

*Capacity Building for the Urban Environment:
A Comparative Research, Training and Experience Exchange*

Project Paper No. 13

**Environment and Health Improvement in Jajmau
Area, Kanpur -Lessons and Experiences for
Wider Replication**

by

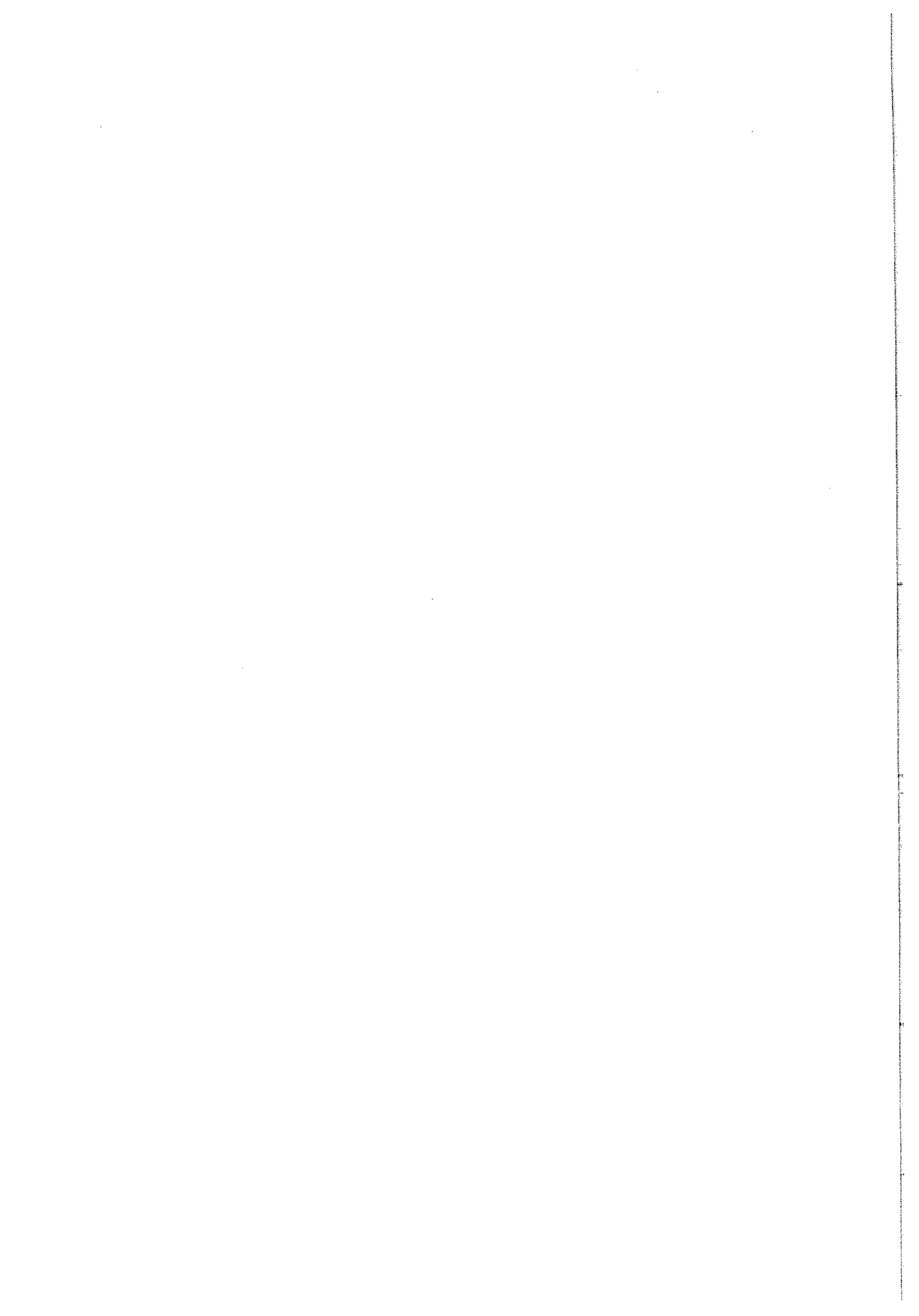
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**Institute for Housing and Urban Development Studies
Rotterdam, The Netherlands
February 1997**



***Capacity Building for the Urban Environment:
A Comparative Research, Training and Experience Exchange***

A project implemented by the

**Institute for Housing and Urban Development Studies (IHS),
Rotterdam**

In co-operation with the

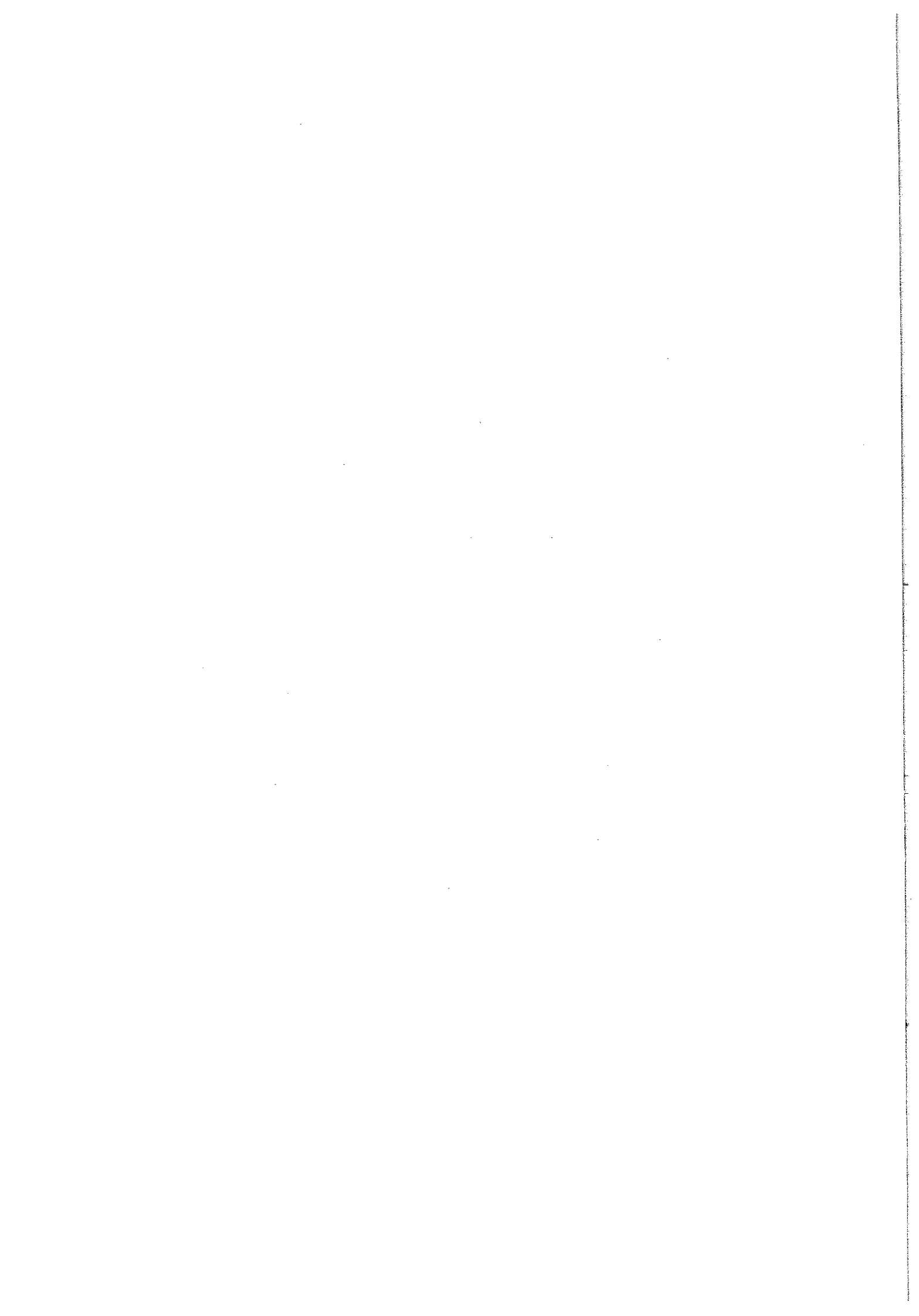
**Instituto de Desarrollo Urbano (CIUDAD), Lima
Institut Africain de Gestion Urbaine (IAGU), Dakar
Instituto para la Democracia Local (IPADEL), Lima
Human Settlements Management Institute (HSMI), New Delhi
Centro de Servicios para el Desarrollo Urbano (PROA), La Paz**

Sponsored by

**Directorate General for International Co-operation (DGIS),
Netherlands Ministry of Foreign Affairs, The Hague**

and

**Swiss Development Co-operation, Federal Department of Foreign
Affairs, Bern**



Introduction to the Project

Focus and Outline of the Project

Capacity Building for the Urban Environment is a comparative research, training and experience exchange project that was launched in October 1994 with the support of the Dutch government. It provides an inventory and review of the experiences of relevant bilateral and multilateral organisations and of Best Practices in urban environmental management. For the countries of India, Peru and Bolivia, it identifies, communicates and extends the application of Best Practices in environmental management for cities. In May 1995, the project was expanded to include Senegal/West Africa with the support of the Swiss government.

The focus of the project is on learning from experiences in urban environmental management at the city level and on developing strategies for capacity building in order to replicate and scale up the best of these experiences elsewhere. The overall co-ordination of the project is the responsibility of the Institute for Housing and Urban Development Studies in Rotterdam, while co-ordination in the participating countries is the responsibility of the following partner organisations:

- Human Settlements Management Institute (HSMI), New Delhi, India;
- Instituto para la Democracia Local (IPADEL), Lima, Peru;
- Instituto de Desarrollo Urbano (CIUDAD), Lima, Peru (since January 1997);
- Centro de Servicios para el Desarrollo Urbano, (PROA), La Paz, Bolivia, and
- Institut Africain de Gestion Urbaine, (IAGU), Dakar, Senegal.

Project Activities

Support to cities in the form of applied research and development activities in the area of urban environmental management has been, and continues to be, provided by the co-ordinating partner organisations through the following set of activities:

Research

Within the applied research programme undertaken in the project, Best Practices in urban environmental management in Bolivia, India, Peru and, to some extent, Senegal were identified, and their lessons and experiences reviewed. An analysis and review of the identified Best Practices then took place involving a large number of individual research groups and professionals. In a process of on-going monitoring and review, guidance and support were provided by IHS and its partner organisations. The results of both the individual studies of Best Practices and their review are being published in several books and papers in both English and Spanish. These and their publication dates are listed in the *Introduction to the Project Papers*, which follows this note.

Networking

In identifying the research priorities of the project, during the conduct of the research studies, and throughout the review of research findings, a structure was developed and utilised to ensure the participation of all interested and concerned individuals and institutions through a consultative process. Expert group meetings and consultative seminars were organised for this purpose.

Capacity Building Strategies

After the Best Practices research, analysis and review were completed for all countries, outline capacity building strategies were developed for each based on what was learned from these local experiences and practices. These strategies were developed through a broad-based consultation process involving a large number of research institutions, individual professionals and academics, city representatives, NGOs and local representatives. They are currently being modified based on the outcome and findings

of Habitat II, which was held in Istanbul in June 1996, and the emphasis has now shifted to applying a number of Best Practices to selected cities.

Best Practices Documentation

Concurrent to and co-ordinated with this project, IHS served as the secretariat of and contributed to the review of the Best Practices that were submitted to the United Nations Centre for Human Settlements (UNCHS) for the *Global Best Practice Initiative for Improving the Living Environment* in preparation for Habitat II. HSMI, PROA, IAGU and IPADEL were also involved and contributed to the national preparatory processes that took place in their own countries. An overview of the Best Practice submissions to UNCHS, as well as summaries of the additional case studies received by IHS, are being made available on the Internet through the IHS Home Page.

Databases

Two databases are also under preparation: an institutional database and a literature database. The institutional database is being developed in co-operation with the International Institute for Environment and Development (IIED) in London. It contains entries on relevant organisations, some of which are documented in extensive profiles, while others are included as shorter reference information entries. IHS is developing the second database, which provides references in the literature on experiences with urban environmental management.

Rotterdam Seminar

The Rotterdam Seminar, which took place in May 1996 during the two weeks preceding Habitat II, brought together all principal researchers, as well as city representatives and other professionals involved in the project for a period of intensive discussions. The seminar resulted in a document that provided a comparative analysis of practices and experiences in the field of urban environmental management. This analysis included the project process and network building, governance, job creation and poverty alleviation and gender. This was published as a book in February 1997 and is listed later in the *Introduction to the Project Papers*.

The Rotterdam seminar also discussed *city-level capacity building strategies* for the cities of Calcutta, India; Ilo, Peru; Santa Cruz, Bolivia and Dakar, Senegal. Experiences in *urban environmental management* were reviewed for the cities of Tilburg, The Netherlands and Nairobi, Kenya.

Habitat II

At Habitat II the project was presented in the Special Meeting on Implementing the Urban Environment, organised by UNEP and UNCHS, as well as in other fora.

Capacity Building Strategies for Peru, Bolivia, India and Senegal

The outline capacity building strategies which were developed in preparation for Habitat II (i.e., by CIUDAD, PROA, HSMI and IAGU with the support of IHS). They are being modified for implementation, which is expected to begin late in 1997.

Outline Training Program for Local Officials, CBO Workers, and other Partners for Peru, Bolivia and India

These training materials are to be developed over the next few months and will comprise curricula for short courses related to the most directly applicable Best Practices identified for each country in view of its national strategy for capacity building in urban environmental management.

The Development of a Medium-Term Capacity Building Strategy for Senegal and West Africa

This activity is in progress and addresses the building of individual and institutional capacities at the local level for urban environmental management in both Senegal and throughout West Africa.

Introduction to the Project Papers

A number of publications have appeared under the Capacity Building for the Urban Environment project. These are listed below and can be ordered from IHS or its partner organisations respectively:

- *Capacity Building for the Urban Environment*, edited by David J. Edelman and Harry Mengers, summarises the research findings of the project and the conclusions of the Rotterdam Seminar. It was published by the Institute for Housing and Urban Development Studies (IHS) in Rotterdam in February 1997;
- *Urban Environmental Management: The Indian Experience*, edited by B.N. Singh, Shipa Maitra and Rajiv Sharma, reviews the Indian experience in urban environmental management and presents all the Indian Best Practice of the project in detail. It was published by the Human Settlements Management Institute (HSMI) and (IHS) in New Delhi in May 1996;
- *Problems and Issues in Urban Environmental Management: Experiences of Ten Best Practices*, also edited by B.N. Singh, Shipa Maitra and Rajiv Sharma reports on the Indian Best Practices of the project in an abridged form. It was published by HSMI and IHS in New Delhi in May 1996, and
- *Ciudades para la Vida: Experiences exitosas y propuestas para la accion*, edited by Liliana Miranda Sara, presents the Best Practices and outline capacity building strategies for Peru and Bolivia for a Spanish speaking audience. It was published as Volume 6 in the Urban Management Series of the joint UNCHS/UNDP/World Bank Urban Management Programme in Quito in May 1996.

The objective of this series of *Project Papers*, then, is to bring to an English speaking, audience the results of the project research in Peru and Bolivia appearing in the Miranda book. In addition, the Indian research, while documented in English in the second and fourth references listed above, has not appeared as complete, individual studies. Consequently, a selection of these will also be chosen for this series. Finally, the first reference in the above list covers aspects of the research undertaken in all four countries of the project.

As a result, the selection of work appearing in the *Project Papers* includes the following:

Bolivia

- 'Urban and Environmental Reality Workshops' by Zoila Acebey;
- 'Urban Agriculture in Community Gardens' by Julio Prudencio Böhr, and
- 'Institutional and Development Framework for Urban Environmental Management in Bolivia' edited by Gastón Mejía.

Peru

- 'Defence and Conservation of the Natural Swamp Area Pantanos de Villa, Lima' by Arnold Millet Luna, Eduardo Calvo, Elsie Guerrero Bedoya and Manuel Glave;
- 'Consultation in Urban Environmental Management: The Case of Ilo' by José Luis López Follegatti, Walter Melgar Paz and Doris Balvín Díaz;
- 'Promotion of Employment, Health and the Environment, Lima' by César Zela Fierro and Cecilia Castro Nureña
- 'Environmental Sanitation and Infrastructure: The Case of the Marginal Urban Areas of the Southern Cone of Lima' by Silvia Meléndez Kohatsu, Víctor Carrasco Cortez and Ana Granados Soldevilla, and
- 'Inter-institutional Consultation and Urban Environmental Management in San Marcos Cajamarca' by Marina Irigoyen and Russeles Machuca.

India

- 'Power to the People: The Local Government Context' by the Times Research Foundation;
- 'Carrying Capacity Based Regional Planning' by the National Institute of Urban Affairs;
- 'NGOs/Civic Societies and Urban Environmental Advocacy' by Development Associates;
- 'Integrated Low-Cost Sanitation: Indian Experience' by Sulabh International Institute of Technical Research and Training;
- 'City-Wide "Best Practices" in Solid Waste Management in Collection, Transportation and Disposal' by HSMI/WMC of UIFW;
- 'Environmental and Health Improvement in Jajmau Area, Kanpur: Lessons and Experiences for Wider Replication' by Ministry of Environment and Forests;
- 'An Approach to Pollution Prevention in Electroplating Sector' by Development Alternatives;
- 'Integrated Study on Wetlands Conservation and Urban Growth: A Case of Calcutta's Wetlands' by Institute of Wetlands Management and Ecological Design;
- 'Sustainable Urban Development: A Case of Navi Mumbai (New Bombay)' by City & Industrial Development Corporation;
- 'Community Based Sanitation and Environmental Improvement Programme: Experiences of Indore, Baroda and Ahmedabad' by Shri Himanshu Parikh, and
- 'Institutional and Development Framework for Urban Environmental Management in India' by HSMI.

It should be emphasised here that the nineteen *Project Papers* in this series reflect the views of their authors only and have been edited to varying degrees. Initial English language editing was done by, among others, B.N. Singh, S. Maitra and R. Sharma for India and by D.J. Edelman for Peru and Bolivia. In fairness to both the authors and the publishers, they should, therefore, be characterised as working papers rather than full academic papers.

David J. Edelman, Series Editor
Rotterdam, February 1997

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Ministry of Environment & Forests, New Delhi

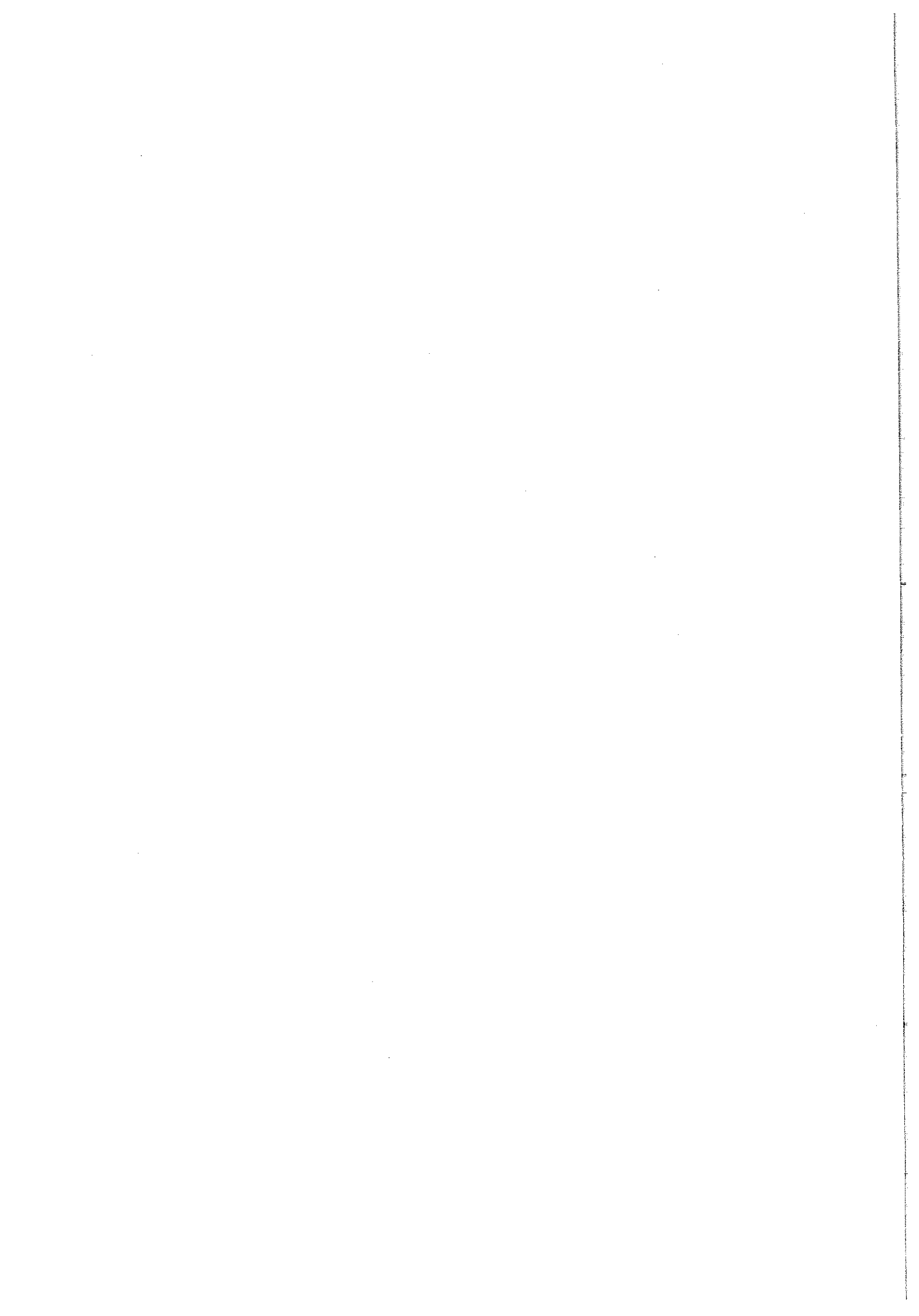
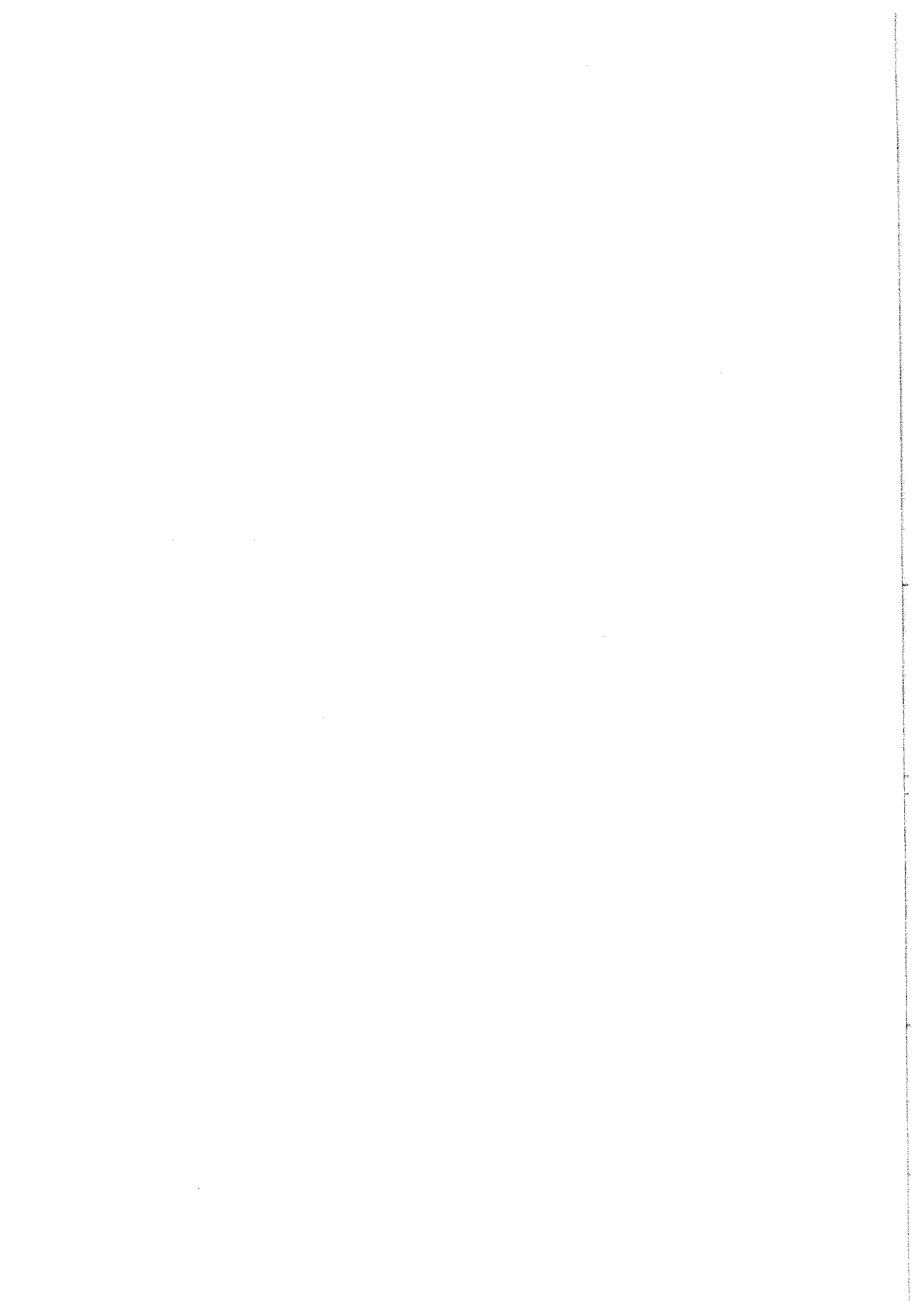


TABLE OF CONTENTS

THE THEME	1
GANGA ACTION PLAN	1
INDO-DUTCH ENVIROMENTAL AND SANITARY ENGINEERING	2
INTERVENTIONS IN WASTE WATER FROM TANERIES	7
INTERVENTIONS IN OCCUPATIONAL SAVETY AND HEALTH PROTECTION	9
SLUM AREA DEVELOPMENT: SANITAION	12
COMMUNITY PARTICIPATION	16
LOW COST SANITATION	18
GENDER ASPECT	21
STRATEGY FORMULATION FOR RIVER CLEANING PROJECTS	22
IDP/GAP EXPERIENCE – RIVER CLEANING PROJECTS	24
BIBLIOGRAPHY	28



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THE THEME

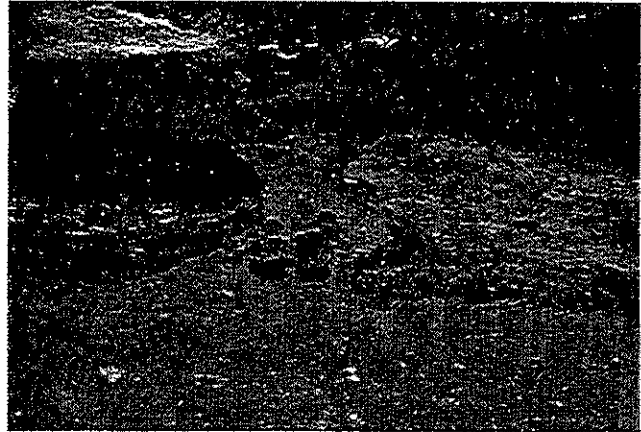
The Indo-Dutch Environmental and Sanitary Engineering Project (IDP) at Jajmau Kanpur has been taken up as part of the Ganga Action Plan (GAP), the main objective of which has been cleaning of the river water to certain acceptable levels. In the implementation of the Indo-Dutch project, emphasis has been on the integrated development of three interdependent elements namely, the river, the industries polluting the river and the low income community sending workers to the industrial units. In the process of implementation of the IDP integrated project, a number of beneficial practices, individually as well as in an integrated manner have been evolved.

The main idea of the study is to develop a theme for best practices for a typical situation that involves water body pollution arising from industries as well as hygienic and health problems of low income communities. There are situations similar to this at a number of places in the developing countries, where such programmes could be beneficially replicated. With this in view, the present report has been prepared in the following sections:

- Ganga Action Plan.
- Indo-Dutch Sanitary Engineering Project - the integrated approach.
- Interventions under the project.
- Community participation with special emphasis on gender aspect.
- Strategy formulation for river cleaning projects.
- Sustainability and institutional development for scaling up.
- Best practices replicability.

GANGA ACTION PLAN

The River Ganga is the lifeline of millions in India. It traverses a length of 2,525 kilometres from its origin in the Himalayas



In Jajmau area (Kanpur) there is heavy discharge of Industrial waste in the river.

to the Bay of Bengal and passes through the three basin states, Uttar Pradesh, Bihar and West Bengal. All along, for centuries past, the river had the cleanest of water. In the recent past, in the process of development and with the emergence of more and more urban settlements and sprawling cities along its banks leading to discharge of liquid and solid waste directly into the river with no prior treatment, has made the river water polluted below even the standards set for bathing, a major *in situ* use most of the major Indian rivers are put to.

A study was carried out in 1985 to determine pollution levels in the Ganga. It was found that the main source of pollution was due to the discharge of urban sewage from 29 cities with population over 0.1 million, 23 cities with population between 50,000 and 100,000 and 48 towns having a population of less than 50,000. These towns and cities depend on the river for potable water, *in situ* uses, fisheries and in turn discharge their waste into the river. Even the towns with sewage treatment facilities, discharge polluted waste water into the river because these treatment systems do not treat all the waste water. The bigger towns and cities were major contributors of the pollution as is evident from the fact that twenty five out of 100 towns located along the river accounted for 88 per cent of the sewage load in the Ganga. Industry in the large towns adds further, often hazardous industrial pollutants to the river. The river stretch along Jajmau-Kanpur, the area of the case study, was



found to contain the highest level of pollution with BOD ranging from 10 to 55 mg/l and DO 4 to 6 mg/l. Upstream of Jajmau-Kanpur, the dry weather flow of the river is diverted into canals for irrigation. As such there is very low dry weather river flow at this place while there is heavy discharge of industrial and municipal waste, resulting in the failure of the self-purification capacity of the river to recuperate its water quality for a long stretch downstream.

To combat this pollution, and improve the water quality all along the river, at least to bathing quality, the Ganga Action Plan was launched in 1985. The Plan is fully funded by the

Government of India and implemented by the three Basin State governments, with the Ganga Project Directorate, Ministry of Environment and Forests (MOEF), as the nodal agency. Its primary focus is on the interception, conveyance, treatment with resource recovery and safe disposal of polluting liquid wastes, including reuse, on land from the cities and towns on the banks of the Ganga. (Refer Box for the identified components of the Ganga Action Plan). Phase-I of the plan implemented between 1985 and 1995 has been successful in reducing the pollution levels of the Ganga to render it fit for bathing (BOD 3 mg/l and DO 5 mg/l).

Components of Ganga Action Plan

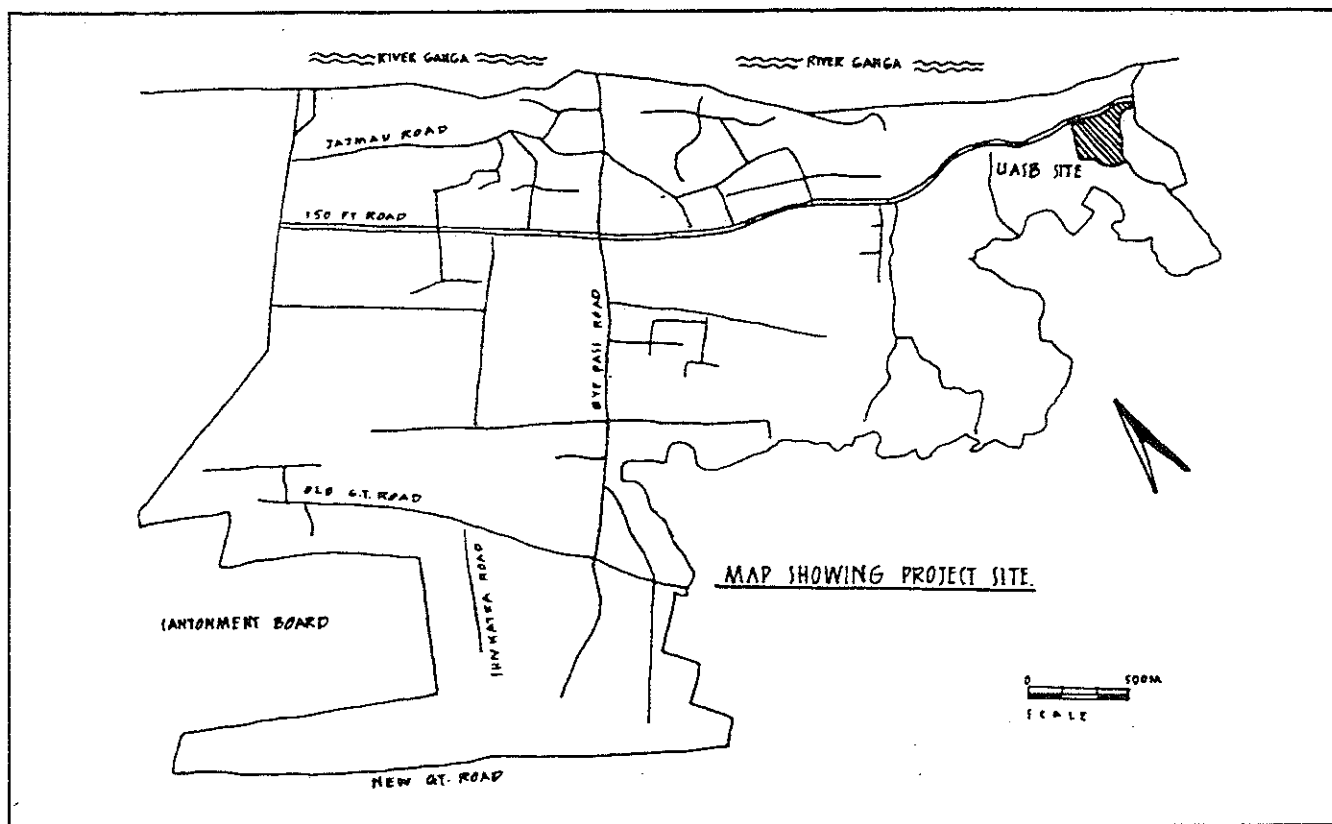
- *Renovation (cleaning/desilting/repairing) of existing sewers and outfalls.*
- *Laying of trunk sewers to tap and divert flow of sewage and other liquid wastes away from the Ganga.*
- *Providing sillage or sewage pumping stations at the outfall points of open drains, to divert the discharge from the river into the nearest sewers and treatment plants.*
- *Setting up of sewage treatment plants to treat the waste water at the outfall end of sewer line, recovering the resource in the shape of biogas, sludge, treated effluent as irrigant etc.*
- *Low cost sanitation schemes in areas adjoining the river to contain open defecation and prevent the wash off of human wastes into the river.*
- *Pilot projects to establish feasibility of innovative technologies application in the treatment of wastes and recovery and recycling of resources/energy recovery, aquaculture etc.*
- *Monitoring of gross polluting industries located on the Ganga and taking necessary steps to reduce water pollution by such units through enforcement of laws.*
- *Construction of electric crematoria along the river bank for cremation of dead bodies to prevent throwing of partially burnt or unburnt bodies into the river. The use of electric crematoria will also save considerable amount of firewood and reduce pressure on the forests.*
- *Construction and development of bathing ghats along the river at selected locations so that the river front is maintained clean and aesthetic.*
- *Biological conservation measures based on proven techniques for purification of streams and restoring the river ecology.*
- *Regular monitoring of water quality by setting up base line, trend and impact stations all along the river in 25 Class-I cities.*
- *Undertaking research for biological restoration of the river.*

INDO-DUTCH ENVIRONMENTAL AND SANITARY ENGINEERING PROJECT (IDP), JAJMAU - KANPUR

Kanpur is one of the major industrial metropolises located on the banks of the river Ganga about 800 km downstream Gangotri, the origin of the Ganga. It is one of the 25 Class-I towns

covered for pollution abatement under Phase-I of the Ganga Action Plan. The city has 175 tanneries located as a cluster along the river in the Jajmau area. The waste water from these tanneries along with chemicals used in the tanning process pollute the Ganga water. Most of the workers in the tanneries live in sordid conditions in a nearby slum area, the liquid and solid wastes from which also pollute the river water.





JAJMAU - THE PROJECT AREA

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

- located on the banks of river Ganga;
- a total area of about 900 ha;
- a major centre of the clustered tannery industry;
- 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 motorised vehicles in highly built-up areas and the north eastern part of Jajmau;
- reasonably well developed urban road network;
- in general poor road conditions except for the arterial roads;
- high traffic density at arterial roads, low traffic density outside arterial roads.

Table 6.1: Population census data of Jajmau and Kanpur city

Year	Jajmau	Kanpur City
1981	79,700	1,639,064
1991	113,806	2,029,889

Source: Govt. of Uttar Pradesh District Census handbook.

THE IDP PROJECT

Although the main objective of the Ganga Action Plan was the cleaning of the river Ganga, in Jajmau, an integrated development approach has been followed under the Indo-Dutch project of GAP with the dual objective of cleaning the Ganga and the integrated development of Jajmau covering both, the work place areas (tanneries) and the living areas with community participation. The project has been taken up under the Indo-Dutch collaborative programme and named as Indo-Dutch Environmental and Sanitary Engineering project (IDP). The philosophy behind IDP is that river cleaning efforts cannot be sustained in isolation of the people and their needs.

The main objectives of the IDP integrated development project have been as follows:

- To design and implement a sanitary engineering project with a view to reducing the pollution load of the River Ganga, by improving sanitary conditions in Mirzapur town as a whole and the Jajmau area in Kanpur, adopting an integrated approach.
- To demonstrate that by using Dutch developed UASB anaerobic waste water treatment processes, a substantial part of the energy requirements for waste water treatment can be met from the production of electricity from biogas, apart from the much lesser requirement of land, equipment and operating reliability under adverse conditions of electric supply.



- To lay special emphasis on the tanneries of Jajmau area with regard to their waste water treatment, chromium recovery at source and solid waste management and occupational, health and safety resources.
- To establish best practices and solutions using a need-based approach, with respect to the basic criteria for the technical designs in sanitary engineering projects in India, as well as the introduction of well established technical solutions in this field.
- To develop effective mechanisms for active community participation with special attention to the role and position of women. Special emphasis to be given to improvement of living conditions of the poorest communities in the area.

The IDP as an integrated approach and GAP are complementary for tackling the urban sanitation issues related to the project area by way of schemes for water supply, storm water drainage, sewerage, solid waste disposal, community participation and occupational health promotion.

INTERVENTION UNDER THE IDP

Deviating from the conventional engineering approach of solving the river pollution problem, the IDP extended its scope to areas such as urban sanitation, community and occupational health, institutional and community participation. Integration of all these was considered essential to achieve the overall IDP objectives of demonstrability and replicability. To this effect there have been technical interventions, interventions of human resource and institutional development, and interventions in community participation, each linked to the other.

Under the GAP in Kanpur, 20 schemes have been taken up in the central drainage district of Kanpur at a total cost of Rs.40.11 crores. Of these, 11 schemes in the project area of Jajmau in Kanpur are part of the Indo-Dutch Cooperation and relate to an integrated approach comprising various infrastructural and other components for Jajmau area. The cost of the Indo-Dutch Project component at Kanpur is expected to be about Rs.28.65 crores.

An important outcome of the implementation of the technical components, namely, water supply and sewerage systems, storm water drainage systems, waste water treatment, low cost sanitation and solid waste management has been to recognise that there is a strong need for close coordination, commitment and cooperation amongst all the participating institutions and the beneficiaries. In this context, the institutional and human resource development activities as well as community participation and health promotion campaigns are of vital importance. While on the subject of institutional cooperation, the role of consultants has been substantial, in terms of participatory, catalytic and financial aspects.

Though the scope of technical interventions has indeed improved the environmental and sanitary conditions in the project areas, the feedback from community participation activities

reveals that there is a definite need to further densify and improve the institutional development and sanitary provisions with an area development approach. The development priorities in such an approach should emanate from within the community itself and could contain all interrelated aspects, such as cost recovery and sustainable operationality.

The IDP interventions which have brought out significant replicable practices could be classified as follows:

I. INTERVENTIONS IN WASTE TREATMENT FROM TANNERIES

- i) Introduction of a new technology (UASB) for waste water treatment.
- ii) Chromium recovery from tannery waste and its recycling.
- iii) Common industrial waste water conveyance system for the tanneries' waste water.
- iv) Handling of tannery solid wastes and recovery of byproducts therefrom has been deferred, though recognised as viable.

II. INTERVENTION IN OCCUPATIONAL SAFETY AND HEALTH PROTECTION MEASURES FOR WORKERS IN TANNERY UNITS.

III. SLUM AREA DEVELOPMENT

- i) Water supply.
- ii) Sanitation.
- iii) Solid waste management.
- iv) Storm water drainage.

IV. INTERVENTIONS IN INSTITUTIONAL DEVELOPMENT

V. COMMUNITY PARTICIPATION

- i) Inter-relationships with technical components.
- ii) Support to area level organisations (ALOs).
- iii) Health related aspects.
- iv) Hierarchical linkages at tactical and operational level community, through change agents and NGOs to local bodies.

VI. DEVELOPMENT OF WOMEN

Training of community womeefolk as plumbers, handpump mechanics, masons and fabricators of FRP toilets, and importantly mothers in poorer communities to contain child morbidity and immunisation.

Each programme/scheme has been analysed to be demonstrative of replicability practice under the following heads:

- i) Background/pre-project condition.
- ii) Programme/scheme implementation experience.
- iii) Evaluation.



INTERVENTIONS IN WASTE WATER FROM TANNERIES: INTRODUCTION OF A NEW TECHNOLOGY

BACKGROUND

Jajmau in Kanpur is one of the most important centres for tanneries to provide leather as raw material and finished leather goods to the Kanpur metropolis as well as for export of footwear and leather goods. The leather industry which is one of the major foreign exchange earners, is often seen from a critical viewpoint for its environmental pollution. During a survey carried out in 1988 in Jajmau by CLRI, there were 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. Including the domestic waste, present and future waste water generation beyond 2001 has been estimated to be 13.5 mld and 20.3 mld respectively.

Under the Ganga Action Plan various technologies for the treatment of domestic waste water and treatment of tannery waste water from the industrial area were tested. As part of the approach, a comparatively newer Dutch technology was introduced at Jajmau for treatment of domestic and tannery waste. The technology is known as Upflow Anaerobic Sludge Blanket (UASB). The UASB system is based on the upward flow of waste water through a sludge layer of active anaerobic micro organisms. (Refer Box for UASB Technology).

ADVANTAGES OF UASB TECHNOLOGY

Some major advantages of UASB technology have been found to be as follows:

- A UASB treatment plant has very few mechanical components, which makes it a system with very low degree of maintenance requirements and it is highly rugged and reliable.
- The energy requirements of a UASB reactor are very low. Instead, it produces energy in the form of biogas which is rich in methane content and has a higher calorific value.
- Even after long sewage feed shutdowns and power breakdowns, the anaerobic purification process starts immediately and no specific operations are required to be executed and can thus stand prolonged shutdowns and can buffer moderate hydraulic shock loads.
- UASB treatment plant has reduced space requirement which is 0.17 ha/mld that is, one fifth of the usual oxidation pond and half that of activated sludge process.
- Sludge from a UASB reactor dewateres quickly, is nonfoul and has good fertiliser value.

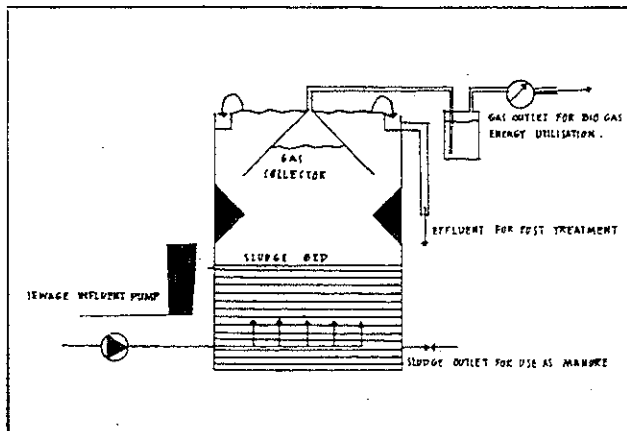


Fig-6.1 Schematic of UASB Reactor

THE PRINCIPLES OF UASB SYSTEM

- The UASB-system is based on the upward flow of waste water through a sludge layer of active anaerobic micro-organisms, thereby packing a large solids residence time in a much lesser reactor volume than the known anaerobic processes.*
- The waste water is equally distributed over the bottom of the reactor.*
- The contact between the micro-organisms and the organic material in the waste water is enhanced by the biogas production as this provides gentle mixing, while the bottom portion of blanket filters the suspended sewage solids.*
- After passing through the sludge bed, the mixture of biogas, sludge and water enters a three-phase separator.*
- The biogas is separated in a gas-collector, whilst the sludge-water mixture enters a settling compartment.*
- Digested sludge particles which are mineralised biomass can settle in the settling compartments and flow back into the digestion compartment, thus providing effective sludge retention in the reactor.*
- The effluent is discharged via an overflow weir to the polishing pond for further treatment.*
- The system produces biogas.*
- Easily dewatered excess sludge can be used as manure.*



- f) The UASB treatment system is lower in investment and life cycle costs compared to conventional aerobic systems. Presently (1995) the cost is around Rs.16 lakh/mld of sewage without post treatment and 19 lakh/mld with post treatment for meeting the GAP standards for river discharge.
- g) The cost per mld for tannery cum domestic waste treatment plant worked out to Rs.52 lakh per mld but this is also comparatively cheaper than the conventional aerobic treatment for such tannery waste water, on life cycle costs due to low O&M costs and resource recovery.
- h) The O&M costs of the UASB technology is much less than the aerobic treatment process since power consumption is negligible and power generated from biogas utilisation adds sustainability to the revenue of the waste water treatment plant.
- i) The replicability of this technology is demonstrated, by adoption of this technology in 18 STPs in the Yamuna Action Plan, after careful examination by Japanese Aid Agency OECF.

For the first time UASB technology was introduced in the country under GAP and the benefits of this were not available earlier.

SCHEME IMPLEMENTATION EXPERIENCE: EXPERIENCE OF 5 MLD UASB TREATMENT PLANT AT JAJMAU

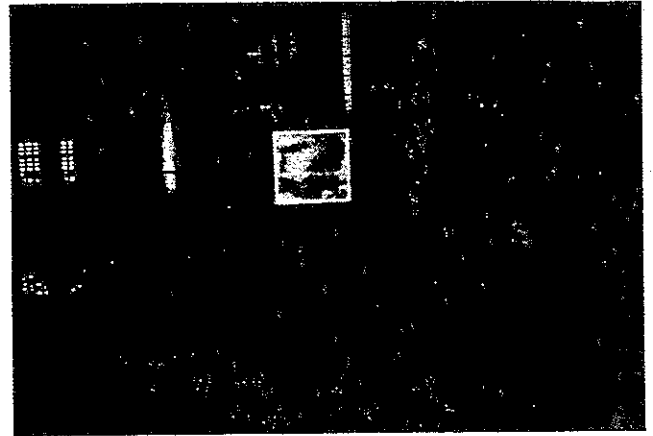
In the initial stages of the project a 5 mld UASB treatment plant for domestic waste water was constructed to demonstrate the viability of the UASB technology under Indian conditions. The performance of the plant was monitored over a period of one year. A joint evaluation mission comprising the experts of India and the Netherlands evaluated the performance of the plant and positively recommended the application of UASB technology for domestic waste water treatment with appropriate post treatment to meet GAP treated sewage standards that is, less than 30 mg/l BOD at 20°C and less than 50 mg/l of suspended solids in the treated sewage.

EXPERIENCE OF UASB PLANT FOR TANNERY WASTE WATER

Based on the results of UASB treatment plants for industrial waste waters elsewhere in the world, it was decided to construct and monitor a pilot plant for treatment of a mixture of tannery and domestic waste. Based on the monitoring results, it was concluded that 1:3 dilution of tannery waste water with domestic sewage was treatable with other control conditions. On the basis of the findings of this pilot reactor, a full scale 36 mld UASB plant has been constructed at Jajmau.

EVALUATION FOR COST EFFECTIVENESS: FINANCIAL ASPECT OF UASB WASTE WATER TREATMENT PLANT

A cost comparison study of sewage treatment plants which have been constructed under the GAP revealed that the investment



The chromium recovery system separates sludge from the liquor for reusing the chrome liquor.

costs for a UASB treatment plant are significantly lower than those of conventional activated sludge process aerobic treatment systems. Cost comparisons between UASB and normal ASTP had also revealed that per mld, gross capital cost (including land cost) for UASB plant was working out to about 70 percent to 80 percent of the gross capital cost in the case of ASTP plant, after considering the O&M costs.

The experience also revealed that the potential resource recovery including biogas and effluent for irrigation alone can cover fully the operating and maintenance costs. In the case of 5 mld UASB plant, this has been estimated at Rs.5 lakh per year (1994):

- a) The anticipated biogas production of the 5 mld UASB plant is estimated as 0.1 m³/kg. COD removed (COD: Chemical oxygen demand mg/l).
- b) The sludge production of the 5 mld UASB plant is above 0.3 kg ss/kg COD removed.
- e) Raw waste water has been applied to the sewage farm for irrigation of crops at an average load of 130 mld. Thus about 2000 acres of land has been brought under cultivation. With this, the Kanpur Nagar Municipality is now leasing the land to farmers for an increased price of Rs.1000/acre per year.

Designing of STPs under an OECF funded programme for cleaning the Yamuna river are now being based on UASB technology after a very thorough evaluation and plants inspection at Kanpur and Mirzapur by two Japanese expert missions in June and September 1995.

INTERVENTION IN WASTE WATER FROM TANNERIES: CHROMIUM RECOVERY AND ITS RECYCLING

BACKGROUND

Of the 175 tanneries in Jajmau, 87 tanneries are partly or completely adopting chrome tanning. The total quantity of



chrome tanning compound applied in Jajmau amounted to 10,000 kg. per day which is equivalent to 1700 kg. of pure chromium. According to the survey only 70 percent of the chromium is taken up by hides which means that every day 1 tonne of chromium is wasted, mostly via the waste water. It is also expected that in future more and more chrome tanning will be applied. Although the trivalent form of chromium which is used in tanneries is less toxic and less dangerous than hexavalent chromium, it is desirable not to spread chromium in the soil or water resources.

SCHEME IMPLEMENTATION EXPERIENCE

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

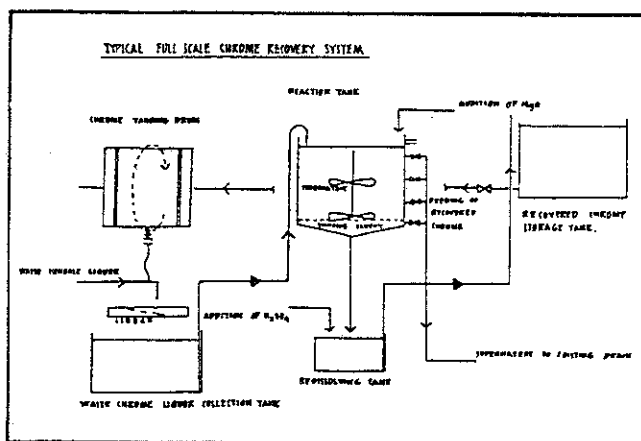


Fig-6.2 Typical full scale chrome recovery system

Experiments with hides tanned with 70 percent fresh chromium and 30 percent recycled chromium showed that the leather has the same quality as leather tanned with 100 percent fresh chromium. Because of the relatively simpler process and low investment costs, the chrome recovery system has been found to be appropriate for tanneries of any size.

TRAINING OF TECHNICIANS AND CHEMISTS

The technicians and chemists designated by the respective tannery owners for the operation of the plants were given adequate training during commissioning and trial runs of the plants. The technical personnel of the chrome tanning section were also trained in adopting the modified tanning system using regenerated chromium.

EVALUATION FOR COST EFFECTIVENESS/REPLICABILITY

After successful introduction of the pilot plant at one of the tanneries, five subsequent units were constructed at five other

tanneries in Jajmau. At various stages of development, the design was optimised and suitable construction materials selected. With innovations, costs of operation, maintenance and investment was reduced. A typical cost benefit analysis of chromium recovery plant is shown in the table 6.2:

Table 6.2: Cost benefit analysis of chromium recovery and reuse (based on January 1992 rates)

i) Tannery processing capacity	5 tons of hides/day 1250 tons hides/year
ii) Use of chromium salt	Rs.3,50,000
iii) Annualised operating and capital cost of the chromium recovery plant including depreciation	Rs.2,47,500
iv) Value of chromium recovered @ Rs.18,000 per ton for 30 tons	Rs.5,40,000
Net profit per year after break even period	Rs.2,93,000

Source: Environmental and Sanitary Engineering Project in Kanpur and Mirzapur - Draft Final Report.

The payback period for the chrome recovery plant is estimated to be less than three years. Realising the cost effectiveness of such a recovery system, six tanneries have so far set up chrome recovery plants having witnessed the pilot plant functioning. But the remaining chrome tanners are not taking the cue and are waiting for Dutch aid for this profitable activity too. They appear to be disinclined to even contribute their share for a revolving fund with equal state loan to create chrome recovery plants on soft repayment terms. It is time now that UPSPCB and the UP Government and its department of environment coerce these tanners through legal actions, to contribute their share or set up chrome recovery plants before scheduled dates, failing which they may be prosecuted.

INTERVENTIONS IN WASTE WATER FROM TANNERIES: COMMON CONVEYANCE SYSTEM

BACKGROUND

In Jajmau, the waste water which originated from the tanneries was either discharged into the sewer system or via various factory outlets, via roads, drains and nalahs to the river Ganga. As per present regulations, waste water with BOD of more than 500 mg/litre is not allowed to be discharged into the public sewer system. Therefore, individual tanneries had to set up fullfledged biological treatment units with sludge dewatering



arrangements within their premises to meet those requirements. The land needs, capital investment and operations and maintenance costs for these individual ventures would have been high for all tanners and for most of the smaller units non feasible/prohibitive. At the same time it would have been rather difficult for the statutory pollution control boards to monitor the continuous and satisfactory operation of all treatment units and ensure compliance of tannery waste treated water effluent quality of all the tanneries on a continuous and representative basis. Sludge originating from these treatment plants had to be disposed of in an appropriate way. Such sludge would still have had a very high BOD requiring further treatment while it would also be contaminated with chromium. Hence for an individual tannery in Jajmau, total treatment for river/public sewer discharge is a non feasible proposition. Under the circumstances, it was decided that tanners would setup only pretreatment facilities in their premises as per the Supreme Court directions and the tanners were to share the cost of common conveyance and treatment for the entire complex in proportion to their pollution load, where state funds are also provided. In a nut shell, a common ETP was to be established on 'polluter pays' principle.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

A separate waste water collection system was designed and constructed to convey all waste water generated from the industrial belt of Jajmau including 2.7 mld of domestic waste water and 8.8 mld of tannery waste water. For ease of maintenance, a surface gravity conveyance system was selected with removable top slabs. Four pumping stations and a common rising main were installed to pump the mixed tannery waste water to a common treatment plant located outside Jajmau town down stream of the river Ganga.

All tanneries were provided with screen/collection chambers located on the tannery premises and connected to the common conveyance system. The tanneries have to convey all their waste water into the respective screen chambers either by gravity or pumping and subsequently demolish or plug all the other remaining waste water outlet drains. They were also to pretreat these wastes as per the Supreme Court directions.

EVALUATION

After the common conveyance system was implemented, a survey to find out its effectiveness was conducted which revealed that 64 per cent of the tannery units were connected to the system with screen chambers, 30 per cent connected directly without screen chambers and 6 per cent did not connect. UPJN jointly with the UP Pollution Control Board are presently in the process of getting the remaining tanneries connected via project screen chambers. All operating units were meeting the Supreme Court directions for pretreatment facilities, as per the latest affidavit of the State Pollution Control Board.

HANDLING OF SOLID WASTE AND RECOVERY OF BY PRODUCTS

BACKGROUND/PRE-PROJECT CONDITION

Jajmau tanneries generate daily about 400 tonnes of solid wastes. Though most of these are utilised for various commercial purposes, the present unhygienic way of collection drying, transportation, spillage, wastage, ineffective utilisation and difficulty in disposing them during the monsoon etc. causes serious environmental pollution problems in Jajmau. The types of solid wastes generated from Jajmau tanneries and their quantity is given in table 6.3:

Table 6.3: Solid Waste generated from Jajmau tanneries.

Type of waste	Quantity (tonnes/day)
Raw hide trimmings and waste	10-15
Dusted/wasted salt	6-10
Hair	Very small quantities
Fleshings and pelt trimmings	30-50
Sludge from lime pit	15-20
Vegetable tanned barks/nuts	200-300
Vegetable tanned trimmings	2.5-3.0
Chrome shavings	6-8
Chrome trimmings and finished leather pieces	2.5-3.0
Buffing	0.5-1.0
Sludge from pre treatment units	50-60 (Expected)

From the above Table 6.3, it is clear that three categories of solid wastes form the major problem from the quantitative point of view, namely fleshings, bark and sludge.

FLESHINGS AND PELT TRIMMINGS

The fleshings cause foul smell and other problems in the area owing to slow drying rate. Furthermore a great part of the fleshings have to be transferred to far off places. Transport of wet fleshings over long distances, which takes place in open trucks, becomes very expensive, offensive and difficult to carry because of the high moisture content and putrefaction effect.

BARK

In Jajmau some 50 tanneries process about 100 tonnes of cow and buffalo hides per day, adopting vegetable tanning using bark and nuts for this process. About 100 to 150 tonnes of bark and 40-60 tonnes of nuts are used and exhaust bark and nuts are discharged as solid waste in wet conditions which



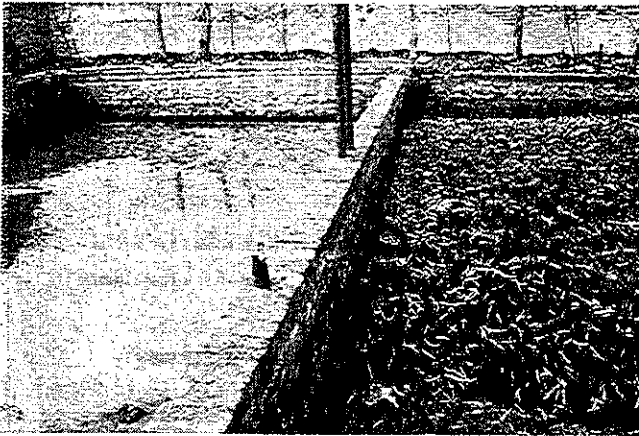
amounts to about 250 tonnes per day. The main environmental problems assessed in the whole process are as follows:

- * Dust generation during the crushing of barks and nuts.
- * No provision to protect workers from dust.
- * For drying wet exhausted bark the whole tannery open areas and pathways outside the premises are used.
- * All areas where the bark is stored produce a stench.

The bark is used as fuel in boilers, however the bark having a loose composition and high moisture content burns very inefficiently.

SLUDGE FROM PRETREATMENT UNITS

Many tanneries have constructed pretreatment systems. In the event of proper operation and maintenance of primary treatment units by the tanneries a large amount of sludge will be generated. After partial drying in sludge drying beds 50-60 tonnes of sludge with 50 percent moisture are expected to be generated from the pre treatment units which will be loaded with chromium, which can be avoided only by chrome recovery plants.



Pre-treatment plants generate large amount of sludge.

PROGRAMME/SCHEME

Extensive surveys and preparatory works were carried out and proposals have been prepared. However the scheme is to be taken up in Phase-II. This scheme has essentially to be an integral part of the project. The daily generation of three to four hundred tonnes of sludge, fleshings and bark continues to affect the environmental and living conditions of the population of Jajmau until improved handling and processing methods are introduced on a full scale. In addition some of the solid waste

is dumped directly into the Ganga or reaches the river via various drains and nalahs. It is demonstrated that vast improvements could be achieved by the introduction of economically and financially viable alternatives.

BARK BRIQUETTES

The technology of agro wastes is available in India. A volume reduction of bark seven to eight times can be achieved by the direct briquetting method without additions. Apart from being a energy source, the cost of briquettes is half that of coal.

GLUE

Processing of dried fleshings into a low quality glue is already done in Jajmau and elsewhere in India (e.g. Bhopal). However the drying of fleshings is causing environmental problems. Hence the method of wet processing into a high quality glue has been proposed for the solid waste management in Phase-II.

SLUDGE

Primary treatment at tanneries consists mainly of alum dosing, precipitation and sludge drying. Sludge originating from the primary treatment plants at the tanneries is highly organic. Thus it is recommended that before final disposal the sludge should be further treated.

INTERVENTIONS IN OCCUPATIONAL SAFETY AND HEALTH PROTECTION MEASURES FOR WORKERS IN TANNERY UNITS

BACKGROUND/PRE-PROJECT CONDITIONS

To assess the preproject conditions on the occupational health a survey involving 605 tannery workers was conducted by ID consultants which revealed certain salient facts.

PREVALENCE OF SYMPTOMS

At the time of examination 57.3 percent of workers reported one or more symptoms. The most common symptoms being backache (16.9 %), cough with expectoration (19.5%), skin lesions (10.4%), difficulty in breathing (5.8%), common cold (9.8%) and watering/redness of eyes (5.0%). The majority of the common symptoms as mentioned were related to work exposures or work postures.

PREVALENCE OF MORBIDITY

The number of workers found to be suffering from some form of occupation related morbidity was 26.4 percent. The major forms of occupational morbidity were lumbar backache posture related (15.5%), respiratory irritation due to workplace dusts/gases (3.8%), conjunctival irritation (3.0%), contact dermatitis (2.5%), occupational asthma (2.2%), and skin/nasal chrome ulcers (2.0%).



ACCIDENTS

About 20.1 per cent of the workers gave a history of having suffered an accident at some time while working in the tanneries, and 11.3 percent stated that they had suffered an accident within the last one year, 5.4 percent during the period from five years back to one year back and 3.4 per cent prior to five years ago. The common types of accidents reported were falls (9.0%) machine cuts (3.0%), knife cuts (2.6%) and machine amputation (1.8%). The occurrence of accidents was high in the beam house (26.7%) and tanyard chrome (26.9%) sections, compared to tanyard vegetable (20.3%), finishing (19.0%) and other sections (9.3%).

MEDICAL AID

The common sources of medical aid in case of accident were private practitioners (9.3% of all workers having availed of their services subsequent to an accident), ESI dispensary hospital (6.6% of all workers) and tannery first aid services (3.8% of all workers).

THE PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

Based on the findings of the situation analysis, an intervention programme was formulated by the project. The programme was executed under the responsibility of the Kanpur Nagar Mahapalika and aimed at diminishing the risk of occupational health hazards. Support was provided to Kanpur Nagar Mahapalika by Kanpur Medical College, project staff, the Regional Labour Institute and the Directorate of Factories. The programme interventions are as follows:

FIRST AID AND SAFETY TRAINING TO TANNERY WORKERS

Tannery workers are trained in first aid and safety measures to be followed in tanneries. Other actions carried out are

- i) workers interested in the environmental issues related to tanneries to be stimulated,
- ii) awareness programmes conducted about the environmental effects of the handling and disposal of hazardous substances,
- iii) unsatisfactory conditions at certain work stations like grinding, spray painting, buffing section etc. to be improved,
- iv) first aid kits frequently examined for their proper use and replenishment of contents.

WORKSHOP ON OCCUPATIONAL AND ENVIRONMENTAL HEALTH AT JAJMAU

A workshop on occupational and environmental health improvements at tanneries in Jajmau Kanpur was held from 5 to

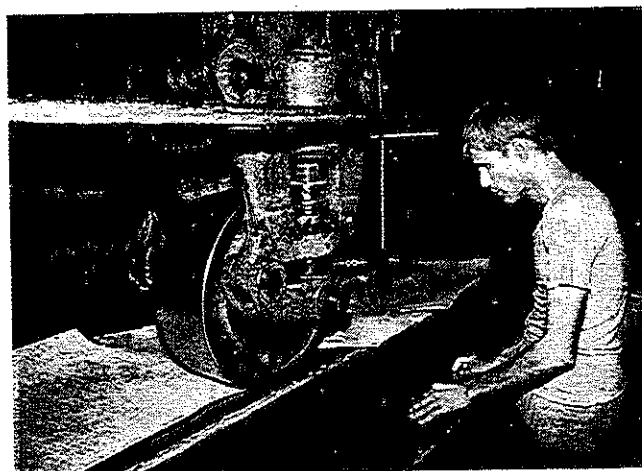
9 March 1990. The workshop made a number of suggestions on the subject, some of the important ones being

i) Formation of safety councils in tanneries

This is to include tannery workers who have been trained in first aid and also representatives from the management. The safety council to regularly meet to review health and safety measures.

ii) Machine protection/workshop improvements

In view of the fact that the primary hazard analysis has revealed certain hazardous work situations in tanneries, it was recommended that machine working stations (grinding, chrome tannery drains, buffing of hides, staking machines, spray painting section) should be rendered safe for working by installation of protective measure/devices. It was also recommended that a suitable engineering consultancy firm which normally renders such types of services to tannery owners should be contracted for designing machine protective devices.



Improved machines are designed for prevention of accidents

iii) Medical treatment for follow-up survey

The surveys should be carried out and attempts made to get all the eligible workers registered for Employees Scheme for Insurance (ESI). Also the services of ESI should be maximally utilised.

EVALUATION

Following the recommendations of the workshop, the programme has been successfully completed and some tannery owners have implemented improvements in their tanneries. Another positive effect of the occupational health programme was the inclusion of occupational health as one of the main elements for industrial counselling in the framework of the bilateral collaboration on environmental protection between the Government of



India and the Government of the Netherlands. The evaluation of the occupational health programme in the framework of the overall evaluation of the project yielded positive results. Yet a study is required to be carried out so far to measure the long term impact of the occupational health programme. This aspect is of crucial importance in view of the replicability of the programme and for design of future activities.

SLUM AREA DEVELOPMENT: WATER SUPPLY

BACKGROUND/PRE-PROJECT CONDITIONS

The existing water supply system for Jajmau was 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 system covers most of the area, with individual connections for 47 percent of the population and from public stand posts 10 percent of the population. The remaining population obtained water from other sources like handpumps, the shallow open wells. The handpumps lacked proper maintenance, the shallow dry wells supply water below quality and also tend to dry up in the hot season because of insufficient depth.

Though much of the distribution system was new, its operation was far from satisfactory. Water supply was intermittent with sometimes three hours of low pressure supply per day; the revenue received was only for 20 per cent of the water produced. In addition there were numerous illegal connections, which in general, have been constructed poorly, a situation which adds significantly to the losses due to leakage from the system. The survey indicated that unaccounted water amounted to approximately 40 percent of the water produced of which 25 percent was due to illegal connections.

Operation and maintenance is the responsibility of the Kanpur Jal Sansthan (KJS). The water works under KJS include pumping stations, treatment plants as well as distribution network. The procedure of getting a regular connection is time consuming and discouraging because of the long distances between the central office and Jajmau, leading to illegal tapping. In case of regular connections, meter reading, billing and collection carried out by KJS required a lot of improvement.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

As an initial step, an extensive survey was carried out to assess the condition of the available water supply assets, as well as the amount of water lost through leakage and wastage. Based on the information obtained, a crash programme was formulated to augment the number of handpumps with 180 units with simultaneous construction of three new tubewells and regeneration of two existing tubewells. The new tubewells were connected to the respective overhead tanks by pressure lines.

For the design of the water supply system, the following criteria were adopted:

* Average water consumption for standposts	27 lpcd
* Average water consumption for house connections	150 lpcd
* Seasonal peak factor	1.3
* Daily peak factor for hourly consumption	2.0
* Waste water generation factor	0.7
* commercial and institutional demand as percentage of total demand	3%
* Industrial demand at year 2021	7300 m ³ /day

EVALUATION

With increased water supply infrastructure, the number of daily supply hours in Jajmau went up substantially. However the problems of illegal connections of households continued to remain, the cost of illegal connection is about seven times lower than an official regularised connection. In spite of this the Kanpur Jal Sansthan performance in Jajmau area compared with the rest of Kanpur before and after project intervention showed impressive performance.

Table 6.4: KJS Performance comparison of Jajmau and rest of Kanpur

	Jajmau		Rest of Kanpur	
	1987	1993	1987	1993
- Number of houses assessed for ARV	8900	12600	-	-
- Number of registered house-connections	3400 (a)	7398 218% of (a)	42509 (b)	4762 1 112%
- Revenue collection (in Rs.lakhs per annum)	8.5	19.3	362.0	581.5

Source: KJS

The member of registered house connections in Jajmau grew by about 118 percent while the figure for the rest of Kanpur city grew only by 12 percent. The annual revenue collection performance in Jajmau more than doubled (127% growth) over the project period while the rest of Kanpur grew by 60 percent.



SLUM AREA DEVELOPMENT: SANITATION

BACKGROUND/PRE-PROJECT CONDITIONS

Sulabh International carried out a survey on behalf of the project to assess the existing sanitation service levels in Jajmau, Kanpur. The survey covered 1724 households out of a total of 20,445 households. The results of the survey are shown in Table 6.5:

Table 6.5: Status of Sanitation at Jajmau in Kanpur based on a survey in 16 sample areas

Category	Actual HH	Latrine with conn. to pits/tanks	Latrine with conn. to sewers	Dry/bucket latrines	No latrines	Total HH sample areas
1.	4156	29	18	110	199	356
2.	844	7	49	5	137	198
3.	2858	17	63	10	341	431
4.	8113	43	119	81	242	489
5.	4474	-	249	-	1	250
Total	20445	100	498	206	920	1724

The survey indicated that more than half of the households had no latrines at all while 65 percent have substandard latrines.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

To gain experience by evaluation related to implementation, public acceptance and performance, in the first instance a crash programme was formulated which included the following:

- Conversion of 88 bucket latrines
- Construction of 55 new latrines
- Construction of 4 community sanitation blocks with 10 seats each.

After the success of the crash programme, to provide access to sanitation to the total population the following programme was carried out:

	Number	Population covered 1987
- Private on-site latrines	2430	12490
- Private off-site latrine	2366	12161
- Public latrine complexes	12(140 seats)	7000
- Sewer connections	14287	73437
Total		105088

Low cost pour flush latrines were included in the programme. Depending on the presence of the sewers, these latrines were either connected to leaching pits or to the sewers. For those people who can not afford private latrines or do not have sufficient space in their premises, and for the floating population public latrines were constructed.

Three types of private on-site latrines were designed for various numbers of users namely 10,15 and 20 users. After a survey it was revealed that the actual number of users of private latrines hardly exceeded 10 in all cases. Subsequently about 95 percent of the private on-site latrines had soakage pits with a capacity of 10 users. The existing unhygienic bucket latrines were all converted into either on-or-off or off-site sanitary pour flush latrines with water seal and connection to either soak pits or sewer system.

The sewerage system of Jajmau was laid out to cater to the population for the year 2021 which is estimated to be 181192. It was experienced that by and large the houses with private water supply connections were taking sewer connections at their own cost. At some locations public pressure to connect to the newly laid sewers was so high that certain sewers had to be commissioned before hydraulic testing could be completed.

The community sanitation blocks are operated and maintained by Sulabh International on a pay-and-use basis, which charges male adults a nominal fee. The private off-site latrines are to be maintained by the house owner who only once in a few years has to empty one of the two soak pits on an alternate basis.

EVALUATION

The project provided sanitary facilities to the entire population. But the Jajmau population grew from 105088 in 1987 to 165,000 in 1993 an increase of 65 per cent in 6 years which was not anticipated. *Perhaps a lesson for pilot projects in big cities can be learnt that if integrated infrastructural improvements are implemented in only a small part (5%) of the city, an additional population growth has to be anticipated possibly due to improved services. Even tannery owners, that is, families with higher income are setting up their residences inside the Jajmau area.*



Monitoring and evaluation revealed that non provision of superstructure in low cost sanitation is a major bottleneck in their usage. Therefore it could be recommended that in low cost sanitation (LCS) programmes, construction of superstructure and water supply needs to be included in the total package.

A unique feature of the LCS programme has been the training and involvement of women masons in the construction of LCS facilities. This has enhanced the involvement of women in development work, community mobilisation, income generation for women and resulted in good quality work.

SLUM AREA DEVELOPMENT: SOLID WASTE MANAGEMENT

BACKGROUND/PRE-PROJECT SITUATION

In the pre-project situation solid waste collection and disposal was in a two stage system. In the first stage of primary collection, the 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 of waste collection, the waste is transported by tipper trucks to disposal sites. The loading of the trucks is done either manually or mechanically.

Within Kanpur Mahapalika two departments are involved in solid waste collection and disposal, for example, Health Department and City Cleansing. The 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 for the disposal of wastes.

In general, the pre-project solid waste management in the Jajmau residential area was very poor and numerous piles of refuse are scattered all over the area. Domestic solid waste is usually thrown on the streets from where it is supposed to be collected by road sweepers. About 194 sweepers are deployed and 40 handcarts are in working condition. As per the norms of KNM there is a shortage of 100 sweepers and 110 handcarts.

Loading of trucks by front end loaders is very slow and often causes traffic jams in crowded streets. The loading of most trailers and mini tractors 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 estimated total quantity of solid wastes generated in Jajmau excluding reused tannery waste is tonnes per day is as shown in Table 6.6:

Table 6.6: Estimated total quantity of solid waste generated at Jajmau

	1987	1991	1995	2001
	105000	120000	140000	175000
Domestic solid waste at 0.5 kg/cap. day	55	60	70	90
Roadside drain cleaning	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.

The pre-project method of disposing solid waste creates many health risks for the population and gives disease vectors like flies and vermin a chance to breed.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

The solid waste management proposed scheme consisted of five basic elements:

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

Accordingly the programme had the following highlights:

- i) The population is to bring the waste outside the houses into the roadside bins. Sweepers collect the domestic solid waste from these bins in their handcarts and dispose of it in containers. This handcart system is called primary collection.



- ii) As a secondary collection, a dumper placer system is used for collection of the containers and for the transfer of solid waste to the disposal sites.
- iii) At the disposal sites a sanitary landfill operation is carried out with equipment like tractors with dozer blades.
- iv) Roadside drains and gully pits are cleaned by the same sweepers. Each sweeper is given the responsibility for cleaning one area.
- v) Commercial waste is placed by the producers directly in the containers.
- vi) For hospital waste, handcarts, bins and an incinerator are proposed.
- vii) In order to keep operations as hygienic as possible, a truck and the use of canvas slings are suggested for the removal of animal carcasses.
- viii) 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.

Evaluation

The experiences gained during Phase-I in three pilot areas were very useful in planning for solid waste management in the whole of Jajmau. The experiences can be summarised as follows:

- i) The programme was successful and improved the solid waste management situation considerably.
- ii) The assignment of area responsibility to sweepers instead of a task responsibility has greatly facilitated the accountability of sweepers' performance.
- iii) The condition of areas in terms of paved road and provision of proper drainage system greatly influenced the performance of solid waste management. Handcarts proved difficult to move on unpaved 'bumpy' roads, while undrained ponds and depressions were not cleaned by sweepers.
- iv) Some kind of institutionalised incentive system in the more deprived/poor areas proved very useful like 'Best sweepers of the year' award or just some direct payment by the public. In the more well to do areas, such an incentive system was already in practice.

- v) As Jajmau has a shortage of 100 sweepers as per KNM norms, some areas have to be cleaned on a contractual basis. Experience showed that contractors recruited from the benefiting community itself though mandals proved much more successful than contractors coming from outside the target areas.

INSTITUTIONAL DEVELOPMENT

BACKGROUND

The strength, capacity and quality of local institutions dealing with the provision of services such as water, sewerage, solid waste is of paramount importance for the sustainability of the project interventions. While local level agencies directly deal with project implementation, national and state agencies provide policy guidance. The important institutions covered in the project are UP Jal Nigam (UPJN), Kanpur Jal Sansthan (KJS), Kanpur Nagar Nigam (KNN).

Institutional development aims at providing a mechanism within the project area so that the efforts can be sustained even after the capital investment on the project are gradually withdrawn. Thus the institutional development in the present context is the process to enhance the capacity and capabilities of the responsible agencies concerned with the eventual operation and maintenance of the environmental and sanitary facilities provided under the project. It consists of the following:

- i) Institutional strengthening - a process which aims at the establishment of the necessary infrastructure (staffing, budgets, equipment, materials, etc.) to carry out its task.
- ii) Training, which is a method for human resource development and improvement of the capabilities and skills of the different layers of staff responsible for operation and maintenance of the schemes.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCES

Under institutional development, programmes for the establishment of O&M systems for each scheme with financial and staffing implications were drawn up in consultation with the agency concerned.

The training was seen as a means of improving the inter-relationship within the various municipal agencies and the relationship between the implementing agencies and the beneficiaries. A series of courses were arranged for

- i) The latest information on a broad range of low cost, easy to use and appropriate technologies in the field of environmental and sanitary engineering.



- ii) Good project management education in public health and hygiene and community participation - essential for the success of water supply and sanitation components of the project.
- iii) Importance of involving those who will actually use water supply and sanitation facilities taking into account relevant socio-economic and cultural factors. This was accomplished by using different techniques for communication with small and large groups of the community in the project.
- iv) Targeted selected information dissemination to engineers and other professionals, field staff, and government decision makers. Training activities were carried out to strengthen institutional development of these agencies, so that effective operation and maintenance of the new facilities to be installed under this project is ensured.

The training activities were directed - (i) at the policy level to involve key decision makers, (ii) at the management level to involve general managers, engineers involved in day to day management, (iii) at the technical level to involve the engineers, operators and skilled workers, and (iv) at the beneficiary-level to involve the users of facilities and the community in general.

EVALUATION

It was observed that participants from various local agencies and other categories took a keen interest in the different training programmes. These programmes had a positive impact on the attitude of the participants towards various issues raised especially with regard to operation and maintenance.

The outcome of the training imparted is very positive and UPJN engineers are quite involved independently in various operational aspects of the 5 mld UASB treatment plant at Kanpur.

Experience indicates that it will be appropriate for municipal agencies to have training cells responsible for human resource development within the organisation as well as for coordination of training programmes.

FINANCIAL ANALYSIS

There were 11 schemes under the Indo-Dutch project for the Ganga Action Plan Phase-I at Jajmau in Kanpur. Total investment in these schemes was Rs.3349 lakh with a breakup as follows:

	Cost (Rs. lakh)
i) Sewer cleaning	29.45
ii) Expansion of sewerage system	269.00
iii) Storm water drainage improvement system	257.18
iv) UASB plant (36 + 5 mld)	1863.07
v) 10 M ³ UASB pilot plant for tannery waste water	11.42
vi) Chrome recovery pilot plant	2.87
vii) Low cost sanitation	167.51
viii) Water supply programme	245.17
ix) Solid waste management	41.70
x) Public health education and community development	32.63
xi) Common conveyance system for tannery waste water	429.00
	3349.00

Source : MOEF

In the case of UASB STP a further break up is as follows:

5 MLD domestic waste sewerage treatment plant	100.16
36 MLD tannery cum domestic waste sewerage treatment plant	1762.91

The capital investments in all the above schemes has been made by the Central Government from the Dutch assistance amount except in the case of the 36 MLD tannery cum domestic waste sewerage treatment plant and common conveyance system for tannery cum domestic waste where the sharing has been as follows:

Central Government share (from Dutch assistance)	65%
State Government	17.5%
Tanners	17.5%



O&M COST

Most of the schemes above for O&M and recovery are linked to the city as a whole to be borne by the municipality. In the case of 36 mld UASB plant and low cost sanitation O&M and recovery have been separately worked out and the same is as follows.

The O&M for 36 mld treatment plant at Jajmau, Kanpur

	Annual O&M Cost (Rs. lakh)
i) UASB plant	124.12
ii) Raw sewerage pumping	12.73
iii) Individual waste water conveyance system	26.86
iv) post treatment plant	53.76
Total (Rs. lakh per year)	217.47
Saving of electricity	48.00
Net O&M cost	169.47

Source: Report Effluent Discharge Levies, Kanpur (UP) by IWACO B.V.

The final O&M cost is 1.69 crore per year. Sixty per cent the O&M cost is to be borne by the tanners and forty per cent the Kanpur Nagar Nigam.

LOW COST SANITATION

There are two types of low cost sanitation (i) pour flush toilets (individual), and (ii) community complexes. In the individual toilets, construction upto plinth was done free of cost under the Indo-Dutch programme and the beneficiary was to construct the superstructure and maintain the complete toilets. In community complexes, these are maintained by Sulabh (NGO) on a 30-year maintenance contract. They have kept a caretaker for maintenance as well as for collection of use charge. The male members pay Rs.0.50 to Rs. one for one time use while females and children are provided free service. In certain cases Rs. 50 per family per month is charged.

COMMUNITY PARTICIPATION WITH SPECIAL EMPHASIS ON GENDER ASPECT

BACKGROUND

In the pre-project situation, there was no direct or indirect involvement of the community in planning or implementation of any tasks which lead to the common good of the community

and also enhance the environmental conditions of the area. One of the project objectives laid out was to develop effective mechanisms for active community participation with special attention to the role and position of women. Special emphasis was to be given to the improvement of the living conditions of the poorest communities.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

Related to the project objectives, the following activities were carried out as interventions in community participation:

- i) Prioritisation of the project activities for those areas which belong to the poorest of the poor according to the socio-economic criteria of the project and preparing an inventory of pre-project sanitary facilities.
- ii) Community participation for planning, implementation, operation and maintenance of the different project components, with special focus on women.
- iii) Interventions in the field of drinking water supply and sanitation.
- iv) To facilitate the implementation of the programmes in regard to identified needs, perception and attitude of different categories of population in terms of income levels, caste, class, community and gender.
- v) To enhance the health awareness level of the residents in Jajmau in general, and of the tannery workers in particular, by way of preventive and curative occupational health interventions.
- vi) To facilitate the training programme for different target groups of the population to achieve and sustain the project objectives.

The community was treated as "directly approached unit" with intermediaries for participation in the schemes of water supply and low cost sanitation. Direct communication channels were established between the socio-economic unit of the project staff and the community. By the end of the project period a large group of trained community based intermediaries or change agents existed in the project to carry out the proper operation and maintenance of the infrastructure created under the project.

An "indirect-approach" was followed in public health programmes. Instead of using direct communication, the community was reached via a network of trained change agents such as traditional birth attendants (TBAs), private medical practitioners (PMPs), primary school teachers (PSTs), anganwadi workers (AWWs), adult education teachers (AETs).



INTER-RELATIONSHIP WITH TECHNICAL COMPONENTS

In the beginning it was found that there was a kind of insensitivity in the community towards the project, the reasons being:

- The prevailing poor levels of services before the project interventions.
- The poor financial position of the maintenance agency.
- The large distance between the centralised maintenance office and the project area.

Water supply and sanitation were in a very bad condition. The involvement of the target population was found crucial for introducing measures conducive to environmental improvements. The approach was therefore, to help the community to help themselves. The community was broadly involved in the following technical activities:

HANDPUMP

- Identification of
 - locations for handpumps,
 - community based handpump caretakers at the time of installation.
 - community based handpump mechanics.

LOW COST SANITATION

- Identification of
 - beneficiaries for the construction of pour flush latrines,
 - sites for public latrine complexes,
 - community based male and female masons.

REHABILITATION OF WATER SUPPLY

- Identification of
 - community based standpost caretakers,
 - sites for public standposts,
 - community based standpost mechanics,
 - illegal water connections.

SOLID WASTE MANAGEMENT

- Identification of
 - location of roadside bins for the primary collection of solid waste,
 - community based volunteers for the community based monitoring of the solid waste management schemes.

HANDPUMPS

From the outset, the community was involved in the site selection of handpumps. Awareness campaigns were launched at the time of handpumps installation itself and two community based handpump caretakers were identified for each handpump. Care was taken that at least one of the two was female. Preference was given to persons who were more motivated and who were living close to the handpumps. These caretakers were given short training for making the community aware of the proper use of these handpump as well as of using handpumps water for drinking purposes and safe storage of drinking water within the home. The caretakers were also trained in the regular preventive maintenance of the handpumps.

Kanpur Jal Sansthan was the executing agency. The handpump locations were decided jointly by the project staff, KJS staff in consultation with the community. Location of 180 handpumps was identified and marked at site by the project. Subsequently a survey conducted by the project indicated that out of 180 handpumps installed, only one was found to be unacceptable by the community.

One problem that did arise over time, however, was that the KJS mechanics who had been trained by the project to carry out repairs of handpumps were frequently unavailable at the time of handpump breakdowns. This resulted in handpumps remaining unused for periods up to two weeks before another KJS mechanic could be arranged to carry out the repair. To solve the problem, in the second phase of the project, some of the community based caretakers were therefore trained to become handpump mechanics to implement a single tier maintenance system.

The local mandal is the nodal agency for the maintenance and repair of handpumps. A special tool kit essential for the repair of handpumps is provided to each of the fourteen mandals. One tool kit is available at the community centre. The mandal also maintains a community handpumps O&M fund. This fund is used for the purchase of spare parts. The perceptible change in maintenance of handpumps before and after the project intervention is shown in table 6.7:



TABLE 6.7: AVERAGE TIME BETWEEN BREAKDOWN AND REPAIR

Activity	No. of Days	
	Before Project	After Project
Handpump breakdown reaction time	1-2	1-1.5
Complaint to be lodged by handpump caretaker	3-4	-
Community based handpump mechanics to repair and mandal support for procurement of spares	-	1-1.5
Community to collect funds for spare	3-5	-
Handpump repair time (Total)	10-14	2-3

LOW COST SANITATION

In the beginning of the project, the construction of on-site pour flush latrines was started. For proper implementation, it was decided that under the crash programme 600 units should be constructed initially. The responsibility of construction was given to an outside agency. It was found that the work was of poor quality and it did not correspond to the original design submitted by the agency. The progress of the work was slow. There was also dissatisfaction among the community volunteers trained under the project.

There was need for a different approach as the project was confronted by an awakened and motivated community. For the effective implementation of this scheme, it was decided to involve the community in general and women in particular in scheme implementation. The project thus had twin objectives - firstly with the involvement of women, the scheme would be implemented more effectively because of better communication with the local community. Secondly women were to be trained in trades which were until then considered to be of the male domain only. With this in mind, three groups of female masons and subsequently one group of male masons were trained. They received very positive support from the community mandals and the community, which helped not only in identifying the beneficiaries but also helped them in the execution of the scheme.

During the two days of pour flush latrine construction, the community based masons were trained to communicate the messages related to health, hygiene and sanitation to the occupants of each house. This was a basis for effective communication, as the masons were also from the same community.

The quality of work was found to be satisfactory and the status survey carried out in December, 1992 indicated that about 85 percent of the beneficiaries were using the toilets. This was during the time that latrine construction was still in progress.

REHABILITATION OF PIPED WATER SUPPLY

Rehabilitation of piped water supply included the repair of leakages, replacement of old dilapidated pipelines and regularisation or disconnection of illegal house connections. It also included promotion of house connected supplies, awareness enhancement related to water wastage, finance, public health and careful planning of standpost supplies for the deprived sections of the community.

The project in close association with the Urban Community Development (UCD) Cell of KNN, the field staff of KJS, community volunteers and local mandals took the initiatives to raise the awareness of the community for preventing water wastage and illegal connections, and promoting legal house connections from the piped water supply.

The following community awareness measures were taken:

- * Leaflets prepared by the project were distributed.
- * Audio cassettes were recorded and played on rickshaws.
- * Banners were displayed at important crossings.
- * Decentralised camps and area meetings were organised.

Efforts were made simultaneously along with the above, for pressurisation of water pipeline sections, so that improvement in water supply was felt by the community.

Trained female plumbers were able to repair leakages and disconnect illegal connections. They also explained and convinced the community about the role that the community members can play in the improvement of the water supply system. About 3500 illegal house connections were disconnected. Disconnection on such a scale without arousing any kind of



adverse reaction of the local community towards the project is demonstrative of the fact that through strong community organisation, management can gain beneficiary confidence in its efforts to establish an effective water supply system.

PUBLIC STANDPOSTS

From the financial point of view, it is important for the water supply agency to maximise the number of house connections and to minimise the number of public standposts. However the objective is the provision of water to all urban citizens including the poor and the floating population. Public standposts are a must in most cities. Under the project, 120 standposts were provided.

Through mandals and community volunteers, the standposts catering to the poorest of the poor and in some cases for the floating population, were completed. Community based standpost mechanics and caretakers were trained by the project. Thirty standpost mechanics were trained to maintain and repair when needed the 120 standposts. The funds for the repair of the public standposts came from the respective mandals.

SOLID WASTE MANAGEMENT

At the start of the project, the solid waste management was not properly organised. The number of staff involved in its management was insufficient. As it was not feasible to increase the number of government staff, an attempt was made to provide for a solid waste management system that is manageable by the existing staff and outside contracted labour. It was also decided to involve the community, on contract basis, for the operation and maintenance of the systems as well.

Through the organisation of community meetings, in close association with the Urban Community Development Cell of KNN and the mandals, the community was asked to dispose of the solid waste only at the roadside bins and preferably before the emptying of the bins that is, before 11.a.m. Through a format, community volunteers monitored the quality of work carried out by the sweepers within the respective area, although officially the work of sweepers was supervised by the sanitary supervisor of each respective area. However, this community based monitoring system was designed to involve the community in implementation of the scheme and to provide for interaction between the beneficiary and the implementing agency namely the Health Department of KNN. In the first phase, this scheme was executed in three demonstration areas.

The monitoring of these three demonstration area was done jointly by the Public Health officials and through community volunteers. The experience from the demonstration areas has shown that the community is prepared to cooperate to achieve good environmental and sanitary conditions. As soon as the roadside bins were in place the community gradually started putting the household solid waste into them. The success of the community participation in the implementation of this scheme can be attributed to the active role played by the change agents and the mandals.

SUPPORT TO AREA LEVEL ORGANISATIONS (ALOS)

The project pursued a definite policy of creating community based structures known as ALOs or mandals. This was made possible with the training of a significant number of change agents or intermediaries in different pockets of the project area, especially within the poorest sections of the society. An attempt was made to create grassroots level organisations and provide them with an interface between the community and the existing local governmental agencies. It is in this perspective that the area level mandals have been trained, and have become dynamic organisations at the grassroots level. These area level organisations have been trained to prepare the communities to operate and carry out certain activities by themselves on an autonomous basis.

The mandals played a very active role in the following:

- The identification of beneficiaries to be provided with pour flush latrines under the low cost sanitation scheme.
- The identification of change agents/intermediaries namely, private medical practitioners, primary school teachers, Anganwadi teachers, community volunteers and so forth.
- The identification of community based mechanics for handpumps and standposts.
- Identification of school for the school sanitation programme.
- In organising cultural programmes such as puppet shows, slogan competitions, art competitions, quiz competitions and a Race for the Environment. All these programmes were organised to improve the awareness of the community in the project area with respect to health, hygiene and sanitation.
- For the execution of the scheme of social forestry and in the establishment of useful interaction with the Department of Forestry.
- For organising the Adult Education Centre, the mandals helped in the selection of teachers as well as in the selection of premises which can be used for organising classes on a purely voluntary basis.

HEALTH RELATED ASPECTS

There is an established link between environmental protection and the improvement of the living conditions of the community specially the low income residential areas. Health promotion of the community is thus of paramount importance. Activities related to health can broadly be classified into four categories:

- i) Support to health intermediaries
- ii) Primary health care production unit



iii) Diarrhoea incidence study and control

iv) Development of communication material.

SUPPORT TO HEALTH INTERMEDIARIES

The community is reached by the involvement of trained health intermediaries:

Private Medical Practitioners (PMPs) were trained for diarrhoea management,

prevention and promotion of water usage and sanitation. Emphasis was laid on specific health education inputs which the PMP's are to provide to their patients.

Traditional Birth Attendants (TBAs) received training in safe delivery practices and delivery kits. They were also involved as change agents and promoters of the environmental sanitation aspect.

Angan Wadi Workers (AWWs) were given orientation to play a catalytic role in promoting activities related to water and sanitation. Their services were also used for marketing Safe Delivery Packets to expectant mothers and also ORS packets to diarrhoea patients.

Primary School Teachers (PSTs) Five groups of PSTs totaling about 100 were trained to educate the families through the children. It was also seen as an essential component of the school sanitation programme.

Community Volunteers (CVs) Nearly 200 CVs were selected from different areas and provided with training for improved environmental sanitation, better water use, diarrhoea management practices, use of ORS and establishment of community level organisation.

Adult Education Teachers (AETs) Twenty women were selected from the most backward of slums in Jajmau and trained in the effective method of running adult education centres.

Primary Health Care Production Unit

A production unit for the preparation of ORS and safe delivery packets was set up at the community centre. Four women were trained for the production of ORS packets. Because of its low cost and easy availability, the packets gained acceptance amongst the people and the women working on the scheme received small amounts as profit also.

Longitudinal study of diarrhoea incidence

In cooperation with the Kanpur Medical College, five rounds of diarrhoea incidence study have been completed. It was noted that the rate of diarrhoeal incidence in the under 5-years age children was reduced from 23 percent to 7.5 percent.

Development of communication material

Flip cards containing key messages on river pollution, solid waste, sanitation, safe water practices, personal hygiene, diarrhoeal management and preparation of home made ORS packets were distributed to facilitators at the community level. Leaflets were developed on sanitation, solid waste, handpumps and piped water supply. Video films have been prepared on skill training of female construction workers and traditional birth attendants. Materials from other sources were also used.

Evaluation

The IDP has initiated a programme with strong focus on communities and their involvement in the planning, implementation, operation and maintenance. The involvement of the communities through change agents was done to create a sustainable set up for community participation in effective utilisation of the installed facilities. They have formed the potential nucleus for community level organisations, which in turn are able to communicate directly with the available governmental infrastructure on the one hand and also mobilise community manpower.

During the inventory phase, a number of surveys and in-depth studies were conducted and contacts were established with informal leaders at the community level. The contacts resulted in the establishment of informal groups of men and women in selected slum areas. In the selection of handpump sites, caretakers, female masons, plumbers and FRP workers, direct communication lines were established between the field staff and the community via their representatives, mainly the community volunteers.

The community volunteers were selected from all over the project area and after undergoing proper training, have now been attached to the mandal (ALO) of their area or of the nearest neighbouring area.

An indirect approach is followed throughout the different training programmes. By means of trained intermediaries, the community is reached. Training of professional intermediaries has a twofold aim. The first is to improve their professional skills and the second is to prepare them for improving the knowledge, attitudes and practices (KAP) of the community at large.

The project has made a concerted effort to interrelate and combine technical and socio-economic activities. Its implementation networking of the intermediaries has proven to be very useful. In the initial phase, this helped in reaching out to the public at large and in the final phase it is hoped that this will ensure the sustainability of the facilities provided by the project and will help in retaining the improvement in KAP.

The project facilitated the formation of area level organisations or mandals. These mandals enhanced the activities in the



community, brought about marked cohesiveness and finally resulted in the formation of an apex body through voting. The experience of the project with the ALOs has raised several points which should be kept in mind for replication of this practice. These are:

- i) The orientation of mandal representatives proved so significant in enhancing their activities that, in future, their training should be done in the earlier stages of the project.
- ii) In areas where mandals do not already exist, efforts should be made to facilitate the formation of mandals as early as possible.
- iii) The involvement of the ALO representatives in formulating and implementing the activities of a project should be ensured.
- iv) Where such mandals are already in existence they can be consulted in the formulation stage when surveys are done, regarding vital problems faced by the people in those areas and their suggestions can be sought about possible remedies.
- v) Mere training and the organising of mandals should not be an end in itself. The goal should be to utilise them as a means to fulfil project objectives and goals. For this, it is essential to provide them with ample confidence and an awareness of their own organisational strength. This can be achieved by consulting them at each stage of the project.
- vi) The experience clearly demonstrates that with the involvement of the area level organisations in the formulation and implementation of project schemes not only can the project costs be reduced but also the quality of works can be improved considerably compared to those done through agencies by outside contractors. In addition it enhances community participation in the overall development process.

IMPROVEMENT IN KAP

Diarrhoeal incidence can be an important surrogate parameter for monitoring and evaluating the status of water supply, sanitation and community health for a specific project area. During the course of the project, six rounds of diarrhoeal incidence surveys were carried out by the Kanpur Medical College. The results of these studies have direct bearing on the community knowledge, attitude and practices, (KAP).

It has now become increasingly evident that the mere provision of safe drinking water and sanitation facilities is not going to produce a perceptible dent in the problems of diarrhoea and water borne diseases unless human and behavioural aspects concerning water and sanitation facilities are also taken into account.

Thus IDP project has projected very well the significance of community participation in environmental development. The results achieved merit in the total integrated project as one beneficial replicable practice elsewhere.

GENDER ASPECT: DEVELOPMENT OF WOMEN

BACKGROUND

Women in any community provide a crucial link for the integrated development scenario. The IDP project provided enhanced role for women. The need was realised for creating opportunities for specific development orientation in the given social context. The restricted entry of women into work fields such as that of plumbers, fitters or masons are not so much because they are back breaking or too tiring, but they are historically and culturally being done by men only. Female construction workers have in fact physically a far more difficult job. Hence it was resolved to train women so as to not only question the very basis of gender discrimination but also to prove a point for women that they can do similar jobs as well as and along with men.

Three different types of skill training programmes for women were carried out in the field of water and sanitation.

TRAINING OF WOMEN AS MASONS

In Jajmau initially a batch of 15 women was given training in the field of construction as masons. To ensure that the female masons could function independently without outside support, a cooperative of all the women was formed and they were registered under the Society's Registration Act as an Independent society.

After the training, the women were assigned the task of constructing sanitary latrines by the Kanpur Nagar Mahapalika with advance payment. Subsequently in order to keep abreast of the work load and time constraints of the implementation of low cost sanitation scheme, two more batches of women masons composed of 15 women each were trained and registered as women's societies. In addition, a group of twenty men were also given training as masons.

TRAINING OF WOMEN AS PLUMBERS

As part of the work of rehabilitation of water supply programme for Jajmau, both the executing agencies namely, UP Jal Nigam and Kanpur Jal Sansthan (KJS) felt the need for trained plumbers/fitters to initiate this programme. As no such staff was available with these agencies it was decided to recruit fifteen women from the project area and train them as plumbers/fitters. The socio-economic unit of the project having already gained the experiences of training women in masonry works, readily took up the challenge for training women plumbers.



TRAINING OF WOMEN IN FABRICATION OF FRP PRODUCTS

The FRP centre was initiated because of the large requirement of sanitary pans of uniformly ensured quality in the LCS programme. In the absence of local suppliers of quality products, the idea was put forth to establish an FRP production centre. The earlier skill generating programmes had generated enough interest in the area - women had already started enquiring about this new skills training programmes.

PRODUCTION OF FRP PANS FOR POUR FLUSH LATRINE

The FRP production unit has been constructed by the female masons. Women fabricators also formed into a society and did production as well as marketing.

EVALUATION

The findings indicate that not only did the women masons construct good quality latrines, they also acted as motivators, promoting the community's adoption and proper usage of sanitary latrines. All four women's mason societies have successfully completed the construction of about 2500 sanitary latrines in Jajmau as part of low cost sanitation scheme. In addition to sanitary latrines these female groups have also completed the construction of one community centre, one FRP production centre, one nursery and labour quarter at the zonal garage.

All the fifteen women plumbers worked full time with Kanpur Jal Sansthan and UPJN in the rehabilitation work of legalising connections, installing water metres, repairing leakages and making new connections. They have registered as a society with the name 'Sahastradhara'. It is however, felt that the women working in the FRP unit should have skills in marketing of the product so as to compete with the local traders.

In general, the practices followed in IDP described in this section have proved to be highly beneficial which and capable of being replicated.

STRATEGY FORMULATION FOR RIVER CLEANING PROJECTS

The river cleaning programmes undertaken so far have laid emphasis on capital works such as interception/diversion of waste water, its treatment, certain activities like low cost sanitation, crematoria and bathing ghat development. Industrial pollution was to be taken care of through enforcement of laws. The O&M of the facilities created is the responsibility of the state organisation. In the absence of pressure groups from the public it leaves much to be desired. Further the local people specially those from low income groups, do not perceive/see much to their benefit from such massive investment, although these are the first victims and of maximum damage arising

from any water/sanitation related epidemics for want of massive investments in these river clean up facilities.

In the present project, linkages have been taken further to the sources, considering the lowering of the pollution levels of the pollutants at the source. Further the involvement of workers in that industry, training them for occupational health and safety, involving the residential community in improving the physical infrastructure, better health for the members of the community, has successfully sought their participation in the project. This approach has possibilities for the sustainability of the assets created. Technical inputs for cleaning the water body would not arouse public investment nor sustain itself for long. In the present context IDP has been taken up within the GAP overall frame, but based on the experiences of the project it is concluded that the river cleaning strategy in general should include successful elements of IDP and thus river cleaning should not necessarily depend on the second level project like the IDP. The river cleaning strategy based on the experiences of IDP will have following components:

- i) Integrated approach.
- ii) Holistic technical inputs.
- iii) Institutional development.
- iv) Community participation.

INTEGRATED APPROACH

As the purely sectoral approach to solve environmental problems have not succeeded, the IDP project demonstrates that an integrated approach towards the project should be formed for sustainable impact. The vertical integration from project formulation to operation and maintenance and horizontal integration of various interrelated aspects should be included. Integration of beneficiaries' desires through community participation as well as interagency coordination of design, implementation and O&M are major aspects to be incorporated in an integrated approach. Because of its complexity and sheer volume of work, early priority setting is advocated.

HOLISTIC TECHNICAL INPUTS

The holistic approach to technical interventions is required which should be based on realistic projections and designs. These include house to house surveys, studies on willingness to pay and affordability to pay and so on.

INTRODUCTION OF NEW TECHNOLOGIES

The UASB waste water treatment technology was successfully introduced and a 5 mld domestic and waste water treatment plant has been operated and maintained.

An investment in the economics of the UASB system when used for the treatment of domestic waste water definitely



revealed its lower investment and operation cost per mld of water.

Similarly, the results of the chrome recovery pilot plant were very promising technically as well as economically. Thus the introduction of new technologies provided financial benefits as well as reduced the pollution levels.

OPERATION AND MAINTENANCE

As part of the strategy, the operation and maintenance aspects of technical facilities should be taken into account during the planning and design stage in order to guarantee long term sustainability of the facilities. This means that in a given context the choice of technology application should not necessarily be the most advanced and the latest or the cheapest but should be appropriate and cost-effective enough including its operation and maintenance costs.

COST RECOVERY AND FINANCING MANAGEMENT

The technical interventions to improve cost recovery should be based on needs and paying capacities of the beneficiaries. Tariff setting and the revenue collection structure should be reviewed taking the following principles into account.

- i) Beneficiaries should contribute to the cause of O & M and investment of the services provided to them to an extent, whereby an optimum mix of subsidy and direct beneficiary contribution is established.
- ii) Sharing of the cost of services related to pollution abatement should be based on the principle of "polluter pays", whereby the polluter should pay for the cleaning of the pollution brought by him into the environment.

DEVELOPMENT OF MIS

For the efficient management of the scheme, the management information system (MIS) including physical and financial progress indicators, periodic critical action points as well as quality aspects have proven to be very effective as a tool by all parties involved. Amongst other things, it revealed critical elements in the project's time bound completion schedule and addressed at critical action points for the attention of all players. MIS reports were also instrumental in quality monitoring and control, apart from cost and time controls.

In order to achieve timely completion, to control costs and to attain required quality standard an effective monitoring set up is needed. In this regard regular meetings to review the progress at monthly intervals should be part of the strategy.

INSTITUTIONAL DEVELOPMENT

In the experience of the IDP, the institutional development activities created a significant momentum with regard to organizational improvement and financial management. A number of related conclusions are:

- i) Institutional development should start at an early stage of project implementation preferably concurrent with the project implementation stage.
- ii) For synchronisation of project execution, it is important to strengthen coordination through establishment of project management groups. Such units in the IDP had a telling demonstrative effect on the new schemes in GAP-I.
- iii) The implementing agencies should include the socio-economic unit, O&M department, and training facility.
- iv) Performance standards should be streamlined and set up, where there are none. There should be lucid formats of designs and operating data and manuals for an improved reporting and communication system, apart from sound O&M practices including inventory management.

COMMUNITY PARTICIPATION

The involvement of the community in dealing with the user aspect of technical inputs has been proved to be strategically the most important. The area level organisation (ALOs) and trained agents of change fully participated in the decision making processes for - (i) Selection of priority areas, (ii) prioritisation of area specific needs, (iii) preparation of area development plans.

The experience with the ALOs that is, the mandals has been very constructive and effective. ALOs should be part of the strategy. With community participation there was increase in KAP.

GENERAL STRATEGY ASPECTS

CRASH PROGRAMMES

A special consideration under this project was given to crash programmes. They were meant to tackle quickly some obvious bottlenecks in the existing sanitary conditions. It was further found that it created a positive attitude within the people in the project areas, because they could see the work started almost immediately.

SOCIO ECONOMIC COMPONENTS

Besides community participation, the socio economic compo-



ment which has produced very impressive results in - i) support of technical activities, ii) public health promotion, iii) occupational health promotion, iv) skill training, and v) strengthening of community organisations.

EVALUATION AND MONITORING MISSIONS

The mid term evaluation missions were instrumental in producing opportunities for all involved parties to review developments and redesign policies and approach to achieve the project objectives. The monitoring missions provided useful second opinion information which helped the government in its decision making.

IDP/GAP EXPERIENCE BASED STRATEGY FOR RIVER CLEANING PROJECTS

SUSTAINABILITY OF THE PROGRAMME

THE CONCERN

One important concern towards the completion of IDP is that the achievements of the project are sustained and action taken for its scaling up so that the reasonable gains achieved so far, be further strengthened and coverage is increased. The Ganga River Cleaning Programmes in India are thus far implemented by the state governments with 100 percent assistance from the central government but the expenditure on operation and maintenance of assets created under the programme, is shared between the centre and the states for the first three years and subsequently the complete maintenance is to be done by the state governments. However to obtain an effective involvement and motivation of the states concerned in further National River Conservation Programmes, the centre and states participate equally in capital costs while the O&M burden is squarely on state agencies, through cost recovery and efficient service delivery. The provision of resource recovery by way of production of power from methane, treated water for irrigation and sludge as manure, under the IDP programme, did contribute towards the operation and maintenance cost. However the major portion of O&M cost had to come from the general revenues of the states which implies a responsibility for local bodies as well. In general, state governments and the local bodies with whom the O&M of the facilities rest, have always been facing resource constraints; as a result some of the facilities in course of time ran the risk of becoming defunct.

REVENUE GENERATION MEASURES

Resources at the local level are raised through water and sewer taxes. Generally, water tax is levied at 14 percent of the annual rateable value of the property and the sewerage tax at 4 percent. If the house is actually connected with the water system, the owner has to pay an additional charge which is proportionate to the volume of water consumed. For the billing and collection of revenues, the local bodies depend fully upon the number of properties that have been officially regis-

tered. A study conducted in this regard revealed that out of an estimated 0.3 million properties in the city of Kanpur, only 0.1 million have actually been registered by the Kanpur Nagar Nigam. As a consequence, Kanpur Jal Sansthan collects only one-third of the potential revenue income of about Rs.0.8 million which is hardly sufficient to cover the salaries of its 2500 staff. Similarly, the Kanpur Nagar Nigam which looks after other civic amenities such as street lighting, storm water drainage, garbage disposal, public health, has poor revenue collection owing to non-registration of many properties and under-valuation of the registered ones. Yet another study revealed that half the water supply connections in Kanpur were unauthorised. This did not allow the authorities to collect the water charges, but made it impossible to carry out its leak detection programme to prevent the losses from physical leakage.

The following action has, therefore, been envisaged to augment the resources for O&M:

- i) Registering of all unregistered house properties.
- ii) Authorising/disconnecting unauthorised water connections.
- iii) Plugging the physical leakages in the water supply system and ensuring better water supply to citizens.
- iv) Efficient and computerised billing and collection of charges.

INTEGRATION OF URBAN SERVICES ORIENTED PROGRAMMES

In most states the urban development and health departments are already operating several projects as centrally sponsored schemes with emphasis on:

- i) Urban poverty alleviation through employment generation.
- ii) Community based activities for improvement of urban slum and sanitation.
- iii) Child and women welfare development particularly of low income strata.
- iv) Promoting NGOs in community awareness and health promotion campaigns.

These schemes are supported by the central government and soft loans from HUDCO. Since the river action plan supports similar activities such as low cost sanitation, solid waste disposal, river front development, wood efficient cremators and community participation and help minimise the stress of poverty on environment and quality of life of the city and the river, it is befitting that the on-going programmes of the state are



integrated and dovetailed with the river action plan so as to make both these programmes more meaningful. This will enable NRCP to cover basic human issues relating to poverty and living conditions which will reinforce.

PLANNING URBAN EXTENSIONS

New extensions to the urban area without proper infrastructure are bound to add to the pollution load to the city. Urban development departments of the states have been advised to enact suitable laws to provide for decentralised sewage and garbage disposal facilities for the new areas independent of the core city infrastructure. The beneficiaries of such an infrastructure should share amongst themselves the capital and O&M costs to obtain sanitation services to their satisfaction without burdening the city's core infrastructure.

LONG TERM SUSTAINABILITY: ICDP

The need for a long term arrangement to ensure sustainable operation and maintenance of assets had been engaging the attention of the Indo Dutch project. In the course of implementation of the project, it was increasingly felt that the resources for O&M should primarily come from the users of the facilities. With this in view, a new project the Ganga Institutional and Community Development Project (ICDP) has been initiated since March, 1995. This project is a logical extension of IDP to strengthen the local bodies with appropriate action plans at local and state levels to render the schemes, benefits sustainable.

The ICDP have, in the first instance, reviewed the current state of affairs as an input for strategy formulation. In India, in the recent past, two important changes have taken place at the national policy level, one of liberalisation of the economy and the second the constitutional amendment for conferring powers to local bodies for planning and development. These changes have brought in a very special environment of positive change. Economic liberalisation was a move away from centralised planning to a more market oriented approach. Thus, the financing of metropolitan development, it is stated in the Eighth Plan, should, in principle be from local resources and self financing in nature. As per the 73rd and 74th constitutional amendments, the state governments will transfer powers to municipal bodies and recognise these as a more autonomous third tier of the government. These amendments provide the means for implementation of national strategies at the local level. Further, the devolution of fiscal responsibility proposed by the state finance commission will lead to a desirable transparency in fiscal matters and improve financial management. The creation of a third tier of government, at local level, implies a need to develop local policies and strategies. While the, municipal authorities are aware of the policy changes that have been introduced, action has not yet been taken to translate these into clear local policies and actions. The ICDP will support and help guide the process of change.

WEAKNESS OF THE EXISTING INSTITUTIONS

The ICDP has also in its initial review assessed that with the meagre allocation of resources to the urban planning and development sector, the state retaining a monopoly over financial resources for grants and subsidies, and urban centres like Kanpur growing rapidly because of the urbanisation taking place in the country, the capacity of the government for investment compared to the need has diminished. The present rural bias in planning, general budgetary constraints plus the inability of agencies to generate internal resources does not allow demand for services to be met. The diagnostic review carried out as part of this project and part of the draft inception report of ICDP revealed some weaknesses of the existing institutions:

- i) **Mismatch between institutional capacities and responsibilities:** Over a period of time the capacity of the institutions in each urban sub-sector has seriously lagged behind the growing urban needs, be they in terms of coverage or quality of service. At the same time, depending on contemporary needs or project compulsions, greater responsibilities have been assigned to local institutions without any corresponding effort to ensure that these institutions are strengthened to carry out their enhanced tasks by improving their MIS systems, retraining their staff, equipping offices with adequate automation, computerisation and communication, adopting reward/merit based personnel policies and improvements in rational pricing policy for services provided.
- ii) **Lack of adoption of commercial/semi-commercial policy and practices:** Urban services are frequently considered, by various parties involved, as meeting essential public welfare needs and hence gratis. It is traditionally believed that provision of urban infrastructure facilities fulfils a basic human need and that users cannot be denied free access to urban services. This attitude has prevented the emergence of a policy which ensures that revenues equal (or exceed) expenditure at least in the upper economic strata consuming 80 percent of goods and services. At present the larger the increase in production of urban services, the higher will be the mismatch between revenue and expenditure. This is mainly so, because most of the beneficiaries are not adequately charged nor are the costs collected effectively for the services provided.
- iii) **Rigid and inward looking institutions:** Local institutions are not, on the whole, driven by the needs or demands of consumers. They look towards the state government for survival or expansion, rather than to the people for whom they were constituted. This institutional culture does not result in actions to strengthen user organisations nor to provide resources to support their activities. There is an over-emphasis on construction activities, with systematic neglect of



other vital areas such as assets maintenance and resource mobilisation. As creatures of the state, they follow state personnel policies, rules and regulations and instead of being entrepreneurial in cultural orientation, they are inward looking institutions, unable to grasp opportunities.

- iv) **State monopoly in the urban services sector and scarcity of resources:** On the one hand the state agencies acquired a monopoly in production, retailing and O&M of urban sanitation facilities and on the other, owing to lack of resources and poor cost recovery, the supply of services fell woefully short of requirements.

IDENTIFIED ACTIVITIES

For scaling up and even maintaining the local services level of the achievements of the IDP project, the weakness of institutions at policy level and at working level are to be tackled. To achieve this objective, a set of activities have been identified by ICDP which are briefly as under:

- i) **Activities to promote commitment:** This will include basic issues such as privatisation, cost recovery, staff motivation and also inter-agency cooperation.
- ii) **Activities to optimise distribution and coordination of roles:** The idea is to establish clarity regarding the distribution of roles and responsibilities. The idea is also to explore alternative arrangements for service delivery in urban areas, possibility for internal delegation of powers compatible with responsibility or delegating roles to ALOs that is, mandals.
- iii) **Activities for improved O&M practices:** This will focus mainly on two areas -(A) Improving the efficiency and service delivery and effectiveness of O&M carried out by public utilities and municipal institutions. The activities will include - (a) decentralisation of O&M of water and sewerage systems to zonal level; (b) training of operators; preparation of guidelines for management information system; (d) computerisation of O&M planning budgeting and monitoring; (e) computerised registration and billing of water consumers and easy access and broad based payment centres. (B) Identification of tasks under O&M which can be more effectively carried out by ALOs that is, mandals. This will include research, analysis and presentation of appropriate models used in India and elsewhere for privatisation, commercialisation, corporatisation and participation in delivery of services and revenue collection centres management.
- iv) **Activities to enhance the financial viability:** This will deal with privatisation of recovery and computerisation of billing system, telescopic tariff to curb

wastage, incentives for timely payment and vice-versa and to simplify collection.

- v) **Activities to promote organisational development:** This will include analysis of organisations, objectives, key tasks and performance indicators and also developing training plans for staff of the agencies, exposure to successful case histories and training with efficiently functioning municipalities abroad, through twinning arrangements.
- vi) **Activities to strengthen user involvement:** Strategies and action plans to strengthen the community based organisation (CBOs) and develop their role and linkages with services delivery. Also to strengthen women's participation in CBOs.
- vii) **Activities to intensify private sector involvement:** This will include private sector involvement in -(a) meter reading, billing and collection, (b) in O&M of water supply system particularly pumps, overhead tanks and piping system valves and metres, (c) in solid waste management by contracts for primary collection and transportation to the designated areas.
- viii) **Activities to privatise certain sewage treatment plants and pumping stations on BOT or BOOM basis.**

THE PROPOSED STRATEGY

To conduct the activities and take of the weaknesses outlined above, the ICDP have identified a seven point strategy:

- i) Development of networks and relationships at three levels, namely, user level, local-level and state level.
- ii) Adoption of step by step approach to organisational improvement.
- iii) Exposure of the key staff to suitable examples of innovative projects in India and abroad.
- iv) Discussion and articulation of policy issues.
- v) Training needs assessment for human resource development.
- vi) Regular formal evaluation during the period of the project.
- vii) To use technical assistance from ICDP only as a catalyst.

With activities identified and the strategy as given above, it is expected that the ICDP will achieve the desired results for the sustainability and scaling up of the IDP project.



BEST PRACTICES REPLICABILITY

Based on the experiences gained in the present project, the replicability of practices could be in the following ways:

- I) Specific practices.
- II) Typical situation.
- III) A framework for integrated approach for improved urban environment management.

REPLICABILITY OF SPECIFIC PRACTICES

For replicability, the beneficial practices could be pulled out from the Indo-Dutch Environmental and Sanitary Engineering project in relations to - i) Tannery industries, ii) UASB technology, iii) upgradation of the environment in the slum settlements, including the practices of community participation and institutional development. These specific practices could be replicated not necessarily in River Action Plans but also in different situations with similar environmental problems.

TYPICAL SITUATION

The typical situation i.e. water body, industry polluting the water body and low-income settlement providing workers to the polluting industries exists at large number of locations in India and outside. The present practice as an integrated approach could be taken as one single practice for such a typical situation and could be taken up for replication.

A FRAMEWORK FOR INTEGRATED APPROACH FOR IMPROVED URBAN ENVIRONMENT MANAGEMENT

Finally, the basic concept of the project i.e. an integrated approach which has been so well implemented as part of this project could be fully enhanced with a new framework of integration for improved urban environment management. This would require - i) development of an information base, ii) need based projects to relate to information base, iii) enhancement of public awareness and participation, and iv) an appropriate institutional arrangement.

i) Development of an Information base

Based on the experience of the project, it could be said that for a well integrated approach to a project, the first requirement is the development of an information base. The objective often would be to optimise decision making in order to make strategic choices based on local needs and perceptions, ideas and visions on what should happen in the city, what all activities should be taken care of for a quick and good response of the community towards environmental improvement, and how best the condition for both the citizens and the economic activities can be created. The whole process of data collection and analysis, evolving the formulation of a vision and strategy for

conservation, improvement and further development of the urban environment, is a vital step in the development cycle. In the context of present project, the information required relates to the economic and social activities that lead to environmental degradation, nature and type of pollution sources and the types and costs of possible interventions and their effectiveness and resource mobilisation strategies.

Based on the experience of the Jajmau project, it could be said that the information base provided a more realistic perspective about the socio-economic fabric of people in certain specific areas and the type of sanitary service level that were appropriate and affordable for a certain living standard and life style. For instance sewers were not planned in areas which could not afford a water supply house connection and a sewer house-connection. Instead they were provided with on site LCS facilities. But information base did not attempt the institutional capacities, resources vis-a-vis needs of the IDP for achieving long term sustainability through appropriate parallel measures in the IDP implementation phase.

ii) Need based project to relate to information base

Service standards must be in accordance with affordability and partial interventions must be avoided. Because of high cost of investments, service standards should be designed in accordance with affordability and willingness to pay in different areas of the city of course not sacrificing, the absolute minimum level of environmental hygiene and sanitation for the poorest of the poor.

The experience of the projects indicates, that the intervention required should be planned in such a manner that they focus on public health improvements, reducing the threats to the urban environment and contribute sustainable economic development. In order to accomplish these goals, problems such as inadequate domestic waste water treatment, industrial pollution and inadequate solid waste collection and disposal should be resolved through investment in pollution abatement measures. Partial intervention i.e. water supply without sanitation, storm water drainage without solid waste management should be avoided. The experience in Jajmau reveals that through community participation, technical investments like handpumps, water supply, LCS, solid waste disposal etc have better chances for long term sustainability. In this manner the concept of integrated approach becomes a reality.

iii) Enhancement of public awareness and participation

After the measures for the improvement of the urban environment are accepted and supported by the communities, an on-going interface between the communities and municipal agencies is required. To facilitate an effective communication, community level organisations like the mandals in Jajmau should be established and encouraged to interface continually. An awareness raising campaign about the clean environment and its relationship with better health can be meaningfully chan-



nelled through these mandals to reach grass root levels. These area level organisations could also provide interface in the operation of infrastructure assets created and also as local interest groups to monitor the functioning of the river cleaning mechanisms, say treatment plants for sustainability of the project. In addition to this a permanent community development cell within the local body staffed with trained community workers can play a catalytic role in establishing the dialogue between the communities and the various city level agencies. Such a cell existed within the Kanpur Nagar Nigam and with their involvement in the community participation effects were visible and quick.

iv) An appropriate institutional arrangement

The technical and financial strength and appropriate organisational frame work of the implementing agencies is of crucial importance in the sustainability, and thus for replicability for additional projects under the River Action Plan elsewhere in India. For this certain degree of freedom has to be provided to the concerned institutions for O&M and for financial commitments. The institutions should have freedom for enhancing charges for services. They should be allowed to decide themselves for the integration of existing sanitation programmes in the overall project. Part of the services at construction distribution and maintenance level should be allowed to be privatised.

For privatisation of services, contracting out could be adopted which is the most common means of involving the private sector. It is flexible as it is possible to contract out either relatively minor items of works such as maintaining small parks or large scale activities such as solid waste management or operating a sewerage treatment plant. For small and simple contracts, it is easy to monitor performance. Contracting leads to efficiency in expenditure as private firms have flexibility in employment of workers as part-time, temporary etc. with rewards for work.

TRAINING MODULE FOR CAPACITY BUILDING

The beneficial practices and experiences of the IDP project could be taken up on training module to convey to the trainees its (i) integrated approach, (ii) holistic technical inputs, (iii) institutional development, and (iv) community participation. Some of the specific practices/experiences should form special units in the training module; these are:

- i) UASB technology for sewage treatment.
- ii) Community participation for the area development and maintenance of infrastructure assets.
- iii) Programme for women development.
- iv) Efficient accounting and finance management practices for cost efficient service delivery.

With some further work, the UASB technology could be made into a full training module by including technical and financial details and a site visit.

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