



1.0 SUMMARY AND CONCLUSIONS OF EIA

1.1 Introduction on Kochi Barrage Project

Government of Maharashtra (GoM) has been giving utmost importance for developing the irrigation projects for transforming the underutilized dry lands into perennial green fields and enriching lives of people, particularly in the drought prone areas. The Pench Project is one of such projects undertaken in the past and irrigating considerable extent of Nagpur district through its Left Bank and Right Bank Canals. The Pench Right Bank Canal (PRBC) provides irrigation to the areas falling between Kanhan River in the north and Nag River in the south. Besides providing irrigation facility PRBC supplies water for industrial needs of Koradi Thermal Power Station (KTPS) and drinking water to Nagpur city. On account of diversion of substantial quantum of PRBC waters meant for irrigation in the command area to KTPS and Nagpur city, the downstream areas beyond Nagpur city, have started facing water shortages for irrigation. This has forced the authorities to suspend water supply to 3960 ha irrigable command area south of National Highway-6 which fall in the tail end portions of the PRBC command area in Kamptee tahasil of Nagpur district. These conditions have resulted in agitations by the affected farmers of the tail-end portions of PRBC command area for restoring irrigation in their area.

In view of the fact there are no other dependable water resources other than Kanhan River to restore irrigation facility in the affected area; and no site other than at Kochi is suitable for storing the share of 15 TMC Kanhan River water allocated to Maharashtra with least submergence, the only most-suitable site at Kochi has been selected for construction of a barrage.

1.2 Benefits of Kochi Barrage Project

The following are the anticipated benefits from the Kochi Barrage Project:

- With provision of assured quantum of water this project will restore irrigation facility in 3960 ha irrigable command area under PRBC.
- This project would transform lives of about 20000 people in this drought prone area and enrich their quality of living;
- About 5.87 Mm³ water will be supplied for drinking purposes of Nagpur city, Khapa municipal area and Badegaon villages;
- About 15.0 Mm³ additional water will be supplied for expansion of KTPS;
- About 2.00 Mm³ drinking water will be provided to the submergence villages of Madhya Pradesh free of cost;
- As the proposed command area under this project is an integral part of the existing PRBC command area, this has full-fledged distribution network and comprehensive command area development works, hence additional CAD works are not required;
- Percolation of surface water into sub-soil will recharge the deep groundwater tables and raise groundwater levels to some extent;
- The feeder canal alignment passes through gently sloping terrain without any major undulations; hence the shallow canal construction does not envisage deep cuttings or major embankments that may result in water seepage;
- The distributaries were provided with lining, hence seepage from canals is not anticipated;
- Water logging problems are not anticipated good terrain slopes, moderate percolation rates and deep groundwater tables;



- As all CAD works and drainage measures were already completed long ago, hence drainage problems are not anticipated in the command area;
- This project will provide immense benefits in the command area and facilitate multiplier effect for comprehensive infrastructure and economic development of the region as well as Maharashtra State.

1.3 Necessity of EIA & EMP for Kochi Project

Kochi Project is a water resources development project proposed for supplying water for irrigation, industrial need and drinking purposes. Being this project involves in land acquisition, displacement of people and submergence aspects; this is likely to create some adverse environmental impacts, though these are anticipated to be minimal. In order to mitigate the likely adverse environmental and social impacts; to ensure that the existing environmental and socio-economic conditions will further improve, but in no case deteriorate; an Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP) are essential. Also from the statutory point of view, that the proposed irrigable command area under this project is about 3960 ha; this project requires environmental clearances from the Ministry of Environment and Forest (MoEF). In order to meet the statutory requirements, the EIA and EMP have been prepared by covering the following major aspects:

1. Establishing the existing environmental and socio-economic conditions in the proposed project area through review of literature and conducting primary environmental monitoring, covering Pre-monsoon, Monsoon, Post-monsoon seasons of year 2009 and winter season of 2010;
2. Environmental Impact Assessment i.e. assessing the impacts of the proposed project on various environmental and socio-economic parameters;
3. Developing an Environmental Management Plan for outlining mitigation measures for limiting any likely adverse environmental and social impact due to the proposed project and to ensure the environmental conditions in the project area would improve further for environmental sustainability and in no circumstances, these would deteriorate;
4. Social Assessment for assessing the Socio-economic status of the project affected persons and displaced persons from the submergence area;
5. Developing a Rehabilitation & Resettlement Plan for resettling the displaced persons of 4 villages from the dam seat and submergence area;
6. Developing a Compensatory Afforestation Plan for compensating the loss of forest due to the project;
7. Developing a Greenbelt Development Plan at the foot of the dam, along the feeder canal and main canal;
8. Developing a Catchment Area Treatment Plan for the intercepted catchment area of the project;
9. Developing the Muck Disposal Plan for stacking the surplus muck from the barrage and canal sites;
10. Developing a Fisheries Development Plan in the reservoir;
11. Developing a Conservation Plan for the severely affected fauna if any;
12. Suggesting improvements to the existing Command Area Development Plan, if required;
13. Identification of critical environmental and socio-economic attributes that require monitoring and developing a post-project monitoring program; and
14. Providing a framework for institutional strengthening and implementation of the suggested mitigation measures in the Environment Management Plan.



1.4 Baseline Environmental Status

The existing baseline environmental conditions in the project area have been established through review of secondary data and primary field surveys covering aspects related to land use, micro-meteorology, ambient air quality, water quality, soil quality, noise levels, aquatic and terrestrial ecology, socio-economic conditions of people, healthcare facilities and infrastructure development. The primary surveys for assessing the surface and groundwater quality, and groundwater fluctuations were conducted in all 4 seasons of the year covering Pre-monsoon, Monsoon, Post-Monsoon seasons of 2009 and of and winter season of 2010. All the other environmental surveys were conducted during the Pre-Monsoon and Post-Monsoon seasons of year 2009. The socio-economic surveys of the Project displaced persons were conducted once during the EIA period.

1.4.1 Physiography of the Project Area

The catchment area of the project consists of different types of landforms such as hills, foot hills, river valleys and plains. However the command area of the project has gently sloping terrain and facilitates irrigation by gravity. A few minor irrigation tanks and ponds exist in the command area.

1.4.2 Geology

The only geological formation in Kochi area is the Deccan basalt flows with intertrappean beds at places. The river banks are covered by alluvium, sand and silt. No minerals of economic importance are known to occur in any part of submergence and command area.

1.4.3 Seismicity

In the seismic zoning map of India as per IS 1893 (Part-I):2002, the Kochi Barrage site falls in Zone-II, which is not considered to be prone for severe earthquakes. Moreover, being this is only a barrage project storing moderate quantum of water that too from the later part of the monsoon, this project will not create any seismic impact.

9.4.4 Meteorology & Climate of Project Area

The climate of project area is characterized by general dryness throughout the year except during the southwest monsoon season. The project area falls in the 'Scarcity' agro-climatic zone and the rainfall completely depends on vagaries of monsoon. This area frequently faces severe drought conditions resulting in partial or complete failure of crops and lead to scarcity conditions.

The cold season prevails from December to the middle of February. This is followed by hot season which lasts till the end of May. June to September is the south-west monsoon season and the two months October and November, constitute the post-monsoon season.

Winds are light to moderate in other seasons and during south-west monsoon these become stronger. The mornings are calm as compared to the evenings.

In western parts the climate is pleasant with moderate temperatures and becomes hotter in the east. May is the hottest month while December is the coldest month. The lowest temperature recorded was at 6.5⁰ C on January 11, 1999 and the highest temperature was recorded at 47.7⁰ C on June 5, 2003.



The command area remains dry during the pre-monsoon and winter, whereas during, monsoon and post-monsoon season there is increase in the moisture levels in the air. The morning least relative humidity varied from 21% during pre-monsoon to the highest maximum of 89% during winter. The evening relative humidity ranged from least 11% during the pre-monsoon season to the highest 84% during monsoon season.

The rainfall showed considerable variations from year to year. The average annual rainfall during 1997-2006 was 1145 mm and varied from the lowest 749.2 mm in 2004 to highest of 2054.8 mm in 2006. The heaviest rainfall in 24 hr recorded at Nagpur during the past decade was 800 mm on June 22, 2006.

1.4.5 Soil Environment

Soils of the project catchment and command area belong to the black cotton soil and are deep blackish in colour. These are good in fertility but some of them contain higher to moderate concentrations of calcium carbonate.

In order to assess the quality of soil, 13 soil samples each were collected and analyzed during Post-Monsoon of 2009 and Pre-Monsoon of 2010. These showed slight/moderate alkaline conditions with reference to pH, which is a common phenomenon in drought prone areas. Organic carbon is low in these soils. Potassium is very high while nitrogen is very low and phosphorus is low. The micro-nutrients associated with heavy metals in soils showed deficiency of zinc. The hydraulic conductivity is slow to moderately slow. This indicates that the area is free from pollution, but deficient in some micro nutrients.

1.4.6 Water Environment

Kanhan River and its tributaries Jam Nadi and Khekhra Nalla are the important water courses in the free catchment area of project. All these rivers are non-perennial and the flows mostly confine to monsoon and some part of post-monsoon. During pre-monsoon season all rivers practically go dry. On account of prevailing virgin natural settings along Kanhan River, no industrial effluents or mine wastes are dumped in this river; hence the water quality of this river is good and suitable for irrigation.

The groundwater tables are very deep both in the catchment and command areas of the project and only marginal groundwater table fluctuations have been reported in these areas during different seasons of the year. In order to assess the groundwater table fluctuations in the project area primary monitoring of groundwater tables in 5 wells of catchment area and 12 wells of command area covering all seasons of the year was undertaken. This monitoring undertaken during Pre-Monsoon, Monsoon and Post-Monsoon seasons of 2009 and winter season of 2010 revealed deeper groundwater tables ranging from 5.45-15.63 m below the ground level. Only marginal groundwater table fluctuations were recorded in these wells during different seasons of the year. In view of this scenario even after provision of irrigation in the command area, only marginal increase in groundwater tables is anticipated and in no circumstances the risen water tables would cause water logging problems.

For establishing water quality in the project area during each season, altogether 13 groundwater samples and 5 surface water samples have been collected from different representative locations of the study covering the submergence and command area; and analyzed in a laboratory recognized by the Ministry of Environment and Forests.



The water quality at different locations of Kanhan River has been found to be neutral. As there is no intervention of industrial effluents and chemicals heavy metals in water have been found to be within prescribed limits. However, fecal pollution in river water is noticed due to the anthropogenic activities along the river. Kanhan River water is suitable for irrigation; and also suitable for drinking, however only after disinfection.

In general the groundwater quality is moderate and at some locations more hardness, higher concentrations of calcium carbonates have been found. It is anticipated, after restoration of assured irrigation in the command area some percolation of surface water into the sub-surface will take place and the dissolved solids and hardness in groundwater will be diluted at least to some extent.

1.4.7 Noise Environment

In order to establish the prevailing ambient noise levels and to assess the impacts of noise generation due to construction activities, the noise monitoring was carried out in 8 locations covering the barrage site, canal alignment, muck disposal site and transportation corridor during Pre-monsoon and Post-Monsoon seasons of 2009. The baseline noise levels ranged from 59.1 -65.4 dB(A) which are well within the permissible levels for rural and residential areas.

1.4.8 Air Environment

The proposed Kochi Project is an irrigation project hence air pollution by means of burning fuels, emitting large volume of gases, etc. are not involved in this project. The air pollutants causing some minor impacts in the local area around the construction sites are dust generated due to excavation, blasting, movements of vehicles and dumping of muck at disposal sites; and marginal gaseous emissions resulting from to operation of DG sets, dewatering pumps and movements of vehicles. These pollutants are anticipated to be minimal mostly confining to the construction sites and along roads and feeder canal.

In order to establish the prevailing ambient air quality and to assess the impact of project construction activities on the local environment, baseline ambient air quality monitoring was conducted in pre-monsoon and post-monsoon seasons of 2009 at the proposed barrage site and feeder canal alignment, as these are the only air quality impacting areas in the entire project area. Air quality monitoring was conducted at Kochi and Nandapur on either bank of Kanhan River and at Tighai on the proposed feeder canal alignment. The outcome of these surveys in both seasons revealed that all air quality parameters such as SPM, RPM, SO₂ and NO_x are within permissible limits and in conformity with the National Ambient Air Quality standards prescribed by CPCB for rural/residential areas.

1.4.9 Land Use Pattern

Land use pattern of the project catchment area has been established through review of secondary data and also through interpretation of latest satellite imageries. This revealed that crop-land is the most predominant land use followed by water bodies mainly covering Kanhan River, scrub lands, degraded forests (zudpi jungles), built-up areas and barren lands.

Land use pattern in the project command area revealed cultivated land is the most predominant land use followed by built-up areas, water bodies and scrubs. No lands are left as fallows.



1.4.10 Ecology

There are some forest patches in the submergence area belonging to the categories of zudpi jungles and protected forests. While the zudpi jungles mainly consist of shrubs and few big trees, protected forests have moderate vegetation. Thick vegetation is absent in the project submergence area. In the command area other than vegetation on the field bunds and along roads, no forest or thick natural vegetation is prevailing.

There are no wildlife sanctuaries or wildlife protected areas in the entire project area. Excessive biotic interference in the region has resulted in dry conditions hence xero phytic species are predominant.

The existing ecological conditions in the project area have been established based on review of secondary information and also by conducting detailed primary ecological field surveys during the Pre-Monsoon and Post-Monsoon seasons of 2009. These surveys were conducted at 4 terrestrial sites and 2 aquatic locations in and around submergence area; and at 2 terrestrial sites and an aquatic location along the feeder canal alignment. In the command area 5 terrestrial sites and 2 aquatic locations have been covered under ecological surveys.

Altogether 406 species of plants have been recorded during the primary sampling studies. The vegetation studies showed highly degraded landscapes due anthropogenic disturbances. Although clear cutting was not observed in the sampling sites, disturbance in terms of heavy grazing is found to be common. The tree cover is sparse and mostly consists of exotic and invasive species. The submergence and command areas do not contain any endangered or threatened species of plants having significant conservation value.

Aquatic ecological studies revealed the presence of different species of algae, phytoplankton and zooplankton in Kanhan River. The biotic community composition reveals these are mesotrophic with neutral or moderately rich nutrients indicating absence of pollutants.

The fauna of the study area mostly consists of commonly occurring species; and no endangered species have been reported. About 84 bird species are reported from the area, mostly around the rivers. Most of the birds belong to Schedule IV. Only House crow, Jungle crow and Common hawk are listed in Schedule V. No birds belonging to Schedule VI i.e. endangered, threatened, vulnerable categories are observed in the study area.

There are about 12 species of mammals in the area and all of them belong to Schedule-II to IV. Only House rat, Grew musk shrew and bat have been found to be in the Schedule-V category. About 22 species of reptiles belonging to Schedule-II and V categories and about 37 types of fishes are reported from the project area. About 22 species of butterflies have been noticed in the study area.

1.4.11 Health care Systems

The study area has poor network of health facilities. Saoner town about 13 km from the barrage site and Kamptee at about 17 km from the command area have Rural Hospitals. Khapa, Kelod and Badegaon located at about 8-10 km from the submergence area have Primary Health Centres (PHC). Waroda within the command area and Kuhi at about 4 km from command area have PHCs. Most of larger villages have health sub-centres. Besides these regular medical services under the supervision of doctors and paramedical staff, some public institutions



such as selected Gram Panchayats, Schools and Anganwadi centres also function as the Drug Distribution Centres for preventive healthcare. There are a few private clinics in bigger villages.

Few malarial diseases are reported from the project area, and these are mainly due to the water storage habits of people in view of prevailing scarcity conditions. More occurrences of Malaria have been reported during pre-monsoon and post-monsoon months during May and November. No epidemics related with JE have been reported during the past five years.

Regular anti-malarial activities like spraying and also undertaking biological control measures by means of culturing Guppy fish in hatcheries near the mosquito breeding places for preventing mosquitoes breeding are being practiced. Besides administering medicine to the patients, Passive Surveillance by collecting blood smears, intensive mass surveillance activities are carried out regularly.

1.4.12 Demography and Socio -Economic Conditions

1.4.12.1 *Socio-Economic Conditions of Command Area*

The total population of project command area as per 2001 Census was 19843 souls residing in 4081 households. This reveals an average family size of about 5 (4.86) persons per family. The male population worked out to be about 51.33% and the females to be about 48.67%. The sex ratio, which is expressed as the number of females per 1000 males, was observed to be only 948, which is considered to be low.

About 17.09% of command area people belonged to Scheduled Castes (SC) while about 4.66% belonged to Scheduled Tribes (ST) thus indicating that socially weaker section/ backward caste people constituted to about 21.75% of total population.

The command area experienced a lower literacy rate of 64.77%. The male literacy rate, i.e. the percentage of literate males to the total literates worked out to be 71.79%. The female literacy rate, which is an important indicator for social change, was observed to be 57.36% only.

Only 55.57% of command area people are engaged in one or the other income-earning activities and fall under the category of workers. These include of 42.79% population engaged as main workers and 12.78% people engaged as marginal workers. The remaining 44.43% people are unemployed or in the categories of children and the old.

The distribution of workers by their occupation indicates that agricultural labourers are the most predominant category of workers constituting to about 33.5% population followed by the cultivators who worked out to about 10.7% population. The main and marginal agricultural labourers formed about 18.08% and 9.25% of total population, thus indicating that about 27.33% population belonged to category of agricultural labourers. The main and marginal cultivators formed about 17.67% and 2.74% of total population, thus indicating that about 20.41% population belonged to category of cultivators.

The main and marginal household industrial workers constituted to about 2.31% and 0.13% of total population respectively while revealing a mere 2.44% population of the command area is engaged in household industrial works.



Industrial development is poor in the villages proposed for irrigation under this project, though some small scale industries are located outside the command area. Only 2.44% of command area population is engaged as industrial workers.

1.4.13 Land Acquisition & Resettlement Issues

Altogether about 869.86 ha private lands will be acquired for the dam seat, submergence and feeder canal; and this land is owned by about 748 landowners (PAFs). Most lands proposed for submergence face frequent floods of Kanhan River.

Due to proposed construction of barrage in the immediate vicinity of Kochi village, all 625 families of this village will be resettled in an alternate location away from the barrage site. Due to formation of reservoir and storage of water 2 villages of Maharashtra namely Dhalgaon Khairi and Raiwadi will be partially submerged and about 431 families from these villages may require to be resettled on higher grounds outside the submergence area. Similarly 19 families located in agricultural fields in Khapa Padriwar village in Chindwara district of Madhya Pradesh will be displaced due to submergence. All displaced families of these 4 villages will be resettled in the proposed resettlement colonies outside the areas of submergence. The rehabilitation & resettlement of displaced families of Kochi, Dhalgaon Khairi and Raiwadi villages in Maharashtra will be done as per the provisions of the Maharashtra Project Affected Persons Rehabilitation Act, 1999. The 19 families located in agricultural fields of Khapa Padriwar village in Madhya Pradesh will be paid monetary compensation for the loss of their houses along with compensation to affected land.

1.4.14 Places of Historical and Archaeological Importance

There are no temples or monuments notified by the Archaeological Survey of India as well as the Maharashtra State Archeology Department, within the submergence and command areas of the project.

1.5 Environmental Impact Assessment

Kochi Project will provide immense benefits to the drought prone area by means of restoring irrigation facility in the severely affected command area, providing additional industrial water for expansion of KTPS and drinking water to Nagpur city. While giving only benefits to the existing command area of PRBC, this project will not have any adverse impact on this command area. Due to its moderate submergence area this project is not anticipated to cause major environmental impacts, though some minor impacts related with land acquisition and submergence of zudpi jungle would take place; which however would be mitigated with appropriate management measures.

1.5.1 Impacts during Construction Phase

Being this is a barrage project not involving mammoth concrete dam structures the only moderate levels of construction activities would take place and are not anticipated to be very high. Levelling of site for construction of the barrage, excavation of feeder canal, transportation of excavated material from the project sites, stacking the surplus muck, etc. will be undertaken during construction phase and all these will have some short-time impacts that will be confined only to the construction phase. These impacts would be permanently ceased after the barrage construction.



During construction period on account of blasting, drilling, operation of DG sets and dewatering pumps and plying of heavy earth moving vehicles, trucks and dumpers, etc. the dust levels in the atmosphere will be increased. Also the gaseous emissions from vehicles, DG sets and oil engines will cause for minor increase in gaseous pollutants at the project sites. Hence these would have some temporary impacts on the ambient air quality in the area, though these are not anticipated to be high. No village including the nearest Nandapur will be affected due to air pollution, as this village is located at about 1 km from the barrage site.

Burning of firewood/fuel by the construction workers for their cooking may have minor impact on the local air quality, which however can be avoided with provision of alternate cooking fuel such as kerosene or L P gas, if feasible.

Construction of barrage will be taken-up when there is no/ little water in the river, hence water pollution due to construction activities will not take place. Though some minor flows exist in the river this water will be diverted away from the active construction site and will be conveyed through well defined channels. Hence contamination of river water due to construction activities is not likely to take place.

The major noise generating activities during barrage and canal construction phase would be the drilling, excavation, operation of construction equipment, plying of construction vehicles and blasting. During the construction phase, the construction activities would have some noise impacts on people and wildlife. The anticipated noise levels would be around 80-90 dB(A) at the project site during the peak hour construction period. As controlled blasting would be undertaken, this will have only marginal impact on the nearest Nandapur village located at about 1 km distance. However, this would have some temporary impact on the wildlife in vicinities of the barrage site and may cause their temporary shifting to other areas either to the upstream or downstream of the barrage site.

The barrage construction and transportation activities during the construction phase would cause some disturbances to the local fauna, hence temporary shifting of fauna from the barrage site to the upstream or downstream areas along the river slightly away from the barrage site may take place. As there are plenty of similar habitat areas along the river in upstream and downstream, the impact on fauna will be minimal.

In the barrage construction and excavation of feeder canal considerable extent of employment will be generated and this will be a major positive impact. For the unskilled and semi-skilled workers, preference will be given to the local people; hence these will be the most beneficial ones due to project construction, which is a positive impact.

1.5.2 Impact during Operational Phase

During the post-construction phase all environmental impacts occurred during construction stage would be ceased. During this phase most positive impacts due to water supply for industrial, drinking and irrigation purposes will be resulted. Adverse environmental impacts including the drainage impacts in the command area are not anticipated during this phase the full-fledged command area development works including drainage works have already been completed long ago.



1.5.2.1 Positive Impacts

- **Impact on Social Environment**

During the operational phase Kochi Project would provide immense benefits to farmers of this drought prone area by means of dependable and assured irrigation facilities. This will enable the farmers who at present are hardly taking a single crop to take at least 2 crops with enhanced cropping pattern and crop yields. A large number of agricultural labourers who are getting wage labour only for a few weeks in a year at present will secure assured employment for about 6-9 months in a year. The fisheries development in the reservoir and rivers would lead to enhanced income to the fisher-folk having access to the fisheries. All these are positive impacts due to the project and would transform the living conditions of people in the command area and fisher-folk having approach to the reservoir.

Besides providing irrigation facility and direct employment to the entire command area, this project would indirectly create impetus to the development of agro-based and allied ancillary industries and infrastructure development in the region and provide direct and indirect employment to a large number of people. This will lead for overall economic development with a multiplier-effect in the backward area and will enhance revenue accruals to the State exchequer.

- **Impact on Land Use**

Kochi Barrage Project will restore assured irrigation facility to 3960 ha and transform the presently kept dry lands into lush green irrigated fields. The greenbelt development around the barrage, feeder canal and main canals in the command area would enhance scenic beauty and aesthetics in the project area. Due to submergence of the project the existing agricultural lands and Zudpi jungles in the submergence area will be inundated and a sheet of water will occur in the previous land area.

- **Impact on Surface Water Resources**

By formation of reservoir and storing the water which otherwise was draining-out to the downstream areas, this project will enhance surface water resources in the region, which is a positive impact. As water utilization will be limited only to the allocated quantum by the Godavari Water Disputes Tribunal, this project will not have any adverse impact on the competing water users and their riparian-rights in downstream areas. Due to release of controlled water flows from the barrage in the non-monsoon seasons the downstream areas of Kanhan River will contain adequate water throughout the year.

- **Impact on Groundwater Resources**

Due to presence of water for longer duration in the river, reservoir, feeder canal, irrigation canals and fields of command area; percolation of water into the sub-surface will take place. This will recharge the groundwater tables which are very deep at present to some extent. This is a positive impact due to the project.

- **Impact on Ecology and Bio-Diversity**

Due to formation of a moderate size reservoir and feeder canal and presence of water for long duration in these water bodies and command area many birds from the adjoining drought prone areas and also from faraway places are likely to be



attracted to this region. The enhanced presence of avifauna in the reservoir and river will substantially improve ecological conditions. Increased moisture content in soils of river banks will increase greenery and fodder availability and this will facilitate more nesting sites for birds and habitats for wildlife.

There are no rare or endangered fauna in the project area. Also migration-routes of avifauna are absent in this area. Hence adverse impacts associated with the sensitive biological aspects are not involved in this project.

Due to controlled water releases from the reservoir to the downstream areas of the river, no adverse impacts on the downstream ecology are anticipated.

Due to construction of barrage and formation of reservoir the previously existed nesting sites and wildlife habitats will be inundated and force them to shift to other nearby areas, which is an adverse impact. However, due to moderate size of the reservoir in the huge Kanhan River valley, plenty of areas suitable for nesting of birds and habitats of wildlife are available on river banks; hence the affected wildlife will shift to these new areas. As habitat requirements of local fauna are too general and can be served by the amply available adjacent areas, no impact on wildlife will be occurred.

- Impact on Climate

Due to presence of water in the reservoir, rivers, canals and irrigated fields for more duration of the year, relative humidity in atmosphere will be increased and this would bring-down ambient temperatures in this summer-scorch region.

- Impact on Aesthetics

Construction of dam and formation of reservoir and canals will create water fronts in the region and will improve the aesthetic values in this otherwise dry area. The reservoir may facilitate boating and water sports. The proposed tree plantations around the dam and canal, and development of gardens at the dam-foot will enhance scenic beauty in the project area. These will serve as picnic spots in the region and may attract many tourists; which are positive impacts due to the project.

1.5.2.2 Likely Adverse Impacts

- Impact on Soil

Major extent of the command area has moderate slopes and soils have moderate infiltration rates. Command area development plans have already been implemented and all the required irrigation structures and drainage have already been provided in the entire command area. The ground water tables in the command area are very deep hence problems associated with rise in water tables and resultant water logging and soil salinity are not anticipated in the command area. Even if any such problem would arise in the future, this can be mitigated with improved surface and sub-surface drainage arrangements.

- Impact on Noise Levels

During the post-construction phase of the project all noise generating activities will be ceased. The only major noise generating activity during this phase is operation of barrage gates, that too only when the reservoir is full. The noise generated due



to the barrage gate operations will be about 70 dB(A), hence will not have any noise impact even on the nearest human settlement of Nandapur located at about a kilometer from the barrage.

- Impact on Ambient Air Quality

During the operation phase of the project, no air quality impacts would be involved.

- Impact on Wildlife

After formation of reservoir the wildlife in the submergence area will move to other nearby areas, as the habitat requirements of the local wildlife are general; and ample numbers of suitable sites for their habitats are available in the nearby areas. Though this is an adverse impact this would occur and have only a temporary impact.

In the initial days of canal excavation, due to dissection of the area by the canal, the excavated canals may act as barriers for free movement of people and animals. These would however cross the canals above the constructed bridges, after construction of the bridges. Hence, the impacts will be temporary.

- Impact due to Excess Use of Fertilizers and Pesticides

In the post-irrigation scenario, if farmers tend to use more fertilizers and pesticides these may result in soil and water pollution. Hence, it should be essential to use the fertilizers and pesticides in a judicious manner without causing soil and water pollution.

- Impact on Human Health

With presence of water for more duration, the humidity levels in the atmosphere will be increased and this may lead to some water related vector borne diseases. Also due to possible proliferation of mosquitoes and snails, some water borne diseases are likely to be resulted during the monsoon and post-monsoon seasons in the command area.

1.6 ENVIRONMENT MANAGEMENT PLAN

Kochi Project would have some social and environmental implications though they are anticipated to be the minimum. To further minimize the environmental losses and negating adverse impacts to the possible extent through technical judgment and implementation of appropriate mitigation measures, an Environmental Management Plan has been developed.

9.6.1 Environment Management Plan during Construction Phase

The following mitigation measures during construction period would be needed:

- Undertaking excavations and construction activities at the project sites with utmost care to the environmental aspects and safety measures;
- Using the generated muck from project sites for constructing the earthen dam if suitable, or filling the low-lying areas;
- Stacking the surplus material in identified muck disposal sites away from the project site, with appropriate slopes, in a systematic manner;



- Compacting of muck dumps, covering them with topsoil excavated from construction sites and undertaking plantations on them for minimizing erosion;
- Adopting appropriate measurers for minimizing vibrations and noise levels during blasting;
- Carrying out construction activities only during daytime in order to avoid noise impacts on the surrounding areas;
- Undertaking dust control measures such as water sprinkling on the haul roads;
- Maintaining the diesel powered construction vehicles properly, for minimizing smoke emissions;
- Providing noise protection devices like earmuffs and earplugs to the workers operating the high noise generating equipment;
- Providing adequate numbers and sizes of road bridges wherever the canal severs the existing road/cart tracks;
- Providing footbridges wherever the traditional paths are severed due to canal construction;
- Provision of cooking fuel to construction workers through contractors to prevent felling of trees for fire wood for their cooking; and
- Provision of separate and adequate sanitation facilities for male and female workers and providing septic tanks to toilets at construction camps.

1.6.2 Management Plan during Operational Phase

The following mitigation measures would be required during the operational phase of the project:

- Undertaking tree plantations at the dam-foot, around the dam and along the canal;
- Growing grasses on the muck dumps formed along the canals for their strengthening, and preventing from erosion;
- Nurturing the plantations through the Social Forestry Department, at least for 3 years till the plants become self-sufficient;
- Providing sub-soil drainage at places where water logging is anticipated;
- Imparting training to farmers for optimal use of fertilisers and pesticides as per the actual requirements of crops based on scientific evaluation of fertility status; and preventing their excessive use, which otherwise may adversely affect the crops;
- Implementing crop-cycling for improving organic matter in soils and giving slight inputs of nutrients to enhance the crop pattern and crop yields;
- Undertaking periodic water quality testing of Kanhan River, and if the water quality is not meeting the standards, appropriate treatment measures would be undertaken for ensuring proper water quality;
- Ensuring no illegal felling of trees takes place in the vicinity of project sites;
- Minimizing movement of project vehicles and excessive blowing of horn and lighting during night time to avoid disturbances to wildlife in project area;
- Undertaking strict law enforcement measures for conservation of wildlife near the dam and along canal;
- Undertaking appropriate measures for development of fisheries and aquatic life in the reservoir;
- Preventing excessive growth of aquatic weeds in reservoir for controlling nutrition levels, and to allow free-flow of water in canals;
- Creating fisheries hatcheries and culturing fish in existing tanks of the command area and reservoir for creating employment to people and improving water quality in water bodies;



- Undertaking catchment area treatment plans and soil conservation measures in critical areas prone to soil erosion by means of watershed management plans by the Soil Conservation wing of Agriculture Department and Forest Department of Government of Maharashtra for minimizing sedimentation in reservoir and other water bodies; and
- Flushing out silt from the reservoir by opening gates during monsoon.

9.6.3 Command Area Development

The command area of Kochi Barrage Project is an integral part of PRBC, where adequate command area development measures have already been implemented. These include development of water resources, judicious method of water application, suitable soil and crop management practices and scientific scheduling of irrigation. These mainly included:

- Conservation measures such as land levelling, land shaping, smoothening, grading, land development and forming earth bunds;
- Field drains with appropriate sizes;
- Efficient surface drainage for removal of excess water due to heavy rains/seepage from canals or excessive irrigation;
- Efficient sub-soil drainage for removing the excess water from the sub-soil areas; and
- Stabilizing, strengthening and deepening the existing main drains to the possible extent for enabling them to carry excess water from fields, rapidly.

1.7 Public Health Management

Public Health management measures include:

- Undertaking adequate curative and preventive measures for eliminating the risk of outbreak of any water borne and parasitic disease in the area;
- Strengthening the existing healthcare facilities by appointing adequate number of medical and paramedical staff;
- Maintaining good environmental, health and sanitation conditions at the construction camps; and
- Carrying out regular surveillance and health improvement programs by the Health Department for preventing health disorders in command area.

1.8 Post-Project Monitoring and Management

During post-project monitoring stage, for effective environmental management soil and water quality in some critical areas of the command area may need to be monitored. Developing an Environmental Management Program under the Coordination Committee of the Water Resources and Agriculture Departments and implementing the identified mitigation measures in the identified environmentally problem areas, if any would safeguard environmental conditions in the project command area.

1.9 Organization for Environment Management

The Superintending Engineer and Administrator Command Area Development Authority would implement the proposed Environment Management Plan in coordination with various departments of GoM.



1.10 Budgetary Allocation for Environmental Measures

The total cost of Kochi Project is estimated to be about Rs. 26225.278 lakhs as per the Schedule of Rates of Nagpur region for year 2007-08. Costs on environmental aspects such as plantations along the feeder canal and downstream of dam is Rs. 18.258 lakhs.

1.11 Conclusions

The proposed Kanhan River Project will provide assured surface water irrigation facility to 3960 ha ICA. With provision of its immense benefits to the irrigation scarce drought prone area of Kamptee tahsil in Nagpur district, this project would lead for overall socio-economic and infrastructure development of the region. By supplying considerable quantities of food and non-food products, this project would be beneficial even to the other areas. **With impressive Benefit Cost Ratio of 1.542 and least minimal environmental and social impacts; the proposed Kochi Barrage Project is justifiable.**