JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
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MINISTRY OF ENVIRONMENT AND FORESTS

THE STUDY
ON
WATER QUALITY MANAGEMENT PLAN
FOR
GANGA RIVER
IN
THE REPUBLIC OF INDIA

FINAL REPORT

VOLUME IV FEASIBILITY STUDY FOR PROJECT CITIES

VOLUME IV-4 FEASIBILITY STUDY FOR VARANASI CITY
PART IV INSTITUTIONAL DEVELOPMENT PROGRAMME

JULY 2005

TOKYO ENGINEERING CONSULTANTS CO., LTD.
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FINAL REPORT
ON
WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER
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ABBREVIATIONS

AL	Aerated Lagoons
ASP	Activated Sludge Process
BOD	Bio-chemical Oxidation Demand
CCTV	Closed Circuit Television
DOH	Department of Housing
DUD	Department of Urban Development
DUDA	District Urban Development Authority
DUEPA	Department of Urban Environment and Poverty Alleviation
FAB	Fluidised Aerated Bio-reactor
HDB	Housing Development Board
HP	Horse Power
HRD	Human Resources Development
IDCB	Institutional Development and Capacity Building
IDP	Institutional Development Programme
IMS	Information management system
JICA	Japan International Cooperation Agency
JS	Jal Sansthan
M&E	Mechanical and Electric
MIS	Management Information System
MLD	million litre per day
MLSS	Mixed Liquid Suspended Solid
NLCP	National Lake Conservation Plan
NN	Nagar Nigam
NRCD	National River Conservation Directorate
NRCP	National River Conservation Plan
O&M	Operation & Maintenance
PCB	Pollution Control Board
PMC	Project Management Consultant
SPS	Sewage Pumping Station
STP	Sewage Treatment Plant
SUDA	State Urban Development Authority
TF	Tricking Filter
TSS	Total Suspended Solid
UASB	Up-flow Anaerobic Sludge Blanket
UP	Uttar Pradesh
UPJN	Uttar Pradesh Jal Nigam
WSP	Waste Stabilisation Pond

CHAPTER 1

INSTITUTIONAL BACKGROUND

PART IV INSTITUTIONAL DEVELOPMENT PROGRAMME

CHAPTER 1 INSTITUTIONAL BACKGROUND

1.1 EXISTING ORGANISATIONS INVOLVED IN SEWERAGE

The major administrative units that are closely related to water quality management under Ganga Action Plan (GAP) are shown in Figure 1.1. It presents hierarchic tiers of the national, the state (Uttar Pradesh (UP) State Government) and the municipal levels of organisations. There are two major groups of organisations: One group is associated with urban development and the second group is associated with environmental conservation and pollution control. Both groups are administratively separate entities and fall under different Ministries. However, for implementation of NRCP activities, coordination amongst these organisations is vital. The details about organisations discussed here are based on the review in the Volume III-9, Institution Development Programme, in the Master Plan Report.

1.1.1 National Level Organisations

At the central government level, the present study is administratively related with

- National River Conservation Directorate, Ministry of Environment and Forests
- Department of Urban Development, Ministry of Urban Development and Poverty Alleviation.

National River Conservation Directorate (NRCD) was created in 1985 as a wing of the Ministry of Environment and Forests. It provides fund for and oversees implementation of National River Conservation Plan (NRCP) and National Lake Conservation Plan (NLCP) in all states of India. The GAP under NRCP is being implemented in 59 cities/towns in 5 states. The implementing agency in the state of Uttar Pradesh is UP Jal Nigam. Under Ganga Action Plan Phase-I, Rs. 4,517 million (US$ 103 million) investment has been made in 25 cities/ towns in these five states, which includes six districts of UP.

1.1.2 State Level Organisations

At the Uttar Pradesh State government level,

- Department of Urban Development (DUD), Department of Urban Environment and Poverty Alleviation (DUEPA), and Department of Housing (DOH) under the Ministry of Housing, Ministry of Urban Development and Urban Poverty Alleviation.
- UP Pollution Control Board under the Ministry of Environment.

Under DUD, there is Directorate of Local Bodies and UP Jal Nigam as depicted in Figure 1.1. Directorate of Local Bodies is overseeing, advising and transferring the state subsidy to local bodies at Municipal Corporation, Municipalities, or Nagar Panchayat level for cities and towns, respectively. UP Jal Nigam (Water Corporation) is planning and constructing water supply and wastewater facilities for all the local bodies. Constructed facilities are to be transferred to the local bodies for their operation and maintenance.

Under DUEPA, there are State and District Urban Development Agencies. They plan and develop plots of land in and around the local bodies, particularly larger cities. In these land development projects, they develop roads, drainage and sewers, besides constructing buildings for sale. However, some drains and sewers, it is reported, are not connected to the existing facilities properly to discharge

storm water and wastewater. Also, there was strong perception that there was an urgent need for better coordination with the future plans that cities and other agencies were envisaging.

Under DOH, there are State Housing and Development Board, and City (District) Development Authority. Both develop new colonies on their own plans. They are also responsible for installation of sewers and drains within their colonies. Once these colonies are sold out, maintenance of sewers and drains as well as solid waste disposal comes under the responsibility of respective local bodies.

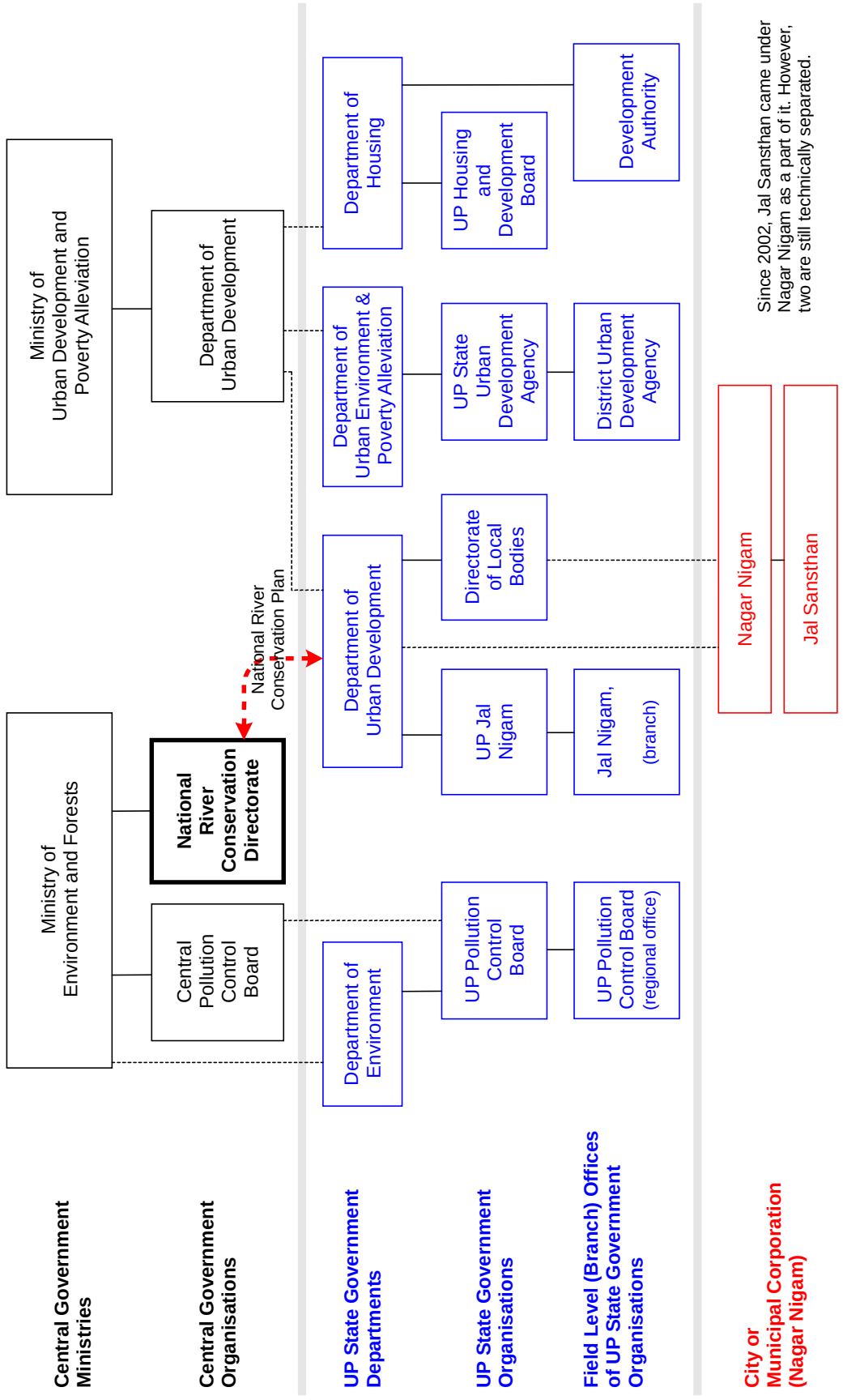

Figure 1.1 Institutional Alignment related to Water Quality Management under GAP

The division of responsibilities amongst local and state organisations, for development and maintenance of sewerage collection and treatment systems is summarized as follows:

Table 1.1 Management Responsibilities for Environmental Public Services

MANAGEMENT RESPONSIBILITY	ORGANISATION	FUNCTIONS
• Master planning	UPJN (Jal Nigam)	• Physical Infrastructure • Capacity and location of facilities
	DA	• Spatial arrangement • Land use • Population projections
	JS (Jal Sansthan)	• Physical Infrastructure for water supply facilities • Capacity and location of facilities (water supply)
• Design and construction	UPJN	• Sewerage infrastructure for River Pollution Abatement Action Plans. • Water supply and sewerage infrastructure for urban development
	DA (Development Authority)	• Infrastructure for new development areas
	HDB (Housing Development Board)	• Infrastructure for state housing developments
• Operation and maintenance	UPJN	• Trunks sewers • Interception and treatment works • Storm water pumping stations • Compliance with environmental regulations
	NN (Nagar Nigam)	• Storm Water Drains • Solid waste disposal
	JS	• Sewers and pumping stations • Water supply treatment and distribution works
• Pollution control and monitoring	UPPCB (Pollution Control Board)	• Monitoring and preventing entry of polluted wastewater (if they do not meet discharge standards) into nalas and rivers. • Regulating industries

1.1.3 Planning

The Varanasi Development Authority (VDA) at the local level is responsible for preparing spatial master plans for land use. It does not however prepare infrastructure master plans.

Town and country planning is supposed to prepare overall development master plans including infrastructure servicing.
Jal Nigam (UPJN) at the state and local level prepares plans for water supply and sewerage systems, primarily for expansion in response to population growth. They are also supposed to prepare master plans.

1.1.4 Design and Construction

Jal Nigam (UPJN) at the state and local level designs some sewerage systems, primarily trunk sewers, and all sewage treatment installations. For nearly 2 decades their primary focus has been pollution control in response to NRCD's River Pollution Abatement Action Plans because sewerage development was given a lower priority in earlier development plans and consequently meagre funding was available in this sector.

The Varanasi Development Authority (VDA) designs and constructs the sewerage system for the new development areas of Varanasi City falling under VDA jurisdiction.

The Housing Board (UPHB) at the state level designs and constructs sewerage systems for new state housing projects.

1.1.5 Operation and Maintenance

The responsibility for operation and maintenance of the sewerage system currently rests with the Jal Sansthan.

Under the terms of the UP Water Supply and Sewerage Act, 1975, the functions assigned to Jal Sansthan in relation to sewerage are:

(1) "Where feasible, to plan, promote and execute schemes of, and operate, sewerage, sewage treatment facilities and disposal and treatment of trade effluents."

(2) "To manage all its affairs so as to provide the people of the area within its jurisdiction…where feasible, with efficient sewerage service."

Jal Nigam (UPJN) at the local level has in most cases retained physical possession of all the assets created under the Ganga River Action Plan. It was expected to transfer the facilities to the city governments (local bodies). However, they are at present carrying out operation and maintenance of sewage treatment works, pump stations (sewage and stormwater) and interceptor sewers. Jal Nigam has also retained responsibility for planning and implementing sewerage schemes.

Jal Sansthan (which legally became part of the Municipal Corporation in 2002) carries out all water supply operation and maintenance and sewerage maintenance activities. In most cases Jal Sansthan has not yet taken over responsibility for O&M of assets created under GAP.

The Varanasi Nagar Nigam carries out maintenance of surface drains (nalas) and canals.

1.2 KEY ISSUES

There are several institutional and financial weaknesses that adversely affect the quality and extent of sewer coverage as well as ability to provide adequate operation and maintenance:

(1) No master plans for urban infrastructure

There is no master planning for physical infrastructure. The absence of a M/P leads to the fragmented and uncoordinated implementation of infrastructure by several implementing agencies, each fulfilling their immediate short-term objectives. As a result several schemes cannot be integrated into the main trunk sewer network.

(2) Lack of single point responsibility

Several implementing agencies at state and local levels are developing land and infrastructure in the City. Their efforts are not well coordinated, especially in the absence of a master plan. Although taxes and water charges are collected at the local level, accountability to the citizens for sewerage and drainage problems is obscured by the lack of single point responsibility. Similarly, accountability for achieving water quality objectives is unclear.

(3) Insufficient revenue for O&M

Municipal corporations have the power to impose a tax for water, and a separate sewer/drainage tax. These taxes are based on the annual rental value of the property which does not reflect the real value

of the property. Municipal corporations also collect revenue from the sale of water through their Jal Sansthans; however the state government controls the water tariff. Municipal corporations are allowed to pool all sources of revenue to finance maintenance and development of municipal infrastructure. The revenues are at present insufficient to cover O&M costs. Measures are required to increase revenues to cover the true cost of service delivery.

UPJN has no such source of revenue. It depends on state funding to operate and maintain facilities. At present, local Jal Sansthans are expected to operate all new assets created by other implementing agencies however they do not in general have the required financial or human resources. As a result most Jal Sansthans have refused to accept responsibility for O&M of assets created by UP Jal Nigam.

1.3 RECOMMENDATIONS FOR INSTITUTIONAL STRENGTHENING

The overall effectiveness of sewerage systems and the ability to implement O&M improvements will be directly affected by the above key institutional issues.

Institutional restructuring is necessary to realize improvements in sewerage services both in terms of coverage and quality, as well as a reduction in unit costs.

The following priorities for restructuring are set in response to the institutional issues that significantly affect operation and maintenance of proposed sewerage projects:

(1) Reorganise at the state level to provide a single point of responsibility for planning and implementation of water and sewerage infrastructure
(2) Reorganise at the local level to provide a single point of responsibility for O&M of sewerage with accountability to people of Varanasi.
(3) To move towards a commercially viable operation, becoming financially sustainable in terms of covering O&M expenditure and decreasing transfer of funds/subsidy from state government.

1.3.1 Institutional Arrangements for Improving Planning and Implementation

Recommendation:
Create a nodal agency at the state level that is responsible for developing water and sewerage infrastructure master plans. The nodal agency would be responsible for reviewing all development projects proposed by state and local authorities for conformity with master plans. Development should not proceed without approval from the nodal agency. Projects prepared by Jal Nigam, Development Authority and Housing Board should be coordinated through the nodal agency.

UPJN at the state level should continue with implementation of capital projects for trunk sewer and treatment facilities in accordance with master plan proposals. UPJN would carry out preparation of detailed design reports and project management services for construction. The funding for infrastructure projects would be provided by Central and State government however a formal mechanism for sharing investment costs with development authorities (public and private) and municipal corporations is required.

1.3.2 Reorganisation for Single Point of Responsibility

The proper functioning of branch sewers and trunk sewers is closely linked to the operation of sewage pumping stations. Therefore, it is operationally desirable for the functions to be performed by one agency because the degree of coordination otherwise required between two organisations may be very difficult to achieve.

Recommendation:
Transfer the responsibility for O&M of all sewerage assets to Jal Sansthan. UP Jal Nigam at the local level should provide technical support and specialised skills to Jal Sansthan on a contract basis. Alternatively Jal Sansthan can contract to the private sector. This option would strengthen accountability to the people of Varanasi. It also improves the linkage between revenue collection and the funding of O&M expenditures at the local level.

The main difficulty in transferring assets to Jal Sansthan is that currently they do no have the capacity to undertake all of the O&M functions. For effective implementation of the above recommendations it would be necessary to create additional capacity in Jal Sansthan especially in the context of managing complex sewerage schemes.

Recommendation:
Transfer responsibility for O&M of drains and storm water pumping stations to Jal Sansthan Sewerage division.

The sewerage and drainage systems have many aspects in common and there is considerable operational advantage in bringing the two systems under the management of one authority. These are:

- responsibility for all water born pollution would clearly be placed in the hands of the single body
- single point responsibility for surface drainage leads to greater accountability and better maintenance of the pump stations
- technical expertise in all areas of operations management can be concentrated in a “centre of excellence”.
- Both systems have similar needs for map based records and condition information systems
- A single unit would simplify implementation of the short term proposal for diverting polluting flows from the nalas to the trunk sewers
- A large pool of resources is directly available to meet emergency situations
- Amalgamation of maintenance of pumping stations in particular would enable a higher level of technical resource to be supported for the combined total units.

1.3.3 Recommendations for Financial Strengthening

Recommendation:
Municipal corporations through their Jal Sansthans can gradually increase water and sewerage taxes to properly fund O&M. Initially, state government should subsidize funding shortfalls for O&M budgets. In addition, the following measures can be implemented by Jal Sansthan to increase revenues:

- Improve collection efficiency
- Install water meters in commercial/industrial, larger households
- Regularize illegal/informal water connections

Recommendation:
The UPMC act should be amended:

- to change tax rate based on property value instead of rental value
- to reassess property values every 5 years
- to authorize local bodies to increase tax rates as required to cover provision of services

Recommendation:
VDA in its sale price of property can build in an amount (10%) which can later be transferred to JS for O&M of assets created.

Management organisation and improvements for operation and maintenance are discussed in the following Chapter.

CHAPTER 2

OPERATION AND MAINTENANCE OF EXISTING SEWERAGE SYSTEM

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2.1 EXISTING SEWERGAE FACILITY

2.1.1 Collection System

Old Main Trunk Sewer (District I)

The sewerage system in Varanasi was commissioned in the Year 1917 (Old Main Trunk Sewer). This sewer begins at Assi and passes thorough thickly populated areas of the town viz. Central Drainage Zone. Earlier it used to discharge untreated sewage into River Ganga, nearly 400 meters downstream of Malviya Bridge. It is a circular brick sewer in lime mortar of 7 km length. Its size varies from 750 mm to 2400 mm diameter.

In GAP I, this untreated sewage was diverted to Konia MPS, from where it was pumped and treated at Dinapur STP. The capacity of Dinapur STP is 80 MLD, however the Konia MPS receives around 130 MLD of sewage. Presently, this excess flow of sewage is diverted to River Ganga with a gate arrangement provided in a Special Manhole.

In the absence of any interceptor sewer, in Sub Central Drainage Basin (District II), the sewage flow of this area is not fully defined. A part of sewage from District II is discharged into Old Main Trunk Sewer and remaining flow is discharged into River Varuna through storm water drains.

Orderly Bazaar Sewer (District I and II)

Orderly Bazaar Sewer was commissioned in Year 1917 along with Old Main Trunk Sewer. This sewer was laid from Collectorate's office and, earlier, connected to Main Trunk Sewer after crossing the Varuna River and railway line. In 1946, the bridge supporting this line across Varuna River was washed away in the floods resulting in the discharge of untreated sewage into Varuna River.

Ghat Intercepting Sewer (District I)

The Ghat Intercepting sewers were constructed in 1971 for the purpose of interception of sewage discharging into the River Ganga from a number of old drains between Meer Ghat and Trilochan Ghat. It consists of 300 mm dia CI pipe of 1184 m length and the outfall of this sewer is at Trilochan Ghat. The interceptor sewer serves the Ghat portion of the town on bank of Ganga river that cannot be drained into the Old Main Trunk Sewer.

Several branch sewers and laterals have been laid from time to time. It is assessed that the total length of sewer network in city is about 400 kms.

Under GAP I, interception and diversion works of following six major drains on western bank of River Ganga were carried out, through five Ghat pumping stations. These pumping stations lift sewage into Old Main Trunk Sewer.

Shiwala Ghat Drain
Harischandra Ghat Drain
Mansarovar Ghat Drain
Ghora Nala (Dr. R. P. Ghat Drain)
Jalesan Drain
Trilochan Ghat Drain

Existing Pumping Stations

Ghat Pumping Stations (District I)
Under GAP I, a new pumping station was added at Mansarovar Ghat and the other four existing pumping stations along the left bank of River Ganga were upgraded, by UP Jal Nigam.

Assi Main Pumping Station (District II)
Under GAP-I, a pumping station was installed for interception and diversion of sewage flowing through Assi Nala. The sewage is being lifted and pumped to Bhagwanpur STP. The details of this pumping station are given in Table 2.1.

Table 2.1 Details of Assi SPS

Installed capacity	833 lps
Installed pumps	3 x 50 HP – 5000 lpm @ 24 m head 1 x 22.5 HP – 3000 lpm @ 15 m head
Diesel generating sets	1 x 70 kVA
Rising main	400 mm dia PSC

Konia Main Pumping Station (District I)
100 MLD MPS was constructed under GAP-I at village Konia. This MPS was constructed to lift sewage from Old Main Trunk Sewer to Dinapur STP. In this MPS, pumping is carried out in two stages, three screw pumps in first stage followed by a set of centrifugal pumps in second stage. The sewage lifted by screw pumps passes through screening and grit removal units. The existing facilities in Konia MPS are presented in Table 2.2.

Table 2.2 Existing Facilities in Konia MPS

Konia MPS First Stage	
Installed capacity	3 x 1158 = 3474 lps
Installed pumps	3 x 215 HP – 1158 lps @ 8.51 m head
Pretreatment Units	
Screens	2 nos. mechanically operated – 50 MLD each
	1 no. manually operated – 50 MLD
Detritor	2 nos. of 100 MLD each
Konia MPS Second Stage	
Dimensions	32 m x 6 m
Installed capacity	3480 lps
Installed pumps	3 x 215 HP – 740 lps @ 8.51 m head 3 x 150 HP – 420 lps @ 8.51 m head
Diesel generating sets	4 x 500 kVA
Rising main	1200 mm dia PSC (New) 900 mm dia Hume Steel (Old)

2.1.2 Sewage Treatment Works

Existing Sewage Treatment Facilities

In total there are four STPs in Varanasi, to treat the sewage generated in the city. Among these four STPs, three were constructed under the GAP-I and are, presently, maintained by UPJN. The fourth STP of 1.8 MLD, Lalpur STP lies outside the project area and serves the area covered under the Lalpur Town Planning Scheme Phase-I. This STP is maintained by VDA. Table 2.3 presents the source of details of sewage inflow, design capacities, etc., of these STPs.

Table 2.3 Existing STPs in Varanasi

Sr.	Location	Source of sewage	Design capacity (MLD)	Amount of sewage received	District
1	Dinapur	Konia MPS	80 MLD	100 MLD	Outside of the City limit
2	Bhagwanpur / BHU	Assi pumping station and BHU campus	8 MLD	12 MLD	II
3	DLW	DLW campus	12 MLD	6 MLD	Outside of the City limit
4	Lalpur	Lalpur Town Planning Scheme Phase I	1.8 MLD	Nil*	Outside of the City limit

* The plant was not in operation during the site visit made by JICA Study Team.

2.2 EXISTING OPERATION AND MAINTENANCE MANAGEMENT

2.2.1 O&M Organisation: Jal Sansthan

Jal Sansthan is responsible for operation and maintenance of water supply and sewerage systems. Since 2002, it has been placed under the Nagar Nigam. Therefore, legally it is a part of Nagar Nigam, yet the two organisations (Varanasi Nagar Nigam and Jal Sansthan) still operate independently and are technically separate entities. The Jal Sansthan still maintains its own organisation, financial accounts and revenue collection unit, which is totally separate from that of Nagar Nigam.

Water and sewerage tax/charges are sources of *Jal Sansthan's* income. In the absence of water metering, both taxes are assessed on percentages of the annual rental value of residents' property. According to Jal Sansthan data, approximately 78 percent bills are being collected in recent years. However, even if all the bills were collected, it would not be sufficient for the operation and maintenance of the water supply and sewerage facilities installed and transferred to it by UP *Jal Nigam* and other state level organisations like District Urban Development Agency.

One of the major issues has been the problem in assessment of annual rental value and 5 yearly re-assessment, which has not been practiced by Varanasi Nagar Nigam. This is leading to low revenue for the Jal Sansthan, whose charges are as a fixed % of property tax. Further, they are also not allowed to increase the rates, mostly due to political pressure. Second issue has been the ban on general recruitment, which is making the organisation less efficient. Thirdly, there are no funds available for training, human resource development and infrastructure development, which is seriously affecting the performance of the organisation. In absence of these, the organisational culture of Jal Sansthan is far below the desired levels. At present, local Jal Sansthans are expected to operate all new assets created by other implementing agencies. However, in absence of adequate financial or human resources, Jal Sansthan is not able to take over the responsibility for O&M of assets created by UP Jal Nigam. This aspect has been reviewed and improvements have been suggested elsewhere in the report.

1) Organisation Structure

The organisational structure of the Jal Sansthan (Varanasi) is presented in Figure 2.1. The organisation is headed by a General Manager and takes care of both water supply and sewerage management functions for the city of Varanasi. However, in practice, the major focus is on water supply, whereas sewerage management receives very low priority. The organisational chart indicates that the Sansthan has been organised to cater to geographical areas of Varanasi and responsibilities have not been defined on functional basis.

The organisation has 1 General Manager, 5 Executive Engineers, 9 Assistant Engineers and 13 junior engineers amongst a total staff of 727. Besides, administration and finance division, it has planning

and construction divisions for water supply. It also has operation and maintenance division for water supply functions. However, for sewerage services, such system does not exist. In fact, sewerage is a minor function of most water supply engineers. The organisation has been engaged in sewerage management for quite a number of years and therefore has the technical capabilities and manpower to plan, develop and maintain such facilities. The infrastructure and equipment available with the organisation are quite old and not much addition of equipment has taken place during last few years. Overall, for sewerage management the equipment could be categorised as old or obsolete.

2) Qualifications, Experience and Competence of Personnel

Qualifications and experience of personnel and staff training records were not made available and therefore it is not possible to appraise detailed competencies of group of individuals. However, from the discussions and site visits, it could be stated that maintenance management (for sewerage as well as for water supply) is undertaken on an ad hoc basis. It was also observed that the work gangs usually do not know which work they will be doing during the day, until they report to work.

The site work was not always carried out in an organised way. Indeed, at some of the sites, it was not very clear, who was the in-charge official(s). Working practices were observed to be not in accordance with The Manual on Sewerage and Sewage Treatment (i.e. The Manual on Sewerage and Sewage Treatment, Second Edition prepared by the Expert Committee constituted by the Ministry of Urban Development, Government of India, and published in 1995). During maintenance works, the site safety was either non-existent or of very poor quality.

3) Current Maintenance Practices

The current maintenance practices are reactive rather than preventive and routine as per manual. Most of the maintenance is carried out in response to customer complaints related to overflows etc. These problems are normally resolved by clearance of blockages in the sewer. There is no evidence of a planned regime of cleaning or inspection of the system. Any repairs to the system arise from problems noted during blockage clearance or from customer complaints. Besides this, record keeping was highly limited and in some cases even inaccurate.

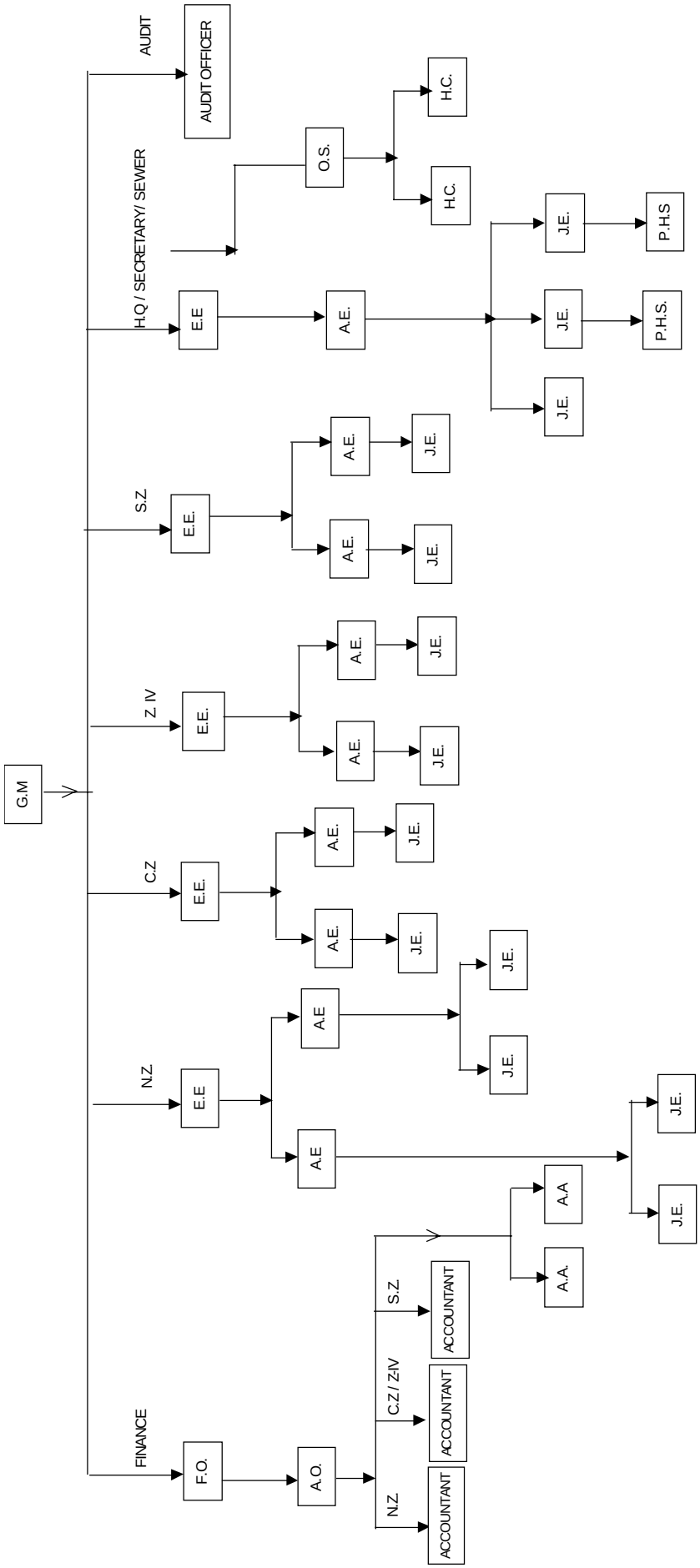


Figure 2.1 Organisation Chart of Jal Sansthan (Varanasi)

2.2.2 O&M Organisation: UPJN

(1) Present Human Resources and Equipment for Sewerage

The Construction and O&M Division for sewerage functions within UPJN is headed by a General Manager (in the rank of superintending engineer), who takes care of sewerage facilities including pumping stations developed during Ganga Action Plan. It has 3 project managers (in the rank of executive engineers), 10 project engineers (in the rank of assistant engineers) and 37 assistant project engineers (in the rank of junior engineers) amongst a total staff of 274 for the purpose.

(2) Qualifications, Experience and Competence of Personnel

Similar to JS, full details of qualification and experience of the personnel and staff training records could not be made available and therefore it is not possible to appraise competencies of group of professionals. However, from the available information, it emerges that most of the engineering staff either had a degree (4-5 years course) in civil/mechanical/electrical engineering disciplines or a diploma (3 years course) in above disciplines. They have not undergone any specific training in environmental aspects, or wastewater treatment etc. Further, the team drew the impression that maintenance management was practised very much on an ad hoc basis. It also emerged that the work gangs usually did not know, which works they would be undertaking during the day, until they report to work.

(3) Current Maintenance Practices

The current maintenance practices are reactive rather than preventive or as per manual. Most of the maintenance is carried out in response to observed errors, information related to overflows and backing up of customer's discharges. These are normally resolved by clearance of blockages in the sewer. There is no evidence of a planned regime of routine maintenance of the plant and pumping systems. Any repairs to the system arise from problems noted during general check up and or if observed by pump operator etc. Maintenance records were either very poorly maintained or were absent. .

The site work was mostly carried out in an unorganised way. Working practices were observed to be not in accordance with The Manual on Sewerage and Sewage Treatment (i.e. The Manual on Sewerage and Sewage Treatment, Second Edition prepared by the Expert Committee constituted by the Ministry of Urban Development, Government of India, and published in 1995). Further, similar to Jal Sansthan, the site safety was of very poor quality, except when entering the manholes. Even then, it was of low quality and cannot be specified as per standards.

The operation and maintenance regime at pumping stations is unclear. A common factor is that pumping is intermittent on the basis of lengthy daily power outages during which diesel generators are not put into operation.

Station attendants have limited functions. They turn pumps on or off at pre-defined times with limited reference to incoming flow levels. They are not required or trained to be able to carry out any basic maintenance such as tightening of gland packing. This level of maintenance is the responsibility of a travelling fitter and labourers who are supposed to attend to the station each day to carry out routine maintenance duties.

Minor electrical problems are to be attended by a visiting electrician on notification by the station attendant. Any more advanced maintenance is in theory supposed to be contracted out to pump manufacturers but there is little evidence that such work is carried out.

As built drawings are not kept and maintenance records are limited.

CHAPTER 3

OPERATION AND MAINTENANCE IMPROVEMENTS

CHAPTER 3 OPERATION AND MAINTENANCE IMPROVEMENTS

3.1 COLLECTION SYSTEM

3.1.1 Types of Maintenance

Good operation and maintenance practices for sewerage systems are well documented in both the Indian Manual of Sewerage and Sewage Treatment, and the Sewer Inspection and Rehabilitation Manual sponsored by the Foundation for Water Research (WRc) of the United Kingdom

These documents identify the full range of activities necessary to keep a sewerage system in good condition. Ideally all elements of a sewerage system should receive the highest levels of maintenance to ensure its performance is not compromised in any way. However, this is an unrealistic aspiration for any sewerage authority to contemplate.

There are three broad policy options:

- Purely reactive
- Totally planned
- Selective planned/reactive

A more appropriate and cost-effective approach is to achieve a balance between planned and reactive maintenance in providing an acceptable and reasonable level of service.

Reactive maintenance is responding to problems as they occur and will always be required even where there are planned programmes of maintenance. Typical examples are blockage clearance and repair of collapsed pipes. This is a crisis maintenance approach where maintenance and rehabilitation is triggered by failure. For the critical parts of the system it is difficult to equate this option with any move towards optimal cost effectiveness. It ignores the growing deterioration problems, technological developments and any need to improve efficiency. It may lead to a total breakdown of the system at some time in the future requiring massive capital investment.

Planned maintenance is a system of inspection and maintenance aimed at reducing the frequency or risk of failure. It is not the same as routine maintenance where activities are carried out on a fixed, regular frequency. It requires an assessment of the need for and frequency of maintenance operations in order to balance the cost of maintenance with the level of service provided.

Many parts of a sewer system operate quite satisfactorily with minimum maintenance. Research has shown that for approximately 80% of the system the cost of dealing with problems reactively is sufficiently low for this to be the most cost effective solution. For these areas, planned maintenance cannot be justified. However, for the more expensive 20% of the system, the studies have demonstrated that detailed inspection and planned maintenance can be justified because it reduces the frequency and the costs associated with repairing or replacing major assets.

The key to a cost effective maintenance strategy is the recognition that maintenance and rehabilitation programmes should retain as much as is practicable of the existing network by a combination of optimising hydraulic performance and the use of renovation.

Therefore, regular inspection and assessment is required to identify those elements of the sewer system that will require attention on a regular and planned basis. Elsewhere the sewers only need to be dealt with on a reactive basis.

3.1.2 Maintenance Objectives

At present there is concern that assets are not being properly maintained or operated thereby compromising on asset life and project objectives such as pollution control. Maintenance is currently carried out on a reactive basis and relevant records do not appear to be maintained.

Proper collection system maintenance is required to maintain an integrated network of sewers with the capacity to receive and convey efficiently and effectively to treat all suitable domestic, industrial, institutional and commercial wastewaters.

Operation and maintenance of the collection systems should therefore evolve to include more planned maintenance. As well as being more cost effective, a planned maintenance programme will minimise nuisance to customers.

The maintenance management programme should be designed to meet set objectives such as:

1) To ensure the structural integrity of each element of the sewerage system thereby protecting the significant investment in infrastructure.
2) To ensure that all work is carried out in a cost effective, safe and timely manner.
3) To monitor the performance of the sewerage systems by inspection, flow measurement and modelling.
4) To reduce the impact of sewer operations on the public and on the environment.

3.1.3 Immediate Priorities

(1) Establish System Records and Maps

Planned maintenance will be dependent upon obtaining, verifying and maintaining proper system records. The study team emphasises the need to collect and to store centrally all existing records of the sewerage network by setting up a comprehensive computerised database at the local level. This database is typically referred to as a sewer inventory.

A sewer inventory should include the following data: sewer ages, shapes and materials, their depth and cover levels, inlet and outlet sewer sizes, their structural conditions and need for rehabilitation. The sewer inventory database should also include a record of all maintenance activities carried out.

Initially an intensive programme of field survey work will be required in order to establish a sewer inventory database. Data collection must be supported by appropriate developments in hardware and software tools. The following steps will be required to establish sewer inventory and base maps:

1) Collect all existing records and as built drawings
2) Conduct a geo-referenced alignment survey of all trunk, lateral and branch sewers
3) Conduct CCTV inspection of all major sewers
4) Develop GIS based sewer system maps
5) Develop GIS based applications for visual interpretation of database on maps.

Remarks:

1) As built drawings should be converted into digital format and archived in a computer based document system.
2) The records of property connections to the sewers should be linked with the records held by the billing departments so that the GIS data-base becomes a joint technical and financial tool.
3) A procedure should be set up to continually supplement and up-date the sewer inventory.

4) The system should be set up to ensure that up-to-date records are available to all those who should make use of the information: planners, designers, personnel in charge of operation and maintenance.
5) GIS based applications that are commercially available can provide collection system operators with the tools to evaluate large wastewater collection systems and to plan sewer system maintenance and improvements. GIS can provide spatial and visual presentation of data thereby enhancing the ability to interpret data and identify problems.

(2) Inspect Critical Sewers and Assess Conditions

A comprehensive survey of critical sewers is required in order to:

- Develop the sewer inventory data
- Assess the physical condition of sewers
- Identify critical sewers and priorities
- Identify maintenance, rehabilitation or replacement needs

The WRc manual defines critical sewers as those where the consequences of a collapse would be the most severe, costly and disruptive. These critical sewers should therefore be inspected periodically and maintained in good condition.

The initial planning prior to the inspection should cover:

- Selection of sewers for CCTV or man entry
- Identification of flow by-pass arrangements
- Improving manholes where access for the necessary surveys is inadequate

The comprehensive survey and inspection will identify the defects and form the basis for preparing a planned sewer maintenance and rehabilitation programme.

(3) Upgrade Pumping Stations O&M Procedures

The primary objective of operating and maintaining a pump station is to keep the station in continuous operation in order to prevent sewage overflows to the environment and flooding in upstream reaches of the incoming sewers.

There is an urgent need to formalize operational procedures and record keeping. The project considers that the following activities are critical to the successful operation of pumping stations:

- Developing equipment operation and maintenance manuals
- Developing procedures for normal, abnormal, and emergency conditions
- Developing systems for recording daily operating conditions
- Establishing systems for recording equipment maintenance and breakdown history

Operation manuals and specifications are indispensable for operation control and maintenance of pumps. To prevent wrong operation of equipment, operation manuals should be prepared and ready for reference at any time. Operation manuals that normally come with the equipment will do, but it should be noted that such manual content is often limited to the equipment concerned and lacks a description of the system as a whole, such as the interlock with surrounding equipment.

Emergency response procedures should be developed for abnormal conditions such as pump failure, power failure, high water levels in the sump. The emergency response manual should include the following items:

- List of contact addresses of equipment manufacturers, etc.
- Job assignments for all personnel in emergencies

- Emergency communication network
- Procedures for contracting emergency work.

To ensure efficient operational control of the pumping station and to enable early detection of any abnormality, it is indispensable to record operating conditions in daily and monthly logs. It is also important to record all maintenance activities, including equipment failures, and repairs in order to develop historical data and analyse failure trends to justify the economics of replacement.

3.1.4 Typical Routine Maintenance Activities

(1) Sewer Maintenance

1) Sewer and manhole mapping

Location and surveying of sewerage assets to form a record of the system. The need is determined for the extent of records available of the existing system and information available from third parties at time of takeover.

2) Routine, systematic inspection and cleaning of sewers

Every year, the whole sewer network should be visited, about 5 to 10% of the network should be inspected by CCTV camera, and a systematic cleaning of about 20% of the network should be undertaken.

As the system record evolves, and as the results of future, planned CCTV sewer surveys are analysed and added to the records, it will be possible to identify those areas of the sewerage system which, although appearing to function adequately, are in need of maintenance.

The problems within the system may include silt, sediment, garbage, rags, grease, building debris and rubbish and/or household rubbish, or they may be technical, such as slack gradients or poorly made property connections.

The operation and maintenance sewerage management team will be able to assess the problems, and formulate structured planned maintenance schedules to reduce the number of emergency incidents.

Where the problem cannot be dealt with cost effectively by short-term maintenance, then appropriate repair works or rehabilitation works will need efficiently to be programmed.

3) Emergency cleaning and blockage clearance of sewers

Cleaning and blockage clearance will involve a mixture of reactive and planned maintenance work:

- Reactive maintenance will be needed to clear blockages which may cause localised flooding or restricted toilet use.
- Where there are persistent problems it may become necessary to carry out sewer cleaning on a planned maintenance basis (see below).

All work carried out, including the exact location and cause of the problem, will be logged into the data base in order to ensure that the problem has been resolved efficiently and as a guideline to any future systematic planned maintenance procedures.

4) Repairs to sewers and manholes

Repairs to sewers and manholes involve also a mixture of reactive and planned maintenance work.

Reactive maintenance will be needed to carry out emergency repairs to minimise any risk to health and safety arising from collapses, to maintain the fabric of the sewerage systems, to minimise the number of collapses and to reduce infiltration and ex-filtration from the system.

When there are repetitive problems, then repairs can be done on a planned maintenance basis (see below).

All work carried out, including the exact location and nature of the problem, should be logged into the data-base in order to ensure that the problem has been resolved efficiently and as a guideline to any future systematic planned maintenance or major capital procedures.

5) Routine, systematic maintenance and rehabilitation of sewers and manholes

Historically it has been international practice to assume that a sewerage system has a finite life of between 30 and 100 years after construction. It then needs replacement.

Current international practice is to implement a rehabilitation policy whereby the condition of the existing sewerage network is improved by systematic renovation or, if this will not achieve the required result, by the replacement of parts of the system by new pipelines. Thus the major expense of total renewal will never be necessary and the sewerage system will have an infinite life.

The sewerage network should be analysed in detail to assess the structural and service conditions of the system, to verify information and to quantify 'the local knowledge' of the system – that is the situation where customers are aware of sewerage system problems, but they have not bothered reporting the problems.

The problems, whether structural condition, service condition or other known problems, should then be assessed in detail in order to:

- Set priorities against each problem and need.
- Consider rehabilitation options and develop integrated solutions to problems.
- Identify the most cost effective solution.
- Update the sewerage records on the sewerage base plan or data-base.

(2) Installation and Inspection of Service Connections

Old service connections should be checked at a rate of about 20 to 30% per year. New service connections should be installed as per requirements.

(3) Control of Storm Water Discharges into Sewers

Storm water drains have been connected to sewerage systems in order to divert both sullage and storm water to the sewers. The sewerage systems have not been designed to take storm water flows and the practice of connecting the storm water system into sewers gives rise to:

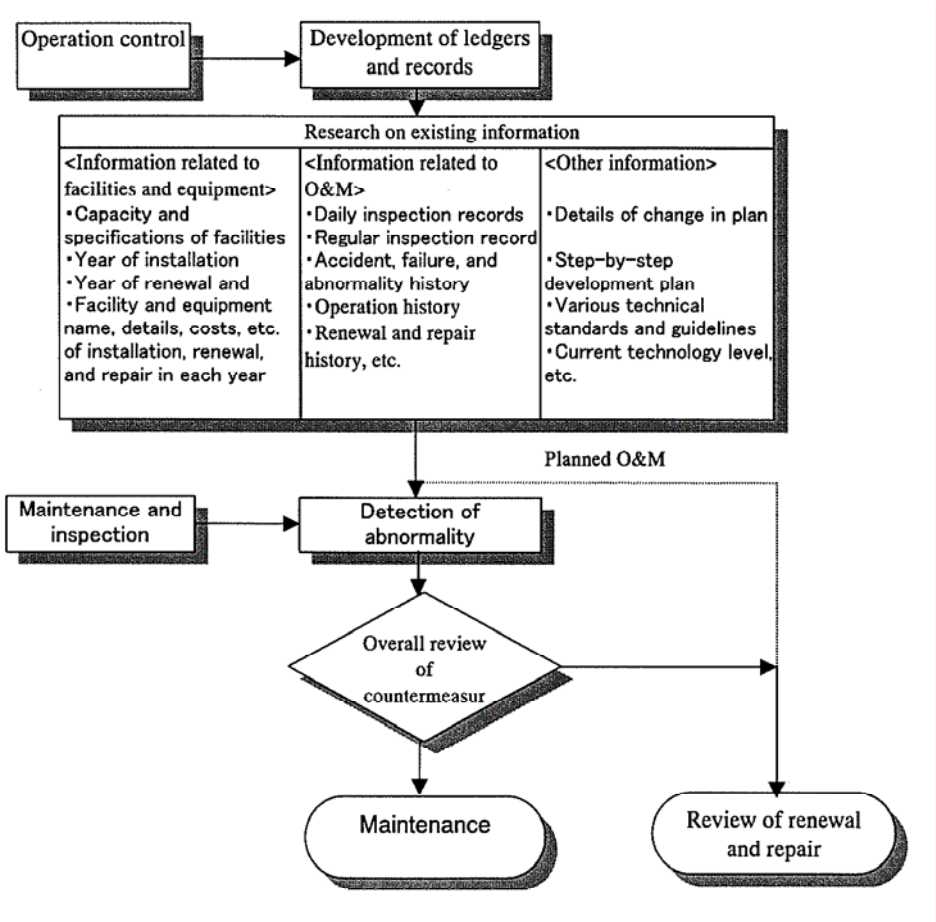
- Sewage surcharge from the system as the sewers become overloaded.
- Flows far in excess of the design flows reaching the existing sewage treatment works resulting in discharges of untreated sewage into the nala.

From the comprehensive data-base records of the sewerage systems and their ancillaries it will be possible to identify each and every connection from the storm water system into the sewerage system. After identifying the connections it will then be possible to:-

- Prepare standard drawings for the construction work required to remove each connection without causing community problems, which effectively means after the storm water drains have by others been made to function properly.
- Identify and quantify the extent of the problem caused to the sewerage system by the connection.
- Set priorities for disconnecting these connections.
- Phase the work to suit other needs, for example sullage diversion out of storm water drains into sewers.

(4) Pump Station Operation and Maintenance

Pumping station O&M activities should be re-organised along the lines shown in the following flow chart with emphasis on proper record keeping.



The most important aspect of pump maintenance is lubrication. it is often observed that lubricating oils/grease of adequate viscosity is not supplied as required to gears and other operating parts, causing unnecessary wear and tear. It is important to ensure oil supply without fail by promoting recognition of its importance as a basic and elementary step in operation and maintenance of machinery. It is essential that operators recognize the fact that machinery as well as the pump facilities do not always operate simply by turning ON power supply and cannot withstand severe or abnormal operating conditions.

Maintenance requirements for pumps, motors and switchgear at pumping stations is identified in Table 3.1 below

Table 3.1 Maintenance of Mechanical and Electrical Equipment at Pump Stations

Item	Daily	Monthly	Every 3 Months	Every 6 Months	Every year
Pumps	- Leakage through packing - Bearing temperature - Undue noise or vibration - Pressure voltage and current readings			- free movement of gland on the stuffing box - cleaning and oiling of gland-bolts - inspection of packing and repacking if necessary - alignment of the pump and drive - cleaning oil lubricated bearings and replenishing clean oil - if bearings are grease lubricated the condition of grease should be checked and replaced to correct quantity if necessary	- cleaning and examination of all bearings for flaws - examination of shaft sleeves for wear or scour - checking clearances of wear rings - examine impellors and vane tips for pitting or erosion - check for end-play on bearings - re-calibrate all flow meters and instruments - test pump to determine if proper hydraulic performance is being obtained - for vertical turbine pumps the above inspections should be bi-annual
Motors	- Check bearing temperature - Undue noise or vibration	- Nothing special	- Blow away dust and clean any splashing of oil or grease - Check wear of slip ring and brushes; smoothen contact surfaces or replace if necessary. - Check cable connections and terminals and insulation near the lugs - Check to be sure there is no water in the stators of the electric submersible pump sets - Clean and tighten all contacts	- Check condition of oil and grease and replace if necessary - Test insulation by megger	- cleaning and examination of all bearings for flaws - check end-play of bearing and reset
Switchgear, starters	- Check the phase indicating lamps - Note readings of voltage current, and frequency - Note energy meter readings	- Examine contacts of relay or circuit breaker. Clean if necessary - Check setting of overcurrent relay, low-voltage coil and tripping mechanism; oil in the dash-pot relay	- check fixed and moving contacts of circuit breakers - check condition and quality of oil/liquid in circuit breaker, and auto transformer starter.	- Clean and blow clean transformer cells, electrical cabinets.	- Calibrate all indicating meters.
Transformer substation	- Nothing special	- Nothing special	- Check condition of high tension bushings - Check condition of the de-hydrating breather and replace the silica gel charge if necessary	- Check di-electric strength and acid test of transformer oil and filter - Test insulation by mugger - Check continuity to proper earth connections	- Check resistance of ground electrode - Bi-annual: complete inspection including internal connections, core and windings

(5) Screen and Grit Removal

Screen and grit chambers require daily inspection. Equipment selection and facility design should be simple to operate and minimize labour.

Due attention should be paid to the following points regarding flow velocity control in the grit chamber:

- An excessively high water level in the chamber causes a decrease in flow velocity, resulting not only in sedimentation of sludge and corrosive organic matter, but also settling of sand in conduits.
- Contrary to this, excessive lowering of the water level causes deterioration of the sedimentation efficiency, allowing sand to flow into the collection system and the treatment plant.

Accordingly, it is important to find out the appropriate water level in the chamber. It is also important to select the pump control method that enables adequate water control (setting of the pump operation level and ON/OFF control in the pumping well).
Considerations during daily control activity are as follows:

- Removal of screenings as frequently as possible
- Immediate removal of grit accumulated in the sand pit.
- Immediate disposal of removed screenings and grit because they will decay and present sanitary problems, such as generation of offensive odours and flies.

3.1.5 Summary of Collection System Maintenance Programme

The proposed sewerage maintenance programme is summarized in the following Table 3.2.

Table 3.2 Sewerage Maintenance Programme

Type of activity	Description	Frequency
Sewer inventory	GIS base maps, data collection, updating	Permanent Initial 3-year programme to implement software and populate the data base using specialist consultants.
Sewer survey and inspection	cleaning, CCTV inspection, assess condition, identify critical sewers	Initial 3 year programme using contractors and specialist consultants
Routine inspection & cleaning	Follow-up routine cleaning	20% network / year
	CCTV Survey	5 to 10% network / year
Emergency blockage clearance	Sewer clearance	Permanent
Sewer & Manhole repairs	Emergency repair	Permanent
Planned maintenance & rehabilitation	Sewer replacement or other rehab. Technologies	Permanent
Service Connections	Check and repair of existing connections	20% of total No. / year
	Installation of new connections	As required (according to sewer system expansion)
Control of storm water discharge into sewers	Identification of connections	Permanent
	Remove connections	Permanent

The immediate priorities are:

- to establish adequate records of the critical sewers
- to complete structural surveys of critical sewers

- upgrade equipment and O&M procedures at pumping stations

These activities can be run concurrently but they will take time to implement. The implementation of sewer inspections and GIS based maps as outlined could require at least 3 years before it can be integrated into a planned maintenance and rehabilitation programme.

It is an inescapable consequence of introducing more detailed maintenance and planning methods that the acquisition and analysis of data will be much more demanding in manpower and financial resources than a reactive crisis management approach. Local bodies do not have the resources or skills to organise or fund these activities. It is clear that a significant level of technical assistance and external funding will be required.

3.2 SEWAGE TREATMENT OPERATION AND MAINTENANCE IMPROVEMENTS

3.2.1 General

The Project has appraised the existing sewage treatment works operation and maintenance and has stated that the works are not well operated and poorly maintained.

Operation and maintenance improvements should initially be carried out at the existing sewage treatment works, but this works will effectively be a training ground for establishing procedures and an organisation capable of running the proposed future sewage treatment works.

The Project emphasises the need to set up and to maintain accurate records which give full details of the design criteria and sizes of treatment units, etc. and comprise a diary of every significant event at the works. These records should be checked on each routine supervisory site visit. The records should include comprehensive details, with drawings and service manuals, for all electrical and mechanical components indicating their dates of manufacture and installation, and a detailed service/maintenance history for each unit. Detected faults should be recorded and reported to ensure that remedial action will be taken as soon as possible to have the faults rectified.

3.2.2 Routine Inspections of the Works

Weekly routine inspection of the mechanically cleaned screen should be made to ensure its efficient operation. This includes checking its mechanical operation for any abnormal noise, that it is running on normal amps, the control panel for “trip” lights, the state and cleanliness of the brush cleaning mechanism, the efficiency of the wash water jetting, etc.

Weekly routine inspection of the grit removal plant should be made to ensure its efficient operation. This includes checking its mechanical operation for any abnormal noise, that it is running on normal amps, the control panel for “trip” lights, the state and cleanliness of the unit, particularly that of the grit washer.

On every visit of supervisors (at least once a week), the buildings and concrete structures, such as the aerated tank beams, should be checked for evidence of damage and deterioration, with appropriate records kept and monitored.

Every month, the same should be inspected in detail.

3.2.3 Routine O&M of The Screening and Grit Removal Units

The manually raked screens should be raked as found necessary, but at least once per day, allowing screening materials to drain and be disposed of in a skip or bin, and then cleaned and brushed

afterwards. The skips should be checked on every supervisory visit for containment of material, drainage of water and for sanitary disposal of their contents as necessary.

The following programme is proposed:

Table 3.3 Maintenance of Screening and Grit Removal Units

Daily	Regularly	Weekly	Every Month	Every 3 Months
Remove grit and screenings	Hose down all screening plant	Check all emergency stop buttons Inspect mechanically cleaned screen Inspect grit removal plant	Drain grit chamber Remove grit from site Check building and concrete structures (aerated tank beams)	Check all inlet and outlet penstocks in screening unit Drain screen chamber and remove grit and debris Check channel seals

3.2.4 Repair and Overhauling of Electrical and Mechanical Equipment

Electrical and mechanical equipment at the treatment works that is in very poor condition should be repaired/replaced as soon as possible and brought up to the required, safe electrical standards.

Planned preventative maintenance procedures should thereafter be implemented to ensure that all equipment is properly maintained so that it will fulfil its purpose.

The maintenance programme of mechanical and electrical equipment is proposed in the following Table 3.4.

Table 3.4 Maintenance of Mechanical and Electrical Equipment of Waste Water Treatment Works

	Weekly	Monthly	Every 3 Months	Every 6 Months	Every year
Greasing	- Check levels and quality of oils, fill up if necessary - Grease certain components manually – slide of screens, etc.	- Grease pump parts – joints, plummer blocks, etc.	- Check levels and qualities of oils in pumps - Change oil in compressors - Grease hoisting apparatus - Grease fans	-	- Change oil in reducers
Mechanical equipment	- Check clogging conditions of sieves, filters and various units, and clean	- Check tightening of stuffing boxes - Check alignments of couplings - Check tightening of chains and belts - Check pump vibration - Check wearing of chains, pinions, etc. - Carry out operating test for valves and priming pumps - Carry out on-load tests of power generators sets while checking operating parameters (pressure, temperature, etc.)	- Check wearing of grit extraction pumps and other pumps, classifiers screws, filtering panels and lifting screws - Check equipment of compressors, blowers and miscellaneous rotary machines	- Check wearing of screen slides, rollers and plummer blocks of conveyor belts - Check scrapers, scum skimmers of settling tanks, etc.	- Carry out checks and compulsory regular tests of pressure units and hoisting machinery - Check pump, motor, etc. bearings
Electrical equipment	- Check levels of electrolyte in and charge batteries (if need be) - Check carbons, rings, starting devices, etc. - Clean probes	- Check insulation	- Check to be sure there is no water in the stators of the electric submersible pump sets - Check centre columns of radial bridges of circular structures - Check cables and lugs	- Clean and blow clean transformer cells, electrical cabinets and motors	- Carry out compulsory check of conformity.

3.3 CONTRACTING OUT

3.3.1 General

The Project recommends strengthening the capacity of local Jal Sansthan for O&M of sewerage. The establishment of a new Sewerage Division within Jal Sansthan is discussed in elsewhere.

All sewerage operations and maintenance activities should be reviewed for suitability of contracting to private sector or public service providers. Employing contractors provides an opportunity of minimizing internal costs with the advantage of competition in the market place. Alternatively it can be used to provide resources to meet short-term peaks in workload or provide services that require specialized skills or equipment.

Before deciding staffing levels, training and equipment needs for the new sewerage division, it should be decided what, if any services should be contracted out. A decision regarding what tasks/components will be 'Contracted out' and for what total periods needs to be treated as an urgent matter, as it will greatly effect the labour force held by the sewerage authority.

Even if it is decided to let some tasks out to another public agency (e.g. UPJN) or to private sector contractors**,** the Sewerage Authority should always retain overall responsibility for and should closely control and supervise the work carried out by others, and so it will still require competent managers and supervisors.

3.3.2 Scope

'Contracting out' can make good sense economically. It can be an alternative in the following alternatives:

(1) Design

The standard scenario for 'Contracting out' is when there is a 'one-of' task to be performed, for example the design of a new sewage treatment works. The reasoning is that it would be uneconomic for the new Authority to set up and train a specialist team of designers capable of designing a modern sewage treatment works, when there is only a few works to be designed.

The economic solution is to hire a firm of consulting engineers who have a team that specialises in the design of sewage treatment works, and let them carry out the design. A variation would be to hire a specialist company that will provide the complete sewage treatment works on a turn-key basis.

(2) Operation and Maintenance

Servicing and maintenance of specialised plant by Contracting out can also be economically sensible, based upon the similar reasoning that it may not be worth training an in-house team to service and maintain particular specialised plant when the supplier of the specialised plant already has a team of persons who can carry out this work.

(3) Labouring jobs

Even labouring jobs can often economically be Contracted out, but for rather different reasons. For example, the reason may be that the work in question is seasonal, and it would be uneconomical for the Authority to appoint permanent staff for such seasonal work because of the difficulty of finding work to give the labourers to do out of season.

Another economic reason could be that privately employed labourers could receive higher wages than

the Authority is allowed to pay for particularly unpleasant jobs which Authority labour will not carry out.

(4) Specific tasks

There are specific, relevant tasks that could be contracted out, as described in the following clauses.

1) Contracting Out Sewer Inspection Surveys to Establish the Sewer Inventory

All the trunk and secondary lateral sewers need to be surveyed in detail in order to build up the data base recommended as being absolutely necessary.

Developing the sewer inventory and GIS applications, as well as the initial inspection and condition assessment of the sewer system are considered to be specialized projects that would be implemented by external resources. These projects would include capacity building and technology transfer to a specialized unit within the new sewerage division.

After the initial development and assessment, the on-going routine inspection of the sewer system can be carried out by the specialized sewer inspection unit and external contractors for CCTV and cleaning works.

2) Contracting Out Design

In this context, the term 'design' should be taken to include also the preparation of specifications, bills of quantity and working drawings.

It may be noted that the Contracting out design still requires that the Authority has staff capable of drafting and negotiating the Agreement which confirms the appointment of the contractor or other Authority and tells them what is required and to what criteria and standard the work is to be done.

Design of new trunk sewers, pumping stations and treatment works can ideally be contracted out to specialist engineering consultants. Project management for engineering studies and detailed designs could be contracted out to UPJN.

3) Contracting Out Sewerage Construction Supervision

'Contracting out' this type of work can also be economically sensible, provided that is remembered that the Authority has to supervise closely the supervisors.

4) Contracting Out Sewage Treatment Construction Supervision

This type of 'Contracting out' can also be economically sensible, although not so positively in that, as the proposed new sewage treatment works will be expanded regularly in the future, it may pay the Authority to build up its own, in-house competent Civil Engineering Construction Supervision team.

If the design and construction are let under a 'turnkey' arrangement, the Authority will still need to supervise the work.

5) Contracting Out Sewerage Operation And Maintenance

The responsibility for Sewerage O&M is already partly transferred to City Municipal Corporation. Whether or not additional assets can be transferred in the near future needs to be considered by policy and decision makers.

There are however aspects that can and probably should be Contracted out, such as CCTV surveys to inspect sewers, sewer rehabilitation, cleaning using specialized equipment and the construction of property drains.

6) Contracting Out Sewage Treatment Operation And Maintenance

Contracting out of the servicing and maintenance of specialised plant can make economic sense.

The operation and maintenance of the proposed new sewage treatment works for a fixed period could be included as part of a 'turn-key' design and construction contract.

Overall, both UPJN and Jal Sansthan have qualified and experience people to manage sewerage facilities, once installed. However, based on discussions, it is our perception that they lack planning and management perspective of sewerage management. Further, both the organisations were not observing proper maintenance management guidelines. The major reasons seems to be: lack of specialised designated staff in adequate numbers, knowledge of staff, lack of training and availability of maintenance manual, finance, poor organisational culture etc. Poor record keeping was observed to be a common feature amongst both the organisations.

CHAPTER 4

HUMAN RESOURCES DEVELOPMENT

CHAPTER 4 HUMAN RESOURCES DEVELOPMENT

4.1 HUMAN RESOURCES, FACILITIES AND EQUIPMENT FOR OPERATION AND MAINTENANCE

4.1.1 General

The Project recommends strengthening the capacity of local Jal Sansthan for O&M of sewerage. The establishment of a new Sewerage Division within Jal Sansthan is discussed in the following Chapter.

Before deciding staffing levels it is important to decide what, if any services should be contracted out. Since there is probably not enough time to hire and train staff for all O&M activities associated with the project it is assumed that the following functions will be contracted out:

- Cleaning of sewers using high pressure sewer jetting equipment
- The initial inspection and condition assessment of sewers using CCTV
- Development of GIS tools, sewer inventory and base maps
- Operation and maintenance of treatment plants
- Development and delivery of training programmes

The following staffing proposals are for the immediate future, to achieve immediate improvements in sewer maintenance. Staffing and the training of personnel, both supervisory and field workers, will be a major initial task for the new authority. It is therefore recommended that a special Human Resources Cell be created for the duration of the re-organisation project. This cell would be responsible for developing job descriptions, job re-classification, hiring management and supervisory staff and delivery of training programmes.

The suggested human resource requirements for pump stations and treatment plants are in accordance with directives issued for GAP projects by UP Ministry for Urban Development as well as additional guidelines of UP Government**.** However, efforts have been made to reduce the number of employees, wherever possible. Annual recurring costs on staffing are based on the salaries, which have been used by UPJN in estimating O&M costs for the year 2004-05.

4.1.2 Staff Requirements

(1) Management staff requirements

Jal Sansthan has a total of 1 Superintending engineer, 5 Executive Engineers, 9 Assistant and 13 Junior Engineers and a large number of operatives to operate and maintain the water supply and sewerage system within the municipal areas. The sewage treatment works created under Ganga Action Plan are operated and maintained by UPJN with a total workforce of 315 including 1 Superintended Engineer, 2 Executive Engineer and 17 Junior Engineers.

Considering the fact that under new institutional arrangements, all the three facilities (sewer lines, pump houses and STPs) would be maintained by one single organisation (Jal Sansthan – as suggested) and the project recommends that the overall management of the Sewerage Division should be with one Superintending Engineer.

(2) Recommendations of requirement of operation and maintenance staff for sewer

General

Sewer maintenance generally involves regular inspection of all sewers, sewer cleaning operations, both preventive and corrective, and occasional repairs to manholes. Categories and extent of personnel

required for these activities have been worked out on the basis of quantity of work. To determine personnel requirements reference was made to the following indicative rates, as presented in Table 4.1, which have been applied to other countries similar to India.

Table 4.1 Indicative Numbers of Manpower and Equipment

Description	Minimum No of Operatives	Frequency	Equipment	Remarks
Routine inspection	2 operatives	2 hours/km,	Medium sized van	
Mechanical cleaning of sewers	4 operatives	5 to 10 km/year	Truck with mechanical equipment	
Pressure cleaning of sewers	2 operatives	200 to 400 m /day (for diameter of 200-500 mm)	Pressure Jetting Unit	Suggested to contract out
Emergency blockage clearance	2 operatives	1 to 4 hours each	Pressure Jetting Unit	Suggested to contract out

Inspection and routine, systematic cleaning of sewers

The project recommends the length for annual inspection of sewers should be 1/3 of the total length; it indicates that all the sewers will be inspected and cleaned once in 3 years. However, a priority shall be put on critical sewers and the frequency of inspection and cleaning should be prioritised. **Generally it is more cost effective to use contract services for CCTV inspection** since the equipment is specialised and costly to repair and maintain. Man-entry inspections would be carried out by inspectors specially trained to recognize sewer defects. Therefore, it is recommended to contact out this service also. However, annual contracts for cleaning and CCTV inspection would be supervised by in-house staff. Therefore it is recommended that a specialized inspection unit be created within the new sewerage division to:

- Monitor sewer inspection and cleaning contracts
- Maintain sewer inventory database
- Carry out man-entry inspection of sewers
- Review CCTV tapes and assess physical conditions
- Identify priorities for maintenance and rehabilitation

The Project recommends the following staff and equipment for regular inspection and cleaning:

- Regular inspection and cleaning team: headed by 1 junior engineer
- Inspection team: comprising of 1 driver, 1 inspector and 2 operatives equipped with a medium sized van for normal man-entry inspections, mechanical cleaning, and supervision of CCTV surveys, etc.
- Routine cleaning team: comprising of 1 driver and 3 operatives equipped with a pressure jetting/ vacuum unit.

The medium sized vans would be equipped with drain rods and fittings, road and pedestrian warning signs and three safety frames to surround open manholes, picks, shovels, brooms, sledge hammers, wheelbarrow and manhole lifting keys. There would also be boxes containing personnel safety equipment such as safety helmets, spark proof hand lamps, gas detection equipment, gloves, harnesses and ropes. A comprehensive first aid box with barrier creams, and also rags and disinfectant for cleaning both persons and equipment, should also be provided on every vehicle.

Emergency cleaning and blockage clearance of sewers and repairs to sewers and manholes

The Project recommends the following staff for cleaning and blockage clearance and emergency

repairs:

- Emergency cleaning and blockage clearance and repair team: headed by 1 junior engineer
- Manual cleaning teams: equipped with a medium sized van for mechanical cleaning. Each team would comprise of a driver and three operatives. The vehicles should be equipped as described above.
- Pressure cleaning teams: equipped with a pressure jetting unit for tasks within the sewerage system, which can not be carried out by sewer operatives equipped solely with drain rods. Each team would comprise of a driver and three operatives. The vehicles will be equipped in a similar manner to the medium sized vans but with additional equipment including a variety of nozzles.

All the vehicles would be equipped with a mobile radio for communication between the teams and controllers to ensure that the teams are able to carry out emergency sewer cleaning and blockage clearance tasks without the need to visit the depot between jobs.

- Emergency repair team: comprising of 2 drivers and 5 operatives, equipped with a large size van with the same equipment as indicated above and a medium sized vehicle for the transport of additional equipment - warning signs, traffic barriers and temporary fencing, materials, compressors, waste materials etc., as necessary for the works.

In the short term the Project has assumed that all emergency repairs to the sewerage system will be carried out by excavation and also that any excavation needing specialist excavation plant and machinery will be contracted out or carried out by a special division within the proposed organisation (Jal Sansthan). That is, such work will not be deemed to be part of operations and maintenance.

Planned, systematic maintenance and rehabilitation of sewers and manholes

Workload will be based on annual inspections. In general the workload is expected to be quite high initially because maintenance has been neglected and observed conditions are poor. **Specialised sewer rehabilitation work would be contracted out.** However this work would need to be supervised by the inspection unit. Supervision of specialised rehabilitation could be outsourced to UPJN.

The Project recommends the following staff for planned maintenance:

- Planned maintenance team: comprising of 1 junior engineer, 1 driver and 3 operatives and equipped with a medium sized van. Additional materials to be carried on the vehicle to include manhole detection equipment and small tools such as hammers and chisels, sand and cement.

These teams will carry out planned works including locating and raising manhole covers and frames, replacing manhole steps and minor repairs to shallow sewers.

Assessment of structural condition

The Project recommends the following staff to assess structural condition of sewer:

Structure assessment team: comprising of 1 junior engineer, 1 driver and 3 operatives, equipped with a medium size van with the required tools to assess sewer condition.

Recommendations on Staffing and Equipment for Sewerage Maintenance

Table 4.2 Recommendation of Staffing and Equipment for Sewerage Maintenance

No.	Type of activity	Description	Junior Eng.	Staff			Equipment / team
				Operative/ inspectors	Drivers	Total	
1	Routine inspection & cleaning	Man-entry inspection	1	3	1	4	Medium van + mechanical cleaning equipment (rods)
		Cleaning		3	1	4	Pressure jet machine
2	Emergency blockage clearance and repairs	Sewer clearance	1	3	1	4	Medium van + mechanical cleaning equipment (rods)
				3	1	4	Pressure jet machine + set of nozzles
		Emergency repairs		5	2	7	Large van + mechanical cleaning equipment Medium lorry + works material, equipment, tools
3	Planned maintenance & rehabilitation	Sewer replacement or manhole repairs	1	3	1	4	Medium van + equipment for manhole repair, etc.
4	Assessment of structural condition		1	3	1	4	Medium van + equipment for structural assessment

Proposed staff requirement for sewer maintenance

The proposed staff requirement for O&M of sewerage maintenance is estimated by following steps:

- Estimate the total length of sewer pipelines in the City including trunk, lateral and branch sewer. The length is calculated assuming the coverage area of branch sewer and 385 m/ ha of average branch sewer length (see Sewerage M/P).
- Work out the number of teams for routine inspection and cleaning team assuming the criteria of 2 hours/km for inspection and if required cleaning and 1/3 of the total sewer distance for inspection and cleaning

The calculation process is attached in Table 3 in ANNEX. The following is summary of proposed staff requirement for sewer maintenance.

Table 4.3 Recommendations on Staffing and Equipment for Sewer Maintenance (Varanasi)

	Type of activity	Description	No. of Teams	Total
1	Routine inspection & cleaning	Man-entry inspection	1	4
		Cleaning	1	4
2	Emergency blockage clearance and repairs	Sewer clearance	1	4
			1	4
		Emergency repairs	1	7
3	Planned maintenance & rehabilitation	Sewer replacement or manhole repairs	1	4
4	Assessment of structural condition		1	4
	Total		7	31

(3) Recommendations of requirement of operation and maintenance staff for pumping station

General

The routine operation and maintenance of pumping stations would be the responsibility of the Pump

Station Manager. The personnel requirements for operation and maintenance of sewage pumping stations varies depending on the size of pumps or handling capacity per day of the operating pumps at the station. The total number of pump station facilities including those operated by UPJN for GAP related projects is 7 and 1 more has been sanctioned and 6 proposed by JICA Study. These 14 pumping stations will require considerable human resources for their smooth functioning.

Pumping station operation requires the provision of teams of operators on shift to cover the 24hr period. A minimum of three operators per station would be required. General housekeeping maintenance of the stations and their campus would be the pump operator's responsibility (It needs to be included in their responsibilities as a part of their posting/appointment offer).

Introduction of telemetry and automatic control can reduce manpower requirement particularly at the smaller stations but requires economic and reliability analysis to justify the capital expenditure. These advanced techniques have not been recommended under the present context.

Maintenance of the pumping station can be split into three types:

- Routine/preventive maintenance of M&E equipment
- Emergency servicing
- Planned repairs and replacement of equipment

Routine maintenance and planned repair or replacement of the M&E equipment

Basic servicing of equipment for the pump stations can be carried out in-house by teams of qualified electrical and mechanical technicians. The *routine servicing* of electrical and mechanical equipment would be the responsibility of the Electrical and Mechanical Supervisors (1 each). The work should be scheduled based upon both operating and maintenance manuals and also upon the in-house recording and monitoring systems.

For routine maintenance and overhauls on pumping stations, it is recommended that a group of electrical and mechanical teams would look after pumping stations comprising of 1 electrical, 1 mechanical and 1 helper/apprentice. The teams would be mobile and responsible for a certain number of facilities therefore they would be equipped with 1 medium sized van. The medium sized vans would be equipped with tools, miscellaneous small parts and fittings for routine electrical/mechanical maintenance. It would also have the provision for personnel safety equipment such as safety helmets, spark proof hand lamps, gas detection equipment, gloves, harnesses and ropes, road safety equipment. A comprehensive first aid box with barrier creams, and also rags and disinfectant for cleaning both persons and equipment, should also be provided on every vehicle.

Overhauling of equipment should be based upon the recommendations of operating and maintenance manuals. Substantial overhaul works (e.g. large pumps) should be contracted out to the specialist contractors or pump manufacturers. Necessary mechanical tool kits, chain and pulley blocks etc. should be made available for repair and maintenance.

Emergency repair and servicing of electrical and mechanical equipment

The Project recommends that the pump stations should be manned twenty four hours, all 365 days of a year and hence it will be necessary to implement a shift system of working with emergency call out procedures and to appoint more competent operatives as shift leaders. The Project recommends that all existing electrical and mechanical equipment at the works should be repaired as soon as possible after a problem occurs. Substantial repair and replacement work should be contracted out to specialised agencies or pump manufacturer. Allowance should be made within the budget for a percentage of the capital cost of the M&E equipment to cover for repair and replacement together with an amount for basic servicing materials and consumables. Each team would comprise of 1 driver, 1 electrician (or

mechanic) and 1 apprentice. The teams would be mobile and would respond to emergency calls. Each team would be equipped with 1 medium sized van.

UP State guidelines

The staff requirement for pumping stations according to the directives issued by UP Department of Urban Development for GAP works is summarised in the following table:

Table 4.4 Staff Requirement for Operation and Maintenance of Pumping Station
(Guidelines of UP Department of Urban Development)

Level	4	5	5	5	5	5	Total
Post / Capacity	Jr. Engineer	Mech. cum fitter	Electrician	Pump Operator	Beldar	Sweeper	
90 HP	0.25	0.5	1	3	2	1	7.75
150 HP	0.25	1	1	3	2	1	8.25
300 HP	0.5	1	1	3	2	1	8.50
500 HP and above	1	1.5	1	3	2	1	9.50

JICA Recommendations

The number of employees has been reduced by JICA Study Team from those proposed in the above UP guidelines wherever possible. The following table summarises the staffing for operation and maintenance of pumping stations as recommended by JICA Study Team.

Table 4.5 Recommendation of JICA Study Team on Staff Requirement for Operation and Maintenance of Pumping Stations

Level	4	5	5	5	5	5	
Post / PS capacity	Jr. Engineer	Mech. cum fitter	Electrician	Pump Operator	Beldar	Sweeper	Total
90 HP	0.25	0.25	0.25	3	1	1	5.75
150 HP	0.25	0.25	0.25	3	1	1	5.75
300 HP	0.5	0.5	0.5	3	1	1	6.50
500 HP and above	1	1	1	3	2	1	9.00

Note: Assistant engineers should be assigned to large, important pumping stations or a cluster of pumping stations where necessary for appropriate management.

The total number of staff for O&M of pumping stations is calculated using the table below. These staff shall be distributed to two special teams comprising of routine & planned maintenance team and emergency repairs team as described in table below.

Table 4.6 Staffing and Equipment for Pump Station Operation & Maintenance

Type of activity	Staff / team				Equipment / team
	Mechanical	Electric	Helper/ Operator	Driver/ Labour	
Routine maintenance & planned overhauls	1	1	1	1	Medium van + tools/parts
Emergency repairs	1	1	1	1	Medium van + tools/parts
Pump operation	-	-	3	-	1 team for each pump station for 3 shifts in 24 hrs operation

Proposed staff requirements for O&M of pumping station

The total number of O&M staff required for pumping station is estimated as below and the detail numbers are estimated in Table 3 in ANNEX.

Table 4.7 Staff Requirement for Pump Station Operation & Maintenance (Varanasi)

Level	2	3	4	5	5	5	5	5	Total
Title	Ex. Engineer	Asstt. Engineer	Junior Engineer	Mechanic	Electrician	Pump Operator	Labour/ Beldar	Sweeper	
Nos. of required staff	0	2	5	9	8	39	19	12	94

(4) Recommendations of requirement of operation and maintenance staff for sewage treatment plants

Routine operation and maintenance of the treatment units

The routine operation and maintenance of the treatment units would be the responsibility of the Operations (Process) Supervisors and a workforce. The Project recommends that the treatment works should be manned twenty four hours each day and hence it is essential to implement a shift system of working with emergency call out procedures and to appoint more competent operatives as shift leaders.

Repair and servicing of electrical and mechanical equipment

The Project recommends that all existing electrical and mechanical equipment at the treatment works should be repaired/replaced as soon as possible after a breakdown.

The *emergency repair* and overhauling of electrical and mechanical equipment would be the responsibility of the Electrical and Mechanical Supervisor and the skilled operatives (electricians and mechanics). Overhauling of equipment should be based upon the recommendations of operating and maintenance manuals.

The *routine servicing* of electrical and mechanical equipment would also be the responsibility of the Electrical and Mechanical Supervisor and the skilled operatives (electricians and mechanics). The work should be scheduled based upon both operating and maintenance manuals and also upon the in-house recording and monitoring systems.

Process control and monitoring of the treatment efficiency

The chemical laboratory would fall under the responsibility of the Laboratory Chemist. The Laboratory has to have sufficient equipment and apparatus to perform its desired functions i.e. from

sampling to final analysis and reporting.

UP State guidelines

The personnel requirements for operation and maintenance of treatment plants vary depending on the size of the plant and type of plant. The staff requirements for GAP projects for different types of processes and capacities are determined by UP Ministry for Urban Development guidelines as presented in Table 1 in ANNEX.

JICA Recommendations

The JICA Study Team considers that by combining the management of different STPs under one single umbrella, proposed treatment works can each be operated and maintained by a reduced number of properly trained staff and workforce of personnel. The staffing for O&M of sewage treatment plant recommended by JICA Study Team based on UP state guidelines are summarised in the table below with details in Table 2 in ANNEX. The major differences are as follows:

- Number of labours are reduced considerably
- Staff requirement for UASB+ Aerated Lagoons (AL) is added
- Staff requirement for large capacity STPs (Activated Sludge and UASB+AL) is added.

Table 4.8 Recommendation of JICA Study Team on Staff Requirement for Operation and Maintenance of Sewage Treatment Plant

Process	Level / Post Capacity	2 Ex. Engineer	3 A.E (E&M)	3 A.E. (Civil)	4 J.E. (E&M)	4 J.E. (Civil)	4 Chemist	5 Total 5 Level
Activated Sludge Process	10 mld		1		4			38
	40mld		1		4			51
	80mld	1	1		6	1	1	71
	120mld	1	1	1	6	2	1	85
	200 mld	1	1	1	6	2	1	98
Aerated Lagoons	10 mld		1		4	1		19
	40mld		1		4	1		22
	80mld		1		4	1		37
	120mld		1	1	4	2		42
Oxidation Pond / Waste stabilisation Pond	10 mld		1			1		15
	40mld		1			1		19
	80mld		1			1		32
	120mld		1			1		40
H.Rate Filtration	10 mld		1		4			38
	40mld		1		4			50
	80mld	1	1		6	1	1	70
	120mld	1	1	1	6	2	1	83
Oxidation Ditch	10 mld		1		4	1		30
	40mld		1		4	1		34
	80mld	1	1		6	1	1	61
	120mld	1	1	1	6	2	1	66
UASB + Aerated Lagoons / Fluidised Aerated Bio-Reactor	10 mld		1		2	1		31
	40mld		1		2	1		35
	80mld	1	1		4	1	1	63
	120mld	1	1	1	4	2	1	74
	200 mld	1	1	1	4	2	1	85
	300 mld & above	1	1	1	6	3	1	96

Note: see Table 2 in ANNEX.

Proposed staff requirement for O&M of sewage treatment plant

The staff requirement for O&M of sewage treatment plant is summarised in table below and the detail is enclosed in Table 3 in ANNEX.

Table 4.9 Staff Requirement for Operation and Maintenance of Sewage Treatment Plant (Varanasi)

No.	STP	District	Status	Design Capacity (MLD)		Process	Level/Number of required staff							Total
							2	3	3	4	4	4	5	
				Stage I	Stage II		Ex. Eng.	A.E (E&M)	A.E. (Civil)	J.E. (E&M)	J.E. (Civil)	Lab Chemist	Level 5 total	
1	Dinapur STP	I	Existing	80	80	ASP	1	1	0	6	1	1	71	81
2	Sathwa STP	II	Proposed	200	225	UASB + AL	1	1	1	4	2	1	85	95
3	Bhagwanpur STP	III	Existing	9.8	9.8	ASP & TF	0	1	0	4	0	0	38	43
4	Ramna STP	III	Sanctioned	37	75	WSP	0	1	0	0	1	0	19	21
	Total			326.8	389.8		2	4	1	14	4	2	213	240

(5) Other major staff requirement

Staffing for contract operations

It is highly probable, for economic and logistic reasons, that operation and maintenance of the new treatment works will be contracted out to the private sector. However, it is very essential for the "Sewerage Division" in Jal Sansthan to monitor the performance of the contract operator to ensure that assets are well maintained and the effluent discharges are within required limits/standards. Under the contracting out scenario, a specialised unit within the sewerage division needs to perform the following functions:

- Supervise all preventive maintenance activities on critical mechanical and electrical equipment to ensure that they are carried out in accordance with maintenance schedules
- Supervise repairs and overhauls
- Ensure that adequate maintenance records are kept by the contractor and transfer the data into the Sewerage Division's maintenance database
- Sample treatment plant effluent and carry out lab analysis
- Ensure that the contract operator is properly recording and reporting treatment plant process parameters
- Assist the contract operator in troubleshooting

The section should consist of:

- 1 assistant engineer responsible for contract administration and reporting as well as overall staff supervision supported by requisite staff

GIS base map and sewer inventory database

Record keeping and mapping are mainly office based activities and would require 1 junior engineer for the inventory data, and 1 junior engineer together with computer operator for GIS mapping. A team of 5 people would be adequate for a system of this size.

Others

Other staff requirement is listed in Table 5.1 in Chapter 5.

(6) Summary of required engineering professional

It is recommended that for three major technical facilities, following management professionals are required:

- For sewer lines and pumping stations: 1 Executive Engineer, 4 Assistant Engineers and 11 Junior Engineers besides required staff

- For the three sewage treatment plants: 2 Executive Engineers, 6 Assistant Engineers and 21 Junior Engineers besides required staff

4.1.3 Manpower Costs for Operation and Maintenance

Manpower costs of operation and maintenance for all the facilities including existing, sanctioned and proposed facilities have been estimated in Table 3 in ANNEX and the summary of manpower costs are summarised in the following table.

Table 4.10 Summary of Manpower Costs for O&M (Varanasi)

Facility	Cost in 1,000 Rs.
Sewers	3,617
Pumping Stations	7,880
Sewage Treatment Plants	20,922
Total	32,419

Note: The cost estimation includes all the facilities (existing, sanctioned and proposed).

4.2 HUMAN RESOURCES DEVELOPMENT

4.2.1 General

This discussion concerns the perceived level of skills in the public sector regardless of which agency possesses the skills.

It should be noted that it is not part of this Project to determine in detail the level of the skills of individuals. Therefore, what follows is necessarily a generalisation.

A general assessment of current human resources development for operational and maintenance management among the two organisations (UPJN and JS) indicates the following common trends:

- Limited technical skills to plan and implement projects
- Limited managerial skills
- no technical operations and maintenance skills
- no budgets for training and development

Ability to manage the environmental impacts of its operations is inadequate. Inadequate staffing levels compound the training and human resources development (HRD) issues. The current mix of skills within public service utilities is inadequate for effective management and performance of pollution control and wastewater infrastructure. Properly trained personnel are essential at all levels if the sewerage operation function is to be carried out efficiently and effectively.

The following training issues are identified:

- the majority of managers and engineering staff have not received training since their formal pre-service education
- Most managers and engineers have not had formal technical training in wastewater engineering or operations management
- Training needs are conducted irregularly
- Training courses are not readily available

Human resources development must anticipate future trends and react well in advance with an appropriate staffing and training strategy. The following training objectives are set in response to foreseeable development of sewerage infrastructure:

- Develop a cadre of environmental management professionals within both organisations
- Improve managerial and technical skills for planning, design, implementation and evaluation of investments in sewerage infrastructure
- Increase the level of specialization in operation and maintenance units, whose activities have a direct impact on pollution prevention efforts and water quality objectives.

- Where possible, re-train and upgrade skills of existing personnel to meet the changing skill sets required for environmental management.

Unless these objectives are achieved, large investments in sewerage development will not provide the intended benefits.

4.2.2 National/ State Capacity for Training

Both at state level and national level, there are a large number of colleges, vocational institutions and training organisations, which provide training. For different levels of training, we are considering different institutions. Although Varanasi has an educational infrastructure that could potentially meet the institutional requirements for training but the present education generally lacks planning and practical operating needs of the urban environmental sector and current curriculum and pedagogical methods are inadequate for our needs. Besides these, there are limitations in sanitation training capacity, which would limit the quality of output due to the following reasons:

- A limited number of training institutions for higher level training.
- Absence of sector specific equipment required for practical, operational-oriented training.
- Inadequate linkages between government entities and educational/training institutions resulting in differences between the training offered and operational sector requirements.

Technician level training is provided exclusively by vocational institutions (Industrial Training Institutions), but they do not maintain adequate links to urban utilities therefore the training tends to be impractical and not sufficiently up-to-date. These vocational schools offer general training aimed to develop students/trainees as fitters, welders, blacksmiths, carpenters, mechanics, electricians, motor mechanics, instrumentation mechanics etc. with no specific focus on specialised skills for urban infrastructure. Further, their current infrastructure availability is a matter of concern. However, they possess a potential knowledge and skill base and therefore these institutions could be used with some inputs from the project, adaptation to project needs and with some infrastructure addition.

General financial management, bookkeeping and accountancy training offered are generally business oriented and don't focus on the specific needs of urban/municipal finance. Further, local bodies are in the process of introducing double entry accounting system, which would require specialised institutions/resource persons.

(1) Available Options

A number of national, regional and local engineering colleges offer civil/mechanical/ electrical/ environmental engineering degrees at Bachelor's level with specific specialization at Master's level. Various distinguished colleges like Benaras Hindu University, MLNNIT, Allahabad; Aligarh Muslim University, IIT, Kanpur etc. offer even specialisation in wastewater treatment. Therefore, arranging technical training at these institutions could be one of the options. Some of them do offer regular training activities but the regular training activities may not meet our objectives. In that case, if needed, the project should plan for customised training programmes. These customised programmes would be designed and delivered based on specific requirements and on dates convenient to the organisations. Although their cost could be little higher than conventional training programmes and have limited peer learning component into it, they would be able to meet the project needs better.

For managerial subjects, a good number of training institutes provide a wide range of potentially relevant training in areas such as Project Planning and Management, Financial Management, Marketing Management, Corporate Strategy, Human Resources Management. However, they lack specific focus on the requirements of urban water and sewerage utilities. These organisations could be

very useful, as they would be willing to adapt to meet our requirements. However, the project management unit should be able to express the specific objectives and learning objectives of each HRD/training activity, and should be able to check, if the suggested curriculum and training delivery strategy, training materials and resource person(s) – as suggested by a typical training organisation-could meet the project requirements and standards. This activity could be managed by the HRD cell, which could be established within the project at the State level rather than at City level.

Improving capacity within selected training institutions is not a specific objective of the project. However, development of institutional training capacity can occur through the proposed HRD strategy by involving local training institutions in training events, course design and direct provision of in-service training.

(2) HRD Strategy

In the short term, HRD is modulated by the need to provide staff with the required qualifications and in sufficient numbers to carry out the many new tasks that come with the proposed investment projects and programmes being implemented by NRCD.

The strategy for achieving the proposed HRD objectives will consist of re-training and/or hiring personnel to meet the needs of individual investment projects and programmes. Thus each future investment project should include a comprehensive HRD component to ensure successful and sustainable implementation of the project.

For structural projects (e.g. wastewater treatment plants), all organisations involved in the project decision-making hierarchy will be included in the HRD component. This will include organisations involved in the initial planning, design, implementation and finally operations.
In developing specific HRD programmes for each organisation the following methodology should be applied:

- Identify all organisations that will be involved in the investment or capacity building project
- Identify the existing skill sets, and supporting systems or tools in each organisation and compare to those required
- Identify existing staff that have the potential to upgrade their skills or achieve the desired qualifications
- Hire qualified staff in appropriate numbers to fill the gaps
- Provide technical assistance, training and tools (software, hardware, equipment) to support staff.

In the longer term, there will continue to be a large number of investment projects in the sector whose funding can support staff training and technical assistance. However, by the mid-term each organisation should strive to increase the level of funding in their annual operating budgets for HRD. In this way, organisations can develop some autonomy and develop their own HRD programmes customized to meet their specific needs. HRD should be aimed at maintaining the skills of professionals, managers, and operators trained on previous projects.

A cadre of environmental management professionals will eventually be established. Organisations will need to plan for the eventual replacement of highly trained managers, technicians, and operators. In addition to the on-going training required to maintain acquired skills, HRD programmes should also focus on hiring and training potential candidates to assume key positions in the organisation.

(3) Implementation of HRD

Training will be delivered by:

- technical assistance at the project identification and planning stage,
- formal training courses during project implementation
- on-the-job training during the commissioning period, and
- technical assistance for a period of at least two years after the implementation of a project

The training programme developed under the project should have three parts:

- basic management skills for all administrators and unit managers
- intensive and specialized technical training for operators
- specialized vocational skills training for maintenance personnel

1) Management Training

The management training needs identified by the project at managerial and professional levels are the following:

- Project planning,
- Project management,
- Financial management, life cycle cost analysis, cost accounting
- Human resource management,
- Records management (GIS, database),
- Reporting,
- Operation and maintenance management,
- Procurement,
- Contract supervision.

2) Technical Training

It is expected that many of the technical functions in the sewerage sector will be contracted out in the future. However, this does not mean that the in-house technical professionals can be less skilled. Indeed, they will need to be as skilled as if they were to carry out all the functions themselves, because they will have to instruct and supervise and control closely those to whom the work is contracted out (and who may have profit as their main motive for taking on the work).

The technical training needs identified by the project at professional and technical operations levels are the following:

- Emerging Wastewater/Sewage Treatment Options
- Automation and Process Controls in Sewerage/Wastewater Treatment
- Monitoring and Evaluation of Sewerage Facilities including Plant Performance: setting evaluation criteria in local context, developing data collection strategies and methodologies, evaluation, cost effectiveness of evaluation etc.
- Wastewater sampling and laboratory analysis
- Maintenance Management Systems for Sewerage Facilities
- Basics of Information Management Systems and Financial Information Management Systems
- Sewer Inspection Programme Management and Rehabilitation Techniques
- Design of Pump Stations
- Pump Hydraulics
- Sewer Design and Sewer hydraulics –including some software applications
- Computer skills to use information management system (IMS) and FIMS
- Basics of GIS for Urban Infrastructure (sewerage management focus)

- Database Management
- Selection of Equipment for Specific Applications (operations management, data analysis etc.)
- Construction Supervision
- Quality Assurance Systems in Construction and Operation of Sewerage Facilities
- Techniques of Environmental Monitoring and their Interpretation
- Sewage Farming
- Development of greenbelts and their maintenance

Electrical and mechanical maintenance personnel should also be included in a similar training programme but at a less advanced level.

3) Training for Sewer Maintenance Field Staff

All collection system personnel should be trained to maintain sewers and manholes safely by teaching the skills and knowledge needed to clear sewers of silt and blockages.

Safe working practices should be taught concerning all sewer and manhole cleaning and maintenance operations.

The training should include such details as:

- characteristics of sewerage systems,
- how to recognise different types of sewer and manhole construction materials,
- the nature of sewage and common causes of sewer blockages,
- the interpretation of sewerage plans and drawings,
- the importance of safe working procedures and hygiene during sewerage work
- the importance of following manufacturers' recommendations when making repairs to sewerage pipelines,
- the methods available for dealing with sewage flows during sewer maintenance, modifications or repairs,
- how to make property connections into manholes and how to bench manholes.
- How to fixing manholes and raising frames

Training for selected operatives should also be given in:

- the safe use of high pressure water jetting equipment including the theory and working principles of high pressure water jetting,
- practical aspects of the equipment and on how to select ancillaries for a particular application,
- the identification of hazards in the workplace.

4) Training for Electricians and Mechanics

The training should include details such as:

- Switchgear and starters
- Instrumentation and control
- Motor maintenance & repairs
- Troubleshooting pumps
- Pump maintenance
- Shaft alignment
- Bearings and seals
- Welding

- Pump hydraulics and performance
- Diesel generator maintenance

In addition to the above suggested training areas and realising the fact that maintenance management operates on certain guiding principles, which have been developed after years of experience, there would be need for developing/adapting manuals especially for the operation and maintenance of various sewerage facilities. These manuals would provide guidance to both managers and operators in proper management of various sewerage facilities. Therefore, development/adaptation of manuals should be undertaken as a separate activity.

CHAPTER 5

FUTURE MANAGEMENT STRUCTURE

CHAPTER 5 FUTURE MANAGEMENT STRUCTURE

5.1 GENERAL

As described in previous chapter, the present management for the operation and maintenance of the sewerage infrastructure cannot cope with the present situation. Organisations are carrying out breakdown maintenance, severely compromising asset life and system performance. There is limited positive and meaningful co-operation between the agencies involved.

Sewerage systems are rapidly expanding and will continue to do so in the future. Projects sanctioned under GAP and interventions implemented under the proposed priority projects will ensure that most of the sewage flows will be treated by 2015.

There is therefore a significant and urgent need to improve the management and organisation of the operation and maintenance for sewage collection and treatment functions. This will require major institutional re-organisation and the building up of capacity and competence within the sewerage sector.

As discussed in the previous chapter, responsibility for O&M should rest with a single sewerage authority.

It is expected that this new sewerage authority will be integrated with the existing Water Supply Corporation (Jal Sansthan). However, in the context of this Report, the proposals made are, for clarity, for the management of sewerage functions only.

Obviously, several of the technical services, admin and financial functions can be provided by existing water supply departments.

What follows is a list of the tasks together with recommendations as to how they may functionally be grouped together to foster the development of specialized skills.

5.2 SUMMARY LIST AND CATEGORISATION OF TASKS

It is convenient to categorise the sewerage tasks for which the new Authority will be responsible into several headings:-

(1) *Administration and Finance* of the Sewerage Division excluding Revenue collection which it is assumed will be carried out by the Water Division but including sector financial control, planning and management of capital investment programmes, advice on legislation, public relations and publicity, new business and office services.

(2) *Personnel* including recruitment and appointments, education and training.

(3) *Planning*, forward and current.

(4) *Major capital works*, including design and preparation of specifications and bills of quantity for new sewers, pumping stations and treatment plants.

(5) *Contracts preparation and supervision* of implementation, including approving payments to contractors and suppliers and recording unit construction prices for use in estimating.

(6) *Operation and maintenance* of sewage treatment works, in-house and contract operations.

(7) *Operation and maintenance* of branch and trunk collector sewers, sewage pumping stations, including sewer inspection and condition assessment, and determining rehabilitation needs.

(8) *Technical Services, field support*, carrying out topographical surveys, specialised GIS computer systems, sewer mapping and sewer inventory database, monitoring flow in sewers and nalas, maintaining a technical library and records such as engineering reports and drawings.

(9) *Technical Services, environmental*, laboratories, monitoring effluent quality at treatment plant and nalas, inspection and control of industrial discharges into public sewers, removing industrial discharges from nalas.

(10) *Improvement works*, such as organising and supervising property connections, improving branch sewer coverage, removing storm water from sewers, disconnecting sewers from drains, including design, and preparation of specifications and bills of quantity.

(11) *Support Services*, purchasing and managing stores for parts, equipment and construction supplies, including management and maintenance of vehicles and maintenance equipment.

5.2.1 Grouping of Tasks into Managing Departments and Sections

Department A: Administration and Finance - Task 1, 2

(1) Overall Administration and Office services
(2) Finance
(3) Legal aspects and Public Relation
(4) Personnel
(5) Training.

Department B: Engineering – Tasks3, 4 and 5
(in the short term this service would be provided by a special unit from UPJN)

(1) Planning
(2) Design
(3) Contract
(4) Construction, Quality Management

Department C: Operation and maintenance treatment works - Tasks 6

(1) Process Control/Optimisation
(2) O&M treatment plants

Department D: Operation and maintenance collection - Tasks 7

(1) Operation and maintenance Sewers
(2) Operation and maintenance Pump Stations
(3) House connections

Department E: Technical Services - Task 8, 9,10
(in the short term this service could be provided by a special unit from UPJN)

(1) Environment: Protection and Monitoring
(2) Laboratories

(3) Topo surveys and GIS Mapping
(4) Improvement works
(5) Records and Library

Department F: Support Services - Task 11

(1) Special Procurement
(2) Stores for parts, construction materials and equipment
(3) Vehicle/fleet management, equipment maintenance.
(4) Environment: Protection and Monitoring
(5) Laboratories for pollution and chemical analysis
(6) Topographic surveys and GIS Mapping
(7) Improvement works
(8) Office automation, Information Systems, Records and Library (being a technical activity, these have been suggested under Technical Services)

5.2.2 The Proposed Management Structure and Staffing

The above recommendations are presented diagrammatically in Figure 5.1. Taking into account the future management organisation, the tasks to be performed, and also the future structure of the sewerage system, the number of staff for operation and maintenance of the sewerage system and the sewage treatment works has been calculated, which is based on recommendations made in Chapter 4. The staff requirements would be as follows:

Level 1	Superintending Engineer	1
Level 2	Executive Engineer /Administrative Officer	6
Level 3	Assistant Engineers, Environmentalist and Assistant Admn. Officer	20
Level 4	Junior Engineers, Administrative Assistant	61
Level 5	Assistants, Operatives, Drivers, Sweepers, Peon, Laboratory Staff,	389
		477

Preliminary details of staffing are given in Table 5.1. The proposed staffing is required for the normal functioning of Sewerage Division of the Jal Sansthan (or may be renamed as Varanasi Water Supply and Sewerage Board). The staffing is based on the assumption of completion of works under Phase II of the GAP Project, including sanctioned projects and proposed JICA Feasibility Study projects.

However, some of the tasks of the organisations may be contracted out so that they are carried out by other public agencies and /or by private sector contractors. Even if it is decided to let some tasks out to private sector contractors and other agencies, the Sewerage Division will still require level 1 to level 3 officers to prepare contracts and to supervise (level 4 officers) and control those carrying out the work. That is, the savings to the arising from 'Contracting out' would be mainly in the large number of operatives and their foremen, equipment and vehicles.

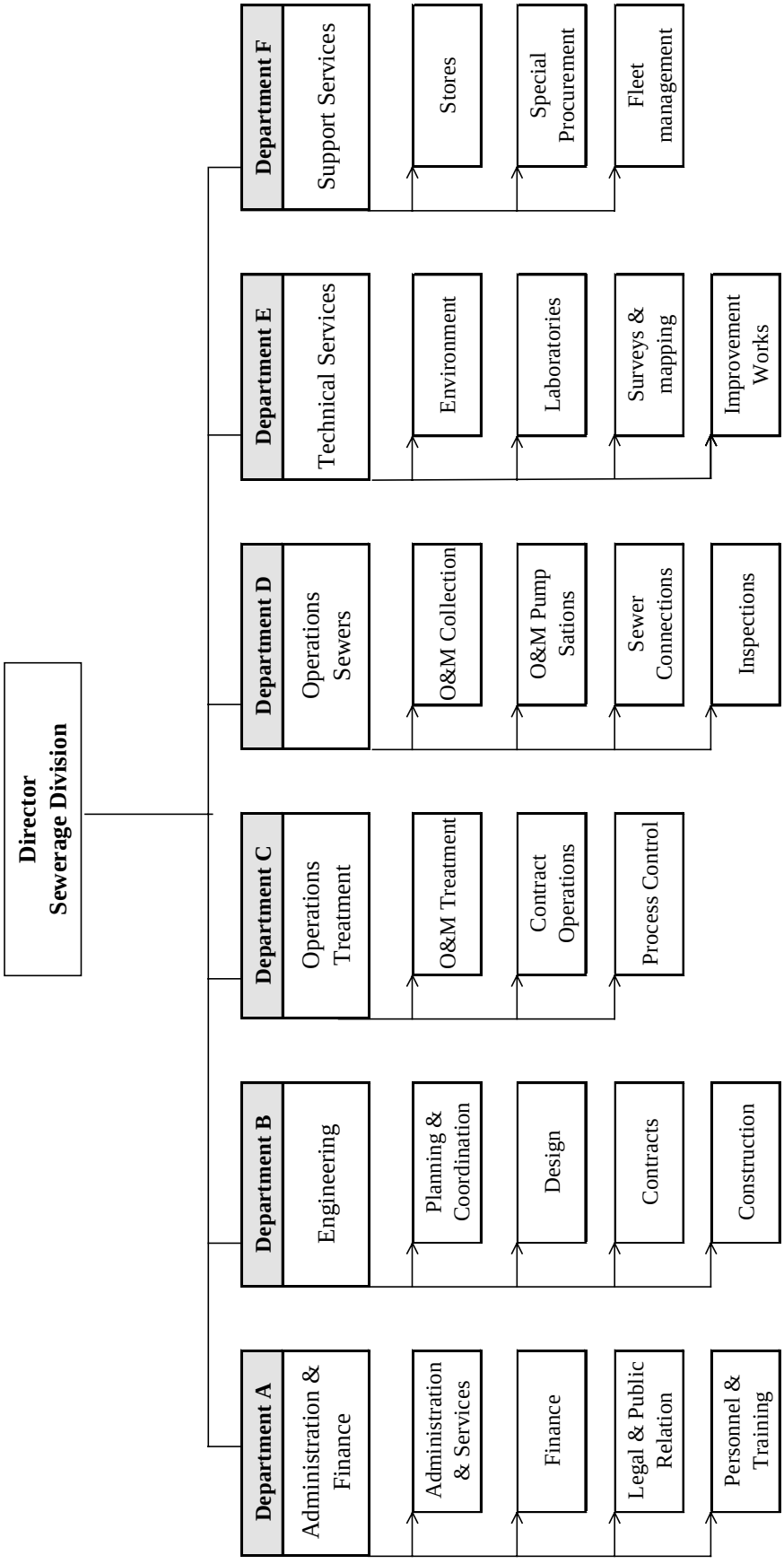


Figure 5.1 Varanasi City Sanitation Management Structure

Table 5.1 Staffing and Equipment for Sewerage Management Functions (Varanasi)

Level 1		Level 2		Level 3		Level 4		Level 5	Total
Division	**No.**	**Department**	**No.**	**Section**	**No.**	**Sub Section/Unit**	**No.**	**No.**	**Division**
Director (in the rank of Superintending Engineer)	1	A. Administration and Finance	1	Administrative Services	1	General Administration	1	2	
						Office services	1	2	
						Internal Audit	1	2	
				Legal and Public Relations	1	Legal	1	1	
						Public Relations, Complaints, Unions	1	2	
				Personnel and Training	1	Personnel	1	2	
						Payroll, Travel	1	2	
						Training	1	1	
				Support Services Stores, Procurement Fleet and Equipment management	1	Stores (spare parts, materials, tools, supplies)	1	1	
						Special procurement	1	1	
						Vehicle and equipment maintenance	1	1	33
		B. Engineering Services	1	Planning and Coordination, Contracts	1	Planning	1	2	
						Coordination	1	1	
						Contract Preparation	1	2	
						Contract Evaluation, legal	1	1	
				Design	1	Wastewater Engineering	1	2	
						Civil Engineering	1	2	
						Electrical Engineering	1	1	
						Mechanical Engineering	1	1	
				Construction and Quality	1	Construction supervision	1	3	
						Codes and Quality Management	1	1	30
		C. Sewage Treatment Operations (4 plants)	2 Dinapur STP Sathwa STP	Process Control	1	Process Engineering	1	213	
						Laboratory services	2		
				Operation and maintenance	5	Civil and General	4		
						Electric & Mechnical	14		242
		D. Sewer Operations – Collection System	1	O&M of Collection System	1	Routine inspection & cleaning	1	31	
						Emergency blockage clearance and repairs	1		
						Planned maintenace & repairs	1		
						Assessment of structural conditions	1		
				Cnnections	1	Civil –Connections	1	2	
				O&M Pumping	2	Electrical & Mechanical	6	89	138
		E. Technical Services	1	Environment and Laboratory Management (Sathwa- main laboratory)	1	Monitoring quality and quantity of sewage, nala flows and effluents from treatment plants	1	2	
						Industries and liaison with Industries	1	1	
						Laboratories	1	2	
						Field sampling		5	
				Survey and Mapping	1	Topographic surveys	1	3	
						GIS base mapping	1	1	
						Sewer inventory database, drawing and printing services		1	
				Sewerage Improvements, Database and Automation	1	Flow monitoring of sewers, nalas etc.	1	2	
						Other sewerage improvements	1	2	
						Computer services, MIS and FIMS, Log Records of plants, pump houses etc.	1	2	33
Total	**1**		**6**		**20**		**61**	**389**	**477**

CHAPTER 6

METHODOLOGY
OF
SETTING UP THE PROPOSED NEW ORGANISATION

CHAPTER 6 METHODOLOGY OF SETTING UP THE PROPOSED NEW ORGANISATION

6.1 INTRODUCTION

This section advises how to set up the proposed Management Structure of the Sewage Division at Jal Sansthan, and also the initial steps required so that the Division can start to function.

Whether or not it has been decided to 'Contract out' selected tasks does not affect the procedure described below. It will, however, affect the level of management staffing in the relevant Sections and the numbers of operational personnel required.

6.2 SETTING UP THE MANAGEMENT STRUCTURE

STEP 1: Responsibilities of the Sewerage Division

At the present time, not all these functions are under the control of Jal Sansthan.

It was suggested earlier in this Report that they should all be controlled in the future by the new Sewage Division at Jal Sansthan. This does not, however, mean for example that the new Authority will design all new sewers. However, it is expected that the new Authority will be closely involved in coordinating with all other agencies engaged in such work.

It does also mean that, once the senior Managers of the Division are functioning in their posts, early firm decisions need to be taken regarding which tasks should be 'Contracted Out' in order that the Division will be appropriately staffed with an adequate labour force. One particular case of ‘Contracting out’ will be the O&M of the treatment plants and pumping stations to UPJN or the private sector.

The following discussions assume that the new Authority will be responsible for all the tasks listed above.

STEP 2: Personnel – Professional and Supervisory

(1) Agree Management structure.

(2) Decide job categories and the status of each job.

(3) Decide salaries and other emoluments for each post.

(4) Prepare job descriptions for every post.

(5) List and review qualifications and experience of every professional and supervisory staff member and record.

(6) Fill every post (Job) with appropriate existing staff members so far as is possible.

(7) By comparing job descriptions and the qualifications of appointees, determine, plan, design and arrange educational and training courses in order to bring individual qualifications and experiences in line with specific post (Job) requirements.

(8) Fill all outstanding vacancies by recruitment of suitable candidates.

(9) Appoint department and section heads as soon as possible and let them take up their posts, so that they can carry out, with assistance and support as necessary, most of the tasks listed in this section.

STEP 3: Offices and other practical details for Management Structure

(1) Decide upon required sizes of offices required.

(2) Examine existing and other offices offered and tailor requirements to what is available.

(3) Decide upon furniture required.

(4) Examine existing and offered furniture and prepare order lists of additional furniture required.

(5) Decide upon equipment required.

(6) Examine existing and offered equipment and prepare order lists with specifications of additional equipment required.

(7) Decide upon vehicles required to function properly.

(8) Examine existing and offered vehicles and prepare order lists with specifications of additional equipment and vehicles required.

(9) Arrange for the installation of both internal and outside communication apparatus.

6.3 SETTING UP THE WORKING STRUCTURE

This structure will comprise mainly field workers, but it will also include some more junior office staff, such as draughtsmen, print shop workers, laboratory technicians and scientific inspectors.

STEP 4: Personnel - foremen, tradesmen and semi-skilled workers

(1) Agree team names, structures, composition and personnel requirements.

(2) Agree job categories and the status of each job.

(3) Agree salaries and other emoluments for each post.

(4) Prepare job descriptions for every team position.

(5) List and review qualifications and experience of every available skilled and semi-skilled staff member and record.

(6) Fill every post (Job) by appropriate existing staff members so far as is possible.

(7) By comparing job descriptions and the qualifications of appointees, determine, plan, design and arrange educational and training courses in order to bring individual qualifications and experiences in line with specific post (Job) requirements.

(8) Fill all outstanding vacancies by recruitment of suitable candidates.

STEP 5: Accommodation, including mess-rooms, toilets with showers, locker rooms and stores for field-work operations

(1) Decide upon required sizes and locations of buildings and/or rooms required.

(2) Examine existing and other buildings and/or rooms offered and tailor requirements to what is available.

(3) Decide upon furniture required.

(4) Examine existing and offered furniture and prepare order lists of additional furniture required.

(5) Decide upon equipment required.

(6) Examine existing and offered indoor equipment and prepare order lists with specifications of additional equipment required.

(7) Examine existing and offered equipment and prepare order lists with specifications of additional equipment required.

6.4 TASKS ON WHICH TO COMMENCE WORK

STEP 6:

(1) Plan a publicity campaign, stating the Division's plans for improving the sewerage service, with particular reference to the need to end discharges of sullage into storm water drains and also aimed at persuading property owners to connect to sewers.

(2) Review, programme and budget for the operation and maintenance of priority projects.

(3) Plan in-house workshops and seminars, initially to instruct senior management but later for all staff members bearing responsibility.

(4) Plan in-house training for both staff and operatives.

(5) Collect and centralise sewerage information including property connection records. Start to establish the Divisional library.

It is strongly recommended that the new Sewage Division will be absolutely responsible for receiving, assembling, checking, up-dating as found necessary, recording and storing ready for reference all of the City's sewerage and sewage treatment records, preferably in a GIS computer data-base which other authorised agencies and persons can tap.

(6) Carry out sewer inspections. Identify critical sewers, assess condition and maintenance needs. Programme and budget for rehabilitation.

(7) List and review all in progress and planned sewerage schemes.

(8) Review in the field the methodology and the efficiency of the existing sewer maintenance programmes and decide how they can be improved.

(9) Improve the operation and maintenance of the existing Sewage Treatment Works, including the capabilities of its laboratory and the efficiency of process control. Prepare manuals for operatives where necessary.

(10) Plan and implement a programme for measuring flows and taking sewage samples from the drains and sewers.

(11) Review all work in progress and all Sewerage and Sewage Treatment operation and maintenance from the point of view of safety.

(12) Select and survey pilot areas for improving branch sewer coverage. Plan, programme and budget for branch sewer improvements.

6.5 PILOT PROJECT APPROACH

Whole scale re-organisation and implementation of new O&M practices may not be feasible given the many institutional constraints that are present in the sector.

As an alternative, O&M improvements could be implemented on a limited (pilot area) only. The pilot area would correspond to a fixed geographical area such as a sewerage district and selection would be based on identified project priorities. It should also take full account of discussion with the relevant operating authority.

The option of a pilot based approach might be preferred for the following reasons:

- Allows concentration of resources to ensure full implementation of all activities and reduces the risk of failure
- A group of “experts” can be developed through al levels of staff and workers in the district. This group can then provide the core of experience to other groups
- Additional operating areas can be added to over time as experience grows and performance reaches required standards.
- Operating procedures can be evolved and refined in a single operating group before expanding to new areas. This helps to ensure commonality of approach and also allows for later comparison of performance across the operating areas.

Key actions that need to be implemented for this approach to be successful:

- Responsibility for all O&M activities to rest with one identifiable officer, of sufficient stature and experience in the relevant authority
- That officer should only be tasked with this responsibility and not be required to carry out other significant duties.
- Officer should be given sufficient delegated authority to actually achieve the required performance and standard of service
- The budget for operating in the pilot area must be properly defined and provided for in the relevant authority’s finances
- This budget will need to be increased as the pilot area is expanded.
- Liaison with drainage and solid waste authorities need to be in place to ensure proper coordination of activities.
- Appropriate technical and financial support to be given by outside bodies during start-up period.

This list of actions is not exhaustive but is intended to highlight those areas that must be addressed before significant progress can be made.

CHAPTER 7

INSTITUTIONAL DEVELOPMENT

CHAPTER 7 INSTITUTIONAL DEVELOPMENT

7.1 SYSTEM DEFICIENCIES

Varanasi Nagar Nigam, Varanasi Jal Sansthan and U.P. Jal Nigam, have several deficiencies, lack of sharing of common information, resources amongst each other etc. Nagar Nigam and Jal Sansthan are public service organisations but they work in isolation and do not much interact with public or call for their opinion in operational matters and developmental issues. Some observations are summarized below:

1. There is a clear overlap in several area of operation between Nagar Nigam and Jal Sansthan.

   (a) While Jal Sansthan is responsible for maintenance of main and trunk sewers, Nagar Nigam maintains the branch and laterals. The Nagar Nigam do not have the requisite expertise and the equipment to carry out the maintenance of sewer lines; hence only manual cleaning is done. This dual responsibility interferes with the smooth functioning of the respective departments and moreover similar types of jobs being done by two different sets of people and organisation.
   (b) Nagar Nigam, collects property tax and Jal Sansthan collects Water Tax, Water Charge and Sewer Tax from the residents / property owners of Varanasi. Tax Collectors of both the departments visit the same household for their portion of revenue. The Taxpayer has to visit two different offices for payment of his dues and redressal of problems.

2. Nagar Nigam is not properly equipped to handle the cleaning of sewers and normally try to muster help from Jal Sansthan on personal level. However still the responsibility of maintaining the branch sewers lies with the Nagar Nigam.

3. The local Pollution Control Unit of UP Jal Nigam was formed primarily with the execution of the works under Ganga Action Plan and the operations and maintenance thereof was supposed to be transferred to the local body. However, this is not the case in Varanasi. Operations and maintenance of the Sewer Treatment Plant is still under UP Jal Nigam.

4. While Nagar Nigam and Jal Sansthan face a shortage of manpower, on the other hand UP Jal Nigam has a surplus manpower. A very small percentage of the total manpower is now looking after the assets under Gap Phase I.

5. Lack of networking of the organisations and sharing of common database. Nagar Nigam is responsible for fixing the Annual Rental Value of all properties within the municipal limits and charge Tax there on. The Jal Sansthan is also supposed to use the same Annual Rental Value to impose Water Tax on the consumer but the same is not readily available.

6. All the organisations are primarily conducting breakdown maintenance work. Preventive or routine maintenance seems to be lacking. This is resulting in the systems not functioning to the optimum.

Possible options are prepared considering the most obvious gaps in the organisations. On assessing the institutions, it is felt that there are major items, which require strengthening in the concerned areas. However, apart from the institutional strengthening a reshuffling in the responsibilities between the organisations is necessary. This constitutes a medium and long-term strategy.

7.2 MEDIUM AND LONG TERM INSTITUTIONAL DEVELOPMENT

7.2.1 Objectives of Institutional Development

The Institutional Development Programme (IDP) is expected to implement institution engineering intended to:

- Financially and organisationally strengthen city offices so that they can implement succeeding phases of the sewerage projects proposed in the Master Plan and the Feasibility Study

- Build and strengthen sewerage divisions in city office so that they can provide the public infrastructure services in accordance with the objective, principles and guidelines.

- Prepare an action plan required for the above and their time schedule for implementation and support their implementation

7.2.2 Proposed New Roles of Relevant Organisations

It is utmost important to identify the role of each of the organisations, i.e., UP Jal Nigam, Ganga Pollution Control Unit, Nagar Nigam and Jal Sansthan.

Nagar Nigam and Jal Sansthan are complementary organisations and carry out many common functions. Hence they should be under the same management. It recommended that Jal Sansthan set up sewerage division and all the revenues and costs be centralized with operational autonomy of the departments.

UP Jal Nigam, Ganga Pollution Control Unit, Varanasi can be made responsible for the construction and setting up of sewerage treatment plant under contract of Jal Sansthan and then hand it to Jal Sansthan for operation and maintenance.

The following new roles and responsibilities are recommended for major players of sewerage system management. These roles and responsibilities should be reviewed in the implementation stage of Institutional Development Programme.

Nagar Nigam (City Office)

i) Owner of the assets created
ii) Member of the board of director of Jal Sansthan (sewerage division in city office)
iii) Approval of budget for sewerage system
iv) Coordination body with other organisations such as Development Authority

Jal Sansthan (City Office)

i) Sewerage system management
   - Planning and designing
   - Implementation of sewerage project
   - Supervision of construction works
   - Operation and maintenance of sewerage facility
   - Revenue collection and generation
   - Financial management of revenue and expenditure

UP Jal Nigam

i) Contract-based work for Jal Sansthan
   - Planning and designing of sewerage system
   - Supervision of construction works of sewerage facility
   - Operation and maintenance of sewerage facility

ii) Training of sewerage engineer
iii) Provision of official examination and certification for sewerage engineer
iv) Research and development of sewerage technology
v) Preparation of manual and guidelines for planning, designing and operation & maintenance

The following figure explains a concept of the proposed structure of the relevant organisations and roles.

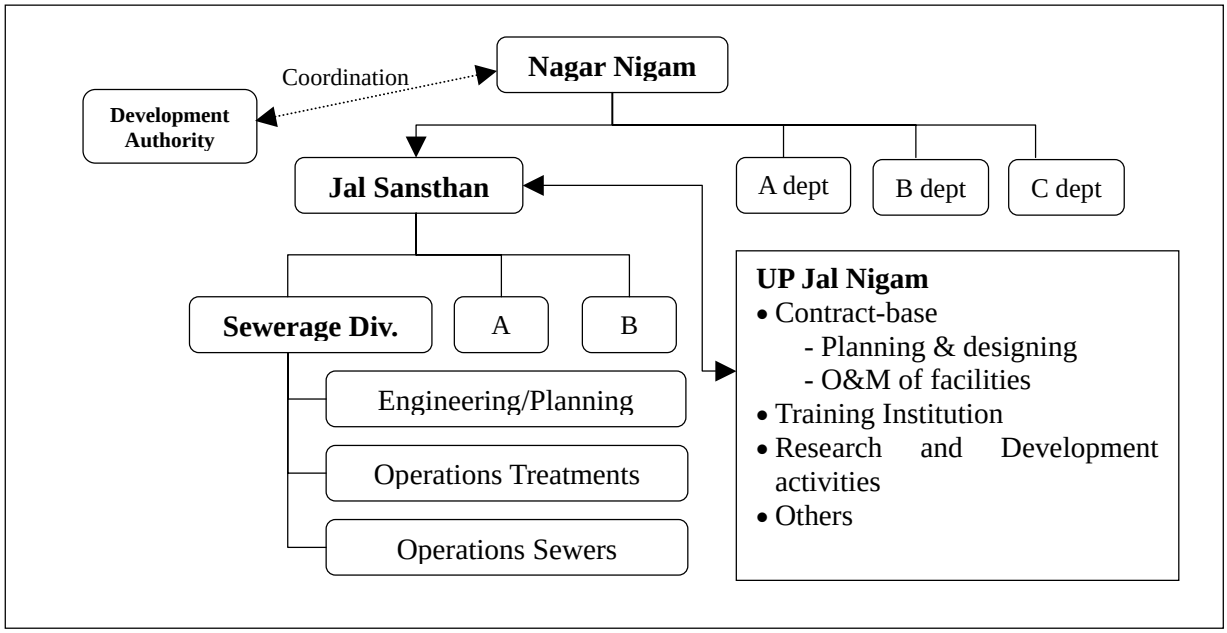
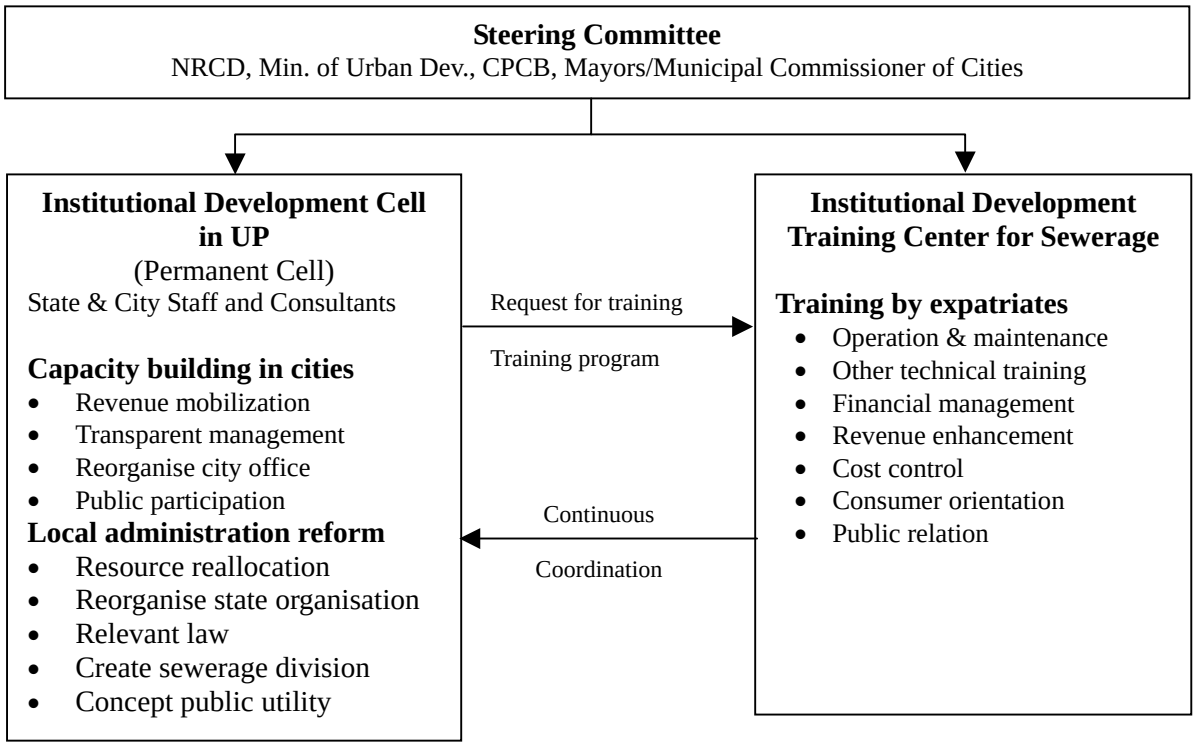


Figure 7.1 Concept of a New Organisational Structure and Roles

This structure will be the proposed final goal. In intermediate period, a transitional authority may be required. To transit to the proposed structure, an action plan including a detailed time for implementation shall be prepared in Institutional Development Programme.

7.2.3 Institutional Setting Up for Institutional Development Programme

To achieve these objective, a task force named Institutional Development Programme Cell shall be organised in the UP government. This cell shall stay at least 5 years or permanently until the needs cease to exist. Also a team of international and local consultants shall be mobilized to help the IDP Cell for the period of 5 years. Creation of a Institutional Development Training Centre is also proposed to satisfy needs for trainings, which shall develop manpower and expertise required for the new integrated sewerage service. Location and mandates of IDP Cell and its linkages with the Steering Committee and Training Centre are shown below.



Note: Staff shall be selected from the State Govts. (UPJN) and City Office (Nagar Nigam and Jal Sansthan)

Figure 7.2 Institutional Development Cell

7.2.4 Institutional Development Cell

It is proposed that an independent programme cell be created in the UP Department of Urban Development. The IDP cell shall report directly to the Principal Secretary and shall be staffed with experts of engineering, law, finance and local administration selected among from the relevant departments of the UP state and 4 cities. The steering committee of the ID Programme shall be convened by NRCD with members from the National Department of Urban Development, Central Pollution Control Board, the UP State Government and the Mayors or Municipal Commissioner of 4 cities. A consultant team shall be employed by NRCD and attached to the IDP cell for assistance and collaboration.

The IDP cell in collaboration with the consultant shall undertake the two-tier municipal reform programme. The first tier, involving coordination among taxpayers, cities' population and personnel of city office, is a painstaking and time-consuming attempt to attain consensus of all levels on the desirable city office and its providing public infrastructure services.

A. Capacity building in 4 cities by replicating lessons learned in the Agra Municipal Reform Project and other municipal reform projects, including, but not limited to:

- Structuring appropriate systems for effective revenue mobilization from city tax (property tax, water/ sewerage tax, etc.)

- Structuring appropriate systems for financial management and complaint redressal, the latter of which shall be enforced to public relations activities

- Structuring appropriate systems for service delivery of the municipal services including particularly sewerage services, taking into account possible private sector participation

- Implementing a large scale public awareness and participation programme in 4 cities

The second tier of the programme, being purely administrative and hence involving only administrators, is comparatively simple attempt. It will include only some amendment of local administrative law and shuffling of some personnel. It may be implemented in the shorter period of time, if consensus among the top level decision makers is attained.

B. Formulation and implementation of the local administrative reform to bring about decentralization, delegation and devolution of the operational, human and financial resources from state to cities, by the following order:

- Identifying the resources needed by cities in providing public infrastructure (municipal) services

- Identifying and selecting the resources of the state government, which are needed by cities and can be transferred from state to cities

- Identifying and selecting the regulatory functions and the engineering & specialist functions of the state organisations including Jal Nigam so that the desired regulation and control as well as the level of technical standards and quality can be enforced and maintained

- Reviewing and drafting the relevant laws and regulations including those for the public servant's cadre so that the transfer of the above resources may be brought about. In any case, duplication or unclear definition of responsibility and jurisdiction shall be eliminated, so that every relevant organisation may clearly perceive its judicial and operational arena, its boundary and linkages to those of the others.

- Structuring in the cities' water and sewerage division appropriate systems to pursue the objective, principles and guidelines of the pubic infrastructure services

7.2.5 Consultant for Institutional Development Programme

This consultant team attached to the IDP Cell may be called as IDP consultant, which shall be employed separately from the consultant for the detailed design and supervision of construction for the sewerage project. The IDP consultant in collaboration with the IDP Cell is expected to concentrate on the institution engineering to mobilize and reform the institutional framework, i.e., regulatory framework of the State and Cities. It shall, also, focus on the institution engineering to reshape the operational, human and financial resources of cities, particularly those of the water and sewerage divisions. It will identify and formulate actions and measures to be taken by step-by-step to evolve the present city offices to the full-fledged city offices. These actions and measures include introduction of new management systems, shift of the regulatory frameworks and perceptions or working environments, in which the stakeholders will play their roles. Training of personnel at many levels will become necessary to quickly adjust themselves to the new roles and environments. Such training programmes may be formulated by the IDP Cell with its consultant. Implementation of these trainings, however, shall be made by a separately proposed "Institutional Development Training Centre for Sewerage Management."

7.2.6 Institutional Development Training Centre

Institutional Development Training Centre shall be established separately under NRCD or UP state Government. In cooperation and collaboration with the IDP Cell, it will develop and provide necessary trainings of personnel relevant to the IDP during and after the period of the Programme. As India is required to launch the integrated sewerage service as a new public service, the concept, objective, principles and guidelines of the public infrastructure service shall widely be understood and practiced. The integrated sewerage system also is a young technology in India. Many engineers, technicians and business managers shall be invited for various training including that in the developed countries. The Institutional Development Training Centre shall satisfy needs for such trainings.

7.3 SHORT TERM INSTITUTIONAL DEVELOPMENT

7.3.1 Possible Options for Achieving the Desired Expertise and Strengthening of Institutions

On a careful analysis of the functioning of the three Organisations namely:

a. Varanasi Nagar Nigam
b. Varanasi Jal Sansthan
c. UP Jal Nigam, Ganga Pollution Control Unit, Varanasi

It is noticed that one thing is common to all and that is each of these organisations insures any thing between 35 to 40 percent of its expenditure on manpower of the worker level. Several time the nature of job done by personnel's of two organisations namely Varanasi Nagar Nigam and Varanasi Jal Sansthan are similar. However they represent different organisations hence have to carry on their activities independently.

Further the study reveals that in case of Varanasi Nagar Nigam persons who have been given no formal training do cleaning of branch sewers manually. They do not have access to any mechanised equipment. Further they have very little idea about the safety measures and precautions that should be taken while carrying out the cleaning operation. Often Varanasi Nagar Nigam requests for help from Varanasi Jal Sansthan in cases where they are not able to handle with their existing resources.

Moreover under the present structure the different organisations are involved at different places in the management of the same system. Varanasi Nagar Nigam is responsible of maintaining the branch sewers and the Varanasi Jal Sansthan is maintaining the trunk and main sewers and finally the Varanasi Jal Nigam is maintaining the Sewage Treatment Plants. Under the present system the efficiency of each organisation is dependent on the quality of manpower and skills to handle a situation.

7.3.2 Recommendation for Strengthening Operations and Maintenance with Existing Manpower:

There are two options available for Strengthening and Capacity Building and efficient and effective maintenance operation.

Option –1

The manpower resources of the two organisations may be merged into a single entity and the cross-organisational expertise can be utilised for effective and efficient management of the sewerage and other systems in the city of Varanasi.

Sewer System Management and Operation:
Thus the job of operation and maintenance of the total sewer system can come under one organisation, which will be able to cater to the needs of the entire city.

Revenue Collection:
Similarly the revenue collection of the two organisations namely Varanasi Nagar Nigam and Varanasi Jal Sansthan can be handled centrally and the existing resource can be optimally used without additional recruitment of manpower.

Option –2

Sewer System Management and Operation:
The operation and maintenance of the sewer system can be out sourced and the existing capacities can be hired out to the contracting organisation. Thereby reducing or sharing the load of manpower cost between the Nagar Nigam and Jal Sansthan on one end and Contracting organisation on the other end.

Revenue Collection:
In order to ensure that maximum revenue is collected this activity can be outsourced and the collecting organisation may be given a percentage out of the revenue collected. It will also ensure that all the connections in case of water and all the properties are properly counted and valued. The contractor will ensure near to 100% tax collection and will also help in enhancing the revenue net.

7.3.3 Skill and Capacity Enhancement of Existing Manpower

Varanasi Jal Sansthan and Varanasi Nagar Nigam should conduct suitable training for enhancing the technical capacities of the existing manpower so as to carry out routine jobs efficiently and effectively. Crises Management training should also be imparted. This will also help them in handling complex issues more systematically.

This Skill Enhancement training will reduce the involvement of senior management in day-to-day operations. The time of the senior management can then be spent on strategic planning and developmental issues.

Training should be imparted to use computers and work in a computerised environment.

7.3.4 Improvement of Working Environment

Presently Varanasi Nagar Nigam, Varanasi Jal Sansthan and Varanasi Jal Nigam has plenty of office space, but the same is not properly organised. The furniture is very uncomfortable and needs to be changed. There is a distinct need for a comprehensive training on personal and office hygiene. The present condition of the offices does not motivate the employees to sit in the office for long hours and diligently carry out their duties.

There is a need to redecorate the offices and make the work place more comfortable and attractive. There is a need for a public relations department that can solve problems of the people visiting the offices and efficient public redressal. This will also reduce interaction of the general public interactions with the office staff thereby increasing their output.

7.3.5 Interaction of the Public of Varanasi in Developmental and General Issues:

There is a clear need for a close participation of the public at large of the city of Varanasi on issues concerning development. Effort should be made to invite suggestion from the general public on new projects and developmental issues. Tools like newspaper radio or television should be used to communicate with the public and suggestions invited. Even in case of fixing up the rates of determining the Annual Rental Value if public participation method is adopted the acceptability level will be very high.

It is generally noticed that any activity where there is active public participation a sense of ownership

emerges and the level of acceptability is high.

7.3.6 Introduction of Computerised System for Accounting and e-Governance

Out of the three organisation in question only two of the will have public dealing, i.e., Varanasi Nagar Nigam and Varanasi Jal Sansthan and these two would need better systems to work more efficiently and address to public issues without loss of time. Hence the accounting, billing and payment system, complaint redressal, etc., should be computerised in the first phase. Database management system software needs to be introduced so that there can be sharing of information between organisations or departments.

All the zones should be networked to the head office. Bill payment, registration of birth and death, complaints and other such facilities should be made available to the public at the Zonal level.

Annual Rental Value calculator should be loaded on to the Internet and the same should be available at the Zonal centres.

Accounts should be audited every year by private firm of Chartered Accountants and Balance Sheet should be made at the end of each financial year and published in the local newspaper and public should be given an opportunity to be heard in case they have any questions.

Table 7.1 Target Group for Training Programmes

Organisation	Training Need	Target Group
Varanasi Nagar Nigam	Routine maintenance of branch and laterals	Labours
	Practices adopted in other countries	Higher rank officials
	Handling of manual equipments/ machines for carrying out routine maintenance	Sanitary inspectors, supervisors and labours
	Appropriate health and safety procedures while carrying out maintenance	Sanitary inspectors, supervisors and labours
	Computer training on keeping a structured database and records.	Health Officer, Sanitary inspector and supervisor
Varanasi Jal Sansthan	Routine maintenance of main and trunk sewers	Operators
	Best Practices adopted in other countries for sewer cleaning	General Manager/ Executive Engineer
	Operation of suction machines of higher capacities	Operators
	Appropriate health and safety procedures while carrying out maintenance in sewers	Executive Engineer/ Assistant Engineer/ Junior Engineer
	CCTV Operation	Executive Engineer/ Assistant Engineer/ Junior Engineer/ Operators
	Computer training on keeping a structured database and records. Training on networking	Office Superintendent and technical Staff
	Civic duty training	General Manager/ Executive Engineer
UP Jal Nigam	Technological innovations for treatment of sewage	General Manager
	Meaningful and appropriate R&D efforts	General Manager/ Project Managers/ Executive Engineers
	Best practices adopted at international levels for treatment of sewage	General Manager/ Project Managers/ Executive Engineers
	Energy Recovery from sewage	Project Managers/ Executive Engineers
	Detailed operation of the STP	Operators and Field Staff
	Use of latest analytical techniques, equipments in the lab for analysis of sewage	Operators and Field Staff
	Appropriate health and safety procedures while carrying out O&M of STP	Executive Engineers/ Operators
	Computer training on keeping a structured database and records and networking.	Computer Department/ Executive Engineers
	Civic duty training	General Manager/ Project Managers/ Executive Engineers

CHAPTER 8

ACTION PLAN
FOR
INSTITUTIONAL CAPACITY BUILDING AND DEVELOPMENT FOR OPERATION AND MAINTENANCE ORGANISATION

CHAPTER 8 ACTION PLAN FOR INSTITUTIONAL CAPACITY BUILDING AND DEVELOPMENT FOR OPERATION AND MAINTENANCE ORGANISATION

8.1 GAPS AND DEFICIENCIES

All the organisations have some deficiencies while carrying out their designated roles for operation and maintenance of sewerage system. These are summarized below:

8.1.1 Technical

1. All the organisations in general lack the expertise and the manpower to discharge their day to day duties and functions.
2. The number of non-technical staff is higher in proportion to the number of technical staff.
3. The posts filled up are less than the posts sanctioned by the State Government.
4. There is also an overlap which is seen in the functions related to O&M of the assets that were created previously
5. Most of the maintenance work is done manually. The number of mechanical equipments is inadequate as compared to the amount of work causing delays and incomplete maintenance work. The laboratory equipments also need improvements.

8.1.2 Financial

1. Lack of funds and resources is the major hindrance in all the organisations
2. All the organisations are doing breakdown maintenance work only due to lack of funds. Preventive or routine maintenance seems to be absent. Hence the system does not function to the optimum.
3. Need for a sustainable and perennial source of fund for operation and maintenance

8.1.3 Communication

1. Adequate communication facilities are lacking in the offices
2. Networking of organisations and lack of systematic data base results in the records and data not being readily accessible. Data sharing between the organisations also require improvement.

8.1.4 Institutional

1. Lack of single point responsibility for sewerage system and fragmented responsibility
2. Lack of institutional and management capability of Jal Sansthan and Nagar Nigam on sewerage system
3. Redefining of roles and responsibilities of relevant organisations
4. Reorganising sewerage division in Nagar Nigam/Jal Sansthan
5. Strengthening sewerage management capability of Nagar Nigam and Jal Nigam

8.2 INSTITUTIONAL DEVELOPMENT AND CAPACITY BUILDING PLAN

An Institutional Development Plan (IDP) or Institutional Development and Capacity Building (IDCB) plan has been formulated considering the most obvious gaps in the organisations. The primary objectives of the IDCB is to introduce systems into the organisation/institution to enable it to:

- Create assets without cost and time over-runs and
- Operate and maintain these resources in a self sustaining manner

The IDCB is based on the following basic concepts.

- Capital Works will be executed by the UPJN
- This implementation will be monitored by an independent IDP Consultants
- The ownership of the assets created shall be with NN.
- Operation and Maintenance (O & M) of the assets created shall be
  - Carried out by JS/NN, or
  - Contracted out to a private operator/ UPJN
- Self sustainability would be achieved by strengthening the finances of the JS/NN
- Required manpower with the requisite skills would be deployed
- Improve communication between various organisation
- Improve single point responsibility for sewerage management by NN
- Preparation of legislative amendments if required

The IDCB based on the above concept is presented in the following sections.

(1) Ownership

The ownership of the assets so created will be with the NN as this agency is legally required to create these assets and operate and maintain them

(2) Capital Works

As mentioned above, UPJN is mandated to prepare, execute, promote and finance schemes for the supply of water and sewerage disposal. Hence, this project would be implemented by UPJN.

As the ownership of the assets created would be with NN and NN/JS may be involved in the O&M of the assets, it is essential that a core group of technical staff/ engineers from both these institutions are seconded to UPJN during the execution of the project. A programme for “on the job” training for this core group is discussed under the subsequent section on manpower.

An independent consultancy firm should be appointed as project management consultants (IDP consultants), under the Divisional Commissioner to monitor the progress of the project implementation. This IDP consultants will be responsible to submit progress reports on a monthly basis, raise timely warnings about possibilities of cost or time over-runs and suggest and monitor the implementation of such recommendations.

IDP consultants would also be responsible for the certification of bills raised by the implementing agency.

(3) Operation and Maintenance

The most important objective is to have: “Operate and maintain these resources in a self-sustaining manner”.

The O & M requirement of various components under feasibility Study (F/S) is discussed in the respective section of the report.

The O & M of the assets so created would be contracted out to a private organisation or a GoUP organisation, this will permit efficient and professional service. A concept for sustainable O&M is presented in following sector. However, a detailed plan should be formulated for sustainable operation and maintenance.

8.3 METHODOLOGY AND ACTION PLAN FOR SUSTAINABLE OPERATION AND MAINTENANCE

Sustainability of O&M consists of two components, namely, financial and capacity enhancement of operation and management. This requires that sufficient revenues, capable human resource and requisite infrastructure are available to permit proper operation and maintenance.

The prime responsibility of operation and maintenance of the assets created under this project is to be with the NN/JS. The following sections present and explain the measures to be implemented by the NN/JS to achieve the above objective. All these measures aim at reaching in a short and medium term perspective the self-sustenance objective.

These measures are divided, as stated above, into two categories, namely, Financial and Institutional Capacity Building. The first category of measures are devoted to the objective of reducing the revenue deficit, and the second category aims at enhancing the capacity of the operating agency through human resources development and provision of requisite infrastructure. This methodology is graphically presented in Table 8.1 and described in the following sections.

Financial Sustainability is achieved by converting revenue deficit in to a revenue surplus. The measures to achieve this can be divided into two sub-categories: (i) measures to reduce costs, and (ii) measures to increase revenues.

8.3.1 Financial Sustainability

(1) Measures to reduce costs

Any organisation is subjected to two type of cost

- direct cost (operating costs)
- indirect cost (essentially management/administration expenses)

Direct costs

Jal Sansthan is an organisation, which is (i) a Public Enterprise, (ii) a monopoly, and also (iii) with external constraints (to satisfy the demand with deficient resources).

On one hand, even if the Jal Sansthan had the power to take some actions for instance the reduction of sewerage over flow rates, the impact of this measure will not be immediate because of the time required for repair and replacement. In this way (with short term impact), the possibility of reduction of costs in repair and maintenance expenses (due to old and damaged assets) are limited. However, there are two important categories of costs that could be reduced:

i) Power charges
ii) Salaries and wages

As costs are the results of consumption of quantities times the unit tariff, theoretically to reduce the costs it is relevant to reduce both quantities and unit tariff. However very often it is only possible to act on one of these factors because the other is not under control (specially purchase tariffs because they are imposed by suppliers). Despite this, reduction of expenditures should be possible for power charges and salaries and wages.

Table 8.1 Methodology and Action Plan for Sustainable Operation and Maintenance

Objective Operate & maintain the assets in a self sustainable manner	Reduce Revenue Deficit	Reduce cost	Reduce direct charges	1	Optimise energy utilisation & operation cost (energy audit)
				2	Increase productivity
			Reduce indirect charges	3	Reduce interest/dividend
				4	Reduce administrative charges
		Increase revenue	Improved billing & bill collection	5	Increase tax net
				6	Reassessment of properties
				7	Reduce process time per bill
				8	Increase collection by introducing incentive schemes
			Utilise by-products	9	Use energy generated for running the treatment plant
				10	Sell manure and treated water
			Increase tariff	11	Increase sewerage charge by 7.5 %
				12	Link tariff with production cost
	Capacity Enhancement	Human Resource	Training	13	On the job training
				14	Specialised training
			Public private partnership	15	Enhance internal capacity
				16	Contract out the services
				17	Procurement of necessary maintenance equipment
		Infrastructure	Engineering	18	Procurement of sophisticated equipment
			Management	19	Record management
				20	Financial management
	Institutional Set Up			21	Reorganise sewerage division
				22	Enhance capability of city office

Action 1: Power charges

It is obvious that the Jal Sansthan uses a huge quantity of energy (kWh) because of (i) the bad conditions of the pumps in operation, and (ii) the losses in the network which cause wastage of power. Great efforts to reduce power consumption have to be implemented.

The proposed assets have to be energy efficient, as the project will be implemented by a core group with Jal Sansthan being a part of it. Strategies such as using Variable Frequency Drive have to be adopted while formulating the schemes for pumping station. Furthermore, a strict equipment selection criteria has to be generated for selection of equipment and the same should be adopted through out the project.

In the Income & Expenditure Account for Jal Sansthan, the cost on account of pay and allowance is 63 % of the total expenditure. This could be significantly reduced, however, it is impossible to reduce individual level of wages (individual wages will increase annually due to inflation rate).

The O&M staff for the project should be sufficiently lean, especially the strength of non-technical staff to reduce the cost of salary and wages. This reduction in non-technical staff can be compensated by introduction of computerization.

Action 2: Non-Technical Staff

The non-technical staff should be minimal. Infrastructure in the form of computerization along with specific training programme should be provided for.

In addition to the above, productivity of the existing labour force can be improved thus restricting new recruitment or filling of vacancies created by staff leaving the institution.

Action 3: Increase Efficiency

An “on the job” training programme can be devised to increase the productivity of the personnel.

Indirect Costs

The indirect cost of agency like JS can be classified into two, one is the interest paid for the loans and the other is the administrative expense. In general, such organisation pays two categories of interest:

(i) The first is the interest for loans borrowed from L.I.C and other financial institutions and this is normal considering that it is a “real” long-term loan.
(ii) The second is the interest on Government capital for an annual amount and these amounts are not for a loan taken from the Government, but as interest on Government capital. In fact these interests are “dividends”.

The second type of interest is very unusual. Nowhere does a company pay dividends to shareholders when there is a deficit and moreover when the same shareholders provide annual capital contribution to compensate for the losses. It is more relevant not to pay such “interest/dividends” on Government capital, but the approach should be tried to reduce the capital contribution if any.

It is proposed to undertake detail investigation of the present administrative expense of the JS to reduce the second type of indirect cost, administrative expenses.

Action 4 : Interest charges and Administrative Expense

The expenditure - "Interest/dividends" on Government capital – should be reduced/eliminated, if possible at the earliest and administrative Expense should be reduced.

(2) Measures to Increase Revenue

Three major strategies are proposed for increasing the revenue and make the operating agency, Jal Sansthan, a self-sustainable organisation. They are broadly

- Improved billing and bill collection
- Utilize the by-products
- Increase the tariff

i) Improved billing and bill collection

Increase in the volume of billing and increase in the bill collection efficiency results in substantial increase in the revenue income of the organisation. Some of the strategies that can be adopted for increasing the revenue income are:

- Increase the Tax Net
- Reassessment of properties
- Reduce process time per bill
- Increase productivity by introducing incentive schemes

ii) Increase Tax Net

In general, in most of the JS and ULBs considerable number of records falls far short of the total number of properties included in the tax net. One such example is Kanpur, where more than 300,000 properties were not included in the tax net. The reasons for this are many but primarily consist of lack of human and financial resources. It is hence, imperative to conduct a comprehensive survey of the entire municipal area to bring all the properties under the tax net. In addition the property permission applications should be integrated with the sewerage tax billing. This can be effectively carried out by creation of a GIS based database.

This system was implemented under the Institutional and Community Development Project (ICDP) Mirzapur. Significant improvement has been achieved in Mirzapur due to the implementation of this system. Description of the system adopted is presented as a case study.

Case Study 1: Tax net Extension in Mirzapur

Mirzapur is a town in Uttar Pradesh with a population of around 200,000 people. When the ICDP started in 1995 (Phase I) the Mirzapur Nagar Palika (MNP) did not have sufficient revenues to pay staff salaries. Urban services were very poor with most of the streets clogged with garbage, streets blocked by solid wastes, most water connections broken and water being pumped from the supply lines with the help of Tulu pumps.

ICDP decided to work on two fronts- immediate visible improvement in Municipal services and restoration of financial health of MNP.

Based on a Pilot Area Programme, Mirzapur solid waste collection system was developed. All repairable equipment such as tractors, tractor trolleys, handcarts, etc. was restored. A specially modified rickshaw with garbage collection trolley was constructed and tested. A ramp platform was designed to facilitate the emptying of rickshaws and handcarts into the tractor trolleys. The programme has been very successful with the residents of the city perceiving a qualitative change and financially participating in the programme.

Simultaneously, steps were taken to improve the financial health of the MNP. These included complete enumeration survey and mapping of all the properties, computerization of registers, computerization of billing and collection and development of rationale for valuation and assessment of properties to provide a basis for property tax. To-day the entire data base including information on infra structure is on a GIS platform.

In 1998, revised demands for tax based on realistic assessment of property values were sent out, which, as expected, met with massive protest from the people. This led to political intervention and suspension of the notifications. The Government of Uttar Pradesh, however, committed to this reform and is expected to implement it in a phased manner.

Although Mirzapur Model is not directly related to water supply it is important for its replicability in Municipal reforms and as an example of people's willingness to pay if there is perceptible improvement in service levels.

Action 5: Increase the Tax Net

Carry out property survey along with the size and type of water connection and broaden the tax net in the short term. As a long term planning strategy, create a GIS database of the existing properties, water and sewerage system and integrate this database with the property permission applications.

iii) Reassessment of properties

In most cities in UP, the assessment of property values was done many years ago. Property tax is applied based on the annual rental value of the property, which is unrealistic. Water and sewerage charges, which in turn are a percentage of the property tax, thus also become unrealistic. A reassessment of all properties as per their present value would significantly increase the revenue without any increase in the tariff.

Since Water and Sewerage tax are linked with the property tax, revenue on that account will also increase with reassessment of the property values.

There is less coordination between Nagar Nigam and Jal Sansthan on assessment and collection of property tax. The collection and assessment of property tax should be coordinated between Nagar Nigam and Jal Sansthan. This coordination work itself reduces the cost.

Action 6: Reassessment of Property Values

Along with the property survey, a re-assessment of the property values should be carried out to have realistic basis for property tax. The collection and assessment of property tax should be coordinated between Nagar Nigam and Jal Sansthan.

In the long term, water and sewerage tax should be linked with the actual consumption of water, to achieve this objective in the medium term the water and sewerage tax could be linked with property tax and size of water connection. In the long term metering of water connection should be implemented. Consideration of this concept will be studied and if feasible it will be planned for future.

Action 7: Revise Criteria for Water and Sewerage Tax

Start the process of water and sewerage charges based on dual criteria of property tax and size of water connection. Initiate, a study to evaluate the implementation of metering over the entire city.

iv) Reduction in the Bill Process Time

The billing records in Varanasi are at present maintained on paper and the bills and receipts are written by hand. This method is time consuming and results in procedural delays. One way to overcome this limitation is computerization of the whole system. This system was implemented under the Institutional and Community Development Project (ICDP) in Kanpur, one of the Four Master Plan cities, and Mirzapur. Significant improvement has been achieved in these cities due to the implementation of this system. Description of the system adopted in these cities is presented as a case study.

Case Study 2 – Computerization of Billing System in Kanpur and Mirzapur

The Institutional and Community Development Project (ICDP) was initiated at Kanpur and Mirzapur cities in March 1995,as a part of the effort to reverse the pollution in river Ganga. ICDP was a joint effort of Government of India (GoI) and the Government of the Netherlands. National River Conservation Directorate of Ministry of Environment and Forests, GoI, was the principal counterpart for these Indo-Dutch Projects. At the State level, ICDP work with the Department of Urban Development, whereas the Nagar Nigam (the urban local body), and the Jal Sansthan (the municipal water supply and sewerage authority) are its partners at the municipal level.

Ganga Action Plan focuses on creating new or improving existing infrastructure, whereas ICDP is concerned with the organisational, financial, administrative and social factors that determine the effectiveness and the sustainability of municipal services. The efforts of ICDP fall under three broad categories:

- Revenue enhancement geared to improving the financial position of municipal institutions (KNN, KJS and MNP).
- Institutional strengthening of these municipal institutions (including decentralization) leading to improved service provision, with special attention to solid waste management, water supply, and community-level infrastructure such as toilets, drains, and pavements.
- Promoting community and private sector participation.

At the beginning of the ICDP all records in Kanpur and Mirzapur were still maintained on paper only, bills were handwritten, and accounts procedures were antiquated. Since 1997, the Mirzapur Nagar Palika, the Kanpur Nagar Nigam, and the Kanpur Jal Sansthan have gradually introduced more efficient ways of doing their work. The use of Information Technology (IT) has been crucial. IT not only helps municipalities to work faster with fewer people, it also significantly improves the accuracy and reliability of information. Both in Kanpur and in Mirzapur part of the taxation and billing database has been computerised. Bills are now printed instead of handwritten, the municipal accounts are being computerised, personnel management is being supported by payroll software, and a Geographical Information System (GIS) provides a robust and reliable way for improving various municipal functions.

One of the systems introduced by ICDP was computerised database and billing system for water and sewerage. The Kanpur case shows that substantial improvements can be made through the introduction of relatively straightforward IT solutions.

It needs to be emphasised that the Kanpur system is not a blueprint that can be followed blindly. Nonetheless, it is meant to provide useful leads and lessons for developing similar applications elsewhere.
The KJS is mandated to provide water and sewerage services to the city of Kanpur, which has some 2.7 million inhabitants (Census result 2001). The KJS has approximately 2300 employees.
The Jal Sansthan relies on two sources of income, first one consists of taxes and charges paid by its consumers (households, institutes and commercial enterprises). The second is made up of grants from the state government.

Grants from the State government traditionally cover the deficits of the municipal agencies. This, however, is expected to change due to the prolonged fiscal crisis of the UP Government, which requires the municipalities to raise more revenue through local taxation and service charges. In future, the municipal bodies are expected to cover at least their salaries and administrative costs. Cost-saving and efficiency-enhancing technologies are therefore more than welcome.
Jal Sansthan water and sewerage bill for property owners consists of the following items:

- Water taxes (a fixed percentage of the Annual Rental Value (ARV) due by all occupants of properties within 100 meter on either side of a water pipe, whether connected or not);
- Water charges (if the property has a water connection and the actual use of water exceeds the water tax. In the absence of water meters the minimum charges are estimated based on the ARV, the diameter of the water pipe, and type of connection, i.e. Domestic or commercial);
- Sewerage tax (a percentage of the ARV due by all occupants of properties within 100 meter on either side of a sewerage line, whether connected or not);
- Sewerage charges (if the property is actually connected to the sewer, taking the number of sewer seats into account);
- Service charges (based on the diameter of the water pipe);
- A surcharge (a 10% penalty on the pending balance of last year's bill);
- A rebate (a 10% deduction in case of timely payment)

On 31 January 2001, there were 167,707 records in the 7 databases covering 6 administrative Zones and a number of colonies. The KJS database is derived from the property tax files of the KNN. When a house is assessed for property tax by the KNN, the basic data (house number, name of owner or occupant, ARV) have to be communicated by the KNN to the KJS. The application of a computer-based billing system was thought to have the following advantages:

- Faster generation of bills;
- Easier addition of new records;
- Automatic generation of management information system (mis) reports for:
    - Ward- and zone-wise achievements,
    - Demand collection–outstanding balance per zone,
    - Lists of defaulters;
- Saving staff time (which can be re-directed to increased effort in collection and ground inspection);
- Avoiding fraud and manipulation of records;

Municipal reform is a continuous effort, similarly introduction of IT is not a one-time event, but it requires continuous refinement of systems, periodic up-gradation of software, and ever further integration of administrative and production systems. Hence many of the instruments developed or introduced by ICDP will need to be up-graded. Furthermore, integration of various subsystems (e.g. taxation and accounts) also has to be enhanced.

Action 8: Computerization of Billing System

The whole billing system has to be computerized and the staffs are to be trained to undertake this assignment.

v) Increase in collection

Incentive awards are a way of rewarding employees with cash, goods or holidays rather than increases in pay and these incentives are linked with performance.

The Kanpur Jal Sansthan has introduced one such scheme, which has lead to the increase in the revenue by many folds. The present incentive scheme proposed by KJS for the year 2004-05 is presented below:

In order to speed up the recovery amount and encourage the recovery person for the year 2004-2005 different rate of commission given to the recovery person after recovery.

Per Month recovery amount (Lakhs)	Commission amount (in Rs.)
Rs. 1 lakh and above upto Rs.1.25 lakhs	300/-
Rs.1.25 lakh and above upto Rs. 1.5 lakhs	350/-
Rs. 1.5 lakh and above upto Rs. 1.75 lakhs	400/-
Rs. 1.75 lakh and above upto Rs. 2.00 lakhs	450/-
Rs. 2.0 lakh and above upto Rs. 2.5 lakhs	500/-
Rs. 2.5 lakh and above upto Rs. 3.0 lakhs	700/-
Rs. 3.0 lakh and above upto Rs. 3.5 lakhs	900/-
Rs. 3.5 lakh and above upto Rs. 4.0 lakhs	1100/-
Rs. 4.0 lakh and above upto Rs. 4.50 lakhs	1300/-
Rs. 4.5 lakh and above upto Rs. 5.0 lakhs	1500/-
Rs. 5.0 lakh and above upto Rs. 5.5 lakhs	1700/-
Rs. 5.5 lakh and above upto Rs. 6.0 lakhs	2000/-

After every Rs. 6.00 lakhs and above 0.5 % commission will be paid extra. This amount is not included in the government revenue. If the recovery person who is not able to recover the minimum amount given in table, then please note after 3 months the said person is given an official notice.

However, one of the limitations in this model is that the incentive is based on a single parameter, the amount of money collected per month. Implementation of this model may lead to a creation of a limited target circle from where the bill collectors will have a fixed collection. Thus this model may be modified to include the number of bills collected as another parameter. This will lead to the broadening of the tax net as well.

Action 9 : Incentive scheme

Formulation of the incentive scheme, based on the amount collected and the number of bills collected

vi) Utilize the By Products

The sewage generated form the Varanasi city is to be treated in the proposed STP located in Sathwa. UASB followed by AL is the technology selected for treating the sewage. One of the major advantages of this technology is generation of value added by products. The various by products generated are:

- Biogas
- Treated Water

- Digested sludge (Manure)

These by-products have a commercial value and a market, which can generate some income. One such example is illustrated below as a case study.

Case Study 3 - Sewage Reclamation Plant in Mumbai Port Trust

Spread over five hectares of Mumbai Port Trust land near the Sassoon Docks, the beautiful garden was, until the early '80s, a dump. Citizens groups, the World Wide Fund for Nature and moneyed corporate stepped in, and through a high court order, the Port Trust was instructed to lay the botanical garden.

Mumbai Port Trust has developed a botanical garden in early '80s to comply with the high court order. The garden is spread over five hectares of land and has a variety of common and unusual trees, complicated and pretty heap of rock and vegetation. The far side of the garden overlooks the sea.

The water for maintaining this garden is sourced from the sewage water reclamation plant (SWRP) of 200 cum/day capacity. MWH India Pvt Ltd (MWH) designed the plant and it was also constructed under the supervision of MWH. The plant was commissioned and till date being maintained by MWH.
The guard collects Rupees 2 per person to enter the sprawling garden. This money is used for maintenance of the garden.

Thus the by-products can be sold to generate some revenue, however this needs a detailed study to assess the market potential.

Action 10: Sell the By Products from STP

Carry out a detail study to assess the market for selling the by products generated from the STP.

vii) Increase tariff

Increasing the tariff will have a significant impact on the sustainability of the O&M. At present, JS collects sewerage tax and charges, which is percentage of the water tax and charges, from the citizens. The sewerage tax cannot be increased, as there is cap on the tax, however, the sewerage charges could be increased. This increment could be by two ways, one is to adopt the resolution passed by the UP Government to increase the charges by 7.5 % annually.

Ideally the cost of service should be equal to the revenue income. Review of the income and expenditure statement of the JS reveals that considerably high ratio of the total expenditure is spent on the electricity charges. Thus it shall be ideal to relate the increase in the tariff with the electricity charges. One such example occurred in the country in the state of Tamil Nadu is presented as a case study below.

Case Study 4 - Increase in the Water Tariff by TWAD Board

Tamil Nadu Water Supply and Drainage Board has stated that electrical energy charges have been increased with effect from 1.12.2002 as 25% in High Tension and 112.5% in Low Tension electric supply. The increase in water tariff due to increase in electrical energy works out to Rs. 0.79 per 1000 litres. The Board of Tamil Nadu Water Supply and Drainage Board has approved the increase in the tariff and forwarded their recommendation to the Government for their approval. The Government has examined the resolutions of Tami Nadu Water Supply Drainage Board carefully and approved the revision in water tariff.

The revised water tariffs are given below.

Sr.	Name of Beneficiary	Existing Water tariff per 1000 litres (Rs.)	Revised water tariff proposed per 1000 litres (Rs.)
1.	Corporations/Municipalities/Urban Town Panchayats	3.50	4.50
2.	Rural Town Panchayats/Village Panchayats	2.25	3.00
3.	Industries and other Beneficiaries	10.50	15.00

For the water supplied through public fountains in rural areas, a suitable surcharge on property tax shall be levied as water tax and the amount should be maintained in a separate water supply account at the village panchayat level.

Action 11: Increase the Tariff

As a long term strategy, the JS should pursue the UP Government to link the tariff with the cost of production, specifically the cost of electricity charges.

8.3.2 Capacity Enhancement

Capacity enhancement of the organisation shall be carried out by undertaking human resource development programmes. This human resource development programme should be suitably supported, by enhancing the infrastructure of that particular organisation. This section of the report presents the strategy for capacity enhancement through human resource development programme and infrastructure development.

(i) Human Resource Development

A general assessment of current human resources for operational and maintenance management among the two organisations (UPJN and JS) indicates limitations in the following areas.

- Technical skills to plan and implement projects
- Managerial skill
- Technical operations and maintenance skills

There are also limited budgets available for training and development of human resources.
These limitations could be over come through a structured human resource development programme. The programme shall consist of providing training to enhance the skill level and public private partnership to perform the task at hand. The human resource development programme has been developed on the basis of an exercise carried out to understand the needs for this project.

(ii) Requisite manpower

The requisite manpower would be deployed from the existing staff or additional staff would be hired or contracted. The detail manpower requirement is discussed in the respective sections of the report.

Based on the above the project specific manpower requirement should be estimated and the deficit, if any, should be made up through recruitment/ contract appointment.

Action 12: Manpower

Determine the requirement of technical manpower and recruit/ contract requisite manpower.

(iii) Training programmes

In addition to the required number of persons, it is necessary that the manpower have requisite skills. These skills will be developed by providing adequate training to the JS/NN staffs. The detail training strategy, based on the assessment of the needs of these organisations, is described below.
Specially designed "on the job" and in-house training programmes shall be conducted to match the skills required with the available skills in the existing staff.

The requisite training programmes identified are grouped into two different categories, namely, management and technical training.

Management Training

The management training shall be provided to the managerial staff and the identified training needs are:

- Project planning
- Project management
- Financial management, life cycle cost analysis, cost accounting
- Human Resource Management
- Data management (GIS, database),
- Management Information System (MIS)
- Operation and maintenance management
- Procurement
- Contract supervision
- Computer and GIS

Technical training

It is expected that number of project will increase over the time, thus the work load on the existing staff will increase. Thus the technical skills of the professional, necessarily, has to be increased and improved in the future. The technical training needs identified by the project at professional and technical operations levels are the following:

Sewerage Engineers

- Sewer inspection and rehabilitation methods
- Sewer design and sewer hydraulics
- Pump station design and pump hydraulics
- Wastewater treatment process control
- Wastewater sampling and laboratory analysis
- Computer and GIS

Electricians and Mechanics

- Switchgear and starters
- Instrumentation and control
- Motor maintenance & repairs
- Troubleshooting pumps
- Pump maintenance
- Shaft alignment
- Bearings and seals
- Welding
- Pump hydraulics and performance
- Diesel generator maintenance

Sewer Maintenance Field Staff

- How to recognise different types of sewer and manhole construction materials
- The nature of sewage and common causes of sewer blockages
- The interpretation of sewerage plans and drawings
- The importance of safe working procedures and hygiene during sewerage work
- The importance of following manufacturers' recommendations when carrying out repairs of sewerage pipelines
- The methods available for dealing with sewage flows during sewer maintenance, modifications or repairs,
- How to make property connections into manholes and how to bench manholes
- How to fix manholes and raise frames
- The safe use of high pressure water jetting equipment including the theory and working principles of high pressure water jetting
- Practical aspects of the equipment and how to select ancillaries for a particular application
- The identification of hazards in the workplace

Financial training

- Financial analysis, planning and management
- Accounting
- Advanced accounting system
- Billing and collection of sewer charge/tax
- Mechanism of sewer charge/tax
- Computer and GIS

(iv) Implementation of Training Programme

Over all responsibility of organising/conducting these training programmes shall be a part of the IDP consultants assignment. However, selection of the personnel to be trained shall be identified by the IDP consultants in consultation with respective agencies.

IDP consultants shall conduct “on the job” training during the construction period on operation and maintenance of similar assets. This strategy would facilitate in having trained personnel for commissioning, operation and maintenance of the assets created under this project.

The other formal training courses mentioned above and additional specialized training, such as sewer design and sewer hydraulics, pump station design and pump hydraulics, wastewater treatment programmes shall be conducted by Government / Private institutions. Some of the training institutions that are well known in the country are:

- Administrative Staff College of India (ASCI), Hyderabad.
- Indian Institute of Technology
- Indian Institute of Management
- National Institute of Urban Affairs, New Delhi.
- Human Settlements Management Institute (HSMI), New Delhi.
- Centre for Development Studies, Uttaranchal Academy of Administration.
- Engineering Staff College of India, Hyderabad.
- All India Institute of Hygiene & Public Health, Kolkatta.
- Research and Training Centre, Maharashtra Jeevan Pradhikaran.
- Civil Training Institute and Research Centre, Municipal Corporation of Greater Mumbai
- Indian Institute of Health Management Research (IIHMR), Jaipur

Identification of the training needs, development of training programmes and selection of the training institute shall be included under the scope of the IDP consultants.

Action 13: Training (Management, technical and financial)

Identification of the training needs, development of training programmes and selection of the training institute.

(v) Public – Private Partnership

It is understood that there is need for capacity enhancement of the JS/NN for undertaking the O&M of assets. Thus, as a short-term strategy, some of the sewerage operations and maintenance activities shall be contracted out to private sector or public service providers. This will also provide an opportunity to minimize the internal costs with the advantage of competition in the market place. Alternatively it can be used to provide resources to meet short-term peaks in workload or provide services that require specialized skills or equipment.

However, in both the cases, the overall responsibility should be with JS/NN and should closely control and supervise the work carried out by others, and so it will still require competent managers and supervisors.

These contracts should also be used as an opportunity to provide “on the job” training to the personnel of the organisations.

Some of the works that can be undertaken through Public – Private Partnership are:

- Design of sewerage system
- Regular Servicing and maintenance of specialised equipment/ plants
- Seasonal labouring jobs
- sewer inspection surveys to establish the sewer inventory
- Sewerage Construction Supervision
- Sewage Treatment Construction Supervision
- Sewage Treatment Operation and Maintenance

However, a detail study has to be carried out to identify the opportunities for public- private partnership programmes. This study can be a part of the IDP consultants.

Action 14: Public – Private Partnership

Conduct a detail study to identify the opportunities for public private partnership programmes.

(vi) Infrastructure Enhancement

The infrastructure requirements can be categorized into two groups, namely, Management infrastructure and Engineering infrastructure. The management infrastructure primarily consist of computers with accessories and the requisite software, which will be used for data management and financial management. More emphasis shall be given on the data management aspects, as the maintenance will be dependent upon obtaining, verifying and maintaining proper system records. Thus there is need to collect and to store centrally all existing records of the sewerage network by setting up a comprehensive computerised data base, Sewerage System Inventory, at the local level. The following steps will be required to establish sewer inventory and base maps:

- Collect all existing records and as built drawings
- Conduct a geo-referenced alignment survey of all trunk, lateral and branch sewers
- Conduct CCTV inspection of all major sewers
- Develop GIS based sewerage system maps
- Develop GIS based applications for visual interpretation of database on maps.

This can either be a part of the IDP consultants, as a package or it could be contracted out as a separate assignment under the public private partnership programme. As stated earlier this database can be further utilized, while granting permission for construction of new property / expansion of existing property.

Action 15: Procurement of Hardware and Software tools

Procurement of hardware and software for creating a sewerage system inventory and develop a GIS based system application for visual interpretation.

Other than the hardware and software, maintenance of sewerage system demands a defined set of engineering equipment. The detail requirement of equipment is discussed in the respective sections.

Action 16: Procurement of Engineering Equipments

Procurement of engineering equipment for proper maintenance of the sewerage system.

8.3.3 Communications

As stated above, a number of organisation will be involved in the implementation of this project. The IDP consultants are expected to coordinate the activities of these various organisation. This requires a communication system between and among three organisations and the IDP consultants. An appropriate infrastructure, software, hardware and training should be provided for this communication system.

Action 17: Communication

Establishment of a comprehensive and reliable communication system among the organisations, involved and IDP consultants.

8.3.4 Institutional Setting Up

i) Establishment of sewerage division in Jal Sansthan and Nagar Nigam

Sewerage systems are rapidly expanding and will continue to do so in the future. Projects sanctioned under GAP and interventions implemented under the proposed priority projects will ensure that most of the sewage flows will be treated by 2015.

There is, therefore, a significant and urgent need to improve the management and organisation of the operation and maintenance for sewage collection and treatment functions. This will require major institutional re-organisation and the building up of capacity and competence within the sewerage division. Responsibility for O&M, planning/designing and construction should rest with a single sewerage authority in a city.

It is proposed in the long run that this new sewerage authority will be integrated with the existing Sewerage and Water Supply Corporation (Jal Sansthan), which is administrated under Nagar Nigam. However, in the context of this Report, the proposals made are, for clarity, for the management of sewerage functions only.

The steps to be taken for establishment of a new single organisation have been described in the Previous Chapter, "Methodology of Setting up the Proposed New Organisation."

Action 19: Establishment of sewerage division in Jal Sansthan and Nagar Nigam

Reorganise JS and NN as a single point of responsibility for sewerage management.

ii) Capacity building of City Office

To enhance capacity of city office (Nagar Nigam) the followings shall be considered.

- Identifying the resources needed by cities in providing public infrastructure (municipal) services for sewerage
- Identifying and selecting the resources of the state government, which are needed by cities and can be transferred from state to cities
- Identifying and selecting the regulatory functions and the engineering & specialist functions of the state organisations including Jal Nigam so that the desired regulation and control as well as the level of technical standards and quality can be enforced and maintained
- Reviewing and drafting the relevant laws and regulations including those for the public servant's cadre so that the transfer of the above resources may be brought about. In any case, duplication or unclear definition of responsibility and jurisdiction shall be eliminated, so that every relevant organisation may clearly perceive its judicial and operational arena, its boundary and its linkages with those of the others.

The terms of reference for this works are attached hereto. These works shall be done in Institutional Development Cell (IDP Cell) described in the previous section. The required action plan including a time schedule for implementation shall be prepared beforehand and its implementation shall be assisted by the consultants appointed.

Action 18: Capacity Building of City Office (Nagar Nigam)

Identification of the resources needed by cities and the resources of state government that can be transferred to cities, and drafting the relevant laws and regulations for these.

8.3.5 Summary of IDP

The strategic action plan is primarily project specific, however, some of the actions proposed apply to the entire organisation, for example, reforms in billing procedures. The entire action plan with its applicability is summarized in Table 8.2.

Table 8.2 Summary of IDCB Action Plan

Sr.	Objective	Action	Agency
A. Financial Sustainability			
1	1. Reduce costs	Measures to reduce power consumption have to be implemented.	Organisation
2		Reduce number of non technical staff.	Organisation
3		An "on the job" training should be implemented to increase the productivity of the personnel.	Consultant
4		The expenditure - "Interest/dividends" on Government capital – has to be reduced/eliminated, if possible.	Organisation
5	2. Increase Revenue	• Carry out property survey along with the size and type of water connection and broaden the tax net in the short term. • As a long term planning strategy, create a GIS database of the existing properties, water and sewerage system and integrate this database with the property permission applications.	Consultant Consultant
6		Along with the property survey, a re-assessment of the property values should be carried out to have realistic basis for property tax.	Consultant
7		• Start the process of water and sewerage charges based on dual criteria of property tax and size of water connection. • Initiate, a study to evaluate the implementation of metering over the entire city.	Consultant Consultant
8		The whole billing system has to be computerized and the staffs are to be trained to undertake this assignment.	Consultant
9		Formulation of the incentive scheme, based on the amount collected and the number of bills collected	Organisation
10		Carry out a detail study to assess the market for selling the by products generated from the STP	Consultant
11		As a long term strategy, the JS should pursue the UP Government to link the tariff with the cost of production, specifically the cost of electricity charges.	Organisation/ Consultant
B. Institutional Capacity Building			
12	1. Human Resource Development	Determine the requirement of technical manpower and recruit/ contract requisite manpower	Consultant
13		Identification of the training needs, development of training programmes and selection of the training institute.	Consultant
14		Conduct a detail study to identify the opportunities for public private partnership programmes	Consultant
15	2. Infrastructure Development	Procure Hardware and software for creating a sewerage system inventory and develop a GIS based sewer application for visual interpretation.	Consultant
16		Procure engineering equipment for proper maintenance of the sewerage system.	Consultant
C. Communication			
17	Communication	Establish a comprehensive and reliable communication system between the organisations involved and IDP consultants.	Consultant
D. Institutional Development			
18	Institutional setting	Establishment of sewerage division in Jal Sansthan and Nagar	Organisation/

Sr.	Objective	Action	Agency
	up	Nigam	Consultant
19		Capacity Building of City Office (Nagar Nigam)	Organisation/ Consultant

8.4 COST ESTIMATE AND IMPLEMENTAION

IDCB has to be provided with sufficient fund for its implementation. At this stage it is difficult to accurately estimate the financial requirements for this implementation as the cost of various actions proposed depends on the number of unknown variables. Based on past experience, however, a preliminary estimate is presented in this section.

The above summary states that the IDCB programme shall be classified, for the purpose of estimation, into three categories.

- Consultancy services
- Training, and
- Infrastructure

Consultancy Services, primarily, needed for conducting a detail study for data generation and conversion of data into a GIS, property survey and reassessment, identifying the training needs, development of strategy for revision of sewerage charge and establishment of comprehensive communication system.

Training

The suggested training modules are based more on general assessment of the competencies of human resources available and the competencies required based on consultant's judgement. Similarly, no identification of training institutions has been precisely done. It should be kept in mind that training costs vary substantially with the selection of the institution. Therefore, an attempt can only be made to estimate costs with average data and to arrive at a tentative estimate of costs.

The training costs mainly consists of cost of resource persons, cost of training management (organisational cost) and cost of facilities (training room laboratory, audio-visual facilities, training materials etc.) and personal costs (travel, per diem etc. of trainees). The organisational cost varies with the reputation of the organisation, actual person engaged in assisting the training, duration of training, etc. Similarly, for few specialized management and technical training (wastewater treatment options, automation and process control, safety etc.) training may be organised in India but the resource persons could be invited from outside the country. However, for estimation, an average cost of training has been considered and budgetary estimates have been provided. The component wise estimation for training is presented in Table 8.3.

Table 8.3 Component wise Training cost

Training provided through technical assistance	1	2	3	4	5	6
	Trainees	Course units	Days/unit	Trainer days	trainer cost/days	Total cost in rupees
(1) Management Training	30	8	60	480	35,000	**16,800,000**
(2) Technical Training						
Basic management/technical skills	30	6	20	120	35,000	4,200,000
Specialized operator training	40	8	30	240	35,000	8,400,000
on-the-job training	50	10	30	300	35,000	10,500,000
Total short-term				660		**23,100,000**
Operational training						
Basic management/technical skills	30	6	20	120	35,000	4,200,000
Specialized operator training	40	8	30	240	35,000	8,400,000
on-the-job training	50	10	30	300	35,000	10,500,000
Total mid-term						**23,100,000**
(3) Financial training						
Managerial class	5	10	30	300	35,000	10,500,000
Support staff	20	10	30	300	35,000	10,500,000
Total financial training						**21,000,000**
Total training						**84,000,000**

1. Trainees - the number of people that need to take training courses
2. Course units - the number of units in each training course (1 unit = 1 week of training
3. Days/unit - the number of days required for the trainer to develop and deliver the training unit
4. Trainer days - (2) times (3) - the total number of days needed by the trainer
5. Trainer cost per day - daily rate for trainers to develop and deliver training including site visit
6. Total cost - cost to develop and deliver the training course

Infrastructure Enhancement

Infrastructure enhancement of the IDCB can be grouped into two groups, Hardware- Software and Engineering Equipments for operation and maintenance. A budgetary estimate for Infrastructure enhancement is provided in Table 8.4. Hardware and software include followings:

- Office arrangement and furniture
- Computers and printers/plotters and software
- GIS software
- GIS Development of users and infrastructure
- Accounting software and its development

Table 8.4 Cost for Infrastructure Enhancement (Draft)

Sr.	Description	Unit Cost	Quantity	Amount
1	Hardware and Software		LS	5,000,000
2	GIS inventory development		LS	8,000,000
3	Accounting and billing software development		LS	4,000,000
4	Equipments			
a	Sewerage Equipment			15,950,000
b	Lab Equipment		LS	350,000
Total				33,300,000

LS: Lump Sum

Details of the operation and maintenance equipment are shown below. The number of equipment would be required for the maintenance of the sewerage system. These would be as listed below.

Table 8.5 Capital Costs of Maintenance Equipment

Sr.	Equipment	Nos.	Unit	Rate /unit	Amount
1	Jetting machines	2	Nos.	4,000,000	8,000,000
2	Tankers with suction machine	2	Nos.	2,500,000	5,000,000
3	Trolley mounted diesel engine and non clog sewage pumps set with all accessories like delivery pipe, suction pipe sluice valve, non return valve etc.	2	Nos.	300,000	600,000
4	Air blower	2	Nos.	300,000	600,000
5	Maintenance van or equivalent	2	Nos.	750,000	1,550,000
6	Other operation equipment as per manual		Nos.	200,000	200,000
Total					**15,950,000**

IDP Consultants Cost

As for the Varanasi project, IDP consultants have two types of services as follows;

Task 1: Coordination activities among national, state and local governments (4 cities) and formulation of a comprehensive planning and implementation of municipal institutional reform to achieve Medium and Long term target (assuming 5 years programme).

Task 2: Inter-city activities to attain short or immediate term target of capacity building of local government (assuming 2-3 years programme).

	Task 1	**Task 2**
Expertise	**Man-Month**	**Man-Month**
Foreign Consultants		
Team leader /institutional development	24	8
Financial management & control	12	12
Pubic utility/ law	6	4
Human resource assessment/training	6	4
Operation & maintenance engineer		8
Sub-total man-month	**48**	**36**
Local Consultants		
Deputy leader cum financial management & control	36	20
Pubic utility	24	10
Cost control manager	12	20
Operation & maintenance engineer		10
Computer system engineer		20
Sewerage law/Local public utility law	48	6
Human resource assessment /training	24	24
Sub-total man-month	**144**	**110**
Cost of International consultants	57,600,000	43,200,000
Cost of Local consultants	36,000,000	27500000
Total	93,600,000	70,700,000

Note:
Unit costs for consultants including remuneration, transportation, logistics etc.
International consultants 1,200,000 Rs / man-month
Local consultants: 250,000 Rs. / man-months

Summary of Cost Estimate

A summary of the cost estimate for IDCB component is presented in Table 8.6.

Table 8.6 Cost Estimates for IDCB (Varanasi)

Sr.	Description		Cost
1	IDP Consultancy Services	Task 1	93,600,000
		Task 2	70,700,000
2	Training		84,000,000
3	Infrastructure Enhancement		33,300,000
Total			281,600,000

A preliminary implementation schedule is presented in Table 8.7.

Table 8.7 Preliminary Implementation Schedule for IDCB (Varanasi)

Million Rs.

	2006	2007	2008	2009	2010	2011
IDCB	56.3	84.5	84.5	28.2	14.1	14.0

CHAPTER 9

IMPROVEMENTS
IN
SANITATION OUTSIDE THE SCOPE
OF
THIS REPORT

CHAPTER 9 IMPROVEMENTS IN SANITATION OUTSIDE THE SCOPE OF THIS REPORT

9.1 INTRODUCTION

Improving the sewerage and sewage treatment system alone will not make Varanasi City sanitary. Other improvements are also required. This Section reviews some of these activities required. Most of them are the responsibility of the Municipal Corporation.

9.2 ON SITE SANITATION

The residential zones where there is no sewerage can be either unsewered higher-class low density areas, or congested slum areas. Both of them have on-site sanitation installations.

Even the best on-site sanitary installations will become unsanitary if they are not serviced when necessary:

⇒ Septic tanks and other on-site sanitary installations connected to soakage arrangements need de-sludging before they become filled and contain so much sludge that it is carried over in the effluent to block the soakage arrangements.

⇒ Single pit latrines and double pit pour flush latrines - which are recommended as on-site sanitary installations for slum areas - need to be de-sludged before they become filled and start to overflow.

Wet sludge from on-site sanitary units is wet, foul, polluting and dangerous. It must be removed, transported and disposed of with care. In the case of double pit latrines the sludge is dry and relatively innocuous at the time it is removed, so that it can be removed by hand.

No provision has been made to accept these wastes into sewerage systems or at the existing and proposed sewage treatment works. This is mainly because:

- they would tend to block sewers unless the wastes are macerated before entering the sewers, which is considered to be an expense which in the circumstances of Varanasi is not warranted (as there are other, more convenient and cheaper, ways of disposing of them);
- the proposed new treatment works is located well outside the City and therefore it would be inconvenient as a disposal area for these sludges.

These sludges are too foul for simple dumping on the surface of land.

They are potentially good for crops, as they contain both fibre to improve the soil condition and plant nutrients, and they can be spread upon agricultural land provided that they are quickly buried.

Or, they can be mixed with garbage at garbage landfill dumping sites, or at garbage composting sites where they will provide nitrogen which the process of composting requires.

The Project suggests that the Environmental Monitoring Group to be set up should monitor on-site sanitary installations after construction so as to ensure that they are properly maintained and serviced and that sludge is correctly disposed of. This regulatory unit could work in conjunction with those who will promote public awareness of good sanitation practices.

9.3 CLEANING OF STORM WATER DRAINAGE SYSTEMS

Many storm water drainage systems do not drain directly into nalas, sometimes because the final connections were apparently never made, but mainly because some storm water drains are discontinuous often because building across them or collapses or other blockages.

Varanasi City needs continuous, efficient storm water drains in order to avoid flooding during heavy rain. Particularly a major problem is that floods tend to drain into sewers, through poor manhole and inspection chamber walls and covers, or through cracks or bad joints in sewers.

Also, if areas and plots are regularly flooded during rain because there is no way for the floodwater to escape, then it is very tempting for those affected to make a deliberate connection into a sewer so that the sewer will act as a storm water drain.

Garbage and other wastes should not be dumped and allowed to remain in any Varanasi storm water drains, because this is a major reason why large parts of Varanasi are currently unsanitary, but for this Project the specific problem is to protect the sewers. The Project is particularly concerned that garbage deposited in storm water drains often finds a way into the sewerage system.

This task is not simply a matter of more frequent cleaning of garbage from storm water drains. The most important aspect in the medium and long term is for the attitudes of some of Varanasi residents to change.

This could hopefully be achieved by vigorous sanitary awareness campaigns, by advertising and by the enforcement of regulations and the application of penalties if necessary, so that offenders no longer dump litter and garbage indiscriminately into storm water drains or indeed on to any public area.

9.4 GARBAGE COLLECTION AND DISPOSAL

Varanasi can never be sanitary until its streets and storm water drains are kept clean and its garbage is regularly collected and disposed of in a sanitary manner.

This task is not simply a matter of more frequent cleaning of garbage from premises, drains, streets and other public places. The most important aspect in the medium and long term is for the attitudes of some of Varanasi residents to change.

Of course, a major incentive to such a change is that there are plenty of convenient alternative acceptable ways - refuse bins and the like - into which litter and garbage can be dumped.

There is a great need to improve the service level of garbage collection and removal from slums. Most slums are full of scattered garbage which it seems is rarely if ever collected.

This situation is very discouraging to those residents and others who are trying to improve the sanitary states of slums and their homes because, whatever they accomplish, their area will never be sanitary if scattered garbage remains.

The disposal of collected garbage currently cause environmental and public nuisance and a danger to public health. Proper landfill sites away from developed areas of Varanasi need to be prepared for garbage disposal, perhaps after some salvaging and/or treatment, and used and kept clean.

9.5 STREET CLEANING

This is a particular aspect of garbage collection and disposal.

Street cleaning is carried out manually in Varanasi by sweepers who pile the litter and debris into heaps at the side of the road pending its collection by the garbage collection service. In the time interval between sweeping and collection the garbage is often dispersed by traffic.

The Project suggests that the methods of street cleaning should be reviewed but more importantly recommends that there should be vigorous sanitary awareness campaigns to minimise litter and garbage dumping.

In order to achieve this sanitary awareness it would be necessary to ensure that the garbage service completely covered Varanasi including the slum areas and that there were adequate means of disposing of litter and garbage.

9.6 THE CLEANLINESS OF NALAS

Nalas are supposed to receive the discharge from the City's storm water drains during periods of rainfall, and they are expected to remain dry at all other times.

The Project Sanitation report has described how industrial wastewaters and sullage are entering storm water drainage systems, and has commented upon the garbage and litter that are also ultimately discharged into the nalas, causing both nuisance and danger to public health.

The recommendations made earlier in this Section to clean the storm water drains, and to improve garbage collection and disposal, will go a long way towards cleaning the nalas. The overall objective should be to eliminate all dry weather discharges into nalas but this is unlikely to happen in the short term.

Annexure

ANNEX Table 1 Requirement of Operating Staff for STPs (Guidelines of UP Department of Urban Development)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	Level	2	3	3	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Post	Ex. Engineer	A.E (E&M)	A.E. (Civil)	J.E. (E&M)	J.E. (Civil)	Chemist	Assitant Chemist	Lab Assistant	Lab attendant	Fitter (Mech.), 1st class	Electrician, 1st class	Fitter (Mech.), 2nd class	Electrician, 2nd class	Gerdener	Driver	Cleaner	Jr. Account.	UDC	LDC/ Typist	Peon	Jr. Steno	Sweeper	Weldar-cum blacksmith	Operator	Labour (Beldar)	Total
Activated Sludge Process	10 mld		1		4				1	1	1	1		1	1		1	1	1	1	1		1		12	28	57
	40mld		1		4				1	2	1	1		1	1		1	1	1	1	1		1		16	44	78
	80mld	1	1		6	1	1	1	1	2	2	2	1	2	2	1	1	1	1	2	2	1	2	1	19	54	108
	120mld	1	1	1	6	2	1	1	1	2	2	3	1	2	2	1	1	1	2	3	3	1	2	1	19	73	133
Aerated Lagoons	10 mld		1		4	1			1	1		1	1	1	1			1	1	1			1		4	10	30
	40mld		1		4	1			1	1		1	1	1	1			1	1	1	1		1		4	14	35
	80mld		1		4	1		1	1	1	1	2	1	2	2	1	1	1	1	1	1		2		4	27	56
	120mld		1	1	4	2		1	1	1	1	2	1	2	2	1	1	1	1	2	2		2		4	34	67
Oxidation Pond (Waste stabilisation Pond)	10 mld		1			1			1	1			1	1	1			1	1	1			1			11	22
	40mld		1			1			1	1			1	1	1			1	1	1			1			20	31
	80mld		1			1			1	1			1	1	2			1	1	2	1		2		1	36	52
	120mld		1			1			1	1	1		1	1	2			1	1	2	1		2		1	50	67
H.Rate Filtration	10 mld		1		4				1	1	1	1		1	1			1	1	1	1	1	1		12	28	57
	40mld		1		4				1	2	1	1		1	1			1	1	1	1		1		16	44	77
	80mld	1	1		6	1	1	1	1	2	2	1	1	2	2	1	1	1	1	2	2	1	2	1	19	53	106
	120mld	1	1	1	6	2	1	1	1	2	2	2	1	2	2	1	1	1	2	3	3	1	2	1	19	72	131
Oxidation Ditch	10 mld		1		4	1			1	1	1	1		1	1			1	1	1	1		1		8	21	46
	40mld		1		4	1			1	2	1	1		1	1			1	1	1	1		1		8	28	54
	80mld	1	1		6	1	1	1	1	2	2	2	1	2	2	1	1	1	1	2	2	1	2	1	12	48	95
	120mld	1	1	1	6	2	1	1	1	2	2	2	1	2	2	1	1	1	2	3	3	1	2	1	12	52	104

ANNEX Table 2 Requirement of Operating Staff for STPs (Recommendations of JICA Study Team)

	No.	1	2	3	4	5	6	Sub-t	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	Level	2	3	3	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Post	Ex. Engineer	A.E (E&M)	A.E. (Civil)	J.E. (E&M)	J.E. (Civil)	Chemist	5 class total	Assitant Chemist	Lab Assistant	Lab attendant	Fitter (Mech.), 1st class	Electrician, 1st class	Fitter (Mech.), 2nd class	Electrician, 2nd class	Gerdener	Driver	Cleaner	Jr. Account.	UDC	LDC/ Typist	Peon	Jr. Steno	Sweeper	Weldar-cum blacksmith	Operator	Labour (Beldar)	Total
Activated Sludge Process	10 mld		1		4			38		1	1	1	1		1	1		1	1	1	1	1		1		12	14	43
	40mld		1		4			51		1	2	1	1		1	1		1	1	1	1	1		1		16	22	56
	80mld	1	1		6	1	1	71	1	1	2	2	2	1	2	2	1	1	1	1	2	2	1	2	1	19	27	81
	120mld	1	1	1	6	2	1	85	1	1	2	2	3	1	2	2	1	1	1	2	3	3	1	2	1	19	37	97
	200 mld	1	1	1	6	2	1	98	1	1	2	2	3	1	2	2	1	1	1	2	3	3	1	2	1	22	47	110
Aerated Lagoons	10 mld		1		4	1		19		1	1		1	1	1	1			1	1	1			1		4	5	25
	40mld		1		4	1		22		1	1		1	1	1	1			1	1	1	1		1		4	7	28
	80mld		1		4	1		37	1	1	1	1	2	1	2	2	1	1	1	1	1	1		2		4	14	43
	120mld		1	1	4	2		42	1	1	1	1	2	1	2	2	1	1	1	1	2	2		2		4	17	50
Oxidation Pond / Waste stabilisation Pond	10 mld		1			1		15		1	1			1	1	1			1	1	1			1			6	17
	40mld		1			1		19		1	1			1	1	1			1	1	1			1			10	21
	80mld		1			1		32		1	1			1	1	2			1	1	2	1		2		1	18	34
	120mld		1			1		40		1	1	1		1	1	2			1	1	2	1		2		1	25	42
High. Rate Filtration	10 mld		1		4			38		1	1	1	1		1	1			1	1	1	1	1	1		12	14	43
	40mld		1		4			50		1	2	1	1		1	1			1	1	1	1		1		16	22	55
	80mld	1	1		6	1	1	70	1	1	2	2	1	1	2	2	1	1	1	1	2	2	1	2	1	19	27	80
	120mld	1	1	1	6	2	1	83	1	1	2	2	2	1	2	2	1	1	1	2	3	3	1	2	1	19	36	95
Oxidation Ditch	10 mld		1		4	1		30		1	1	1	1		1	1			1	1	1	1		1		8	11	36
	40mld		1		4	1		34		1	2	1	1		1	1			1	1	1	1		1		8	14	40
	80mld	1	1		6	1	1	61	1	1	2	2	2	1	2	2	1	1	1	1	2	2	1	2	1	12	24	71
	120mld	1	1	1	6	2	1	66	1	1	2	2	2	1	2	2	1	1	1	2	3	3	1	2	1	12	26	78
UASB + Aerated Lagoons / Fluidised Aerated Bio-Reactor	10 mld		1		2	1		31		1	1	1	1	1	1	1		1	1	1	1	1		1		8	10	35
	40mld		1		2	1		35		1	1	1	1	1	1	1		1	1	1	1	1		1		8	14	39
	80mld	1	1		4	1	1	63	1	1	1	2	2	1	2	2	1	1	1	1	2	2	1	2	1	12	27	71
	120mld	1	1	1	4	2	1	74	1	1	1	2	3	1	2	2	1	1	1	2	3	3	1	2	1	12	34	84
	200 mld	1	1	1	4	2	1	85	1	1	1	2	3	1	2	2	1	1	1	2	3	3	1	2	1	16	41	95
	300 mld above	1	1	1	6	3	1	96	1	1	1	2	3	1	2	2	1	1	1	2	3	3	1	2	1	20	48	109

Note:
1: UASB+Aerated Lagoons is added to the UP State guidelines.
2: Staff requirement of UASB+ Aerated Lagoons is adopted for FAB.
3: The major difference between the UP State guidelines and JICA recommendation is the number of labour.

Table 3 (1/3) Staff Requirement Calculation Sheet and Cost Estimation (Varanasi)

C. Sewage Treatment Operations

Executive Engineer for STP Division 2
Assistant Engineer 5

No.	STP	District	Status	Design Capacity (MLD)		Process	Level/Number of required staff							Total	Staff number by level				staff cost
							2	3	3	4	4	4	5		2	3	4	5	
				Stage I -2015	Stage II 2016-2030		Ex. Engineer	A.E (E&M)	A.E. (Civil)	J.E. (E&M)	J.E. (Civil)	Chemist Lab service	Level 5 total						Rs.
1	Dinapur STP	I	Existing	**80**	80	ASP	1	1	0	6	1	1	71	81	1	1	**8**	**71**	**7,207,000**
2	Sathwa STP	II	Proposed	**200**	225	UASB + AL	1	1	1	4	2	1	85	95	1	2	**7**	**85**	**8,184,000**
3	Bhagwanpur STP	III	Existing	**9.8**	9.8	ASP & TF	0	1	0	4	0	0	38	43	0	1	**4**	**38**	**3,749,000**
4	Ramna STP	III	Sanctioned	**37**	75	WSP	0	1	0	0	1	0	19	21	0	1	**1**	**19**	**1,782,000**
5	Lohta STP	IV	Proposed		50	UASB + AL								0	0	0	**0**	**0**	**0**
	Total			**326.8**	439.8		2	4	1	14	4	2	213	240	2	5	20	213	20,922,000

D. Sewer Operations – Collection System

1 Executive Engineer for Collection System Division 1 at Head Office
1.1 Assistant Engineer for O&M of Collection System 1 at Head Office
1.2 Assistant Engineer for Connections 1 at Head Office

No.	**Type of activity**	**Description**	**Junior Eng.**	**Staff / team**			**No. of Teams**	**Total**	**Equipment / team**	Staff number by level				**staff cost**
				Operative/ inspectors	**Drivers**	**Total**				2	3	4	5	Rs.
1	Routine inspection & cleaning	Man-entry inspection	1	3	1	4	1	4	Medium van + mechanical cleaning equipment (rods)	1	1	4	31	**3,617,000**
		Cleaning		3	1	4	1	4	Pressure jet machine					
2	Emergency blockage clearance and repairs	Sewer clearance	1	3	1	4	1	4	Medium van + mechanical cleaning equipment (rods)					
				3	1	4	1	4	Pressure jet machine + set of nozzles					
		Emergency repairs		5	2	7	1	7	Large van + mechanical cleaning equipment Medium lorry + works material, equipment, tools					
3	Planned maintenance & rehabilitation	Sewer replacement or manhole repairs	1	3	1	4	1	4	Medium van + equipment for manhole repair, etc.					
4	Assessment of structural condition		1	3	1	4	1	4						
	Total			-	-	-	7	31						

Estimation of required routine inspection teams

Assumptions:	3	years, entire sewers will be inspected and cleaned.
	200	working days/year/team
	6	working hour/day
	0.5	km/hour
Required routine inspection teams	**1**	team (rounded up)

Summary Table of Sewers

	Total Area (ha)	Sewerage Covered Area (ha)		Estimated Length (km)	
		Stage I -2015	Stage II 2016-2030	**Stage I -2015**	Stage II 2016-2030
Existing trunk and lateral sewers	8,266	2,785	8,266	**28**	28
Sanctioned trunk and lateral sewers				**16**	16
Proposed trunk and lateral sewers				**57**	39
Branch sewers				**1,073**	3,182
Total				**1,174**	3,264

Table 3 (2/3) Staff Requirement Calculation Sheet and Cost Estimation (Varanasi)

1.3 Assistant Engineer for O&M PS 2

No.	Name	District	Status	Design capacity Average flow (mld)		Level/ Number of required staff									Sataff number by level				staff cost
						2	3	4	5	5	5	5	5	Total	2	3	4	5	Rs.
				Stage I -2015	Stage II 2016-2030	Ex. Engineer	A. Engineer	Junior Engineer	Mechanic	Electrician	Pump Operator	Beldar	Sweeper						
1	Harishchandra Ghat SPS	I	Existing	7.1	6.2			0.25	0.25	0.25	3.00	1.00	1.00	5.75	0	0	0	6	**422,000**
2	Mansarovar Ghat SPS	I	Existing	2.2	1.9			0.25	0.25	0.25	3.00	1.00	1.00	5.75	0	0	0	6	**422,000**
3	Dr. R.P. Ghat SPS	I	Existing	22.3	19.4		0.50	0.25	1.00	1.00	3.00	2.00	1.00	8.75	0	1	0	8	**733,000**
4	Jalesan Ghat SPS	I	Existing	3.3	2.9			0.25	0.25	0.25	3.00	1.00	1.00	5.75	0	0	0	6	**422,000**
5	Trilochan Ghat SPS	I	Existing	6.5	5.6			0.25	0.25	0.25	3.00	1.00	1.00	5.75	0	0	0	6	**422,000**
6	Konia MPS	I	Existing	0	100		0.50	1.00	1.50	1.00	3.00	2.00	1.00	10.00	0	1	1	9	**944,000**
7	Chaukaghat Right bank MPS	II	Proposed	130	140		0.50	1.00	1.50	1.00	3.00	2.00	1.00	10.00	0	1	1	9	**944,000**
8	Chaukaghat Left bank MPS	II	Proposed	14	19			0.25	1.00	1.00	3.00	2.00	1.00	8.25	0	0	0	8	**587,000**
9	Sathwa MPS(STP site)	II	Proposed	185	200						3.00			3.00	0	0	0	3	**198,000**
10	Narokhar Nala SPS	II	Proposed	14	18			0.25	1.00	1.00	3.00	2.00	1.00	8.25	0	0	0	8	**587,000**
11	Saraiya SPS	II	Proposed	3.7	3.1			0.25	0.25	0.25	3.00	1.00	1.00	5.75	0	0	0	6	**422,000**
12	Phulwaria SPS	II	Proposed	7.6	7.6			0.25	1.00	1.00	3.00	2.00	1.00	8.25	0	0	0	8	**587,000**
13	Assi MPS	I/III	Existing	-	-									0.00	0	0	0	0	**0**
14	Nagwa Nala SPS	III	Sanctioned	37	50		0.50	1.00	1.50	1.00	3.00	2.00	1.00	10.00	0	1	1	9	**944,000**
				432.7	573.7	0	2	5.25	9.75	8.25	39	19	12	95.25	0	2	5	88	7,634,000
				Total(rounded up)		**0**	**2**	**6**	**10**	**9**	**39**	**19**	**12**	**97**	0	2	6	89	7,880,000

Note:
E: Existing P: Proposed
S: Sanctioned A: Augmented

Table 3 (3/3) Staff Requirement Calculation Sheet and Cost Estimation (Varanasi)

Average Salary Used for Manpower Cost Estimation

Level	Description	Average Salary per month in Rs.	Salary used for costing (Add 10%)	Annual amount in Rs.
Level 1	Superintending Engineer	28,000	30,800	**369,600**
Level 2	Executive Engineer	25,000	27,500	**330,000**
Level 3	Asst. Engineer	22,000	24,200	**290,400**
Level 4	Junior Engineer	18,000	19,800	**237,600**
Level 5	Labours Average	4,995	5,500	**66,000**

Source: Operation and maintenance of 60 MLD STP, Naini, Allahabad
Letter No. 488/401/4, Dated 3/3/-4; Enclosure No. 10
Some of monthly wages taken from UP Jal Nigam, Estimate for Operation & Maintenance of Assets created under GAP Phase I, at Allahabad.

Appendix A

Appendix A Terms of Reference for Capacity Building of City Office

The present terms of reference set forth tasks that the IDP Cell shall undertake in collaboration with the team of consultants. As shown in the Task Schedule, major tasks are grouped into three.

Tasks and Task Numbers

A. Capacity building in 4 cities will be pursued throughout the first phase and the second phase of activities, each one of which will take place approximately for two years and three quarters of a year. This task group consists of four tasks:

   1. Revenue enhancement,
   2. Improvement of transparent and accountable management,
   3. Restructuring and reorganisation of city divisions (including Jal Sansthan) and
   4. Public participation into management of city office.

B. Formulation and implementation of the local administrative reform will take place mostly in the first phase. This task group consists of 6 tasks:

   1. Identification of resources that city needs,
   2. Selection and transfer of national and state resources to city,
   3. Reorganisation of state organisations including Jal Nigam,
   4. Amendment or creation of sewerage law, local public utility law and other laws,
   5. Restructuring or creation of the city's water supply and sewerage division, and
   6. Conversion of perception from mere operation and maintenance of sewerage facilities to the public utility service and dissemination thereof.

C. Task 11 will be programming of various training, which will help relocation of engineers, technicians, administrators, financial controllers and business managers.

Description of Tasks in Phase 1

Task 1 Before its abolition in UP state (late1990's), Octroi tax was the largest source of city's revenue. Cities did not need to develop taxation system of property tax (house tax, water and sewer tax) that was the second largest source of revenue. Even after the abolition cities did not make consistent effort to increase revenue collection, as the state transfer has been expected to fill up the loss of Octroi tax. In Agra Municipal Reform Project and in the other many cities, attempts to enhance taxation system have been and are being begun by, in most cases, enhancing the tax net and standardizing the property valuation method. IDP shall study carefully feasible and replicable lessons from other cities for application to the target cities.

IDP shall enumerate all the city tax items and review and analyse in detail the city's ongoing taxation procedures including ledger of properties, list of taxpayers, valuation of property, billing and collection, possible evasion, etc. On basis of the analysis and the lessons from other cities, revenue division shall be created or reorganised with proper procedure including, among others, preparation of complete and accurate property ledger (refer to Terms of Reference for Agra Municipal Reform Project), and feasible options to improve tax revenue and their justifications shall be formulated and presented to the city officers and taxpayers for their acknowledgement and consensus. This is the most crucial part of the institution engineering. Coordination of interests of various parts of citizens shall be patiently pursued. Efforts shall be exercised to reach the majority consensus through Task 4: Public participation and other group meetings or individual meetings. If the proposed taxation system requires resolution by the city

assembly, IDP shall assist the city office in preparation of ordinance and briefing materials, and participate in the assembly to testify the expert's view.

During the course of implementation of taxation reform, IDP shall closely monitor its progress and help expedite the process by computerization, inputting the geographic information system (GIS), streamlining work flow of revenue division, training under Task 11, etc.

Task 2 Transparent and accountable management of city office will be pursued initially through strengthening the financial management/control and establishment of public relations unit.

Betterment of financial management and control shall start with introduction of the double entry and accrual basis bookkeeping with accounting system on the internationally accepted standards. Financial management consultants shall undertake a thorough audit of the existing financial reports of Nagar Nigams and Jal Sansthans. The biased financial information due to improper or incorrect bookkeeping shall be rectified. At the same time estimation of asset as well as scale of potential revenue and expenditure will be made. Cities' financial officers shall be invited and participate in the process (in-service training).

"Complaint Redressal" activities shall be strengthened, and the Public Relations Unit shall be created. Complaint redressal is a passive concept, as it will not work, unless and until a complaint reaches the city office. Public relations activities shall be active and bi-directional, as they shall include not only complaint redressal but also addressing the public and the residents through publication, broadcasting, press release, various meetings, etc. on the activities, services and the mandates in general of the city office.

IDP shall create and organise the public relations division in each city office with mandate of information disclosure, residents consultation, opinion survey, complaint redressal, etc., so that management of the city office can be transparently presented to every citizen.

Task 3 Restructuring and reorganisation of city office shall be made in two phases. In the phase 1, concept of the future city service shall be elaborated on the basis of an organised information collection through:

- observation tour to the developed cities
- analysis of the existing constraints and bottlenecks
- hearing and survey from city officers and citizens, etc.

City's mandates, functions and services at target years of 2010, 2015 and 2030 shall be envisioned and defined. Practical step by step procedures to reach targets shall be developed. Primary attention shall be addressed to the regulatory frameworks to ensure the principles of single entity and technical and financial autonomy of the public utility service.

Task 4 Public Participation into task 1, 2 and 3 shall be pursued throughout the Programme activities. Refinement of taxation system (Task 1), creation of the public relations unit (Task 2) and desired roles of city (Task 3) shall be discussed with stakeholders in city (industrial and commercial bodies, voluntary bodies, institutions, individuals, etc.). For this purpose, a public participation programme shall be developed and implemented by utilizing publications, broadcasting, press, schools, various gatherings and individual interviews/ meetings.

Task 5 To operate the sewerage service in accordance with objective, principles and guidelines of the public utility, what the present city lacks and needs shall be identified among from legal mandate or jurisdiction and operational, human and financial resources. Particular attention will be paid to:

- Single management - To mandate the sole responsibility to the water supply and sewerage

division, how shall the present laws/ ordinances be amended?
- Operational resources - Stocktaking of the existing facilities or enumeration of assets shall be made to evaluate technical consistency of the facilities.
- Human resources - Are the present staff qualified sufficiently for operation of sewage treatment plants, etc.? Are trainings needed? Recruit and transfer of technical personnel and business managers needed?
- Financial resources - How much costs will be expended for proper operation of the public utility service including costs for operation and sufficient maintenance of facilities?

Task 6 On basis of the outcomes of Task 5, the national and state's jurisdiction, human and financial resources shall be sought for transfer to cities. Shall technical personnel of the state (particularly Jal Nigam) be transferred? Can the state fund transfer be increased? Shall a new tax be created? Shall laws be amended or created? If so, what will be the practicable procedures to bring them about? As a result, an implementation programme shall be formulated and implemented.

Task 7 If parts of jurisdictional authority and personnel of the state organisation (particularly Jal Nigam) are to be transferred to city, how it shall be evolved? It is suggested that it will stay with the regulatory function and the engineering and specialist function. Technical as well as business standards shall be set and enforced to maintain quality of the public utility services. In the present UP, Jal Nigam has only aggregation of technical personnel for sewerage operation. IDP in collaboration with Jal Nigam shall identify and formulate design criteria and other technical standards and guidelines. Law and ordinances will be drafted in Task 8 for enforcement. A wing of Jal Nigam shall be reorganised for effective enforcement of technical standards to maintain quality of service. Another wing may be reorganised for storage or aggregation of technical experts for advancement of water supply and sewerage technology, training institution of the technology, source of manpower for transfer or on the contract basis and so on. Technology and manpower assessment shall be made. Desirable functions will still be sorted out and elaborated. Applicable procedures to make the organisation evolve to exercise such major functions shall be formulated and implemented.

Task 8 Water Supply and Sewerage Act, UP Municipalities Act, UP Jal Nigam Act and other existing laws shall be reviewed in the light of findings and outcomes of the foregoing tasks 1 through 7. Necessary amendments and new laws will be drafted. If the business activities of public utility service provider need to be governed, such a law shall be created. If transfer of personnel from state to city requires adjustment of cadres, and if a new tax shall be created, such laws shall also be amended or created. Briefing materials and testimonial documents shall be prepared to persuade and convince the public including members of the State Legislative Assembly. Under the guidance of the Steering Committee, IDP shall take every possible measure to get these amendments and laws sanctioned by the state legislature.

Task 10 Conversion of perceptions from a mere operation and maintenance of infrastructure to the full fledged public utility service shall be made clear and evident to everyone and every layer of the society. The citizens should be told that they are owners of the city services. Officers should learn how to serve the citizens. The public utility service shall be provided as and to the extent that are demanded by the citizens. The objective and principles of the utility service shall be widely known. This task shall be linked with Task 4: Public Participation. City officers shall also learn the conversion. Their training or re-training needs shall be assessed and identified as a part of Task 11.

Task 11 All the training needs that are complementary to tasks 1 through 10 shall be sorted out and training programmes shall be formulated for the implementation in institutions within and out of India. In the case that the Institutional Development Training Centre be established, it will implement most of such trainings.

Description of Tasks in Phase 2

Tasks 1 and 2 After completion of these tasks in the 10th quarter of the IDP activities, reviews and evaluations of the progress shall be made at suitable intervals. If progress and achievements are found unsatisfactory, all the necessary measures to improve the programmes shall be planned and implemented. If such may include additional input of resources, assessment of resources required shall be made.

Task 3 and 9 In addition to the programmes developed in the phase 1, detailed programmes shall be formulated in the phase 2. Such programmes should entail creation or reorganisation of departments of the city office. Utmost attention shall be addressed to the organisation of the water supply and sewerage division in the city office in accordance with the objective, principles and guidelines, as IDP's basic objective is to create a sustainable public utility service provider. As city is expected to be fully authorized legally to provide full fledged city services by the end of the phase 1, ownership is already fostered. Technical and financial autonomy of the division shall be ensured to insulate it from undue interventions. To house the water supply and sewerage division, financial control division, revenue division and public relations division in the city office, the latter also needs to articulate its activities into several functional divisions. Residents registration function shall be integrated into one division (with many branch offices area-wise), as it shall prepare and furnish accurate residents ledger, that should be basis of taxation and other city services of other divisions. Policy planning division, urban development division shall be established to coordinate and approve all the development activities by city itself and other state and private developers. The city needs to be consulted and authorized to govern any significant activity in and around the city boundary.

Establishment and reorganisation of most of these divisions shall be implemented in the quarters 11 through 13, and review and evaluation of progress shall be made at the proper interval.

Tasks 4 and 10 Citizens' ownership over every part of the city services, concept of public interest and massages of policymakers of the city office shall be repeatedly discussed among all the parts of residents through gatherings, medias and publications. Public participation programme prepared in the phase 1 may have to be amended or revised from time to time, and be implemented repeatedly even after the IDP.

Task 11 Needs and areas of training evolve as time goes. Training programme developed in the phase 1 shall be reviewed and revised repeatedly.

Appendix B

Appendix B Terms of Reference for Agra Municipal Reform Project

Background and context

Under the Yamuna Action Plan (YAP) project, sewerage facilities have been created in 15 towns (8 towns in UP including Agra, 6 towns Haryana and Delhi). The responsibility for maintenance of these assets is vested with the respective Urban Local Body in each town. However, these agencies lack the financial, institutional and technical capacity to effectively manage these assets. Japan Bank for International Cooperation (JBIC) conducted a study to identify the institutional and capacity building measures for ULBs in these towns.

During presentation of the results of this study to the Government of Uttar Pradesh (GoUP), a suggestion was given to JBIC to conduct a specific study for Agra Nagar Nigam (ANN) by contextualizing the best practices from other ULBs in the country that have successfully implemented and sustained municipal reform measures.

Accordingly, a specific study titled "Collaborative Study on Municipal Reforms in Agra Nagar Nigam" was initiated by JBIC. The objectives of the study were as follows:

1. Facilitate key stakeholders (senior management and municipal councilors to develop a consensus on the nature and direction of reform process within ANN)
2. Develop a detailed action plan for key reform initiatives by contextualizing the best practices in the country
3. Demonstrate the impact of reform through a pilot project that can be potentially replicated to other areas in ANN

The study adopted a highly participative approach in which a reform team headed by the Mayor of Agra was constituted. The team also consisted of the Nagar Ayukta (MNA), heads of departments in ANN, General Manager, Agra Jal Sansthan and key councillors from all political parties. As many as seven workshops were held during the course of the study to obtain consensus from the Reform Team at each stage.

Six areas were shortlisted for preparation of detailed action plan for reform. These include:

1. Implementation of Self-Assessment System (SAS) for Property Tax
2. Implementation of Capital Cost method for non-residential properties
3. Private Sector Participation in operation and maintenance of municipal services
4. Public participation in service delivery
5. Strengthening financial management system
6. Implementing complaint redressal system

A pilot project consisting of primary and secondary collection of garbage from an extension colony in Agra was also configured in close involvement with citizens and ANN. Proposals were invited from three parties from which one party was short-listed and the consultants also prepared draft contractual documents.

Objectives of the proposed AMR project

In order to implement the core recommendations in each of the reform areas, it is necessary to appropriately configure a specific project titled "Agra Municipal Reform", hereinafter referred to as the AMR Project.
The objectives of the proposed project are as follows:

1. Putting up appropriate systems for effective revenue mobilization from Property Tax (for both residential and non-residential properties)
2. Developing and implementing pilot projects through private sector participation in improving service delivery in municipal services. These pilot projects would be

implemented in four service areas – water supply, SWM, sewerage and street lighting
3. Implementing a large scale public participation programme in Agra
4. Putting up appropriate systems for complaint redressal and financial management

Successful implementation of the reform programme in Agra could become a role model for implementation across other towns in Uttar Pradesh. The scope of the AMR Project has been limited to a 15-18 month time frame. While the action plan for reform presented in the report indicates a phasing plan over the next 3-5 years (especially for private sector participation projects), only the first phase projects (specifically the pilot projects identified in street lighting and solid waste management) have been considered as part the AMR project.

Project Components and activities

The specific project components for implementing the AMR project have been identified along the specific areas of reform is listed below:

Component 1 - Property Tax

A. Training of ANN revenue staff on Self-Assessment System and Capital Cost method for non-residential properties:

All the employees of the revenue department, including Tax superintendent, Assistant tax superintendent, Revenue inspector and the Tax collector would be trained on the new Self-Assessment System (SAS) and the Capital Cost Method for assessing non- residential properties.

Note:

(i) Agra Nagar Nigam has started the Self Assessment System (SAS) for the residential properties. Revenue staff has also been trained on the SAS.
(ii) Capital Cost method of assessment of non-residential/commercial properties is already in vogue and the Engineering and Revenue Staff has been trained for this sytem.
(iii) The consultant's would improve upon this system and provide supervisory and advisory support during the period of the project.

B. Development of PT handbook:

A user-friendly Property Tax handbook is being prepared by ANN and would be available for sale at a nominal price (or distributed to public free of cost). The PT handbook would be used as a potent tool to communicate about the PT rules to the citizens. About 2,00,000 PT handbooks are proposed to be printed for distribution.

Note:

(i) The user friendly property tax handbook had been prepared and launched in July, 2002. The handbook has been made available to the concerned staff for appropriate follow up. The Property Tax handbook is available for sale to the general public at Rs.10/- per copy. The handbook also contains the bank challan, in triplicate, for depositing the assessed tax in their neighbourhood bank/branch at their convenience. So far 110000 Property Tax handbooks have been printed and made available for sale.distribution.
(ii) The consultants may give any suggestions for qualitative improvement of the handbooks. The actual printing etc. will be undertake by Nagar Nigam on their own.

C. Complete physical survey of the city and general assessment:

At present the quality of information regarding the PT assesses is very poor. Under the SAS a complete and accurate assessment list is necessary. Hence, for the successful implementation of the

SAS information would need to be sourced, reconciled and corrected from multiple sources. The reconciled information obtained from the entire population of Agra would then have to be entered into the computerized database. While the Revenue department would undertake the actual reconciliation of data, the process of converting the manual information into computerized format would require external professional support.

***Note**:*

(i) Nagar Nigam has engaged a consultant to undertake the property listing and identification based on G.I.S. Land mapping in April 2001. The firm is preparing digitized based maps after detailed physical surveys and preparing GIS. Revenue clerks have also been trained for computerization of the property records.

(ii) The consultant for the AMR project will need to carry on the work by building on the deliverables and output of the earlier consultants and also work hand in hand during the overlapping period of appointment. It will be with scope of work of AMR project to undertake the contact. Survey on basis of the base maps available with Nagar Nigam. The staff of Nagar Nigam Property tax deptt. will be used during the exercise. The contact survey will focus on collection of not more than 10 attributes based on the format to be prepared in consultation with Agra Nagar Nigam. However one of the attributes essentially will be plinth area of the properties which will be calculated on found by a simple method of Length X Breadth (atleast 95% accuracy). The data so collected will be linked to the spatial maps available with Nagar Nigam Agra in GIS format. The consultants shall also devise a scientific numbering system for all dwelling units within the area under the Agra Nagar Nigam jurisdiction.

(iii) GoUP has nominated an Additional Mukhya Nagar Adhikari (AMNA) who will be the TEAM LEADER for the whole exercise including the Property Tax Revenue. This will ensure that central coordination is maintained and ensures that PT improvements are being performed objectively. This will ensure proper disciplinary approach to collection and installation of PT system.

D. Development of a software for PT- database design & and application software :

Prior to the start of the software development process the System Requirement Definition would be designed by a software developer in close co-ordination with ANN in order to minimize the glitches in software design. About 10 personal computers would be procured to be used for the data entry in different zones. The computers, however, would physically be located at the Head Office.

Note:

(i) Tenders have been invited on 23-08-2002 for the purchase of 10 new PCs and other accessories as plotter printer LAN etc. The computer room furnishing in the ANN head office is also in progress.

(ii) *ANN will be procuring the GIS software and have the base maps in GIS format for the Area under ANN jurisdiction. The consultants will need to customize that software and develop property tax specific application. Also any further software to be developed should be totally compatible with the GIS software.*

E. Finalise bank collection system :

Systems would be put in place to provide for the PT payable under SAS to be collected through banks. Firstly, the banks have to be identified; the registers/records of remittances and procedures have to be established to reconcile the daily balances of remittances through the bank etc.

***Note:** Banks/branches have been empanelled through the city to receive the PT payable under SAS, alongwith the duly filled up forms of SAS. The reconciliation of daily balances of remittances is also in progress through these banks/branches.*

F. Integration of Revenue function with Agra Jal Sansthan As part of the initiative of integrating the revenue collection staff of both ANN and AJS, there would be interaction with the senior offices, state Government. This would be done with an aim of taking stock of the staff inventory of both organisations, revising the organisation structure, revising geographic jurisdictions, negotiating the proposal with the labour unions etc.
Note: *Due instructions are awaited from GOUP for integration of revenue function with AJS.*

G. Planning and implementing the PR campaign :

Planning a massive PR campaign to increase the awareness of the SAS system of determining PT would be done by identifying a suitable PR agency and planning the PR activities. The PR activities planned would then be implemented by using various channels to disseminate information throughout the year. The communication campaign would be interspersed with media events.
Note: *The PR campaign for SAS awareness has been started along with the introduction of SAS system. The detailed planning and implementation of the PR campaign in extension to the efforts started by ANN have to be worked out in consultation with the consultant appointed by J.B.I.C.*

H. Conducting Property Tax camps :

Property tax camps for tax mobilization is expected to be carried out throughout the year. There would be about 25 such camps carried out each quarter. The process of conducting such camps would be institutionalized.
Note:

(i) *The details of property tax camps to be under taken in the various areas of the city have to be worked out by the consultant in consultation with ANN*

(ii) *Public Participation could be more effective if cooperation with Consumer products based private sector companies is sought for sponsoring events.*

I. ANN to prepare specific proposals for seeking clarifications and guidelines, which should be provided by GoUP :

ANN would be supported in preparation of detailed proposals and submitting to Government of Uttar Pradesh for approval in different areas including 'Discounts to be provided to tax assesses for payment within specified dates', 'Collection of water and sewerage charges along with PT', etc.
Note: *Detailed shall be worked out in consultation with the consultant for preparing specific proposals for seeking clarification and guidelines forwarded by GOUP*

The following would be the outputs and benefits that would be realized by implementing the above activities:

- Trained revenue staff who would have clear idea of deliverables and targets;
- A PT management system which is computerized leading to effective monitoring and control which are essential in plugging the revenue leakages
- An updated database of properties and tax assesses
- Greater public awareness and acceptance of the new system

There would also be considerable financial benefit that would accrue by implementing the above project. Implementation of the above project would ensure that the 100% of the properties are under the tax net. Additionally, changeover to the SAS using Unit Area Method is expected to yield about 50 – 100% (on a conservative basis) additional revenues by assessment values and preventing under assessment.

Component 2 - Private sector Participation in service delivery

Implementation of the following projects involving private sector participation:

1. **Primary and secondary collection of garbage**:

Currently, there is a proposal by an NGO to conduct primary and secondary collection of garbage from the 7500 households of Kamla Nagar that is sustained through user fees. The project would involve a one-time capital investment costs by ANN towards procurement of cycle carts, bins, uniform, tools, etc. Though the user fees will be used to support this programme, there would be an additional cost component towards providing O&M support to the private player for the fifteen month period that will be met by the ANN separately.

The following are the expected benefits by the implementation of this project:

- Efficiency and timeliness of services to the residents
- People's active participation in civic management
- O&M costs would be partly borne by the citizens
- The project could serve as a model project, which could be replicated in the other parts of the city.

The Consultant is only expected to provide technical guidance to ensure sustainability is maintained after the 15 months of the project is complete.

2. **Transportation of garbage to landfill site:**

ANN will be work to develop a private sector contract for the collection of garbage from the dhalao point and transportation to the landfill site would be managed in a selected area through private operator. The project would cover about 10% of the total area of Agra i.e. about 20sq.km. The project would involve a one-time capital cost towards upgradation of existing vehicles of ANN before handing over to the private operator. As a cost component, it would also entail the cost of O&M support to the private player for three months towards the manpower and fuel expenses.

3. The following are the expected benefits by the implementation of this project:

- Greater cleanliness and improved hygienic conditions on account of efficient garbage disposal,
- Increased efficiency in the operation of garbage transportation,
- The greater efficiency achieved by the Private sector player could be used as a benchmark improving ANN's own performance,
- The project could serve as a model project, which could be replicated in the other parts of the city.

The Consultant is only expected to provide only technical guidance to ensure sustainability is maintained after the 15 months of the project is complete.

4. **Primary collection and composting of biodegradable garbage from hotels:**

Such a project would involve collection of biodegradable garbage from hotels on a daily basis, transportation of garbage to composting site, composting of the garbage. The project is currently operating in a limited area by an NGO at Agra. The objective would be to scale up the current project and make it financially self sustainable through user charges. All large sources of biodegradable wastes would be covered under the scheme would be covered under this project. The cost of operations could be partially or fully recovered through user charges from hotels and sale of compost.

5. The following are the expected benefits by the implementation of this project:

- Reduction in the load on landfill sites,
- Better hygienic conditions near the municipal bins,

- The ongoing project on composting biodegradable wastes could be made financially sustainable through the expansion of operations and the imposition of user charges.

The Consultant is only expected to provide only technical guidance to ensure sustainability is maintained after the 15 months of the project is complete.

6. **O&M of street lights:**

The operation and maintenance of all streetlights in a particular locality or geographical area could be given to one private agency. The project being envisaged would have a scope of operating & maintaining about 1000 streetlights or about 8-10% of the total area of the city.

7. The following are the expected benefits by the implementation of this project:

- Efficient operations which would mean timely replacement of defective bulbs.
- The project could serve as a model project, which could be replicated in the other parts of the city.
- Greater cost savings by involving the private sector participant.

The Consultant is only expected to provide only technical guidance to ensure sustainability is maintained after the 15 months of the project is complete.

For all the projects listed out above the following activities need to be carried out:

Detailed structuring of each of the projects:
The detailed structuring of the project would involve defining the scope of work clearly, assessing the conditions under which the project would be suitable, arriving at the duration of the project, etc.

A. Managing the project contracting process:
As part of managing the project contracting process the bid documents would be prepared, bids would be invited by floating tenders, the bids would then be evaluated based on the criteria of evaluation developed jointly with ANN and finally the private player would be selected. The final contract document would then be prepared after detailed negotiations with the potential private party.

Monitoring the Operation of Projects:
Once the contract is in place an institutional mechanism for the continuous monitoring of the projects would be put in place

Component 3 - Public Participation

The scope of this activity would include managing a large public participation programme through the platform of "Agra Safai Abhiyan". The specific activities would include:

A. Facilitating formation of resident associations and citizen committees:
Partnerships would be entered into on a proactive basis with civil communities, NGOs/CBOs etc.

B. Structuring formal mechanisms for interaction between ANN and citizen groups:
The partnerships forged would be formalised through appropriate contracts and institutional mechanisms would be established for continuing and proactive interaction between ANN and the citizen groups.

C. Planning and coordination of activities for Agra Safai Abhiyan:
The activities for the Agra Safai Abhiyan would be planned meticulously and implemented.

D. Coordinating all activities relating to print and electronic media including preparation of short audio-visual films

As part of leveraging public relations as a prime strategic tool for encouraging large-scale community participation, several initiatives would be taken to utilise PR for eliciting public participation in municipal services. As part of the PR initiative the public would constantly kept informed about the activities of ANN through press conferences, media interviews, seminars, etc. Apart from information dissemination the PR exercise would also involve developing short video films on successful initiatives by various community groups to be broadcast on local television channels as well as cinema halls.

The following would be the outputs and benefits that would be realised by implementing the above activities:

- A better civic sense leading to better waste management by citizens
- A platform for involvement of the public in future initiatives
- The formation of at least 5 Resident Welfare Associations in different parts of the city
- The project could serve as a model project, which could be replicated in the other parts of the city
- Reduction in the overall cost of Solid Waste Management due to the successful implementation of the 'Agra Safai Abhiyan' campaign

Component 4 – Complaint Redressal System

A. Integrating ward level offices and head office of ANN:

The integration of the ward-level offices of ANN would be done through Radio Transmitters, which would be procured and provided to each of the zonal engineers.

B. Strengthening infrastructure in field offices of ANN:

Investments would be made to improve the basic infrastructure like telephone, seating space, etc., in the field offices of ANN.

C. Development of detailed manual for complaint redressal :

A manual for complaint redressal would be prepared detailing the roles and responsibilities of the personnel involved along with the procedures to be followed under the complaint redressal system.

D. Training of staff on the complaint redressal process:

The staff involved would be trained on the complaint redressal process on improvement of their softer skills required while dealing with the general public.

E. Monitoring the complaint redressal process:

The institutionalised complaint redressal process would then be monitored on an ongoing basis for a period of 6-8 months to refine and better the system.

The following would be the outputs and benefits that would be realised by implementing the above activities:

- Increased willingness to pay due to an efficient grievance redressal mechanisms coupled with greater public participation and private sector initiatives, which would pave the way for imposing conservancy tax for areas served by ANN
- Closer and effective monitoring of the sanitary field workers because of better feedback mechanisms.
- The project could serve as a model project, which could be replicated in other service lines

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NATIONAL RIVER CONSERVATION DIRECTORATE (NRCD)
MINISTRY OF ENVIRONMENT AND FORESTS

THE STUDY
ON
WATER QUALITY MANAGEMENT PLAN
FOR
GANGA RIVER
IN
THE REPUBLIC OF INDIA

FINAL REPORT

VOLUME IV FEASIBILITY STUDY FOR PROJECT CITIES

VOLUME IV-4 FEASIBILITY STUDY FOR VARANASI CITY
PART V ECONOMIC AND FINANCIAL EVALUATION

JULY 2005

TOKYO ENGINEERING CONSULTANTS CO., LTD.
CTI ENGINEERING INTERNATIONAL CO., LTD.

FINAL REPORT
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ABBREVIATIONS

AgO	Agricultural Products
AO	Actual Output by permanent skilled labour,
APSL	Actual Permanent Skilled Labour
ARV	Annual Rental Value
ATP	Affordability to Pay
B/C	Benefit Cost ratio
CA	Cropped Area
CPI	Consumer Price Index
CVM	Contingent Valuation Method
E&M	Electrical and Mechanical
EAP	Entire Economic Active Population
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
FP	Financial Price
GAP	Ganga Action Plan
GRDP	Gross Regional Domestic Products,
HH	Household
JICA	Japan International Cooperation Agency
NPV	Net Present Value
O&M	Operation and Maintenance
OECD	Organization for Economic Cooperation and Development
PAHO	Pan American Health Organization
Rs.	Indian Rupees
SCF	Standard Conversion Factor
SPRL	Shadow Price Rate for Land
SWCF	Shadow Wage Conversion Factor
WTP	Willingness to Pay

CHAPTER 1

INTRODUCTION

PART V ECONOMIC AND FINANCIAL EVALUATION

CHAPTER 1 INTRODUCTION

In general, a project will be evaluated taking engineering, economic/financial, institutional and environmental aspects into consideration. The engineering aspects are studied and form a part of the technical feasibility of the project from the viewpoint of construction, operation and maintenance. The institutional aspect of the project evaluates the existing organisation and management structures and suggests capacity building measures. The environmental aspects are studied on environmental reliability from the viewpoint of water quality, living environment, biodiversity and so forth.

The economic aspect of the project is to determine whether the project can contribute to the improvement in the socio economic condition of people living in cities along the river, in this case Ganga, and the financial aspect determines whether a project can add to improvement in the financial condition.

An economic evaluation of the project is based on the economic cost benefit. The benefits should be measurable in terms of direct monetary value addition. The economic benefit to the people can be tangible and/or intangible but it needs to be evaluated as it contributes to the national/regional economy. The economic cost can be derived by eliminating the distortion caused by the taxes, charges, duties that may be levied as per the laws and/or some other rules or regulations applicable at that point of time from financial cost.

With regards to the financial viability, it is to be determined whether the enterprise, in this case it is called as “Water Supply and Sewerage Services Provider” (hereinafter referred as “the Service Provider”), is likely to be financially viable taking financial cost and financial benefit into account.

The financial cost includes initial outlay or investment cost, operation and maintenance cost, and replacement and renewal cost. The financial benefit means direct revenue derived from, in this case, taxes and/or charges from sewerage and indirect revenue in terms of sale of by-products such as treated water for irrigation and dried sludge in the form of compost.

CHAPTER 2

EXISTING FINANCIAL SITUATION

CHAPTER 2 EXISTING FINANCIAL SITUATION

2.1 OVERALL ECONOMIC BACKGROUND

Under this Chapter we will discuss in brief the financial situation of various organisations that affect this Project and National Government (Government of India) and Government of Uttar Pradesh

1. National Government
2. State Government, in this case Uttar Pradesh
3. UP Jal Nigam
4. Varanasi Nagar Nigam
5. Varanasi Jal Sansthan

2.2 BRIEF FINANCIAL BACKGROUND OF THE NATIONAL GOVERNMENT

The financial situation of the National Government (i.e. Government of India) is rather healthy since 1999-2000. It means that the Government finance has been supported by both the tax revenues in revenue account (current account) and receipts in the form of public debt in capital account and there is a sharp rise in them since 1999-2000.

Out of the total tax revenue, around 62 % - 74 % comes from the taxes on commodities and services which are indirect taxes. The receipts in revenue account (current account), i.e. grant-in-aid are less than 1 % consisting of external grant assistance and aid materials & equipment in the nation as discussed in the Master Plan Study Report. The share of the external debt to the capital income ranges between 2.0 % to 3.2 %.

On the expenditure side

1. **General Services** are almost half of the total expenditure.
2. **Economic Development Services** are the second largest head of expenditure.
3. **Grants-In-Aid** are the third largest head of expenditure**.** In this category, the Grants-In-Aid to State Governments are at the top sharing 95.4 % of the total expenditure.
4. Expenditure on **Social Services** is the fourth group sharing around 5 % only of the total expenditure. The expenditure on **Water Supply and Sanitation** concerning the Project stands at third position under this expenditure group (Social Services) with a share of 4.7 % as per data of 2002-3. (for detailed review refer Appendix A)

2.3 BRIEF FINANCIAL BACKGROUND OF THE UTTAR PRADESH STATE GOVERNMENT

The financial figures since 1997-98 for the Uttar Pradesh State show a deficit. However the financial estimates for 2000-01 and 2001-02 show a positive balance. (Detailed analysis of the same is given in Appendix B)

The largest head of revenue of the Uttar Pradesh State is the Tax Revenue with a share of around 80 % according to financial statement 1997-98 as discussed in the Master Plan Study Report. Loans and Advances from Centre (the National Government) show a large share of inflow at 30.8 % as indicated in the same statement.

The expenditure on the other hand comprises of 5 categories:

1. Developmental Expenditure
2. Non-Developmental Expenditure
3. Grants-In-Aid and Contributions,
4. Compensation and Assignments to Local Bodies and Panchayati Raj Institutions and
5. Reserve with Finance Department.

Developmental Expenditure and Non-Developmental Expenditure are the major expenditure categories. Expenditure on **Water Supply and Sanitation** related to the Project ranges only from 3.6 % to 7.0 % as per the financial status of 1994-95.

2.4 FINANCIAL BACKGROUND OF THE UTTAR PRADESH JAL NIGAM

Following table shows a summary of balance sheet of Uttar Pradesh Jal Nigam (UPJN). According to this table, the UPJN has suffered deficits in these 3 years.

Table 2.1 Summary of Balance Sheet of Uttar Pradesh Jal Nigam

(Unit: million Rs.)

Credit	Fiscal Year			Debit	Fiscal Year		
	1998-99	1999-2000	2000-01		1998-99	1999-2000	2000-01
Current Assets	33,023	37,149	42,859	Liabilities	44,105	48,552	55,046
Fixed Asset	10,701	11,186	12,025	Surplus or Deficit for the Year	-381	-217	-163
Total Assets of UPJN Only	43,724	48,335	54,883	Total Liability of UPJN Only	43,724	48,335	54,883
Assets of Civil and Design Services	6,771	8,489	10,462	Liabilities of Civil and Design Services	6,524	8,199	10,153
				Surplus or Deficit for the Year in Grand Total	247	290	309
Grand Total of Assets	50,495	56,824	65,345	Grand Total of Liability	50,495	56,824	65,345

Source: UPJN.

However, the UPJN Construction and Design Services consisting of Civil Wing and Nalkoop Wing, produce surplus offsetting the deficit of UPJN as shown in the above table. Therefore, financial situation of the UPJN is healthy in total.

Income of the UPJN mainly consists of Cent age, Survey and Project Fees, Interest on Loansa Other Interest, and Grant from UP State Government for Maintenance Schemes, Grant from UP State Government for H.R.D., Income from Maintenance Schemes, Other Income, and Grant paid by UP State Government for Loan of Life Insurance Corporation.

And its expenditure mainly consists of Salaries and Wages, Travelling and Daily Allowance, Interest, Expenditure on Maintenance Schemes, Other Expenses and Pension and Gratuity. A summary of its income and loss (expenditure) statement is shown in the above statement.

The major work of UPJN is management of water supply, sewerage and sewage treatment facilities. According to the said financial statement of the UPJN, the expenditure on maintenance schemes for such facilities is only around 13 % of the total expenditure. It may be dispersed in the other expenditure items such as salaries and wages, travelling and daily allowance, or other expenses and so forth.

According to a list of fixed assets of the UPJN, the main fixed assets of the UPJN are the UPJN own scheme's Hand Pumps sharing about 95.4 % of total value of the fixed assets as of 2000-01.

2.5 FINANCIAL BACKGROUND OF VARANASI MUNICIPAL CORPORATION (VARANASI NAGAR NIGAM)

Following table shows a summary of Balance Sheet of Varanasi Municipal Corporation (Varanasi Nagar Nigam) and details are shown in Table 1-1 in Appendix H.

Table 2.2 Summary of Balance Sheet of Varanasi Municipal Corporation

(Unit: million Rs.)

Receipts in Current Account					
Description	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Revenue receipts	283.65	356.15	514.83	440.17	413.13
Receipts in Capital Account					
Capital Receipts Total	0.00	0.00	0.00	0.00	0.00
Opening Balance	32.25	7.97	42.28	91.45	91.44
Revenue Account Total	283.65	356.15	514.83	440.17	413.13
Capital Account Total	0.00	0.00	0.00	0.00	0.00
Total	315.90	364.12	557.11	531.62	504.57

Source: Budget Statement of the Nagar Nigam -Varanasi for 1999,2000,2001,2002,2003.

(Unit: million Rs.)

Expenditure in Current Account					
Description	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Revenue Expenditure	307.93	321.84	465.66	440.18	395.00
Expenditure in Capital Account					
Capital Expenditure	0.00	0.00	0.00	0.00	0.00
Revenue Account Total	307.93	321.84	465.66	440.18	395.00
Capital Account Total	0.00	0.00	0.00	0.00	0.00
Closing Balance	7.97	42.28	91.45	91.44	109.57
Total	315.90	364.12	557.11	531.62	504.57

Source: Budget Statement of the Nagar Nigam -Varanasi for 1999,2000,2001,2002,2003.

As shown in the above table, the financial statement shows a rather sound position in Current Account. However, it is supported by the state transfers as shown in Table 1-1 in Appendix H. The amounts of the state transfer share to the total revenue are showing at 71.7 % in 1998/99, 79.1 % in 1999/00, 78.6 % in 2000/01, 74.4 % in 2001/02, and 66.7 % in 2002/03. These state transfers were made to make up for the loss of revenue due to abolition of Octroi Tax since 1990. These state transfers belong to income category of “Non Tax Revenue”. According to the information the amount of state transfer depends upon the population of the city.

On the receipt side Property Tax forms a major share of revenue. The share of Property Tax to Total Tax Revenue 84.6 % in 1998-99, 80.4 % in 1999-2000, 70.3 % in 2000-01, 66.7 % in 2001-02 and 56.0 % in 2002-03. In Varanasi, self assessment system is being introduced for assessing the annual rental value of properties. This information is given to us by the officers of Varanasi Municipal Corporation.

The other revenue category is called as “Suspense Account” consisting of the Security Deposits from Contractors and Staff Repayment. They are negligible and very small.

Expenditures are itemized as “Salary”, “Maintenance/Charges”, “Administrative Expenditure”, “Other Expenditure including Development” and “Suspense Account”.

The expenditure on Staff Salaries is the highest sharing at a rate of 66.3 % in 1998-99, 72.1 % in 1999-2000, 63.5 % in 2000-01, 64.3 % in 2001-02 and 62% in 2002-03 of the total Expenditure.

The share of wages for sweepers is around 55% of the total Expenditure on Salary, which is more than half.

2.6 FINANCIAL BACKGROUND OF VARANASI JAL SANSTHAN

Following table shows a summary of financial status of the Varanasi Jal Sansthan, and details are shown in Table 1-2 in Appendix H.

Table 2.3 Summary of Financial Statement of Varanasi Jal Sansthan

(Unit:Million Rupees)

City/items	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Income						
Water tax	24.30	48.78	62.01	66.32	77.25	82.28
Water charge	27.73	21.31	17.34	22.35	14.68	15.33
Sewer tax	6.38	6.59	6.85	9.04	10.85	11.15
Sewer charge	-	-	-	-		
Other Income	2.26	2.81	1.76	0.63	0.51	0.98
Grant	-	2.32	1.41	-		
Total Income	60.67	81.81	89.37	98.34	103.29	109.74
Expenditure						
Establishment	55.33	66.47	79.96	85.65	82.67	85.08
Electricity	51.18	60.29	72.05	100.12	120.75	155.65
Consumables	5.25	5.41	5.37	5.09	6.46	5.99
Maintenance	-	-	-	-		
Others	22.46	26.00	24.34	25.10	28.40	30.08
Total Expenditures	134.22	158.17	181.72	215.96	238.28	276.80
Balance	-74	-76	-92	-118	-135	-167

(Note) Expenditure for Establishment includes salary and wages.

The major head of income of the Varanasi Jal Sansthan is water tax and water charge, it amounts to nearly 95% of the total revenue. The percentage of share for different years are 85% in 1998/99, 93% in 1999/00, 96 % in 2000/01, 99 % in 2001/02, 99% in 2002/03 and 99 % in 2003/04 of the total income as shown in Table 1-2 in Appendix H. However the income from sewer tax/ charge for the same fiscal years were 10.5%, 8.05%, 7.66%, 9.19%, 10.50 and 10.16%, respectively of total income. This part of revenue concerns the project.

Collection rate for the two main items of revenue, i.e., water tax /water charge and sewer tax/ charge are in the range of 85 % and 78%, respectively.

On the expenditure side there are two major heads of expenditure, i.e., Establishment and Electricity charges. They have the largest share under the expenditure head as shown in Table 1-2 in Appendix H. Establishment accounts for an average of 42% and electricity accounts for nearly 56% of the total expenditure.

It is clear from the above table that the revenues of Jal Sansthan Varanasi are not sufficient to pay the electricity bill. Hence the same have to be paid directly by the UP State Government. The system of payment of these bills as explained to us is as follows:

1. The bills raised by the UP Power Corporation are sent directly to the Jal Sansthan
2. The bills are verified and approved and signed by the Finance Officer of the Jal Sansthan.
3. The verified bills are then sent to the Nagar Nigam for further processing and payment.
4. Nagar Nigam verifies the bills and sends the same to the State Govt.for payment.
5. The electricity charges are paid to the UP Power Corporation directly by the State Government as per the recommendations of the Eleventh Finance Commission out of the Octroi Compensation due to be received by the Nagar Nigam.

CHAPTER 3

ECONOMIC EVALUATION

CHAPTER 3 ECONOMIC EVALUATION

3.1 IDENTIFICATION OF ECONOMIC BENEFITS AND COST

(1) Economic Benefits

Economic benefits that can be expected in this kind of project are (1) an amount of willingness of people to pay (WTP), (2) a saving amount of medical expenditure of people and saving in the subsidy amount spent by the Government on such medical institutions such as hospitals, clinics health centres etc, (3) saving in the amount of salaries/wages of the people, etc. The latter two benefit categories will be derived as a result of decrease of suffering rate of water borne diseases due to improvement of water environment.

i) The Amount of WTP for Improvement of Water Quality of the River Ganga

The WTP factor used for analysis of the Ganga Action Plan[1] (hereinafter referred to as "GAP Report") for improvement of water quality of the river Ganga has also been applied here. The methodology used is called as "the Contingent Valuation Method (CVM).

ii) The Amount of WTP for Improved Sewerage Services

Contingent valuation survey was conducted with the objective of finding out the willingness to pay for the facilities to be constructed in the near future[2]. The amount of WTP is not a basic unit for setting up a tariff system, but the basic unit for the socio-economic benefit.

iii) Saving of Medical Expenditure

This kind of project may contribute to improve the people's living environment. If water quality is improved by a project, water borne diseases may decrease and, people's burden on medical expenditure and saving of the subsidy allocated by the Government for Hospitals operations and other medical centre services will also decrease. This is an indirect socio economic benefit. In other words, it can be expected that the purchasing power or capability of the people could be increased due to improvement of water quality.

The benefits derived can be measured in the form of (1) reduction in suffering rate of water borne diseases to the total number of diseases (%), (2) effect of this kind of project on the incidence of water borne diseases (%), (3) numbers of outpatients and inpatients suffered by water borne diseases and (4) financial situation of such medical institutions consisting of revenue and expenditure.

iv) Saving of Salaries/Wages

People suffering from water borne diseases have to keep off their work for long span of time. This results in loss of salary/wage for the number of days being absent from work. The actual amount of saving after implementation of the project can be estimated with the average income per capita and the medical data discussed in the paragraph of (iii) above.

[1] "*A Cost-Benefit Analysis of the Ganga Action Plan*" the Ministry of Environment and Forests, the Government of India and the Department for International Development, the Government of the United Kingdom, January 1998.

[2] Miura, 2000 in his HP. The related references are K. Kuriyama "*Public Works and the Value of Environment*" Tsukiji, 1997, K. Kuriyama "*The Value of Environment and Its Evaluation Method by Applying of CVM*" the Hokkaido University Press, 1998, Washida, Kuriyama, Takeuchi ed. "Existing Situation of Project Evaluation –A Paper for Workshop for Evaluation of Environmental Project–" and N. Hidano "*Economic Evaluation on Environment and Official Administration –A Manual for the Contingent Valuation Method*" Keiso, 1999.

v) Environmental Benefit due to Improvement of Water Quality

The Project aims at improvement in the quality of water of the river Ganga. Better quality of water, will surely improve the bathing population at the ghats along the river. The bathing people can be divided into two categories as (1) the regular users, and (2) the occasional users.

The benefit derived by regular users has already been discussed under the points (iii) and (iv) above. On the other hand, Varanasi has a large number of floating populations as the city has religious significance. The occasional users consist of such type of people who have real religious or sightseeing purpose. Such tourists or pilgrims spend a lot of money in the cities along the river Ganga, and contribute to the regional and local economy. Improvement in the quality of water will definitely increase the number of occasional users and will directly and indirectly contribute to the improvement in the economic status of the local and regional population.

JICA Study Team in 2003 conducted a survey to find out the number of regular and occasional bathing population. It was found that the numbers of regular population bathing in the river is 24,090 per day and occasional bathing population is 306,925 per day.

vi) Other Socio-Economic Benefits

Furthermore, there may be other kinds of socio-economic and/or environmental benefits like those, which may be derived from conservation of the bio-diversity, and from increasing of agricultural productivity because of improved water quality.

(2) Economic Cost

As mentioned above, the economic cost is also to be converted from the financial cost. In this case, a Standard Conversion Factor (SCF) for tradable equipment and materials, shadow price for land acquisition cost and/or housing compensation, and for labours for the construction works, cost of transfer items such as personal income tax and corporate income tax should be taken into account.

3.2 ECONOMIC EVALUATION INDICES

Economic costs and benefits throughout the project life are compared in terms of present values. If the total present value of economic costs equals that of economic benefits (when, B/C=1), the discount rate used to calculate the present value is called as “economic internal rate of return (EIRR)” and uses as the main index of project evaluation to judge the project feasibility and/or viability. The other two indices are Net Present Value (NPV) and B/C Ratio. (Appendix C gives details on economic evaluation indices used)

3.3 ECONOMIC EVALUATION

(1) Estimation of Economic Benefits

a. WTP for Improvement of Water Quality of the River Ganga

According to the GAP Report, the WTP was at Rs.167.23 per household per annum at 1995/96 price level. This WTP has been used by converting into the present price level of 2003 using the Consumer Price Index (CPI) at 8.69 % inflation rate per annum as shown in Table 2 in Appendix H. The envisaged amount of WTP for this component in 2004 is at Rs.354 per annum per household as shown in the following table:

Table 3.1 Envisaged Amount of WTP for Improvement of Water Quality of Ganga River

(Unit: Rs./annum.HH)

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Envisaged WTP	167	182	198	215	233	254	276	300	326	354

b. WTP for Sewerage Services

According to the Survey on Public Awareness made by JICA Study Team in 2003, the amount of WTP for sewerage services is estimated at Rs. 90/month per HH as shown in the following table. This amount can be annualised at Rs.1,080 per household (Rs.90 × 12 months).

Table 3.2 Existing Connection Rate, Existing Capability to Pay, Average Existing Charge and Willingness to Pay in Varanasi

Income Group	Existing Sewer Connection Rate	Rate of HHs Connected with Existing Sewerage System and Have Capability to Pay	Wastewater Disposal Services			
			Average Expenditure for Wastewater Disposal Including Existing Sewerage Services		WTP for Improved Sewerage Service	
	%	%	Rs./month	Rs./year	Rs./month	Rs./year
Low	39.8%	36.7%	42	504	22	180
Medium	70.7%	75.2%	90	1080	65	504
High	72.2%	84.6%	333	3996	183	852
Average	60.9%	65.5%	155	1860	90	516

Source: Public Awareness Survey, JICA Study Team, 2003.

The amount of the WTP above is the basic units for estimation of economic benefit. Using this basic unit, the annual economic benefit is to be calculated by multiplying the number of served households. The total service population, the number of people to be connected, the entire households served and the number of households connected are estimated in Table 4 in Appendix H. In this case, average family size is estimated at 7.40 per HH in Varanasi as of 2001 Population Census of India.

Using the above mentioned two factors (1) the basic unit of the economic benefit based on the WTP (2) the number of served HHs and number of connected HHs, the annual economic benefit based on the WTP can be estimated.

The benefit will accrue year after year from the commencement of the construction works. Since the estimated costs consist of rehabilitation of existing facilities and construction of new facilities, there will be a gradual increase in the number of HHs served and connected.

After the year 2015, it is assumed that the same amount of economic benefit based on the WTP in the year 2015 will continue to accrue till the end of the project life, because the capacity of the waste water treatment plant has been designed to handle the projected population for the year 2015.

c. Saving of Medical Expenditure Due to Decrease of Suffering Rate of Water Borne Diseases

Generally speaking, suffering rate of water borne diseases to the total morbidity rate is 30 %. However, as per the available data, morbidity rate caused by the water borne diseases was 38.0 % of total morbidity rate in Varanasi in 1997 before the implementation of the GAP Project. An average

morbidity rate of three cities of Patna, Kanpur and Haridwar after the implementation of project[3] was 17.7%. Since the above observation per4tains to the GAP Project, the same is being used for Varanasi also. Accordingly, difference of 20.3 % (= 38.0 % - 17.7 %) is a basic factor for estimation of economic benefit based on the saving of medical expenditure.

Regarding medical expenditures, following information/data are available from a result of "A Benefit Incidence Analysis for India"[4]. Physical data may be applied to the Project directly. But since monetary data is at 1995/96 price level, it should be converted to 2004 price level by using the CPI (= 8.69% per annum).

Converted Information/Data to Present Value:

For Outpatient in the State of Uttar Pradesh:		
Average number of visits to public hospitals:	50.7	visits/1,000 persons per annum
Average amount of charges per outpatient:	94.5	Rs./visit
Average amount of public subsidies per outpatient:	200.7	Rs./visit per outpatient
For Inpatient in the State of Uttar Pradesh:		
Average number of hospitalization:	1,018	times/100,000 persons
Average staying days:	14.6	days/hospitalization
Average amount of charges per inpatient:	139.6	Rs./day
Average amount of public subsidies per intpatient:	1,204.2	Rs./day

(Note) Figures in monetary terms are converted into 2003-price level.

Transportation cost for visit to the hospital has to be added to the said medical expenditures. This is as per the interview survey conducted by the JICA Study Team with the cycle Rickshaw pullers and some patients at Varanasi.

Table 3.3 Transportation Cost per Patient to Visit Hospitals

(Unit: Rs./one way per Patient)

Name of Hospital	Radius from the Place of Origin to Hospitals	Maximum Transportat-ion Cost (Rs)	Minimum Transportat-ion Cost (Rs)	Average Transportat-ion Cost (Rs) per paitent
Nagar Mahapalika Hospital	1.5 km	10	5	7.50
Shiv Prasad Gupt Hospital	3.5 km	15	5	10.00
Ramakrishna Mission Hospital	3.5 km	15	5	10.00
Child Welfare & Maternity Hospital	1.5 km	10	5	7.50
Ballabhram Saligram Hospital	2.5 km	10	5	7.50
BHU Hospital	2.5 km	10	5	7.50
			Overall Average:	8.33

d. Saving of Salaries/Wages Due to Decrease in Suffering Rate of Water Borne Diseases

Water borne diseases result in a loss of either earnings of an individual or would effect the productive output of an organisation. This kind of losses concerning the salaries/wages could be mitigated if the water borne diseases can be reduced.

At present, the average income level in Varanasi is at Rs. 9,047/month per HH, and is illustrated in Table 5 in Appendix H.

People who may suffer from these kinds of diseases are generally the working members in each household. The average family size in Varanasi is 7.4 as already mentioned above. Among the family

[3] M.N.Murty "*A Cost Benefit Analysis of the Ganga Action Plan*" Oxford University Press, 2000.

[4] National Council of Applied Economic Research, ed. "*Who Benefits from Public Health Spending in India*" 2002.

members indicated in the relevant table, number of the working members in a house hold are 1.75 in Varanasi as per the Census 2001. Therefore, the average amount of salaries and/or wages of each working member may be estimated at Rs5,170/capita in Varanasi.

e. Contribution to Local Economy Derived from Bathing Population

The local officials were of the opinion that in case the water of the ghats was cleaner, there will be an increase of regular users by at least 10%, and occasional users by 5%. The incremental daily bathing population is projected as shown in the following table. Bathing population in Varanasi is summarised in Table 3 in Appendix H.

Table 3.4 Projection of Incremental Bathing Population

(persons/day)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Regular Users	2,552	2,624	2,695	2,767	2,838	2,910	2,981	3,053	3,125	3,196	3,268
Occasional Users	15,963	16,280	16,604	16,935	17,272	17,615	17,966	18,323	18,688	19,059	19,438

i. Regular Users

It is estimated that the clean river water will encourage regular bathing population to visit the ghats more frequently and would encourage economic activities. It is estimated that average per day expenditure of a visitor to the ghat will be around Rs.45/day including transportation and some snacks.

ii. Occasional Users

The occasional users come from various parts of the country and they spend money on transportation, food, stay and general purchases. It is estimated that these persons would spend around Rs.150 per person day in addition to the expense of travelling from their place of residence to Varanasi.

iii. Varanasi Ghats

Ghat is a riverbank provided with steps or slopes leading to a river for bathing or cremation. Ritual bathing is taken in the sacred river Ganga. Varanasi is well known as a city of ghats as well as religious and spiritual city where to liberate soul from human body to ultimate is considered very poise. Ghats in Varanasi have great religious and historical importance. Every day thousands of people visit the city and the ghats at Varanasi and on important fairs and festivals, hundreds of thousands of people gather in the city for holy dip and rituals on the Varanasi ghats from all over India and world. In addition, the city is one of the most famous tourist places in India and attracts domestic and foreign tourists in large numbers.

According to the Department of Culture, Varanasi, there are 84 ghats along the river Ganga at Varanasi. Out of these 77 ghats are listed below.

List of Ghats along the Ganga River in Varanasi

Sl. No.	Site Name	Sl. No.	Site Name		
	Bhelupur Ward		**Dashashwamedh Ward**		**Kotawali Ward**
1	Assi Ghat	29	Raja Ghat	53	Mehta Ghat
2	Ganga Mahal Ghat	30	Babuwa Pandey Ghat	54	Ram Ghat
3	Reevan Ghat	31	Pandey Ghat	55	Jatar Ghat
4	Tulsi Ghat	32	Dimpatiya Ghat	56	Raja Gwalior Ghat
5	Bhadaini Ghat	33	Chowshahi Ghat	57	Bala Ghat
6	Janki Ghat	34	Raja Mahal Ghat	58	Panch Ganga Ghat
7	Anandi Mai Ghat	35	Munshi Ghat	59	Durga Ghat
8	Vachchhraj Ghat	36	Darbhanga Ghat	60	Brahma Ghat
9	Jain Ghat	37	Ahilyabai Ghat	61	Bundi Parkota Ghat
10	Shri Nishad Raj Ghat	38	Sheetla Ghat	62	Lal Ghat
11	Panch Kot Ghat	39	Prayag Ghat	63	Shir Hnuman Gharhi Ghat
12	Prabhu Ghat	40	Dashashwamedh Ghat	64	Gay Ghat
13	Chet Singh Ghat	41	Dr. Rajendra Prasad Ghat		
14	Niranjani Ghat	42	Maan Mandir Ghat		
15	Mahainrvani Ghat	43	Tripur Bharavi Ghat		**Adampur IInd Ward**
16	Shivala Ghat	44	Meer Ghat	65	Badrinath Ghat
17	Gularia Ghat	45	Lalita Ghat	66	Trilochan Ghat
18	Dandi Ghat			67	Gola Ghat
19	Prachin Hanuman Ghat		**Chowk Ward**	68	Mehashwar Ghat
20	Karnatak State Ghat	46	Sindia Ghat	69	Samka Ghat
21	Harishchandra Ghat	47	Manikarnika Ghat	70	Teliyana Nala Ghat
22	Lali Ghat	48	Sankta Ghat	71	Naya Ghat
23	Vijay Nagar Ghat	49	Gaushala Ghat	72	Nishad Ghat
24	Kedar Ghat	50	Jalasen Ghat	73	Prahalad Ghat
25	Chowkia Ghat	51	Ganga Mahal Ghat	74	Raj Ghat
26	Someshwar Ghat	52	Ganesh Ghat	75	Bhaisasur (Raj Ghat) Ghat
27	Mansarovar Ghat			76	Khrikeya Ghat
28	Narad Ghat			77	Keshav Ghat

f. Contribution to Increase the Productivity of Agricultural Crops

The new STP will be able to discharge around 200 mld of additional water which means additional 3,000 ha of irrigated land, as one mld of water can irrigate 15ha of agricultural land. The additional agricultural benefit has been calculated as below:

$$15 \text{ ha} \times 200 \text{ mld} = 3{,}000 \text{ ha}$$

According to the statistics, the existing yields of paddy and wheat are;

Paddy: 18.23 quintal/ha (=1.82 tons/ha) in non-irrigated area, and
26.04 quintal/ha (=2.60 tons/ha) in irrigated area.
Wheat: 16.41 quintal/ha (=1.64 tons/ha) in non-irrigated area, and
23.44 quintal/ha (=2.34 tons/ha) in irrigated area.

Cropping pattern of the crops are not clear, but the period from the transplanting to the reaping stage for paddy is 100 days in addition to the nursery period of around 30 days. The period of transplanting to the reaping stage for wheat is also around 100 days. These crops are cultivated by rotation, and both the crops are cultivated once a year.

Sugar cane, potatoes, mustard and other crops are cultivated between paddy and wheat seasons as secondary crops. But, they are negligible. Therefore, the paddy and the wheat are adopted for estimation of agricultural benefit as an economic benefit of the Project. Their farm grade prices are as follows:

Paddy:	450 Rs./quintal	=	4,500 Rs./ton
Wheat:	560 Rs./quintal	=	5,600 Rs./ton

In other words the farmers' gross income may be estimated at:

Paddy:	450 ×26.04 =	11,718	Rs./ha in irrigated area, and
	450 ×18.23 =	8,204	Rs./ha in non-irrigated area.
Wheat:	560 ×23.44 =	13,126	Rs./ha in irrigated area, and
	560 ×16.41 =	9,190	Rs./ha in non-irrigated area.

While, their production cost is as follows:

Paddy:	Seed	425 Rs./ha
	Fertilizer	1,500 Rs./ha
	Wages for labour	2,800 Rs./ha
	Irrigation water charges	1,150 Rs./ha
	Other expenses	1,200 Rs./ha
	Land revenue	0 Rs./ha
	Total	7,075 Rs./ha
Wheat:	Seed	1,130 Rs./ha
	Fertilizer	1,200 Rs./ha
	Wages for labour	2,100 Rs./ha
	Irrigation water charges	2,000 Rs./ha
	Other expenses	425 Rs./ha
	Total	6,855 Rs./ha

Farmers' income is calculated as:

11,718 Rs./ha (Paddy) +13,126 Rs./ha (Wheat) = 24,844 Rs./ha in irrigated area, and
8,204 Rs./ha (Paddy) + 9,190 Rs./ha (Wheat) = 17,394 Rs./ha in non-irrigated area.

And, the production costs in total are estimated at:

13,930 Rs. = 7,075 Rs./ha (Paddy) + 6,855 Rs./ha (Wheat).

Therefore, their net income per unit area (ha) may be estimated at:

24,844 Rs. – 13,930 Rs. (in irrigated area) + 17,394 Rs.- 13,930 Rs. (in non-irrigated area) =14,378 Rs./ha per year

Based on the above data, the total agricultural benefit can be estimated as follows applying the total area of 3000 ha to be newly irrigated:

14,378 Rs./ha per year × 3000 ha = 431,34,000 Rs./year (rounded at 43.13 million Rs./year in total) as of 2004 price level

This agricultural benefit should be added to the above mentioned benefits derived from socio-economic activities.

(2) Summary of Economic Benefits

Following table shows a summary of unit economic benefits:

Table 3.5 Summary of Unit Economic Benefits (Varanasi)

As of 2003 Price Level

WTP for Improvement of Water Quality of the River Ganga	WTP for Sewerage Treatment Services	Saving of Medical Expenditure Due to Decrease of Suffering Rate of Water Borne Diseases		Saving of Salaries/Wages Due to Decrease of Suffering Rate of Water Borne Diseases		Contribution to Local Economy Derived from Bathing Population		Agricultural Benefit (Paddy + Wheat)
		Outpatients	Inpatients	Outpatients	Inpatients	Regular Users	Occasional Users	
Rs./household/annum						Rs./person/annum		Rs./ha/annum
326	1,081	11.9	150.2	3.1	9.1	16,425	54,750	14,378

The economic benefit shown in the above table consist of (1) the WTP for improvement of water quality of the river Ganga, (2) the WTP for sewerage services, (3) the saving of the medical expenditure of the people due to decrease of suffering rate of water borne diseases, (4) the saving of salaries/wages due to decrease of suffering rate of water borne diseases, (5) the incremental contribution to the regional economy derived from bathing population, and (6) agricultural benefit due to discharge of the treated water for irrigation. The future number of households, sewer connected households, etc in Varanasi to estimate economic benefits is projected as shown in Table 4 (1/2) and (2/2) in Appendix H assuming improved sewer coverage and connection rate.

(3) Estimation of Economic Cost

The Project cost is estimated at Rs.4,831 million excluding the price contingencies (price escalation) in Table 3.6 and in Table 6 in Appendix H for detail. Economic cost of the Project is estimated at Rs. 3,906 million excluding price contingency.

Table 3.6 Summary of Project Costs

Item	Total	2006	2007	2008	2009	2010	2011
Sewerage							
Direct Construction Cost	3,262.37	4.32	779.71	824.67	586.92	781.87	284.88
STP & PS	1,354.54	0.00	338.56	338.56	225.81	338.71	112.90
Pipe	1,907.83	4.32	441.15	486.11	361.11	443.16	171.98
Land Acquisition	198.26	198.26	0.00	0.00	0.00	0.00	0.00
Detailed Design	195.73	182.24	13.49	0.00	0.00	0.00	0.00
Supervision	163.12	0.22	38.99	41.23	29.35	39.09	14.24
Project Administration	163.12	0.22	38.99	41.23	29.35	39.09	14.24
Physical Contingencies	163.12	0.22	38.99	41.23	29.35	39.09	14.24
Total	4,145.72	385.48	910.17	948.36	674.97	899.14	327.60
Non-sewerage							
Direct Construction Cost	278.42	51.85	72.47	92.98	61.12	0.00	0.00
Detailed Design	13.92	2.59	3.62	4.65	3.06	0.00	0.00
Supervision	13.92	2.59	3.62	4.65	3.06	0.00	0.00
Project Administration	27.85	5.19	7.25	9.30	6.11	0.00	0.00
Physical Contingencies	13.92	2.59	3.62	4.65	3.06	0.00	0.00
Total	348.03	64.81	90.58	116.23	76.41	0.00	0.00
Public Participation & Awareness (PP/PA)	56.45	12.9	10.3	9.6	7.8	8.1	7.7
Institutional Development Programme (IDP)	281.60	56.30	84.50	84.50	28.20	14.10	14.00
Total	4,831.80	519.49	1,095.59	1,158.72	787.42	921.31	349.27
Price Contingencies (Price Escalation)	2,631.18	139.55	408.58	565.54	491.24	708.63	317.64
Financial Cost (Excl. Price Contingencies)	4,831.80	519.49	1,095.59	1,158.72	787.42	921.31	349.27
Financial Cost (Incl. Price Contingencies)	7,462.98	659.04	1,504.17	1,724.26	1,278.66	1,629.94	666.91
Economic Cost (Excl. Price & Physical contingencies)	3,768.53	363.47	876.58	917.32	615.80	720.25	275.11
Economic Cost (Excl. Price contingencies)	3,906.62	365.66	909.82	953.10	641.08	750.74	286.22
Foreign Finance (Loan Amount)	7,074	455	1,458	1,674	1,243	1,591	653
Local Finance	389	204	46	51	35	39	14

The financial cost of the project including price contingencies is Rs.7,462 million. The local Indian fund required will be Rs.389 million and Foreign Currency Loan component is Rs.7,074 million.

The operation and maintenance (O&M) costs are estimated at Rs.177 million per annum in financial term and Rs.144 million in economic term for 2015. Replacement cost is estimated at Rs.682 million in financial term for mechanical and electrical components of pumping stations and treatment plants and Rs. 600 million in economic term. This replacement cost would be accrued every 15 years after completion of the facilities including proposed, existing and sanctioned facilities. Following table summarise O&M and replacement costs of the Project.

Table 3.7 Summary of Operation and Maintenance and Replacement Costs

Item	Estimated current value of facility	2011	2012	2013	2014	2015	2015
Annual O&M							
O&M cost (financial)			150.78	159.65	168.52	177.39	177.39
O&M cost (economic)			122.34	129.53	136.73	143.93	143.93
Ratio			0.85	0.90	0.95	1.00	1.00
Replacement	**Year**						
1. Proposed facilities		**2026**	**2041**	**2056**			
Financial cost	1,355	406.36	406.36	406.36			
Economic cost		358.01	358.01	358.01			
2. Sanctioned and existing facilities							
Financial cost	919	275.78	275.78	275.78			
Economic cost		242.96	242.96	242.96			
3. Total							
Financial cost		682.14	682.14	682.14			
Economic cost		600.97	600.97	600.97			

Standard Conversion Factor (SCF):

Standard Conversion Factor (the SCF) should be taken into account for tradable equipment and materials when the financial cost is converted into the economic cost. The SCF is calculated as 0.88101 as shown in Table 7 in Appendix H with its calculation process.

Income Tax:

Corporate income tax to the contractor: 35 % for the contractors and personal income tax: 10 % for the labour according to the Income Tax Act in India. The corporate income tax is applied for net profit of contractors, and personal income tax is applied for total labour cost. In this case, net profit of contractors is assumed at 10 % of the direct construction cost.

Shadow Wage Rate of Unskilled Labour:

In the GAP report, 0.5 of the shadow wage rate was applied. So, the same shadow wage rate is applied in the Project since the Project forms a part of the GAP report.

Shadow Price of Land:

The shadow price rate for land can be estimated as 0.0906. The economic cost for land can be estimated based on the financial cost for land multiplying this shadow price rate (for details on calculation of Shadow Land Price refer Appendix C)

Table 3.8 Basic Data and Estimation of Shadow Price Rate for Land in Uttar Pradesh

Cropped area:	26,609	(1,000 Ha as of 1999/00 in Uttar Pradesh)
GRDP in agricultural	627,320	(Million Rs. as of 1999/00 in Uttar Pradesh)
Financial price of land to be acquired	260	(1,000 Rs./Ha according to the interview survey to the UPJN by the JICA Study Team)

Calculation:

$$SPRL = \frac{A_gO / CA}{FP_p} = \frac{627{,}320 \times 1{,}000{,}000 / 26{,}609 \times 1{,}000}{260 \times 1000} = 0.0906$$

In this case, gross regional domestic products (GRDP) in agricultural products is applied instead of the amount of agricultural products (A_gO) above.

Others:

- Price escalation should not be included in the cost side.
- Discount rate of 10 % and 5 % is applied.
- Project life is set as 50 years after completion of the construction works

(4) Economic Evaluation

Economic evaluation for the project is made by using a cash stream as shown in Table 8 in Appendix H taking the conditions and assumptions above into account. Results are summarised as follows:

Table 3.9 Results of Economic Evaluation in Base Case

Index	Discount rate 10 %	Discount rate 5 %
NPV	237 million Rs.	4,164 million Rs.
EIRR	10.7 %	10.7 %
B/C)	1.06	1.75

The EIRR is calculated at 10.7 % and the B/C are1.06 for 10% and 1.75 for 5 % discount rate.

There would be several other indirect socio-economic benefits of this project. These benefits derive from increase in number of tourists, conservation of the bio-diversity, and increase of agricultural productivity etc. If these intangible benefits could be converted into monetary terms, economic feasibility of the project would become higher.

CHAPTER 4

FINANCIAL EVALUATION

CHAPTER 4 FINANCIAL EVALUATION

4.1 INTRODUCTION

The financial benefit means amount of direct revenue that is collected by the Service Provider (project implementation organisation) for the sewerage and sewage treatment facilities in the form of "Sewer Tax and Sewer Charge". In the State of Uttar Pradesh, the service provider is the local "Jal Sansthan", in this case, the Varanasi Jal Sansthan belonging legally to the Municipal Corporation (called locally as "Nagar Nigam") is also the project implementation organisation. The Jal Sansthan also supplies potable water in addition to providing the sewerage services to the people.

Financial costs include direct construction cost, taxes, land acquisition and housing compensation, physical contingencies, administration, engineering cost for detailed design and supervision and preparatory study for the institutional development, and replacement cost. However, price escalation is excluded from the costs for financial evaluation.

Financial costs and benefits throughout the project life are compared in terms of present values. If the total present value of financial costs equals that of financial benefits (when, B/C=1), the discount rate used to calculate the present value is called as "financial internal rate of return (FIRR)" and used as the main index of project evaluation to judge the project viability as well as the Net Present Value (NPV) and B/C Ratio (refer Appendix D for detail).

4.2 EXISTING FINANCIAL CONDITION

Estimation of a financial benefit for this kind of project, should be done using the existing tariff structure and then enhance/ establish a new tariff taking into account the affordability of people to pay (the ATP).

(1) Existing Tariff System

There are three kinds of taxes levied in the State of Uttar Pradesh on property:

i) Property Tax for houses and land
ii) Water Tax, and
iii) Sewer Tax.

The tax rates are:

a) Property Tax: 15.0% of the annual rental value of properties
b) Water Tax: 12.5% of the annual rental value of properties, and
c) Sewer Tax: 4.0% of the annual rental value of properties.

These rates may differ a little bit depending upon cities and areas in the whole India, but in the targeted 4 cities, the same rates are applied.

The assessment of annual rental value (ARV) of the properties within the municipal limits is done by the Municipal Corporation. Presently the system of determining the ARV is called as "Self-Assessment System". The owner of the property has to pay property tax with a rate of 15% of the ARV so assessed.

Water/sewerage tax is paid by all those persons who do not have a water/sewer connection but their house is within 100 m of a pipe line/sewer. Water charges are paid by those houses which have regular water connection. However, houses that have connected water supply, both water tax and water charges are calculated, and the higher of the two is charged. The people who pay water charge should also pay sewer charge at a rate of 25 % of the amount of the water charge, if they have a sewer connection.

(2) Affordability to Pay

Average rate of connection to the existing sewerage facilities is around 60.9 % in whole Varanasi City, but the households (HHs) that are connected with existing sewerage system and have capability to pay are only 65.53 % (as of 2003) as given in Table 3.2. According to the same table, the annual average household expenditure for wastewater disposal services is a sum of Rs.1,860 (=Rs.155 × 12 months) including disposal made by themselves and the charge for existing sewerage services.

The Pan American Health Organisation (PAHO) recommends that the affordability of people to pay for the services of water supply and sewerage is 5 % of the total income per household as a maximum consisting of 3.5 % for water supply and 1.5 % for sewerage.

Following table shows a summary of income level surveyed by JICA Study Team in 2003. Details are shows in Table 5 in Appendix H.

Table 4.1 Average Income Level by Income Group in Varanasi

(Rs./month/household)

Income group	Average Monthly Household Income
Low	3,017
Medium	9,123
High	19,338
Average	10,493

Source: Public Awareness Survey, JICA Study Team, 2003

From the figures indicated in the above table, their annual average income level can be estimated as Rs.125,916 per HH (=Rs.10,493 ×12 months), and their affordability to pay for wastewater disposal services can also be estimated at Rs.1,889/annum per HH (=Rs.125,916 × 1.5 %) from the viewpoint of PAHO's recommendation. In other words, their existing expenditure for wastewater disposal services is almost the same with a logical amount of affordability to pay.

(3) Existing Financial Data of Jal Sansthan

Result of a study conducted by the JICA study team shows that, the overall average amount paid per HH for sewerage services is around Rs. 111 per annum. This is as per the information provided by the Varanasi Jal Sansthan and share for sewerage has been derived using assumptions such as the approximate percentage of connected population to the existing sewerage system (= 78 %) as indicated in the table below.

Table 4.2 Average Income per Bill from Sewerage in Varanasi

Location: Varanasi

	Charge raised					Value per bill raised in Rs.		Charge collected in million Rs.				Recovery Rate percent	
Year	No of Bills-Water	Amount in Rs.million	No of Bills-Sewer	Amount in Rs.million	Total Bills	Water	Sewer	No of Bills-Water	Amount in Rs.million	No of Bills-Sewer	Amount in Rs.million	Water	Sewer
1999-00	101430	68.38	73258	7.65	174688	674.16	104.48	86520	58.33	52410	5.476	85%	72%
2000-01	104940	76.72	75797	9.04	180737	731.08	119.28	88200	64.48	64240	7.662	84%	85%
Average						702.62	111.88					85%	78%

4.3 FINANCIAL EVALUATION

(1) Estimation of Financial Costs

The project cost is estimated at Rs. 4,831 million in financial term excluding the price escalation in total and shown in Table 6 in Appendix H. The annual disbursement of the construction cost is shown in Table 3.6 in Chapter 3.

The operation and maintenance (O&M) costs are estimated at Rs.177 million per annum in financial term for 2015 in Table 3.7. Replacement cost is estimated at Rs.722 million for pumping stations and treatment plants. This replacement cost would be accrued every 15 years after completion of the facilities including proposed, existing and sanctioned facilities.

(2) Nature of Sewerage Project

In this type of the project for development and improvement of public utility or social infrastructure so called as "public work", it may not be adequate to analyse cost recovering ability by financial benefit (revenue from collection of user charge). The required cost for sewerage services is much more than that for water supply services. Nevertheless, the charge for sewerage services is usually lower than that for water supply. Thus, generally sewerage projects cannot recover all O&M costs as well as initial capital outlay. Following illustrations depict a Japanese example of cost recovery of sewerage services.

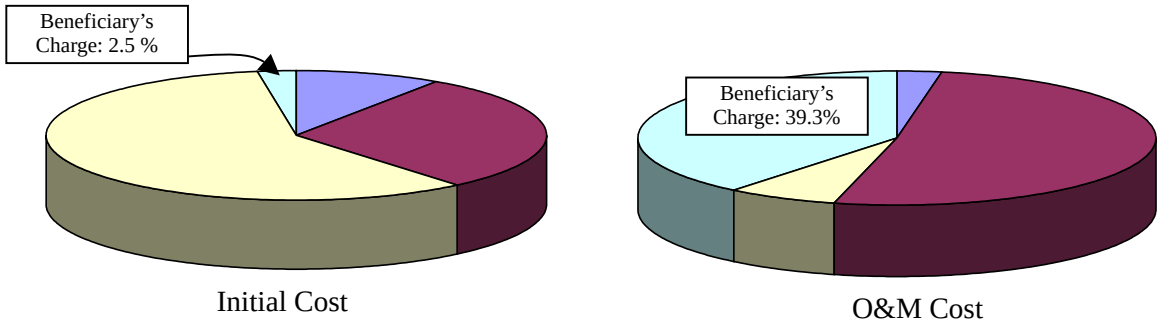


Figure 4.1 Share Rates of Beneficiaries (Users) in Initial Cost and O&M Cost for Sewerage Services in Japanese Case

As shown in the figures above, the beneficiary's initial connection charge (advance payment) can recover only 2.5 % of the total initial cost and user service charge can recover about 40 % of the O&M cost in Japan. A major fraction of the remaining costs are financed by the general account of the central government and/or the local government.

Among the OECD member countries, there is no country that can recover initial cost and O&M cost by the revenue collected from users.

In the sewerage projects, initial capital outlay cannot be recovered by user charge and only some part of the O&M costs can be recovered by the sewerage tax/charge. Therefore, only O&M cost and sewerage user charge but not initial capital cost are considered in financial evaluation of the Project.

(3) Financial Evaluation

The O&M cost of non-sewerage scheme consisting of construction of community toilets and the Dhobighats is excluded in financial evaluation because it should not be recovered by sewerage user charge and it will be recovered by the user charge of each component on self-sustainable basis.

Sewerage projects are public works and their financial viability cannot be worked out using standard financial evaluation techniques as they cannot generate profit or expect cost recovery as their objective. The main objective of such projects is to provide better living conditions to the residents of the city and also make the environment clean and friendly. Hence it cannot be evaluated as a commercial project for cost recoveries and profit objectives.

These projects need a large initial capital outlay, which cannot be recovered from the beneficiaries. At

the same time these projects have a very high operation and maintenance and replacement costs. Hence, it is very difficult to evaluate the financial viability of these kinds of projects.

Since the project is public work the capital cost shall be paid out of the general account of the local, state and/or national governments and O&M costs should be recovered from sewerage charge or tax from the users as much as possible and general account of the local government.

The project is financially evaluated preparing a cash stream as shown in Table 9 in Appendix H. The required user charge to recover the entire O&M and replacement cost assuming exiting bill collection rate is estimated at Rs. 2,040/per annum per household. The detailed cash flow is shown in Table 9 in Appendix H. The estimated average current sewer charge per bill is Rs.112 per annum. The required user charge is about 18 times higher than the current charge level and almost same as the estimated maximum affordability to pay of Rs. 1,889 per annum.

In the basic financial evaluation the required sewer tax/ charge levels to recover the entire cost of O&M is worked out. Then, in the following chapter, benefit increase measures are discussed and detailed financial analyses are conducted to make the project financially feasible as much as possible.

(4) Repayment Schedule of Foreign Loan in Basic Case

Under the existing value per bill and the existing charge collection rate of Jal Sansthan in Varanasi, the amount to be borne out of the general account of the State Government is estimated as shown in Table 11 and Table 12 in Appendix H together with a repayment schedule of the initial investment cost. Table 11 shows the case in category of the General Project under the terms of 30 years repayment period including 10 years of grace period with 1.3 % of annual interest rate. Table 12 shows the other case in category of the Specified Environmental Project under the terms of 40 years repayment period including 10 years of grace period with 0.75 % of annual interest rate.

In the latter case, the State Government of Uttar Pradesh should bear the amount of Rs. 133 million in 2013, Rs. 142 million in 2014 and Rs. 151 million in 2015. The Project is designed for 2015 population scale, and it is assumed that the same house connection rate may be kept. Therefore, after 2015, the same amount of state transfer will be needed if the capital cost is granted by the National Government.

CHAPTER 5

RECOMMENDATIONS

CHAPTER 5 REVENUE INCREASE MEASURES

5.1 INTRODUCTION

To make the project feasible, revenue increase is required to reduce the burden on the Local and State Government finances to O&M cost of the project. Following measures are proposed here to increase the revenue and thus make the operating agency partially self-sustainable.

- Improvement of billing and bill collection
- Utilise the by-products of sewerage system
- Others such as improvement of accounting system

5.2 IMPROVEMENT OF BILLING AND BILL COLLECTION

Increase in the volume of billing and the bill collection efficiency results in substantial increase in revenue. Following are revenue increase measures.

- Increase the tax net
- Reassessment of properties
- Reduce process time per bill
- Increase productivity by introducing incentive schemes

(1) Increase Tax Net

In most of the Jal Sansthans, considerable number of records falls far short of the total number of properties included in the tax net. One such example is Kanpur, where more than 300,000 properties were not included in the tax net. The reasons for this are many but primarily consist of lack of human and financial resources. It is hence, imperative to conduct a comprehensive survey of the entire municipal area to bring all the properties under the tax net. In addition, the property permission applications should be integrated with the sewerage tax billing. This can be effectively carried out by creation of a GIS based database.

(2) Re-assessment of Properties

In most cities in UP, the assessment of property values was done many years ago. Property tax is based on the annual rental value of the property, which is unrealistic. Water and sewerage charges, which in turn are a percentage of the property tax, thus also become unrealistic. A re-assessment of all properties as per the present valuation would significantly increase the revenue without any increase in the tariff. Since Water and Sewerage tax are linked with the property tax, revenue on that account will also increase with re-assessment of the property values.

(3) Reduction in the Bill Process Time

Integrated computerized system should be introduced. The billing records in Varanasi are at present maintained on paper and the receipts are written by hand. This method is time consuming and results in procedural delays. One way to overcome this limitation is computerization of the whole system. This system was implemented under the Institutional and Community Development Project (ICDP) in Kanpur.

(4) Increase in Collection

One of the options that can be looked into for increase in collection is to privatise the billing and collection.

Jal Sansthans need to get a survey done of all the houses connected to the sewerage facility. This will give the exact figure of the number of connections and will help in getting an approximate value of the

revenue that can be realized in the form of water and sewerage dues.

The billing and the collection of the sewerage and water dues can be outsourced to a private enterprise. This will ensure that the demand for the charges is raised accurately and in totality. The private enterprise will ensure maximum collection.

The Jal Sansthans can give the billing and collection contract with a condition that the contractor would be required to pay 50% of the anticipated total collection in advance. The contractor should be given a collection based incentive. This will motivate the contractor to ensure proper timely and full collection.

(5) Revision of the Existing Tariff System

The average ability to pay (ATP) for sanitation is Rs. 1,889 per household per annum and the required charge per bill is estimated at Rs.2,040 per household per annum assuming existing sewer connection rate and bill collection rate, but the actual unit value per bill is only Rs. 112 per bill per annum. In this regard, the sewer tariff could be increased to some extent because passing on the entire burden of the differential of the O&M cost and recovery from tax and charges to the State Government will also be not a good idea.

However, it will not be possible to increase the tariff based on the affordability to pay of each household. The tariff system revision should be supported by rules, regulations and/or laws together with restructuring of the Service Provider.

(6) Sewer Connection (Billing) and Bill Collection Rate

Following figure shows the conservative projection of the number of all the entire households in the city area, the households in the sewer area, the sewer connected households (or sewer charge billing households) and sewer bill collected households until the target year 2015 based on existing collection. The detail projection is shown in Table 4 in Appendix H.

As seen in the figure, there is high potential to increase sewer connection and improve sewer charge collection efficiency.

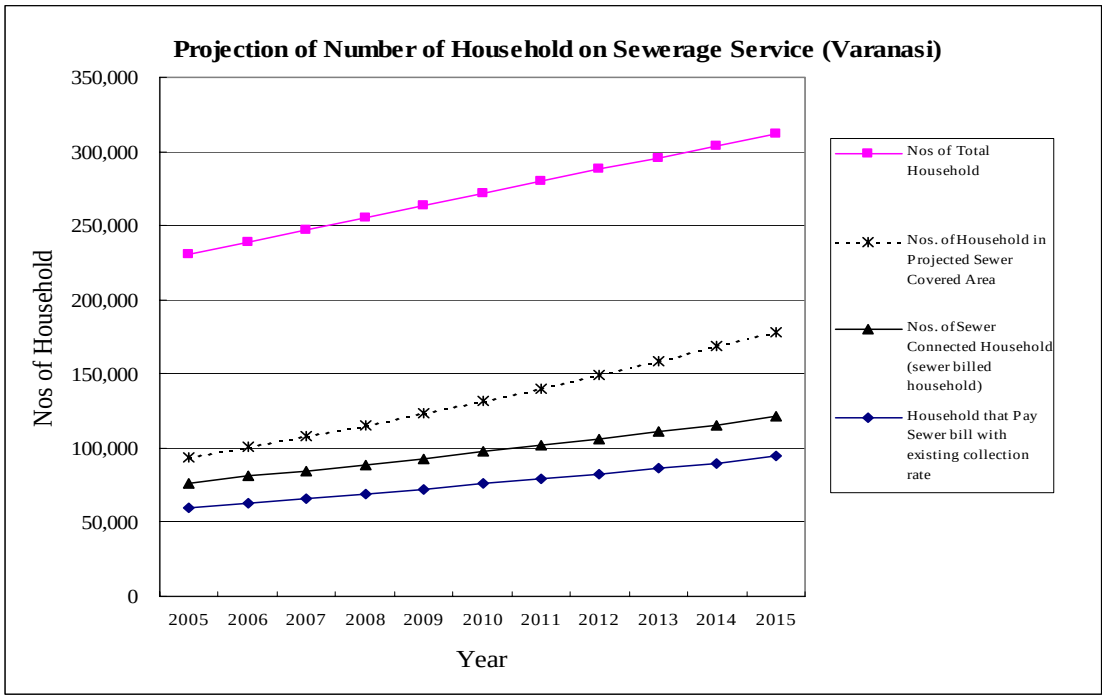


Figure 5.1 Number of total households in the city, households in the sewerage service area, sewer connected households and sewer bill collected households

5.3 UTILISATION OF BY-PRODUCTS

It will be necessary at this stage to find alternative sources of revenue that could reduce the additional O & M cost burden on the general account of the State Government.

The sewage generated in the city of Varanasi will be treated in sewage treatment plant (STP), which would generate treated water and digested sludge or more commonly known as compost. Both of these resources have commercial value and generate additional revenue to the operating agency. As calculated in Table 10 in Appendix H an amount of Rs.17.6 million per annum could be recovered from these resources, i.e., sale of treated water for irrigation purposes and digested sludge (compost used as manure).

The rates used for calculation of the revenue from treated water are the prevailing rates charged by the irrigation department. The rate for compost is very conservatively estimated at Rs 0.50 /kg.

5.4 FINANCIAL EVALUATION FOR CASE STUDY OF REVENUE INCREASE MEASURES

The amount of revenue generated from taxes and charges by the Service Provider, Varanasi Jal Sansthan, can cover only around 5 % of the total O&M cost in 2015, and the remaining amount would be borne by the U.P. State Government. Therefore, tariff revision or revision in the annual rental value of properties and improvement of charge collection rate are recommended so that the amount of the State transfer could be reduced as discussed hereunder.

Following table shows the result of the case studies taking into account the additional sources of revenue and improvement in the charge collection rate and charge level and sewer connection rate.

Table 5.1 Summary of Case Studies for Recovering the O&M Cost

Case in Sewer Charge level	Total O&M Cost required	Base Case		Case - 1				Case - 2			
					Optional Sources				Optional Sources		
		Revenue from sewer charge	Amount to be borne by State Transfer	Revenue from sewer charge	Revenue from treated water sales	Revenue from sludge sales	Amount to be borne by State Transfer	Revenue from sewer charge	Revenue from treated water sales	Revenue from sludge sales	Amount to be borne by State Transfer
Million Rs./year											
Existing	177.4	8.9	168.5	9.8	3.9	13.7	150.0	15.0	3.9	13.7	144.8
100%	177.4	17.8	159.6					30.0	3.9	13.7	129.8
400%	177.4	44.5	132.9					75.1	3.9	13.7	84.7
950%	177.4	93.5	83.9					157.8	3.9	13.7	2.0
Conditions		Exiting sewer collection rate		1) 5% increase of sewer charge 2) 5 % increase of collection rate 3) New revenue sources (sales of sludge as fertilizer and treated water for irrigation)				1) Increase in bill collection rate to 90 % 2) Increase in connection rate to 80 % in sewered area 3) New revenue sources (sales of sludge as fertilizer and treated water for irrigation)			

Note:

	Existing Collection Rate of Bills	Existing Charge Level (Rs./Bill/ Year)	Affordability to Pay based on the income level: 1.5 % of average annual income per HH (Rs./Rs. per annum)
Lucknow:	80%	573	2,775
Kanpur:	50%	1,221	1,648
Allahabad:	56%	265	1,964
Varanasi	78%	112	1,889

Case-2		Case-1	
Estimated percentage of house connections in the sewered area	40%	charge	0.05
Estimated percentage of households in the sewered area	24%	collection	0.05
Estimated percentage of bill collected households out of total households in sewered area	48% in 2015		
Proposed collection rate	90% fixed		
Proposed connection rate	80% fixed		

Reference:

Existing average expenditure for waste water disposal services per household in other cities in India

New Barrackpore	1116
Budrwan	603
Rajkot	318
Jaipur	297

As of 1995, 2004-price level

Recovered ratio of sewer charge to O&M cost in other cities in India

New Barrackpore	5%
Burdwan	9%
Rajkot	10%
Jaipur	27%
Vijayawada	6%

As in the year 1995

Assuming the connection rate of 90 % in sewer area and the bill collection rate of 90 %, the amount to be borne by the State transfer will be reduced from Rs.169 million to Rs.145 million.

In this case, if the charge level is increased by 100 % (2 times of the existing charge level of Rs.112/HH per annum, in other words, the charge level will be revised to Rs.224/HH per annum), the amount to be borne by the state transfer will be reduced to Rs.130 million.

Furthermore, if the charge level will be increased by 950 % (10.5 times of the existing charge level, in other words, the charge level will be revised to Rs. 1,176/HH per annum), the revenue and O&M cost

will be balanced. Even at this charge level, the charge to be revised is within the affordability to pay for sanitation (Rs. 1,889/HH per annum).

From this viewpoint, a revision of the charge level is required by means of not only the revision of the existing tariff system but also the reassessment of the Annual Rental Value of properties since the charge level is closely linked with the Annual Rental Value of properties.

5.5 OTHER RECOMMENDATIONS

(1) Improvement in the Accounting Systems

Presently the Municipal Corporations do not use professional help in their accounting and continue to maintain accounts on single entry systems. However this is not the case with the Jal Sansthans and they are using services of qualified professional Chartered Accountants. Attempts in isolation are also being made to computerize the billing and improve collection process. However this process is still in a very nascent stage.

Also, there seems to be lack of standardization on the accounting system and reporting. There is a lot of ambiguity about heads of expenditure and income both at the Municipal Corporations and Jal Sansthans.

Most of the Jal Sansthans are inadequately equipped with computers and although they have positive and forward looking Finance Officers, there is a lack of professional assistance and guidance.
However some of our recommendations are as follows:

1) A good accounting software needs to be implemented which can bring in standardization across the Jal Sansthans and Nagar Nigams in book keeping. This will help in having a better control and timely finalization of accounts.

2) All the zones need to be connected with each other and to the main office through a dedicated Wide Area Network connectivity. This will help in better monitoring the activities of each zone.

3) Standardised Management Information System formats and extensive use of computers can help in improving the efficiency and effectiveness of the accounting, inventory and other functions.

4) The present staff needs to be trained on use of computers.

Detail description of ways to introduce the above mentioned measures has been given in a separate Volume titled “Institutional Development Programme”.

(2) Lessons From the Other Cities

The Study Team has made interview surveys and reconnaissance in some of the other cities as well i.e., Ahmedabad and Surat in the State of Gujarat and Indore in the State of Madhya Pradesh for reference. In Gujarat, a specified tax called as “Octroi Tax” is still in force. The Octroi Tax is like an import custom at city level which is applied for the purpose of activation of the regional industries and protect them from the external economic pressure.

The Octroi Tax revenue shares at 57 % in Ahmedabad and 40 % in Surat. Following figure illustrates its transition in Ahmedabad:

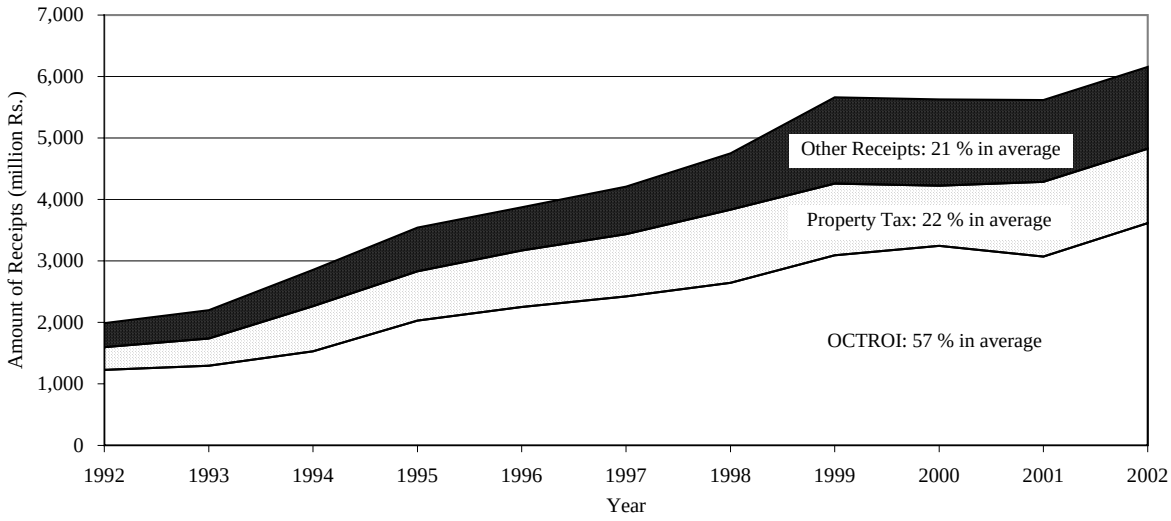


Figure 5.2 Income Statement of Ahmedabad in the State of Gujarat

Further, the Ahmedabad Municipal Corporation issues a specified bond called "City Bond" which is tax-free. The City Bond has been issued 3 times in 1998, 2002 and 2004, with assured returns of 14.00 %, 9.00 % and 6.85 % respectively.

In Madhya Pradesh, the Octroi Tax was abolished in 2001, but the Indore Municipal Corporation received a specified "Octroi Compensation Transfer" from the State Government as well as has been receiving general State Transfer thereafter. Therefore, it seems that the Indore Municipal Corporation is keeping the same financial scale with that in the time when the Octroi Tax was still in force.

The above mentioned financial back ground is completely different from the targeted 4 cities belonging to the State of Uttar Pradesh.

Furthermore, these cities, without exception, require special features from the financial and institutional viewpoints which are:

1) To adopt a systematic accounting system with "the double entry book keeping" using computers,
2) To adopt auditing system with professional chartered accountants,
3) To adopt a rational tax collection method using banking system,
4) To own accountability for all the information and data including financial status to the public,
5) To keep a good relationships between institutions concerned so that information/data can be exchanged with each other any time, and
6) To keep link and close coordination with other organisations under the Municipal Corporation, so that it becomes able to work like one single entity as a whole.

Almost all of these lessons should be reflected in the targeted cities as Project Implementing Organisations to execute and promote it for the future. Details of these matters concerning institutional development programmes are discussed in another volume of this report.

Details on the said interview survey and reconnaissance in the other cities are attached hereunder as Appendix E, F and G..

Appendix A

APPENDIX A

REVIEW OF THE NATIONAL GOVERNMENT FINANCES

The financial situation of the National Government (i.e. Government of India) is rather healthy since 1999-2000. It means that the Government finance has been supported by both the tax revenue in revenue account (current account) and receipts in the form of public debt in capital account and there is a sharp rise in them since 1999-2000.

Out of the total tax revenue, around 62 % - 74 % comes from the taxes on commodities and services which are indirect taxes. The receipts in revenue account (current account), i.e. grant-in-aid is less than 1 % consisting of external grant assistance and aid materials & equipment in the nation as discussed in the Master Plan Study Report. The share of the external debt to the capital income ranges between 2.0 % to 3.2 %.

On the expenditure side **General Services** is almost half of the total expenditure. The General Services consists of Organs of State, Fiscal Services, Interest Payment and Servicing Debt, Administrative Services, Pensions and Miscellaneous General Services, and Defence Services. **Economic Development Services** is the second largest head of expenditure. It consists of Agriculture and Allied Activities, Rural Development, Special Areas Programme, Irrigation and Flood Control, Energy, Industry and Minerals, Transport, Communication, Science Technology and Environment, and General Economic Services. The third largest group of expenditure is **Grants-In-Aid** (consists of Grants-In-Aid to State Governments, Grants-In-Aid to Union Territory Governments, Payment of States' Share of Union Excise Duties, Technical and Economic Cooperation with Other Countries, and Aid Materials and Equipment). In this category, the Grants-In-Aid to State Governments are the top sharing at 95.4 % of the total expenditure. It means that almost all Grants-In-Aid are for the government transfer to the states. Expenditure on **Social Services** is the fourth group sharing around 5 % only of the total expenditure. It consists of General Education, Technical Education, Sports and Youth Services, Art and Culture, Medical Public Health, Family Welfare, Water Supply and Sanitation, Housing, Urban Development, Information and Publicity, Broadcasting, Welfare of Scheduled Castes, Scheduled Tribes and Other Backward Classes, Labour and Employment, Social Security and Welfare, Nutrition, Relief on Account of Natural Calamities, Other Social Services, and Secretariat-Social Services. The expenditure on **Water Supply and Sanitation** concerning the Project stands at third position under this expenditure group (Social Services) with a share of 4.7 % with General Education at top with 36.2% and Medical Public Health and Housing at the second position sharing 10.8% and 10.9%, respectively as per data of 2002-3.

Appendix B

APPENDIX B

REVIEW OF THE FINANCIAL POSITION OF STATE OF UTTAR PRADESH

The financial figures since 1997-98 for the Uttar Pradesh State show a deficit. The yearly financial figures for 2000-01 and 2001-02 which are estimates show a positive balance. An analysis of the same is as under:

The largest amount of revenue of the Uttar Pradesh State is the Tax Revenue with a share of around 80 % since 1997-98 according to its financial statement as discussed in the Master Plan Study Report. In tax revenue, the share of State's own Tax is slightly more than 50 % to the total tax revenue during last 8 years since 1994-95, remaining amount comes as a share from National Government from other taxes consisting of Income Tax, Estate Duty, and Union Excise Duties.

The state's own tax income, consists of Agricultural Income Tax and Taxes on Professions, Trades, Callings and Employment which are less than 1 %. The amounts of Taxes on Property and Capital Transactions consisting of Land Revenue, Stamps and Registration Fees, and Urban Immovable Property Tax share ranging from 7 % to 8 % to the total Tax Revenue.

Loans and Advances from Center (the National Government) show a large share of inflow at 30.8 % as indicated in the same statement.

The expenditure on the other hand comprises of 5 categories, Developmental Expenditure, Non-Developmental Expenditure, Grants-In-Aid and Contributions, Compensation and Assignments to Local Bodies and Panchayati Raj Institutions and Reserve with Finance Department.

Developmental Expenditure and Non-Developmental Expenditure are the major expenditures categories, and the former is slightly larger than the latter as per the actual expenditure shown in since 1994-05 till 1999-2000.

The Development Expenditure consists of Education, Sports, Art and Culture, Medical and Public Health, Family Welfare, Water Supply and Sanitation, Housing, Urban Development, Welfare of Scheduled Caste, Scheduled Tribes and Other Backward Classes, Labour and Labour Welfare, Social Security and Welfare, Food and Nutrition, Relief on account of Natural Calamities, and Others as shown in the table below.

Among them, the expenditure for Education, Sports, Art and Culture is largest one sharing at 60 % or more. The second one is the expenditure for Medical and Public Health ranging from 11 % to19 % of its share rates. The share of **Water Supply and Sanitation** related to the Project ranges only from 3.6 % to 7.0 % since 1994-95 as shown in the above table.

The economic development expenditure consists of Agriculture and Allied Activities, Rural Development, Special Area Programmes, Irrigation and Flood Control, Energy (Power), Industry and Minerals, Transport and Communications, Science, Technology and Environment, and General Economic Services.

According to the data, the expenditures for Agriculture and Allied Activities, and Rural Development are the largest ones ranging from 55 % to 65 % totally during last several years. The share of expenditure on Irrigation and Flood Control partly related to the Project are in the range of 16 % to 36 % since 1994-05.

In the Capital Account, the expenditure for Total Capital Outlay and Loans and Advances by State Government share around 70 % or more since 1994-95. The Total Capital Outlay means the direct investment for development consisting of Social and Economic Services. The Loans and Advances by

State Government mean loans and advances for the development projects for both the Social Services and Economic Services in the State.

Appendix C

APPENDIX C

ECONOMIC EVALUATION INDICES

The EIRR is to be calculated using a cash flow of economic cost and economic benefit during the project life. This EIRR is defined by the following formula:

$$\sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t} = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t}$$

Where, T = the last year of the project life,
C_t = an annual economic cost flow of the project under study in year t,
B_t = an annual benefit flow derived from the project in year t, and
R_e = the Economic Internal Rate of Return (EIRR) (a discount rate to be used for costs resulted at the same amount of the benefits in terms of the present value).

The NPV is expressed as "B-C" and defined by the following formula:

$$NPV = B - C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t} - \sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t}$$

It means that, if the present value of the benefit subtracting by the present value of cost would become positive, then the project being under study will have a reliability to execute.

The B/C Ratio is defined by the following formula:

$$B/C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t} \Big/ \sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t}$$

It means that, if the rate of the present value of the benefit dividing by the present value of the cost would become more than "1.00", then the project being under study will have a reliability to execute.

The project life is assumed at 50 years after completion of the construction works for the Project. Cash flow of the economic cost and economic benefit should be made for the first year of the construction works to the end of the project life.

In this case, annual operation and maintenance cost (O&M Cost) should be taken into account. And, some amount of replacement cost should also be taken into consideration since some parts of the initial works for the facilities as metal works may not be durable during the project life.

Shadow Price of Land:

Agricultural productivity is one of index for estimation of shadow price of land. The formula is as follow:

$$SPRL = \frac{A_g O / CA}{FP_p}$$

Here, $SPRL$: a shadow price rate for land,
A_gO: amount of agricultural products,
CA: harvested or cropped area (ha), and
FP_p: financial price of land to be acquired for the Project.

Concerning the data for inserting to the formula above, following data is available from the same Statistics above, and using these data, the shadow price rate for land can be estimated at 0.0906. The economic cost for land can be estimated based on the financial cost for land multiplying this shadow price rate.

Appendix D

APPENDIX D

FINANCIAL EVALUATION INDICES

Financial costs and benefits throughout the project life are compared in terms of present values. If the total present value of financial costs equals that of financial benefits (when, B/C=1), the discount rate used to calculate the present value is called as "financial internal rate of return (FIRR)" and uses as the main index of project evaluation to judge the project viability as well as the Net Present Value (NPV) and B/C Ratio. This FIRR is to be calculated by the same manner with the economic evaluation using a cash flow of financial cost and financial benefit during the project life. This FIRR is defined by the following formula:

$$\sum_{t=1}^{t=T} \frac{C_t}{(1+R_f)^t} = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_f)^t}$$

Where, T = the last year of the project life,
C_t = an annual economic cost flow of the project under study in year t,
B_t = an annual benefit flow derived from the project in year t, and
R_f = the Financial Internal Rate of Return (FIRR) (a discount rate to be used for costs resulted at the same amount of the benefits in terms of the present value).

The NPV is expressed as "B-C" and defined by the following formula:

$$NPV = B - C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_f)^t} - \sum_{t=1}^{t=T} \frac{C_t}{(1+R_f)^t}$$

It means that, if the present value of the benefit subtracting by the present value of cost would become positive, then the project being under study will have a reliability to execute.

The B/C Ratio is defined by the following formula:

$$B/C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_f)^t} \Big/ \sum_{t=1}^{t=T} \frac{C_t}{(1+R_f)^t}$$

It means that, if the rate of the present value of the benefit dividing by the present value of the cost would become more than "1.00", then the project being under study will have a reliability to execute.

The project life is assumed at 50 years after completion of the construction works for the Project in the financial evaluation too. Cash flow of the financial cost and financial benefit should be made for the period from the first year of the construction works to the end of the project life.

In this case, annual operation and maintenance cost (O&M Cost) should be taken into account as the same manner in case of the above economic evaluation. And, some amount of replacement cost should also be taken into consideration since some parts of the initial works for the facilities as metal works may not be durable during the project life.

Appendix E

APPENDIX E

A REPORT ON AHMEDABAD MUNICIPAL CORPORATION

Introduction To Ahmedabad City

Ahmedabad is the largest city in the state of Gujarat situated on the banks of Sabarmati River. It is fast approaching to be recognized as a mega city, with rapidly growing population Trade, Commerce, Industry, education etc. Ahmedabad has had a significant role in the development of the country. It has the largest textile industry.

Historically this city has played a major role in the Independence movement of the Nation. The Ashram established by Mahatma Gandhi on the banks of river Sabarmati became a centre of all political activities and movements.

Today Ahmedabad has established one of the most prestigious educational Institution of the country in various fields be it management, design, engineering etc.

Ahmedabad Municipal Corporation

1. General Information

The Ahmedabad Municipal Corporation was established in 1950 as body corporate under the provisions of "The Bombay Provincial Municipal Corporation Act" of 1949. Ahmedabad Municipal Corporation serves an area of around 190.80 sq. kms. including the city and its peripheral areas and provides a range of civic services to around 35.4 lakh citizens of the city of Ahmedabad.

2. Responsibilities

The Bombay Provincial Municipal Corporation Act defines the scope and extent of responsibilities of the Corporation. The Act has entrusted on Ahmedabad Municipal Corporation the responsibility for the maintenance, operation and development of certain public utilities in the city. The services currently being provided by the Ahmedabad Municipal Corporation are classified as obligatory and discretionary services.

2.1 Obligatory

The BPMC Act has identified a list of mandatory functions/services for which the Ahmedabad Municipal Corporation has to make reasonable and adequate provision. These obligatory functions/services are listed as under:

(1) the watering, scavenging and cleansing of all public streets, collection, removal, treatment and disposal of sewage,
(2) the construction, maintenance and cleansing of drains and drainage works, and of toilets, water-closets, urinals and similar conveniences;
(3) the construction or acquisition and maintenance of public hospitals and dispensaries including hospitals, maintaining, aiding and suitably accommodating schools for primary education
(4) the lighting of public streets, maintenance of municipal office and of all public monuments and open spaces and other property vesting in the Corporation;
(5) the registration of births and deaths; and,
(6) the management and maintenance of all municipal water works and the construction or acquisition of new works necessary for a sufficient supply of water for public and private purposes.

2.2 Discretionary

The Corporation may, in its discretion, provide from time to time, certain activities, which may promote public safety, health or convenience. In this regard the Ahmedabad Municipal Corporation has been providing services such as establishments of institutions for the disabled persons, maintenance of secondary schools, running of dispensaries, maternity homes, general hospitals, Post-Graduate Medical College, maintenance of gardens, planting of trees on road sides, holding of exhibitions etc. to the city of Ahmedabad. The State Government, provides grants to Ahmedabad Municipal Corporation to compensate it as far as possible for the expenditure incurred on these boards.

3. Organisational Structure

The Ahmedabad Municipal Corporation has divided its functions into five zones, each covering of nearly Two Hundred Thousand properties. There are enough executive powers given to the operations staff for better implementation. Secondly there is a lot of administrative support from the politicians.

The organisational Structure is given below:

- Municipal Commissioner is the Head of the Ahmedabad Municipal Corporation
- Under him are nine Deputy Municipal Commissioners and they are
  a. Five Zonal Deputy Municipal Commissioners
  b. One Deputy Municipal Commissioner- Projects
  c. One Deputy Municipal Commissioner- Finance
  d. One Deputy Municipal Commissioner-Octroi
  e. One Deputy Municipal Commissioner- Administration
- The Zonal Deputy Municipal Commissioners have the following departments under him:
  a. Engineering
  b. Administration
  c. Health
  d. Town Planning
  e. Tax
- In case of Tax department
  Head of the department is the Deputy Assessment Tax Collector
  - Two Assistant Managers
    - Four Divisional Superintendents
      - Twelve Inspectors
        - Twenty Four Sub Inspectors

In addition to the above Deputy Municipal Commissioner one person from the police department in the rank of Inspector General Of Police is deputed for ensuring proper enforcement of law.

4. Reforms

4.1 Civic Centers

Ahmedabad Municipal Corporation has set up 16 “City Civic Centers” that provides basic facilities to the citizens. Some of the services provided by these centers are:

a. Assistance in assessment of Annual Rental Value of Property
b. Payment of various Taxes
c. Birth and Death registration certificate
d. Registration of Shops and Establishment
e. Booking of various municipal corporation facilities
f. Approval of House Plan
g. Complaints Redressal

Ahmedabad Municipal Corporation has tied up with various banks and one can pay taxes in the local bank or thru credit card on the net.

4.2 Up gradation and Maintenance Of Existing Systems

In order to save on Capital Investment the old equipments have been refurbished and their capacities enhanced to cope up with the increase in the load. Measures are being taken to design equipments that could be used to maintain the sewerage system which would not involve huge cost outlay.

Ahmedabad Municipal Corporation has tied up with "Nirma Institute of Technology to help design and develop indigenous scavenging and dredging equipments. Students are being funded to carry out projects for and on behalf of the corporation.

4.3 Privatization and Partnership

Efforts are towards reducing the manpower and other long-term overhead costs by contracting various activities like solid waste management, water supply and maintenance of sewers to private parties. The Ahmedabad Municipal Corporation normally out sources its functions to the family of the employees. Cleaning of streets and scavenging to the extent of 50% has been outsourced. Production and maintenance of water supply has been outsourced to the extent of 70%.

Maintenance of parks, gardens, and traffic circle is outsourced to private companies.

Public facilities like public toilets and urinals have been contracted out for running and maintaining.

4.4 Improvement in Systems

4.4.1 Accounting System

The accounting system has been computerized and double entry system of accounting has been introduced. A system of continuous audit has also been introduced. The Budget and actual financial situation are displayed on the website.

4.4.2 Octroi Recovery System

Measures have been adopted to improve Octroi recovery and valuation. A three-tier system has been adopted for recovery of Octroi Tax. The first level being the entry point the second point is the check post manned by professionals who check for the valuation of goods. The layer is a team of young personnel who check vehicles carrying goods at random and have the power to charge fine up to 10 times of the value of tax in case of false, short or under valuation. These teams have been equipped with wireless systems for communication.

4.4.3 Simple Annual Rental Value Assessment System

The process of devising a rational system of Valuation of Property for Taxation purpose, this was devised with active participation of the general public and it took nearly two years to devise and implement the present carpet area based method of Valuation. The method is scientific and simple.

The revision in the rates of property tax is again done with active participation of the public at large.

In order to successfully implement the new system the Ahmedabad Municipal Corporation had employed private parties to carry out exact measurement of each and every property in order to find out the exact carpet area.

4.4.4 Capacity Building

Extensive training is being imparted to existing employees, for capacity building to work in multi-tasked environment. Training is also being held for Corporations. Corporations and senior officials of the corporation are being sent to various other countries to see, learn and adopt best practices existing in developed countries.

5. Project Financing

Ahmedabad Municipal Corporation in addition to utilizing its own revenue has also borrowed from LIC, HUDCO, NHB, ICICI Bank, Gujarat Housing Board and Gujarat Municipal Finance Board and Tradable Bonds. These loans have been specifically utilized for part financing various water supply and sewage schemes, integrated urban development programmes etc. that the Corporation has undertaken over the years. These loans have a tenor ranging from 5 to 15 years and are at fixed interest rates, which range from 7.5 % to 12.25 % pa.
Ahmedabad Municipal Corporation is the first in the country to raise funds by issuing tradable Bonds to the public. Since 1995 the Corporation has made 3 issues of Bonds. The first issue was in 1998, second in 2002, and third in 2004. The Bonds are listed on stock exchanges and CRISIL (an organisation involved in rating public issues of companies) has rated Ahmedabad Municipal Corporation Bonds as AA SO+. The Bonds do not have a guarantee of the State they are issued on the strength of the Ahmedabad Municipal Corporation.

6. Finances

Ahmedabad Municipal Corporation derives its revenue from both tax and non-tax sources. Tax revenue, is the primary source of income for over the last few years and has constituted around 80% of the total revenue, comprising of Octroi Tax and Property Tax.

6.1 Octroi

Octroi is a tax levied on goods imported by road, rail or air into the City for either consumption or trade within the City. The Octroi funds (which account for 70% of the total tax revenue) are collected on daily basis from the various collection points and are deposited in the Corporation's Central Treasury account on the subsequent day.

6.2 Property Taxes

The other major source of revenue for the Corporation is the Property-based taxes. This tax is levied on both the residential and non-residential properties. In past The Corporation maintained a record of the Average Ratable Value of all the properties existing within the city limits.

The Property Tax collections made by AMC grew from Rs. 33.58 crores in 1991-92 to Rs. 92.08 crores in 1996-97 registering an annual growth of 22%. A new area-based framework for property tax assessment and billing/payments through e-Governance has improved transparency and collection efficiency considerably.

The Corporation has been generating surplus each year after meeting it regular expense obligations. An analysis of the financial statement of 2002-03 shows:

- Establishment expenses account for around 40% of the revenue or 48% of the total expenditure
- The debt servicing cost is around 15.48% of the revenue

The surplus so generated is being used as corporation's contribution towards building capital assets.

Ahmedabad Municipal Corporation has been given AAA SO+ rating by CRISIL for most secured investment.

7. Lessons Learnt

1) Ahmedabad Municipal Corporation does not depend upon the State Government for any financial assistance, as it is able to muster up a large amount of revenue in the form of Octroi Tax. Ahmedabad being an industrial town has a lot of inflow of goods from other parts of the country especially Maharashtra.
   The Ahmedabad Municipal Corporation has very easy and user-friendly systems for payment of taxes, assessment of Annual Rental Value of Properties, spot delivery of various registrations a licenses (such as birth and death registration, shop license etc.).
2) Enough executive powers are vested with the persons carrying out operation in the city.
3) Major development activities and routine activities such as increase in the property tax rate are done in consultation with the residents of the city. The resident are encouraged to participate in any form of dialogue with the Ahmedabad Municipal Corporation
4) There is complete operational and financial transparency. The budget for the year is posted on to the website for the citizens to go through and comment.
5) Actions on complaints are taken within 24 hrs.
6) Ahmedabad Municipal Corporation has launched a drive to reduce its overheads by contracting major maintenance activities to private parties especially its employees.
7) The property tax revenue is 25% of the total revenue of the Ahmedabad Municipal Corporation and the major component is Octroi which is around 55% to 60%
8) The per capita spend on Property Tax is Rs.347.38
9) Capital expenditures are met by external sources i.e. through Bonds and loans from State Financial Instutions. The revenue meets the debt service obligation.

Appendix F

APPENDIX F

A REPORT ON SURAT MUNICIPAL CORPORATION

Introduction To Surat City

The historical development of Surat dates back to 300 B.C. It situated on the bank of river Tapi, near its confluence with Arabian Sea, in the State of Gujarat. Surat was the most coveted trading cities on the Indian coastline. Over the centuries various communities such as Munhall's, British, and Portuguese etc have traded out of this city. Currently fiber and diamond cutting polishing and exporting are the main business of the city of Surat.

Surat Municipal Corporation

1. General Information

Surat Municipality dates back to 1852 A.D., was converted into the Municipal Corporation in 1966, and governed by the "Bombay Municipal Corporation Act". It has an area of 112.27 sq. kms, with a present population of 2.80 million growing at an average rate of 6.2% per annum (highest in the country).

The city has a literacy rate of 83.3% being the highest in the country. Surat proudly claims to be a ZERO unemployment city.

Surat Municipal Corporation is entirely computerized and has e-governance. The corporation uses more than 1,000 computers all interlinked with LAN and WAN it has both intra net and Internet to run and manage the entire activities of the city of Surat. Residents of Surat can transact activities and file complaints thru Internet and conveniently located civic centers.

The Municipal Commissioner on a daily basis is personally looking after the monitoring of Complaint and its Redresses.

The accounts are maintained on a double entry system and are continuously audited by the audit department. The accounting activities and the budget for each year are loaded on to the website of Surat Municipal Corporation.

2. Responsibilities

The Surat municipal Corporation offers a varied number of civic, public health, education, and registrations and licensing services, some of the services rendered are:

- Construction, maintenance of roads, bridges flyovers, street lighting, providing potable water, sewerage, maintaining of the sewerage treatment plant solid waste management.
- Constructing, running and maintenance, of hospitals, medical college, schools, community halls, libraries, parks and gardens.
- Registration of birth and death, food inspection and licensing etc.
- Town planning and slum rehabilitation and relocation.
- Disaster Management is any key activity.

3. Organisation its Structure and Activities

Surat Municipal Corporation for administrative convenience is divided into seven zones. The Municipal Commissioner is the head of the organisation to support him he has three Deputy Commissioners, three Assistant Commissioners, two Executive Engineers, City Engineer and Director

Planning.

Deputy Commissioner (Spl.) is the head of the Southwest Zone and is responsible for collection of Octroi in addition to his other regular duties like managing traffic, parks and gardens, Fire services etc.

Deputy Commissioner (Gen) is the head for the East Zone; look after finance and accounts, information systems, finance and tax policies etc.

Deputy Commissioner (Health & Hygiene) looks after the public health issues like family planning, death and birth registration etc.

Director planning carries out the Town Planning activities.

Assistant Commissioner (P &I) is in charge of the North Zone and also looks after the Public relations activities

Another Assistant Commissioner is looking after disaster Management, slum rehabilitation and relocation, monitoring businesses of Surat, etc.

However the Central and West Zone are looked after by Executive Engineers who also look into the sewer, drainage maintenance and water supply and maintenance.

The City Engineer is in charge of framing policy and executing activities relating to town planning street lighting, roads, bridges etc

There is dean for the Surat Medical College who is also an employee of the Surat Municipal Corporation.

The total number of employees at Surat Municipal Corporation is around15,500 of which class IV employees (sweepers, peons drivers etc) are around 5,700, which include Regular, Part time employees and contracted workers. The total outlay under the salary head is around Rs.400.00 million per annum.

Surat Municipal Corporation has introduced a dress code for its employees.

4. Civic Services

4.1 Sanitation and Solid Waste Management

The corporation has 5,700 persons employed for carrying out the solid waste management activities. Out of this there are around 4,700 regular employees of the corporation, 600 part time workers. The corporation gives Grants to the Resident welfare Associations to carry out the collection of solid waste from their own society. Door-to-Door collection of solid waste is also in force. Fines are imposed for throwing garbage on the street. The disposal of the solid waste is privatized to the extent of 60%.

World's largest sewerage Treatment Plant has been installed and the current capacity is 562.5 MLD and the sewage generation is only 425 MLD. The main sewerage lines cover 95% of the area. The sewerage, waste and storm water management including running of Sewerage Treatment Plant cost the Surat Municipal Corporation Rs.40.00 cores per annum which is approx 10% of the total outlay.

4.2 Basic Services

Basic services such as water Supply, Sewerage, Solid Waste Management, Roads, Street Lighting have been provided to a level of 97% on an average.

Roads have been broadened and beautified and 100% street lighting. Energy saving traffic signals has been installed.

In addition Surat Municipal Corporation has set up 13 "City Civic Centers" that provides basic facilities to the citizens. Some of the services provided by these centers are:

a. Assistance in assessment of Annual Rental Value of Property
b. Payment of various Taxes
c. Birth and Death registration certificate
d. Registration of Shops and Establishment
e. Booking of various municipal corporation facilities
f. Approval and copy of the Plan

4.3 Slum Rehabilitation

Surat Municipal Corporation has spent more than Rs.75.00 cores for the rehabilitation and relocation of the slum dwellers. The corporation has two main schemes under the slum rehabilitation programme:

a. Site and Service: Under this programme the slum dweller is being given a developed piece of land with all civic services like water, sewerage, lighting for constructing houses, free of charge.
b. Belt House programme: Under this scheme constructed houses at the cost of Rs.68,000/= is given to the slum dwellers on a monthly installment of Rs.481/ payable over a period of 15 years.

This has lead to release of some prime located properties, which were under the control of the slum dwellers. They were sold or commercial complex were constructed and the same became a source of revenue for the Corporation.

4.4 Employment Generation Programmes:

The corporation under various schemes of the State and Central government has launched several employment generation programmes. Surat Municipal Corporation claims that the city of Surat has zero unemployment.

5. Reform and Capacity Building

Surat Municipal Corporation is proud of its reform and capacity building exercise, which has converted the city from the title of **Dirty City** to the "**2nd Best City to Live In India**".

Some of the reforms are:

Administrative: The Surat Municipal Corporation has a transparent administrative system. Uses modern technology like computers for e- Governance, and Boi – Metric attendance system Continuous training to its employees is some of the administrative reforms.

Energy Reform: An Energy Audit department has been set up to monitor and make continuous effort to use effective and efficient energy saving devices. Power generation plant running on the Biogas methane has been set up it is expected to save Rs.4.2 million per annum.

Disaster Management: Continuous efforts are being made to strengthen the relief and rescue team for managing disaster with the help of public participation.

Finance and Taxation: The accounts are maintained on a double entry system and are totally computerized. Simple self-assessment scheme is launched and lifetime vehicle tax introduced. Tax rates are being decided with active public participation.

6. Information & Technology

Surat Municipal Corporation has a comprehensive website and an I.T. policy. The website has all the information relating to the activities policies, Laws including budget and final accounts.

There are 13 civic centers which are linked to each other and to the main server at the head office thru LAN and WAN.

The key areas that have been computerized are, Public Health Engineering system, Disease Monitoring System, Grievance Redressal System, Water Quality System, Budget and performance monitoring system, Tax monitoring system, Materials Management, e- library.

7. Public Participation

The Surat Municipal Corporation encourages discussion with the public and invites suggestion on various issues involving developmental, maintenance, finance and other relating to civic facility.

The Surat Municipal Corporation uses various modes mass communication such as Radio, Newspaper, and Websites. Suggestions received are seriously reviewed and pros and cons of each suggestion is looked into and action taken.

Public awareness campaigns are launched encouraging public to come up with suggestions for constant improvement.

Surat City has the world's largest sewerage treatment plant. The Industrialists of the city have contributed money for the setting up of the plant along with the contribution of Surat Municipal Corporation.

8. Financial Systems

Income
Surat Municipal Corporation is self-sufficient and generates annual revenue to the tune of Rs.780.00 crores (as per the current year budget). The major source of revenue is the Octroi tax, next to this is the property tax as per the statistics the property tax recovery is to the tune of 92%. The Breakup of the revenue sources is as below:

	Income	(unit in Rs. Crores (=10 million))
i)	Octroi Tax	Rs.300.00
ii)	Property Tax	Rs.280.00
iii)	Sale Of Properties	Rs.200.00
iv)	Grant from State	Rs.040.00
v)	Other Income	Rs.060.00
	Total Income	Rs.780.00

The Octroi Tax is around 40% of the Total revenue and Property Tax is around 38% of the total revenue. Surat Municipal Corporation also sells properties, which are at prime location; the revenue from them is around 27%.

Expenditure
Surat Municipal Corporation is constantly investing in building capital assets from its revenue. In the current financial year it is proposed to spend around Rs.300.00 crores in Capital asset building, which

will amount to 50% of the total expenditure. The expense on establishment, repairs and maintenance etc. would be around Rs.300.00 crores. The corporation at no point of time has to fall back on the State Government for resources for operation and maintenance.

9. Strengths Of Surat Municipal Corporation

1) Surat Municipal Corporation is a forward looking organisation and has won several awards:
   - Dubai International Award for Best Practice in Solid Waste Management and Urban Governance
   - National Award for Best Employer to provide employment to Physically Handicapped people.
   - Govt. of Gujarat Award to Surat Municipal Corporation for special contribution towards development of Surat city.
   - Best Practice Award for Grievance Redressal System by CMAG.

2) The executive powers of the commissioner are delegated to the persons carrying out operations hence better management and tax recovery.

3) The Surat Municipal Corporation maintains total transparency by displaying the financial and operation information on the website.

4) Energy audits are being carried out to monitor and save energy.

5) Active public participation in development activities. One of the pages on the website caters to public opinion on various issues. Public relations department constantly looks into the suggestions received from the public and compiles them for the governing body to take decision.

6) The Octroi tax revenue is around 60% of the total revenue of the Corporation.

7) Property tax is around 40% of the total revenue.

8) The per capital spending on property Tax in Surat (as per 2004-05 projected data) is Rs.871.42

9) The Surat Municipal Corporation does not depend on the State Government for any financial assistance. The own revenue is sufficient enough to take care of it operating and developmental activities.

10) Civic centers provide assistance to the residents of Surat with respect to payment of Taxes, Assessment of Annual Rental Value of property, Grievance Redressal, registration of Births and Deaths, Shops and Business Establishment License etc.

11) Rehabilitation and relocation of slum dwellers to better concrete houses at affordable prices and use of prime location land occupied by slum dwellers, for commercial purpose.

Appendix G

APPENDIX G

A REPORT ON INDORE MUNICIPAL CORPORATION

Introduction To The City

Holkar Dynasty established Indore City during 17th century. Maharani Ahilya Bai ruled the city during the 19th century and during her regime the city reached it glory. It is the largest city in the State of Madhya Pradesh and is also known as the commercial capital of the state. The main business is textile, grains, pulses etc. The city is spread over 130.17 sq. kms. and has a density of population of 12579 per sq kms.

Indore Municipal Corporation

1. About Indore Municipal Corporation

Indore Municipality was established in 1870, was converted into the Municipal Corporation in 1956 under the provisions of the "Bombay Municipal Corporation Act". Its limits are spread over an area of 130.17 sq. kms, with a population of 1.63 million growing at an average rate of 1.9% per annum.

Indore Municipal Corporation has most of its function computerized and also has e-governance. The computers of the corporation are networked using LAN and WAN it has both intra net and Internet to run and manage activities of the city. Residents of can transact activities and file complaints and conveniently located civic centers.

The Municipal Commissioner on a daily basis is personally looking after the monitoring of Complaint and its Redressal

The accounts are maintained on a double entry system. The main source of revenue is property tax as Octroi tax has been abolished; hence a large amount of fund is transferred from the state as assistance. There is a proposal to reintroduce Octroi Tax in the near future to make the corporation self-sustainable.

2. Functions of Indore Municipal Corporation

The functions of Indore Municipal Corporation have been clearly divided into two categories, namely Executive Function and Regulatory Function.

Executive Functions include constructing and maintaining basic civic facilities for the residents of Indore city. The same are listed below:

a. Water Supply
b. Sewerage and Drainage
c. Sanitation
d. Roads
e. Street Lighting
f. Garden & Parks
g. Education
h. Social welfare

The Regulatory Functions comprise of legal compliance, which involve registration or issue of licensing and protecting the misuse of the properties that belong to Indore Municipal Corporation. These are as follows:

a. Birth & Death Registration
b. Building plan Approvals

c. Licensing of colonies
d. Disease Control
e. Food and Hygiene
f. Encroachments
g. Shop licensing
h. Assessment of Properties
i. Tax Calculation/ Collection
j. New connections for Water

3. Organisational Structure and Responsibilities:

Indore Municipal Corporation has been divided into eleven zones for administrative convenience and for better service to the residents. Zonal Officer directly reports to the Assistant Municipal Commissioner who heads each Zone. The Municipal Commissioner is the head of the Corporation.

The functions of the Indore Municipal Corporation have been decentralized to zones and each zonal office acts as mini Municipal Corporation. The Zonal Head for efficient and smooth working is vested with some of the administrative powers of the Municipal Commissioner. Each zone has Building Inspector, Asst. Engineer Public works, Asst. Engineer Water Supply, Asst. Revenue Officer, Health Inspector, Asst. Engineer Electrical Department. They all report to the Zonal Officer. The services offered by each zone to the residents are: Birth and Death Registration, Tax collection Counters, Assessment of Taxes, Maintenance of roads, water and sewer systems, new connections, Health and Sanitation service, Licensing, Public grievances and Redressal.

All administrative activities and strategic planning happens at the head office. The accounts and Information & Technology departments are also located at the head office and are being looked after by the Asst. Commissioner and The Municipal Commissioner.

The total strength of the corporation is around 6800 employees.

4. Reforms

The 74th Constitutional Amendment has placed the onus of providing Civic Services on to the Urban Local Bodies.

Indore Municipal Corporation adopted several measures and carried out activities, which lead to extending a convenient and friendly environment for the residents of Indore City.

4.1 Reorganizing the Revenue System and Department

The revenue department has been reorganized and separate cells with sufficient executive powers for smooth functioning have been vested in them.

(1) Survey Section: a survey section has been created for conducting base line surveys of properties. This section is continuously in a look out for properties that are escaping assessment, or have illegal water connection and trying to increase the tax net. This increased the tax net of properties from 1,55,000 in 1999-2000 to 2,40,000 in 2002-2003, water connections from 98,000 to 1,39,000 for the same period.
(2) Assessment section: The responsibility of this section is to assist in assign properties and also carry out reassessment of under assessed properties
(3) Recovery and Vigilance Section: This section has been entrusted with the responsibility of recovering outstanding tax and non-tax dues of the Municipal Corporation. The section has the power to seize and auction properties wherever necessary, also impose interest penalties and fines.

(4) Marketing Section: Administration and control of the municipal properties and advertisement hording. This section is the caretaker of the municipal properties and the advertisement hording.

Introduction of simple self-assessment procedure and rationalization of the tax structure was a major part of tax reform. Tax bills are delivered in partnership with private organisations. Collection is done at civic centre which are computerized, and linked with WAN.

These reforms led to an increase in the revenue from Rs.160 million to Rs.630 million which is nearly 3 times from 1995-96 to 2002-03.

The website of the Indore Municipal Corporation is comprehensive and exhaustive.

4.2 Comprehensive use of the Information & Technology

Indore Municipal Corporation along with its technical partners Oswal Data Processors developed a tailor made accounting system to maintain accounts on a double entry. Monitoring of performance of the staff is also done on the computer. All entries related to property tax, water tax, shops rent, birth death certification, cash collection are being maintained through computers which are linked together with LAN and WAN.

The most significant effect of the reform process was sharing of data between Municipal Corporation and other administrative department of the State Government. The Municipal Corporation has installed a computer at the District Registrar's Office who deals with the registration of transfer of properties. In case of any sale or purchase transaction of a property both the seller has to obtain a no dues certificate from the Municipal Corporation.

Information relating to Indore Municipal Corporation is also available on the website.

4.3 Capacity Building

Training is imparted to the employees of the Indore Municipal Corporation in order to improve their management skills. Officers are encouraged to participate in seminars and workshops for capacity building.

Institute of Management Studies has developed a comprehensive training programme for the elected representatives as well as corporation officials to enhance personal effectiveness and capacity building. Effectiveness of this programme is being monitored under the Indo-USAID Financial Institutions Reform and Expansion project.

Indore city serves as a Resource City with City of Garland Texas, USA specifically in the technical municipal management areas of financial management, citizen participation/communication, and solid waste management and energy efficiency under a programme sponsored by I.C.M.A.

4.4 Communication with Citizens and Public participation

There is an intensive, active and constant communication with the citizens using various methods such as meetings with the representatives of the resident welfare associations, using cable television, billboards, and advertisements in the newspapers for educating the public about the importance of tax payment and other issues. As a result of this communication Indore Municipal Corporation was able to generate not only public awareness but also a sense of responsibility towards the city.

The residents of Indore city came forward to contribute towards making of a cemented lane or by lane in their colony. It is observed that one third of the cost of making lanes and by lanes has been borne by

the residents. Another landmark is that one single resident of Indore has contributed 50% of the cost of constructing and auditorium which was made at a cost of Rs.3.00 crores.

Grievance Redressal cell is formed which comprises of the Mayor, Municipal Commissioner, and all the Head of Departments. They visit each zone and interacted with the residents on an assigned day and solved their problems on the spot.

The municipal corporation making residents aware of its importance organises rain water-harvesting awareness camps. Presently Indore Municipal Corporation is giving cash incentive of Rs.1000/ and rebate of 6% on Municipal Taxes to residents for implementing Rain Water Harvesting. As a result more than 3000 residential buildings have implemented rainwater harvesting.

4.5 Road Development

The Indore Municipal Corporation formed a separate cell called as the road Design and Development cell. This cell with the help of retired senior residents of the city designed and developed a strategy for improving the road conditions using modern technology and high standards.

The fund required for the construction of the roads was raised by issuing Development Bonds bearing interest rate of 11.5% secured by State Guarantee and loan @ 10.5% from HUDCO.

4.6 Slum Development and Rehabilitation programme

Under this programme the Indore Municipal Corporation is actively involved in rehabilitation of the Slum dwellers. It is now constructing RCC houses for them at a cost of Rs.1.00 lacs out of which Rs.25, 000/= is being received as subsidy from the central government under the Slum networking Programme. The balance amount is to be paid by the slum dweller in easy daily installment.

4.7 Financial Management

It is utmost important to have good financial management systems for any organisation to function properly and successfully. Indore Municipal Corporation appointed a qualified Chartered Accountant to head the Finance Department. Unless all the data generated is not captured properly the analysis of the same cannot be done properly and efficiently. Indore Municipal Corporation has computerized accounting and uses double entry system.

Better budgeting systems have been introduced in order to prune avoidable expenses, also cost control wherever necessary.

The major source of revenue of the Municipal Corporation has been divided into two categories:

Internal Source or Municipal Corporation's source: This source comprises of Property Tax, Water Tax/ charges, advertisement tax, show Tax, License free, Shop rent, Other Fees. The income from own sources shows a constant and stable growth. In the year 1997-1998 the income was Rs.194.87 million, which has grown to Rs.635.12 million in the year 2002-2003 an increase of nearly 325.9%.

External Source: The components of this source are in terms of State transfers in the form of: Octroi compensation, Passenger Tax Share, share in Stamp duty, State Finance Commission, Educational grants, Road repair grants etc. The External source contributed Rs.867.53 million approx 136.59% of the own source.

On an analysis of the financial statements it is noticed that the Indore Municipal Corporation out of its operating revenue contributes towards Capital Expenditure.

Analysis of some of the expense items for 2002-2003:

- In the year 2002-2003 the surplus generated out of revenue was 15%.
- The expense on Tax collection is around 3.6% of the total tax revenue and around 1.5% of the total revenue.
- The expenditure on public health and sanitation is around 7.8% of the total revenue generated
- Water supply expense is around 27% of the total revenue generated however the tax and water charge are not sufficient enough to cover up the costs.

Indore Municipal Corporation has won the Dubai International award for best Practices.

Appendix H

Appendix H: Table 1-1 Annual Financial Statement of Nagar Nigam (Varanasi)

(Unit: million Rs.)

Receipts in Current Account					
Description	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Revenue receipts	283.65	356.15	514.83	440.17	413.13
1 Taxes Revenue	39.71	43.83	52.41	68.78	90.12
Property Tax	33.58	35.24	36.82	45.90	50.46
Taxes on Vehicles	1.15	3.91	5.41	6.21	4.71
Advertisement Tax	0.73	2.47	2.84	2.93	2.84
Other Tax	1.24	2.21	1.11	1.31	1.16
Stamp & Registration Fee	3.00	0.00	6.23	12.43	30.96
2 Non Tax Revenue	241.82	309.05	459.03	366.30	319.64
Rent from Municipal Property	7.80	10.59	19.23	15.59	16.16
Sale Of Properties	0.75	2.36	1.39	0.64	0.02
Charge for damages/ fines	13.49	9.26	23.91	9.65	5.83
Road Cutting Charge	0.00	0.00	0.00	0.00	0.00
Other Rental	0.44	0.20	0.29	0.79	2.09
Interest Income	0.09	0.12	1.83	3.89	2.78
State Transfer	203.40	281.79	404.82	327.32	275.72
Education	0.00	0.00	0.00	0.00	0.00
Road	0.00	0.00	0.00	0.00	0.00
For Development Activities	25.03	32.91	102.08	26.83	2.42
Medical & Health Services	1.97	0.00	7.38	3.80	0.00
General	176.41	248.88	295.37	296.69	260.00
Revolving Fund	0.00	0.00	0.00	0.00	13.30
Miscellenous Income	15.85	4.74	7.57	8.41	17.04
Transfers from Urban Development Authorities for Maintenances of New Colonies	0.00	0.00	0.00	0.00	0.00
3 Suspense Account	2.12	3.27	3.38	5.09	3.36
Security Deposits from contractors	1.67	1.23	1.74	3.11	2.15
Staff Repayments	0.44	2.04	1.64	1.98	1.22

Expenditure in Current Account					
Description	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Revenue Expenditure	307.93	321.84	465.66	440.18	395.00
1 Salary & Administration	204.12	232.02	295.57	283.18	244.91
Administration	11.27	13.08	15.69	16.73	13.22
Taxes	24.40	26.92	30.98	30.56	27.10
Sweepers	119.38	132.47	161.38	160.05	135.84
Maintenance Staff	0.67	0.99	0.84	0.76	0.82
Medical & Health Services	4.79	4.66	5.42	5.88	4.74
Civic Service Staff	26.34	29.44	34.78	35.43	30.76
Education	0.07	0.03	0.00	0.00	0.00
Pension/ Provident Fund	17.20	24.43	46.48	33.77	32.43
2 Maintenance/ Charges	91.27	77.72	154.18	134.76	132.80
Civic Services Lighiting,Fire,Parks etc	4.54	4.07	13.50	8.16	5.53
Road repairs/ Other Public Conveniences	59.31	32.59	84.06	88.52	91.75
Buildings/Ghats	1.19	0.85	1.61	1.47	1.37
Vehicles& Equipment	15.70	16.51	28.83	20.65	22.20
General	4.01	16.91	16.76	5.97	3.54
Educational Instutions	0.10	0.17	0.19	0.12	0.13
Medical & Health Services	6.42	6.61	9.24	9.87	8.28
3 Administrative Expenditure	9.99	9.40	13.04	18.60	14.66
4 Other Expenditure	0.00	0.00	0.00	0.00	0.00
5 Suspense Account	2.55	2.71	2.86	3.64	2.64
Security Deposits refunds to contractors	1.94	1.25	1.07	2.10	1.26
Staff Loan	0.61	1.46	1.79	1.54	1.38

Receipts in Capital Account					
Capital Receipts Total	0.00	0.00	0.00	0.00	0.00
Loan	0.00	0.00	0.00	0.00	0.00
Center Transfer	0.00	0.00	0.00	0.00	0.00
State Transfer	0.00	0.00	0.00	0.00	0.00
Revolving Fund	0.00	0.00	0.00	0.00	0.00
Other sources	0.00	0.00	0.00	0.00	0.00
Opening Balance	32.25	7.97	42.28	91.45	91.44
Revenue Account Total	283.65	356.15	514.83	440.17	413.13
Capital Account Total	0.00	0.00	0.00	0.00	0.00
Total	315.90	364.12	557.11	531.62	504.57

Expenditure in Capital Account					
Capital Expenditure	0.00	0.00	0.00	0.00	0.00
Sewers & Public Toilets	0.00	0.00	0.00	0.00	0.00
Others	0.00	0.00	0.00	0.00	0.00
Revolving Fund	0.00	0.00	0.00	0.00	0.00
Revenue Account Total	307.93	321.84	465.66	440.18	395.00
Capital Account Total	0.00	0.00	0.00	0.00	0.00
Closing Balance	7.97	42.28	91.45	91.44	109.57
Total	315.90	364.12	557.11	531.62	504.57

Source: Budget Statement of the Nagar Nigam -Varanasi for 1999,2000,2001,2002,2003

Note: In Varanasi, the Grants from the State Government are not shown in the Capital Account. They are treated as revenue account as the same is given in lieu of Octroi Tax.

Appendix H: Table 1-2 Annual Financial Statement of Jal Sansthan (Varanasi)

(Unit: million Rs.)

Receipts in Current Account

Description	1997-98	1998-99	1999-2000	2000-01
Revenue Receipts	60.36	81.81	89.37	98.33
1 Tax Revenue	30.38	55.37	68.86	75.36
Water Tax	24.00	48.78	62.01	66.32
Sewer Tax	6.38	6.59	6.85	9.04
2 Water Charge	27.73	21.31	17.34	22.35
3 Government Grants	0.00	2.32	1.76	0.00
Grant for Handpumps	0.00	2.32	0.00	0.00
Grant from Jal Nigam	0.00	0.00	1.68	0.00
Other Grants	0.00	0.00	0.08	0.00
4 Others	2.26	2.81	1.41	0.63

Expenditure in Current Account

Description		1997-98	1998-99	1999-2000	2000-01
Revenue Expenditure		134.22	158.37	181.73	215.95
1 Salary	0.00	55.33	66.47	79.96	85.65
Salary & Allowances		54.39	64.51	77.61	82.27
Pension		0.94	1.96	2.35	3.38
2 Repairs & Maintenance		4.06	7.63	5.48	6.66
3 Consumables		5.25	5.41	5.37	5.09
4 General Operations		0.00	0.00	0.00	0.00
5 Electricity		51.18	60.29	72.05	100.12
6 General Tax		0.00	0.00	0.00	0.00
7 Administerative Expenditure		0.52	0.69	0.75	0.29
8 Interest		0.41	0.41	0.41	0.41
9 Depreciation		17.47	17.47	17.70	17.73
10 **Excess of Receipts over Payments (loss/Profit)**		-73.86	-76.56	-92.36	-117.62

Receipts in Capital Account

Description	1997-98	1998-99	1999-2000	2000-01
Capital Receipts	929.39	1,023.74	1,142.42	1,293.90
Capital Fund	344.07	391.40	488.35	488.35
Government Grants	22.76	22.76	22.76	23.92
Reserves Depreciation	68.83	86.31	104.01	121.75
Employee fund	11.00	12.55	15.21	18.13
Borrowings	303.89	303.89	303.89	303.89
Payables	178.84	206.84	208.19	337.87

Expenditure in Capital Account

Description	1997-98	1998-99	1999-2000	2000-01
Capital Expenditure	929.39	1,023.74	1,142.42	1,293.90
Fixed Assets	345.32	351.17	371.05	389.16
Investments	84.88	84.88	84.88	84.88
Other assets	98.49	110.42	116.86	132.62
Surplus / Deficit	400.70	477.27	569.63	687.25

Source: Audited Balance Sheet of Jal Sansthan for 1998,1999,2000,2001

Appendix H: Table 2 Group-wise Consumer Price Index for Industrial Workers in India

A. Consumer Price Index (Base : 1982=100)

Year	Financial year average index for:						
	General	Food	Pan, Supari, Tobacco and Intoxicants	Fuel & Light	Housing	Clothing, Bedding and Footwear	Misc.
1990-91	193	199	243	186	185	154	187
1991-92	219	230	280	204	198	169	210
1992-93	240	254	315	220	212	185	232
1993-94	258	272	340	234	224	201	251
1994-95	284	304	368	243	237	227	273
1995-96	313	337	397	260	255	253	294
1996-97	342	369	432	295	280	271	322
1997-98	366	388	479	328	304	286	354
1998-99	414	445	515	353	389	296	386
1999-00	428	446	565	379	437	306	416
2000-01	444	453	592	454	463	315	442

B. Variation Against Previous Year

Year	Price Increasing Ratios against Previous Year for:						
	General	Food	Pan, Supari, Tobacco and Intoxicants	Fuel & Light	Housing	Clothing, Bedding and Footwear	Misc.
1990-91	-	-	-	-	-	-	-
1991-92	13.47%	15.58%	15.23%	9.68%	7.03%	9.74%	12.30%
1992-93	9.59%	10.43%	12.50%	7.84%	7.07%	9.47%	10.48%
1993-94	7.50%	7.09%	7.94%	6.36%	5.66%	8.65%	8.19%
1994-95	10.08%	11.76%	8.24%	3.85%	5.80%	12.94%	8.76%
1995-96	10.21%	10.86%	7.88%	7.00%	7.59%	11.45%	7.69%
1996-97	9.27%	9.50%	8.82%	13.46%	9.80%	7.11%	9.52%
1997-98	7.02%	5.15%	10.88%	11.19%	8.57%	5.54%	9.94%
1998-99	13.11%	14.69%	7.52%	7.62%	27.96%	3.50%	9.04%
1999-00	3.38%	0.22%	9.71%	7.37%	12.34%	3.38%	7.77%
2000-01	3.74%	1.57%	4.78%	19.79%	5.95%	2.94%	6.25%
Average Annual Increase Rate Since 1990-91	8.69%	8.57%	9.31%	9.33%	9.61%	7.42%	8.98%

Source : Labour Bureau, Govt. of India.

Appendix H: Table 3 Average Number of Ghat Users in Varanasi

Varanasi (Unit: Persons/Day)

Name of Ghat	Regular Users			Ocassional Users		
	Male	Female	Total	Male	Female	Total
Assi Ghat	1,800	600	2,400	13,000	12,000	25,000
Ganga Mahal Ghat	125	75	200	700	700	1,400
Reevan Ghat	40	60	100	1,300	1,800	3,100
Tulsi Ghat	100	200	300	1,000	2,000	3,000
Bhadaini Ghat	40	10	50	200	50	250
Janki Ghat	150	100	250	500	400	900
Anandi Mai Ghat	150	100	250	1,200	800	2,000
Vachchhraj Ghat	175	125	300	1,700	1,300	3,000
Jain Ghat	80	20	100	800	200	1,000
Shri Nishadraj Ghat	60	15	75	700	100	800
Panch Kot Ghat	65	15	80	700	200	900
Prabhu Ghat	60	10	70	300	50	350
Chet Singh Ghat	50	10	60	250	50	300
Niranjani Ghat	80	20	100	400	100	500
Mahanirvani Ghat*	-	-		-	-	
Shivala Ghat	30	30	60	300	400	700
Gularia Ghat	150	50	200	500	800	1,300
Dandi Ghat	400	100	500	500	700	1,200
Prachin Hanuman Ghat	100	50	150	800	1,200	2,000
Karnataka State Ghat*	50	-		125	25	
Harishchandra Ghat*	-	-		-	-	
Lali Ghat	40	10	50	125	25	150
Vijay Nagar Ghat	325	125	450	800	400	1,200
Kedar Ghat	400	400	800	2,500	2,500	5,000
Chowkia Ghat	50	25	75	75	50	125
Someshwar Ghat	70	30	100	300	200	500
Mansarovar Ghat	70	30	100	350	250	600
Narad Ghat	300	100	400	1,000	2,000	3,000
Raja Ghat	500	200	700	3,000	5,000	8,000
Babuwa Pandey Ghat	100	50	150	300	400	700
Pandey Ghat	450	50	500	500	1,500	2,000
Dimpatiya Ghat*	10	-		75	25	
Chowshahi Ghat	500	100	600	500	1,500	2,000
Ranamahal Ghat	460	40	500	300	100	400
Munshi Ghat	280	100	380	2,800	1,200	4,000
Darbhanga Ghat	350	20	370	1,500	1,000	2,500
Ahilyabai Ghat	50	75	125	3,000	4,000	7,000
Sheetla Ghat	75	100	175	1,500	2,500	4,000
Deshashwamedh Ghat	1,500	2,000	3,500	40,000	60,000	100,000
Dr. Rajendra Prasad Ghat	500	350	850	2,500	6,000	8,500
Prayag Ghat	125	175	300	2,000	3,000	5,000
Maan Mandir Ghat	300	100	400	2,500	2,500	5,000
Tripura Bhairavi Ghat	200	100	300	1,700	1,300	3,000
Meer Ghat	100	50	150	700	300	1,000
Lalita Ghat	125	25	150	700	200	900
Sindia Ghat	250	100	350	1,500	1,500	3,000
Manikarnika Ghat	350	50	400	4,000	1,000	5,000
Sankta Ghat*	N	N		-	-	
Gaushala Ghat	25	25	50	400	600	1,000
Jalesan Ghat	60	15	75	400	100	500
Gnagamahal Ghat*	-	-		-	-	
Ganesh Ghat*	-	-		-	-	
Mehta Ghat	175	75	250	400	1,100	1,500
Ram Ghat	60	40	100	600	1,400	2,000
Jatar Ghat	75	25	100	600	200	800
Raja Gwalior Ghat	80	20	100	600	200	800
Bala Ghat	150	50	200	700	300	1,000
Panch Ganga Ghat	250	150	400	2,000	2,000	4,000
Durga Ghat	300	100	400	3,000	2,000	5,000
Brhama Ghat	200	100	300	1,200	800	2,000
Bundi Parkota Ghat	55	15	70	350	150	500
Sheetla Ghat (2nd)	125	75	200	400	300	700
Lal Ghat	35	15	50	350	250	600
Shir Hanuman Gharhi Ghat	400	150	550	2,500	2,000	4,500
Gaay Ghat	300	200	500	2,000	3,000	5,000
Badrinath Ghat	200	100	300	800	1,200	2,000
Trilochan Ghat	450	150	600	4,500	3,500	8,000
Gola Ghat	400	100	500	600	400	1,000
Maheshwar Ghat	475	25	500	2,000	3,000	5,000
Sankata Ghat	150	50	200	200	800	1,000
Teliyana Nala Ghat	150	75	225	1,500	4,000	5,500
Naya Ghat	230	70	300	3,000	6,000	9,000
Nishad Ghat*	15	5		-	-	
Prahlad Ghat	450	350	800	3,000	3,500	6,500
Raj Ghat	125	75	200	800	1,200	2,000
Bhaisasur (Raj Ghat) Ghat	50	10	60	250	50	300
Khrikeya Ghat	100	50	150	450	1,000	1,450
Aadi Keshaw Ghat	150	40	190	3,000	12,000	15,000
Total excl.Ghats with *	16,345	8,145	24,490	134,600	172,325	306,925
Average per Ghat	234	116	350	1,923	2,462	4,385

(Note) Data for Ghats with * are imcomplete, so excluded in the analysis.
Source: Interview Survey by JICA Study Team, 2003.

Appendix H: Table 4 (1/2) Population and Household Projection on Sewer Services (Varanasi)

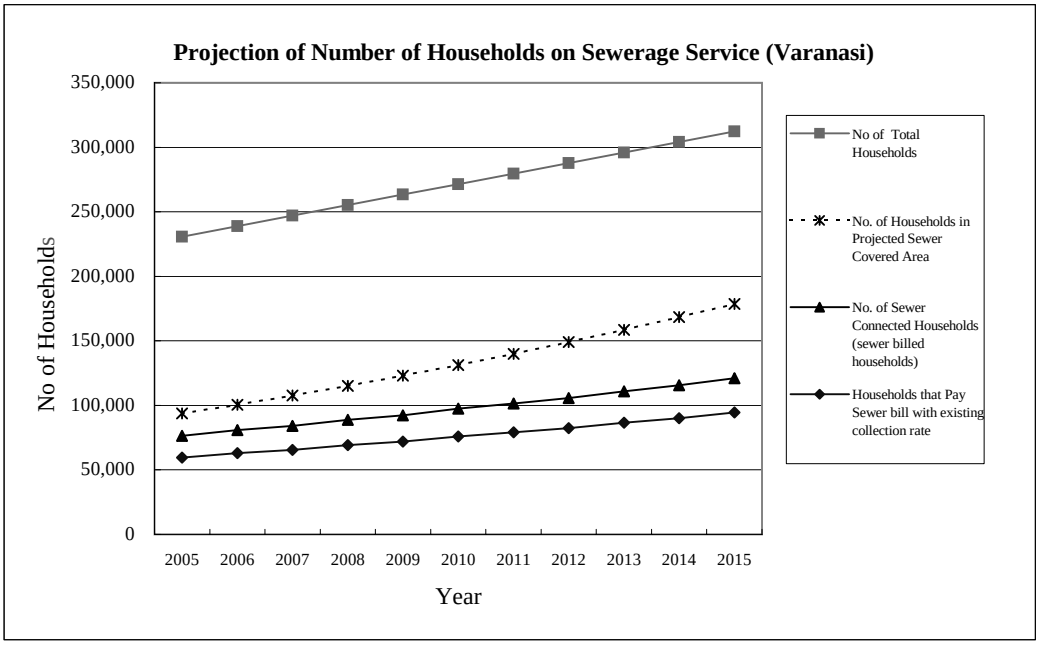
	Population					Projected Connection Rate (%)					Population Connected				
	District I	District II	District III	District IV	Total	District I	District II	District III	District IV	Total	District I	District II	District III	District IV	Total
2005	520,663	630,770	172,312	95,216	1,418,961	0.61	0.19	0.19	0.00	0.331	317,604	119,846	32,739	0	470,189
2006	524,626	657,135	184,372	102,969	1,469,102	0.62	0.20	0.22	0.00	0.338	325,268	131,427	40,562	0	497,257
2007	528,589	683,496	196,431	110,723	1,519,239	0.63	0.20	0.24	0.00	0.340	333,011	136,699	47,143	0	516,853
2008	532,552	709,860	208,490	118,477	1,569,379	0.64	0.21	0.27	0.00	0.348	340,833	149,071	56,292	0	546,196
2009	536,515	736,224	220,550	126,231	1,619,520	0.65	0.21	0.29	0.00	0.350	348,735	154,607	63,960	0	567,302
2010	540,477	762,587	232,609	133,983	1,669,656	0.66	0.22	0.32	0.00	0.359	356,715	167,769	74,435	0	598,919
2011	544,440	788,951	244,668	141,737	1,719,796	0.66	0.23	0.34	0.00	0.363	359,330	181,459	83,187	0	623,976
2012	548,403	815,316	256,727	149,491	1,769,937	0.67	0.23	0.37	0.00	0.367	367,430	187,523	94,989	0	649,942
2013	552,366	841,677	268,787	157,245	1,820,075	0.68	0.24	0.39	0.00	0.375	375,609	202,002	104,827	0	682,438
2014	556,329	868,041	280,845	164,998	1,870,213	0.69	0.24	0.42	0.00	0.380	383,867	208,330	117,955	0	710,152
2015	560,292	894,405	292,905	172,752	1,920,354	0.70	0.25	0.44	0.00	0.388	392,204	223,601	128,878	0	744,683
2016	563,255	924,027	304,976	180,641	1,972,899	0.71	0.27	0.46	0.03	0.403	399,911	249,487	140,289	5,419	795,106
2017	566,218	953,648	317,047	188,529	2,025,442	0.71	0.30	0.49	0.07	0.423	402,015	286,094	155,353	13,197	856,659
2018	569,180	983,271	329,118	196,419	2,077,988	0.72	0.32	0.51	0.10	0.439	409,810	314,647	167,850	19,642	911,949
2019	572,143	1,012,892	341,188	204,308	2,130,531	0.73	0.34	0.54	0.13	0.457	417,664	344,383	184,242	26,560	972,849
2020	575,106	1,042,514	353,259	212,196	2,183,075	0.73	0.37	0.56	0.17	0.476	419,827	385,730	197,825	36,073	1,039,455
2021	578,069	1,072,135	365,330	220,085	2,235,619	0.74	0.39	0.58	0.20	0.493	427,771	418,133	211,891	44,017	1,101,812
2022	581,032	1,101,757	377,401	227,974	2,288,164	0.75	0.41	0.61	0.23	0.511	435,774	451,720	230,215	52,434	1,170,143
2023	583,994	1,131,380	389,473	235,863	2,340,710	0.75	0.44	0.63	0.27	0.532	437,996	497,807	245,368	63,683	1,244,854
2024	586,957	1,161,002	401,544	243,752	2,393,255	0.76	0.46	0.66	0.30	0.551	446,087	534,061	265,019	73,126	1,318,293
2025	589,920	1,190,623	413,615	251,641	2,445,799	0.77	0.48	0.68	0.33	0.568	454,238	571,499	281,258	83,042	1,390,037
2026	592,883	1,220,245	425,686	259,529	2,498,343	0.77	0.51	0.70	0.37	0.590	456,520	622,325	297,980	96,026	1,472,851
2027	595,846	1,249,866	437,756	267,418	2,550,886	0.78	0.53	0.73	0.40	0.609	464,760	662,429	319,562	106,967	1,553,718
2028	598,808	1,279,489	449,827	275,308	2,603,432	0.79	0.55	0.75	0.43	0.627	473,058	703,719	337,370	118,382	1,632,529
2029	601,771	1,309,110	461,898	283,196	2,655,975	0.79	0.58	0.78	0.47	0.651	475,399	759,284	360,280	133,102	1,728,065
2030	604,734	1,338,732	473,969	291,085	2,708,520	0.80	0.60	0.80	0.50	0.669	483,787	803,239	379,175	145,543	1,811,744

	The Number of Total Households										Households Connected				
	District I	District II	District III	District IV	Total	District I	District II	District III	District IV	Total	District I	District II	District III	District IV	Total
2005	84,661	102,564	28,018	15,482	230,725						51,643	19,487	5,323	0	76,453
2006	85,305	106,851	29,979	16,743	238,878						52,889	21,370	6,595	0	80,854
2007	85,949	111,138	31,940	18,004	247,031					(Persons/HH)	54,148	22,227	7,666	0	84,041
2008	86,594	115,424	33,901	19,265	255,184	Income Group	Family Size				55,420	24,239	9,153	0	88,812
2009	87,238	119,711	35,862	20,525	263,336		Lucknow	Kanpur	Allahabad	Varanasi	56,705	25,139	10,400	0	92,244
2010	87,882	123,998	37,823	21,786	271,489	Low	6.18	6.38	6.67	7.64	58,002	27,280	12,103	0	97,385
2011	88,527	128,285	39,783	23,047	279,642	Medium	5.99	6.03	6.10	7.60	58,428	29,506	13,526	0	101,460
2012	89,171	132,572	41,744	24,307	287,794	High	6.27	6.80	6.20	6.97	59,745	30,492	15,445	0	105,682
2013	89,816	136,858	43,705	25,568	295,947	Overall Average	6.15	6.40	6.32	7.40	61,075	32,846	17,045	0	110,966
2014	90,460	141,145	45,666	26,829	304,100	Source:	A result of the Study on Public Awareness made by JICA Study T				62,417	33,875	19,180	0	115,472
2015	91,104	145,432	47,627	28,090	312,253						63,773	36,358	20,956	0	121,087
2016	91,586	150,248	49,590	29,373	320,797						65,026	40,567	22,811	881	129,285
2017	92,068	155,065	51,552	30,655	329,340						65,368	46,519	25,261	2,146	139,294
2018	92,550	159,881	53,515	31,938	337,884						66,636	51,162	27,293	3,194	148,285
2019	93,031	164,698	55,478	33,221	346,428						67,913	55,997	29,958	4,319	158,187
2020	93,513	169,514	57,440	34,503	354,970						68,265	62,720	32,167	5,866	169,018
2021	93,995	174,331	59,403	35,786	363,515	input cells					69,556	67,989	34,454	7,157	179,156
2022	94,477	179,147	61,366	37,069	372,059						70,858	73,450	37,433	8,526	190,267
2023	94,958	183,964	63,329	38,352	380,603						71,219	80,944	39,897	10,355	202,415
2024	95,440	188,781	65,292	39,634	389,147	Note:					72,534	86,839	43,093	11,890	214,356
2025	95,922	193,597	67,254	40,917	397,690	This table is generated by revising the Sewerage Master Plan data.					73,860	92,927	45,733	13,503	226,023
2026	96,404	198,414	69,217	42,200	406,235						74,231	101,191	48,452	15,614	239,488
2027	96,886	203,230	71,180	43,483	414,779						75,571	107,712	51,961	17,393	252,637
2028	97,367	208,047	73,143	44,766	423,323						76,920	114,426	54,857	19,249	265,452
2029	97,849	212,863	75,105	46,048	431,865						77,301	123,461	58,582	21,643	280,987
2030	98,331	217,680	77,068	47,331	440,410						78,665	130,608	61,654	23,666	294,593

	Population in Sewerage Covered Area					Projected Sewerage Covered Area Percentage (%)					Households in Sewerage Covered Area				
	District I	District II	District III	District IV	Total	District I	District II	District III	District IV	Total	District I	District II	District III	District IV	Total
2005	416,530	126,154	34,462	0	577,146	0.80	0.20	0.20	0.00	0.410	67,728	20,513	5,604	0	93,845
2006	424,947	151,141	42,406	0	618,494	0.81	0.23	0.23	0.00	0.420	69,097	24,576	6,895	0	100,568
2007	433,443	177,709	51,072	0	662,224	0.82	0.26	0.26	0.00	0.440	70,479	28,896	8,304	0	107,679
2008	442,018	205,859	60,462	0	708,339	0.83	0.29	0.29	0.00	0.450	71,873	33,473	9,831	0	115,177
2009	450,673	235,592	70,576	0	756,841	0.84	0.32	0.32	0.00	0.470	73,280	38,308	11,476	0	123,064
2010	459,405	266,905	81,413	0	807,723	0.85	0.35	0.35	0.00	0.480	74,700	43,399	13,238	0	131,337
2011	468,218	299,801	92,974	0	860,993	0.86	0.38	0.38	0.00	0.500	76,133	48,748	15,118	0	139,999
2012	477,111	334,280	105,258	0	916,649	0.87	0.41	0.41	0.00	0.520	77,579	54,354	17,115	0	149,048
2013	486,082	370,338	118,266	0	974,686	0.88	0.44	0.44	0.00	0.540	79,038	60,218	19,230	0	158,486
2014	495,133	407,979	131,997	0	1,035,109	0.89	0.47	0.47	0.00	0.550	80,509	66,338	21,463	0	168,310
2015	504,263	447,203	146,453	0	1,097,919	0.90	0.50	0.50	0.00	0.570	81,994	72,716	23,813	0	178,523
2016	506,930	249,487	140,289	5,419	902,125	0.90	0.27	0.46	0.03	0.460	82,428	40,567	22,811	881	146,687
2017	509,596	286,094	155,353	13,197	964,240	0.90	0.30	0.49	0.07	0.480	82,861	46,519	25,261	2,146	156,787
2018	512,262	314,647	167,850	19,642	1,014,401	0.90	0.32	0.51	0.10	0.490	83,295	51,162	27,293	3,194	164,944
2019	514,929	344,383	184,242	26,560	1,070,114	0.90	0.34	0.54	0.13	0.500	83,728	55,997	29,958	4,319	174,002
2020	517,595	385,730	197,825	36,073	1,137,223	0.90	0.37	0.56	0.17	0.520	84,162	62,720	32,167	5,866	184,915
2021	520,262	418,133	211,891	44,017	1,194,303	0.90	0.39	0.58	0.20	0.530	84,595	67,989	34,454	7,157	194,195
2022	522,929	451,720	230,215	52,434	1,257,298	0.90	0.41	0.61	0.23	0.550	85,029	73,450	37,433	8,526	204,438
2023	525,595	497,807	245,368	63,683	1,332,453	0.90	0.44	0.63	0.27	0.570	85,463	80,944	39,897	10,355	216,659
2024	528,261	534,061	265,019	73,126	1,400,467	0.90	0.46	0.66	0.30	0.590	85,896	86,839	43,093	11,890	227,718
2025	530,928	571,499	281,258	83,042	1,466,727	0.90	0.48	0.68	0.33	0.600	86,330	92,927	45,733	13,503	238,493
2026	533,595	622,325	297,980	96,026	1,549,926	0.90	0.51	0.70	0.37	0.620	86,763	101,191	48,452	15,614	252,020
2027	536,261	662,429	319,562	106,967	1,625,219	0.90	0.53	0.73	0.40	0.640	87,197	107,712	51,961	17,393	264,263
2028	538,927	703,719	337,370	118,382	1,698,398	0.90	0.55	0.75	0.43	0.650	87,630	114,426	54,857	19,249	276,162
2029	541,594	759,284	360,280	133,102	1,794,260	0.90	0.58	0.78	0.47	0.680	88,064	123,461	58,582	21,643	291,750
2030	544,261	937,112	379,175	145,543	2,006,091	0.90	0.70	0.80	0.50	0.740	88,498	152,376	61,654	23,666	326,194

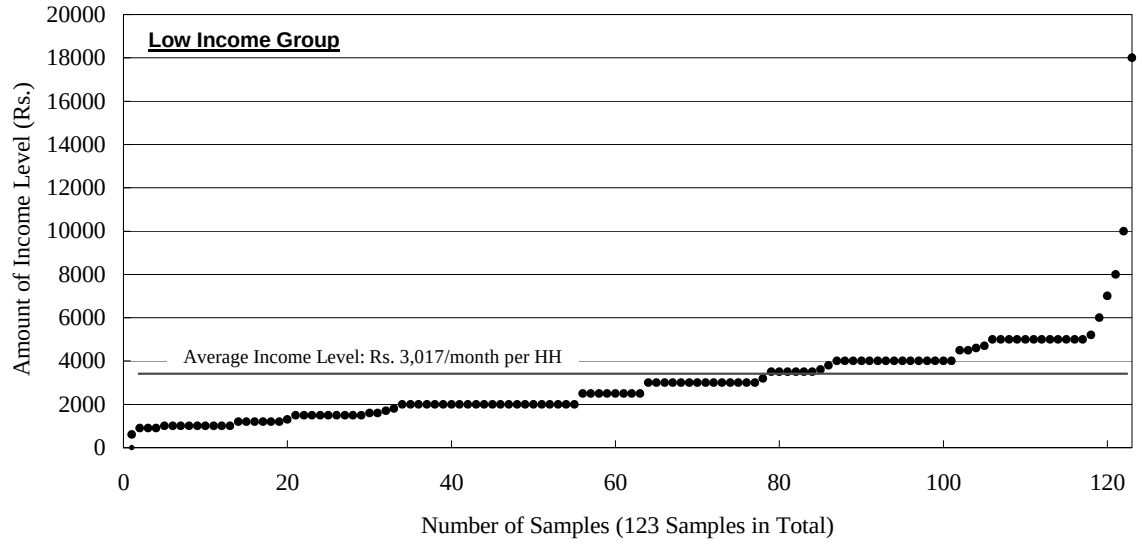
Appendix H: Table 4 (2/2) Population and Household Projection on Sewer Services (Varanasi)

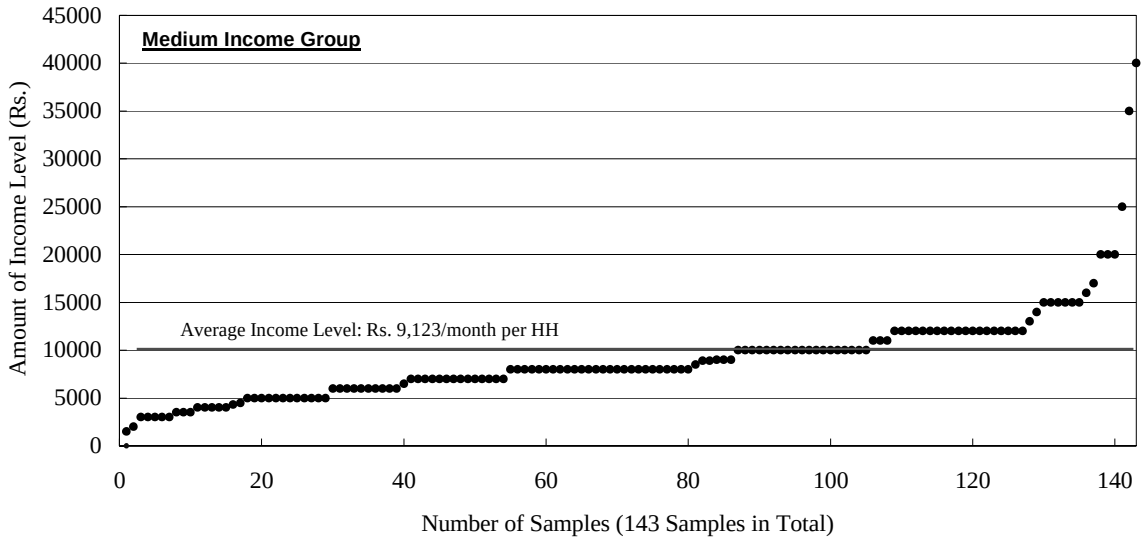
Year	Population Projection	No of Total Households	Projected Sewer Covered Area (branch sewer covered area)	No. of Households in Projected Sewer Covered Area	Projected Rate of Sewer Connection (sewer billed households)	Sewer Connected Population	No. of Sewer Connected Households (sewer billed households)	Percentage of Sewer connected Households that Pay Sewer Bill (existing collection rate)	Households that Pay Sewer bill with existing collection rate
2005	1,418,961	230,725	0.41	93,845	0.331	470,189	76,453	0.78	59,633
2006	1,469,102	238,878	0.42	100,568	0.338	497,257	80,854	0.78	63,066
2007	1,519,239	247,031	0.44	107,679	0.340	516,853	84,041	0.78	65,552
2008	1,569,379	255,184	0.45	115,177	0.348	546,196	88,812	0.78	69,273
2009	1,619,520	263,336	0.47	123,064	0.350	567,302	92,244	0.78	71,950
2010	1,669,656	271,489	0.48	131,337	0.359	598,919	97,385	0.78	75,960
2011	1,719,796	279,642	0.50	139,999	0.363	623,976	101,460	0.78	79,139
2012	1,769,937	287,794	0.52	149,048	0.367	649,942	105,682	0.78	82,432
2013	1,820,075	295,947	0.54	158,486	0.375	682,438	110,966	0.78	86,553
2014	1,870,213	304,100	0.55	168,310	0.380	710,152	115,472	0.78	90,068
2015	1,920,354	312,253	0.57	178,523	0.388	744,683	121,087	0.78	94,448
2016	1,972,899	320,797	0.46	146,687	0.403	795,106	129,285	0.78	100,842
2017	2,025,442	329,340	0.48	156,787	0.423	856,659	139,294	0.78	108,649
2018	2,077,988	337,884	0.49	164,944	0.439	911,949	148,285	0.78	115,662
2019	2,130,531	346,428	0.50	174,002	0.457	972,849	158,187	0.78	123,386
2020	2,183,075	354,970	0.52	184,915	0.476	1,039,455	169,018	0.78	131,834
2021	2,235,619	363,515	0.53	194,195	0.493	1,101,812	179,156	0.78	139,742
2022	2,288,164	372,059	0.55	204,438	0.511	1,170,143	190,267	0.78	148,408
2023	2,340,710	380,603	0.57	216,659	0.532	1,244,854	202,415	0.78	157,884
2024	2,393,255	389,147	0.59	227,718	0.551	1,318,293	214,356	0.78	167,198
2025	2,445,799	397,690	0.60	238,493	0.568	1,390,037	226,023	0.78	176,298
2026	2,498,343	406,235	0.62	252,020	0.590	1,472,851	239,488	0.78	186,801
2027	2,550,886	414,779	0.64	264,263	0.609	1,553,718	252,637	0.78	197,057
2028	2,603,432	423,323	0.65	276,162	0.627	1,632,529	265,452	0.78	207,053
2029	2,655,975	431,865	0.68	291,750	0.651	1,728,065	280,987	0.78	219,170
2030	2,708,520	440,410	0.74	326,194	0.669	1,811,744	294,593	0.78	229,783

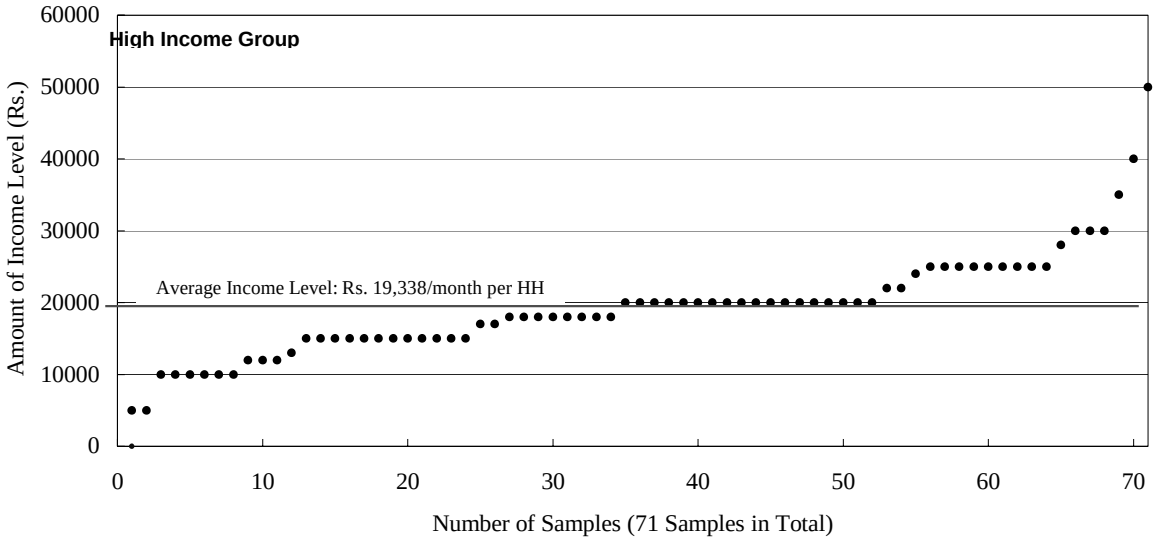


Appendix H: Table 5 Income Level (Varanasi)

Source: A result of the Study on Public Awareness made by JICA Study Team, 2003.







Appendix H: Table 6 Cost Estimation of the Project

(Unit: million Rs.) As of 2004

Cost Items	Total	Disbursement Schedule					
		2006	2007	2008	2009	2010	2011
Sewerage							
Direct Construction Cost	3,262.37	4.32	779.71	824.67	586.92	781.87	284.88
STP & PS	1,354.54	0.00	338.56	338.56	225.81	338.71	112.90
Pipe	1,907.83	4.32	441.15	486.11	361.11	443.16	171.98
Land Acquisition	198.26	198.26	0.00	0.00	0.00	0.00	0.00
Detailed Design	195.73	182.24	13.49	0.00	0.00	0.00	0.00
Supervision	163.12	0.22	38.99	41.23	29.35	39.09	14.24
Project Administration	163.12	0.22	38.99	41.23	29.35	39.09	14.24
Physical Contingencies	163.12	0.22	38.99	41.23	29.35	39.09	14.24
Total	4,145.72	385.48	910.17	948.36	674.97	899.14	327.60
Non-sewerage							
Direct Construction Cost	278.42	51.85	72.47	92.98	61.12	0.00	0.00
Detailed Design	13.92	2.59	3.62	4.65	3.06	0.00	0.00
Supervision	13.92	2.59	3.62	4.65	3.06	0.00	0.00
Project Administration	27.85	5.19	7.25	9.30	6.11	0.00	0.00
Physical Contingencies	13.92	2.59	3.62	4.65	3.06	0.00	0.00
Total	348.03	64.81	90.58	116.23	76.41	0.00	0.00
Public Participation & Awareness (PP/PA)	56.45	12.9	10.3	9.6	7.8	8.1	7.7
Institutional Deveopment Programme (IDP)	281.60	56.30	84.50	84.50	28.20	14.10	14.00
Total	4,831.80	519.49	1,095.59	1,158.72	787.42	921.31	349.27
Price Contingencies (Price Escalation)	2,631.18	139.55	408.58	565.54	491.24	708.63	317.64
Financial Cost (Excl.Price Contingencies)	4,831.80	519.49	1,095.59	1,158.72	787.42	921.31	349.27
Financial Cost (Incl.Price Contingencies)	7,462.98	659.04	1,504.17	1,724.26	1,278.66	1,629.94	666.91
Economic Cost (Excl.Price &Physical contingencies)	3,768.53	363.47	876.58	917.32	615.80	720.25	275.11
Economic Cost (Excl.Price contingencies)	3,906.62	365.66	909.82	953.10	641.08	750.74	286.22
Foreign Finance (Loan Amount)	7,074	455	1,458	1,674	1,243	1,591	653
Local Finance	389	204	46	51	35	39	14

O&M				Year			
			2012	2013	2014	2015	2016
O&M cost (financial)			150.78	159.65	168.52	177.39	177.39
O&M cost (economic)			122.34	129.53	136.73	143.93	143.93
O&M yearly ratio			0.85	0.90	0.95	1.00	1.00
Replacement				Year			
1. Proposed facilities		2026	2041	2056			
Financial cost	1,355	406.36	406.36	406.36			
Econimic cost		358.01	358.01	358.01			
2. Sanctioned and existing facilities							
Financial cost	919	275.78	275.78	275.78			
Econimic cost		242.96	242.96	242.96			
Total							
Financial cost		682.14	682.14	682.14			
Econimic cost		600.97	600.97	600.97			

(Note)

1.	There is no FC Portion in Direct Construction Cost.		
2.	Engineering Cost for Detailed Design for Sewerage Schemes:	6.00%	of Direct Construction Cost.
3.	Engineering Cost for Detailed Design for Non-Sewerage Schemes:	10.00%	of Direct Construction Cost.
4.	Engineering Cost for Supervision:	5.00%	of Direct Construction Cost.
5.	Cost for Social Awareness:	1.00%	of Direct Construction Cost and Engineering Cost for Detailed Design.
6.	Administration Cost for Sewerage Schemes:	5.00%	of Direct Construction Cost.
7.	Administration Cost for Non-Sewerage Schemes:	10.00%	of Direct Construction Cost.
8.	Physical Contingencies:	5.00%	of Direct Construction Cost.
9.	Share Rate of Equipment/materials to STP and Pumping Stations:	70%	
10.	Share Rate of Labor Cost to STP and Pumping Stations::	30%	
11.	Share Rate of Equipment/materials to Trank/Branch Sewers:	50%	
12.	Share Rate of Labor Cost to Trunk/Branch Sewers:	50%	of Direct ConstructionCost.
13.	Share Rate of Labor Cost to Non-Sewerage Schemes:	50%	
14.	SCF:	0.88101	(SCF: Standard Conversion Factor for tradable goods)
15.	Contractor's Profit:	10%	of Direct Construction Cost and Engineering Cost in LC portion.
16.	Corporate Income Tax:	35%	of corporate income.
17.	Personal Income Tax:	10%	of labor cost.
18.	Shadow Price Rate:	0.0906	of land acquisition cost.
19.	Shadow Wage Rate:	0.5	of labor cost.
20.	Price Escalation for LC:	8.69%	per annum for LC Portion other than Engineering based on last 10 years in India according to the Statistics.
21.	Price Escalation for FC:	0.50%	per annum for FC Portion as Engineering based on last 10 years according to the the Bank of Japan.
22	Replacement cost	30%	STP & PS construction cost

Appendix H: Table 7 Calculation of Standard Conversion Factor

(Unit: million Rs.)

Year	Import Amount*	Export Amount*	Import Duties (Custom Duties)**	Export Tax	Export Subsidies
1992-93	633,745	536,883	237,764	0	0
1993-94	731,010	697,514	221,927	0	0
1994-95	899,707	826,741	267,891	0	0
1995-96	1,226,781	1,063,533	357,568	0	0
1996-97	1,389,197	1,188,171	428,510	0	0
1997-98	1,541,763	1,301,006	401,928	0	0
1998-99	1,783,319	1,397,531	406,683	0	0
1999-00	2,152,365	1,595,614	484,196	0	0
2000-01	2,308,728	2,035,710	341,630	0	0
Total	12,666,614	10,642,704	3,148,096	0	0
Source:				SCF =	0.88101

*: Handbook of Statistics on Indian Economy, Reserve Bank of India, 2001.

**: Indian Public Finance Statistics 2002-2003.

Note: $$SCF = \frac{\sum I + \sum E}{(\sum I + \sum I_{customs}) + (\sum E - \sum E_{tax} + \sum E_{subsidy})}$$

Where, SCF = standard conversion factor,
I = import amount,
E = export amount
$I_{customs}$ = import duties (custom duties)
E_{tax} = export tax, and
$E_{subsidy}$ = export subsidies.

Appendix H: Table 8 Calculation of Economic Internal Rate of Return (EIRR) (Varanasi)

(Unit: Rs. Million)

Year in Order	Fiscal Year	Economic Cost				Economic Benefits													Cash Balance
						WTP for Improvement for Water Quality		WTP for Sewerage Services		Saving of Medical Expenditures	Saving of Salaries/ Wages	Contribution to Local Economy				Agricultural Benefit Due to Treated Water Discharged for Irrigation	Total		
												Regular Users		Occasional Users					
		Construction Cost	O&M cost	Replacement cost	Total	Total households	Basic unit: **326** Rs./Y per HH	Total households	Basic unit: **1,081** Rs./Y per HH	Basic unit: **162** Rs./Y per HH	Basic unit: **12** Rs./Y per HH	Population Projection	Basic unit: **16,425** Rs./Y per person	Population Projection	Basic unit: **54,750** Rs./Y per person	**14,378 Rs. /ha**		
0	2005																		
1	2006	363			363												0	-363	
2	2007	877			877												0	-877	
3	2008	917			917												0	-917	
4	2009	616			616												0	-616	
5	2010	720			720												0	-720	
6	2011	275			275												0	-275	
7	2012		122		122	287,794	94	105,682	114	17	1	2,981	49	5,989	328	43	646	524	
8	2013		130		130	295,947	96	110,966	120	18	1	3,053	50	6,108	334	43	663	534	
9	2014		137		137	304,100	99	115,472	125	19	1	3,125	51	6,229	341	43	680	543	
10	2015		144		144	312,253	102	121,087	131	20	1	3,196	52	6,353	348	43	697	553	
11	2016		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
12	2017		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
13	2018		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
14	2019		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
15	2020		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
16	2021		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
17	2022		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
18	2023		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
19	2024		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
20	2025		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
21	2026		144	601	745	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	-40	
22	2027		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
23	2028		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
24	2029		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
25	2030		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
26	2031		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
27	2032		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
28	2033		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
29	2034		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
30	2035		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
31	2036		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
32	2037		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
33	2038		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
34	2039		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
35	2040		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
36	2041		144	601	745	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	-40	
37	2042		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
38	2043		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
39	2044		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
40	2045		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
41	2046		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
42	2047		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
43	2048		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
44	2049		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
45	2050		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
46	2051		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
47	2052		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
48	2053		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
49	2054		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
50	2055		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
51	2056		144	601	745	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	-40	
52	2057		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
53	2058		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
54	2059		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
55	2060		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
56	2061		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
57	2062		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
58	2063		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
59	2064		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
60	2065		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
61	2066		144		144	312,253	102	121,087	131	20	1	3,268	54	6,479	355	43	705	561	
Total		3,769	7,873	1,803	13,444		5,577		7,168	1,074	81		2,940		19,443	2,372	38,657	25,212	
Net Present Value (Discount Rate at 10 %					3,660												3,896	237	
																EIRR:		10.7%	
																B/C		1.06	
(Note) It is assumed that occasional bathing population is one third of that got from the Interview Survey from the conservative viewpoint.																Discount rate		0.1	

Appendix : Table 9
Estimation of Suitable Revenue Level of Jal Sansthan to Recover O&M Cost (Varanasi)

(Unit: Rs. Million)

Year in Order	Fiscal Year	Financial Cost				Financial Benefit		Cash Balance
		Const-ruction Cost	O&M cost	Re-place-ment cost	Total	Amount of Revenue to Be Balanced with O/M Cost		
						Connected HHs	Value per Bill to Be Needed (Rs/Bill)	
							2,040	
0	2005							
1	2006	0	0	0	0	0	0	0
2	2007	0	0	0	0	0	0	0
3	2008	0	0	0	0	0	0	0
4	2009	0	0	0	0	0	0	0
5	2010	0	0	0	0	0	0	0
6	2011	0	0	0	0	0	0	0
7	2012	0	151	0	151	101,460	166	15
8	2013	0	160	0	160	105,682	172	13
9	2014	0	169	0	169	110,966	181	13
10	2015	0	177	0	177	115,472	188	11
11	2016	0	177	0	177	121,087	198	20
12	2017		177	0	177	121,087	198	20
13	2018		177	0	177	121,087	198	20
14	2019		177	0	177	121,087	198	20
15	2020		177	0	177	121,087	198	20
16	2021		177	0	177	121,087	198	20
17	2022		177	0	177	121,087	198	20
18	2023		177	0	177	121,087	198	20
19	2024		177	0	177	121,087	198	20
20	2025		177	0	177	121,087	198	20
21	2026		177	0	177	121,087	198	20
22	2027		177	0	177	121,087	198	20
23	2028		177	682	860	121,087	198	-662
24	2029		177	0	177	121,087	198	20
25	2030		177	0	177	121,087	198	20
26	2031		177	0	177	121,087	198	20
27	2032		177	0	177	121,087	198	20
28	2033		177	0	177	121,087	198	20
29	2034		177	0	177	121,087	198	20
30	2035		177	0	177	121,087	198	20
31	2036		177	0	177	121,087	198	20
32	2037		177	0	177	121,087	198	20
33	2038		177	0	177	121,087	198	20
34	2039		177	0	177	121,087	198	20
35	2040		177		177	121,087	198	20
36	2041		177	0	177	121,087	198	20
37	2042		177	0	177	121,087	198	20
38	2043		177	682	860	121,087	198	-662
39	2044		177	0	177	121,087	198	20
40	2045		177	0	177	121,087	198	20
41	2046		177	0	177	121,087	198	20
42	2047		177	0	177	121,087	198	20
43	2048		177	0	177	121,087	198	20
44	2049		177	0	177	121,087	198	20
45	2050		177	0	177	121,087	198	20
46	2051		177	0	177	121,087	198	20
47	2052		177	0	177	121,087	198	20
48	2053		177	0	177	121,087	198	20
49	2054		177	0	177	121,087	198	20
50	2055		177	0	177	121,087	198	20
51	2056		177	0	177	121,087	198	20
52	2057		177	0	177	121,087	198	20
53	2058		177	682	860	121,087	198	-662
54	2059		177	0	177	121,087	198	20
55	2060		177	0	177	121,087	198	20
56	2061		177	0	177	121,087	198	20
57	2062		177	0	177	121,087	198	20
58	2063		177	0	177	121,087	198	20
Total		0	9,171	2,046	11,217		10,193	-1,024
NPV (Discount Rate at 10 %)					1,067		1,069	2
B/C								1.00

Appendix H: Table 10 Establishment of New Financing Sources (Varanasi)

Due to Irrigation Water Supply Utilizing the Treated Water

As of 2004

Description	Calculation
Unit Price of Treated Water to Be Supplied: (According to Agriculture Department)	1,150 Rs. per ha
Irrigatable Area per Unit Volume of Water: (According to Agriculture Department)	15 ha per mld
Varanasi	200 mld
Period to Be Needed the Irrigation Water:	Paddy - 130 days Wheat - 100 days Total 230 days
Irrigatable Area by Delivering the Treated Water in Total (= 15 ha × 200 mld):	3,000 ha
Expected Total Sold Amount in Total: (= 1,150 Rs. ✕ 3,000 ha)	3,450,000 Rs./season
Adjusted Sold Amount in Total: (Assumed Selling Risk: 25%)	2,587,500 Rs./season
Irrigation for the Other Season for Greens: (Assumed Proportion of Water to Be Used for Greens: 50 % in Addition to the Main Crops)	1,293,750 Rs./season
Total Expected Amount due to Selling the Treated Water:	3,881,250 Rs./season

Due to Utilization of Generated Sludge as Fertilizer after Treatment

Sludge generated	Calculation
Expected Generated Volume of Sludge: (According to Expert of the Study Team)	250 mg/litre
Expected Volume of Compost Generated from Dry Base Sludge after Treatment: (According to an information from UPJN based on existing example in Allahabad)	250 kg/mld
Expected Selling Price:	0.5 Rs./kg

Existing Example in Allahabad

Generated Volume of Dry Base Sludge:	15	tons/day
Total Generated Volume per Month:	450	tons/month
Selling Price:	60,000	Rs./month
Unit Price per ton:	133	Rs./ton
(= Rs.60,000 ÷ 450 tons) =	0.133	Rs./kg

Generated Volume of Dry Base Sludge in Varanasi: (= 250 kg/mld ✕ 200 mld / 1,000))	50 tons/day
Generated Volume of Wet Base Sludge in Varanasi: (Water Content: 50 %.) (=25 ton × (1+1)	100 tons/day
Expected Selling Amount of Dry Base Sludge as Fertilizer (= 0.5 Rs./kg ✕ 31,000 kg ✕ 365 days):	18,250,000 Rs./year
Adjusted Sold Amount in Total: (Assumed Selling Risk: 25%)	13,687,500 Rs./season

Appendix H: Table 11 Repayment Ability for the Project of Improvement of Sewerage Facilities under the General Project (Varanasi)

Reference:

Conditions

1) Existing Charge Collection Rate (78%) and Existing Sewer Charge (112 Rs.)

2) Category of General Projects

30 Years of Repayment Period & 1.3 % interest rate per year

Expenditure from General Account

(Rs.million)

Year in Order	Fiscal Year	Out Flow					In Flow						Expenditure from the General Account of the Municipal, State & National Governments		
			Foreign borrow												
		Improve-ment of Sewerage Facilities	Interest Payment	Repay-ment of Principal	Total	O&M and Replace Cost	Foreign Borrow	Revenue in Case of Existing Collection Rate with Existing Value per Bill	Revenue Due to Newly Established Financing Sources (Selling of Treated Water for Irrigation and Sludge as Fertilizer)	State Govern-ment Transfer for Filling Deficit of O&M Cost	In flow in Total	Cash Balance	Annual Expendi-ture from General Account for **O/M Cost**	Annual Expendi-ture from General Account for **Initial Cost**	Total Amount of State Transfer
1	2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2006	659	6	0	665	0	455	0	0	0	455	-210	0	665	665
3	2007	1,504	25	0	1,529	0	1,458	0	0	0	1,458	-71	0	1,529	1,529
4	2008	1,724	47	0	1,771	0	1,674	0	0	0	1,674	-97	0	1,771	1,771
5	2009	1,279	63	0	1,341	0	1,243	0	0	0	1,243	-98	0	1,341	1,341
6	2010	1,630	83	0	1,713	0	1,591	0	0	0	1,591	-123	0	1,713	1,713
7	2011	667	92	0	759	0	653	0	0	0	653	-106	0	759	759
8	2012	0	92	0	92	151	0	9	18	124	151	-92	124	92	216
9	2013	0	92	0	92	160	0	9	18	133	160	-92	133	92	225
10	2014	0	92	0	92	169	0	9	18	142	169	-92	142	92	234
11	2015	0	92	0	92	177	0	9	18	151	177	-92	151	92	243
12	2016	0	92	0	92	177	0	9	18	151	177	-92	151	92	243
13	2017	0	87	354	441	177	0	9	18	151	177	-441	151	441	592
14	2018	0	87	354	441	177	0	9	18	151	177	-441	151	441	592
15	2019	0	83	354	436	177	0	9	18	151	177	-436	151	436	587
16	2020	0	78	354	432	177	0	9	18	151	177	-432	151	432	583
17	2021	0	74	354	427	177	0	9	18	151	177	-427	151	427	578
18	2022	0	69	354	423	177	0	9	18	151	177	-423	151	423	574
19	2023	0	64	354	418	177	0	9	18	151	177	-418	151	418	569
20	2024	0	60	354	413	177	0	9	18	151	177	-413	151	413	564
21	2025	0	55	354	409	177	0	9	18	151	177	-409	151	409	560
22	2026	0	51	354	404	177	0	9	18	151	177	-404	151	404	555
23	2027	0	46	354	400	177	0	9	18	151	177	-400	151	400	551
24	2028	0	41	354	395	860	0	9	18	833	860	-395	833	395	1,228
25	2029	0	37	354	390	177	0	9	18	151	177	-390	151	390	541
26	2030	0	32	354	386	177	0	9	18	151	177	-386	151	386	537
27	2031	0	28	354	381	177	0	9	18	151	177	-381	151	381	532
28	2032	0	23	354	377	177	0	9	18	151	177	-377	151	377	528
29	2033	0	18	354	372	177	0	9	18	151	177	-372	151	372	523
30	2034	0	14	354	367	177	0	9	18	151	177	-367	151	367	518
31	2035	0	9	354	363	177	0	9	18	151	177	-363	151	363	514
32	2036	0	5	354	358	177	0	9	18	151	177	-358	151	358	509
33	2037	0	0	354	354	177	0	9	18	151	177	-354	151	354	505
34	2038	0		354	354	177	0	9	18	151	177	-354	151	354	505
35	2039	0				177	0	9	18	151	177	0	151	0	151
36	2040	0				177	0	9	18	151	177	0	151	0	151
37	2041	0				177	0	9	18	151	177	0	151	0	151
38	2042	0				177	0	9	18	151	177	0	151	0	151
39	2043	0				860	0	9	18	833	860	0	833	0	833
40	2044	0				177	0	9	18	151	177	0	151	0	151
41	2045	0				177	0	9	18	151	177	0	151	0	151
42	2046					177	0	9	18	151	177	0	151	0	151
Total		7,463	1,736	7,781	16,981	7,520	7,074	312	615	6,593	14,593	-9,907		16,981	

(Note)

(1) Interest rate of foreign loan: 1.30%

(2) Equal annual repayment amount of capital for foreign loan (Rs.million): 354

Appendix H: Table 12 Repayment Ability for the Project of Improvement of Sewerage Facilities under the Specified Environmental Project (Varanasi)

Reference:

Expenditure from General Account

Conditions

1) Existing Charge Collection Rate (78%) and Existing Sewer Charge (112 Rs.)

2) Category of Specified Environmental Projects

40 Years of Repayment Period & 0.75 % interest rate per year

(Rs.million) (Rs.million)

Year in Order	Fiscal Year	Out Flow				In Flow							Expenditure from the General Account of the Municipal, State & National Governments		
			Foreign borrow												
		Improve-ment of Sewerage Facilities	Interest Payment	Repay-ment of Principal	Total	O&M and Repalce Cost	Foreign Borrow	Revenue in Case of Existing Collection Rate with Existing Value per Bill	Revenue Due to Newly Established Financing Sources (Selling of Treated Water for Irrigation and Sludge as Fertilizer)	Local Govern-ment Transfer for Filling Deficit of OM Cost	In flow in Total	Cash Balance	Annual Expendi-ture from General Account for **O&M Cost**	Annual Expendi-ture from General Account for **Initial Cost**	Total Amount of State Transfer
1	2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2008	1,724	13	0	1,737	0	1,674	0	0	0	1,674	-63	0	63	63
5	2009	1,279	22	0	1,301	0	1,243	0	0	0	1,243	-57	0	57	57
6	2010	1,630	34	0	1,664	0	1,591	0	0	0	1,591	-73	0	73	73
7	2011	667	39	0	706	0	653	0	0	0	653	-53	0	53	53
8	2012	0	39	0	39	151	0	9	18	124	151	-39	124	39	163
9	2013	0	39	0	39	160	0	9	18	133	160	-39	133	39	172
10	2014	0	39	0	39	169	0	9	18	142	169	-39	142	39	181
11	2015	0	39	0	39	177	0	9	18	151	177	-39	151	39	190
12	2016	0	39	172	211	177	0	9	18	151	177	-211	151	211	362
13	2017	0	39	172	211	177	0	9	18	151	177	-211	151	211	362
14	2018	0	37	172	209	177	0	9	18	151	177	-209	151	209	360
15	2019	0	36	172	208	177	0	9	18	151	177	-208	151	208	359
16	2020	0	35	172	207	177	0	9	18	151	177	-207	151	207	358
17	2021	0	34	172	206	177	0	9	18	151	177	-206	151	206	356
18	2022	0	32	172	204	177	0	9	18	151	177	-204	151	204	355
19	2023	0	31	172	203	177	0	9	18	151	177	-203	151	203	354
20	2024	0	30	172	202	177	0	9	18	151	177	-202	151	202	353
21	2025	0	28	172	200	177	0	9	18	151	177	-200	151	200	351
22	2026	0	27	172	199	177	0	9	18	151	177	-199	151	199	350
23	2027	0	26	172	198	177	0	9	18	151	177	-198	151	198	349
24	2028	0	25	172	197	860	0	9	18	833	860	-197	833	197	1,030
25	2029	0	23	172	195	177	0	9	18	151	177	-195	151	195	346
26	2030	0	22	172	194	177	0	9	18	151	177	-194	151	194	345
27	2031	0	21	172	193	177	0	9	18	151	177	-193	151	193	344
28	2032	0	19	172	191	177	0	9	18	151	177	-191	151	191	342
29	2033	0	18	172	190	177	0	9	18	151	177	-190	151	190	341
30	2034	0	17	172	189	177	0	9	18	151	177	-189	151	189	340
31	2035	0	15	172	187	177	0	9	18	151	177	-187	151	187	338
32	2036	0	14	172	186	177	0	9	18	151	177	-186	151	186	337
33	2037	0	13	172	185	177	0	9	18	151	177	-185	151	185	336
34	2038	0	12	172	184	177	0	9	18	151	177	-184	151	184	335
35	2039	0	10	172	182	177	0	9	18	151	177	-182	151	182	333
36	2040	0	9	172	181	177	0	9	18	151	177	-181	151	181	332
37	2041	0	8	172	180	177	0	9	18	151	177	-180	151	180	331
38	2042	0	6	172	178	177	0	9	18	151	177	-178	151	178	329
39	2043	0	5	172	177	860	0	9	18	833	860	-177	833	177	1,010
40	2044	0	4	172	176	177	0	9	18	151	177	-176	151	176	327
41	2045	0	3	172	175	177	0	9	18	151	177	-175	151	175	326
42	2046	0	1	172	173	177	0	9	18	151	177	-173	151	173	324
Total		5,300	900	5,332	11,533	7,520	5,160	312	615	6,593	12,680	-6,372		6,372	

(Note)

(1) Interest rate of foreign loan: 0.75%

(2) Equal annual repayment amount of capital for foreign loan (Rs.million): 172

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NATIONAL RIVER CONSERVATION DIRECTORATE (NRCD)
MINISTRY OF ENVIRONMENT AND FORESTS

THE STUDY
ON
WATER QUALITY MANAGEMENT PLAN
FOR
GANGA RIVER
IN
THE REPUBLIC OF INDIA

FINAL REPORT

VOLUME IV FEASIBILITY STUDY FOR PROJECT CITIES

VOLUME IV-4 FEASIBILITY STUDY FOR VARANASI CITY
PART VI STAKEHOLDER MEETING

JULY 2005

TOKYO ENGINEERING CONSULTANTS CO., LTD.
CTI ENGINEERING INTERNATIONAL CO., LTD.

FINAL REPORT
ON
WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER
JULY 2005

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APPENDIX

CHAPTER 1

OBJECTIVE

PART VI STAKEHOLDER MEETING

CHAPTER 1 OBJECTIVE

In accordance with the new JICA guidelines of Environmental and Social Considerations, a stakeholder meeting was to be held for the purpose of informing the feasibility study (F/S) project for Varanasi City to the stakeholders and public. The stakeholder meeting was to be organized by the Indian side in collaboration with JICA Study Team.

The objective of the guidelines is to encourage the recipient governments to take appropriate considerations of environmental and social factors. The basic principles regarding environment and social considerations are;

- Cover a wide range of the environmental and social impacts
- Ensure the accountability and transparency of decision-making
- Ensure a wide range of meaningful participation of stakeholders
- Disclose information
- Enhance organizational capacity

Based on the guideline, the stakeholder meeting was held on 14th September 2004 in Varanasi.

CHAPTER 2

PROCEDURE

CHAPTER 2 PROCEDURE

2.1 ORGANIZER

The organizer of the stakeholder meeting in Varanasi was the Department of Urban Development, Government of U.P., and under this, Varanasi Nagar Nigam (VNN), U.P. Jal Nigam (UPJN) and Varanasi Jal Sansthan (VJS) had the responsibility to hold the stakeholder meeting.

The preparations such as selection of stakeholders, programme and venue etc. were decided by the organizers in collaboration with JICA Study Team.

2.2 SELECTION OF STAKEHOLDERS

The organizers in consultation with JICA Study Team decided the range of stakeholders to be invited to the meeting and following stakeholders were selected;

- Elected Public Representatives
- Ministries and Govt. Agencies
- Project Affected People
- Officers of U.P. State Government and State Undertakings
- International Organizations and Donors
- NGOs
- Well-Informed Persons / Experts
- Media

2.2.1 Project Affected People

As the project will cover the whole area of Varanasi, therefore, representatives of the City were selected as stakeholders, i.e. Mayor, M.L.As, M.P.s, and corporators (working committee members and representatives of each political party), who are selected by direct election by the residents.

A new STP is proposed at Sathwa area and the most affected people are residents of this area. The STP is surrounded by 11 villages in Chiraigaon and Harahua Block. From each block and village, the heads (representatives) were selected as stakeholders. Taking into consideration the access to the venue, a car was arranged to pick them up and drop.

2.2.2 NGOs

Active NGOs in environmental field are identified by VNN, UPJN and VJS and selected as a stakeholder.

The following is the list of stakeholders and invitees.

List of Stakeholders and Invitees

Target People at the Location
Representatives of villages expected to be affected by land acquisition
Chiraigaon Block: Hasanpur, Singhpur, Sathwa, Hulasipur, Hirdaipur, Rajnahiya, Goithahan, Akatha
Harahua Block: Dhuripur, Sai, Soyepur

Local Associations Dhobi Association Representative of Slum Dwellers (CDS)
Non Government Organizations (NGOs) , Community Based Organizations (CBOs)
Central Govt. Agencies Ministry of Environment & Forests/ NRCD, New Delhi Ministry of Urban Development, New Delhi Central Pollution Control Board Central Water Commission
Local Govt. Mayer, Members of Parliament (MPs) and Members of Legislative Assembly (MLAs) from the city, Deputy Mayor, Corporators, Divisional Commissioner (DC), District Magistrate (DM), Development Authority (DA), Central Water Commission (CWC), State Pollution Control Board (SPCB), Irrigation Department, Tourism Department, District Urban Development Authority (DUDA), Cantonment Board
International Organizations and Donors Embassy of Japan, JICA India Office, JBIC India Office, World Bank, USAID
Well-Informed Persons / Experts
Media

2.3 PRE-MEETING AT CHIRAIGAON BLOCK OFFICE

Before stakeholder meeting, pre-meeting was held at Chiraigaon Block Office on 1st September. Chiraigaon and Harahua are near the area of proposed STP site and some villagers might be affected by land acquisition.

The meeting was held only for the resident of Chiraigaon and Harahua Block as sometimes the people tend not to be able to speak up their opinions in front of many stakeholders. The objective of the pre-meeting was to inform the contents of the project, especially STP and receive the comments / questions from villagers (Minute of Meeting is attached as Annexure I).

Some raised the problem due to Dinapur STP and worried that the same might happen at Sathwa area also. These concerns were solved through explanation of rehabilitation / renovation of Dinapur STP being included in the project and new technology adopted in Sathwa STP so as not to cause any problems.

2.4 PREPARATION OF P ROGRAMME

Programme was decided in consultation with VNN and UPJN as below:

2:30 – 2:40	Welcome Speech
2:40 – 2:50	Inauguration
2:50 – 3:05	Introduction of the JICA Study
3:05 – 4:10	Explanation of the Project Components, Operation & Maintenance, Environmental Impact Assessment (EIA)
4:10 – 4:40	Questions & Answers
4:40 – 4:50	Speech by Chief Guest
4:50 – 5:00	Closing Remarks

2.5 PREPARATION OF OTHERS

2.5.1 Venue

The location of Stakeholder Meeting was decided as Senate Hall, Banaras Hindi University, with capacity of 170 persons. The banners were prepared by VNN and JICA Study Team and hanged at the gate of University, gate of the Senate Hall and inside the hall.

2.5.2 Invitation Cards

The invitation cards were prepared both in English and Hindi. The responsibility of sending invitation cards to stakeholders was entrusted to VNN, and JICA Study Team helped to deliver the invitation cards to Delhi and Lucknow. The cards were delivered from 3rd September and the stakeholder meeting was also informed through JICA Study Team's Homepage. Invitation cards were sent to 161 persons.

2.5.3 Stationeries / Brochure

The bags for note pad / pen / brochure / comment sheets were arranged. The brochures were prepared in Hindi and English to give more detail information to the stakeholders (Attached in Annexure-III). The comment sheets were prepared to receive the comments from the participants since Question and Answer session was not enough to receive the comments from all the participants.

CHAPTER 3

STAKEHOLDER MEETING

CHAPTER 3 STAKEHOLDER MEETING

The stakeholder meeting was held on 14th September 2004 at Senate Hall of Banaras Hindu University. The meeting started from 3:00 and 139 persons were participated. Cars went to the proposed STP site to pick up the villagers and 27 villagers including village heads / officers of Block Development Office participated.

In the Question & Answer session, many participants spoke out their opinions and active discussion was held. Minute of Meeting is attached in Annexure-II, and key issues raised by participants are as below;

- The area where the farming is less or any one area can be taken as proposed STP site, so that people could not be affected.
- The area of Development Authority also should be included in the project.
- As seen in Dinapur, drinking water / ground water and crops are affected due to STP, and odour of sludge is also a problem. It is necessary to make it clear how to treat these issues.
- The electricity produced by biogas should be also delivered to villagers also.
- If the sludge with many chemicals like Zink, Cobalt, Nikel etc. are used as manure, chemical balance of the field will be effected. The provision to check the sludge and treated water are necessary.
- Corporators were not involved in the planning stage, even though they know the city very well. It seems that there is no transparency and public participation so far.
- The transparency of finance is also required.

Appendix A: Minutes of Pre-Meeting at Chiraigaon Block Office
Appendix B: Minutes of Meeting on Stakeholder Meeting
Appendix C: Brochure

Appendix A

Appendix A Minutes of Pre-Meeting at Chiraigaon Block Office

Minute of Pre-Meeting at Chiraigaon Block Office

Nagar Nigam and UP Jal Nigam in collaboration with JICA Study Team organized a meeting on September 1, 2004 at Chiraigaon Block office involving the representative of UP Jal Nigam, Varanasi Nagar Nigam, Heads of Chiraigaon Block and Harahua Block along with Heads of nearby Villages at proposed Sathwa STP site. The meeting was organized with a view to inform residents of the project area and discuss various socio-economic and environmental implications of the project apart from taking their views and ideas regarding the same. It was a preparatory exercise of stakeholders meeting, which is scheduled on 14th September 2004.

The meeting started at 11.00 A.M. with the welcome note and introduction of the study by Mr. Ajay Singh of JICA Study Team. Mr. Ajay Singh briefly informed to participants as how and when the JICA Study started and further elaborated on it significance. Mr. Singh also outlined the various schemes comprising of sewerage and Non-Sewerage, which are proposed under the Master Plan and Feasibility Study including the proposed STP at Sathwa Village.

After Mr. Ajay Singh completed the introductory part, Mr. D.P. Singh, Project Manager, UPJN elaborated on the Sathwa STP. He explained about the technology, capacity and various other salient features of STP. He emphasized on the significance of proposed STP and explained as how after this STP becomes functional, the water quality of river Ganga will improve substantially. He said the plant will have many positive impacts on the economic conditions in the area, as the area being mainly agrarian, it is expected that irrigation outreach will increase tremendously as the treated water may be used for the irrigation purposes leading to a positive impacts on the yield of crop, thus residents will be able to draw direct economic benefits from this plant. However, the participants had many issues related to the proposed STP at Sathwa as they compared it with the Dinapur STP and various problems, as they felt related to this, which can be summarized as follows;

1. Mr. Manglu Yadav of Dinapur raised the environmental and health problem being faced by people that are caused by Dinapur Plant. He said that due to the said plant, ground water in nearby villages has been significantly affected and large no of people are suffering with many diseases due to this. There are frequent outbreaks of water born diseases in the area. Also, the heavy sludge deposition has led to growth of mosquito and flies making people highly prone to Malaria and other diseases. He affirmed that frequent illness not only affects the health but also the economic conditions of people. All other participants including the blockheads were in agreement with the person who raised the complaint and raised almost similar kind of queries.

2. Majority of participants expressed their concerns and doubt regarding the proposed STP at Sathwa and highlighted their worries regarding this.

3. Responding to participant's queries, Mr. D. P. Singh of UPJN, explained the basic problem of Dinapur STP, which is the main cause of problems being faced by local residents. He said that Dinapur STP was conceptualized and commissioned around 20 years back and at this time govt. standards of treatment was mainly on BOD, COD, TSS, etc. and not on faecal coliform/ bacterial treatment. Thus, in Dinapur plant, the mechanism of treating faecal coliform was left out, which results to lot of problems as mentioned by participants. He explained further that the proposed plant at Sathwa is based on the modern technique of USAB and Aerated lagoon, which is efficient to treat the bacteria also effectively. He and Mr. Ajay Singh assured to participants that JICA Study Team has studies all the issues concerning to environment and health related to installation of proposed STP and the efforts has been taken to minimise the problem as much as it can and requested to participants not to compare this plant with Dinapur.

Mr. D.P. Singh informed the participants that JICA in its plan has also taken the rehabilitation of Dinapur STP, in order to do away the demerits it has and making it adequately functional. This was soundly appreciated by all participants.

4. Mr. Ajay Singh of JICA Study Team added that the problem as cited by people from Dinapur STP is also largely concerned with the adequacy and performance of STPs. He said that for an effective and desired results, it is important that STP is properly functional and operated and maintained appropriately, he informed that JICA has also taken due care for the sustainability of the plant it is proposing and focusing on suitable and self sustainable O&M measures.

5. After the explanation and discussion from JICA side, some participants desired that to instil trust and confidence among people, rehabilitation of Dinapur STP should be taken first and once people are made satisfied, another STP at Sathwa should be constructed. Responding to this, Mr. D.P. Singh said that it is possible as before commissioning of STP, the preliminary works like laying of sewer etc has to be taken then only the new STP can be constructed/ installed. He said it is possible that rehabilitation of Dinapur STP may be taken prior to commissioning of new STP.

After discussion on aforementioned issues, Shri Gopal Singh, Block Head, Harahua welcomed JICA Study team proposed STP at Sathwa site. He told that in Varanasi city, the sewerage problem is one of the most problems and if it will not be solved then they all can face a severe problem due to wastewater. He also said that there is problems of pollution due to Dinapur plant but as JICA Study Team is going to upgrade the plant and the new technologies are being used in the Sathwa Plant so he feel that due to Sathwa STP there will be not such problem as in Dinapur now. He also told the participants that there are some problems even in any work so we should cooperate with the proposed plan. He also told to JICA Study Team that their plan would be successful and the money provided by them will be fully utilized while making sewerage plan and if problems arise as for land availability then he will provide the it at his area (Harahua Block) and told that they all will cooperate for the success of the JICA project.

JICA Study Team and participants appreciated Mr. Gopal Singh and greeted his opinion. Smt. Asha Yadav said that the people are too much disappointed with the Dinapur plant experience and so they are afraid. She told the participants as the JICA Study team is assuring for the new technology that no such water pollution or groundwater contamination arise, so we will cooperate with this project.

Ms. Daida, JICA requested to participants that they should not have the feeling of JAPAN or India's project and have the ownership feeling regarding the project and they should participate and cooperate with the project for its success.

Finally, every body present appreciated JICA's move to improve the sewage system of Varanasi and assured to cooperate and support JICA team in all initiatives as and when desired. The meeting ended with the vote of thanks of Chiraigaon Block Development officer Mr. Ayodhya Prashad Vishwakarma.

Annex: Participants List of the Meeting

Annex

Participants of the Meeting

1. Smt. Asha Yadav, Block Head, Chiraigaon, Varanasi
2. Shri Gopal Singh, Block Head, Harahua, Varanasi
3. Mr. Dharam Pal Singh, Deputy Block Head, Chiraigaon, Varanasi
4. Mr. Ayodhya Prasad Vishwakarma, BDO, Chiraigaon
5. Mr. Premchandra Gupta, ADO, Chiraigaon, Varanasi
6. Mr. Brajesh Kumar Pandey, Asst. Accountant, Chiraigaon, Varanasi
7. Mr. Ashok Kumar Yadav, Junior Deputy Bock Head, Chiraigaon, Varanasi
8. Mr. D. P. Singh, Project Manager, Jal Nigam, Varanasi
9. Mr. L.N. Prasad, Project Manager, Jal Nigam, Varanasi
10. Mr. A. R. Rastogi, Project Engineer, Jal Nigam, Varanasi
11. Mr. Lokesh Kumar Jain, Nagar Niogam, Varanasi
12. Mr. A. K. Singh, Asst. Engineer, Nagar Nigam, Varanasi
13. Prof. Rakesh Pandey, Professor, BHU, Varanasi
14. Dr. Arvind Joshi, Reader, BHU, Varanasi
15. Mr. Paras Nath Patel, Village Head, Paterwa, Varanasi
16. Mr. Dharmendra Kumar Patel, B.S.S. President, Varanasi
17. Mr. Daya Shanker Singh,
18. Mr. Mangla Yadav, Village Head, Dinapur, Varanasi
19. Mr. Satyendra Singh, Yariyasanpur, Varanasi
20. Mr. Ramdular, Village Head, Phulpur, Varanasi
21. Mr. Asarafi, Village Head, Milkipur, Varanasi
22. Mr. Kallu Prashad Gupta, member of Village Panchayat, Banakat, Varanasi
23. Mr. Kamleash Kumar Singh, Dharhara, Cholapur, Varanasi
24. Mr. Braj Mohan, Village Head,
25. Dhirendra Singh, Sanyha Block, Varanasi
26. Mr. Shyam Ji Kumar, Village Head, Shivapur, Harahua Block, Varanasi
27. Mr. Hiralal Yadav, Member of Harahua Block, Varanasi
28. Mr. Somas Yadav, Village Head, Sandaha, Varanasi
29. Mr. Somnath, Sonbarsa, Varanasi
30. Mr. Shobh Nath, Member of Shivrampur Panchayat, Harahua, Varanasi
31. Smt. Manju, Banakat, Varanasi
32. Smt. Rajkumari, Village Head, Singhpur, Varanasi
33. Smt. Tara, Village Head, Saraiya No. 2, Varanasi
34. Mr. Rakesh Kumar Dixit, Head of village Panchayat, Musafabad, Varanasi
35. Smt. Vimla Yadav, Member, Village Panchayat, Faridpur, Varanasi
36. Mr. Rajendra Yadav, Member, Village Panchayat, Faridpur, Varanasi
37. Smt. Pratibha, Member, Village Panchayat, Khejalpur, Varanasi
38. Ms. Shoko Yamada, JICA Study Team
39. Ms. Kyoko Daida, JICA
40. Mr. Ajay Singh, JICA Study Team
41. Mr. Rajesh Singh, JICA Study Team (MWH India Pvt. Ltd., Mumbai)
42. Mr. Arvind Pandey, JICA Study Team

Appendix B

Appendix B: Minute of Meeting on Stakeholder Meeting

Minute of Meeting on Stakeholder Meeting

Varanasi Nagar Nigam, in collaboration with JICA Study Team, organised a Stakeholder Meeting on September 14, 2004 at Senate Hall, Banaras Hindu University, Varanasi involving representatives from NRCD (MoEF), UP Jal Nigam, Varanasi Jal Sansthan, Central Water Commission, NGOs, societies, representatives of Chiraigaon and Harahua block and residents and village heads of the villages that might be affected with project and professors & academicians from BHU and others educational institutions.

The meeting started at 3.00 pm with the welcome note of Mr. Lal Ji Rai, Municipal Commissioner, Varanasi. Subsequently, Mr. B. Sikka, Additional Director, National River Conservation Directorate (NRCD), Ministry of Environment &Forests, Govt. of India, briefly explained the objectives of the study and its origin as how it was planned and started.

After this, Mr. Virendra Singh, Hon'ble Minister of State, Govt. of UP, made the inauguration speech. In his speech he highlighted the significance of River Ganges and expressed concern over the state of pollution in the river. He stressed that there is urgent needs of effective interventions to address the issue adequately by using suitable technologies. He expressed his deep gratitude to JICA for undertaking this study and formulation of the Master Plan.

Mr. Momose, the Team Leader of JICA Study Team briefed the components of the Study. Following this, the experts of JICA Study Team presented following items to the stakeholder, which was followed by questions and answers.

1. Sewerage plan

Mr. Asthana, Adviser of JICA Study Team told that the objective of the project is to improve the water quality of the Ganga and Varuna rivers in Varanasi. He outlined the existing pollution scenario and present situation of sewerage system of Varanasi city through the slides and showed that only 30 percent of the sewage is being treated presently and the rest 70 percent flows directly to the rivers without treatment contributing heavily to the pollution load of river. In his presentation, Mr. R.C. Asthana detailed out various plans and proposals of the JICA Study Team to improve the situation, that's comprising of;

(i) Rehabilitation of existing facilities (Dinapur & Bhagwanpur STP, Konia MPS, old trunk sewers, pumping stations at Ghat area),
(ii) Construction of new facilities (trunk sewers and interceptors, lift pumping stations, STP).

Mr. Asthana said, that JICA Study Team has focused mainly on Varuna river and trans Varuna areas in its plan which were left and not included in GAP-I which is of great significance from the point of view of tackling the rivers pollution. He then presented the Sathwa STP plan, which is based on USAB and aerated lagoon methods. He informed to the participants about the merits and advantages of this technology, which has been found extremely successful in Nasik. He also informed that the treated water would be discharge into the irrigation canal and can be used for irrigation purpose. The treated water will be nutrient and will be beneficial for the crops.

2. Non-sewerage plan and environmental impact assessment

Mr. Ajay Singh, Sr. Programme Coordinator of JICA Study Team explained the non-sewerage plan and Environmental Impacts Assessment. He said, along with sewerage measures, non-sewerage measures are also important, as open defecation along the ghats area and slums, laundry activities along the river and others are also one of the pollution sources, which besides affecting the water quality of river also affect the environmental, and hygiene conditions of river beds and the city. Realizing this, JICA Study Team has proposed LCS (Low Cost Sanitation) and Dhobi Ghat programme, which will be

constructed on demand base. He informed that firstly 5 slums and 1 Dhobi Ghat will be taken as pilot project, and after its success, other selected facilities will be implemented. If the pilot project will not be properly operated and maintained, then no other facilities will be implemented.

Presenting the Institutional Development aspects, Mr. Singh in his presentation outlined that at present, many organizations like UPJN, VNN, and VDA are involved in construction and O&M of sewerage system, as a result, there is no clear responsibility among these organizations and often leads to over lapping and lack of coordination. He said to address this problem and ensure effective O&M, JICA Study Team propose an integrated Institutional System both sewerage and non-sewerage measures. JICA Study Team also recommends people's participation and awareness programme for the effective O&M of the facilities and proposed an Institutional Development Programme and PP/PA activities.

After this, Mr. Singh presented the results of the EIA (Environmental Impact Assessment) study, conducted by JICA Study Team. It was informed to the participants there are no major impacts due to trunk sewer and pumping stations. There are some impacts identified due to STP and mitigation measures are also identified by JICA Study Team.

Mr. Singh finally informed about the Ghat improvement project at Manikarnika Ghat and briefed the progress and O&M Plan.

3. Comments / Questions & Answers session

Some issues emerged in question & answer session.

- The area where the farming is less or any other area can be taken as proposed STP site, so that people could not be affected. For example, military area / barren land is appropriate for the STP site.
- This is a great project that will help in solving the coming future problems of sewage and pollution. The recommendation is to include the area of Development Authority for sewerage development. And target year of the project should be for 100 years.
- As seen in Dinapur, drinking water / ground water and crops are affected due to STP, and odour of sludge is also problems. It is necessary to make clear how to tackle these issues.
- Ganga pollution problem is not at all the basic problem of the river system, if you know the technology that how to utilize the sand-bed. The technology of river system is not considered in the study.
- The electricity produced by Biogas will be also delivered to villagers or not!
- If the sludge with many chemicals like Zink, Cobalt, Nikil etc. are used as manure, chemical balance of the field will be effected. The provision to check the sludge and treated water are necessary.
- Corporators were not involved in the planning stage, even though they know the city very well. It seems that there is no transparency and public participation so far.
- Please tell that the finance from Japan will be grant or loan, how much the amount is, and how it will be used?
- The process of selection of pilot project is not clear. How the Manikarnika Ghat, and not the Harishchandra Ghat is selected as pilot project.

The JICA Study Team answered the above comments point wise as follows:

- The plan is included the area, seeing the future development.
- The lessons learnt from Dinapur STP is great helpful for making plan. A sewerage complete lining is studied for Sathwa STP, and proper lining of sludge bed and lining of irrigation canal is also proposed. In addition, the bacteria removal process unit, which is not included in GAP Phase-I, is also proposed so that the contamination of water will not happen. In Dinapur and

Bhagwanpur STP, the bacteria removal process unit will be installed, and no more water contamination will happen.

- JICA Study Team conducted the environmental impact assessment of the odour due to sludge, the conclusion is there would be no such problem, as proper treatment technique is proposed.
- Distribution of electricity to the near by villagers would be possible if excess power remains. The power is primarily for the STP.
- Regarding finance, JICA Study Team has just estimated the cost because this is a study and how much money to implement the project would be needed, India Govt. will decide.
- Mr. Sikka of NRCD said, generally Govt. of India release 70 percent amount for any such project and State Govt has to bear 30 percent. In this JICA project possibility is that JBIC, which is Japanese Govt. funding agency, would provide 85 percent of total expenditure as a loan. The loan will be taken by the Govt. of India and not by the Govt. of UP State. But if the project is approved then UP state Govt. will have to bear 15 percent of the total project cost. He said that Govt. Of India will not provide the money for O&M. This is a very important thing that also to be debatable that how the State Govt. will arrange the money for O&M. Now when the project of JICA and JBIC on institutional strengthening will be implemented, then the JICA team and also JBIC can suggest the measures and guidelines. Now it will depend on State Govt. and Nagar Nigam to make further improvements if necessary.
- Mr. Sikka also said that Govt. of India is also serious for O&M activities as the money provided to some other projects in states were found that there is no proper O&M, so if Govt. of India finds that there is such possibility and if State Govt. can ensure to provide the proper O&M, then Govt. of India also can pull its hand back.
- Mr. Ajay Singh answering to the process of selection of pilot project said that the selection of Manikarnika Ghat as pilot project has been done in consultation with stakeholders and Varanasi Nagar Nigam. Even all the facilities that have been constructed/ proposed for construction have been identified and selected in consultations with stakeholders and for this purpose, JICA Study Team organised five workshops in Varanasi. It was explained that initially, six ghats were chosen through detailed study of having questionnaire survey and group discussion at the ghat area, and then one workshop was organised in presence of main stakeholders and residence and decide Manikarnika Ghat. There was 100 percent public participation in selection of pilot project as all representatives of stakeholders have been present while deciding any issue related to the pilot project.

The meeting ended with thanks to the participants by the Chief Engineer, Varanasi Nagar Nigam.

Annex I: List of participants
Annex II: Comments by the participants and Reply from the Organizer

Annex I

Participants' List of Stakeholder Meeting held on 14 September 2004

1. Ministries and Govt. Agencies	(1)
NRCD, New Delhi	Mr. B. Sikka
2. Affected People at the Location	(35)
M.L.A	Mr. Ajay Rai
Corporator	Mr. Manoj Rai
Corporator	Mr. Sagar Sharma
Corporator (former)	Mr. K.V.Karma
[Harahua Area]	
Block Head, Harahua	Mr. Gopal Singh
Former Block Head, Harahua	Dr. Ram Katvar
Former Block Head, Harahua	Mr. Uday Shanker Singh
Pradhan (Village Head), Harahua	Mr. Nahholal Mishra
Village Head, Harahua	Mr. A.K. Singh
Village Head, Harahua Block	Dr. Bhupendra Singh
Mamber of Village Panchasyat, Harahua	Kailash Nath
Mamber of Village Panchasyat, Harahua	Mr. Munna Singh
Block Development Office, Harahua	Mrs. Neeuja Gupta
[Chiraigaon Area]	
Member of Village Panchayat	Mr. Akhilesh
Member of Village Panchayat	Mr. Sudarshan Singh
Water Management Society (President)	Profossor S.K. Pandey
Village Head	Mr. Mani Yadav
Member of Village Panchayat	Mr. Bindu
Gram Panchayat	Mr. Rakesh Dixit
Member of Village Panchayat	Mr. HanshRaj
President - Kisan Mitra (Farmer Friends)	Mr. Dhirendra Singh
Gram Pradhan) (Village Head)	Mr, Om Prakash Singh
Member of Village Panchayat	Mr. Mahesh Kumar
BDC (Block Development Committee)	Mr. Gaensh Kumar Sharma
BDC	Mr. Munna Singh
BDC	Mr. Manoj Kumar Singh
BDC	Mr. Bindu Yadav
Villager	Mr. Sarvesh Kumar Singh
Block Development Office, Chiraigaon	Mr. A.P. Viswakrma
Block Development Office (Deputy), Chiraigaon	Mr. D.P. Singh
Block Development Office (Assistant), Chiraigaon	Mr. P.C.Gupta
[Slum Association]	
C.D.S. Community Development Society), Sundarpura Slum Area (President)	Mrs. Durgawati
C.D.S. (President)	Mrs. Kiran Bharti
C.D.S., Karaundi Slum Area (President)	Mrs. Kusum Patel
C.D.S. (President)	Mrs. Shakuntla Jain
3. Govt. People of U.P. State	(10)
Minister of Science & Technology, U.P. Govt.	Mr. Virendra Singh
Nagar Nigam (Lucknow), Commissioner	Mr. S.P. Singh
UP Jal Nigam, Lucknow, Chief Engineer	Mr. Khanna
Forest Dept. Lucknow	Mr. Ruppk De
UP Jal Niga, Allahabad, Chief Engineer	Mr. J.B. Vats
Varanasi Development Authority (former President)	Mr. S.K. Singh
Central Water Commission, Varanasi	Mr. H.P. Srivastava
DUDA, Varanasi	Mr. G.P.N.Singh
DUDA, Varanasi	Mr. S.P. Shukla
DUDA, Varanasi	Mr. H.B. Mangari
4. International Organizations and Donors	(4)
JICA India Office	Mr. Ito
JICA India Office	Ms. Matsuda

JICA India Office	Mr. Subrota
JBIC India Office	Mr. M.P. Singh
5. Non Government Organizations	(10)
Jain & Associates	Shri R.C. Jain
Jain & Associates	Mr. N.N. Singh
Urmila Khadi Gramodhyog Samiti, Varnasi	Mr. Pankaj Kumar Singh
Urmila Khadi Gramodhyog Samiti, Varnasi	Mr. B.P. Srivastava
Kendriya Dev Deepavali Mahasamiti	Mr. Vageesh Dutt Mishra
Kendriya Dev Deepavali Mahasamiti	Mr. Dinesh Suri
Praduashan Mukti Jan Jagran Samiti	Mr. Vinod Kumar
Samajwadi Majdoor Sabha, Varanasi	Mr. Rajesh Kumar Mishra
Samajwadi Parti, Varanasi	Mr. Akhilesh Mishra
Social Worker	Shri Shanti Lal Jain
6. Well-Informed Persons / Experts	(11)
BHU	Mr. U.K. Chaudhary
Dept. of Geography, BHU	Dr. Rana P.B. Singh
BHU (Botany)	Professor L.C. Rai
Institute of Technology, BHU	Mr. Ajay Bharti
BHU (Sociology)	Mr. Arun Kumar Dubey
BHU (Sociology)	Dr. Arvind K. Joshi
Institute of Technology, BHU	Dr. J. Singh
BHU	Mr. Deepak K. Saxena
BHU (Research Fellow (Environment Science)	Mr. Abhishek Mukherjee
T.M. Bhagalpur University	Mr. G.C. Pandey
BHU (Civil Engineering)	Mr. Arvind Kumar Mishra
7. Media	(19)
Hindustan (Hindi Newspaper)	Mr. A. K. Lari
Hindustan (Hindi Newspaper)	Mr. SriRam Tripathi
Hindustan (Hindi Newspaper)	Mr. Ashutosh Pandey
Danik Jagaran, Chiraigaon	Mr. Anil Kumar Singh
Aaj' (Daily Hindi Newspaper)	Dr. Mahesh Gupta
Aaj' (Daily Hindi Newspaper)	Mr. Radhyeshyam Mishra
Aaj' (Daily Hindi Newspaper)	Mr Uttam
Dainik Jagran (Hindi)	Mr. Rajesh Pandey
Amar Ujala (Hindi)	Mr. Dinesh Mishra
Jansatta Exp.	Mr. Rajesh Kumar
San Marg (Hindi Danik Newspaper)	Mr. H.N. Mishra
San Marg (Hindi Danik Newspaper)	Mr. Anuj
Chiraigaon	Mr. A.P. Viswakarma
Gandive (Daily local Hindi Newspaper)	Mr. Sakha Prakash
Sahara T.V.	Mr. Rajesh Gupta
Sahara T.V.	Mr. Santosh Sharma
Sity Cable	Mr. Devashish
Sity Cable	Mr. Ballulal
ETV	Mr. Satyendra
8. Others	(10)
Indian Army Force (Retired Captain)	Mr. Rajiv Pandey
	Mr. L.K.Singh
PSO	Mr. Afroz Khan
BHU (Student)	Mr. Rahul Kumar
BHU (Student)	Mr. Bipin Kumar Tiwari
BHU (Student)	Mr. Ashutosh Kumar Yadav
BHU (Student)	Mr. Ajeet Kumar
BHU (Student)	Ms. Kiran Sharma
BHU (Student)	Ms. Alka Tiwari
BHU (Student)	Mr. Neeraja Singh
9. Organizer	(39)

VNN (Municipal Commissioner)	Mr. Lal Ji Rai
VNN (Deputy Municipal Commissioner)	Mr. K.P. Tripathi
VNN (Chief Engineer)	Mr. S.K. Srivastava
VNN	Mr. Subhas Pandey
VNN	Mr. R. K. Wadhwani
VNN	Mr. R.S. Khanna
VNN	Dr. D. Chaturvedi
VNN	Mr. K. K. Gupta
VNN	Mr. L.K. Jain
VNN	Mr. Jiauddin
VNN	Mh. Ameel Siddiqui
VNN	Mr. S. K. Singh
VNN	Mr. A. K. Singh
VNN	Mr. A. Singh
VNN	Mr. N. K. Jaiswal
U.P. Jal Nigam, Varanasi (GM)	Shri D. S. Varshney
U.P. Jal Nigam, Varanasi (Project Manager)	Shri D.P. Singh
U.P. Jal Nigam, Varanasi (Project Manager)	Mr. L. N. Prasad
U.P. Jal Nigam, Varanasi	Mr. A .R. Rastogi
U.P. Jal Nigam, Varanasi	G.D. Khare
U.P. Jal Nigam, Varanasi	Mr. J.P.Mani
U.P. Jal Nigam, Varanasi	Mr. C.D.S. Yadav
U.P. Jal Nigam, Varanasi	Mr. R. C. Gupta
U.P. Jal Nigam, Varanasi	Mr. S. K. Mishra
U.P. Jal Nigam, Varanasi	Mr. Naval Kishore
Jal Sansthan, Varanasi	Mr. B.K. Singh
Jal Sansthan, Varanasi	Mr. K.M. Gupta
JICA Study Team (Team Leader)	Mr. Kazufumi Momose
(Deputy Team Leader)	Mr. Hirotaka Sato
(Deputy Team Leader)	Mr. Tadao Funamoto
(Social Consideration / Hygiene Education)	Mr. Kenji Igarashi
(Social Consideration / Hygiene Education)	Ms. Shoko Yamada
(Adviser)	Mr. R.C. Asthana
(Facilitator)	Mr. Rakesh Pandey
(Senior Programme Coordinator)	Mr. Ajay Singh
(Consultant)	Mr. Punit Mathur
(Consultant)	Mr. V.N. Sontakke
(Consultant)	Mr. Rajesh Singh
(Asst. Coordinator)	Mr. Arvind Pandey
Total Participants	**(139)**

Annex II

Comments by Participants and Reply from the Organizer

1. Mr. Abhishek Mukherjee
Research Fellow (Environment Science), (IMS) BHU, Varanasi

The project is good, but the project is very big and its steps are not clear. There is lack of transparency. It needs highly qualified and skilled persons, which will increase the budget. And without this the plan will not work successfully.

(Reply)

- We agree that transparency is a key to the project succeed. For that purpose, Public Participation and Public Awareness campaign programs is included in the proposed project to keep the project transparency. Further, in the project, the IDP (Institutional Development Program) is proposed to improve institutional arrangement of the Project, and the transparency will be strengthened in its process.

2. Mr. Rupak De
Conservator of Forests, Project Formulation, Forest Department, Lucknow

A seven km stretch of river Ganga in Varanasi has been declared as a wild life sanctuary. In first phase of Ganga Action Plan, a Turtle Rehabilitation Project was taken up for helping in control of river line pollution that occurred especially through disposal of partially burnt human bodies and animal carcass into the river.

The fresh water turtles were bred at especially created Breeding Centres at Varanasi and Lucknow. The project was successful but was discontinued a few years after the inception.

The heavy pollution of the river can be ameliorated- biologically - through renewal of the Turtle Project. This can be done through revival of the existing facilities and trained staff. This will help to

1. Revive and supplement riverine biological diversity.
2. Bio-control of pollution
3. An index of pollution control through revival of biological diversity

(Reply)

- Our plan consists in sewerage and non-sewerage schemes including Community Toilet Complex and Constructed Dhobighat Programs, through which most of major pollution sources can be tackled. In this schme, we have proposed engineering approach to reduce organic and bacterial pollution load and alleviate the river pollution. As you suggest, biological approach may be effective to improve river water quality as a supplemental measure. However, this measure is to be properly evaluated before its implementation.

3. Dr. Bhupendra Pratap Singh
Village Head, Bara Lalpura, Harahua Block, Varanasi

1. The STP should be installed far from the City area.
2. There should be provision of increasing the capacity of the STP from 200 mld to 1000 mld.
3. New and improve techniques should be used to save the environment from pollution
4. The project area for sewerage system should touch at least whole the area of Development authority.
5. We welcome JICA for checking all the drains to flow directly into the river.

(Reply)

- We have proposed our plan considering your concern such as remoteness of the STP from the city, coverage of the development area upto the year 2030, technical viability of the STP etc.

4. Mrs. Neerja Gupta
Block Development Officer, Harahua Block, Harahua, Varanasi

1. The major point of the organised workshop, under the water quality management of river Ganga, is that for the implementation and operation purpose only one agency should have given the responsibility or all the existing agencies work as they are working. In this reference, it is very important to notice that these all agencies have overloaded with all the works. These agencies are free from one another and so they have no coordination in between them. Due to this, the responsibility has not been decided. So it is very necessary that for the Project work only one agency's work responsibility would be more successful.

2. Participation of Nagar Nigam and Jal Sansthan is also required because ground water and management of Sewage is the main work of the project.

(Reply)

- We agree with your opinion about the single responsible authority for this project. The Institutional Development Program (IDP) has been prepared for this purpose. We have proposed that Nagar Nigam, under which Jal Sansthan and UP Jal Nigam work, has a full responsibility for the Project and is a single authority of the Project in the City.

5. Mr. Rajiv Pandey
Retired Captain, Indian Army Force

1. The Plan is very good and should be implemented as soon as possible

(Reply)

- No answer required. We hope the Project will be taken up by your government and implemented soon.

6. Mr. Vageesh Dutt Mishra, (Social Worker)
General Sectretary, Kendriya Dev Deepavali Mahasamiti

The plan should be provided in written after that comments would be provided. Then the project will be transparent and public participation will be managed.

(Reply)

- The final report of this Project will be opened to the public at the office of Nagar Nigam, Jal Sansthan and U.P. Jal Nigam Varanasi.

7. Mr. Rakesh Dixit
Officer of Village Panchayat, Block Chiraigaon, Varanasi

1. The study and survey report of JICA Study Team should be publicly published.
2. Implementation work should be through ground level and there should be appropriate monitoring so that the project could be correctly implemented.
3. In present situation, the possibility of work is not reliable, so it should be publicised

that in which area of Trans Varuna the project would be implemented and then comments should be enquired.

(Reply)

- The final report will be opened to the public at the office of Nagar Nigam, Jal Sansthan and U.P. Jal Nigam Varanasi.
- At the implementation stage an appropriate monitoring system for the Project will be established and the Project will be appropriately monitored.

8. Mr. Vinod Kumar

President, Pradushan Mukti Jan Jagran Samiti, Dinapur, Varanasi
(*Public Participation society for Pollution removal*)

1. The compensation for the previous work for Land Acquisition should be given to concern people and according to the govt order they all should be provided the job. All the pending cases of court should be taken back which are still on the landlords.
2. Dinapur STP was projected during Ganga Action Plan Phase – I. Hospital should be provided to Dinapur area and medicine spray should also be provided in keeping the support of the living people. The provision of odour removal should be provided as urgent.
3. Proper management of Irrigation in this area as the ground level is getting down other wise the land of this side will become unfertilised.

(Reply)

- In the Project, the rehabilitation and renovation of Dinapur STP have been also proposed for appropriate treatment for organic and bacterial pollution of sewage in the City. These measures will ameliorate the existing pollution caused by effluent of the STP in the nearby villages and improve the quality of groundwater.
- Proper management of irrigation water use to prevent groundwater depletion will be done by other project or scheme.

9. Mr. Anil Kumar Singh,

Reporter, Dainik Jagran, Chiraigaon, Varanasi

1. The existing STP and in proposed STP, there is no measure of treating chemicals, so it should be clarified and appropriate techniques and measures should be included in the report and clarified. The new project is given for implementation to UP Jal Nigam to which there is many complaints regarding the STP. Would they be able to remove the old problems?
2. Due to the treated effluent, which is used for farming, bad impact the crops; environment and ground water are badly effected. Would the new project be successful in eliminating all these old problems? There are still doubts over this.
3. The problems in Operation and maintenance after the implementation will not happen. Is the team self believes with this concern?

(Reply)

- The concentration of harmful chemicals of the raw sewage in Varanasi, such as Chromium, Arsenic, Mercury and Cadmium, are below detective levels (BDL) according to the water quality monitoring results conducted by JICA Study Team so that the chemical effect on groundwater, crops and environment is not expected. The major concerns about treated effluent use for farming will be caused by bacterial pollution without appropriate disinfection measure and due to ill operation and maintenance of STP. In the Project, chlorination facility is installed in the proposed STP and measures for improvement of operation and maintenance of STP will be proposed.

10. Bindu Yadav
BDC, Chiraigaon, Varanasi

1. The construction of the trunk sewer and sewerage systems are urgently required to save the river Varuna and Ganga and to make clean the city and its environment. The target of treatment capacity year should be planned for year 2040 in place of year 2030, it would be beneficial as per the development and increase of population in this city.
2. The STP area people should be employed in that sewerage systems, such provision should be made.
3. There would be no harmful situation produced in any condition like such provision is required and if it happened then it would be the responsibility of local govt. and state govt.

(Reply)
- The target year 2030 is decided by Japanese and Indian governments. Therefore, the change of target year is not possible. The employment of villagers near the STP will be considered by local and state government bodies in the implementation stage. This employment shall be encouraged.

11. Mr. Santosh Kumar Mishra
Leader (Labour), Samajwadi Majdoor Sabha, Varanasi
(*Samajwadi labourer Parti*)

1. The project is appreciable and agreeable.
2. After the implementation of the project which agency will be responsible for conducting it?
3. After Implementation of the project, the responsibility of operation and management should be provided to only one agency in place of dividing the work so that its responsibility should be clear. Along with this, NGOs and other freelance environmentalist should be nominated for their views and suggestion time to time.

(Reply)
- JICA Study Team has proposed one organization should have a full responsibility of planning and operation and maintenance in IDP (Institutional Development Programme), in which Varanasi Nagar Nigam will be a single responsible organization for sewerage and non-sewerage scheme and Jal Sansthan and UP Jal Nigam will be worked under VNN.

12. Mr. Rajesh Kumar Mishra
President, Samajwadi Majdoor Sabha, Varanasi
(*Samajwadi labourer Parti*)

1. No doubt that through this plan, the water quality will improve of the river Ganga and Varuna. Along with this Varanasi people will be beneficiated through this project impact.
2. Drinking Water quality will also improve after the treatment plan installation and sanitation will improve after the Dhobi Ghat construction.
3. It should be started as soon as possible without any possibility of problem through which certainly Varanasi will develop.

(Reply)
- No answer required. We appreciate this comment.

13. Mohd. Ziauddin,
Executive Engineer, Varanasi Nagar Nigam

1. The project 'water quality management for river Ganga' is boon for Varanasi people
2. The project is planned and detailed how to check the sewage etc. pollution could not meet to river Ganga, but it was not specified that the pollution which is flowing with the river will be how treated which is also required to clarify.

(Reply)

- The sewage discharged into all drains in the City will be intercepted before entering the Ganga, conveyed to proposed and existing STPs and appropriately treated. Besides, existing trunk sewers and pumping stations will be also rehabilitated to convey future expected increased flow of sewage to STPs. The treatment method of proposed STP will be UASB followed by Aerated Lagoon and Chlorination. The effluent quality of the STP meets the national standards for STP effluent.

Appendix C

Appendix C: Brochure

Stakeholder Meeting on
Pollution Abatement Project for Varanasi

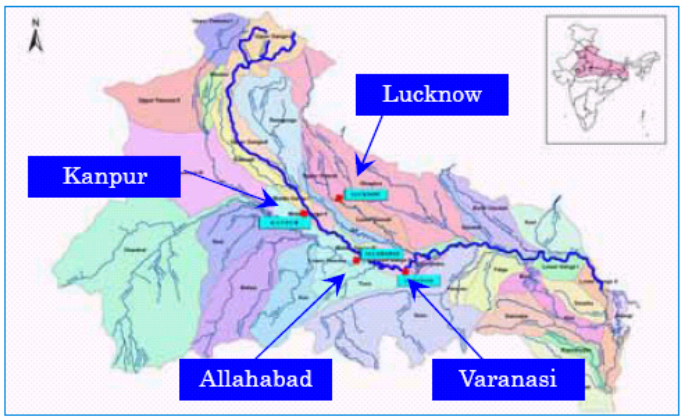
BRIEF OUTLINE OF WATER QUALITY MANAGEMENT PLAN FOR GANGA RIVER IN THE REPUBLIC OF INDIA

September 14th 2004

INTRODUCTION OF THE ENTIRE PROJECT

Ganga Basin, the largest river basin of Republic of India, is supporting nearly 40 percent of the country's population. River Ganga and its tributaries, besides being a source of water supply and irrigation, are also regarded as sacred rivers and extensively used for bathing by millions of people. The mounting pollution of river Ganga and its tributaries due to increased human and industrial activities has adversely affected the human health and biodiversity of the eco-system. To control further pollution and improve the river water quality, the Government of India is implementing the Ganga Action Plan (GAP). The first phase of GAP, which was launched in 1985 has been completed, while the second phase is presently under implementation.

The Government of Japan is collaborating with Government of India on this important programme by providing assistance through the Japan International Cooperation Agency (JICA) for taking up a Development Study relating to 'Water Quality Management Plan for Ganga River Basin'. The Study focuses on formulation of the water quality Master Plan (M/P) for the four large and important towns of Kanpur, Allahabad, Varanasi and Lucknow. The target year of Master Plan is 2030.



VARANASI PROJECT

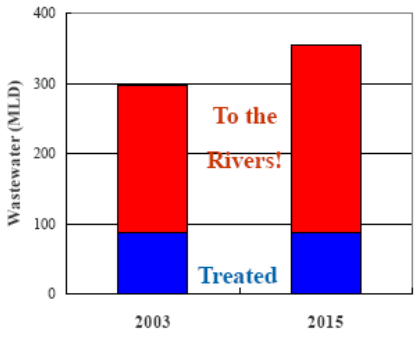
OBJECTIVES OF VARANASI PROJECT

To improve water quality of Ganga and Varuna Rivers,

- Through reducing major pollution sources, domestic wastewater (Sewerage Measures)
- Through reducing open defecation and washing cloth activities in ghat area (Non-Sewerage Measures)

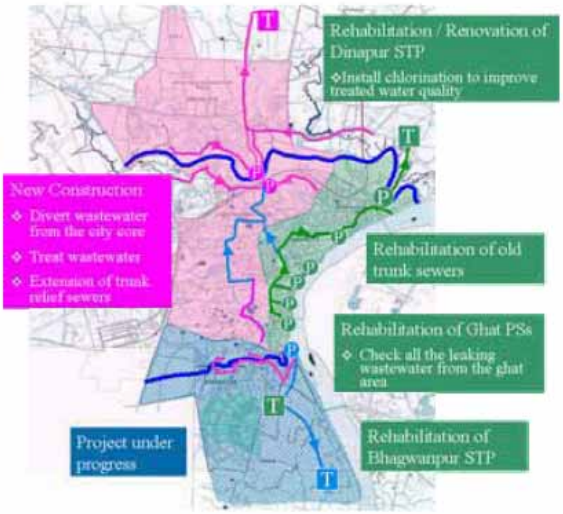
PROBLEMS IN WATER POLLUTION IN VARANASI

- Major pollution source of Ganga and Varuna Rivers is domestic wastewater
- At present, only limited wastewater (30%) is treated, the remaining (70 %) is discharged into Ganga and Varuna Rivers without treatment
- Without this project, more wastewater will find it way to Ganga and Varuna Rivers in future, and pollute the same more
- Sewerage facilities are not properly operated and maintained
- Open defecation and laundry activities are one of the pollution source



MAJOR PROJECT COMPONENTS

- Sewerage Measures
  - ✧ Rehabilitation/renovation of existing facilities
    - Sewage Treatment Plant – Improve the treated water quality
    - Pumping Station – Intercept all the leaking wastewater from the ghat area
  - ✧ Construction of trunk sewers and interceptors to collect and convey wastewater
    - Divert wastewater from the city core
  - ✧ Construction of sewage treatment plant
    - Treat collected wastewater to desirable level
- Non-Sewerage Measures
  - ✧ Community Toilet Programme
  - ✧ Constructed Dhobi Ghat Programme
- Non-Facility Measures
  - ✧ Strengthening of operation and maintenance and management (Institutional strengthen)
  - ✧ Public awareness and participation (PP/PA) programme



BENEFITS

- Check almost all the untreated wastewater before entering the Rivers
- Improve water quality of the Ganga and Varuna
- Improve sanitary conditions in the ghat area
- Improve bathing environment
- Improve Municipal water quality (the quality of the water source will be improved)
- Improve sanitary conditions in the City
- Reduce risk of disease and enhance human health
- Nutrient rich treated water is used for irrigation
- Improve the image of the City
- Enhance the value of the City
- Increase in employment opportunities during construction and O&M stage

IMPACTS AND MITIGATION MEASURES

Impact	Mitigation Measures
Sewage Treatment Plant	
• Resettlement	• STP site is selected properly, so that resettlement is avoidable
• Income loss due to land acquisition	• To be compensated by money or alternative land
• Water contamination in receiving body (Irrigation canal)	• Disinfection through chlorination • Appropriate O&M • Set-up monitoring mechanism
No major impact of installation of pumping station and trunk sewer	
Risk (Power failure)	
• Untreated wastewater discharge into the Rivers while power cut	• Provision of generator and fuel • Budget provision for fuel • Appropriate O&M • Set-up monitoring mechanism

बाराणसी नगर में गंगा प्रदूषण नियंत्रण योजना पर
स्टेकहोल्डर की कार्यशाला

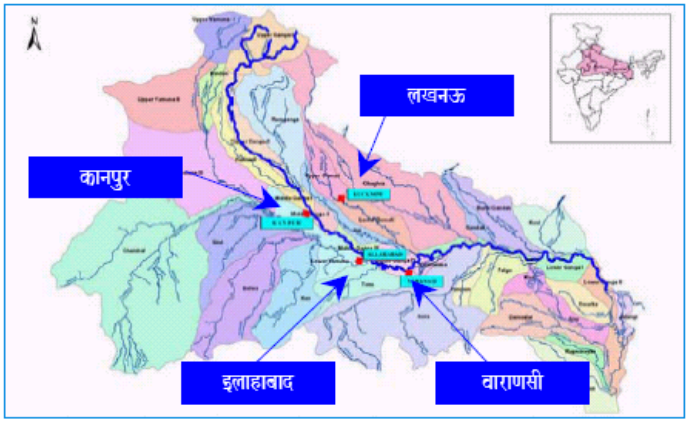
गंगा नदी के लिए जल गुणवत्ता प्रबन्धन योजना की संक्षिप्त रूपरेखा

सितम्बर 14 2004

परियोजना - एक परिचय

गंगा नदी भारतवर्ष की नदियों में सबसे बड़ी नदी है एवं गंगा नदी व इसकी सहायक नदियों से देश की करीब 40 प्रतिशत जनसंख्या लाभान्वित होती है। गंगा नदी एवं इसकी सहायक नदियाँ, जल आपूर्ति एवं सिंचाई के स्रोत के अतिरिक्त पवित्र नदियाँ मानी जाती है और बड़े पैमाने पर लाखों लोग इनमें स्नान करते हैं। मानव एवं प्रौद्योगिक क्रियाकलापों के बढ़ने के फलस्वरूप गंगा एवं इसकी सहायक नदियों में बढ़ते प्रदूषण ने मानव स्वास्थ्य एवं जीवों के जीवन चक्र पर बुरा प्रभाव डाला है। बढ़ते प्रदूषण को रोकने व नदी जल गुणवत्ता को सुधारने के लिए भारत सरकार ने गंगा कार्य योजना (जी.ए.पी.) का शुभारम्भ किया। वर्ष 1986 में शुरू किया गया गंगा कार्य योजना का प्रथम भाग पूर्ण हो चुका है, जबकि इसका द्वितीय भाग, वर्तमान में, प्रारम्भ की ओर अग्रसर है।

इस महत्वपूर्ण कार्यक्रम पर, भारत सरकार व जापान सरकार के संयुक्त प्रयास से, जापान इन्टरनेशनल कोआपरेशन एजेन्सी (जाइका) के सहयोग द्वारा 'गंगा नदी के लिए जल गुणवत्ता प्रबन्धन योजना' के रूप में एक विस्तृत अध्ययन करवाया जा रहा है। यह अध्ययन चार बड़े व महत्वपूर्ण नगरों - वाराणसी, इलाहाबाद, लखनऊ व कानपुर के लिए, जल गुणवत्ता मास्टर प्लान बनाने पर केन्द्रित है। मास्टर प्लान का अभिकल्पित (Target) वर्ष 2030 तक है।



वाराणसी परियोजना

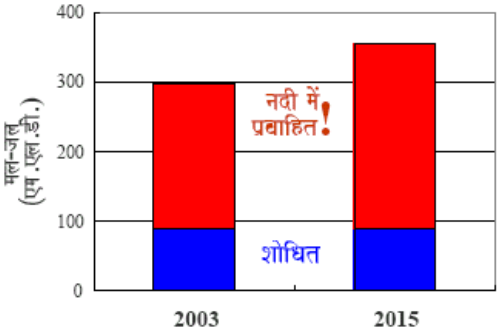
वाराणसी परियोजना का उद्देश्य

गंगा एवं वरूणा नदियों की जल गुणवत्ता सुधारना,

- जलोत्सारण सुविधा (Sewerage Measures) उपलब्ध कराते हुए प्रदूषण स्रोतों एवं घरेलू गंदे जल से होने वाले प्रदूषण भार को कम करना।
- खुले स्थान में शौच एवं धोबी घाट द्वारा होने वाले प्रदूषण की रोकथाम

वाराणसी में जल प्रदूषण की समस्याएं

- गंगा एवं वरूणा नदियों के प्रदूषण का मुख्य स्रोत घरेलू मल-जल (Sewage) है।
- वर्तमान में, केवल सीमित (30 प्रतिशत) मल-जल का शोधन होता है बाकी बचा हुआ (70 प्रतिशत) बिना शोधित हुए गंगा एवं वरूणा नदियों में मिल जाता है।
- इस परियोजना के लागू न होने पर, इससे भी अधिक मल-जल गंगा एवं वरूणा नदियों में जाएगा और इनमें प्रदूषण बढ़ेगा।
- जलोत्सारण सुविधाओं (Sewerage Facilities) का उचित रख-रखाव नही है।
- खुले स्थान में शौच एवं धुलाई कार्य भी प्रदूषण के स्रोतों मे से एक है।



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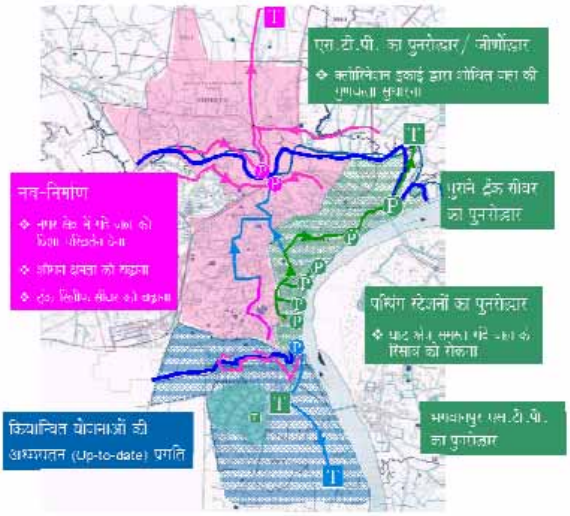
परियोजना के मुख्य अवयव

- जलोत्सारण सुविधाएं (Sewerage Measures)
  - ✧ वर्तमान सुविधाओं का पुनरोद्धार/जीर्णोद्धार
    - मल-जल शोधन संयन्त्र (STP) - शोधित जल की गुणवत्ता को सुधारना
    - पम्पिंग स्टेशन - घाट क्षेत्र में मल-जल रिसाव की रोकथाम
  - ✧ मल-जल को एकत्र करने व भेजने के लिए ट्रंक सीवर व इन्टरसेप्टर का निर्माण
    - नगर क्षेत्र में मल-जल को दिशा देना
  - ✧ मल-जल शोधन संयन्त्र (STP) का निर्माण
    - एकत्रित मल-जल का मानक स्तर तक शोधन
- नोन सीवरेज सुविधाएं (Non Sewerage Measures)
  - ✧ सामुदायिक शौचालय कार्यक्रम
  - ✧ धोबी घाट निर्माण कार्यक्रम
- परोक्ष (Non-Facility) सुविधाएं
  - ✧ अनुरक्षण (O&M) एवं प्रबन्धन को मजबूत करना (Institutional strengthen)
  - ✧ जन जागरूकता एवं सहभागिता (PP/PA)



परियोजना से लाभ

- नदियों मे प्रवाह से पूर्व सम्पूर्ण गन्दे जल की रोकथाम
- गंगा एवं वरूणा नदियों के जल की गुणवत्ता में सुधार
- घाट क्षेत्र की स्वच्छता की स्थिति में सुधार
- स्नानार्थ वातावरण में सुधार
- नगर महापालिका क्षेत्र के पेयजल की गुणवत्ता में सुधार
- नगर क्षेत्र की स्वच्छता की स्थिति में सुधार
- बीमारियों के खतरे में कमी एवं जन स्वास्थ्य में वृद्धि
- जल प्रदूषण के बारे में लोगों की जागरूकता बढ़ाना
- पोषक तत्वों सहित शोधित जल का सिंचाई हेतु उपयोग
- नगर क्षेत्र की छवि में सुधार
- नगर की समृद्धि में वृद्धि
- योजनाओं में निर्माण एवं रख-रखाव के समय रोजगार के अधिक अवसर

प्रभाव एवं उचित निस्तारण

प्रभाव	उचित निस्तारण
मल-जल शोधक संयन्त्र (**STP**)	
• पुनर्स्थापना	• पुनर्स्थापना को रोकने के लिए उचित एस.टी.पी. स्थल का चुनाव किया जा चुका है
• कृषि भूमि अधिग्रहण से आय में कमी	• धन द्वारा क्षतिपूर्ति या अन्य स्थल पर भूमि देकर
• जल प्रदूषण (सिंचाई नहर)	• क्लोरिनेशन द्वारा विषाणु संक्रमण दोष दूर कर • उपयुक्त रख-रखाव • अनुश्रवण (Monitoring) व्यवस्था बना कर
ट्रंक सीवर व पम्पिंग स्टेशन के निर्माण से कोई विशेष प्रभाव नही बाधा (विद्युत आपुर्ति बाधित होने पर)	
• विद्युत आपुर्ति बाधित होने पर बिना शोधन के गंदे जल का नदियों में प्रवाह	• जनरेटर व ईधन सुविधा का उचित प्राविधान • ईधन हेतु पर्याप्त बजट • उपयुक्त रख-रखाव • अनुश्रवण (Monitoring) व्यवस्था बना कर