

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

FOR

**VEERABHADRESHWARA LIFT IRRIGATION SCHEME**

at

BAGALKOT DISTRICT, KARNATAKA

Project By



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## 1. Introduction

Veerabhadreshwara Lift Irrigation Scheme is proposed by KNNL to irrigate 17,377 Ha of dry lands in Bagalkot District and Belgaum District. The proposed project falls under 1(c) of EIA Notification, 2006 and the command area of the project is >10,000 Ha and therefore according to EIA Notification, 2006 and its subsequent amendments in 2014 it is categorized as 'A' and requires Environmental Clearance from MoEF, New Delhi. The Terms of reference (ToR) for the project was accorded by Ministry of Environment, Forests and Climate Change (MoEF) vide letter no. No. J-12011/21/2015-IA-I dated 17.11.2015. This EIA report presents baseline data collected during three seasons viz, Post-Monsoon season (Dec 2015 to Feb 2016), Pre-Monsoon season (March 2016 to May 2016) and Monsoon season (June 2016 to Aug 2016) for physical, biological and socio-economic components of environment, identification, prediction and evaluation of impacts based on the project activities and to prepare Environmental Management Plan (EMP) for mitigation of adverse impacts due to the proposed project.

## 2. Project Description

The proposed scheme envisages lifting of 2.5 TMC of water from Ghataprabha River by lift near Chikkur Tanda Village, Mudhol Taluk, Bagalkot District, Karnataka to provide irrigation facility to 17,377 Ha in 4 villages of Mudhol taluk of Bagalkot District and 30 villages of Ramdurga Taluk of Belagavi Districts respectively. The proposed irrigation is only for Khariff season. Out of 2.50 TMC of water, 2.4 TMC water will be utilized for irrigation and 0.10 TMC of water will be used for filling up of the tanks in the command area of this scheme.

Government of Karnataka (GoK) has accorded administrative approval for Veerabhadreshwara Lift Irrigation Scheme Vide Order No: WRD 5 MPS 2013, Bengaluru dated 21.01.2015 and the total cost of the project is 544.00 Crores.

Table 1 Salient Features of the project

1	Name of the Scheme	Veerabhadreshwara LIS
2	Name of the river	Ghataprabha
3	Geographical Location of Lift point	Latitude – 16 <sup>o</sup> 13'07.66"N Longitude – 75 <sup>o</sup> 23'11.08"E
4	Location of the Lift point	Near Chikkur Tanda Village, Mudhol Taluka, Bagalkot District, Karnataka
5	Type of the project	Irrigation, filling up MI tanks in command area.
6	Estimated cost of the project	Rs. 544.00 Cr
7	Command Area	17,377 Ha
8	No. of villages benefitting	34
9	Allocated water	70.75 M.Cum (2.5 TMC)
10	Cropping pattern	Kharif (June - October)
11	Irrigation intensity	100%
13	Submergence area	Nil
14	Rehabilitation and Resettlement	Nil
15	Total Land required	125 Ha
16	Total forest land required	Nil
17	Power Requirement	30 MvA, Source – Hubballi Electricity Supply Company Limited (HESCOM).

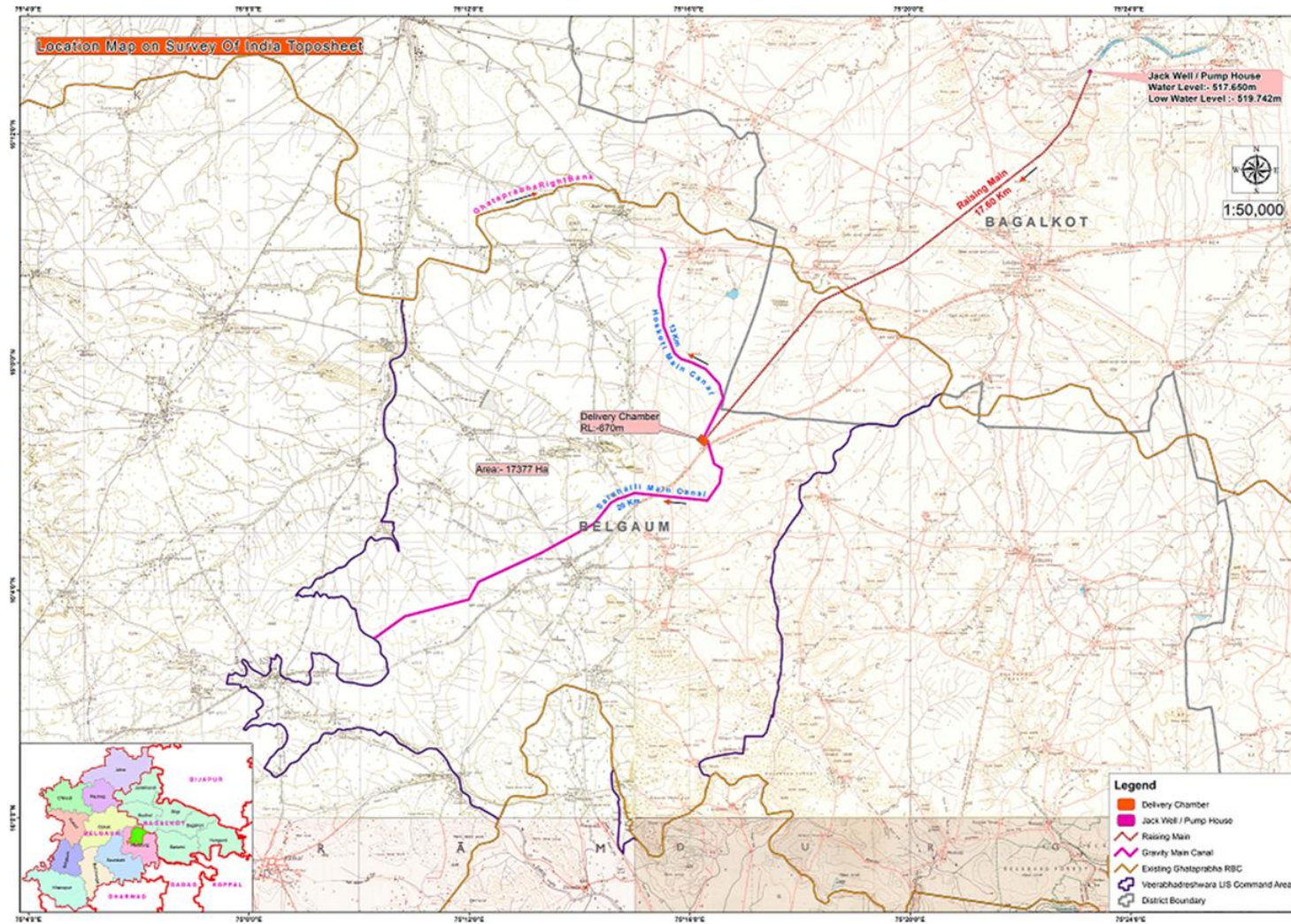


Fig 1 Location map of VBLIS on SoI toposheet

## 2.1 Need for the project

VRLIS is proposed to irrigate dry lands in villages of Mudhol and Ramdurga taluks. The villages coming under this scheme are drought affected and agriculture is the only source of livelihood and income. The entire district area of Belagavi and Bagalkot districts are falling under Northern Transitional Zone. This region receives an annual rainfall between 486 mm with uneven distribution. The uplands of southern and western part of the catchment is covered by deep well drained, clayey soils associated with deep well drained gravelly clay soils. The low lands of the same part of the catchment are covered by deep, moderately well drained clayey soils.

The area of Left side of Ghataprabha Right Bank Canal at R.L. 610.00 m is being irrigated and the area above this level could not be brought under irrigation. Similarly from Malaprabha Left Bank Canal an area of Right side is being irrigated below the R.L. 610.00 m. There is also a LIS of Rameshwara Lift Irrigation Scheme covering the area of west side. In between lays the fertile land that is deprived of irrigation facility which is at higher R.L. of 670.00 m. The area of nearly 17,377 Ha is possible to be irrigated by lifting water to an R.L. 670.00 m.

In this regard, VBLIS is considered to be the feasible for eradication of poverty in the region. The people of the region have no other employment opportunities except agriculture. 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

The rainfall data of gauging station Madarkhandi which is near the command area has been considered for a period of 24 years from 1985-2009 for computing average annual rainfall in the area. The proposed project is planned to utilize water only during June-October. Sufficient flow of water is available in the river in the order of 13-61 TMC of water. The project is designed keeping in view of the demand of downstream flow (e-flow). As per the above table, sufficient flow of around 98% is available for downstream ecosystem services. Hence, there is no impact on downstream of lift point (Ghataprabha River) due to drawl of water for the proposed project. It is observed from Yield catchment there is sufficient water available for this Scheme.

## 2.3 Command area of the project

The command area of 17,377 ha is spread across Mudhol Taluk of Bagalkot District, Ramadurg Taluk of Belgaum District. There are 34 villages benefitting under the scheme and 10 No's of MI tanks will be filled. The list of benefitting villages is given below.

Table 2 List of benefitting villages

Sl. No	District	Taluk	Village Name
1	Bagalkot	Mudhol	Killa Hoskoti
2			Dadahatti
3			Gudaganal
4			Mallapur
5	Belagavi	Ramdurg	Venkatapur
6			Gudagoppa
7			Hoskoti
8			Budni
9			Tondikatti
10			Bichguppi
11			Kullar



Sl. No	District	Taluk	Village Name
12			Timmapura
13			Udapudi
14			Bhidaki
15			Rokkadakatti
16			Panchagaon
17			Bannur Tanda
18			Rampura Tanda
19			Dadibhavi Tanda
20			Chandargi M
21			Godchi
22			Totagattii
23			Sidnal
24			Chandargi
25			Kesaragoppa
26			Gudikoppa
27			Chikkoppa
28			Hirekoppa
29			Murkatnal
30			Bannur
31			Salhalli
32			Aribinchi Tanda
33			Obalapur Tanda
34			Guttigoli

Table 3 List of tanks proposed for filling

Sl. no	MI Tank name	Capacity (Mcft)	Covered under
1	Bijaguppi	5.32	Hoskoti main canal
2	Guttigoli	7.84	
3	Kullur	10.87	
4	Chillminala	1.78	Salahalli main canal
5	Godachi	8.20	
6	D.Sapodla	2.0	
7	Rokkadahatti	2.13	
8	Toranahatti	63	
9	C-Hours	8.9	
10	Bannur	25	

## 2.4 Irrigation Planning and structural components of the project

An intake channel (100m) is proposed to lift the water from Ghataprabha River. A jackwell cum pump house will be constructed to pump the water to the Delivery chambers through a MS rising main of 17.20 Km length (2.690m dia). The intake level is kept at RL 516m and the RL of delivery chamber is kept at RL 670 m with static head of 154 m. The area of 17,377 Ha is proposed to be irrigated by providing two main canals viz Hosakoti Main canal running a length of 13.0 km and providing irrigation to 5900ha and Salahalli Main canal of length 20.0 km to provide irrigation to 11,477 ha. The technical details of the project are given below;

Table 4 Technical details of the project

<b>A. Lift Location</b>	
Name of the river	Ghataprabha river
Lift Point	Near Chikkur Tanda village, Mudhol Taluka, Bagalkot District.

Ground Level	RL 516.00 m
CBL	RL 510.00 m
Delivery Level	RL 670.00 m
<b>B. Intake Canal</b>	
Lenth	100 m
Bed width	3.0 m
Side slope	1:1
Free board	0.6 m
<b>C. Jackwell cum pumphouse</b>	
No. of Pumps	4 + 1 standby
Total Power Requirement	30 MvA
Source	HESCOM
<b>D. Rising Main</b>	
Length	17.20 Km
Diameter	2.690 m
Material	Mild Steel
<b>E. Delivery Chambers</b>	
RL of DC	670 m
Dimension	24.2 m x 24.2 m
Irrigating Area	17377 Ha

## 2.5 Land Requirement

The proposed project requires 125 Ha for implementation of the project. The land required is only for construction of Jack well cum pump house, Intake canal and Delivery chambers. No forest land is required for the project. The required land will be acquired as per the Right to Fair Compensation and Transparency in Land Acquisition Act, 2014.

## 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 under. The estimated percentage area of these crops and their corresponding yields are given below;

Table 5 Existing cropping pattern in the command area

Sl. No.	Crops	% of area	Area in Ha.	Yield Qtl/ha
1	Maize	50	5648	7.5
2	Local Jowar	50	5648	5.0
<b>Total</b>		<b>100</b>	<b>11296</b>	

## 2.7 Proposed cropping pattern details

In view of introducing Drip Irrigation system in the entire command area of 17,377 ha, the following cropping pattern (for Khariff Season) is proposed.

Table 6 Proposed cropping pattern

Sl. No.	Crops	Area in ha	% area
1	Ground nut	5213	30
2	Hy. Jowar	3996	23
3	Hy. Maize	1912	11
4	Bajra	6256	36
<b>Total</b>		<b>17377</b>	<b>100</b>

### 2.2.10 Benefit cost ratio

The benefit cost ratio has been worked out to 1.32 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 Post-Monsoon Season (Dec 2015 to Feb 2016), Pre-Monsoon season (Mar 2016 to May 2016) and Monsoon Season (June 2016 to Aug 2016). 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 in general is gently undulating plain with slight ruggedness. The topography of the project area is partly plain and partly sloping. The elevation in the study area ranges from RL 350.00 m to RL 700.00 m.

##### **3.1.2 Ambient air quality**

The results of ambient air quality reveal that, PM10 was in the range between 71-42 mg/m<sup>3</sup> and whereas PM2.5 was in the range between 27 - 17 mg/m<sup>3</sup>. SO<sub>2</sub> and NO<sub>2</sub> are in the range between 9.70 – 2.53 mg/m<sup>3</sup> and 14.04 – 7.20 mg/m<sup>3</sup> respectively. The air quality index in the study area is found to be satisfactory for PM10 and PM2.5 and good for gases (SO<sub>2</sub> and NO<sub>2</sub>).

##### **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 43.0 – 51.74 d(B)A for day time and 38.04 - 41.35 d(B)A for night time during Post-Monsoon season. The noise levels during Pre-Monsoon season is ranging between 42.82 – 53.6 d(B)A for day time and 35.71 – 37.75 d(B)A for night time and 46.34 – 48.8 d(B)A for day time and 35.02 - 39.05 d(B)A for night time during Monsoon season respectively. 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-III 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 Basalt belonging to Deccan Trap of Upper Cretaceous to Lower Eocene age. Other rock types observed are Dolomite, Quartzite, Banded Hematite Quartzite, Limestone, Chert-Breccia and Argillite of Simkeri Sub group and Lokapur Subgroup belonging to Kaladgi Super Group of Middle Proterozoic Age.

##### **3.1.6 Soil characteristics**

The soils in the Ghataprabha project area are mostly black soil, while the red and mixed soils constitute only 20 percent, and are two to four feet deep, heavy in texture, with 45 to 55 per cent clay and contain free calcium carbonate throughout the profile. There is generally a zone of salt concentration in the soil profile at a depth of 18 to 36 inches, the principal salt being gypsum. Below the gypsum layer occurs 'murrum' which is practically impermeable to water, so that the internal drainage of the soil is lateral rather than vertical within the profile.

The black soils on shale, limestone and basalt are deep, are moderately well drained, clay with slow permeability and is rich in bases (alkaline condition) and has a very high water holding capacity. The red soils occurring on sandstone ridges are shallow, excessively drained, and loamy soils with moderate to rapid permeability. Red soils developed on quartzite occurring on uplands shallow to deep, well drained loamy to clay with moderate permeability.

### 3.1.7 Hydrology

The study area forms a part of Bagalkot and Belgaum which is a part of Ghataprabha River Catchment / Basin. Kullur Halla, Kallumatti, Virupaksha Halla and are the three Nalas culminating in to Dodda Halla finally joining Ghataprabha River in the study area. Most of these are seasonal rivers which drain in to Ghataprabha River. Drainage pattern is observed to be dendritic to sub-dendritic with drainage density varying from 0.60 to 0.85 Kms. / Sq. Kms.

Water table generally follows the topography of the study area and is at greater depths in the water divide area and topographic heights but occurs at shallow depth in the valleys and low lying terrain and therefore groundwater moves down and follows the gradient from the higher to lower elevations i.e. from recharge area to discharge areas. The general flow direction of groundwater in the study area is towards North.

### 3.1.8 Surface Water and Ground water

The baseline status of water quality in the study area was established. Water samples were collected from 5 locations (1 No. surface water & 4 No. ground water) in the study area during the study period.

During Post Monsoon season, the physico-chemical parameters for Ghataprabha River at Chikkur Tanda village are well within the standards. Total Hardness was reported to be 352 mg/L, Conductivity was observed to be 1166 $\mu$ s/cm. Total Coliform were found to be absent in the sampled location. Total Hardness in ground water was ranging from 340 mg/l at Kesarakoppa village to 484 mg/l at Chippalkatti village and whereas the Nitrate levels are ranging from 0.45 mg/L at Rokkadakatti village to 21.3 mg/L at Chippalkatti village and are well within the standards. Fluoride was not found in any of the locations and MPN is less than 1.8/100ml. Heavy metals absent in all the locations. Overall, the ground water quality was found to be good and confirming to IS standards.

During Pre Monsoon season, The physico-chemical parameters for Ghataprabha River at Chikkur Tanda village are well within the standards. Total Hardness was reported to be 392 mg/L, Conductivity was observed to be 1030  $\mu$ s/cm. 2 No's of CFU/100ml Total Coliform were found in the sampled location. The ground water quality analysis results reveal that, Total Hardness was found in the range of 348 – 472 mg/l. Iron was ranging between 0.003 mg/l at Dadanatti village to 0.11 mg/l at Kesarakoppa village. Conductivity was observed to be in the range of 1330  $\mu$ s/cm at Rokkadakatti to 1959  $\mu$ s/cm at Dodanatti

During Monsoon season, Total Hardness was found to be 488 mg/L. Iron was found to be 0.02 mg/l. Conductivity was observed to be higher than post monsoon and pre monsoon season and was found 1683  $\mu$ s/cm. Total Coliform were not found in the sampled location. The ground water quality analysis results reveal that, the Total Hardness was well within the standard limit at all the locations and ranging between 180mg/L at Rokkadakatti and 480 mg/L at Dadanatti. Calcium (136 mg/L at Doddanatti to 28 mg/L at Rokkadakatti mg/l),

### 3.1.9 Land use assessment

The results indicate that the core zone is dominated by crop lands followed by forest and water body. It also includes barren rocky land agricultural plantation. 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 7 Land use patterns prevailing in 10 –km radius of the proposed project site

Sl. No	Land Use	Area	
		(ha)	%
1	Barren Rocky / Stony Waste	629.11	3.62
2	Degraded Forest	81.00	0.47
3	Fallow land	166.41	0.96
4	Gullied / Revinous Land	1.83	0.01

5	Kharif + Rabi (Double Crop)	5074.55	29.20
6	Kharif crop	2888.79	16.62
7	Lake / Tanks	80.36	0.46
8	Land with scrub	896.38	5.16
9	Land without scrub	654.72	3.77
10	<i>Prosopis Juliflora</i>	13.84	0.08
11	Rabi crop	6699.83	38.56
12	River / Stream	74.11	0.43
13	River Island	1.76	0.01
14	Village	114.30	0.66
	<b>Total</b>	<b>17377.00</b>	<b>100.00</b>

## 3.2 Biological Environment

### 3.2.1 Flora

A total of 122 plant species were recorded in both core and buffer area of the proposed project site. Of which 36 belong to tree species, 14 belongs to shrub species and 72 species belongs to herbs respectively. Out of the 122 plant species recorded in quantitative study, one species belongs to vulnerable category of IUCN.

### 3.2.2 Fauna

The field sighting and published records for the region indicated that 11 mammals were reported for the region. There are about 32 birds recorded for the region, which are more common found in outside the project area. There are 11 species of butterflies were observed in core and buffer area of the project. A total of 9 reptiles and two amphibians were also observed in the project area. Majority of the fauna recorded or reported for the region were also observed outside the project area in semi-arid region of Karnataka.

### 3.2.3 Protected Areas

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

### 3.2.4 Forest land

No forest land is needed for any construction activity in the project area.

## 3.3 Aquatic Ecology

Detailed Physico-chemical and Biological studies carried-out in the river Ghataprabha, in and around the project site, presents 'optimum' features to support/sustain varieties of aquatic life present. The river is found to be 'free' from pollution threat.

The plankton constituents of the Ghataprabha river at the project site Chikoor Tanda, Lokapur Hobli, Mudhol taluk, Bagalkot district studies (Summer, Pre - monsoon), recorded a very 'Poor' picture, particularly, during the February, 2016 when the which marked the on - set of summer period. It is also true to state that 'Pre - Monsoon and Monsoon' seasons could be categorised as 'Poor' plankton production periods. As the data infer, though the Phytoplankton, by species composition (15nos.) had a better representation, but, by numbers and percentage - wise, the zooplankton (10Nos.) fared well. Phytoplankton numerically, ranged between 4 - 137 u/L and the zooplankton, between 7 - 332u/L

The indigenous fish species, some of which grows to large-size, are being harvested in very small sizes only. Species like *Puntius pulchellus*, *Labeo calbasu*, *L.fimbriatus*, *Sperata aor*, *S.seenghala* and *Wallago attu* are rarely caught which once contribute significantly in the fish composition of the species harvested. The species, such as *L.calbasu* and *W.attu* are found marketed in. Miserably, very small sizes; the arguments forwarded by the fishermen is that, in the absence of fast-growing larger-sized fish-Gangetic and Indegenous carps and catfish, they are but helpless in operating only the small-meshed nets to ekk out their livelihood. The catch

composition and the size of the fish species being harvested are not very encouraging for the efforts the fishermen put-in. Even during the prime monsoon season, average fish catch per fishermen is around 6-10kg only and, during the lean season it will be around 2-3kg only.

## **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 SO<sub>2</sub>.
- 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.
- Labor 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 operation of machineries like concrete plant, cranes, batch plants, material lifting operations, communication noise, including DG sets 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/flies, 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.

#### **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 Ghataprabha river basin.
- Loss of productive soil and impact on natural drainage pattern: The majority of the land coming in buffer area is belonging to crop land, where farmers are practicing mixed cropping pattern. The proposed project doesn't affect the land use or drainage of the area. The project proponent only requires 125 ha for construction activities.
- Study of the problem of landslide and assessment of soil erosion potential and the impact: Since the working area is not much deep and terrain, it is proposed to have proper drainage system to divert the drainage water away from the workings, there shall be no problem on land slides.
- 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.



- Ensure that soil horizons are replaced in the same order that they were removed.

#### 4.5 Biological Environment

A total 125 Ha of area (includes lift, jack well cum pump house & Canals) is going to 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:

No forest area will be diverted for non forestry activity. Hence, there is no impact on flora and fauna 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 8 Criteria for evaluation of impacts

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

Table 9 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			
<b>A. Construction Phase</b>														
<b>1.Impacts on Land Environment</b>														
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	
<b>2. Impacts on Water Environment</b>														
1	Eutrophication	Sewage from labor camp	H	✓			✓	✓			✓	Red	Green	
		Muck disposal	H	✓			✓	✓			✓	Red	Green	
2	Change in River	Construction of Intake	M	✓			✓		✓		✓	Orange	Green	

Sl.No	Environmental Attributes	Project Activities	Nature of Impacts											Without EMP	With EMP
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative				
	Water Quality	canal, jack well cum pump house, sumps, disnets													
		Diversion of river water	H		✓	✓		✓		✓					
		Decomposition of sediments and deposition of organic matter	M	✓			✓	✓			✓				
		Washing of equipments	L	✓			✓	✓			✓				
		Muck disposal	M	✓			✓	✓			✓				
3	Change in surface and ground water quality	Sewage from labor camp	H	✓			✓		✓		✓				
<b>3. Impacts on Air Environment</b>															
1	Increase in dust concentration	Construction equipments, operation of DG sets,	M	✓			✓	✓			✓				
		Excavation	H	✓			✓	✓			✓				
2	Fugitive Emissions from various sources	Vehicular movement	H	✓			✓	✓			✓				
		Loading and dislodging Use of sand, fine aggregates	M	✓			✓	✓			✓				
		Batching plant	M	✓			✓	✓			✓				
3	Increase in SO <sub>2</sub> , PM, NO <sub>x</sub>	Vehicular movement	M	✓			✓	✓			✓				
		Operation of DG sets	M	✓			✓	✓			✓				
		Fuel Combustion in equipments and Vehicles	M	✓			✓	✓			✓				
		Burning of fuels from construction workers	M	✓			✓	✓			✓				
4	Impact on Human Health	Emission of Dust particles	M	✓			✓	✓			✓				
<b>4. Impact on Noise Environment</b>															

Sl.No	Environmental Attributes	Project Activities	Nature of Impacts											Without EMP	With EMP
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative				
1	Increase Noise Level	Movement of vehicles	M	✓			✓	✓				✓			
		Operation of D.G sets	L	✓			✓	✓				✓			
		Movement of vehicles carrying raw materials	M	✓			✓	✓				✓			
<b>5. Impact on Biological Environment</b>															
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	✓			✓	✓				✓			
<b>6. Impact on Socio-economic Environment</b>															
1	Land acquisition	Affecting livelihood	H		✓	✓		✓				✓			
2	Impact on Human Health	Due to water/air borne diseases, traffic movement	H	✓			✓		✓			✓			
<b>B. Operation Phase</b>															
1	Impacts on Land Environment	Application of natural fertilizers and pesticides	H		✓	✓		✓		✓					
2	Impact on water environment	Application of fertilizers and pesticides	M		✓	✓			✓	✓					

## 5. Analysis of Alternatives

The area of Left side of Ghataprabha Right Bank Canal at R.L. 610.00 m is being irrigated and the area above this level could not be brought under irrigation. Similarly from Malaprabha Left Bank Canal an area of Right side is being irrigated below the R.L. 610.00 m. There is also Rameshwara Lift Irrigation Scheme covering the area of west side. In between lays the fertile land that is deprived of irrigation facility which is at higher R.L. of 670.00 m. The area of nearly 17,377 Ha is possible to be irrigated by lifting water to an R.L. 670.00 m. For this Veerabhadreshwara Lift Irrigation Scheme is proposed to irrigate. The farmers of the area are demanding for the 'Lift Irrigation Scheme' to mitigate their sufferings.

Earlier, it was proposed to irrigate the said area villages under Saundatti & Ramdurga taluks by lifting water from Ghataprabha River near Aralimatti village in Gokak Taluk. Since the 'Rameshwara LIS' was implemented with lifting point near Aralimatti village in Gokak taluk, the water availability at the proposed location for 'Veerabhadreshwara LIS' could not be established at the above lifting point.

Subsequently the alternate lifting location with sufficient availability of water was investigated and could be stationed near Chikkur Tanda in Mudhol taluk on the right bank of Ghataprabha River. From the proposed lifting point (Chikkur tanda) by harnessing 2.50 TMC it's possible to irrigate area under Ramadurga & Mudhol taluks.

Lifting water from the newly proposed lifting point will provide irrigation to 4 villages in Mudhol taluk & 30 villages in Ramdurga taluk, for which no alternative irrigation means are available. The total area proposed to irrigate is 17,377 Ha. In previous DPR, out of 2.60 TMC, 0.13 TMC of water was considered for filling of M.I. tanks. Hence, in the revised DPR 2.40 TMC of water is considered for irrigating 17,377 Ha of land in Mudhol & Ramdurga taluks and 0.10 TMC of water is considered for filling of M.I. tanks coming under the command area of VLIS.

## 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 10 Environmental Monitoring Plan for construction phase (24 months)

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
Surface water quality of Ghataprabha River	pH, Temperature, EC, TDS Alkalinity, TH, DO, BOD, COD, NO <sub>3</sub> , PO <sub>4</sub> , Cl, SO <sub>4</sub> , Na, K, Ca, Mg, Silica, Oil & grease, MPN, Total coliform	Fortnightly once until completion of Intake canal	Chikkur Tanda (Near Lift Point), Down stream and Upstream of lift point (3 No.)	Contractors or agencies appointed by KNNL	15,000/-
Ground water quality	pH, Temperature, EC, TDS Alkalinity, TH, NO <sub>3</sub> , PO <sub>4</sub> , Cl, SO <sub>4</sub> , Na, K, Ca, Mg, Silica, Oil & grease, MPN, Total coliform	Once in a month	Rikkadakatti, Kesarakoppa, Chippakatti, Dadanatti (4 Nos.)	Contractors or agencies appointed by KNNL	20,000/-
Soil Quality	pH, EC, Mg, Ca, Alkalinity, Cl, Na, K, Organic Carbon, K, PO <sub>4</sub> , SAR, N and Salinity	Once in a month	Chikkur Tanda, Hosakalli, Mallapur, Bannur, Chandargi, Bijjiguppi, Kallur	Contractors or agencies appointed by KNNL	24,500/-

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
			(7 No.)		
Air Quality	PM <sub>10</sub> , PM <sub>2.5</sub> , NO <sub>2</sub> and SO <sub>2</sub>	Monthly	Dadanatti Village, Obalapur, Sidnal, Tondikatti. (4 Nos.)	Contractors or agencies appointed by KNNL	24,000/-
Noise Levels	Leq Day, Leq Night in dB(A)	Monthly once until completion of construction works	Dadanatti Village, Obalapur, Sidnal, Tondikatti. (4 Nos.)	Contractors or agencies appointed by KNNL	16,000/-
Sub-Total / month					99,500/-
<b>Sub-Total A - For 24 months</b>					<b>23,88,000/-</b>
Aquatic life	Limnological and biological studies	Six monthly once until completion	Near Lift Point (1 No.)	Contractors or agencies appointed by KNNL	1,50,000/-
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	4,00,000/-
Sub-Total / 6 month					5,50,000/-
<b>Sub-Total B - For 24 months</b>					<b>22,00,000/-</b>
<b>Total</b>					<b>45,88,000/-</b>

Table 11 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 Ghataprabha river	pH, Temperature, EC, TDS, Alkalinity, TH, DO, BOD, COD, NO <sub>3r</sub> , PO <sub>4r</sub> , Cl, SO <sub>4r</sub> , Na, K, Ca, Mg, Silica, Oil & grease, MPN, Total coliform	Quarterly once for 3 years	Chikkur Tanda (Near Lift Point), Down stream and Upstream of lift point (3 No.)	Agencies appointed by KNNL	15,000/-
Soil Quality	pH, EC, Mg, Ca, Alkalinity, Cl, Na, K, Organic Carbon, K, PO <sub>4r</sub> , SAR, N and Salinity	Quarterly once for 3 years	Chikkur Tanda, Hosakalli, Mallapur, Bannur, Chandargi, Bijjiguppi, Kallur (7 No.)	Agencies appointed by KNNL	24,500/-
Sub-Total / 3 months once					39,500/-
<b>Sub-Total A for 3 years</b>					<b>4,74,000/-</b>

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
Aquatic life	Limnological and biological studies	Yearly once for 3 years	Near intake canal (1 No.)	Agencies appointed by KNNL	1,50,000/-
<b>Sub-Total B for 3 years</b>					<b>4,50,000/-</b>
<b>Total</b>					<b>9,24,000/-</b>

Based on the above and as per the guidelines of MoEF under the supervision of Executive Engineer, GRBCC Division No: 05 KNNL, Koujalagi, Gokak Taluk, Belagavi District, every six monthly compliance reports shall be submitted to Regional Office of MoEF, Bengaluru.

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

## 7. Social Impact Assessment

### 7.1 Project affected villages

One of the direct impacts of the project is Land acquisition and this project requires land from twelve villages as detailed in the Table below.

Table 12 Details of project impacted villages

Si.No.	Village Name	Taluk /District
1	Chikkur Thanda	Mudhol Taluk, Bagalakov District
2	Chawadapur	
3	Naganapur	
4	Dadanatti	
5	Hosakoti	
6	Guttigoli	Ramadurga Taluk, Belgaum District
7	Tondikatti	
8	Kullur	
9	Thimmapur	
10	Panchagaon	
11	Boodanur	
12	Kadampur	

### 7.2 Impact of the project

- Agriculture is the back bone of economy of the region. However, due to the inconsistent monsoons and erratic rainfall, the overall agricultural production and consequently the per capita income and the overall economy of the region is low. During summer season, even drinking water needs to be transported to this famine struck area. Hence, this proposed project is a welcome movement which is designed to irrigate 17,377Ha of land spread across 34 villages of Ramdurga taluk of Belagavi district and Mudhol taluk of Bagalkote district, in addition to providing drinking water and sub-soil replenishment. This will help to improve the agricultural output which in turn will increase the per capita income of the people of the region.

- Around 500 people (100 Technical and 400 construction labourers) are expected to get employment for the construction of intake channel, jack well cum pump house, raising main, delivery chambers and distribution network consisting of Lift cum Flow Irrigation System. During operation phase labourers will be appointed operation and maintenance of the jack well.
- The only negative impact is that some people will lose their agricultural land for the project construction purposes and they will be sufficiently compensated as per rules. The project design will take due care to ensure that no residential or commercial properties affected and there is no need for any displacement of families. People are aware of this and they have no objection to give their land taking appropriate compensation.
- The project will ensure some additional demands for construction of linking roads, sanitation facilities and such other developmental interventions.
- So overall impact of the project is positive which will have long term future impacts in the development contributing greatly to the development of the region in particular and Karnataka State in general

## 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.
- It allows a greater area of land to be used for crops in areas where rain fed production is impossible or marginal. Presently, 11295 Ha practicing rainfed agriculture and due to the implementation of the scheme 17377 ha will be under irrigation.
- Extensive agricultural production supplies raw materials to the nearby small scale industries thereby increasing the economy in the region.
- Increased benefits from flood control, soil erosion, etc
- Altogether, population of 51,773 belongs to 10,046 Households in the command area will be benefitted directly under the scheme.
- Direct employment opportunities for 400 members during construction phase and 40 members during operation phase of the project. 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.
- Labor requirement will be reduced considerably.
- The project requires only 125 Ha for implementation of the scheme and does not envisages rehabilitation and resettlement.
- No tree cutting 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
<b>A. Construction Phase</b>						
<b>1. Air Environment</b>						
Fuel combustion from construction equipments	Emission of pollutants (PM, SO <sub>2</sub> )	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, main and branch canals, distributaries	Contractor & KNNL	Thorough out 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, main and branch canals, distributaries	Contractor & KNNL	Water sprinkling - 3 times/day
Burning of fire wood	Emission of pollutants (C, SO <sub>2</sub> )	Labor camps supplied with LPG facility	Reduction in emission levels	Labor camp	Contractor & KNNL	Thorough out the construction period (24 months)
Operation of DG sets, excavation	Health problems to labors	Usage of Nose masks	Healthy working environment	Intake canal, jack well cum pump house, main and branch canals, distributaries	Contractor & KNNL	Thorough out the construction period (24 months)
<b>2. Noise Environment</b>						
Operation of DG	Increase is	PPEs such as, ear plugs and ear	Reduction in	Intake canal, jack	Contractor &	Thorough out the

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
sets and usage of construction equipments	noise levels	muffs will be provided to the workers, Acoustic enclosures for DG sets	noise levels	well cum pump house, main and branch canals, distributaries	KNNL	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, main and branch canals, distributaries	Contractor & KNNL	Thorough out the construction period (24 months)
<b>3. Water Environment</b>						
Sewage from labor camps	Surface and ground water pollution	Treatment through septic tank and soak pit	Reduction in pollution load	Labor camps	Contractor & KNNL	Thorough out the construction period (24 months)
Stagnation of water	Mosquito breeding grounds	Providing proper sanitary facilities	Healthy environment	Labor camps	Contractor & KNNL	Thorough out the construction period (24 months)
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, main and branch canals, distributaries	Contractor & KNNL	Thorough out 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
<b>4. Soil Environment</b>						
Construction of labor camps, stockyards	Loss of fertile soil	Waste land will be used for erection of labor camps	Land resource optimization	Waste land	Contractor & KNNL	Thorough out the construction period (24 months)
Maintenance of DG sets and	Soil contamination	Maintenance at service centres	Reduction in soil	Intake canal, jack well cum pump	Contractor & KNNL	Thorough out the construction period

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
construction machineries			contamination	house, main and branch canals, distributaries		(24 months)
<b>5. Solid and Hazardous waste Environment</b>						
Excavation	Change in hydraulic regime	Reuse of excavated earth	Natural drainage pattern maintained	Intake canal, jack well cum pump house, main and branch canals, distributaries	Contractor & KNNL	Thorough out the construction period (24 months)
Improper dumping of solid waste from labor camps	Water pollution	Labor camps at 1 km away from river, Disposal to Municipal Authorities	Reduction in siltation and eutrophication	Approach canal and river course	Contractor & KNNL	Thorough out the construction period (24 months)
<b>6. Biological Environment</b>						
Construction activities	Wilting of plants	Water sprinkling	Normal photosynthetic activity	Intake canal, jack well cum pump house, main and branch canals, distributaries	Contractor & KNNL	Thorough out 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	Thorough out 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	Thorough out the construction period (24 months)
Washing of construction equipments	Reduced DO levels	Washing at authorized service stations	Aquatic system maintained	Ghataprabha river	Contractor & KNNL	Thorough out the construction period (24 months)
<b>7. Socio-economic environment</b>						

Project Activity	Impacts	Mitigation measures	Advantage	Location	Responsibility & Monitoring Agency	Time frame
Land acquisition	Affecting livelihood	Compensation as RFCLA&TRR Act 2013	Sustainability for livelihood opportunities	Chikkurthanda, Chawadapur, Naganapur, Dadanatti, Hosakoti, Guttigoli, Tondikatti, Kullur, Thimmapur, Panchagaon, Boodanur, Kadampur	KNNL	6 months
Vehicular movement	Health problems	Water sprinkling and movement of vehicles carrying raw materials only during night time.	Healthy environment	Chikkur Tanda	Contractor & KNNL	Thorough out the construction period (24 months)
<b>B. Operation phase</b>						
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

## 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, Belgaum.

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 (Smoothening / grading/leveling)

### 9.1.2 Green belt development plan

#### 9.1.2.1 Plan for conservation of RET species

All along the intake canal and around the pump house, *Chloroxylon swietenia*, listed as the vulnerable tree by the IUCN shall be planted at a distance of 5 m. Similarly, the medicinal herb *Gloriosa superba* will be planted on either side of the intake canal and around pump house for species conservation. Only the native forest trees will be grown in the afforestation programs.

#### 9.1.2.2 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.

Silvi-Pasture refers to the planting of the trees in a predominately grassland so as to provide fodder all the year round. This afforestation is aimed at not only addition of tree species, but also addition of highly nutritive and palatable grass species in the area, thereby providing much needed nutritious fodder to the livestock population.

Table 13 Green belt development 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	30	Bagalkot KFD Nursery	After completion of inspection path works	KNNL
Jack well cum pump house	70	Bagalkot KFD Nursery	After completion of site works	KNNL
Command area	10/ ha	Bagalkot KFD Nursery	First 2 years of operation phase (First Phase) - 87000 Second Phase - 87000	KNNL and KFD

Table 14 Species recommended for green belt development

Sl.No	Local Name	Botanical Name	Sl.No	Local Name	Botanical Name
1	Ala	<i>Ficus bengalensis</i>	18	Kadivala	<i>Stephegyne parviflora</i>
2	Basari	<i>Ficus infectoria</i>	19	Kadnugge	<i>Moringa pterygosperma</i>
3	Beete	<i>Dalbergia latifolia</i>	20	Kakke	<i>Cassia fistula</i>
4	Buruga	<i>Bombax ceiba</i>	21	Kanagalu	<i>Dillenia pentagyna</i>
5	Dindiga	<i>Anogeissus latifolia</i>	22	Kaval	<i>Careya arborea</i>
6	Godda	<i>Lannea coromandlica</i>	23	Mathi	<i>Terminalia tomentsa</i>
7	Goni	<i>Ficus mysorensis</i>	24	Muthuga	<i>Butea monosperma</i>
8	Halasu	<i>Artocarpus heterophyllus</i>	25	Nandi	<i>Lagerstroemia lanceolata</i>
9	Honne	<i>Pterocarpus marsupium</i>	26	Nelli	<i>Emblica officinalis</i>
10	Hunalu	<i>Terminalia paniculata</i>	27	Neralu	<i>Syzygium cumini</i>
11	Ippe	<i>Madhuca Indica</i>	28	Shivani	<i>Gmelina arborea</i>
12	Jagalaganti	<i>Diospyros montana</i>	29	Tadasalu	<i>Grewia tilaefolia</i>
13	Jambe	<i>Xylia xylocarpa</i>	30	Tare	<i>Terminalia bellerica</i>
14	Saguvani	<i>Tectona grandis</i>	31	Hunase	<i>Tamarindus indica</i>
15	Yethiga	<i>Adina cordifolia</i>	32	Honge	<i>Pongamia pinnata</i>
16	Mavu	<i>Mangifera indica</i>	33	Huruglu	<i>Chloroxylon swietenia</i>
17	Kadugeru	<i>Semecarpus anacardium</i>	34	Bevu	<i>Azadirachta indica</i>

## 9.2 Fisheries Development Plan

The richness of the wide spectrum of native flora and fauna in the lotic and lentic water bodies in particular, is governed by their Zoo geographical locations. Majority of the lotic water bodies in country, based on such precise identities, inherently, do not harbour the fast – growing fish species of commercial importance. Thus, in order to auger enrichment of the indigenous piscine fauna in the systems and to enhance considerable fish production from such resource, efforts to transplant several native as well as the exotic fish from one river to the other or from rivers to the impounded waters such as tanks, natural – and man – made lakes are in practice. Often selected fish, on commercially – based considerations, are transplanted from one river to the other. Farm – grown fish fingerlings of Indian major carp such as catla catla, Labeo rohita and *cirrhinus mrigala* and the exotic carp, *Cyprinus carpio communis*, *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix* and *Aristichthys nobilies* are also stocked in both lotic – and the lentic water bodies so as to improve the stock, better utilization of the fish food available and to retard the extinction of native fish species.

To a large extent, it is quite possible to enhance the productivity of a water mass by introducing and acclimatization process through supplanting a more viable and valuable commercial fish species into the biotope which uses the same feed web as the less –

valuable members of the indigenous fauna. This leads to establishment of new food – niches resulting, to a large extent, in high fish yield. Transplantation of indigenous and exotic fish species in the river systems in the state, however, is not so common. Proper attention in this sphere has to be directed by introducing fast – growing fish species, sport – fish, cold – water fish and the non – predatory Gangetic Pangasius pangsius after studying the environmental factors and zoogeographical distribution patterns of each. On the lines of stocking such components in good many rivers also which viably boost the fish production facilitating scores of fishermen engaged in the profession in such locations to ekk – out their livelihood honorably. For this Rs. 10 lakhs will be earmarked for fisheries management plan.

### 9.3 Muck Disposal plan

Table 15 Muck disposal plan

Total excavated quantity cum	Service Road and Inspection Path	Formation of embankment	Filling trenches	Land leveling	Construction of CD works
1303275	390982	195492	521310	130328	65163

### 9.4 Cost for implementing EMP

Table 16 Cost for implementing EMP

Item	Particulars	Estimated Cost in Rs.
<b>I. Construction Phase</b>		
<b>A. Air Pollution Control</b>		
Water sprinkling	400/- x 2 tractors x 3 trips per day x 24 months (excluding rainy season and holidays)	14,40,000.00
Personnel protective equipments	Lumpsum	25,000.00
Chimney to DG sets	Lumpsum	75,000.00
LPG as cooking fuel	2 cylinders per unit x 50 units x 550 x 24 months	13,20,000.00
<b>Sub-total A</b>		<b>28,60,000.00</b>
<b>B. Noise Pollution Control</b>		
Personnel protective equipments	Lumpsum	25,000.00
<b>Sub-total B</b>		<b>25,000.00</b>
<b>C. Water Pollution Control</b>		
Septic and soak pit	Lumpsum	1,50,000.00
Sand bags	Lumpsum	25,000.00
<b>Sub-total C</b>		<b>1,75,000.00</b>
<b>D. Solid &amp; Hazardous Waste Management</b>		
Solid waste collection bins with shed	Lumpsum	25,000.00
Hazardous waste collection area with shed	Lumpsum	20,000.00
Health checkups for labour	Lumpsum	2,00,000.00
<b>Sub-total D</b>		<b>2,45,000.00</b>
<b>E. Biological Environment</b>		
Plantation around intake canal and jack well	100 Saplings X 500 Rupees	50,000.00
Agro forestry development	174000 saplings x 10 Rupees	17,40,000.00

Fisheries development	Lumpsum	10,00,000.00
<b>Sub-total E</b>		<b>27,90,000.00</b>
<b>F. Socio-economic Environment</b>		
Land acquisition	125 ha x 3.924 lakhs x 2 x 100% solatium	19,62,00,000.00
Awareness and Training	5 lakhs per year x 3 years	15,00,000.00
<b>Sub-total F</b>		<b>19,77,00,000.00</b>
<b>G. Environmental Monitoring during construction period</b>		45,88,000.00
<b>Sub-total G</b>		<b>45,88,000.00</b>
<b>Total (A-G)</b>		<b>20,83,83,000.00</b>
<b>II. Operation Phase</b>		
Environmental Monitoring for 3 years		9,24,000.00
Green Belt mainatenance for 3 years		10,00,000.00
Awareness and Training for 3 years		10,00,000.00
Soil conservation measures and implementation of CAT plan for 5 years		9,95,00,000.00
<b>Total</b>		<b>10,24,24,000.00</b>