

CHAPTER – I

INTRODUCTION

1.0 General

National Water Development Agency (NWDA) was set up by Government of India as an Autonomous Society under Ministry of Water Resources in July, 1982 to study the feasibility of National Perspective Plan and give concrete shape to it. Accordingly, after carrying out detailed technical studies, NWDA identified 16 links under Peninsular Component and 14 links under Himalayan Component in the country for feasibility studies. Ken-Betwa Link is one of the 16 links under Peninsular Component of National Perspective Plan for Water Resources Development for which feasibility report was prepared by NWDA in the year 1995 and circulated among all concerned. Since then continuous efforts were made by NWDA, Central Water Commission (CWC) and Ministry of Water Resources to arrive at consensus between two beneficiary States of Uttar Pradesh (UP) and Madhya Pradesh (MP). Finally consensus was arrived at among Centre and concerned States and a tripartite Memorandum of Understanding was signed by Madhya Pradesh, Uttar Pradesh and the Union Government on 25th August 2005 for preparation of Detailed Project Report (DPR) of Ken – Betwa link. A copy of MoU is annexed at Annexure – 1.1. Subsequently, the work of preparation of DPR was entrusted to NWDA by Ministry of Water Resources in January 2006.

The DPR of Ken-Betwa Link Project was completed in December, 2008 and the report was sent to Govt. of MP and UP for their examination and comments in February, 2009. Keeping in view the comments of Govts. of UP and MP, Secretary (WR) convened a meeting with concerned Principal Secretaries of MP and UP on February 3, 2010, to sort out various issues raised by them. It was decided in the said meeting that the DPR of the project will be prepared in two Phases. In Phase-I, Daudhan dam, two power houses and link canal will be included. Under Phase-II, alternative projects proposed in Betwa Basin by Govt. of MP will be taken up simultaneously after completion of their

survey and investigation works and examining their techno-economic viability. The Detailed Project Report (DPR) of Ken-Betwa Link Project was completed by NWDA in December, 2008. During the Secretary level meeting held on February 3, 2009, it was decided that DPR of Ken-Betwa Link Project will be prepared in two phases. In Phase-I, Daudhan Dam and its appurtenant works, two tunnels, two power houses and link canal will be included. The Phase-II will comprise projects proposed by Government of M.P. in Betwa Basin.

The Detailed Project Report (DPR) of Ken-Betwa Link Project, Phase-I was completed by NWDA in April, 2010 after incorporating the inputs as received from Govt. of M.P. and U.P. and circulated to concerned State Governments.

Further, during the meeting held under the Chairmanship of Secretary (WR), Govt. of India with the representatives of Govts of M.P. and U.P. on August 4, 2010 at New Delhi, it was decided that survey and investigations (S&I) works of proposed projects in Betwa Basin including Lower Orr major dam and preparation of Detailed Project Report (DPR) of Ken-Betwa Link Project, Phase-II will be taken up by NWDA.

After firming up the feasibility of the projects in close association with the officials of Water Resources Department, Govt. of M.P., NWDA has carried out the Surveys and Investigations works of the Lower Orr major dam and Babnai, Tharr medium dam and five barrages namely Neemkheda, Parariya (Madhopur), Narkheraghat, Kotha and Bijrotha (Rajkhera) under Ken-Betwa Link Project Phase-II. In addition, the Barari and Kesari barrages proposed in Upper Betwa basin and surveyed during preparation of DPR of Ken-Betwa Link Project Phase-I were also included in Phase-II of the project.

Further, during the November 20-22, 2013 the Central Water Commission (CWC) design team headed by Chief Engineer, Design (NW&S) and officers of NWDA inspected the proposed dam/barrage sites under Ken-Betwa Link Project, Phase-II to review design features and feasibility of the locations of dams/barrage sites. After visiting the various proposed sites, CWC

team made the following recommendations for deciding the planning of the project for preparation of the DPR of Ken-Betwa Link Project, Phase-II.

- (a) The Kotha barrage is a promising project with the new pond level of El 396/397 m. The proposal for this structure needs to be further supplemented with additional investigations tests and data.
- (b) The pond levels of Tharr and Babnai need to be revised to bring their storage within the confines of the river banks as submergence for these projects lies in active agricultural land. However, prima facie it was observed that bringing pond level below the banks in these barrages would result in very small storage and may not be attractive. Instead, a series of check dams can be thought of.
- (c) The Bijrotha and Narkheraghat barrages may be dropped as Kotha barrage would serve their objectives.
- (d) Neemkheda barrage also needs to be reviewed in view of the weir already constructed downstream of it and wide submergence envisaged by it.
- (e) The Parariya barrage can be dropped. Instead, the pond level of Barari can be raised to serve the objectives of Parariya barrage. However, for the present, Govt. of MP has already constructed a weir downstream of Parariya site which is taking care of the present irrigation requirements envisaged from Parariya barrage. The site for Barari can be chosen depending upon the bridge requirement of local population. This would apportion part of the expenditure towards that service making the project more attractive.

To discuss above recommendations and finalise the project proposals a review meeting was held under chairmanship of Chairman, CWC on November 26, 2013. The officers from CWC and NWDA participated in the meeting. After detailed discussions, it was decided that following five structures as suggested by CWC are to be included in the DPR of Ken-Betwa

Link Project, Phase-II. Therefore DPR of Ken-Betwa Link Project Phase-II has been prepared considering the following five structures.

1. Lower Orr Dam
2. Neemkheda barrage
3. Barari barrage
4. Kesari barrage
5. Kotha barrage with increased pond level i.e. 396 m

The inspection report of CWC team visit to Ken-Betwa link, Phase-II projects on river Betwa during November 20-22, 2013 is given at Annexure-1.2.

1.1 Outline of Projects taken up under Ken–Betwa Link Project Phase-II

Ken Betwa Link Project envisages transfer of surplus water from Ken basin to Betwa basin to provide water to water short areas of Betwa basin by substitution, keeping the needs of the in-basin requirements of Ken basin involving both the States of UP and MP in view and ensuring equity, optimization of water use and cost effectiveness. This report deals with the preparation of DPR of Ken-Betwa Link Project, Phase-II.

The project envisages construction of 45 m high dam, namely Lower Orr across river Orr (about 9 km upstream of confluence of Orr river with Betwa), 91.26 km long left bank canal including cross drainage structures, four barrages in the upper Betwa sub-basin namely Neemkheda, Barari, Kotha (Betwa river), Kesari (Keotan river) and various canals offtaking from barrages including canal structures etc. The 75% dependable yield of Orr river at Lower Orr proposed dam site has been assessed as 363 MCM. The gross storage capacity of Lower Orr dam is 372 MCM from which it is proposed to provide irrigation to an area of 67570 ha annually lying in the district of Shivpuri. The Lower Orr reservoir will also provide 6 MCM of water for drinking water supply in the enroute of the canal benefiting about 1.65 lakh people. An area

of 31277 ha is proposed to be brought under irrigation annually from the above four barrages with combined gross storage of about 140 MCM in the district of Raisen, Vidisha, Sagar and Ashoknagar of Madhya Pradesh. Index map of Ken-Betwa Link Project, Phase-II showing important features is enclosed as Plate-1.1 in the Part 1 of Volume-V.

The total cost of the project at 2012-13 price level has been estimated as Rs. 2282.94 Crores. The Benefit Cost ratio for the project has been worked out to be 1.56 and the Internal Rate of Return (IRR) as 14.87%.

The Ken–Betwa Link Project, Phase–II envisages construction of following components of the project:

(I) Lower Orr dam

The proposed dam site is located across Orr River which is a tributary of Betwa River near the village Didauni in the tehsil of Khaniadana located on toposheet No. 54 L/1 on the border of Shivpuri and Ashok Nagar district of Madhya Pradesh. The main aim of the Lower Orr project is to provide irrigation and domestic water supply to water deficit areas of Shivpuri district of MP. The latitude and longitude of the dam site are 24⁰50'50" N and 78⁰05'55" E respectively. The proposed dam site is about 6 km from Chanderi - Pichhore Road. Chanderi is the nearest town and Lalitpur is the nearest railway station. Gwalior is the nearest airport, which is about 150 km from the site. The total catchment area of Orr river upto Lower Orr dam is 1843 sqkm. The 75% and 50% dependable annual yield of the sub-basin upto the proposed dam site has been assessed as 362.53 MCM and 501.15 MCM respectively.

The proposed Lower Orr dam envisages the construction of a composite dam. In the proposed composite dam, the concrete dam portion is 487.00 m long with 247 m long spillway and 240 m long Non Overflow blocks. The earthen portion of dam is 1731 m long with a maximum height of 45.0 m. A 91.260 km long main canal has been proposed on the left bank of river. The FRL of the Lower Orr project is kept as 380 m. The submergence area at FRL is 2723 ha.

This component of the project will provide annual irrigation to 67570 ha in Shivpuri district of MP with 150% irrigation intensity utilizing 329.67 MCM. Beside 6 MCM water will be provided for drinking water supply to the enroute villages and towns in the vicinity of the canal. About 1.65 lakh people will get drinking water at a consumption rate of 100 lpcd.

(II) Neemkheda Barrage

The proposed barrage site is located on Betwa river near village Neemkheda in Goharganj tehsil of Raisen district of Madhya Pradesh. This site is located on toposheet No. 55 E/11. The latitude and longitude of the barrage site is 23⁰16'40" N and 77⁰40'49" E respectively. The proposed barrage site is about 15 km from Raisen which is the nearest town. Bhopal is nearest railway station and airport, which is about 30 km from the site. The catchment area of Betwa river upto Neemkheda barrage is 1976 sqkm.

The total length and height of barrage is 203 m and 10.65 m respectively. The pond level of barrage is 426.0 m. The submergence area at proposed pond level is 484 ha which is entirely in the river gorge portion. The storage capacity is 11.06 MCM. This barrage will provide an annual irrigation of 3066 ha at 100% intensity of irrigation in Raisen district of MP.

(III) Barari barrage.

The proposed barrage site is located on Betwa River near the village Barrighat in Vidisha district of Madhya Pradesh and is located on toposheet No. 55 E/14. The latitude and longitude of the barrage site is 23⁰40'30"N and 77⁰50'30"E respectively. The proposed barrage site is about 28 km from Vidisha on Vidisha – Lashkarpur – Barrighat road. Vidisha is the nearest town and nearest railway station. Bhopal is the nearest airport, which is about 80 km from the site. The total catchment area of Betwa river upto Barari barrage is 5474 sqkm.

The submergence area at proposed pond level of 407.72 m is 597 ha and storage capacity is 14.00 MCM. Total length of proposed barrage is 440

m. The proposed barrage will provide an annual irrigation of 4444 ha through lift at 100% intensity of irrigation in Vidisha district of MP.

(IV) Kotha Barrage

The barrage site is proposed across Betwa River near village Kotha in Ganj Basoda Tehsil of Vidisha district and located on toposheet No. 54 L/4. The latitude and longitude of the barrage is 24⁰03'28" N and 78⁰01'16" E respectively. The proposed barrage site is about 6 km from Mandi Bamora on Ganj Basoda – Bina road. Vidisha is the nearest town and nearest railway station. Bhopal is the nearest airport, which is about 175 km from the site. The total catchment area of Betwa river upto Kotha barrage is 8711 sqkm.

Considering the site conditions at the barrage site and as recommended by CWC, the height of barrage has been proposed as 13.5 m. The proposed pond level of this barrage is 396.0 m and river bed is 384.0 m. Submergence area at proposed pond level is 2210 ha and storage capacity is 104.60 MCM. The barrage will provide an annual irrigation of 21697 ha in the districts of Vidisha, Sagar and Ashoknagar of MP. The intensity of irrigation is considered as 125% for this component.

(V) Kesari Barrage

The proposed barrage site is located on River Keotan, a tributary of Betwa River, near village Didholi in the Basoda tehsil of Vidisha district of Madhya Pradesh and is located on toposheet No. 55 I/1. The latitude and longitude of the barrage site is 24⁰52'32" N and 78⁰1'34" E respectively. The proposed dam site is about 11 km from Ganj Basoda which is the nearest town and nearest railway station. Bhopal is the nearest airport, which is about 110 km from the site. The catchment area of Kesari barrage is 506 sqkm.

Submergence area at proposed pond level of 403.90 m is 362 ha and storage capacity is 10.0 MCM. Total length of barrage is proposed as 181 m. About 2070 ha area will be irrigated (including lift) by the barrage at 140% irrigation intensity.

1.2 Justification and Objective of the project

The main objective of Ken-Betwa Link Project is to make water available to water deficit areas mainly in Upper Betwa basin and drought prone, backward and water scarce area of Bundelkhand region of MP and UP. 75% dependable yield of Ken river at proposed Daudhan dam site assessed in Phase-I of DPR of this project is 6590 MCM. After accounting for upstream and downstream requirements of existing, ongoing and proposed projects, the surplus water to be diverted through the link annually was assessed as 1074 MCM, out of which after utilizing 483 MCM of water in the enroute of Ken-Betwa link canal for irrigation, drinking water supply including transmission losses and balance 591 MCM is proposed to be transferred to the Betwa river for utilization in the upstream of Parichha weir. Five structures including one major dam viz. Lower Orr and four barrages in Upper Betwa region have been planned under this Project which will utilize about 489 MCM of water by way of substitution against 591 MCM of water proposed to be transferred from Daudhan through Ken-Betwa link canal. This will provide annual irrigation to about 0.99 lakh ha at different intensity of irrigation. The projects for utilization of remaining water will be reviewed/planned in due course by Govt. of MP in phased manner. The remaining water if any, after utilizing in the above proposed projects will be used by Govt. of MP for domestic and industrial purposes for which planning will be done later.

Since, this link project has taken into consideration in-basin requirements of all the existing, ongoing and proposed projects upstream and downstream of Ken basin while working out surplus water at Daudhan dam, the proposed diversion of water from Ken to Betwa through link and its utilization in Betwa basin on substitution basis is justified.

Further, the command area identified under this project lie in drought prone and water scarce region of Betwa basin. This link project will definitely bring economic prosperity to this area due to increased agricultural activities.

1.3 Project planning and optimization of Benefits under Phase-II

After meeting the in-basin and committed downstream water requirements of UP and MP, 1074 MCM of water is proposed to be transferred from Daudhan dam on river Ken through Ken-Betwa link, out of which 366 MCM of water (277 MCM for MP and 89 MCM for UP) will be utilized for irrigating 0.60 lakh ha in enroute command at 100% intensity of irrigation and 49 MCM of water will be provided for drinking water supply to enroute villages and towns. Remaining 591 MCM (excluding transmission losses of 68 MCM) will be transferred to Betwa river through Barwa Sagar reservoir and Barwa nallah (natural stream) in the upstream of Parichha weir. Five structures planned by NWDA under Phase-II Project will utilize 489 MCM (The utilization of 4 barrages will be 158.94 MCM) of water by way of substitution against 591 MCM of transferred water to provide an annual irrigation to 98847 ha at different intensity of irrigation viz. Lower Orr dam (150%), Neemkheda barrage (100%), Barari barrage (100%), Kotha (125%), Kesari (140%). Projects for utilization of remaining water will be reviewed/planned by Govt. of MP.

Thus, benefits from the Phase-II Project have been optimized in the following manner:-

I. Irrigation Benefit

Name of proposed Structures		Annual Irrigation (ha)
a)	Lower Orr dam	67570
b)	Neemkheda barrage	3066
c)	Barari barrage	4444
d)	Kotha barrage	21697
e)	Kesari barrage	2070
Total		98847 ha

II. Drinking water supply

Provision of 6 MCM of water has been kept for providing drinking water to enroute villages and towns of Lower Orr canal offtaking from proposed Lower Orr dam, about 1.65 lakh people will get drinking water facility from the project.

III. Flood control benefits

Though no flood cushion has been provided in the reservoirs proposed in the Betwa basin under Phase-II, however regulated releases from Lower Orr dam and various canals offtaking from barrages will moderate flood intensity in Betwa river to some extent.

IV. Other benefits

Though not planned, many other incidental benefits like recharge of ground water in command area, development of agro based industries/food processing units, employment generation in construction phase and afterwards, development of tourist spots, development of infrastructure etc. will accrue from the project. This will result in upliftment of socio-economic condition of people in general living in water scarce areas of Vidisha, Raisen, Shivpuri and Ashoknagar districts of MP state.

1.4 Approach adopted

1.4.1 Surveys and Investigations works done departmentally

NWDA has adopted two pronged action for preparation of DPR of Ken-Betwa Link Project, Phase-II. Major part of the detailed surveys and investigations of the project for which in house capability was available, has been done by NWDA itself whereas other specialized surveys and investigations along with technical studies were outsourced, mostly to other Government Agencies. Surveys and Investigation works carried out departmentally by NWDA are as under:-

1. Dam/barrage axis surveys of Lower Orr, Neemkheda, Barari, Kotha and Kesari barrages.

2. Survey of Lower Orr canal offtaking from Lower Orr dam carried out by Madhya Pradesh Water Resources Department has been considered in the report.
3. Submergence area survey of Lower Orr dam.
4. The sample command area survey for Lower Orr dam.
5. Collection of soil samples for borrow area survey of Lower Orr and along the proposed canal as suggested by CSMRS.
6. Identification of quarries, digging of pits and collection of samples from stone quarry sites and sand quarry sites for construction material survey under guidance of CSMRS.
7. Hydrological observation at Lower Orr G&D site at Didauni established by NWDA.

1.4.2 Surveys and Investigations carried out by other agencies/departments

1.4.2.1 Borrow area survey, geotechnical investigation, construction material survey, testing of rock samples

The work of borrow area survey, geotechnical investigation, construction material survey, testing of rock samples etc. in respect of the Lower Orr dam, four barrages have been carried out by CSMRS.

1.4.2.2 Geological Investigations

The geological investigation including geological mapping, logging of drill holes, preparation of geological section etc. for Lower Orr dam, Neemkheda and Kotha barrages has been carried out by Geological Survey of India (GSI), Bhopal for the project. Geological Investigation of Kesari and Barari barrages carried out by GSI earlier (2007) has been utilized.

1.4.2.3 Drilling Works Ken Betwa Link Phase-II

The drilling work for Lower Orr dam and four barrages namely Neemkheda, Barari, Kotha and Kesari have been carried out as per the

suggestions given by the GSI, Bhopal. Water percolation tests (WPT) have also been carried out during drilling.

1.5 Technical Studies

1.5.1 Design of important project components and writing of Design chapters

Lower Orr dam and four barrages namely Neemkheda, Barari, Kotha and Kesari barrages are considered under Ken-Betwa Link Project, Phase-II. Following four design Directorates of CWC were involved in design work of important structures along with preparation of design chapters:

1. CMDD (NW&S) Directorate
2. Embankment Design (NW&S) Directorate
3. Gates Design (NW&S) Directorate
4. BCD (NW&S) Directorate

1.5.2 Irrigation planning studies

Irrigation Planning (South) Directorate of Irrigation Management Organisation, CWC was involved in irrigation planning studies of all five structures of Ken-Betwa Link Project Phase-II.

1.5.3 Construction Planning, Equipment Planning and Manpower Planning

Construction Machinery Consultancy Directorate of Central Mechanical Organisation, CWC was involved in construction planning, equipment plannings and man power planning studies of all five components of Ken-Betwa Link Project, Phase-II.

1.5.4 Hydrological Studies

Hydrological studies of Lower Orr dam and four barrages Neemkheda, Barari, Kotha and Kesari considered at present under Ken-Betwa Link Project Phase-II has been carried out by National Institute of Hydrology, Roorkee.

1.5.5 Study of Seismic Parameters

Site specific ground motion seismic study for Lower Orr dam has been carried out by Central Water and Power Research Station (CWPRS) Pune.

1.6 Socio-economic Survey, Environmental Impact Assessment Study

A. Lower Orr Dam

Environmental Impact Assessment Study of Lower Orr dam has been carried out by M/s Water and Power Consultancy services Ltd. (WAPCOS) Gurgaon, Haryana. Socio-economic Impact Assessment Studies and Rehabilitation & Resettlement Plan of Lower Orr dam has been carried out by Department of Sociology, Hamidia College, Bhopal as per the recommendations of Water Resources Department, Govt. of Madhya Pradesh.

B. Neemkhera, Barari, Kotha and Kesari barrages.

Environmental Impact Assessment, Socio-economic Impact Assessment Studies & Rehabilitation and Resettlement Plan of four barrages namely Neemkheda, Barari, Kotha and Kesari have been carried out by M/s AFC Limited, Hyderabad.

1.6.1 Methodology adopted

Detailed Project Report of Ken-Betwa Link, Phase-II has been prepared by NWDA utilizing the services of Government departments like CWC, CSMRS, NIH, CWPRS, GSI, WAPCOS and reputed educational institutions/other Govt. Organizations like NRSC, Hyderabad and Agricultural Finance Corporation Limited, Hyderabad and Hamidia College, Bhopal. Topographical surveys of dam axis, canals, barrage axis, command area surveys etc. were done departmentally by NWDA. However, private parties were engaged where Government agencies were not available for completing the work in time bound manner like drilling work.

The DPR of the Project is in 5 volumes. The Main Report of the DPR is contained in Volume-I. The data and detailed reports of various expert agencies associated with the work are contained in Volume-II and III as

Annexures. The relevant drawings are furnished in Volume–IV and V of the Report.

1.6.2 Data collection

The preparation of DPR of the Project required various data/information. Data/information required by Design Organization of CWC were collected during field surveys. Rainfall and meteorological data were collected from IMD, Pune whereas hydrological observation data and ground water data were collected from CWC and CGWB respectively and supplied to NIH, Roorkee for Hydrological Studies and IMO, CWC for Irrigation Planning Studies. Data regarding cropping pattern, yield of crop per ha, cost of produce, cost of cultivation etc. were collected from State Agriculture Departments and made available to CWC. Report of Lower Orr Project prepared by MP, WRD was collected. Test results/outputs given by CSMRS and GSI formed inputs for designers of the project. Thus there were many inter-dependent activities, apart from normal data collection. All these activities were successfully managed by NWDA officers and various data required by the Consultants were supplied to them for the preparation of this report.

1.6.3 Planning and Layout

A joint visit of the Upper Betwa region/river course, by senior officers of NWDA and Water Resources Department, Govt. of Madhya Pradesh was carried out for finalization of project sites in the Upper Betwa region in view of feasibility of projects and suggested by Water Resources Department authorities of Govt. of MP. L–section survey of Betwa river was also carried out by NWDA, to finalize the location of storage/diversion structures on Betwa river. Initially one major dam namely Lower Orr across river Orr (tributary of Betwa), two medium dams namely Tharr across river Newan (tributary of Betwa) and Babnai across Babnai river (tributary of Betwa) and seven barrages namely Neemkheda, Parariya, Barari, Narkheraghat, Bijrotha, Kotha across Betwa river and Kesari across Keotan river (tributary of Betwa) were proposed under Ken–Betwa link Project, Phase–II. Accordingly the Surveys and Investigation works were carried out.

On the recommendation of CWC team headed by Chief Engineer (Design – NW&S), who inspected the structure sites on river Betwa during 20–22 November 2013, only one major dam namely Lower Orr dam and four barrages namely Neemkheda, Barari, Kotha and Kesari have been considered in the present DPR of Ken – Betwa Link Project, Phase – II.

1.7 Engineering assessments and Front end Engineering

1. Lower Orr dam

The height of Lower Orr dam has been designed as 45.0 m. The length of the dam will be 2218 m including the spillway length of 240 m. The spillway will have 12 nos. of gates of size 15 x 10 m.

The left bank canal will have a bed width of 5 m and depth of 3.06 m. at head and a bed width of 3.0 m and depth 1.7 m at end.

2. Neemkheda barrage

The barrage will be 203 m long with a spillway of 200 m (10 bays of 18 m width with 10 nos. of piers of 2 m thick).

3. Barari barrage

The barrage will be 440 m long with a spillway of 310 m (25 bays of 10m width with 24 nos. of piers of 2.5 m thick). A pipe portion of 4.0 km long followed by a ridge canal of 4.70 km long has been proposed under this barrage.

4. Kotha barrage

The barrage will be 579 m long with a spillway of 576 m (32 bays of 15 m width with 32 nos. of piers of 3 m thick).

5. Kesari barrage

This barrage will be 181 m long with a spillway of 118 m (10 bays of 10 m width with 9 piers of 2.0 m thick). A pipe portion of 2.9 km long followed by 9.6 km long canal has been proposed under this barrage.

1.8 Socio-Economic Aspects

1. Lower Orr dam

The Lower Orr reservoir submerges about 2723 ha of land (at 380 m FRL). A total of 12 villages will be affected. Out of these 7 villages will get submerged fully and 5 villages partly. Socio-economic Impact Assessment Studies and Rehabilitation & Resettlement Plan of Lower Orr reservoir has been carried out by Department of Sociology, Hamidia College, Bhopal as per the recommendations of Water Resources Department, Govt. of Madhya Pradesh. The total no. of Project Affected families has been estimated as 944 under Lower Orr reservoir. The average literacy rate in the area is 67.49 %. The male and female literacy rates are 71.42 % and 54.21 % respectively. The SC and ST households of the Project Affected Areas have been found out as 6.84 % and 31.36 % respectively. The prominent occupation is agricultural labour which accounted for about 42.56 % of total workers and is followed by cultivators (48.30 %). About 43 % of female workers and 57 % of male workers are dependant on agriculture.

The project area is dominated by cows, buffalos and goats with 4.62, 3.20 and 4.14 animals per household respectively. To a lesser extent, it is buffaloes (3.2) and sheep (1.98).

The agricultural implements of the project area mainly consist of tractors with trolley, ox drawn ploughs, sprayers, electrical pumps and diesel pumps.

The main source of income for the project families is from the agriculture based activities which account nearly 77.83% of the overall income. The income and expenditure patterns of the project area are furnished in Table-1.2.

Table- 1.2
Income and Expenditure patterns of the project area

Income particulars	%	S. No	Expenditure Particulars	%
Agriculture	61.62	1	Food	41.03
Agri. Labour	16.21	2	Fuel	1.20
Non-Agriculture	7.22	3	Clothes	8.13
Livestock	14.12	4	Housing	1.21
Business	0.63	5	Education	7.48
Sericulture	0	6	Health	8.58
Minor Forest Produce	0	7	Social Ceremony	13.19
Govt. / Private Service	0.20	8	Agri. and Livestock	18.17
Others	0	9	Others	1.01
Total	100.00			100.00

The major part of the Lower Orr reservoir submergence area falls in semi pucca houses category accounting for about 17.24 %., which is covered with GI or AC sheets followed by kutchra (hut) houses made of agricultural waste covered roof which accounts to 55.98 % and small percentage of 26.78 % of houses are pucca houses.

The caste wise distribution of affected households in Lower Orr reservoir is given below in Table-1.3.

Table-1.3
Castewise distribution of affected households under Lower Orr reservoir

No. of PAF's					% of total				
SC	ST	BC	OC	Total	SC	ST	BC	OC	Total
79	314	167	384	944	8.7	33.26	17.69	40.68	100

The age wise distribution of household population within Lower Orr reservoir area is furnished in Table-1.4.

Table- 1.4

Age-wise distribution of affected households Population under Lower Orr reservoir

S.No.	Village	Age Group (Years)					
		0-6	7-17	18-35	36-60	Above 60	Total
1	All villages affected by Lower Orr Project						
2	No. of Population affected	241	472	873	1186	167	2939
3	% of Total affected Population	8.20	16.05	29.70	40.35	5.7	100.00

2. Four Barrages

As the submergence of all the four barrages lie in the gorge portion of the river, hence no population is affected.

1.8.1 Financial aspects of the Project

After extensive surveys/studies on Lower Orr dam and four barrages Neemkheda, Barari, Kotha and Kesari barrages, the project affected families and land acquisition, the Resettlement and Economic Rehabilitation Plan for the families was suggested by the consultant based on the Policy entitled “National Rehabilitation and Resettlement Policy-2007” of Department of Land Resources, Ministry of Rural Development, Govt. of India and Ideal Rehabilitation Policy for Madhya Pradesh-2002 (IRPMP-2002) and the guidelines issued by the Ministry of Rural Development, Govt. of India and Govt. of MP at the prevailing (during 2006-2007) minimum agricultural wage. For the Environment Management Plan, a provision of Rs. 53.37 crores for

Lower Orr dam and Rs. 37.52 crores for four barrages has been kept. The total cost of project affected families rehabilitation and economic Resettlement Plan for the entire Ken-Betwa Link Project, Phase-II is worked out to be Rs. 213.11 crores. Complete details of the Comprehensive Environmental Impact Assessment of Ken-Betwa Link Project, Phase-II are furnished in Chapter-VIII and IX.

1.8.2 Financial and economic analysis

The total cost of the Ken–Betwa Link Project, Phase-II including Rehabilitation and Resettlement plan works out to Rs. 2282.94 crores at 2012-13 price level. The annual cost of the project including cost of maintenance of headworks, dam appurtenants, depreciation etc. works out to Rs. 271.91 crores. The net benefit from agricultural produce and generation of fishries annually have been worked out to Rs. 371.45 crores and Rs. 53.88 crores respectively. Accordingly, the benefit–cost ratio has been worked out as 1.56 and the Internal Rate of Return is 14.87 %. Head wise details are furnished below in Table-1.9.

Table – 1.9

Cost of Head work	Cost of Canal and Canalisation	Cost of Command area development	Annual cost of the project	Net benefit from the project	Benefit cost Ratio	Internal rate of Return (IRR)
1	2	3	4	5	6	7
1482.85	752.40	16.53	271.91	425.48	1.56	14.87%

1.9 Clearances required

Ken-Betwa Link Project Phase-II will require the following (Table-1.10) clearances from the agencies indicated against each:

Tabel-1.10

Clearances required from other agencies

S. No.	Clearance	Agency
(i)	Techno-economic	Central Water Commission/MoWR
(ii)	Forest	Ministry of Env. and Forests
(iii)	Environmental	Ministry of Env. and Forests
(iv)	Wildlife	Central Empowered Committee, MOEF
(v)	Rehabilitation & Resettlement Plan of Tribal Population	Ministry of Tribal Affairs (MOTA)

Based on above, investment clearance will be accorded by Planning Commission.