

**EXECUTIVE SUMMARY OF  
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT  
ಕರಡು ಪಲನರ ಆಫಾತ ಅಂದಾಜೀಕರಣ ವರದಿಯ ಕಾರ್ಯಕಾಲ ನಾರಾಂಶ**

**HERKAL (SOUTH) EXTENSION LIFT IRRIGATION SCHEME  
ಹೆರ್ಕಲ್ (ದಕ್ಷಿಣ) ವಿಸ್ತರಣೆ ಏತ ನೀರಾವಲ ಯೋಜನೆಯ**

BAGALKOT DISTRICT, KARNATAKA

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**APRIL 2018**

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FOR  
HERKAL (SOUTH) EXTENSION LIFT IRRIGATION SCHEME**

**at**

**BAGALKOT DISTRICT, KARNATAKA**

Project By



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**NABET/EIA/1518/SA 024**

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## **1. Introduction**

Herkal (South) Extension Lift Irrigation scheme envisages lifting of 1.136 TMC of water from Ghataprabha River to provide irrigation facility to 6,100 Ha of command area and benefitting 19 villages of Bagalkot district. The scheme also envisages filling of 6 MI tanks in the command area. Out of 1.136 TMC of water about 0.418 TMC of water shall be used for filling of MI tanks. The proposed irrigation is for Khariff and Rabi seasonal period and the intensity of irrigation is 100%.

The proposed project falls under 1(c) of schedule of EIA Notification, 2006. The command area of the project is <10,000 Ha and therefore according to EIA Notification, 2006 and its subsequent amendments in 2014, the proposed project is categorized as 'B' and requires Environmental Clearance from SEIAA, Karnataka. The Terms of reference (ToRs) for the project was accorded by State Level Environmental Impact Assessment Authority, Karnataka vide letter No. SEIAA 23 IND 2017 on 07.02.2018. Governments of Karnataka (GoK) have accorded administrative approval (Annexure - 2) for HSELIS vide order No. WRD 139 KBN 2017, Bengaluru dated 08.11.2017 and the total cost of the project is 238 Crores. The lifting of water from Ghataprabha River neither involves submergence nor Rehabilitation and Resettlement. Further, there are no ecologically sensitive areas, national parks, wildlife sanctuaries, Reserve Forests in the command area and no forest land is required to implement the scheme.

## **2. Project Description**

Herkal (South) Extension Lift Irrigation scheme has been proposed by the Krishna Bhagya Jala Nigama Limited, Govt. of Karnataka to provide irrigation to the drought prone villages and irrigation facility deprived areas of Bagalkot district. This will provide stability to agriculture and thus improving the per capita income and standard of living of the people. The command area is a left out area under Upper Krishna Project. Hence, the project is necessary to the drought prone area. There is a representation from local farmers and elected representatives to provide irrigation facilities to the left out area. To eradicate regional imbalances and equitable distribution of water, the proposed project is essential.

The surrounding areas of the proposed Herkal (South) Extension Lift Irrigation Scheme command area is a left out area of Herkal (South) Lift Irrigation scheme covered under Upper Krishna Project. There is a representation from local farmers and elected representatives to provide irrigation facilities to the left out area. To eradicate regional imbalances and equitable distribution of water, the proposed project is essential.

Table 1 Salient Features of the project

1	Name of the project	Herkal (South) Extension Lift Irrigation Scheme
2	Type of project	Irrigation
3	Type of Irrigation	Gravity Flow Irrigation
4	River	Ghataprabha
5	Latitude and Longitude of Lift Point	16°12'45"N and 75°30'27.09"E
6	Water Utilization	1.136 TMC
7	Command Area	6,100 Ha
8	Villages Benefitted	19 villages
9	Cost of the Project	238 Crores
10	Land required for Project	159 Ha.
11	Forest Land requirement	Nil
12	Submergence	Nil
13	R & R	Nil
14	Power requirement	4.5 MW - KPTCL
15	B.C Ratio	1.3
16	Irrigation intensity	100%



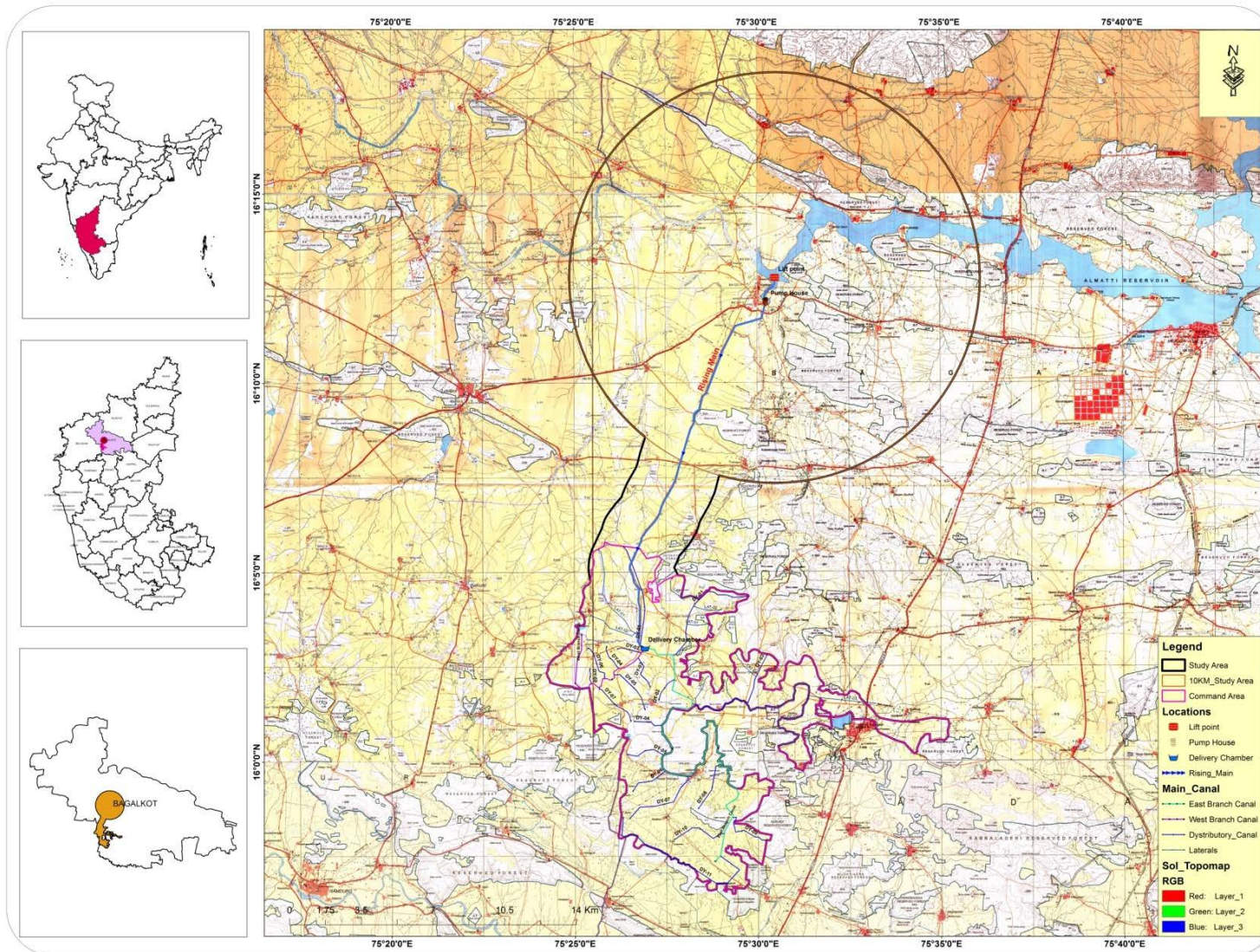


Fig. 1 Location map of the project

## 2.1 Need for the project

HSELIS is proposed to irrigate dry lands in 19 villages of Bagalkot 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 taluk are considered to be the more backward taluk. 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 Herkal (South) Extension Lift Irrigation Scheme is located on the backwaters of Almatti Reservoir which is at a distance of 45.78 km from lift point. Ten day average flow of Ghataprabha River was reviewed from gauging stations for the period between 1985-2009. The proposed scheme is designed keeping the downstream users in view.

## 2.3 Command area of the project

The command area of 6,100 Ha is spread across Bagalkot district. There are 19 benefitting villages under HSELIS. The lists of benefitting villages are given below.

Table 2 List of benefitting villages

Sl. No.	Name of the village	Sl. No.	Name of the village
1	Kainakatti	11	Kerur
2	Vodenahoskoti	12	Halkurki
3	Fakeerbudhihal	13	Yankanchi
4	Sagnur	14	Mattikatti
5	Hanamneri	15	Kadapatti
6	Chinchalkatti Thanda	16	Anawala
7	Hawalakoda	17	Shipparamatti
8	Huligeri	18	Bellikindi
9	Redder Timmapur	19	Nandihal
10	Jangawad		

## 2.4 Irrigation Planning and structural components of the project

The intake canal is located near Kaladagi village with approach road. The technical details of the intake canal are given below;

Table 3 Technical details of the project

Particulars	Details
Length of intake canal	1.589 km
Bed width	2.5 m
Intake level	513.00 m
Ground Level	522.765 m
Max. Water Level	524.26 m
Top of intake	526.56 m
Height of the intake wall	15 m
No. of Vents	4
Size of vent	3.1 m X 2.1 m
Designed discharge/ vent	0.935 cumecs
Size of trash rack panel	3.1 m x 3.7 m
Gate type	Vertical lift
Free board	0.3
Bed slope	1:30
Side slope	1:1
Velocity	0.969 m <sup>3</sup> /s

## 2.5 Jack well cum pump house

Static head has been calculated as the difference between the delivery level in the DC and the normal operating level in the sump. To this the losses in the rising main, valves, manifold, pump delivery pipe, vertical column etc, have been added to arrive at the gross pumping head. The technical details of the Jack well cum pump house are given below;

Table 4 Technical details of Jack well cum pump house

Particulars	Details
Structure	
Size	20.1 x 12.9 m

Particulars	Details
Service bay level	526.56 m
Pumps	
Total capacity	4572 (3 x 1524 kW)
No of pumps	3 + 1
Rate discharge	0.722 cumec/ pump

## 2.6 Rising main

MS pipes with inner lining and outer guniting is considered for design of rising main. The design velocity shall not be less than 0.6m/sec to avoid deposition in the pipe and shall be not more than 2 m/sec in order to avoid abrasion of the pipe material.

Table 5 Technical details of Rising main

Particulars	Details
Type	MS encased in RCC
Length	19 km
Thickness	1370 m

## 2.7 Delivery Chamber

RCC delivery chamber is proposed at the end of rising main. Technical details are as follows:

Table 6 Technical details of Delivery chamber

Particulars	Details
Type	Square with CC walls on all sides
Size	10.1 x 10.1 x 4 m
Full Tank Level	650.00 m

## 2.8 Gravity Canal Distribution Network

The proposed command area will be irrigated through East and West branch canals. The proposed method of irrigation is conventional flow irrigation system and the area is vast. Hence, two canals have been proposed one each for East and West command area.

Table 7 Details of Gravity Canal Distribution Network

Sl. No.	Particulars	Canal length in km.
1	East branch canal	23.93
2	West branch canal	7.44
<b>Total (A)</b>		31.40
3	Distributaries	60.00
4	Laterals and sub laterals	25.00
<b>Total (B)</b>		<b>85.00</b>
<b>Grand total</b>		<b>116.4</b>

## 2.9 Land Requirement

The proposed project requires 159 Ha for implementation of the project. The land required is only for construction of Jack well cum pump house, Raising main, Intake canal, Delivery chamber, main canals and distributaries. The required land will be acquired as per the Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013. Break-up of land requirement are as mentioned below:

Table 8 Detailed land breakup

Sl. No.	Components	Land required (Ha.)
1	Jackwell cum pump house	16
2	Main canal	47
3	Distributaries	74
4	Laterals	22
Total		159

## 2.10 Cropping pattern

Crops are mainly grown under two seasons the monsoon crop or the Khariff and the winter crop or the Rabi. Jowar, Ground Nut, Sunflower and pulses are grown both in Khariff and Rabi season while Wheat is grown as a Rabi crop. Cotton and Chillies are grown across both seasons. However, the project earlier being a part of UKP-II follows the approved cropping pattern and is the one recommended by Principal Agricultural Officer, Bijapur.

Table 9 Approved cropping pattern

Sl. No.	Crop	Intensity	J		J		A		S		O		N		D		J		F		M		A	
			I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
<b>KHARIFF</b>																								
1	Maize	15%	■	■	■	■	■	■	■	■	■													
2	Jowar	15%			■	■	■	■	■	■	■													
3	Ground Nut	20%		■	■	■	■	■	■	■														
4	Sun Flower	5%			■	■	■	■	■															
5	Pulses	5%		■	■	■	■	■																
<b>RABI</b>																								
1	Jowar	10%									■	■	■	■	■	■	■	■	■					
2	Safflower	2.5%									■	■	■	■	■	■	■	■	■	■				
3	Gram	5%									■	■	■	■	■	■	■	■	■					
4	Sun Flower	2.5%									■	■	■	■	■	■	■	■	■					
5	Wheat	5%									■	■	■	■	■	■	■	■	■					
6	Ground Nut	2.5%									■	■	■	■	■	■	■	■	■					
<b>TWO-SEASON</b>																								
1	Cotton	5%					■	■	■	■	■	■	■	■	■	■	■	■	■					
2	Vegetables	5%				■	■	■	■	■	■	■	■	■										
3	Chillies	2.5%				■	■	■	■	■	■	■	■	■										

## 2.11 Benefit cost ratio

The benefit cost ratio has been worked out to 1.12 considering the annual administrative expenses, depreciation charges and electrical energy charges.

Table 10 Benefit-cost ratio for HLIS

A	Gross Receipts	Before Irrigation	After Irrigation
1	Gross value of farm produce	1495.63	9865.16
2	Dung receipts(at 30% of the fodder expenditure)	67.30	295.95
3	Total A : Gross Receipts(1+2)	1562.93	10161.12
B	EXPENSES:		
1	Expenditure on seeds	55.34	115.980
2	Expenditure on manure etc.	129.19	240.111
3	Expenditure on hired labour (human and bullock)	299.13	1973.03
4	Fodder expenses (as percentage of gross value of produce)	224.34	986.52
	(15% ,10% of item A.1)		
5	Depreciation on implements (2.7% of Item A.1)	40.382	266.359

<b>A</b>	<b>Gross Receipts</b>	<b>Before Irrigation</b>	<b>After Irrigation</b>
6	Share and cash rent (5% 3% of Item A.1)	74.781	295.955
7	Land Revenue (2% of Item A.1)	29.913	197.303
8	Total B : Expenses (1 to 7)	853.08	4075.26
C	NET VALUE OF PRODUCE		
1	Total gross receipts (Total A.3)	1562.93	10161.12
2	Minus total expenses (Total B.8)	853.08	4075.26
3	Net value of product © : [1-2]	709.86	6085.86
D	ANNUAL BENEFITS:		
1	Net value after irrigation (C:3)		6085.861
2	Minus Net value before irrigation (C:3)		709.855
3	Net annual benefits (D):[1-2]		5376.006
E	Other net annual benefits due to aquaculture including pisciculture, drinking & industrial water supply, hydro-power generation, animal husbandry, catchment area treatment chargeable to project, canal bank plantation, reservoir periphery, afforestation etc		
	Total E		0.000
F	TOTAL NET ANNUAL BENEFITS (D3+E)		5376.006
G	ANNUAL COSTS		
1	Interest on Capital @10% ( Estimated total cost of the project including cost of land development @ Rs.1000/ Ha) (Rs.1707 Lakhs + 32 Lakhs)		2990.000
2	Depreciation of the project at 1 % of the cost of the project for 100 years life excluding cost of Land, R&R cost		238.000
3	Annual operation and maintenance charge at Rs 600 per Ha of ICA		73.200
4	Energy cost for Lift Head works		6.250
5	Mainatenance of the Head works at 1% its cost		176.429
6	Depreciation of the pumping system @ 8.33% of the cost of the pumping system assuming life of the system as 12 years		238.361
7	Depreciation of the raising mains @ 3.33% of the cost of the raising mains assuming life of the system as 30 years		418.500
8	Total (E):Annual costs (1 to 6)		4140.741
	Benefit cost ratio = $\frac{F: \text{Annual benefits}}{G.7: \text{Annual cost}}$	$\frac{5376.006}{4140.741}$	1.30

### **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 (October to December 2017). In addition to the baseline environmental monitoring, field inspection in the study area, collection of primary and 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 towards water body (Ghataprabha River). According to Digital Elevation map (DEM) of the study area elevation ranges from RL 420 m to RL 590 m.

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

The results of ambient air quality reveal that, PM<sub>10</sub> was in the range between 52 to 69 µg/m<sup>3</sup> and whereas PM<sub>2.5</sub> was in the range between 17 to 24 µg/m<sup>3</sup>. SO<sub>2</sub> and NO<sub>2</sub> are in the range between 5.16 µg/m<sup>3</sup> to 8.57µg/m<sup>3</sup> and 17.03µg/m<sup>3</sup> to 23.05 µg/m<sup>3</sup> respectively. The air quality index in the study area is found to be satisfactory for PM<sub>10</sub> and good for PM<sub>2.5</sub> and 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 46.4 to 48.7 dB(A) for day time and 37.2 to 40.4 dB(A) for night time. Overall, the noise levels in all the seasons were observed to be well within the CPCB standards. Results of Ambient Noise Levels are given below.

##### **3.1.4 Seismicity**

The Karnataka state is categorized as moderate to low seismic risk zone. The following Districts are falls in Zone III (Moderate Damage Risk Zone - MSK VII) viz., Bidar, Gulbarga, Vijayapura, Bagalkot, Belagavi, Dharwad, Uttar Kannada, Shimoga, Udupi, Dakshina Kannada and Kodagu. All other Districts are falling under Zone II (Low Damage Risk zone - MSK VI). Therefore, the proposed lift location and command area falls in 'low damage risk zone'. Hence, probabilities of earthquake occurrence are very less.

##### **3.1.5 Geology and Minerals**

The main rock type observed along rising main is limestone. No rock outcrops were seen around the Delivery Chamber area. Both chemical and high grade limestone suitable for cement manufacturing is available in Kaladagi.



### **3.1.6 Soil characteristics**

Growth of the plants is mainly dependent on soil characteristics. Soil is formed due to the interaction of living organisms, rocks, air, water and other materials. There will be variation in colour, clay content, organic matter, depth, pedogenic process depending on land use, land cover and climatology.

Soil plays a vital role in EIA studies because disturbance in the soil will leads to deterioration of other components of environment such as air, water quality and health. Baseline data on the soil is useful in preparing the Catchment Area Treatment Plan including engineering and biological measures. Understanding the nature, characteristics, extent and distribution of different soils as well as their properties is helpful in the soil management and conservation, crop production, water control and structure support.

### **3.1.7 Hydrology**

Bagalkot District is drained by the River Krishna and its tributaries Ghataprabha and Malaprabha. Krishna River enters the district at Terdal village in Jamakhandi Taluk and flows in south easterly direction and forms the northern boundary of the district separating it from Vijayapura District. A Major dam has been constructed across the Krishna River near Almatti in the district. Don River is the tributary of the Krishna River and flows for about 160 Kms in a meandering course from west to east in the central part of the District. The water of this river is generally brackish. Drainage pattern is sub-dendritic to sub-parallel in nature.

### **3.1.8 Surface Water**

The baseline status of water quality in the study area was established. Water samples were collected from 6 locations. Out of which 3 location was surface water and another 3 location was ground water.

Total Hardness in the surface water ranged from 590-853 mg/L, Dissolved oxygen ranged from 4.2-4.7 mg/L, conductivity and chloride were 1035-1131  $\mu$ S/cm and 129.95-171.94 mg/L respectively. Due to improper sanitation and utilization of river water for various domestic purposes Total Coliform was present in lift point, upstream and downstream of Ghataprabha river stretch.

### **3.1.9 Ground Water**

The ground water quality analysis results reveal that, the Total Hardness was found to be 546 mg/L near Kainakatti village, 640 mg/L near Kerur village & 700 mg/L near Kakanur village, Electrical Conductivity was 2230  $\mu$ s /cm in Kainakatti village, 1698  $\mu$ s /cm near Kerur village & 220  $\mu$ s /cm near Hire mural village. Total Coliform was <1.8 MPN Index/100 ml in all three samples.

### 3.1.10 Land use assessment

The results indicate that the area is dominated by crop lands followed by Scrub forest. The details are as follows:

Table 11 Land use / land cover classification in the study area

Sl. No.	Land use	Area (sq. Km.)	Area (Ha.)	Percentage (%)
1	Agricultural Plantation	0.13	13	0.030
2	Barren rocky/Stony waste	7.58	758	1.737
3	Built-up	8.05	805	1.845
4	Crop-Land	357.26	35726	81.875
5	Eucalyptus plantation	2.72	272	0.623
6	Land with/without scrub	7.46	746	1.710
7	Quarrying	0.04	4	0.009
8	Mixed Forest Plantation	1.47	147	0.337
9	Scrub forest	43.86	4386	10.052
10	Water body	7.79	779	1.785
<b>Total</b>		<b>436.35</b>	<b>43,635</b>	<b>100</b>

## 3.2 Biological Environment

### 3.2.1 Flora and Fauna

The diversity of trees too less near lift point, only *Acacia nilotica* (n=6) found all along the riparian stretch, however the diversity of trees good in command area a total of 10 species belonging to 9 families were identified, among them *Chloroxylon swietenia* and *Santalum album* are the two species belonging to Vulnerable category and *Acacia nilotica* belonging to Least Concerned category as per the IUCN conservation status, 2017 and remaining are common to the region. *Eucalyptus Citriodora* (n=26), *Azadirachta indica* (n=24) and *Chloroxylon swietenia* (n=10) are the three dominant tree species recorded during the study. *Acacia nilotica*, *Eucalyptus Citriodora*, *Leucaena leucocephala* and *Azadirachta indica* are the important agroforestry tree species widely grown in Silvi pastoral system of agro forestry systems to enrich green cover.

*Chloroxylon swietenia* is the most important species having an IVI of 114.13 followed by *Ailanthus excelsa* and *Eucalyptus Citriodora* having IVI values of 57.31 and 30.18 respectively. *Azadirachta indica* had the least IVI of 7.683. The dominant tree species, *Azadirachta indica* contributed basal area of 0.368 m<sup>2</sup>/ha followed by *Eucalyptus Citriodora* and *Acacia nilotica* with basal area of 0.107 m<sup>2</sup>/ha and 0.037 m<sup>2</sup>/ha respectively.

In addition to this, diversity indices such as Shannon-Weiner diversity index and Simpson diversity index were estimated to be 1.76 and 0.790. The girth class distribution shows maximum number of stems falls under 30-60 cm girth class (47 trees) which contributes 57.32% of the total

individuals followed by the girth class of 60-90 cm (21 trees) and 0-30 cm (13 trees) which contributes 25.61% and 15.85% respectively of the total individuals. However, 53 species of herbs, 21 species of shrubs and 4 species of climbers were recorded in command area. And near lift point 31 species of herbs, 7 species of shrubs and 3 species of climbers were recorded.

The command area and the proposed lift point supports a fair amount of faunal species with nearly 61 (n=475) and 33 (n=183) avifaunal species respectively and similarly, 18 (n=58) and 2 (n=2) butterfly species were recorded in the command area and proposed lift point respectively. However, *Pavo cristatus* (Indian peafowl) belongs to Schedule - I of Wildlife (Protection) Act, 1972. As per IUCN conservation status 2017, most of the recorded species belongs to Least Concern category. Indian Palm Squirrel, Small Indian Mongoose and Indian Hare are some of the mammals recorded during the study. All the species are common to the region and no RET species were recorded in the study area.

### 3.2.2 Protected Areas

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

### 3.2.3 Aquatic Ecology

Detailed limnological and Fisheries investigations carried-out in the Ghataprabha river, in and around the project site, indicated 'Optimum' features to support and sustain the aquatic biodiversity of the system. This lotic water body, as the data indicates, is free from pollutional influence. Totally 47 fish species were recorded.

## 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 labour camps.
- Due to operation of DG sets and excavation, labourers are prone to health problems.
- Fugitive dust emissions during excavation for main canal, branch canals and distributaries

#### Mitigation measures

- HSD with low sulphur content will be used for the construction equipments/ vehicles which have 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).

#### Mitigation measures

- 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 labourers 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 grill 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 labour camps leads to infiltration into the subsurface soil and finally affects the quality of 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 labour will be done.
- No construction labour 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 Soil Environment**

### **4.4.1 Impacts during construction phase:**

- Temporary loss of soil may be envisaged during the construction phase, if construction site, temporary offices, workers camps, stockyards, borrow areas etc are located on fertile areas and if haul roads and traffic during construction etc are routed through agricultural lands.
- Solid waste generated from labour camps during construction phase is not properly collected and disposed to municipal authorities; it will create leaching problems thereby affecting soil biota.
- Leakage of used oil from DG sets on the land will impact the soil biota.
- Movements of heavy machinery will create hard pan thereby affecting crop growth.
- Improper handling of excavated earth while constructing canal line, pump house, delivery chamber and while laying pipelines etc., will create soil loss and menace.
- Salinization of irrigated land, pollution by pesticides used for crop protection.

- Natural drainage will be affected due to excessive soil erosion.
- Improper muck disposal leads to Leachate formation and nearby riverine pollution at the lift point.
- Mitigation measures:
- Labour camps will be constructed in the vacant/ barren lands so that impact on agricultural lands is nullified.
- Maintenance and period repairs of machineries will not be taken up in the project site vicinity. Maintenance of DG sets will be done at the vendors place and will not taken up near project site.
- Storm water drainages and underground drainage of seepage water from construction area will be provided with retention tanks to hold for at least 2 hours and periodic cleaning of silt collected in the tanks.
- Adequate vertical and horizontal drains, drainage along road sides, cross drainages etc., will be constructed for slope stabilization.
- Muck disposal plan will be implemented as per EMP (Chapter-9)
- There will not be any impacts on soil during operation phase.

#### **4.5 Impact on Biological Environment**

No rare, threatened, endangered plant or animal species are found in the region as there are no protected areas or ecologically sensitive areas within 10 Km radius from the proposed project components. About 108 trees shall be removed during the construction of project components. The trees situated on the bunds of agricultural plantations and in Government lands (if any) will be removed with prior approval for construction of main canal.

A total 159 Ha area is going to be acquired for the proposed project area and involves no forest area. Hence it can be concluded that there will be no significant impact on the biodiversity of the area.

#### **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 12 Criteria for evaluation of impacts

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



Table 13 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														

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	Eutrophication	Sewage from labor camp	H	✓			✓	✓			✓		
2	Change in River Water Quality	Construction of Intake canal, jack well cum pump house, sumps, disnets	M	✓			✓		✓		✓		
		Diversion of river water	H		✓	✓		✓		✓			
		Decomposition of sediments and deposition of organic matter	M		✓		✓	✓			✓		
		Washing of equipments	L	✓			✓	✓			✓		
		Muck disposal	M	✓			✓	✓			✓		
3	Change in ground water quality	Sewage from labor camp	M	✓			✓		✓		✓		
3. Impacts on Air Environment													
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	✓			✓	✓			✓		

Sl. No.	Environmental Attributes	Project Activities	Nature of Impacts										
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative	Without EMP	With EMP
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	✓			✓	✓			✓		
4. Impact on Noise Environment													
1	Increase Noise Level	Movement of vehicles	M	✓			✓	✓			✓		
		Operation of D.G sets	L	✓			✓	✓			✓		
		Movement of vehicles carrying raw materials	M	✓			✓	✓			✓		
5. Impact on Biological Environment													
1	Pressure on existing natural resources	Immigration of labour population	L		✓	✓		✓			✓		
2	Reduced Photosynthetic activity, Wilting of plants	Transportation of construction materials	M		✓		✓		✓		✓		
		Site Clearance	M		✓	✓		✓			✓		

Sl. No.	Environmental Attributes	Project Activities	Nature of Impacts											
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative	Without EMP	With EMP	
3	Impacts on Fishes and Aquatic Ecosystem	Increase in turbidity of water due to Washing of machineries	M	✓			✓	✓				✓		
		Sewage from labour camp	H	✓			✓	✓				✓		
4	Tree cutting	For construction of project components	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	✓			✓		✓			✓		
7. Impact on Soil Environment														
1	Soil pollution	Temporary loss of soil may be envisaged during the construction phase	M	✓			✓	✓		✓				
		Leaching of solid waste generated from labour camps	H	✓			✓		✓			✓		
		Leakage of used oil from DG sets on the land	H	✓			✓	✓				✓		
		Hard pan created by movements of heavy machinery	H	✓		✓				✓		✓		

Sl. No.	Environmental Attributes	Project Activities	Nature of Impacts										
			Magnitude	Reversible	Irreversible	Long Term	Short Term	Direct	Indirect	Positive	Negative	Without EMP	With EMP
		Leakage of used oil from DG sets	H	✓		✓		✓			✓		
		Improper handling of excavated earth	H	✓		✓			✓		✓		
		Salinity of irrigated land	M	✓		✓		✓			✓		
		Blockage of Natural drainage due to soil erosion	H	✓		✓		✓			✓		
		Leachate formation due to improper muck disposal	H	✓		✓		✓			✓		
8. Impact of Solid waste on land Environment													
1	Disposal of waste	Irregular practice in disposal of waste	M		✓		✓	✓			✓		
2	Change in natural flow of water	Storage of excavated earth and Boulders	H		✓	✓		✓			✓		
8. Impact of Solid waste on water Environment													
1	Sedimentation	Movement of Muck along with Runoff	M		✓	✓		✓			✓		
2	Fisheries and Aquatic biota	Entering of Boulders to river/ water body	H		✓	✓		✓			✓		

## 5. Analysis of Alternatives

The proposed command area villages are deprived of irrigation facilities from existing irrigation schemes like Ghataprabha Right bank canal (GRBC), Ghataprabha Left bank canal (GLBC), Malaprabha Left bank canal (MLBC) and Alamatti Right bank canal (ALBC). The command area villages are drought prone areas and irrigation to this region is being done through Herkal (South) Extension Lift Irrigation Scheme.

## 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 14 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 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 and Total Coliform	Monthly once	Near Lift Point, Downstream and Upstream of lift point (3 Nos.)	Contractors or agencies appointed by KBJNL	38,250/-
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 & Total Coliform	Monthly once	Kaladagi village, Kerur village and Kakanur village (3 Nos.)	Contractors or agencies appointed by KBJNL	27,670/-
Soil Quality	pH, EC, Mg, Ca, Alkalinity, Cl, Na, K, Organic Carbon, PO <sub>4</sub> , SAR, N and Salinity	Monthly once	Kaladagi village, Kalsakoppa village Yandigeri village, Kainakatti village and	Contractors or agencies appointed by KBJNL	50,640/-

Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Locations	Responsibility	Estimated Cost in Rs.
			Kardigudda village (5 Nos.)		
Air Quality	PM10, PM2.5, NO2 and SO2	Monthly once	Near Lift Point (Kaladagi), Kainakatti village and Hawalakod village (3 Nos.)	Contractors or agencies appointed by KBJNL	28,300/-
Noise Levels	Leq Day, Leq Night in dB(A)	Monthly once until completion of construction works	Near Lift Point (Kaladagi), Kainakatti village and Hawalakod village (3 Nos.)	Contractors or agencies appointed by KBJNL	20,500/-
<b>Sub-Total / month</b>					<b>1,65,360/-</b>
<b>Sub-Total A - For 24 months</b>					<b>39,68,640/-</b>
Aquatic life	Limnological and biological studies	Six monthly once until completion	Near lift point (1 No.)	Contractors or agencies appointed by KBJNL	75,000/-
Health check ups	Spirometry, Pulse Oxymetry, Blood Test, Lung Function Test, Eye test, Physical fitness tests	Six monthly once until completion	Labor camps (1 No.)	Contractors or Doctors / PHC appointed by KBJNL	1,25,000/-
<b>Sub-Total / 6 month</b>					<b>2,00,000/-</b>
<b>Sub-Total B - For 24 months</b>					<b>8,00,000/-</b>
<b>Total (A+B)</b>					<b>47,68,640/-</b>

Table 15 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>3</sub> , PO <sub>4</sub> , Cl, SO <sub>4</sub> , Na, K, Ca, Mg, Silica, Oil & grease, &Total Coliform	Quarterly once for 3 years	Near Lift Point, Downstream and Upstream of lift point (3 Nos.)	Agencies appointed by KBJNL	38,250/-
Soil Quality	pH, EC, Mg, Ca, Alkalinity, Cl, Na, K, Organic Carbon, K, PO <sub>4</sub> , SAR, N and Salinity	Quarterly once for 3 years	Kaladagi village, Kalsakoppa village, Yandigeri village, Kainakatti village and Kardigudda village (5 Nos.)	Agencies appointed by KBJNL	45,000/-
<b>Sub-Total /3 months once</b>					<b>83,250/-</b>
<b>Sub-Total A-for 3 years</b>					<b>9,99,000/-</b>
Aquatic life	Limnological and biological studies	6 Monthly once for 3 years	Near intake canal (1 No.)	Agencies appointed by KBJNL	75,000/-
<b>Sub-Total B-for 3 years</b>					<b>75,000/-</b>
<b>Total (A+B)</b>					<b>10,74,000/-</b>

Based on the above and as per the guidelines of MoEF under the supervision of Executive Engineer, Dam Division, Almatti, 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 influenced villages

There are 10 influenced villages spread across Badami taluk of Bagalkot District. As detailed below. The total land areas of these villages are 9148.83 ha and there are 2033 households. Haligeri village have the maximum number (470) of households and Hanamaneri (38) have the minimum number of households.

Table 16 Land area and Households in influenced villages

Sl. No.	Villages	Total land area (Ha)	No. Households
1	Kainakatti	595.05	156
2	Jangawad	952.96	120
3	Narenur	1748.11	493
4	Saganur	502.41	81
5	Sheeparamatti	414.39	121
6	Bellikindi	552.33	93
7	Hawalkhod	943.28	168
8	Haligeri	1809.19	470
9	Chinchalakatti	1069.77	293
10	Hanamaneri	561.34	38
	<b>Total</b>	<b>9148.83</b>	<b>2033</b>

### 7.2 Positive and Negative impact of the project

- Herkal (South) Extension Lift Irrigation scheme is proposed to irrigate an area of 6,100 ha spread across 19 villages of Bagalkot District, utilizing 1.136 T.M.C water from Ghataprabha River. This will help to increase the agricultural production during both Khariff and Rabi seasons which in turn will raise their economic status and standard of living. This will have major impact on the area; especially entire population in this region depends on agriculture for their subsistence.
- Employment Generation due to the project: - During the project construction phase and operation-management phase additional employment will be generated and local labourers will be engaged for works. Around 160 people (25 Technical and 140 construction labourers) are expected to be employed temporarily for the construction work of intake channel, jack well cum pump house, raising main, delivery chambers, main canals and distribution network

by conventional system with flow irrigation. During operation phase labourers will be appointed for operation and maintenance of the Jack well.

- The only negative impact is that 39.6 acres of dry land spread across 10 villages and owned by some of titleholders will be lost for the project construction purposes, but they will be sufficiently compensated as per the new 2013 Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (2015 Karnataka Rules) applicable in the State. None of the residential or commercial properties are impacted and there is no displacement of PAPs.
- 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 cooperate 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 2,033 households in the command area will be benefitted directly under the scheme.
- Direct employment opportunities for 160 members (20 Technical and 140 construction labourers) will be provided during construction phase. Further, indirectly labour 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 159 Ha for implementation of the scheme and does not envisage rehabilitation and resettlement.
- 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**

EMP provides a delivery mechanism to address the adverse environmental impacts of a project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project related work<sup>1</sup>.

Integrated approach during project planning, design, construction and operation work acts as a better tool for implementation of Environmental Management Plan. The EMP measures include mitigation or enhancement measures as appropriate to the nature of impacts and are explained in the following sections. These include:

- Catchment area treatment plan
- Command area development
- Green belt development
- Fisheries conservation and management plan
- Muck disposal plan
- Restoration of quarry sites and landscaping
- Groundwater management plan
- Public health delivery system and provision of drinking water supply to local community
- Sanitation and Solid Waste Management Plan in labour camps
- Local Area Development Plan
- Environmental Safeguards during construction activities
- Environmental monitoring programme
- Reservoir RIM treatment

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<sup>1</sup> <https://www.adb.org/sites/default/files/institutional-document/33739/files/environment-safeguards-goodpractices-sourcebook-draft.pdf>

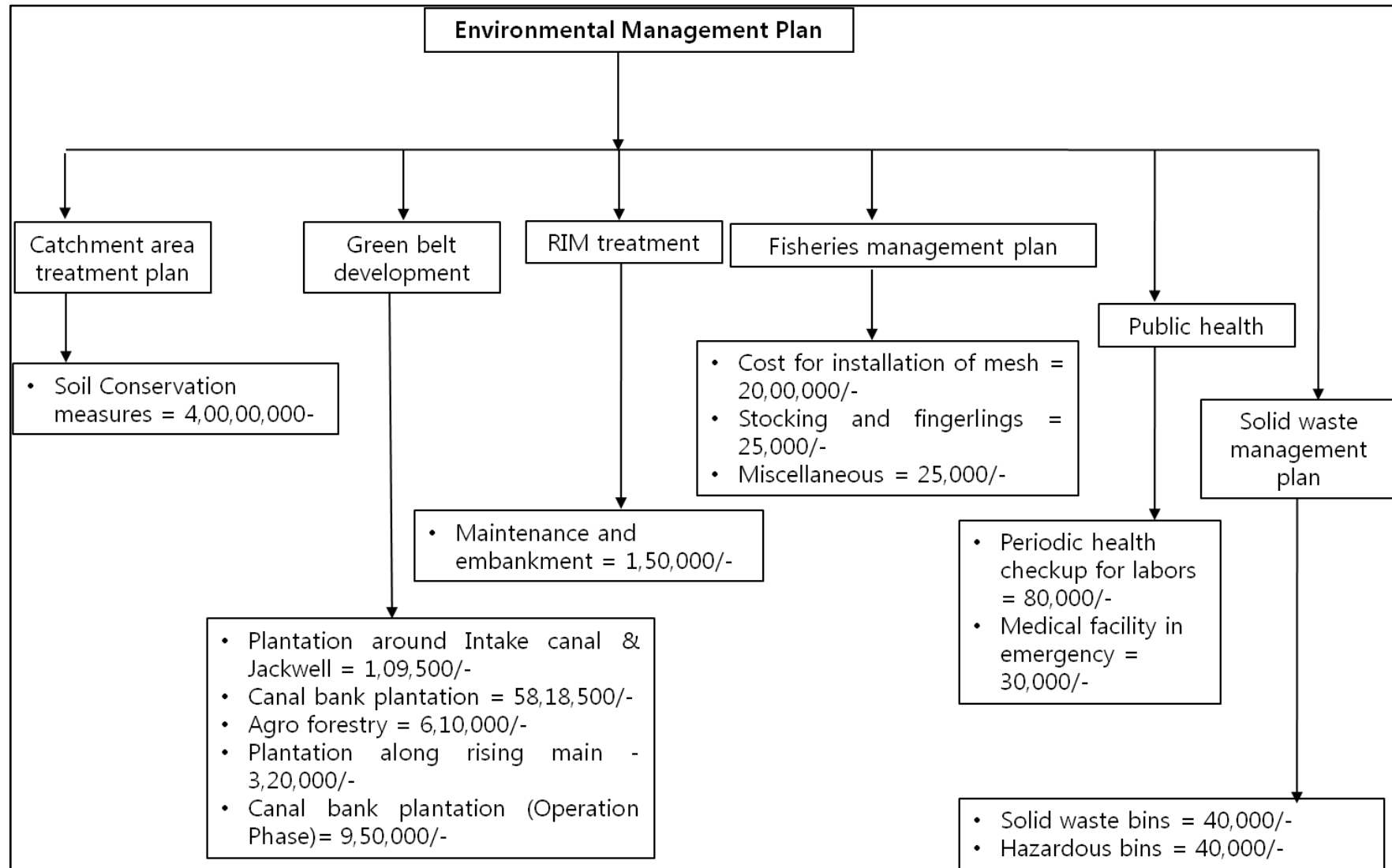


Fig 2. Environmental Management Plan flow chart

## 9.1 Green belt development plan/afforestation

### 9.1.1 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 programs. 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 17 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	318	Bagalkot KFD Nursery	After completion of inspection path works	KBJNL
Jack well cum pump house	120	Bagalkot KFD Nursery	After completion of site works	KBJNL
Rising main	3800	Bagalkot KFD Nursery	After completion of inspection path works	KBJNL and KFD
East and West branch canals	6,274	Bagalkot KFD Nursery	After completion of inspection path works	KBJNL and KFD KBJNL and KFD
Distributaries	12,000	Bagalkot KFD Nursery	After completion of inspection path works	KBJNL and KFD
Laterals and sub laterals	5,000	Bagalkot KFD Nursery	After completion of inspection path works	KBJNL and KFD
Command area	10/ ha (6,100)	Bagalkot KFD Nursery	First 2 years - 30,500 Next 2 years - 30,500	KBJNL and KFD

Table 18 Species recommended for plantation

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 tomentsa</i>
6	Halasu	<i>Artocarpus heterophyllus</i>	21	Nandi	<i>Lagerstroemea lanceolata</i>

Sl. No	Local Name	Botanical Name	Sl. No	Local Name	Botanical Name
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 Muck Disposal plan

All the muck generated out of the project activity will be reused for various project activities and the details are given below;

Table 19 Muck disposal plan

Sl. No.	Project activity	Type of excavation	Volume of excavation in Cum.	Swelling Factor	Volume of muck generated in Cum.	Qty. to be used (cum)
1	Raising Main	Underground	446	1.4	625	563
2	Delivery chamber	Surface	81	1.4	114	103
3	Pump House	Underground	3889	1.4	5445	4900
<b>Total</b>					<b>6183.4</b>	<b>5,657</b>

About 5,657 cum of muck will be left unused by Project Proponent which will be given to farmers for their field.

## 9.3 Environmental Pollution Control

During construction phase of the proposed project following measures will be taken to control Air, Noise and Water pollution.

Table 20 Cost estimate for Environmental Pollution Control

Sl. No.	Items	Particulars	Cost (Rs.)	Time period	Implementing agency
<b>Air Pollution control</b>					
A.	Water sprinkling	400/- x 2 tractors x 3 trips per day x 12 months x 25 days	7,20,000/-	Construction phase	KBJNL

Sl. No.	Items	Particulars	Cost (Rs.)	Time period	Implementing agency
		(excluding rainy season and holidays)			
B.	LPG as cooking fuel	Lumpsum	50,000/-		
C.	Chimney to DG sets & PPEs	Lumpsum	30,000/-		
<b>Total (A)</b>			<b>8,00,000/-</b>		
<b>Noise Pollution control</b>					
A.	Personnel Protective Equipments	Lumpsum	25,000/-		
<b>Total (B)</b>			<b>25,000/-</b>		
<b>Water Pollution control</b>					
A.	Septic tank, soak pit and sand bags	Lumpsum	25,000/-		
<b>Total (C)</b>			<b>25,000/-</b>		
<b>Total (A+B+C)</b>			<b>8,50,000/-</b>		

#### 9.4 Cost estimates for implementation of EMP

Cost for implementing Environmental Management Plan. The total amount to be spent for implementation of Environmental Management Plan (EMP) is Rs. 246.7 lakhs

Table 21 Cost for Implementing Environmental Management Plan

Sl. No.	Particulars	Cost (Rs.)
1	Catchment area treatment plan	4,00,00,000
2	Green belt development	89,46,000
3	Fisheries conservation and management plan	2,50,000
4	Public health delivery system	1,10,000
5	Sanitation and Solid waste management plan	80,000
6	Socio-Economic Environment (Land acquisition)	19,64,00,000
7	Environmental pollution control	8,50,000
8	Reservoir treatment	1,50,000
<b>Total</b>		<b>24,67,86,000</b>

#### 9.5 Cost for implementing Environmental Monitoring Programme

The cost of environmental monitoring programme during construction phase is Rs. 47,68,640/- and during operation phase is Rs.10,74,000/-.