Kanpur Nagar Nigam and Mechanical Engineer (Street Lighting) is responsible for installation, replacement, repairs, operation and maintenance of street lights in the city. The budgeted amount for purchase of items for street lighting needs to be enhanced by at least 10-15% over and above Rs.3.67 cr.

9.6.1 Electricity Charges

During the year 2005-06, KESCO raised monthly bill of Rs.54.22 lakh i.e. an annual bill of Rs.6.5 cr. This is a large amount being spent on street lighting.

The bills are raised on fixed charges per light point as no metered supply is being given. For un-metered supply, KNN is being charged @Rs.850.00 per KW or part thereof per month. The monthly bills are raised on the basis of verified number of points at the beginning of the year and additions, if any during the month as intimated above.

9.6.2 Key Issues

- There is provision of improvement of G.T. road between Rama Devi and Kalyanpur to 4 lane and provision of street lighting needs to be made accordingly. A budgetary provision needs to be included for augmenting street lighting.

- The entire city area is not covered by lighting system and developing areas have no street lighting. Once the lamps and tubes get fused, it takes months for replacement and streets and roads remain dark. A system has to be developed for timely replacement.

- There is an expenditure of almost 11-12 crores in this sector and studies need to be conducted on how to reduce this huge cost.

9.6.3 Strategies

- The payment to electricity board should be based on metering. KNN should experiment with light operated sensors, which will automatically switch on and switch off the lights with daylight. This will save electricity.
- The maintenance of electric connections and fittings should be improved to reduce the burn out rate.
- It is suggested to explore public participation by giving annual operation and maintenance contracts to reputed manufacturers like Bajaj, Philips or G.E., etc. KNN may succeed to strike on lesser cost and the surplus staff may be utilized somewhere else.
- Solar system may be tried and a study is required to find viability of higher initial investment vis-à-vis electricity bills of KESCO.

9.7 SOCIAL INFRASTRUCTURE

9.7.1 Medical Facilities

In Kanpur metropolis, abundant medical facilities are available. It has large concentration of doctors and nurses and exclusive assembly of medical specialists and consultants. At present, Kanpur city has about 9 Government, 33 private Hospitals and about 600 clinics. Some of the major hospitals are LLR Medical College Hospital, ESI Hospital, Hallet Hospital, R.K. Devi Hospital, Swaroop Nagar etc. Apart from hospitals, numerous dispensaries are also functioning in Kanpur city and some of them deal with specialised treatments. These hospitals and dispensaries are heavily strained due to lack of health facilities in nearby areas. The out-patient departments are very congested The patients have to wait for long hours for their turn

In Kanpur, unhygienic conditions prevail throughout the city. This has an impact on contamination of the drinking water which leads to water borne diseases.

The occurrence of water borne epidemics have been nil in the last 3-5 years, however, there have been occurrence of water borne diseases in the past few years (table 9.9). The areas that are prone to water borne diseases are Sakera, Juhi Puram Purwa and Juhi Garha, Babu Purwa, Colonel ganj, Talak Mahal, Begum ganj, Rail bazaar.

Table 9.9 Trend of Water Borne Diseases in Kanpur

Description	1996	1997	1998	1999	2000
No. of Gastro cases	315	230	350	250	127
No. of deaths of gastro cases	5	2	2	3	1
No. of jaundice cases	106	63	44	53	39
No. of deaths of jaundice cases	29	19	22	20	11

Source: CMO, Kanpur

Malaria is prevalent in Kanpur from July to October every year corresponding to rainy season and the subsequent period of water retention and stagnation. Concentration of P. vivax cases occurs along the Ganga with a high frequency in Jajmau and Nawabganj areas. The entire river bed area poses serious health hazard for vector borne diseases due to stagnation of clear and dirty water in pools. Although malaria cases are seen on a rise in the last 4 years, there have been no major outbreaks of any water borne diseases or epidemics in the last 3-5 years. During 2000-04, cases of malaria registered with Chief Medical Officer (CMO) is given in table 9.10.

Table 9.10 Trend Analysis of Malaria Cases

Species	2000-01	2001-02	2002-03	2003-04
P. falciparum	2	3	-	4
P. vivax	370	355	400	571

Source: Chief Medical Officer, Kanpur

9.7.2 Education Facilities

Kanpur city has gradually emerged as a dynamic educational centre due to availability of every kind of academic and professional institutions. Kanpur is host of several institutes of repute such as Indian Institute of Technology Kanpur, two universities, viz. Kanpur University and Chandra Sekhar Azad University of Agriculture and Technology, a Medical College and technical institutions such as the National Sugar Institute, the Central Textile Institute and the Leather Institute etc.

At present (2006), 2 lakh students are enrolled in the 432 primary schools and 69,198 students have been listed in the 39 junior high schools.

Some of the problems faced by education department are: poor turn out in the primary and junior high schools despite several schemes launched by the state government. Secondly, there is an acute shortage of teaching staff. According to officials, no teacher has been recruited for the primary and junior high school since 1972. Most of the schools either lack of teacher or are working with the support of Shiksha Mitra. Thirdly, student's strength has decreased due to mushrooming of private schools in city areas. Fourthly, parents have lost hope in government education centres and for the better education they are sending their children to private centres.

9.7.3 Lake and Water Bodies

The main river of Kanpur is river Ganga and Pandu. Since 1921, Ganga course has shifted from the right bank to the left bank. Therefore, a channel from the river course to Bhaironghat was made for the main water supply intake of Kanpur. Another river, Pandu is meandering river and it flows into Ganga at a point of 25 km of downstream of Kanpur. The highest water level in the river is 119.6m above MSL and the mean water level is 114.5 MSL.

The naturally existing water bodies in the city are water pool near Allen Forest and water ponds in the rail yard area along GT road near tatmill (CPCB). The two tanks at Motijheel were used as freshwater reservoirs for drinking water supply to the city but now abandoned due to excess silting and damage of the feeder canal. Other fresh water bodies in the city are the upper Ganga canal network flowing in the south city.

Under U.P. Housing Board Yojana No. 1, 2 and 3 total 5 water bodies falls whose area is approx. 20 acre. There is also a hundred year old water body, whose capacity is 5000 square meter, near atik bhawan in the campus of Chandrasekhar Ajad Agriculture and Industrial College. Earlier rain water from nearby area used to be collected in this water body and used for irrigation purposes. Later on due to construction of buildings and roads, the natural flow got obstructed.

9.7.4 Development of Parks

In Kanpur, there are total 281 parks. Out of total parks, 94 are developed park whereas 49 semi-developed park and 138 are un-developed park. Maximum developed park are in 6th and 5th zone and semi-developed park are in 5th zone.

Table 9.11 Parks Developed by KNN

Zone No.	Develop Park	Semi-develop Park	Un-developed Park	Total
1	16	07	19	42
2	10	07	08	25
3	11	06	22	39
4	15	10	17	42
5	20	12	54	86
6	22	07	18	47
Total	**94**	**49**	**138**	**281**

Source: Information received from Kanpur Nagar Nigam, 2006

Kanpur Nagar Nigam is planning to develop few parks with the help of Resident Welfare Associations.