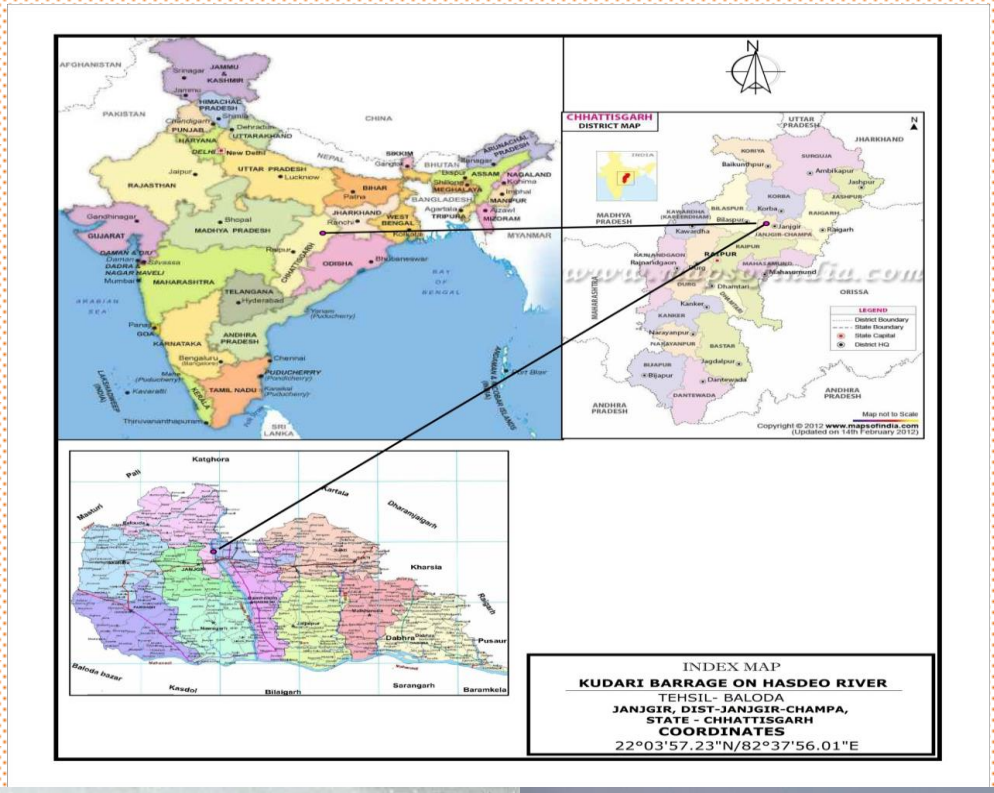
# EXECUTIVE SUMMARY FOR THE CONSTRUCTION OF KUDARI BARRAGE ON RIVER HASDEO AT JANJGIR CHAMPA, CHHATTISGARH

## Sponsor:
## Water Resource Department, Government of Chhattisgarh





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# EXECUTIVE SUMMARY

## 1.0 INTRODUCTION

As per the guidelines of the Ministry of Environment and Forest (MoEF). Government of India, Environmental Impact Assessment (EIA) is a prerequisite for launching any major development project. In compliance with this requirement the water resource Department, Janjgir-Champa, Chhattisgarh retained M/s ANANCON LABORATORIES PRIVATE LIMITED, Nagpur to prepare the Environmental Impact Assessment (EIA) report of the proposed construction of Kudari Barrage.

The EIA report present the objectives and scope of this study, the environmental baseline status of the project area, identification of major environmental impacts, prediction of various impacts during and after the proposed developmental activities, evaluation of these impacts, followed by suggestions for effective environmental management plan to minimize the adverse impacts.

Kudari Barrage project envisages construction of Barrage across the river Hasdeo a tributary of river Mahanadi in the main basin of river Hasdeo. Hasdeo river originating from southern part of Hasdeo Mountain. Eastern part is divided from tributaries of river Rihand (North flowing) and Mand basin of Raigarh district. Western Part is divided from the tributaries of Arpa river of Bilaspur district (south flowing), southern boundary creates by tributary of sheonath river and Mahanadi itself. The upper reaches of Hasdeo river covers Manendragarh, Sonhat, Baikunthpur and Chirmiri area in Kore district and remaining central and lower part of the river covers Katgora, Korba and Champa district. Hasdeo river runs through the plain area which is full of agriculture land and meets the Mahanadi river at Mouhadih village of Janjgir-Champa. The project is to provide water for thermal power plants, recharging groundwater, drinking water and for lift irrigation purposes. Districts are backward districts with scarcity of water and people in the region are dependent on the rains. The purpose of the project is to storage of 15.60 Mcum of water supply for Industrial use and domestic water supply in summer period and to facilitate neighboring villages for Kharif crop by lift irrigation.

The proposed Barrage site is situated on Hasdeo river, near village Kudari of tahsil Baloda in Dist – Janjgir – Champa (C.G.). The proposed site is 15 km away from Champa by all-weather road. Its nearest Railway station is Champa which is 10 km away. The Distance from District Head Quarter Janjgir is 10 km by road. The barrage site is located at latitude of 22°03'58" N and longitude of 82°38'00"E. There is no effect on any structure across the Hasdeo River upstream of this barrage on going from this scheme.

The Kudari barrage Project is a medium scheme for storage of water (15.60 Mcum) envisages construction of a barrage with 30 Nos of bays size 12m X 6.05m provided without afflux bund minimum affix of 0.5m. The average height of barrage will be 6.05 meters in gourge to impound a gross storage of 15.60 $Mm^3$. There will be no significant impact on natural flow of river. In monsoon season all the gates will remain open, therefore probability of deposition of sand / silt is least. There will be nominal 3.08 Ha area under submergence. The average height of banks from the bed level of river will be between 7 to 8.5 m, whereas the proposed height of the structure will be only 6.05 m so that the storage of water will be within the bank boundaries.

### 1.1 Salient Feature of the Project

The Kudari Project is a proposed medium Project across the river Hasdeo, a tributary of Mahanadi river in Hasdeo Basin in Chhattisgarh State. The project envisages the construction of barrage of about 432.14M. long with concrete central gated (30 nos. bays of 12m X 6m). The Kudari barrage will

have storage of 15.6 $Mm^3$. It is proposed to supply this water to power plants. There is no command area of this project. The total catchment area of barrage site (near village Kudari) is 7795 sq.km.

The area under submergence is only 3.08 Ha within the barrage. The total land requirement for the project is estimated to be 6.59Ha. out of this 3.3 Ha will be private revenue land, 3.56 ha will be Govt land (barrage land). No forest land comes under the submergence.

There are 3 raingauge stations influence in catchment area of this project. As Topography is flat, it is felt more appropriate to work out the weighted rainfall on the basis of Thiesens polygon. The rainfall data available for a period of 40 years are being used for developing weighted rainfall and yield for this Kudari barrage yield study.

The gross yield worked out to be 15.60 $Mm^3$ and @ 75% dependability is 11.7 $Mm^3$.

### 1.2 Proposed Work

The major work to be taken up under the Kudari Barrage project is:

- Construction of barrage with central gated spillway across Hasdeo River near village

Kudari barrage scheme is administratively approved by Government of Chhattisgarh dated 22-07-2008. The administrative approval is Rs. 9778.47 lakhs for water storage for Nistar, recharging of ground water, water supply to proposed power plants for M/s Chhattisgarh power generation company Limited Raipur (earlier known as C.S.E.B. Mandwa) and M/s Chhattisgarh Steel and power Limited on agreement basis and for communication. This will also serve the unemployment problem of labours. Hence, this scheme will prove the boon to the area. This barrage accommodated a cause way for connecting villages on either side of bank. Also due to water supply for industrial use, revenue recovery of Rs. 7.608 crores per year is expected. Hence proposal is recommended for according administrative approval.

### 1.3 Description of Environment

The study area mainly comprises the catchment area, the area of submergence, and the command area of the Kudari project. There is no command area for this project as whole water will be supplied to power plants. The total catchment area is 7795 sq.km, falling in Janjgir-Champa districts. The area of submergence is only 3.08 Ha within the barrage area.

**Physical Environment**

The Hasdeo river originates from southern part of Hasdeo mountain, flows through north to south and subsequently for the most part east to west. It flows for 333 km through the plain area which is fully agricultural land and meets the Mahanadi river at Mautadih village of Janjgir – Champa. The important tributary is Arpa river at Bilaspur district. Southern boundary creates by tributaries of Sheonath river and Mahanadi itself. Its total catchment area is 7795 sq. km.

Surface geological studies and the bore hole logging have indicated the presence of over burden of older and younger alluvium consisting of calcified clay and silt at places having pebble bed, comprising pebbles and course sand and highly weather basalt. 30Nos. of bays (being gate size 12 m X 6 m) are proposed in the river bed.

## 2.0 Baseline Environmental Status and Identification of Impacts

### 2.1 Air Environment

Four major air pollutants viz. particulate matter, ($PM_{10}$) and $PM_{2.5}$, Sulphur dioxide ($SO_2$) and dioxide of nitrogen (NOx) representing the basic air pollutants in the region were identified for AAQM.

The pollutant levels (24 hourly avg.) at these sampling stations reflect that the regional background, i.e. mean levels of $PM_{10}$ is 41-71 µg/$m^3$ whereas $PM_{2.5}$ is 14-26 µg/$m^3$. The concentration of other gaseous pollutants were, $SO_2$: 9-21 µg/$m^3$ and NOx: 11-24 µg/$m^3$ during the study period.

### 2.2 Noise Environment

The noise levels in the residential zone and the commercial zone ranged between 52-55 dBA during daytime and 40-43 dBA during night time and between 57-68 dBA during daytime and 50-53 dBA at night time respectively.

Noise levels were also monitored in schools, hospitals and temples in the study area i.e. silence zone. The noise levels varied from 49-54 dBA during daytime and 35-38 dBA during night time.

### 2.3 Water Environment

The surface and groundwater samples collected were analyzed for physico-chemical parameters to arrive at the baseline environmental status of water quality.

The physico-chemical characteristics of surface water for summer season indicates, pH: 7.43 – 7.69, TDS: 134-226 mg/l, whereas total hardness was found to be in the range of 104-184 mg/l as $CaCO_3$. The chloride and sulphate were observed in the range of 26.42-47.69 mg/l and 12.62-18.4 mg/l respectively.

Nitrate was found in the range of 4.39-13.62 mg/l. Heavy metals were found to be within the permissible limits of drinking water.

The physico-chemical characteristics of groundwater indicate pH in the ragne of 7.61-7.90, TDS 172-301 mg/l. The inorganic parameters viz. total hardness 118-214 mg/l; Nitrates were 4.37-7.92 mg/l.

The surface water was found to be faecally contaminated and hence need chlorination before consumption. Most of the groundwater samples were also found to be faecally contaminated and hence need chlorination before consumption.

### 2.4 Land environment

Agriculture being a major activity in the villages, more than 65% land under cultivation. The irrigated agriculture land covers only 0.55% crops. Only 1.01%land comes under the barren land including gouchar and groves.

Jawar, Paddy, Cotton, Tur are grown in Kharif season. Unirrigated crops like Wheat and Bajara are the prominent crops grown in the Rabbi season. Paddy is the major crop in Kharif season and Mung, Tur, Jowar and Cotton are prominent crops of the study area.

The texture of the soil is silty clay. The bulk density of the soil is in the range of 1.07 – 1.12 g/cm$^3$. The water holding capacity is in the range of 42.08-43.81. pH is an important parameter which indicates the alkaline and acidic nature of soil. The pH of the soil in the study area is slightly to moderately alkaline in reaction having pH in the range of 7.01-7.12. The soluble salt content in all the soils are low (EC<1 dS/m), chemical analysis shows that the soils are normal. The most important cations present in soluble state in the soil are calcium and magnesium. It was observed that calcium and magnesium are in the range of 178.05-230.45 mg/kg and 142.65 – 205.50 mg/kg respectively.

In general, the soil in the region has moderate adsorption capacity as evident from the cation exchange capacity which was found to be in the range of 10.88 – 13.9 c mol ($P^+$) $Kg^{-1}$ soil. Soils from all the villages are normal with respective to alkalinity as exchangeable sodium percentage of soils is below 15.

Organic carbon and available nitrogen, phosphorous and potassium are found to be in the range of 1.10-1.46% and 105.55-165.75, 32.50 – 51.50 and 140.50-194.00 kg/ha respectively. Soil samples are poor to medium level content in organic carbon. Data indicates that soil are medium fertile but the available potassium present in the soil shows high fertility level.

## 2.5 Biological Environment

Biological monitoring was carried out based on topography, land use, vegetation pattern, etc. The study area mostly comprises of agricultural fields, rivers and nallahs. Out of total area studies, 171 plant species were recorded, comprising 80 trees, 33 shrubs, 14 herbs, 19 climber / linas, 23 grasses and 2 parasitic plants. The dominant plant in the study area was *Prosopis julifiora*, which founds commonly near the river, nallahs and village westland. The *Parthenium* was a common weed growing in westland and in agricultural field. *Azardirachta* was a common tree near the villages and on the hedge of agricultural field.

No forest area comes under the study area. The commonly found wild animals in the study area are Black buck and Wild boar. They live in the agricultural field and near the river and nallah side. The black buck comes in an endangered category. Some reptiles like cobra, water snakes, monitor lizards and common lizards were also observed near the village boundary.

A total of 91 faunal species were observed in the study area, out of which 12 species belonging to mammalian, 07 species of reptile Claus and Amphibians, 47 of class Aves, 14 species belonging to class insect and 11 species belong to class Pisces.

## 2.6 Socio-economic Environment

The socio-economic profile of village falling in the area in the vicinity of the project has been covered in varied perspectives. It includes information on demography, infrastructural facilities, economy, health, literacy and cultural and aesthetic attributes. The quality of life (QOL) index for the villages show a reasonably satisfactory level.

Total 10 villages were surveyed to know the opinion about the project, structured questionnaire were used for survey. For group discussion, panchayat Bhavan, Aanganwadi, community halls were used for survey. Household and group discussion & infrastructural facilities in the villages were discussed. The observations and perception of the people are given in the report.

Good economic conditions in terms of income, employment, food, clothing and shelter contribute towards higher QoL-value, while factors like inadequate medical and educational facilities, social-insecurity, water scarcity, insufficient irrigation facilities, inadequate sanitation facilities bring the QoL-Value down.

The average QoL index values are estimated as:

QoL (S) = 0.55

QoL (O) = 0.56

QoL (C) = 0.55

### 2.7 Identification of Impacts

For the activities envisaged under the project, impacts have been identified for the preconstruction, construction and post construction and operation phases of the project using the network approach which involves an understanding of the cause condition effect relationship between an activity and environmental parameters. The network indicates the primary, secondary and tertiary impacts due to the various activities.

The significant environmental issues due to the proposed construction of Kudari barrage are broadly identified as under:

- Impact on river hydrology and sediment transport
- Impact on water table and consequent water logging
- Impact on the water quality
- Impact on the terrestrial flora and fauna due to site clearance and construction activities in the project area.
- Impact on land use pattern and land availability
- Impact on air quality and nose levels during the construction period
- Direct and indirect impacts on the local community
- Impact on wildlife, sensitive area, and archaeological sites

## 3.0 PREDICTION OF IMPACTS

### 3.1 Air Environment

During construction phase of the project, the major activities are drilling, blasting, quarrying transportation and construction of barrage and other components of project. All these activities lead to on increase in concentration of air pollutants, particularly particulate matter, NOx and hydrocarbons (HC) which are further added due to increase vehicular traffic. However, the levels of $SO_2$, Nox and Hydrocarbons were observed well below the stipulated standards during the construction phase.

It is predicted from CL4 model that the maximum contribution to ground level concentrations of CO, HC, NOx and Particulate matter due to vehicular movement will be less than 5µg/$m^3$ beyond 500 m from the road. It is noteworthy, that this activity is mainly located away from this proposed project.

### 3.2 Noise Environment

The study area is heavily affected by transportation due to State Highways i.e. SH-9 and NH-200. The trucks, buses, cars, jeeps and two wheelers are running through this route. Considering natural growth and increase due to proposed project, traffic composition was considered for SH-9 and NH-200.

The predicted cumulative noise level at 50m – 100 m from the centre of the road i.e. SH – 9 ranged between 65-70 dBA. On NH – 200 the cumulative noise level at 50-100 m varied between 62-65 dBA.

Compressor, feed pumps and generator etc. would be the main sources of noise during the construction phase of the barrage. The noise levels expected would be in the range of 75-85 dBA due to construction activity. This temporary increase in noise levels would not have any significant impact on the community.

### 3.3 Water Environment

Surface water quality was monitored to assess the impact of the proposed activity. The assessment parameters indicated that surface water is good physico-chemically. However there will be maximum dilution due to rain water runoff collected in the barrage if river and Nallahs are discharged into the barrage. If the discharges are properly managed, them there will not be any impact of the river and nallahs on the barrage water collected during rainy season. The surface water is faecally contaminated and not useful for drinking purpose unless chlorinated.

There is no command area for this barrage. The entire water will be used for the supply to the thermal power plants, drinking and recharging of ground water and if possible for lift irrigation purpose.

### 3.4 Land Environment

The construction of the barrage will cause rise of the water table in the upstream part of the barrage. The soil here is silty clay and topographically the area is plain (i.e. relatively flat). Hence water logging may not occur in the area.

Seepage from irrigation canals and excess irrigation of field would lead to rise of water table, and increases in salinity of soils. Further assured water supply for irrigation if used may lead to use of HYV (High Yielding Variety) seeds. HYV seeds demand considerable use of fertilizers which could play a role in increasing the salinity of soils.

**Existing crop Pattern**

The predominant crops prevailing in the area are Jowar, Cotton, Mung and Tur. The subsidiary cropping pattern consists of pulses, wheat & cotton.

| Sr. no. | Name of Crops | % |
|---|---|---|
| 1 | Jowar | 9 |
| 2 | Pulses | 2 |
| 3 | Paddy | 62 |
| 4 | Cotton | 20 |
| 5 | Vegetables | 1 |
| Rabbi | | |
| 6 | Gram | 2 |

| | | |
|---|---|---|
| 7 | Wheat | 2 |
| | Vegetables | 2 |
| | Total | 100.00 |

**Proposed Cropping Pattern (if used for lift irrigation)**

The cropping pattern proposed is based mainly on the agroclimatic zoning of the region keeping in view of soil condition. The L.S. Cotton, Hy, Jawar, Tur & Paddy also find place in view of the fact that these are high yield crops when adequate supply of water is assured. People can be encouraged to grow these profitable varieties in lieu of the conventional crops. The proposed cropping pattern which is predicted after the barrage construction will be as follows:

**Proposed Cropping Pattern**
**(If used for lift irrigation)**

| Season | Sr. No. | Name of Crops | % |
|---|---|---|---|
| A) Tow seasonal crops | 1) | Chilies | 3 |
| | 2) | Cotton | 10 |
| B) Kharif season crops (unirrigated) | 1) | Pulses, Tur | 5 |
| | 2) | Paddy | 65 |
| C) Kharif Seasonal (Irrigated) | 1) | Hy. Jowar & maize | 9 |
| | 2) | Vegetables | 20 |
| D) Rabi Crops Follow on crops | 1) | Gram after Bajara or Jowar | 20 |
| | 2) | Wheat after Bajara | 5 |
| | 3) | Sunflower, Safflower | 10 |
| | 4) | Vegetable (Tomato, Cauliflower & Cabbage etc.) | 30 |
| **Grand Total** | | | **177** |

### 3.5 Biological environment

- Hasdeo river is a perennial river, so fishery activity is prominent, therefore, these activities may not be affected, rather there will be more fishing activities in the barrage.
- Because of barrage formation, the fishery production will be improved and the local people may get benefit of good fishery production
- There is no submergence, however the catchment area is mostly agricultural, rainfed forming with low plant and animal diversity. No endangered or endemic plant was recorded from study area and faunal diversity represented by black buck, wild boar only. Thus biodiversity of plant and animals would not be adversely affected

### 3.6 Socio Economic Environment

The project will create employment and business opportunities during construction phase at local as well as district level. Agriculture related employment will continue during operation phase of the project. Increased revenue to the government through taxes will be on indirect benefit.

Improved infrastructural facilities like road, communication, market, health, services and other amenities will help in the development of the region. These facilities would be used by local people and would help in betterment and upliftment of the quality of life of local people. The formation of barrage near village Kudari may promote tourism activities in the project area as well as a source of income for the local people.

Expected charge in subjective quality of life (QoL) may increase up to 0.55 and cumulative may increase to 0.56 in the project region as the activity may bring development.

## 4.0 Environmental Impact Statement

### 4.1 Air Environment

The air pollutants relevant to the activities of barrge project were identified as $PM_{10}$, $PM_{2.5}$, $SO_2$ and NOx. Lower levels Particulate Matter were contributed due local atmospheric surroundings with flat plain area without industrial activities. The respirable particulate matter varied from 41-71 µg/$m^3$. The concentration of $SO_2$ and NOx were well within the established standards.

The potential air pollution sources are due to vehicular traffic. Presently the traffic density is concentrated on SH-9, NH-200. The vehicular density will be expected to rise after the construction of proposed barrage is completed. The impact of vehicular activity on air quality adjacent to vehicular movement on SH-9, NH-200 is predicted using CALANE – 4 model developed by USEPA. It is predicted that the maximum contribution to ground level concentrations of CO, HC, NOx and Particulate matter due to vehicular movement will be less than 5 µg/$m^3$ beyond 500 m from the road.

### 4.2 Noise Environment

On the basis of expected noise levels estimated through standard attenuation model, it is observe that general noise levels on the barrage site and in the surrounding villages will be within the prescribed standard limits.

### 4.3 Water Environment

The data collected during summer season indicates that surface water interms of river water is not fit for drinking water since it is bacteriologically contaminated. However maximum provision has been made to use this barrage water for supply to power plants purpose. If used for drinking purposed it should be chlorinated first. Due to maximum collection of rain water into the barrage, the dilution effect may reduce the mineral content and there will not be much impact on the productivity of soil and crops if used for lift irrigation.

The groundwater of nearby village is moderately mineralized interms of dissolved solids, hardness, chloride and sulphate. It was also found to be faecally contaminated at certain locations so proper precaution should be taken to avoid any further contamination of the ground water.

### 4.4 Land Environment

Soils of proposed Kudari Barrage project are dominantly (82%) deep to very deep (50 to 100 cm and above), dominantly (78%) medium to fine texture (c, sic, sil, sicl, l), retentive for available water (184 mm/m) good in infiltrability of surface water (0.95 cu/hr), moderate in drainability (0.7 cm/hr), calcareous in nature, moderately alkaline in reaction (pHs = 7.34-8.74), free from salinity (ECe = 0.28 – 0.85 ds/m) and sodicity (ESP = 1.49 – 3.12) hazards.

Hasdeo river water is of good quality physico-chemically, it can be used for lift irrigation (pH = 7.9, ECw = 420 µg/cm, SAR = 1.48 and RSC = Nil) and free from salinity and sodicity hazards. Groundwater from bore wells during summer season is also free from water salinity and sodicity hazards (pH = 7.33 to 7.68, ECw = 0.40 to 0.45 ds/m, SAR = 2.71 to 3.01). Residual sodicity of

groundwater is absent in 65 -75% of bore wells but is found high (RSC = 4.16 to 4.40 meq/l) in 35% observed wells i.e. Alkaline groundwater in certain pockets.

### 4.5 Biological Environment

The associated activities of the proposed Kudar barrage may have adverse impact on the natural vegetation and animal life. However, with the implementation of mitigation measures like tree plantation and greenbelt development, afforestation and irrigation activities, the ecosystem balance in the region will be restored to a great extent.

### 4.6 Socio-economic Environment

It is envisaged that implementation of welfare measures including provision of basic facilities / amenities would result into increase in subjective QoL Index ($QOL_{(s)}$) from 0.55 to 0.56. However, objective QoL index needs to be ascertained after implementation of EMP. Overall, there would be positive impact on socio-economic environment due to upliftment of living standard of the people as a result of implementation of suggestions given in EMP.

## 5.0 Environmental management Plan

The project activities during the preconstruction, construction and operational phase will have impacts, both positive and negative on various environmental components. An environmental management plan has been suggested for mitigation of adverse impacts and to maximize beneficial impacts.

The catchment area of 7795 sq.km has been divided into different watersheds based on the tributaries or nallahs, which are non-perennial. Under this CATP issues addressed are (i) forestry (ii) wood plantation (iii) soil conservation and irrigation proposals. Engineering measures include construction of check dams, contour bunding, trenches and bench terracing.

For effective implementation of recommended environmental monitoring plan, it will be necessary to establish and develop adequate facilities for sampling and analysis. It will be desirable to set up an environmental monitoring cell by Water Resource Department, Janjgir-Champa with competent trained staff and adequate instrumentation support.

The implementation of the mitigation plan should be regularly reviewed by a high level committee consisting of members drawn from Kudari barrage Project, Water Resources Department, Chhattisgarh, Pollution Control Board, Central Water Commission and Forest Department so as to ensure compliance with the recommendations.

Budgetary Provision for EMP (Rs. In lakhs) has been provided as under:

| | |
|---|---|
| 1) Health management Plan | - 27.95 |
| 2) Bio-diversity conservation plan | - 10.00 |
| 3) Fisheries Development & management plan | - Nil (benefited) |
| 4) Catchment area Treatment Plan | - 49.77 |
| 5) Environmental monitoring | - 60.2 |
| | 147.92 |
| | (Say 148 lakhs) |