

CHAPTER-X

COST ESTIMATE, BENEFIT COST RATIO AND FINANCIAL ASPECTS

10.0 General

The Ken-Betwa Link Project, Phase-II envisages construction of a dam namely Lower Orr across river Orr, a tributary of Betwa river, four barrages namely Neemkheda, Barari, Kotha across Betwa river in upper reach, Kesari barrage on river Keotan, a tributary of Betwa river, a Canal from Lower Orr dam and canals from Barari, Kotha and Kesari barrages. No canals are proposed under Neemkheda barrage. The water required for irrigation will be pumped from the Barari and Kesari barrage ponds.

The Ministry of Water Resources, Government of India has issued Guidelines for preparation of Detailed Project Report for irrigation and multipurpose projects in 2010. For preparing the cost estimates of Ken-Betwa link project Phase-II, these Guidelines of MOWR have been followed.

The cost estimates have been worked out by calculating the quantities of different items of the works involved for the execution of the project components. The rates for principal items of various works have been taken from “Unified Schedule of Rates-2007-08 ” of Govt. of Madhya Pradesh and enhanced to 2012-13 price level by considering 8% escalation per annum to arrive the cost of the project components. However, the cost of steel has been considered at prevailing market rate (2013) i.e.Rs.42000.00 per tonne.

10.1 Classification of units

The Ken-Betwa Link Project, Phase-II broadly comprises the following components:

1. **Lower Orr dam**
 - (a) 45 m. high earth cum concrete dam proposed across the Orr river (a tributary of Betwa river),
 - (b) 91.260 km long Main Canal from the left NOF section of the dam.
 - (c) 9 major and 11 minor CD structures across the Lower Orr main canal
 - (d) Canal falls of 12 Nos., cross regulators of 20 nos., canal escapes of 4 nos., village road bridges of 27 nos. and double road bridges of 8 nos. across the Lower Orr main canal.
2. **Neemkheda barrage**
3. **Barari barrage** and a canal of 4.7 km length from Right bank with pumping system
4. **Kotha barrage** and LBC and RBC of 39 km and 44 km length respectively
5. **Kesari barrage** and a canal of 9.55 km length from Right bank with pumping system

The cost estimate of the Project has been grouped into the following units. Table 10.1 shows the unit wise cost estimate of project.

Table-10.1
Cost Estimate of the Project

(Rs. Crore)

Component	Unit-I	Unit-II	Unit-III	Unit-VI	Total
	Head works	Canals and Conveyance system	Power & Equipment	Command Area Development	
Lower Orr Dam					
Lower Orr dam	816.11				816.11
Lower Orr Canal		543.46		11.26	554.72
Barrages					
Neemkheda	666.74			0.61	912.11
Barari			23.91	0.89	
Kesari		36.71	7.25	3.47	
Kotha		172.23		0.30	
Total	1482.85	752.40	31.16	16.53	2282.94

Thus, the total cost of the Project works out to Rs. 2282.94 crore at 2012-13 price level, which includes Environmental Implementation Plan (EMP) and Socio-economic Survey and Rehabilitation & Resettlement Plan. The general abstract of cost of the project is given in Annexure-10 of Volume – II. The details under various heads are described in the following paragraphs.

10.1.1 Unit – I: HEAD WORKS

Unit-I Head works mainly includes cost of the following structures of the project:

- Lower Orr dam including Earth dam, Non-over flow sections, Over flow section with spillway, Gates & energy dissipation arrangements etc.
- Four barrages with main concrete structures, guide bunds, gates etc.

The total cost of Unit-I: Head Works is estimated to be Rs 1482.85 crore. Details are given in Annexures-10.1, 10.1.1 & 10.1.2 of Volume – II and their sub-annexures. The sub-head wise details are given below:

10.1.1.1 A - Direct charges

In general, Direct charges cover minor heads like I-Works, II-Establishment, III-Tools & Plants, IV-Suspense and V-Receipts & recoveries.

I-Works

A. Preliminary Rs. 2740.95 lakh

Provision under this sub-head has been made to cover the actual expenditure incurred on detailed survey & investigation works mentioned below for preparation of Detailed Project Report of this project.

- Topographical surveys & investigations
- Hydrological & meteorological surveys
- Geological & Geotechnical surveys

- Construction material survey
- Seismic studies
- Construction of access Roads to facilitate site investigations
- Charges for consultancy works for various studies and
- Preparation of Detailed Project Report

However, for detailed survey & investigations for establishing the final locations of different project components at pre construction stage, a lumpsum provision of 2% of I-Works has been considered under this sub-head. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexures.

B. Land Rs. 21671.16 lakh

Under this sub-head, provision for acquisition of land for construction of the project, colonies, offices, stores, stock yards, working area and approach roads etc. , compensation for houses, solatium charges, standing crops and other immovable properties, cost of resettlement colonies for displaced persons, economic rehabilitation of PAFs, training of R&R staff and PAFs etc. have been considered as per the provisions made under National Rehabilitation & Resettlement Policy – 2007 of Govt. of India. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexures.

C. Works Rs. 88564.67 lakh

This sub head includes cost of construction of following components:

- Lower Orr – Earth dam, concrete dam (OF & NOF portions) & its appurtenant works etc.
- Four barrages with main concrete structures, guide bunds, gates etc.

The quantities and the cost of the components have been evaluated as per the design and drawings supplied by the Specialized Directorates of Central Water Commission, New Delhi. Necessary provisions have been made for spillway radial gates with embedded parts,

stop logs and hoisting arrangements etc. for Lower Orr dam and steel vertical gates with embedded parts, stop logs and hoisting arrangements etc. for barrages. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexures.

K. Buildings

Rs. 8115.19 lakh

It is assumed that the some of the existing buildings & infrastructure facilities created at Rajghat dam during its construction will be utilized during construction of Lower Orr dam and its canal. Hence the cost of buildings for Lower Orr project has been considered at 50% cost of the buildings. Accordingly, provision has been kept under this sub-head for construction of temporary & permanent buildings for both residential & non-residential purposes and hostel accommodation for various categories of staff, offices, inspection bungalow, circuit house, workshops, stores, sheds as well as other service buildings like hospitals, schools, police stations, post offices & welfare centres etc. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexure.

M. Plantation

Rs. 16.80 lakh

Under this sub-head, cost of proposed plantation in the colony area and along the approach roads to the dam/barrage sites have been considered. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexure.

O. Miscellaneous

Rs. 829.42 lakh

Under this sub head, provision has been made to cover the cost of the following works:

- Capital cost of electrification, medical equipment, firefighting equipment, furniture and crockeries for inspection bungalow and circuit houses, initial camp equipment for hospital, primary & secondary schools, community centre etc.
- R & M of above equipments/infrastructural facilities etc.
- R & M of inspection vehicles, market complex, police station, post office, pump house , telephone lines etc.

Provision has also been made for other miscellaneous items such as inaugural foundation laying ceremony, compensation to work men, visit of VIP dignitaries, anti malaria measures, security arrangements for dam and barrage sites, flood lighting, model studies, data processing machines etc. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexure.

P. Maintenance Rs. 913.35 lakh

Under this sub-head provision has been made to cover the cost of maintenance of all works during the construction. A provision of 0.25% on cost of concrete dam (Over flow & Non-over flow sections) and 0.5% on cost of earthen dam, 1% on the cost of permanent buildings and 1% on cost of maintenance of roads has been considered for lower dam. A provision of 0.25% on cost of works, 2% on the cost of temporary buildings, 1% on the cost of permanent buildings and 1% on cost of roads has been made towards maintenance charges. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexure.

Q. Special Tools & plants Rs. 4371.48 lakh

Under this sub-head provision has been made at 25% of capital cost of major construction equipments. Cost of inspection/ transportation equipment has been added to the above cost in full to arrive the total cost chargeable under this sub-head. The recoveries on account of resale value of Q-Spl. T&P is considered as 75% of the capital cost of the major construction equipment chargeable to Q-Spl. T&P and 75% on 20% cost of inspection/transport equipment chargeable to Q-Spl. T&P. which works out to Rs. 3070.15 lakh. Details of the equipment as suggested by CMO, CWC, New Delhi and the cost that is to be chargeable to the project works are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexure.

R. Communication Rs. 464.73 lakh

Necessary provision has been made under this sub-head to cover the cost of widening of existing roads in the near vicinity of the project area, formation of approach roads to project area from the existing roads, W.B.M road from quarry sites to dam/barrage sites etc. The details

are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexure.

X. Environment and ecology Rs. 9089.02 lakh

This sub-head includes provision for extensive management measures to sustain environment and ecology such as compensatory afforestation and bio-diversity conservation, fisheries management plan, environmental management in labour camps, public health delivery system, restoration and land scapping of project sites, greenbelt development, air, water and noise pollution control measures, energy conservation measures, public awareness programmes, local area development plan, catchment area treatment plan, disaster management plan, environmental monitoring during construction phase (EMP), purchase of instrument and equipment etc. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II and its sub-annexures.

Y. Losses on stock and unforeseen items Rs. 270.66 lakh

Provision has been made for losses on stock and unforeseen @ 0.25% on all sub-heads under I-works excluding sub-heads A- preliminary, B- land & Q-Spl. T&P. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II.

II- Establishment Rs. 11537.63 lakh

The project is planned to be completed in a total period of 4 years and 2 months. Provision has been made @ 10% of I-Works excluding B- land towards establishment & pensionary charges. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II.

III- Ordinary Tools & Plant Rs. 1370.47 lakh

Provision has been made under this head for ordinary Tools & Plant @ 1% of I-Works. This provision is distinct from the Q-Spl. T&P and is meant to cover the cost of survey instruments, camp equipment and other small tools & plant. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II.

Suspense

It is assumed that all the outstanding suspense would be cleared by adjustment to appropriate heads on completion of the project. As such no provision has been kept under this head.

IV- Receipts & recoveries Rs. 3559.26 lakh

Under this head, estimated recoveries by way of resale or transfer of temporary buildings, special T&P and by resale or transfer of generator sets, electrical lines, telephone lines and other accessories are accounted for and provision has been made accordingly. The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II.

10.1.1.2 B - Indirect charges Rs. 1888.53 lakh

Provision for abatement of land revenue and Audit & account charges are covered under ‘Indirect charges’ at the following rates

- Abatement of land revenue - 5% of the cost of land
- Audit and account charges - 1% of I-Works

The details are given in Annexures- 10.1, 10.1.1 & 10.1.2 of Volume – II.

10.1.2 Unit – II: CANALS AND CONVEYANCE SYSTEM

Unit-II covers the cost of the following components along with their appurtenant works

- A 91.26 km long Canal off-taking from Lower Orr dam
- A 4.70 km long Canal off-taking from Barari barrage
- Two Canals of 39 km (LBC) & 44 km (RBC) long off-taking from Kotha barrage.
- A 9.55 km long canal off-taking from Kesari barrage

The total cost of Unit-II: Canals and conveyance system is estimated to be Rs. 752.40 crore at 2012-13 price level. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub annexures of Volume – II. The sub-head wise details are discussed in the following paragraphs.

10.1.2.1 A - Direct charges (Lower Orr, Barari, Kesari & Kotha canals)

I- Works

A. Preliminary Rs. 1068.61 lakh

Provision under this sub-head has been made to cover the actual expenditure incurred on detailed survey & investigation works mentioned below for preparation of Detailed Project Report of this project.

- Topographical surveys & investigations
- Geological & geotechnical surveys
- Construction material survey
- Vehicle charges for inspecting officers for site investigations
- Survey & camp equipment
- Charges for consultation for various studies
- Actual expenditure on establishment and
- Preparation of Detailed Project Report

However, for detailed survey & investigations for establishing the final locations of different project components at pre construction stage, a lumpsum provision of 2% of I-Works has been considered under this sub-head. The details are given in Annexures 10.2, 10.2.1 and 10.2.2 of Volume – II.

B. Land Rs. 6761.92 lakh

Under this sub-head, provision for acquisition of land for construction of canal off-taking from Lower Orr dam, canals off-taking from Barari, Kotha, Kesari barrages, approach roads, canal structures etc. , solatium charges, compensation for standing crops and other immovable properties, rent for use of land prior to acquisition, economic rehabilitation measures etc. have been considered. The details are given in Annexures 10.2, 10.2.1 and 10.2.2 of Volume – II.

C. Works Rs. 117.95 lakh

This sub head includes cost of construction of head regulators to be provided at off-take points of the canals. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

D. Regulators Rs. 1964.86 lakh

Under this sub-head, provision for cross regulators at appropriate locations where branch canals take off from main canal, desilting chamber at beginning of Canal off-taking from Lower Orr dam have been made. Provision for Cross Regulators for branch canals has also been made. The cost of regulators are arrived based on the estimated cost of the typical regulator proportionate to discharges. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

E. Falls Rs. 400.40 lakh

Falls proposed along the Lower Orr main canal at suitable locations. Under this sub- head, provision for canal falls has been made based on the cost curves prepared for Bargi diversion project, Govt. of M.P. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

F. Cross drainage structures Rs. 5346.97 lakh

The cross drainage works proposed across the main canal and branch canals are aqueducts, drainage syphons, canal syphons, super passages and under tunnels to facilitate the crossing of rivers/streams. The cost of the structures are deduced from the cost curves. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

G. Bridges Rs. 1094.30 lakh

A number of bridges (Double lane & village road) are required to be constructed across the canal, off-taking from Lower Orr dam to facilitate crossing of various roads. Necessary Provision has been made in the estimate towards construction of these bridges. The estimates are prepared based on the cost curves. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

H. Escapes **Rs. 389.00 lakh**

Under this sub-head, provision has been made for canal escapes at suitable locations where drainage facilities exist to take care of the discharges in the eventuality of canal breaches. The estimates are prepared based on the cost curves. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub annexures of Volume – II.

K. Buildings **Rs. 0.00 lakh**

Provision for construction of temporary & permanent buildings for both residential & non-residential buildings for various categories of staff, offices, etc. for canal have been included under Unit –I Head works of Lower dam and barrages. Hence no provision has been made under this subhead.

L. Earthwork & Lining **Rs. 28577.57 lakh**

The earthwork quantities involved in cutting based on the type of soils are separately worked out. The quantity of earthwork required for embankment from borrow areas are separately worked out. The detailed estimates are prepared considering the levels taken at 30 m interval along the canal and the detailed drawings supplied by CWC, New Delhi. Provision is also made for branch canals proportionate to the discharges of the main canals. Lining is provided for both main and branch canals at bed and side slopes in the entire length of canals as per the drawings. Provision is also made in the estimates for pressure relief and drainage arrangements under lining, expansion joints etc. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

M. Plantation **Rs. 13.02 lakh**

Under this sub-head, cost of plantation along the main canals on both sides have been provided. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

O. Miscellaneous **Rs. 228.70 lakh**

Under this sub head provision has been made to cover the cost of the following works:

- Capital cost of electrification, fire fighting equipment, telephones, wireless sets, equipment for quality control and field labs, initial equipment and other accessories for hospitals etc.
- R & M of above equipments/infrastructural facilities etc.
- R & M of inspection vehicles, inspection bungalow etc.

Provision has also been made for other miscellaneous items such as inaugural foundation laying ceremony, compensation to work men, flood lighting, model exhibits etc. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

P. Maintenance Rs. 435.10 lakh

Under this sub head provision has been made to cover the cost of maintenance of all works during the construction of canals. A provision of 1% cost of I-works less A-Preliminary, B-Land, M-Plantation, O-Miscellaneous, Q-Spl. T&P and X-Environment & Ecology has been made. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

Q. Special Tools & Plants Rs. 1852.90 lakh

Under this sub-head, provision has been made at 25% of capital cost of major construction equipment. Cost of inspection/ transportation equipment proposed for Lower Orr canal has been added to the above cost in full to arrive the total cost chargeable under this sub-head. The requirement of construction equipment for the canals from the barrages have been considered in their respective head works. The recoveries on account of resale value of Q-Spl. T&P is considered as 75% of the capital cost of the major construction equipment chargeable to Q-Spl. T&P and 75% on 20% cost of inspection/transport equipment chargeable to Q-Spl. T&P. Details of the equipment as suggested by CMO, CWC, New Delhi and the cost that to be chargeable to the canal works are given Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

R. Communication Rs. 97.65 lakh

Under this sub-head, provision for construction of temporary roads and remodeling of existing roads for approach to canals and regulatory system, quarry sites and other working areas has been kept. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

U. Distributaries & Minors Rs. 1936.82 lakh

Under this sub-head provision has been made for providing distributaries & minors considering a cost of Rs. 3800/- per ha for the total culturable command area of canals offtaking from Lower Orr dam and Barrages. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

V. Water courses / field channels Rs. 2785.45 lakh

Under this sub-head provision has been made for providing water courses and field channels considering a cost of Rs. 5465/- per ha as worked out for a typical block of culturable command area under Upper Betwa projects viz. Barari, Kesari and link canal during preparation of DPR of Ken-Betwa link (Year-2008), for which the representative sample command area survey of 10% of CCA was carried out. The same rate has been adopted for the command area under Lower Orr canal and Barrage canals. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

W. Drainage Rs. 254.85 lakh

Under this sub-head a provision has been made at the rate of Rs. 500/- per ha. for field drainage in the total command areas of projects. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 and their sub-annexures of Volume – II.

X. Environment & Ecology Rs. 0.00 lakh

Provision for Environment & Ecology under canals have been included in the respective Unit –I Head works. Hence no provision has been made under this sub-head.

Y. Losses on stock and unforeseen Rs. 109.38 lakh

Provision has been made for losses on stock and unforeseen @ 0.25% on all sub-heads under I- works excluding sub – heads: A- preliminary, B- land & Q-Spl. T&P. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 of Volume – II.

II- Establishment Rs. 4667.36 lakh

Provision has been made as per norms @ 10% of I-Works excluding B- land towards establishment & pensionary charges. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 of Volume – II.

III- Tools & Plant Rs. 534.36 lakh

Provision has been made under this head for ordinary Tools & Plant @ 1% of I-Works. This provision is distinct from the Q-Spl. T&P and is meant to cover the cost of survey instruments, camp equipment and other small tools & plant. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 of Volume – II.

Suspense

It is assumed that all the outstanding suspense would be cleared by adjustment to appropriate heads on completion of the project. As such no provision has been kept under this head.

IV- Receipt & recoveries Rs. 1356.85 lakh

Under this head, estimated recoveries by way of resale or transfer of temporary buildings, special T&P and by resale or transfer of generator sets, electrical lines, telephone lines and other accessories are accounted for and provision has been made accordingly. Details are given in Annexure 10.2, 10.2.1 and 10.2.2 of Volume – II.

10.1.2.2 B - Indirect charges Rs. 736.43 lakh

Provisions for abatement of land revenue and Audit & account charges are covered under ‘Indirect charges’ at the following rates

- Abatement of land revenue - 5% of cost of land
- Audit and account charges - 1% of I-Works

Kotha Canals:**Rs. 14077.55 lakh**

In absence of detailed field survey & investigation works and detailed designs, the cost of Kotha canals have been arrived on proportionate basis by considering the cost of Lower Orr canal per km length per cumec discharge. The total cost of canals under Kotha barrage has been assessed to be Rs. 7500.02 lakhs for LBC and 9723.01 lakhs for RBC. The cost of these canals are included in the Unit-II: Canal System of this project. The details are given in Annexure – 10.2 of Volume – II.

10.1.3 Unit – III: POWER AND EQUIPMENT Rs. 3116.10 lakh

Under this head, a provision of Rs. 2390.68 lakh and Rs. 725.42 lakh have been made for lifting water from Barari and Kesari barrages respectively towards the cost of Power & Equipment comprising pump & equipment, raising mains, power station & electrification. Details are given in Annexure 10.3 and 10.3.1 of Volume – II.

10.1.4 Unit – IV: Navigation works

Navigation is not proposed under this project. Hence, no provision is required under this sub head.

10.1.5 Unit – V: WATER SUPPLY WORKS Rs. 0.00 lakh

This project envisages providing drinking water supply to the tune of 6 Mm³ to the villages and towns located adjacent to canal alignment in the command area of Lower Orr project. Water will be supplied through main canal and various branch canals, whose cost is already considered under Unit -II : Canal system. However, water supply network to the local areas will be the responsibility of the local development body / local administration. Hence, no provision towards water supply works at local level has been kept under this head.

10.1.6 Unit–VI: COMMAND AREA DEVELOPMENT Rs.1653.00 lakh

The total culturable command area covered under the Ken-Betwa link project (Phase-II) is 71392 ha. This area is covered by canal system of Lower Orr dam and four barrages. Out of 71392 ha of CCA, an

area of 16530 ha requires land leveling and shaping to facilitate irrigation and also to prevent soil loss due to erosion in undulating areas. Hence a provision of Rs. 1653.00 lakh has been made at Rs. 10000/- per ha for development of Command area. Details are given in Annexure-10.4 of Volume – II.

10.1.7 Power Requirement

It is estimated that 2.78 Million Units of power is required to lift waters from the Barari and Kesari barrages. The cost of power has been considered as Rs. 3.00 per unit. Thus the total cost of power is estimated to be Rs. 83.40 lakh annually for lifting the waters from the above said barrages. Details are given in Annexures -10.5 and 10.7 of Volume – II.

10.2 Net revenue expected from different components of project

It is estimated that the net value of agriculture production in post project period is Rs. 44547.52 lakhs and the same pre-project period is Rs. 7402.59 lakhs. Thus the net annual irrigation benefits from the total command area works out to Rs. 37144.93 lakhs as summarized in Table-10.2 and details are given in Annexure – 10.6 and its sub-annexures of Volume – II.

Table – 10.2
Net value of agriculture production in pre and post project scenario
and net annual irrigation benefits

Unit: Rs in lakhs

S. No.	Name of structure	Pre-project Scenario	Post-project Scenario	Net annual irrigation benefits
1	2	3	4	5
(i)	Lower Orr dam	5152.03	30881.34	25729.30
(ii)	Neemkheda barrage	228.53	1289.53	1061.00
(iii)	Barari barrage	343.44	1920.35	1576.91
(iv)	Kesari barrage	132.78	883.40	750.68
(v)	Kotha barrage	1545.81	9572.84	8027.03
	Total:	7402.59	44547.52	37144.93

It is proposed that 6 MCM of water is to be supplied for domestic needs. It is estimated that the revenue generated from domestic water supply will be Rs. 15.60 lakhs considering Re. 0.26 per cum. It is also proposed to develop fisheries in the Lower Orr reservoir by which Rs. 5388.00 lakhs of revenue could be generated annually. Thus the net income/benefits from various sources is estimated to be Rs. 42548.53 lakhs. Details are given in Annexure – 10.7 of Volume – II.

10.2.1 Productivity of project in terms of percentage financial returns.

The details of productivity in the command area at pre and post project scenarios are summarized in Table 10.3.

Table – 10.3

Details of Productivity in the Command area

Unit: Quintals

Crop	Lower Orr		Neemkheda		Barari		Kotha		Kesari	
	Pre Project	Post Project	Pre Project	Post Project	Pre Project	Post Project	Pre Project	Post Project	Pre Project	Post Project
Kharif	212550	1842554	9626	9626	12974	12974	50654	130574	4326	14310
Rabi	549555	1315390	28597	104240	37372	168880	146409	659560	12488	56200
Perennial	18000	540500	1200	3500	0	0	0	0	0	0
G. Total	780105	3698444	39423	117366	50346	181854	197063	790134	16814	70510
Net increase in production	2918339		77943		131508		593071		53696	
% of increase	374%		198%		261%		301%		319%	

10.3 Benefit– Cost Ratio and Internal Rate of Return

10.3.1 Irrigation project

10.3.1.1 Allocation of cost

Allocation of the cost of the project to different components is worked out based on the guidelines given in IS: 7560-1974 by adopting the

“Water releases approach” under the “use of facility method”. The total cost of the project is estimated to be Rs. 228293.79 lakhs which includes the cost of Head works, Canal system, Power & Equipment and Command area development. Details are given in Annexure-10.7 of Volume – II.

10.3.1.2 Estimate of Annual Cost

The details of annual cost of the project are given below in Table 10.4:

Table – 10.4
Details of annual cost of the project

S. No.	Description	Rs. in lakh
1.	Interest on Capital Cost of the Project including cost of Command area development @ 10%	22829.38
2.	Depreciation of the project @ 1% the Cost of the project for 100 years of life (Irrigation component)	2235.25
3.	Annual O&M charges @ Rs. 600/- per ha for total CCA of 71392 ha.	428.35
4.	Maintenance of head works @ 1% of the Cost of Head works	1482.85
5.	Depreciation of the pumping system at 3 Barrages:	
	(a) Pump & Equipment @ 8.33 % on Rs. 987.94 lakh	82.30
	(b) Rising main @ 3.33% on Rs. 962.02 lakh	32.04
	(c) Civil works of power Station @ 2% on Rs. 857.33 lakh	17.15
6.	Power Charges for lifting water from 3 Barrages @ Rs. 3/- per unit for 5.53 MU.	83.40
	Total Annual Cost:	27190.70

10.3.1.3 Benefit - Cost Ratio

As described in the above paras, the net annual benefits from various components of the project works out to Rs. 42548.53 lakhs and the annual costs works out to Rs. 27190.70 lakhs. Thus the Benefit - Cost Ratio of the project works out to 1.56. Details are given in Annexure-10.7 of Volume – II.

10.3.1.4 Financial internal Rate of Return (FIRR)

The project has been planned to be completed in a period of 4 years 6 months excluding pre construction year. The phasing of the expenditure has been planned accordingly. The details of yearly expenditure chargeable to link project have been given in Annexure 10.8 of Volume – II. Considering life of the project as 100 years after its completion, the Financial Internal Rate of Return (FIRR) of the Ken-Betwa link project (Phase-II) has been computed as 14.87 %. Details are given in Annexure-10.9 of Volume – II.

10.3.1.5 BC ratio for flood control component of the project.

No cushion in the reservoir storage is provided exclusively for flood control. Flood control is only an allied benefit from Lower Orr dam. Hence, no B.C. ratio for flood control component of the project is worked out.

10.3.2 Benefits other than those considered in the BC ratio and FIRR.

Benefits from Irrigation component, drinking water supply and fisheries have been considered for assessing the B.C. Ratio. Besides, tourism development which is not quantified can be created at Lower Orr dam and other 4 barrages of Ken-Betwa link project (Phase-II). The project will go a long way in raising the socio-economic status of the people benefited by the project. It would also provide the impetus to industrialization and overall economic development of the region.