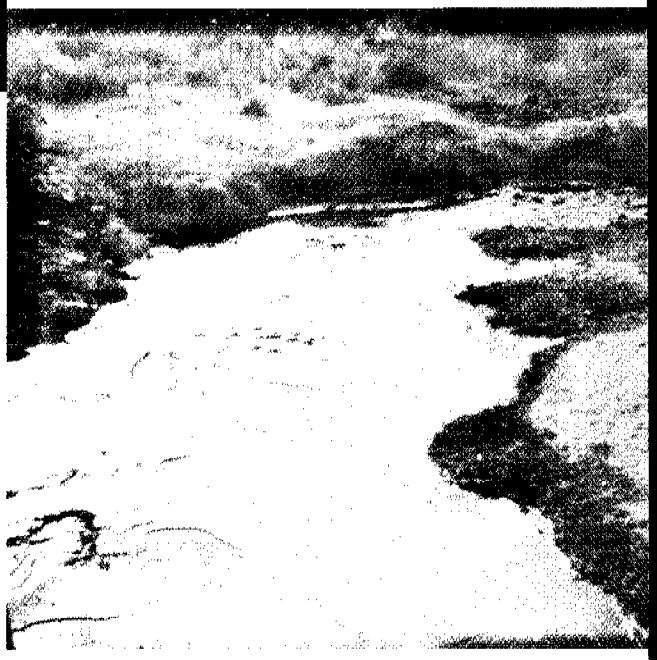
Clean WATER

ENVIRONMENTAL GOVERNANCE-1



- ECONOMIC INCENTIVES
- LAW ENFORCEMENT
- CLEANER TECHNOLOGIES
- INSTITUTIONAL ARRANGEMENTS
- PEOPLES' PARTICIPATION

INDIRA GANDHI INSTITUTE OF DEVELOPMENT

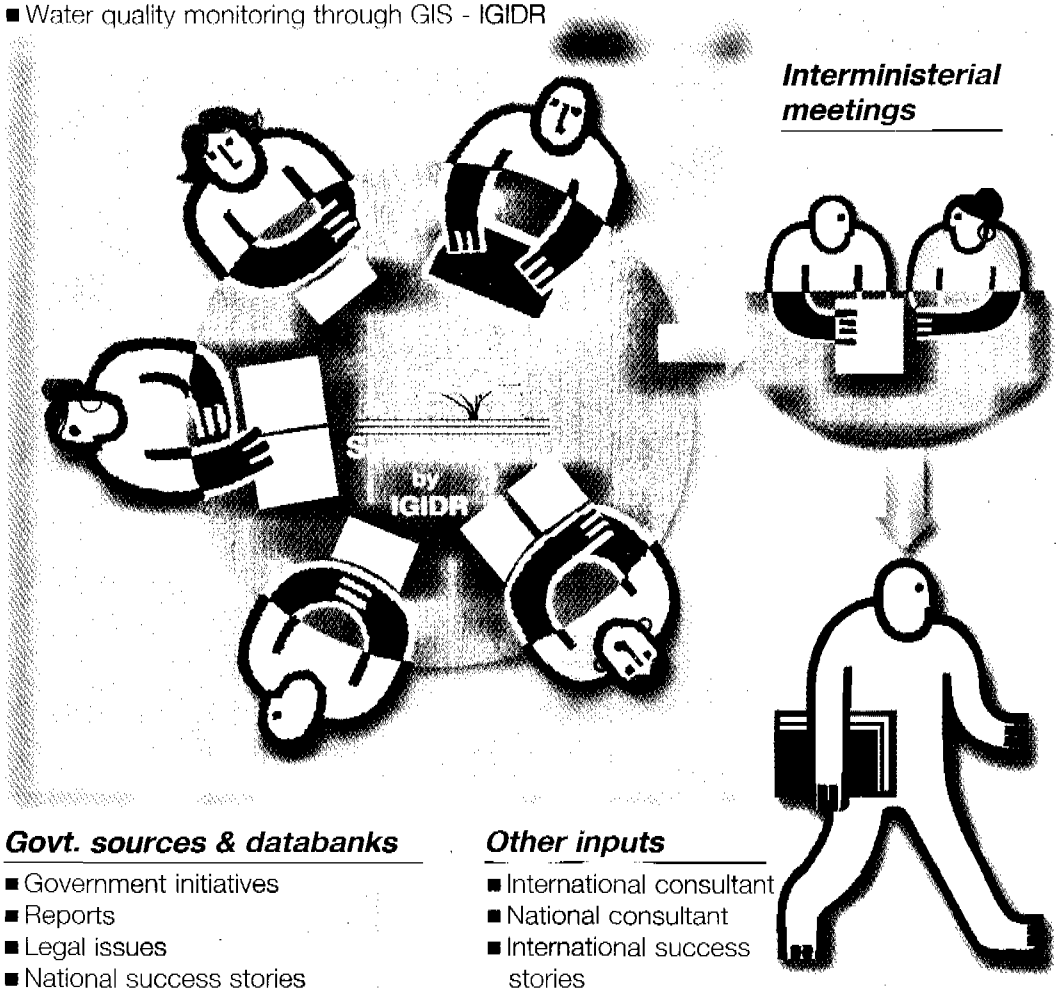
Linkages for
Water Quality Management Strategy Development

Case studies

- Water resource accounts in Bhavani river basin- MIDS
- Water resource valuation in Delhi - NEERI
- River basin management stratergy - CWRDM
- Review of environment laws - NLSIU
- Water quality monitoring through GIS - IGIDR

Consensus building

- Regional workshops
- National workshops
- Task Force meetings
- Steering committee meetings



Interministerial meetings

Govt. sources & databanks

- Government initiatives
- Reports
- Legal issues
- National success stories
- Five Year Plans
- Policy documents

Other inputs

- International consultant
- National consultant
- International success stories
- International conventions and commitments

Water quality management strategy

Preface

. The Indira Gandhi Institute of Development Research was requested by the Ministry of Environment and Forests, to implement the United Nations Development Programme's *Capacity 21 project* in India. A number of activities have been under taken under the project over the last 4 years and a series of strategy briefs on environmental governance have been prepared encompassing the following five areas (1) Clean water (2) Sustainable wetlands (3) Land and forests (4) Air Pollution and health (5) Environment in economic decision making

In this brief, issues related to water quality management are discussed. Pollution reduces the availability of water for specific uses, and as a consequence conflicts over water are rising. The extent and causes of water pollution, and its health and other consequences faced by women, children and society in general are outlined here. The economic, legal and technological approaches necessary to reduce or at least contain the problem and the need for consultation with stakeholders and peoples' participation in water resource management are discussed.

Water quality management strategy for India has been arrived at by a long capacity building process that began in 1995. First, IGIDR and collaborating institutions initiated consultations with stakeholders, with grassroots level studies. This was followed by stakeholder participation workshops at the regional level. To build consensus national workshops were organised to incorporate insights of other experts and also results of analytical case studies from around the country.

The strategy was synthesised further after critical analysis of earlier exercises on policy and strategy formulations, including information contained in five-year plans, experiences of Central Pollution Control Boards and databases of government and non-government agencies. The synthesis was discussed at the interministerial meeting where representatives of stakeholder ministries, whose co-operation is essential for water quality management, were present.

It is envisaged that these strategy briefs will be distributed to the members of the legislative assemblies of various states, members of parliament, government and non-government organisations, industrialists, members of judiciary, experts, academics, and the public in general.

Another series of detailed studies and analysis is also under way for readers who would like more details.

We welcome your feedback and suggestions.

Jyoti Parikh Kirit Parikh

Jyoti Parikh and Kirit Parikh
National Project Co-ordinators for Capacity 21 Project

Clean WATER

Water is essential for survival. But today about 200 million people in India do not have access to safe drinking water. Most of our water sources are polluted with untreated/partially treated wastes from industry, domestic sewage and fertilizer/pesticide run off from agricultural fields. According to Ministry of Rural Development, about 1.5 million children under 5 years die each year due to water related diseases, and the country also loses over 200 million person days of work a year because of these diseases. Studies show that better water supply and sanitation facilities can considerably reduce illness and death due to water related diseases. Deaths due to diarrhoea can be reduced by 65 per cent, while overall child mortality can be reduced by 55 per cent.

India has a long tradition of managing water, but increasing demands due to population and industrial growth and agricultural development pose new challenges. The quantity and quality of available water is decreasing, aggravating the already serious situation. According to the Ministry of Water Resources, water shortages in India will become even more pervasive by 2025 and stress human and economic development. Appropriate management of water resources is crucial for future economic development and protection of human health and life itself.

THE AIM OF THIS STRATEGY BRIEF IS TO ENSURE WATER SECURITY FOR PRESENT AND FUTURE GENERATIONS, PRESERVE WATER QUALITY AND ASSURE THAT WATER IS AVAILABLE EQUITABLY TO ALL MEMBERS IN THE SOCIETY.

Water resource management is a State and concurrent subject under schedule VII of the Indian constitution. There are numerous institutions dealing with water resource management both at central and state level like Ministry of Water Resources, Ministry of Environment & Forests, Central and State Groundwater Boards, Ministry of Agriculture, Ministry of Industry, State Irrigation Departments and Central and State Pollution Control Boards.

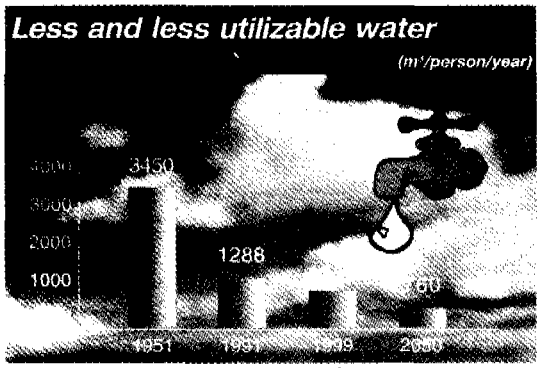
Through a process of grassroot studies, regional and national workshops, interministerial meetings with stakeholder institutions, a water quality management strategy brief for India has been formulated and presented here.

The aim of this strategy brief is to ensure water security for present and future generations, preserve water quality and assure that water is available equitably to all members in society. The strategy recognises that every water use generates wastewater that damages water quality, thus reduces quantity of water available for

use. Hence this strategy brief focuses on efficient and sustainable water quality management while suggesting ways to maintain the integrity of ecosystems.

Considerable investments are required to provide clean water. A time bound programme must be initiated to ensure sustainable use of invaluable water resources. The ministries and agencies that control water resources, those that use them and those that control quality and treat wastewater have to work together. A multi-layered approach, which involves implementation of legislation, introduction of new and traditional technologies for water conservation, recycling and reuse, economic incentives for users and the involvement of people who have a stake in the use of the resource are required.

CO-OPERATION IS NEEDED AMONG THE MINISTRIES AND AGENCIES THAT CONTROL WATER RESOURCES, THOSE THAT USE THEM AND THOSE THAT CONTROL QUALITY AND WASTE-WATER TREATMENT.



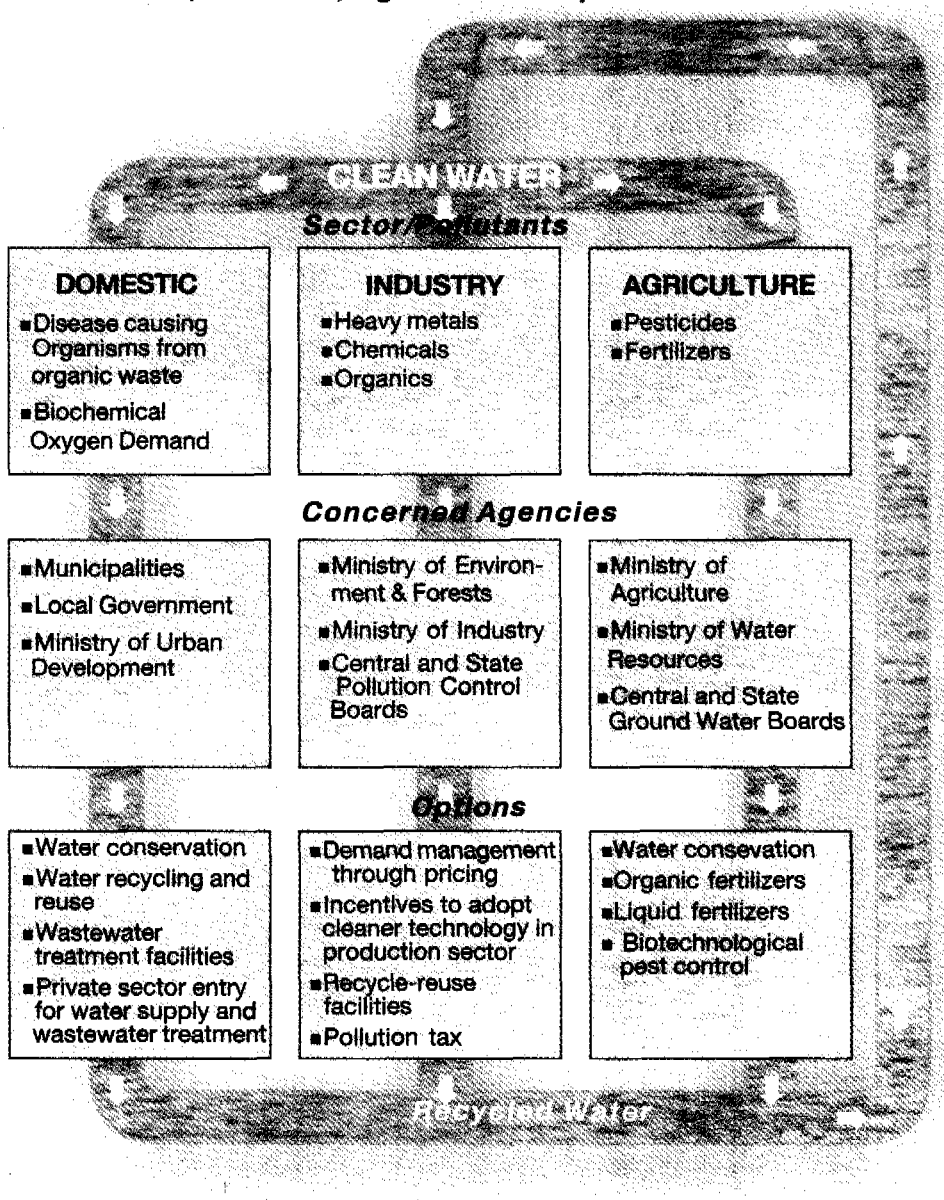
Source: Ministry of Water Resources, Government of India, '99

WATER AVAILABILITY

India receives nearly 4000 cubic kilo meters of water annually through the

SUNJAY MONGA

Water: Users, Polluters, Agences and Options



seasonal monsoon rains and rivers that flow down from the snow capped Himalaya and other mountain ranges. Due to a large and increasing population, the amount of utilizable water available per person per year is only 1250 cubic meters and is likely to decrease further *(See chart: Less and less utilizable water)*. The distribution and availability of water is not uniform across the country or through the year. Surface sources often run dry in the summer and groundwater availability

varies from the rich aquifers of the Indo-Gangetic-Brahmaputra plains to the comparatively low yielding hard rock regions of peninsular India.

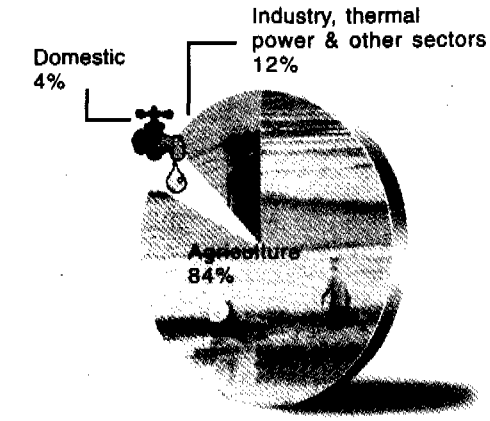
Water Use

Most of the country's water is used to irrigate agricultural fields. A small proportion of it is consumed in people's homes, while industry and other users claim about 12 per cent of the water. *(See chart: water use in different sectors).* The average consumption per person is only about 680 cubic meters per person per year for all uses, but it is projected to increase. *(See increasing demand for water).*

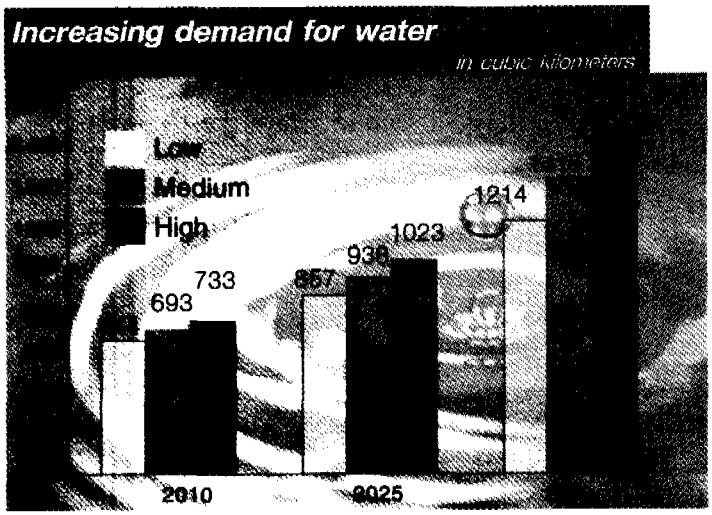
In 1993, only 78 per cent of rural and 85 per cent of urban inhabitants had access to drinking water. About 143,000 villages still have acute water problems, and many more have unreliable water supply. The government plans to provide drinking water to these villages in the 9th five year plan at a cost of Rs 40,000 crores.†

Over-exploitation of ground water is a very serious problem and the water table has steadily been falling in many parts of the country. There are more than 4.79 million electric and 3.7 million diesel pumps withdrawing ground water across

Water use in different sectors



Increasing demand for water



As per Ministry of Water Resources, demand for water is increasing rapidly due to agricultural, industrial and population growth. As per the Lower bound on demand projected for water in all sectors put together, it will increase from 644 cu.km in 2010 to 1214 cu.km in 2050. Similarly, as per the higher bound projected water demand, it will increase from 733 cu.km in 2010 to 1674 cu.km in 2050. Total water requirement would be much in excess of total average utilizable water resources of 1086 cu. km. Concerted efforts are needed at national and regional levels to harness more water to make it utilizable.

Source: Ministry of Water Resources (1999), Water Resources Development Plan of India: Policy and Issues, Government of India.

† *Lakh= Rs.10^5, Crore = Rs.10^7, 1 USD = Rs. 42.00*

the country. Of the ground water extracted, some 90 per cent is used for irrigation, and only 6 per cent of the total volume pumped is used for domestic purposes. Ground water is a shared common property resource and there is a need to evolve appropriate institutional mechanisms for its management.

Water Pollution

Even after anactment of Water (Prevention and Control of Pollution) Act as early as in 1974, water quality continues to deteriorate in the country. Rivers, streams and ground water are severely polluted. The water quality in most of the country's rivers is below CPCB prescribed criteria. The amount of pollutants that find their way into water sources are way above receiving water bodie's natural assimilative capacity. Surface water pollution is increasingly becoming a source of conflict among upstream and downstream water users because the later suffer the effects of upstream pollution. Water quantity available for specific uses will decline with pollution. When quality deteriorates, water loses its economic value. For example, with progressive quality deterioration, water uses may successively shift from drinking water to bathing water, water for livestock, agriculture and industrial uses and so on *(See box: Primary water quality criteria)*. Pollution also creates water scarcity in regions which otherwise have abundant water resources. *(See box: Conflict resolution to prevent pollution)*.

BHAVANI RIVER BASIN

Conflict resolution to prevent pollution

Conflicts about sharing water are common, but conflicts over polluted water are increasing recently. Chennai based Madras Institute of Development Studies (MIDS) has detailed conflicts between agriculturists, industry and domestic users for water in the Bhavani river basin, in Tamil Nadu. Effluents discharged by industrial units upstream of the Bhavanisagar dam accumulate in the reservoir during the summer months. Farmer's organization and NGOs have protested that the discherge of effluents affects the quality of water for downstream uses such as irrigation and drinking. This has led to an unbelievable situation where the down stream farmers are requesting the dam authorities NOT to release water.

Previously water was primarily used for agriculture and other sectors made little demands. With urbanisation and industrialisation in the region, the conflicts have grown. The number of water consuming industries in the Bhavani basin has increased dramatically. From 3 units in the 1950s they have increased to 257 in 1990s. Of these, 35 units are major water consumers and use 98 per cent of the water i.e. 84.5 million litres per day. The aggregate industrial water consumption in the basin is 86.4 mld.

Most of these industries are located on the banks of the river. Effluent from distilleries, sugar, tanneries, dyeing, and pulp and rayon units have an impact on water

Primary Water Quality Criteria

Criterion	Class A	Class B	Class C	Class D	Class E
Dissolved Oxygen (mg/l) minimum	6	5	4	4	
BOD (mg/l) maximum	2	3	3		
Total coliform count (MPN/100 ml) maximum	50	500	5,000		
pH	6.5-8.5	6.5-8.5	6-9	6.5-8.5	6.5-8.5
Free ammonia (mg/l) maximum				1.2	
Conductivity (micro mho/cm) maximum					2,250
Sodium absorption ration maximum					26
Boron (mg/l) maximum					2

BOD: Biochemical oxygen demand; pH: measure of the acidity or alkalinity of water. MPN: Most probable number; Mho: unit of conductivity.
Class A: Drinking water source without conventional treatment. Class B: Water for outdoor bathing.
Class C: Drinking water with conventional treatment. Class D: Water for wildlife and fisheries.
Class E: Water for recreation and aesthetics, irrigation and industrial cooling

Groundwater which used to provide guarantee against pollution, has not been spared either. Not only do pollutants from surface sources leach into the aquifer below, but with increasing groundwater exploitation, inorganics like fluoride and arsenic present below the ground also find their way into the extracted water. They cause fluorosis and arsenic poisoning. Groundwater pollution is particularly serious as 80 per cent of domestic water needs are met from this source.

quality. 84 per cent of the effluents is produced by the pulp and rayon industry.

Not only the various sectoral demands for water, but also the discharge of untreated effluents and sewage by industry and towns directly into the river has created conflict amongst the stakeholders. Redressal through the judicial system is an expensive and time consuming process. The MIDS study therefore recommends that the stakeholders in the basin can establish a "forum" where they can discuss and negotiate the issues relating the degradation and depletion of the water resources. Contractual settlements have to be worked out which are informal and transparent. Legal remedies can be sought only if negotiated settlements fail.

Pollution Contributors

The main sources of water pollution are domestic sewage, industrial effluent and agricultural runoff. The lack of investment in appropriate infrastructure to manage these wastes has been a major factor in deterioration of water quality across the country.

About 75 per cent of the waste water produced is from domestic sector, but the sewage treatment facilities are

Water related diseases

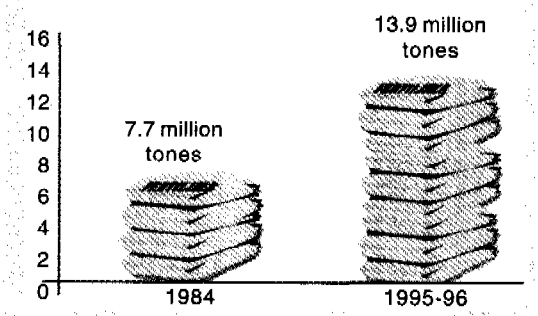
- Diarrhoea
- Hepatitis
- Roundworm
- Hookworm infection
- Trachoma
- Guinea worm
- Schistosomiasis
- Leishmaniasis
- Lymphatic filariasis

India loses about Rs. 36,600 crore per year due to water related diseases.

inadequate in most cities and almost absent in rural India. Only 25 per cent of class I cities (population more than 100,000), have wastewater collection, treatment and disposal facilities. And less than 10 per cent of the 241 smaller towns have wastewater collection systems. Some 20 per cent of all the wastewater generated in class I cities and only 2 per cent of all wastewater generated in class II towns is treated. In 1988 Mumbai and Delhi individually generated more wastewater than all the class II towns put together.

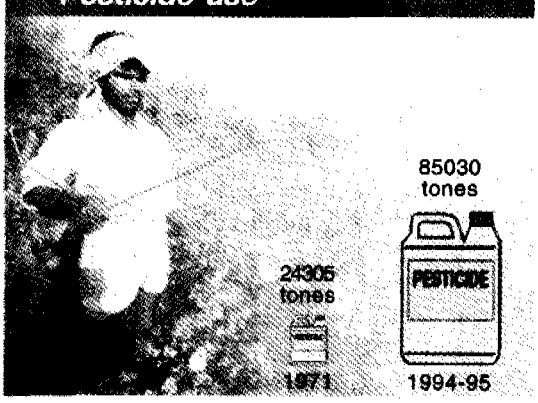
Estimates of wastewater generated in rural India are not available, but only 3.15 per cent of the rural population had access to sanitation services in 1993. According to Central Statistical Organisation, in 1993, about 75.7 million people in cities and 563.6 million people living in rural areas do not have access to toilets of any type. As a result huge quantity of organic waste finds its way into water bodies exposing the population to disease.

Fertilizer use



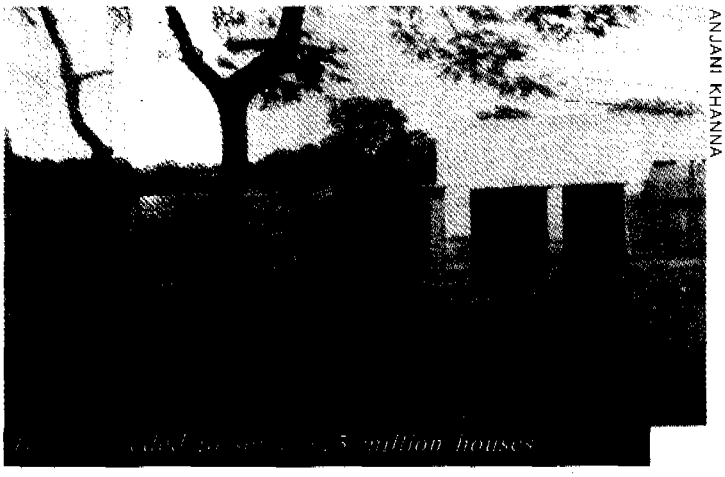
Indian industry has grown substantially in the last four decades. According to CPCB, as of 1995, out of 8,432 large and medium industries in the country, only 4,989 (59%) have installed appropriate measures [adequate and operating effluent treatment plants (ETP)] to treat wastewater before discharge. ETP in 1,233 units are not adequate. There are over two million small-scale industries in the country which also produce considerable effluents. Policy makers have so far ignored pollution contribution from small scale industries.

Pesticide use



(Central Statistical Organisation, 1997)

With the advent of the Green Revolution, agriculture in India has become very resource intensive. High yielding varieties require high chemical and water inputs, and these are often applied indiscriminately. Excess chemicals find their way into water sources, thus polluting them. Pollution from agricultural


ANJANI KHANNA

chemicals is difficult to monitor and control. In comparison to the developed countries, overall amount of chemicals does not seem to be large, the manner in which it is applied, where it is applied (upstream) are causes for concern *(See charts: Fertilizer use and Pesticide use).* Excess fertilizer enriches the receiving water bodies resulting in proliferation of biota, which eventually use up all the exygen in the water. Pesticides in the water accumulate with increasing concentration in the food chain, thus affecting the various animals and plants in the food chain, including humans.

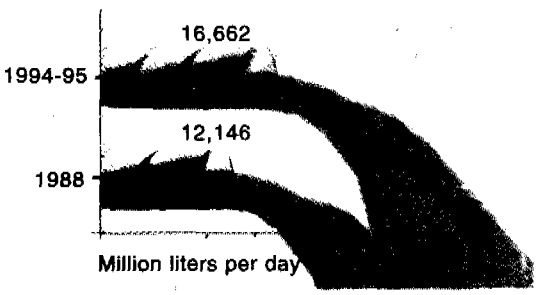
Cleaning up Costs

Several studies have shown that cleaning up domestic and industrial wastewater is expensive. But as the benefits to the society are undoubtedly great, huge investments in domestic and industrial wastewater treatment systems are now essential.

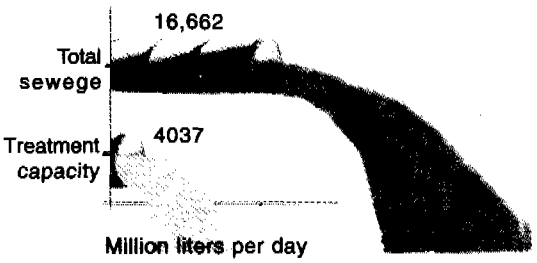
According to estimates more than Rs.46,000 crores would be required to construct toilets in the 115 million homes that are presently without toilets. In addition sewerage systems to collect wastewater and to feed it to the treatment plants would also require considerable finance. For example, under Ganga Action Plan sewerage provision in Mirzapur, a city with a populatin of one million, cost Rs. 10.87 crores. Investment would vary with topography, population spread, wastewater generation and existing capacities.

Wastewater treatment facilities are

Domestic sewage in class 1 cities



Inadequacy of sewage treatment facilities in class 1 cities



Technology choices

An IGIDR study reveals that a combined initial capital investment of Rs.6128 to 7353.6 crore and about 12,256 acres of land would be required to treat wastewater using ASTP technology in 3696 cities/towns in the country. Oxidation pond technology on the other hand would be a cheaper option at a capital investment of only Rs. 1838 crores, but the land requirement would be 61,280 acres, much of which would have to be urban or town lands.

Costs of domestic wastewater treatment

Technology	Land required *Hectares/mld*	Capital costs *Lakh rupees/mld*	Operation & maintenance costs *Lakh rupees/mld/year*
Activated Sludge Treatment Plant (ASTP)	0.4	35-40	3.0
Oxidation Ponds	1.0	12-15	0.5
Aerated Lagoons	0.6	15-20	2.75
Upward Anaerobic Sludge Blanket (UASB)	0.2	23-28	1.5
Duckweed and fish culture technology	0.7-1.0	10-12	0.5-1.0
Karnal Technology	1.0 -1.5	0.6-0.8	0.25-0.3
Trickling filter	0.4	35-40	3.0

Source: Ministry of Environment and Forests, 1998

expensive and the appropriate technology choices must be made, based on wastewater characteristics and the cost-effectiveness of the options available. The availability and cost of land is important in the choice of technology. Of the available technologies, oxidation ponds and aerated lagoons appear to be least expensive, but they require 3 to 5 times more land than other technologies. The initial capital costs of Activated Sludge Treatment Plant (ASTP) and Upward Anaerobic Sludge Blanket (UASB) technologies are higher, but their land requirements are lower. Though the land requirements for oxidation ponds and aerated lagoons seem high, these ponds can be for instance, used for aquaculture, leading to substantial economic benefits. *(See box: Technology choices).* While such land based solutions may be ideal in some areas in the short term, in the long term cleaner technologies and practices as well as land minimising treatment technologies may be necessary. Decentralized recycle/reuse systems are also required, even if they are moderately capital intensive.

Indian industry may have to spend around 2 to 5 per cent of its capital investment on pollution control. The costs of operating these facilities are anywhere between 15 to 30 per cent of the investment made on the treatment facilities, on an annual basis. The total annual investment needed for water

pollution abatement across all the water polluting industries is estimated at Rs.1,400 crores which, is about 1.17% of the annual turnover of these industries.

As regulations become more stringent, waste treatment facilities will have to become increasingly efficient, leading to sharp increases in costs. An effluent treatment plant wtih 99 per cent efficiency can almost cost twice as much as one with 90 per cent efficiency for certain critical pollutants such as colour or total dissolved solids. Studies have shown that common effluent treatment plants can be viable and affordable for small-scale industries.

WHILE THERE ARE SEVERAL LAWS THAT RELATE TO POLLUTION CONTROL, MULTIPLICITY OF LAWS CREATES ITS OWN AMBIGUITY, BEHIND WHICH OFFENDERS HIDE. POLLUTION CONTROL LAWS SHOULD BE CONSOLIDATED.

EXISTING POLLUTION CONTROL MECHANISMS

Several laws have been enacted over the years dating back from 1923, to regulate environmental pollution. State and Central Pollution Control Boards have been constituted to control and monitor water pollution. They are mandated to ensure that the prescribed standards for effluent discharges are maintained, and penalties can be imposed under the law. *(See box: Water pollution control laws).* Recently Central and State Ground Water Boards have been created to monitor and manage groundwater resources.

The government also offers limited economic incentives to encourage industry to comply with the prescribed standards *(See box: Economic incentives).* So far there have been no serious attempts of using economic instruments such as pollution taxes or marketable pollution permits, which provide incentives to the polluters for adopting the cheapest pollution abatement technologies.

While there are several laws that relate to pollution control, multiplicity of

Economic Incentives

- Depreciation allowance: A depreciation of 100 per cent is provided on specific equipment installed by manufacturing units to control pollution.
- Water cess: If an industry has installed equipment for treatment of sewage or effluent, it can avail of a rebate of 70 per cent on the water cess, which is levied on water use.
- Concessional custom duty: Equipment and spares for pollution control attract reduced rates of customs duty.
- Excise duty: Excise duty at reduced rate of 5 per cent on manufactured goods that are used for pollution control.
- Soft loans: Financial institutions can extend soft loan facilities for installation of pollution control equipment.
- Subsidies: Small scale industries can receive financial assistance and subsidies to set up common effluent treatment facilities.

Water pollution control laws

- Water (Prevention and Control of Pollution) Act, 1974.
- Water (Prevention and Control of Pollution) Cess Act, 1977.
- Environment (Protection) Act, 1986.
- Public Liability Insurance Act, 1991.
- Environmental Impact Assessment Notification (1994).
- Environmental Audits.
- Ambient Water Quality and Effluent Standards.

laws creates its own ambiguity, behind which offenders hide. Pollution control laws should be consolidated. The present laws place undue emphasis on criminal procedure, which hampers appropriate environmental management *(See box: Problems with the laws).*

CONTINUING POLLUTION
A FAILURE OF POLICY

Despite the enactment of laws, waterpollution continues unabated, pointing to an obvious failure in policy and legislation and in their implementation. The pollution control boards are poorly staffed, lack technical facilities to control and prevent

Problems with the laws

Although elaborate provisions of law appear to exist, the law remains ineffective and the environment continues to deteriorate. Experts from the National Law School of India University, Bangalore have evaluated the existing pollution control laws and suggested several reforms.

They suggest that the principal legislation is repetitious and poorly drafted. The laws are not backed by sound policy pronouncements and the legislation does not appear well thought out but seem ad hoc. This is especially true of a number of rules and notifications like the Coastal Regulation Zone and the Environment Impact Assessment notifications issued in recent times.

The pollution control laws are based on a command and control regime with an emphasis on punitive rather than pro-active and preventive measures. Though the boards have wide ranging powers, including the ability to hold industrialists personally liable for environment damage these are rarely exercised effectively. Undue emphasis is placed on criminal procedure, and as a result there is considerable delay in convictions. Before judicial process is initiated against polluters, spaces for cooperation and partnerships between various groups should be explored. Central and state boards also need powers to impose progressive monitory penalties on the polluters. This will, to a great extent, reduce need for time consuming legal recourse.

Greater cooperation between central and state pollution control boards is needed. Conflicts over jurisdiction between the state boards and the district administration should also be resolved for effective implementation of legal provisions.

Another major lacuna in the law is that some areas like groundwater pollution remain outside the purview of the pollution control laws. Consolidation and codefication of the law would remove some of these problems.

pollution and have meager financial resources. A lack of willingness to implement policy is also apparent. They have also failed to bring offenders to book. Thousands of cases have been initiated against polluting industries, but only a handful of convictions have been obtained. For example, in Rajasthan only two convictions have been obtained, despite nearly 7,000 cases filed in court against air and water polluters.

INTERMINISTRIAL CO-ORDINATION IS ALSO ESSENTIAL FOR EFFECTIVE IMPLEMENTATION AND THE ROLE OF AN AWARE, ACTIVE AND VIGILANT CITIZENRY ALSO MUST NOT BE UNDERVALUED.

The present policy relies on industry specific effluent standards, which are prescribed based on best available technology. Naturally, industries do not reveal what is possible and manage to get a lax standard. The volume of water used is taxed. The cess charged is not meant to reduce concentration of pollutants, but to reduce quantity of wastewater released through water conservation.

Though the pollution control boards routinely monitor the quality of water in lakes and rivers, they are not so regular about monitoring the effluents produced by industries. Also, even if several polluting industries meet CPCB statutory requirements, ambient water quality can deteriorate if there are a number of such industries in a locality.

Polluting industries are usually willing to make a one-time investment and set up effluent treatment plants, especially if the investments involved are small. But as operating costs can be high they are often reluctant to run these plants. After an initial verification that pollution control devices have in fact been installed by the industry, the Central and State pollution control boards are not equipped to check on their regular operation, allowing the offenders to get away.

The present pollution control policy doesn't address small-scale industries, which pollute with impunity. Setting up functioning common effluent treatment plants, through appropriate incentives are important. Small-scale industries may have to be relocated together to facilitate the establishment of such facilities.

Water Quality Management Strategy

Clean water is not a luxury. It is a necessity. With sensible policies water bodies can be cleaned, saving crores of rupees in health costs and protecting our land and water resources for future generations. A comprehensive multi-pronged water quality management strategy includes strict implementation of pollution control

A COMPREHENSIVE WATER QUALITY MANAGEMENT STRATEGY, WHICH INCLUDES THE STRICT IMPLEMENTATION OF POLLUTION CONTROL LAWS, CLEAN TECHNOLOGIES, PEOPLE'S PARTICIPATION AND FISCAL INCENTIVES IS NECESSARY.

Water Quality Management Strategy

It is clear that water quality management strategy has to be bold on several approaches simultaneously to address the problems. Five such approaches are highlighted below:

Economic incentives

- Price of water should reflect its scarcity value and environmental costs.
- Reduce water use through pricing.
- Operationalize 'Polluter Pays Principle' through tax based on pollution load rather than on water consumption
- Higher credit rating for green industries
- Reduce subsidies on fertilizers and pesticides

Law enforcement and other controls

- Consolidate pollution control laws and implement them.
- Make clean technologies in new industries mandatory
- Require environmental audits for industry

Cleaner technologies

- Introduce cleaner technologies, reuse and recycling of water in industry..
- Reduce irrigation water use through water conservation technologies.
- Encourage integrated pest management practices.
- Encourage use of vermiculture and organic manures.

laws, promotion of cleaner technologies, fiscal incentives and economic instruments of appropriate prices, taxes and property rights. Interministerial co-ordination is also essential for effective implementation. An aware, active and vigilant citizenry is critical for success.

Water Conservation

The water quality management strategy brief provides a broad framework for pollution control. All water use produces effluents. Minimising the amount of

Reducing demand

- In Bogor, Indonesia water fees were increased by about 30 per cent resulting in a 29 per cent decrease in water consumption. Big consumers were then advised and provided necessary devices to reduce consumption further. Monthly water use decreased further by 29%.
- Mexico City has replaced 350,000 toilets with smaller six-liter models, saving enough water to meet the household needs of 250,000 additional residents.
- In Beijing water price is linked to the amount of water used. Water consumption quotas and fines for excess use are set.
- Water use per person has been reduced in Jerusalem by 14 per cent, by using water saving devices, detecting and repairing leaks, and more efficient irrigation in its parks.
- Water use per capita declined by nearly 10 per cent in Waterloo, Canada due to higher water prices, distribution of water-saving devices, and public education.

- Cheaper technologies for treatment of domestic effluents

Institutional arrangements

- Strengthen central and state pollution control boards
- Empower municipalities and grampanchayats to control pollution
- Involve private sector in water supply, wastewater collection and treatment in urban areas
- Build clean technology databanks.
- Time bound programe to cover towns and cities with sewage treatment

Peoples' Participation

- Involve local people in water management
- Provide information to the public
- Initiate water conservation awareness campaigns

water used can have an immediate impact on the quality of water. The strategy identifies demand reduction for water as a major priority. Water is still treated as a free good, to be used liberally, and to be sullied with impunity. Pricing water to reflect its scarcity value, can encourage users to be more prudent in its use. The price of water should also include opportunity costs and environmental impacts of its use (*See box: Delhi: Willing to pay for clean water).*

With appropriate water conservation strategies as much as 63 cubic km of water can be saved in the agriculture sector, 2 cubic km in the domestic and 25 cubic km in the industrial sector by 2025, from the projected demand *(See box Reducing Demand).*

Better pipeline management can curtail water losses. Domestic wastewater can be reused and recycled for agricultural and industrial purposes. Awareness campaigns and appropriate water saving devices to reduce demand need to be introduced in urban areas.

The agricultural water demand also needs to be controlled. Subsidies on rural electricity and agricultural water supply that encourage wasteful use of water must be reassessed. Drip and sprinkler irrigation technologies should be encouraged, particularly in water deficient regions. As these technologies reduce water use they also reduce fertilizer/ pesticide runoff from agricultural fields, reducing the amount of pollutants that eventually find their way into the water bodies.

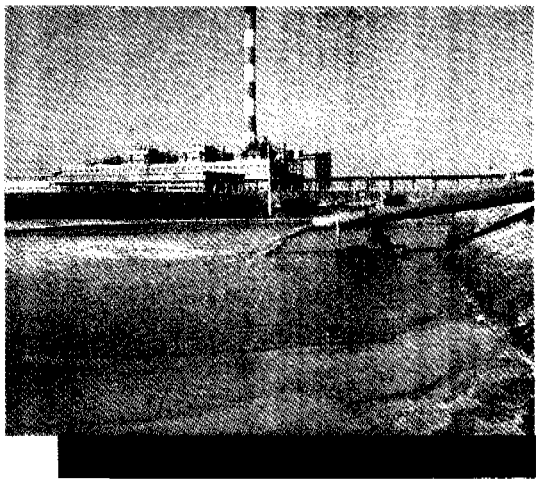


PHOTO COURTESY: BUSINESS INDIA

Let Polluters Pay

Polluters usually do not feel the effects of the pollution caused by them and the adverse effects are borne by other parties. The polluter is rarely held accountable for the damage, and continues to pollute with impunity. Recognising that the polluter is in fact passing on the costs of his polluting activities to an unsuspecting citizenry, it is essential that the "Polluter Pays Principle" is made operational. Quantifying and putting a cost to these adverse effects of pollution, and then incorporating them into the

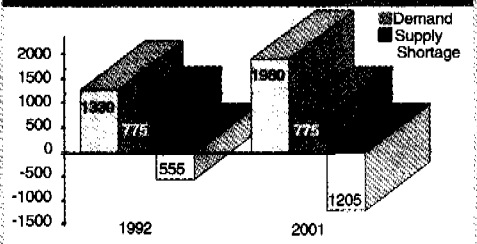
DELHI:

Willing to pay for clean water

Delhi's ever growing population reels under severe water shortages, and the river Yamuna is severely polluted. The costs of neglect, uncontrolled and unplanned water use, are enormous. A Capacity 21 study by the Nagpur based National Environmental Engineering Research Institute measured, using environmental economics, the costs of replenishing the diminishing groundwater and of cleaning up the river.

The availability of water has decreased from 1847 million cubic metres (mcm) per year in 1992 to 1441.74 mcm per year in 1995, and the ground water levels in the once rich flood plain and contiguous areas have been steadily falling as water is uncontrollably mined. Untreated domestic

Increasing demand supply gap



Integrated Economic and Environmental Accounts for Delhi *(Water sector, 1995)*

Sector	GDP (Rs.Crore)	Wastewater Discharge (MCM/Year)	Ground Water Decline and degradation avoidance costs (Rs.Crore)	Wastewater Treatment costs (Rs.Crore)
Domestic	–	562	782	31
Agriculture, forestry etc.	538	12	434	1
Industry	5059	206	822	11
Trade and commerce	12633	55	71	3
Total	18230	835	2109	46

IT IS ENVISAGED THAT IF INDUSTRY GROWS AT 8% PER ANNUM, NEW INDUSTRIAL CAPACITY WILL DOUBLE IN 9 YEARS. IF WE MAKE SURE THAT NEW INDUSTRIES CHOOSE CLEANER TECHNOLOGY WE WOULD HAVE GREENER GROWTH.

decision making process and deciding the price of water accordingly can resolve such problems.

Encouraging Industry to Act

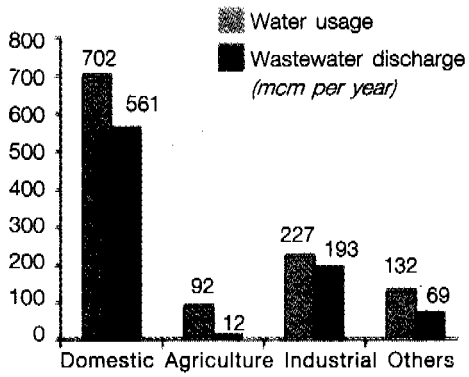
Industry is gradually beginning to realise that pollution control is a reality they can not avoid. However, their reluctance to act has to be tackled in a manner that is more effective than the existing command and control regime. Large investments in treatment facilities are essential and these must be encouraged through economic incentives.

Water efficient and cleaner technologies should be made mandatory, particularly in new industries as nothing in production sector can be

waste, agricultural runoff and untreated waste from the thousands of industries in the National Capital Territory all eventually find their way into the Yamuna.

The city is drawing an annual benefit (1996) to the tune of Rs.2110 crore (from the future generations) by ground water mining (withdrawal of ground water beyond sustainable levels). The study included the cost of constructing a dam outside Delhi as an alternative source to groundwater, conveyance of this water to the city and its distribution and storage. The study also attempts to put a value on the surface water in the National Capital Territory. To do this it attempts to capture the intuitive value people place on the Yamuna. A sample of about 100 people were asked to indicate their willingness to pay for the different functions of the river, for reliable water supply and its consumption, pollution prevention and water purification. The study estimated that people in the region were willing to pay as much as Rs 345.65 crore for pollution prevention through wastewater collection and treatment and about Rs 170 crore for improved water supply. They were also willing to pay substantially for cleaning up the river.

Sectoral use discharge accounts



The situation in Delhi is serious. Water conservation and wastewater recycling are crucial. Sewage systems need to be extended through the city and waste treatment undertaken. These studies clearly reveal that the people of Delhi want clean water and are willing to pay for it. The administration cannot hide behind a paucity of funds and should clean up.

absolutely clean. If we start investing in cleaner technology from now, and if the industry grows at 8 per cent per annum as envisaged, in 9 years 50% of the industry will have cleaner production. Databanks of clean technologies should be maintained with the pollution control boards and these must be referred to when consent to the industry is granted. Environmental Impact reports are approved by MOEF, so it must be responsible for insisting on cleaner technology for new industries.

Old industries should also be encouraged to shift to water efficient technologies, reuse and recycling through appropriate pricing of water. If water pricing can not be reformed these should be made mandatory. Higher credit rating for green industries would also encourage entrepreneurs dependent on the market for capital, to be more responsible for the environment.

Industries should be taxed based on the amount of pollutants in the effluent rather than on the water they consume. This will give them an incentive to reduce their pollution load. Self-monitoring by the industry, through environmental audits which are regularly published, would enhance compliance and reduce the burden on the monitoring agencies.

Dealing with Domestic and Agriculture Pollution

While there is a framework in place to deal with industrial pollution, mechanisms to address pollution in the agriculture sectors are not in place. This is out of the ambit of the pollution control boards.

New institutional mechanisms need to be explored to monitor and manage domestic and agricultural pollution. Responsibilities should be either vested with the Central and State pollution control boards or existing institutions like the Public Works Departments, Municipalities or Gram Panchayats.

PRIVATE SECTOR ENTRY AND PARTNERSHIP BETWEEN PRIVATE AND PUBLIC INSTITUTIONS, SHOULD BE EXPLORED TO PROVIDE DOMESTIC WATER SUPPLY, SANITATION AND WASTEWATER TREATMENT FACILITIES IN URBAN AREAS.

As most municipalities are cash-strapped, involvement of the private sector and partnerships between private and public institutions, need to be explored to provide domestic water supply, sanitation and wastewater treatment facilities, in urban and semi-urban areas. Cheaper domestic wastewater treatment technologies, like biological treatment need to be examined as alternatives to the more expensive conventional treatments.

An important first step is to curtail overuse of fertilizers and pesticides through appropriate pricing. Subsidies that encourage overuse should be removed. Environment friendly practices like vermiculture, use of organic manure and integrated pest management practices that obviate the need for persistent pesticides should be vigorously encouraged.

People in Partnership

It has become increasingly evident that it is virtually impossible for the Government to monitor the activities of individuals, industries and institutions across the country. A vigilant stakeholder with strong and technically equipped institutional support can play a very important role in managing the environment. Vigorous awareness campaigns should be encouraged as experience in the industrialized countries has shown that polluting firms react to popular pressure, and are keen to clean up their act to maintain a green profile.

VIGILANT STAKEHOLDERS WITH STRONG AND TECHNICALLY EQUIPPED INSTITUTIONAL SUPPORT CAN PLAY A VERY IMPORTANT ROLE IN MANAGING THE ENVIRONMENT.

A citizen's right to information and regular publication of environmental audits of firms can be very effective in cleaning up industrial pollution.

While citizens should be seen as allies, water resource use and pollution monitoring and control institutions also need to be strengthened.

Institutions

To monitor industrial, domestic and agricultural pollution institutional mechanisms that could involve the stakeholders need to be evolved. The pollution control boards should generate and maintain data that can be made available to concerned citizens, who can play a crucial role in ensuring that water resources are conserved and environment health is maintained. They should be provided the necessary teeth to implement the law. State-of-the-art monitoring technology should be provided to measure pollutants, and the technical skills of the manpower upgraded.

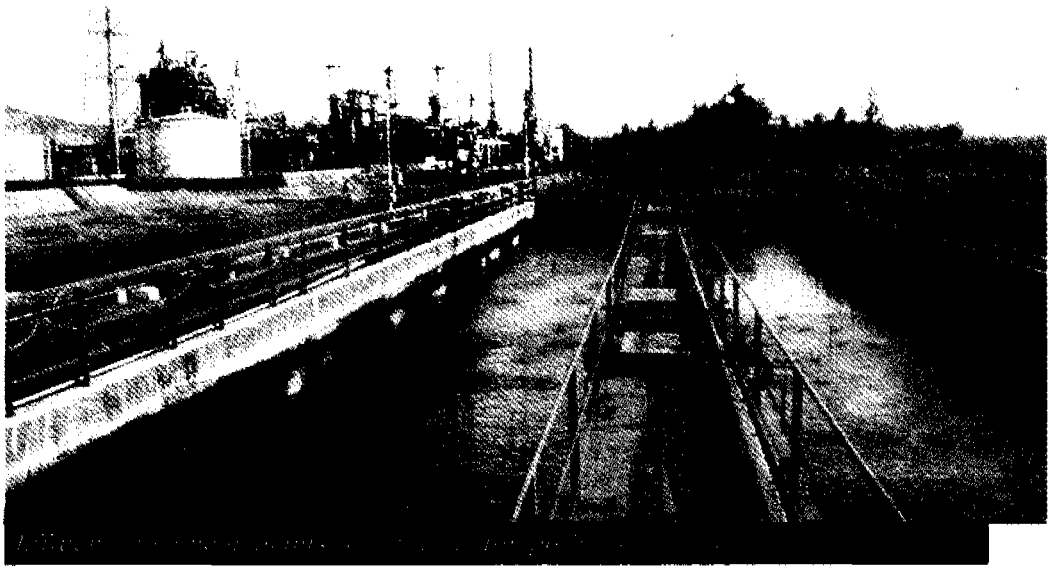


PHOTO COURTESY-BUSINESS INDIA

Notes:

Consensus and Capacity Building Events under Water Quality Focal Area

1996

January: Training course on Environment and Development: Economic and Technical Issues for central and state pollution control boards, IGIDR, Mumbai.

December: Training course on Environmental Economics for collaborating institutions, IGIDR, Mumbai.

1997

April: International training course on Environmentally Sustainable Development for Asia-Pacific Region, IGIDR, Mumbai.

May: Regional workshop on Natural Resource Accounting and Economic Valuation of Water Resources in Bhavani River Basin, Coonoor, Tamil Nadu.

October: Workshop on Environmental Database in Indian Economy, IGIDR, Mumbai.

December: National workshop on "Water Quality Management for the 21st Century", IGIDR, Mumbai.

1998

March: Brainstorming with Maharashtra ministry of environment and state pollution control board to discuss results of Krishna Basin case study and resource allocation issues.

May: Regional workshop on Conflict Resolution in Bhavani Basin, stakeholders meeting, Erode, Tamil Nadu.

Regional workshop to discuss water quality and river basin management strategies at Calicut.

December: International workshop on Capacity Building in Environmental Governance for Sustainable Development, IGIDR, Mumbai.

1999

January: National workshop on Evaluating the Environmental Laws and pro posal for Reforms, NLSIU, Bangalore.

March: Interministerial meeting to discuss Draft Water Quality Management Strategy for India, MOEF, New Delhi.

Outreach activities upto May 1999

Outreach	No. of activities	Participants
Collaborating institutions	5	15
Regional workshops	3	95
National workshops	4	75
International workshop	1	75
International training	1	24
Interministerial meeting	1	31
Grassroot level involvement	Data Collection/Regional Workshop	450
Grass root level participation	Data collection/ conflict resolution forum in Bhavani basin	190

Notes:

Indira Gandhi Institute of Development Research
Kirit Parikh, Jyoti Parikh, Raghu Ram Tata

Acknowledgements

Collaborating Institutes

National Environmental Engineering Research Institute
P. Khanna, P. Rambabu, Sreenivasa Rao

Madras Institute of Development Studies
Paul P. Appasamy, L. Venkatachelam, M. Sabesh, E. Lakshmanakumar, V. Sampath Kumar, V. Prabhar Gnanakkan, Vincent Jayakumar, R. Rajendran, P. Arunachalam, Prakash Nelliyat

Centre for Water Resources Development and Management
P. Basak, E.J. James, M.D. Nandeshwar, P.N. Unni

National Law School of India University
M. K. Ramesh, K. Lenin Babu, B. Deepa, Anand Mohan Bhattarai

Task Force Members

Dilip Biswas, Chairman, CPCB
V.P. Jauhari, Principle Secretary, Andhra Pradesh
Baldev Sahai, Ahmedabad

Ministry of Environment and Forests

Suresh Prabhu, Minister for Environment and Forests
Vishwanath Anand, Secretary
Malti Sinha, Additional Secretary
Nirmal Andrews, Joint Secretary
Ujjwal Choudhury, Director (IC), National Project Director, Capacity 21 Project

Planning Commission

S.R. Hashim, Member Secretary and Chairman, Capacity 21 project steering committee
Pradeep Kumar, Adviser (Environment and Forests)
G. Thimmaiah, Former Member and chairman, Capacity 21 project steering committee
K.M. Lal, former Senior Advisor

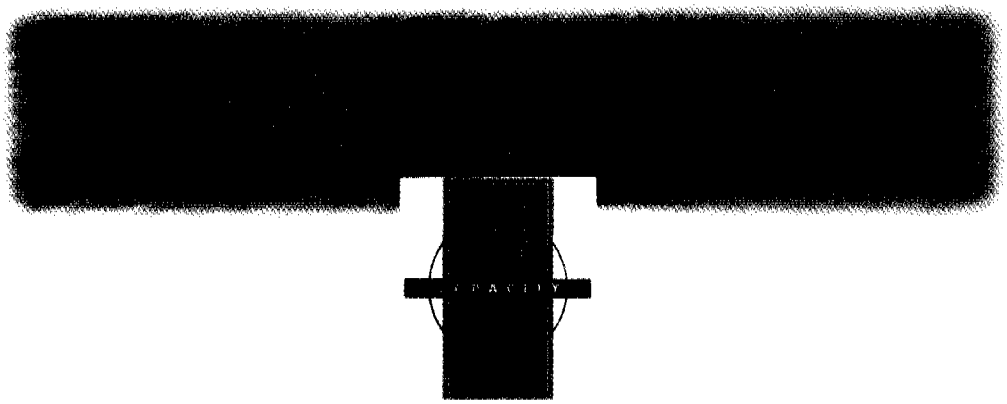
***United Nations Development Programme* – New Delhi**

Brenda Macsweenie, Resident Representative
Hans von Sponeck, former Resident Representative
Pradeep Monga, Assistant Resident Representative
Keshav Desiraju, former Assistant Resident Representative.
Veronica Peris, Programme Officer

***United Nations Development Programme* – New York**

Roberto Lenton, Director, SEED
Philip Dobie, Director, UNSO
Anita Nirody, Deputy Coordinator, Capacity 21 Project
Michio Kakegawa, Programme Specialist, Capacity 21 Project

Cover photos, courtesy: (Top) SUNJAY MONGA, PORPOISE PHOTOSTOCK, (Bottom) BUSINESS INDIA



Rational environmental governance is essential for sustainable development. To make correct development choices the country's people and institutions must understand complex environmental and developmental issues and their implications.

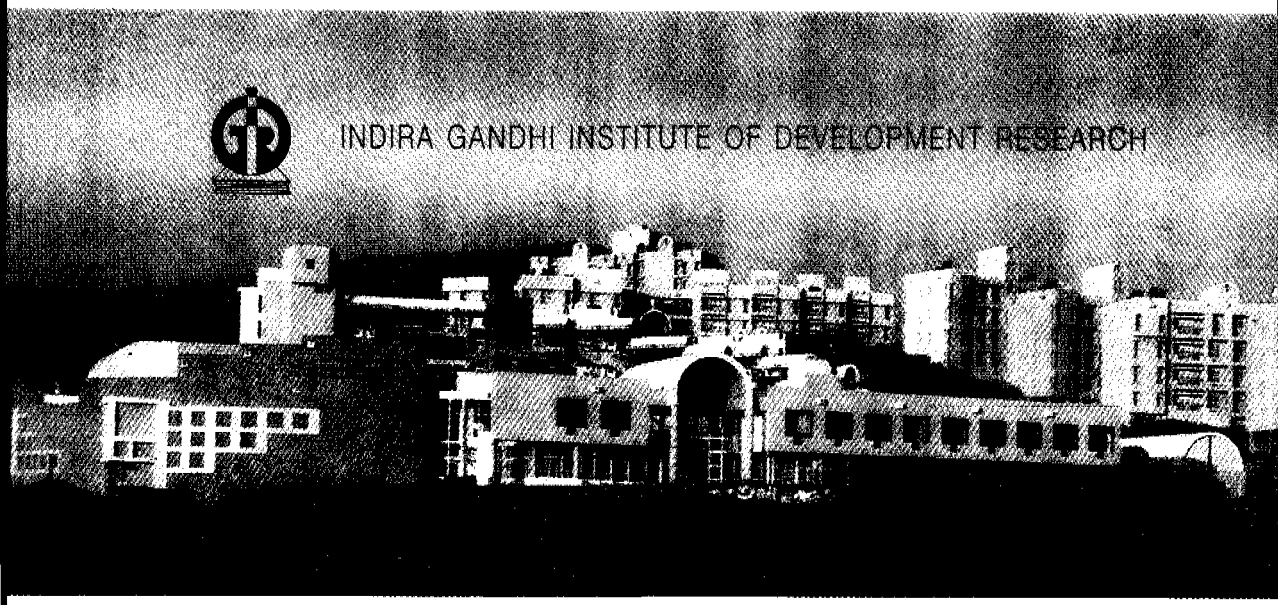
To meet the challenges of the 21st Century, the United Nation Development Programme's (UNDP) Capacity 21 Project for India was initiated in 1995. It has the overall goal of building understanding and capacity in environmental economics in national research institutions, natural resource ministries, the Planning Commission, non government organisations, private sector and among stakeholders who have an interest in the state of the environment. The project aimed to broaden the perspective of decision and policy makers in government and outside to include a concern for sustainability.

The Indira Gandhi Institute for Development Research has been awarded the responsibility of implementing the Capacity 21 Project in India, under the overall supervision of the Ministry of Environment and Forest, Government of India. Several of the country's premier institutions including the Institute of Economic Growth, New Delhi, the National Environmental Engineering Research Institute, Nagpur and the Bombay Natural History Society, Mumbai have collaborated on the project.

The Capacity 21 project is focused on Air Quality, Water Quality, Common Property Land Resources and Biodiversity. Strategy briefs for each of these areas has been prepared through a process of research and consultation.

Specific case studies in particular areas were commissioned and these and others were discussed in national and regional workshops. Consultations with stakeholders, experts, researchers, bureaucrats and other decision-makers are an important input into the strategies.

The strategy briefs presented here take into account environmental economics along with stakeholders' perspective as well as legal, institutional and gender issues. They embody multi-disciplinary perspectives, but also represent a consensus. These strategy briefs provide a broad framework for environmental governance in the aforesaid four focal areas.



The Mumbai based Indira Gandhi Institute of Development Research (IGIDR), was established by the Reserve Bank of India, and inaugurated by the then Prime Minister Rajiv Gandhi in December 1987. The institute was established to study national and global issues relating to economic development, to promote and conduct research, to teach and train professionals and to promote national and international collaboration. The Institute is a deemed university and conducts M.Phil/Ph.D. programmes in development policy.

Located on a 14 acre campus, the Mumbai based institute has an active research programme focused on economic development and policy research. Some of the areas of interest include macroeconomic, trade, monetary and fiscal policies, economic reforms, poverty, employment, energy systems, technology assessment, local, national and global environmental issues, agricultural and rural development.

To facilitate dissemination of its policy oriented research the Institute encourages work in collaboration with government departments and international agencies. Earlier work has involved studies for the economic advisory council to the Prime Minister, Planning Commission, Department of Energy, Ministry of Environment and Forests, UNCED, UNDP, UNCTAD, ESCAP, The Asian Development Bank and the World Bank. The Institute hosts national and international conferences and network with other academic and non government organisations.

DESIGNED AND PRINTED BY : ENVISAGE, TEL:864 4200.