

Executive Summary

1.0 Introduction

The Government of Maharashtra has prepared a scheme intending to provide irrigation facilities in Warud Taluka of Amravati District. This irrigation project is proposed in Godavari basin. The existing Groundwater Survey Department had carried out a detailed survey of the catchment area in the year 1990 and 1998. According to their investigation, yearly groundwater recharge is 5546.39 ha-m, whereas groundwater use is worked out to be 5847.66 ha-m. This shows that the yearly groundwater use is higher than the yearly groundwater recharge in the area and because of this, the bore wells and open wells have become dry. GSDA declared 48870 ha of land in Warud Taluka as dark watershed.

The dam across Shakti River is proposed to be constructed to fulfill the increasing demand of irrigation and to meet the acute shortage of water in this area.

Location of Dam Site and Diversion Site:

The proposed Dam site is called the Pandhari dam site and is located near the village Pusala in Warud Taluka of Amravati District. The dam site is located at Latitude of 21°31'55" (North) and Longitude of 78°21'45" (East). The Pandhari dam is proposed to be constructed on the Shakti river, which is the right bank tributary of Wardha river in Godavari basin. At the diversion site, it is proposed to construct a barrage across the river Wardha near village Pipalgaon to divert the flow of Wardha River through an intake structure. Diversion site is located at latitude 21°34'15" (North) and longitude 78°25'30" (East).

2.0 Project Description

Wardha Diversion medium level irrigation project has two sites. The first site is at village Pimpalgaon and the second site is at village Pandhari near Pusla village.

Diversion Weir

Diversion weir across Wardha river has an effective length of 230 m, which includes 103 m long earthen bund and a 10 m long NOF. Intake structure is

proposed at RD 417 m. Radial gate of 6m x 6m size is provided for intake structure. Feeder canal starts from intake structure and its length is 6.5 km and intended to divert flood water into Pandhari Dam. Capacity of feeder canal is designed as 70 cumecs having 6.72 m bed with full supply depth of 3.60 m. 52.60 Mm³ yield can be diverted through this feeder canal. In canal alignment path, there is deep cut of about 20 to 22 m in 2nd km and about 50 to 60 m between 4th and 5th km respectively. Tunnels are provided from R.D. 1290 m (300 m) and from RD 2790 m to 4440 m (1650 m). Bed with of tunnel is kept as 5.50 m with F.S.D. of 360 m.

Pandhari Medium Project

Dam across Shakti river at 2 km u/s of Pusla village of Warud taluka has a length of 3.3 km with maximum height of 25.09 m. The central gated spillway has length of 56.25 m with 4 radial gates of size 12m x 6.5m. It is proposed to pass the designated flood of 1469.50 cumecs. 16.50 km long right bank canal off taking at 3540 m is proposed to irrigate 8150 ha of land and right bank canal of Pandhari medium project is running at R.D. 1020 m to 1920 m.

Hydrology

From the stations are Multai Wai and Mahendri Monthly rainfall data of monsoon month of three rain-guage stations established in an around the catchment of Wardha diversion and proposed Pandhari dam site (67sq.km) site were used for analysis. Therainfall data was used for the period 1973 to 2003. The monthly monsoon yield generated at this site using rainfall-runoff correlation's is considered to compute annual series.

Catchment Area

The catchment area upto Wardha diversion project sites 347 sq.km out of which 5 sq. km is from Maharashtra and 342 sq.km is from Madhya Pradesh. Catchment area upto proposed Pandhri tank/dam project site is 67 sq.km out of which 49 sq.km. area is of Maharashtra and 18 sq.km area is of Madhya Pradesh

Dam and General Layout:

Maximum height of dam is 2500 m, and spillway is proposed between RD 1900 m to 2020 m with four gates of 12 m x 6.50 m size. The head regulator is proposed at RD 3540 m at Right flank of river. The tail channel is provided to carry the flood discharge to the main river.

Section of the Dam:

The soil samples for this project are collected and are being tested for different soil tests to decide the suitability of these soils. The detail of the section is as below; Top Width of Dam: 4.50 m. top width of dam is proposed for throughout the length of dam. Top level is 435.70 m; Slopes and berms: d/s Slope: 2:1 for height of 9.0 m with berms of 5.0 m at 9 m. After that slope 3:1 and 7 m. Then side slope 3:1 for remaining height of dam; u/s Slope: 3:1 for a height of 9 m. After that 3.5:1 for a remaining height of dam; Hearting Zone: The top width of Hearting is kept as 3.0 m. The Top level of hearting is kept at R.L 434.20 m. i.e., 0.5 m. above M.W.L. the u/s and d/s slopes for the Hearting Zone are provided as 1:1; Inclined Filter: An inclined sand filter of 1.0 m thickness is provided on the d/s slope of the Hearting zone upto R.L 433.70 m; u/s Slope Protection: Stone pitching of 30 cm thickness over a 15 cm. Sand bedding and 15 cm. Quarry spuals is provided from TBL to MDDL.; d/s Slope Protection: Pitched drains chutes & gutters are provided along the d/s slope and berms to drain out the rainwater.

Heading up weir at Diversion Site

Maximum flood discharge from the catchment area is worked out be 3356.35 cumecs. For which gated heading up weir is designed for the discharge. The discharging length has been worked out to be 90 m. It is observed that 5 lifts type gates of 15 m x 6.50 m size are sufficient to pass the design discharge. A deck bridge, hoisting arrangement etc., are provided on the piers and the abutments on both the sides. The foundation of the gated weir is decided on the basic of trial bores and it is 0.60 m in hard rock. Below foundation consolidation graviting is proposed.

Submergence:

The total area proposed to be acquired at this RL is 754.02 ha. This consists of 135 ha. of forest land and area 592.50 ha of private land and 26.52 ha of Government Land. No archeological importance or temples mosque going under submergence. The existing electric line for length at about 4.5 kms is likely to be submerged.

3.0 Baseline Environmental Status

Baseline environmental quality data was collected for various environmental components viz., air, noise, water, land, biological and socioeconomic environment within the impact zone of 10 km radial distance from the proposed site. The data was collected in the pre-monsoon season of the year 2007. The data

collected forms the basis for predicting and evaluating the potential impacts of the project and evolving an effective EMP for minimizing the adverse impacts.

3.1 Air Environment

Four major air pollutants viz., Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur Dioxide (SO₂) and Oxide of Nitrogen (NO_x) representing the basic air pollutants in the region were identified for AAQM.

The high volume samplers fabricated according to NEERI's design were used for air sampling. The significant air pollutants, viz., SPM, RPM, SO₂ and NO_x were monitored on 24 hourly basis. SPM and RPM were analyzed by gravimetric method. The gaseous pollutants (SO₂ and NO_x) were analyzed using standard wet chemical methods. 12 sampling locations were selected depending on the importance of site and/or sensitivity of the receptors around the proposed project.

Particulate Matter:

The minimum and maximum SPM values varied between 104-380 $\mu\text{g}/\text{m}^3$, while average SPM concentration varied in the range of 126-202 $\mu\text{g}/\text{m}^3$. The 98th percentile values of SPM ranged between 143-206 $\mu\text{g}/\text{m}^3$.

The RPM minimum maximum concentrations were observed to be in the range of 17-93 $\mu\text{g}/\text{m}^3$ in the study area. The averages of RPM concentrations at individual locations vary between 34 $\mu\text{g}/\text{m}^3$ and 73 $\mu\text{g}/\text{m}^3$. The 98th percentile values of RPM concentrations at individual locations vary between 59.9 $\mu\text{g}/\text{m}^3$ and 92.1 $\mu\text{g}/\text{m}^3$, which were below the CPCB standard (100 $\mu\text{g}/\text{m}^3$).

Gaseous Pollutants:

The average concentrations of SO₂ at individual stations were in the range of 9-16 $\mu\text{g}/\text{m}^3$, while the minimum and maximum concentrations were recorded between 4 $\mu\text{g}/\text{m}^3$ and 22 $\mu\text{g}/\text{m}^3$. The 98th percentile value of SO₂ varied in the range of 13-21 $\mu\text{g}/\text{m}^3$. The mean concentrations of NO_x were in the range of 6-16 $\mu\text{g}/\text{m}^3$ and the minimum and maximum concentration were observed to be in the range of 3-26 $\mu\text{g}/\text{m}^3$. The 98th percentile values varied between 9-25 $\mu\text{g}/\text{m}^3$. The cumulative percentile levels and the 98th percentile concentrations of SO₂ and NO_x were well within the stipulated standard (80 $\mu\text{g}/\text{m}^3$) of CPCB for residential, rural and other areas at all stations during study period.

3.2 Noise Environment

The sampling was carried out at 16 locations including dam and diversion site. The day time and night time noise levels for Residential, Commercial and Sensitive areas are reported. There were no industrial zones within the 10 Km radius of the study area. The background noise levels were measured using the Lutron SL-4001 Sound Level Meter.

The noise levels in the residential zone ranged between 47-57 dBA and 32-42 dBA during day time and night time. At the commercial zone, the noise level ranged between 60-66 dBA and 35-40 dBA during day time and night time. In the Silence zone, the noise levels varied from 44-50 dBA and 32-37 dBA during day time and night time respectively. The noise level in project site, ranged between 41-43 dBA at day time and 30-32 dBA at night time.

3.3 Water Environment

Surface Water:

The physico-chemical characteristics of water at Rawala Lake and Pulsi Dam (May 2007) were pH: 7.3 and 7.8; TDS : 264 and 222 mg/l; TSS : 42 and 35 mg/l. Alkalinity: 191 and 159 mg/l as CaCO₃; Total hardness: 249 and 175 mg/l as CaCO₃; Chloride: 32 and 29 mg/l; Sodium: 21 and 19 mg/l; Potassium: 3 and 4 mg/l whereas the Temperature for both the samples were the same i.e., 28°C.

The organic load in terms of COD was found to be 48 and 98 mg/l, whereas BOD was found to be 10 and 15 mg/l. Nutrients with respect to Nitrates were same for both the samples, i.e., 1 mg/l and Phosphates as 0.02 and 0.58 mg/l.

Groundwater:

The physico-chemical characteristics of groundwater indicates pH in the range of 7.5-8.1; temperature 27-29°C; turbidity 1 to 13 NTU, TDS: 311-1004 mg/l. The highest conductivity in groundwater was found in village Pusala followed by Dhanodi, Malkapur and Tiwasghat. Total Suspended Solids (TSS) concentration was in the range of 1-15 mg/l.

The inorganic parameters viz., alkalinity was in the range of 108-300 mg/l as CaCO₃; total hardness 223-567 mg/l as CaCO₃; chlorides 31-194 mg/l. Nitrates and phosphates were 1-8 mg/l and 0.01-0.52 mg/l respectively.

Bacteriological Characteristics:

Surface and ground water samples were collected in sterilized bottles and preserved. The samples were analyzed for total and faecal coliforms by membrane filtration technique.

The results of bacteriological analysis of samples collected from river showed total coliform counts varying from 300-360 CFU/100 ml and faecal coliform counts as 30-40 CFU/100 ml. The groundwater samples show total coliform between 35-620 CFU/100 ml and faecal coliforms as ND-45 CFU/ 100 ml. The presence of faecal coliforms in both surface water and groundwater warrants the need for chlorination before consumption.

3.4 Land Environment

For assessment of land environment soil samples from 13 locations were collected in the study area and analysed for relevant parameters.

Physical Properties:

Physical characteristics of soil samples are delineated through specific parameters, viz., particle size distribution, texture, bulk density, porosity and water holding capacity. The particle size distribution in terms of percentage of sand, silt and clay show that the soil in study area is clay followed by sandy clay loam.

The bulk density of soil in the region is in the range of 1.18-1.36 g/cm³, which is considered as moderate. Variations in soil porosity and water holding capacity of the soil are in the range of 38.6 - 58.81% and 40.2 - 62.60% respectively.

Chemical Properties:

pH of the soil in the study area was observed to be in the range of 7.2-7.6, which indicates that soil is neutral. The soil samples from villages Khaperkheda, Sawangi and Loharn are slightly alkaline as their pH was found the range of 7.9 to 8.1. The electrical conductivity of the soil extract was in the range of 0.209 to 1.040 dS/m.

Amongst the soluble cations, Ca²⁺ and Mg²⁺ were observed in the range of 1.28 to 1.96 and 0.03 to 0.60 meq/l respectively and Na⁺, and K⁺ were in the range of 0.51 to 1.9 and 0.2 to 1.3 meq/l of soil extract respectively.

Majority of soil in the region has very high adsorption capacity as their Cation Exchange Capacity (CEC) is more than 30 cmol (p⁺) kg⁻¹. The soils from villages Wathoda, Pandhari and Mahendri have moderate adsorption capacity.

Amongst the different exchangeable cations, calcium is prominent followed by magnesium. The concentrations of calcium and magnesium vary from 11.8 to 30.6 cmol (p⁺) kg⁻¹ and 8.2 to 14.4 cmol (p⁺) kg⁻¹ of soil respectively. Sodium and potassium were in the range of 1.2 to 3.0 cmol (p⁺) kg⁻¹ and 0.6 to 1.8 cmol (p⁺) kg⁻¹ of soil respectively.

Organic carbon in soil samples vary in the range of 0.34 to 0.52 kg/ha, which was low and available phosphorus and potassium varies from 11.0 to 18.4 and 206.2 to 316.2 kg/ha respectively. However, available nitrogen showed low value (180.2 to 274.6 kg/ha).

Soil samples were also analyzed for heavy metals content with minimum and maximum concentration such as Chromium (Cr) 2.2-7.3 mg/kg, Zinc (Zn) 12.1-22.1 mg/kg, Lead (Pb) 17.7-27.3 mg/kg, Nickel (Ni) 8.2-15.1 mg/kg, Cadmium (Cd) 1.06-1.97 mg/kg, Cobalt (Co) 33.4-65.4 mg/kg, Manganese (Mn) 151.7-343.7 mg/kg, Iron (Fe) 7525.4-16395.4 mg/kg and Copper (Cu) 13.1-39.6 mg/kg.

Soil Microbiology:

The Total Viable Count (TVC) of soil varied from (15 x 10⁶ to 27 x 10⁶ CFU/g). Different microflora observed of soil samples were Fungi (3 x 10⁴ to 5 x 10⁴ CFU/g), Actinomycetes (2x 10⁴ to 6 x 10⁴ CFU/g), Rhizobium (2 x 10⁴ to 6 x 10⁴ CFU/g) and Azotobactor (2 x 10⁴ to 5 x 10⁴ CFU/g).

Land Use/ Land Cover:

Landuse/ land cover pattern of the study area was carried out by Remote Sensing Technique, using IRS 1 C LISS III data. The region has been divided into five major categories or classes namely, agricultural land, forests, wasteland, water bodies and built-up land. Agricultural land consists of 83.48% of the study area which is further categorized into five sub-classes namely Cropland (68.27 %), Plantations (8.13 %), Fallow (3.41 %), land with scrub (3.11 %), Land without Scrub (0.56 %). Forests make 10 % of the whole region. Wasteland comprises 3.89 %, water bodies 1.39 % while built-up area comprises of 1.24 % of the study area.

3.5 Biological Environment

Total 18 sampling location were selected for study on biological survey based on topography, land use, vegetation pattern, The observation were taken in submergence area of proposed dam diversion site including forest area (reserved forest, and community forest), non-forest area (agricultural field, riverside and villages).

Biodiversity in Study Area:

According to Forest working Plan of Amravati Forest Division (2004-2005), a total of 119 plant species were reported which consist of 69 trees, 15 shrub, 10 herb, 15 grass and bamboos and 10 climbers. 63 plant species were recorded, which consist of 43 trees, 7 shrubs, 2 herb, 5 grasses and bamboo.

The most common tree in the study area are *Tectona grandis*, *Azadirachta*, *Butea monosperma*, *Pongamia pinnata*, *Dalbergia sisso* and *Acacia nilotica*. The common shrubs in study area were *Nerium sp.*, *Datura sp.* Dominant families recorded in the study area were Acanthaceae, Caesalpiniaceae, Combretaceae, Ebenaceae, Euphorbiaceae, Fabaceae, Labiaceae, Leguminosae, Lamiaceae, Lythraceae, Meliaceae, Mimosaceae, Moraceae, Myrtaceae, Papilionaceae, Poaceae, Rubiaceae, Rutaceae, Rhamnaceae, Sapotaceae, Tiliaceae, Verbenaceae.

Floristic Structure and Composition:

Many medicinal plants were found amongst which *Azadirachta indica*, *Acacia nilotica*, *Ficus bengalensis*, *Pongamia pinnata*, etc. Total density of all plant species present in rural area is 180/ha. Simpson's diversity index (SDI) for trees in study area is observed to be 0.068.

Medicinal Plants:

The study area shows remarkable presence of medicinal plants. Out of total 63 plants studied, 22 plant species comprising 16 trees, 1 herb, 1 shrub, 2 grasses and 1 bamboo having medicinal value. The common herbal medicinal flora of the study area consists of trees *Aegle marmelos*, *Azadirachta indica*, *Tamarindus indica*, *Butea monosperma*, *Embllica officinalis* and shrub *Vitex negundo* and herb *Ocimum sanctum*.

Reserved Forest:

There is one reserved forest i.e., Mahendri reserve forests in the study area. The teak forests and mixed forests mainly consist of *Tectona grandis*, *Azadirachta indica*, *Terminalia chebula*, *Terminalia arjuna*, *Albizia odoratissima*.

Wildlife Habitat:

During the field survey, only one snake species (Krait) was sighted in a nearby village Malkhed but no wild animal was observed during the survey in the forest. This may be due to hot climate as the survey was conducted in the last week

of May 2007. Squirrels were sighted in all the sampling locations and monkeys were also observed.

Avifauna:

The actual count of birds was made by the standard survey technique. Maximum number of species of birds that were observed at Pusli and Tiwasaghat were 8, followed by 7 species at Dhanodi and Malkapur, while 5 species at Pusla, Loharn, Linga, Pandhari and Karwar. However minimum numbers of 4 species were observed in Wai, Khaperkheda, Wathoda and Sawangi. Birds like black drongo, cormorant, purple sunbird, cattle egret, Indian myna, Indian ring dove, sirkeer cuckoo and spotted owlet, bar headed goose, blue tailed bee eater, painted francolin, pheasant tailed jacona and oriental white eye were observed in the study area and are the most prominent species.

3.6 Socio-economic Environment

The total population of the study area is 46665 of which 24087 are males and 22578 are females. The sex ratio (number of female per thousand male) in the region is 937. The project area spreads in 25373 ha and corresponding population density is 44 people per sq/km. The literacy rate is 66.38% and more than 57.25% of the main workers are engaged in agricultural activities.

Most of the villages are having basic infrastructural facilities like drinking water supply, medical, power supply, P & T and communication.

Socio-economic survey was conducted in randomly selected 17 villages within 10 km radial distance and data was collected for the indicators of quality of life. The average cumulative Quality of Life Index (QoL) of the study area was estimated to be 0.43.

4.0 Environment Management Plan

Based on the baseline data collected during pre-monsoon season for various environmental components viz., air, noise, water, land, biological and socio-economic as well as prediction and evaluation of impacts, strategies and control measures have been formulated for minimizing the potential adverse impacts due to installation and commissioning of proposed project. The component wise EMP measures are delineated as follows:

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
A. Pre-Construction Phase				
1	Public Acceptance	<ul style="list-style-type: none"> Positive programme of information, effective communication and public education in the back drop of the EIA Report 	<ul style="list-style-type: none"> Irrigation Department, Public Relation Department 	<ul style="list-style-type: none"> Separate fund to be provided
2	Land Acquisition	<ul style="list-style-type: none"> Strict compliance of the rehabilitation and resettlement scheme approved by the state Govt. for the project 	<ul style="list-style-type: none"> Irrigation Department, Revenue Department 	<ul style="list-style-type: none"> Families will be rehabilitated by constructing houses for each family by irrigation Department
3	Social Disruptions	<ul style="list-style-type: none"> Payment of monetary compensation and / or rehabilitation and resettlement of project affected people 	<ul style="list-style-type: none"> Irrigation Department, Revenue Department 	<ul style="list-style-type: none"> As monetary compensation
4	Monitoring of Shakti River	<ul style="list-style-type: none"> Conduct monitoring studies of dam upstream and downstream of Shakti river to determine baseline status 	<ul style="list-style-type: none"> Irrigation Department, Other Government lab. 	<ul style="list-style-type: none"> Monitoring studies need additional funding. This is a continued activities and financial provision should be made even in operational phase
B. Construction Phase				
5	Site clearance	<ul style="list-style-type: none"> Minimum damage to existing structures, flora and fauna and other infrastructure service Identify sites for stocking construction materials, avoid water ways 	<ul style="list-style-type: none"> Irrigation Department Irrigation Department 	<ul style="list-style-type: none"> Foundation excavation. This can be considered with clearing the site for the bed of reservoir Since the quarry selected for rubble is only 4 km away from dam site much stocking will not be required
6	Earth work Excavation	<ul style="list-style-type: none"> Ensure unobstructed natural drainage through proper drainage channels/structure 	<ul style="list-style-type: none"> Irrigation Department 	<ul style="list-style-type: none"> Foundation excavation of dam including blasting is partially completed. This can be considered while

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
				construction of balance length of canals
		<ul style="list-style-type: none"> ▪ Disposal surplus excavated earth at identified site ▪ Ensure minimum hindrance to normal local activities and business 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ Land is already acquired for the purpose of dumping of debris ▪ This can be observed during the construction of dam and canals
7	Vegetation	<ul style="list-style-type: none"> ▪ Plantation on area/and the periphery of construction site to minimum visual impact and soil erosion ▪ Programme the work to avoid loss of standing crops in the submergence area 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ Separate provision is made in the project estimate ▪ This can be considered after finalizing the programme of construction of dam
8	Ecological Resources	<ul style="list-style-type: none"> ▪ Plantation programme near dam site and submergence area for compensation. ▪ If excavation has to be done in usable land, top soil (30 cm) shall be preserved and returned after construction work is completed, so as to minimize impact on ecosystem agriculture etc. 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ Can be implemented at the time of plantation programme ▪ Can be implemented as the project work progresses
9	Soil Erosion/Silt Runoff/Sediment Transport/Water Quality	<ul style="list-style-type: none"> ▪ Provision of cut off drains and holding tanks ▪ Grow Different Varieties of grass on the loose soil ▪ Ensure steps to prevent earth and stone from silting upto existing natural drainage system 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ Irrigation department should take up the project work

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
		<ul style="list-style-type: none"> ▪ Reasonable measures to prevent direct discharge of polluted waters from construction activities into water bodies ▪ Minimum exposure of soil types susceptible to wind and water erosion ▪ Treatment of borrow pit, quarries, runoff and erosion control through proper drainage channels and structures ▪ Plant along the shoreline of reservoir 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ This can be achieved by periodical wetting of work site which will increase the cost of the project ▪ Separate provision is to be provided in the project estimate to accommodate this recommendation
10	Soil Compaction	<ul style="list-style-type: none"> ▪ Restrict traffic movements and use low ground pressure machines ▪ Preserve top soil to be replaced after completion of construction activity ▪ Avoid Wet Soils 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ No remarks ▪ No remarks ▪ No remarks
11	Road Construction/ Disruption of Service	<ul style="list-style-type: none"> ▪ Minimum interruption to utility services through proper planning and scheduling of activities and inter-departmental coordination ▪ Prevent slope destabilization and provide workers safety while reconstruction of road 	<ul style="list-style-type: none"> ▪ Irrigation Department /Local Bodies ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ No remarks ▪ No remarks

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
		<ul style="list-style-type: none"> Preference to local workers/skilled persons during construction, operation and maintenance 	<ul style="list-style-type: none"> Irrigation Department 	<ul style="list-style-type: none"> No remarks
12	Dust/Air Pollution	<ul style="list-style-type: none"> Dust control through sprinkling of water at construction site and access roads particularly in place near village Stock piles and storage areas shall be covered or watered to prevent dust pollution Trucks to transport construction materials shall be covered to minimize spills/accidents 	<ul style="list-style-type: none"> Irrigation Department Irrigation Department Irrigation Department/ Local Bodies 	<ul style="list-style-type: none"> Provision made in the project
		<ul style="list-style-type: none"> Periodical and preventive maintenance of construction equipment and vehicles to meet emission standards 	<ul style="list-style-type: none"> Irrigation Department, / Motor Vehicle Department/Local Bodies 	
13	Noise Pollution	<ul style="list-style-type: none"> Check the measure taken by the manufacturers to minimize noise while procuring machinery equipment 	<ul style="list-style-type: none"> Manufactures of Equipments, Irrigation Department / Contracting Agency 	
		<ul style="list-style-type: none"> Provide car mutt/plugs/ personnel protection equipment to workers working near machines, boring sites and crushers operation Ensure proper maintenance of machines and trucks to keep them with low noise 	<ul style="list-style-type: none"> Irrigation Department / Contracting agencies/ Local Bodies Irrigation Department / contracting agencies/ Local Bodies 	

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
		<ul style="list-style-type: none"> ▪ Sound barriers shall be installed and trees shall be planted as appropriate during the construction phase 	<ul style="list-style-type: none"> ▪ Irrigation Department 	
14	Risk of Accidents	<ul style="list-style-type: none"> ▪ Ensure workers/public safety and minimize accidents through efficient lighting equipment and safety signs shall be installed at work sites and temporary road and efficient traffic regulation ▪ Provide temporary crossing/ bridges to facilitate normal life and business ▪ During construction, effective safety and warning measures shall be adopted to reduce accidents 	<ul style="list-style-type: none"> ▪ Irrigation Department/ Local Bodies ▪ Irrigation Department ▪ Irrigation Department 	
15	Catchment Area Planning and Treatment	<ul style="list-style-type: none"> ▪ Control and treatment measures related to runoff and soil loss 	<ul style="list-style-type: none"> ▪ Irrigation Department 	
16	Disposal of spoils/debris	<ul style="list-style-type: none"> ▪ Soil erosion control measures at the identified spoil disposal site ▪ Ensure disposal of spoils/ debris at identified and demarcated site ▪ Avoid damage to slopes and fields and operate disposal sites with care ▪ Undertaken restoration of areas used for dumping of muck disposal 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department ▪ Irrigation Department ▪ Irrigation Department 	<ul style="list-style-type: none"> ▪ No Remark

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
17	Construction Camps	<ul style="list-style-type: none"> ▪ Provide chlorinated drinking water at the camps and shall meet the national potable water standards ▪ Ensure adequate public health facilities to workers ▪ Adequate measures, such as provision of septic tanks/sanitary pit latrines shall be taken at the construction camp sites for sanitary disposal of excreta ▪ Garbage shall be collected in garbage cans at fixed places & disposed in land fills 	<ul style="list-style-type: none"> ▪ Irrigation Department / Water Authority/ Local Bodies ▪ Irrigation Department / Health Department ▪ Irrigation Department / Constructing Agencies / Local Bodies ▪ Irrigation Department /Local Bodies 	<ul style="list-style-type: none"> ▪ No Remarks ▪ The hospital building is partially completed at dam site which can be renovated to satisfy this recommendation ▪ No remarks ▪ Separate provision shall be provided in the estimation. So project cost will increase
18	Traffic and Transport	<ul style="list-style-type: none"> ▪ Local construction materials shall be used as much as possible to avoid long distance transport of construction materials, especially earth and stones ▪ Adequate action to direct traffic shall be taken in consultation with highway and police department when roads are jammed during the construction period 	<ul style="list-style-type: none"> ▪ Irrigation Department ▪ Irrigation Department / Traffic Police 	<ul style="list-style-type: none"> ▪ No remarks
19	Aesthetic Impairment	<ul style="list-style-type: none"> ▪ Aesthetic enhancement through proper housekeeping of construction sites ▪ Disposal of construction wastes at the identified disposal site (s) 	<ul style="list-style-type: none"> ▪ Irrigation department ▪ Irrigation Department / PCB 	<ul style="list-style-type: none"> ▪ No remarks ▪ No remarks

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
		<ul style="list-style-type: none"> Complete construction activity by removing all temporary structures, restoring the project and surrounding areas as near as possible to the pre-construction condition 	<ul style="list-style-type: none"> Irrigation Department 	<ul style="list-style-type: none"> No remarks
C. Post-Construction Phase				
20	(a) Reservoir Operation	<ul style="list-style-type: none"> Incorporate operational mechanism in the dam design to allow minimum flow downstream of dam to maintain riverine ecology. The mechanism provided shall be free from human interference. 	<ul style="list-style-type: none"> Irrigation Department / PCB 	<ul style="list-style-type: none"> No remarks
	(b) Barrage	<ul style="list-style-type: none"> The carrying capacity of the river up to RL 447.75 m is about 3125.0 cumecs considering afflux due to abstracted water way of barrage so during high flood bottom of gates should be lifts above RL 447.50 	<ul style="list-style-type: none"> Irrigation Department 	<ul style="list-style-type: none"> No remarks
21	Change in Hydraulic Regime	<ul style="list-style-type: none"> Ensure such minimum flow of water immediately downstream of dam during lean season to maintain the riverine ecology 	<ul style="list-style-type: none"> Irrigation Department / PCB 	<ul style="list-style-type: none"> To be studied and fixed
22	Surface Water Contamination	<ul style="list-style-type: none"> Provide regular reservoir water quality monitoring to facilitate control Protection of bund slopes through appropriate measures such as stone/ concrete pitching and turfing to minimize erosion 	<ul style="list-style-type: none"> Irrigation Department /PCB /NGOs Irrigation Department 	<ul style="list-style-type: none"> No remarks No remarks

Sr. No.	Environmental Issue	Action to be taken	Agency responsible for Action	Remark
		<ul style="list-style-type: none"> Harvesting of fishes prior to initiation of desilting of dam to prevent fish mortality 		
23	Catchment area Planning & Treatment	<ul style="list-style-type: none"> Control and treatment measures related to runoff and soil loss Afforestation of degraded forest land and strict adherence to periodic updating 	<ul style="list-style-type: none"> Irrigation Department Irrigation Department / Forest Department 	<ul style="list-style-type: none"> No remarks Funds to be provided the project estimate
24	Disposal of Spoils/debris	<ul style="list-style-type: none"> Soil erosion control measures at the identified spoil disposal sites Ensure disposal of spoils/debris at identified and demarcated sites Avoid damage to slopes and fields and operate disposal sites with care Undertake restoration of areas used for dumping of muck disposal 	<ul style="list-style-type: none"> Irrigation Department / PCB Irrigation Department Irrigation Department/ PCB Irrigation Department 	<ul style="list-style-type: none"> Since separate space is already allotted for dumping of debris by acquiring land soil erosion control at post constructional phase will not be difficult No remarks Since separate space is already allotted for dumping of debris by acquiring land soil erosion control at post constructional phase will not be difficult
25	Others	<ul style="list-style-type: none"> Implement a well planned programme of human resource development aimed at increasing the competence and capabilities of technical and administrative personnel at all levels 	<ul style="list-style-type: none"> Irrigation Department 	

4.0 Resettlement and Rehabilitation for the Project Affected People

Through detailed field investigations, it is observed that the project would displace one village comprising a population of 231 people.

The socio-economic conditions are represented through a set of Quality of Life (QoL) indicators. For the construction of dam project, the land acquisition process involves seven villages. From the survey two basic issues emerged pertaining to the project affected families.

Socio-economic Survey in Project Affected Villages:

Through detailed field investigations, it was observed that the total land (including both agriculture and non-agriculture land) has been acquired from seven villages out of which five villages are inhabited, while two villages (Rampur and Humanpeth) are uninhabited but the owner of the agricultural land are from Pusla village. The project affected villages are Khaperkheda, Pandhari, Pusla, Pipalgaon, Karwar. Total land acquired from these 7 villages is about 931 ha.

- ◆ Total agricultural and non-agricultural land will be acquired from Khaperkheda village for the proposed project.
- ◆ Out of the total land acquired for the proposed project, approximately 26.52 ha of land is government land and 210 ha is forest land, while 695.43 ha is private land.
- ◆ The primary occupation of the people is mainly agriculture and most of them are engaged as agricultural labourers. The major crops grown are cotton, Jowar, soybean, oranges and other crops are Bajra, pulses etc. The average annual income of the people of the project affected villages is in the range of Rs. 10-15 thousand per year through agricultural.
- ◆ Almost all the people in the Project Affected Villages are aware about the project and land acquisition. They fear that acquisition of land may affect their source of income.

Policy:

The principles and provisions set out for rehabilitation of the displaced families, at their new resettlement/village site without affecting their social and economic life are described below:

- ◆ Each project affected family, which will be rendered houseless on account of acquisition of land /house for the project shall be entitled for residential houses.
- ◆ While developing the rehabilitation sites, modern civic amenities such as Panchayat, power supply drinking water facility, drainage facility, health centres, schools, market and transport etc.
- ◆ For imparting education to the children, primary and middle school shall be provided. Further, to avoid the difficulties of travelling long distances, high school facility shall also be planned.
- ◆ Electrification at the resettlement site shall be carried out.
- ◆ Free transport facility for conveyance of dismantled material and household articles from the existing houses to new settlement sites shall be made available to the villages.
- ◆ A community hall for the new village shall be constructed for socio-cultural activities, functions, ceremonies and services.
- ◆ A playground shall be constructed in the new village, and a metalled road from the rehabilitated village upto the dam site shall be constructed
- ◆ Project authorities should provide vocational training and preference in employment to the affected people. These facilities will help the villagers to earn their livelihood.
- ◆ The facilities like post office, police post and bank should be extended to the villagers by the project authorities and these should be located near the project colony.

Land Details of Project Affected People

Sr. No.	Name of Village	Total Land (in ha)	Land Acquired (in ha)	Proposed land for allotment (in ha)
1.	Khaperkheda	209.6	54.61	248.91
2.	Pandhari	162.85	43.93	108.8
3.	Pusla	702.86	371.39	38.78
4.	Rampur	178.69	174.7	45.80
5.	Humanpeth	610.57	12.46	13.23
6.	Pipalgaon	330.52	11.26	4.8
7.	Karwar	511.41	27.08	27.55
Total		2706.5	695.43	487.87

Source: Information provided by proponent