NATIONAL HIGHWAYS AUTHORITY OF INDIA

Bangalore-Chennai Expressway Phase-II- Wildlife Proposal for Project Stretch falling within ESZ of Kaundinya Wildlife Sanctuary in Chittoor District in the state of Andhra Pradesh

(WL Proposal No. WL/AP/ROAD/418292/2023)

BIODIVERSITY IMPACT ASSESSMENT & WILDLIFE MITIGATION PLAN

NATIONAL HIGHWAYS AUTHORITY OF INDIA

PROPOSED DIVERSION OF FOREST LAND FROM PALAMNER RESERVED FOREST WITHIN RAYALA ELEPHANT RESERVE FOR CONSTRUCTION OF BANGALORE CHENNAI EXPRESSWAY PHASE-II IN CHITTOOR DISTRICT IN THE STATE OF ANDHRA PRADESH

BIODIVERSITY IMPACT ASSESSMENT & WILDLIFE MITIGATION PLAN

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1 INTRODUCTION

Conservation of wildlife is one of the important requirements of the present time in order to achieve the goal of sustainable growth. Loss of wildlife is one of the consequences of modern development pattern including demand of natural resources due to population growth. The loss of wildlife results into ecological imbalances. It is the demand of the time to integrate the ecological issues along with social and financial and commercial aspects of a project development.

This realization has initiated serious efforts towards conservation of wildlife. The present report is the evaluation of the existing status of the wildlife in and around proposed Bangalore Chennai Expressway (BCE) phase II project alignment comes within Eco sensitive zone of Kaundinya Wildlife Sanctuary and Palamaner Reserved Forest of Rayala Elephant Reserve in Chittoor District, Andhra Pradesh, and propose offset measures to any negative impact on wildlife due to the coming project.

1.1 Objectives of Biodiversity Study

The Biodiversity Management Plan lead to conservation of essential ecological diversity to preserve the continuity of food chains. The genetic diversity of plants and animals is preserved. By this study of Wildlife conservation plan, wild animals and plants are preserved. It provides immediate benefits to the society such as recreation and tourism & its conservation serves as an insurance policy for the future.

The main objectives of biological study were:

- To collect the baseline data for the study along with a description of the existing terrestrial, wetland and aquatic biodiversity.
- To assess the scheduled species in the proposed site (rare, endangered, critically endangered, endemic and vulnerable).
- To identify the locations and features of ecological significance.
- To identify the Impacts of proposed project before, after and during development phase.

1.2 Need for the project

Road projects are generally undertaken to improve the economic and social welfare of those using the road or served by it. Increased road connectivity can facilitate the fast and smooth movement of traffic thereby reducing travel times and lower the costs of vehicle use. Benefits include increased access to markets, jobs, education and health services, and reduced transport costs for both freight and passengers, reduce fuel consumption and exhaust emissions from the vehicle plying on the road.

1.3 Project Brief

- The project section of Bangalore Chennai Expressway Phase-II starts from N.G. Hulkur of Bangarupet Taluka in Kolar District of Karnataka at project Km 71.000 and ends at project Km 156.00 at Ramapuram village of Gudipala Taluk in Chittoor district of Andhra Pradesh. The project alignment of Phase-II passes through 39 villages.
- The total length of proposed BCE Phase-II is 85.00 Km.
- The geographical extension of the project road section is between 13°0'28.14"N Latitude & 78°25'33.77"E Longitude 13°7'15.53"N Latitude & 79° 6'13.41"E Longitude.

Sl. No.	Bangalore-Chennai Phase-II	Design Chainage (km)		Length (km)
		From	To	
A.	**Project section in Karnataka State (Kolar District)**			
1	Starts from Km 71.000 near N.G. hulkur Village, Bangarpet Mandal, Kolar District, Karnataka and ends at km 75.300 Puganahalli of Bangarpet Mandal and again at and from Km 82.407 at Yethurahalli of Mulnagalu Mandal to Km 83.598 in Chukkanahalli of of Mulnagalu Mandain Karnataka.	71+000	75+300	4.300
		82+407	83+598	1.191
			Total	**5.491**
B.	**Project section in Andhra Pradesh State (Chittoor District)**			
	Starts from Km 75.300 near state border KN/AP at Nernipalli village and ends at km 82.407 at Javunipalli near state border AP/KN and again starts at Km 83+598 at Totakanama village of Venkatagir Kota Taluk of Chittoor District and ends at Km 156+000 near 190.Ramapuram Village, Gudipala mandal, Chittoor District in Andhra Pradesh.	75+300	82+407	7.107
		83+598	156+000	72.402
			Total	**79.509**
			Total length of BCE Phase-II	**85.00**

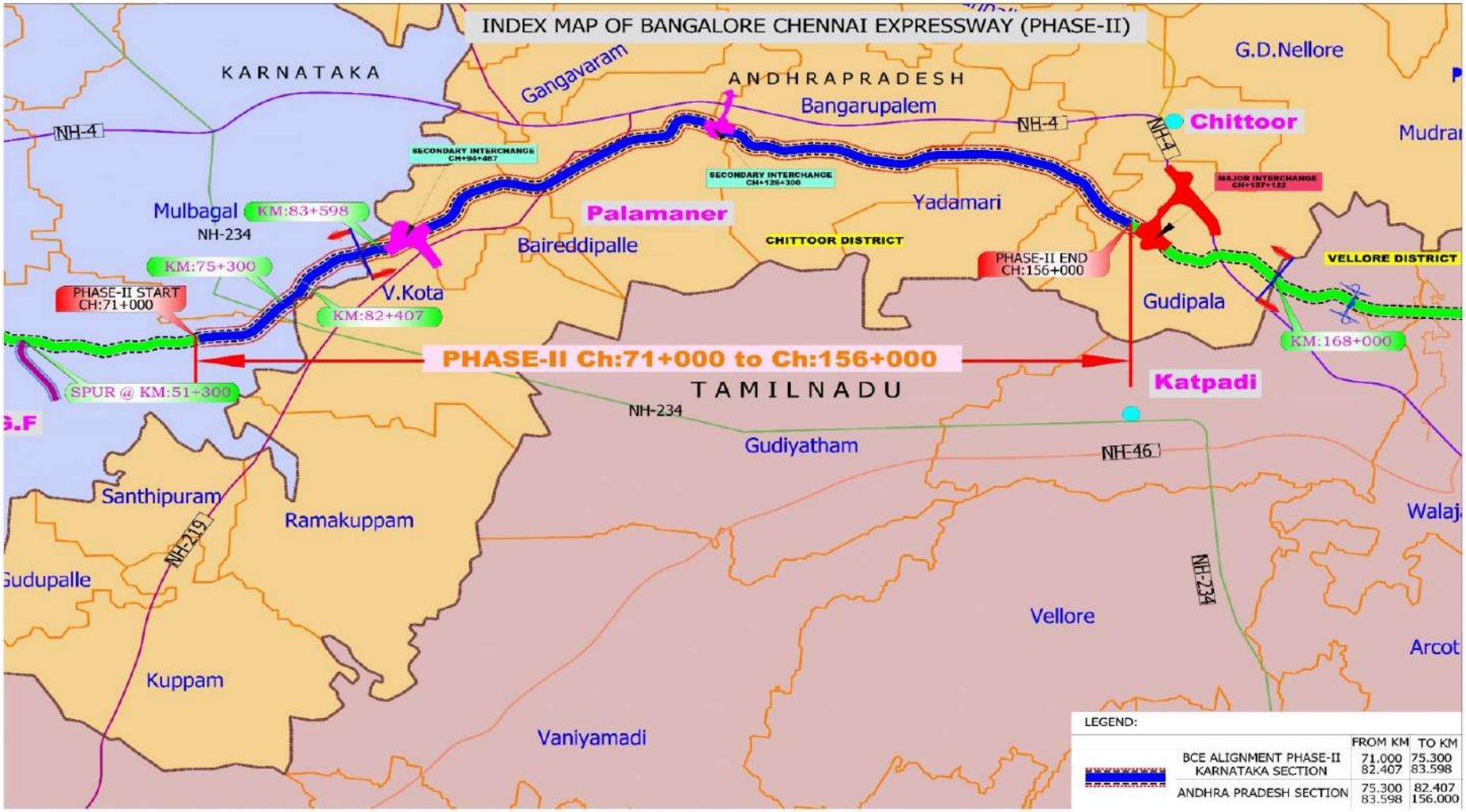


Figure 1: Location Map of BCE-Phase-II

1.3.1 Salient Features of the Project:

The following table presents an overview of the project

Table 1: Salient Features of the Project

A. General Information:

S. No.	Project Components	Details For BCE-Phase-II
1.	Project	Development of new Bangalore- Chennai Expressway Phase-II in the state of Karnataka and Andhra Pradesh.
2.	Administrative locations	Kolar district in Karnataka, Chittoor District in Andhra Pradesh,
3.	State	Karnataka and Andhra Pradesh
4.	Length of the Project road	85.000 Kms
5.	Terrain	The project road is in plain/Rolling/Hilly terrain
6.	Major Settlement along the Project Stretch	N.G. Hulkur, Venkatagiri Kota, Totakanama, Kammanapalle, Jallipeta Palamaner, Yadamari. Pullayagaripalle, Bandivadlavooru and Ramapuram
7.	Rivers/Streams/Canals	The project mainly crosses rivers namely Kaundinya, Apart from this river, there are number of seasonal natural streams/nallahs crosses the project road.
8.	Ponds/Tanks/Reservoirs	The project alignment passes through 12 No. irrigation Tanks.
9.	Forest area	61.73 ha of forest land involved in the project. Reserved Forest (RF) is located in Rayala Elephant Reserve which is coming in Palamaner in Chittoor District in the state of Andhra Pradesh.
10.	Ecologically Protected areas	One protected area i.e. Kaundinya Wildlife Sanctuary is located on southern side of the project alignment. The proposed alignment of Bangalore-Chennai Expressway Phase-II does not pass through the Eco-sensitive area of Wildlife Sanctuary, but the project section from Km 86.500 to Km 135.500 falls within 10 Km radius from outer boundary of Kaundinya Wildlife Sanctuary. The nearest distance of the project alignment is 2.207 Km from project Km 122.450. The Eco-sensitive zone of this sanctuary is yet to be notified.
11.	Archaeological/ Heritage Site	Nil

B. Other Project Features:

S. No.	Items	Proposed Total BCE Phase-II
1.	ROW	90 m
2.	Carriageway	4- Lane dual carriageway with 21 m depressed median for future expansion to 8-Lan toward median side. The Paved Carriageway shall be 22.50 meters for four lane sections excluding median but including edge strip.
3.	Design Speed	120 Kmph
4.	Major Bridge	17 (16 Nos and 1 major canal over bridge)
5.	Minor Bridge	34 Nos.
6.	ROB	Nil
7.	No. of Culverts	157 Nos. (129 Nos. along Main Alignment & 23 Nos. along Interchanges and 5 on reconstruction of existing culvert)
8.	Vehicular Underpass	20 Nos.
9.	Vehicular Overpass	8 Nos. (7 in main carriageway and 1 in interchange)
10	Light Vehicular Underpass	26 Nos.
11.	Interchange	4 Nos.
12.	Flyovers	11 Nos. (9 in main carriageway and 2 in interchange)
13.	Rest Area	4 Nos. (Including Both Sides)

S. No.	Items	Proposed Total BCE Phase-II
		(Both sides to BCE, At km 92+320) & 137+400 LHS and 142+050 RHS
14.	Toll Plaza	2 Nos. (2 Nos on Interchanges)
15.	Truck Lay Byes	3 Nos. Both side at km 115+800, Vengasandra and at km 151+577 LHS, Mapakshi
16.	State Border Check Post	2 location at km 73+300 RHS, Kadriganakuppa and km 84+400 LHS Totakanama
17.	Street Light	The street light has been proposed for locations at LVUP, VUP, Interchange, Check Post, Truck lay bye, Way side amenities and Toll Plaza Locations.
18.	High Mast Light	The High mast lighting has been proposed along the project highway locations in interchange locations, Rest area, Toll plaza locations and border check post locations.
19.	Connecting Roads	12.506 km on Main Expressway and 3.480 Km on Interchange locations
20.	Land acquisition	Total: 918.5228 Ha Pvt. Land: 686.5949 Ha Govt. Land: 231.9279 Ha
21.	Acquisition of Structures	146
22.	Affected Persons/Families	Project Affected Persons= 474 Project Displaced Family: 80
23.	Tree Cutting	Total Trees: 27703 Non-Forest Trees: 23041 Forest Trees: 4662
24.	Acquisition of Reserved Forest Land	61.73 Ha

1.4 Need for Biodiversity Impact Assessment

Conservation of Biodiversity is one of the important requirements of the present time in order to achieve the goal of sustainable growth. Loss of Biodiversity is one of the consequences of modern development pattern including demand of natural resources due to population growth. The loss of wildlife results into ecological imbalances. It is the demand of the time to integrate the ecological issues along with social and financial and commercial aspects of a project development.

This realization has initiated serious efforts towards conservation of Biodiversity. The present report is the evaluation of the existing status of the wildlife in and around proposed Bangalore Chennai Expressway (BCE) phase II and assess the potential impacts due to the project and to formulate mitigation and management measures against the identified potential impacts.

As explained earlier, proposed project alignment of Bangalore Chennai Expressway Phase-II does not pass through of Kaundinya Wildlife Sanctuary boundary, however the part of the project alignment from proposed chainage 86.500 in Totakanama Village under Venkatagiri Kota Mandal of Chittoor District to proposed chainage 135.500 at Bodabandla village Bangarupalem mandal under Chittoor District falls within 10 km radius of Kaundinya Wildlife Sanctuary. Since the boundary of the Eco-Sensitive Zone (ESZ) of Kaundinya Wildlife Sanctuary has not yet been notified, 10 Km radius around the outer boundary of the Kaundinya Wildlife Sanctuary has been considered as Eco-Sensitive Zone in line with the Supreme Court's Direction. The Project does not involve diversion of forest land within the Sanctuary area (Protected Area), but the project section from proposed chainage 115.228 to chainage 122.300 passes through Palamaner Reserved Forest and involves diversion of 61.73 Ha of Reserved Forest Land in Chittoor District. Therefore, it is

needed to prepare Biodiversity Impact Assessment.

2 METHODOLOGY

2.1 Study Area

The proposed project is an Expressway connecting Bangalore to Chennai. The proposed Phase-II of Bangalore Chennai Expressway starts from Km 71.000 near N.G. Hulkur Village, Bangarpet Taluqa, Kolar District, Karnataka and ends at km 156.000 near Ramapuram Village, Gudipala mandal, Chittoor District, Andhra Pradesh of Proposed BCE. The total length of proposed Bangalore Chennai Expressway (Phase-II) is 85.0 Km. The project stretches falls in the state of Karnataka and Andhra Pradesh. The proposed ROW width is 90 m throughout the project length.

The proposed alignment of BCE II is passing through the Palamaner Reserved Forest, Palamaner Range of Chittoor West Forest Division in the state of Andhra Pradesh from chainage 115.228 to 122.300. Length of proposed Palamaner Reserved Forest along with the proposed alignment is 7.1043.

Further, part of the project section of Bangalore Chennai Expressway (BCE) phase II project alignment falls within 10 km radius of outer boundary of Kaundinya Wildlife Sanctuary in Chittoor District, Andhra Pradesh. Since the boundary of the Eco-sensitive Zone for Kaundinya Wildlife Sanctuary is yet to be notified, 10 Km radius has been considered as Eco-sensitive Zone as per direction of the Supreme Court. The project section from proposed chainage 86.500 in Totakanama Village under Venkatagiri Kota Mandal of Chittoor District to proposed chainage 135.500 at Bodabandla village Bangarupalem mandal under Chittoor District falls within 10 km radius of Kaundinya Wildlife Sanctuary. There is a discontinuation between Chainage 97.000 to 99.000 i.e. part of village ganginayanipalli, kammanapalli, settipalle, belupalli of Baireddypalle mandal under Chittoor District which is outside the 10 km radius of Eco sensitive zone of Kaundinya Wildlife Sanctuary. The nearest distance of the project alignment is 2.207 Km from the boundary of Kaundinya Wildlife Sanctuary at chainage 125.500 in the village No.165 Mogili at Bangarupalem Mandal of Chittoor District.

2.2 Data Collection and Survey

Data for Flora & Fauna was collected from the area of BCE phase II project alignment comes within Eco sensitive zone of Kaundinya Wildlife Sanctuary and Palamaner Reserved Forest. The baseline survey of the study area was conducted in the month of December 2020. In data collection the support and help of Forest Department and local persons was also taken. Information on wildlife was collected mainly through site survey, interviews of the local people and interaction with the local Forest department.

The present study on the floral assessment for the project activity is based on field survey of the area. Inventory Methodology was adapted to the baseline data of floral diversity in the BCE phase II project alignment comes within Eco sensitive zone of Kaundinya Wildlife Sanctuary and Palamaner Reserved Forest using the relevant toposheets of scale 1:50000.

Quadrate Methodology was adapted for the baseline data from the Kaundinya Wildlife Sanctuary and Palamaner Reserved Forest. The study was aimed to identify plant resources and obtaining a

broad representation of the existing floristic variations in the protected and reserved areas. The tree details were Enumeration of the plant wealth was done by surveying the area through walking followed by collection and identification of plant specimens. Sample plots were selected in such a way to get maximum representation of different types of vegetation and plots were laid out in different parts of the buffer area along the entire stretch of the proposed Express way ROW. The tree species, shrubs, herbs and climbers observed in the buffer area.

Table 2: Procedure of Data Collection and Parameters Considered for the Survey

Sr. No.	Aspect	Data Type	Mode of Data collection	Parameters Considered	Remarks
1.	Terrestrial Biodiversity	Primary data collection	By field survey and interaction with public.	Floral and Faunal diversity	**Floral Diversity:** Random survey, sapling survey/forest inventory, walking transects, collection and identification with the help of relevant literature. **Faunal Diversity:** direct and indirect sampling, walking transects, point sampling and nest sampling etc.
2.		Secondary data collection	From authentic sources like Forests department of Andhra Pradesh and available published literatures from ZSI, BSI etc.	Floral and Faunal diversity and study of Vegetation, forest type, importance etc.	Data collected from the working plan of the region, forest types from the authentic literature.
3.	Aquatic Biodiversity	Primary data	By field survey	Floral and Faunal diversity	**For Plankton Study**- Lackey's drops method and light microscope **For other aquatic**- Random survey, opportunistic observations
4.		Secondary data collection	From authentic sources like Forests department of Andhra Pradesh.	Floral and Faunal diversity and Study of vegetation, forest type, importance etc.	Desktop literature review to identify the representative species of threatened species, population and ecological communities.

For the preparation of Wildlife Mitigation and Conservation Plan for the proposed project section located in forest area and Eco-sensitive Zone of Kaundinya Wildlife Sanctuary, the guidelines "Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife, 2016" prepared by the Wildlife Institute of India has been followed.

3 GENERAL ENVIRONMENTAL SETTINGS OF PROJECT AREA

The present Chapter provides an overview of general environmental settings along the project alignment.

3.1 Physical Environment

3.1.1 Physiography

The project stretch is located over flat to rolling and hilly terrain. Hilly terrain is mainly met in the forest stretch of Palamaner in Chittoor district. Project area falls in Kaundinya river basin. There is only one rive called Kaundinya river flows in the project area. Apart from this river, there are some local streams/nallahs which cross the project alignment all the streams and river are ephemeral in nature and carry water during rainy season. Apart from the rivers and streams the area along the project alignment is dotted with a number of minor irrigation tanks.

3.1.2 Geology & Soil

The area along the project alignment is underlain by formations of Archaean, Proterozoic, Jurassic Cretaceous Tertiary and Quaternary ages whereas. The soil within the study area is predominantly red loamy soil to red sandy soil and varies from brown clayey soil to black cotton soils.

3.1.3 Seismicity

The project stretches of Phase-II falls under ZONE II of seismic zone of India. This zone is classified as least active Zone.

3.1.4 Climate

semi-arid climate, characterized by typical monsoon tropical weather with hot summers and mild winters. The year is normally divided into four seasons. They are; a) dry season during Jan-Feb, b) pre-monsoon season during Mar-May, c) Southwest Monsoon season during Jun-Sep and d) Post or Northeast monsoon season during Oct-Dec.

Mean maximum temperature of in the project area varies from 29.5°C to 40.5°C and mean minimum temperature varies from 18.2 °C to 28.3 °C. Relative humidity during morning hours varies from from 59.9% to 83.1% and during evening hours it changes from 39.6% to 70.6%. The district receives rainfall which varies from 85.4 mm to 151.00 mm through the South West Monsoon (From June to September) and it varies from 135.7 mm to 268.00 mm in North East Monsoon (From October to December). Average rainfall of the district is 1096 mm. The mean annual rainfall in the area is 1096 mm. The average wind speed in the project area varies from 3.8 Km/Hour to 6.1 Km/Hr.

3.1.5 Land Use

The land use along the proposed project in Kolar and Chittoor districts is predominantly

agriculture land followed by forest and waste land.

3.1.6 Water Resources

Surface water Resources

The BCE Phase-II alignment crosses the Kaundinya River between Km 110.500 to 110.600 This river is ephemeral. Apart from Kaundinya river, there are few local streams and nallahs located in the project area which carry water only during monsoon period. The project alignment is dotted with water tanks. The project alignment passes through 12 minor irrigation tanks, out of 12 water tanks, 1 water tank is in Kolar district section and 11 in Chittoor district. Elevated structures have been provided across these water tanks to avoid impacts on storage capacity of these water bodies.

Ground Water Resources

The project area falls under Safe to semi-critical zone with respect to groundwater utilization and is suitable for artificial groundwater recharge. The water table in the study area during pre-monsoon ranges from 5 to 10 m bgl. The net annual groundwater availability varies from 29144 Ham in Kolar District to 153857 ha m in Chittoor District,

Ground Water Quality

The ground water samples were tested from 4 locations to assess the physic-chemical characteristics of groundwater within project area and found that pH varies between varied from 6.8 to 7.93, TDS (mg/l) varies between 112 mg/l to 776 mg/l., Total Hardness ranged between 276mg/L and 329 mg/L, Heavy metals like, As, Hg, Lead, Boron were below detectable limit. No sign of microbial contamination found in any of the samples.

Surface Water Quality Results: The pH value ranged between 7.17 to 7.68, DO ranges 6.0 mg/l to 6.7 mg/l, BOD $_{(3\ day\ 27\ deg\ C)}$ varies from 3mg/l to 15 mg/l and COD ranges from 37.2 mg/l to 46 mg/l l, Total dissolved solids varied from 332 mg/l to 402 mg/l, Total coliform (MPN/100ml) varies between 90 to 140.

3.1.7 Ambient Air Quality

To assess the ambient air quality within the project area post-monsoon air quality monitoring was carried out at 4 locations between March-May 2018. All the stations fall in residential and commercial rural zone. mean concentration of PM_{10} in ambient air varied between 68.5 µg/m^3 at N.G. Hulkur and 93.9 µg/m^3 in the study area, which were within the maximum permissible limit of the National Ambient Air Quality Standards i.e. 100 µg/m^3. The highest mean concentration of PM_{10} 93.9 µg/m^3 was recorded in the air sample collected from Ramapuram Village near NH-4, which represents Residential and area with mixed activities. $PM_{2.5}$ concentration were recorded in the range from 37.3 µg/m^3 near N.G. Hulkur to 47.1 µg/m^3 at Ramapuram Village near the end point of the project stretch. The mean concentration of SO_2 in air samples varied between 13.2 µg /m^3 and 16.3 µg /m3 which is well within the prescribed limits 80 µg /m^3at all locations. Similar to SO_2, the NOx levels at all monitoring locations were recorded well within the prescribed limits of 80 µg /m^3. The mean concentration of NOx in ambient air was recorded between 22.0 µg /m^3 to 31.8 µg /m^3. The CO levels in the air samples were found in the range of 0.253 mg/m^3 to 0.631 mg/m^3 which is within the prescribed limit of 4.0 mg/m^3mg/m^3.

3.1.8 Noise Quality

The mean daytime equivalent noise levels were recorded between 60.3 Leq dB(A) to 62.3 Leq dB(A). The maximum mean daytime noise level was recorded at Bellu Palli Cross along NH-219 (62.3 Leq dB(A)) followed by RER forest section (61.8 Leq dB(A)), H.G. Hulkur (61.5 Leq dB(A)), and least in Yadamari (60.3 Leq dB(A)). At all the monitored locations, the equivalent noise levels exceeded the permissible limit for residential area (55 Leq dB(A) but were within the limit for commercial areas (65 Leq dB(A)). In the forest stretch the noise levels were recorded along the existing NH-4, where the traffic density is high. The number of curves and hilly gradient also caused more noise along the highway due to traffic movement.

The nighttime equivalent noise levels were also recorded at 4 locations along the project alignment. At all the monitoring locations the nighttime equivalent noise levels exceeded the maximum limit for Residential area but were within the limit of commercial area. The mean nighttime noise level **was recorded between 46.9 Leq dB(A) at Yadamari to 48.1 Leq dB(A) at Forest Section of RER.** The higher noise levels in the forest stretch of RER may be attributed to the heavy traffic movement on existing NH-4 throughout the period and the curves and gradient add to the noise generation by traffic in the area.

3.1.9 Soil Quality

The analysis results reflect that pH level of the soil in the study area is normal to saline with pH ranging from 7.46 to 8.40. The soil texture mainly varies from Silty Sandy Loam to sandy clay Loam to Silty clay loam along the proposed project alignment. Organic carbon in the soil varies between 1.12% to 1.63%. Electrical conductivity is normal and favorable for germination as all the samples have results below 1000 µS/ cm. The moisture retention capacity varies from 6.21% to 6.8% among all the soil samples taken along the project road. Infiltration rate varies from 6.34 mm/hr to 19.3 mm/hr.

3.2 Ecological Environment

Phase-II of the Expressway does not pass through any ecological protected area (Wildlife Sanctuary/ National Park, Tiger Reserve or Eco-sensitive zone). However, Kaundinya Wildlife Sanctuary exist within 10 Km radius of the project alignment between Km Km 86.500 to Km 135.500. The project alignment is passing through Palamaner Reserved Forest Area, under Chittoor Forest Division and constitute part of Rayala Elephant Reserve. The RF land to be diverted for expressway is 61.73 Ha. There are about 4662 trees in Palamaner RF coming within proposed ROW of the project road.

There are about 23041 trees falling within proposed RoW in non-forest area. The predominant tree species are mango, Neem, Sheesham, coconut, etc.

Among the faunal species, common animals like dogs, cats, monkey, pig and cattle are present. Avifauna includes common birds like peacock, myna, kingfisher, pigeon, kite, egret.

3.3 Social Environment

The proposed Bangalore-Chennai Expressway Phase-II is a greenfield alignment and the alignment has been finalized in such a manner that there is least advesre impact on social,

environment and ecological features. All the settlement areas have been avoided. However, acquisition of few structures is unavoidable. Out of the total surveyed households, a total of 474 persons are affected due to acquisition of houses and other assets. Among affected person due to acquisition of structures are 269 Male and 205 females. A total no. of 80 households (PAHs) consisting of 80 families (PAFs) will be affected. All the affected PAH and PAF will require to be displaced due to the project.

The analysis of Socio-Cultural profile of the surveyed households shows that along the project corridor, there were households belonging to two religions viz. Hindus (92.5%) and Muslims (7.5%). Social group-wise most of the affected people represents the backward caste (55.0%), General constitute (35%), Scheduled Castes comprises around 2.5%. The Scheduled tribe population constitute about 7.5% of total affected households. Observed across the family pattern majority (78.75%) of the affected households are joint families and of the remaining 21.25 % percent of the affected households live as nuclear families.

Most of the households are staying along the roadside from a long time where in nearly 37.8 % of them are living since more than 10 years. About 1.27% of them are found to have settled in the last 2-6 years. Occupation wise, most of them are engaged into Agriculture where around (25%), of the Daily Wages followed by housewife 37.5%, 21.3% shop owners, remaining involve in Trade/Business and Non-Agricultural Labors and other occupations such as Agricultural Labors, private service and others.

4 BIODIVERSITY PROFILE

4.1 Kaundinya Wildlife Sanctuary

The Kaundinya Wildlife Sanctuary (KWLS) is located in Palamaner - Kuppam forest ranges of Chittoor district of Andhra Pradesh. The KWLS in Chittoor West Division with an extent of 357.63km was notified u/s 18 of wildlife protection act 1972 vide GO Ms. 82 EFES&T (For-III) Dept. dated 27.06.1998. The Eco Sensitive Zone of Kaundinya Wildlife Sanctuary is not yet notified so 10 km radius around the outer boundary of Kaundinya Wildlife Sanctuary is considered as Eco sensitive zone (ESZ) in line with Hon'ble Supreme Court's direction.

Kaundinya Wildlife Sanctuary is the only sanctuary in Andhra Pradesh with a population of elephants. he sanctuary is covered by southern tropical dry deciduous and thorn forests. Some of the important flora consists of *Albizzia amara*, *Acacia sps.*, Lagerstroemia, Ficus, bamboo, and a species which is a regeneration of Santalum album. Apart from Elephant, some of the animals found in the sanctuary are: sloth bear, panther, cheetal, chowsingha, sambar, porcupine, wild boar, jungle cat, jackal, jungle fowl, starred tortoise and slender loris.

To protect and conserve elephant Kaundiniya Wildlife Sanctuary was declared. Further additional area also added to Kaundinya Wildlife Sanctuary to have continuity to the movement of Elephants thus, Government of Andhra Pradesh EFS&T (For-II) vide G.O. Ms No 106 dated 09.12.2003 has issued notification for 'Rayala Elephant Reserve'. The project alignment passes through the notified area of Rayala Elephant Reserve (RER).

Chittoor West division, spread over a vast region covering Chittoor, Palamaner, Kuppam, Madanapalle and Punganur ranges. The forests of this division, though extending over a large area with elevation ranging from 300 meters to 1370 meters above MSL, do not present any diversity in composition and quality of the crop, probably due to their disposition on only one distinct soil type that has resulted from the Archaean gneissic formation. The locality factors prevalent in the area could not have produced anything superior to the low dry mixed deciduous thorn type. In accordance with ''A Survey of Forest Type of India" by E.G. Champion and S.K. Seth published in 1966. The division has 2 type of forest namely 1) The Southern Tropical Dry Mixed Deciduous Type and 2) The Southern Tropical Thorn Type

4.1.1 Type of Forest

Andhra Pradesh is situated on the south eastern coast of India and spreads over an area of 38,575.48 km2 respectively. The area under forest cover is 38,575.48 km2 (20.11% of the geographical area). Based on classification of Champion and Seth, the forest types of Chittoor district of Andhra Pradesh are as follows:

- **Dry Red Sanders Bearing Forest (5A/C2):** It is a tropical dry deciduous forest with Pterocarpus santalinus in the top storey. Other species present in the type are *Pterocarpus marsupium, Chloroxylon swietenia, Albizzia amara, Acacia leucopholea, Hardwickia binata* and dry grasses.
- **Southern Dry Mixed Deciduous Forest (5A/C3):** This forest type occurs in all over

Andhra Pradesh. It is formed by a mixture of tree species, all of which are deciduous. The important species are *Dalbergia latifolia, Terminalia tomentosa, T. chebula, T. paniculata, Pterocarpus marsupium, Anogeissus latifolia, Santalum album, Chloroxylon swietenia, Acacia chundra, Dendrocalamus strictus* and good deal of grasses.

- **Dry Deciduous Scrub (5/DS1):** A low broken soil cover of shrubby growth 3-6m high including some tree species reduced to similar conditions, usually many stemming from the base. This forest type occurs in all over Andhra Pradesh. The important species are *Pterocarpus marsupium, Anogeissus latifolia, Bridelia retusa, Terminalia chebula, Emblica officinalis, Annona squamosa and Phoenix humilis* with grass cover.

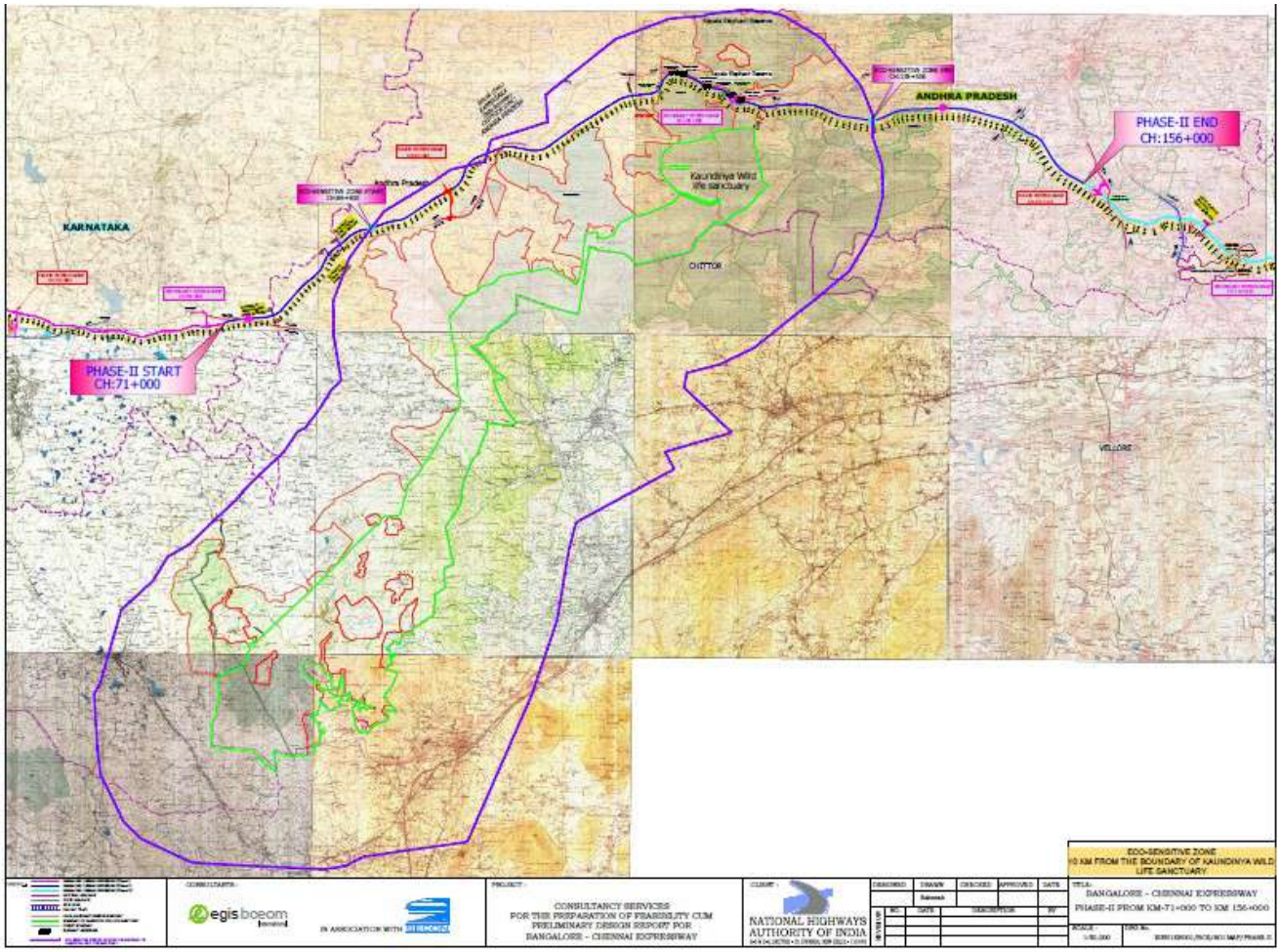


Figure 2: Alignment of Bangalore Chennai Express Way Phase-II within 10 Km Radius of Koundinya Wildlife Sanctuary

4.2 Flora Diversity

Sustainability of the wildlife of an area is very much depended on the flora of the area. It provides food and shelter for the wild animal. The relation between flora and fauna are very much interdependent. So wildlife conservation plan must include flora of the study area.

4.2.1 Floristic Composition along the Proposed ROW Road Alignment

A total of 214 plant species comprising 134 tree species, 24 shrubs,52 herbs and 4 climbers were recorded in around the proposed ROW. Three near threatened plant species Pterocarpus santalinus were recorded during the survey. The proposed ROW passes mainly through barren land agriculture areas.

A. Trees

In the proposed study area constitute tree species are Tabled below, with their scientific name, English, or Popular names.

Table 3: Trees in Study Area

Sl. No.	English / Popular Name	Botanical Name	Presence Within ROW of Expressway
1	Babul	*Acacia Arabica*	
2	Roller thoru	*Acacia latronum*	+
3	Panicled acacia	*Acacia leucophloea*	
4	Red cutch	*Acacia sundra*	
5	Bael tree	*Aegle marmelos*	
6	Tree of heaven	*Ailanthus excelsa*	
7	Stone mango	*Alangium salvifolium*	+
8	Cheekreni	*Albizzia amara*	
9	Siris	*Albizzia lebbeck*	+
10	Black siris	*Albizzia odoratissima*	
11	White siris	*Albizzia procera*	
12	Axle wood	*Anogeissus latifolia*	+
13	Bullocks Heart	*Annona reticulata*	+
14	Bombay Atalantia	*Atalantia racemosa*	+
15	Neem	*Azadirachta indica*	+
16	Mahua tree	*Bassia latifolia*	
17	Mountain eboney	*Bauhinia racemosa*	+
18	Semal	*Bombax malabaricum*	
19	Bras tree	*Borassus flabellifer*	
20	Salai	*Boswellia serrata*	
21	Kadapa almond	*Buchanania axillaris*	+
22	Bastard teak	*Butea frondosa*	
23	Mutuga	*Butea monosperma*	
24	Kassod tree	*Cassia siamea*	+
25	Golden – shower	*Cassia fistula*	
26	Ceylon Tea	*Cassine glauca*	+
27	Cashew	Castanea sp	
28	Black Oil Plant	*Ceiba pentandra*	+
29	Satin wood tree	*Chloroxylon swietenia*	+
30	Rai avla	*Cicca acida*	+
31	Lime	Citrus sp	
32	Rafter wood	*Cleistanthus collinus*	
33	Coconut	*Cocos nucifera.*	+
34	Dahiphalas	*Cordia macleodii*	+
35	Indian Rose-wood	*Dalbergia latifolia*	

Sl. No.	English / Popular Name	Botanical Name	Presence Within ROW of Expressway
36	Pachari	*Dalbergia paniculata*	
37	White Gulmohar	*Delonix elata*	
38	Gulmohar	*Delonix regia*	
39	Pachari	*Dichrostachys cinerea*	
40	Crispate	*Diospyros chrloroxylon*	
41	Goose – Berry	*Diospyros melanxylon*	
42	Indian Coral Tree	*Dolichandrone falcata*	
43	Crispate	*Dolichandrone crispa*	
44	Goose-Berry	*Emblica officinalis*	
45	Indian Coral tree	*Erythrina indica*	
46	Bastard Sandal	*Erythroxylon monogynum*	
47	Grey Gum	*Eucalyptus tereticornis*	
48	Nilgiri	*Eucalyptus globulus*	+
49	Wood Apple	*Feronia elephantum*	
50	Wood Apple	*Feronia Limonia*	+
51	Indian Fig	*Ficus bengalensis*	
52	Gum Fig	*Ficus glomerata*	
53	Bodhy	*Ficus religiosa*	
54	Ficus mollis	*Ficus mollis*	+
55	Ramontchi	*Flacourita ramontchi*	
56	Cool pot	*Flaggea leucopyrus*	
57	Gummy cape Jasmine	*Gardenia gummifera*	
58	Gardenia	*Gardenia latifolia*	+
59	Gardenia	*Gardenia Turgida*	+
60	Mexican Lilac	*Gliricidia sepium*	+
61	White catamaran tree	*Givotia rottlariformis*	
62	Gobbali	Vachellia nilotica	
63	Jana	*Grewia asiatica*	
64	Chittijana	*Grewia damine*	
65	Jana	*Grewia rotundi folia*	
66	Dhaman	*Grewia tiliaefolia*	
67	Gangi	Grewia tenax	
68	Jana	*Grewia villosa*	
69	Chittijana	*Gyrocarpus americanus*	
70	Anjan	*Hardwickia binata*	
71	Easter tree	*Holarhena anti dysenterica*	
72	Indian Elm	*Holoptelea integrifolia*	+
73	Torch tree	*Ixora parviflora*	
74	Black ixora	*Ixora nigricans*	+
75	Jackfruit	*Artocarpus heterophyllus*	+
76	Nandi	*Lagerstroemia parviflora*	
77	Hale	*Leucaena leucocephala*	
78	Dog wood apple	*Limonia crenulata*	
79	Sapota	Manilkara zapota	
80	Uti	*Maba buxifolia*	
81	Mango	*Mangifera indica*	+
82	Alli	*Memecylon edule*	

Sl. No.	English / Popular Name	Botanical Name	Presence Within ROW of Expressway
83	Peeli kaner	*Mexican Oleander*	+
84	Milk tree	*Mimuseps hexandra*	
85	Tetu	*Oroxylon indicum*	+
86	Togari wood of Madras	*Morinda tinctoria*	
87	Thingam	*Wodina wodier*	
88	Thati	Palmyra Palms	
89	Amla	Phyllanthus emblica	
90	Madras Thorn	*Pithecellobium dulce*	+
91	Nalla balsu	*Plectronia didyma*	
92	Balusu	*plectronia parviflora*	
93	Indian Beech tree	*Pongamia glabra*	
94	Pongam Tree	*Pongamia pinnata*	+
95	Bastard Teak	*Premna tomentosa*	
96	Jammi	*Prosopis spicigera*	
97	Indian red pear	*Protium serratum*	+
98	Hill Mango	*Proteum caudatum*	
99	Bija sal	*Pterocarpus marsupium*	+
100	Redsanders	*Pterocarpus santalinus*	+
101	Travellers terror	*Pterolobium indicum*	
102	Indian Redwing	*Pterolobium hexapetalum*	+
103	Almond	*Prunus dulcis*	
104	Dhanimma	*Punica granatum*	
105	Manga	*Randia dumetorum*	
106	Grey emetic nut	*Randia uliginosa*	
107	Tooth Brush tree	*Salvadora persica*	
108	Sandalwood tree	*Santalum album*	
109	Soap nut	*Sapindus emarginatus*	+
110	Rain Tree	*Samanea saman*	+
111	Thagadu	*Senna auriculata*	
112	Marking nut	*Semecarpus anacardium*	
113	Indian red wood	*Soymida febrifuga*	
114	Trumpet flower tree	*Stereospermum chelonoides*	+
115	Padize Wood	*Stereospermum personatum*	+
116	Indian hogplum	*Spondias mangifera*	
117	Sterculia	*Sterculia urens*	
118	Snakewood	*Strychnos nuxvomica*	
119	Clearing nut tree	*Strychnos potatorum*	
120	Jamun	*Syzygium Cumini*	+
121	Java plum	*Syzygium jambolanum*	
122	Peru	*Psidium guajava*	+
123	Tamarind tree	*Tamarindus indica*	+
124	Teak	*Tectona grandis*	+
125	Arjun	*Terminalia arjuna*	
126	Behere	*Terminalia bellerica*	
127	Gallnut	*Terminalia chebula*	
128	Thulam	*Terminalia elliptica*	
129	Plam	*Trachycarpus fortunei*	

Sl. No.	English / Popular Name	Botanical Name	Presence Within ROW of Expressway
130	White wood chaste tree	*Vitex leucoxylon*	+
131	Ivorywood	*Wrightia tinctoria*	
132	Jujube tree	*Zizyphus jujube*	
133	Ber	*Ziziphus maurituiana*	+
134	Gotti	*Zizyphus xylopyrus*	

B. Shrubs:

In the proposed study area constitute shrubs are tabled below, with their scientific name and Family names.

Table 4: Shrubs in Study Area

Sl. No.	Scientific Name	Family	Presence within ROW of Expressway
1	Abutilon indicum	Malvaceae	+
2	Aerva lanata	Amaranthaceae	+
3	Agave americana	Agavaceae	+
4	Anisomeles malabarica	Lamiaceae	+
5	Azima tetracantha	Salvadoraceae	+
6	Calotropis gigantea	Asclepiadaceae	+
7	Canthium parviflorum	Rubiaceae	+
8	Capparis sepiaria	Capparaceae	
9	Carissa carandas	Apocynaceae	+
10	Cassia auriculata	Caesalpiniaceae	
11	Chromolaena odorata	Asteraceae	
12	Euphorbia caducifolia	Euphorbiaceae	
13	Gossypium hirsutum	Malvaceae	
14	Hibiscus ovalifolius	Malvaceae	+
15	Ipomoea carnea	Convonvulaceae	+
16	Jatropha glandulifera	Euphorbiaceae	+
17	Kirganelia reticulata	Euphorbiaceae	+
18	Lantana camara	Verbenaceae	+
19	Opuntia dillenii	Cactaceae	+
20	Themeda triandra	Poaceae	
21	Triumfetta rotundifolia	Malvaceae	+
22	Typha angustata	Typhaceae	+
23	Xanthium strumarium	Asteraceae	
24	Zizyphus nummularia	Rhamnaceae	+

C. Herbs

In the proposed study area constitute Herbs are tabled below, with their scientific name and Family names.

Table 5: Herbs in Study Area

Sl. No.	Scientific Name	Family	Presence within ROW of Expressway
1	Abutilon indicum	Malvaceae	+
2	Acalypha indica	Euphorbiaceae	+
3	Achyranthes aspera	Amaranthaceae	+
4	Aerva lanata	Amaranthaceae	
5	Alloteropsis cimicinsa	Poaceae	+
6	Alternanthera sessilis	Amaranthaceae	
7	Amaranthus viridis	Amaranthaceae	
8	Ammania baccifera	Lythraceae	+
9	Argemone Mexicana	Papaveraceae	+
10	Aristida adscensionis	Poaceae	+
11	Aristolochia grandiflora	Aristolochiaceae	
12	Bacopa monnieri	Scrophulariaceae	+
13	Blumea mollis	Asteraceae	+
14	Boerhavia diffusa	Nyctaginaceae	+
15	Boerhavia erecta	Nyctaginaceae	+
16	Borreria ocymoides	Rubuiaceae	
17	Caralluma adscendens	Apocynaceae	
18	Cassia auriculata	Fabaceae	+
19	Cassia obtus	Fabaceae	+
20	Centella asiatica	Apiaceae	+
21	Chloris barbata	Poaceae	+
22	Cleome viscose	Marsiliaceae	+
23	Coldenia procumbens	Boraginaceae	+
24	Corchorus tridens	Malvaceae	
25	Crassocephalum crepidioides	Asteraceae	+
26	Croton bonplandianus	Euphorbiaceae	
27	Croton sparsiflorus	Euphorbiaceae	+
28	Cyperus rotundus	Cyperaceae	+
29	Dactyloctenium aegyptium	Poaceae	
30	Dentella repens	Rubiaceae	
31	Digitaria bicornis	Poaceae	
32	Euphorbia caducifolia	Euphorbiaceae	+
33	Euphorbia hirta	Euphorbiaceae	+
34	Euphorbia prostrata	Euphorbiaceae	+
35	Evolvulus alsinoides	Convonvulaceae	+
36	Fimbristylis bisumbellata	Cyperaceae	+
37	Fimbristylis schoenoides	Cyperaceae	+
38	Justicia prostrate	Acanthaceae	
39	Justicia tranquebariensis	Acanthaceae	+
40	Kyllinga nemoralis	Cyperaceae	+
41	Lagascea mollis	Asteraceae	+
42	Lindernia ocymoides	Linderniaceae	
43	Ludwigia hyssopifolia	Ongraceae	+
44	Marsilea quadrifolia	Marsileaceae	
45	Merremia tridentata	Convonvulaceae	+
46	Mimosa pudica	Fabaceae	+
47	Nymphaea nouchali	Nymphaeaceae	+

Sl. No.	Scientific Name	Family	Presence within ROW of Expressway
48	Ocimum basilicum	Lamiaceae	+
49	Oxalis corniculata	Oxalidaceae	+
50	Panicum brevifolium	Poaceae	
51	Parthenium hysterophorus	Asteraceae	
52	Pennisetum americanum	Poaceae	+

D. Climbers:

In the proposed study area, the constitute Climbers are tabled below, with their scientific name and Family names.

Table 4.4: Climbers in Study area

Sl. No.	Scientific Name	Family	Presence within ROW of Expressway
1	Abrus precatorius	Fabaceae	+
2	Citrullus colocynthis+	Cucurbitaceae	+
3	Passiflora edulis	Passifloraceae	+
4	Pergularia extensa	Asclepiadaceae	+

4.3 Fauna Diversity

To prepare a detailed report on the status of wildlife biodiversity within Koundinya Wildlife Sanctuary and Palamaner Reserved Forest radial area along the proposed ROW to assess the impacts due to the project activity and evolve suitable mitigation measures to protect and conserve wildlife biodiversity following components were studied:

1. Wildlife Survey (Diversity)
2. Habitat Study (Feeding, Breeding and Roosting areas)
3. Distribution/Status of Birds
4. Rare & Endangered species of Fauna
5. Specific local characteristics of biodiversity in the study area.

4.3.1 Methodology for Faunal Diversity:

For the sampling of mammals, direct count on open width (10m) transect was used. In addition, information on recent sightings/records of mammals by the villagers/locals was also collected. For carnivores, indirect sampling was carried out and the mammals were identified by foot marks, faeces and other marks/sign created by them. In case of reptiles mainly lizards were sampled by direct count on open width transects.

The study of fauna takes substantial amount of time to understand the specific faunal characteristic of area. The assessment of fauna has been done by extensive field survey of the area. During survey, the presence of wildlife was also inhabitants depending on animal sightings and the frequency of their visits in the project area which was later confirmed from forest department, Wildlife Department etc. The visit was conducted along with forest and wildlife department to ascertain faunal diversity. Interaction with local people to collect faunal diversity

and movement.

Figure 3: Site visit conducted along with forest and wildlife department to ascertain faunal diversity and Elephants movement

(i) Forest Fauna

Koundinya Wildlife Sanctuary is the only sanctuary in Andhra Pradesh with a population of Asian elephants. Part of Palamaner Reserved Forest is treated as Rayala Elephants reserve. Apart from Elephant, some of the animals found in the sanctuary are: sloth bear, panther, cheetal, chowsingha, sambar, porcupine, wild boar, jungle cat, jackal, jungle fowl, starred

tortoise and slender loris. Important wild fauna are discussed below.

(ii) Elephants Corridor

Movement of herds of elephants have been recorded observed in the mentioned project at 3 locations at project chainage, km 117.035 (13°12'12.82" N latitude and 78°46'33.0" E Longitude), km 120.300 (13°11'40.0" N latitude and 78°48'13.0" E Longitude) and km 122.205 (13°11'22.0" N latitude and 78°49'13.0" E Longitude).

a. Endangered Species

45 species of vertebrates could be seen in the vicinity of the proposed project. Endangered species among the observed species likely to be present along the proposed ROW of the express way are listed below in the table. It was observed that out of 45 species only 6 are listed in the Schedule I under Wildlife Protection Act, 1972 and Near Threatened, Vulnerable, Endangered & Critically Endangered categories of IUCN.

b. Mammals

Important mammals of Koundinya Wildlife Sanctuary are tabled below:

Table 6: Mammals in Study Area

Appendix. 19)List of Mammals with national and local status

Sl.No.	*Common Name*	*Zoological Name*	*Local Name*
1.	Leopard	*Panthera pardus*	Chirutha Puli
2.	Jungle Cat	*Felis chaus*	Adivin Pilli,Jungu Pilli
3.	Hyena	*Hyaena hyaena*	Kornagandu
4.	Sloth Bear	*Melursus ursinus*	Elugubanti
5.	Indian Fox	*Vulpes bengalensis*	Gunta nakka
6.	Golden Jackal	*Canis aureus*	Nakka
7.	Wild Dog	*Cuon alpinus*	Rechu kukka
8.	Wolf	*Canis lupus*	Todelu
9.	Grey Mongoose	*Herpestes edwardsii*	Mungisa
10.	Small Indian Civet	*Vierricula indica*	Punugu Pilli,Punigi Pilli
11.	Common Palm Civet	*Paradoxurus hermaphroditus*	Marabekku
12.	Indian Flying Fox	*Pteropus giganteus*	Gabadai
13.	Indian Pangolin	*Manis crassicaudata*	Alawa,Pangolin
14.	Indian Porcupine	*Hystrix indica*	Yedupandi
15.	Three-striped Palm Squirrel	*Funambulus palmarum*	Vudutha,Odata
16.	Blacknaped Hare	*Lepus nigricollis nigricollis*	Kundelu,Kuundeli
17.	Asian Elephant	*Elephas maximus*	Eenugu
18.	Indian Wild Boar	*Sus scrofa*	Adavi pandi
19.	Chowsingha	*Tetracerus quadricornis*	Konda gorre
20.	Spotted Deer	*Axis axis*	Duppi
21.	Barking Deer	*Muntiacus muntjak*	Adavi gorre

22.	Mouse Deer	*Moschiola memmina*	Kurra Pandi
23.	Bonnet Macaque	*Macaca radiata*	Koti
24.	Hunuman Langur	*Semnopithecus entellus*	Kondamuchu
25.	Slender Loris	*Loris lyddekerianus*	Dewanga pilli

Appendix (20) List of Birds With National and Local Status

Common Name	Scientific Name
Grebes	**Podicipedidae**
Little Grebe	Tachybaptus ruficollis (Pallas,1764)
Cormorants/Shags	**Phalacrocoracidae**
Little Cormorant	Phalacrocorax niger (Vieillot, 1817)
Herons, Egrets & Bitterns	**Ardeidae**
Little Egret	Egretta garzetta (Linnaeus, 1766)
Cattle Egret	Bubulcus ibis (Linnaeus, 1758)
Indian Pond - Heron	Ardeola grayu (Sykes, 1832)
Storks	**Ciconiidae**
Painted Stork	Mycteria leucocephla (Pennant, 1769)
Asian Openbil-Stork	Anastomus oscitans (Boddaert, 1783)
Swans, Geese & Ducks	**Anatidae**
Lesser Whistling-Duck	Dendrocygna javanica (Horsfield, 1821)
Cotton Teal	Nettapus coromandelianus (Gmelin, 1789)
Spot-billed Duck	Anas poecilorhyncha J.R. Forester, 1781
Northern Shoveller	Anas clypeala Linnaeus, 1758
Northern Pintail	Anas acuta Linnaeus, 1758
Garganey	Anas querquedula Linnaeus, 1758
Common Teal	Anas crecca Linnaeus, 1758
Hawks, Eagles, Buzzards, Old World Vultures, Kites, Harriers	**Accipitridae**
Oriental Honey-Buzzard	Pernis ptilorhynchus (Temminck, 1821)
Black-shouldered Kite	Elanus cacruleus (Desfontaines, 1789)
Black Kite	Milvus migrans (Boddaert, 1783)
Egyptian Vulture	Gyps bengalensis (Gmelin, 1788)
Short-toed Snake-Eagle	Circactus gallicus (Gmelin, 1788)
Shikra	Accipiter badius (Gmelin, 1788)
Eurasian Sparrowhawk	Accipiter nisus (Linnaeus, 1758)
White-eyed Buzzard	Butastus leesa (Franklin, 1832)
Black Eagle	Ictinaetus malayensis (Temminck, 1822)
Changeable Hawk-Eagle	Spizaetus cirrhatus (Gmelin, 1788)

Falcons	**Falconidae**
Common Kestrel	Falco tinnunculus Linnacus, 1758
Pheasants, Partridges, Quails	**Phasianidae**
Grey Francolin	Francolinus pondicerianus (Gmelin, 1789)
Common Quail	Coturnix coturnix (Linnaeus, 1758)
Jungle Bush-Quail	Perdicula asiatica (Lantham, 1790)
Red Spurfowl	Galloperdix spadicea (Gmelin, 1789)
Grey Junglefowl	Gallus sonneratii Temminck, 1813
Indian Peafowl	Pavo cristatus Linnaeus, 1758
Buttonquails/Bustardquails	**Turnicidae**
Common Buttonquail	Turnix suscitator (Gmelin, 1789)
Common Name	**Scientific Name**
Rails, Crakes, Moorhens, Coots	**Rallidae**
White-breasted Waterhen	Amaurorins phoenicurus (Pennant, 1769)
Common Moorhen	Gallinula chloropus (Linnaeus, 1758)
Common Coot	Fulica atra Linnaeus, 1758
Jacanas	**Jacanidae**
Pheasant-tailed Jacana	Hydrophasianus chirurgus (Scopoli, 1786)
Painted-Snipes	**Rostratulidae**
Greater Painted-Snipe	Rostratula benghalensis (Linnaeus, 1758)
Plovers, Dotterels, Lapwings	**Charadriidae**
Little Ringed Plover	Charadrius dubis Scopoli, 1786
Yellow-wattled Lapwing	Vanellus malabaricus (Boddaert, 1783)
Red-wattled Lapwing	Vanellus indicus (Boddaert, 1783)
Sandpipers, Stints, Snipes Godwits & Curlews	**Scolopacidae**
Wood Sandpiper	Tringa glareola Linnaeus, 1758
Little Stint	Calidris minuta (Leisler, 1812)
Stione-Curlew & Stone-Plovers/Thick-knees	**Burhinidae**
Stone-Curlew	Burhinus oedicnemus (Linnaeus, 1758)
Sandgrouse	**Pteroclididae**
Chestnut-bellied Sandgrouse	Pterocleus exustus Temminck, 1825
Pigeons & Doves	**Columbidae**
Blue Rock Piegeon	Columba livia Gmelin, 1789

Little Brown Dove	Streptopelia senegalesis (Linnaeus, 1766)
Spotted Dove	Streptopelia chinensis (Scopoli, 1786)
Yellow-legged Green-Pigeon	Treron phoenicoptera (Latham, 1790)
Parakeets & Hanging-Parrots	**Psittacidae**
Alexandrine Parakeet	Psittacula eupatria (Linnaeus, 1766)
Rose-ringed Parakeet	Psittacula Krameri (Scopoli, 1769)
Plum-headed Parakeet	Psittacula Cyanocephala (Linnaeus, 1766)
Cuckoos, Malkohas & Coucals	**Cuculidae**
Brainfever Bird	Hierococcyx Various (Vahl, 1797)
Asian Koel	Eudynamys scolopacea (Linnaeus, 1758)
Greater Coucal	Centropus Sinensis (Stephens, 1815)
Owls	**Strigidae**
Eurasian Eagle-Owl	Bubo bubo (Linnaeus, 1758)
Spotted Owlet	Athene brama (Temminck, 1821)
Nightjars	**Caprimulgidae**
Common Indian Nightjar	Caprimulgus asiaticus Latham, 1790
Kingfishers	**Alcedinidae**
Small Blue Kingfisher	Alcedo atthis (Linneaus, 1758)
White-breasted Kingfisher	Haleyon smyrnensis (Linneaus, 1758)
Lesser Pied Kingfisher	Ceryle rudis (Linnaeus, 1758)
Common Name	**Scientific Name**
Bee-eaters	**Meropidae**
Small Bee-eater	*Merops orientalis Latham, 1801*
Blue-tailed Bee-eater	*Merops philippinus Linnaeus, 1766*
Rollers	**Coraciidae**
Indian Roller	*Coracias benghalensis (Linnaeus, 1758)*
Hoopoes	**Upupidae**
Commpn Hoopoe	*Upupa epops Linnaeus, 1758*
Hornbills	**Bucerotidae**
Indian Grey Hornbill	*Ocyceros birostris (Scopoli, 1786)*
Barbets	**Capitonidae**
Brown-headed Barbet	*Megalaima zeylanica (gmelin, 1788)*
Coppersmith Barbet	*Megalaima haemacephala (P.L.S. Muller, 1776)*

Woodpeckers	**Picidae**
Lesser Golden-backed Woodpecker	*Dinopium benghalense (Linnaeus, 1758)*
Larks	**Alaudidae**
Ashy-crowned Sparrow-Lark	*Eremopterix grisea (Scopoli, 1786)*
Swallows & Martins	**Hirundinidae**
Common Swallow	*Hirundo rustica Linnaeus, 1758*
Red-rumped Swallow	*Hirundo daurica Linnaeus, 1771*
Wagtails & Pipits	**Motacillidae**
Large Pied Wagtail	*Motacilla maderaspatensis Gmelin, 1789*
Bulbuls & Finchbills	**Pyenonotidae**
Red-whiskered Bulbul	*Pyenonotus jocosus (Linnaeus, 1758)*
Red-vented Bulbul	*Pyenonotus cafer (Linnaeus, 1766)*
Yellow-throated Bulbul	*Pyenonotus xantholaemus (Jerdon, 1844)*
White-browed Bulbul	*Pyenonotus luteolus (Lesson, 1841)*
Ioras, Chloropsis/Leafbird, Fairy-Bluebird	**Irenidae**
Common Iora	*Aegithina tiphia (Linnaeus, 1758)*
Gold-fronted Chloropsis	*Chloropsis aurifrons (Temminck, 1829)*
Shrikes	**Laniidae**
Brown Shrike	*Lanius cristatus Linnaeus, 1758*
Bay-backed Shrike	*Lanius vittatus Valenciennes, 1826*
Thrushes, Shortwings, Robins, Forktails, Wheaters	**Turdinae**
Oriental Magpie-Robin	*Copsychus saularis (Linnaeus, 1758)*
Indian Robin	*Saxicoloides fulicata (Linnaeus, 1776)*
Babblers, Laughingthrushes, Babaxes, Barwings, Yuhinas	**Timaliinae**
Jungle Babbler	*Turdoides striatus (Dumont, 1823)*
Golderest, Prinias, Tesias, Warblers	**Sylviinae**
Ashy Prinia	*Prinia socialis Sykes, 1832*
Common Name	**Scientific Name**
Plain Prinia	**Prinia inornata Sykes, 1832**
Common Tailorbird	Orthotomus sutorius (Pennant, 1769)

Monarch-Flycatchers & Paradise-Flycatchers	**Monarchinae**
Asian Paradise-Flycatcher	Terpsiphone paradisi (Linnaeus, 1758)
Flowerpeekers	**Dicaeidae**
Thick-billed Flowerpecker	Dicacum agile (Tickell, 1833)
Tickell's Flowerpecker	Dicaeum erythrorhynchos (Latham, 1790)
Sunbirds & Spiderhunters	**Nectariniidae**
Purple-rumped Sunbird	Nectarinia zeylonica (Linnaeus, 1766)
Purple Sunbird	Nectarinia asiatica (Latham, 1790)
Munias (EStrildid Finches)	**Estrildidae**
Black-headed Munia	Lonchura malacca (Linnaeus, 1766)
Sparrows & Snowfinches	**Passerinae**
House Sparrow	Passer domesticus (Linnaeus, 1758)
Yellow-throated Sparrow	Petronia xanthocollis (Burton, 1838)
Weavers	**Ploceinae**
Baya Weaver	Ploceus philippinus (Linnaeus, 1766)
Starling & Mynas	**Sturnidae**
Common Myna	Acridotheres tristis (Linnaeus, 1766)
Orioles	**Oriolidae**
Eurasian Golden Oriole	Oriolus oriolus (Linnaeus, 1758)
Black-headed Oriole	Oriolus xanthornus (Linnaeus, 1758)
Drongos	**Dicruridae**
Black Drongo	Dicrurus macrocercus Vieillot, 1817
Crows, Jays; Treepies, Magpies	**Corvidae**
Indian Treepie	Dendrocitta vagabunda (Latham, 1790)
House Crow	Corvus splendens Vieillot, 1817
Jungle Crow	Corvus macrorhynchos Wagler, 1827

Appendix.21) List of amphibians with national and local status

Caommon Name	Scientific Name

HPHIBIA

1	Common Indian Toad	Bufo melanostictus Schneider
2	Ferguson's Toad	Bufo scaber * Schneider
3	Marbled Toad	Bufo stomaticus Lutken
4	Painted Kaloula	Kaloula taprobanica** Parker
5	Ornate Microhylid	Microhyla ornata Dumeril & Bibron
6	Narrow Mouthed Frog	Microhyla rubra Jerdon
7	Balloon Frog	Uperdon globulosus** Gunther
8	Marbled Balloon Frog	Uperodon systoma* Schneider
9	Skittering Frog	Euphlyctis cyanophlyctis Schneider
10	Indian Pond Frog	Euphlyctis hexadactylus Lesson
11	Indian Bull Frog	Hoplobatrachus tigerinus Daudin
12	Indian Cricket Frog	Fejervarya limnocharis Boie. in Weig.
13	Indian Burrowing Frog	Sphaerotheca breviceps Schneider
14	Indian Burrowing Frog	Tomopterna rolandae** Dubois
15	East Asian Tree frog	Polypedates leucomystax** Gravenhorst
16	Common Tree Frog	Polypedates maculatus Gray

Sl. No.	English / Popular Name	Scientific Name	IUCN Red List Categorisation	Schedule as per Wildlife Protection Act
1	Panther	Panthera pardus	NT	I
2	Hyena	Hyaena Hyaena	NT	III
3	Jungle cat	Felis chaus	LC	II
4	Sloth bear	Melursus ursinus	VU	I
5	Fox	Vulpes bengalensis	LC	II
6	Jackal	Canis aureus	NT	II
7	Wild dog	Cuon alpinus	EN	II
8	Civet cat	Viverricula indica	LC	II
9	Wolf	Canis lupus	LC	I
10	Elephant	Elephas maximus	EN	I
11	Wild Boar	Sus scrofa	LC	III
12	Common Monkey	Macaca mulatta	LC	II

Abbreviation for IUCN Red List Categorisation

- LC-Least Concern
- NT-Near Threatened
- VU-Vulnerable
- EN-Endanger

c. Birds

Table 7: Avifauna in Study Area

Sl. No.	English / Popular Name	Scientific Name	IUCN Red List Categorisation	Schedule as per Wildlife Protection Act
1	Babbler jungle	Turdoides striata	LC	-
2	Bulbul, green	Pycnonotidae	_	IV
3	Bulbul	Pycnonotidae	_	IV
4	Crow, jungle	Corvus macrorhynchos	LC	-
5	Common Indian Crow	Euploea core	LC	IV
6	Doves	Columbidae sp.	_	IV
7	Fly catcher, paradise	Terpsiphone	LC	-
8	Heron, Indian pond	Ardeola grayii	LC	-
9	Hoopee	Upupidae		-
10	Hornbill, grey	Ocyceros birostris	LC	-
11	Jungle fowl, Red	Gallus gallus	LC	-
12	Grey Jungle Fowl	Gallus sonneratii	LC	-
13	Koel	Eudynamys scolopaceus	LC	-
14	Night jar	Caprimulgidae	-	IV
15	Owl, dusky horned	Bubo virginianus	-	-
16	Jungle Owlet	Galucidium radiatum	LC	-
17	Parakeets	Psittacidae sp.	-	IV
18	Parakeet, Large Indian	Psittacula eupatria	NT	-
19	Partride, grey	Perdix perdix	LC	-
20	Pea fowl	Pavo cristatus	LC	I
21	Pigeon, common green	Columbidae	-	IV
22	Pigeon, Blue rock	Columba livia	LC	IV

Sl. No.	English / Popular Name	Scientific Name	IUCN Red List Categorisation	Schedule as per Wildlife Protection Act
23	Stork	Ciconiidae	NT	IV
24	Cotton Teal	Nettapus coromandelianus	LC	IV

Abbreviation for IUCN Red List Categorization

- LC-Least Concern
- NT-Near Threatened
- VU-Vulnerable
- EN-Endanger

d. Reptiles

Table 8: Reptiles in Study Area

Sl. No.	English / Popular Name	Scientific name	IUCN Red List Categorisation	Schedule as per Wildlife Protection Act
1	Python	*Pythonidae*	VU	I
2	Krait	*Bungarus coeruleus*	II	II
3	Cobra	*Naja Naja*	LC	II
4	Russell's viper	*Daboia russelii*	LC	II
5	Pit viper	*Crotalinae*	-	-
6	Rat snake	*Ptyas mucosus*	Not Evaluated.	II
7	Grass snake	*Natrix natrix*	LC	_
8	Water snake	*Nerodia*	Near Threatened	-
9	Star tortoise	*Geochelone elegans*	VU	IV

Abbreviation for IUCN Red List Categorisation

- LC-Least Concern
- NT-Near Threatened
- VU-Vulnerable
- EN-Endanger

e. Fishes

Apart from above wild animals few important fishes also recorded in the Koundinya Wildlife Sanctuary and its ESZ are tabled below:

Table 9: Reptiles in Study area

Sl. No.	Common Name	Scientific Name
1	Lalimurrel	*Ochiocephalu striatus*
2	Rohu	*Barbis saranat*
3	Khaul	*Barbis Sarana*

5 ANTICIPATED POTENTIAL IMPACTS OF PROJECT

5.1 Fragmentation of Habitat:

The project alignment doesnot pass through the Kaundinya Wildlife Sanctuary, but it passes through Palmner Reserved Forest outside the boundary of the Sanctuary for a length of 7.104 Km. The baseline study revealed that ther is no natural habitat located in the vicinity along the proposed ROW of the Expressway. Beyond the forest stretch the predominant landuse is agriculture and human settlement. Since forest pockets are located towards both the sides of the project alignment in the forest section, construction of Expressway may create obstruction in movement of wild animals and habitat fragmentation. However such impacts can be minimised by providing structural measures such as elephant underpasses and other wild animal underpasses and non-structural measures such as creation of water holes, in the forest stretch at potential movement locations of wild animals in forest section.

5.2 Reduction in green cover due to cutting of trees.

The removal of trees, plants and poles in the strip forest along the road would result in the decrease in already existing green cover and reduction in their food resource and shelter. The proposal would result in the felling of about 4662 trees are located in the forest patch of Palamner Reserved Forest In addition trees are also required to be felled in the non-forest area in Chittoor District. Altogether, about 26918 trees are likely to be impacted in Chittoor District due to the proposed project. The cutting of trees will result into reduced buffering of air pollutants, hotter, drier microclimate on localised level along the proposed ROW.

- Permission of cutting of trees will be obtained from the line department, i.e. Forest Department.
- All efforts will be made to preserve trees by restricting tree cutting within the formation width. Special attention will be given for protecting giant trees, and locally important trees (having cultural importance)
- Compensatory plantation within non-forest area will be carried out along the space available within the proposed RoW in the ratio of at least 3 times as much the trees are proposed to be cut. It is proposed to do 3 rows of tree plantation on either side by following the guidelines provided in IRC: SP: 21:2009
- The cutting of forest trees along with compensatory afforestion and diversion of forest land will be dealt under Forest (Conservation Act) and all the mitigation measures will be provided in accordance with the legal provision of Forest (Conservation) Act.

5.3 Impact on Forest Land

The baseline study reflects that the project alignment is passing through Palamaner Reserved Forest in Chittoor district of Andhra Pradesh from proposed Chainage Km 115.228 to 122.300. As a result, there will be diversion of 61.73 Ha of forest area for construction of road in this stretch. The diversion of forest area in the proposed ROW will result into cutting of 4662 trees in the RF

area. This is a long term permanent impact.

Mitigation Measures

- The Forest Clearance for diversion of 61.73 Ha of Palamaner Reserved Forest and cutting of forest tree is required to be obtained from MoEFCC prior to construction as per the provisions of Forest (Conservation) Act, 1980.
- The NHAI shall bear the cost of NPV and compensatory afforestation to carry out afforestation double the land of impacted forests on degraded forest land. NHAI shall also pay net present value and other charges as per demand note of the forest division.
- The Forest Department will carry out compensatory afforestation on identified land as a compensatory measure.
- Felling, conversion and disposal of the trees within the forest area will be undertaken by Andhra Pradesh Forest Department after following rules and regulations issued in this regard from time to time by the Government of Andhra Pradesh.
- All the conditions stipulated in the Forest Clearance will be adhered to during project execution.

5.4 Dust Generation and Gaseous Emissions

The construction activities such as clearing and grubbing, earth works, embankment construction and movement of construction vehicles and equipments shall generate lots of dust. This will cover the leaf surface and affect photosynthesis of plants situated along the proposed ROW. However, Such impact is localized and short lived till the construction activities. This is limited to construction period and gets washed away with the first monsoon shower. These impacts can be mitigated effectively through proper planning, scheduling and by application of environmental friendly construction practices. The construction vehicles and equipments deployed for the project may generate a lots of smoke which will pollute the air and affect forest areas and heavy traffic movement after the completion of the project may also result in more air pollution.

5.5 Noise Pollution

Movement and operation of heavy machineries and of transport vehicles shall generate some noise. Noise induces physiological and behavioral changes. No blasting should be done

which will result in considerably less noise pollution. No construction activities will be taken up during night hours in the forest stretch.

5.6 Risk of Forest fire

Due to increase in human activities, negligence etc. forest fire may take place. Fire is mostly anthropogenic in origin. This, in turn, may deprive wildlife of their cover and food.

5.7 Man-wild animal conflict

This is a general impact where any development is undertaken in forest area. Due to this project also, there is potential risk of man animal conflicts. However, through certain precautionary

measures and awareness generation among workers and road users, such risks can be minimized.

All these perceived impacts/threats due to this project needs be removed through different measures in order to improve the habitat for wildlife so that their status can be enhanced and healthy environment is created. The measures for the same have been outlined in the next chapter.

6 MITIGATION AND MANAGEMENT PLAN

6.1 General Mitigation Plan During Construction Period

6.1.1 Mitigation Measures for Dust and Emission Control

Dust Control Measures:

- Dust control measures such as regular water sprinkling in construction areas, camp site, plant site and other allied sites will be carried out to control dust. All the construction plants and equipment will be fitted with dust control and pollution control equipment and adhere to the emission standards.
- Transportation of construction materials will be done with tarpaulin coverage during the construction stage.
- During the sub-grade construction, sprinkling of water will be carried out on regular basis during the entire construction period especially in the winter and summer seasons.
- In case fly ash is used, dust emission during its loading and unloading, storage at open place and handling for road construction shall be suppressed by regular water sprinkling.
- Dust emission from stock piles of excavated material will be controlled either by covering the stockpiled materials or water spraying over it.
- As soon as construction is over all the surplus earth will be utilized properly all loose earth will be removed from the site.

Gaseous Pollution:

- All the Construction vehicles and machineries will be regularly maintained to conform to the emission standards stipulated under Environment (Protection) Rules, 1986.
- Asphalt mixing / Stone Crusher plans should be located at least 800 m away from any habitation or sensitive environmental site and at least 250 m away from highway towards downwind direction and at least 10 Km away from Sanctuary area.
- All the DG sets will conform to the emission standards as stipulated under Environment (Protection) Rules, 1986.
- The workers working at asphalt mixing and subsequent application of asphalt mix on road surface will be provided with heat resistant shoes and masks.

6.1.2 Mitigation Measures for Noise Pollution

Noise due to machine operation and vehicles is likely to disturb wildlife. This would be minimized to least possible level. This would be achieved by proper maintenance of machinery and use of efficient muffling devices. No nighttime construction works will be allowed in the forest stretch.

6.1.3 Protection Measures against Forest Fire

- No Stone Crusher, HMP, Batching Plant or WMM or other construction plants will be established in the forest stretch.

- The Contractor will maintain firefighting equipments at the site during construction activities to act immediately in case of forest fire. The accidental fires in the project area shall be extinguished immediately. Hence in project area no fire will be allowed to spread to any part including nearest vegetation.
- The workforce will strictly be prohibited with smoking in the forest stretch during works at site.

6.2 Wildlife Mitigation and Conservation Plan

Wildlife conservation is the practice of protecting wild plant and animal species and their habitat. Wildlife plays an important role in balancing the ecosystem and provides stability to different natural processes of nature like rainfall (transpiration from plant), changing of temperature (heat evolution by animals), and fertility of soil (making of manure by earthworm). The goal of wildlife conservation is to ensure that nature will be around for future generations to enjoy and also to recognize the importance of wildlife and wilderness for humans and other species alike.https://en.wikipedia.org/wiki/Wildlife_conservation - cite_note-1 Wildlife conservation has become an increasingly important practice due to the negative effects of human activity on wildlife. An endangered species is defined as a population of a living species that is in the danger of becoming extinct because the species has a very low or falling population, or because they are threatened by the varying environmental or prepositional parameters like (landslides, increase in temperature above optimum temperature, acid rain). Wildlife is part of nature which maintains equally distribution of food instead of over use of food by one human.

6.2.1 Conservation and Management Approach

Following approach towards conservation and management of biodiversity has been adopted:

i. The existing trees within the project ROW will be preserved by restricting tree felling within permanent construction area only.

ii. Trees plantation along the project alignment. Plantation of indigenous species and fruit trees will be preferred.

iii. Provision of additional protection for wild animals

iv. Wildlife conservation plan will include inside project area and outside project area;

Outside project area plan will be implemented in close consultation with the forest department.

6.2.2 Conservation Plan Inside Project Area

It is proposed to carry out compensatory plantation along the Expressway in the available space within ROW, this will provide shelter for various birds, reptiles, lizard etc. The tree plantation will also provide shelter fauna like squirrel and other animal wild animal which resides with human settlement.

1. Trees are usually used for nesting; therefore, large trees are to be preserved wherever necessary & planted in core zone.
2. Yearly monitoring of birds & Fauna population, breeding, feeding, nesting, movement & dispersal to be done scientifically by wild life experts / institution/ organisation preferably in winter season.

3. Bird house and other rehabilitation measures.
4. Creating awareness among the construction worker at construction phase and traffic at the of operation phase will be created for mammals, reptiles and birds' conservation. Putting boards with slogans along roadside & important sensitive places.
5. Project will ensure no construction activities before NOC.
6. Compliance of all NOC condition at the time of construction.
7. Control of water, soil & noise pollution which impact in birds & Fauna breeding & its population.

(A) Engineering Measures for Wild Animal Passages:

The mitigation measures have been identified in accordance with the site surveys, consultation with the forest department and in accordance with the guidelines "Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife, 2016" prepared by the Wildlife Institute of India.

To avoid habitat fragmentation and severance problem due to proposed expressway, adequate measures have been incorporated in design in the form of bridges, elephant underpasses, culverts in the forest stretch. Based on survey of elephant movement routes in consultation with the forest department, Elephant underpasses have been proposed at 3 locations. As additional measures for ensuring free movement of wild animals in the forest stretch minor bridges have been proposed across all the streams intercepted by the project alignment in the forest area. A total number of 3 box culverts have also been proposed which will also provide access to the small sized wild animals.

Table 10: List of Proposed Elephant Underpasses and Elevated sections in Rayala Elephant Reserve

S. No.	Project Chainage (km)	Total Length (excluding earth retaining structure)	Carriageway width (m)	Deck width (m)	Vertical Clearance (m	Remarks
1	116.905-117.360	455	2 x 12.75	2 x 13.75	Minimum 6.0 m As per Plan and Profile	Elevated (Elephant Underpass at km 117.035)
2	120.081-120.406	325	2 x 12.75	2 x 13.75		Elevated (Elephant Underpass at km 120.300)
3	121.900-125.945	4030	2 x 12.75	2 x 13.75		Elevated (Elephant Underpass at km 122.205)
B.	**Elevated Section in Reserved Forest Stretch**					
1	117.645-117.840	195	2 x 12.75	2 x 13.75	Minimum 5.5 m as per plan and profile	Other Elevated structures
2	121.581-121.776	195	2 x 12.75	2 x 13.75		Elevated Expressway

Table 11: Proposed Minor Bridges in Palamaner Reserved Forest Stretch

S. No.	Chainage (km)	Linear Waterway (m)	Carriage-way Width (m)	Deck Configuration (m)	Width of open median (m)	Existing Feature	Place
1	114.855	40	2 X 12.75	2 x 13.75	18.5	Gobbillakoturu	Palmaner

S. No.	Chainage (km)	Linear Waterway (m)	Carriage-way Width (m)	Deck Configuration (m)	Width of open median (m)	Existing Feature	Place
						Tank	
2	115.53	10	2 X 12.75	2 x 13.75	18.5	Stream	Palamaner reserved forest
3	116	8	2 X 19.50	2 x 20.50	18.5	Stream	Palamaner reserved forest
4	116.652	50	2 X 12.75	2 x 13.75	18.5	Stream	Palamaner reserved forest
5	127+050	20	2 X 12.75	2 X 13.75	18.5	Stream	Mogili

The proposed Cross section for Elephant Underpass is presented in **ANNEXURE-1**

Table 12: Box Culverts in Palamner Reserved Forest Stretch

S. No.	Chainage (Km)	Type of Culverts	Span / opening (No. x Length in m x Height in m)	Location
1	118.785	RCC Box	1 x 2.0 x 2.5	Palamaner Reserved Forest
2	119.375	RCC Box	2 x 3.0 x 2.5	Palamaner Reserved Forest
3	119.580	RCC Box	1 x 2.0 x 2.5	Palamaner Reserved Forest

The expressway will be fully access control with average embankment height of 2 m and chain link fencing will be provided all along the project length on either side of the ROW. Chain link fencing shall be provided along the entire length on either side (including transverse requirements at structure locations). The fencing shall be embedded on concrete of minimum M15 grade as per design. The total height of fencing shall be 2.5 m above ground. Chain link fencing conforming to ASTM F 1553-06 shall be fixed on GI pipe/RCC posts. GI pipe/RCC posts shall be embedded in concrete to a sufficient depth.

The fence shall be placed 2m inside from the ROW edge on both sides as per the manual. At connecting roads, it shall be provided between expressway and connecting road and on expressway side of the connecting road to arrest the illegal access to the expressway. At all CD structure and bridge locations, the fencing shall be discontinued by turning it towards the wing/return wall to allow crossing through these structures during dry seasons. Thus the wild animals will be obstructed to move on road and will cross the road through underpasses, culvers, bridges to be provided at the above locations. By this engineering measures the risk of collision of vehicle with wild animals can be reduced to minimum.

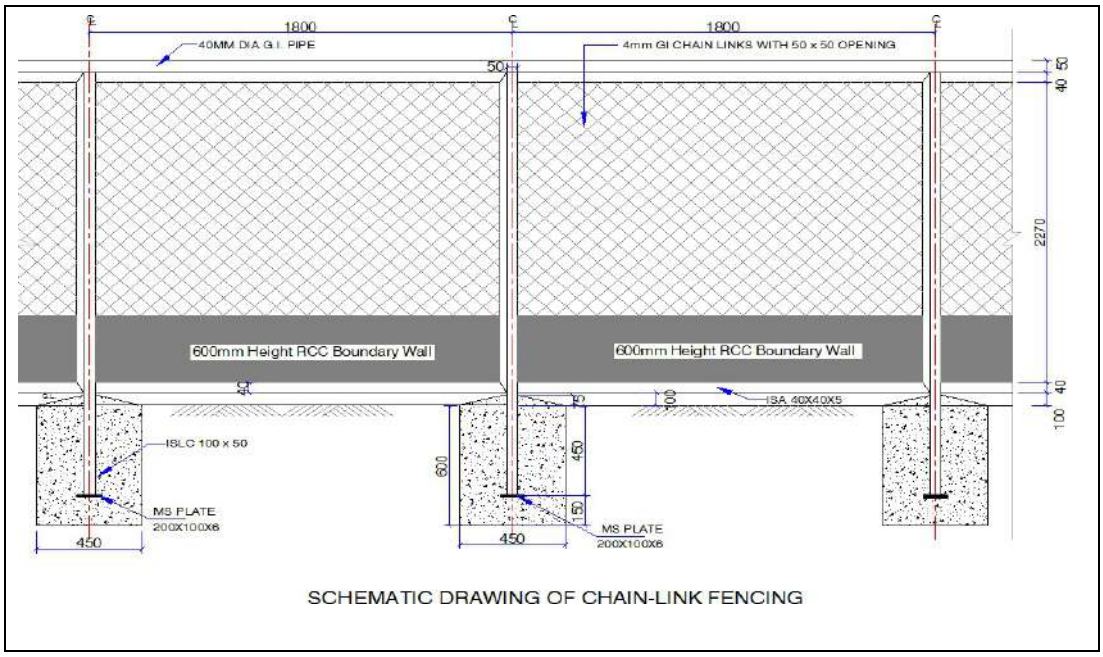


Figure 4: Schematic Plan of Chain Link Fencing along ROW

In addition to above engineering measures, wildlife conservation plan has also been prepared as additional mitigation measures such as provision of water holes, watch towers, firefighting arrangements, awareness & warning signboards, soil conservation measures, animal treatment facilities, awareness trainings, etc. Negative impact on the forest and wild life on the area is envisage due to this project. There is a chance of potential for habitat fragmentation by the proposed road. It is proposed to provide engineering measures (structural measures) at the identified sites of animal movements along with Elephant Movement Routes. The project will have three phases i.e. Pre-construction, construction phases and operation phases. In both phases there are chances of confrontation between man and animals. The mitigation measures have been proposed for different phases of the project:

(B) Mitigation Measures During Construction phase

- Precaution need to take at the time of construction to avoid any eventualities. During Construction it shall be ensured that the Contractor shall be abide by all the rules and regulations pertaining to Forest Protection as well as Wildlife Protection. Strict monitoring will be done to ensure that there is no trespassing within the boundary of Wildlife Sanctuary.
- No labour camp or plant site will be established in the vicinity of the Wildlife Sanctuary and siting criteria for establishing the construction plants as per CPCB and ASPCB norms will be strictly followed.
- Construction worker should be given awareness regarding how to behave at the time of interaction with the animal, especially in case of facing elephants. Adequate safety and protection with special insurance cover should be provided to those workers.
- Adequate measures will be taken to control dust generation during works along the Wildlife sanctuary area. By application of these measures there will not be any impact on wildlife Sanctuary area due to construction works.

(C) Mitigation Measures against Impacts on Forest

- The Concessionaire will submit site specific Environmental Management Action Plan along with their work plan for working in the forest stretch and will strictly follow all the precautionary measures as approved and directed by the AE/PIU-NHAI
- The concessionaire will be responsible for obtaining necessary permission for temporary access to the site through forest area, clearance of vegetation for construction of temporary access within forest and will abide by all the conditions stipulated in the clearance/ permission.
- The Contractor will obtain requisite permission from Forest & Wildlife Department for movement of manpower and machineries in the reserved Forest area and submit the copy of the same to AE and PIU-NHAI. The contractor will submit specific work plan with regard to temporary land width for diversion or any activity in accordance with the conditions of the respective Forest Department while working in RF sections.
- The contractor will not extract earth materials from forest area. The clearing and grubbing will be restricted to only proposed ROW. The Contractor will not take away the excavated materials generated due to excavation and road bed preparation within the forest stretch without proper permission from the forest department. The excavated materials within the forest stretch will be stacked at the pre-identified site in consultation with the forest department.
- The Construction camp, work force camp, construction plants, stock yards, vehicular/equipment servicing area and other allied sites shall not be established in the vicinity/nearby forest areas. At least 1 Km distance shall be kept from boundary of Reserved Forest area and 10 Km from Eco-sensitive area/Wild Life Sanctuary.
- The contractor will not operate any borrow area or stone quarry within the forest area.
- The approach of balance cut and fill will be adopted to minimize the generation of construction/ excavation wastes. The excavated materials will be reused to minimize the disposable waste.
- All the non-usable cutting materials will be stacked separately as per instruction and guidance of the Forest Department and follow the method for disposal of all the waste generated from the forest area as approved by the Forest Department.
- No debris/ waste materials will be disposed off within the forest area.
- Tree cutting within the forest stretch will be restricted to only area the diverted as per forest clearance.
- Movement of vehicles and equipments in the forest stretch will strictly be ensured within the pegged area only. The use of horns will be bare minimum
- The Work force shall be strictly prohibited from entering into forest areas beyond the work zone or private lands under any circumstances. The Contractor will provide mobile toilet units for the workforce at site
- The contractor will prepare bitumen mix for black topping/ pavement outside forest area to avoid any risk of forest fire and damage to the forest area and wild animals
- The Contractor will sensitize the workforce about the risk of forest fire and no smoking shall be allowed within the forest section.

- No cooking will be allowed in the forest area.
- The Contractor will develop emergency action plan in consultation with Forest Department to deal with forest fire or animal attacks
- The Contractor will maintain firefighting equipments at the site during construction activities to act immediately in case of forest fire.

(D) Mitigation Measures against Impacts on Wild Animals/Habitat:

- The Contractor will obtain requisite permission from Forest & Wildlife Department for movement of manpower and machineries in the reserved Forest area and submit the copy of the same to AE and PIU-NHAI. The contractor will submit specific work plan with regard to temporary land width for diversion or any activity in accordance with the conditions of the respective Forest Department while working in RF sections.
- During continuance of the contract, the contractor and his sub-contractors, if any, shall abide at all times by all existing enactments on environmental protection and rules made thereunder, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.
- State rules for hunting (wild life protection) will be adhered and rules for Bird catching (wild life protection) will be adhered to.
- It will be responsibility of the Contractor to ensure that there is no illegal poaching of wild animals around the area of activities by his staff, labours or sub-contractors personnel.
- Adequate measures will be taken to control dust generation during works along the Wildlife sanctuary area.
- The contractor will maintain a register for spotted animals in the vicinity of construction area in forest section during the construction period and submit the periodic report to the Authority Engineer and PIU. The construction activities in the forest area should be avoided during monsoon period as frequent movement of reptiles and other wild animals have been reported during monsoon period and therefore there is risk of damage to the wild animals will be more during this season.
- Construction vehicles will run along specified access to avoid accidents to cattle or wild animal
- In the forest section the construction work shall be restricted to day hours only and work shall not be carried out in the late evening hours/night hours /early mornings.
- The work force shall be oriented not to feed monkeys in order to avoid accident with the monkeys
- The Contractor will Strictly comply with the conditions stipulated by the Forest department during works and also ensure that the sub-contractor also follows the same.
- All work force shall be oriented to keep calm and walk away from the scene, in case, wild animals are sighted either during work hours. The site worker will strictly be advised not to try to catch wild animals on their own as the animal may hurt them in self-defense. On sighting of wild animal at site, the work will be stopped and the Wildlife Authority should immediately be informed and the work will be restarted after taking consent from the Forest/Wildlife Authority.
- The Contractor will develop emergency action plan in consultation with Forest Department to deal with forest fire or animal attacks

- The Contractor will maintain firefighting equipments at the site during construction activities to act immediately in case of forest fire.

(E) Non-structural Measures:

Following non-structural mitigation measure in addition to the structural measures have been proposed:

- Comply with condition stipulated in the forest clearance and recommendations of NBWL.
- Construction of water holes and habitat improvement measures away from road on either-side will help in less movement of wild animals across the road.
- Roadside Warning and caution signboards to alert driver about presence of Wildlife crossing zone.
- No Horn Zone at the specific corridor location
- Awareness signboards for conservation of ecology and wildlife, Road side sign board will inform about the location of the corridor, Speed restriction in corridor and its buffer area
- Installation of signboards in accident prone areas to alert drivers
- Installation of Animal Detection System/Radio collar / or other technological devices for real-time monitoring for elephant and other wild animal movement to alert motorist about the presence of animals along road.
- Speed restriction and enforcement of no horn zone within forest stretch
- Deployment of patrolling staff for the protection of elephants and other wild animals along the highways
- Location specific Structure may be provided at the corridor areas to avoid any conflict between man and elephant and other wild animals
- Public education and awareness programmes
- Parking of vehicles, roadside shop along the expressway alignment in the forest stretch area should not be permitted.
- No roadside shop along the expressway alignment near the corridor area should be permitted.
- Action Plan will be prepared in consultation with the forest department for action in case of presence of wild animals over road and collision with animals.

6.2.3 Conservation Plan Outside Project Area

Conservation plan for wild animals will be implemented with the help of forest department. Following action will be taken by the project for the conservation & management of wild animals.

1. Project will not throw and dump any waste in the eco sensitive zone.
2. Water holes/pond will be provided at suitable locations for storage of water for drinking purposes for wild animals in forest with the help of forest department. These pond and water bodies will also provide food and shelter to the number of aquatic animals and birds.
3. Bird house and other rehabilitation measures will be provided in consultation with the forest department

4. 16 Watch towers at 500 m distance outside PROW may be established with due permission from the forest and wildlife department.
5. Provision of access control will restrict the entry of wild animal in the expressway
6. Establishment of trained primary response team (village level) for proper rescue of injured wild animals in distress to avoid man-animal conflict and provision for training of rescue teams, purchase of equipment such as net, tranquilizer equipments, cage and vehicle, etc. for the proper rescue and translocation of animals to meet the MoEF&CC guidelines for elephants, leopards, etc.
7. Creating awareness among the people in the surrounding study area for mammals, reptiles and birds conservation. Putting boards with slogans along roadside & public places.
8. Anti-poaching campaign in the study area during construction as well as operation stage.
9. **Provision for Treatment Centre for injured Wild animals**: There will be provision for construction of treatment centre for treatment of injured and sick wild animals. The user Agency will provide support in establishment of treatment centre by the department of Forests & Wildlife.

6.3 Action Plan for Flora Conservation and Management Plan

a. Preservation of Existing Trees

The development of express way will require felling of trees within the Proposed ROW. The tree felling will be restricted to only within the permanent construction area with prior permission from the line department. Compensatory plantation will be done as per conditions stipulated in the tree felling permission. No outside tree will be disturbed beyond boundary of the PROW.

b. Flora Development

Apart from compensatory plantation, additional plantation has been proposed in the form of wildlife conservation plan. The plants not only serve various direct environmental facilities, but also have indirect positive environmental impacts such as reduction in heat reflected from constructed road. The project proponent will plant tree along the express way, which will work as barrier for the movement of pollutants and help in pollution control. Green belt will be developed with the aim to form a curtain to check the spread of fugitive dust. Hence, the plantation will consist of trees, shrubs, and climbers. With these above considerations following, local plant species will be taken for plantation.

6.4 Budget Allocation for Wildlife Conservation Plan:

Development of Pond /water hole as well as Watch tower will be promoted by the project with help of forest and wildlife department. Road side plantation will be done by project authority plantation area. Project will try to save as much as possible existing trees. To implement the above mentioned Wildlife Conservation plan, for "Bangalore Chennai Expressway Phase II", a budget is proposed for the activities for the successful implementation of conservation plan given in table below.

6.4.1 Budget proposed for Wild life Mitigation Plan

Table 13: Estimate to implement the conservation plan as per Schedule-I and II of Indian Wildlife Protection act (1972)

Estimate for implementation of Wild Life Conservation Plan- Elephant Corridor		
Sl.No	**Description**	**Requirement (in lakh)**
1	Construction of Water bodies/ Water Holes, Ponds, borewells, solar pumps and others for providing water for the elephants and wildlife	90.000
2	Habitat improvement and development of grassland / pastures & plantations, food availability for wild life, maintenance of elephants, conservation measures, plantation of suitable species in forest areas.	60.000
3	Soil and Moisture conservation works in buffer areas and forest areas.	70.000
4	Capacity building of elephant trackers, base camp workers and forest staff. Provision for providing safety guards, uniforms, training and staff welfare and others.	70.000
5	Improvement of livelihoods of local communities through Eco tourism activities, and development of infrastructure and maintenance of eco-tourism sites, forest administration etc.,	460.000
6	Provisions for constructions of wildlife treatment center and equipment. Forest Department will provide land. Provision for providing rescue vehicles, vehicles for wildlife monitoring, conservation, quick response fire fighting etc., Project proponents will construct treatment center and procure vehicles and handover to the forest /wildlife department, Chittoor West Division, Chittoor.	188.000
7	Mitigation of Man-Animal conflict, elephant drives, Compensation of crop damages and others, elephant proof trenches, Solar fencing, errection of hanging solar fencing and maintenance etc., Maintenance of rescue vehicles, vehicles for wildlife monitoring, fire fighting, elephant drives, mobility charges etc.,	590.000

8	Providing funds for forest/wild life department for watch towers, awareness generation of local people, organizing camps, Environment Education Centers, Nagaravans etc.,	100.000
9	Documentation of wildlife and provision for wildlife survey, wildlife research, study on Animal behavior, procurement of hardware and software, technology upgradation & overheads etc.,	70.000
	Total ::	**1698.000**

Project Director
NHAI, PIU,Chittoor

Divisional Forest Officer
Chittoor West Division,Chittoor

COUNTER SIGNED

Chief Conservator of Forests
Ananthapuramu Circle, ANANTHAPURAMU.

1/8/2012

Pri. Chief Conservator of Forests (WL)
& Chief Wildlife Warden, A.P.

3/8/12

Note : for Sl. No.6 shall be executed by the user agency as follows.

1. User agency shall keep fund of 188 lakh with their own and item no.6 shall be done by them only.

2. Necessary drawing and land shall be provided by wildlife / forest division of Chittoor West Division, Chittoor for construction of treatment center. The procurement of items in Sl.No.6 shall be done by user agency according to the requirement put forth by wildlife / forest division West and handed over to the wildlife / forest division, Chittoor West for use within the division.

3. Rs. 1510 lakh shall be submitted to office of Divisional Forest Officer, Chittoor West Division, Chittoor, in charge of KWLS by user agency for executing the works mentioned under serial 1 -5 and 7-9 only.

4. In item No.6, construction will be done within 2 years and procurement and handover will be done within 6 months of start of Wildlife Mitigation Plan.

Table 14: Year wise Fund Allocation of the Estimate to Implement the Conservation Plan

Action to be taken							
Sl.No	**Description**	**Year wise breakup over the period of 5 years (in lakhs)**					
		2022-23	**2023-24**	**2024-25**	**2025-26**	**2026-27**	**Total (5 Years)**
1	Construction of Water bodies/ Water Holes, Ponds, borewells, solar pumps and others for providing water for the elephants and wildlife.	30	30	15	10	5	90
2	Habitat improvement and development of grassland / pastures & plantations, food availability for wild life, maintenance of elephants, conservation measures, plantation of suitable species in forest areas.	20	20	10	5	5	60
3	Soil and Moisture conservation works in buffer areas and forest areas.	20	20	15	10	5	70
4	Capacity building of elephant trackers, base camp workers and forest staff. Provision for providing safety guards, uniforms, training and staff welfare and others.	20	20	20	5	5	70
5	Improvement of livelihoods of local communities through Eco tourism activities,	160	200	65	25	10	460

	and development of infrastructure and maintenance of eco-tourism sites, forest administration etc.,						
6	Provisions for constructions of wildlife treatment center and equipment. Forest Department will provide land. Provision for providing rescue vehicles, vehicles for wildlife monitoring, conservation, quick response fire fighting etc., Project proponents will construct treatment Centre and procure vehicles and handover to the forest /wildlife department, Chittoor West Division, Chittoor.	(Project proponent will complete in stipulated time)					188
7	Mitigation of Man-Animal conflict, elephant drives, Compensation of crop damages and others, elephant proof trenches, Solar fencing, errection of hanging solar fencing and maintenance etc., Maintenance of rescue vehicles, vehicles for wildlife monitoring, fire fighting, elephant drives, mobility charges etc.,	165	300	100	15	10	590
8	Providing funds for forest/wild life department for watch towers, awareness generation of local people, organizing camps, Environment Education Centers,	25	35	25	10	5	100

	Nagaravans etc.,						
9	Documentation of wildlife and provision for wildlife survey, wildlife research, study on Animal behavior, procurement of hardware and software, technology upgradation & overheads etc.,	20	20	15	10	5	70
	Total	**460**	**645**	**265**	**90**	**50**	**1698 lakhs**

Project Director
NHAI, PIU,Chittoor

Divisional Forest Officer
Chittoor West Division,Chittoor

COUNTER SIGNED
01/08
Chief Conservator of Forests
Ananthapuramu Circle, ANANTHAPURAMU.
1/8/2022

Pri. Chief Conservator of Forests (WL)
& Chief Wildlife Warden, A.P.

7 CONCLUSION AND RECOMMENDATIONS

The study area comprises of and Palamaner Reserved Forest and ESZ of Koundinya Wildlife Sanctuary in Chitoor district, Andhra Pradesh. Some of the reported fauna was given protection by the Indian wild life (Protection) act, 1972, by including them in different schedules. The base line study was conducted for the evaluation of the Floral & faunal biodiversity of the terrestrial environment of the study area of proposed Bangalore Chennai Express Way Phase II project. The conservation plan has been prepared for the protection of Scheduled –I&II fauna on the basis of habitat improvement way conservation to facilitate the existing wildlife in terms of protection of elephants corridor, food shelter & water requirement for the fulfilment of the aim of this conservation plan. Total 16 species of fauna are documented which belongs to 6 from Schedule-I & 10 species of fauna form schedule-II as per Wildlife Protection act, 1972. So, wild life conservation plan has been prepared.

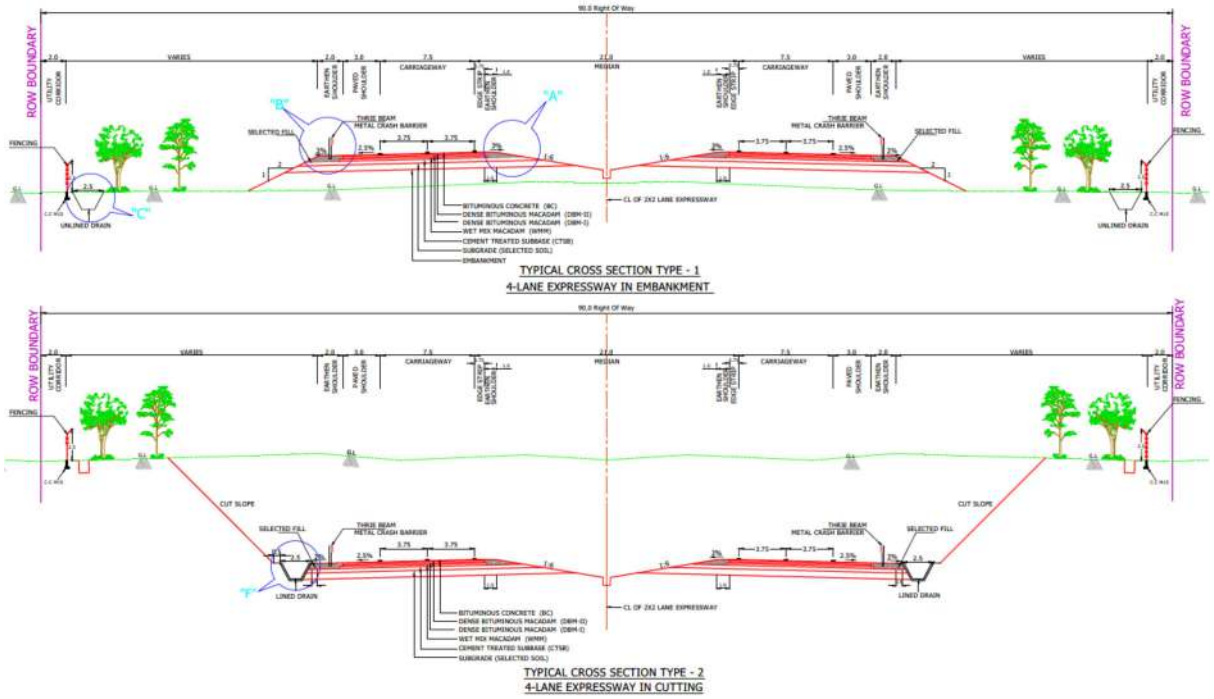
In the project, engineering measures for ensuring safe crossing of wild animals have been included. Since the project is passing through Rayala Elephant Reserve and falls within 10 Km radius of the Kaundinya Wildlife Sanctuary, adequate provisions of animal underpasses, which includes 3 nos. of Elephant Underpasses at the identified location in consultation with the Forest Department and other culverts and elevated structures.

The elephant under passes and other structural measures have been provided in the project in forest stretch in line with guidance document "Eco-friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife" prepared by Wildlife Institute of India. The other measures on wildlife conservation has also been proposed in the project. With implementation of both engineering measures and non-structural measures will definitely minimize the risks for wild animals due to the project.

A budgetary provision of INR 1698 lakh has been made for Wildlife Management Mitigation Plan.

Annexure-1

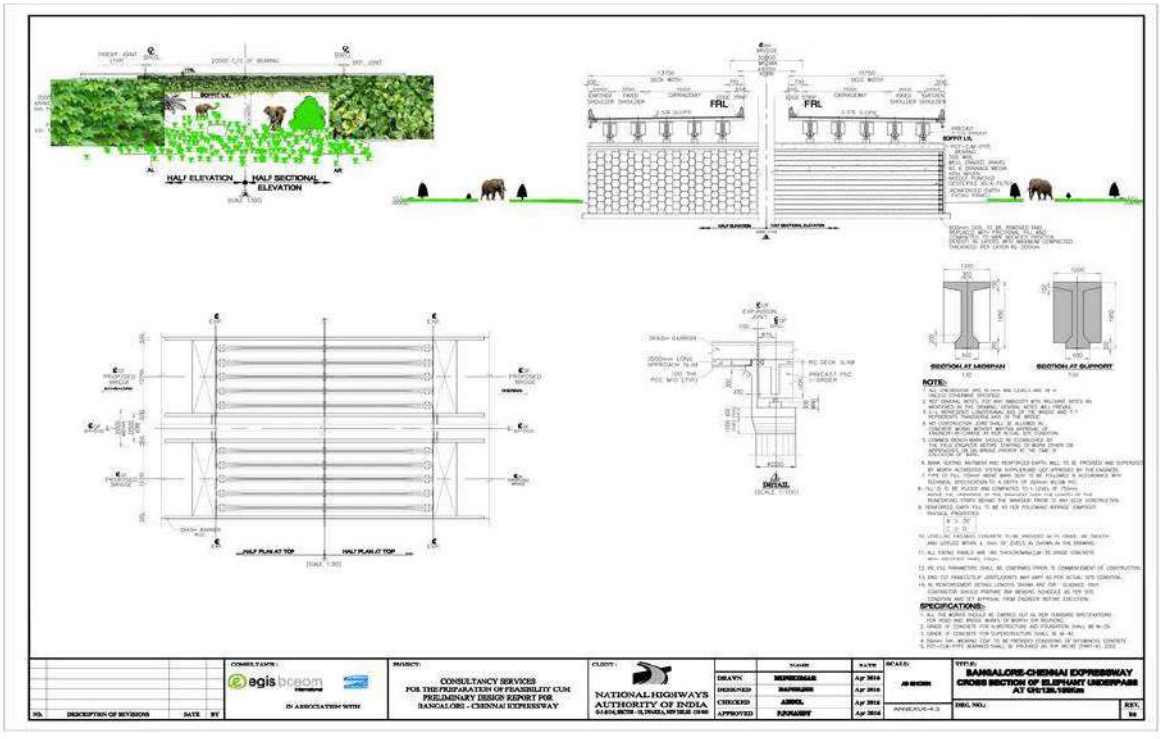
Typical Cross Section



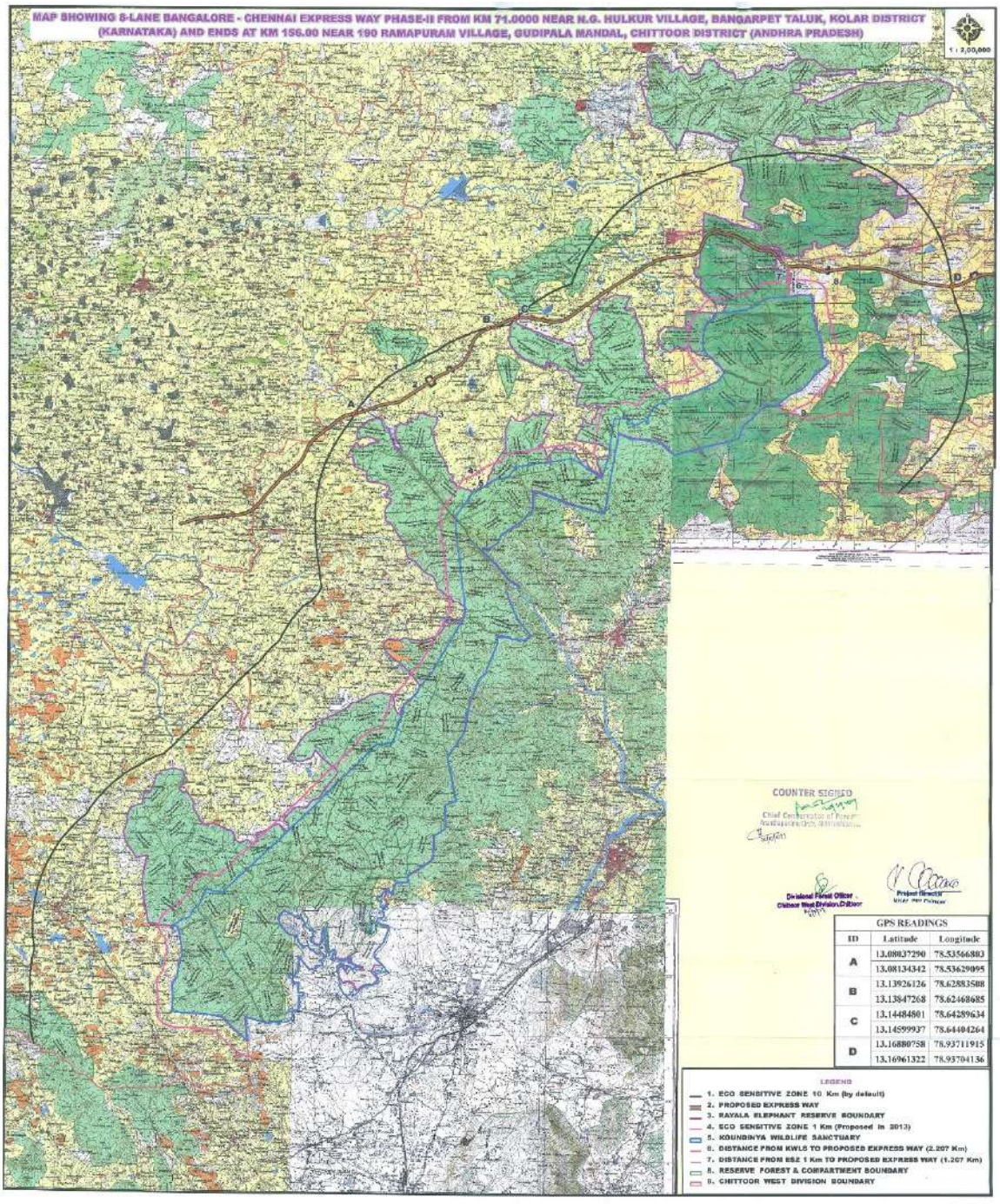
TYPICAL CROSS SECTION TYPE - 1
4-LANE EXPRESSWAY IN EMBANKMENT

TYPICAL CROSS SECTION TYPE - 2
4-LANE EXPRESSWAY IN CUTTING

TCS of Elephant Underpass



Annexure-2


MAP SHOWING 8-LANE BANGALORE - CHENNAI EXPRESS WAY PHASE-II FROM KM 71.0000 NEAR N.G. HULKUR VILLAGE, BANGARPET TALUK, KOLAR DISTRICT (KARNATAKA) AND ENDS AT KM 156.00 NEAR 190 RAMAPURAM VILLAGE, GUDIPALA MANDAL, CHITTOOR DISTRICT (ANDHRA PRADESH)
1 : 2,00,000
COUNTER SIGNED
GPS READINGS
ID | Latitude | Longitude
A | 13.08837290 | 78.53566803
13.08134342 | 78.53629095
B | 13.13926126 | 78.62883588
13.13847268 | 78.62468685
C | 13.14484801 | 78.64289634
13.14599937 | 78.64404264
D | 13.16880758 | 78.93711915
13.16961322 | 78.93704136
LEGEND
1. ECO SENSITIVE ZONE 10 Km (by default)
2. PROPOSED EXPRESS WAY
3. RAYALA ELEPHANT RESERVE BOUNDARY
4. ECO SENSITIVE ZONE 1 Km (Proposed in 2013)
5. KOUNDINYA WILDLIFE SANCTUARY
6. DISTANCE FROM KWLS TO PROPOSED EXPRESS WAY (2.207 Km)
7. DISTANCE FROM ESZ 1 Km TO PROPOSED EXPRESS WAY (1.207 Km)
8. RESERVE FOREST & COMPARTMENT BOUNDARY
9. CHITTOOR WEST DIVISION BOUNDARY