



1.0 EXECUTIVE SUMMARY

1.1 Introduction on Bhagadi Larger Minor Project

Government of Maharashtra (GoM) has been giving utmost importance for developing irrigation projects for transforming the underutilized dry lands into perennial green fields and enriching lives of people, particularly in the drought prone areas. The Bhagadi Larger Minor Project is one among such projects.

There have been persistent demands and agitations by farmers of the drought prone areas of Achalpur and Chandur Bazar tahasils of Amravati district for assured surface-water irrigation facility, as their areas are totally dependent on mercy of monsoon and frequently facing droughts. Groundwater in this area contains slightly higher levels of calcium carbonates, dissolved solids and hardness; and not much agreeable for irrigating the soils which also have slightly higher levels of calcium carbonates. As these soils are well-suited for irrigation with surface water as the source, GoM is making all possible efforts for tapping all surface water sources by constructing dams, barrages and lift irrigation schemes across the rivers and nalas in the region. Bhagadi Larger Minor (LM) Project across Bhagadi Nala near Talni village of Chandur Bazar Tahasil is one among such projects.

After conducting detailed investigations, on account of minimum submergence area the project site at Talni was finalized for construction of dam and formation of reservoir. This project would provide safe irrigation facility to 985 ha irrigable command area in Achalpur tahasil of Amravati district.

1.2 Benefits of Bhagadi LM Project

The following are the anticipated benefits from this project:

- With provision of assured and quality surface water for irrigating 985 ha ICA, this project would transform the lives of about 6000 people in the drought prone area and enrich their quality of living;
- About 0.719 Mm³ water will be supplied for drinking or industrial purposes in the nearby areas of the project;
- Project would provide immense benefits to its command area and would have multiplier-effect in development of the region;
- Irrigation through application of good surface water on the soils having higher concentrations of calcium carbonates would considerably dilute the prevailing salts in soils; and would facilitate improved cropping patterns and achieving higher agricultural productivity;
- Percolation of surface water into subsurface would dilute the prevailing higher concentrations of calcium carbonates and salts thus improving the groundwater quality;
- Deeper groundwater resources will be recharged to some extent due to percolation of surface water into subsurface;
- The prevailing deep groundwater levels would never pose any problem associated with water-table rise after provision of irrigation;
- Seepages from canal would be minimum as the terrain has gentle slopes; and only shallow canals not requiring deep cuttings or major embankments will be developed;
- Least drainage problems are anticipated due to availability of adequate ground slopes to drain-out excess water from fields;
- Absence of reserved forests or ecologically sensitive areas in the project area.



1.3 Description of Bhagadi LM Project and its Salient Features

Bhagadi LM Project is planned across Bhagadi Nala in the revenue area of Talni village in Achalpur tahasil of Amravati district, at about 34 km from Amravati city. The location of this project and its catchment and command areas are shown in **Figure-1**.

The salient features of this project are presented in **Table-1**.

TABLE-1
SALIENT FEATURES OF BHAGADI LARGER MINOR PROJECT

Sr. No.	Head	Particulars of Data/ Information
1	Location	Talni Village
	Latitude	20° 09' 34" N
	Longitude	77° 33' 51" E
	Toposheet No.	55 G/11 and 55 G/12
2	Name of water body	Bhagadi Nala
	River basin	Tapi
	Sub-basin	Purna
3	Catchment area	
	Gross catchment area	32.069 sq km
	Free catchment area	32.069 sq km
	Upstream reservation	Nil
	Classification of catchment area	Good
4	Rainfall	
	Influencing rain gauge station	Achalpur
	50% Dependable monsoon rainfall	20.638 cm
5	Yield	
	50% Dependable yield	6.931 Mm ³
	Net yield available for water planning	7.917 Mm ³
	Annual utilization	7.07 Mm ³
	Upstream reservation	Nil
	Spill over	0.698 Mm ³
6	Losses	
	Evaporation losses	1.395 Mm ³
	Silt losses	0.57 Mm ³
7	Storage Capacity	
	Gross storage at Full Reservoir Level (FRL)	5.576 Mm ³
	Live storage	5.366 Mm ³
	Dead storage	0.21 Mm ³
8	Controlling Levels	
	Nala Bed Level (NBL)	328.130 m
	D Supply Level (DSL)	332.600 m
	Minimum Draw Down Level (MDDL)	334.000 m
	FRL	339.500 m
	Highest Flood Level (HFL)	341.350 m
	Top Bund Level (TBL)	342.850 m
9	Details of Dam	
	Type of dam	Rolled Filled Earthen Dam
	Maximum height of dam	14.72 m
	Length of dam	2460 m (including waste weir)



Sr. No.	Head	Particulars of Data/ Information
10	Spillway	
	Type of spillway	Channel type
	Location	Left side of dam (396-540 m)
	Length of spillway	144 m
	No. of gates	Nil
11	Head Regulator (HR)	
	No. of Regulators	1
	Location of HR	On left bank of nala at RD 330 m
12	Canal	
	Total length of Main Canal	8790 m
	Left Bank Canal	8790 m
	Right Bank Canal	Nil
	Irrigable Command area under LBC	985 ha
13	Land Requirement for Project	
	Total area	224.08 ha
	Submergence area	174.00 ha
	Government land	Nil
	Submergence ratio	15.45% (< 25%)
14	Command Area	
	Gross Command Area (GCA)	1213 ha
	Cultivable Command Area (CCA)	1103 ha
	Irrigable Command Area (ICA)	985 ha
	Tahasils benefited	Achalpur (Amravati district)
	Villages benefited	6
15	Cost Economics	
	Total estimated cost	Rs. 1954.093 Lakhs
	Cost/ Mm ³ of Gross Storage	Rs. 347.95 Lakhs
	Cost/ ha of ICA	Rs. 1.445 Lakhs
	Benefit Cost (BC) Ratio	1.755 (> 1.00)
	Economical Rate of Return	17.19%

1.4 Necessity of EIA & EMP

Bhagadi Larger Minor Project is an irrigation project for providing irrigation facility to 985 ha ICA; hence this requires an Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP); and environmental clearances from the Maharashtra State Environment Impact Assessment Authority (MSEIAA). 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 project area through review of literature and also conducting primary environmental monitoring, covering 3 seasons of year 2012;
2. Environmental Impact Assessment i.e. assessing the anticipated impacts of Bhagadi LM project on various environmental parameters;
3. Environmental Management Plan for outlining mitigation measures for limiting any likely adverse environmental and social impact due to the project and to ensure the environmental conditions in the project area would improve further for environmentally sustainability and in no-circumstances, these would deteriorate;



4. Social Assessment for assessing the socio-economic impacts of the project on the project affected persons due to land acquisition from them;
5. Rehabilitation Action Plan for improving the socio-economic conditions of the project affected persons;
6. Suggesting a Command Area Development Plan;
7. Reviewing the requirements of Catchment Area Treatment Plans in view the project area falls in the zone not-prone to severe soil erosion;
8. Identification of critical environmental and socio-economic attributes requiring monitoring during operational phase; and developing a suitable post-project monitoring program;
9. Providing a framework for institutional strengthening and implementation of the suggested mitigation measures.

1.5 Baseline Environmental Status

The existing baseline environmental conditions and social aspects pertaining to the project area are established through review of secondary data and also by conducting primary field surveys covering environmental components of meteorology, ambient air quality, noise levels, soil quality, groundwater table fluctuations, aquatic and terrestrial ecology during pre-monsoon and post-monsoons seasons; and water quality during 3 seasons viz. pre-monsoon, monsoon and post-monsoons seasons of EIA period. Land use pattern and socio-economic conditions of project affected persons have been studied once during the study period.

1.5.1 Physiography of the Project Area

The catchment as well as command area of the project has gently sloping terrain falling towards Bhagadi Nala. No tank or pond exists in the entire project area.

1.5.2 Geology

The only geological formation at the dam site, its catchment and command areas is alluvium. No other geological formations or minerals are known to occur in any part of the project area.

1.5.3 Seismicity

In the seismic zoning map of India, the Bhagadi Project site falls in Zone-II, with a basic horizontal seismic coefficient of 0.029, which is not considered to be prone for severe earthquakes.

1.5.4 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.

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 representing the retreating-monsoon.

May is the hottest month while December is the coldest month. Based on the IMD, Amravati observatory monitored data during 1997-2009 the lowest temperature recorded was at 5.3^o C on 27th February 2000 while the highest temperature was recorded at 46.6^o C on 5th June 2003.

The area remains dry during the pre-monsoon and winter, whereas during the monsoon and post monsoon season an increase in moisture levels in air takes place. The morning least relative humidity varied from 30% during pre-monsoon to the highest maximum of 97% during monsoon. The evening relative humidity ranged from least 14% during pre-monsoon to the highest of 93% during monsoon.

The average annual rainfall of project area during 1997-2009 was 662.75 mm. The highest rainfall of 1000.7 mm was recorded in 1999 and the lowest 60.0 mm in 2009. The heaviest rainfall during any 24 hours duration was received on 14th June 2001 measuring about 194.8 mm.

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.

1.5.5 Air Environment

Bhagadi LM Project is an irrigation project hence the impacts related with air pollution are minimal and exclusively prevail during construction phase. Baseline ambient air quality monitoring was conducted at 6 locations covering vicinities of the dam site, proposed canal alignment and other areas in different directions from the dam site during Pre-monsoon and Post-Monsoon seasons of 2012. This revealed that all tested air quality parameters such as PM₁₀, PM_{2.5}, SO₂, NO₂ and CO were within permissible limits conforming to the National Ambient Air Quality Standards prescribed by CPCB for rural/residential areas.

1.5.6 Noise Environment

Noise monitoring was carried out at 6 locations of the study area during pre-monsoon and post-monsoon seasons. This revealed the maximum Leq ambient noise levels at different locations of the study area varied from 42.7 to 51.5 dB(A) during day time. These were found to be within the permissible levels for rural and residential areas.

1.5.7 Soil Environment

Soils of project area belong to the Purna alluvium and are deep blackish in colour. These are good in fertility but contain slightly higher levels of calcium carbonates.

During EIA period, 6 soil samples were collected from different locations of the project area during Pre-monsoon and Post-monsoon seasons and were tested for their physic-chemical characteristics. These showed slight alkaline conditions with reference to pH, which is a common phenomenon in this area. None of the soil samples showed acidic conditions. In these soils nutrients of organic carbon and phosphorus are low. Potassium is very-high and nitrogen is very-low. The remaining soil quality parameters are well-within permissible limits. This indicates that the area is free from pollution, but deficient in some nutrients.



1.5.8 Water Environment

Purna and Sapan Rivers are important water courses in vicinities of project area. These are non-perennial and the flows are mostly confined to monsoon and some part of post-monsoon. During pre-monsoon season both rivers go practically dry.

Groundwater is available in limited quantities that too at more depths. As the project area consists of thick alluvium, only marginal groundwater fluctuations take place during the Pre-monsoon and Post-monsoon seasons. As assessed by Groundwater Surveys and Development Agency, GoM, very few wells are feasible in this region.

During EIA period, primary water table fluctuations have been measured at 9 open wells during Pre-monsoon and Post-monsoon seasons of 2012. Occurrence of groundwater at more depths ranging from 10-20 m below the ground level (BGL) has been found. These varied from 11.37 m BGL at Sawalapur in vicinities of Purna River to 21.73 m at Meghnathpur. Among the monitored 9 wells, only marginal groundwater table fluctuations ranging between 0.14 and 0.67 m have been noticed during Pre-monsoon and Post-monsoon seasons. In view the project area is situated in thick alluvial region where only marginal water table fluctuations take place, this area is not likely to experience drastic water table rise after introduction of irrigation facility. Hence no problems associated with increased groundwater tables such as water logging or its induced soil salinity in the post-irrigation period are anticipated.

Groundwater quality in the project region is moderate with slightly higher levels of calcium carbonates, dissolved solids and hardness, while making this water not much agreeable for drinking, however suitable for irrigation for growing saline-resistant crops.

For establishing water quality, 6 groundwater samples from different locations of the project area were collected during three seasons of 2012 and analyzed. Three surface water samples were collected during monsoon and post-monsoon seasons when water was available in water bodies. No sampling was possible as these water bodies went dry. Water quality of all surface water bodies revealed neutral conditions. Due to absence of any industrial activity in the project area there is no interference of industrial or chemical pollution which is established due to non-detectable levels of heavy metals in surface as well as groundwater. Minimal levels of fecal pollution in surface water areas were noticed attributing to anthropogenic activities in vicinities of rivers and nala.

Groundwater quality reveals presence of slightly more levels of calcium carbonates, dissolved solids, hardness in some analyzed samples. However these are within the permissible limits for irrigation on normal soils. It is anticipated, after introduction of irrigation in the area, due to percolation of surface waters into sub-surface, the dissolved solids and hardness in groundwater will be diluted to some extent by improving groundwater quality and also soil quality.

1.5.9 Land Use Pattern

Land use pattern of the project catchment area, command area and also the area falling within 10 km radius around the project location has been established based on digital interpretation of satellite imageries by deploying GIS techniques.



It is revealed that crop land is the most predominant land use accounting to 69.27% of the area followed by the lands with or without scrubs (14.45%) and current fallows (13.49%). Almost all current fallows are normally cultivated, however left as current fallows during certain times. The field surveys and ground-truthing conducted in the project command area revealed that almost all current fallows are agricultural lands and cultivated in one or the other season though at times these are left as fallows. Inclusive of these current fallows the agricultural lands works out to 82.76% of the project area.

1.5.10 Ecology

There are no natural forest growths in any part of the project area. Also there are no wildlife sanctuaries or protected areas within 10 km from the project area.

Baseline ecological conditions in project area have been established based on review of secondary information; and also by conducting primary field surveys at 5 terrestrial and 2 aquatic sample sites during pre-monsoon and post-monsoon seasons. These represented different physiognomic and habitat categories. Altogether 134 plant species have been recorded during the study period.

Considerable biotic interferences and anthropogenic disturbances resulted in dry conditions while limiting the vegetation to xerophytic species. Although clear cutting of trees was not observed in sampling areas, disturbance in terms of grazing has been found. The tree cover is sparse and consists of native and exotic species. No endangered or threatened species of plants having significant conservation value have been reported either in the submergence area or command area of the project.

Aquatic ecological studies in Bhagadi Nala and Sapan River revealed presence of different species of algae, phytoplankton and zooplankton. Biotic community composition revealed their mesotrophic conditions having neutral or moderately rich nutrients and absence of pollutants.

Fauna of the study area mostly consists of some commonly occurring species. No rare or endangered species of fauna are reported. About 64 bird species are reported from this area, mostly along the water courses. Most of the birds belong to Schedule IV. Only House crow is listed in Schedule V. No birds belonging to Schedule VI i.e. endangered, threatened, vulnerable categories are observed in the study area.

About 11 species of mammals mostly belonging to Schedule-II to IV have been reported from the project area. Only house-rat is found to be in the Schedule-V category. About 11 species of reptiles belonging to Schedule-II and IV categories, and about 11 types of fishes are reported. About 18 species of butterflies have been noticed during field studies.

1.5.11 Healthcare Systems

Achalpur town has a Rural Hospital. Yesurna village has a Primary Health Centre (PHC) and the larger villages have health sub-centres. Besides these regular medical services under 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. Private clinics are not reported from any village. As a whole, the prevailing healthcare conditions are reasonable.



Few malarial diseases are reported from the project area, mainly due to stagnation of water in dirty pools near the existing bore-wells in villages; and also water-storage habits of people. More occurrences of malaria have been reported during May and November representing the monsoon and post monsoon seasons. No epidemics such as JE have been reported during the past five years.

Regular anti-malarial activities such as spraying are regularly taken-up. For preventing mosquito breeding, biological control measures such as culturing Guppy fish in hatcheries in some selected locations is being practiced.

Besides administering medicine to the patients, Passive Surveillance by collecting blood smears and undertaking intensive mass surveillance activities are carried out regularly.

1.5.12 Demography and Socio-Economics

As per 2001 Census, 5890 people were residing in 6 villages of the project command area. The total male population worked out to about 50.97% and the females to about 49.03%. The sex ratio, which is expressed as the number of females per 1000 males, was observed to be about 962, which is considered to be moderate.

About 14.87% of population in the command area belonged to Scheduled Castes (SC), while 3.06% of population belonged to Scheduled Tribes (ST) thus indicating that socially very-backward castes constituted to about 17.93% of total population.

The command area experienced a moderate literacy rate of 71.83%. The male literacy rate, i.e. the percentage of literate males to the total males worked out to be 76.48%. The female literacy rate, which is an important indicator for social change, was observed to be 67.00%.

As per 2001 census about 48.32% of population was engaged as workers in different occupations. The main workers and marginal workers constituted about 40.10% and 8.22% of total population respectively. Cultivators and agricultural labourers were most predominant categories among the main workers as well as marginal workers. The main and marginal cultivators formed about 10.41% and 1.02% of total population, thus indicating that about 11.43% population belonged to category of cultivators. The main and marginal agricultural labourers formed about 25.79% and 6.81% of total population, thus indicating that about 32.60% population belonged to category of agricultural labourers.

The command area is devoid of any industry; hence only about 0.41% population is engaged as household industrial workers. About 0.24% population is engaged as main household industrial workers while about 0.17% is engaged as the marginal industrial workers.

1.5.13 Land Acquisition & Rehabilitation Issues

About 197.0 ha private land presently used for cultivation on both banks of Bhagadi Nala would be required for the project. This land is owned by 161 landowners (PAFs). Due to land losses about 79 PAFs are likely to become landless. The remaining would lose only a part of their landholding, and would possess some land even after land acquisition.



No human settlement or house will be affected due to this project. Hence displacement of PAPs from their residences and their resettlement are not involved.

Land required for the dam seat is acquired with direct negotiations with the PAPs. The land in submergence area is likely to be acquired under provisions of the Land Acquisition Act. The land losers would be provided rehabilitation benefits in accordance with the Maharashtra Project Affected Persons Rehabilitation Act, 1999.

1.5.14 Places of Historical and Archaeological Importance

No religious place or monument notified by Archaeological Survey of India or by Maharashtra State Archeology Department exists in any part of the project area.

1.6 **Environmental Impact Assessment**

Bhagadi LM Project will provide immense benefits to the drought prone area by means of providing assured irrigation facility. This is not anticipated to cause major adverse environmental impacts due to its smaller size. However a few minor impacts related with drainage may take place, if appropriate management measures are not implemented.

1.6.1 Impacts during Construction Phase

Project activities undertaken during construction phase such as levelling of site, construction of dam, excavation of canals, transportation and stacking of excavated material from the project sites, etc. result in some short-time impacts as described below.

- **Impact on Ambient Air Quality**

During construction period, on account of construction activities, operation of DG sets and plying of heavy earth moving vehicles dust levels in atmosphere get increased. Also the gaseous emissions from vehicles and DG sets cause increase in gaseous pollutants at the project sites. These impacts are felt only for a short-time hence purely temporary in nature. No human settlement including the nearest Talni village is affected due to air pollution, as it village is located at 1.6 Km from the dam site.

Burning of firewood/fuel by the construction workers for their cooking might cause some impacts in the villages where they are residing.

- **Impact on Noise Levels**

The major noise generating activities during construction phase are excavation, operation of construction equipment and plying of construction vehicles. Blasting is not involved in this project due to presence of only alluvium. The anticipated noise levels are about 80-90 dB(A) at active construction sites during active construction period, hence would have some impacts on construction workers at the construction site and wildlife in its vicinities. These would cause temporary shifting of wildlife from vicinities of the dam site to other nearby areas. Noise impacts are not anticipated even on the nearest Talni village as it located at about 1.6 km from the dam site.



- Impact on Wildlife

Due to disturbances during construction period the prevailing wildlife at the dam site move away from their original habitats to the nearby Purna and Sapan River valleys having better or similar habitat conditions; or upstream or downstream areas of Bhagadi Nala. Though this is an adverse impact, this would have only a temporary impact as the habitat requirements of local wildlife are general and ample areas better areas for their habitats are available in nearby areas.

Excavated canal acts as a barrier for movement of wildlife and people who used to move freely, hence an adverse impact. These however would cross the canal by using new bridges constructed across the canal. Wildlife may get confused initially and forced to traverse for longer distances for crossing the canal. However, subsequently these would get accustomed and cross the canal without any confusion. Hence this would be a temporary impact.

1.6.2 Impact during Operational Phase

All adverse environmental impacts associated with project construction stage would be ceased after completion of the project.

1.6.2.1 *Positive Impacts*

- Impact on Social Environment

During operational phase, this 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 to take at least 2 crops with enhanced cropping pattern and crop yields in place of their taking a single crop at present. 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. Fisheries development in project reservoir 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 the fisher-folk near the project site having fishing rights in the project 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 project area; and provide direct and indirect employment to a considerable number of people. This will lead for overall economic development with a multiplier-effect in this backward area and will enhance revenue accruals to the State exchequer.

- Impact on Land Use

The project will transform large extents of dry lands in the drought prone areas into lush green irrigated fields by providing assured irrigation facilities. Besides economic development, this project would also enhance scenic beauty in the command area with lush green fields. The proposed tree plantations around the dam and along the canals will improve aesthetic beauty.



- Impact on Surface & Groundwater Resources

Under the crop planning of this project, only the allocated water for this project would be utilized as per the actual water requirement of crops. Hence this would not cause any adverse impact on the downstream water resources, competing water users or riparian-rights of the downstream areas.

Due to presence of water in project reservoir, canals and fields of command area, percolation of water into the sub-surface would take place. This would recharge the subsurface by raising the groundwater tables marginally.

- Impact on Groundwater Quality

With application of surface water for irrigation on the project area soils having higher levels of calcium carbonates and percolation of nala water to sub-surface some dilution of these pollutants in command area soils and groundwater sources would take place. These conditions would improve soil and groundwater quality to considerable extent, which is a positive impact due to the project.

- Impact on Ecology and Bio-Diversity

Due to formation of reservoir and storing of water, ecological conditions of the reservoir area will be improved with presence of aquatic life. The terrestrial ecological conditions along the nala banks will be substantially improved by providing fodder and nesting facilitate for the wildlife. Also due to the anticipated groundwater recharge, vegetation in the area will be enhanced, which is a positive impact. Availability of water in the project reservoir and canals; and plantations around the dam and along canals would attract more birds and enhance presence of avifauna in the region.

There are no rare or endangered species of flora and fauna or migration-routes of avifauna in the project area. Hence impacts related with these sensitive aspects are not involved in this project. No adverse impacts are anticipated on downstream aquatic life in Bhagadi Nala due to regeneration flows from the dam.

- Impact on Climate

On account of presence of water for more duration in the reservoir, canals and irrigated fields relative humidity levels in atmosphere will be increased to some extent and temperature levels would be fallen marginally in this summer-scorch region.

- Impact on Water Resources

By storing nala water which otherwise was draining-out to the downstream areas, this project will enhance water resources in the region by creating a reservoir. In view only the allocated yield will be utilized, this project will not create any adverse impact on the downstream users.

- Impact on Aesthetics

Formation of reservoir and canals will create water fronts in the area and will improve aesthetic values in this otherwise dry area. The reservoir may serve as a picnic spot, when water is available in it. The proposed tree plantations around the dam and canal will enhance scenic beauty around them.



1.6.2.2 Likely Adverse Impacts

- Impact on Ambient Air Quality

No air quality impacts would be involved during operation phase of the project.

- Impact on Noise Levels

After construction of dam and canal all noise generating activities will be ceased, hence noise impacts are not involved in post-construction phase of this project.

- Impact on Wildlife

No adverse impacts would be felt on wildlife during operation phase of the project.

- Impact on Soil

Entire command area has moderate slopes and soils have moderate infiltration rates. The ground water tables in command area are never likely to rise to such an extent by causing any problem associated with water logging and the resultant soil salinity. Even if such problem is resulted at any future date, this can be mitigated with suitable surface and sub-surface drainage arrangements.

- Impact due to Excess Use of Fertilizers and Pesticides

In the post-irrigation scenario, farmers may tend to use more fertilizers and pesticides, and excessive use of 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 slightly increased. This may lead to some vector borne diseases in the area. Also due to possible proliferation of mosquitoes and snails, some water borne diseases are likely to result when water is present in the reservoir.

1.7 ENVIRONMENT MANAGEMENT PLAN

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

1.7.1 Environment Management Plan during Construction Phase

The following mitigation measures during construction period are needed:

- Undertaking excavations and construction activities at project sites while giving utmost care to the environmental aspects and safety measures;
- 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 haul roads;
- Maintaining the diesel powered construction vehicles properly, for minimizing smoke emissions;



- Adopting appropriate noise attenuation measurers for minimizing noise levels in the area;
- Providing noise protection devices like earmuffs and earplugs to the workers operating the high noise generating equipment;
- Using the generated earthen material (muck) from project sites for construction of earthen dam;
- Stacking the surplus material in identified muck disposal sites, with appropriate slopes, in a systematic manner;
- Compacting the muck dumps and undertaking plantations on them for minimizing erosion; Providing adequate number road bridges of appropriate dimensions wherever canal severs the existing road/cart track;
- Providing footbridges wherever the existing traditional paths are severed due to canal construction;
- Providing cooking fuel to construction workers through contractors to prevent felling of trees for fire wood for their cooking; and
- Providing adequate sanitation facilities for male and female workers separately and connecting them to septic tanks.

1.7.2 Management Plan during Operational Phase

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

- Undertaking tree plantations at foot of the dam in its downstream side, and along the canal;
- Growing grasses and undertaking plantations on muck dumps for their strengthening and preventing their erosion;
- Nurturing the plants at least for 3 years through Social Forestry Department, GoM till the plants become self-sufficient;
- Providing sub-soil drainage at places, if 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 of soils; 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 for enhancing crop yields;
- Undertaking periodic water quality testing of Bhagadi Nala and Sapan River, and taking appropriate measures if the water quality is not meeting the standards;
- Ensuring no illegal felling of trees takes place in vicinities of project sites;
- Minimizing movement of inspection 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 and canal for controlling nutrition levels; and allowing free-flow of water in canals;
- Creating fisheries hatcheries and culturing fish in project reservoir for creating employment to people and also improving water quality in reservoir; and
- Undertaking Watershed Management Plans by the Agriculture Department GoM, only if it assesses such plans are required and only when surplus funds are made available, in view the project catchment area is not prone for severe soil erosion.



1.7.3 Command Area Development

Command area development programmes encompassing integrated development of water resources, judicious method of water application, suitable soil and crop management practices and scientific scheduling of irrigation, mainly including the following to be implemented:

- Adopting suitable watershed management and soil conservation measures like land development or land shaping, smoothening, grading and forming earth bunds and land levelling;
- Constructing appropriate sizes of field drains;
- Providing efficient surface drainage for removal of excess water which may occur due to heavy rains/ seepage from canals or excessive irrigation;
- Providing efficient sub-soil drainage for removing excess water from sub-soil areas, if it occurs;
- Stabilizing, strengthening and deepening the existing natural drains to possible extent for enabling them to rapidly carry excess water from fields; and
- Restoring soil quality with gypsum or chemical treatment, only if these are affected due to water logging.

1.7.4 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 Yesurna Primary Health Centre and other healthcare facilities by appointing adequate number of medical and paramedical staff;
- Maintaining good environmental, health and sanitation conditions at construction areas; and
- Carrying out regular surveillance and health improvement programs by the Health Department for preventing health disorders in project area.

1.8 **Post-Project Monitoring and Management**

During post-project monitoring period, for effective environmental management in terms of soil and water quality in the project area some representative areas need to be monitored. Developing an Environmental Management Program under the Coordination Committee of Water Resources and Agriculture Departments, GoM and implementing the identified mitigation measures in problematic areas would safeguard environmental conditions in the project area.

1.9 **Organization for Environment Management**

The Superintending Engineer of Upper Wardha Project Circle would implement the proposed Environment Management Plan in coordination with various other departments of GoM.



1.10 Budgetary Allocation for Environmental Measures

The total cost of Bhagadi Larger Minor Project is estimated to be about Rs. 1954.093 lakhs. Of this about Rs. 2.625 lakhs will be used for tree plantations in vicinity of dam and along the canal. As per irrigation norms, it is presumed that one-third of the total 1103 ha CCA (about 367 ha) might require land drainage. For implementing drainage measures Rs. 7.721 lakhs have been proposed.

1.11 Conclusions

Bhagadi Larger Minor Project will provide assured surface water irrigation facility to about 985 ha ICA. With its immense benefits to the drought prone areas of Amravati district, this project would contribute 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 areas away from the project site.

With Benefit Cost Ratio of 1.40 in the drought prone area and favourable 17.19% Economic Rate of Returns; and least adverse environmental and social impacts, Bhagadi Larger Minor Project is a beneficial project.