CHAPTER THREE

Water Resources Management: An Overview
Outline:

1. Potable drinking water for villages.
2. Management of water supply.
3. Urban water supply programme.
4. Rural water supply programmes.
5. Rural water supply during plan period.
7. Institutional framework of water supply.
8. Ground water: A source of water supply.
9. Water supply for irrigation.
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Water is a basic necessity of life. Needless to emphasise, the use of water for domestic purposes is most essential. Despite 46 years of independence, there are still many villages in India where drinking water facilities are not available for the masses. The Indian villages suffer either from water scarcity or from salinity of water. It has been estimated that people in more than one lakh villages in this country are suffering from scarcity of drinking water as the exploitable water resources in the rural areas are limited. Human existence on the globe is dictated by three natural sources—air, water and food which are made available initially free of cost as gifts. Human survival ends within three minutes without air, within three days without water and within thirty days without food. Over the centuries, however, food became scarce, consequently, human efforts were needed to produce it and thus, followed a system of marketable products. In course of time water too, though made available by nature, is becoming scarce, insufficient and unsafe for human consumption, but not yet competing with food. Fortunately, air has still remained as a gift of nature. One can easily observe the relationship between the duration of survival without food, water and air and degree of human effort to consume them. The crux of the point is that humanity has to make some efforts, either collectively or individually, to avail of the basic essential natural gifts for their own survival and welfare. Collective production assumed the nature of governmental activity in terms of bearing the major responsibility of the survival and
welfare of their subjects in particular and the community in
general through proper utilisation of the three natural
gifts. As food had become a priced and marketable product,
potable water has neither remained as nature's gift nor a
purely private products, but as a quasi-public goods. To a
large extent, it has become the responsibility of the
government to produce, collect, process and supply the safe
drinking water as a public service to the majority of the
community through budgetary resources. Hence, in this
chapter a strenus attempt has been made to review the
existing condition of present water resource management in
India.

Potable drinking water for villages:

It has been estimated that people in more than one lakh
villages in this country are suffering from scarcity of
drinking water as the exploitable water resources in the
rural areas are limited. The drought of 1979-80 was
accompanied by an acute shortage of drinking water in many
parts of the country as a result wells, tanks and other
sources of water had dried up in large numbers. It is found
that even where water is available in rural India it is often
brackish and not potable. Many parts of the country
particularly Assam, Manipur, Imphal and some parts of Bengal
and Kerala have ground water sources containing excess iron.
At many places surface water also has iron usually in
dissolved state. Such water has particular musty colour and
is muddy. Epidemiological studies have proved that the entric diseases are water-borne.

The importance of providing safe-drinking water supply was fully recognised in the Fifth Five Year Plan which included provision of safe drinking water for villages in its Minimum Needs Programme. In sustaining the process of economic and human resource development and improving the quality of our environment, India as a signatory of the United Nations, water conference at model plate (Argentina) in 1977, pledged its full support to the International Drinking Water Supply and Sanitation Decade (1981-1990).

Until the third Five Year Plan, drinking water supply in the rural areas was a component of the amenities scheme of the Community Development Programme. In 1971-72, a total of 1.52 lakhs villages in the country were identified as villages without a safe-drinking water source and by March 1980 almost 95 thousand problem villages had been provided with safe-drinking water facilities. Now the gravity of the problem has been fully realised which has added urgency to the search for lasting solution to the water problem. It has been proposed to cover all villages by the Rural Water Supply Scheme under the Minimum Needs Programme.

The Process of planning for safe-drinking water supply consists of:
(a) Study of water resources position and water supply scheme;
(b) Assessment of the existing water supply conditions;
(c) Identification of problem villages;
(d) Estimation of water requirements, and;
(e) Implementation and monitoring of water supply schemes.

Management of water supply:

The management of water resources could effectively be studied by understanding the potential available, the level of development of the area, distribution, supervision and control of water supply.

The amount of water available on the earth is 140 crores cubic meter as three fourth of the earth is covered with water. 97% of the water present on earth is salty and the fresh water accounts only 3% of which 2% lies available in the arctic, antarctic and glacier regions. Thus, only 1% of the earth's water is maintaining the human race. Out of this water 80% is consumed for food production.

Domestic water consumption forms a significant part of the total water consumption of the country. It is an undeniable fact that safe drinking water is necessity the most important use of water related for health and welfare of the people. Estimates made in this regard reveal that water use may be of the order of 540 cu.km. Out of this 470 cu.km. is for irrigation and 70 cu.km. for other uses including domestic 16.7 cu.km. The domestic requirement estimated for 1991 was about 26 cu. kms. and by 2025 the demand would increase almost eight-fold.
Organisation (WHO) and Pollution Control Boards. The reality and gravity of these data are realised only in times of major epidemic. The biggest epidemics in the world due to infections hepatitis in Delhi during the month of December 1955 and the recent one of cholera during the month of June - July 1988, when over 15 thousand cases of acute diarrhea and vomiting were reported are some of the glaring instances revealing the enormity of the problem.

After independence, the need to ensure wholesome water supply has engaged the attention of the government. Though organised water system were attempted first in the three presidency towns of Calcutta, Bombay and Madras in late 1870, measures to secure better health for the people found emphasis only on the curative side. The Health Survey Development Committee (Bhore committee) which submitted its report in 1946 for the first time invited attention to the importance of safe water supply on a country wide basis. The Environmental Hygiene Committee (1948-49) appointed by the union government was the first agency of its type charged with an over all assessment of the problem in the field of Environmental Hygiene. It recommended the provision of water supply for 90 percent of the population. In 1954 the National Programme for providing safe drinking water to urban areas was launched.

**Urban Water Supply Programme:**

Urban areas are much better placed as generally tap water is being supplied therein by the municipal authorities.
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Urban areas are much better placed as generally tap water is being supplied therein by the municipal authorities.
Really speaking, in urban concentration, life would not be possible without some kind of organized water supply. Thus, in cities it is more or less a usual and well accepted feature. There is a matter of survival, not of development.

During the International Water Decade, India has, certainly, made many efforts. Various graphic and visible targets have been set some of them are as follows:

The Decade Programme was launched in India on 1st April 1981 with the object of increasing the urban population coverage with water supply facilities from 72.25 in 1981 to 100 percent in 1991. During the seventh Five Year Plan an outlay of Rs. 2,935.64 crores under the state sector and Rs. 30.11 crores under the central sector have been provided for urban water supply and sanitation. The decade targets are given below in Table 1.

TABLE - 1

<table>
<thead>
<tr>
<th>Sector category</th>
<th>As on 31-3-81</th>
<th>As on 31-3-91</th>
<th>Level of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Water Supply</td>
<td>77%</td>
<td>100%</td>
<td>Piped water supplies in all communities, where feasible; demand range 70-250 lpcd. average 140 lpcd. Standposts in fringe areas, if necessary at strategic locations, demand range 25-79 lpcd. average 40 lpcd.</td>
</tr>
</tbody>
</table>

In cities, the affluent sections of the population be provided with house connections and for the economically backward sections standposts may be provided at strategic points. The water supply to uncovered towns should receive higher priority. The rehabilitation of urban water supply systems should also receive special consideration. The towns are to be selected based on the criteria that they (i) already have piped water supply systems, (ii) have population less than One lakh (iii) represent various socio-economic, cultural and geophysical conditions; and (iv) are interested and financially viable, so that the schemes can be implemented expeditiously.

Rural Water Supply Programmes

The rural water supply activities remained a part of the Integrated Rural Development Approach, until the third Five Year Plan (1961-66) where rural water supply was linked with other activities of rural development such as sanitation, health etc. The National Water Supply and Sanitation Programme was introduced in 1954. It was found during the mid-sixties that rural water supply schemes were implemented in the easily accessible villages only. Therefore, the government requested the states to identify problem villages. The Government of India assisted the states to establish special investigation divisions in the fourth Plan to carry out the identification of problem villages. The norm set was that the villages which have no source of safe-drinking water within a distance of 1.6
kilometers or with in a depth of 15 meters. Other problem villages are those where available water has excessive salinity, iron, fluoride or other toxic elements or where diseases like cholera, guinea worm etc. were endemic.

Having covered the problem villages, water supply facilities are proposed to be extended to villages as per liberalised norms, i.e., within a distance of 0.5 kilometer enhance present norms of water supply from 40 litres to 70 litres per capita per day and provide one source (tube-well) with handpump or standposts) for a population of 150 against the existing norm of 250-300 persons. Priority to be accorded for coverage of scheduled caste/scheduled tribe habitations.

Considering the magnitude of the problem and with a view to accelerating the pace of coverage of problem villages the central Government introduced the Accelerated Rural Water Supply Programme (ARWSP) 1972-73 to assist states and Union Territories with 100 percent grants-in-aid to implement the schemes in such villages. The programme continued in 1973-74 but with the introduction of Minimum Needs Programme (MNP) during the fifth plan it was withdrawn but reintroduced in 1974-75. With the coverage of about 94 thousand problem villages till the beginning of the sixth plan, about 2.31 lakhs remaining to be covered as on 1st April, 1980 when the water Decade Programme was launched.

The main focus of Decade Programme was on rural water supply. The highest priority had been given to these areas,
particularly in regard to the problem villages. After 40 years of Independence, most of the villages in India still relied for their domestic water supply on a large number of contaminated traditional sources like open wells, etc. The decade targets are given below in table II:

**TABLE - 2**

Decade Target for Rural Water Supply

<table>
<thead>
<tr>
<th>Sector Category</th>
<th>Coverage</th>
<th>Level of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>As on 31.3.81</td>
<td>Target for 31.3.91</td>
</tr>
<tr>
<td>Rural Water Supply</td>
<td>31%</td>
<td>100%</td>
</tr>
</tbody>
</table>


Water supply maintenance in rural areas was handled mainly by state Public Health Engineering Departments or Panchayats. In a few cases local bodies like Zila Parishads or Block level samitis are also entrusted with this responsibility. Regarding piped water supply systems in the villages, the situation was usually much worsed. Panchayats
were functioning only where state governments and Union Territories were making adequate allocations for maintenance. In individual single point water supplies, either from dug wells, tube wells, spring or public standpost systems, there was no responsible institution to provide proper system maintenance. In August 1985 the subject of the rural water supply and sanitation was transferred from the Ministry of Urban Development to the Department of Rural Development, Ministry of Agriculture with the objective of faster development of the programmes.

The National Drinking Water Mission was launched as one of the Five Societal Missions in 1986. For providing safe drinking water to the rural population, the Government of India continues to give top priority through ARWSP. At the commencement of the seventh plan 1.62 lakhs problem villages remained to be covered with safe drinking water facilities. 1.49 lakhs villages have been covered so far and 13 thousand were left. 7 thousand villages are likely to spill over to the eighth plan. Also 55 Mini Mission Districts were identified to focus attention on some of the most difficult parts of the country. These are for:

i. Control of brackishness;
ii. Control of flurosis;
iii. Removal of excess iron;
iv. Guineaworm eradication;
v. Scientific Source finding;
vi. Water quality Surveillance;
vii. Improvement of traditional method
viii. Improvements of maintenance methods; and
ix. Community involvements through panchayats.

The following norms have been adopted for providing drinking water in identified problem villages;

i. 40 litres of safe drinking water per capita per day for human beings.

ii. 30 lpcd. additionally for cattle in the desert districts.

iii. One handpump or Standposts for every 250 persons.

iv. The water source should be located within 1.6 kms. having a minimum depth of 15 mts. and within 100 meters elevation difference.

The government has also decided from 1990-91 to charge a minimum of 25 percent of ARWSP funds for scheduled castes (SC) and 10 percent for drinking water supply to scheduled tribes (ST). It has been specified that the first source of drinking water has to be provided in SC/ST localities and at the time of formulating the schemes, coverage of SC/ST habitants should be given first preference and the highest priority to assure easy access to water supply facilities.

As far as investments are concerned, India spent 2.34 percent of its total public sector outlay on rural drinking water sector in the sixth plan and 1.77 percent in the Seventh Plan. The table III sets out in actual terms
investments (by centre and states) in the Seventh Plan.

TABLE - 3
Actual Terms Investments in the Seventh Plan
(By Centre & States)

<table>
<thead>
<tr>
<th>Period</th>
<th>MNP (in crores of rupees)</th>
<th>ARWSP (in crores of rupees)</th>
<th>TOTAL (in crores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985-86</td>
<td>412.89</td>
<td>297.43</td>
<td>710.32</td>
</tr>
<tr>
<td>1986-87</td>
<td>470.37</td>
<td>322.13</td>
<td>792.50</td>
</tr>
<tr>
<td>1987-88</td>
<td>505.85</td>
<td>385.99</td>
<td>891.84</td>
</tr>
<tr>
<td>1988-89</td>
<td>537.62</td>
<td>437.86</td>
<td>975.48</td>
</tr>
<tr>
<td>1989-90</td>
<td>540.11</td>
<td>462.71</td>
<td>1002.82</td>
</tr>
</tbody>
</table>

10 percent of MNP and ARWSP funds are allowed for operations and maintenance of rural water supply.

Source: Journal of the Indian law Institute vol 33. No. 4 October-December 1991, Bhagwandas Road, New Delhi.

Table 3 reveals the amount India spent in the year 1985-86 of its total public sector outlay on rural drinking water was; Rs. 412.89 crores on Minimum Need Programme and Rs. 297.43 crores on Accelerated Rural Water Supply Programme, in 1986-87, Rs. 470.37 crores on MNP and 322.13 on ARWSP, in 1987-88, Rs. 505.85 crores on MNP and 385.99 crores on ARWSP in 1988-89, Rs. 537.62 crores on MNP and Rs. 437.66 on ARWSP and on 1989-90, Rs. 540.11 crores on MNP and Rs. 462.71 crores on ARWSP. The table also shows that the total investment are Rs.710.32 crores, Rs. 792.50 crores, Rs. 891.84 crores respectively. The table also reveals that 10 percent of MNP and ARWSP funds are allowed for operations and maintenance of rural water supply.
Rural water supply during plan periods:

The problem of rural water supply has emerged as one of the pertinent problems at the present stage of economic development in India. The seriousness of the problem is realised from the disparities it has created between regions and often within the same region. Most of the villages in India are without adequate facilities of drinking water. Several rural water supply schemes have been taken up, in the main, under the programmes for community development, local development works and welfare of backward classes. They are supplemented by the National Water Supply and Sanitation Programme (NWSSP) introduced by the central government towards the end of 1954. This was mainly to deal with the provision of water supply to group of villages through works requiring a measure of technical skill in design and construction. Waterborne and other allied diseases are responsible for a large incidents of mortality and morbidity in the community which can be brought under control by protected water supply methods.

An attempt has been made here to evaluate the performance of water supply during plan periods. The first Fire Year Plan estimated at Rs. 24 crores for urban and rural water supply and sanitation. A sum of Rs. 6 crores was provided as grants towards rural water supply schemes. However, the schemes included in the first plan did not make satisfactory progress due to shortage of materials, inadequate infrastructural facilities and lack of adequate
public health engineering staff in the states to implement the schemes. Although public health engineering organisations were set up at the center and in several states most of these organisations were not adequately staffed.

The second plan made a tentative provision of Rs. 28 crores for rural water supply. This was much higher than the first plan outlay under Rural Water Supply Scheme.

A provision of about Rs. 67 crores was available in the third Five Year Plan for rural water supply. This includes Rs. 35 crores for the village water supply programmes. Further, a sum of about Rs. 16 crores under the plans of the states under the Community Development Programme and about Rs. 4 crores under the programme for the welfare of backward classes were made available. The major part of the amount provided for the village water supply programmes are intended to be available for (a) backward areas, (b) areas not covered by CDP, (c) Pre-extension blocks, and (d) blocks which have completed their first and second stage in the CDP. The village water supply programme (VWSP) was introduced during this plan. It was intended primarily to deal with rural water supply at the village level. The VWSP was proposed to be undertaken at the block level through Panchayat Samitis and village Panchayats, and the funds being routed through the organisations at the Block Level. While executing the programme, emphasis was laid on providing water to areas which suffered from water scarcity and salinity.
and where water-borne diseases were endemic.

After the third Five Year Plan there was a small break of three years in the planning period on account of shortage of financial resources and the satisfactory performance of the third Five Year Plan. This break of three years is known as the plan holiday in India.

During the three successive annual plans, 478 schemes were undertaken at an estimated cost of Rs. 24 crores. The work done in 1961-69 added 6 thousand villages to those having piped water supply. Under CDP, local development works and welfare of backward classes, the construction and renovation of wells and installation of handpumps were estimated at Rs. 12 million.

The fourth plan outlay was estimated at Rs. 125 crores for rural water supply which meant for the areas of acute water scarcity. A massive operation was undertaken during the fourth plan for drinking water supply in rural areas. A provision of Rs. 3.5 crores was made in the central sector assistance from UNICEF in the shape of high speed drilling rigs for exploitation of ground water resources in hard and rocky areas. The provision of equipments were made available to states for implementing the programme. Besides, central assistance was provided to institutions for imparting training in public health engineering. Several a courses for water works were conducted by the Union Government. The training programme was proposed at an estimated cost of Rs. 25 lakhs.
At the commencement of fifth Five Year Plan, there was a provision to provide safe water supply in problem villages. At the end of the fourth Five Year Plan, it had been estimated that there were 1.13 lakhs of such villages. In the first three years of the plan, a provision of Rs. 201.10 crores was made to cover 57.8 thousand villages. For the remaining two years, the allocation was made on the basis of providing safe water supply for the additional 53.9 thousand villages. In addition to this, the Minimum Needs Programme was introduced in the fifth plan. A sum of Rs. 180.14 crores 157.87 crores was made available. However, the revised fifth plan shows a sum of Rs. 38.24 crores as total outlay under the programme.

During the sixth Five Year Plan, a massive programme for providing drinking water facilities in the rural areas was introduced under the Minimum Needs Programme. More than 80 percent of the 2.31 lakhs village were identified as "problem villages" at the beginning of the sixth plan and were expected to be covered by the end of the sixth plan period. The remaining problem villages were proposed to be covered in the seventh plan. The criteria to identify a problem villages are as follow:

1. Villages which do not have an assured source of drinking water within a reasonable distance of 1.5 km.

2. Those in which diseases like cholera, guineaworm etc. are
(3) Those where the available water has an excess of salinity, iron, fluorides and other toxic elements.

The results achieved were truly impressive, as 1.92 lakhs villages out of the total number of 2.31 lakhs identified problem villages, as well as 47 thousand other villages were provided with water supply during the sixth plan. The plan provided for a substantial outlay on water supply and sanitation amounting to Rs. 3922.30 crores out of which Rs. 3307.08 crores in the states sector and Rs. 614.22 crores in the central sector. Within the sector, high priority was accorded to the provision of drinking water to what were identified as problem villages, for this purpose on outlay of Rs. 2007.11 crores was provided out of which Rs. 1407.11 crores in the states sector under Minimum Needs Programme and Rs. 600 crores in the central sector. The importance of this programme was enhanced when it was brought under the revised 20 point economic programme in 1982-83.

The seventh Five Year Plan, keeping with the objectives of the International Water Supply and Sanitation Decade (1981-90) was to provide adequate drinking water facilities for the entire population both in urban and in rural areas. With the increasing awareness of the vital importance of the provision of potable water to all citizens in the rural areas, rural water supply was included in the Minimum Needs Programme in the fifth Five Year Plan and in the revised 20 point programme in the sixth plan.
In view of the resource constraint in the seventh plan, it was not desirable to go for expensive water supply services and therefore low cost methods were preferred. The rural water supply continues to be a part of the Minimum Needs Programme as well as the revised 20 point programme can be judged from the quantum jump in investment in this programme. There has been an increase in the central assistance. The seventh Five Year Plan was provided an outlay of Rs. 5522.47 crores, Rs. 5285.64 for the water supply and sanitation programme which comes to 3.62 percent of the total plan outlay. The emphasis was considerably greater in respect of rural water supply and an increased outlay or Rs. 3454.47 crores has been envisaged for this programme in the seventh plan.

A little thought has been given in the seventh plan to redefine the problem villages on the basis of per capita norms for water supply for rural areas and the measures to be undertaken in each case. The seventh plan proposed to cover all those villages which do not have an assured source of water supply within a distance of 0.5 km. as against the present norms of water supply from 40 liters per capita per day to 70 lpcd. It also ensures that the poorer section of the society especially the scheduled caste and scheduled tribes and landless agricultural labourers will avail the opportunity equally.
In order to tackle special problems of water supply, the seventh Five Year Plan introduced a new policy towards certain states and to hilly areas by providing special attention, it has been realised in the sixth plan that maintenance of the assets created for water supply was neglected due to lack of funds and lack of suitable machinery.

A corrective measure has been proposed in the seventh plan by providing 10 percent of the plan fund under Minimum Needs Programme for maintenance of the water supply system in rural areas. A new scheme was introduced to involve the voluntary organisations to implement plan programme thereby enlisting community participation in the execution and maintenance of water supply schemes in the rural areas for which a provision of Rs. 2.5 crores has been made.

The problem of rural water supply has been given due attention and corrective measures have been taken since inception of the planning in India. Significant improvement has taken place in the plan outlay of the water programme starting from the first Five Year Plan. There has been an increase in investment on rural water supply especially in the sixth and seventh plans. The seventh plan targets to solve the problem of rural water supply in all the problem villages in the country was certainly a massive programme to benefit the rural masses in improving their level of living.
World Bank and UNICEF Programmes:

Realizing the lack of fund in the Urban Water Supply/Water drainage Programme, other sources have been restored. The programme of improvement/extension in the water supply water drainage arrangement has been done with the help of World Bank. The improvement/extension of water supply system is also proposed with the help of HUDCO.

According to the direction of the Rural Development Department, Ministry of Agriculture of the Government of India in the states unified water supply and environment cleaning project have been proposed with the financial support of the World Bank. The main purpose of the project was to provide the facilities of clean drinking water, to clean lavatory and water drainage so as to provide health to the public and to raise their living standard by educating and making them conscious about their participation in the programme.

UNICEF has been providing assistance for deep well handpumps for rocky and hilly areas of the country. To make water supply schemes effective UNICEF also helps in organising training programmes for concerned officers and imparts knowledge regarding the maintenance of the schemes.

Despite of collaboration with various organisations such as the United Nations Development Programme (UNDP), WHO, UNICEF, WORLD BANK and HUDCO, India has not fully
achieved its water supply targets. The availability of safe drinking water for all people is still a far cry. However, the notable achievements have been made in rural water supplies.

**Institutional Frame Work for Water Supply:**

In India water supply is recognised as a legitimate field of municipal enterprise. There are mainly four kinds of municipal bodies, viz, (i) city corporations; (ii) municipalities; (iii) town areas; and (iv) notified areas.

Municipal corporations, which are at the top, are supposed to be the most developed form of urban government. The municipalities come next. Small and growing towns often have Town Area, Notified Area committees respectively. Though there are different corporation legislations for different states, corporation government structure throughout India is structurally uniform.

In certain cases specialised agencies such as the local level agency Jal Sansthan in Uttar Pradesh or a State level agency like Karnataka Water Supply and Sewerage Board, handle the respective water supply network. A special agency the Calcutta Metropolitan Water and Sanitation Authority is set up in Calcutta. Tamil Nadu has established a State Level Board for water supply and sewerage. The idea was to set up an autonomous body to look after all aspects of water supply and sewerage. Legislations have been drafted which define in varying degrees the board's duties, Powers, responsibilities
and the constitution. In Delhi, water supply and sewage disposal are undertaken by the specialised undertaking of the Municipal Corporation of Delhi.

It is one of the very important responsibilities to arrange and ensure safe and potable drinking water supply to the city dwellers. Although this is a complicated task, the same constitutes one of the basic infrastructure services. Preservation of public health in the city is also as engaging responsibility of the municipal chairman and all this requires huge finance, radical legislative measures and suitable administrative organisation and procedures, to follow the rapid pace of Urbanisation.

Major problems pertaining to inadequate delivery of urban water supply in cities are attributed to financial inequalities of respective agencies to maintain water delivery at a reasonable level. The receipts on account of sale of water in Indian cities are fairly low compared to the non plan expenditure on water treatment and distribution. According to a study conducted by the National Institute of Urban Affairs (NIUA) for the Eighth Finance Commission, the prevailing levels of municipal water supply seem to be far below the smallest size of towns ranging from a population of five to 20 thousand people. It is also reported that the average per capita receipts from the sale of water are substantially lower than the existing level of municipal expenditure on the maintenance of water supply network. This
mismatch creates wide-ranging implications on the quality of water delivery in cities. If the municipalities find a ready excuse in the paucity of funds at the policy level, the question of operation and maintenance seldom receives the type of attention deserves. The record in respect of operation and maintenance of existing systems is dismal indeed. Official and non-official studies have revealed that water treatment plants and filter units, except in a precious few cases, were non-functional or defective and this was equally true of chlorinators. The job of replacement of water mains, which are normally as old as 90 years, is due in most cities particularly in core-city areas. However, as a result of lack of funds this work has not been done. These mains have got a lot of rust and fungus which has substantially reduced their carrying capacity ultimately leading to low pressure of supply.

Another part of the preventive maintenance that is job of leak detection not being attended properly. It is reported that 30 percent of Delhi's potable water supply -100 million gallons a day - is wasted through leakage and pilferage. This high percentage of loss was despite the fact that the Delhi Water Supply and Sewage Disposal Undertaking had leak detection division equipped with sophisticated electronic devices. Yet another important part of routine maintenance that gets affected by the shortage of funds is the process of water treatment. In Agra as per the water conditions the type of treatment that is needed is hyper
chlorination. However, in practice normal chlorination is being done. This mismatch between expenditure and receipt on account of providing water supply seems to be a result of the following factors:

(i) Water supply rates are very low.

(ii) Recovery ratios are poor.

(iii) Wastage of water and lack of discipline in water consumption, etc.

Water supply rates in cities are determined by the respective state governments. In most cases like that of Haryana, Karnataka and other these rates remain the same for the entire state. In Uttar Pradesh, water rates vary from time to time. However, in all cases, the prevailing rates are abnormally low compared to the cost of production as well as distribution. Although, differential rates are applied for various consumers, a substantial variation does not exist. As per Delhi budget proposals for the year 1989-90, hotels, ice factories, cooling plants, cinemas and industries have to pay higher rates for use of filtered water. Offices, banks, hospitals, restaurants, eating places and shops have to pay Rs. 2.00 per kl. upto 50.00 kl. and Rs. 3.00 per kl. for additional consumption. On the other hand, the tariff on domestic consumption, which till date was being charged at 35 paise per kl. for 25.00 kl. per months is now 35 paise and 70 paise per kl. for additional consumption. Minimum flat charges would be Rs. 8.00 per month.
As in the case of other revenue components, the recovery ratio on account of sale of water also remains fairly low. This is mainly because of the apathetic attitude of our bureaucratic machinery and also because of the provision of free water supply to low income housing areas. Such as slums, squatters, etc, through public standpost. Lack of discipline in water consumption is another important factor in accounting for low level of receipts. Not only in the case of public standposts but also individual connections there is no discipline as far as water consumption is concerned. Two reasons exists for such wastage. First there is lack of public awareness about the whole question of supply of filtered water. Secondly, in most of the cases whereby the individual connections are provided for residential use-water supply is priced through a flat rate charges. Another tragic fact is that water meters wherever provided are not found in working condition to record the correct consumption. Hence, even those consumers having water meters are actually charges on flat rate basis.

Ground Water: A Source of Water Supply:

Among the corporation cities, a majority derive their raw water supply mainly, from the rivers running close by, supplemented in some cases by canal supply, tube-wells and bores. In urban conditions, advanced water treatment is generally feasible and therefore water sources of comparatively poor quality may be accepted. The increasing
demand of water for different purposes and at the same time, the limited available quantities make it obligatory to use even sewage water. It is estimated that the demand for drinking in Delhi is likely to cross 592 mgd. by 1995. The total supply at present is only 412 mgd. against the assessed demand of 472 mgd. Though 90 percent of the raw water is being tapped from surface sources and the remaining 10 percent from ground sources through tubewells and rannery wells, it is still insufficient to fulfill the demands of all.

About 85 percent of the rural water supply is based on ground water. In rural areas, the emphasis is to locate water sources requiring the simplest possible treatment or on treatment before consumption. Though groundwater is not always free from pollution, by locating and designing wells and bore-holes conveniently, it is still possible to locate water sources of such quality that do not require treatment. Due to increased demand for drinking water, there is increased exploitation of groundwater in the entire subcontinent during the past four decades. Present policy is of adopting quick remedies like digging borewells whenever there is water scarcity. Monitoring of ground water availability being a more complex and expensive operation which is often neglected.

In many regions, the hydrologic cycle is being distributed by the deforestation. The need to produce more
food, fibre and shelter has caused many sheds to undergo rapid land-use changes altering drastically its hydrologic characteristics. Efforts are being made in some villages to develop the rural economy on a water-shed basis. The strategy is to make consistent efforts to pre-locate water in the soil at various stages and then to utilise it wherever and whenever required by the adopting scientific methods.

**Water Supply for Irrigation:**

Water is a National Resource but it is a state subject and irrigation development is the responsibility of the states. This fact, however, should not stand in the way of forming a bold national policy of development of waters. It is with this purpose in view that the National Water Development Agency with the Irrigation Ministers of the states as members was constituted. Its objective is to carry out survey, investigations and studies for the peninsular rivers development component of the National Water Plan. The Agency proposes to start with the Mahanadi in Orissa; and the river in the southern part of the peninsula would be taken up subsequently. Later on, Scheme will be implemented to link the Ganga and Mahanadi with Cauvery and other rivers. This development has been the latest addition to the administrative framework of irrigation management. Other salient features of this framework or system are at the central government level, the Ministry of Irrigation is responsible for overseeing the irrigation development of the nation. Its technical arms are the Central Water Commission
and National Water Resources Development Council who are concerned in helping the ministry and the Planning Commission in developing the irrigation components of the Five Year Plans; they also scrutinise and approve the technical feasibility of the states medium and major irrigation projects, assist the central government and the states in negotiating for loans from international organisation for irrigation projects, prepare the National Water Plan for irrigation network development and try to bring about settlements in inter-state river water disputes.

The organisational arrangement for the construction, operation and maintenance of irrigation projects differ from one State to another. In most states, however, project design provides for the construction of all works, down to outlets, main water drains and water courses. The farmers have to construct their field channels and drains. Generally, the irrigation departments seems to be not directly responsible for the development of irrigation command areas which are left to be done by other state level departments, such as, Agriculture, Soil Conservation and Revenue.

A chief Engineer is the operational head of the irrigation department in each state looking after the construction of major and medium irrigation projects. There are several divisions in a state and each division is under an additional chief Engineer, who is rested with both the
construction and maintenance of projects on a zonal basis. He is assisted by superintending engineers under whom are the investigation and planning wings of the major and medium irrigation works. They are supported by executive engineers, assistant executive engineers, assistant engineers and field level workers. The design of major and medium works is supervised by a central design directorate of the irrigation department. Besides this department, most states have a Command Area Development Authority (CADA) manned by personnel from irrigation, agriculture and statistics departments. CADA functions to improve the on-form water use management aspects of irrigation development. In addition, there are groundwater development boards in some states. Minor irrigation programmes are vested with the agricultural departments of the states. Besides this the research institutes carry out the work or analysing soil, concrete etc. Notwithstanding, this clearcut separate line of agency responsibility, there is a growing awareness in recent times among the administrators, professionals and farmers that for higher agricultural output, ways have to be found to increase the efficiency and productivity of irrigation water at the farm level.

This is the crucial issue when one discusses irrigation management in our country. The key questions involved are:
(1) Creation of potential;
(2) Utilisation of irrigation potential created;
(3) Capability for paying its own way,
(4) Its contribution to overall national development.

Official data on irrigation indicate that the potential created so far benefits 54 percent of the irrigable land in the country and the utilisation of even this potential. The irrigation potential created, however, during our plans have increased threefold. The total area irrigated in the country which stood at 22.6 million hac. before the advent of planning in 1951 has been rising steadily and was 61.4 million hac. As the national water development plan has been implemented fully, the official sources expect that the potential would go up to nearly 150 million hac. by the end of the century and this might involve an outlay of Rs. 50 thousand crores. Asia has the largest chunk under irrigation at 31.3 percent of the arable area.

India has 24 percent of its area under irrigation. On the basis of the source of irrigation, the coverage of the potential in India in the last few years are as follows.

TABLE - 4

The Coverage of Irrigation Potential in India

<table>
<thead>
<tr>
<th>Sources of Irrigation</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Canals</td>
<td>40</td>
</tr>
<tr>
<td>(b) Wells</td>
<td>43</td>
</tr>
<tr>
<td>(c) Tanks</td>
<td>10</td>
</tr>
<tr>
<td>(d) Other sources</td>
<td>7</td>
</tr>
</tbody>
</table>

An important point to be noted in this respect is the regional variation. The southern states command 57 percent of the area under tanks, which in the north is nil, in the Central, Eastern and Western regions it is 16.6 percent, 18.3 percent; and 7.8 percent respectively. Tank irrigation is the cheapest, and rural electrification has boosted the energisation of wells. If the number of pumpsets per thousand hectares of cropped area is an index of the extent of their use the statewise data are as follows:

**TABLE - 5**

**Statewise Data of Pumpsets (per '000' hac. of cropped area)**

<table>
<thead>
<tr>
<th>Name of State</th>
<th>No. of pump sets per thousand hectares of cropped area</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Tamil Nadu</td>
<td>111</td>
</tr>
<tr>
<td>(b) Punjab</td>
<td>36</td>
</tr>
<tr>
<td>(c) Haryana</td>
<td>33</td>
</tr>
<tr>
<td>(d) Maharashtra</td>
<td>27</td>
</tr>
<tr>
<td>(e) Karnataka</td>
<td>25</td>
</tr>
<tr>
<td>(f) Andhra Pradesh</td>
<td>25</td>
</tr>
<tr>
<td>(g) Kerala</td>
<td>22</td>
</tr>
</tbody>
</table>


Other states fall below the all India average of 21. The shortcoming and failures on the irrigation potential side, have been reiterated off and on in many a workshop and seminar. The centre's stock explanation has always been that the cost of escalation, the inadequacy of funds and the
taking up by each state more projects for execution than can be managed realistically have occasioned delays and disappointments.

This section can best be concluded by mentioning about the great potential of water as an input for agricultural production. It is reckoned as "a hectare of land brought under the plough yields 0.9 metric tonnes of cereal, with irrigation it goes upto 3.5 and with addition of a tonne of fertiliser nutrients, it reaches the level of 9 to 13 metric tonnes" Efficiency of irrigation in Asia is illustrated by the fact that 0.045 hectares of paddy land in Japan yield enough rice to provide a diet of 2,500 calories per person per year but for the same diet 0.1 hectare is required in USA and 0.3 in India.

The second crucial area is the utilisation of the potential created. To make the existing irrigation system of major and medium projects effective and rewarding the sine qua-non requirements are:

(i) Construction of field channels and provision of drainage;

(ii) Minimising seepage losses; and

(iii) Command area development, to offer an economic cropping pattern.

Till now the professional personnel employed in the irrigation ministry and respective state level irrigation departments, who are trained primarily in civil engineering
have only been concerned with the water delivery system above the canal outlets. Delivery of water at the watercourse level and its eventual use in farmer's fields has been considered the farmers responsibility. These users have the approval of Ministry of agriculture and the state level agriculture departments and supported through research in the agriculture universities, institutes and by cadres of extension personnel. At the farmer's level of contact, however, such extensions assistance has been almost totally on a single item basis e.g. plant protection, improved seed varieties, fertilisers, pesticides, credit and subsidy etc. There is, at present, no overall extension component packaged as on farm water management advice. This package, besides the items mentioned, should also contain formation of field channels, provisions of adequate drainage, removal of salinity, minimising of seepage losses through sealing of field channels, annual maintenance works to keep the tanks and canals productive and flood control measure. (For the last mentioned item, the centre had provided Rs. 1045 crores in the sixth plan as against an expenditure of Rs. 976 crores in all the earlier plans put together. The centre has recently noted with concern that some of the states were making reduced allocations of flood control works and had not provided adequate funds even for maintenance of existing works).

The Command Area Development Programme was introduced in 1974. Since then CADAs have covered 76 projects and 15
million hectares have been irrigated. However, much remains to be done in an accelerated fashion before the effectiveness of this programme can be felt by the farmer. A serious weakness here is the failure to develop the acute sufficiency in advance through the laying of canals. In the sixth plan matching grants and loans are provided to the states for construction of channels to cover 12 lakhs hac. under CADA. The CADA, must provide the most economical cropping pattern which should be demonstrated to convince the farmers. The incomplete package given to the farmer does not help him to increase the fertiliser efficiency, this is manifested from the fact that the cereal yields in the assured areas of irrigation steadily remain around one tonne per hectare and cropping intensity below 1.5. If cereal production does not attain a level of three tonnes per hectare, it is most uneconomical, the cost of food continues to be high and beyond the purchasing capacity of the rural poor.

A review made by the Planning Commission found that the utilisation of irrigation potential was poor and the pace of exploitation of the vast ground-water potential in some states (Uttar Pradesh and West Bengal) very slow. It is hoped that the National Development Plan would ensure optimum use of available water as it aims at increasing irrigation potential by 35 million hac. and development of 40000 MW of power besides affording flood protection and drainage. The centre also recommends to the states the adoption of alternative sources of energy in irrigation such as solar
pumps and wind mills. Some states including Bihar, Gujarat, Madhya Pradesh, Punjab, Tripura and West Bengal had made beginning in this direction.

Summary:

It may be summarised from the foregoing discussion that water is basic necessity for any living thing. It is sad commentary that in spite of 46 years of freedom, there are still many villages in India where people have to take water from the same source where domestic animals also drink water as there is no safe drinking water facility in such villages. The Indian villages suffer either from water scarcity or from salinity of water. It has been estimated that people of more than one lakh villages in this country are suffering from scarcity of drinking water as the exploitable water resources in the rural areas are limited. It is said that human survival ends within three minutes without air, within three days without water and within thirty days without food. The potable water has neither remained as nature's gifts nor a purely private product, but as a quasi-public goods. To a large extent, it has become the responsibility of the government to supply the safe drinking water as a public service to the majority of the community.

It is found that even where water is available in rural India, it is often brackish and not potable. Many parts of the country particularly Assam, Manipur, Imphal and some parts of West Bengal and Kerala have ground water sources
containing excess iron. At many places surface water also has iron usually in dissolved state. Such water has particular musty colour and is muddy. Epidemiological studies have provided that the entric diseases are water-borne.

The importance of providing safe drinking water was fully recognised in the Fifth Five Year Plan, which included provision of safe drinking water for villages in its Minimum Needs Programme. The process of planning of MNP consists of:

(a) Study of water resources position and water supply scheme, (b) assessment of the existing water supply condition. (c) identification of problem villages, (d) estimation of water requirements and (e) implementation and monitoring of water supply projects.

The amount of water present of the earth (140 crores cubic meters) as three-fourth of the earth is covered with water. 97% of the water present on earth is salty and the fresh water account for only 3% of which 2% lies available in the arctic, antartic and glacier regions. Thus only 1% of the earth's water is maintaining the human race. Out of this 80% is consumed for food production.

It is an undeniable fact that the most important use of water related to health and welfare of the people is for drinking purpose. Estimates made in this regard reveal that water use may be of the order of 540 cu. km. Out of this
470 cu. km is for irrigation and a 70 cu km for other uses including domestic use which is 16.7 cu km. Still there are places in India where water is more precious than milk. In some villages people have to walk several kilometers for sweet water. In Rajasthan Beawara city is supplied with drinking water only once in 72 hrs.

Urban areas are much better placed as generally tap water is being supplied therein by the municipal authorities. Urban life would not be possible without some kind of organised water supply. It is a matter of survival, not development. During International Water Decade, India has certainly made many efforts to solve the water supply problem and to provide safe drinking water to the 100% urban population.

The rural water supply activities remained a part of the Integrated Rural Development Approach, until the Third Five Year Plan (1961-66) where rural water supply was linked with other activities of rural development such as sanitation, health etc. The National Water Supply and Sanitation Programme was introduced in 1954. It was found during mid-sixties that rural water supply schemes were implemented in the easily accessible villages only. Therefore, the government requested to states to identify problem villages. The government of India assisted the states to establish special investigation divisions in the Fourth plan to carry out identification of problem villages. The norm was set that the villages which have no source of
safe drinking water within a distance of 1.6 kilometers or within a depth of 15 meters. Other problem villages are those where available water has excessive salinity, iron, fluoride or other elements or where diseases like cholera, guinea worm, etc. were endemic. After covering problem villages, water supply facilities are proposed to be extended to villages as per liberalised norms, i.e. within a distance of 0.5 kilometer enhance present norms of water supply from 40 liters to 70 liters per capita per day and provide one source (tubewell with handpump or Standposts) for a population of 150 against the existing norms of 250-300 persons. For the coverage of problem villages the central government introduced the Accelerated Rural Water Supply Programme (1972-73) with the objective to assist states and Union Territories with 100% grants-in-aid to implement the schemes in such villages. But with the introduction of MNP during Fifth Plan it was withdrawn and reintroduced in 1974-75. The NDWM was launched as one of the five societal mission in 1986 for providing safe drinking water to the villages.

Realizing the lack of fund in the urban water supply/water drainage programme, other sources are restored. The programme of improvement/extension in the water supply/water drainage arrangement has been done with the help of Word Bank. The UNICEF has been providing assistance for deep well handpumps for rocky and hilly areas of the country.
The first Five Year Plan estimated at Rs.24 crores for urban and rural water supply & sanitation. A sum of Rs.6 crores was provided as grants forwards rural water supply schemes. The second plan made a tentative provision of Rs.28 crores for rural water supply, which was much higher than first plan a provision of about Rs.67 crores was available in the third Five Year Plan. The fourth plan outlay was estimated at Rs.125 crores for rural water supply which for the areas of acute water scarcity. A massive operation was undertaken during the fourth plan for drinking water supply in rural areas. In the fifth plan the Minimum Needs Programme was introduced. A sum of Rs. 180.14 crores was made available. During the sixth plan, a massive programme for providing drinking water facilities in the rural areas was introduced under the Minimum Needs Programme. More then 80% of the total 2.31 lakhs villages were identified as problem villages at the beginning of the sixth plan and were expected to be covered by the end of sixth plan period. The seventh five year plan, keeping with the objectives of the International Water Supply and Sanitation Decade (1981-90) was to provide adequate drinking water facilities for the entire population both in urban and in rural areas.

In collaboration with various organisations such as WHO, UNICEF and World Bank, etc., many activities have been initiated and many programmes formulated but the availability of safe drinking water to all people is still a far cry. It may be due to shortage of materials, obsolete machines,
inadequate infrastructure and lack of people participation etc.

Official data on irrigation indicate that the potential created so far benefits 54% of the irrigable land in the country and utilisation of even this potential. The total area irrigated in the country which stand at 22.6 million hac. As the National Water Development Plan has been implemented only it is expected that potential would go up to 150 hac. by the end of this century.
REFERENCES


