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REACHING THE UNREACHED: CHALLENGES FOR THE 21ST CENTURY

# Problems facing water supply and sewage

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IT HAS BEEN estimated that over 700,000 Crores (£140bn) is to be spent on infrastructure projects in India in the next six years. This investment embraces the power sector, transportation (roads, railways, airports and ports / harbours), telecommunications and the water sector.

The supply of potable water in India is a State responsibility. The provision of adequate water supplies to large urban centres such as the cities of Madras, Bangalore and Hyderabad as well as Industrial town's such as Tirupur, is of great importance not only for the health of the general public, but also for the increasing demands of industry. Historically, water supply to these large cities has been less than adequate, with requirement far overweighing available supplies. At present, for example, Bombay city, considered by many the most modern and advanced city in India, receives water for only a small proportion of each day. In other cities such as Madras, supply of water is often less frequent. In Tirupur water has to be tankered in every day. Existing demand therefore is artificially constrained by both the lack of an available resource and an inability to distribute the treated water product.

Due to local topography, water has often to be conveyed great distances via large diameter pipelines and pumping installations. Schemes proposed for Madras, Hyderabad and Bangalore comprise transmission mains of 230km 130 km and 100km respectively. The cost implications for these capital schemes are huge. Furthermore, as much as 25 per cent of all water is made available from public standpipes (i.e. free of charge). The water is subsidised, by the various Water Supply and Sewerage Boards and therefore, the most cost-effective method of financing, construction and operating / maintaining these large water supply schemes is today a focus of attention for State Governments.

Another major problem facing the water supply sector is the loss unaccounted for water or Non Revenue water (NRW), which comprises physical and non physical losses of water arising from:

- Present bursts - awaiting repair.
- Longer standing bursts-either not yet located or not known about.
- Leakage from ferrules, communication, supply pipes and weeps from joints, valve glands.
- Reservoir and treatment plant overflows.
- Losses through errors in the billing system.

Hitherto not much attention has been placed on evaluating and minimising NRW in an attempt to optimise distribution system operations. Values of NRW for various countries in comparison to India are listed below:

| *Country* | | *NRW (as per cent of production* |
|---|---|---|
| Dubai | | 14 (in 1989 47 per cent) |
| Singapore | | 11 |
| Hong Kong | | 22 |
| Malaysia | < | 40 (in 1987 43 per cent) |
| Taiwan | | 23 |
| Thailand (Bangkok) | | 35 |
| Vietnam (Ho Chi Minh City) | | 41 |
| Spain | | 25 |
| UK | | |
| Italy | | 30 |
| INDIA | > | 50 (estimate) |

These countrywide NRW values are volumetrically and economically very significant and indicate a wide range in performance achieved. However, they do mask the range of values which occur within a specific country. For example the range of NRW values applicable to various water supply districts in Malaysia (applicable for 1987) range from 20 per cent to 65 per cent of production.

Whilst other problems facing the water sector - which are not too dissimilar to other sectors - such as insufficient training, bureaucratic setup and lack of resources for operation and maintenance have been discussed at various other fora and hence will not be discussed here. This paper describes five specific water supply and sewerage projects in India designed to improve the national infrastructure.

## New veeranam water supply scheme, Madras

In 1993, the Madras Metropolitan Water Supply and Sewerage Board (MWSSB) engaged a local consulting firm to prepare a feasibility report for a scheme to supply Madras (population 5.6 million) with 180MLD supply form Veeranam Lake. The existing water requirement in Madras is 1800 MLD while available reliable resources is only 600 MLD.

Acer Consultants in association with a local consulting firm were then retained to review the recommended scheme, carry out the detailed design and prepare tender documents which were complete by the end of 1995. Construction will commence in 1996. The components of the project include:

- Intake and pumping station.
- Water treatment works.
- Treated water pumping station.
- Electrical sub-stations, feeders transformers and switchgear.
- 230km steel transmission mains (1.6m dia) from the raw water pumping station to water treatment works and from the treatment works to Madras.
- Treated water storage

The New Veeranam Project is being financed by an IDA credit from World Bank, who have imposed a rigorous set of procedures for project review, tendering separate consultancy contracts for feasibility study design and construction supervision and for the letting of various construction contracts.

## Novel water resources for Madras fertilisers Ltd

Madras Fertilisers ltd (MFL) operate a 750 tone per day (TPD) ammonia plant, 885 TPD urea plant and three NPK plant trains of 2000 TPD capacity. The 18 MLD raw water requirement for these plants was provided by MWSSB from aquifers located approximately 10km from the factory site. During the severe droughts in 1983 and 1987, MWSSB imposed a total ban on water supplies to industry which led to a shut down of the ammonia and urea plants for prolonged periods.

The factory has a raw water requirement to satisfy three specific needs:

- Water for cooling purposes 12MLD
- Water for steam 4MLD
- Water for potable needs 2MLD

MFL sought to replace the requirement for cooling purposes with an alternative source and evaluated the possibility of utilising:

- Seawater for indirect cooling of process water or supplement the existing by desalination
- City sewage available after preliminary treatment but requiring tertiary treatment and demineralisation prior to use as feed stock to the existing factory water supply system.

While annual operating costs for indirect cooling by seawater and the sewage options were not very different, the seawater option needed twice the capital cost and a longer lead time compared to purified sewage effluent reuse from the adjacent city wastewater treatment works.

MFL asked Nuchem Weir, a Weir Westgarth-Nuclear Plastics India joint venture company, to produce a plant using a reverse osmosis (RO) based process to convert 15MLD of effluent to 12MLD of usable industrial grade water suitable for feeding their cooling towers.

The first stage of the solution is the provision of a chemical treatment plant to condition the treated sewage before it enters the RO module. The product water is blended with groundwater to increase the overall output of the plan.

The treatment plant was funded by MFL and commissioned in May 1993. A stabilised cooling water supply is of great commercial benefit to MFL. The release of 12 MLD of potable water back into the Madras supply system assists in meeting the social pressures of an ever increasing population.

Madras Metro accepted the principle of providing an industrial water supply from the re-use of purified sewage effluent. The Japanese OECF has agreed to funding 100MLD plant to treat a proportion of the city's sewage, thus creating an equivalent industrial water resource and effectively augmenting the reliable yield of the city's supplies.

## Bangalore water supply

The city of Bangalore has been the fastest growing urban centre in India with a growth rate of 76 per cent and 40 per cent in the last two decades respectively. It is estimated that by the year 2001 the population of Bangalore will be approximately 6 million spread over an area of some 700 square km.

This rapid growth rate is putting great strain on the city's existing infrastructure. Since formally gaining the status of "Mega City" in 1993, the city has approved considerable investment directed by developing and improving infrastructure facilities in Bangalore.

The existing supply of water available to Bangalore is 570MLD whilst the present demand is 680MLD. However, a proportion of the supply cannot be distributed due to a lack of:

- Treated water storage.
- Capacity in distribution system.
- Booster pumping stations installed capacity.

The immediate aim of BWSSB is to improve supplies to the customer by:

- Replacement of corroded and encrusted pipes in the old city of Bangalore.
- Laying of new trunk and feeder mains to areas unserved by present system.
- Provision of booster pumping stations.
- Provision of electronic flow measuring devices to effectively control water supply and minimise system losses.
- Provision of water storage reservoirs.
- Installation of diesel generators to ensure continuous pumping of water.

OECF has recently agreed to finance the next major new water supply project (Cauvery IV) delivering potable water over 100kms from the River Cauvery.

## The Krishna water supply project, hyderabad

Hyderabad is yet another India city with over 5 million population. Piped water is often only available for a few hours each day. A new supply from the River Krishna some 130km to the south of the city has been developed and offered to World Bank for funding. The components of this project are similar to those for the New Veeranam project for Madras. However, the Andhra Pradesh Government, anxious to implement this US$300 million project, were concerned that normal World bank procedures could significantly delay project implementation. The Hyderabad Water Supply and Sewerage Board (HWSSB) invited tenders for the complete design, build, operate and finance of the Krishna Water Supply Project on a BOT basis. Acer Consultants, heading a consortium, submitted a tender towards the end of 1995 which is under evaluation.

## Tirupur area development programme (TADP)

Tirupur is a Municipal town located 50kms east of the city of Coimbatore in TamilNadu. It is India's leading cotton knitwear centre accounting for over 90 per cent of all India's export in this sector. However, the level of infrastructure in this town leaves a lot to be desired. Therefore the New Tirupur Area Development Corporations Limited (NTADCL) comprising of Govt of India, Govt of Tamilnadu and Tirupur Exporter's Association (TEA) was formed. TADP is proposed to be implemented on a BOT basis. Recovery of investments would be effected through the levy of user charges. NTADCL which in turn, would promote a Special Purpose Entity (who bring in some debt and equity) to implement the entire project by upgrading the infrastructure in the town and surrounding area.

NTADCL has recently invited shortlisted agency's for consideration for the Construction, installing and commissioning as well as Operation & Maintenance of infrastructure in the town to include :

- Water Supply - 185 MLD of surface water from the Bhavani, flowing about 55km from Tirupur.
- Comprehensive underground drainage, sewerage & sewage treatment system.
- Industrial effluent treatment, inclusive of common effluent treatment plants, (CETP's). This will involve collection and treatment from numerous dying and bleaching units (1.2MLD daily), it is proposed that 3 CETP's are to be set up in this area.
- Road network improvements and expansions. The road projects relate to the formulation of ring roads around the town and the strengthening of select existing roads.

## Conclusion

The upgrading of water supply and sewerage services is a costly business. Today, external aid is the only real method of funding these major projects in India, but the rigorous procedures adopted by aid agencies often impose a financial penalty on the project. Practical alternatives must exist to provide a phased improvement of the city's infrastructure to include:

- Solutions that have to evolve which embrace private sector initiatives.
- Political sensitivities need to be respected.
- Access to funding, to secure substantial growth in water supply capital expenditure, has to be achieved (which the India Government cannot expect to provide) if the increasing demands of industry and that of the expanding middle class are to be met.
- A mix of alternatives would be required, as it is unlikely that only one type of solution will satisfy the sensitiveness of private sector involvement to provide a public water supply service across the Nation.
- There may be solutions adopted similar to the "Hyderabad" model of total private sector supply, maybe with encouragement of consumer share ownership. At the end of the scale is "partnering" with the existing Water Supply and Sewerage Boards, Government agencies and Muncipal Corporations, eg Tirupur, which will mean different things in different situations. However, in each of these scenarios, a mechanism for payment to the private sector has to be secured. It is imperative to find solution which satisfy the requirements of the banks who have put the funds in good faith to enable the project to proceed, and which secure a reasonable return on the capital employed by all the parties concerned.
- The response by the Water Authorities in trying to meet the ever increasing financial and performance demands placed on them needs to be concentrated more and more on the understanding, control and therefore economic management of water use/conservation and NRW including:
  - The management of water demand (conservation)
  - the successful identification and implementation of leakage (or NRW) control policies
  - adoption of adequate Regulatory Framework for design and operational control mechanisms to reduce NRW, and to avoid contamination and pollution incidents.