GOVERNMENT OF INDIA
MINISTRY OF IRRIGATION
(Now Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation)

NATIONAL PERSPECTIVE FOR WATER RESOURCES DEVELOPMENT

NATIOANL PERSPECTIVES FOR WATER RESOURCES DEVELOPMENT

1. Introductory

Water is the most precious gift of nature of India. Its most beneficial use is a sine quanon, not only for the economic development but also for meeting the growing good requirements of the country. The rainfall in the country is confined to 90 to 100 days of monsoon season and is unevenly distributed both in space and time even during monsoon season. More and more storage reservoirs are, therefore, essential to achieve high degree of utilisation for various purposes. Agricultural production needs to be more than doubled in the coming two decades or so and most of it has to come by more efficient land and water management in existing irrigated areas, and by extending irrigation to new areas. There is hardly any scope to increase the cultivated areas. Conservation and most efficient utillisation of the water resources for beneficial use such as irrigation, hydropower, flood control, water supply, navigation and other purposes through storage reservoirs and water transfer systems will also provide large scale additional employment opportunities to several millions living in the rural areas. While planning the various projects, it is essential to ensure that environmental values are preserved and enhanced. With economic development, the possibilities of pollution of our water resources increase and we should be continuously on the alert to ameliorate existing pollution and ensure that no new sources of pollution are created.

2. Availability of Water

By the turn of the century, water will be a critical resource to mankind and therefore should be husbanded in a most scientific and efficient manner. In India, the availability of water is highly uneven, both in space and time. The prime source of water is precipitation which is confined to only about 3-4 months in the year and varies from 10cm in the western parts of Rajasthan to over 1000 cm to Cherapunji in Meghalaya. As a result, the country is afflicted by drought-flood-drought syndrome. Nearly a third of the country is drought prone while an eighth of the country is flood prone. Flood plains in fact occupy some of the most populous regions in our country. The total surface water available to our country is nearly 1440 million acre ft of which only 220 million acre ft are being now used. The rest is flowing waste causing, disastrous floods year after year. Further, several man made activities often aggravate the flood situation because of the large scale encroachment of flood plains by habitation and by temporary and permanent construction, as a part of the process of population increase as well as of developmental activities. Cutting of the trees and degradation of the forests and vegetable cover results in heavy soil erosion and transport of silt alongwith flood waters. This causes serious problems. In the plains where river course changes, erosion takes place and river bed as well as the flood levels go on rising causing more and more disastrous floods.

It has been assessed that at the most the plans evolved by State Governments can utilize not more than 540 M acre ft of water. This includes the use from a large number of inter-state Schemes benefiting more than one State on which understanding would have to be reached on planning and implementation. However, if we take a national view and harness major inter-State and international rivers in

the largest interest of the country as well as neighboring countries, the benefit would increase considerably. At least 180 million acre ft more water could be utilized in our country, 40 million kW of power can be generated and perennial inland navigation could be provided. Also very large benefits of flood control would be achieved. This is feasible by providing storages at appropriate locations and inter-linking of the various river systems. If we look beyond the boundaries of the States and even beyond the boundaries of the national frontiers and conceive of the optimum development of the rivers of the sub-continent, each state in our country and each country in the sub-continent stands to gain by way of additional irrigation, hydro-power, generation, navigation and flood control.

National perspective of water resources development therefore envisage optimum development of the major river systems of the sub-continent including inter-State and international rivers. The Ganga-Brahmaputra-Meghna is a major international drainage basin which carries more than 1,000 million acre ft of water. India is an agricultural country and irrigation is the largest consumer of water. About 90 percent of the water being used consumptively in the country is required by irrigation. The same position will continue more or less in future. One ton of paddy requires 4000 tons of water for irrigation. Similarly, one ton of wheat requires 1500-2000 tones of water. This gives an idea of the enormous quantity of water required for producing food and demonstrates not only large and growing needs of water, but underscores and necessity for most efficient utilization of water. We must prevent precious water being spoiled by way of pollution. We must preserve environment by harnessing, developing and utilizing the waters. Water is a scarce commodity and even today several basins such as Cauvery, Yamuna, Sutlej, Ravi and other smaller inter-State/Intra-State rivers are short of water. The drought prone areas in the country have hardly water available for even drinking purposes during summer months. India is a country of monsoons. 85-90 percent of the waters flow down to the sea during monsoon months. So far India has built over 600 storage dams with an aggregate capacity of 130 million acre ft. Although this itself is a commendable progress, it falls far short of the requirements either to control the floods successfully or to enable bulk of the water resources being utilized. The small storages we have built hardly enable a seventh of the water available in our country to be utilized beneficially for consumptive purposes. United States of America has almost the same quantum of total water as India, but dams built in the country hold five times as much water as we do, 99 districts of the country are classified as drought prone and an area of 40 million ha. Are liable to suffer from recurring floods.

3. Progress and Programmes of Irrigation Development

At the time of independence the area under irrigation was only 20 million ha. Since then upto end of 1979 the area under irrigation has been stepped up to about 57 million ha. Water is a master input to agriculture. With high yielding varieties possible under irrigation, and with increased doses of fertilizers the food production has been stepped up to 125/130 million tones. However, rate of increase in food production has just managed to equal the rate of population growth. We must increase the rate of agricultural growth to four percent at least. Agriculture continues to be the dominant factor in the Indian economy as it contributes about 50 percent of

the value of the total national production. Even a single year's drought, therefore causes a severe stress on the overall economy of the country.

On the basis of a broad assessment, it has been estimated that the ultimate irrigation potential of the country is 113 million ha. Comprising the following:

(i) Through Major and Medium Schemes	58.5 million ha.
(ii) Through Minor Surface water Schemes	15.2 million ha.
(iii) Through Ground Water Schemes	39.3 million ha.
	113.00 million ha.

In order to keep pace with the increasing population, which is expected to increase from the present 660 million to about 900 million by the turn of the century, it is necessary to increase the tempo of irrigation development. Accordingly, our endeavor would be to bring about 110 million ha. Under irrigation by turn of the century.

This will need tremendous efforts both in physical terms as also in terms of financial outlays and yet even after achieving this target about 45 percent of the total cropped area of the country will still have to depend on the vagaries of the monsoon. However, by optimum storage of our water resources and interlinking of our rivers, it is possible to extend significantly the total irrigated area.

4. Need for National Planning

In recent years considerable interest has been evinced both in the press and other public forums as well as in the Parliament regarding the need of a National Water Policy aiming at optimum development and most efficient utilization of the country's water resources for the benefit of the entire nation, overriding narrow regional considerations. Such a programme providing for storages and transfers of surplus waters can mitigate the ravages of annually recurring floods and also minimize the miseries brought by droughts.

In the past, there have been a couple of attempts at evolving such a national plan for development of the entire water resources of the nation. These proposals had, however, basic limitations.

5. Dr. Rao's Proposal- Ganga-Cauvery Link

Dr. Rao's proposal visualized the following:

(i) Ganga-Cauvery link
(ii) Ganga-Brahmaputra link
(iii) Canal from Narmada to Gujarat and Western Rajasthan
(iv) Links from Western Ghats
(v) Link from Chambal to Ajmer
(vi) Canal from Mahanadi to Sharda

It was proposed to transfer 20 million acre ft. of water during the monsoon by pumping from the Ganga River over a head of 1800ft. to irrigate 4 million ha. The scheme would have required 5 to 7 million kW of power. With the high lifts involved, and the intermittent nature of water transfer, and the energy situation in the country, the economics of the scheme are doubtful. This also has obviously no flood control benefits.

6. Captain Dastur's Proposals-Garland Canal

Captain Dastur's proposal mainly consists of two canal viz. (i) The Himalayan Canal at a level of 1100-1500ft. and (ii) the Garland Canal at a level of 800-1000 ft. He also proposed to have lakes one mile wide and 100ft. deep along the canal alignment by cutting back the hill slopes. The Dastur proposals suffer from fundamental technical deficiencies. Further, the pattern of development envisaged would, even if feasible, involve outlay of the order of 120 lakh crores.

7. National Perspective for Water Resources Development – Board Approach and Principles

The Ministry of Irrigation and the Central Water Commission have formulated a National Perspective for Water Development. The broad approach adopted is as follows:

(i) Existing uses have been kept undisturbed;
(ii) Normal water development under the existing legal and constitutional framework is assumed to take place fully by the turn of the century;
(iii) The perspective envisages developments within the frame work of all the existing agreements between or amongst the states within the country as well as existing treaties with the neighbouring countries;
(iv) As the storage sites are limited on account of topographical and other resources, the plan is based on optimum development of available storage sites including development of new storages, big and small, wherever feasible. Inter-linking of the major rivers is envisaged;
(v) The plan envisages multipurpose and multi-objective development of water resources, namely, irrigation, flood control, hydro-power generation and navigation;
(vi) Power installations have been so envisaged that peak requirements of the regional power grid are made to the maximum extent. These would also enable exploitation of secondary powers during monsoon which would meet fully the demand for lifting waters;
(vii) While planning inter-basin and inter-State transfer of waters, reasonable needs of the basin States for the foreseeable future have been kept in view and provided for;
(viii) Most efficient use of land and water in the existing irrigation and hydro-power stations has been kept as a principal objective to be achieved in the next 15-20 years;
(ix) So far as irrigation benefits are concerned, supply of water to meet the requirements of the existing coastal irrigation areas, particularly the deltas, such as the Godavari, Krishna, Cauvery, Mahanadi etc. has been

major objective so that waters released thereby from the respective basins can be used for irrigating drought striken areas at higher contours in the upper reaches. This will minimise energy demands;

(x) Water development should have preservation and enhancement of the environment as one of the major objectives, and provide for the funds needed for afforestation and improvement of forests in areas nearby. Recreation, fisheries development etc. should also be taken into account;

(xi) Domestic and industrial uses of water as well as for irrigation should be given high priority. Pollution control should be one of the main objectives; and

(xii) The people to be displaced by project works should be given liberal facilities for rehabilitation and resettlement so that their living conditions are improved. It might be necessary to resettle as many of the displaced people as possible in the areas to be benefited by the projects.

OUTLINE OF THE PERSPECTIVE

This perspective comprises two main components, viz:

(i) Himalayan Rivers Development, and
(ii) Peninsular Rivers Development

These are briefly outlined below.

HIMALAYAN RIVERS DEVELOPMENT

Himalayan Rivers Development envisages construction of storage reservoirs on the main Ganga and the Brahmaputra and their principal tributaries in India and Nepal alongwith inter-linking canal system to transfer surplus flows of the eastern tributaries of the Ganga to the West apart from linking of the main Brahmaputra with the Ganga. Apart from providing irrigation to an additional area of about 22 million hectares the generation of about 30 million kilowatt of hydro-power, it will provide substantial flood control in the Ganga-Brahmaputra basin. It would provide 40,000 cusecs to Calcutta Port and would provide navigation facilities across the country. The scheme will benefit not only the States in the Ganga-Brahmaputra Basin, but also our neighbours – Nepal and Bangladesh as well as the Northern and the Western States in our country. Implementation of this scheme will however largely depend on the cooperation of neighbouring countries.

OUTLINE OF PENINSULAR RIVERS DEVELOPMENT

This is divided in four major parts.

Part-I- Interlinking of Mahanadi-Godavari-Krishna-Pennar-Cauvery

Amongst the peninsular rivers the Mahanadi and the Godavri are likely to have sizable surpluses. It is, therefore, possible to divert the surplus of the Mahanadi and

the Godavari to the water-short rivers viz; the Krishna, the Pennar and the Cauvery. The Mahanadi will also be linked on the north with Bura-Balang, and 6 million acre feet of Mahanadi waters will be utilized for irrigating the coastal areas in Orissa and interlinking the rivers to even out the hydrological variations.

Essentially this proposal contemplates diversion of 15 million acre feet of Mahanadi flows to the Godavari and a transfer of 30 million acre feet from the Godavari and its tributaries to the Krishna Basin. Allowing for 15 million acre feet from the Mahanadi, this would mean a net diversion of only 15 million acre feet from the Godavari to the Krishna.

The link from the Mahanadi to the Godavari will be along the East Coast and would not involve any lift. The links between the Godavari and the Krishna will be from Polavaram to Vijayawada, Inchampalli to Pulichintala, Inchampalli to Nagarjunasagar and Wainganga to Srisailam. The last two links would involve lifts of the order of 360 feet and 400 feet respectively.

The transfer of Wainganga waters to Srisailam reservoir on the Krishna would enable the present inflows at Srisailam reservoir of the order of 9 million acre feet to be utilized upstream in the drought areas of Maharashtra and Karnataka. This is an important benefit and part of the water diverted from Wainganga to Srisailam would enable Andhra Pradesh to provide irrigation in Rayaleseema and Nagarjunasagar Stage-II Command.

Waters diverted from Wainganga to Srisailam would be transferred to the Pennar by gravity. It would irrigate the chronically drought affected areas of in Rayaleseema. Part of the supplies could be stored at Gandikota, a natural gorge across the Pennar river. It could then be picked up lower down the Pennar river and diverted south to the Cauvery at the Upper Anicut. Another canal will take off from the Upper Anicut to the Vaigai river.

Part-II- Interlinking of West Flowing Rivers, North of Bombay and South of Tapi

A number of rivers of short length flow in the West Coast North of Bombay and South of Tapi. Amongst the rivers are Ulhas, Vaitarni, Damanganga, Mindhola, Purna, Ambica, Auranga, Par and Kolak. These coastal rivers drain over 20,000 square kilometers areas of high rainfall ranging from 2000 to 2500 millimetres annually and carry plentiful supplies and have short coastal plains and therefore have significant surpluses.

Construction of as many optimal storages as possible on these streams and interlinking them can make available appreciable quantum's of water for transfer to areas where additional water is needed badly.

Two link-canals are envisaged. The first canal will run northwards from Damanganga and connect it with the Tapi and Narmada rivers. Backed by the construction of as much storages as possible such a link canal will provide the requisite supplies to the Ukai left bank and Kakrapar left bank canal areas and

release about 3.5 million acre ft. of Tapi waters which can be used in the lower areas of the Narmada canal releasing in turn a corresponding quantity of water for extension of irrigation to Saurashtra and Kutch areas from the Narmada high level canal. Several alternative alignments at various levels would appear to be practicable and the relative techno-economic advantages would be investigated.

A southern link canal starting from the Damanganga can run along a suitable alignment at the appropriate elevation to Bombay, The canal backed by the construction of as many storages as feasible can convey supplies of about 1 million acre feet for water supply to the metropolitan area of Bombay, and depending on the quantum harnessed, also provide irrigation to the coastal areas in Maharashtra.

Part-III- Inter-linking of Ken with Chambal

The Ken, Dhasan, Betwa, Sindh Chambal rivers are southern tributaries of the Yamuna draining about 2.4 lakh square kilometers including Malwa plateau and Bundelkhandand Baghelkhand which are amongst the most backward regions in the country and are prone to frequent droughts. The annual run-off of the rivers at their outfalls is about 40-50 million acre feet but it is characterized by extreme variations from year to year. Much of the existing major irrigation is concentrated in the lower reaches of these rivers along the Yamuna bank.

On the Ken river there are possibilities of building a Greater Gangau Dam which are being investigated by Madhya Pradesh. There may also be other storage possibilities in the basin which need to be considered. In order to provide a water grid for Madhya Pradesh and Uttar Pradesh in this region, an inter-linking canal could be identified backed by as much storage as feasible. The link canal can take off from the Greater Gangau Dam at elevation 1100 ft and connect the Ken, Dhasan, Betwa, Sindh and Chambal. As much storage as possible on these and other intermediate river could be developed.

The U.P. Government have under contemplation the proposal for a storage on the Yamuna river at Panchnad site. 3 million acre feet of waters could be lifted from this reservoir, with the lift being limited to 100 feet to begin with. The lifted waters could take over much of the existing irrigation along the bank of the Yamuna in the Betwa, Dhasan and Ken systems. This will release waters for use in the higher reaches of the rivers.

The 1972 Inter-State Agreement on the Rajghat Project on Betwa river provides that all the surplus waters at Rajghat, after meeting the projected needs of the Rajghat Project, could be utilized by Madhya Pradesh. A scheme of development as outlined earlier may enable the transfer of about 2 to 2.5 million acre-feet of waters to the Chambal basin and take over the requirements of Ambah and Morena branches of the Chambal Project in M.P. The corresponding water released at higher elevation could be utilized in Ujjain-Indore areas of M.P. to increase the irrigation facilities in upper areas of Rajasthan.

At the Panchnad site, abundant supplies are likely to be available in the Yamuna for a good part of the year. These could be utilized to generate the power needed for lifting waters and for meeting the local power needs.

The lower reaches of the Chambal, Sindh, Kunwari, Pahuj and Yamuna may also be investigated for the location of small storages/pondages upstream of Panchnad. These can provide some additional useful storage facilities and water could be lifted to the adjacent areas. The ravines may also be reclaimed and brought under irrigation.

Part-IV – Diversion of West Flowing Rivers

The narrow coastal plains of India along the West Coast stretching from Kanyakumari in the South to the Tapi in the North have special and distinct features both in topography and water resources. Bulk of the rainfall is contributed by the South-West monsoon and a good part of it precipitates on the Western side of the Western Ghats because of the high mountains in this region. The rainfall varies from 1500 millimetres to 5200 millimetres. The narrow coastal belt has numerous rivers and streams which empty into the Arabian Sea. The West flowing rivers in Kerala alone carry an average annual flow of 62 million acre feet and those in Karnataka 50 million acre feet. All the waters that flow down the rivers cannot be utilized for several practical reasons.

The problem in Kerala is, therefore, one of storage and conveying water from one river basin to another and transferring the surplus portion of it from west to east for irrigation in an economical manner. Fortunately, there exists a possibility of such economic transfer along the Kallada river ridge. A short tunnel in the upper reaches of the Kallada river will enable transfer of water from east to west by means of a tunnel. Other possibilities could also be studied.

The construction of a canal along the west coast at about elevation of 500 feet MSL should also not present any insurmountable difficulties. It could be contour canal in some reaches, cut and cover section in a few parts and pass through tunnels in some difficult spots. A few storages may also be feasible which could feed the inter-linking canal and also release water for Kerala lower down. The capacity may be planned to meet all the requirements of the Kerala areas uncommanded by other projects, and for transfer of some waters.

Benefits and Phasing

The overall scheme is estimated to cost approximately Rs.50,000 crores and would give additional benefits of 25 million hectares of irrigation by surface waters, 10 million hectares by increased use of ground waters and generation of 40 million kilowatt of power, apart from benefits of flood control, navigation etc. The distinctive feature of the scheme is the transfer of water essentially by gravity and only in small reaches by lifts not only technically feasible but also economically viable when compared to the present cost of development of irrigation facilities. The technology proposed in this scheme is already known and tried successfully in our own country

and does not involve experimentation or research. Besides, it is capable of planning and implementation entirely by the Indian experts without any foreign assistance.

Initially, priority is proposed to be given to the development of storages and gravity links in order to exploit maximum benefits of hydro-power generation in initial stages and at the same time extend irrigation benefits to large areas. This could be later on followed by lift components.

State-wise benefits (approximately) of water for irrigation are given below

State	Additional quantum of water which can be utilized (Million acre feet)	Additional area which can be irrigated (Thousand hectare)
Orissa	6.0	1171
Andhra Pradesh	24.0	4685
Maharashtra	6.5	1269
Karnataka	6.5	1269
Tamil Nadu	12.0	2342
Kerala	5.0	976
Madhya Pradesh	2.5	488
Uttar Pradesh	2.5	488
Gujarat	3.5	683

A flow chart of the major peninsular river development is enclosed.

From the Himalayan Rivers Development, major irrigation benefits would accrue to U.P., Bihar and West Bengal. Substantial benefits would also accrue to M.P. It may also be possible to extend some benefits to Haryana, Punjab, Rajasthan and Gujarat.

Discussions with State Governments

The component of Peninsular Rivers Development can be planned and implemented solely within our country by cooperation amongst the States. At the instance of our Prime Minister, the Secretary, Ministry of Irrigation therefore, held discussions with the Irrigation Secretaries and Chief Engineers of the concerned State Governments in June 1980.

The initiative taken by the Government of India in preparing the scheme benefiting various regions was welcomed by the States. The general consensus emerged that the monsoon flood waters which otherwise run waste into the sea should be conserved in various storage reservoirs, big and small. The water so conserved could then be utilized for irrigation, power generation etc. The benefits of water development could be enhanced considerably if waters are transferred over long distances for irrigating large area in drought affected and backward regions. However, there was general feeling that water requirements of various areas within

the basins should be assessed realistically and was therefore agreed unanimously that the various reservoir sites should be surveyed and investigated most expeditiously. Most of the States wanted the Central Government to take initiative in cooperation with the State Governments in this connection. It was also agreed that the State Governments will provide outline plans of water development indicating the existing and prospective water requirements in their territories latest by September, 1980. The Central Government on its own will also take up studies regarding possibilities of development within the basins as well as outside in order to firm up the quantum of water to be transferred. Agreement regarding allocation of waters to the different areas would have to be reached at political level within the broad framework of a national policy for development and use of water which is becoming more and more scarce in our country. It was indeed gratifying that the scheme prepared by the Central Government evoked a favourable response from one and all the States and that the States readily agreed to cooperate in further studies including the investigations of the dam sites.

It is now proposed to undertake the work of surveys and investigations in the Central Sector in cooperation with States by setting up a separate agency exclusively devoted to this work.

Conclusion

Development envisages construction of about 150 million acre feet of storages. These storages and the interlinks will enable the additional utilization of nearly 170 million acre feet of water for beneficial uses in our country, enabling irrigation over an additional area of 35 million hectares, generation of 40 million kilowatt of hydro-power capacity, flood control and other multipurpose benefits.

Benefits of NPP

The National Perspective Plan would give additional benefits of 25 million hectares of irrigation from surface waters, 10 million hectares by increased use of ground water, totaling to 35million hectares and 34,000 MW of hydro-power generation. In addition the likely incidental benefits are:

Mitigation of Droughts
Flood Control
Domestic & Industrial Water Supply
Navigational Facilities
Employment Generation
Fisheries
Salinity Control
Pollution Control
Recreation Facilities
Infrastructural Development
Socio – Economic Development