

**EXECUTIVE SUMMARY OF
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

FOR

ALAVANDI-BETAGERI LIFT IRRIGATION SCHEME

at

KOPPAL DISTRICT, KARNATAKA

Project By



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1. Introduction

Alavandi-Betageri Lift Irrigation Scheme (ABLIS) is proposed to irrigate dry lands in villages of Koppal Taluk and District. The proposed command area is left out area of existing irrigation systems viz., Singatalur Lift Irrigation Scheme and Hirehalla Lift Irrigation Scheme. Therefore, the need of the proposed scheme is of priority which could benefit the drought affected villages, meet the demands of the farmers and shall also improve the Irrigation potential and Socio-economic conditions of Koppal Taluk and District. SEIAA issued the TORs for the project vide Letter No. SEIAA 57 IND 2016 dated 08.03.2017 based on which Draft Environmental Impact Assessment (EIA) Report was prepared along with in line as per generic structure in the EIA Notification, 2006 by MoEF, Govt. of India. The said EIA report includes the data on various field studies undertaken by the accredited experts including baseline environmental data collection from the study area during the study period March 2017 to May 2017, in line with the TORs, anticipated impacts (identified, predicted & evaluated) on different components of the environment, delineating specific Environmental Management Plan (EMP) including Environmental Monitoring Programme along with the budgetary provisions to be undertaken by KNNL stating responsibilities of various parallel departments for effective implementation of the same.

2. Project Description

The proposed scheme envisages lifting of 0.5 TMC of water from Tungabhadra River near Hankunti village of Koppal Taluk, Koppal District, Karnataka by lift and providing Irrigation facility to 2,425 Ha in 6 villages of Koppal Taluk and District. The proposed irrigation is only during Khariff season and the intensity of irrigation will be 100%.

Governments of Karnataka (GoK) have accorded administrative approval for ABLIS vide order No. WRD 108 MTP 2014, Bengaluru dated 30.12.2014 and the total cost of the project is 87.10 Crores.

Table 1 Salient Features of the project

1	Name of the Scheme	Alavandi-Betageri LIS
2	Name of the river	Tungabhadra
3	Geographical Location of Lift point	Latitude 15°09' 31.63" N, Longitude 76° 03' 36.97" E
4	Location of Lift point	Near Hankunti Village, Koppal Taluk and District
5	Type of project	Irrigation
6	Mode of irrigation	Gravity flow irrigation
7	Estimated cost of the Project	87.10 Crores
8	Command Area	2,425 Ha
9	No. of villages Benefitted	6
10	Villages benefitted	Mainahalli, Handral, Alavandi, Kavaloor, Hiresindogi, Bikkanahalli
11	Allocated water	0.50 TMC
12	Cropping pattern	Khariff (June - November)
13	Irrigation intensity	100%
14	Submergence	Nil
15	Rehabilitation & Resettlement	Nil
16	Land requirement	70 Ha
17	Forest Land requirement	Nil
18	Power requirement	2.6 MW Source- GESCOM
19	B.C Ratio	1.32

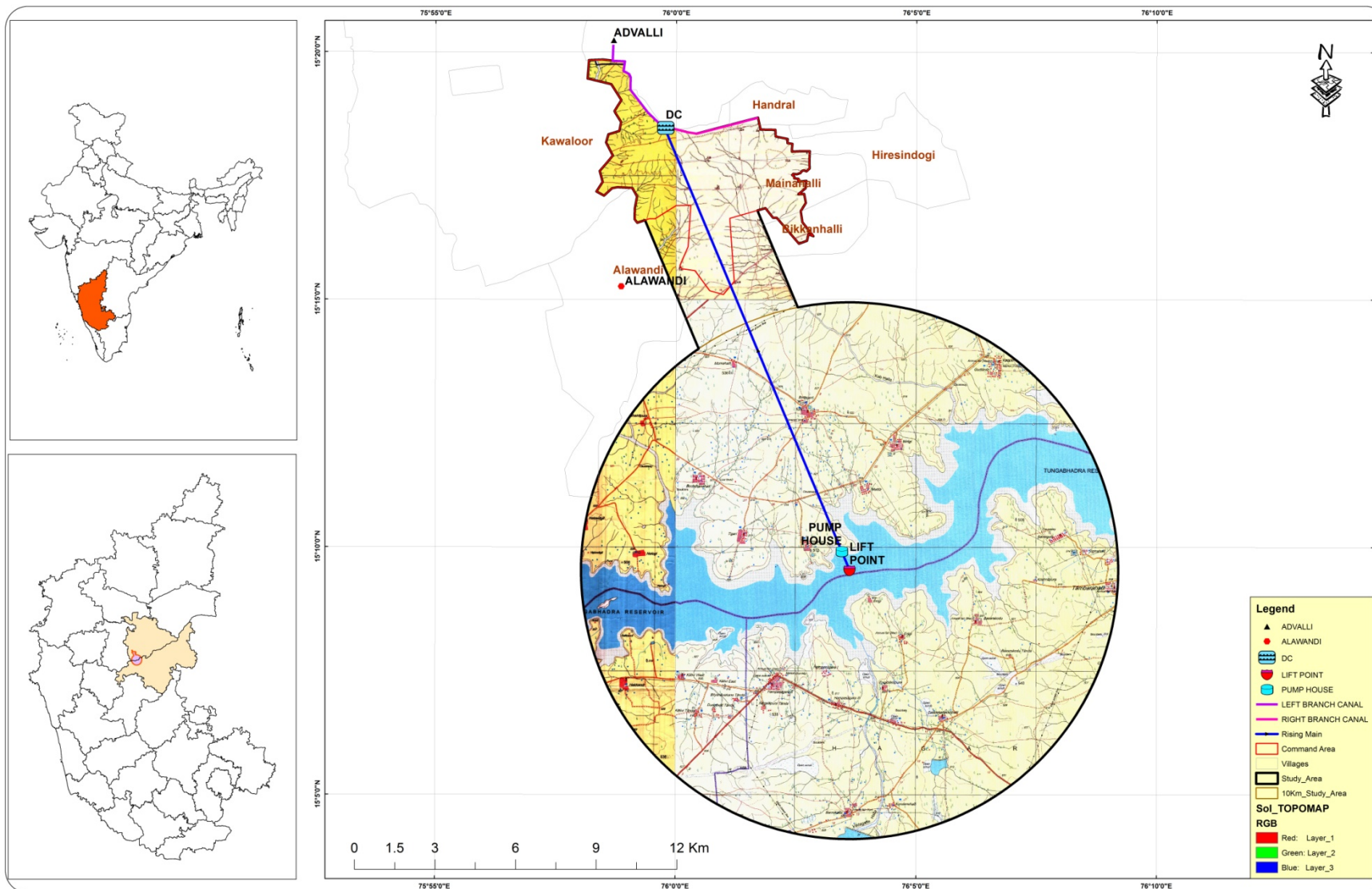


Fig. 1 Location map of the project

2.1 Need for the project

ABLIS is proposed to irrigate dry lands in six villages of Koppal Taluk and District. The villages coming under this scheme are drought affected and agriculture is the only source of livelihood and income. Drought causes agriculture a risky venture and the proposed taluks are considered to be the more backward taluks. Due to which people are constantly translocating to adjoining towns and cities. The people of this region have no other employment opportunities except agriculture and there is potential land bank to grow suitable crops in the region. Hence providing irrigation and stabilizing the agricultural production, provides a much needed relief to the people. It improves the per capita income and standard of living of the people. Further it utilizes the water and land resources and substantially improves GDP contribution from agriculture.

2.2 Water availability

Proposed Alavandi-Betageri Lift Irrigation Scheme is situated on the upstream of the confluence of Tungabhadra and Varada rivers. The CWC gauge site of Tungabhadra River is at Haralahalli and that of Varada River is at Marol. It is proposed to lift 1.602 cumecs of water from Tungabhadra River to irrigate 2425 ha of Khariff - semi dry crop (June to September). From the observations of the minimum flow statement of Tungabhadra River at Haralahalli for a period of 18 years (1982-83 to 1999-2000) and that of Varada River at Marol for a period of 22 years (1978-79 to 1999-2000), the requirement of water for the Khariff period is 492.06 Mcft. Out of which, 0.5 TMC will be utilised for the proposed scheme.

2.3 Command area of the project

The command area of 2,425 Ha is spread across Koppal Taluk and District. There are 6 benefitting villages under ABLIS. The lists of benefitting villages are given below.

Table 2 List of benefitting villages, Koppal Taluk and District

Sl.No	District	Taluk	Name of the benefitting village
1	Koppal	Koppal	Alavandi
2			Mainahalli
3			Handral
4			Hiresindogi
5			Bikkanahalli
6			Kavaloor

2.4 Irrigation Planning and structural components of the project

An intake channel (1.02 Km) is proposed to lift the water from Tungabhadra River. A jack well cum pump house will be constructed to pump the water to the Delivery chamber through a MS rising main of 16.765 Km length (Diameter - 1000 mm). The RL of delivery chamber is 565 m. The entire 2,425 Ha command area will be irrigating under single stage. The technical details of the project are given below;

Table 3 Technical details of the project

A. Lift Location	
Name of the river	Tungabhadra River
Lift Point	Near Hankunti Village, Koppal Taluk, Koppal District
B. Intake Canal	
Length	1.02 Km
Discharge (required) QR	2.703 cumecs
Discharge (designed) QD	2.703 cumecs
Bed width	Varies from 1.50 m to 2.25 m
Bed level at off take	RL 493 m
Side slope	Depends on strata classification
Free board	0.45 m
C. Jackwell cum pumphouse	

No. of Pumps	2 working + 1 standby
Total Power Requirement	2652 KW
Source	GESCOM
D. Rising Main	
Length	16.765 Km
Diameter	1000 mm
Material	Mild Steel
E. Delivery Chambers	
RL of DC	565 m
Size	12.5 m x 12.5 m
E. Canals	
Left Bank canal	
Irrigating Area	567 Ha
Length	3.9 Km
Required discharge (QR)	0.366 Cumecs
Designed discharge (QD)	0.368 Cumecs
Right Bank canal	
Irrigating Area	1858 Ha
Length	2.28 Km
Required discharge (QR)	1.198 Cumecs
Designed discharge (QD)	1.290 Cumecs

2.5 Land Requirement

The proposed project requires 70 Ha for implementation of the project. The land required is only for construction of Jack well cum pump house, Raising main, Intake canal and Delivery chambers. The required land will be acquired as per the Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013.

2.6 Existing cropping pattern details

The present agricultural practices including the crops grown are tuned to the rainfall regime. The crops grown are Khariff crops only which are as follows. The estimated percentage area of these crops and their corresponding yields are given below;

Table 4 Existing cropping pattern in the command area

Sl. No.	Crops	Intensity (%)	Crop Area (Ha)
1	Maize	38.71	600
2	Pulses (Horse gram)	19.36	300
3	Chillies	12.90	200
4	Groundnut	16.13	250
5	Sesamum	12.90	200
	Total	100	1,550

2.7 Proposed cropping pattern details

In view of introducing flow irrigation system in the entire command area of 2,425 Ha, the following cropping pattern (for Khariff Season) is proposed.

Table 5 Proposed cropping pattern

Sl. No.	Crops	Intensity (%)	Crop Area (Ha)
1	Maize	39.88	967
2	Pulses (Horse gram)	15.05	365
3	Groundnut	23.05	559
4	Hybrid Jowar	22.02	534
	Total	100	2,425

2.8 Benefit cost ratio

The benefit cost ratio has been worked out to 1.1 considering the annual administrative expenses, depreciation charges and electrical energy charges.

3. Description of baseline environment

In order to assess the baseline environmental status, command area, 10 Km radius from the main project components were considered and the data was collected for Pre - Monsoon Season (March 2017 to May 2017). In addition to the baseline environmental monitoring, field inspection in the study area, collection of primary & secondary information for all the environmental components and discussions with the officials and local public were conducted by the experts.

3.1 Physical Environment

3.1.1 Topography

The topography of the area in general is a continuous sloping area without much of undulations. The area mainly comprises of moderately gentle slope, very gentle slope and gentle slope. Of which moderately gentle slopy areas are predominantly found in the command area.

3.1.2 Ambient air quality

The results of ambient air quality reveal that, PM₁₀ was in the range between 51 – 68 µg/m³ and whereas PM_{2.5} was in the range between 16 – 29 µg/m³. SO₂ and NO₂ are in the range between 0.95 – 1.31 µg/m³ and 3.04 – 4.07 µg/m³ respectively. The air quality index in the study area is found to be satisfactory for PM₁₀ and good for PM_{2.5} and gases (SO₂ and NO₂).

3.1.3 Ambient Noise levels

The results of ambient noise levels were compared with Residential standards and results reveal that, the noise levels in the study area ranging from 50.92–51.31 d(B)A for day time and 41.99 – 42.16 d(B)A for night time during study period. Overall, the noise levels in all the seasons were observed to be well within the CPCB standards.

3.1.4 Seismicity

The proposed project area is located in the Zone-II of Seismic Zoning Map of India. Hence, the area is very less prone to Earthquakes.

3.1.5 Geology and Minerals

The main rock type observed in the command area is Granites & Gneisses belonging to Peninsular Gneissic Complex of Archaean Age followed by Schists belonging to Dharwar Super Group of Lower Proterozoic age.

3.1.6 Soil characteristics

In the study area the soil types found in the command area are predominantly deep, well-drained, calcareous soils and very shallow, well drained, clayey soils. The black cotton soil is rich in bases (alkaline condition) and has a very high water holding capacity. Major area of ABLIS is covered by black, clay soils constitute roughly 95 percent, and are shallow to moderately deep (22.5 to 90 cm), clayey, with 45 to 55 per cent clay and contain free calcium carbonate throughout the profile. There is generally a zone of calcium nodules and gypsum in the soil profile at a depth of 45 to 90 cm, the principal salt being gypsum. Below the gypsum layer disintegrated impermeable murrum layer exists, the internal drainage of the soil is lateral rather than vertical within the profile.

The soil types found in the command area are black colored. The study area is experiencing relatively plain not affected by fully erosion in the past, but the analysis indicates that certain areas were with rill and sheet erosion.

3.1.7 Hydrology

The Project site and the command area forms part of the Tungabhadra sub-basin of the Krishna Basin. The lift point is at Hankunti Village. Rayan Halla, Kumbhara Halla, Hasarugonne Halla & with Chenna Halla are the four streams culminating in to Hire Halla finally joining Tungabhadra River in

the study area along with Kab Halla joining Tungabhadra River. All these are ephemeral which drain in to Tungabhadra River. Drainage pattern is observed to be dendritic to sub-dendritic with drainage density varying between 1.4 to 1.8 Kms. / Sq. Kms. Dense drainage is observed in the North and Western portion of the command area while the southern portion of the command area is occupying sparse drainage. All the stream courses flow from higher reaches to lower levels following topography.

3.1.8 Surface Water

The baseline status of water quality in the study area was established. Water samples were collected from 4 locations. Out of which 1 location was surface water.

In Pre - Monsoon season, total Hardness in the surface water was found to be 88 mg/L, Dissolved oxygen was found to be 6.5 mg/L, conductivity and chloride were 632 μ S/cm and 87.97 mg/L respectively. Due to improper sanitation and utilization of river water for various domestic purposes Total Coliform was present at Downstream of Tungabhadra River (Near lift Point).

3.1.9 Ground Water

In Pre - Monsoon season, the ground water quality analysis results reveal that, the Total Hardness was found in the range of 160 mg/L near Proposed Jackwell & pumphouse area to 1140 mg/L at Mainahalli, Conductivity and Chlorides ranged from 855 μ S/cm near Proposed Jackwell & pumphouse area to 3020 μ S/cm at Mainahalli and 73.97 mg/L near Proposed Jackwell & pumphouse area to 619.8 mg/L at Mainahalli respectively. Whereas Total Coliform was absent in the samples. Suspended solids was absent near Proposed Jackwell & pumphouse area whereas present at Mainahalli (1 mg/L) and Kavaloor (2 mg/L).

3.1.9 Land use assessment

The results indicate that the core zone is dominated by crop lands followed by water body. The ground truth survey revealed that the crop land shown in the satellite imagery is coming in semi-arid region and farmers depend on monsoon for cultivation.

Table 6 Land use / land cover classification in the study area

Sl. No.	Land use	Area (sq. Km.)	Area (Ha.)	Percentage (%)
1	Agricultural Plantation	0.745	74.5	0.208
2	Barren rocky/Stony waste	0.758	75.8	0.212
3	Built-up	4.110	411	1.150
4	Crop-Land	286.958	28695.8	80.261
5	Land with/without scrub	1.596	159.6	0.446
6	Mixed Forest Plantation	0.066	6.6	0.018
7	Water body	63.271	6327.1	17.697
8	Waterlogged	0.028	2.8	0.008
Total		357.532 sq. Km.	35,753.2 Ha	100.00

3.2 Biological Environment

3.2.1 Flora

A total of 27 plant species were recorded in the study area of which 12 belong to tree species, 7 belongs to shrub species and 8 species belongs to herbs respectively. The proposed project area is vacant with sparse distribution of trees. During the survey, 12 tree species (69 trees) were identified in the study area belonging to 7 families. Fabaceae species (n=6) are commonly found tree species in the region. *Azadirachta indica* is widely spread across the study area (IVI-102.34) followed by *Acacia nilotica* (IVI-42.75) and *Aegle marmelos* (IVI-40.94) indicating dry, hot and humid climatic conditions of the region. *Tectona grandis* and *Tamarindus indica* are commonly observed tree species planted by the farmers in the agricultural bunds which has high timber value. The tree diversity at Kavaloor is higher followed by Handral and Mainahalli. The diversity of shrubs in the study area is limited (n=7) and due to the summer, herbaceous community (n=8) was dry as they are seasonal to monsoon and post monsoon. *Prospopis juliflora* and *Calotropis*

procera are the chief shrub community found abundantly in the study area especially in agricultural lands.

3.2.2 Fauna

The field sighting and published records for the region indicated that 7 mammals were reported for the region. There are about 39 birds recorded for the region of which 3 birds belongs to Schedule – I of Wildlife (Protection) Act, 1972. There are 13 species of butterflies were observed in the project site. A total of 4 reptiles was observed in the project area.

3.2.3 Protected Areas

There are no protected areas or eco-sensitive areas within the 10 Km radius of main project components and command area.

3.3 Aquatic Ecology

Detailed Limnological and Fisheries investigation carried – out in the river Tungabhadra, in and around the project site, indicate 'Optimum' Physico – chemical and biological features to support and sustain the aquatic life present.

The fish food organisms – the Phyto and the Zooplankton had a 'poor presentation, both by numbers and species – wise. Scores of planktivore fish recorded subsists on the available food which is likely to improve during the post monsoon period due to the influx of nutrients for the catchment area as they play a vital role in the over – all biological productivity of the system.

Forty three species of fishes along with 3 crustaceans and one amphibian species were recorded at Tungabhadra River.

Fish seed stocking and the fisheries developmental strategies have been highlighted which should be taken – up with all sincerity and seriousness by the concerned Government Institutions to facilitate fisheries development on the basis of scientific know – how available to help the fisher folk to ekk – out their livelihood honorable.

4. Anticipated Environmental Impacts & Mitigation Measures

Due to the activities of the project, there will be potential impacts on the environment of varying magnitude. Most of the impacts are likely to occur during the construction phase of the project. The following section reveals the prediction of impacts due to the project on the physical, biological and social environment. Impacts have been assessed based on the information collected from the primary and secondary data.

4.1 Ambient Air Quality

The construction of the project is expected to last approximately in 24 months. The initial site clearing will be followed by site preparation activities

Sources of air pollution

- Pollution due to fuel combustion in equipments. The operation of construction equipments requires combustion fuel. Normally, diesel is used for such equipments. The major pollutant which gets emitted as a result of combustion of diesel is SO₂.
- Dust pollution: The operation of the trucks carrying construction materials to the site, batching plants during the construction phase is likely to generate fugitive emissions, which can move even up to 100 m in predominant wind direction.
- Emissions due to usage of firewood for cooking at labor camps.
- Due to operation of DG sets and excavation, laborers are prone to health problems.
- Fugitive dust emissions during excavation for main canal, branch canals and distributaries.

The following mitigation measures will be followed to control potential emissions of fugitive dust during construction of the project:

- HSD with low sulphur content will be used for the construction equipments/ vehicles which has low ash content.
- Unpaved roads in the project construction site are watered frequently as necessary to prevent fugitive dust. All vehicles carrying construction materials are covered with tarpaulin to avoid spillage of construction materials.
- All the trucks carrying construction materials to the site shall be inspected regularly and shall have valid Pollution under Control (PUC) certificate.
- Labors camps shall be provided with LPG facilities.
- Usage of PPEs like nose masks will be provided.
- During excavation, regular water sprinkling will be undertaken to avoid fugitive dust.

4.2 Ambient Noise Level

Sources of noise pollution

- During construction phase, various sources of noise pollution arise due to Concrete Batch Plant, Crane, Generator, Tractor, Welder / Torch, Vibrating Hopper etc.,
- Other source of noise pollution includes movement of vehicles for unloading of construction materials, fabrication, handling of equipments.
- Construction activities are expected to produce noise levels in the range of 80 – 95 dB (A).

Various measures proposed in spite of noise levels are lower than the prescribed standard values as per CPCB, are presented below.

- DG sets are placed on the rubber cushion padding, enclosed and maintained well in good condition. It is encased and barricaded & taken to all places where it will be used. This reduces the noise level in and around the source by 4 dB.
- Ear plugs must be provided to all employees and laborers while working, irrespective of the noise levels as protection, to receive the noise and as well as exposure of the same for a longer period.
- During construction time, possible chances of number of trucks coming to the project area is more carrying debris, muck etc and the drivers of these vehicles must be instructed with sign boards and not to use shrill horns for any purpose.
- Silent Zone boards must be installed at all places where human activities are there along with proper training to them to handle various equipments, tools and other related items.
- Personal protective equipments like ear plugs must be distributed to all and compulsorily workers are made to use the same.
- Acoustic hoods, silencers are used at these locations and these noise generating sources are kept under enclosures.
- Supervisory staff must check and monitor to ensure the workers to follow all the above said measures while at work.
- Controlled blasting will be undertaken wherever necessary to minimize the noise even though it is cost effective.

4.3 Water Environment

Sources of water pollution;

- Improper treatment of sewage from labor camps leads to infiltration into the subsurface soil and finally affects the ground water.
- There will be creation of unaesthetic conditions in the site, attracts mosquitoes/fly, thereby chances of deteriorating the health of the workers in unhygienic conditions.
- Improper disposal of construction debris, used oil, diesel for DG sets, etc will result in ground water contamination and in turn affecting drainage of the area.
- Spillage of excavated earth during construction of intake canal leads to turbidity of river water.

The mitigation measures include;

- The sewage generated from the labour camps shall be treated in the Septic Tank and Soak Pits designed and constructed as per IS 2470 Part-I & Part-II.
- There will be no open discharge of sewage from labour camps and the labour camps will be provided with sufficient bathrooms and toilets. Periodical health check-ups for labors will be done.
- No construction labor camps are allowed within 1 Km from the river bed.
- Construction debris will be reused at site, used oil generated from the DG sets will be stored separately and handed over to authorized recyclers.
- During construction of intake canal, the river course and the point of contact of intake canal will be provided with sand bags.
- The leakages of oil spills from machinery shall be collected in leak proof barrels and then disposed off to KSPCB authorized dealers.
- In addition to DG sets, CNG will have to be used where ever available and possible to control the noise and vibration resulted from DG set.
- Generally, if DG sets are inevitable, it must be encased temporarily to arrest the noise resulted from vibration as well as DG noise.

4.4. Land Environment

Sources of Land pollution;

- Impacts on the natural drainage system and soil erosion: There shall not be any affects in the core or buffer area either on the drainage or on the water regime of the area. The proponent will undertake afforestation using native species to prevent top soil erosion. However, it is proposed to construct check dams with gully plugs, retaining walls against slope coming in command area of Tungabhadra river basin.
- Loss of productive soil and impact on natural drainage pattern: The majority of the land coming in buffer area belongs to crop land. The proposed project doesn't affect the land use or drainage of the area. The project proponent only requires 69.911 Ha for construction activities.
- The afforestation program is aimed at planting native species capable of forming good humus, so that the water retention capacity of the floor is high and surface erosion is reduced. Effective steps like afforestation using leguminous plants by mulching with proper drainage and retaining walls to minimizing soil loss if any and maintaining the nutrient of the soil of the area as existing in the buffer zone.

Mitigation measures:

- Top soil patches are scattered with thickness varying from 5cm to 50 cm. This soil will be removed in advance and staked separately at designated area with a height not exceeding 2m.
- Select soil stockpile location to avoid slopes, natural drainage ways and approach road points.
- Temporary seeding - protect topsoil stockpiles by temporarily seeding preferably grass and legume species as soon as possible, within 30 days after the formation of the stockpile.
- Permanent vegetation - if stockpiles will not be used within 12 months they should be stabilized with permanent vegetation to control erosion and weeds.
- Before spreading topsoil, establish erosion and sedimentation control structures such as diversions, dikes, waterways and sediment basins.
- Maintain grades on the areas to be top soil.
- Roughening - Immediately prior to spreading the topsoil, loosen the sub-grade by disking or scarifying to a depth of at least 100 mm to ensure bonding of the topsoil and subsoil.

4.5 Biological Environment

A total 70 Ha of area (includes lift, jack well cum pump house & Canals) will be acquired for the proposed project area. There is no reserve forest either in barrage or in proposed canal area of the project. Also, there were no trees coming in proposed pump house and canal area. Hence we can safely conclude that it won't have any impact on biodiversity of the area.

Mitigation measures:

There are no removal of trees for construction of canals and canal bank plantation. However, Agro forestry activities will be proposed to improve the biological environment of the region.

4.6 Evaluation Impacts

Matrix method was used to identify interactions between various project activities and environmental parameters and components. Later, a weightage of 1-10 shall be given to the impacts based on the significance of the impacts. The impacts are quantified 'with' and 'without' EMP. The criteria adopted for weightage are given below;

Table 7 Criteria for evaluation of impacts

Sl.No	Criteria	Score
1	Minor impact	1-2
2	Medium impact	3-4
3	Significant impact	5-8
4	Major impact	9-10

Table 8 Evaluation of Impacts

Sl. No.	Environmental Attributes	Project Activities	Nature of Impacts										Without EMP	With EMP
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative			
A. Construction Phase														
1. Impacts on Land Environment														
1	Land	Construction of intake canal, pump house and rising main	M		✓			✓	✓			✓	Orange	Green
		Excavation for canal	H		✓	✓			✓			✓	Red	Green
		Vehicular movement	M	✓				✓	✓			✓	Green	Green
2	Change in Topography	Construction of intake canal, pump house and rising main	M		✓	✓			✓			✓	Orange	Green
3	Loss of Productive Soil	Construction site, temporary offices, workers camps, stockyards	M	✓				✓		✓		✓	Orange	Green
		Construction of Haul roads	L	✓				✓	✓			✓	Green	Green
		Excavation for canal	H		✓	✓			✓			✓	Red	Green
4	Compaction of Soil	Site Clearance	L	✓				✓	✓			✓	Green	Green
		Movement of vehicles	L	✓				✓	✓			✓	Green	Green
5	Contamination of Soil	Machinery and operation of the Diesel Generator Sets	M		✓			✓		✓		✓	Orange	Green
		Labor camps	H	✓				✓		✓		✓	Red	Green
2. Impacts on Water Environment														
1	Eutrophication	Sewage from labor camp	H	✓				✓	✓			✓	Red	Green
2	Change in River Water Quality	Construction of Intake canal, jack well cum pump house, sumps, disnets	M	✓				✓		✓		✓	Orange	Green
		Diversion of river water	H		✓	✓			✓		✓		Red	Green

Sl. No.	Environmental Attributes	Project Activities	Nature of Impacts										
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative	Without EMP	With EMP
		Decomposition of sediments and deposition of organic matter	M		✓		✓	✓			✓	Yellow	Green
		Washing of equipments	L	✓			✓	✓			✓	Light Green	Green
		Muck disposal	M	✓			✓	✓			✓	Orange	Green
3	Change in ground water quality	Sewage from labor camp	M	✓			✓		✓		✓	Red	Green
3. Impacts on Air Environment													
1	Increase in dust concentration	Construction equipments, operation of DG sets,	M	✓			✓	✓			✓	Yellow	Light Green
		Excavation	H	✓			✓	✓			✓	Red	Light Green
2	Fugitive Emissions from various sources	Vehicular movement	H	✓			✓	✓			✓	Red	Light Green
		Loading and dislodging Use of sand, fine aggregates	M	✓			✓	✓			✓	Orange	Light Green
		Batching plant	M	✓			✓	✓			✓	Orange	Light Green
3	Increase in SO ₂ , PM, NO _x	Vehicular movement	M	✓			✓	✓			✓	Orange	Light Green
		Operation of DG sets	M	✓			✓	✓			✓	Orange	Light Green
		Fuel Combustion in equipments and Vehicles	M	✓			✓	✓			✓	Orange	Light Green
		Burning of fuels from construction workers	M	✓			✓	✓			✓	Orange	Light Green
4	Impact on Human Health	Emission of Dust particles	M	✓			✓	✓			✓	Orange	Light Green
4. Impact on Noise Environment													
1	Increase Noise Level	Movement of vehicles	M	✓			✓	✓			✓	Orange	Light Green
		Operation of D.G sets	L	✓			✓	✓			✓	Light Green	Green
		Movement of vehicles carrying raw materials	M	✓			✓	✓			✓	Orange	Light Green
5. Impact on Biological Environment													

Sl. No.	Environmental Attributes	Project Activities	Nature of Impacts										
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative	Without EMP	With EMP
1	Pressure on existing natural resources	Immigration of labor population	L		✓	✓		✓			✓		
2	Reduced Photosynthetic activity, Wilting of plants	Transportation of construction materials	M		✓		✓		✓		✓		
		Site Clearance	M		✓	✓		✓			✓		
3.	Impacts on Fishes and Aquatic Ecosystem	Increase in turbidity of water due to Washing of machineries	M	✓			✓	✓			✓		
		Sewage from labor camp	H	✓			✓	✓			✓		
6. Impact on Socio-economic Environment													
1	Land acquisition	Affecting livelihood	H		✓	✓		✓			✓		
2	Impact on Human Health	Due to water/air borne diseases, traffic movement	H	✓			✓		✓		✓		
B. Operation Phase													
1	Impacts on Land Environment	Application of natural fertilizers and pesticides	H		✓	✓		✓		✓			
2	Impact on water environment	Application of fertilizers and pesticides	M		✓	✓			✓	✓			
3	Impact on Aquatic life	Construction of intake canal and pump house	H		✓	✓		✓			✓		
4	Impact due to project failure	Land acquisition and lack of Power supply	H		✓	✓		✓			✓		

5. Analysis of Alternatives

The command area villages are deprived of irrigation facilities as this area is lying above the canal level of Mundaragi branch canal of Singatalur LIS project. The eastern side of the command area is covered under Hirehalla LIS. Thus, the villages under the proposed command area are deprived of irrigation facilities. In order to provide irrigation to these deprived villages Alavandi-Betageri Lift Irrigation Scheme has been proposed.

6. Environmental Monitoring Program

The purpose of the monitoring programme is to ensure that the objectives of the project is achieved through the mitigation measures and result in desired benefits to environment and local population of the region.

Table 9 Environmental Monitoring Plan for construction phase (2 years)

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
Surface water quality of Tungabhadra River	pH, Temperature, EC, TDS Alkalinity, TH, DO, BOD, COD, NO ₃ , PO ₄ , Cl, SO ₄ , Na, K, Ca, Mg, Silica, Oil & grease, MPN, Total Coliform	Fortnightly once until completion of Intake canal	Near Lift Point (Hankunti), Downstream and Upstream of lift point (3 Nos.)	Contractors or agencies appointed by KNNL	9,000/-
Ground water quality	pH, Temperature, EC, TDS Alkalinity, TH, NO ₃ , PO ₄ , Cl, SO ₄ , Na, K, Ca, Mg, Silica, Oil & grease, MPN, Total Coliform	Once in a month	Mainahalli, Handral, Kavaloor, Alawandi (4 Nos.)	Contractors or agencies appointed by KNNL	10,000/-
Soil Quality	pH, EC, Mg, Ca, Alkalinity, Cl, Na, K, Organic Carbon, K, PO ₄ , SAR, N and Salinity	Once in a month	Mainahalli, Handral, Kavaloor, Alawandi, Hiresindogi (5 Nos.)	Contractors or agencies appointed by KNNL	10,000/-
Air Quality	PM ₁₀ , PM _{2.5} , NO ₂ and SO ₂	Monthly	Lift point - Hankunti, Kavaloor (2 Nos.)	Contractors or agencies appointed by KNNL	12,000/-
Noise Levels	Leq Day, Leq Night in dB(A)	Monthly once until completion of construction works	Lift point - Hankunti, Kavaloor (2 Nos.)	Contractors or agencies appointed by KNNL	2,000/-
Sub-Total / month					43,000/-

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
Sub-Total A - For 24 months					10,32,000/-
Aquatic life	Limnological and biological studies	Six monthly once until completion	Near lift point (1 No.)	Contractors or agencies appointed by KNNL	45,000/-
Health check ups	Spirometry, Pulse Oxymetry, Blood Test, Lung Function Test, Eye test, Physical fitness tests	Six monthly once until completion	Labor camp (1 No.)	Contractors or Doctors / PHC appointed by KNNL	1,25,000/-
Sub-Total / 6 month					1,70,000/-
Sub-Total B - For 24 months					6,80,000/-
Total (A+B)					17,12,000/-

Table 10 Environmental Monitoring Plan for operation phase (3 years)

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
Surface water quality of Tungabhadra River	pH, Temperature, EC, TDS Alkalinity, TH, DO, BOD, COD, NO ₃ , PO ₄ , Cl, SO ₄ , Na, K, Ca, Mg, Silica, Oil & grease, MPN, Total Coliform	Quarterly once for 3 years	(Near Lift Point), Downstream and Upstream of lift point (3 Nos.)	Agencies appointed by KNNL	15,000/-
Soil Quality	pH, EC, Mg, Ca, Alkalinity, Cl, Na, K, Organic Carbon, K, PO ₄ , SAR, N and Salinity	Quarterly once for 3 years	Mainahalli, Handral, Kavaloor, Alavandi, Hiresindogi (5 Nos.)	Agencies appointed by KNNL	17,500/-
Sub-Total /3 months once					32,500/-
Sub-Total A-for 3 years					3,90,000/-
Aquatic life	Limnological and biological studies	6 Monthly once for 3 years	Near intake canal (1 No.)	Agencies appointed by KNNL	30,000/-
Sub-Total B-for 3 years					30,000/-
Total					4,20,000/-

Based on the above and as per the guidelines of MoEF under the supervision of Executive Engineer, TR Division, KNNL, Munirabad, six monthly compliance reports shall be submitted to Regional Office of MoEF, Bangalore.

In order to verify the effectiveness of monitoring program, Regional Office, MoEF, Bangalore and Regional Office, KSPCB, Koppal will be the enforcing agency to monitor the project activities.

7. Social Impact Assessment

7.1 Project influenced villages

One of the direct impacts of the project is Land acquisition and this project requires land (70 Ha) for the construction of intake canal, jack well cum pump house, Rising main, etc.

Table 11 Details of project influenced villages

Sl.No.	Impacted villages	Taluk & District
1	Kavaloor	Koppal Taluk and District
2	Alavandi	
3	Handral	
4	Hiresindogi	
5	Mainahalli	
6	Bikkanahalli	

7.2 Impact of the project

- Alavandi-Betageri Lift Irrigation scheme is proposed to irrigate an area of 2,425 Ha spread across 6 villages of Koppal Taluk and District, utilizing 0.5 T.M.C of water from Tungabhadra River during Khariff season. This will help to increase the agricultural production during Khariff season which in turn will raise their economic status and standard of living.
- Employment Generation due to the project: Around 100 people (30 Technical and 70 construction labourers) are expected to be employed for the construction work of intake channel, jack well cum pump house, raising main, delivery chamber and

distribution network with flow irrigation. During operation phase labourers will be appointed for operation and maintenance of the jack well.

- The only negative impact is that 70 Ha of dry land for the project construction purposes, but they will be sufficiently compensated as per Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act (RTFC&LARR Act), 2013.

So overall, impact of the project is progressive for the development of the villages and the agricultural production will increase contributing to the economy of the region. Villagers, generally welcome such irrigation projects and cooperates with the land acquisition process. The Department takes due care to consider the development needs of the people and due care will be taken to avoid all negative impacts.

8. Project Benefits

- Agricultural linkages will be considerably improved.
- The project improves total farm output and hence raises farm income.
- Project improves yields through reduced crop loss due to erratic, unreliable or insufficient rainfall. The details before and after the advent of irrigation is given below.
- Extensive agricultural production supplies raw materials to the nearby small scale industries thereby increasing the economy in the region.
- Altogether, population of 23,374 belongs to 4,854 families in the command area will be benefitted directly under the scheme.
- Direct employment opportunities for 100 members (30 Technical and 70 construction labourers) will be provided during construction phase. Further, indirectly labor opportunities will be substantially improved since larger area will be brought under irrigation.
- It improves fodder crops and in turn dairy farming in the command area. The project requires only 70 Ha for implementation of the scheme and does not envisage rehabilitation and resettlement.
- No tree cutting is involved and no forest land required for implementation of the scheme. Agro forestry shall be taken up in command area and it improves the ecosystem services.

9. Environmental Management Plan

Although agriculture is usually associated with its positive impacts on human life, irrigation practices may be associated with impacts on environmental conditions, which may eventually curtail the sustainability of irrigation projects. For this reason, Environmental Impact Assessment (EIA) has been recognized as an integral part of the early planning studies of irrigation projects in order to identify any expected negative impacts and suggest the necessary mitigation plans to curb these impacts through formation of Environmental Management Plan (EMP).

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
A. Construction Phase						
1. Air Environment						
Fuel combustion from construction equipments	Emission of pollutants (PM, SO ₂)	High speed Diesel with low sulphur content will be used for the construction equipments/ vehicles which has low ash content	Reduction in pollutants level	Intake canal, jack well cum pump house	Contractor & KNNL	Throughout the construction period (24 months)
Vehicular movement and operation of batching plants	Dust pollution	Water sprinkling and vehicles should be covered with tarpaulin, speed limit restrictions	Reduction in fugitive emissions	Intake canal, jack well cum pump house, access roads, around construction site, disnets	Contractor & KNNL	Water sprinkling - 3 times/day
Burning of fire wood	Emission of pollutants (C, SO ₂)	Labor camps supplied with LPG facility	Reduction in emission levels	Labor camp	Contractor & KNNL	Throughout the construction period (24 months)

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
Operation of DG sets, excavation	Health problems to labors	Usage of Nose masks	Healthy working environment	Intake canal, jack well cum pump house, access roads, around construction site, disnets	Contractor & KNNL	Throughout the construction period (24 months)
2. Noise Environment						
Operation of DG sets and usage of construction equipments	Increase in noise levels	PPEs such as, ear plugs and ear muffs will be provided to the workers, Acoustic enclosures for DG sets	Reduction in noise levels	Intake canal, jack well cum pump house, access roads, around construction site, disnets	Contractor & KNNL	Throughout the construction period (24 months)
Vehicular Movement	Increase in noise levels	Construction activities shall be restricted only to day time	Reduction in noise levels	Intake canal, jack well cum pump house, access roads, around construction site, disnets	Contractor & KNNL	Throughout the construction period (24 months)
3. Water Environment						
Sewage from labor camps	Surface and ground water pollution	Treatment through septic tank and soak pit	Reduction in pollution load	Labor camps	Contractor & KNNL	Throughout the construction period (24 months)
Stagnation of water	Mosquito breeding grounds	Providing proper sanitary facilities	Healthy environment	Labor camps	Contractor & KNNL	Throughout the construction period (24 months)

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
Excavation and operation of DG sets	Muck generation, blockage of natural drains and contamination of ground water	Reuse of muck at site, disposal of used oil KSPCB authorized preprocessors	Reduction in surface and ground water contamination	Intake canal, jack well cum pump house, disnets	Contractor & KNNL	Throughout the construction period (24 months)
Construction of intake canal	Increase in turbidity levels in river	Provision of sand bags	Healthy aquatic ecosystem	Intake canal	Contractor & KNNL	4 Months
4. Soil Environment						
Construction of labor camps, stock yards	Loss of fertile soil	Waste land will be used for erection of labor camps	Land resource optimization	Waste land	Contractor & KNNL	Throughout the construction period (24 months)
Maintenance of DG sets and construction machineries	Soil contamination	Maintenance at service centres	Reduction in soil contamination	Intake canal, jack well cum pump house, access roads, around construction site, disnets	Contractor & KNNL	Throughout the construction period (24 months)
5. Solid and Hazardous waste Environment						
Excavation	Change in hydraulic regime	Reuse of excavated earth	Natural drainage pattern maintained	Intake canal, jack well cum pump house, disnets	Contractor & KNNL	Throughout the construction period (24 months)
Improper dumping of solid	Water pollution	Labor camps at 1 km away from river,	Reduction in siltation and eutrophication	Intake canal and river course	Contractor & KNNL	Throughout the

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
waste from labor camps		Disposal to Municipal Authorities				construction period (24 months)
6. Biological Environment						
Construction activities	Wilting of plants	Water sprinkling	Normal photosynthetic activity	Intake canal, jack well cum pump house, access roads, around construction site, disnets	Contractor & KNNL	Throughout the construction period (24 months)
Labor camps	Riverine water pollution	Labor camps at 1 km away from river, restrictions for not using the river water	Zero water pollution	Labor camps	Contractor & KNNL	Throughout the construction period (24 months)
Use of fire wood	Cutting of trees	LPG for labor camps	Positive ecosystem services	Labor camps and its surrounding	Contractor & KNNL	Throughout the construction period (24 months)
Washing of construction equipments	Reduced DO levels	Washing at authorized service stations	Aquatic system maintained	Tungabhadra river	Contractor & KNNL	Throughout the construction period (24 months)
7. Socio-economic environment						
Land acquisition	Affecting livelihood	Compensation as RFCLA&TRR Act 2013	Sustainability for livelihood opportunities	Mainahalli, Handral, Hiresindogi, Bikkanahalli, Kavaloor, Alavandi	KNNL	6 months
Vehicular movement	Health problems	Water sprinkling and movement of vehicles	Healthy environment	Hankunti village, Koppal taluk	Contractor & KNNL	Throughout the

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
		carrying raw materials only during night time.				construction period (24 months)
B. Operation phase						
Excess application of fertilizers and pesticides	Soil and water contamination	Awareness on organic farming practices	Reduction in pollution load	Command area	KNNL and Water user Associations	3 years
Due to construction of Intake canal and Pump house	Affecting aquatic life	Fish mesh will be provided near intake at floor levels	Fish movement into pump house can be restricted	Intake Canal & Jackwell	Contractor & KNNL	During construction of Jack well

9.1 Command Area Development Plan

9.1.1 Water Users' Association (WUA)

The modern irrigation management aims at high efficiency of water conveyance and appropriate methods of water application, through participatory irrigation management at each stage of irrigation development. In Karnataka, it is essential to promote and implement the theme of participatory irrigation management in all the Irrigation projects through formation of Water Users' Association. The construction of OFD works will be taken up after formation of WUAs under the supervision of CADA.

The efficient management of irrigation water for maximizing productivity requires, firstly the efficient on farm water management and secondly the optimization of the use of water and land, through appropriate methods of water application. The efficient on-farm water management is related to water delivery system and allied works in the command area, which distributes the water to each farm. The items of works pertaining to on farm water management are termed as "On Farm Development Works". The On Farm Development works comprise of the following,

- Maintenance of disnets, sumps
- Control structures
- Maintenance of Automation
- Surface Drainage system
- Farm roads
- Land forming (Smoothing / grading/leveling)

9.1.2 Green Agro forestry activities in command area

Agro-forestry refers to the practice of Agriculture and Forestry in the same piece of land. The Karnataka Forest Department (KFD) has accorded high emphasis on farm forestry as a component in the afforestation programmes. The sector of Agro-forestry or Farm Forestry has a good potential as most of the agriculture lands are devoid of any trees, in the district. The trees if planted on the bunds and on the boundary of the lands, protect the crops from the desiccating high winds and also provide additional income from the trees to the farmer apart from providing him fodder and fuel as well.

Table 12 Green belt developments Plan around intake canal and jack well

Area proposed for Green belt	No. of saplings	Source for saplings	Time frame	Responsible agency for implementation
Intake canal	20	Koppal KFD Nursery	After completion of inspection path works	KNNL
Jack well cum pump house	40	Koppal KFD Nursery	After completion of site works	KNNL
Command area	10/ ha	Koppal KFD Nursery	First 2 years - 12125 Next 2 years -12125	KNNL and KFD
Canal Bank Plantation	1236	Koppal KFD Nursery	After completion of inspection path works	KNNL and KFD

Table 13 Species recommended for green belt development

Sl.No	Local Name	Botanical Name	Sl.No	Local Name	Botanical Name
1	Ala	<i>Ficus bengalensis</i>	16	Kadnugge	<i>Moringa pterygosperma</i>
2	Basari	<i>Ficus infectoria</i>	17	Kakke	<i>Cassia fistula</i>
3	Beete	<i>Dalbergia latifolia</i>	18	Kanagalu	<i>Dillenia pentagyna</i>
4	Buruga	<i>Bombax ceiba</i>	19	Kaval	<i>Careya arborea</i>
5	Dindiga	<i>Anogeissus latifolia</i>	20	Mathi	<i>Terminalia tomentosa</i>

Sl.No	Local Name	Botanical Name	Sl.No	Local Name	Botanical Name
6	Halasu	<i>Artocarpus heterophyllus</i>	21	Nandi	<i>Lagerstroemea lanceolata</i>
7	Honne	<i>Pterocarpus marsupium</i>	22	Nelli	<i>Emblica officinalis</i>
8	Hunalu	<i>Terminalia paniculata</i>	23	Neralu	<i>Syzygium cumini</i>
9	Ippe	<i>Madhuca Indica</i>	24	Shivani	<i>Gmelina arborea</i>
10	Jagalaganti	<i>Diospyros montana</i>	25	Tadasalu	<i>Grewia tilaefolia</i>
11	Jambe	<i>Xylia xylocarpa</i>	26	Tare	<i>Terminalia bellerica</i>
12	Saguvani	<i>Tectona grandis</i>	27	Hunase	<i>Tamarindus indica</i>
13	Yethiga	<i>Adina cordifolia</i>	28	Honge	<i>Pongamia pinnata</i>
14	Mavu	<i>Mangifera indica</i>	29	Huruglu	<i>Chloroxylon swietenia</i>
15	Kadugeru	<i>Semecarpus anacardium</i>	30	Bevu	<i>Azadirachta indica</i>

9.2 Fisheries Development Plan

Around 5 lakhs fish fingerlings comprised of Indian major crap – *catla catla* -40.0% *Labeo rohita* - 30.0% and *Cirrhinus mrigake*-30.0% in the size of over 75 mm are to be introduced in the Tungabhadra river annually in and around the project site. The project site authorities related to this project could also contribute their service and also submit their indents well in advance say during January – February of each year to the respective officers of the department of fisheries who, on their part, will make sure to effect the supply required, around August – September, the process helps in increased fish production from the river Tungabhadra and their reservoir/impounded to be formed. The entire profession since years, generation after generation to modestly ekk out their livelihoods. Rs. 5 lakhs is earmarked for this purpose.

9.3 Muck Disposal plan

Table 14 Muck disposal plan

Total excavated quantity cum	Service Road and Inspection Path	Formation of embankment	Filling trenches	Land leveling	Construction of CD works
181875	54563	27282	72750	18188	9092

9.4 Cost for implementing EMP

Table 15 Cost for implementing EMP

Item	Particulars	Estimated Cost in Rs.
A. Construction Phase		
A1- Environmental Pollution Control		
1. Air Pollution Control		
Water sprinkling	400/- x 2 tractors x 3 trips per day x 12 months 25 days (excluding rainy season and holidays)	7,20,000.00
Personnel protective equipments	Lumpsum	20,000.00
Chimney to DG sets	Lumpsum	20,000.00
LPG as cooking fuel	4 cylinders per unit x 15 units x Rs.550/- x 24 months	7,92,000.00
Sub-total 1		15,52,000.00
2. Noise Pollution Control		
Personnel protective equipments	Lumpsum	25,000.00
Sub-total 2		25,000.00
3. Water Pollution Control		
Septic and soak pit	Lumpsum	30,000.00

Sand bags	Lumpsum	20,000.00
Sub-total 3		50,000.00
4. Solid & Hazardous Waste Management		
Solid waste collection bins with shed	Lumpsum	20,000.00
Hazardous waste collection area with shed	Lumpsum	20,000.00
Sub-total 4		40,000.00
Sub-Total A1		16,67,000.00
A2 - Green belt development		
Plantation around intake canal and jack well	60 Saplings X Rs. 250/-	15,000.00
Canal bank plantation	6180 m X 1 sapling/ 5 m = 1236 saplings X 250/- rs.	3,09,000.00
Sub-Total A2		3,24,000.00
A3 - Agro forestry activities		
Agro forestry development	24250 saplings x Rs. 10/-	2,42,500.00
Sub-Total A3		2,42,500.00
A4 - Fisheries development		
Fisheries development	Lumpsum	5,00,000.00
Sub-total A4		5,00,000.00
A5. Socio-economic Environment		
Land acquisition	127.75 Acres x 1.05 Lakhs x 2 x 100% solatium	7,27,00,000.00
Awareness and Training	2.5 lakhs per year x 3 years	7,50,000.00
Sub-total A5		7,34,50,000.00
A6. Environmental Monitoring		
During construction period	Air, water, noise, soil, health checks and biological studies for 2 years	17,12,000.00
Sub-total A6		17,12,000.00
Total (A1 to A6)		7,78,95,500.00
II. Operation Phase		
A7- Environmental Monitoring		
Water, soil, and biological studies for 3 years		4,20,000.00
Sub-total A7		4,20,000.00
A8 - Green belt Mainatenance		
Canal bank plantation mainatenance for 3 years		5,00,000.00
Sub-total A8		5,00,000.00
A9 - Catchment area treatment		
Soil conservation measures and implementation of CAT plan for 5 years		1,28,00,000.00
Sub-total A9		1,28,00,000.00
Total (A7 to A9)		1,37,20,000.00