Jalvigyan Sameeksha—a publication of
Indian National Committee on Hydrology
Vol. VII, No. 2, December 1992

Water Conservation Through Inter Basin Transfers

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Abstract : *Inter basin transfers imply large investment, technological challanges trade off between various objectives, political concensus, mechanism of equitable distribution of costs and benefits and a host of other issues. Some proposals made for interlinking of rivers and transfer of water from one basins to other have been discussed in this paper. Major considerations of an interbasin transfer & design criteria to be adopted have also been foccused.*

1. General

1 1 The increasing needs for water in many parts of the world for meeting varied demands for food, fibre, industry etc. has given boost to large interbasin transfers in the last few decades. The strategies for storing the river flows including monsoon flows for regulated supplies to regions in the basin and outside the basin if needed such that the natural runoff does not flow waste to the sea, forms an important part of water conservation efforts. Excellent examples and success stories abound not only in India but also in USA, USSR, Canada and other countries. The Indira Gandhi Nahar Project, the Periyar-Vaigai project in India, California valley Development in USA, and Volga development in USSR are standing examples of how the large interbasin transfers result in water conservation and bring about alround Socio Economic growth (Table 1 and 2 of Annexure).

2. Development by Inter Basin Transfers

The idea of interlinking of rivers and inter basin transfer are not new in India. In the nineteenth century, Sir Arthur Cotton made a navigational plan from Assam to Bombay. Several other contingent plans have also hitherto been developed for increasing the gross irrigated area by optimum water resources development within individual basins and also resorting to transbasin transfer wherever feasible. Better and efficient use of existing water resources will not only increase the overall food production but in Indian context, extensive irrigation will also play an equally important role in economic development and raising standard of living of the people. National Water Policy (1987) has also enunciated similar approach to drought management. As per this policy drought prone areas should be made less vulnerable by resorting to transfer of surface water from surplus areas to drought prone areas wherever feasible and appropriate. Pastures, forestory which are other modes of development which are relatively less water demanding should be encouraged.

Some of the important links constructed in

India for inter basin transfer of water are indicated below :

1. K.C. (Kaddappa-Cauvery) Canal (1860-70)
2. Periyar-Vaigai (1986)
3. Rajasthan Canal
4. Parambikulam-Aliyar
5 Sharda Sahayak
6. Ramganga-Ganga
7. Beas-Sutlej

The following interbasin links are under constructfon in India :

1. Telugu Ganga (Krishna to Madras)
2. Sutlej Yamuna link
3. Sardar Sarovar Project
4. Nagarjun Sagar
5. Tungbhadra High Level Canal.

3. Earlier proposals

Some proposals made for interlinking of rivers and transfer of water from one basin to other, made by eminent persons in past are discussed in the following paragraphs.

3.1 Sir Arthur Cotton's Navigational Plan

Sir Arthur Cotton made a navigational plan from Assam to Bombay. This proposal envisaged interlinking of major rivers for transportation of goods on water. This proposal was not taken up, except in areas where it operated.

3.2 Dr. K.L. Rao's Proposals

Out of the several National Plans for efficient utilisation of water resources for the entire nation, the one proposed by Dr. K.L. Rao former Union Minister for Irrigation has a broad plan for inter-connecting Ganga with Cauvery, Brahmputra with Ganga and other smaller links. Dr. Rao's proposal is also popularly known as Ganga Cauvery link The proposal consists of following components.

(i) Ganga Cauvery link connecting the Ganga with Cauvery and passing through basins of Sone, Narmada, Tapi, Godavari, Krishna and Pennar.

(ii) Brahmputra-Ganga link

(iii) Canal from Narmada to Gujarat, Western Rajasthan and Maharashtra.

(iv) Links from the rivers of Western Ghats to east.

The Gange-Cauvery link proposal envisages lifting of 24670 Mcm (20 million acre ft) of water from a barrage across Ganga at Patna. The canal is to deliver 283 cumecs (10,000 cusecs) for 300 days to drought prone areas in south Bihar and southern Uttar Pradesh within Ganga basin itself. Another 1416 cumecs (50,000 cusecs) for 180 days is to be pumped across Vindhyas with a lift of about 542 m (1800 ft.) to irrigate 4 million ha. The power requirement for such a scheme would be of the order of 5 to 7 million KW or 5000 to 7000 MW.

The river Brahmaputra carries enormous flows even in non-monsoon which are normally unutilised. The proposed Brahmaputra-Ganga link canal envisages 3209 km. long link canal starting from a barrage across Brahmaputra at Jogigopa and terminating at Farakka Barrage in West Bengal. The canal traverses about 120 km. in Bangladesh and proposes to enhance the lean flow of Hoogly river by about 1133 cumecs (40,000 cusecs) and irrigation and other uses in Bangladesh and enroute.

Another proposal is for construction of storages tn Arunachal Pradesh, Sikkim, Bhutan and Nepal for storing surplus flows of river Brahmaputra and Ganga and their tributaries and interlinking them by a link canal along the foot-hills of Himalayas. Enormous power production and lean flow augmentation is possible under the scheme. However, a lot of engineering problems may be encountered to take the canal across natural drainages at regular intervals. Dr, Rao's estimated the cost

of Ganga-Cauvery link at Rs. 12,500 crores. The proposal was examined in CWC and it was observed that though proposal was technically feasible, but costs were under estimated. Due to seepage and other losses enroute, the actual benefits would be substantially reduced. The scheme would require a large block of power estimated at 7200 MW for pumping water. Due to these reasons the proposal was not taken up for detailed studies.

3.3 Captain Dasturs plan

Captain D.J. Dastur had prepared a proposal in the seventies for utilisation of water resources in the country. The proposal envisages construction of two canals viz.

(i) The Himalayan Canal at a level of 335-457 m (1100-1500 ft.) and 2400 km. long, to collect waters of Ravi, Sutlej, Yamuna, Ganga and Brahmputra. The canal was also proposed to be extended towards south of Brahmaputra by another 1770 km.

(ii) The Central and Southern Garland Canal at a constant elevation between 244 m and 305 m and 9332 km. length.

He also proposed to have lakes 1.6 km (1 mile) wide and 30 m (100 ft) deep along the canal alignment by cutting back the hill slopes. On examination, it was found that the proposals suffer from fundamental technical deficiencies and was costwise prohibitive. Further, the pattern of development envisaged would, even if feasible, involve outlay of the order of Rs. 12 million Crores against Rs. 24,100 crores as estimated by Capt. Dastur i.e. 500 times more. Hence, this proposal was also not taken up for detailed studies.

3.4 National Prospective Plan

The erstwhile Union Ministry of Irrigation and the Central Water Commission examined the various proposals and formulated the National Perspectives for water resources development in the year 1980. It has two components viz.

(i) the Himalayan River Development and

(ii) the Peninsular River Development.

3.4.1 The Himalayan Rivers Development component consists of inter-linking river Ganga and Brahmaputra and its tributaries similar to that of Dr. K.L. Rao's plan. This Component envisages :

(i) Construction of storage dams on Ganga, Brahmputra and their principal tributaries in India and Nepal.

(ii) Interlinking canal to transfer surplus flows of Kosi, Gandak and Ghaghra to the west end of Ganga, and the Yamuna to the Sutlej and Beas. Then part supplies of Beas and Ravi would be available for further transfer to South to drought prone areas of Haryana, Rajasthan & Gujarat.

(iii) Brahmaputra will be linked to Ganga to augment dry whether flows of the Ganga.

(iv) With this proposal about 148000 Mm^3 of additional water would be available to irrigate 22 M ha area.

(v) There will be power generation of about 30,000 MW.

(vi) The Scheme will benefit not only India, but our neighbours Nepal & Bangladesh. But the implementation will however depend on the cooperation of Nepal and Bangladesh.

3.4.2 The Peninsular River Development consists of the following four major parts viz.

(i) Inter-linking of Mahanadi-Godavari-Krishna-Pennar and Cauvery,

(ii) Inter-linking of west flowing rivers North of Bombay and South of Tapi,

(iii) Inter-linking of ken with Chambel,

(iv) Diversion of west flowing rivers of kerala & Karnataka.

3.5 National Water Dcvelopment Agency (NWDA) was set up under Ministry of Irrigation in July, 1982 to study the National Perspective Plan and to draw up feasibility reports of the water transfer links with the following objectives.

(a) To promote scientific development for optimum utilisation of water resources in the country.

(b) To carry out detailed surveys and investigations of the possible storage reservoir sites and interconnecling link in order to establish feasibility of the proposal of Peninsular River Development forming part of National Perspective for water resources development prepared by Ministry of Water Resources and Central Water Commission.

(c) To carry out detailed studies about the quantum of water in various Peninsuler River System and which can be transferred to other basins/States in the foreseeable future.

(d) To prepare feasibility reports of various components of the scheme relating to Peninsuler River Development.

Subsequently NWDA has also taken up similar studies relating for Himalayan River Development.

4. Major considerations of an interbasin transfer

4.1 The definitions of an inter basin transfer vis-a-vis an inbasin transfer is hazy, in that, almost all development taken place so far, in strict terms, is inter basin in character as inbasin development ought to be confined to water use within the geographicel area contributing to its flow. Nevertheless, let us confine our discussion to water transfers to outside a basin (directly outflowing into sea or a large lake). Does this sort of development differ drastically with that of any inbasin transfers ? The answer is probably no, as no specific guidlines, rules or procedures seen to have be adopted by any basin authority.

4.2 The nature of this development is characterised by four distinct features.

(i) The transfers involved are generally large with long lengths often with pumping and/or tunnelling at one or more points or to cross basin divides.

(ii) With multiplicity of interests and authorities involved, necessity of a seperate structure for sharing of costs and benefits at planning and menagement stages.

(iii) Large socio economic and environmental ramifications.

(iv) Involvement of two or more political authorities like a region, state or even a country, thus needing political concensus

5. Design Criteria to be adopted

5.1 In view of the above characteristics, the following points need special attention.

5.2 Technological aspects

Again restricting our discussion to large scale inter-basin transfers. some specific aspect in investigation, planning, execution and operation are called for. Investigation, for storages, distribution system and command area need be same as that of conventional Water Resources Project. However, during investigations special emphasis as regards present State/status of irrigation, irrigability etc. of enroute areas in the near vicinity along the major canal system need also to be carried out. The transfers often Involve long tunnelling and/or pumping along the route, special studies may have to be carried out to assertain the technological feasibility of these special structures both for design as well as construction as many a time no precedence exists and usual guidelines or thumb rules (which are necessary even in most sofisticated

designs) may not be applicable. To cite an instance, the proposed Brahmaputra Ganga link canal design needs to be done with different yardsticks as the design discharge of about 2836 cumec (1,00,000 cusecs) is perhaps one of the largest canals of its sort.

The hydrological studies to be carried out for inter basin transfer should encompass the catchment areas of the storages as well as that of intermediate small and big drainages along the main canal. It is desirable and profitable to link these intermediate streams rather than taking the canal below or above the drainages, to tap excess water if any of these intermediate streams and to take advantage of the variation of rainfall and demand pattern enroute.

Detailed optimisations and simulation studies together with application of suitable economic models will be needed to decide the type of facilities of crossings. If proper and sufficient storages are not available near the command area (which are expected to be far way from the exporting basin) dynamic regulation of the canal with automatic gate regulation mechanism and computer software now being developed in many institutions, may be desirable for smooth regulation and optimum utilisation.

Many aspects of inter basin transfer have been discussed adequately in the special session of International Commission of Irrigation and Drainage held at Athens, Greece–1978. In this context, the following basic principles were enunciated for consideration of large scale water transfers.

(a) The present and future requirement in the reasonable foreseeable future of exporting basins should be met or safeguarded.

(b) The requirement of the basin of the region importing the water should be reduced to to the minimum by :

(i) Tapping of alternate resources of water cheaper than imported water.

(ii) Effecting saving in existing water resources without impairing efficiency.

(c) It further added that political and social considerations should be given due weightage in such a mass transfer.

As discussed, the next step in the planning is to assess the surplus available in the exporting basin. It is to be demonstrated that there exists sufficient surplus not only for the present needs but also for the ultimate requirement or at least all forseeable reasonable needs in the coming decades. There are no specific guidelines as to the time horizon of planning. All the water needs envisaged in the individual Master plan of basins prepared by the concerned State or concerned organisation (including existing, ongoing and proposed projects) at rates contemplated should be taken for assessment of future needs. Water requirement for other uses like hydropower, industry, municipal supplies including urban and rural be estimated as per prevalent standard practices. The requirements for maintaining the alluvial morphology and the salinity control etc., provision should be earmarked for assessing the water balance situation.

5.3 Socio-economic & environmental considerations

5 3.1 The justification of the plan in the final analysis is done not solely on financial returns or even economic viability but with criterion how far the projects fulfils the desired socio-economic goals as these plans have vast ramifications for the exporting as well as recipient basins. Often the financial returns are too meagre in comparision to that of other plans in water resources sector as the true opportunity cost of the supplies can not be recovered due to many variety of national objectives including productivity, equity, regional development etc. Hence, of late, international organisations including UNDP, World Bank are advocating the individual development plans with objectives

as increase in net consumption benefits, regional income distribution, employment generation etc. Accordingly the procedures suggested in UNIDO guidelines, World Bank etc. are being increasingly adopted. Because of the large distances involved, a question such as who should bear the cost and who reaps the benefit and mode of compensation etc. often arises and debated and is more predominant in the final selection of plan.

5.3.2 The positive and adverse environmental effects of these interbasin transfers are almost similar to that of inbasin development except for some aspects. The question of compensation of the affected persons and role of beneficiaries in far away places needs altogether different outlook. The link canal often has to cut across natural drainages for most part of the length unlike a conventional canal which reaches the ridge within a short distance from the headwork. Tampering the natural drainage on such a large scale need careful design specially the cross drainage works to minimise adverse effects. However, the canal system often is boon for meeting the enroute domestic water requirements and at times irrigation needs thus justifying the whole endeavour. The water resources planner however has to quantify these positive impacts outweigh the adverse impacts.

6.1 Public participation

Need of active involvement of end users is increasingly recognised world over. The populace at large, are to be involved at all stages of planning and an open door policy of dissemination of information together with proper information systems, quantification techniques and extensive use of audio visual media is called for to signal the genuine intent of the Water Resources planner and the imperatives of the development and safeguards for environmental qualify contemplated. An attempt has already been initiated with the successful dialogue between the predevelopment and proenvironment lobbies at the last 3rd National Water Convention and National Seminar on large dams at Nagpur during Feb., 1992.

7. Conclusion

Interbasin transfers imply large investment, long gestation periods, technological challenge, trade off between various objectives including resources development and environmental quality, political concensus, mechanism of equitable distribution of costs and benefits and a host of other issues. Many may be sourmountable like technological needs and some like trade off satisfying halfway. But plan allocations, in India context, may be too meagere because of competing demands. Future compulsions. like taking up of Narmada Development, may dictate course of action in the coming decades. Large storages capable of developing huge water potential for irrigation hydropower are still to be utilised in many basins mainly in the Himalayan belt, Godavari basin, Mahanadi Basin and in other smaller basins in the western coast. At any rate the water resources planner has a job in hand who has the responsibility of introducing innovative design and management techniques for quantification of positive and adverse impacts of the endeavour specially by use of state of art, operation research techniques and other tools in water resources systems engineering and help in dissemination of information to one and all for reaching a consensus in these mega ventures. Encouraging signs from international bodies are pouring in about their desire to fund these large plans on commercial lines. As enunciated in the Athens, ICID, 1978 conference. interbasin transfers may be a last resort in some instances but when these are invitable by National Compulsions, our planning endeavour should not be found lacking and a shelf of readymade feasible plans should be ready for due consideration at appropriate time.

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