GOVERNMENT OF INDIA
ENVIRONMENT AND FORESTS
PROJECT DIRECTORATE

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE GENERAL OF
INTERNATIONAL COOPERATION
DAL/ZZ

ENVIRONMENTAL AND SANITARY ENGINEERING PROJECT IN KANPUR AND MIRZAPUR

UNDER GANGA ACTION PLAN

MID TERM STATUS REPORT

JUNE 1989

HASKONING
NIJMEGEN
THE NETHERLANDS

EUROCONSULT
ARNHEM
THE NETHERLANDS

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BOMBAY
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IRAMCONSULT
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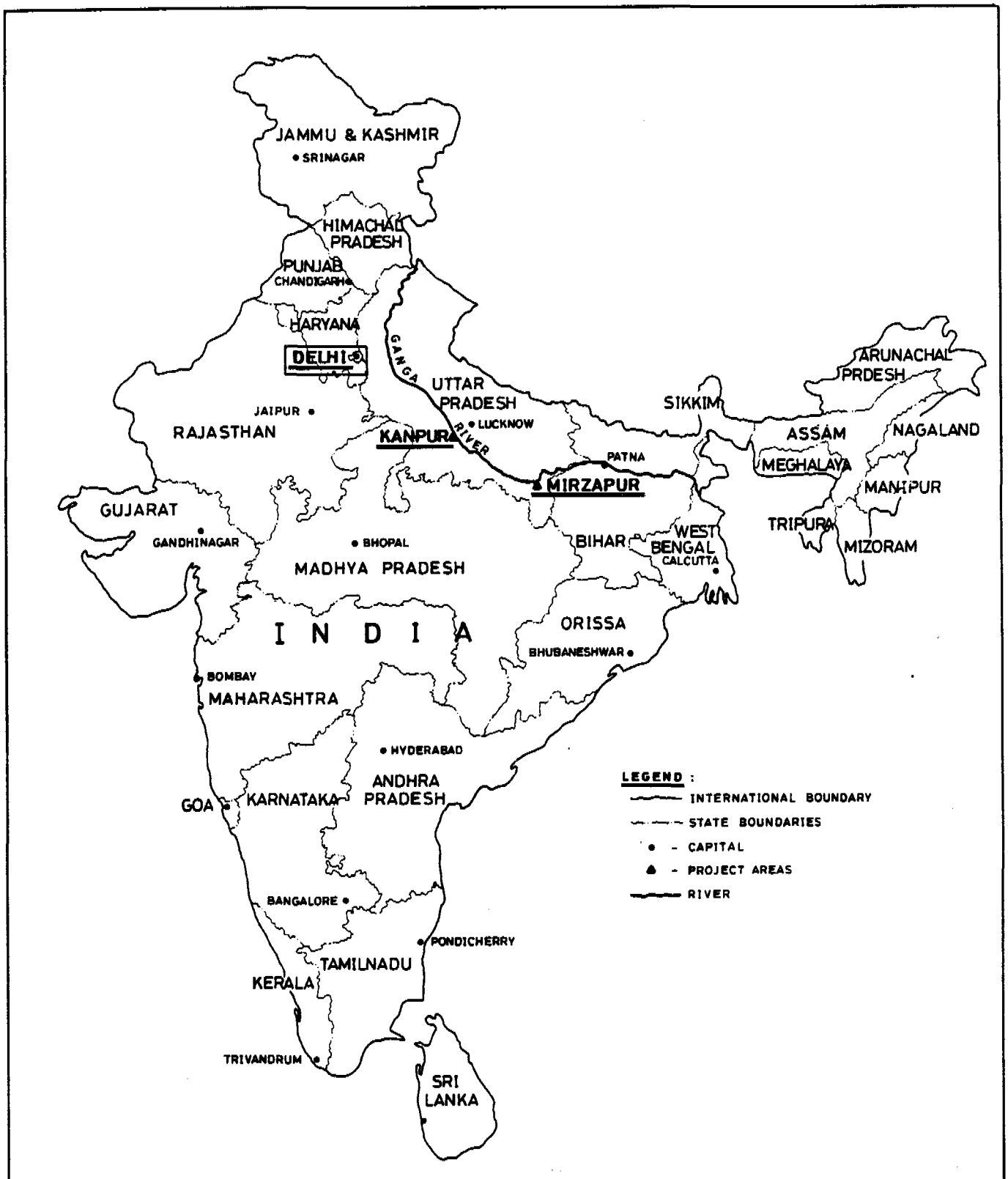
FIGURES

LIST OF ABBREVIATIONS

AC	Asbestos Cement
AMU	Aligarh Muslim University
ANMTC	Auxiliary Nurse Midwife Training Centre
AWW	Anganwadi Worker
BHU	Banaras Hindu University
BOD	Biological Oxygen Demand
CGA	Central Ganga Authority
CI	Cast Iron
CLRI	Central Leather Research Institute
CMO	Chief Medical Officer
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board, New Delhi
CSIR	Council of Scientific and Industrial Research, India
DGIS	Directorate General of International Cooperation, The Netherlands
DM	District Magistrate
DPR	Detailed Project Report
ESI	Employees State Insurance
GL	Ground Level
GPD	Ganga Project Directorate
GT Road	Grand Trunk Road
GU	University of Amsterdam, The Netherlands
HSMI	Human Settlements Management Institute
HUDCO	Housing and Urban Development Cooperation
ICDS	Integrated Child Development Scheme
IHS	Institute of Housing Studies, Rotterdam
ILO	International Labour Organisation
IPS	Intermediate Pumping Station
ITRC	Industrial Toxicological Research Centre
KAP	Knowledge Attitudes Practiser
KDA	Kanpur Development Authority
KIT	Royal Tropical Institute, Amsterdam
KIWA	Testing and Research Institute of the Netherlands Waterworks Association
KJS	Kanpur Jal Sansthan
km	Kilometer
KMC	Kanpur Medical College
KNM	Kanpur Nagar Mahapalika
LCS	Low-Cost Sanitation
lpcd	Litres per capita per day
LU	Agricultural University of Wageningen
m	Metre
MCH	Maternal and Child Health
MLD	Million Litres per Day
mm	Millimetre
MNP	Mirzapur Nagar Palika
MPS	Main Pumping Station
MSL	Mean Sea Level
mwc	Metres Water Column
NEERI	National Environmental Engineering Research Institute

NEI	Netherlands Economic Institute
NGO	Non Governmental Organisation
No.	Number
OHT	Overhead Tank
O & M	Operation and Maintenance
ORS	Oral Rehydration Solution
PHC	Primary Health Care
PMG	Programme Management Group
PMP	Private Medical Practicioner
ppm	Parts per million
PSM	Preventive and Social Medicine
PVC	Poly Vinyl Chloride
Ref.	Reference
RIVM/BOS	Netherlands Institute of Public Health and Environmental Hygiene
RLI	Regional Labour Institute
Rs.	Rupees
RTI	Royal Tropical Institute, Amsterdam
SPM	Social and Preventive Medicine
sq. km	Square Kilometer
SS	Suspended Solids
STP	Sewage Treatment Plant
TBA	Traditional Birth Attendant
TNO	Council for Scientific and Industrial Research in The Netherlands
TT	Tetanus Toxoid
TW	Tubewell
UASB	Upflow Anaerobic Sludge Blanket
UCD	Urban Community Development
UP	Uttar Pradesh
UPJN	Uttar Pradesh Jal Nigam
UPPCB	Uttar Pradesh Pollution Control Board



CLIENT :	FIGURE 1.1	
JOB :	SCALE	
DRAWING : PROJECT AREAS IN INDIA	DRWN BY	
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	DATE	

1. INTRODUCTION

The "Indo-Dutch Environmental and Sanitary Engineering Project Kanpur and Mirzapur" under the Ganga Action Plan is currently being executed within the Indo-Dutch bilateral development cooperation framework.

The project aims at integration of physical, social, and health related improvements and it is expected that the developed approach and methodology can be replicated in other Intermediate Urban Settlements in India. The project is being supplemented by a training programme to facilitate the transfer of new technologies and improvement of operation and maintenance of the new facilities.

The project started in June 1987 and has now reached a stage wherein certain planned activities have been accomplished and a major shift to implementation of physical works will take place.

1.1 PURPOSE OF REPORT

Since the inventory and design phase has been completed and some experience about execution has been gained, it is now felt pertinent to make an assessment of the achievements accomplished so far against the background of the objectives and the integrated project approach and methodology.

The purpose of the report is first of all to provide the counterpart organizations and the funding agency with an overview of objectives and related project activities which have been formulated and elaborated during the past two years together with a constructive evaluation of opportunities and constraints experienced so far. Secondly the report will provide comprehensive background information to the Joint Indo-Dutch Mission, carrying out the external mid-term evaluation in June 1989.

Thirdly the formulation of the report by the multi-disciplinary group of professional project staff provides an opportunity for internal exchange of information and a joint reflection on the course of action taken in the project so far.

It should be noted that views and opinions expressed in this report are those of the advisory group and do not necessarily represent those of the counterpart organizations or executing agencies.

For detailed information on various project activities reference can be made to the reports prepared by the project. The various reports are listed in the attached bibliography.

1.2 LIMITATIONS

Although most of the Designs have been completed and a certain amount of construction experience has been gained, it has to be taken into account that the project is still in the middle of its planned completion and that the major execution works are still to be carried out. As soon as the major works will start it can be assessed whether the chosen plan of action for implementation will be able to address the stresses and constraints which will be encountered before reaching the target completion dates.

Since at this stage most of the execution is yet to start and that a number of implementing agencies are involved, it is difficult to give a final opinion on the demonstration value and related impact of the project.

Also since the investment costs for some major schemes have not yet been officially decided, it is not possible to carry out a detailed financial analysis. There are, however, indications that the total costs for both Kanpur and Mirzapur will exceed their planned ceilings by GPD of respectively Rs. 15 and 9 crores. This probably will influence the viability of the investment in terms of the affordability, subsidy levels and the related cost recovery structure.

Once the total investment costs for all planned schemes become available, it will be discussed with various agencies related to the project to what level investments can be made and which cost reductions are necessary.

In addition an agreement should be reached on phasing of investments in order to ensure that the facilities provided by the project can be sustained by the local level community.

Finally it should be noted that the report is compiled of contributions by different professionals attached to the project. Although the overall aim is to present a homogeneous and coherent document it is obvious that style and presentation will not be consistent.

1.3 STRUCTURE OF THE REPORT

The report starts with an overview of objectives and related project activities as well as special considerations laid down in the original project documents.

After an elaboration on the integrated approach and the relatively complicated institutional setting the pre-project situation and the planning sequence for project components will be discussed.

Subsequently the technical project components and community and health related aspects will be presented aiming to provide also interlinkages between the different aspects. After discussion of the financial aspects and training, an attempt has been made to carryout a retrospective analysis and subsequent suggestions for further policy formulation and related adjustments for implementation of the project.

2. PROJECT BACKGROUND

The history of the Project dates back to 1985 when the existing bilateral development cooperation sectors between India and the Netherlands were expanded with the addition of Environmental Protection and Management. The first major collaborative effort was identified within the Ganga Action Plan which was then recently initiated by the Government of India. The deliberations between the Ganga Project Directorate and the Netherlands Identification and Fact Finding Missions resulted in a project which included besides prevention of the pollution of river Ganga also the improvement of the environmental and living conditions of the people of Jajmau, the industrial area of Kanpur and Mirzapur. The location of the two project towns is shown in Figure 2.1.

2.1 THE GANGA ACTION PLAN

The Ganga is the most important river of India and has served as the cradle of Indian civilization. Many towns on the Ganga, for example Kanpur, Allahabad, Patna and Calcutta, have very large populations and the river serves as the source of water supply for these towns. The Ganga is, however, being grossly polluted especially near the towns situated on its banks. Urgent steps need to be taken to prevent this pollution and restore the purity of river water.

The Ganga passes along 29 Class I cities (population over 1,00,000), 23 Class II cities (population between 50,000 and 1,00,000), and about 48 towns having less than 50,000 population. In those towns where there is no sewerage system or the coverage is only partial, the domestic and industrial waste water flows through open drains and finally finds its way into the river. Unfortunately, even in some of the sewered towns, a similar situation arises when pumping stations are non-functional due to poor operation and maintenance or non-availability of electric power.

The intensity of irrigation in the Ganga basin is very high. About 43 percent of the total irrigated area in the country is located in the Ganga basin. Practically the entire dry weather flow is diverted to the Upper Ganga Canal at Hardwar and whatever flow is regenerated between Hardwar and Aligarh is again diverted to the Lower Ganga Canal near Aligarh. As a result of this, there is very little dry weather flow in the Ganga at Kannauj and Kanpur where there is a heavy inflow of pollutants in the river. The Ganga receives over 60 percent of its water from Yamuna, Ghagra, Kosi and Gandak, all joining the main river at or at points below Allahabad. The Hardwar-Kanpur-Allahabad stretch is, therefore, particularly vulnerable.

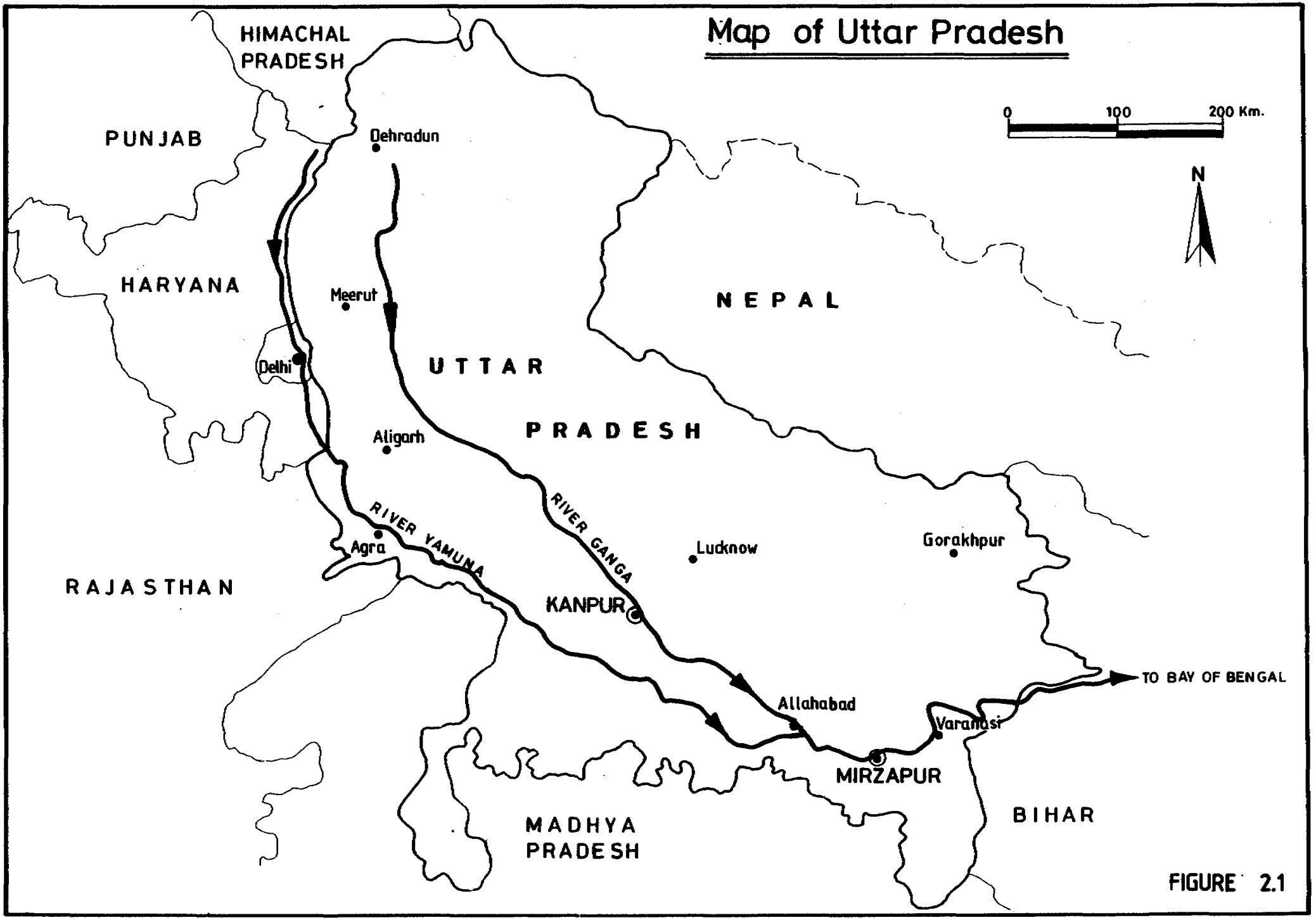

Map of Uttar Pradesh
HIMACHAL PRADESH
PUNJAB
HARYANA
RAJASTHAN
NEPAL
UTTAR PRADESH
MADHYA PRADESH
BIHAR
Dehradun
Meerut
Delhi
Aligarh
Agra
Lucknow
Gorakhpur
KANPUR
Allahabad
Varanasi
MIRZAPUR
RIVER YAMUNA
RIVER GANGA
TO BAY OF BENGAL
0
100
200 Km.
N

FIGURE 2.1

Formulation of the Action Plan

In 1980 the Central Pollution Control Board was asked to make a study of the source and extent of pollution in the Ganga and to come up with a programme for its prevention.

The study of water pollution in the Ganga basin prepared by the Central Pollution Control Board in 1984 is the country's first comprehensive assessment of the problem. The report reveals:

- Three fourths of the pollution of the Ganga is from untreated municipal sewage.
- Out of this 88% comes from 27 Class-I cities.
- Only a few towns have sewage treatment facilities, but even these are not functioning.
- Industries accounted for 25% of the total pollution, but this was far more acute in areas such as Calcutta and Kanpur.

This inventory of pollution formed the basis for the Ganga Action Plan document prepared by the Department of Environment in December, 1984. Since the inventory had identified domestic wastes from the 27 Class-I cities along the river Ganga as the major cause of pollution, the Action Plan's thrust is to divert such wastes away from the river.

Components of the Action Plan

The Ganga Action Plan aims to divert the sewage now flowing into the river to other locations for treatment. The following have been identified as the main components of the action plan:

- Renovation (cleaning/desilting/repairing) of existing trunk sewers and outfalls to prevent the outflow of sewage into the Ganga.

- Construction of interceptors to divert flow of sewage and other liquid wastes away from the Ganga.

- Renovation of existing sewage pumping stations and sewage treatment plants and installation of new sewage treatment plants to recover the maximum possible resources.

- Providing sullage or sewage pumping stations at the outfall points of open drains, to divert the discharge from the river into the nearest sewers and treatment plants.

- Low cost sanitation schemes in areas adjoining the river to reduce or prevent the flow of human wastes into the river.

- Pilot projects to establish cost effective systems for diversion of wastes now flowing into the river, their treatment and resource recovery.

- Pilot projects to establish feasibility of technology application in the treatment of wastes and resources/energy recovery.

Depending on feasibility, circumstances and availability of funds certain other components will need to be taken up in the present or subsequent phases, such as:

- Extending the existing sewage systems in the towns to cover the unsewered areas.

- Prevention of throwing of dead bodies into the river.

- Regulation of the use of pesticides and insecticides for agriculture in such a way that surface run-off from cultivated areas does not carry excessive quantities of these materials to the river.

2.2 PROJECT IDENTIFICATION AND FORMULATION

In mid 1985 an Identification Mission from the Netherlands, consisting of two Dutch experts, arrived in India to look into the possibilities for bilateral cooperation in the field of Environment. During their discussions with the Ministry of Environment, GOI, they were requested to identify the possibilities of Dutch cooperation in projects under the Ganga Action Plan.

After discussions with the Ganga Project Directorate, a body within the Ministry of Environment, they were asked to visit U.P. State. During the visit they identified two towns namely Kanpur and Mirzapur. In Kanpur the industrial area Jajmau was identified for reasons of introducing Dutch developed technologies mainly for the reduction of the industrial/tannery pollution load. Mirzapur on the other hand was chosen for reasons of its limited size, so that an Integrated Environmental and Sanitary Engineering Project could be implemented there. The mission proposed to field a Fact Finding Mission to formulate definite proposals for the Integrated Environmental and Sanitary Engineering Projects at Jajmau, Kanpur and Mirzapur.

The Fact Finding mission was carried out in January-February 1986 by a team of Dutch and Indian Experts. The objectives of this Fact Finding Mission were to collect sufficient data for the formulation of definite proposals for an integrated project in the two towns. The mission had to formulate proposals which reflected the recommendations of the Identification Mission with regard to the identified two towns, the use of appropriate clean technologies and the investment levels.

The Fact Finding Mission in consultation with the state and local implementing agencies and the GPD spelled out the project components with their investment levels for an implementation duration of four years.

At this stage U.P. Jal Nigam was the principal implementing agency for the Ganga Action Plan Projects in U.P. In view of the fact that the Indo-Dutch projects were to contain elements additional to the Ganga Action Plan like Water Supply, Solid Waste Management, Community Participation and Public Health Promotion the need to involve local municipal agencies more in the project was realized by the Fact Finding Mission. In view of this, the mission also recommended a project organizational set-up to coordinate the implementation efforts. Their suggestions were later on translated into an organizational set-up with on-site working groups at Kanpur and Mirzapur and a Project Review Panel in New Delhi by the follow-up mission of Mr. Zeper (RIVM/BOS), who also drafted the official Terms of Reference for the project.

Based on the TOR some selected groups of Dutch and Indian Consulting firms were invited to present a technical and financial proposal to the Directorate General of International Cooperation in the Netherlands.

Finally, a group comprising of HASKONING, EUROCONSULT, AIC and IRAMCONSULT were awarded the consultancy assignment to carry out the project.

2.3 PROJECT FRAMEWORK

The project aims at interventions related to sewerage and stormwater drainage, water supply and sanitation, anaerobic treatment of waste water, reuse of effluent, collection and disposal of solid waste, public health education and community development. Special emphasis is being given to training for improving operation and maintenance of the provided facilities and transfer of knowledge.

The project is being executed in different project cycles. A schematic description of the project cycle is presented in **Figure 2.2.** Phase I covers the first 1 1/2 years during which the inventories and designs were to be prepared as well as certain crash programmes were to be identified and implemented. It was also envisaged to construct a first module UASB treatment plant in Jajmau, Kanpur for predominantly domestic waste water and a pilot UASB plant for treatment of tannery waste water as well as a chrome recovery pilot plant at one of the tanneries. These plants were also to be monitored during this period and the results were to be used for the design of the remaining treatment systems in Kanpur as well as in Mirzapur.

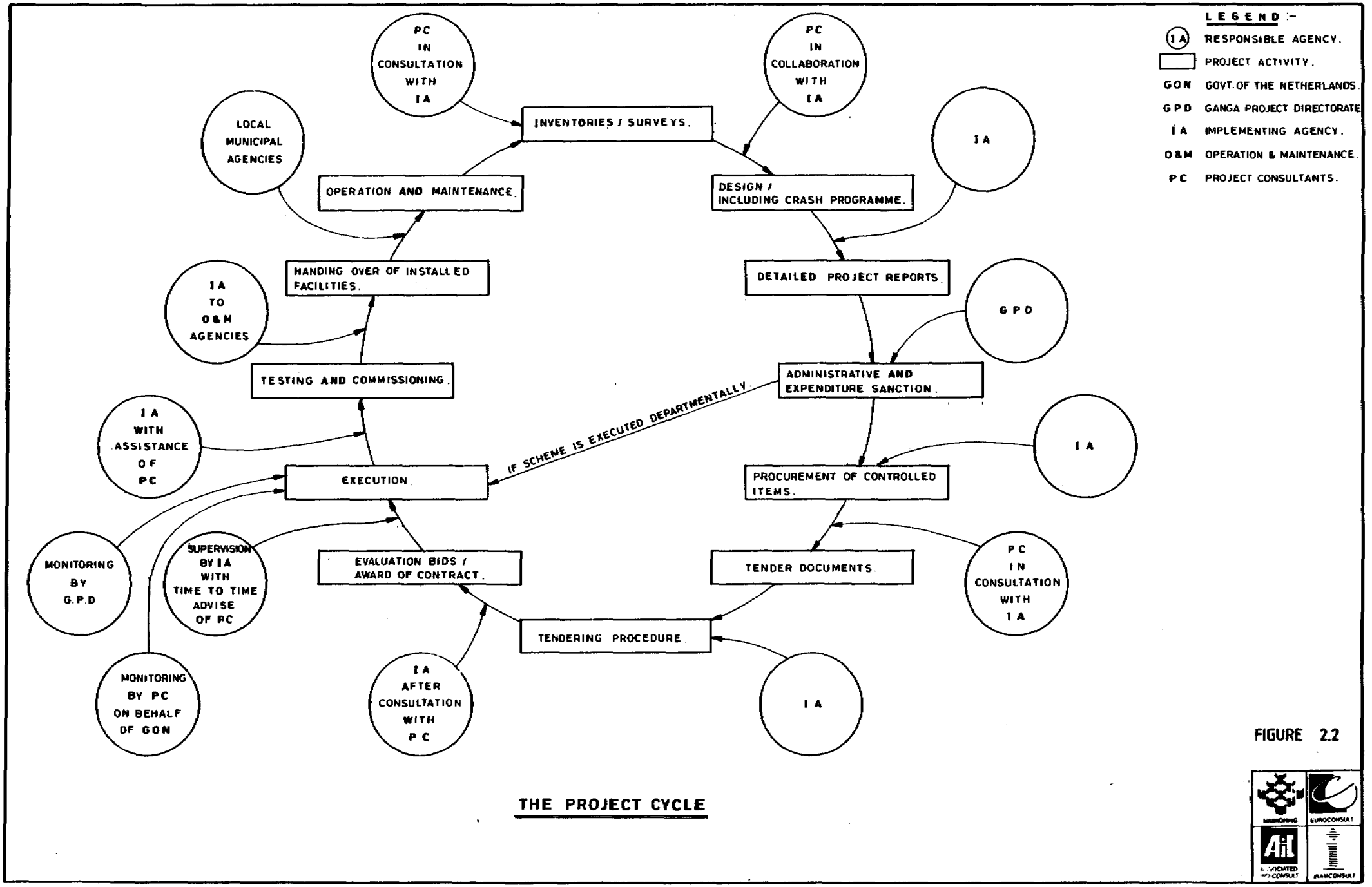


FIGURE 2.2

THE PROJECT CYCLE

After this 1 1/2 year period the workplan included a 2 1/2 year period during which the detailed designs and tender documents had to be prepared as well as the execution of various schemes had to be undertaken and completed.

The Ganga Project Directorate under the Ministry of Environment and Forests at New Delhi is the main counterpart organization for this project.

The project implementation is guided and monitored by the Royal Netherlands Embassy in New Delhi. In order to strengthen the technical capability of monitoring, RIVM/BOS has been assigned as project advisor on behalf of the Netherlands authorities.

For the execution of the project, project offices were established by the consultants at Kanpur, Mirzapur and New Delhi. The project office in New Delhi provides the necessary logistics and interactive support particularly with the GPD and the Netherlands Embassy. The offices in Kanpur and Mirzapur serve as field offices for technical and non-technical staff. The Kanpur office in addition, is the main design office for the project.

3. OBJECTIVES AND THEIR ACCOMPLISHMENT

3.1 OBJECTIVES

The Ganga Action Plan aims at "Reduction and Prevention of Pollution of the river Ganga". It is obvious that this overall aim also serves as the main development objective for the project. In addition to the reduction of the pollution load of the river Ganga the project aims at improvement of the environmental and living conditions of the people in Jajmau, Kanpur and Mirzapur.

More specifically the following immediate objectives were formulated:

- To develop integrated delivery systems for sewerage, stormwater drainage, water supply, sanitation, treatment of domestic and industrial waste water, collection, disposal and possibly treatment of solid waste, and public health education utilizing effective community participation, with the aim not only to control pollution on the river Ganga, but also to improve the general living conditions of the target population in Kanpur and Mirzapur.

- To demonstrate the application of such an integrated approach in Jajmau, an area which is characterized by a mixed industrial and residential use within the city of Kanpur, and the medium sized city of Mirzapur and to develop basic criteria for the technical designs in sanitary engineering projects for combined treatment of domestic and industrial waste water.

- To demonstrate that by using an anaerobic waste water treatment process, a substantial part of the energy requirements for waste water collection and treatment can be covered by its production of biogas.

Accomplishment of these immediate objectives can only be undertaken with a coordinated implementation of the measures which are summarized in the next para and which will be subsequently elaborated upon in the following Chapter.

Integrated planning and implementation of these measures is necessary to achieve the objectives because the effect of each measure is closely interlinked with that of other measures.

3.2 MEASURES FOR ACCOMPLISHMENT

In order to achieve the objectives a number of curative and preventive measures are being implemented which are summarized below.

- Construction of Interceptors

Both in Kanpur and Mirzapur sewage outfalls exist directly connected with the Ganga through sewers and nalahs. In Mirzapur it is intended to intercept the nalah system which mainly has outfalls into Ganga and convey the sewage to a site for treatment outside the built-up area. This conveyance can only be achieved by the use of pumping stations which should be kept to a minimum in view of the need to minimize requirements for operation and maintenance.

In Jajmau, Kanpur the open drains which have outfalls into Ganga mainly carry tannery waste water. The topography of the area near the Ganga, the location of the tanneries, as well as the legislative constraints require that the interception of the open drains/nalahs will be designed as a Industrial sewerage system to which all tanneries should be connected.

- Introduction of the Upflow Anaerobic Sludge Blanket Process (UASB) for Treatment of Waste Water

The intercepted Industrial and domestic waste water have to be treated upto the desired levels set forth by the Government agencies for discharging into surface waters or open land.

The UASB treatment technology which was since long established for the treatment of Industrial waste water has recently been developed for treatment of domestic waste water as well by LUW, The Netherlands. As this treatment option offers favourable possibilities for treatment of waste water under Indian conditions it has been agreed to introduce the UASB technology in Kanpur and Mirzapur.

- Introduction of the Chrome Recovery Technology in the Tanneries of Jajmau, Kanpur

Chrome Tanning constitutes the major tanning process in the tanneries of Jajmau. In the near future most of the growth is expected in the use of chrome tanning. Out of the total quantity of chrome used for tanning purposes more than half remains in the tannery waste water and is ultimately reaching the Ganga untreated.

It is envisaged that through the introduction of the chrome recovery technology a substantial amount of chrome can be reused. This contributes to the reduction of the pollution load and offers financial benefits to the tanners.

- Provision of Low Cost Sanitation

At present in both project areas a large part of the population has no sanitary facilities. Low cost private pour flush latrines will therefore be provided. Depending on the presence of the sewers, these latrines will either be connected to leaching pits or to a sewer. For people who can not afford a private latrine or who do not have sufficient space in their premises, and for the floating population public latrines will be provided.

- Rehabilitation and Augmentation of the Water Supply System

The water supply system in the project areas is far from satisfactory. In order to improve the living and hygienic conditions in the areas rehabilitation of the water supply system is an urgent requirement. Augmentation of the system can only be taken up after it has been rehabilitated. Needless to say that the planning of the sewerage system and sanitation should go hand in hand with the planning of water supply activities.

- Improvement of Storm Water Drainage

In both towns during heavy rains many areas are flooded due to the improper functioning of the stormwater drainage system either because of insufficient carrying capacity or on account of choking. This causes immense inconvenience as well as insanitary conditions since most of these stormwater drains also carry domestic and industrial waste water. Stormwater drains will therefore be upgraded, renovated and extended where needed to remove the present bottlenecks.

- Solid Waste Collection and Disposal

The present level of facilities for solid waste collection and disposal is insufficient. People generally dispose their waste on road sides. This creates health hazards and easily chokes sewer lines and stormwater drains. Collected solid waste is also often dumped on the banks of Ganga which pollutes the river. The proper collection, transportation and controlled disposal of solid waste is an essential part of any environmental upgrading programme and hence is being undertaken by the project.

- Enhancement of the Knowledge, Attitudes and Practices of the Target Population

All technical interventions for a cleaner environment and healthier living conditions as listed above will not be possible without the active involvement of the people. In order to enhance the knowledge and the subsequent change in attitudes and practices of the beneficiaries, community workers are actively involved in activities related to promotion of awareness, initiating social organization and grass root level transfer of knowledge.

- Promotion of Public and Occupational Health

As public health standards are very low in the project areas, the target population will be educated to use the facilities in such a manner that their hygienic conditions are improved. Also occupational health interventions for tannery workers in Jajmau and carpet weavers in Mirzapur are virtually non-existant. Improvement of the occupational health situation will considerably contribute towards improvement of the living conditions of the work force in industries and is supposed to have a spin off effect to their families as well.

- Transfer of Know-how through Training

As mentioned earlier, training will be undertaken to bring about the involvement and participation of the community as beneficiaries in the project. This involves training in operation and maintenance of facilities such as handpumps and latrines and education in public health and environmental hygiene. It will also highlight user participation as well as help in developing positive community attitudes towards safe drinking water and sanitation. Volunteers from the communities will be trained as caretakers for handpumps and possibly other sanitation facilities.

In addition, training is an important element in the project to ensure Human Resource Development and transfer of knowledge to the local agencies that are involved in the project. Certain new technologies like the UASB process and chrome recovery are being introduced by this project. Transfer of these technologies will be ensured through off- and on-the-job training.

4. SPECIAL CONSIDERATIONS

The Project has certain specific and distinctive features in comparison with other Ganga Action Plan projects in U.P. They are mainly related to approach and methodology especially the integrated project approach and the efforts to bring about effective community involvement and participation in the project and to increase peoples awareness towards public health. Also the demonstration character for replication in similar development projects as well as the improvement of the vocational possibilities of female construction workers.

4.1 INTEGRATED PROJECT APPROACH

The Environmental and Sanitary Engineering Project, Kanpur-Mirzapur under the Ganga Action Plan comprises an integration of various project components. These components are technical, socio-economic and institutional. The integration, refers to interrelationships between the technical components namely, sewage treatment, sewerage and stormwater drainage, water supply, sanitation and solid waste management. At the same time it refers to the integration of the technical "distribution systems' with the socio-economic, cultural and institutional "Receiving Structure" at community level. A schematic presentation of the Integrated Project Approach is given in Figure 4.1.

The interdependency of different components results in mutual influences, both in positive and negative respect. In other words: interventions in one particular component creates positive or negative impacts on one or more components of a certain system which have to be anticipated and addressed during project implementation.

As such the integrated approach can be defined as "a strategy for interventions in different inter-related components aiming at a harmonious functioning of a system".

In reality we, unfortunately, have to conclude that most systems are not functioning properly and that therefore an integrated approach is needed to achieve an improved harmonization between different components with the ultimate aim to provide an acceptable level of quality of life for the people on a sustained basis.

Socio-economic and cultural aspects form an important element in the integrated approach. As mentioned above the main task is to mutually adjust the technical "distribution systems" and the socio-economic "receiving structure" in order to promote efficiency and effectiveness. It is the people who, to a great extent, use the technical facilities and have to be made responsible for certain tasks related to operation and maintenance.

OVERVIEW MAIN COMPONENTS

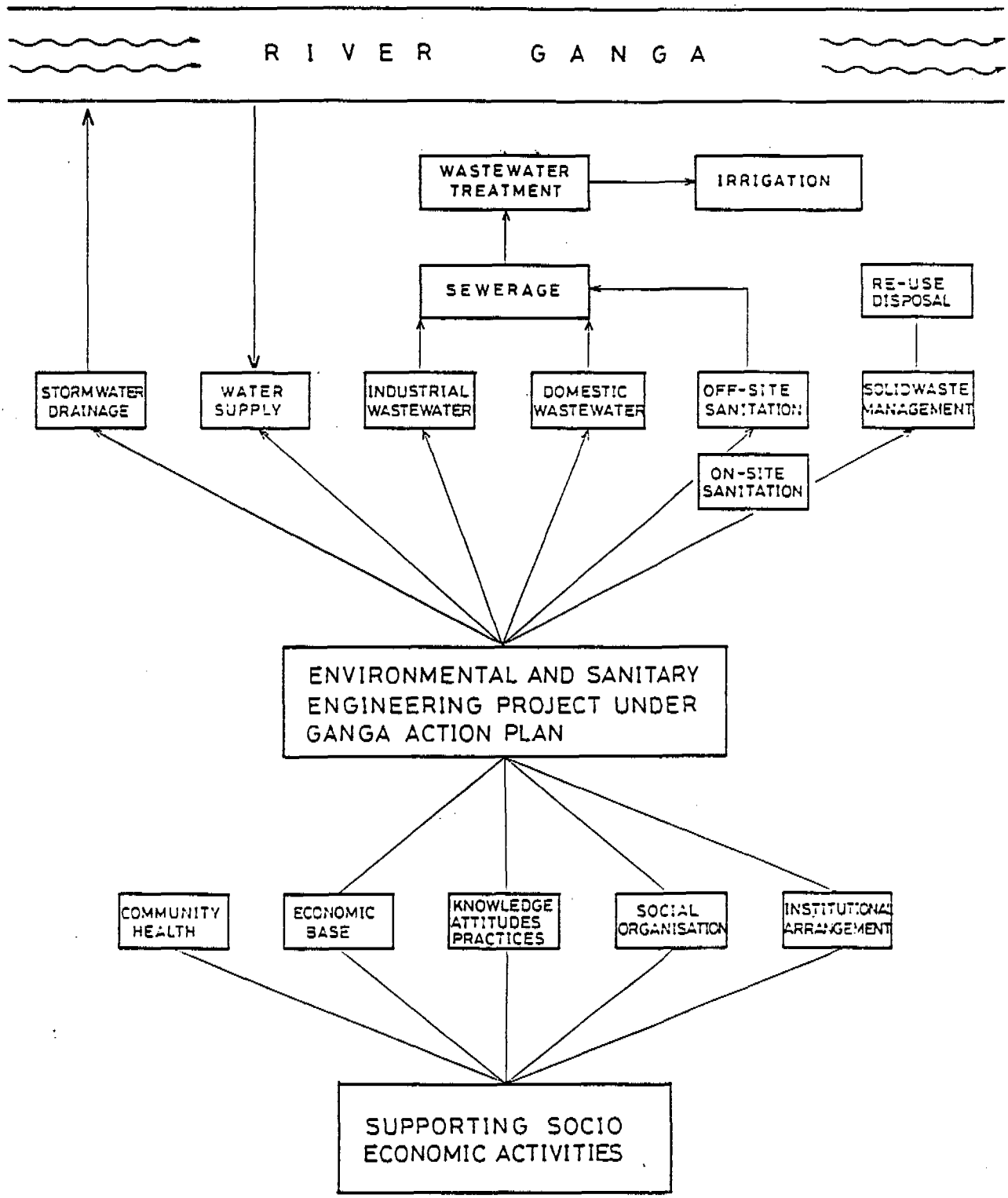


FIGURE 4.1

This responsibility can be translated in financial contributions as well as a utilization of local skills and labour. It is at the same time obvious that existing knowledge, attitudes and practices at the community level have an impact on the proper use and functioning of infrastructure and services. Examples are many and include e.g. willingness to pay; handling of solid waste; attitudes towards maintenance; sanitary habits; perceptions on hygiene and health.

The "Receiving Structure" contains both potentials and constraints which influence development efforts.

The peoples skills, inventiveness and community strength represent a potential that has to be recognized and utilized. Constraints, on the other hand, can be found in certain values and attitudes resulting in practices which have a negative effect on technical changes which have to be introduced through the project.

4.2 DEMONSTRATION CHARACTER OF THE PROJECT

The project introduces certain innovative approaches and Technologies which have not been applied in India before within a comprehensive set-up. Amongst them are the Integrated Project Approach, UASB treatment technology and the Chrome Recovery Technology.

In addition to accomplishing actual improvements in Kanpur and Mirzapur this project therefore also aims at demonstrating the replicability of the approach and methodology in other large and middle zone towns in India. The demonstration character implies a strong emphasis on documentation of experiences, development of audio-visual materials, monitoring, evaluation and feed-back.

4.3 INVOLVEMENT OF THE FEMALE CONSTRUCTION WORKERS

In the construction Industry women have various specific roles which are usually tiring and back-breaking yet low paid. Women do the unskilled jobs of breaking stones, lifting and carrying mortar, bricks and sand etc. They have very little opportunities to upgrade their skills.

In the side letter for this project the attention to the application of Indian Labour Laws particularly for female construction workers has been drawn. This includes payment of equal wages to men and women not below the rates notified under the minimum wage act. Also employment cards and wage slips should be given to them.

Since under the project a considerable amount of building activity will take place the idea gradually took shape, to start a training programme for female construction workers as masons. Especially, the low cost sanitation programme was found to be a suitable entry for their employment after being trained. It is intended that after gaining sufficient experience in the LCS programme they will be able to carry on in other similar jobs.

4.4 CRASH PROGRAMMES

In conjunction with the main activities in the initial stage of the project viz. inventory, designs, tender documents, crash programmes were identified and initiated in the field of water supply and sanitation.

These crash programmes are meant to tackle evident bottlenecks in the existing system with an aim to improve the performance of the facilities and to demonstrate to the people in the project areas that immediate improvements are possible. The identified crash programmes form an integral part of the project although it is evident that the primary focus is on short term measures to improve living conditions for the target population.

5. INSTITUTIONAL FRAME WORK

5.1 PROJECT INSTITUTIONAL SET-UP

The project is designed and implemented in a relatively complex Institutional Setting. The main reasons for this situation are as follows:

a. The multi-disciplinary and integrated nature of approach and methodology.

b. The execution of the work in different locations and by various executing agencies.

c. Decision making process and execution responsibility at three different government levels, i.e. central, state and municipal.

At the central level the Ganga Project Directorate (GPD) at New Delhi is the counterpart organization for the project. GPD functions as a wing of the Ministry of Environment and Forests of the GOI to appraise and sanction schemes and to coordinate the implementation of the Ganga Action Plan in the three States of Uttar Pradesh (U.P), Bihar and Bengal.

The U.P. State Government, Department of Housing and Urban Development has been entrusted by the GPD to implement on its behalf the Ganga Action Plan in U.P. This department coordinates the implementation by the various executing agencies at state and local level through state level and divisional level steering committees.

The U.P. Jal Nigam, a state-wide agency under the U.P. State Government, Department of Housing and Urban Development has been appointed to implement the water supply, sewerage and stormwater drainage and sewage treatment schemes under the project. In addition, at Mirzapur, U.P. Jal Nigam is implementing the LCS scheme. In order to execute the schemes more effectively the U.P. Jal Nigam has established a Ganga Pollution Control Unit at Kanpur headed by a General Manager. At Mirzapur the Ganga Action Plan works are supervised by a Superintending Engineer who is responsible to the Chief Engineer Allahabad. This Superintending Engineer, in addition to Ganga Action Plan schemes, looks after other projects also.

At Kanpur the Kanpur Nagar Mahapalika is entrusted with the execution of the Low Cost Sanitation, solid waste management as well as the community participation and health promotion programme. The Kanpur Jal Sansthan (KJS) is responsible for the installation of the handpumps under the water supply programme and the execution of crash programme for sewer cleaning.

In Mirzapur the Mirzapur Nagar Palika is carrying out the implementation of solid waste management and community participation and health aspects.

The Project Institutional Set-up is given in Figure 5.1.

PROJECT INSTITUTIONAL SET-UP

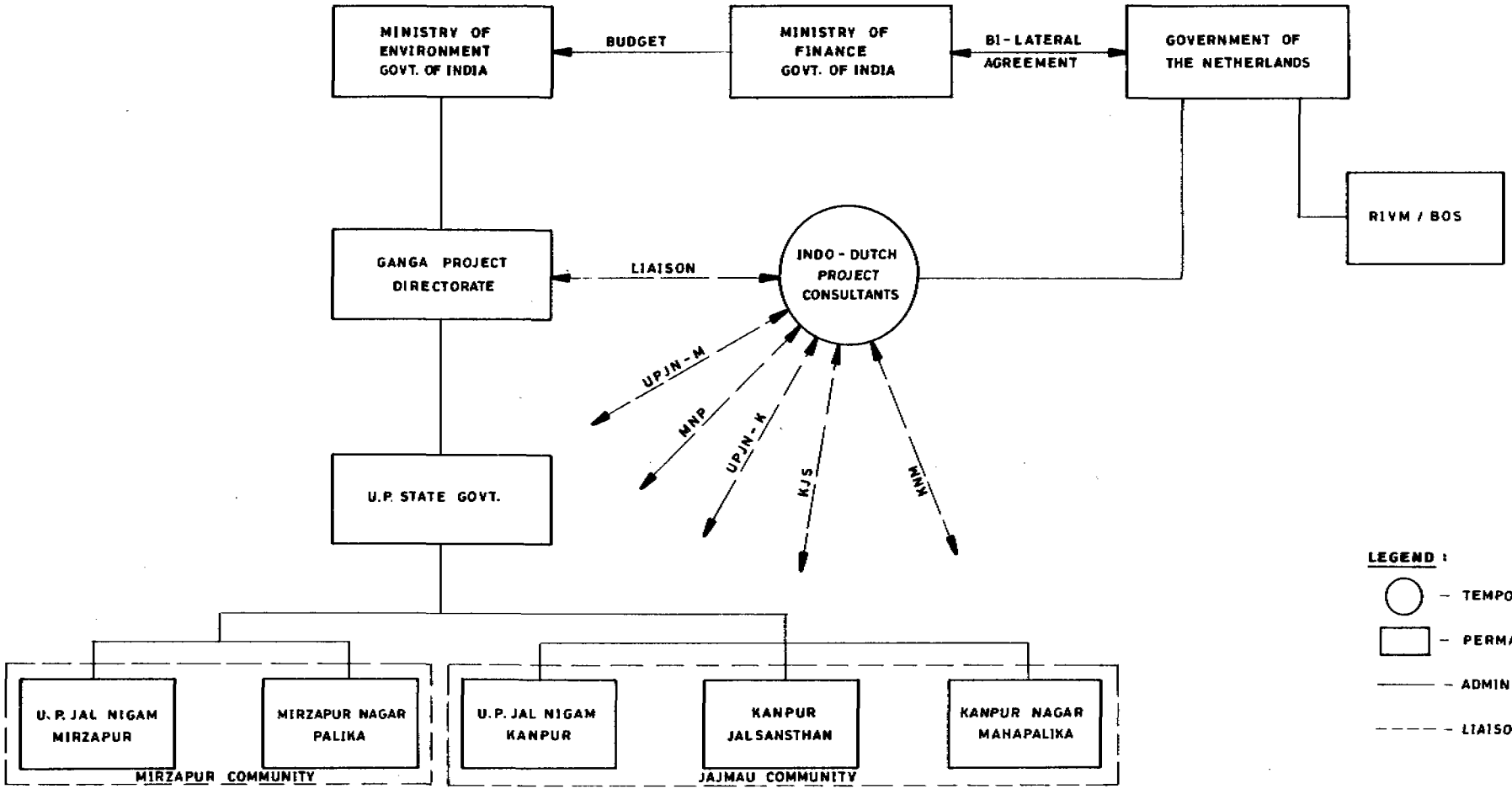


FIGURE 5.1

5.2 PROJECT CONSULTANCY SET-UP

The project Consultancy set-up comprises of four consultancy firms namely HASKONING and EUROCONSULT from The Netherlands and AIC and IRAMCONSULT from India who are providing the main consultancy inputs with regard to the Environmental and Sanitary Engineering Aspects. In addition to this, complementary support is provided by a number of Institutions.

Because of the large number of interrelated activities, experts from the following institutions in The Netherlands and in India were asked to participate in the project.

- Agricultural University of Wageningen (LUW), Netherlands (Scientific background of the UASB process and The extension support)
- Netherlands Institute for Testing and Research of Water Supply Equipment (KIWA) (Leak detection in water supply)
- Royal Tropical Institute (KIT), The Netherlands (Health related aspects)
- University of Amsterdam, The Netherlands (Community Involvement with emphasis on the role and position of women)
- Institute for Housing Studies (IHS), The Netherlands (Training aspects)
- Human Settlements Management Institute (HSMI/HUDCO), India (Training coordination)
- TNO/ILS, The Netherlands (Tannery aspects)
- Central Leather Research Institute Madras (CLRI), India (Tannery aspects)
- Aligarh Muslim University, India (Scientific support for influent, effluent and sludge characteristics for UASB process)
- Banares Hindu University, India (Public Health and Occupational Health)

The Project Consultancy Set-up is given in Figure 5.2.

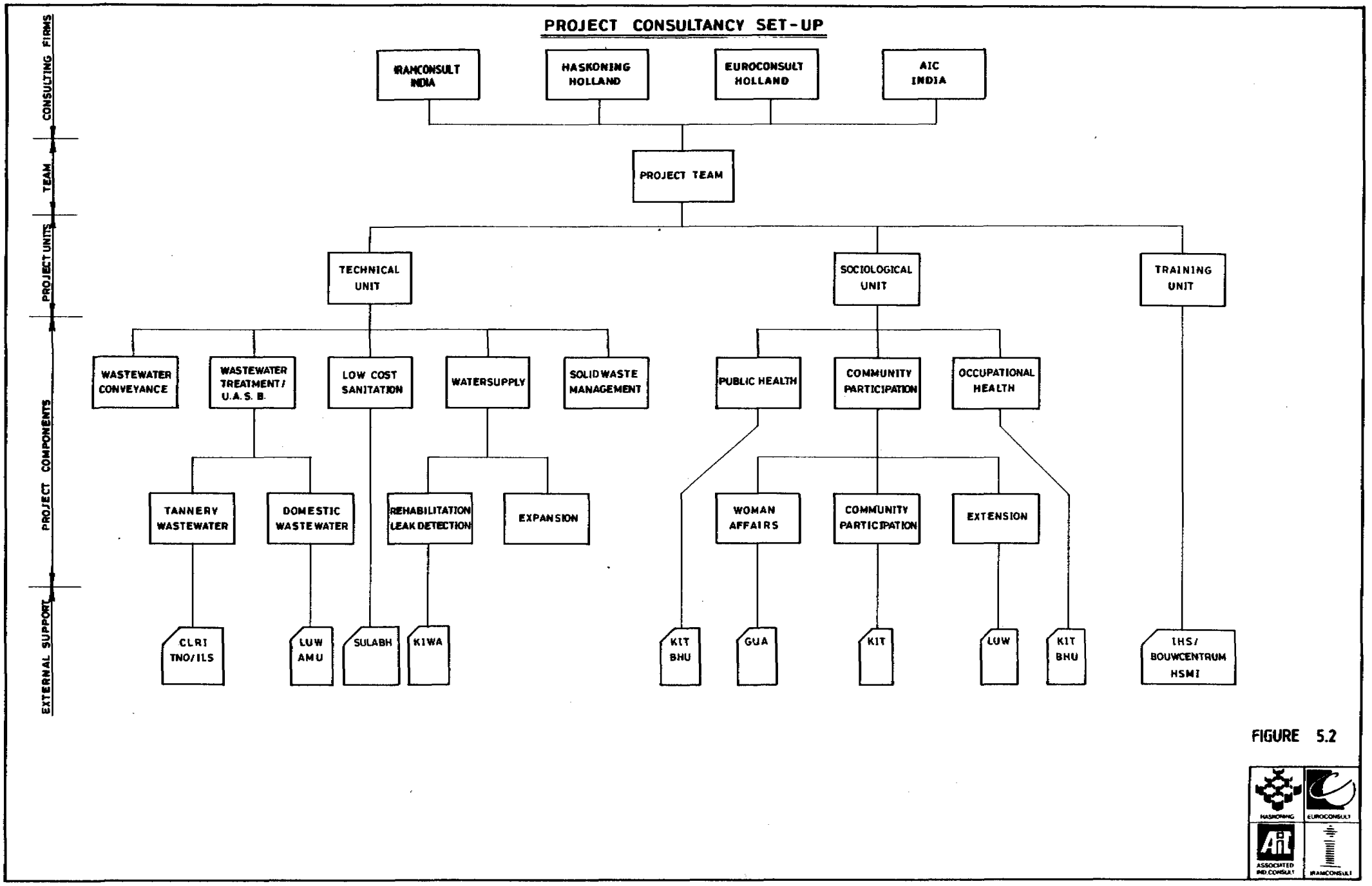

PROJECT CONSULTANCY SET-UP
CONSULTING FIRMS
TEAM
PROJECT UNITS
PROJECT COMPONENTS
EXTERNAL SUPPORT
IRAMCONSULT INDIA
HASKONING HOLLAND
EUROCONSULT HOLLAND
AIC INDIA
PROJECT TEAM
TECHNICAL UNIT
SOCIOLOGICAL UNIT
TRAINING UNIT
WASTEWATER CONVEYANCE
WASTEWATER TREATMENT / U.A.S.B.
LOW COST SANITATION
WATERSUPPLY
SOLID WASTE MANAGEMENT
PUBLIC HEALTH
COMMUNITY PARTICIPATION
OCCUPATIONAL HEALTH
TANNERY WASTEWATER
DOMESTIC WASTEWATER
REHABILITATION LEAK DETECTION
EXPANSION
WOMAN AFFAIRS
COMMUNITY PARTICIPATION
EXTENSION
CLRI TNO/ILS
LUW AMU
SULABH
KIWA
KIT BHU
GUA
KIT
LUW
KIT BHU
IHS/ BOUWCENTRUM HSMI

FIGURE 5.2

5.3 PROJECT MONITORING AND DECISION STRUCTURE

The existing data for the various project schemes in Jajmau and Mirzapur were found to be inaccurate and insufficient for design purposes. The project therefore initiated a series of inventories and surveys. This task was undertaken in consultation with the local implementing agencies. Thereupon the designs for the various schemes were made in collaboration with the respective implementing agencies. As a parallel activity certain crash programmes were designed to tackle evident bottlenecks in the existing systems as well as to provide immediate relief where needed to the target population. After finalization of the designs, the design reports and construction drawings are handed over to the implementing agencies for preparation of Detailed Project Reports (DPR). Before starting the preparation of the DPR's the design concepts are jointly reviewed and agreed upon.

A DPR contains agreed designs, schedules of rates, unit rates, unit estimates, bill of quantities and summary of cost estimates, as well as working drawings. This document is first appraised and approved internally within the respective implementing agencies after which it is sent through U.P. Government to the GPD for administrative approval and expenditure sanction.

On the recommendations of the GPD the two project towns of Kanpur and Mirzapur have a project manager each acting on behalf of the U.P. State Government for overall coordination of the Ganga Action Plan schemes. In Kanpur the Mukhya Nagar Adhikari of the KNM is the Project Manager and in Mirzapur this responsibility is delegated to the District Magistrate of Mirzapur. Before the DPR's are sent to the GPD it is a requirement that they are signed by the project manager of the respective towns and the consultants' project manager.

The administrative approval means that in the context of a certain budgetary allocation the scope of the scheme is acceptable. The expenditure sanction means that the implementing agency is allowed to make investments related to the approved scope of work. The GPD conducts a technical and financial appraisal of the DPR's.

If GPD could regularly participate in the final technical meetings on design concepts at the local level, clarifications may not be necessary at the appraisal stage within GPD. This will not only facilitate quick appraisal and grant of expenditure sanction by GPD but also prevent the possibilities of reduction of work elements and change of costs.

After the expenditure sanction GPD advances money to the respective implementating agencies who can start the execution either departmentally or by tendering the work to contractors. During the preparation of the DPR and the grant of expenditure sanction by GPD, tender documents are prepared by the consultants. Departmental execution of schemes involves direct purchase of equipment and materials as well as hiring labourers etc. to carryout the work elements of the schemes under direct responsibility of the implementing agency. Even for works which are tendered to contractors the implementing agency does the procurement of so-called controlled items like cement, steel, bricks etc. If this results in a low quantum of work contractors may not be interested and the remaining work is in that case carried out departmentally. Also for example, emergency and relief works are usually implemented departmentally.

The tendering procedure starts with a notification in selected newspapers. Interested bidders apply for purchase of tender documents. Applicants who do not have sufficient experience can be refused. Contractors who have obtained bid documents submit their bids to the implementing agency which evaluates the bids mainly on financial considerations. During the course of evaluation of the bids the implementing agency consults the project consultants.

In view of technical considerations and quality of work the prevailing tendering procedure within the implementing agencies could be considerably improved if advance prequalification of contractors for each specific project scheme is undertaken. This prequalification should then result in a shortlist of not more than 5 contractors per scheme who will ultimately be invited for the final bids. In view of the collaborative nature of the project the prequalification evaluation should be jointly undertaken by GPD, the concerned implementing agency and the project consultants.

During execution of the works the day-to-day responsibility for supervision lies with the implementing agency. The project consultants provide time-to-time advise to the implementing agency on construction aspects. In addition the project consultants monitor the quality of work on behalf of the government of The Netherlands.

Except a few, the contractors which have so far worked on this project have lacked not only in technical skills but also appeared to have a poor construction management setup. This means that continuous supervision by the implementing agencies is extremely important. A person with a long practical experience in the respective fields as a work supervisor is permanently required at the site. Major project schemes should have site offices of the implementing

agency which should be used by the permanent supervisory staff as well as for consultations with the project consultants and contractors. The supervisory works at site should be headed by at least an assistant engineer. He should be available at site every day in the morning and afternoons as well as during periods when critical work elements like casting of concrete are being executed.

In order to review the progress and to discuss the forthcoming works it is necessary to have a weekly site meeting where the implementing agency, the project consultants and the contractor are present.

The existing practice in U.P. with regard to water supply and sewerage schemes is that U.P. Jal Nigam designs and implements them and then they are handed over officially to the local municipal agencies for operation and maintenance. Ganga Action Plan works like sewage pumping stations and sewage treatment plants will follow the same practice except that they will be operated and maintained during the seventh five year plan (ending March 1990) by the U.P. Jal Nigam. For these two schemes the cost of operation and maintenance will be borne by GPD. It is foreseen that also in the next five year plan the schemes will be maintained by U.P. Jal Nigam but the cost of operation and maintenance may be equally shared by the GPD and U.P. State Government.

The skills of the existing O&M staff within the various agencies need to be improved through training. In case of new technologies like the UASB process technology transfer is required with regard to design criteria, construction methods and operation and maintenance practices. The project consultants are providing these inputs through a series of training sessions and on the job training.

The role of the target population as recipients of the various facilities needs to be taken into account during all phases of the project. In order to accomplish this the project team has a sociological unit which supports the technical interventions at community level as well as undertakes supporting programmes in the field of public health, occupational health and women's aspects.

The day-to-day activities of the project are regularly discussed by the local implementing agencies and the consultants. For major issues like land acquisition, financial outlays of various schemes, disbursement schedules etc. as well as review of the progress of work a Project Review Panel has been constituted which meets two times a year at specified decision moments in the project, viz inception report, technical designs, evaluation report etc. The Project Review Panel which meets at the GPD headquarters at New Delhi comprises of representatives of the GPD, U.P. Government, U.P. Jal Nigam, Royal Netherlands Embassy and its advisor the National Institute of Public Health and Environmental Protection (RIVM) and the Consultants.

6. PRE-PROJECT SITUATION

6.1 JAJMAU, KANPUR

Jajmau is a part of the city of Kanpur located in the North-East on the banks of the river Ganga. It occupies an area of 962 hectares with an average altitude of 122.5 m above MSL. The Jajmau area is shown in Figure 6.1.

The 1981 census record indicates the population of Jajmau as 97,700. The survey carried out in 1987 indicates the population as 105,000. The population projection for the year 2001 is 1,75,000 while a marginal additional growth upto 182,000 is expected upto the year 2021.

Jajmau is characterized by a mixed land-use pattern. The most important feature is the largest cluster of tanneries in India, numbering more than 150. In general, the area is inhabited by low income groups especially unskilled industrial workers.

Although Jajmau is included in the overall Development Plan for Kanpur and subsequently land has been reserved for different uses such as roads, gardens, green belts, residential areas, areas reserved for public facilities like sewage treatment plant, industries etc. the actual land use is completely different. The facilities to be provided under this project have been based on the existing situations.

At the start of the project, available data were incomplete. Some skeletal maps showing the area (known as T.P. drawings) at 1:1000 scale were available being however, inaccurate. Maps showing services, facilities were not available. An overall map with the proposed land use as prepared by KDA was available.

In order to assess pre-project conditions a community and baseline survey was carried out in June and July 1987 to collect data on existing services and living conditions. Subsequently an inventory was carried out for the entire project area.

Jajmau area with a population of 1,05,088 had 20,445 households with an average family size of 5.14.

The water supply situation in Jajmau was below acceptable levels. A total of 47% of the population had private house connections from the piped water supply system and 10% depended on public taps. In Jajmau there are a large number of private handpumps whereas the public handpumps were few in number. The piped water supply is intermittent, for about 4 hours in the morning and 4 hours in the evening.

An estimated 60% of the population does not have private latrine facilities. 8,391 latrines are connected to septic tanks, leach pits or sewers and there are 3551 dry bucket type latrines.

There are about 70 km of sewers in the range of 100 mm to 600 mm to serve basically the southern area. Even though sewers above 300 mm are partially silted they generate some flow. Smaller sewers are practically completely choked due to insufficient sizes, and water and improper construction. About 60% of the wastewater generated by the tanneries in Jajmau is conveyed to the 90" sewer. This sewer is the most important outfall sewer of the city drainage district of which Jajmau is a part.

The area is served by 123 km of roadside drains, 10 km of sub-main drains and 7 km of main drains which are open natural stormwater channels, reaching Ganga river. Most drains are heavily silted.

There is virtually no solid waste collection and disposal system. In most areas domestic waste litters all over for a long time (even weeks) before some efforts are made to collect or dispose it. In the industrial belt the whole area is strewn by wood bark for drying. It gives a typical stench especially during rainy season. Other solid wastes from the tanneries are mostly stored and reused. However the storing is done haphazardly leading to smell nuisance.

About 60,000 people in Jajmau are connected to the 90" sewer, which reaches Jajmau Pumping Station. From there the untreated sewage is pumped for irrigation purposes or is discharged into the river Ganga. This amounts to a BOD 5 load of 60,000 x 50/1000 x 365 = 1095 tonnes/year discharged on land or river untreated. The remaining 45,000 people defeacate in open fields. This pollution load is 400 tonnes/year. Field surveys and other water analysis indicate that dug wells and shallow water are highly polluted through domestic sewage and industrial waste water but the deeper aquifer at 40/50 m depth, tapped by handpumps and still deeper aquifer at 300-400 m depth tapped by deep tubewells are still safe and yields potable water.

The tanneries (151) are discharging about 5,800 m^3/day of waste water either in the 90" sewer (60%) or in the storm water system reaching the Ganga river directly (40%).

6.2 MIRZAPUR

Mirzapur is a town of approximately 140.000 inhabitants, situated on the right bank of the river Ganga. It is a district head quarter and an important town in eastern Uttar Pradesh. It lies mid way between Allahabad and Varanasi. The Mirzapur Project Area is indicated in Figure 6.2.

The Mirzapur municipal board includes the township of Vindhyachal, which is a famous pilgrim center of India. Vindhyachal however, does not form a part of this project.

Mirzapur has been developing alongside the major traffic corridors and the present built up area is becoming more dense. The variation in the ground level of the inhabited portion of the town is approx. 2 meters. The inhabited portion does not get flooded because the river bank is fairly high.

Mirzapur is famous for its carpet and brass-ware manufacturing which are the main cottage industries of the town. Carpet exports is a major commercial activity of Mirzapur.

Living conditions in Mirzapur are generally poor with intermittent water supply, inadequate sanitary facilities and overcrowding, especially in the core area. Many houses have no latrine, whereas many others only have insanitary bucket latrines. The population in this poorly served area has a low awareness of the relationship between sanitation, use of water and health.

The growth rate of Mirzapur township follows the demographic characteristics of the All-India rural settlements (less than 2% per year) which is far below the urban growth rates that have been observed in the past decades (up to more than 4% per year).

The employment characteristics (11% primary sector, 29% secondary sector and 60% tertiary sector) are apparently based on two major assets of Mrizapur town: its function as a regional service-centre for Mirzapur district (administration, health services, education and transport related services) and cheap labour force in predominant small scale and cottage type of manufacturing brass utensils and carpets.

A secondary system of regional roads connects Mirzapur with its hinterland. It can be noted that the two major transportation routes via the bridge towards the Grand Trunk Road in the North and Great Deccan Road (National Highway No.7) in the south, have both very poor capacity in the connections with the urban road network of Mirzapur.

The urban layout of Mirzapur is dictated by the location of the core area in between Ganga river and railway line and the radial development along the major transportation lines.

For development planning purposes two issues at the local level are predominant and important:

a. the eminent need for drastic rehabilitation of the core area in terms of environmental and sanitary improvements.

b. A tendency for outward extension alongside the regional arterials.

In view of the above, the utility systems subsequently should be designed in a way that incremental development is possible, focussing on the existing needs in the present built up areas with possibilities for future extensions in the transition zones around the core area.

The available data base was limited in view of the particular planning and design needs. In the initial stage of the project, the available data consisted of:

- an overall map of Mirzapur obtained from the Tehsil office;
- a rough map with limited data on the water supply system (OHT's, main network);
- data on the existing tubewells;
- geological data of the Mirzapur area;
- a 1984 UPJN report on Prevention of Pollution of Ganga river in Mirzapur, including a rough contour map of the town;
- Some general data like the number of community latrines and equipment for solid waste collection;
- a June 1987 UPJN report on a water supply scheme for Mirzapur.

At the start of the project existing knowledge on the pollution load in Mirzapur was limited. Therefore, a sampling programme was carried out in the three major nalahs of Mirzapur, both under dry weather and stormwater flow conditions. The quantity of waste water discharged by all the nalahs into the Ganga was also estimated.

Apart from this sampling programme, water temperatures were recorded in these nalahs. The results of the waste water analysis for the two major closed nalahs, which discharge the main portion of the waste water, show that the characteristics of the waste water were typical of domestic sewage. This is not surprising in view of the limited industrial activities that take place in Mirzapur.

In order to assess pre-project conditions a community and baseline survey were carried out in June and July 1987 to collect data on existing services e.g. drinking water supply, stormwater drainage, health services, sanitation and other civic amenities in the project area. It was considered necessary to collect data in the entire project area as there are likely to be wide variations from area to area in the level of services.

The Mirzapur project area proved to be heterogeneous and was therefore divided into 20 sectors. These sectors were further divided into survey units, each of which contains approximately 50-150 households. Data were collected per survey unit.

In all, 32% of the houses had flush latrines. About 50% of the flush latrines were connected to a septic tank or leaching pit or any related method of on-site disposal. The other 50% are connected to drains, either a closed nalah or an open road drain or unlined drain. An additional 17% of the houses were provided with bucket latrines.

The remaining 51% of the population uses either the open field or public latrines for defecation. There are 16 public latrines in Mirzapur. Because of poor maintenance, water logging and dilapidated structures, however, these are below acceptable standards.

Especially in the core area there is a problem of defeacating in the open as there is hardly any place. Hence, the backyards of houses which are normally small lanes have been turned into places for defeacation for those who have no alternative.

The water supply situation in Mirzapur was below acceptable standards. In all 57% people depended on private water supply as against 43% depending on public water supply. More well to do people have installed tullu pumps to lift water out of the pipe system.

The pressure is very low at the taps and leakages in the network are so extensive that installation of tullu pumps has become a common feature in Mirzapur. It is clear that this method further reduces the water availability for those households which have not installed this device and for the public standposts.

This is one of the key factor as it is evident that a large number of people therefore depend on public water sources. In the project area there were at the start of the project 323 public standposts, 58 public handpumps and a high number of 289 public wells.

6.3 SOCIO-ECONOMIC AND HEALTH CONDITIONS

6.3.1 INCOME LEVELS AND DISTRIBUTION OF INCOME

For planning of technical interventions, data on the income situation of the target population are essential to determine the affordability of private and public facilities. Additionally, it gives insight into the scope for community contribution towards operation and maintenance of facilities.

Through the community survey overall data were collected on existing sanitary conditions and characteristics of each cluster of houses. The area specific knowledge acquired resulted in the formulation of broad categories, each having its own specific outlook. The main criteria used in categorization were the level of sanitary facilities and the position on land tenancy.

The baseline survey provided detailed data on the income situation in each survey unit. By extrapolation to the area categories an overall picture on the two project areas was obtained.

The findings are summarized below:

KANPUR

The distribution of the monthly income pattern for Jajmau is tabulated in Table 6.3.1.

TABLE 6.3.1: Monthly Income Distribution in %

AREA CATEGORY	0-300	300-600	600-1000	1000-1500	1500-2000	2000 +	TOTAL
Slums in Industrial Area	6.1	51.6	26.7	11.4	2.4	1.6	100 (n=490)
Semi-Authorized Slums	0.0	36.6	26.6	33.3	0.0	3.3	100 (n=30)
Urbanized Villages	1.4	20.8	33.3	20.8	11.1	12.5	100 (n=70)
Res. Area	3.5	15.6	26.6	22.6	20.4	11.3	100 (n=636)
Govt. Housing Colony	1.1	10.4	28.0	24.3	20.1	16.0	100 (n=636)
TOTAL	3.7 (n=56)	27.0 (n=406)	27.1 (n=407)	19.3 (n=290)	13.6 (n=204)	8.9 (n=133)	100 (n=1510)

1/ The project area has been characterized in terms of income and urban development. The area characterization is shown in Figure 6.3.

The lowest average income is found in the slums in the industrial belt, viz. Rs. 745/-, followed by the semi-authorized slums. There appears to be little difference in the average monthly income in the urbanized villages and the residential areas respectively Rs. 1257/- and 1297/-. The highest average income per month Rs.1492/- is found in the government housing colonies.

In view of the social objectives of the project it is important to know how many households live under the poverty line.

The Government of India has defined the poverty line in terms of annual income. A household having an annual income of Rs. 6400/- (Rs. 533 per month) or less may be considered as a family living under this line.

Another category can be distinguished namely, the poorest of the poor. The poorest of the poor have been defined as households having an annual income of Rs. 3500/- (Rs. 291 per month) or less.

Because of data processing considerations Rs. 600/- per month has been taken as the poverty line and Rs. 300/- per month as the upper level for the poorest of the poor. The income pattern of households living under the poverty line is given in Table 6.3.2.

TABLE 6.3.2: Monthly Income Distribution ofr Households living under the Poverty Line, in

AREA CATEGORY	0-100	100-200	200-300	300-400	400-500	500-600	TOTAL
Slums in Industrial Area	0.4	2.1	8.1	27.6	39.9	21.9	100 (n=283)
Semi-Authorized Slums	0.0	0.0	0.0	13.3	23.3	0.0	100 (n=30)
Urbanized Villages	0.0	0.0	6.3	25.0	31.3	37.5	100 (n=16)
Res. Area	4.1	5.8	8.3	19.8	32.2	29.8	100 (n=121)
Govt. Housing Colony	0.0	0.0	9.7	29.0	22.6	38.7	100 (n=31)
TOTAL	0.8 (n=6)	2.7 (n= 13)	7.7 (n= 37)	24.7 (n=119)	35.6 (n=171)	24.1 (n=116)	100 (n=481)

MIRZAPUR

The Baseline Survey provides detailed data of 14 survey units in 5 area categories. Table 6.3.3 indicates the average monthly income in 14 survey units in the five area categories.

Table 6.3.3: Average Monthly Household Income per Area Category

Area Category 1/	No. of households	Average Income (Rs.)
Developed in core	485	920
Developed in fringe	130	1364
Slums in core	79	686
Slums in fringe	86	980
Village type settings	127	735
Total	907	943

1/ The project area has been characterized in terms of income and urban development. The area characterization is shown in Figure 6.4.

As the table indicates, the lowest average monthly income in rupees is found in the slum areas in the core part, followed by the village type settings. The highest average monthly incomes are earned in the developed parts of the fringe areas.

In Table 6.3.4 the distribution of the monthly income clustered in area-categories is given according to different income groups.

Table 6.3.4: Monthly income Distribution of Household in Rupees per Area Categories, in %

Area Category	0-500	500 -1000	1000 -1500	1500 -2000	2000 -2500	2500 -3000	3000	Total
Dev.in core	36	36	13	8	4	3	1	100
Dev.in fringe	24	33	14	12	5	3	9	100
Slums in core	56	24	14	4	3	-	-	100
Slums in fringe	42	33	8	5	7	2	3	100
Village type setting	47	31	16	4	2	-	1	100

In Table 6.3.5 the monthly income distribution of households living under the poverty line is given.

Table 6.3.5: Monthly Income Distribution of Households Living under the Poverty Line, in %

Area Category	0-100	100-200	200-300	300-400	400-500	500-600	Total
Dev.in core	2	4	9	8	13	12	100 n=233
Dev.in fringe	2	3	11	4	5	9	100 n= 43
Slums in core	-	8	28	11	9	8	100 n= 50
Slums in fringe	1	7	10	14	7	7	100 n= 40
Village type setting	2	4	13	12	15	10	100 n= 71
	2 (n=15)	5 (n=41)	12 (n=107)	18 (n=78)	24 (n=103)	21 (n=93)	(n=437)

From the survey it can be concluded that in Mirzapur 48% of the households live below the poverty line or just above it and about 18% of households can be considered as the poorest of the poor.

6.3.2 HEALTH SITUATION AND SERVICES

Jajmau

Jajmau has a very poor health infrastructure. The majority of the people have to rely on medical aid from unqualified private medical practitioners. In the industrial belt there is only one Government run Ayurvedic Health Centre.

Maternal and Child Health Services are extremely deficient. There is one MCH centre for the whole of Jajmau. The majority of deliveries are being conducted by untrained traditional birth attendants (TBAS).

Tannery workers are exposed to various types of occupational health hazards. Workers employed on daily wages are not covered by any kind of health service. Only regular employees avail themselves of health care services extended by the Employees State Insurance (ESI) hospital/dispensary located in the north-eastern part of Jajmau.

Diarrhoea and water related diseases are extremely common in children (19%) as per outcome of the in-depth study on public health aspects. Prevalence of conjuntivitis, boils, round worm, infestations and post polio residual paralysis is quite high in children.

In terms of health infrastructure what basically lacks is community health facilities and a primary health care system. To improve the community based health infrastructure the extension of the Integrated Child Development Scheme (ICDS) to Jajmau was proposed. At present 25 centres have been opened in slum areas and it is expected that 10 more centres will be established soon.

Mirzapur

Mirzapur is equipped with a district hospital, a separate female hospital cum maternity center, a district Ayurvedic hospital and one T.B clinic. These facilities exist in the core part of the town.

Looking into the heterogeneity of the area and population, the health services presently available are insufficient. Distance is also an impediment to take benefit of the facilities.

Environmental pollution resulting from stagnant sewerage water due to choked drains, insanitary condition of community latrines and night soil disposal and heaps and dumps of solid waste are the major sources of sickness. Malaria, Typhoid, Diarrhoea, Polio, Jaundice and Tuberculosis etc. are common in the project area.

Using water from polluted sources adds to the health hazards of the people.

The prevalence of diarrhoea in under-five children was 53% as per findings of the in-depth study on public health aspects prepared by the project (April 1988). Other water related diseases observed were conjuctivitis, round worm infestation, skin-infection (boils). The majority of the people belonging to poor households have to resort to private practitioners. The majority of them are quakes with dubious medical diplomas and degrees.

Delivery of babies in slums is being performed by untrained dais normally under unhygienic conditions. People in these areas are also taking help of trained, mostly retired dais or nurses. In serious cases the services of the district maternity hospital are availed.

Occupational health hazards are quite common among carpet weavers, mostly children, bidi rollers and in brass work.

Mirzapur district has an extensive setup of community health services (ICDS, Primary Health Care Centres, etc.) but it is confined to rural areas only.

7. PLANNING OF ACTIVITIES

For each project or programme proper planning of different activities is needed in order to ensure internal coordination with regard to the "critical path" sequence and the important task to meet the target completion dates. This becomes even more important as inputs in terms of manpower and finance depend to a great extent on a timely delivery of planned project outputs.

In reality the project has been confronted often with a relatively large number of external variables which influence progress and subsequently call for internal remedial action with regard to the planning process for external activities. It is obvious that the comprehensive project we are dealing with here experienced the need for a constant review and adjustment.

This resulted in a practical planning process aiming at internal adjustments between project components maintaining however the overall target completion dates established for main project cycles as much as possible.

The main relevant planning sequences and actions are presented below.

7.1 PROJECT WORKPLAN

The initial workplan of the project was divided into two phases, viz. Phase 1 of 1 1/2 years and Phase 2 of 2 1/2 years.

In Phase 1, the inventories, surveys and preliminary designs of the various project schemes had to be completed. In addition to this it was also planned to formulate some crash programmes in the first few months so that they could be implemented during the remaining Phase 1 duration. In order to demonstrate the applicability of the selected UASB process for treatment of domestic and tannery waste water under Indian conditions it was also planned to design, construct and monitor a first 5 mld UASB module at Jajmau, Kanpur. Furthermore, pilot plants for chrome recovery and UASB tannery waste water treatment were to be designed, constructed and monitored at a selected tannery in the Jajmau area during Phase 1.

During Phase 2 it was planned to utilize the first 6 months for further detailing the designs and for preparation of the tender documents. Immediately after this the construction period of 2 years was envisaged. Based on the results of the monitoring of the plants erected during Phase 1 detailed designs for upscaling the UASB treatment plants at Kanpur as well as at Mizapur was to be carried out in the first few months of Phase 2.

In comparison with the technical components of the project the socio-economic activities cannot follow exactly the same phasing in the planning mechanism. This is mainly because of the fact that there are no specific milestones like detailed designs, tender documents or tendering procedures. Nevertheless, there exist certain phased activities which more or less synchronize with the general project planning.

During Phase 1 a socio-economic data base had to be established through baseline and community surveys for supporting the technical designs as well as to formulate an action plan for community participation and health related activities. Action oriented research to support the technical interventions will obviously continue during the whole project duration as well as guidance of technical interventions at community level. The action plan for community participation and public health aspects resulted in DPR's which were approved in Phase 1 and are to be implemented in the remaining project duration together with the identified implementing agencies.

The division of the project into two phases was required to establish a decision moment where the continuation of the project was to depend on the approval of the investment programme by the Governments of India and The Netherlands.

The initial workplan of the project is attached to the Technical Proposal which the consultants prepared in November 1986. The project started officially on 1st June 1987. Phase 1 was completed in November 1988.

The second phase started immediately thereafter, in December 1988, with further detailing of the designs and preparation of DPR's which was undertaken simultaneously. This was followed by preparation of tender documents and tendering procedures after expenditure sanction by GPD. It is intended to start the mobilization of the contractors immediately after the monsoon in 1989, so that construction activities can start by October 1989.

On account of external factors like prolonged land acquisition procedures, the extension in the construction schedule of the first 5 mld UASB module, and the crash programmes for watersupply, solid waste and sanitation, it became necessary to up-date the workplan together with the manpower inputs for phase 2. This was essential in order to actually achieve the envisaged results of this project in the planned duration.

In up-dating the workplan the increased understanding of the functioning and implementation capacity of the various executing agencies has been taken into account as well.

Based on the discussions with the Royal Netherlands Embassy, the Netherlands Government (DGIS,DAL/ZZ), Project Advisor of RIVM/BOS and after the discussions during the Project Review Panel Meeting in September 1988 it was desired to formulate an up-dated workplan for the period 1st December 1988 - 1st January 1990. While formulating the workplan for the remaining project duration the views of the External mid-term Joint Evaluation Mission will be taken into account as well.

7.2 INVENTORY, MAPPING AND DATA COLLECTION

As has been described in the previous chapter, the available data had to be up-dated and completed considerably for all project components. Much time had to be devoted in searching for the available data, identifying agencies/institutes to carry out the required additional inventories and analyses. Also, much of the available manpower within the project was required for this basic work-element.

In order to meet target completion dates, however, design and planning was already initiated on the basis of available data and maps. Much has been subsequently based on the data collected through the baseline and community surveys, which were carried out at an early stage of the project.

The designs of the crash programmes were also affected due to the need to up-date the available data and base maps.

The inventory, mapping and data collection concentrated on the following key elements:

ITEM	COMPLETION DATE	
	KANPUR	MIRZAPUR
Rainfall intensity data	March' 88	March' 88
Topographical survey and updating maps	July ' 88	March' 88
Landuse data	March' 88	January' 88
Population projections	August' 88	August ' 88
Nalah and sewer inventories	April' 88	February'88
Discharge measurements	July' 88	Nov'87-Aug'88
Waste water quality analysis	July' 88	Mar-Aug' 88
Soil investigations	(UPJN)	August' 88
Hydrogeological investigations	July-Sept'88	July-Sept' 88
Leak detection survey	November' 88	June' 88
Drinking water quality analysis	June' 88	June' 88
Inventory water supply network	October'88	June' 88
Inventory on solid waste (collection system)	April' 88	April' 88
Inventory on sanitary facilities	May' 88	May' 88
Baseline and community survey	January'88	January' 88
Inventory of tannery waste water	June' 88	-

7.3 LAND ACQUISITION FOR SITES

Since the project started in June 1987, plots of land for various technical components were identified in consultation with the implementing agencies. Land acquisition still is one of the most difficult and time consuming elements of the project. This is mainly because of a long acquisition procedure as well as legal disputes on land titles.

In Mirzapur the process of land acquisition for IPS, MPS and STP finally started in July 1988 and it is expected that transfer of ownership will be finalized soon.

The total alignment of the stormwater drainage system in the east zone of Mirzapur was fixed in November, 1988. The stormwater drain varies in width at different distances. The entire land belongs to different private persons and has to be acquired. The acquisition procedure still has to start. **Figure 7.1** shows the locations of various sites required project schemes in Mirzapur.

A site for sanitary landfill at Bari Basahin, which is at the outskirts of the town, had been located. Both, GPD and the UP Government were approached by MNP to get funds in order to purchase the land. Both the agencies are unable to provide these funds. MNP had therefore been requested to identify low lying areas in and around the town and to get into contract with the owners to fill up the land. Four sites have been identified and agreement has been reached with the owners. This is a common practice in many cities in India. Consultants have reservations against this practice for future use because such sites cannot become controlled sanitary landfill sites.

In Jajmau, Kanpur, intensive efforts have been made since the beginning of the project to acquire land. The first plot to be acquired was for the 5 mld UASB treatment plant. This took much more time than was stipulated and hence delayed the start of construction by few months. Though in most of the cases the selected plots of land belong to the KDA or KNM still taking actual possession of these plots is sometimes difficult. This has often affected the design work as well as the time schedule. Certain schemes had to be redesigned when ownership of the selected plot was found to be disputed. **Figure 7.2** shows the locations of various sites required for project schemes in Kanpur.

8. TECHNICAL PROJECT COMPONENTS IN JAJMAU, KANPUR

8.1 TANNERY WASTE MANAGEMENT, KANPUR

8.1.1 EXISTING SITUATION

The leather industry is one of the oldest industries in India. Kanpur is an important center for tanneries, footwear manufacture and leather goods. The development of tanneries in Kanpur has a history of about 14 decades. The leather industry, which is one of the major foreign exchange earners and an important participant in international trade, is often cited for its environmental pollution. In Jajmau there are 151 tanneries located in a cluster along the banks of river Ganga with an estimated present and future waste water discharge of 5.8 to 8.8 million litres per day.

In addition to a large quantity of waste water generation (i.e. 5.8 - 8.8 mld) the Jajmau tanneries on an average generate daily about 400 tonnes of different types of solid wastes. Though most of them are utilized for various commercial purposes like glue making etc., the present traditional way of handling the solid wastes, unhygienic procedures adopted in transportation, drying, difficulties in disposing them during monsoon etc. are causing serious environmental problems.

For further details on Tannery Waste Management reference can be made to. Volumes I, II and III Tannery Waste Management Jajmau, Kanpur.

8.1 2. TANNERIES OF JAJMAU AREA IN KANPUR

Out of 151 tanneries 62 tanneries adopt chrome tanning process exclusively, 50 tanneries adopt vegetable tanning process exclusively, 38 tanneries adopt both chrome tanning and vegetable tanning and 1 tannery is carrying out only dry finishing operations. From the inventory data the tanning processes are classified into 5 major types. The name of tanning process and the estimated average water usage/waste water discharge is as follows:

	Process	Water Usage
1.	Raw to upper (chrome tanning)	30 l/kg of raw hide
2.	Raw to sole (vegetable tanning)	18 l/kg of raw hide
3.	Raw to vegetable tanning (head pieces)	10 l/kg raw hide
4.	Raw to wet blue (chrome tanning)	20 l/kg of raw hide
5.	Wet blue to finish (chrome tanning)	20 l/kg of wet blue

The present and future processing capacity, volume of waste water discharge from each type of tanning process, etc. are shown in Table 8.1.1.

TABLE 8.1.1: PROCESSWISE CAPACITY AND TOTAL WASTE WATER DISCHARGE FROM TANNERIES IN JAJMAU

Sl. No.	Type of tanning process	Processing capacity in kg/day		Volume of waste water discharge in m3/day		Maximum expected percentage of tanneries under operation
		Present	Future	Present	Future	
1	Raw to upper (chrome tanning)	113,000	196,000	3,400	5,580	95%
2	Raw to sole (vegetable tanning)	92,000	137,000	1,700	2,220	90%
3	Raw to vegetable tanning (Head pieces)	12,600	18,300	130	160	90%
4	Raw to wet blue (chrome tanning)	19,400	30,000	400	570	95%
5	Wet blue to finish (chrome tanning)	10,000 *	11,000	200	220	100%
	TOTAL	247,000	392,300	5,830	8,750	
	OR SAY	250 tonnes	390 tonnes	5.8 MLD	8.8 MLD	

* Given in terms of wet blue weight

Note: 1. Present processing capacity and waste water discharge indicates the daily average.

2. Future waste water discharge is based on future processing capacity and maximum expected percentage of tanneries under operation during peak period.

3. Part of wet blue production is used in Jajmau tanneries and part of the production

8.1.3 COMPOSITION OF OVERALL REPRESENTATIVE TANNERY WASTE WATER OF JAJMAU AREA

Preparation of a tannery waste water composite, which represents a realistic overall waste water of the tanneries of Jajmau area was an important task. This could be done based on the inventory data of waste water discharges from different types of tanning processes.

The following two systems were adopted in preparing the overall composite waste water:

a. From the composite waste water of each typical process, an overall composite sample was prepared, by mixing quantities proportional to the quantities of waste water discharged from the tanneries carrying out the five typical processes namely:

- Raw to upper - 3400 m3/day
- Raw to sole - 1700 m3/day
- Raw to vegetable tanning of hide pieces - 130 m3/day
- Raw to wet blue - 400 m3/day
- Wet blue to finish - 200 m3/day

b. Direct composition of an overall waste water mixture by taking proportional samples from all sectional operations.

From the analysis of the three sets of overall composite samples, the value of each parameter is given in ranges. The characteristics of the overall Jajmau tannery waste water composite are furnished in Table 8.1.2.

Table 8.1.2: CHARACTERISTICS OF OVERALL COMPOSITE WASTE WATER FROM JAJMAU TANNERIES

PARAMETERS	VALUE
pH	8.20 - 9.20
Alkalinity (CaCO3)	2000 - 2750
BOD (total) 5 days at 20^{0} C	1950 - 3100
BOD (soluble)	1670 - 2600
COD (total)	4500 - 7500
COD (soluble)	3000 - 4800
Total solids	25600 -37600
Total volatile residue	2700 - 3960
Dissolved solids	22170 -31100
Suspended solids	3430 - 6500
Suspended volatile residue	1375 - 2600
Chloride (as Cl)	10770 -14900
Sulphate (as SO4)	1540 - 3300
Sulphide (as S)	55 - 130
Kjeldahl Nitrogen (as N)	740 - 1400
Phosphate (as P)	1.9 - 5.0
Chromium (as Cr)	160 - 275

Note: All values except pH are expressed in mg/l.

For vegetable tanning the Jajmau tanneries adopt the old traditional vegetable tanning practice using barks and nuts in pits and use less water (i.e. about 20%) compared with tanneries located in other parts of UP and in other states in India.

This has influenced the characteristic of waste water in terms of high total solids (i.e. 25,600-37,600 mg/l), suspended solids (i.e. 3460 - 6500 mg/l), Chlorides (i.e. 10,770 - 14,900 mg/l), BOD (i.e. 1950 - 3100 mg/l), COD (i.e. 4500 - 7500 mg/l) and other pollutants.

8.1.4 ENVIRONMENTAL PROBLEMS IN HANDLING TANNERY SOLID WASTES

Though most of the solid wastes generated in tanneries are utilized in some form or other, the present unhygienic way of collection, drying, transportation, spillage, wastage, ineffective utilization etc., cause environmental pollution problems in Jajmau. The types of solid waste generated from Jajmau tanneries, their quantity and mode of disposal is given in Table 8.1.3.

Fleshings and Pelt Trimmings

The fleshings cause foul smell and other problems in the area due to a slow drying rate. Fast drying is felt necessary, since the production of glue is more easy from dried fleshings than from wet fleshings. Furthermore a great part of the fleshings have to be transported to far off places like Bhopal and South India. This transportation takes place in open trucks. Long distance transport of wet fleshings is very expensive and difficult due to high moisture content and putrefaction effect. So dried fleshings may be considered as a real commodity. In Kanpur a market for dried fleshings exists and many glue manufactures are buying dried fleshings from this market.

Especially during the rainy season the problem becomes more severe as the fleshings are not dried at all. Only a very small part of it is dried on bamboo poles. Probably most of them in putrefied form are washed away with the rain and discharged into the sewer, causing problems of sewer chocking. The vultures and other birds attracted by the fleshings create a problem especially endangering the aircrafts departing and arriving from the nearby airport.

A special problem is due to the discharge of machine fleshings and will be more serious in future due to the expansion of chrome tanning and adoption of the mechanical fleshings by many tanneries. These fleshings have a very low glue yield and the commercial value is almost nil. Nowadays only a few big tanneries are machine fleshing the hides meant for chrome tanning. This small quantity is mixed with the other fleshings and sold out. In future it is expected that more tanners will adopt machine fleshing because of the increase in chrome tanning and cost of manual fleshing. Then a time will come when machine fleshings are not taken up any longer by the glue industry and alternative methods have to be found.

TABLE 8.1.3

SOLID WASTE GENERATION FROM JAJAMU TANNERIES
(Present hide Processing capacity: 250 tonnes/day)

Sl.No	TYPE OF WASTE	QUANTITY TONNES/DAY	MODE OF DISPOSAL	REMARKS
1	Raw hide trimmings and waste	10-15	Major percentage of trimmings are taken away by the raw hide suppliers and balance is sold for glue manufacturer	Head pieces are sold by raw hide suppliers for vegetable tanning process to small tanners. The frequency of disposal is once in 3 or 4 weeks
2	Dusted/Waste salt	6-10	Partly reused for curing and partly dumped in nearby area	Major part goes into the drain
3	Hair	negligible	Discharged with lime sludge & waste water as hair pulp	Likely to cause sewer choking when mixed with lime and discharged with waste water
4	Fleshings and pelt trimmings	30-50	Stocked in a collected central placed & used for glue manufacturing during the months of Nov., Dec., Jan. & February	During monsoons & peak summer the glue manufacturing units are not functioning
5	Sludge from lime pit	15-20	Partly used for filling low lying areas and partly used for construction of huts by labourers	Sold on truck load basis.
6	Vegetable tanned barks/nuts	200-300	Used in boilers after solar drying tanneries and also in brick kilns as fuel	The vegetable tan barks/nuts are generated while processing about 100 tonnes of hides adopting vegetable tanning process everyday. Permanent workers get 4-5 bags free per month. Selling price Rs.100 to 125/tonne on partly dry basis
7	Vegetable tanned trimmings	2.5-3.0	Used for making leather boards Selling price is about Rs.2/kg	Larger cuttings used for footwear manufacture and repairs Selling price Rs. 5-7/kg
8	Chrome shavings	6-8	Used for making leather boards Selling price about Rs.4-5/kg	Partly used for fertilizer
9	Chrome trimmings/finished leather pieces	2.5-3.0	Used for making leather goods manufacture	Selling price Rs. 2-6/kg
10	Buffing	0.5-1.0	Used for filling low lying areas	Partly used as fuel for boilers in few tanneries
11	Chemical containers and other packing materials		Sold periodically	Part of the containers are reused
12	Sludge from pretreatment units	50-60 (expected)	Descision to be taken	

Exhaust barks and nuts

In Jajmau 50 tanneries process about 100 tonnes of cow and buffalo hides per day, adopting vegetable tanning using barks and nuts. For this process 100-150 tonnes of barks and 40 to 60 tonnes of myrobalan nuts are used and exhaust barks and nuts are discharged as solid waste in wet condition which amounts to about 250 tonnes per day.

The main environmental problem assessed in the whole process is as follows:

- Dust generation during the crushing of barks and nuts. No provision to protect the workers from dust and to collect the dust for disposal.

- For drying the wet exhausted barks the whole tannery open areas and pathways outside of the premises are used. Numerous piles of barks with dark brown colour can be seen spread all over Jajmau.

- Besides being kept in heaps all areas where barks is stored produce stench, fly nuisance, rodent problem, leaching of tanning, pollution of the soil, particularly during monsoon.

Sludge from pre-treatment units

Many tanneries have constructed pre-treatment systems comprising of one equalization tank, settling tank with hopper bottom and sludge drying beds. Though these treatment units have been constructed recently, their ultimate efficiency, wet and dry sludge production are yet to be assessed. In the event of proper operation and maintenance of primary treatment units by the tanneries large amounts of sludge will be generated. After partial drying in sludge drying beds the 50 to 60 tonnes of sludge with 50% moisture is expected to be generated from these pre-treatment units. Hence a suitable transportation and disposal system needs to be evolved for the sludge generated from pre-treatment units.

8.2 WASTE WATER TREATMENT, KANPUR

8.2.1 WASTE WATER QUANTITY AND QUALITY

The waste water produced in Jajmau area mainly consists of industrial waste water from the tanning industry and domestic waste water.

The present and future quantities of domestic waste water discharge in Jajmau area has been estimated as:

In 1991	13.5 mld
In 2006	19.9 mld
In 2021	20.3 mld

This domestic waste water from the Jajmau area is discharged into the 90" trunk sewer from where it reaches the Jajmau sewage pumping station.

The main characteristics of the domestic waste water are, COD approximately 500 mg/l,BOD approximately 200 mg/l.

The present discharge of tannery waste water on the basis of a comprehensive inventory and survey in the tanneries of Jajmau area is 5.8 mld. It is expected that in future the production capacity of the tanning industry will increase, resulting in a waste water production of 8.8 mld. The findings are reported in "Tannery Waste Management, Jajmau, Kanpur/Volume I: Inventory and Data Analysis.

Due to the batch wise operation in the tanneries the waste water is discharged mainly during peak hours from 8-10 a.m. and 2-4 p.m. The peak factor is approximately 4. The characteristics of the waste water during peak flows are not uniform. During the morning peak waste water from soaking, liming and chrome tanning is discharged whereas during the afternoon peak the waste water mainly originates from deliming and washing operations.

The overall composite waste water characteristics from Jajmau tanneries have been established on the basis of the inventory and extensive sampling and analysis carried out by CLRI. The characteristics are reported in Volume II of the report "Tannery Waste Management - Jajmau, Kanpur" of November 1988.

The main characteristics of the tannery waste water are :

Total solids	25600- 37600 mg/l
SS	3460- 65000 mg/l
Chlorides	1770- 14900 mg/l
BOD	1950 - 3100 mg/l
COD	4500 - 7500 mg/l

8.2.2 UASB TECHNOLOGY AS A TREATMENT OPTION

The most important considerations for this choice are:

1. The UASB treatment system is relatively simple and also has a relatively lesser number of mechanical parts.

2. Based on presently available data it appears that the investment costs for a UASB treatment plant are lower than for conventional aerobic treatment plants, even lagoons, if cost of land is included.

3. The operation and maintenance costs are lower than those of conventional aerobic treatment facilities due to the low energy requirement.

4. The biogas produced can be used to generate electricity for waste water pumping.

5. The construction area is relatively small.

6. The UASB technology is a flexible system. Contrary to conventional aerobic treatment systems, for which the oxygen supply is the prime design parameter, the design of UASB systems is not governed by the waste water concentration. It therefore, can cope with future changes in their waste water composition e.g. when a mixture of domestic and industrial waste water has to be treated.

Through the project, the UASB technology will be demonstrated and disseminated in India.

8.2.3 PLANNED WASTE WATER TREATMENT PROGRAMME

The project includes the construction and operation of a UASB waste water treatment plant with a capacity of 25 mld (25000 m3/day). It is intended that all tannery waste water, together with part of the domestic waste water from the 90-inch main trunk sewer will be treated in the 25 mld treatment plant.

To assess the lay-out of the final 25 mld treatment plant and to optimize specific design criteria, the first phase of the project includes the construction and operation of a 5 mld module for domestic waste water treatment and a 10 m3 UASB pilot plant at Pioneer Tannery for tannery waste water treatment. The first phase of the project further includes a pilot plant for chrome recovery from tannery waste water and reuse of chromium in the tanning process.

8.2.3.1 First 5 mld UASB Module

Within the overall modular planning for the 25 mld treatment plant, one 5 mld module has been designed and constructed. The main component of the anaerobic treatment plant consists of a UASB reactor. The influent waste water enters at the bottom of the reactor and flows upwards through a bed of anaerobic sludge. During the passage through the sludge bed particulate matter is entrapped and consequently digested. Dissolved material is absorbed by the anaerobic bacteria in the sludge and digested directly. The organic material is converted into biogas, that provides gentle mixing in the sludge bed. To enhance the contact between the sewage and the sludge bed, the entering waste water flow is uniformly spread over the bottom surface.

The upper part of the UASB-reactor is provided with a gas-solid separator. The gas is forced into a gas collector from where it is withdrawn. After degasification the water enters a settling compartment, where sludge can settle and flow back into the digestion compartment. After settling the effluent is collected in overflow gutters and discharged. The schematic flow diagram of the 5 mld UASB plant in Jajmau is shown in Figure 8.1.

The main objectives of the 5 mld plant are:

- to demonstrate the UASB process under Indian conditions.
- to optimize the design criteria for further extension of the UASB treatment system in Jajmau as well as in Mirzapur.
- to assess the treatment efficiencies.
- to setup operation and maintenance guidelines.
- to train plant personnel.

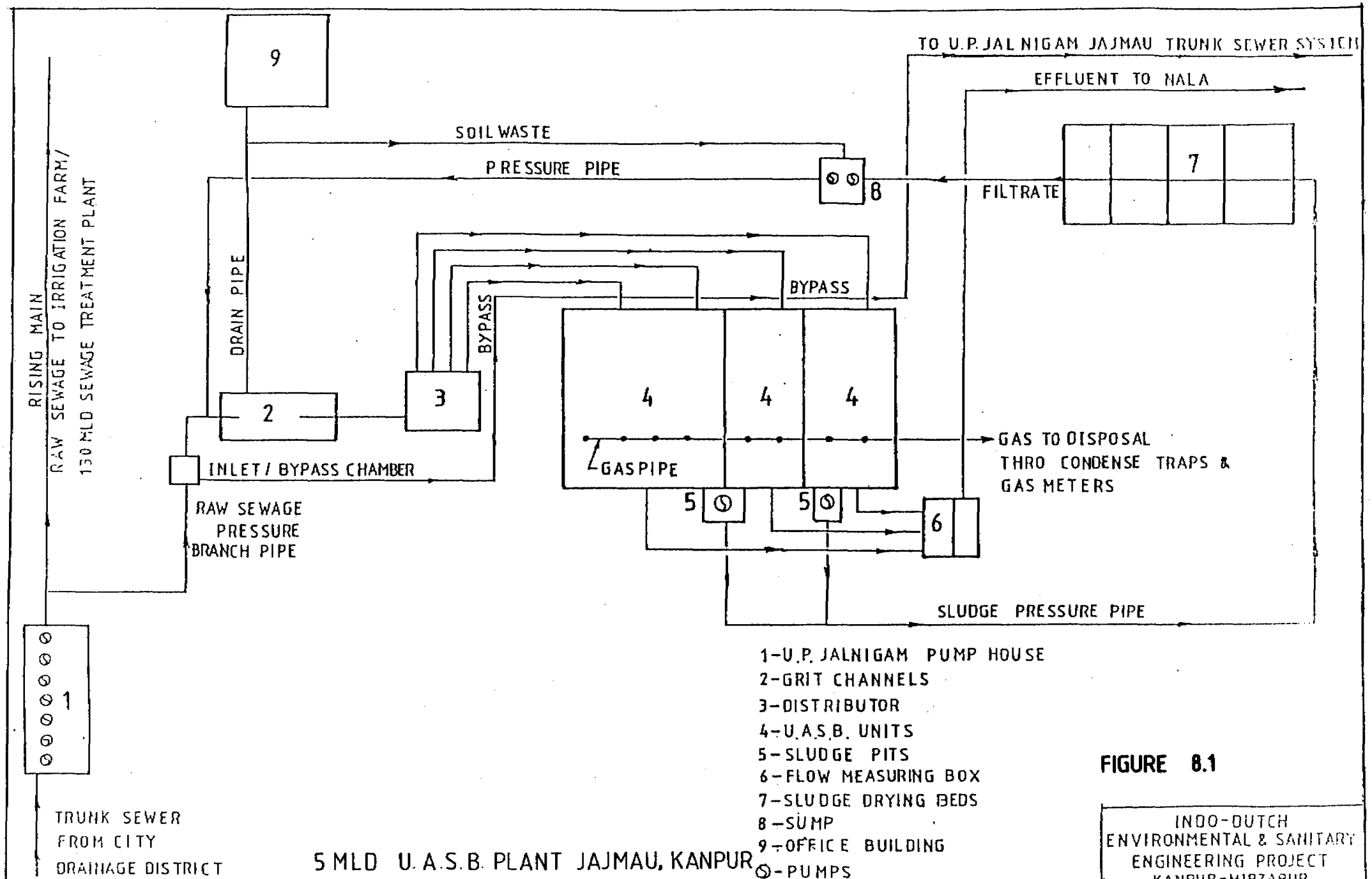
The 5 mld UASB-module of the treatment plant has a volume of approx. 1200 m3. The volume is based on an average hydraulic retention time of 6 hours.

The module is divided into three separate compartments. There are two compartments of 300 m3 each and one compartment of 600 m3.

- The 600 m3 compartment is the reference unit.

- One 300 m3 compartment is provided with a double number of feed inlet pipes at the bottom to assess the effect of uniform spreading of the waste water.

- In the other 300 m3 compartment the effluent overflow gutters are provided with baffles to prevent the overflow of floating material. In this way the formation of a floating layer can be assessed. Furthermore it provides the possibility to assess the effect of retaining floating material on the treatment efficiency.



5 MLD U.A.S.B. PLANT JAJMAU, KANPUR
SCHEMATIC FLOW DIAGRAM

FIGURE 8.1

INDO-DUTCH
ENVIRONMENTAL & SANITARY
ENGINEERING PROJECT
KANPUR-MIRZAPUR
UNDER GANGA ACTION PLAN

The raw sewage at a uniform flow rate of 500 m3/h is tapped through a 355 mm branch pipe from the rising main originating from the Jajmau sewage pumping station. The raw sewage passes a grit chamber consisting of two channels with a capacity of 500 m3/h each. One channel will be in operation whereas the other channel will act as a standby for degritting operations. After the grit chamber the waste water flow is equally divided into 4 flows: 2 for feeding the 600 m3 compartment and 1 for each 300 m3 compartment.

Before entering the second distribution box (in each digester compartment) the flow is adjusted separately for each compartment. Flow adjustment is carried out by by-passing part of the water by means of an adjustable valve and an overflow weir. All by-pass flows are collected and discharged into the 90" trunk sewer.

In the UASB-digester the adjusted flow is equally divided over 18 feed inlet points per 300 m3 reactor volume. One 300 m3 compartment is provided with 36 feed inlet points. Equal flow distribution is achieved through weir overflow for each inlet point separately.

The gas production of each UASB compartment is measured with a gasmeter.

After measuring the gas is flared in the atmosphere at a height of 6m above ground level. It is proposed to use the biogas to generate electricity for pumping when the remaining modules have been constructed. The sludge can be discharged at two levels in the reactor. Excess sludge is pumped to sludge drying beds.

8.2.3.2 Pilot UASB Plant for Tannery Waste Water

The 10 m3 UASB pilot plant is located at the premises of Pioneer Tannery in Jajmau. The main objectives of the pilot plant programme are:

- To assess the required dilution ratio of tannery waste water with domestic waste water to ensure sufficient treatment efficiency as well as a stable process operation.
- To assess the stability of the process towards fluctuations in waste water quality and quantity.
- To establish specific design criteria and operational guidelines.

The UASB pilot plant consists of a steel UASB reactor. The reactor is equipped with an inlet system at the bottom and a three phase separator on top of the reactor. The effluent of the UASB reactor is discharged into the sewer, whereas the biogas is discharged into the open air after measuring the gas flow.

The pilot plant includes a mixing tank for mixing the domestic waste water and the composite sample of tannery waste water. The mixing tank has a volume of 40 m3 and is equipped with two mixers. The composite tannery waste water is prepared by mixing the waste water from the various production processes in a representative ratio. Therefore, the waste water from individual production processes is collected in 6 separate tanks with a storage capacity of 1 to 5 m3.

Further details of the 10 m3 pilot plant are presented in the "Design report UASB pilot plant for tannery waste water, Kanpur", May 1988.

8.2.3.3 Pilot Plant for Chrome Recovery

Of all the 151 tanneries in Jajmau area in Kanpur, 87 are (partly) adopting chrome tanning. The total quantity of chrome tanning compound applied in Jajmau amounts to 10,000 kg per day, which is equivalent to 1,700 kg of pure chromium. According to the survey only 70% of the chromium is taken up by the hides, which means that every day 1 ton of chromium is wasted, mostly via the waste water. It is expected, that in future more and more chrome tanning will be applied.

Although the trivalent form of chromium, which is used in tanneries, is not really toxic and dangerous, it is preferable not to spread the chromium in the environment. So measures must be taken in order to control chromium discharge or prevent it.

The proposed chromium recovery system is based on the property of chrome tanning salts to precipitate almost completely at pH 8-9. The formed sludge is separated from the liquor, dissolved in sulphuric acid and the obtained liquor is reused.

One of the tanning drums of the Pioneer Tannery has been provided with a separate outlet. This outlet is covered with a coarse screen inside the drum to avoid clogging of the outlet by the hides. The exhaust chrome liquor is discharged into a gutter. From the gutter the liquor flows via a screen into a pump pit from where it is pumped to a treatment tank. Magnesium oxide is added to the tank and the liquor is stirred for about 3 hours. Insoluble chromium complexes are formed. After stirring is stopped, the insoluble chromium settles at the bottom of the tank. Next morning the supernatant liquor is removed via a pipe which has an adjustable mouth. Dissolving takes place with concentrated sulphuric acid. After short stirring the recovered concentrated liquor is pumped to a storage tank from where it can be added to the tanning drum. The entire plant is operated with one pump only.

The installation was commissioned on 16th February 1989. From that day on it is now running continuously recovering the chromium of 6 lots of 1,000 kg hides a week.

Detailed information of the pilot plant has been presented in the "Design report chrome recovery pilot plant, Kanpur", May 1988.

8.2.4 CAPACITY OF PLANNED UASB TREATMENT PLANT AT JAJMAU

The planned treatment capacity of the waste water treatment works under this project at Jajmau is 25 mld. Therefore, it is planned to extend the first 5 mld module with 4 more 5 mld units.

It is planned to treat all tannery waste water from Jajmau in the 25 mld UASB treatment plant. The inventory of the 151 tanneries in Jajmau indicates that their waste water flow is 5.8 mld at present and is likely to increase to 8.8 mld. Depending on the results with the mixing ratios of tannery and domestic waste water in the UASB pilot plant at Pioneer Tannery it will be assessed whether treatment of all tannery waste water in the 25 mld UASB is feasible. The results are expected to be available in October/November 1989.

The anticipated treatment efficiences are:

- COD removal 75% to 80%
- BOD removal 85% to 90%
- SS removal 65% to 75%

In view of these treatment efficiencies there will most probably be no need for a post-treatment, if only domestic waste water has to be treated. In case of a mixed tannery and domestic waste water, the effluent characteristics may be such that some sort of a post-treatment may be necessary to meet discharge regulations.

8.2.5 COSTS

25 mld UASB Treatment Plant

The projected investment costs (price level 1988) of the 25 mld plant are presented in Table 8.2.1.

Table 8.2.1: Projected Investment Costs for 25 mld Treatment Plant

	5 mld Plant (Rs.)	20 mld Plant (Rs.)	Total (Rs.)
Civil works	4,800,000	14,950,000	19,750,000
Elec/Mech. works	1,200,000	3,800,000	5,000,000
Water supply works	300,000	-	300,000
Laboratory equipment	-	150,000	150,000
Subtotal	6,300,000	18,900,000	25,200,000
Work charged establishment and contingencies (5%)	315,000	945,000	1,260,000
Total	6,615,000	19,845,000	26,460,000

The running costs of the 25 mld treatment plant have been calculated on the basis of the projected investment cost. The projected running costs are given in Table 8.2.2.

Table 8.2.2: Projected Running Costs for 25 mld Plant

		Rs./year
Personnel		881,000
Power		288,000
Repairs/maintenance		
1% of 19,750,000	197,500	
2% of 5,000,000	100,000 +	
		297,500
Depreciation		
Civil: 3.33% of 19,750,000=	592,500	
El/Mech: 6.66% of 5,000,000=	333,000 +	
		925,500
Interest: 6% per annum of	26,500,000	1,749,000
Laboratory/chemicals		50,000
Miscellaneous		19,000
Total yearly costs		4,210,000
Revenues		
Sale electricity		
282.2 x 24 x 365/kwh	2,472,000	
Sale sludge		
12 x 100 x 365	438,000 +	
		2,910,000
Net yearly costs		1,300,000

Chrome Recovery

The investment costs of a chrome recovery plant at a tannery with a production capacity of 1200 tons/year pelt weight based on preliminary estimates are Rs. 200,000. The cost/benefit ratio of chrome recovery at a tannery with a production of 1200 tons/year is given in Table 8.2.3.

Table 8.2.3: Cost Benefit Ratio of Chrome Recovery

Running costs	Costs Rs./Year	Benefits Rs./Year
Capital costs	18,000	
Depreciation	20,000	
Maintenance 2%	4,000	
Chemicals	72,000	
Power	4,500	
Labour	10,000	
Miscellaneous	10,000 +	
Total	138,500	
Chromium recovered		384,000
Net profit per year		**245,500**

For smaller tanneries the profit will be lower. Yet, calculations show that even for the smallest chrome leather production unit in Jajmau (production of 120 tons a year) a small profit of Rs. 8,000 per year can be achieved.

8.2.6 EXPERIENCES

5 MLD UASB Treatment Plant

Construction of the 5 mld plant started on 1st February 1988. The contract document between the implementing agency and the contractor stipulated that the construction work would be finalized by 1st July 1988. Very soon indications were available that the pace of work was too slow to adhere to the work schedule. The main reason for this problem was that the contractor had subcontracted the work to a number of petty subcontractors. In addition the management at the site proved to be poor. During the prolonged construction period numerous deadlines were given to the contractor by U.P. Jal Nigam. It is obvious that this occurred because of the incapability of the contractor.

U.P. Jal Nigam the implementing agency of the UASB plant, is responsible for daily supervision. In addition the consultants provide advisory support on construction aspects. Initially, the level of supervisory input was not sufficient. For this type of construction continuous work supervision is required. It is therefore recommended that in future a work supervisor, a practically trained person, will be continuously on the site. He should be assisted by a junior engineer who will be responsible for checking measurements, quantities and issue of materials. They should be headed by an assistant engineer who has the responsibility for the whole work and should be continuously at site when critical elements like casting of concrete are undertaken.

The 5 mld UASB module was loaded with sewage in April 1989. The final commissioning of the plant was done in May 1989 after completion of the gas collection system by the contractor. Completion of the treatment plant is therefore exactly 10 months behind schedule.

Because of the above described situation no monitoring results are yet available.

UASB Pilot Plant for Tannery Waste Water

The construction of this plant at Pioneer Tannery in Jajmau started in October 1988 and was commissioned in February 1989, which was 2 months behind schedule.

The plant was seeded with sludge from Jajmau Pumping Station in March 1989 and loaded with domestic sewage. Gas production was also immediately noticeable after seeding, which is a rather promising development.

Chrome Recovery

As far as can be seen now the chromium recovery plant is operating as expected. It will be necessary to further develop a routine way of operation and to simplify the sytem as far as possible.

8.3 SEWERAGE AND STORMWATER DRAINAGE, KANPUR

8.3.1 INDUSTRIAL SEWERAGE SYSTEM

In the Northern Belt of Jajmau, 151 tanneries are concentrated adjacent to the southern bank of the river Ganga. Untreated waste water is either discharged into the Ganga or without permission discharged into the 90 inch trunk sewer running along the 150 Feet Road.

About 60% of the tanneries have made connections to the 90" trunk sewer directly. Other tanneries discharge their waste water randomly from their premises to the surrounding area. This waste water flows through the residential areas on the streets, in stormwater drains, and eventually reaches the Ganges via the existing nalahs.

The regulations for discharge of waste water into surface water or on land require low values of BOD in the effluent. These standards can only be met by rather sophisticated biological treatment systems.

The U.P. State Pollution Control Board has a special requirement that discharge of waste water into a municipal sewer, like the 90" sewer, is not allowed for waste water with BOD values over 500 mg/l. The tannery waste water is of such a composition that this requirement can only be met by operating, individually or commonly, a biological (pre)-treatment plant before discharging into the municipal sewer.

Based on these considerations it was concluded that a separate industrial sewerage system has to be constructed for the tannery waste water to transport it to the 25 mld UASB treatment plant. At the UASB plant this tannery waste water will be mixed with domestic waste water and then treated. The industrial and domestic sewerage system is shown in **Figure 8.2.**

The proposed system is designed to stop the direct discharge of waste water to the Ganga, to improve the general sanitation in the area, and to relieve the 90" trunk sewer of the tannery waste water load. Various alternative methods were analyzed and discussed. The method selected is basically an environmentally sound proposition, simple and easily maintainable. It consists of shallow gravity conveyance channels with removable top slabs for easy cleaning, 4 pumping stations (due to the difference in ground levels), and a rising main leading the waste water to a central treatment plant.

As far as possible it has been avoided to intercept stormwater by the industrial sewerage system. A separate stormwater system has been designed and planned for that purpose. However stormwater from the tannery premises will inevitably come into the industrial sewer system.

The present quantity of tannery waste water is about 5.8 MLD which will increase in future to about 8.8 MLD.

In order to make the proposed system functional the tanners have to bring their discharges to a common pit within their own premises, screen it, and connect the same either by gravity or by pumping to the collecting channels. At the same time all old connections, also those to the 90" sewer must be demolished completely.

The domestic waste water generated in the northern belt from the clusters of houses interspersed between the tanneries will be low and mainly consist of sullage water. Laying a separate system for domestic waste water is therefore not feasible. Connection of the households to channels has therefore been designed. The estimated domestic waste water quantity is 2.7 mld.

The collection system has a network of channels leading to the four pumping stations with a total length of 10,500 m and around 180 connecting pits for the 151 tanneries. The depths of the channels vary between 0.50 - 2m, and their widths from 0.30 - 1.25 m.

All pumping stations will be provided with submersible pumps. Provisions have been made in PS1 and PS2 to intercept respectively the nalahs Chabila Purwa and Bengali Ghat. The rising main will consist of prestressed concrete pipes.

There are certain preconditions which are to be addressed by either GPD and/or UP State Government before it is in principle decided to agree to the scope of this proposed industrial sewerage system. The present discharge regulations specify certain standard for discharging into surface water, open land, and municipal sewer. In addition to this, through a judgement of the Supreme Court, it has become obligatory for all tanners to construct pretreatment facilities.

The proposed industrial sewerage system has been designed taking into account the present discharge regulations. Nevertheless there is an additional benefit that this system through its channelized structure can also withstand waste water which does not meet the present discharge regulations.

Obviously, now the question arises under what conditions the tanneries can be connected to this system. Can they for instance be less stringent than the existing ones? After this has been resolved another question that arises is how will it be possible to enforce all the tanneries to connect to this system.

It is felt necessary that these questions need to be addressed before decisions or investments in this scheme are taken.

8.3.2 DOMESTIC SEWERAGE SYSTEM

Hardly any information was available about the existing system. An extensive field survey lasting 8 months had to be carried out. Location of sewers, status of sewers regarding siltation levels, size, invert levels, presence of manholes, crossconnections with stormwater drainage etc. were collected.

Detailed maps 1:1000 of the sewerage and stormwater drainage system were prepared after completion of the field survey. In some cases the sewers were so severely blocked that levels could not be taken and it had to be decided to base the design on preliminary data, to be checked later on after the proposed crash programme of sewer cleaning.

The existing trunk sewerage system consist of 3 trunk sewers

- One 90-inch trunk sewer, crossing the Jajmau area from West to East. This sewer transports sewage from the city drainage area of Kanpur to the Jajmau pumping station.
- One 24-inch trunk sewer, running from the South to North along the Bypass Road to Lucknow.
- One 18-inch trunk sewer, also running from South to North and laid West of the 24 inch trunk sewer.

The survey indicated that about 70% of the systems is not operational. Maintenance has been neglected completely. People are reluctant to take houseconnections. A summary of the survey findings is tabulated below.

DESIGNATION	NUMBER OF MANHOLES		TOTAL LENGTH EXCL. 90-INCH AND 42-INCH TRUNK SEWERS (M)	FLOW CONDITIONS			
	TOTAL	BROKEN/ MISSING COVERS		CHOKED %	BAD %	POOR %	GOOD TO FAIR %
Sector 1	46	8	2104	80	5	5	10
Sector 2	67	10	1898	75	5	10	10
Sector 3	171	64	3937	75	5	5	15
Sector 4	131	30	6657	20	20	25	35
Sector 5	186	54	8355	40	20	25	15
Sector 6	244	65	7184		90	5	5
Sector 7	76	14	1679	50	20	25	5
Sector 8	-	-	-	-	-	-	-
Sector 9	446	63	12472	50	25	15	10
Sector 10	265	45	7812	70	10	10	10
Sector 11	337	65	13247	50	15	15	20
Sector 12	337	51	10783	25	20	20	35
Sector 13	-	-	-	-	-	-	-
Sector 14	-	-	-	-	-	-	-
Sector 15	-	-	-	-	-	-	-
Sector 16	-	-	-	-	-	-	-
Sector 17	58	5	1480	30	-	20	45
TOTAL	2364	474	77678				

8.3.3 CLEANING AND REPAIR OF SEWERS IN JAJMAU

The findings of the inventory made it clear that a sewer cleaning and rehabilitation programme of the existing system was necessary. Practically all sewers, except the 90-inch sewer which is cleaned under another programme and Bypass road sewer which is a new sewer, have to be cleaned and repairs of manholes are needed.

This programme includes:

- Cleaning of approximately 69 km sewers from which about 1,350 cu.m of silt is to be removed.
- Cleaning of 9 km of trunk sewers with a silt quantity to be removed of 2900 cu.m.
- Purchase of 4 bucket cleaning machines.
- Repair of manholes.

During the preparation of this programme the need for a high pressure jetting machine to clean especially the smaller diameter sewers was recommended. It was agreed with the then Administrator of the KNM, who was also the Vice-chairman of the KJS, implementing agency for the cleaning operations, that high pressure jetting machine available with KJS would be deployed in Jajmau. The bucket cleaning machines for cleaning of the larger diameter sewers were to be procured under this project.

The GPD granted expenditure sanction on 25th June 1988. Unfortunately, the project has not yet started off for inexplicable reasons.

8.3.4 EXPANSION OF THE DOMESTIC SEWERAGE SYSTEM

In order to facilitate developments up to the year 2021 the existing Master Plan of UP Jal Nigam for Jajmau area has been updated. While preparing the overall sewerage plan the following considerations have been taken into account:

- Disconnection of the domestic sewerage system from the storm water drainage system, thereby preventing sewage discharge directly into the river Ganga.
- In areas where piped water supply is not sufficiently affordable, on-site Low Cost Sanitation has been proposed instead of a sewerage system.
- Upgrading of sewer stretches which have incorrect slopes.

The execution of the overall plan is divided into two phases.

The expansion of the domestic sewerage system, phase 1, takes into account the existing built-up areas as well as new residential areas which are likely to develop in the near future. Areas which have virtually no development at present and those areas which are reserved for industries can be taken up under phase 2.

The expansion of the domestic sewerage system under phase I includes:

- Laying of approximately 8 km new sewers, varying from 250 mm to 600 mm diameter, in the residential area between the 150 Feet Road in the North and the G.T. Road in the South.

- Replacement of approximately 13 km of existing mainly smaller diameter sewer lines which have incorrect slopes.

The analysis of the existing sewerage system revealed that approximately 13 km of sewers could not generate the required self cleansing velocities because they were laid under incorrect slopes. These stretches are liable to very frequent and rapid choking even after cleaning. It is felt that the frequency of cleaning in these stretches is so high that it will be impracticable to maintain them. Replacement is therefore the only remedy and essential requirement for the good functioning of the entire system.

More detailed information on the domestic sewerage system is available in the design report "Sewerage and Storm Water Drainage" of November 1988, and the DPR "Expansion of Domestic Sewerage System" Volumes I and II by UP Jal Nigam.

8.3.5 STORMWATER DRAINAGE SYSTEM

The stormwater drainage system consist mainly of 4 outfall nalahs, i.e. Dabka nalah, Bengali Ghat nalah, Burhria Ghat nalah, and Wajidpur nalah. These outfall nalahs have sufficient capaity to drain their catchment areas. Parts of the nalahs need, however, repair and cleaning as well as lining in certain stretches.

Based on the inventory it was observed that most of the stormwater enters the sewerage system through gully pits of which there are about 5,000 constructed in Jajmau.

The overall plan for stormwater drainage in Jajmau takes into account the segregation of the stormwater drainage system from the sewerage system. This part has a financial outlay of approximately Rs. 2.5 crore. In view of the financial ceiling for Jajmau the scope of this plan had to be reduced and now administrative approval for a scheme costing about Rs. 92 lakhs has been given. The alighnments of stormwater drains is shown in Figure 8.3.

The components of the presently proposed stormwater drainage schemes comprise of:

- Lining of downstream part of Bengali Ghat nalah where it crosses a densely populated area.
- Extension of Bengali Ghat nalah to the South.
- Lining of the nalah through the densely populated area Chabila Purwa
- Construction of new stormwater drains in Ompurwa and Tiwaripur where frequent flooding occurs.
- Construction of a new drain along the Bye Pass Road to prevent flooding in a number of undrained areas along this road.
- Cleaning and repair of all existing main drains.

8.3.6 COSTS

In May 1988 rough estimates of the sewerage and stormwater drainage scheme were proposed, mainly for administrative reasons. Because of budgetary constraints the GPD only gave approval for less than 50% of the proposed stormwater drainage, leaving all proposed branch drains.

The administrative approval for the industrial sewerage scheme for the tanneries in the Northern Belt was kept pending by the GPD. Approval will be given after the financial obligation of central Government, municipality, tannery workers, state government etc are worked out for this scheme.

SCHEME	CONSULTANTS PROPOSAL MAY 1988 1/ Rs./lakhs	GPD's ADMN. APPROVAL JUNE/JULY'88 2/ Rs./lakhs	UPJN's DPR ESTIMATE MARCH'89 2/ Rs./lakhs	GPD's EXPENDITURE SANCTION Rs./lakhs
Cleaning and repair of sewers	-	-	-	25.54
Wastewater conveyance system for the Northern Belt	297.43	Not yet received	Not yet ready	Not yet received
Expansion of sewerage system	270.00	292	292.8	Not yet received
Stormwater drainage improvement system	237.82	92.46	114.07	Not yet received

1/ This is excluding work charge establishment (1%), contingencies (3%) and project preparation fee (4%).

2/ Inclusive of work charge, contingencies and project preparation fee.

8.3.7 EXPERIENCES

The DPR estimates of UPJN in general are in accordance with the administrative approval within a range of 10%. Further budget increments of about Rs. 1.5 crore be considered under this project for the stormwater drainage system.

8.4 WATER SUPPLY, KANPUR

8.4.1 EXISTING SITUATION

The existing water supply system for Jajmau, is primarily based upon a number of deep tubewells which deliver water to two overhead tanks, from which water is distributed to consumers via pipe network systems.

The pipe distribution systems cover most of the area, except for parts of the northern industrial strip and other smaller pockets in lower income areas. In the areas receiving a piped water supply, consumers receive water either from individual connections (47% of population), or from public standposts (10% of population). The remainder of the population obtain water from a number of sources, principally from handpumps and shallow open wells which tap the higher water table aquifer. In the northern industrial belt tanneries also provide water from their own private tubewells to the population living nearby.

Despite the fact that much of the distribution system is relatively new, the existing records are not very reliable, and its operation is far from satisfactory. Water supplies are intermittent with sometimes only 3 hours of low pressure supply per day, and revenue is obtained from only approximately 20% of the water produced. In addition, there are numerous illegal connections, which in general, have been constructed poorly, a situation which adds significantly to the losses due to leakages from the system.

As elaborated elsewhere in the report the sanitary conditions are poor and the levels of awareness of the importance of personal hygiene in the area are low. This situation, is made worse by the intermittent water supplies and the leaky condition of the pipe network, and results in an environment where pollution of the distribution system and the resultant incidence of water related infections, is practically inevitable. The very high levels of diarrhoeal diseases within the area is indicative of this situation, and bacteriological analysis of the water has proved this to be so.

The improvement of the water supply system for Jajmau is thus seen as being of primary importance in order to raise the quality of life in the area. Many of the items listed as part of the water supply programme, especially, those with regard to the Administration and Management of the system, are outside the terms of reference for the present project, but have been identified as actions necessary if a sustainable improvement to the conditions within the project area is to be achieved.

8.4.2 CRASH PROGRAMME

Despite the fact that administrative approval for the crash programme was given by the Ganga Project Directorate, financial approval has only been received for the handpump programme. This has meant that progress has been limited.

Crash Programme (Phase 1) includes:

- Provision of handpumps in areas without piped water supply.
- Rehabilitation standposts.
- Construction of 3 new, and regeneration of 2 existing tubewells, to augment the production capacity.
- Construction of rising mains to connect the new tubewells to overhead storage tanks.
- Construction of an additional overhead tank.
- Conduct a leak detections survey in a pilot area.
- Initiate a survey of the existing services within the area.

The construction programme for the handpumps commenced at an early date, however, the installation of the pumps was found to be unsatisfactory, primarily due to the water jetting method used for their construction. This method provides little control over the quality of construction, and together with other implementation defects, led to remedial actions for many of the installation.

The programme has now recommended using a manually operated percussion method. Although slow, this method provides better possibilities of obtaining the standard of workmanship required to provide a satisfactory installation.

The overhead tank has been tendered by UP Jal Nigam, however, the award of the contract has to be delayed until the sanction of the required funds.

Tender documents for the required source works and rising mains, which is the responsibility of the UP Jal Nigam, have yet to be prepared.

As elaborated under Chapter 10, Community Participation and Actual Involvement is considered to be essential. At the outset therefore community related aspects have been incorporated (e.g. preferences, financial position, social profits) through baseline and community surveys. In addition the socioeconomic unit of the project carried out a community awareness campaign in relation to the handpump crash programme, community involvement was also ensured in site selection. The handpump caretakers training programme (first batch) has been carried out. Follow-up programmes are now being planned.

8.4.3. LEAK DETECTION

To obtain an indication of the condition of the existing water mains in the area, a leak detection survey was carried out in the Gaushala area of Jajmau. This area was chosen partly due to its proximity to an overhead tank, thus ensuring a reasonably reliable supply of water, and partly due to the fact that it is a relatively densely populated area, classified as an urbanized village area, which represents an average situation in Jajmau, somewhere between the lower class slums and the higher class residential housing areas.

The survey commenced in early 1988 with the installation and replacement of a number of isolating valves, stopcocks and water meters. The leak detection exercise was conducted in September 1988, and the results, as summarized below, have been used to provide a basis of extrapolating the inputs required for the whole of Jajmau.

Findings

- Unaccounted for water amounted to approximately 40% of the water produced, of which 25% was due to illegal connections.
- The quality of materials and workmanship employed for making houseconnections was very poor, and was the major cause of the leakages found.
- The poor quality of sluice valves, and the lack of attention to providing and maintaining proper stuffing to their gland packing was another identifiable source of losses.
- The quality of the main distribution pipework was found to be acceptable, although the layout of the system, particularly with regard to the numbers and location of isolating valves was inadequate.
- There were a substantial number of illegal connections.
- Many of the connections were not supplied with water meters.

Conclusions

- Considering that the pipelines in this area were constructed only 10 years ago, the level of losses was far too high. It is to be expected that in areas where the distribution system is older, then the losses will be correspondingly greater.
- The practice of allowing householders to construct their own private connections has led to excessive losses due to poor workmanship, and to a high level of illegal connections. Unless regular inspections and strict preventative measures are enforced, the situation will deteriorate further.
- The records of existing pipelines and the registration of connections were totally inadequate.

8.4.4 IMPROVEMENT PROGRAMME

Administrative approval for the on-going implementation of the project, to cover the rehabilitation, leak detection and for augmentation to meet the immediate needs of the area, has already been obtained, although confirmation of availability of funds is still awaited.

The proposed water supply facilities are shown in Figure 8.4.

The works included in phase 3 are those that, on the basis of the projections assumed, will be required to further augment the water supplied to meet the anticipated water demand for the year 2010. It is envisaged that this Phase will commence in the year 1996.

The programme covers the following elements:

Construction Works

- Phase 2:
  - Conduct a planned leak detection programme over the entire area, in coordination with the rehabilitation of the distribution system, concentrating on improving individual connections.
  - Augmentation and extension of the distribution system.
- Phase 3:
  - Further augmentation of the production and distribution capacity of the system, to meet the projected future requirements of the area for the year 2010.

When planning the implementing programme for the water supply system, a number of factors have to be borne in mind, particularly with regard to coordination with the sewer construction programme:

- Sewers being laid at lower levels should be laid before the water supply lines.
- Another argument for laying sewers first, is that they should be operable before additional quantities of waste water are generated by the provision of an improved water supply system.
- To reduce drainage problems in the construction of a sewerage system it is important to commence construction at the downstream end of the system and work upwards. Assuming that the construction of the water supply system will be coordinated with the sewer construction programme, this would lead to the construction work commencing in Zones 1 and 1A, followed by Zone 2, and finally in Zone 3.

- To enable the leak detection and rehabilitation programme construction of a number of the main pipelines.
- The sewers affected by this early construction programme and the preferred order of their construction will be:

  a. The 600 mm diameter sewer running south from the 150 ft. road along the 100 ft. road as far as the junction with the first east-west 100 ft. road.
  b. The 300 mm and 400 mm diameter sewer to be constructed to the south and east of Pokharpur village.
  c. The 450 diameter sewer, running southward along the same 100 ft. road as (a), as far as the old Trunk Road.
  d. The 250 mm diameter sewer to be constructed along the old Trunk Road.

The total length of sewers affected will be approximately 1,650 m.

Administration and Management

- Establish optimum staffing levels and infrastructure for the effective management, operation, maintenance and revenue collection.
- Prepare training programmes as necessary.
- Establish legal framework to enable the Kanpur Jal Sansthan to operate effectively:
  - Responsibility for and ownership of individual connections,
  - Establish realistic tariff levels with a view to eventual self sufficiency.
- Initiate a health education programme.

The technical solutions to rectify the situation are relatively easily identified, their implementation however, due to the congested nature of much of the area, and the lack of reliable records will be more difficult.

Even more challenging, will be the organization and administrative measures that will also be needed to ensure that the system will operate as desired. This will require a high degree of commitment and dedication from the management of the Kanpur Jal Sansthan.

8.4.5 COSTS

A summary of the cost estimates for the proposed works is given in Table 8.4.1.

Table 8.4.1: Cost Estimate Summary

DESCRIPTION	PHASE 1	PHASE 2	PHASE 3	TOTAL
Tubewell construction	25.50		8.50	34.00
Tubewell rehabilitation	4.40		4.40	8.80
Rising mains	8.65		4.25	12.90
Overhead tank etc.	38.80	2.27	3.46	45.02
Rehabilitation	0.76	39.71	7.00	47.47
Distribution		43.85	22.06	65.91
Handpumps & standposts	22.5			22.50
Generators			7.50	7.50
TOTAL	100.61	86.32	57.17	244.10
Total for Phases 1 & 2				186.93
Add 1% work charge				1.87
3% contingencies				5.61
4% Preparation Fees				7.48
TOTAL FOR PHASE 1 & 2				201.88

8.4.6 EXPERIENCES

There have been a number of factors that have had an adverse effect on the progress of the water supply component of the project, and which will continue to do so, unless timely action is taken to remedy their causes.

The records of the existing water distribution system were found to be inaccurate and incomplete. In order to obtain a reasonable understanding of the existing system it was necessary to excavate numerous trial pits to ascertain the location and sizes of the main pipelines. The design of the distribution system was delayed until this exercise was completed.

It must be stressed that the objective of this survey, was simply to obtain sufficient information to facilitate the design of the required augmentation works. It was not intended to produce detailed record drawings of all individual connections etc,. of the entire system.

The production therefore of these detailed records is still required, and is an important component of the proposed programme, and which was not foreseen at the time the project was initiated.

The 1:1,000 mapping used for the design has been enlarged from 1:5,000 mapping. This has been perfectly adequate for the design of the system, however it is suggested that, during the above exercise, these maps are thoroughly checked.

In the absence of expenditure sanction for the majority of the crash programme, most of these works will now have to be included in Phase 2.

If similar delays occur in the subsequent phases of the programme, the consequences to the progress of the project will be far more acute.

This report covers the initial stages of the programme, from which it is evident that there have been a number of problems and constraints that have affected the progress achieved.

The difficulties that are likely to affect the future implementation of the programme however, are potentially much greater and one of the major tasks of the project will be to identify potential sources of problems and take remedial action in time, including:

- The passing of legislation to define the ownership issue of the individual connections to ensure that the Kanpur Jal Sansthan retains the responsibility for the installation, repair and maintenance for the connection up to and including the water meter located adjacent to the consumers property boundary.
- The acquisition of the land and wayleaves necessary to construct the works.
- Streamlining the procedures, and passing the necessary legislation for the Kanpur Jal Sansthan to be able to introduce tariff structures that will lead to eventual self financing of the system.
- Establishing an efficient management unit that will be capable of operating, maintaining and repairing the system, to be responsible for the meter reading, billing and revenue collection activities required and for planning and construction of any necessary extensions and improvements to the system.
- Systematic registration, recording and plotting of all consumer connections, together with the disconnection and penalization of any illegal connection found.
- The definition of the responsibilities and powers of the various organizations involved, e.g.
  - To what extent will the project have powers to ensure good workmanship?
  - How can we ensure that meter reading, billing and revenue collection will take place?

- The Kanpur Jal Sansthan will be the operating authority, whilst the UP Jal Nigam is the implementing authority. Who will be responsible for the leak detection and rehabilitation exercises? These are normal responsibilities on the operating authority.
- What power will the Kanpur Jal Sansthan have for approval/rejection of work?
- Would it be possible to delegate these powers to the project?

It is evident that it will not be possible to effect all of the measures suggested, in the relatively short duration of the project. It will therefore be necessary for the management of the system to actively continue to pursue the main objectives of the programme, i.e.

- To provide adequate quantities of water to consumers 24 hours a day.
- To ensure that the quality of water is safeguarded against pollution.
- To extend the distribution system will cover all people living in the area.
- To achieve financial self-sufficiency.
- A leak detection, registration and rehabilitation programme for the entire area is required urgently.
- Legislation must be sought in order to establish the Kanpur Jal Sansthan's ownership of private connections from the main distribution pipeline up to the water meter.
- Any householder found with an unauthorized connection be penalized.
- The Kanpur Jal Sansthan must be provided with sufficient trained staff, tools, infrastructure and spare parts to enable them to operate, maintain, prepare records, to collect revenues due, and to take disciplinary action, such as disconnection of services, where necessary.

8.5 LOW COST SANITATION, KANPUR

8.5.1 EXISTING SITUATION

In order to assess the existing sanitation service levels in Jajmau, Kanpur, Sulabh International carried out a survey on behalf of the project in 16 sample areas. The survey covered 1724 households out of a total of 20,445 households. The results of this survey are tabulated in the following Table 8.5.1.

Table 8.5.1: Status of Sanitation at Jajmau in Kanpur Based on a Survey in 16 Sample Areas

CATEGORY[1]/ACTUAL HH		LATRINES WITH CONN. TO PITS/ TANKS	LATRINES WITH CONN. TO SEWERS	DRY/BUCKET LATRINES	NO LATRINES	TOTAL HH SAMPLES AREAS
I	4156	29	18	110	199	356
II	844	7	49	5	137	198
III	2858	17	63	10	341	431
IV	8113	43	119	81	242	489
V	4474	-	249	-	1	250
TOTAL	20445	100	498	206	920	1724

1/ The whole project area has been divided into five categories in terms of proliferation of different income groups and urban development.

Category I, i.e. industrial slums in the northern belt along the Ganga

Category II, i.e. qualified slums with slum improvement programme initiated

Category III, i.e., villages partly developed, but still retaining their rural characteristics.

Category IV, i.e., planned residential areas with economic activities in spurts and bursts.

Category V, i.e., planned residential areas for low to medium, and higher income groups. Housing schemes being developed by the Government.

Based on the results of the survey in the 16 samples areas the picture that emerges for the whole project area of Jajmau is given in the Table 8.5.2.

Table 8.5.2: Estimated Status of Sanitation in Jajmau, based on the Survey in 16 Samples Areas

CATEGORY	LATRINES WITH CONN. TO PITS/TANKS	LATRINES WITH CONN. TO SEWERS	DRY/BUCKET LATRINES	NO LATRINES	TOTAL HH
I	330	210	1284	2323	4156
II	30	208	21	584	844
III	113	419	66	2264	2858
IV	779	1975	1345	4018	8113
V	-	4458	-	18	4474
	1252 6.1%	7270 35.6%	2716 13.3%	9207 45%	20445 100%

8.5.2 PROPOSED FACILITIES

The LCS programme in Jajmau consists of a private latrine construction programme and public latrine construction programme for households who do not have sufficient space for leaching pits. The private latrines construction programme is split up into conversion of existing dry/bucket latrines as well as installation of new pour flush latrines which are either connected to sewers (off-site) or leach pits (on-site). The proposed facilities are shown in Figure 8.5.

The number of households which will be depended on the public latrines, and those who might come forward for conversion and new installation of pour flush latrines are tabulated in Table 8.5.3.

Table 8.5.3: L.C.S. PROGRAMME FOR JAJMAU

CATEGORY	EXISTING HH	EXISTING POUR FLUSH LATRINES	EXISTING LATRINES WRONGLY CONSTRUCTED & TO BE REPLACED1/	TO PUBLIC LATRINES 2	NEW OR CONVERSION 3/	
					ON-SITE	OFF-SITE
I	4156	540	60	660	2000	1010
II	844	238	25	-	400	230
III	2858	532	55	110	1000	1270
IV	8113	2754	260	780	1000	3860
V	4474	4458	450	-	-	460
	20445	8522	850	1550	4400	6830

1/ The survey carried out by Sulabh International reveals that approximately 10% of the existing latrines do not function well and are to be replaced (viz. 850 latrines out of 3522).

2/ Aapproximately 1550 households in Jajmau do not have any space for especially leaching pits and are therefore to be provided with public toilets.

3/ The division between on-site and off-site sanitation is based on the inventory of the existing sewerage system and its future expansion.

8.5.3 PROCEDURE FOR CONSTRUCTION OF HOUSEHOLD LATRINES

Once a householder expresses his interest in having a pour flush latrine, the following steps will be followed:

a. The householder will be told about the standard designs, costs and the financial arrangements which apply to him. After assessing the space available and the number of users, the householder will be assisted in deciding the location of pits and selecting a design most suited to his needs. In case there is a loan components in the financing pattern of the local body, the householder will endorse his agreement to make the necessary loan repayment.

b. The suitability of latrine will be determined taking into consideration the sub-soil water level, soil characteristics, location of water sources, foundation and structural conditions of the house etc. A sketch plan of the proposed installation will be prepared in consultation with the house-owner.

c. The application will be submitted to the office of the local authority for approval.

d. After the approval of the application and signing of the loan agreement, the materials will be purchased and the latrine constructed. After construction a certificate should be obtained from the householder indicating that he is fully satisfied with the construction.

e. The latrine adopter will be educated about the use, operation and maintenance. He will also be supplied a printed pamphlet giving necessary instructions.

Financing Pattern in UP for Household Latrines

The LCS programme in UP was initiated in 1980 when the state government agreed to provide 25% of the cost as grant and the balance 75% as loan. The programme did not pick up well on account of heavy financial burden on the beneficiaries. The State Government, therefore, in 1982, decided to increase grant portion to 50%.

The UP Government, at present, is providing financial assistance to individual households to cover the full cost of sanitary latrine. The projects under the Ganga Action Plan are also on the same financing pattern (50% grant and 50% loan). The loan portion is repayed in 5 years with eight and a half percent rate of interest.

Experience has shown that in case it is left to the owner of the house to erect the superstructure, it generally takes a long time to do so. However, since the UP financing pattern does not allow the inclusion of the superstructure the cost for it had to be excluded.

8.5.4 PUBLIC TOILET COMPLEXES

The survey of Jajmau area indicates a demand for public toilets. The existing public toilets are not being used due to acute shortage of water and lack of maintenance on account of which they are not kept clean. The sewers to which the toilets have been connected are generally choked. Since these public toilets have remained out of use for a long time, their structures have not been maintained and are in a dilapidated condition.

Important aspect in selecting the sites is the easy availability of land. In case a site is selected where land acquisition is involved, it takes a considerable time to get the land.

The proposed toilet complexes assure complete privacy to users. Separate sections have been provided for males and females. The entry to the complexes for men and women is separate so that even those women who use veil(Burka) can feel secure.

In all toilet complexes 5 seats for men, 5 seats for women and 3 seats for children have been provided. Furthermore, 2 bathrooms for men and 2 for women have been proposed. The bathroom for men shall be open type without doors while those for women shall have doors. Platforms for washing clothes have also been proposed in both the sections.

A room for the caretaker has been provided in each toilet complex, as they shall remain open almost throughout 24 hours and it is essential that the attendants remain at site all the time for proper operation and maintenance.

Since the present water supply is very poor at all the places selected and a considerable amount of water is required for bathing, washing and keeping the toilets and the campus clean, it is necessary to construct one shallow tubewell at each site as it would not be desirable that supply of water stops for lack of piped water supply.

The initial investment for the construction of community toilet complexes having toilets, bathing and washing facilities is made by the local authorities from the assistance provided by the Ganga Project Directorate.

Sulabh International is operating and maintaining community latrine complexes in many towns on a "pay and use basis". Twenty paise are charged per user. Women, and children are exempted from payment. Use of urinal is without charge.

Local authority on whose behalf the complexes are maintained provide water and electricity for toilet complexes free of cost but is not required to subscribe any amount for the operation and maintenance as well as structural maintenance of complexes incase the complexes are constructed by Sulabh International. Thus the local authority has not to make any budget provision for the same. The cost of repair and maintenance is met from the funds collected from the users.

Soap powder is provided to every person without any extra charge for washing hands and disinfectants are used to keep the toilets clean and in sanitary condition. The complexes can be used round the clock. Maintenance and collection staff is posted in shifts. Sulabh International takes responsibility for operating and maintaining these for 30 years.

8.5.5 COSTS

An expenditure sanction has been given by the GPD for the construction of 4 ten seater public toilets and 550 conversion/new construction of pour flush private latrines for the amount of Rs. 21,65,334/-.

The financial arrangement with the beneficiaries is based on the guideline of the GPD that a maximum of Rs.600 (approximately 50% of total cost excluding superstructure) has to be paid per household. The down payment asked for by the KNM is Rs.35/connection to be paid at the moment of signing the contract for the connection. The rest of the Rs.600 will be recovered from the beneficiaries over a time period of 60 months. An interest of 8.5% is to be paid by the beneficiaries.

For the total amount of the work the GPD has given an administrative approval for the amount of Rs. 249.60 lakhs, inclusive of the above mentioned amount for which expenditure sanction has been given.

A detailed break-up of the costs is given in the DPR on Low Cost Sanitation.

8.5.6 EXPERIENCES

The execution of the crash programme of the LCS schemes in 3 demonstration areas, for which the expenditure sanction had been granted, started in January 1989. Out of the planned 4 public latrine complexes 3 have more or less been completed. The fourth one was delayed because of land ownership disputes. The dispute has recently been resolved and construction has started.

Out of the planned 550 conversion/new constructions of pour flush latrines 450 latrines have been completed. The quality of construction is generally acceptable. However, intensive and constant supervision is required to achieve the required standards of work.

The crash programme in 3 demonstration areas has been initiated to gain experience with LCS acceptance and construction in the Jajmau area.

The most important aspect here is to evaluate the reasons why people participate in the LCS programme or why they don't/cannot. Based on these conclusions the remaining programme will be adjusted accordingly. For instance if it appears that the number of applicants for private latrines is less than the expected number for whatever reasons, more public toilets may be required.

8.6 SOLID WASTE MANAGEMENT, KANPUR

8.6.1 EXISTING SITUATION

The solid waste management scheme will be implemented by the Kanpur Nagar Mahapalika who is also responsible for the operation and maintenance of the system.

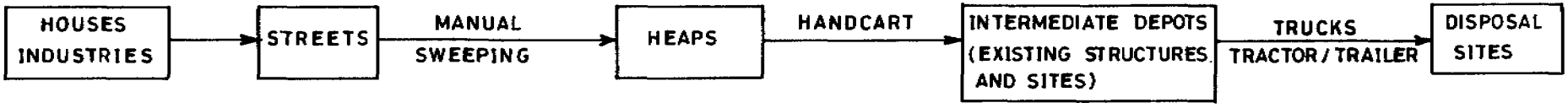
The project area Jajmau forms part of the municipality of Kanpur and has the following characteristics.

- a total area of about 900 ha, inhabited by 105,000 people at present,
- a populated area of about 600 ha,
- distance to Central Kanpur about 10 km,
- in general a low income area,
- poorly developed tax recovery structures,
- high population density and high built-up density, especially in the northern belt and in the southern part,
- poor accessibility for motorized vehicles in highly built-up areas, and north eastern part of Jajmau,
- in general a poor road condition except for the arterial roads, Bypass road, G.T. road, Old Jajmau road (partly) and Chakeri road,
- reasonably well developed urban road network,
- high traffic density at arterial roads, low traffic density outside arterial roads.

The present solid waste collection and disposal system is a two stage system. In the first stage, the primary collection, wastes are collected in handcarts and brought to rubbish depots. The rubbish depots are either masonry structures or open piles of waste. In the second stage, secondary collection, the waste is transported by tipper trucks to disposal sites. The loading of the trucks proceeds manually or mechanically. The present collection and disposal system is given in Figure 8.6.

Within Kanpur Nagar Mahapalika two departments are involved in solid waste collection and disposal, e.g Health Department and City Cleansing. Health Department is responsible for the cleaning of streets and open roadside drains and for night soil collection. City Cleansing is responsible for the transport of wastes from the rubbish depots and disposal of wastes.

Jajmau area can be seen as a `forgotten' part of Kanpur city with regard to solid waste collection and disposal. As a result the hygienic conditions are very poor. Jajmau area, however, is not "forgotten" as a disposal site for Kanpur refuse. Along the G.T. Road and inside Jajmau numerous piles of refuse are scattered all over the area.



CLIENT : GANGA PROJECT DIRECTORATE

JOB : SOLID WASTE MANAGEMENT

DRAWING : PRESENT SCHEME FOR SOLID WASTE COLLECTION AND DISPOSAL IN JAJMAU.

FIGURE 8.6

SCALE	
DRWN BY	PHADKE
CHKD BY	
DATE	31-5-89

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The primary collection in Jajmau covers the road sweeping combined with the collection of domestic solid waste, the drain cleaning, night soil collection, tannery solid waste, hospital waste, animal corpses and other industrial wastes.

Domestic solid waste is usually thrown on the streets from where it is collected by road sweepers. About 194 sweepers are deployed and 40 handcarts are in working condition compared with the present system in Kanpur city 100 sweepers and 20 handcarts two less are deployed now. Waste generated is 0.5 kg per person per day. The amount of waste collected is 55 tonnes per day.

The City Cleansing department uses different types of systems to clean rubbish depots and transport of the waste to disposal sites:

- trucks which are loaded either by front end loaders or manually;
- mini tractors with trolleys;
- bin carriers;
- tractor with trailers which are mostly loaded manually.

Loading of trucks by front end loaders is very slow and often causes traffic jams in crowded streets. The loading of most trailers and minitractors is done manually which is also time consuming and unhygienic. No regular deployment of vehicles for solid waste collection is however available in Jajmau area.

The collected solid waste of Kanpur city and Jajmau is mainly disposed off at two uncontrolled dump sites namely at Ganga Vihar in Jajmau area and at Barra in the southern part of Kanpur. Besides these two authorized sites many other places are being used as dump sites, sometimes on public request.

The present method of disposing solid waste creates many health risks for the population and gives disease vectors like flies and vermin a chance to breed. The crude dump sites are all accessible to scavengers which creates a "recycling of diseases".

The population did not show much faith in the municipality which is quite understandable considering the limited number of sweepers and facilities available in the area.

Many people mentioned that the sweepers deployed by the municipality did not attend to their duties regularly. As a result of this, private sweepers were deployed in more developed areas of Jajmau.

Waste Generation Estimates and Forecasts

Population	1987	1991	1995	2001
	105000	120000	140000	175000
Domestic solid waste at 0.5 kg/cap.day	55	60	70	90
Roadside Drain cleanings	5	6	8	8
Commercial waste	10	12	14	18
Subtotal	70	78	92	116
Hospital waste	0.5	0.5	1	1
Animal corpses	5	5	5	5
Industrial waste*	10	12	15	15
TOTAL in tonnes/day	85.5	95.5	113	137

* The reused quantities of the tanneries are excluded from this estimate.

8.6.2 PROPOSED SOLID WASTE COLLECTION AND DISPOSAL SYSTEM

The solid waste management scheme has been designed in such a way that the solid waste management scheme is not only a procurement scheme but especially contributes to systems management improvement. The proposed collection and disposal system is given in Figure 8.7. The proposed facilities are shown in Figure 8.8.

It is proposed that the execution of the scheme is phased and that the first phase programme is taken up in 3 demonstration areas.

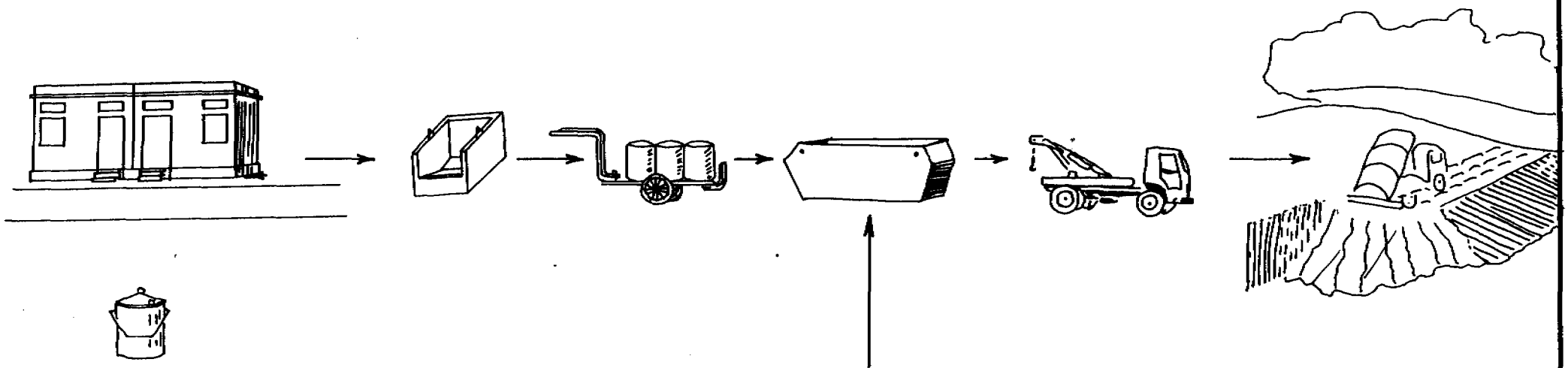
The proposed system contains five basic elements:

- storage at source
- primary collection
- transfer
- secondary collection
- disposal

The population is expected to bring the waste outside the houses into the roadside bins. Sweepers collect the domestic solid waste from these bins and dispose this in containers.

As secondary collection dumper placer system is used for collection of solid waste from the containers and transfer to the disposal sites.

At the disposal sites a sanitary landfill operation is carried out with equipment like tractors with dozer blades.



STORAGE OF WASTE IN BINS IN HOUSES

POPULATION BRINGS WASTE TO ROADSIDE BINS

PRIMARY COLLECTION BY HANDCARTS

TRANSFER OF WASTE TO CONTAINER

SECONDARY COLLECTION BY DUMPER PLACER

DISPOSAL BY SANITARY LANDFILL

ROADS AND ROADSIDE DRAINS

SWEEPING OF ROADS AND CLEANING OF ROADSIDE DRAINS BY HANDCARTS WITH BINS

CLIENT : GANGA PROJECT DIRECTORATE

JOB : SOLID WASTE MANAGEMENT

DRAWING : PROPOSED SCHEME FOR SOLIDWASTE COLLECTION AND DISPOSAL IN JAJMAU KANPUR.

FIGURE	8.7
SCALE	
DRWN BY	
CHKD BY	
DATE	25-1-89

HASKONING EUROCONSULT ASSOCIATED IND.CONSULT IRAMCONSULT

Roadside drains are cleaned by a separate group of sweepers.

Commercial waste is placed by the producers directly in the containers.

For the hospital waste handcarts, bins and an incinerator is proposed and for the animal corpses a truck and the use of canvas slings to make operations as much as possible hygienic. Sewer cleaning is a separate operation carried out by KJS for which under this programme the transport equipment for the sewer cleaning material is provided.

In the first phase one zonal garage is planned for Jajmau. The central garage will be provided with tools for the new dumper placer system of Jajmau.

First Phase Implementation

It is proposed to set-up three demonstration areas for the implementation of the solid waste management scheme in the the first phase for the following reasons. The proposed equipment and facilities for First Phase implementation are given in Table 8.6.1.

- to enable the implementing agency to adapt itself to the new and changed solid waste management system on a smaller operational level before introducing the scheme to the remaining project areas.
- to monitor the deployment of sweeper groups and their adaptability in the use and handling of new equipment.
- to monitor the response of the inhabitants.
- to assess the staffing requirements for nalah cleaning work.

8.6.1 Proposed Equipment and Facilities for First Phase Implementation

No.	SUBJECT	ITEM	QUANTITY
1.	Primary Collection Domestic waste	- Handcart	11
		- Bins	66
		- Roadside bins	90
		- Shovels	11
		- Brooms	30
		- Protective clothing	42
2.	Commercial waste	- Handcarts	16
		- Bins	94
		- Brooms	32
		- Shovels	16
		- Protective clothing	56
3.	Roadside drain cleaning (demonstration areas)	- Handcart	2
		- Bins	14
		- Shovels	3
		- Brooms	5
		- Protective clothing	10
4.	Zonal garage	- Zonal garage & tools	1
		- Protective clothing	8
5.	Secondary collection	- Dumper placer	2
		- Containers	26
		- Protective clothing	6
6.	Disposal*	- Dozer blade for tractor	1
		- Rakes	5
		- Protective clothing	12
		- Upgrading present sites	n.a.
7.	Maintenance	- Tools dumper placer	n.a.
8.	Hospital waste	- Incinerator	1
		- Handcart	2
		- Bins	12
		- Protective clothing	8
9.	Animal corpses	- Truck	1
		- Canvas slings	2
		- Protective clothing	4
10.	Sewer cleaning	- Tractor and loader	1
		- Containers	4
		- Protective clothing	6
11.	Cleaning project area	- Cleaning of rubbish depots	n.a.

Organization of Demonstration Areas

It is recommended to form a Project Management Group (PMG) which will follow the day to day operations in the demonstrations areas. This PMG will consist of a representative from the solid waste collection department of KNM as chairman, a representative of of the Health Department of KNM, and two representatives of the project. The members of the PMG will regularly pay field visits to the demonstration areas and meet at least once a week to discuss the findings of the preceding week and plan the operations for the coming week. The PMG will be responsible for monitoring the demonstration area operations and assess the feasibility of expansion of the system in the other project areas.

Preparation

The following preparatory steps are to be taken:

- the PMG will be formed and the organization set-up must be agreed upon,
- the equipment will be procured and acceptance testing will be done by the consultants and MNP staff,
- the setup will be explained to the sweepers and the population (training and monitoring campaigns,
- health education programme will start,
- for a good start it is strongly recommended to clean the entire area. This will encourage the sweepers and will show the inhabitants the benefits of the approach.

Monitoring

During the execution of the programme in the demonstration areas the following will be closely monitored by the PMG:

- the organization and deployment of the groups of sweepers. Is the number of 2 sweepers per group adequate? How many households do they serve per day?
- the response of the sweepers on the organization in groups, the equipment, the travel distance to the trailer,
- the response of the population concerning waste collection, health promotion and their attitude towards domestic solid waste.

The monitoring data will be carefully recorded in a specified format for further analysis. After monitoring and evaluation the setup of the primary collection and the design of the facilities can be modified, if necessary and the final phase of the project can start.

The financial feasibility of the entire programme has to be worked out, and if required, changes have to be made. Therefore, details of the final phase programme can only be finalized after evaluation of the first phase programme.

Final Phase Implementation

On the basis of the experience gathered during the first phase the final phase will be proposed. For budgetary reasons preliminary estimates however have been made.

Management of Solid Waste Collection and Disposal

Management of solid waste collection and disposal comprises operational structure, finances, public education and participation and legislation.

Taking into account the limited ability of the majority of the population to pay for various public services only limited improvement of the solid waste collection and disposal can be proposed. A minimum service level should be established based on a least cost analysis with a high efficiency.

It is proposed to make one chief sanitary inspector responsible for the Jajmau operation, who works from his office in one of the zonal offices in Jajmau.

Three sanitary inspectors will be working from the three zonal offices, controlling each of their own zone. The proposed organizational setup for Jajmau is given in Figure 8.9.

8.6.3 COSTS

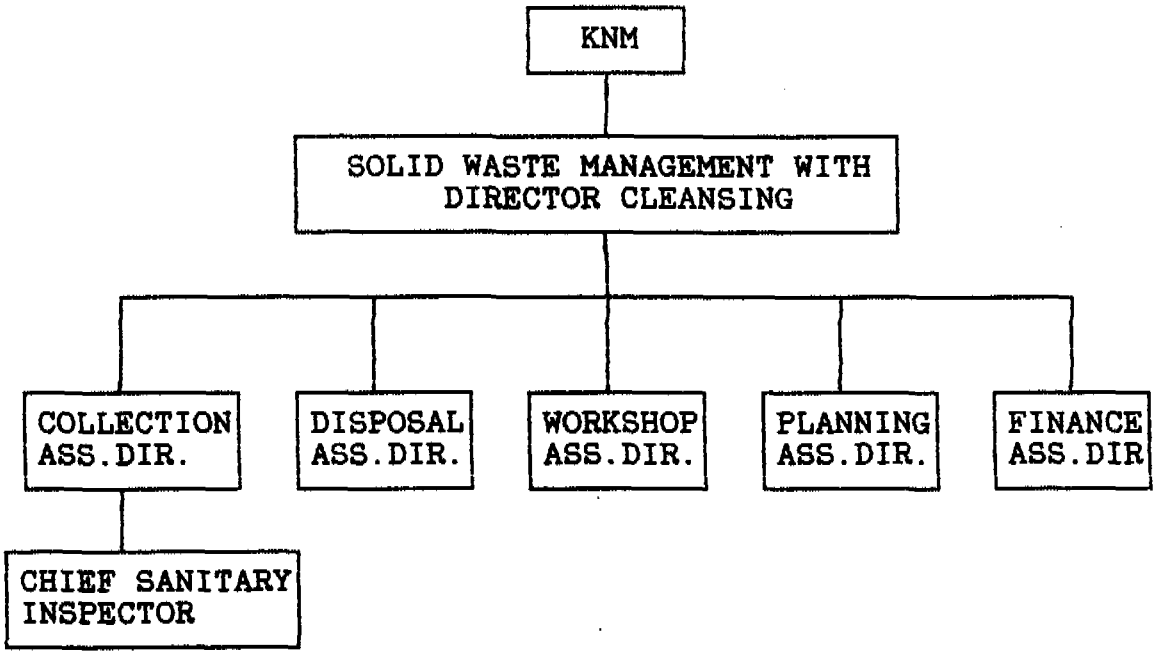
The cost estimates for the proposed first phase equipment and facilities are based on 1988 price levels. The total projected cost for the first phase scheme is Rs. 28.33 lakhs. Expenditure sanction to this scheme was given in May 1989.

8.6.4 EXPERIENCES

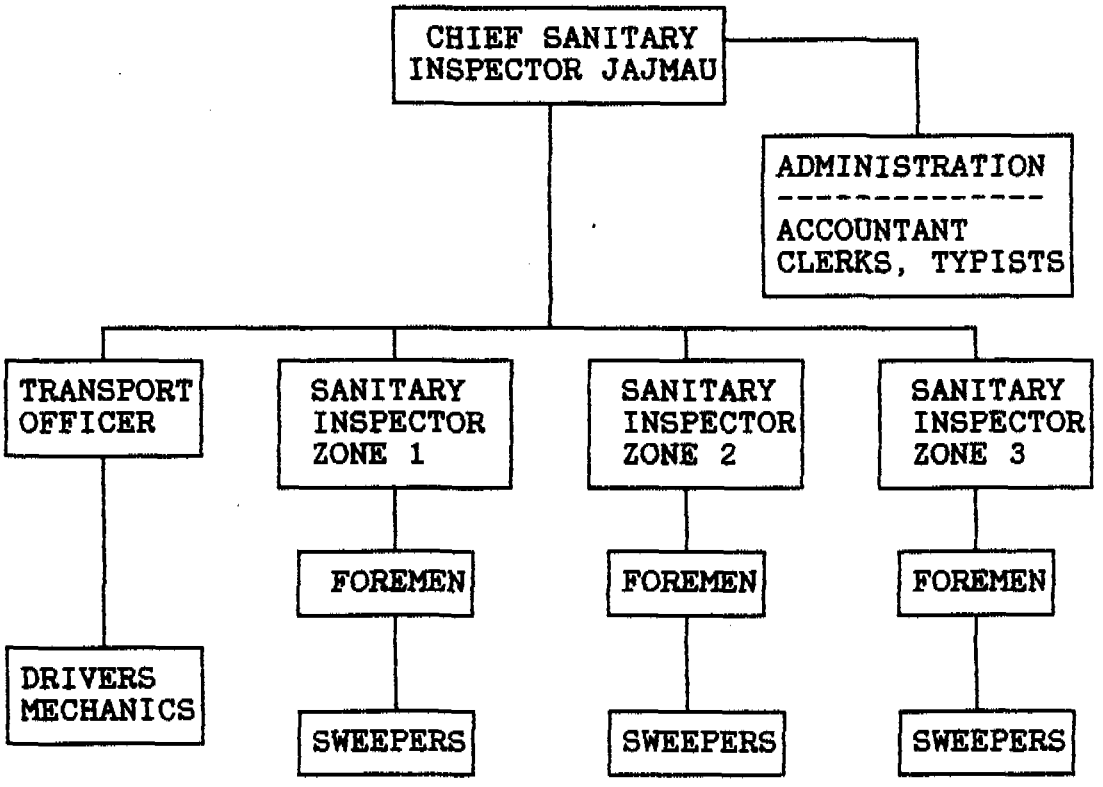
During the inventory phase basic data had to be collected from the KNM. The actual situation found in the field was often different from the records, like presence of sweepers, working condition of equipments etc.

RECOMMENDED ORGANIZATION CHART FOR SOLID WASTE MANAGEMENT

KANPUR



JAJMAU



9. TECHNICAL PROJECT COMPONENTS IN MIRZAPUR

9.1 WASTE WATER TREATMENT, MIRZAPUR

Waste Water Quantity

The measured quantity of waste water which is presently being discharged directly into the Ganga through 6 major nalahs is about 11 mld.

In the year 2006 it is expected that 93,500 people will be discharging to the proposed wide-mesh system. The quantity of waste water discharge to this system and pumped via the Main Pumping Station (MPS) to the future sewage treatment plant is projected to be 14 mld.

In 2021 the population on the wide-mesh system is likely to grow to 110,000 with a waste water discharge of 16.5 mld.

In 2021 it is expected that another 30,000 people will discharge another 4.5 mld directly to the waste water treatment plant through 2 seperate pumping stations. The total quantity of waste water that is to be treated is therefore 21 mld in 2021.

At present, hydraulic peaks in the waste water discharge occur from 7 to 10 a.m. and from 4 to 7 p.m. because in these periods drinking water is supplied. In future it is planned that drinking water will be available 24 hours per day.

Based on a future peak factor of 2.4, the peak discharges are expected to be as follows:

Year 2006 via MPS			1400 m^3/hr
Year 2021 via MPS		1650 m^3/hr	
	via 2 other PS	450 m^3/hr +	
	Total		2100 m^3/hr

The MPS will be constructed as far as civil works are concerned, for a maximum capacity of 1650 m3/hr. Taking into account that the life span of a sewage pump is normally 10-15 years after which they will have to be replaced, a total pumping capacity of 1400 m3/h (i.e. 3 pumps of 470 m3/hr each) will be installed to cope with the waste water flow upto 2006.

Waste Water Composition

In Mirzapur the waste water is mainly of domestic origin, although a small amount of waste water is produced by household industries, such as textile and brass.

At present the waste water COD is about 500 mg/l, and the BOD is 250-300 mg/l. In future, the waste water concentration will change due to the implementation of the Low Cost Sanitation programme. It is estimated that at present approx. 50% of the faecal matter and all sullage water is discharged through the nalah-system (see Chapter 9.4). It is foreseen, that in future 75% of the households will have on-site sanitation facilities, whereas 25% will be connected to the sewerage system.

The World Bank report "Appropriate Technology for Water Supply and Sanitation, Richard G. Feachme, David J. Bradley, Hemda Garelick and D. Duncan Mara, December 1980" states that BOD production in excreta/night soil in urban areas of developing countries is approximately 32 g BOD per adult per day. The pollution load of the sullage is approx. 20 g BOD per inhabitant per day.

Using these figures the average present pollution discharged pcpd is (0.50 x 32) + 20 = 36 g BOD per person per day at present.

In future the average discharge will be (0.25 x 32)+20 = 28g BOD. As a result the COD and BOD concentrations of the Mirzapur waste water will decrease to 28/36 x 100 = 78% of the present BOD.

The COD concentration will become approx. 390 mg/l and the BOD-concentration 195-235 mg/l. These concentrations are sufficient to use the UASB technology for treatment. In Colombia satisfactory BOD reductions of 80% and more have been achieved even with waste water having a BOD concentration of 100-125 mg/l.

Waste water temperature in general is far above 20° C. Only in December/January the temperature can occasionally drop to 17-18 deg. C. The minimum temperature of the sewage is expected to rise when the sewage will be conveyed through the main interceptor trunk sewer and the retention time in the sewer system will increase. The minimum temperature for design is therefore taken as 20° C.

The design of the UASB treatment plant at Mirzapur will be taken up in October 1989 when the monitoring results of the 5 mld UASB plant at Kanpur are available.

9.2 SEWERAGE AND STORMWATER DRAINAGE SYSTEM, MIRZAPUR

9.2.1 EXISTING SITUATION

The project area of Mirzapur can be divided into four main drainage zones.

- The core area
- The civil lines zone
- East zone
- West zone

The core area has a combined sewerage and storm water drainage system which has five main outfalls to the river Ganga. The network consists of four deep laid trunk nalahs, a system of covered main nalahs and a dense network of smaller nalahs and road drains. This drainage network discharges waste water as well as storm water. A large number of latrines discharge directly in the road drains.

The civil lines zone has two outfalls to the river Ganga. The area is drained, directly or indirectly via ponds to open unlined drains. Only a rudiment micro drainage system comprising of smaller nalahs and road drains exists.

The east zone of Mirzapur does not have a drainage network. Internal drainage of sullage and waste water takes place to a large number of ponds. These ponds function as a storage basin. Only during heavy rainfall overflow to the drainage system of the civil lines occurs.

The west zone has some rudiments of a drainage system which is mainly meant to evacuate storm water. There are two outfalls namely Chorwa nalah, which is an unlined drain evacuating directly to the river Ganga, and a lined, partly covered drain starting at Bhansia Ka Tola to the Khandwa nalah.

Although the existing system has been in use as a combined system for quite some time, it was originally designed for storm and sullage water only. Most of the roads have open drains on the sides. People even dispose the night soil directly into these drains which causes nuisance and induces unhygienic conditions. Although the present system is quite adequate as far as storm water is concerned, it generally does not perform with its fullest possible efficiency because of improper maintenance. Drains gradually silt up, as well as solid waste slips into them. Furthermore, both flow and maintenance are often obstructed by encroachments, platforms etc. which are illegally built over and the drains.

In general the condition of the trunk nalahs is such that they can be used in the future sewerage system. Sufficient flow capacity will be available after cleaning. The condition of the covered main nalahs is worse. Siltation levels of upto 100 percent have been observed. The sandstone cover slabs have large irregular joints causing erosion of the upper layers which result in silting of the nalahs. The cross-section of these nalahs varies from 0.2 to 1.0 sq. m. whereas the total length is about 6500 m.

It was found that the flow conditions through the road drains and the smaller open nalahs were often very bad. In about 20 to 30 percent of the road drains, water logging occurs under dry weather flow conditions. This leads to unhygienic conditions. On the other hand, the capacity of the road drains is sufficient to cope with the stormwater flow.

9.2.2 CRASH PROGRAMME

After a preliminary study of the existing drainage system of Mirzapur, a few options were defined for the overall sewerage system. It was decided to use the already existing trunk nalahs and some of the larger drains for the future drainage system. By inspection it appeared that the drains were in a fairly good condition and could be retained for future use, after certain improvements. Cleaning was essential as most of the drains were heavily choked and silted. Therefore, it was decided to clean the drains by bucket machines as well as manually. Furthermore, manholes had to be constructed and a few existing manholes had to be rehabilitated.

The trunk nalahs had collapsed at few spots and at several places, the top slabs of the nalahs were missing. All this needs repair. Two demonstration areas were selected to improve the drainage system to serve as a model for an area with a good drainage system. In these two areas, some existing roadside drains have to be enlarged, slopes improved and sewers to be laid.

The main components of the Crash Programme for sewerage and stormwater drainage are:

- Construction of manholes at regular distances on the trunk nalahs and upgrading of existing manholes to facilitate maintenance.
- Repair and/or upgrading of nalahs.
- Procurement of cleaning and safety equipment for manual and mechancial sewer cleaning, including equipment for transport and disposal of extracted silt.
- Cleaning of nalahs.

Expenditure sanction was granted in March 1988. Due to various reasons work started in September 1988.

9.2.3 OPTIONS FOR SEWERAGE AND STORMWATER DRAINAGE

A number of options for the sewerage and stormwater drainage system in the core area can be considered. A flow diagram of all the options is presented in Figure 9.1.

The core area comprises densely populated areas with sectorwise densities from 300 to 650 persons per hectare. In general all five mentioned options can be considered for implementation. Implementation of a separate system in comparison to a combined system has several difficulties in Mirzapur, as pointed out below :

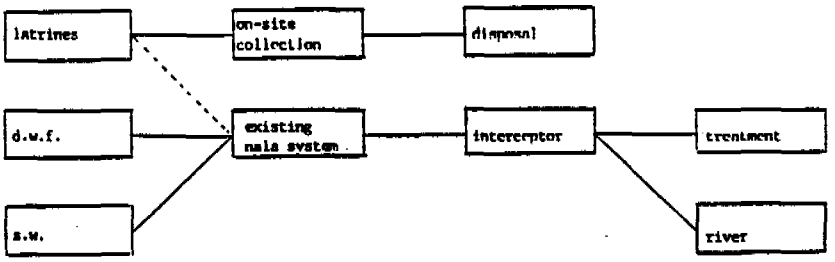
- The already existing set-up in Mirzapur is a combined system. To separate the system i.e. the DWF from SWF will practically be very difficult. This would mean larger road gullies and many small overflow structures at each junction so that DWF can get into sanitary sewers and SWF can overflow into stormwater sewers.This turns out to be an impracticable and prohibitive solution for Mirzapur.
- Crossings of sanitary sewers and stormwater drains lead to difficult situations. The sanitary sewers have to be laid very deep or syphons have to be made.
- In case of a separate system, because of financial constraints , a fine meshed sewerage system can not be provided. Only a wide meshed system is feasible. This means that only few houses will be connected to sanitary sewer. Thus quite a lot of DWF will still flow to the river.
- As separate system also means that apart from a situation like the 0-option, sewers have to be provided on both sides of the roads. Everywhere arrangement for separating DWF & SWF will have to be made and also connections to sanitary and stormwater sewers will have to be made.

For these reasons a separate system in the core area can only be recommended if it provides sufficient financial advantages in comparison to a combined system. In that case only option 4 should be considered. As a major aim of the project is to improve the sanitary conditions in town and thereby the living conditions of the people, option 0 is not preferred. In this option, wastewater will be intercepted and treated, but besides some improvements on the existing drainage, there will be no change in the conditions in town.

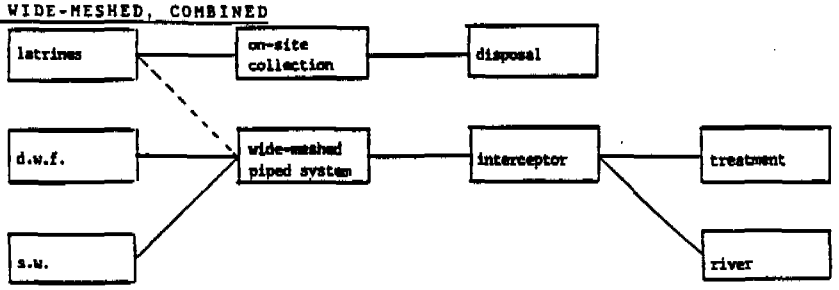
Although the options 1 and 3 provide only a wide-meshed sewer system, these options provide a basic change and improvement of the existing system. Besides this, the wide-meshed system will be designed to form the backdone of a complete future sewer system, which can be realized in phases by connecting sewers to the wide-meshed system.

FIGURE 9.1

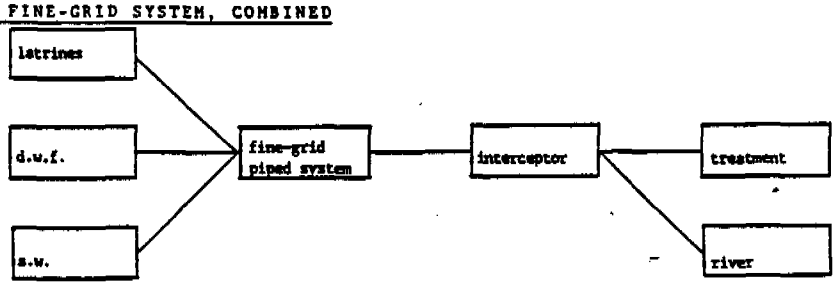
0. UPGRADED EXISTING SITUATION



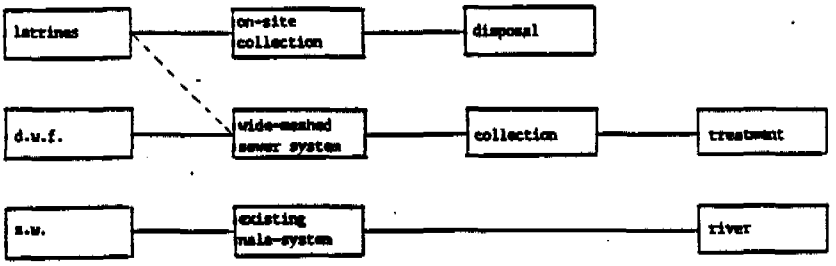
1. WIDE-MESHED, COMBINED



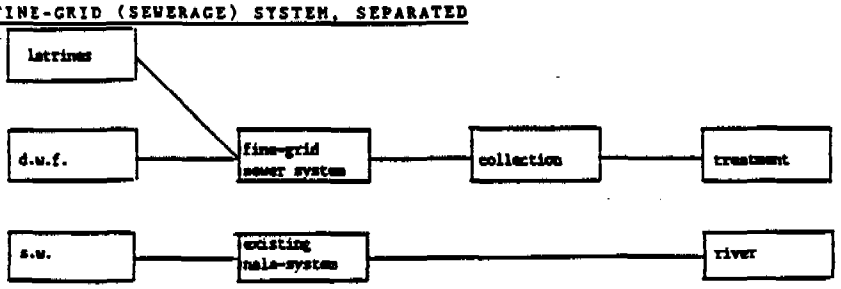
2. FINE-GRID SYSTEM, COMBINED



3. WIDE-MESHED, SEPARATED



4. FINE-GRID (SEWERAGE) SYSTEM, SEPARATED



An approximate cost comparison between the above mentioned options for the core area gives the following picture (net costs, in lakhs of rupees) :

Option 0	Option 1	Option 2	Option 3	Option 4	
382	636	882	559	833	Feb'88

For the whole area of Mirzapur these costs have to be increased by approx. 40 %. Costs include sewerage, stormwater drainage and low - cost sanitation.

Thus it appeared that the costs of a separate and a combined system are almost equal. Therefore, because of the technical reasons as mentioned above and because of the limited budget, a combined wide-meshed system has been selected.

The wide meshed system will make maintenance a lot easier as compared to the existing system. The distance over which the wastewater will flow through the open road drains will be reduced considerably which will result in improvement of the hygienic conditions. Furthermore, only sullage water will be discharged in the road drains.

For the civil lines, east, and west zone the most feasible solution will also be a combined sewerage and stormwater drainage system, in combination with on-site sanitation. This analysis is based on the same technical and economical considerations as have been used for the core area. However, the advantage of a phased construction is even more important in this case.

In the present situation, except for some areas close to the core area, there is no piped drinking water supply system yet in these zones. The development of these areas will be phased over a longer period of time. A development starting with on-site sanitation and discharge of the sullage water through road drains seems to be the most logical and economical solution.

The design of the entire scheme has been made based on adopted options. A master plan has been developed which gives the long term overall view for the sewerage and stormwater drainage system in Mirzapur. The elements of this system which are most needed at present or in the near future have been worked out in detail and are planned to be executed under this project. The major elements of the works to be executed are shown in Figure 9.2.

The plan has been divided into three parts, viz. the interceptor sewer and pumping stations, the wide-meshed system in the core area and the expansion of the drainage system in the non core-area. A brief description of these three parts is given here under.

9.2.4 INTERCEPTOR SEWER AND PUMPING STATIONS

An interceptor sewer is to be constructed to collect the waste water from the existing trunk nalahs and convey it to the treatment plant. The invert levels of Oliarghat nalah and especially of Khandwa nalah, two major trunk nalahs, are relatively deep. Therefore, it is not possible to convey the waste water to the treatment plant only by gravity. In such a case the westward interceptor sewer would have invert levels of around 10 m below ground level in the down stream end. Construction of a big sewer at such depths in the narrow streets of Mirzapur is not considered feasible.

Therefore, making use of natural topography, two intercepting gravity sewers will be constructed starting from a point near Trimohani. One intercepting gravity sewer will flow towards the IPS (westward) and the other towards MPS (eastward).

The IPS will pump the wastewater through a rising main to a point near Trimohani crossing, from where the waste water flows by gravity to the main pumping station (MPS). The westward gravity interceptor will tap the waste water from Kodghat and Khandwa nalah whereas the eastward gravtiy interceptor will tap the waste water of Badlighat and Oliarghat nalah. At the Main Pumping Station (MPS) the waste water of the civil lines zones is collected also. From the MPS all the waste water will be pumped through a rising main to the treatment plant.

9.2.5 WIDE-MESH SEWER AND STORM WATER DRAINAGE SYSTEM

The wide-mesh system comprises laying of sewers along with appurtenant structure and of rehabilitation and construction of road side drains. The sewers will be fed by sullage and storm water through the roadside drains and will also be connected to households for conveyance of night soil. The system is being designed in such a way that the waste water travels a limited distance (about 200 m. max.) in the road drains before entering the sewers.

The following considerations have been taken into account in designing the alignments of the sewers:

- more or less equal distances between the sewers to reduce the average distance of the point of discharge to the sewers.
- connection to a trunk nalah or interceptor sewer
- sufficient space in the road for laying and maintaining the sewer
- population densities
- adoption of the present catchment areas of the trunk nalahs to utilize their total capacity for the discharge of storm water to the extent possible

- ground levels and slopes
- existing smaller nalahs
- improvement of conditions in most affected areas
- future expansions of the system

In areas along the river bank the waste water is generally intercepted as much as possible. It is not feasible to collect the waste water of each and every pocket, which at present is discharging directly to the river. Mainly because of the topography of the area and / or the narrow streets.

9.2.6 EXPANSION OF DRAINAGE SYSTEM IN NON-CORE AREA

This part of the programme consists of construction of sewers and appurtenances, rehabilitation of road drains etc., like for the wide-meshed system in the core area, and apart from that the construction of a main storm water drain with structures in the east zone.

Most of the sewers have been planned in the Civil Lines zone where population densities are already high and where many public facilities are located. In Civil Lines, east of Badshahi nalah, no sewers have been proposed for the time being. Sewers either would have to pass underneath the enlarged stormwater drain, or should be connected to a separate pumping station. The latter option was preferred as it is neither desirable to lay deep sewers to MPS nor to lower the MPS itself.

In the part of Civil Lines where sewers have been proposed, the storm water flow capacity of the existing drainage system has been used wherever feasible in order to minimize the diameters of the sewers. The storm water overflows to nearby ponds which will be connected to the main storm water drain.

The alignment of the existing Badshahi nalah has been used for the proposed main storm water drain in the east zone. The existing drain will be extended to the new Awas Vikas Colony. In a later stage the drain can be extended further and some branches can also be added when the area gradually develops. The drain has been designed for the ultimate calculated peak flow (12 m^3/s). Although present peak flow will be much less, it has been proposed to construct the drain already for its design flow.

Six culverts have to be constructed in the drain, which otherwise will be an unlined open drain. At the outfall near the Ganga River bottom protection works will be required to prevent erosion.

9.2.7 COSTS

In May 1988 rough estimates of all 3 parts of the sewerage and storm water drainage scheme were prepared, mainly for grant of administrative approval by GPD. Because of budgetary constraints, the approved budgets as given in the GPD's administrative approval were lower than the estimated costs.

During the past few months, Detailed Project Reports have been prepared by UPJN, based on the final designs provided by consultants.

An overview of the figures is given below :

SCHEME	CONSULTANTS PROPOSAL MAY'88 (1) Rs./LAKHS	GPD's ADMINISTRATIVE APPROVAL JUNE/JULY'88 (2) Rs./LAKHS	UPJN's DPR ESTIAMTE MAY'89 Rs./LAKHS	GPD's EXPENDITURE SANCTION Rs./LAKHS
1) Crash programme sewerage & storm water	42.10	-	42.10	30.24
2) Interceptor Sewer and pumping stations	204.43	180	Not yet available	Not yet available
3) Wide-meshed system in core area	224.92	152	Not yet available	Not yet available
4) Expansion of drainage system in non-core	79.2 + 50.26	86	Not yet available	Not yet available
TOTAL	558.61	418		

(1) This is excluding work charge, contingencies and project preparation fee.
(2) Inclusive of work charge, contingencies and project preparation fee.

9.2.8 EXPERIENCES

Though the detailed cost estimates are not yet available there are already indications that the budgetary ceiling of Rs. 9 crores for Mirzapur will be exceeded by these plans. It is therefore not unlikely that the plan can be implemented entirely and that priorities as well as cuts may eventually be required.

9.3 WATER SUPPLY, MIRZAPUR

9.3.1 EXISTING SITUATION

Mirzapur has grown from a core area which is strongly characterized by high density, with narrow and congested streets. Conditions which increase the problems of supplying and maintaining public services.

The town's water supply has been developed from a system built in 1914 comprising an impounding reservoir, gravity pipeline, treatment works and distribution system, which still provides 40% of the town's water. The system has subsequently been supplemented by 13 tubewells which pump directly into four overhead tanks, from which water is fed into the distribution system.

The coverage of the population by the system is summarized below:

Population	134,000 (1987)
Population served by piped water:	
- Houseconnections	57%
- Public taps	23%
Number of public taps	323
Number of public handpumps	188 *
Number of public wells	289**

* 120 of which have been recently constructed, financed by the Drought Relief Fund.

** Many of the handdug wells dry up during summers and are polluted.

The losses from the system were found to be excessive, and in the order of 70% of the water produced. Without such a high level of losses, the capacity of the source works, and much of the remaining system would be sufficient to meet the existing and immediate future demands.

The situation of the water supply system in the town however, is very poor, with intermittent supplies and very low pressures.

Conditions are exacerbated by the high peak factors caused by the intermittent supplies, and the widespread use of "tullu" pumps which suck water out of the distribution system during non supply hours, and which effectively empties and depressurizes the system.

The chemical analysis of water samples from six of the tubewells located in the core area of the town, indicated levels of Nitrate that suggest pollution of the ground water in these areas.

The poor sanitary conditions, and the low levels of awareness of the importance of personal hygiene in the area, are described in section 6.3. The situation, is made worse by the intermittent water supplies, the leaky condition of the pipework, and the use of 'tullu' pumps. This results in an environment where pollution of the distribution system and the resultant incidence of water related infections, is practically inevitable. The very high levels of diarrhoeal diseases within the area is indicative of this situation, and bacteriological analysis of the water has proved this to be so.

A further factor, which is the result of the intermittent supplies to the consumers, is that this forces people to keep relatively large quantities of water stored in their houses, to use during none supply hours. A survey of households in the area indicated that this stored water was very vulnerable to pollution and exhibited a much higher degree of bacteriological contamination than the water obtained directly from the mains.

9.3.2 CRASH PROGRAMME (PHASE I)

The work involved in the crash programme has been financed by funds from UP State Government and the Drought Relief Funds, which has resulted in this project having little, or no powers to influence the methods used and the standard of workmanship.

The crash programme works include:

- Installation of 140 handpumps
- Rehabilitation of 170 public standposts
- Division of the distribution system into 4 isolated zones
- Regeneration of 12 tubewells
- Replacement of tubewells pumps
- Installation of chlorinators and renovation of chlorinator rooms
- Construction of 1 Overhead Tank
- Connection of 4 tubewells to 2 overhead tanks.

Regeneration of the tubewells has been completed, and it appears that an increase in overall production capacity of the 12 tubewells from 14 mld to 23 mld has been achieved.

Problems arose over the acquisition of the land for the overhead tank, resulting in delays of commencement of its construction. A new site has been identified. The construction of the tank will start after the monsoon period.

9.3.3 LEAK DETECTION

To obtain an indication of the condition of the existing water mains in the area, leak detection surveys were carried out in two areas of Mirzapur. The areas were chosen partly due to their proximity to overhead tanks, thus ensuring a reasonably reliable supply of water, and partly due to the fact that between them they provide a good representation of the conditions in Mirzapur, including the types of distribution pipework employed in the distribution system.

The surveys commenced with the installation and replacement of a number of isolating valves, stopcocks and water meters. The leak detection exercise was conducted in a series of pressure tests, and the results, as summarized below, have been used to provide a basis for extrapolating the inputs required for the whole of Mirzapur.

Findings:

- Unaccounted for water amounted to approximately 70% of the water produced.
- There was a complete lack of control over private connections in the use of materials, workmanship and the use of "tullu" pumps.
- The quality of materials and workmanship employed for making houseconnections was very poor, and was one of the major causes of the leakages found.
- The quality of the repairs made by the Nagar Palika was also poor and will not withstand an increased supply pressure.
- The pressure rating of the UPVC pipes used of 25 m was insufficient for the conditions. The numbers and location of isolating valves were inadequate.
- Many of the connections were not supplied with water meters.
- Per capita consumption for unmetered connections-75lpcd
- Per capita consumption for metered connections-44lpcd.

Conclusions

- The level of losses and wastage in the area is excessive, and completely unacceptable. It appears to result primarily from the fact that the Nagar Palika has lost control over the system and lacks the resources, and legal and political backing that it will now require to rectify the situation.
- The practice of allowing householders to construct their own private connections has lead to excessive losses due to poor workmanship, and the widespread use of "tullu" pumps exacerbates the situation. Unless regular inspections and strict preventive measures are enforced, the situation will deteriorate further, and a complete breakdown of parts of the system cannot be ruled out.

- Without a comprehensive rehabilitation of the whole system, the losses due to leakages must be expected to increase corresponding to the proposed increase in pressure to the system.
- The records of existing pipelines and the registration of connections were totally inadequate.

Recommendations

- The Nagar Palika needs to reestablish control over the system. This can only be done simultaneously strengthening its authority and by increasing water pressures.
- The interference by the population with the Municipality's water distribution pipe network, and their use of "tullu" pumps needs to be banned, and prosecutions enforced.
- To be effective however, this will need the cooperation of the public, and this can only be achieved if it is possible for the Municipality to provide a reliable service to the consumers.
- It is the Project's opinion, that a leak detection, registration, metering and rehabilitation programme for the entire area is the most important element of any improvement programme and that the commencement of such a programme, should be given urgent priority.
- Simultaneously, but less urgently, it is recommended to construct any additional pipelines and storage requirements that will be required to provide the required pressures, assuming that the leakages and wastage can be reduced to reasonable proportions.
- Legislation already exists that establishes the Municipality's ownership of private connections from the main distribution pipeline up to the water meter. This must be strictly enforced in the rehabilitated areas.
- Legislation against the use of "tullu" pumps should be sought.
- Any householder found with an unauthorized connection to be penalized.
- The Municipality must be provided with sufficient trained staff, tools, infrastructure and spare parts to enslave them to operate, maintain, prepare records, to collect revenues due, and to take disciplinary action, such as disconnection of services, where necessary.

9.3.4 AUGMENTATION AND IMPROVEMENT PROGRAMME

The major part of the proposed works for Mirzapur are rehabilitation, installation of water meters, and registration of connection. Which, to be effective, have to go hand in hand with improvements of the administration, operation, maintenance and revenue collection activities of the Municipality. For the exercise to be effective, a high degree of cooperation will be required, together with intensive liaison with the consumers.

The improvement of the water supply system for Mirzapur, is thus seen as being of primary importance in order to raise the quality of life in the area, and the following programme has been suggested. Many of the items listed, especially those which cannot be included in the present project, but have been identified as actions necessary, if a sustainable improvement of the conditions within the project area are to be achieved.

Construction Works

- Phase 2
  - conduct a planned leak detection programme over the entire area
  - Install water meters to all connections
  - Replace or rehabilitate private connections
  - Augmentation and extension of the distribution system
  - Rehabilitation of the existing distribution system
  - Augmentation of the source

- Phase 3
  - Further augmentation of the storage and distribution capacity of the system, to meet the projected future requirements of the area for the year 2010.

Administration and Management

- Establish optimum staffing levels and infrastructure for the effective management, operation, maintenance and revenue collection.

- Prepare training programmes as necessary.

- Establish legal framework to enable the municipality to operate effectively:
  - Responsibility for, and ownership of individual connections
  - Establish realistic tariff levels with a view to eventual self sufficiency
  - The introduction of penalties against the use of "tullu" pumps and illegal connections.

- Initiate a health education programme.

The technical solutions to rectify the situation are relatively easily identified. Their implementation however, due to the congested nature of much of the area and the lack of reliable records, will be more difficult.

Even more challenging, will be the organizational and administrative measures that will also be needed to ensure that the system will operate as desired. This will require a high degree of commitment and dedication from the management of the Nagar Palika.

The proposed facilities are shown in Figure 9.3.

9.3.5 COSTS

A summary of the cost estimates for the proposed works is given below in Table 9.3.1.

Table 9.3.1: Cost Estimate Summary

DESCRIPTION	CRASH PROGRAMME	PHASE 2	PHASE 3	TOTAL
Crash programme	47.78			47.7
Equipment & training		15.30		15.3
Rehabilitation		82.33		82.33
Reinstatement		14.58		14.58
Overhead tanks		21.50	12.15	33.65
New pipelines		32.49		32.49
TOTAL	47.78	166.20	12.15	226.13
TOTAL FOR PHASES 1 & 2				213.98
ADD 1% Work charge				2.14
3% Contingencies				6.42
4% Preparation Fees				8.56
TOTAL FOR PHASES 1 & 2				321.10

9.3.6 EXPERIENCES

The level of losses from the system has been shown to be extremely high, and therefore greater importance should be placed on remedial works than was previously the case.

Good community relations will be required during the rehabilitation works. The planning of the works and the consequences to the consumers, (better service, but with strict control and revenue collection), should be discussed with those affected, prior to the implementation of each rehabilitation section.

Major issues to be addressed include:

- The clear definition of the areas and extent of the responsibilities and powers of the various organizations involved (The Ganga Project Directorate, the Project Staff, the Jal Nigam and the Nagar Palika) in the implementation of the project, the lines of communications and required procedures.
- The enforcement of the existing legislation defining the ownership of individual connections, to ensure that the Nagar Palika retains the responsibility for the installation, repair and maintenance of the connection upto and including the water meter located adjacent to the consumers property boundary.

- Streamlining the procedures, and passing the necessary legislation for the Nagar Palika to be able to introduce tariff structures that will lead to eventual self financing of the system, and for the banning of the use of "tullu" pumps.
- Improving and maintaining good public relations with the consumers.
- Establishing an efficient management unit that will be capable of operating, maintaining and repairing the system, to be responsible for the meter reading, billing and revenue collection activities required, and for planning and construction of any necessary extensions and improvements to the system.
- Systematic registration, recording and plotting of all consumer connections, together with the disconnection and penalization of any illegal connections found.

For the project to be a success, a much higher degree of workmanship and supervision must be achieved than during the crash programme.

It is evident that it will not be possible to effect all of the measures suggested, in the relatively short duration of the project. It will therefore be necessary for the management of the system, to actively continue to pursue the main objectives of the programme, i.e.

- To supply water to consumers in adequate quantities and pressure, 24 hours a day.
- To ensure that the quality of water is safeguarded against pollution.
- To extend the distribution system to cover all people living in the area.
- To achieve financial self sufficiency.

9.4 LOW COST SANITATION, MIRZAPUR

9.4.1 EXISTING SITUATION

Like in Jajmau, Sulabh International, carried out a survey in 14 sample areas in Mirzapur covering 1,745 households out of a total of 18,079 households. The results of this survey are tabulated in Table 9.4.1.

Table 9.4.1: Status of Sanitation in Mirzapur, Based on a Survey of 1745 Households

CATEGORY 1/	EXISTING HH	SEPTIC TANK		DRY BUKECT LATRINE	NO. LATRINE 3/	HH SAMPLE AREAS
		SOAK PIT	TO DRAIN 2/			
I	8780	5	162	322	287	776
II	2231	6	53	37	52	148
III	1726	4	76	175	289	544
IV	1902	2	19	53	88	162
V	3440	-	8	2	105	115
	18079	17	318	589	821	1745

1/ Mirzapur has been divided into five categories in terms of different income groups and urban development.

Category I i.e. Developed areas in the core part of the city

Category II i.e. Developed areas in the fringe part of the city

Category III i.e. Slums/Low income areas in the core part of the city

Category IV i.e. Slums/Low income areas in the fringe parts of the city

Category V i.e. Village type setting.

The physical boundaries of the categories are shown in Figure ....

2/ To "drain" means connection from septic tank to open drain

3/ "No latrine" means that this group resort to open field defecation, generally road side drains.

The house-to-house survey in the 14 sample areas revealed that approximately 19% have access to water flush latrines connected to septic tanks, (of which approx. 5% discharge effluent to soak pits and 95% directly to open road side

drain). Approximately 34% have dry/bucket latrines and the balance 47% have no latrines in their houses and resort to open defeacation generally using the road side drain or go to public latrines.

Out of 589 households having dry/bucket latrines in the sample area, only 44 households have no space for construction of leach pits either within premises or outside on the footpaths, so conversion of dry/bucket latrines into pour flush water seal latrines shall be feasible in 545 households.

Out of 821 households having no latrines in the sample areas, 138 households do not have space for construction of latrine/leach pits within or outside the premises. So construction of new pour flush water seal latrines is feasible only in 683 households.

9.4.2 PROPOSED FACILITIES

The choice of a wide-meshed sewerage system integrated with the existing nalah system for Mirzapur implies a large scale implementation of on-site sanitation, except in those streets where nalahs, covered drains are existing, and where in a later stage sewers will be laid.

With regard to the procedure for construction of household latrines, public toilet complexes as well as their financing patterns, reference can be made to Chapter 8.5.

The LCS programme consists of construction of private latrines and community toilet complexes. Under the private latrine programme, conversion of unhygienic dry bucket latrines into pour flush latrines will be taken up as well as installation of pour flush latrines in households which so far do not have a private latrine. The private latrine will be mainly of the on-site type, i.e. connected to a leach pit. Only there where it is hygienically possible the private latrine will be connected directly to a covered nalah or a sewer (off-site disposal). The total number of conversions and new latrines is given in **Table 9.4.2.** The proposed facilities under the crash programme are shown in **Figure 9.4** along with the samples areas.

As revealed by the inventory from Sulabh most of the existing flush latrines with septic tanks are directly connected to a drain, i.e. often an open drain. As the discharge/overflow from septic tanks still contains pathogenes, it goes without words that this practice is highly health hazardous. It is therefore proposed to connect these flush latrines to soak pits and/or covered drains/sewers. For budgetary purposes only connections to soak pits have been taken into account.

For those people who do not have sufficient space in either their premises or under the footpaths to build a pour flush latrine with leach pits, 5 community toilet complexes with 20 seats each, and 10 community toilet complexes with 10 seats each are planned. The complexes are divided into male and female sections with an equal share of seats. The female section also has seats for children.

The planned LCS programme for Mirzapur in terms of households per type of provisions is given in Table 9.4.2.

Table 9.4.2: LCS Programme for Mirzapur

CATEGORY	EXISTING HH	ON-SITE				SOAK PITS	OFF-SITE		PUBLIC LATRINE
		CONVERSION		NEW			CONVERSION	NEW	
		INSIDE	OUTSIDE1/	INSIDE	OUTSIDE				
I	8780	1759	401	882	451	1849	1107	975	1356
II	2231	519	32	565	141	883	-	-	141
III	1726	291	87	434	118	242	164	272	118
IV	1902	512	119	678	285	225	-	-	83
V	3440	2	-	2817	56	252	-	-	313
	18079	3083	639	5376	1051	3401	1271	1247	2011

1/ "Inside" means space available for construction of leach pits inside the house/premises. "Outside" means that there is space available under the footpath outside the houses.

Based on the inventory by Sulabh International it is estimated that roughly 50% of the population are either directly or indirectly discharging their night soil and sullage into the present nalah drainage system.

This percentage will change because of the above mentioned LCS programme. Much will depend on the success of convincing house owners with a flush lartrine to install soak pits or where possible to provide a connection to covered a drain/sewer. If all flush latrines are provided with soak pits, then about 20% of the population will be directly discharging their night soil into the sewerage system.

In such case that no flush latrines will be provided with soak pits, but all connected to covered drains, then about 40% of the population will be discharging night soil and sullage directly into the system. It is assumed that with a good promotion campaign the soak pit programme can be largely implemented and that approximately three-fourth of the population will have on-site facilities, while one-fourth will have off-site facilities.

9.4.3 COSTS

The GPD granted an administrative approval of about Rs. 2.24 crores of the entire scheme in July 1988. It is planned to execute LCS programme in stages. Expenditure sanction for the first batch consisting of 2 community toilets and 400 private latrine conversion as well as new constructions was given in October 1988. Construction of new private latrines and conversion of dry bucket latrines started in March 1988. However, the construction of the community complexes has not started yet, because of difficulties with payment of supervision charges to Sulabh International. Based on the experience with the execution of the present LCS schemes, next programme will be identified.

9.4.4 EXPERIENCES

In general it appears that due to the financing pattern applicable for LCS schemes in UP, people do not have a major financial constraint in opting for the LCS facilities. The major limitation for people not to opt for conversions and/or construction of new private latrine are lack of space for leach pits in their houses or because of their status as tenants. The response to the LCS conversion programme is rather promising.

9.5 SOLID WASTE MANAGEMENT MIRZAPUR

9.5.1 EXISTING SITUATION

The solid waste management scheme is being implemented in Mirzapur by the Mirzapur Nagar Palika. The operation and maintenance of the solid waste collection and disposal system will be the responsibility of the Mirzapur Nagar Palika.

The city characteristics determine to a certain extent the feasibility of options for waste collection. The relevant city characteristics of Mirzapur which will be used in this report for designing the solid waste collection system are:

- a total area of about 1800 ha from which 1200 ha is built up area and is designated as project area for solid waste collection and disposal;
- a population of about 140.000 inhabitants (1991);
- an average population density of about 120 persons/ha in the project area;
- very high population density and built-up density in core area;
- poorly developed urban road network;
- poor accessibility for motorized vehicles in core area;
- high traffic densities at arterial roads and in core area;
- in general a low income area;
- poorly developed tax recovery system.

The Department of Sanitation and Public Health within the Mirzapur Nagar Palika is responsible for collection and disposal of solid waste and night soil as well as cleaning of nalahs. The department is headed by the Chief Health Officer assisted by a Health Officer and a Chief Sanitary Inspector. In addition there are sanitary Inspectors, Safai Nayaks, drivers and sweepers.

The existing system of collection and disposal is given in Figure 9.5.

Based on the survey carried out, the following inferences can be drawn:

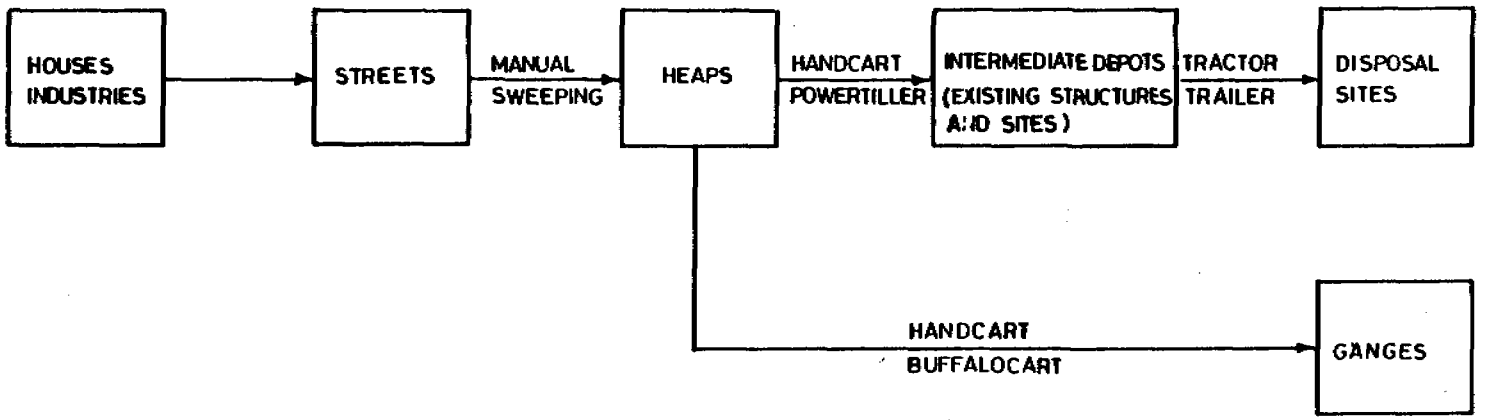
- out of about 134.000 inhabitants, about 82.000 are served with daily solid waste collection (61%);
- the area in which solid waste is daily collected covers about 300 ha, while the total populated area covers about 1200 ha;
- in the area 225 sweepers are deployed, equipped with 120 handcarts. 105 sweepers are working in actual sweeping, and the other 120 are collecting waste in handcarts;
- the amount of waste to be collected and the area to be covered per sweeper varies over the different wards.

- The side lanes and especially poor developed pockets in the core area are not cleaned daily. Solid waste in these areas is usually brought to open spaces. In other parts of the city no facilities or manpower input are regularly available, although some streets are swept in second shifts.

The total budget for Mirzapur Nagar Palika for 1987-88 was Rs.1.73.53.000 from which Rs 58.55.000 (34%) is to be spent on Sanitation and Public Health.

The directly linked revenue resource is through house tax charged at 10% of the Annual Rental Value (ARV) of premises and tax on buildings and lands. Premises with ARV of Rs.90/- and below are not taxed. The ARV revisions have not taken place since a long time and so the revenue generated is quite low, about 15 % of the expenses.

In Mirzapur, the waste collection and street sweeping is executed in a combined operation on a daily basis (except Sundays). In the side streets the waste is collected by the sweepers in small handcarts and brought to a bullock cart or tractor trailer which is progressing simultaneously in the main street. Waste is also collected in power tillers from the streets and taken either to the intermediate rubbish depots or directly to the dumping site.



CLIENT: Ganga Project Directorate

JOB: Solid Waste Management

DRAWING: Present system of domestic and industrial solid waste collection and disposal

FIGURE 9.5

SCALE	
DRWN BY	Shukla
CHKD BY	
DATE	29.12.88

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In general the solid waste collection and disposal can be described as a two stage process. In the first stage (the primary collection), solid waste from streets and nalahs is collected and transported to intermediate rubbish depots. During the second stage (the secondary collection), the wastes are transferred from the intermediate rubbish depots to the disposal site.

Waste Generation Estimates and Forecasts

POPULATION	1987	1991	1995	2001
	134,000	140.000	150.000	162.300
Domestic*	67	70	75	81
Drain	5	5	5	5
Commercial	10	10	11	12
Subtotal	82	85	91	99
Industrial waste **	6	10	10	10
Hospital waste	0.5	0.5	0.5	0.5
Animal corpse	5	5	5	5
Slaughterhouse waste	1.5	1.5	1.5	1.5
Demolition debris	3	3	4	5
TOTAL IN TONNES/DAY	98	105	112	121

* The estimation of the quantity of the domestic solid waste is based on a waste generation of 0.5kg per person per day.

** The future quantity of industrial waste will depend mostly on the future activities of recovering metals from slags.

At present 5 places are used as disposal sites for solid waste. The Mirzapur Nagar Palika does not posses its own disposal site. At the three sites on the bank of the river Ganga the waste is simply tipped over the bank directly or indirectly in the river causing pollution of the river and the bank and creating danger for people who pick plastics, tins and cans.

Waste is usually disposed indiscriminately by the inhabitants, thus leaving the responsibility of removal to the municipality and the stray animals. The discussions at community level revealed that the inhabitants will hopefully dispose their waste at road side bins placed in the streets. The inhabitants did show awareness about certain health risks involved in the improper handling of solid wastes.

9.5.2 PROPOSED COLLECTION AND DISPOSAL SYSTEM

The proposed solid waste collection and disposal scheme has been designed in such a manner that this scheme does not degenerate into merely a procurement scheme but especially contributes to systems management improvement. It is also intended that the domestic solid waste collection and disposal system is environmentally and socially acceptable and economically feasible. The proposed collection and disposal system for solid waste is given in Figure 9.6 and the proposed facilities with zonal boundary are shown in Figure 9.7. For further details reference can be made to "Design Report Solid Waste Management, Mirzapur, December 1988".

First Phase Implementation

The proposed system contains five basic elements; storage at the source, primary collection, transfer, secondary collection and disposal. Emphasis is laid on storage of waste in bins in the house or at the premises. The population is expected to bring the waste to roadside bins. Cleaning of streets is performed separately from collection of domestic waste. Handcarts carrying bins are recommended for the collection of street waste.

The waste from the roadside bins is to be collected by power tillers or handcarts where powertillers cannot ply. The bins are emptied in trailers which are distributed over the city. The trailers are taken by tractors daily. The waste is recommended to be disposed off at a sanitary landfill. The present sites will be upgraded and a new disposal site is being recommended.

The silt from roadside drains is to be collected immediately after cleaning.

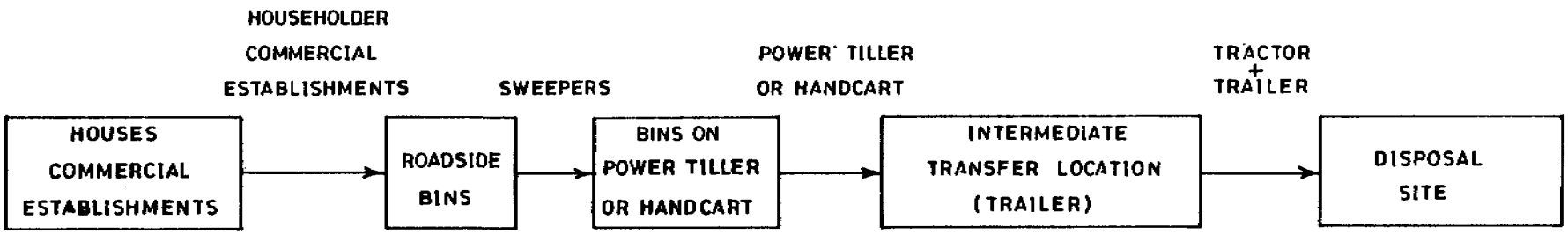
The bullock carts will be gradually phased out.

Hospital waste will be collected in plastic bags and handcarts. The waste will be incinerated within the hospital.

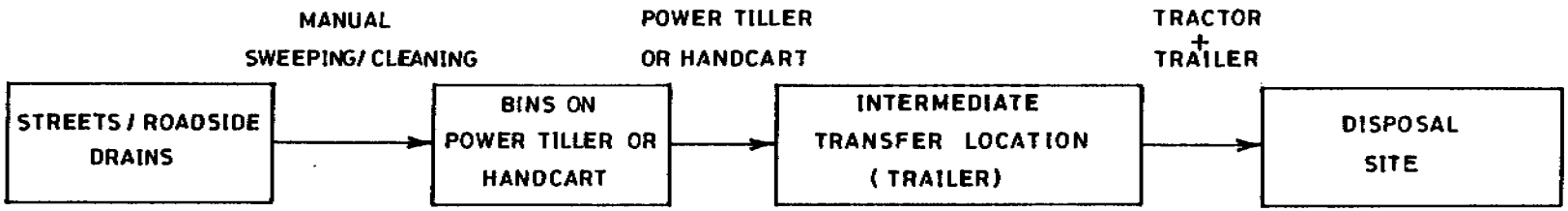
Slaughterhouse waste will be collected in plastic bins carried by powertillers. The waste will be disposed off at the sanitary landfill.

Metal industry waste will be analyzed on heavy metals before final recommendations can be given.

A front end loader will collect demolition debris and perform duties at the sanitary landfill site.



PROPOSED SYSTEM FOR DOMESTIC AND COMMERCIAL SOLID WASTE COLLECTION AND DISPOSAL



PROPOSED SYSTEM FOR ROAD SWEEPING AND ROADSIDE DRAIN CLEANING

CLIENT: GANGA PROJECT DIRECTORATE	FIGURE 9.6		
JOB: SOLID WASTE MANAGEMENT.	SCALE		
DRAWING: PROPOSED SYSTEM FOR SOLID WASTE COLLECTION & DISPOSAL IN MIRZAPUR.	DRWN BY		
	CHKD BY		
	DATE	25-1-89	

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A tractor + loader and containers have been proposed for the collection of sewer cleanings under the sewerage crash programme. The sewer cleaning will be a temporary activity to be executed during the first phase of the project. After the first phase the tractor + loader and containers will be used for the regular solid waste collection system. A dozer blade will be included which can be attached to the tractor. The tractor + dozer, the so called front end dozer, will be used for levelling of waste at the sanitary landfill.

Demonstration Areas

It is proposed to set up three demonstration areas for the implementation of the solid waste management scheme in the first phase for the following reasons:

- to enable the implementing agency to adapt itself to the new and changed solid waste management system on a smaller operational level before introducing the scheme to the remaining project areas.
- to monitor the deployment of sweeper groups and their adaptability in the use and handling of new equipment.
- to monitor the response of the inhabitants.
- to assess the staffing requirements for nalah cleaning work.
- to monitor the organization of transport by handcarts/power tiller for primary collection and recommend the best alternative.

The following areas have been proposed as demonstration areas:

1. Amanganj-Gaibi Ghat,
2. Rambagh and slaughterhouse area,
3. Wellesley Ganj Marg.

The proposed equipment and facilities for first phase implementation are given in Table 9.5.1.

Organization of Demonstration Areas

It is recommended to form a Project Management Group (PMG) which will follow the day to day operations in the demonstration areas. This PMG will consist of a representative from the solid waste collection department of MNP as chairman, a representative of the Health Department of MNP, and two representatives of the project. The members of the PMG will regularly pay field visits to the demonstration areas and meet at least once a week to discuss the findings of the preceding week and plan the operations for the coming week. The PMG will be responsible for monitoring the demonstration area operations and assess the feasibility of expansion of the system in the other project areas.

TABLE 9.5.1

SUMMARY OF COST ESTIMATES FOR PROPOSED FIRST PHASE EQUIPMENT AND FACILITIES FOR SOLID WASTE COLLECTION AND DISPOSAL SCHEME IN MIRZAPUR

No.	Subject	Item	Quantity
1.	Primary Collection	Powertillers	3
		Bins for powertiller	30
		Handcarts	5
		Bins for handcarts	10
		Shovels	11
		Brooms	13
		Protective Clothes	51
		Roadside bins	75
2.	Roadside drain cleaning	Handcarts	15
		Bins for handcarts	30
		Shovels	15
		Brooms	30
		Protective Clothes	81
3.	Secondary Collection	Tractors	4
		Trailers	20
		Protective Clothes	33
4.	Disposal	Dozer blade	1
		Rakes	4
		Office facilities	1
		Protective Clothes	14
		Topographical study	job
5.	Maintenance	Zonal office cum parking	1
		Zonal office	3
		Tools office	1 sets
		Protective Clothes	12
6.	Industrial Waste	Analysis of slags	-
7.	Hospital Waste	Incinerator	1
		Handcarts	2
		Bins for handcarts	4
		Shovels	2
		Brooms	2
		Protective Clothes	10
8.	Slaughterhouse Waste	Handcart	2
		Plastic bucket	60
		Shovels	2
		Brooms	2
		Protective Clothes	10
9.	Animal Corpses	Truck	1
		Canvas slinges	2
		Protective Clothes	4
10.	Construction and demolition debris	Frontend loader	1
		Protective Clothes	2
11.	Cleaning of project areas	-	job

Preparation

The following preparatory steps are to be taken:

- the PMG will be formed and the organizational set-up must be agreed upon,
- the equipment will be procured and acceptance testing will be done by the consultants and MNP staff,
- the setup will be explained to the sweepers and the population (training and monitoring campaigns),
- health education programme will start,
- for a good start it is strongly recommended to clean the entire area. This will encourage the sweepers and will show the inhabitants the benefits of the approach.

Monitoring

During the execution of the programme in the demonstration areas the following will be closely monitored by the PMG:

- the organization and deployment of the groups of sweepers. Is the number of 2 sweepers per group adequate? How many households do they serve per day? How many trips does each handcart make per day?
- the response of the sweepers on the organization in groups, the equipment, the travel distance to the trailer,
- the response of the population concerning waste collection, health promotion, and their attitude towards domestic solid waste.

The monitoring data will be carefully recorded in a specified format for further analysis. After monitoring and evaluation the setup of the primary collection and the design of the facilities can be modified, if necessary, and the final phase of the project can start.

The financial feasibility of the entire programme has to be worked out, and if required, changes have to be made. Therefore, details of the final phase programme can only be finalized after evaluation of the first phase programme.

Final Phase Implementation

The experience gained in the demonstration areas during the first phase will provide the possibility to also plan the collection and disposal system for final phase implementation. At this stage only preliminary projections have been made for the sake of budgetary purposes.

Management of Solid Waste Collection and Disposal

Management of solid waste collection and disposal comprises operational structure, finances, public education and participation and legislation.

Taking into account the limited ability of the majority of the population to pay for various public services, only limited improvement of the solid waste collection and disposal can be proposed. A minimum service level should be established based on a least cost analysis with a high efficiency.

It is proposed to have one superintendent cleansing responsible for the overall tasks of solid waste collection and disposal in Mirzapur. He will oversee the administrative and financial tasks in addition to the day to day management tasks of the solid waste management system. He reports to the Mirzapur Nagar Palika.

In addition it is proposed to have two Chief Sanitary Inspectors and four Sanitary Inspectors for the four zones.

The proposed organizational setup is indicated in Figure 9.8.

9.5.3 COSTS

The cost estimates for the proposed first and final phase equipment and facilities for solid waste collection and disposal are based on 1988 price levels on information from dealers, suppliers, contractors, etc. Contingencies, workcharge establishment and project preparation fees are not included. No correction has been made for inflation.

The total projected cost of the first phase scheme is Rs. 25.64 lakhs. The proposed tentative outlay for the Final phase scheme is about Rs. 43 lakhs.

9.5.4 EXPERIENCES

During the inventorization phase, basic data had to be collected from the staff of MNP. These data were often found not to corroborate with the actual situation especially regarding the deployment schedules of sweepers and equipments.

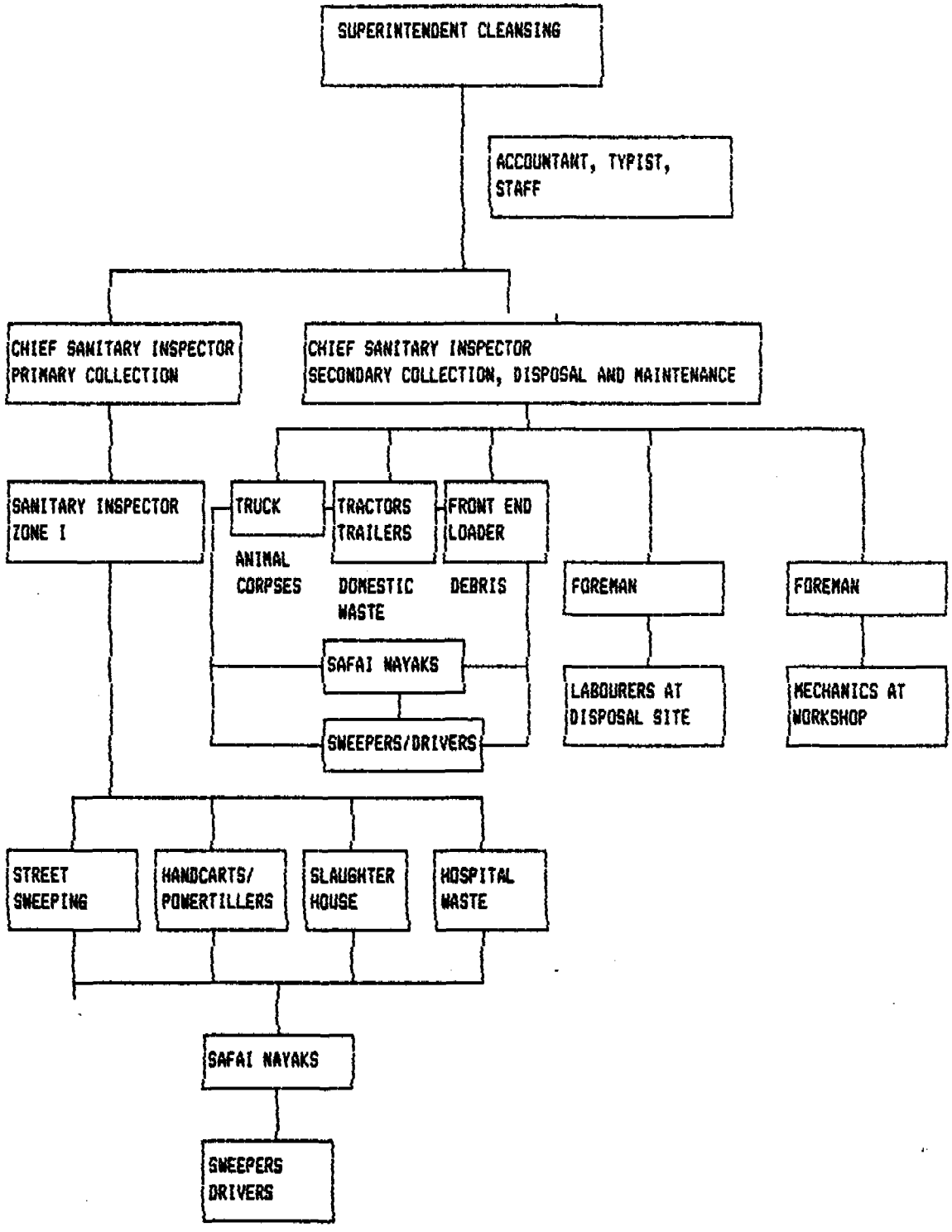


FIGURE 9.8: PROPOSED ORGANIZATIONAL SETUP

10. COMMUNITY PARTICIPATION AND HEALTH PROMOTION ASPECTS

10.1 INTER-RELATIONSHIPS WITH TECHNICAL COMPONENTS

The involvement of the target population is of crucial importance for introducing measures conducive to environmental improvement both at macro and micro levels of society. At the same time it should be noted that community involvement becomes more important when interventions take place within the residential areas, close to the people. It is especially because of the established link between environmental protection and the improvement of the living conditions that community participation and health promotion are important tasks for the project as a whole. It is for this reason that the following tasks have been formulated:

- To ensure that improvement activities carried out by the project will receive priority attention in residential areas which are poverty stricken and have the lowest level access to sanitary facilities.

- To facilitate community participation and involvement in planning, implementation, operation and maintenance of the different technical project components with special focus on role and position of women.

- To ensure that the interventions in the field of drinking water supply and sanitation, as well as the already existing and remaining facilities in this field are beneficial to public health.

- To ensure that the implementation of the improvement programme reflects the identified needs, perceptions and attitudes of different categories of the population (e.g. income levels, caste, class, community and gender).

- To enhance the health of tannery workers and possibly other industrial workers in the project areas by a package of preventive and curative occupational health interventions.

- To facilitate and promote transfer of knowledge and training on different components covered by the project.

As mentioned above community participation and health promotion are most prominent in aspects related to the improvement of living conditions in the low income residential areas.

In the project therefore the main focus in community participation and health promotion is on water supply improvements, solid waste collection and disposal and sanitation. Especially for these components an active involvement and support of the communities is required to make the interventions successful and its impact sustainable.

At this point it should be noted that the relation between technical distribution systems and the community always implies a mutual influence and adjustment. Although inter-relationships are obvious we can formulate a number of practical examples which are summarized below:

Water Supply:	affordability; willingness to pay; operation and maintenance of community standposts or handpumps; water spillage; location; drainage; hygienic practices.
Sanitation:	awareness; affordability; willingness to pay; operation and maintenance (private and public); location; health related knowledge, attitudes and practices.
Solid Waste: Collection and Disposal	awareness; dumping practices; location of facilities; health related knowledge, attitude and practices; affordability.

It is because of these inter-relationships that the project aims at a joint and multi-disciplinary effort involving the beneficiaries, the government, the technical experts and the professionals working in the field of social, health and institutional development.

10.2 ROLE AND POSITION OF WOMEN

Special consideration has been given to the needs and priorities of women during project formulation. It should also be noted that this element forms a special policy area for the overall Indo-Dutch Development Cooperation Programme.

It is widely accepted that environmental and sanitary improvements require a gender specific approach. For effective interventions the active involvement and support of women is required. They are more affected by poor sanitary facilities than men, either directly or indirectly through their children. When children are forced to play in neighbourhoods with polluted and stagnant drains and waste lying around, the mothers are to be approached first when sanitary improvements are discussed and community support towards a change in attitudes and practices is required. When no latrine facilities are available women have to go into the open field before dawn or after sunset for defecation.

Although it is widely accepted to apply a gender specific approach, its implementation is often difficult for different socio-cultural reasons. A systematic attempt was therefore made to facilitate this approach. The first step made was to engage female staff from the project side and the municipalities. In promotion activities, in which mutual understanding and thrust are conditional, female staff facilitates better communication with women.

Additionally, in formulating the programme, special attention was given to gender specific activities. Examples are the skill training programme for female construction workers, the different health orientation programmes and the orientation course for female community volunteers.

In meetings at community level, as a rule separate discussions are held with women.

On the basis of the socio-economic surveys carried out at the beginning of the project it became evident that in order to arrive at more permanent improvements in living conditions additional income generating activities especially for female headed households are a prerequisite. Although not covered by the original terms of reference this component has been identified and support is being provided in its formulation. This sub-project will be initiated shortly.

In view of its importance we present below further details on the planning and implementation of the skill training programme for female construction workers.

In the construction industry, women have very specific roles assigned to them which are tiring and back breaking yet low paid. The myth that soft hands and 'nimble fingers' cannot do hard jobs prevails for women. Women do the unskilled tiring job of breaking stones, lifting and carrying concrete mortar bricks, sand etc. They never get the opportunity to upgrade their skills.

> 'Earlier on, the raj mistry never used to give us a chance to become a raj mistry. We used to give either brick and mortar to them. If by chance we handled their tools, we were scolded and were told that we could not become raj mistry. This attitude of theirs used to hurt us. Moreover, we also did not have any masons tools'. (Extract from an interview for a video film).

Keeping in mind the above factors, under this project, a skill training programme for women construction labourers was drafted in order to train them in masonary work.

The sanitation component of the programme was found to be a suitable entry for skill training because of its prolonged nature. Applying their skills in the sanitation programme would give them practical experience, confidence and credibility to take up work outside the project in future. The training was planned for 15 women of Jajmau, Kanpur and 15 women of Mirzapur.

The training was divided in a three week classroom training and three months on-the-job training.

In Kanpur, Kanpur Nagar Mahapalika(KNM) and in Mirzapur, the Mirzapur Nagar Palika (MNP) was the executive agency of the programme. A team of Sulabh including one engineer, 2 supervisors and one mason provided training in collaboration with KNM staff.

All preparations were a joint effort of Indo-Dutch project staff and staff of KNM/MNP and specially its female community workers.

For identification and selection of trainees, Anganwadi teachers (Kanpur) and community volunteers were involved. The selection was confined to those areas showing a concentration of construction workers and in which through other activities, a good rapport was established.

Group meetings were conducted to discuss the idea and motivate the women.

> 'Meetings were held many times and it was felt that if a man can be a raj mistry then why can't women too become raj mistry. So we all decided to undergo the training'.

> 'I knew how to read and write. But there were many women who did not know how to read and write. Some learnt to read from their children and some from their husbands and those who did not know at all used to come to their friends during the meetings. There they were given slates and their colleagues taught them how to read and write so much so that they started reading an inch tape. Now all of them know how to read and write and measure a tape too'. (extract from an interview for a video film)

During the course of training constant monitoring took place to ensure that through training the women would acquire all required skills. An important factor was group meetings at regular intervals to promote the cohesiveness of the group and to exchange experiences. In this process representatives of Sulabh and the local municipalities participated as well.

The second aim of the group meetings was to prepare the masons for future competition in the open labour market. The formation of a collective which is able to acquire independent assignments in sanitation works from the local municipality or any other party is being encouraged.

Presently women are employed as regular masons in the low cost sanitation programme.

> 'In the beginning people used to have reservations about our doing this sort of a job. But now, since they have come to know what all this training is about and that we can also capably handle this job they now keep silent. Earlier they used to laugh at us and say how can a woman become a mason? Now those very people say with respect-look the raj mistry is coming, where once only men were mistries now women too have become mistries. The construction site at which we are working presently there also, people come and watch us do masons job. They tell us that what we are doing is a novel thing and that we have secured for ourselves a golden opportunity that most women cannot get'. (extract from an interview for a video film)

To make the female masons independent from outside support the formation of a collective consisting of all trained women and possibly supportive female construction workers, is considered to be essential. Group meetings are continuing therefore and are conducted on regular intervals.

Presently it is being considered to give out work to female masons directly through KNM without involvement of Sulabh.

It is intended to organize another similar training programme for a second batch of female construction workers as masons in Kanpur and Mirzapur. The success of this training programme implies that skill training for women in other areas could also be taken up, if possibilities exists.

10.3 METHODOLOGY AND ORGANIZATIONAL SET-UP

During the Design Phase different research methods were being used to arrive at a reliable and representative data base which was needed for technical designs, in-depth studies and additional socio-economic activities. The applied methods and techniques included participatory observation, group interviews, individual in-depth interviews and surveys with the use of a structured questionnaire and random sampling using areas as sample units.

So far the methods and techniques referred to relate to the empirical research inputs for the project. An important part of the methodology in addition relates to the way in which the project staff promoted and ensured an effective involvement and participation of the target population. In general this method can be divided in a direct and indirect approach.

The Direct Approach

During the inventory phase in which a number of surveys and in-depth studies were conducted, contacts were established with informal leaders at community level. The contacts resulted in the establishment of informal groups of men and women in selected slum areas.

In the site selection of the handpumps and the selection of caretakers and female construction workers also a direct approach has been followed. It means that direct communication lines were made between the field staff and the community or through representatives of the women's and men's groups. No intermediate professional groups were involved. Also in the promotion of ORS, in organizing the immunization campaign and selection of trainees for the different orientation courses direct contact with the community was established.

The Indirect Approach

An Indirect Approach is followed in a two-or-three tier system through the different orientation programmes. By means of trained (professional) intermediates the community is reached such as, traditional birth attendants, school teachers, private doctors, Anganwadi workers, handpump caretakers and community volunteers. The orientation courses have a twofold aim. For professional groups the course contents addresses the need for improving their professional skills, while in all courses the key messages developed by the project in collaboration with Unicef, are disseminated.

In conducting the orientation courses for community volunteers the next step has been taken in creating intermediate levels at community level. The idea has been, to establish Mahila Mandals (for women) and Yuwak Mandals (for men). With a permanent infrastructure at community level, responsibilities concerning health promotion and community participation can be gradually handed over to those directly concerned.

The establishment of proper Institutional Arrangements became important when, after completion of the different inventories and the first experiences with providing support towards execution of technical activities, a Detailed Project Report on Health Promotion and Community Participation Aspects was prepared.

With approval and expenditure sanction granted for execution of the DPR in June 1988, the local municipalities were assigned the responsibility for execution of the programme.

Expenditure sanction was granted by the GPD under the condition that a mechanism would be established for monitoring the programme. To address this condition an 'Operational Note' on modalities for execution of the DPR' was prepared for both Kanpur and Mirzapur. It defines the responsibilities of the different parties involved in execution of the programme: The municipalities, the project and different resource organizations.

Although the overall Institutional arrangements are provided in Chapter 5 it is important to elaborate the organization for community participation and public health which is provided below.

Kanpur

A Programme Management Group (PMG) was established for monitoring of the programme. In Kanpur the PMG is chaired by a senior representative of KNM and comprises the Chief Medical Officer (CMO) of KNM, the project officer of the Urban Community Development Project (UCD) at KNM, the

officer in charge of the sanitation department at KNM, a representative of the Department of Social and Preventive Medicine of Kanpur Medical College and the coordinator of the sociological unit of the project. The occupational health expert of the project represents the project on occupational health aspects. The CMO of KNM is directly responsible for the health related aspects, including the occupational health programme. The sanitation department has responsibility for the skill training programme while community participation aspects is under the UCD project officer.

The UCD project of KNM has attached two community workers to the occupational health programme and three workers for the community participation and health related programme as spelled out under the DPR's.

Mirzapur

In Mirzapur a similar set-up was followed. The PMG is chaired by the executive officer of Mirzapur Nagar Palika and comprises the health officer of MNP, a representative from the Department of Preventive and Social Medicine, Banares Hindu University and the coordinator of the sociological unit of the project. Under the DPR , MNP has attached one community worker to the occupational health programme and three community workers to the other programme aspects.

MNP has requested the CMO of Mirzapur district to depute 2 female health workers to MNP for providing additional support. Approval is awaited now from the Ministry of Health, U.P. State Government.

Project Support

A small team provides support to the concerned municipalities in execution of community participation and public health programmes. It consists of one coordinator, one community development expert and specialist women's affairs for Kanpur and Mirzapur each and an occupational health expert. The latter provides support to the health related aspects as well.

The project team concentrates its activities on development and design of the different programme aspects and monitoring of its accomplishment.

The team receives support from different institutes from the Netherlands in the development of activities. The Royal Tropical Institute assists in occupational health aspects and health promotion aspects. The University of Amsterdam advises on women's aspects.

Resource Organizations

Sulabh International

Sulabh International provided support in development and execution of the skill training programme (masonary) for female construction workers. Its local offices in Kanpur and Mirzapur supported the on-the-job training programme.

Kanpur Medical College

Kanpur Medical College provides support to the occupational health programme and the longitudinal study into diarrhoeal incidence. It assisted in development of training materials for the orientation courses for primary school teachers and Anganwadi workers.

Staff of the Dept. of Social and Preventive Medicine is involved as course coordinator and/or resource persons in the different health orientation programmes. Its College of Nursing acted as resource organization for the courses for traditional birth attendants and the community volunteers.

Except for development of training materials, the involvement of KMC is confined to Kanpur.

Banares Hindu University

Banares Hindu University, Dept. of Preventive and Social Medicine, provides similar support to the Mirzapur programme as KMC for Kanpur. It is involved in the diarrhoeal incidence study, the occupational health programme and the orientation courses on health related aspects. It contributed to the development of the training materials for the courses for Traditional Birth Attendants (TBA) and private medical practitioners. Furthermore, it supplies low-cost primary health care packets.

ANMTC, Mirzapur

Auxialiary Nurse Midwife Training Centre (ANMTC), Mirzapur provided in support as resource organization for TBA course. It is envisaged that ANMTC will play a role in follow-up of the TBA course.

Unicef

With the Urban Development Branch of Unicef an extensive collaboration was established on development of urban and slum specific promotion materials. It includes the development and production of leaflets, flip cards and promotion video films. Additionally, its Lucknow office supports the set-up of an O & M system for installed handpumps.

10.4 HEALTH-RELATED ASPECTS

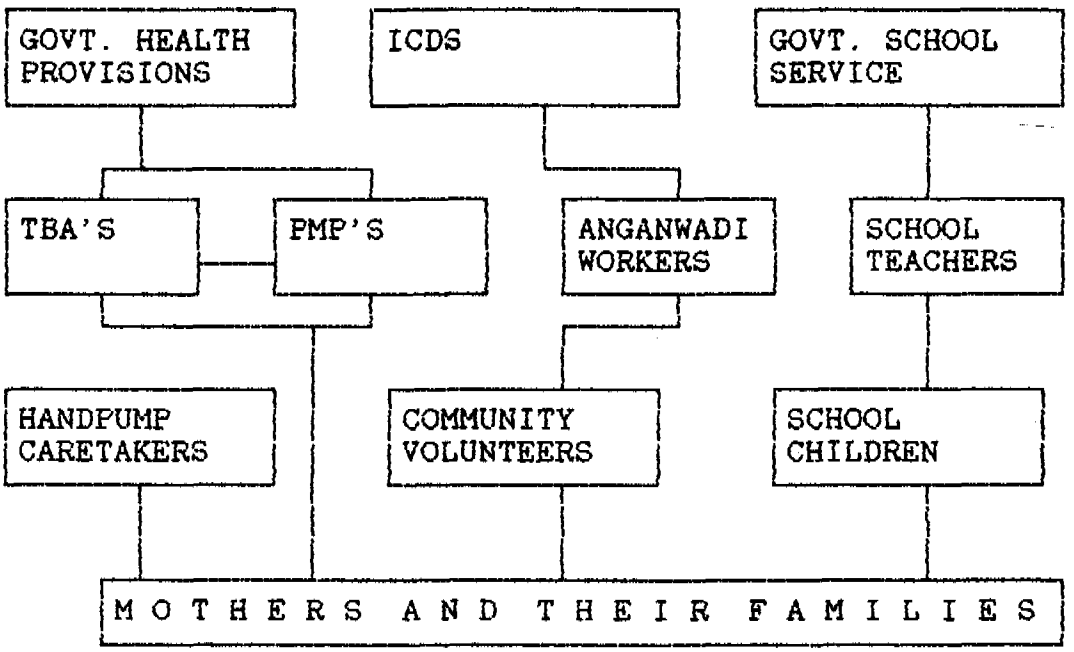
It has been found that in water and sanitation projects, the hardware, whether handpumps, latrines, solid waste containers, or other sanitary facilities are better used if there is community understanding of what is happening and if involvement in planning and execution of the work is ensured.

It has also been found that provision of hardware in isolation may not have any major impact on health, if patterns of use remain inappropriate. Substantial health education of the community is required.

It is clear that when the project is responsible for some health aspects related to water and sanitation, it also has the role to advocate, reinforce and encourage local institutions whose official job is to provide health care.

In the initial stages key promotional messages were identified in the project. These messages were further specified and consolidated as activities began, particularly as the series of flipcards were developed. Informal health promoters in the community were then identified.

They are seen as channels of communication who can transmit the same key messages as the project. The diagram below shows the envisaged flow of information.



The health promoters are also seen as community resource persons, of different levels of education, who can help initiate group activities and motivate the community to cooperate with project activities. Thus, health-related aspects and community participation aspects often overlap.

10.5 COMMUNITY PARTICIPATION ASPECTS

The project opted for a direct and an indirect approach to establish an effective community involvement. The direct approach provided insights in peoples priorities and needs and was instrumental for e.g. in the peoples participation in the site selection of handpumps. It was also used to identify key persons to serve as facilitators between the project and the target population.

In the area of community participation the project has identified the following elements which need priority attention.

1. To provide execution support to technical interventions which are of direct benefit to the target population and for which community support is required.

2. To promote the set-up of operation and maintenance systems for completed facilities with community involvement.

3. To monitor the on-going progress of sanitary interventions and to formulate corrective measures.

ad 1

The leaflet developed in collaboration with Unicef covers the subjects of solid waste, sanitation, handpumps and piped water supply. They specify the hazardous effects of poor sanitary conditions, explain the planned interventions and provide suggestions on how communities can contribute towards improving their own living conditions.

The leaflet in combination with the flipcards will give the required support to `facilitators' at community level for promotion of environmental sanitation.

ad 2

The establishment of a maintenance set-up for handpumps is discussed in detail because it has been the first experience with the set-up of a operation and maintenance system with community involvement in this project.

Caretakers were selected for each handpump in those areas where a substantial number of handpumps were installed. As per Unicef model the caretakers were given the responsibility for lodging complaints about breakdown of the pump, promotion of proper care of the handpump and its surroundings and small repairs.

In site selection of handpumps people were asked at small group meetings to identify and propose sites. In larger meetings site selection was finalized and caretakers were nominated by the community. Initial caretaker training was provided for a selected number of caretakers in both Kanpur and Mirzapur. Training was provided by Unicef and project staff.

ad 3

Action research is required to make corrective measures whenever needed. Examples are the assessment of the handpump installation and private latrine construction programme.

To provide effective support to technical interventions the following criteria and conditions were established:

- Community participation is to be linked and/or integrated with the implementation of technical facilities (e.g. construction of public latrines, conversion of latrines, etc.). It should focus on support for actual improvements. For interventions which are not of direct benefit to the population, the provision of information is sufficient.

- Timing and programming of the promotion of community participation activities are to be in tune with the construction and introduction of the technical facilities.

- A distinction in approach is to be made between slum- and low income areas and areas where mainly private facilities are being installed. The set-up of community level organizations with delegated responsibilities for promotion of environmental sanitation is feasible only in low income areas. In middle and higher income areas efforts are focussed on development of civic sense and intolerable working conditions of e.g. scavengers.

- Community participation at the planning and execution stage is required for the establishment of an `after care' system for operation and maintenance of facilities.

- To consolidate the results of the action approach a continuous appeal is necessary for lasting and prolonged activities. Community responsibility for improved environmental sanitation is the only long term answer to achieve this aim.

- In both direct and indirect approaches attention has been paid to the need to establish social organization at community level. Through regular group meetings both for men and women informal organizations have been stimulated. At present attempts are made to move towards more formal organizations. Mahila Mandals for women and Yuwak Mandals for men.

10.6 ORIENTATION COURSES

As a first opening towards `facilitators' at community level, a number of orientation courses were planned. The courses were prepared for traditonal birth attendants, school teachers, Anganwadi workers, private medical practitioners and community volunteers.

The process was as follows:

THE PRELIMINARY SURVEYS AND INVENTORIES

In order to make the training courses as appropriate as possible, questionnaires were developed for interviewing TBAs, Primary School Teachers and Private Medical Practitioners and Community Volunteers. To find out who they were and what they were doing.

Private Medical Practitioners:

The importance of Private Medical Practitioners was confirmed by the diarrhoea survey, during which parents reported that these people always treat their children. The surveys of PMPs in Kanpur and Mirzapur showed the wide variety of training and background which they had, and the number with no relevant qualifications at all. It also picked up problems which had not been anticipated in the initial course outlines, such as the over-use of I.V. drips and anti-biotics for children with diarrhoea.

Traditional Birth Attendants:

The two surveys of TBAs revealed a great deal about their practices, which allowed the training programme to be modified and made more appropriate.

Inventories were also made of possible referral points for the TBAs who find problems with a pregnant or delivering mother. In Jajmau this led to a good link being made with the ESI Hospital which acted as host for the second batch of training. Links were also made with the Dufferin Hospital in Kanpur as the referral point for uninsured women in Jajmau and with the District Hospital in Mirzapur.

Primary School Teachers

The survey of Primary Schools confirmed what had been suspected, that there were many very small schools in each project area with very few sanitary facilities.

Community Volunteers

The inventory of community volunteers was confined to areas were substantive inputs from the project do or will take place soon. It includes the sanitation areas (private and public), the solid waste demonstration areas, basties with substantial handpump installation and the areas selected for the diarrhoea study. In most of these areas immunization campaign were held as well. Above mentioned areas are not exclusive but often combine one or more interventions.

The inventory of community volunteers was directed towards individuals with whom contacts were established before and showed interest to support the different activities that took place (caretakers, local leadership, organizers of immunization camps, etc.). Data were collected on their background, past involvements in community work and future willingness to contibute. Separate inventories were made for men and women.

Angawadi Workers

The project was involved in initiating the ICDS at Jajmau, Kanpur. Since the structure and objectives of this programme will know no inventory or survey was required.

Survey of institutes to provide training support:

The project has a policy of working with and strengthening local institutions, so the Departments of PSM in Kanpur Medical College and Banaras Hindu University were given responsibility for finalizing course outlines and lesson plans. Other possible teaching resources were identified, including Literacy House in Lucknow. All programmes were executed by the municipalities itselves with support of project staff. Course coordinators and facilitators were drawn from the munipalities and different institutes and agencies.

THE TRAINING COURSES

Traditional Birth Attendants:

Two groups of TBAs were trained in Kanpur and Mirzapur. Good resource people were found in both places and the teaching methodology included a lot of role-plays and songs worked well. All groups were able to visit the referral hospital. There was positive feedback from TBAs, resource people, and observers about the course.

Anganwadi Workers:

Anganwadi Workers are a part of the Integrated Child Development Scheme. They are supposed to run a creche in the mornings for under-fives, with nutritional supplements for malnourished toddlers and pregnant women. In the afternoon they should make home visits and provide health education to mothers.Their task is big and their training and experience inadequate. In Jajmau, Anganwadi workers were given two days of training in December 1988, and a follow-up one day course in February. (Mirzapur does not yet have this programme).

The first course went well, but afterwards it was felt that there was insufficient translation into action. The Anganwadi workers are handicapped by all kinds of fundamental problems (poor accommodation, insufficient supervision) and are somewhat daunted by the size of the task they are supposed to tackle. During the follow-up course it was agreed with them that they would participate in project activities, starting with the diarrhoea survey and the organization of community volunteers. This would get them out of the Anganwadi Centres and into touch with mothers, giving them the experience they need to undertake their other tasks.

Private Medical Practitioners:

PMPs welcomed the opportunity of having their skills updated and being accepted as colleagues by important members of the city's medical profession. However some did not attend the first day for fear that their qualifications would be checked. Attendance on the second day was much better.

Primary School Teachers:

Four groups of Primary School Teachers were trained in both Kanpur and Mirzapur. The course content and the UNICEF educational materials were well taken, and some schools say they have used them in their teaching to the children. Some constraints have affected the extent to which the course content has been used:

- Almost all schools, particularly the municipality schools, have no latrines, hand washing facilities and rubbish bins for use by the children. Thus the most obvious way of teaching, through the supervision of good practices, is denied to them.

- Using Literacy House, Lucknow, to provide some inspiration about alternative teaching methods and initiate cultural competitions among the schools, did not work out.

- School timetables and curricula are very tight and do not allow for much introduction of new subjects: teachers were not enthusiastic about activities which would involve much extra work, such as melas or competitions. What they said was that Saturday afternoons were flexible and usually the whole school then gathered together. This was one of few occasions when they could introduce the subject-matter.

Community Volunteers:

Two training programmes for community volunteers (women and men) were organized in Kanpur and Mirzapur.

The objectives of the programmes are that the community volunteers should be able to discuss, promote and organize within their communities the following:

- Improved environmental sanitation
- Better water-use and sanitation practises
- The need for proper care and maintenance of facilities
- Preparation of ORS and better hygienic practices
- Immunization
- Establishment of community level organizations (Mandals)

The course aimed at community volunteers to be the channels of communication with the basti people.

The training programme was conducted by staff of the municipalities with support of project staff and for Kanpur by the College of Nursing at KMC. Concerned technical officers of the executing agencies participated in the discussions on specific interventions, which resulted in lively discussions and exchange of opinions.

In Kanpur role playes prepared by the Anganwadi workers (ICDS) on the focal themes such as water use/water storage proper excreta disposal, sanitary use of latrines, personal hygiene, proper use of handpump, proper solid waste disposal were used. For Mirzapur a local group of musicians prepared songs on these aspects, while municipality staff conducted role plays.

10.7 PROMOTION MATERIALS

An extensive inventory of existing promotion material on health, environmental, and sanitation aspects was made at an early stage of the project. Although valuable material is available on different topics, the general conclusion was that most of it has been developed for use in rural areas. The conclusion was shared with Unicef that a need existed for development of urban and slum specific promotion materials.

The following promotion materials were developed in collaboration with Unicef.

1. Flip cards
2. Leaflets
3. Promotion video's

ad 1. Flip cards

The flip cards contain the key messages on health, water and sanitation. They cover the following aspects.

- River Pollution
- Solid Waste
- Sanitation
- Safe water practices
- Personal Hygiene and Diarrhoeal Management
- Preparation of Home Made Oral Rehydration Solution (ORS)

The flip cards are being distributed to `facilitators' at community level (community volunteers, Anganwadi teachers, etc.) for dissemination of the messages. Monitoring of their use and impact is provided by the municipalities and the project.

The development of the flip cards required an extensive process of formulation of concepts, field testing and design.

ad 2. Leaflets

Leaflets were developed on :
- Sanitation
- Solid waste
- Handpumps
- Piped water supply

The leaflets were designed for wider distribution and provide information on planned sanitary improvements and how communities can contribute to improving their own environmental and sanitary conditions.

ad 3. Video Films

Video films were prepared on :
- skill training (masonary) for female construction workers
- traditional birth attendants

The main purpose of the video films is to promote the idea of upgrading skills. In addition, promotion materials from other sources are used. It includes video films from GPD and Unicef and other promotion materials.

As for further need of promotion materials the following requirements have been formulated.

1. hoardings
2. sign boards

Hoardings give general information about project activities. Sign boards can be put up at actual sites. For each handpump site it would be useful to put up a signboard indicating proper water use and water handling practices. Based on experience others needs may be identified.

10.8 DIARRHOEA INCIDENCE SURVEY

In-depth investigations were carried out on health aspects related to water and sanitation. The conclusions resulted in the formulation of a longitudinal study into diarrhoeal incidence with the following objectives:

1. To determine the incidence of diarrhoea in children below 5 years of age in selected areas in Jajmau (Kanpur) and urban Mirzapur and to record changes in prevalence and incidence of diarrhoea in children during the courses of study.

2. To study a few epidemilogical correlates of diarrhoea in study areas of Kanpur and Mirzapur.

3. To elicit KAP of mothers and children regarding water use, excreta disposal and diarrhoea management in children and record changes in KAP, if any, during the course of study.

4. To carry out bacteriological surveillance of drinking water at source and at the drinking water storage vessels in the households in study areas.

The study is being carried out in selected areas of Jajmau and Mirzapur with low level of water and sanitation facilities and high prevalence of diarrhoeal morbidities. The study population covers 200 families each having children below 5 years of age. The selected households are visited every 2 months. The first phase of the study is for a period of one year i.e. June/July 1988 to July 1989.

During the first round of the survey general data were collected on the households and prevailing sanitary conditions. The general survey is to be repeated after one year. Bacteriological analysis of drinking water is also being carried out in the study areas.

The findings of the study should provide directions in terms of approaches and focal messages to be adopted for carrying out promotional activities in the area.

10.9 REVOLVING FUND FOR PRIMARY HEALTH CARE PACKAGES

The orientation courses for health promoters in the informal sector are directed both at increasing their professional skills and mobilizing their support towards better sanitary practices. To facilitate their work as health promoters, the need for low-cost and simple primary health care packets was identified.

An example was provided by the P.S.M. Dept. of BHU which assembles kits for use by traditional birth attendants, nutritional packets, contraceptives, ORS packets, etc. During the different courses the of use of these packets was promoted and samples were provided. Distribution channels are being set up now through the intermediate levels and stocks are being replenished. Distribution is still on a limited scale for logistic reasons. Stocks have to be ordered and collected from BHU which especially for Jajmau/Kanpur is a constraint. Production at local level is being looked into by KNM and KMC.

10.10 OCCUPATIONAL HEALTH PROGRAMME

10.10.1 BACKGROUND

A significant proportion of the population in Jajmau (Kanpur) is employed as tannery workers and in Mirzapur as weavers. Therefore, any development programme in Kanpur and Mirzapur should address the needs of tannery workers and carpet weavers. The project has therefore formulated an occupatinal health programme.

The long term objectives of the programme are to improve the working and health conditions in tanneries and in looms.

Short term objectives are:

1. To make a situational analysis of occupational health conditions of tannery workers and carpet weavers.

2. To formulate and execute interventions with the aim to diminish the risk of occupational health hazards.

Methodology being adopted includes the following:

1. Situational analysis, including a health survey of tannery workers and carpet weavers.

2. Formulation and implementation of interventions, based on the results of the situational analysis

3. Follow up and monitoring of the interventions.

4. Dissemination of results to various agencies active in the field of occupational health, including a workshop in collaboration with the International Labour Organization (ILO)

5. Ongoing research and publication

10.10.2 SURVEY FINDINGS OF SITUATIONAL ANALYSIS

A. Kanpur

The objective of the situational analysis has been to analyze the health conditions of the tannery workers in Kanpur. 120 tanneries are presently in operation. Of these, 20 have been covered by the occupational health survey.

Questionnaire technique was employed with the questionnaire administered by the interviewer. Three separate questionnaires were drafted:

- a social questionnaire eliciting personal particulars, employment details, working conditions and practice, facilities available at work and personal habits.

- a medical questionnaire eliciting the prevalence of current symptoms and symptoms in the recent past (within last 15 days) relavent to identifying both occupational and non-occupational morbidity and the health care utilization pattern with emphasis on usage of official health agencies.

- a proforma to record physical facilities and hazardous conditions in different tanneries which was filled in by the surveying physician on the basis of observation during on the spot visits.

In addition a full general and systemic physical examination of each subject was carried out by the surveying physician.

Results

Mean age of workers was 32 years and mean working experience in tanneries was 11.6 years. This meant that the labourers entered into tannery work at a very young age i.e. 20 years. Majority of the workers were illiterate (59.6%).

About 40% of workers were permanent employees while 43% worked on daily wages in tannereis. Different working stations in tanneries from where the workers got selected for study were beam house (24.7%), tanyard vegetable (14.3%), tanyard chrome (13.5%), finishing (28.6%), others (18.7%).

The majority of workers (83.2%) did not get any change in palce of work. Lunch facilites were poor and 50.5% workers took lunch at work-site, 57.3% workers were not using any form of protective device mainly because of two reasons, either these were not provided (28.2% workers) or workers did not consider it necessary to use them (25.8%).

About one-fifth of workers reported (20.1%) having met with some form of accident like, falls (9.0%), cuts (56%), machine amputations (1.8%) and burns (1.2%). Of 70.6% workers who smoked, majority (73.7%) did so at the place of work.

Occupational Morbidities

About one-forth of workers (24.6%) suffered from some form of occupational morbidity like backache (15.5%), chrome ulcers (2.0%), respiratory irrituation (3.8%), occupaitonal asthma (2.2%), conjunctival irritation (3.0%) and contact dermatitis (2.6%).

The prevalence of occupational morbidities excluding backache was 13.6% in tannery workers. Commonest occupatinal response seen in workers was callosities of hands/shoulders (72.6% and 23.9% respectively).

Health care utilization

At the time of survey 57.3% of workers were symptomatic (cough with expectoration 19.5%, difficulty in breathing 5.8%, backache 16.9%, skin lesions 10.4%, common cold 9.8%). 39.8% of workers took treatment for their ailments mainly from private practioners (85.5%) followed byu ESI despensary/hospital (38.4%).

Employment State Insurance (ESI) utilization:

55.9% workers had utilized ESI health services atleast once.

The major reasons for non utilization of ESI services were:

ESI cards not arranged by employer (31.6% workers)
Poor opinion about ESI services (8.2%)

B. Mirzapur

The Occupational Health Programme is being carried out in the urban areas of Mirzapur. The first phase of the programme comprising situational analysis of working environments at different loom sheds including social and health profiles of workers has been completed.

The Occupational Health Survey was carried out in Amanganj and Rukhalghat areas of Urban Mirzapur.

Three predesigned and pretested questionnaires were used to elicit information on the physical condition of the loom (overall-observation schedule), social profile of worker and a medical questionnaire. The questionnaires were, with small modifications similar to those which have been used in Kanpur.

A total of 200 weavers (150 carpet weaver and 50 drugget weavers) were selected on simple random sampling basis from above mentioned areas. Besides, 60 matched controls (non-weavers selected from Rambagh area after matching for age and socio-economic status) were also included in study.

Results

Out of 200 weavers 13.5% were child labourers (less than 14 years). Mean age of weavers was 27 years and their mean (total) working experience of operating looms was 13.4 years. 50.0% of weavers were illiterate.

Majority of loom-sheds (96.5%) had single looms. 49% of weavers surveyed worked on single loom establishment. It was seen that 61% of weavers worked on their own family looms.

Majority of the weavers (70%) earned a monthly income ranging between Rs.300 to Rs.600 (mean monthly income being Rs.349). Almost all of them were being paid at piece rate basis.

Majority of weavers (43%) did not taken any weekly off. No protective devices were being used. Almost all weavers had sustained minor cuts on hands/fingers while working. They all complained of poor visibility in looms sheds (carpet-looms). In a few loom-sheds transparent glass piece had replaced a part of room ceiling to improve illumination.

Medical - Profiles

Common morbidity encountered were diminition of visual acuity (refractive error in 37.5% whereas in controls it was 28.3%) respiratory morbidity (20%) and backache (27%).

Private practitioners were most commonly utilized by weavers (84%). Only 4% utilized government health care agencies (district hospital, district tuberculosis centre, dispensaries etc.).

Employees State Insurance (ESI) health scheme is not available at Mirzapur.

10.10.3 INTERVENTIONS

A. Kanpur

Based on the situational analysis, the following interventions are proposed:

1. Interventions for promotion of labourers health and safety. The health survey revealed a high frequency of accidents. In order to promote safety in the tanneries protective devices for hazardous machines are proposed to be designed and constructed in collaboration with the Regional Labour Institute in Kanpur. 3 tanneries will be selected as demonstration plots. Machine protection and other safety measures (improvement of light, space, ventilation and workfloor conditions) should be included in the demonstration with a detailed plan with instructions how to behave in case of emergencies. "Training and visit" schemes will be organized for tannery owners to visit the plots.

2. Promotion programme for social security and health protection. Immediate efforts should be made for provision of protective devices and ESI cards in consultation with tannery owners. The provision of soap and the creation of canteens should also be discussed.

3. Seminar on occupatinal health. The future programme for tannery owners, tannery workers and the health officials (ESI, KMC) will shortly be introduced and explained through slides, which have been prepared of the protected machines and which reveal the cost-effectiveness of machine protection.

4. Medical follow up, referral and treatment. Those workers, who have been examined during the health survey will be included in a follow up study. If it proves necessary, these workers should be referred directly to the ESI hospital. A special consent from the Director of ESI services for this referral has already been obtained.

5. Training of tannery workers and tannery staff in first aid. A simple manual and posters, based on the health survey will form part of a curriculum with concise information on first aid in tanneries. Staffmembers should be selected and trained more in detail in first aid. For them, a separate, more detailed manual should be developed with the aim to let them keep this manual and use it for first aid.

The organization of first aid, including the administration with description of the referral system should be included in the course. Simple first aid kits will be distributed. ESI doctors will also participate in these courses.

6. Collaboration with ESI services.
The ESI hospital in Jajmau will be supported to establish effective referral linkages and to strenghten extension support with initial help of the project.

7. Case studies into the socio-economic background of tannery workers.
For monitoring purposes of referral effectiveness and health conception of workers, a detailed case study of selected workers will be taken up.

8. Dissemination of results.
Aim of this workshop is to show tannery owners simple low cost measures which serve a three fold purpose: improvement of productivity, working conditions, and health promotion.

9. Research and publication.
Scientific articles will be published in national and/or international journals.

B. Mirzapur

The urban cluster of Amanganj has been selected to start the programme. Based on the results of the situational analysis, the following actions are proposed:

1. Establishment of neighbourhood associations of weavers. Based on the experiences with these associations, a socio-economic feasibility study on the possibility of establishing a weavers cooperative will be the following activity.

2. Adoption of a primary school as a centre of occupational health activities. In the school, a small health centre will be established for the population in the neighbourhood.

3. Training of community volunteers and teachers to provide informal education to the children, working as carpet weavers during a few hours per week or during holidays.

4. Involvement of the already trained private practitioner. The private practitioner, who has been trained in Amanganj, will visit the school three times a week for a few hours in order to give simple medical treatment for the population of Amranganj.

5. Improvement of the working environment by the provision of UNICEF fiberglass roof windows with simple interventions to improve the looms.

6. Dissemination of results, research and publication. The same activities as mentioned under Kanpur are planned for Mirzapur.

10.11 EXPERIENCES

The skill training programme for female construction workers as masons has been quite successful so far. As anticipated these trained women were employed under the LCS schemes of the project. The envisaged linkage of this skill training programme with the execution of the LCS programme unfortunately, could not always materialize sufficiently due to the set backs in the implementation of the LCS schemes. Uptill now alternate work arrangements could be made for them, for example in construction of manholes covers, and building of public toilets outside the project.

The overall experiences with the training courses for 'facilitators' at community level has been positive. Most participants were glad to come and learn.

One lesson to be learnt is that as courses get planned in detail and content modified, there is a tendency to put in more content and involve more people. The result tends to be sessions which are one-way and disconnected from the topics before and after. The lesson is that three or four main teachers are enough, and that one important person only should either open the course or close it but not both.

What is happening on the ground?

The most recent diarrhoea survey has some results which indicate that the key messages have not yet been assimilated appropriately by the target group:

- The provision of handpumps means that many people can now draw clean water. However they are still drinking dirty water. The main source of contamination seems to be:
- clay carrying pots with no handle.
- the placing of storage pot covers on the dirty ground.
- the use of dippers with very small handles.

- ORS is still not sufficiently being used.

The TBAs have mainly assimilated information related to their work of delivering babies. Knowledge and practice regarding cleanliness in their work seems definitely to have been improved. Some of what they have learnt is still not precise enough, like when and how often pregnant women should get Tetanus Toxoid. They are more aware now of ORS preparation and use, but again do not know precisely how to make it.

The more active Anganwadi teachers are indeed promoting ORS, family planning and other aspects not directly related to their creche work. Working with project staff has helped them to widen their sphere of activities.

It is difficult to claim at this point that the training of PMPs or of School teachers has had any trickle-down effect into the community. Follow up is necessary.

The community volunteers participating in the courses were found to be more than willing to render their support to environmental and sanitary improvements and assume community responsibilty .

A problem which remains is the relationship of TBAs and Anganwadi Teachers to the official government system.For the TBAs, the staff who should be in the field and to whom they could refer do not exist, and their reception in the hospitals depends on individuals and is not always friendly.

The Anganwadi workers lack basic equipment and materials, and project staff are maintaining good relationships with the hierarchy of the ICDS programme in order to keep these problems on the agenda.

It is expected that with the distribution of leaflets and flip-cards and the establishment of follow-up systems the involvement of community "facilitators" can be further strengthened .

The positive experience with the occupational health programme is that the linkages with other project interventions, especially the tannery waste water treatment and recovery of chrome, the attitude of the employers and their associations is receptive. Occupational health improvements are considered to be an integral part of a comprehensive set of environmental and sanitary improvements.

Nevertheless, the activities of the Project have raised health consciousness in the population: by interviews, through the health surveys, by emphasizing the connection between cleanliness and health, by incidental advice and help given in specific cases, project staff have helped to make people aware that sickness is often preventable and treatable. As a result a demand for more services is being made, and the project cannot meet it. It can only hope to influence the government structures whose job it is, and perhaps help obtain extra funding. However, doubts remain about the extent to which these structures are able to answer raised demands for better health services with present conditions unchanged. This leaves the project staff in the difficult position of having raised expectations which may not be met.

10.12 FUTURE PLANS AND FOLLOW-UP

Presently the possibilities are being explored to diversify the skill training programme into other areas. Training as handpump mechanics and fitters are seen as possibilities.

A major factor in planning further activities on health-related and community participation aspects is that further support must be given to the sanitation programme, the solid waste scheme which will be started soon, and the water supply programme. These activities will need community support. At the same time, the project will have to start scaling up its activities to cover a greater proportion of the target population, especially those areas covered by handpumps.

The situation now is that in each concentration area there are a number of people who have received training on all or part of the key messages.

It is now logical to concentrate on organizing them into a Mandal or neighbourhood association with the following functions:

- assisting in the implementation of project activities, for example the siting of solid waste bins, handpump maintenance and motivation of families who do not wish their latrines to be converted,

- taking more direct responsibility for the education of mothers, especially on improving water carrying and storage, latrine use and the preparation of ORS. The use of the Project flipcards and leaflets, the production of which is nearly completed, will be a key activity here.

- organizing the community-based distribution of the low-cost health packets produced by BHU. Having low-cost ORS packets which could be sold for some profit is probably the most likely way of getting PMPs to prescribe rehydration.

- using each other as resource persons: examples are:

  - Anganwadi workers can be asked to read the TBA manual to the local TBAs to reinforce what they have learnt;
  - a Community Volunteer who identifies a severely malnourished child could seek advice from the Anganwadi workers;
  - The more skilled PMPs could be asked if they would occasionally help very poor families for free - this offer has been made in Mirzapur;
  - the Mandal, using the flipcards, could influence the community to support the Handpump Caretaker;
  - TBAs can refer mothers to PMPs for TT injections.

- if the Mandal works with the community to make sanitary interventions successful, it will have gained credibility and experience. From this point, health promotion activities with a wider scope would be possible, such as improving immunization coverage or identifying and helping the malnourished children. Key people who have already been trained (Community Volunteers, Anganwadi workers,etc) can form groups to tackle these problems.

Thus the Project can work with these Mandals, reinforcing knowledge and making them more self-sufficient. After that, most of their attention will have to be directed towards other areas.

The community approach formulated above has resulted in a different way of organizing the work. Community workers of the municipalities were assigned individual responsibility for specific concentration areas. A familiar face has to be seen to built up mutual thrust and confidence and strengthening of contacts. Besides area responsibility, field staff has topic responsibility. Group meetings with women, contacts with the female masons, etc. are to be done by female staff. Field staff can provide support to planning and design of programme components.

Scaling up of the activities is possible with effective staff deployment. The field staff of the municipalities has to operate from a community centre to make them more accessible to the target population, has to be mobile and needs adequate incentives for their demanding work.

A receptive social infrastructure is being created at community level and it has to be ensured that execution of work will be speeded up in order to maintain momentum.

Compared to its original planning, the scope of the occupational health programme has been expanded. No experience has been gained yet on the effectiveness of proposed interventions, but it may be expected that present staffing is inadequate to carry out all the formulated tasks.

11. TRAINING

11.1 BACKGROUND

In view of the new technologies, and approaches being adopted during the course of the project, training is considered to be an essential tool to bring about Human Resource Development and community participation. The local counterpart organizations and municipal agencies that are involved during the project phases and after the completion of the project are the main target group. Training is seen as a means of improving the inter-relationship within the various municipal agencies and the relationship between the implementing agencies and the beneficiaries, in view of the integrated nature of the project.

Through a series of off the job sessions the dissemination of information and training materials will:

- Provide the latest information on a broad range of low cost, easy to use and appropriate Technologies in the field of environmental and sanitary engineering.

- Emphasize good project management, education in public health and hygiene and community participation - essential to the success of water supply and sanitation components of the project.

- Emphasize the importance of involving those who will actually use water supply and sanitation facilities taking into account relevant cultural and socio-economic factors. This will be accomplished by using different techniques for communication with small and large groups with a view to involve different members of the community in the project.

- Transfer selected information to engineers and other professionals, field staff, and government decision makers of central, state and local organizations.

Adequate training will strengthen institutional development of these agencies, so that effective operation and maintenance of the new facilities to be installed under this project is ensured.

One of the basic objectives of this project is to demonstrate the application of the Upflow Anaerobic Sludge Blanket (UASB) process developed in the Netherlands. Under this project it is proposed to have a series of training sessions on the UASB technology.

The work plan for the first phase Training Aspects has been formulated. The work plan underlines the activities that will be executed upto November 1989.

For each project component, counterpart organizations with regard to responsibilities for execution and operation and maintenance have been identified. It has been agreed by local agencies, to involve counterpart staff in every on the job planning and design activity in order to transfer knowledge and skills.

The work plan is based on the training needs, as proposed by the various local agencies and takes into account the training requirement of each project component separately. Training Requirements, Target Groups, Resource Organizations and Persons, Training Methodology and Time Schedule for training activities are being proposed. Substantive elements include strategic aspects, UASB sewage treatment, sewerage and storm water drainage, sanitation, water supply and solid waste management.

11.2 EXISTING SITUATION

As per the U.P. Government Act, KJS is responsible for the operation and maintenance of sewage pumping stations and sewage treatment plants (UASB), but for the Ganga Action Plan projects, U.P. Jal Nigam has been assigned the maintenance responsibility for these works. The staff required for the O&M of the UASB sewage treatment plant and the tannery chrome recovery plant has been assigned by UPJN. This staff requires training in operation and maintenance. KJS staff requires training in systematic leak detection in water distribution systems and in sewer cleaning practices. KNM staff requires training in improved sanitation and solid waste management practices.

At present there is a shortage of staff available in Mirzapur within MNP to operate and maintain the handpumps installed recently. Additional staff is foreseen and adequate training is required. MNP staff requires further training in systematic leak detection for water distribution systems and improved sanitation and solid waste management practices. The staff of UPJN needs to be trained for O & M of sewage pumping stations and sewage treatment plants.

11.3 SCOPE OF TRAINING AND TARGET GROUPS

The scope of the workplan for training aspects embodies the first phase training activities that should be executed upto November 1989.

Training activities that are identified in this work plan serve as a support to designs implementation, operation and maintenance of the various project components.

The Target groups have been identified based on the responsibility of the local agencies for execution and operation and maintenance. Personnel will be identified and proposed for training by the local agencies both at the supervisory and working levels.

In this respect four levels of training have been distinguished:

1. Policy level
2. Management level
3. Technical level
4. Beneficiary level

a. Policy level

This involves the key decision makers of national and state agencies who are responsible for strategic planning, formation of legislations, budget control, formulation of norms and regulations and influence policy making. These persons are also involved in defining the scope of projects. Participation is confined to those persons who are directly related to this project.

b. Management level

This involves the General Managers of municipal and state agencies, Engineers who are involved in the day to day management of these organizations and in decision making Persons responsible for in personnel planning and management, as well as managers of sewage treatment plants and pumping stations.

c. Technical level

This involves the Engineers, operators and skilled workers, who play an important role in the stages of design, implementation and operation and maintenance of the project works.

d. Beneficiary level

This involves the training aspects with regard to the users of the facilities, involvement and participation of the community as beneficiaries in the project. This will involve Training in operation and maintenance of supplied facilities and education in Public health and Environmental Hygiene. This will highlight the importance of user participation. The users apart from looking after the facilities constructed for them in the field of water supply and sanitation are also expected to work towards developing positive community attitudes towards safe drinking water and sanitation. This will comprise of more than basic technical instructions to the users of facilities. This will mainly involve groups of men and women volunteers who will be trained as caretakers for Handpumps.

Resource persons and organizations

These are persons or organizations who will contribute to the organization and execution of the various training activities. The persons will be experts in their respective fields. Resource persons will be from the Netherlands and India, drawn from within the consultants team as well from outside institutions.

In order to optimize on training resources and costs, to further the concept of project integration and to have the possibilities of dissemination of knowledge between two different towns, it is proposed to conduct in some cases workshops and classroom training either at Kanpur or Mirzapur jointly for both towns.

The process of on-the-job training has been on going especially with regard to design aspects. The staff of UP Jal Nigam both at Kanpur and Mirzapur has been involved with the consultants team while the designs for sewerage, sewage treatment and water supply schemes were formulated. The stafff of the local muncip[al agencies has also been involved from time-to-time.

The training activities identified so far and to be undertaken upto November 1989 are summarized in Table 11.1.

TABLE 11.1: SUMMARY OF PROPOSED TRAINING ACTIVITIES FOR FIRST PHASE IN KANPUR AND MIRZAPUR

PROJECT COMPONENT	TRAINING ACTIVITIES	LEVEL	PARTICIPANTS	NO. OF PARTICIPANTS	RESOURCE ORGANISATION	METHODOLOGY	DURATION	JOINT OR SEPARATE
Strategic Aspects	1. Present project experiences in integrated project approach	P/M	UPJN, MNP, KDA KJS, KNN, GPD U.P.Govt	20	Project	Workshop	1/2day	Joint Kanpur
	2. Environmental Management and Cost Recovery	P	UPJN, GPD, CPCB UPPCB, KNN KJS, MNP	20	Min of Environment Min of VKDN Meth., Project	Workshop	1 day	Delhi
Sewage Treatment	1. Application of UASB Technology	P/M	UPJN, KJS, UPPCB, etc.	20	Project	Workshop	1 1/2 days	Joint Kanpur
	2. Design and construction of UASB treatment plants	P/M	UPJN	10-10	Project	Class room On-site	1 day	Joint Kanpur
	* 3. Operation, maintenance and monitoring of UASB treatment plants		UPJN	10	Project	Class room On-site (continuous)	1 day	Joint Kanpur
Sewerage and Storm Water drainage	1. O/M and cleaning of sewerage system	M/T	UPJNNIR, KJS MNP	15	Project, others	Class room On-site	2 days	Joint Kanpur
Sanitation	1. Management and conversion of low cost public/ private latrines	M	MNP, KNN	10-15	Sulabh, Project	Workshop	1 day	Joint Kanpur
	2. Public latrines	T	MNP, KNN	63	Sulabh, Project	On-site	3 days	Separate Kanpur & Mirzapur
Water Supply	1. Leak detection	T	MNP, KJS, UPJN	20	Project, UPJN	On-site Class room	2 days	Separate Kanpur & Mirzapur
	2. O/M of water treatment plants and pumping plants	M	MNP, UPJN	10	Delhi Municipal Coorporation Project, Others	Class room	1 day	Separate Mirzapur
	3. Pump operators	T	MNP, KJS	20	Project	On-site Class room	3 days	Separate Kanpur & Mirzapur
	4. Pump attendants	T	MNP, KJS	32	Project	On-site Class room	3 days	Separate Kanpur & Mirzapur
	5. Chlorinator operators	T	MNP, KJS	10	Project	On-site Class room	3 days	Separate Kanpur & Mirzapur
	6. Handpump mechanics	T	MNP, KJS	20	UNICEF, Project	On-site Class room	3 days	Separate Kanpur & Mirzapur
	7. Handpump caretakers	B	Volunteer	60	UNICEF, KJS, MNP UPJN, Project	On-site Class room	2 days	Separate Kanpur & Mirzapur
Solid Waste Management	1. Solid waste management	M	MNP, KNN	10	Project	Workshop Class room	2 days	Joint Kanpur

* This will be repeated two times and a Final presentation of the monitoring results will be done at the end of the monitoring period.

Out of the activities mentioned in Table 11.1, the following training activities have already been organized.

1. Handpump installation and maintenance training at Kanpur (First Batch) - T level - February '88
2. Handpump caretakers training at Kanpur (First Batch) - B level - February '88
3. Handpump caretakers training at Mirzapur (First Batch) - B level - March 1988
4. Present Experiences in Integrated Project Approach at Kanpur - P/M level April 1988
5. Application of UASB Technology at Kanpur - P/M level April 1988
6. Leak detection in water distribution systems at Mirzapur - M/T level- April 1988
7. Leak detection in water distribution systems at Kanpur - M/T level- July 1988
8. Workshop on Solid Waste Management Approach and methodology - P/M level- April 1989

11.4 EXPERIENCES

Due to extension in the construction schedule of the first 5 mld UASB module at Kanpur and the delay in the implementation of the crash programmes and first phase priority programmes certain training elements envisaged to be over by now have been rescheduled to be completed by November 1989. For e.g. it was not possible to conduct a training programme on sewer cleaning because the sewer cleaning work using the bucket cleaning machines has not yet started in Mirzapur and Kanpur.

An evaluation of the above mentioned training programmes was carried out mainly to assess the degree of impact on the target groups. It was also assessed whether the training methodology applied in the programme is effective, and makes a significant contribution to declared goals.

It has been observed that the participants from various local agencies and other categories are taking a keen interest in the different training programmes. The training programmes had a positive impact on the attitude of the participants towards various issues raised especially operation and maintenance. Follow-up programmes are required however to establish effective O & M systems.

One of the bottlenecks that still remains in the execution of training is the lack of a formal institutional set-up within the various implementing agencies for coordinating and documenting the training programmes. This is particularly vital for a new technology like the UASB process which should be further disseminated within the UPJN on a state level by their own trained staff. It would be quite appropriate if all the municipal agencies have a training cell which is responsible for Human Resource Development within the organization as well as coordination of all training programmes.

12. REFLECTIONS ON PAST EXPERIENCES AND FUTURE OUTLOOK

During the last 2 years there have been various ups and downs in the project. Fortunately today, certain planned elements like construction of the 5 mld UASB treatment plant, pilot plant for chrome recovery, UASB pilot plant for treatment of tannery waste water, installation of handpumps, installation of public toilets, conversion of dry bucket latrines as well as installation of pour flush latrines, etc. have materialized.

Many of the following reflections on the past experiences as well as future outlook are valid for both Kanpur and Mirzapur.

This is the only project under the Ganga Action Plan which has a sizeable input of expatriate and local consultants in an advisory role working in collaboration with the implementing agencies.

This situation created initially an unfamiliar work environment within the overall execution set-up of the Ganga Action Plan. Also, the division of tasks between the various local municipal agencies and UP Jal Nigam at that stage was not clearly specified. As time passed the absorption capacity and the execution capabilities evidently became more apparent and hence resulted in a change of implementation roles. At the same time the project monitoring set-up of the GPD was being expanded with the establishment of state level and division level steering committees as well as the appointment of Project Managers in the respective project towns.

Obviously, because of the unfamiliarity of all parties involved in the Kanpur and Mirzapur project as well as the uncertainties about their respective roles, it led initially to some difficulties in coordination of works. Needless to say, the inception period played an important role in establishing a better understanding amongst the different parties.

Also in the inception period, the options for various technical and sociological interventions were formulated in more detail and the need for additional information was established. Often, there were and still are differences of opinion on design concepts as well as the approach and methodology. Adhering strictly to prescribed design norms and standards is not always possible while working with existing infrastructural facilities. An existing infrastructure might impose such boundary conditions that it is impossible to follow the prescribed design standards totally. Flexibility and innovation is then needed.

However, in the course of the 2 year period a fairly good working relationship has been established and it was possible to reach to an agreement on the design concepts between the implementing agencies and the consultants.

It has been experienced that the progress of various project components are to a certain extent dependant on uncontrolable external variables. Land acquisition usually takes more time than anticipated because of the unexpected hold-ups in administrative procedures as well as legal disputes on land titles of private land owners.

Items under controlled procurement like cement, steel, pipes, etc. are sometimes not delivered in time either due to non-availability or strikes within the implementing organization. Strikes at the secretarial level in the UP Government result in situations where decisions do not trickle down to the executive levels causing delays in implementation. Also sudden strikes within the implementing agencies bring the work to a standstill.

As mentioned before a special consideration under this project was given to Crash Programmes. They were meant to tackle quickly some evident bottlenecks in the existing sanitary conditions during the first phase of the project uptill November 1988. It was further expected that this would create a positive attitude within the people in the project areas, because they could see that work started almost immediately while the engineers were still working on the designs.

Crash programmes are in their nature rather small and have a short implementation period. They should therefore be quickly approved and executed. However, appraisal of the crash programmes took considerable time mainly because of disputes over unit rates and fear of setting precedences for other schemes. Execution also appeared to be slow and often of poor quality. Most of the crash programme works only recently started while sewer cleaning activities in Jajmau did not even start yet.

Besides these disappointing aspects, the crash programmes have created a great deal of trust in the people about the project. They are now less sceptical and more convinced that their drinking water situation and sanitary conditions will indeed improve.

Though the crash programmes take much more time in approval as well as execution and quality of work needs continuous attention, they still serve an important aspect of the project, namely arousing popular support. These type of programmes are definitely needed for environmental and sanitary engineering projects like the ones in Kanpur and Mirzapur. People quite often do not understand why it must take such a long time between the first inventory in the area and the start of actual construction.

Crash programmes seem, to be too crash for approval by executive agencies. Their procedures for approval and tendering of these small works are the same as for much bigger schemes. It may therefore be more appropriate to term these programmes "priority" instead of crash programmes.

The application of the UASB technology for treatment of domestic and tannery waste water which is one of the key factors of this bilateral aid project is being introduced in India for the first time. Regardless of the fact that the contractor for the first 5 mld UASB module turned out to be unexpectedly bad, there could have been a stronger supervisory set-up of the implementing agency in order to achieve time bound construction of sufficiently high quality.

The overall observation is that good quality of work could only be achieved through a continuous and time consuming process of monitoring of work and successive corrective measures by project staff. This resulted in a situation in which project staff had to provide substantial implementation support at a time when design work was being carried out. One of the reasons for this inadequate supervisory input from the implementing agencies is on account of their heavy workload in addition to which they have been assigned the responsibility for this project as well. A suitable proposition to overcome this situation is to assign a sufficient number of coordinators, construction supervisors and engineers exclusively to this project scheme-wise.

In order to achieve time bound completion and to attain the required quality standards, an effective monitoring set-up is needed. In this regard it is proposed to institutionalize weekly progress meetings in Kanpur and Mirzapur to review the progress of the past week and to set targets for the coming week. In Mirzapur, the weekly meeting should be convened by the DM in his capacity as the local project manager. It should be attended by the Superintending Engineer of the UPJN together with his Executive Engineer(s) responsible for the works and the Executive Officer of the MNP as well as by the Consultants. Occasionally, the presence of the chairman of MNP may be desirable. This weekly meeting should be conducted with a mutually agreed agenda which covers all relevant items and the minutes should be finalized on the same day. In addition to the weekly progress meeting, regular site meetings should take place between the implementing agencies, its contractors, and the consultants in their capacity as advisors. A similar set-up will be needed for Kanpur.

In addition to the local weekly progress meeting, the GPD should convene monthly monitoring meetings in Delhi, separately for Kanpur and Mirzapur. These meetings should be attended by the project managers of the respective towns, the responsible UP Jal Nigam Engineers in both towns for Ganga Action Plan Projects and the Consultants.

As mentioned before, good quality supervision is an essential requirement to achieve high standards of works. It is therefore proposed to have at least one supervisor on each scheme. He should be continuously at the site and be of the rank of a junior engineer with vast experience in construction supervision. The responsibility of supervision for each scheme should rest with the Assistant Engineer, who should be at the site every morning and afternoon and also continuously during periods when critical elements are being executed.

Naturally, good quality supervision should be supplemented with the input of good and experienced contractors. In order to avoid that a large number of smaller, inexperienced contractors could be awarded the job, resulting in an unmanageable strain on supervision, pre-qualification of contractors for each specific project scheme should be undertaken. This pre-qualification should result in a short list of not more than 5 contractors per scheme, able to manage schemes worth more than Rs. 1 crore, who will ultimately be invited for the final bids.

One of the issues that still needs to be further clarified is the connection of the Jajmau tanneries to the proposed industrial sewerage system. This is particularly relevant in the light of the existing discharge regulations and the recent judgement of the Supreme Court. Today, on one hand it is obligatory for tanneries to reduce their BOD, COD and SS-loads to certain fixed limits before discharging into a municipal sewerage system or surface waters. On the other hand the Supreme Court makes in-house pre-treatment obligatory for all tanneries without prescribing fixed standards for BOD, COD, SS etc.

In order to make the proposed system functional it is required that all tanneries should be connected to it. However, under the present regulations they may not be able to do so without having substantial in-house biological treatment facilities. From a practical point of view this seems to be a remote possibility. Even if this could be achieved to some extent, it will result in production of such quantities of sludge that its disposal will become unmanageable. In view of the above complexities it is felt necessary that this matter is resolved before taking a decision on actual investments in this industrial sewerage system.

The results of the chrome recovery pilot plant are very promising, technically as well as economically. From a technical point of view, operation of the chrome recovery plant proved to be rather easy, the percentage of chrome recovered is high, and the quality of the produced wet-blue is very satisfactory.

Based on preliminary estimates it has been shown that chrome recovery is profitable even for the smaller tanneries. These results were presented to the tanners of Jajmau during a workshop in April 1989. Also the tanners were quite enthusiastic about the chrome recovery process. In order to disseminate the chrome recovery process to the other tanners in Jajmau the regional office of CLRI at Kanpur is expected to play a major role. It is intended to prepare a typical design of a full scale chrome recovery plant with a capacity to handle all the exhaust chrome liquor of a specific tannery. This design will be handed over to CLRI so that at a suitable institutional level the tanners can be supported.

During the inception period it was found that most of the sewers were not functioning properly. This was mainly because of blockage of the sewage flow due to the lack of sewer cleaning, maintenance and repair and poor quality of construction. Sewers were laid under wrong slopes, manholes were not constructed properly, covers were missing, and the manholes were found full of garbage. This poor status of the existing sewerage system is not only hampering the functioning of the present sewerage system, but will also have a bearing on the Low Cost Sanitation programme and the expansion of the domestic sewerage system. Under the Low Cost Sanitation programme most of the private and public latrines are planned to be connected to the sewerage system, which needs to be functional then. The execution of the expansion of the domestic sewerage system can not be taken up if the present system, to which it is to be connected is not cleaned. Delay in execution of the expansion scheme is causing delay in the LCS programme as well. Therefore, a timely execution of the sewer cleaning programme is essential for the progress of the expansion of the sewerage as well as the LCS programme. Efforts have to be made that in future the sewers are maintained properly. Taking into account the distance from Jajmau to the Central part of Kanpur decentralized set-up of an O & M organization within the KJS, specially for Jajmau, seems to be the best solution.

For improvement of the water supply system in Mirzapur, which includes the leakage, repair of pipelines, house connections, and standposts, the UP State Government at the request of GPD has agreed to allocate an additional amount of Rs. 1 crore to supplement the Indo-Dutch bilateral programme. After execution of the crash programme only Rs. 50 lakhs are available. The overall expansion and rehabilitation programme for Mirzapur by far exceeds this amount and therefore priority works have been identified. The available funds limit the execution to mainly the core area of Mirzapur. Repair of distribution mains, installation of necessary sluice valves as well as laying of some new pipelines in the core area, consumes all the available funds. This means that repair of house

connections cannot be included. It is essential that the rehabilitation of house connections is carried out in conjunction with the other rehabilitation works. In the allocation of funds by the Netherlands Government for Mirzapur a water supply component is included as well, which so far has not been utilized. In view of the urgency of the repair of house connections it should be allowed to utilize these funds.

With regard to the amount of leakages and water losses in the house connections, it is recommended to deviate from the existing system and establish the ownership of the various components of the house connections as follows.

The connection of the main, the pipeline from the main to the water meter and the stopcock in between should be the property of the KJS and MNP. Connection to the houses should be made by KJS/MNP itself or approved contractors. Water meters have to be periodically serviced, repaired, and replaced. To recover these costs KJS/MNP can charge the consumer some amount to be added to the water bill.

The remainder of the service connection, from the water meter to the consumers fittings inside the house should be entirely the consumers responsibility to install, and to maintain. Any leakage in this section should be metered, and as the consumer has to pay for the resultant wastage, it is reasonable to expect that he will ensure that it is maintained adequately.

Based on the expected characteristics of the waste water after the execution of the wide-mesh system and LCS programme the UASB process is a viable treatment option for Mirzapur. The design and construction of the treatment plant for Mirzapur will be based on the monitoring results of the 5 mld UASB module at Kanpur. It is planned to have the design ready by end 1989 and to start construction after the monsoon of 1990.

Keeping in view the densely built-up character of Mirzapur, with its limited and narrow access and main roads, careful phasing and planning of the execution of especially pipe laying works is essential. Rehabilitation of the water supply network and sewer laying should be limited and mutually adjusted as far as possible, in order to carry out the works efficiently and to minimize the adverse effects of the execution on the population. However, because of different budgets, procedures and contractors, this will not be easy and flexibility in the planning of the execution will be essential.

The skill training programme for female construction workers as masons has been quite successful so far. As anticipated these trained women were employed under the LCS schemes of the project. The envisaged linkage of this skill training programme with the execution of the LCS programme unfortunately, could not always materialize sufficiently due to the set backs in the implementation of the LCS schemes. Uptill now alternate work arrangements could be made for them, for example in construction of manholes covers, and building of public toilets outside the project. It is intended to organize another similar training for a second batch of female construction workers as masons in Kanpur and Mirzapur. The success of this training programme implies that skill training for women in other areas could also be taken up, if possibilities exist.

At the initial stage of the project it became evident that people living in slum areas often attach higher priority to income generating activities rather than for improvements in sanitary conditions. This, in particular, is more relevant for female headed households. In the inception period it was proposed to start an income generating scheme for women. It is expected that this scheme will be taken up in the near future.

The interventions made by the project in the field of health promotion have supported the existing health care system as well as have stimulated the demand for improved health care facilities.

The outcome of the establishment of facilitators at the community level, which include TBA's, PMPs, School Teachers, Anganwadi Workers and Community Volunteers, has been satisfactory so far. The aim is to bring together these different facilitators into a social infrastructure which can support the planned interventions. In order to sustain these efforts it is necessary to strengthen the community development set-up within the respective municipalities.

For an effective execution of the programmes and to directly communicate with the communities it is imperative to establish community centres in the project areas equipped with necessary facilities and full-time staff. In the light of the overall communication strategy which requires movement of audio-visual equipment, and promotion materials to cater to a large coverage, transportation facilities are essential.

The handpump programmes and LCS programmes have been supported by a parallel sociological activity which includes involvement of the communities for the identification of sites, selection and training of voluntary handpump caretakers, promotion of conversion of dry bucket latrines etc. In the near future the implementation of schemes will be much larger and hence the supporting sociological activities will become more intensified, specially for water supply components like rehabilitation of house connections, removal of tulu pumps, identification of public standpost locations, as well as promotion of better household waste disposal practices, further site selection for public latrines etc.

The tanners in Jajmau in principle welcome the occupational health measures proposed by this project. They definitely see a relationship between the workers health and increase in productivity. The proposed interventions, which will initially be implemented in a few selected tanneries, aim at the improvement of workers health and making the working environment less hazardous. In Mirzapur the occupational health interventions are directed towards the carpet and dhurri weavers in a pilot area with approximately 200 weavers.

The investment ceilings for Jajmau, Kanpur and Mirzapur are guided by the allocations of the Planning Commission for Ganga Action Plan schemes in various towns. At the start of this project, the ceilings for Jajmau and Mirzapur were respectively fixed at Rs. 12 crores and Rs. 5 crores. After establishing the needs during the inception period and further detailing of the schemes, these ceilings were increased to Rs. 15 crores for Jajmau and Rs. 9 crores for Mirzapur around July 1988. Though the DPRs with detailed cost estimates for some major schemes are not yet available, there are indications that these investment ceilings will be exceeded. After all the final cost estimates are available, it will have to be decided what priorities have to be set and/or what cost reductions are needed before granting expenditure sanction for these schemes. For this reason, it is still premature to prepare a solid financial analysis.

Preliminary information is available on the organizational aspects of the implementing agencies especially with regard to operation and maintenance. After all the DPRs have been finalized and tender documents prepared the O & M aspects will be further formulated.

Due to extension in the construction schedule of the first 5 mld UASB module at Kanpur and the delay in the implementation of the crash programmes and first phase priority programmes certain training elements envisaged to be over by now have been rescheduled to be completed by November 1989.

An evaluation of the training programmes that have been completed was carried out mainly to assess the degree of impact on the target groups. It was also assessed whether the training methodology applied in the programme is effective and makes a significant contribution to declared goals. The training programmes had a positive impact on the attitude of the participants towards various issues raised, especially operation and maintenance. Follow-up programmes are required however to establish effective O & M systems.

One of the bottlenecks that still remains in the execution of training is the lack of a formal institutional set-up within the various implementing agencies for coordinating and documenting the training programmes. It would be quite appropriate if all the municipal agencies have a Training Cell which is responsible for Human Resource Development within the organization as well as coordination of all training programmes.

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