Chapter – 1
Introduction

1.1 National perspectives for water resources development

The erstwhile Union Ministry of Irrigation (now Ministry of Water Resources) and the Central Water Commission in the year 1980 formulated the National Perspectives for Water Resources Development, which comprises two main components, viz. Himalayan Rivers Development and Peninsular 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 systems to transfer surplus flows of the eastern tributaries of the Ganga to the West apart from linking of the main Brahmaputra with the Ganga. Peninsular Rivers Development of the National Perspectives Plan includes interlinking of major rivers flowing in the Peninsular India including the southern tributaries of Yamuna. The major parts of this component are (I) interlinking of Mahanadi-Godavari-Krishna-Pennar-Cauvery, (ii) interlinking of west flowing rivers, north of Bombay and south of Tapi, (iii) interlinking of Ken with Chambal and (iv) diversion of west flowing rivers. The interlinking of these rivers will envisage construction of storage reservoirs at potential sites and canal systems for transferring the waters from surplus to deficit basins/areas. The canals will also include tunnels and lifts, wherever necessary.

1.2 History of the Project

a) Earlier Proposals

Preliminary feasibility report of Kalisindh-Chambal link canal project was prepared by NWDA and circulated amongst the members of its Technical Advisory Committee (TAC) and to the concerned State Govts. in September, 1991. The prefeasibility report of Kalisindh-Chambal link project envisaged diversion of 417 Mm^3 of water from river Newaj (a tributary of Kalisindh) and 403 Mm^3 of water from river Kalisindh either to river Chambal at Rana Pratap Sagar or at Gandhi Sagar dam. The diverted water was proposed to be utilised for irrigation at Kota barrage and the water of Chambal thus saved was proposed to be utilised for irrigation to serve the drought prone areas in the upper Chambal sub-basin. The potential storage/diversion sites had been identified and the assessment of their approximate capacity and likely yield was made based on toposheet studies. These projects were proposed to be utilised to upgrade the level of irrigation of some of the tehsils of drought prone districts of Ujjain, Shajapur and Dhar. Irrigation had also been proposed to be extended to an adjoining tehsil of Ratlam district in which the level of irrigation of only 8.7% is likely to be achieved from existing, ongoing and proposed projects.

The quantum of water for diversion was assessed after carrying out the water balance studies of the sub-basins at the diversion points in accordance with the TAC guidelines. As per these guidelines, before qualifying the water surplus for transfer, an irrigation level of 60% of the culturable command area is to be achieved in the donor sub-basin/basin. If this guideline is followed, there will be no surplus water within the Chambal basin for serving the need of drought prone areas of Upper Chambal sub-basin where, with the allocated surface water resources the level of

irrigation of about 5.44% can only be attained. To have an equitable distribution of water in different sub-basins of Chambal basin, a criteria of attaining a minimum irrigation level of 30% both for areas upstream and downstream of diversion point in the donor sub-basin has been adopted. The requirements projected in the indicative master plan have been retained even when their irrigation levels are higher than 30%. Following this approach 820 Mm^3 of water had been assessed as surplus at the diversion points for transfer to serve the drought prone areas of Upper Chambal sub-basin.

The Kalisindh-Chambal link project comprised of:

I. A diversion dam at Mohanpura on river Newaj with gross storage level 395.0 m to divert 417 Mm^3 of water from its own catchment to Kundaliya river through a 68.75 km long canal with FSL of 392.0 m at Mohanpura.
II. A storage dam at Kundaliya on river Kalisindh with FRL 370.0 m, gross storage capacity of 533.0 Mm^3 to transfer 403.0 Mm^3 of water from its own catchment and 337.0 Mm^3 of water received from Mohanpura either to:

    a) Rana Pratap Sagar having FRL of 352.81 m and live storage capacity of 1566.52 Mm^3 through a 114.00 km long water conductor length involving 108.75 km long gravity canal and 5.25 km long tunnel, or
    b) Gandhi Sagar having FRL of 399.89 m and live storage capacity of 7617 Mm^3 through a 96 km long water conductor length involving a gravity canal of 76 km and balance 20 km covered by pipelines, and intermediate reservoirs with a lift of about 50 m. For this alternative, 28.74 MW of power was required for pumping whereas 8.85 MW could be recovered because of additional power generation at Gandhi Sagar due to availability of this additional water. Thus, there will be a net requirement of about 20 MW to operationalise this link.
    c) Another alternative was studied in the Kalisindh-Chambal link linking Kundaliya to Gandhi Sagar to reduce the power burden on the power grid. This alternative utilises part of the alignment of Kundaliya to Rana Pratap Sagar outlined under (a) followed by an alternative alignment meeting ultimately the alignment of Kundaliya to Gandhi Sagar outlined under (b). The capital cost of this alternative was estimated 3% lesser than the alternative detailed under (b).

The studies for alternative (a) & (b) were carried out and presented in PFR of Kalisindh-Chambal link whereas the alternative (c) was only highlighted for the consideration at the feasibility stage of the report.

b) Present Proposals

The Govt. of Madhya Pradesh in their comments on the prefeasibility report of Kalisindh-Chambal link pointed out that the link proposal was not economically viable on account of its low Benefit-Cost Ratio and Internal Rate of Return. Keeping in view the comments of State Govt., further studies have been done to accrue more benefits by increasing the quantum of water for diversion by off-taking the link canal from Parbati River at Patanpur instead of Mohanpura on river Newaj. Therefore, the proposal has now been modified and renamed as Parbati-Kalisindh- Chambal link

project. In the modified proposal, one additional reservoir at Patanpur across Parbati River is proposed to be included in the study. Considering the reservoirs at Patanpur across Parbati, at Mohanpura across Newaj, at Kundaliya across Kalisindh, the simulation studies have again been carried out for various combinations of reservoirs and canal capacities to optimize the benefits. To optimize the capacities of intermediate reservoirs for minimum storage, the studies have been done in series starting from downstream most reservoir, considering the operational details and the capacities of destination reservoir i.e. Rana Pratap Sagar/Gandhi Sagar to accommodate bulk transfer of water in monsoon months and demand pattern of the seven projects proposed by NWDA in the upper Chambal sub-basin. Keeping in view the requirement of seven projects in Upper Chambal sub-basin, the enroute demands for irrigation & domestic use and additional requirement of water ex- Kota barrage, the total quantity of 1360 Mm^3 of water is proposed to be diverted through the Parbati-Kalisindh-Chambal link canal. The salient details of modified proposal are as follows:

i. A 21.0 m high storage dam is proposed at Patanpur across river Parbati to divert the water of Parbati river to the proposed reservoir at Mohanpura dam through a 55.37 km long gravity canal(open channel 48.76 km and tunnel 6.61 km).The link canal is proposed to off-take from left bank of Parbati river at Patanpur reservoir with FSL 411.0 m. The Patanpur reservoir on river Parbati will have gross storage capacity of 156 Mm^3 and area of submergence at FRL will be 29.98 sqkm.

ii. A 24.0 m high storage dam is proposed at Mohanpura across river Newaj to store and divert the surplus water of Newaj and to receive water from Patanpur reservoir and for onward transmission of combined water to Kundaliya reservoir through a 73.17 km long gravity canal (open channel of 68.78 km length and two tunnels of lengths 1.29 km and 3.10 km respectively). The link canal is proposed to off-take from left bank of river Newaj at FSL 392 m. The Mohanpura reservoir will have gross storage capacity of 140 Mm^3 and the area of submergence at FRL 400 m will be 25.10 sqkm.

iii. A 45.0 m high storage dam is proposed at Kundaliya on Kalisindh river to transfer the surplus water available in Kalisindh at Kundaliya and the combined waters received from Patanpur and Mohanpura reservoirs to river Chambal either (a) at Rana Pratap Sagar through 115.08 km long link canal (open channel of 105.52 km length and two tunnels of length 3.6 km and 5.96 km respectively) or (b) at Gandhi Sagar through a 98.09 km long link canal (78.35 km gravity canal and 19.74 km covered by pumping reach). In the case of linking to Gandhi Sagar dam, the lift of about 50.15 m is proposed directly from Kundaliya dam in three stages requiring 22.38 MW of power for pumping whereas 9.07 MW of power is likely to be generated by transferred water at Gandhisagar dam. Thus, net requirement of power for pumping will be about 13.31 MW in this alternative. The actual head in this case for three stage pumping is calculated as 59.07 m. This linkage has been considered as first alternative to Gandhi Sagar. In the present study, this alternative is named as (b)-I. In the second alternative, the link canal alignment will follow the same alignment as in case of Rana Pratap Sagar for a length of 45.0 km

(open channel 41.4 km and 3.6 km tunnel) and thereafter, the canal is proposed to run for a length of 5.0 km in North-Westerly direction to feed the sump well from where a single stage lift of 47.42 m is proposed followed by a 3.2 km long pipe line and 20.09 km long gravity canal upto Gandhi Sagar, requiring 18.10 MW of power for pumping whereas, 9.07 MW of power is likely to be generated by transferred water at Gandhi Sagar. Thus, net requirement of power for pumping will be about 9.03 MW in this alternative. The actual head in this case for single stage pumping is calculated as 62.41 m. This alternative has been named as alt-(b)-II. The last reach of 15.54 km in this alternative is the same as in alternative (b)-I.

In case of linking to Rana Pratap Sagar known as alternative (a) or Gandhi Sagar alternative (b)-II, the link canal is proposed to off-take from left bank of Kundaliya reservoir at FSL 368.7 m with trapezoidal section. The Kundaliya reservoir will have gross storage capacity of 1234 Mm^3 and the area of submergence will be 118.0 sqkm at FRL 378 m.

1.3 The Report

The objective of this feasibility report is mainly for facilitating firming up the proposals and for discussions among the concerned States for arriving at broad consensus / agreements on diversion/utilization of waters, sharing of costs and benefits etc. After arriving at agreements among the concerned States the preparation of Detailed Project report is to be taken up.

This report deals with the feasibility study of the Parbati-Kalisindh-Chambal link project, which is a component of the third part of Peninsular Rivers Development of National Perspective Plan. This proposal envisages diversion of about 1360 Mm^3 combined surplus water of Parbati, Newaj (a tributary of Kalisindh) and Kalisindh rivers for utilization in enroute for irrigation and other uses through link canal and 676 Mm^3 of water is proposed to be transferred to the reservoir already built across river Chambal either at Gandhisagar/or at Rana Pratap Sagar for irrigation in the drought prone areas of upper Chambal catchment on substitution basis where the present level of irrigation is merely 5.44% of Culturable area.

1.4 Aims of the Project

The main aim of the Parbati-Kalisindh-Chambal link project is to make available water to drought prone areas of upper Chambal sub-basin from the surplus water available in its tributaries viz. Parbati and Kalisindh rivers on substitution basis.

Diversion of 676 Mm^3 of water to Chambal river at Gandhisagar/Rana Pratap Sagar will be utilized by way of substitution to provide annual irrigation for 1,09,400 ha in drought prone areas of upper Chambal sub-basin and to augment water in the Chambal river at existing Kota barrage to provide an annual irrigation of about 2150 ha area in the Bhind and Morena districts of Madhya Pradesh. Irrigation benefits in upper Chambal sub-basin will be provided through the seven projects identified by NWDA on the basis of toposheet studies namely Sewarkheri, Ramwasa, Bachora, Soncheri, Sekri Sultanpura, Chitabad in Ujjain district and Paduniya is located in Dhar district of Madhya Pradesh. The surveys & investigation of these identified projects have not been taken up so far but the same will be taken up at the time of

preparation of Detailed Project Report of the link.

In addition to annual irrigation of 1,09,400 ha area in target command in upper Chambal catchment, the enroute irrigation, considering linking to Rana Pratap Sagar i.e. alternative (a), will be 1,08,739 ha area in enroute command (Madhya Pradesh 65,657 ha and Rajasthan 43,082 ha). In case of linking to Gandhisagar, the enroute irrigation benefit has been worked out for both the alternative i.e. (b)-I and (b)-II. Adopting the alternative (b)-I, irrigation benefits in enroute command will be 1,18,860 ha (93,649 ha in Madhya Pradesh and 25,211 ha in Rajasthan) while for Alternative (b)-II, the enroute irrigation benefits will cover an area of 1,17,253 ha (90,474 ha in Madhya Pradesh and 26,779 ha in Rajasthan) in addition to annual irrigation of 1,09,400 ha in target command in upper Chambal catchment.

Under the alternative (b)-I & (b)-II linking to Gandhisagar dam, the link will also provide 50 Mm^3 of water to water deficit existing Bhanpura canal benefiting irrigation to an area of 10,121 ha.

A provision of about 14 Mm^3 of water for drinking water supply to the villages and towns of Madhya Pradesh and Rajasthan located in the vicinity of link canal has been made. This would cater to the needs of about 3.84 lakh people of both the States at consumption of 100 lpcd.

1.5 General description of the Project Area

1.5.1 Location of the Project

The project area is located in Guna, Rajgarh, Shajapur and Mandsaur districts of Madhya Pradesh and Jhalawar, Kota and Chittorgarh districts of Rajasthan. The location of the three dam sites along the link project, seven dams proposed in upper Chambal sub-basin and the destination existing reservoirs across river Chambal are given below:

(a) Proposed dams along the link canal

(i) Patanpur dam site: The proposed dam site is situated on the border of Guna and Rajgarh districts near village Parsana about 35 km from Biaora town of Rajgarh district.
(ii) Mohanpura dam site: The proposed Mohanpura dam site on the river Newaj is located near village Mohanpura of Biaora tehsil in Rajgarh district. **(iii) Kundaliya dam site**: The proposed Kundaliya dam site on river Kalisindh is located near village Kundaliya of Zeerapur tehsil in Rajgarh district of M.P.

(b) Destination Reservoirs

(i) Gandhisagar dam: The Gandhisagar dam already built on river Chambal is located near Gandhisagar colony of Bhanpura tehsil in Mandsaur district of M.P.
(ii)Rana Pratap Sagar: The existing Rana Pratap Sagar dam on river Chambal is located near village Rawatbhata of Rawatbhata tehsil in Chittorgarh district of Rajasthan.

(c) Dams proposed in the upper reaches of river Chambal

The location of seven dams identified by NWDA in the upper reaches of Chambal sub-basin lying in M.P. is furnished below in Table-1.1.

Table – 1.1

Name of Project	Location	
	District	Tehsil
Sonechiri	Ujjain	Khachrod
Ramwasa	Ujjain	Ujjain
Bachora	Indore	Depalpur
Padunia	Dhar	Badnawar
Sewarkheri	Ujjain	Ujjain
Sekri Sultanpura	Ujjain	Barnagar
Chitabad	Ujjain	Mahidpur

1.5.2 Access to Project area

(a) Patanpur dam site: The project area is approachable by road from Biaora to Maksudangarh state highway. It is about 35 km from Biaora town, which is on National Highway No. 3, Agra-Mumbai road. This site is approachable during all the seasons. Biaora is well connected by Ujjain-Guna broad gauge railway line. The nearest airport is Bhopal about 150 km from dam site.

(b) Mohanpura dam site: It is approachable by road from Agra-Mumbai road NH-3. The project site is about 4 km from Parsulia village, which is 10 km from Biaora town situated on NH-3.

(c) Kundaliya dam site: The project site is approachable by Ujjain-Jhalawar state highway and Khilchipur-Jhalawar road. It is about 5 km from Soyatkalan - Nalkheda WBM road and 15 km from Zeerapur by WBM road. Indore is the nearest airport, which is about 175 km from the dam site, and the nearest railway station is Bhawanimandi on Mumbai-Delhi western railway line, which is about 90 km from project site.

The project area is well connected by the Mumbai-New Delhi, Ujjain-Guna railway line and National Highway No. NH-12 and NH-3. There is a network of important district roads in the area connecting villages and tehsil headquarters and railway line in the region. Aerodromes at Bhopal, Indore and Kota also serve the area.

1.5.3 Climatic conditions

The climate of the project area is sub-humid except in certain portions of Rajgarh and Jhalawar districts where it is semi-arid. It has three seasons; the cold season from November to February, the summer season from March to mid June and the south-west monsoon season from the mid June to October. The temperature varies from maximum 42^{o} C in May to minimum 9^{o} C in January. The average annual

rainfall in the project area varies from 800 mm to 1200 mm and it is in the medium rainfall zone.

1.5.4 Topography, physiography and geology

The link project is located mainly in parts of the Malwa plateau of western Madhya Pradesh. It is bounded in the south by the great Vindhyan ranges from where most of the southern tributaries of Yamuna originate. The project area is characterised by a typical Trappean topography comprising extensive plains, low lying flat topped hills and isolated hills forming mesa, bute, cuesta and various other landforms. The rivers mostly flow from south to north with dendritic to sub-dendritic pattern. The drainage density in the area is low to moderate. Vegetation is poor. The area of Shajapur and Rajgarh districts falls under the Malikidesh Physiographic section followed by Umatwara plateau. The northern part of Rajgarh and the southern part of Jhalawar district form the Jhalawar plateau with an average elevation of 300 m to 450 m and interspread by the Ratibar Dungar ranges. The land slopes are gentle from south to north.

The region is occupied by rock masses of two chronologically different geological domains of which the lowermost comprises sub-horizontal sedimentary sequence of the Vindhyan Super group unconformably overlain by thick cover of basaltic lava flows and associated intertrappeans of the Deccan Trap Complex. Alluvium corresponding to the Quaternary to Recent period is mostly confined to the river basins. Soil profile in the area ranges in thickness from 0.5 m to 6 m.

Regional geological information has revealed that the basaltic lava flows occurring along Kundaliya-Rana Pratap Sagar (RPS) alignment or Kundaliya-Gandhisagar alignment belong to the Mandleshwar, Kalisindh and Kankariya - Pirukheri Formations in an ascending order to Malwa Group of the Deccan Trap Complex which unconformably overlies the Suket Shale Formation of Khorip Group of the Vindhyan Super group in Bhanpura-Ramganjmandi-Eklingpura sector of the scheme. The 5.96 km long tunnel near Eklingpura leading to the RPS reservoir runs through the Vindhyan scarp comprising the Suket Shale Formation in the up dip slopes and the Chittorgarh Fort Sandstone Formation on the hill top. Here, the Vindhyan sequence represents part of the south-western limb of the NW trending regional (Jhalawar) anticline.

The area around the Kundaliya dam site is almost flat with rolling undulations on both the flanks of the Kalisindh River. The 3.3 km long dam alignment, except the 0.23 km long river section, has soil cover consisting of yellowish, concretionary soil, sandy-silty loamy soil, black cotton soil in addition to river borne, unconsolidated to semi-consolidated recent sediments of sands, kankars, boulders etc. Near the dam axis, the right river flank has two flow units of mixed characters with a thickness of 8 m to 10 m (Mandleshwar Formation). In the river bed, along the dam alignment, the older flow unit is exposed. The basalt in this flow unit is dark gray, fine to medium grained, hard, compact, massive and rarely prophyritic

1.5.5 Population

(a) Affected and Benefitted: As per 1991 census, the overall average density of population in the command area of the link canal is 139 persons per sqkm. Due to the submergence of the proposed reservoirs, about 5411 families comprising 0.27 lakh people would be affected. Population of about 3 lakh is likely to be benefitted by the project.

(b) Occupation: The work force in the area constituted about 12,245 of the population, out of which 7,639 are cultivators and agriculture labourers. The remaining work force is engaged in brick manufacturing, wood work etc.

1.5.6 Natural resources

Except agricultural land resources, there are no significant mineral or other natural resources available in the command area. However, a few stone quarries in the area and Kota stone is found in Jhalawar and Kota districts of Rajasthan feeding the local construction activity. About 244 ha forest area may come under submergence of Patanpur and Kundaliya reservoirs. All the forest area are protected and open scrubs type.

1.5.7 Land use and socio-economic aspects

On the basis of the statistics available for the year 1995-96, it is seen that the area not under agricultural use in the enroute command is 7.19%. The net sown area is 60.86% and the area sown more than once is 23.9%. Thus the gross cropped area works out to 84.79%.

Agriculture is predominant occupation of the people of the region. Cultivation is mainly dependent upon rainfed tanks, open wells, bore wells and Nallas during Kharif. The tanks and nallas almost get dried up during summer. Hence, agriculture activities in the Rabi season are limited. The comprehensive study on socio-economic, ecological and environmental impact assessment could not be got carried out at the time of preparation of this report. However, the above study has now been awarded to M/s RITES Ltd., Gurgaon (Haryana) and the same will be incorporated in the DPR (Detailed Project Report) of this project.

1.6 Fitment of the scheme in the overall development plan of the river basin

With the coming up of this project, the main benefit shall accrue to the drought prone upper catchment of Chambal basin in the State of Madhya Pradesh where the level of irrigation is merely 5.44% of the culturable area. As a result of transferring 663 Mm^3 of surplus water available in Parbati, Newaj (a tributary of Kalisindh) and Kalisindh sub-basins of Chambal basin to Chambal river either at Gandhisagar or Rana Pratap Sagar, the seven projects identified by NWDA in the upper reaches of Chambal basin for benefiting the drought prone areas of this region can be implemented. The development of irrigation facilities in the drought prone areas of upper reaches of Chambal basin can not be enhanced without implementation of this link project as the Chambal waters have already been harnessed jointly by Govt. of

M.P. and Govt. of Rajasthan through construction of major projects on main Chambal river viz. Gandhisagar, Rana Pratap Sagar and Jawahar Sagar.

1.7 Choice of the project

In the present study, the option-III for all the three alternatives has been studied in detail. The option-I and option-II for all the alternatives, if felt necessary, will be studied at the time of preparation of DPR of the link.

1.8 Stages of development of project

It is proposed that the PKC link project will be completed in a period of 8 years. It is expected that pre-construction survey, investigation, topographical surveys of 7 identified dams in upper reaches of Chambal, design of all civil works would be completed in the 1st and 2nd year. Simultaneously some work will be taken up in upper reaches of Chambal basin and on the enroute areas. The land acquisition for colony, head works, construction of colony, procurement of machinery and layout will be completed in 2nd and 3rd year. The canal excavation and construction of embankment for canal including linking will be taken up in 2nd year and completed in 6th year. Excavation work of spillway for dams will be completed in 4th and 5th year.

The concrete, masonary and earthwork for Patanpur, Mohanpura, and Kundaliya diversion dam and the seven storage/diversion dams in the Upper Chambal sub basin are to be started from the 3rd year and completed in the 7th year. The major cross drainage work along with minor structures will be started in the 4th year and will be completed in 6th year. Construction of pumping stations, installation of the pumps, layout of pipelines and construction of enroute storage structure (sump) for the link to Gandhisagar will be started in the 5th year and will be completed by 8th year. The tunneling work for the link will be started in the 3rd year and will be completed by 7th year. Installation of gates etc. will be done in the 7th and 8th year and the whole project will be completed by the end of 8th year.

1.9 Interlinking of link project with the existing projects

Keeping in view the comments of the Govt. of Madhya Pradesh, the studies have been done to explore the possibility of linking the existing projects namely Chapi, Gagorini, Bhadwara and Bhanpura canal system. The location of Chapi, Gagorini, Bhadwara projects are at higher elevation to the link alignment. Therefore, linkage of these projects is not possible through the proposed P-K-C link project. Only Bhanpura existing canal system can be benefited from this link under alternative (b)-II, linking to Gandhi Sagar. A provision of 50 Mm^3 of water has been kept in this study for benefiting the existing command of Bhanpura canal.

1.10 Interstate aspects

As the project is interstate in nature involving Madhya Pradesh State and Rajasthan State, a consensus on sharing of water is a very important issue. The sharing of Chambal waters is governed by interstate agreement reached between State of Madhya Pradesh and State of Rajasthan according to which the water from Chambal reservoirs is to be shared on 50:50 basis. Since the surplus water is proposed to be

transferred from the tributaries of river Chambal entirely through the territory of Madhya Pradesh and benefiting both the States, a fresh interstate agreement between the two States on sharing of cost & benefits will be required. More details about interstate aspects are given in Chapter-3: 'Interstate aspects'.

1.11 Cost and benefit of the scheme

The economic analysis of the proposed P-K-C link project has been carried out for three alternative alignments of the link canal. Under each alternative three different options have been studied to transfer the water. Accordingly, the cost and benefits adopting 3rd option in each alternative has been worked out. The power consumed in lifting the required quantity of water for transfer to Gandhi Sagar reservoir and the power generated due to availability of the equivalent quantum of water at G.S. has been taken into account in the economic analysis. Based on economic analysis and other merits, linkage to Gandhisagar through alternative-(b)-II with option III has been adopted in the study. The total estimated cost of P-K-C link project works out to Rs.298902/- lakh, Rs.312547/- lakh and Rs.305830/- lakh for alternative (a), alternative (b)-I and alternative (b)-II respectively. The B.C. ratio for whole project including projects proposed in upper reaches of Chambal for all the three alternatives viz. Alt.(a), Alt.(b)-I and Alt.(b)-II is worked out as 1.67, 1.59 and 1.63 respectively.