Report on
Mitigation plan and conservation of wildlife

for

Proposed diversion of 5.94 ha of forest land in Seetharampuram RF of Udayagiri range in Nellore Forest Division for
Upgradation of NH 167B from Porumamilla to Chandrasekharapuram road to two lane with paved configuration by (R&B) NH Division, Vijayawada

Located at: Porumamilla to Seetharamapuram road, Seetharamapuram Mandal,SPS Nellore District, Andhra Pradesh, India

FIELD VISITS AND PREPARED BY :

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STUDY PERIOD: Feb- March, 2022

Latitude: 14.990687
Longitude: 79.105773
Elevation: 333.33±5 m
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1. INTRODUCTION

1.1.   IMPORTANCE OF BIOLOGICAL SURVEY AND NEED FOR THE PRESENT STUDY

Roads are important for improving connectivity and transportation, socio-economic development and the standards of living of a country. At the same time, developments of roads have fragmented wild habitats, obstructed animal movement and have led to road kills. All of these impacts can jeopardize the conservation efforts. To prevent, ameliorate and mitigate road induced negative impacts on wildlife species, several measures need to be considered while aligning, designing and operating a roadway through areas that are sensitive from ecological and conservation standpoint. It is important that authorities insist on the best route options and mitigation measures to protect wildlife habitats. For road development projects which are likely to impact native fauna, advice should be sought from wildlife authorities and specialists. In this paper, several measures to reduce impacts of road on wildlife are outlined especially in the context of roads that are routed through forests, wetlands, rivers and wildlife migration corridors. Elevated highways over wetlands or lowland forest, wider bridges and wildlife-safe tunnels and other nature engineering options are important and should be encouraged as a part of the development of new highways. Signages that provide a means to alert about the locations of wildlife-crossings are also important in controlling the speed of the vehicles especially on roads passing through forest and wildlife habitats.

Biological environment is one of the most important components in environmental impact assessment study. Biotic component comprises of both plants (Flora) and animal (Fauna) communities, which interact not only within themselves but also with the abiotic components, viz. physical components of the environment. Generally, the diversity of biological (flora & fauna) communities is an indicator of prevailing status of environmental conditions. The species of natural flora and fauna get organized into communities with mutual dependencies, which reflect the sensitivity to anthropogenic influences. The status of biotic communities is studied in the form of distribution, abundance and diversity.
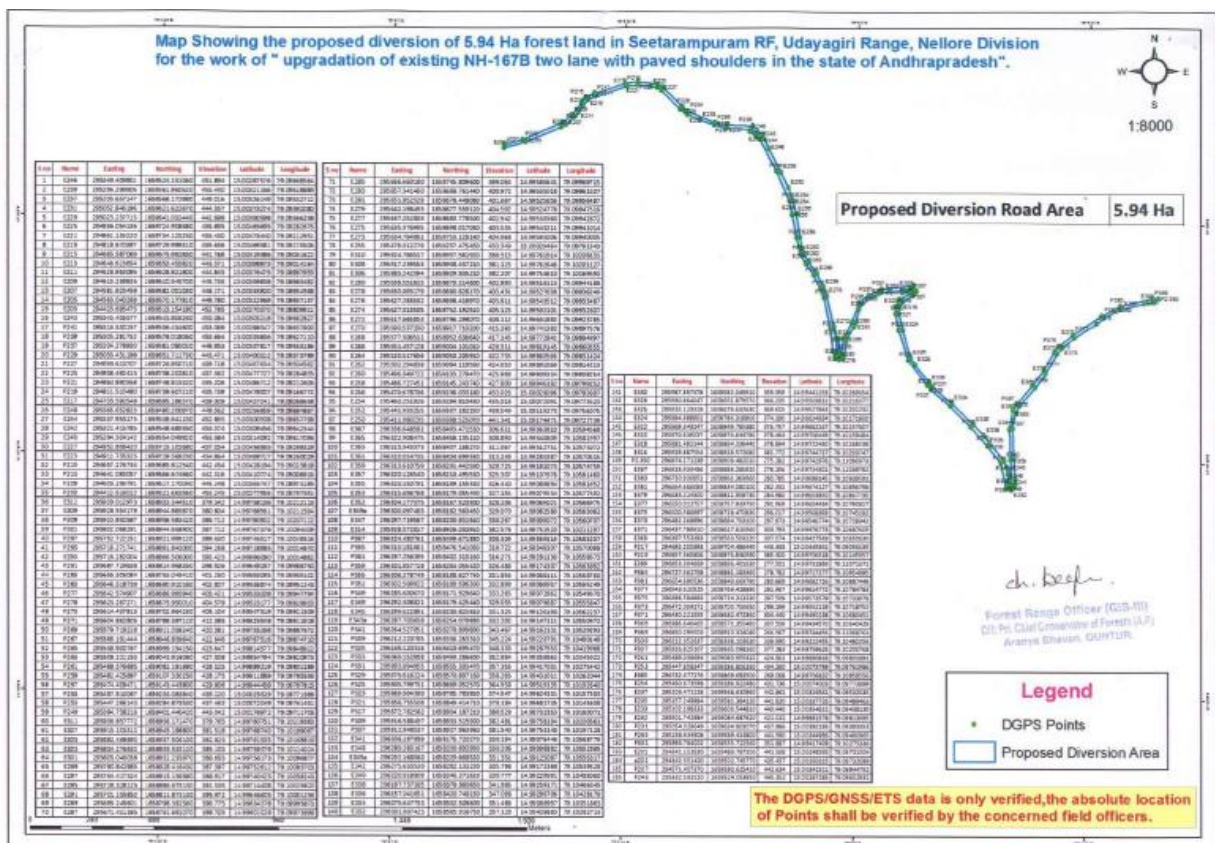
1.2. ROAD RELATED IMPACT ON WILDLIFE GLOBAL SCENARIO:

The direct mortality of animals due to vehicle collisions on road is a primary and obvious effect that reduces animal populations. In addition to the large numbers of vertebrate mortality on roads, insects are also killed in huge numbers, as windshield counts have proven. The house sparrow (*Passer domesticus*) had by far the highest road kill rate. Yet this species has a huge population, reproduces much faster than the road kill rate, and can rapidly recolonize locations where a local population drops. The study concluded, based on the limited data sets available, that none of the more than 100 bird and mammal species recorded had a road kill rate sufficient to affect population size at the national level. Long-term studies of road kills near wetlands illustrate two important patterns. It is suggested that roads along wetlands and ponds commonly have the highest road kill rates, and that, even though amphibians may tend to avoid roads (Fahrig et al. 1995), the greatest impact of transportation on amphibians is probably the road kills (Ashley & Robinson 1996; Fahrig et al. 1995; Vos 1997). Road kill rates are apparently significant for a few species listed as nationally endangered or threatened in various nations. Result of a study on impact of roads and associated vehicular traffic on snake population in eastern Texas by Rudolph et al. (1999) suggest that snake mortality associated with roads and they also found that vehicle traffic reduces the abundance of larger snakes for substantial distances from road corridors. In a 4-year study of 15,000 km of road observations in Organ Pipe Cactus National Monument, Rosen and Lowe (1994) found an average of at least 22.5 snakes killed per km per year due to vehicle collisions. Vehicles often hit vertebrates attracted to spilled grain, roadside plants, insects, basking animals, small mammals, road salt or dead animals. Road kills may be frequent where traffic lanes are separated by impermeable barriers or are between higher roadside banks (Romin & Bissonette 1996). Landscape spatial patterns also help determine road kill locations and rates. Foraging deer are often killed on roads between fields in forested landscapes, between wooded areas in open landscapes, or in conservation areas in suburbs (Romin & Bissonette 1996). In short, road vehicles are prolific killers of terrestrial vertebrates. Nevertheless, except for a small number of rare species, road kills have minimal effect on population size.

1.3. PROJECT DESCRIPTION:

The highway starts at Mydukuru market junction i.e. intersection with NH-67 and connecting porumamilla, Seetharampuram, Kothapalli, Darsi Gunta, CS Puram, Kandukur and ends at Singarayakonda on NH16. It passes through three Major Districts i.e Y.S.R Kadapa, Nellore & Prakasam districts in the State of Andhra Pradesh. This highway acts as a link between NH67 with NH16. The Ministry of Road Transport & Highways (MORT&H) has proposed to upgrade the existing road to two lanes with paved shoulders configuration as the existing road is unable to meet the traffic demand.

The existing road from Km.57/1200 to Km.62/1950 is passing through Seetharampuram RF of Udayagiri Range of Nellore Division in SPS Nellore District of Andhra Pradesh. Therefore, proposal for diversion of 5.94 ha is proposed for improve and widening of the existing road to two lanes with paved configuration. This is submitted that widening and improvement of this section of NH-1678 would further improve connectivity in terms of achieving smooth and safe traffic flow and improve

Map Showing the proposed diversion of 5.94 Ha forest land in Seetarampuram RF, Udayagiri Range, Nellore Division for the work of " upgradation of existing NH-167B two lane with paved shoulders in the state of Andhrapradesh".

level of service. In addition to above, substantial economic gain in terms of reduced Vehicle Operating Cost (VOC) and reduced travel time will be achieved.

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Longitude: 79.108225
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Map Showing the proposed diversion of 5.9406 Ha forest land in Chintodu RF, Udayagiri Range, Nellore District for the work of " upgradation of existing NH-167B two lane with paved shoulders in the state of Andhrapradesh"

RESTRICTED

आंध्र प्रदेश
ANDHRA PRA

Surveyed 1977-78.

DGPS Survey Area Statement in Ha	
Existing Road Area	3.5116
Proposed Area	5.9406

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Legend
• DGPS Points
Proposed Road
Existing Road

0 280 560   1,120 Meters

1:15,000

1.4. GUIDELINES FOR WILDLIFE ISSUES DURING ROAD EXPANSION: BY WILDLIFE INSTITUTE OF INDIA (WII)

For existing facilities, which generally undergo enlargement or upgrading, the focus should be on any necessary repair or rehabilitation of prior environmental damage. For example, a road passing near or through a wildlife area where migration routes have been cut and existing wildlife mortality is significant, special attention would be paid to realignment of the road or the provision of wildlife passages (both over and underpasses).

For existing project, the analyst would:

2. Define the nature of the proposed work and how it would change the existing facility;
3. Identify which, if any, aspects of the existing facility have caused unacceptable negative impacts;
4. Analyse the combined effect of the rehabilitation action with that of the existing facility operations; and
5. Prepare an action plan for the repair of the past damage done and for the prevention of any negative effects resulting from the new work.

The Guidelines for include information relevant to all EIA related projects. It should be applied from the earliest feasibility assessments, as well as from the time of the environmental impact assessment, and continue to be applied throughout the construction and operational phases. Baseline biodiversity surveys, where required, should occur as early as possible (e.g., when wind meteorological masts are erected) and should consider seasonality. A tiered approach to biodiversity surveys could be useful in terms of designing a survey effort commensurate with the stage of project development, also considering the existing biodiversity value of the area.

Site-specific issues: consideration of habitats, geographical location, topography, and vicinity of the existing road to sites of high biodiversity value.

Species-specific issues: surveys should be targeted to species of flora and fauna of high biodiversity value, those with a special international or national conservation status, endemic species, and species that are at elevated risk of impact from proposed

project facilities. For example, species with a relatively high collision risk of Carnivores and Herbivores of the region.

Species with a relatively high risk of visual disturbance include open-country species that instinctively avoid tall structures.

Some species may be attracted to feeding areas, which could further increase potential for collision.

Species at risk of collision with associated train movements include relatively heavy-bodied animals with limited manoeuvrability (e.g., panther, Sloth bare, Nilgai etc), as well as flocking bird species.

Species at risk of habitat fragmentation and associated structures.

Species with a relatively high risk of disturbance from noise (Train movement and horn sound). These impacts and potential mitigation options should be assessed on a species-by-species basis.

Season-specific issues: Surveys should take into consideration certain periods during the year when the project site may have a greater or different ecological function or value (e.g., migration, breeding season, or winter seasons). Surveys should usually be conducted for at least one season when at-risk wildlife is identified.

Longer surveys may sometimes be necessary in areas with exceptional aggregations of at-risk migratory animals and where existing biodiversity data are limited. This would be determined on a project-by-project basis.

Surveys should be designed and implemented to adequately guide the overpasses and underpasses to minimize collision risks to wild species. This is normally expected to entail gathering relatively precise information on the spatial patterns of site utilization by at-risk wildlife species as well as consideration of the locations of certain topographic, ecological, or other landscape features that may attract or otherwise concentrate the activity of movement of wildlife within the project area and its surrounding landscape.

Specific data-gathering methods and study designs should be selected based on site and species-specific considerations, guided by technical experts, and may include vantage point surveys, point count surveys, remote-sensing data-gathering

techniques, and/or other techniques to understand movement patterns, as appropriate. The extent of data collection should be commensurate with the biodiversity risk at the proposed facility.

Depending on the location of the wind energy facility and on species-specific considerations, Collision Risk Modelling (CRM) may be also appropriate, especially when tracks are located close to areas of high biodiversity value.

The utility of CRM is to be evaluated on a project-by-project basis with qualified experts.

CRM is particularly useful at wildlife sanctuaries and National parks facilities where empirical tools are limited and having more ecologically sensitive areas.

Where road approach is near areas of high biodiversity value, project developers are encouraged to implement a coordinated approach to surveys and monitoring.

This approach is cost-effective, as surveys could be jointly planned and implemented with costs shared between developers.

A common survey methodology and approach also lends itself to cumulative impact assessment, as data collection methods and the level of effort could be standardized. Cumulative impact assessments should be undertaken in cases where multiple wind farms are located near areas of high biodiversity value.

1.5.   SCOPE OF THE STUDY:

Conducting one season wildlife (Flora and fauna) monitoring survey in and around the proposed project (Proposed diversion 5.94 ha of forest land in Sitarampuram RF of Udaygiri range for upgradation of NH 167B from Porumamilla to Chandrasekharapuram road to two lane with paved configuration by NHAI) upto 10 km radius to identify the endangered wildlife, migration status, disturbance leading to displacement of wildlife groups, barrier to movements, Collision risk and direct habitat loss and to suggest mitigation plan at species specific, habitat specific and project specific impacts. Conservation plan will be prepared for Schedule I species of Indian Wildlife Protection act (1972).

1.6.   THE OBJECTIVES OF THE STUDY:

I.   To conduct the biodiversity monitoring study in and around 10 km radius of the proposed project.

II.   To identify the endangered wildlife, migration status, disturbance leading to displacement of animal groups, barrier to movements, Collision risk and direct habitat loss in the study area.

III.   Baseline data of Terrestrial biological environment by studying distribution pattern, community structure, population dynamics and species composition of Flora and Fauna.

IV.   List of existing trees on either side of the Road upto 20 m distance and other details such as height, GBH etc.

V.   Areas used by protected, important or sensitive species of Flora or Fauna for breeding, nesting, foraging, resting, over wintering, migration shall be as ascertained.

VI.   To know the habitat and migratory path survey of wildlife population to assess likelihood of impact due to proposed activity.

VII.   To assess the appraisal of issues of wildlife collision near each Eco sensitive points identified during field study.

VIII.   To calculate the mortality and disturbance leading to displacement of animals, barrier to movements, Collision risk with vehicle accidents and direct habitat loss.

IX.   To carryout Ecosensitive point survey within 2 km radius to know the ecology of pray – predator ratio in each cluster.

X.   To assess the impacts on Endangered species from each Ecosensitive location.

XI.   To suggest mitigation measures to minimize/avoid adverse impacts.

XII.   To prepare conservation plan for Schedule I species of Indian Wildlife Protection act (1972).

2. METHODS ADOPTED FOR THE STUDY:

The survey was undertaken by a team of specialists on wildlife. All sampling points are made to two clusters to understand the feeding and foraging behaviour. Species specific survey and analysis methods were adopted for wildlife. A detailed study was undertaken to know the ecological significance of wildlife in different types of ecosystems, cluster sites and observed at different timings.

2.1.   SURVEY TYPES USED:

- Habitat wise survey for Herbivores and Carnivorous animals of the region.
- Point count method for birds near aquatic bodies.
- Direct and indirect evidences for Mammals within 10 km radius of the proposed expansion project.
- Phyto sociological analysis of trees, shrubs and herbs present near each sampling point for roosting and breeding habitats of the birds and bats

2.2.   EQUIPMENT / INSTRUMENTS DEPLOYED

- Digital Camera (NIKON 42 X zoom)
- GPS (Available in Mobile and inbuilt camera)
- Binoculars (OLYMPUS 10 X 50 DPSI)
- Field observation book, Field guides, Pen, Measuring tape etc

2.3.   PRIMARY AND SECONDARY SURVEY

The primary surveys were undertaken to identify the ecological features of the area with particular reference to identify and quantify any sensitive ecological communities in the study area within 10 km radius of the proposed project. Secondary surveys Literature surveys were conducted to identify Rare, Endangered, Endemic and Threatened species (REET) and/or habitats within the study area. The reference has been taken from The Wildlife (Protection) Act, 1972 and Red Data Book.

The study was undertaken from 02.02.2022 to 23.02.2022 (50 days). The relevant, observations noted in that assessment have been included in the current assessment and referenced accordingly.

Table 1: GPS coordinates of the critical habitats observed during the study:

GPS point	Latitude	Longitude
CR 1	14°59'43.75"N	79° 4'29.85"E
CR 2	14°59'31.46"N	79° 4'51.03"E
CR 3	14°59'43.08"N	79° 5'2.97"E
CR 4	15° 0'10.79"N	79° 5'24.73"E
CR 5	14°59'54.90"N	79° 6'2.64"E
CR 6	14°59'36.62"N	79° 6'50.32"E

Figure 1: Map showing Sampling points of the Eco sensitive habitats identified in the proposed project area.

3. BIOGEOGRAPHIC DESCRIPTION OF THE STUDY AREA

FOREST TYPES OF THE STUDY AREA

The proposed project falls in notified Reserved Forest is a mixture of Albizzia amara Zizyphus xylopyrus, Strychnos nuxvomica, Madhuca indica, Sapindus emarginatus, Pterocarpus santalinus, Azadirachrta indica (Neem) etc... Type offorest is dry deciduous and Thorn Scrub Forests. This area falls under the following classification of the Champion & Seth

Dry Red sanders bearing forests	5A/C2
Southern Tropical Dry Mixed Deciduous Forest	5A/C3
Southern Thorn Scrub	6A/C1
Tropical Dry Evergreen Scrub	7/C1/DS1

The study area has an undulating topography characterized by hills, hillocks, wide plains, crop lands and low-lying waterlogged areas. The study of fauna was undertaken within the proposed block and buffer areas. The project area of core and buffer zone represent seetharampuram reserve forest.

To prepare the ecological report under EIA study field visits for the project area has been conducted within 10 km surrounding of the proposed project. From this study a detail report on biodiversity status have been prepared. All the direct sightings were recorded at the study period and also noted faunal species after consultation with local villagers and secondary sources. Based on our field observations and literature survey we found 4 important fauna species which are threatened category (IUCN) and Schedule-I species as per Wildlife Protection Act, 1972 in the study area (Table 1). We reported 3 species of mammals, 1 species of birds in the study area which are shown in Table 1 below

List of Schedule I species of Indian wildlife protection act (1972) found in the Study Area

S.No.	Scientific Name	Common Name	WPA Status	IUCN
1	*Panthera pardus*	Leopard	Part I of Schedule I	EN
2	*Pavo cristatus*	Indian Peafowl	Part III of Schedule I	LC

PROTECTED AREAS & ECO-SENSITIVE AREAS IN THE CORE AND BUFFER ZONES

Figure 2: Map showing distance from Gundla brahmeswaram Wildlife Sanctuary to the proposed project site
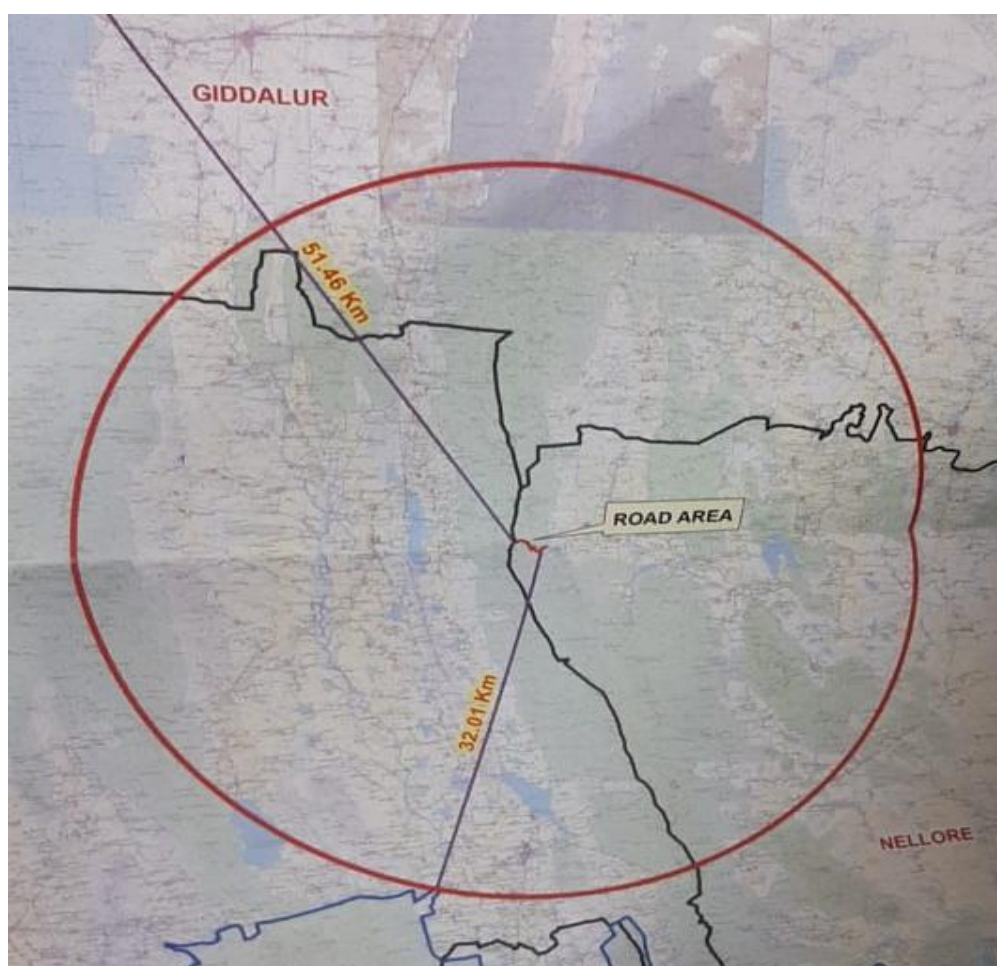
Table 2: Details of protected areas, forests & ecologically sensitive areas

Ecological sensitive habitat	Direction and Distance from the project site.
National Parks/ Wildlife Sanctuary/ Biosphere reserves/ Elephant Reserve/ Any Other Reserve	51.46 km from Gundlabrahmeswaram Wildlife Sanctury and 32.01 km from Sri Lankamalleswaram Wildlife Sanctury.
Reserved Forests	Seetharampuram RF (Within the core project area)
Wildlife Corridors & Routes	Nil
Wetlands / Water bodies	Swamy Cheruvu, Cherlopalle Cheruvu, Devamma Cheruvu
Ramsar Site	Nil within the study area
Important Bird Habitats	Nil within the study area
Breeding/nesting areas of endangered species	Nil within the study area
Mangroves	Nil within the study area

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Longitude: 79.113306
Elevation: 266.98±11 m
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4.0 METHODOLOGY FOR BIODIVERSITY SURVEY

COLLECTING THE DETAILS OF THE PROJECT

Vegetation in core area has been estimated by direct counting of Tree species, their number, GBH value and distance and direction in Row. The vegetation structure of the region was randomly checked at selected habitats and sampling was done near reserved forests. Most of the buffer zone area is under cultivation and hence sampling near pond side and road side are restricted to dense covered regions. To avoid the biased results, statistical analysis is carried out near reserve forests. The remaining buffer zone survey was carried out for validating the secondary data collected at regional level. The status of each identified species was given in terms of four categories such as "Common", "Sporadic", and "Rare". This status is mainly based on Density, Frequency and Abundance estimated during the field visit for Trees, Shrubs and Herbs.

Number of quadrates or belt transacts are finalized based on the Area – Species graph. 20 m X 20 m for tree species, 5 m X 5 m quadrates for shrubs and 1 m X 1 m quadrates for herbs. In locations where the quadrants are not possible such as hilly areas and agricultural, plantation areas a belt transects of 100m X 10m are applied. List of floral species observed at each point are filled in data forms and photographed. Species listed and photographed are compared with standard floras and websites related to conservation status. Girths (GBH at 132 cm from the ground) of trees are recorded

The above parameters are used to determine the following.

- ❖ The density, Dominance, Frequency and their relative values are calculated. The IVI values are graphically represented in the report.
- ❖ The flora data collected from 10 sampling points are analyzed quantitatively from MS Excel and PAST.
- ❖ The biodiversity indices such as Shannon Index, Simpson index, A/F value, Dominance and Evenness e^H/S are statistically anlysed and interpreted the data on ecosystem quality.

QUANTITATIVE ANALYSIS OF THE VEGETATION DATA INTERPRETATION:

Plot-based random quadrate sampling method was adopted to generate the Phyto-sociological data viz., density, frequency, abundance and important value index (IVI). Other ecological parameters such as Shannon-Wiener diversity index, Abundance/Frequency (A/F) ratio for distribution pattern of species and Similarity Index were derived from the above basic data. These indices will also be calculated with statistical tools such as PAST etc.

Calculating Statistical parameters:

Frequency, density, abundance and basal area were calculated following, Misra (1968).

Frequency:

Number of sampling units in which a species occurs X 100

Total number of sampling units studied

Density:

Total number of individuals in all sampling units

Total number of sampling units studied

Abundance:

Total number of individuals in all sampling units

Total number of sampling units of occurrence

Relative Density and Relative abundance

The relative density and dominance values of different species found in the study are shows that the dominant plants of various sites have a high percentage value of density and dominance. These values are incorporated in calculating the Importance value Index.

Relative density (RD):

$$\frac{\text{Number of individuals of a species}}{\text{Total number of individuals of all species}} \times 100$$

Relative frequency (RF):

$$\frac{\text{Number of occurrences of a species}}{\text{Total number of occurrences of all species}} \times 100$$

Relative Abundance (RA):

$$\frac{\text{Total Abundance of individual species}}{\text{Total Abundance of all species}} \times 100$$

Importance Value Index (IVI)

Important Value Index was estimated from the formula developed by Cottam and Curtis (1956).

IVI = RD + RF + RA

IVI for trees (300) was derived from relative density (RD), relative frequency (RF) and relative abundance (RA) whereas the same was calculated for shrubs (200) and herbs (200) from relative frequency and relative density.

DATA INTERPRETATION:

Shannon index: Mathematically it is defined as a diversity index, a measure of biodiversity which quantifies how equal the community is numerically. Normal diversity in ecological studies is ranged from 1.5 to 3.5 (Kerkhoff, 2010). If the value is 1.5 to 2.5 the diversity and dominance of the species is moderate. If the value is 2.5 to 3.5 the diversity and dominance of the species is good,

Simpson 1-D

As species richness and evenness increase, so diversity increases. Simpson's Diversity Index is a measure of diversity which takes into account both richness and evenness. The value of this index also ranges between 0 and 1, but now, the greater the value, the greater the sample diversity.

Evenness: The distribution of individuals over species is called evenness. Species evenness refers to how close in numbers (distribution pattern) each species in an environment is. This index ranges from 0 to 100% indicates lower to higher evenness. High value indicates continuous patches of the species in the study area.

Dominance: It is calculated in Percentage. The dominance value ranges from 0 to 100. It indicates that if the value is high, dominance of a species in the community will as high.

A/F Value: Abundance to frequency ratio (A/F) has been calculated to assess the distribution pattern of species and depending upon the ratios, distribution may be regular (<0.025), random (0.025-0.05) and contagious (>0.05). In natural conditions, contagious distribution is most common type of distribution due to significant variation in environmental conditions (Odum, 1971).

Status of Flora as per Raunkiaer's Frequency Classes

Raunkiaer classified the occurrence of species in an area into five classes of frequency Class – A (1 to 20%), Class – B (21 to 40%) Class – C (41 to 60%) Class – D (61 to 80%) and Class – E (81 to 100). The normal distribution of the frequency percentages derived from such classification is expressed as A>B>C=D<E, and has been named Raunkiaer's "Law of Frequency".

Similarity index:

Similarity index (SI) or Community Coefficient (CC) between the core and buffer zones or between the various Reserve forestes or Ecosystems were calculated following Sorenson (1948).

Indices of similarity = 2C/A+B

Where, C represents the number of species common to both the communities A & B; A and B represent the number of species present in communities A and B including the common species.

PROTOCOLS FOR FAUNA:

Fauna is all of the animal life of any particular region or time and which depends largely on the vegetation type and the abiotic features of the region. Terrestrial animals are animals that live predominantly or entirely on land, as compared with aquatic animals, which live predominantly or entirely in the water (e.g., fish, lobsters, octopuses), or amphibians, which rely on a combination of aquatic and terrestrial habitats (e.g., frogs).

Mammals surveys were conducted by using transect method in all major habitats and recorded the species through direct and indirect evidences. Species were identified using "A pictorial guide to the Mammals of the India" by Prater (1997), Pradhan (2004).

Aves Bird surveys will be carried out through **Point count method** preferably during **dawn and desk**. List will be prepared with available literature from the study area and preliminary observations. Identification of birds will be done using "A pictorial guide to the birds of the Indian Sub-Continent" by Salim Ali and S.D. Ripley (1998). Study will also be conducted to know migration, nesting and roosting of birds.

Reptiles like snakes, lizards, tortoise and turtles will be identified by direct or indirect evidences and available identification keys include Whitaker and Captain (2004).

Amphibians are surveyed at both aquatic and terrestrial systems during day & night searching under the logs and stones, digging through litter and soil, searching short bushes and tree hollows and under fallen barks and water- catching. All the species were identified using keys and descriptions of Daniel (2005).

Fishes from the water body using locally available fishing gears such as cast nets, traps, hook and line and other traditional gears from different locations of the water body. (Generally during the field surveys Fishes, Amphibians and reptiles are mostly collected though secondary data only)

Invertebrates were done along the transect passing through various habitats, species identification was made using

5.0 SURVEY RESULTS

- ❖ The present study was carried out in Winter season for the direct observation in the selected habitats of the study area and anlysed the possible impacts on animals of the proposed road expansion and suggested mitigation measures.
- ❖ The entire study area was anlysed on hypothetical cluster-based analysis.
- ❖ The main two clusters are Pandrangi and SR Puram beats (Compartments 553 and 554). Under each cluster survey points were studied randomly for any impacts on wildlife of the region.
- ❖ Mammals monitoring plan rely on direct field observations, indirect evidences, authentic information, desktop study of available relevant literature as well as subject expert's professional judgment. After review of relevant secondary information available for the area habitat and point surveys were undertaken in Monitoring surveys upto 10 km radius of the project area.

KEY FINDINGS OF BIODIVERSITY MONITORING

Vegetation structure:

Trees: The most common tree species occurring are *Albizzia amara, Aristida dipressa, Aegle marmelos, Aristolochia indica, Azadirachta indica, Bassia latifolia, Butea frondosa, Cassia fistula, Capparis rotundifolia, Casearia esculenta, Cassia occidentalis, Crataeva nurvala, Cynodon dactylon, Grewia tilaefolia, Gmelina asiatica, Helicteres isora, Holarrhena antidysenterica, Pterocarpus santalinus, Pterospermum heyneanum, Santalum album, Strychnos nux-vomica, Sapindus emarginatus, Terminalia bellerica, Terminalia chebula, Tinospora cordifolia, Trichosanthes cucumerina, Xeromphis spinosa* etc. *Amarphophallus sylvaticus, Asparagus racemosus, Curculigo orchioides Decalepis hamiltonii, Dioscorea oppositifolia, Dioscorea pentaphylla, Hemidesmus indicus, Gloriosa superba* etc., have underground tuberous parts of good value. Several species yielding fibre, gums, pulp, resins, oils, dyes, etc., also are present. Collection and selling of honey is a common source of income to the poor, here.

Shrubs: The most common shrubs are *Lantana camera, Hyptis suaveolens, Cassia auriculata, Calotropis procera, Prosopis juliflora, Acacia leucocephala, Catunaregam spinosa, Caesalpinia bonducella, Canthium parviflorum, Carissa carandas, Capparis sepiaria, Celastrus paniculata.*

Herbs: The most common herbs are Tridax procumbens, Cassia occidentalis, Crotan bonplantianum, Datura metel, Eclipta alba, Boerhavia diffusa, Tephrocia purpuria, Achyranthes aspera.Cassia tora, Abutilon indicum Ipomoea macrantha

Climbers: The commonly seen climbers are *Capparis horrida, Abrus precatorius, Hemidesmus indicus, Clitoria ternatea, Cuscuta reflexa, Desmodium triflorum, Pergularia daemia, Desrris scandans, Hemidesmus indicus, Ipomoea pes-caprae, Ipomoea nil, Ipomoea macrantha, Mucuna pruriens, Evolvulous alsinoides, Gloriosa superba.*

Grasses: The common grass species are *Chloris barbata, Cyperus castaneus, and Cynodon dactylon Dactyloctenium aegyptium, Digitaria ciliaris, Eragrostis tenella, Fimbristylis cymosa, Ilaloipsis binata and Imperata cylindrica.*

NON FOREST VEGETATION (ROAD SIDE, VILLAGE SIDE ETC):

In the non-forest area, different types of vegetation are recorded. Tree species are mostly planted and few are natural. Trees available in the non-forest area are classified into the following categories in the study area. These are:

- ❖ **Roadside:** Trees planted along the road side. The dominant plant species are *Dalbergia sisoo, Acacia nilotica*, Neem, *Ficus, Peltophorum, Pongamia pinnata, Mangifera indica, Borassus* etc.
- ❖ **Village woodlot:** Naturally growing or planted trees on community /private land. The dominant plant species are Coconut, *Terminalia* (Badam), *Ficus religiosa*, Banana, Mango, Bamboo, etc.
- ❖ **Pond side vegetation:** The dominant floral species near the ponds and seasonal water bodies are *Samania saman*, *Ipomoea, Typha ungustifolia, Cassia ungustata, Lantana camera, Asperagus* etc.

QUANTITATIVE ANALYSIS

The study area is mainly focused through secondary data validation from primary observations. Checklist is prepared and marked the species noticed during rapid assessment. 20 sampling points are through Area-Species graph. And the quantitative analysis done based on the methodology adopted for various species.

The habit wise and ecosystem wise status of various floral species observed are given here graphically.
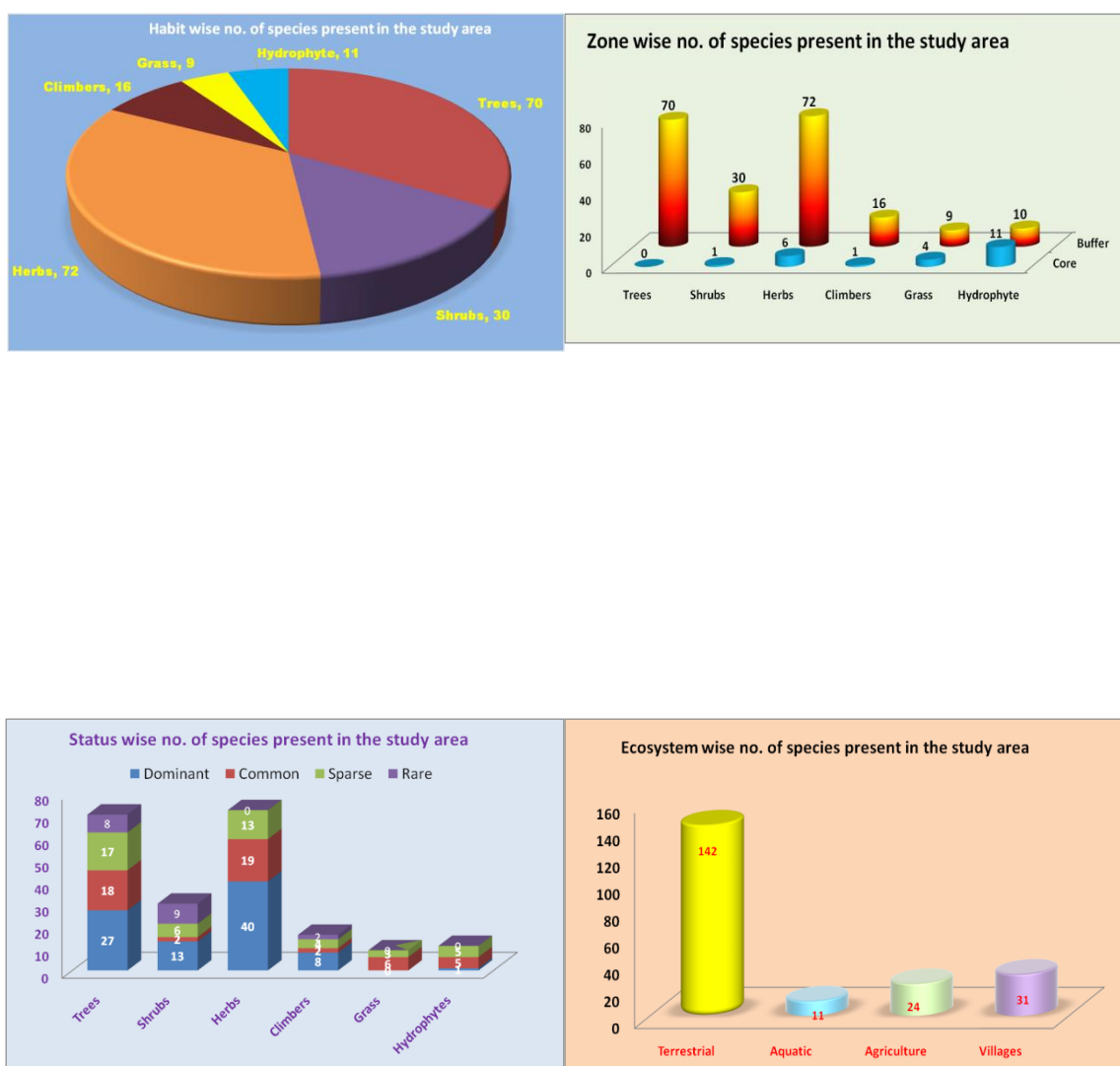
Table: Phytosociological data of study area:

S.No	Scientific Name	Density	Rel Density	Freq-uency	Rel Freq-	Abun-dance	Rel Abun-	IVI
1	*Azadirachta indica*	0.85	3.70	55.00	5.45	1.55	3.42	12.56
2	*Dalbergia sissoo*	1.35	5.87	40.00	3.96	3.38	7.46	17.29
3	*Gmelina asiatica*	0.90	3.91	60.00	5.94	1.50	3.32	13.17
4	*Hardwickia binata*	0.85	3.70	60.00	5.94	1.42	3.13	12.77
5	*Holarrhena antidysenterica*	0.60	2.61	40.00	3.96	1.50	3.32	9.88
6	*Tectona grandis*	1.30	5.65	60.00	5.94	2.17	4.79	16.38
7	*Lannea*	2.70	11.74	50.00	4.95	5.40	11.94	28.63
8	*Lantana camara*	1.10	4.78	60.00	5.94	1.83	4.05	14.78
9	*Leucaena*	0.80	3.48	50.00	4.95	1.60	3.54	11.97
10	*Mangifera indica*	1.25	5.43	40.00	3.96	3.13	6.91	16.30
11	*Morinda tinctoria*	0.55	2.39	55.00	5.45	1.00	2.21	10.05
12	*Phoenix sylvestris*	1.30	5.65	30.00	2.97	4.33	9.58	18.20
13	*Xylia xylocarpa*	1.60	6.96	70.00	6.93	2.29	5.05	18.94
14	*Prosopis juliflora*	1.35	5.87	70.00	6.93	1.93	4.26	17.06
15	*Terminalia alata*	1.15	5.00	65.00	6.44	1.77	3.91	15.35
16	*Saraca asoca*	1.05	4.57	50.00	4.95	2.10	4.64	14.16
17	*Soymida febrifuga*	1.75	7.61	55.00	5.45	3.18	7.03	20.09
18	*Strychnos nux vomica*	0.95	4.13	35.00	3.47	2.71	6.00	13.60
19	*Syzygium cumini*	1.60	6.96	65.00	6.44	2.46	5.44	18.83
			100		100		100	300.00

Figure : Graph showing Important Value Index of dominant tree species within study area
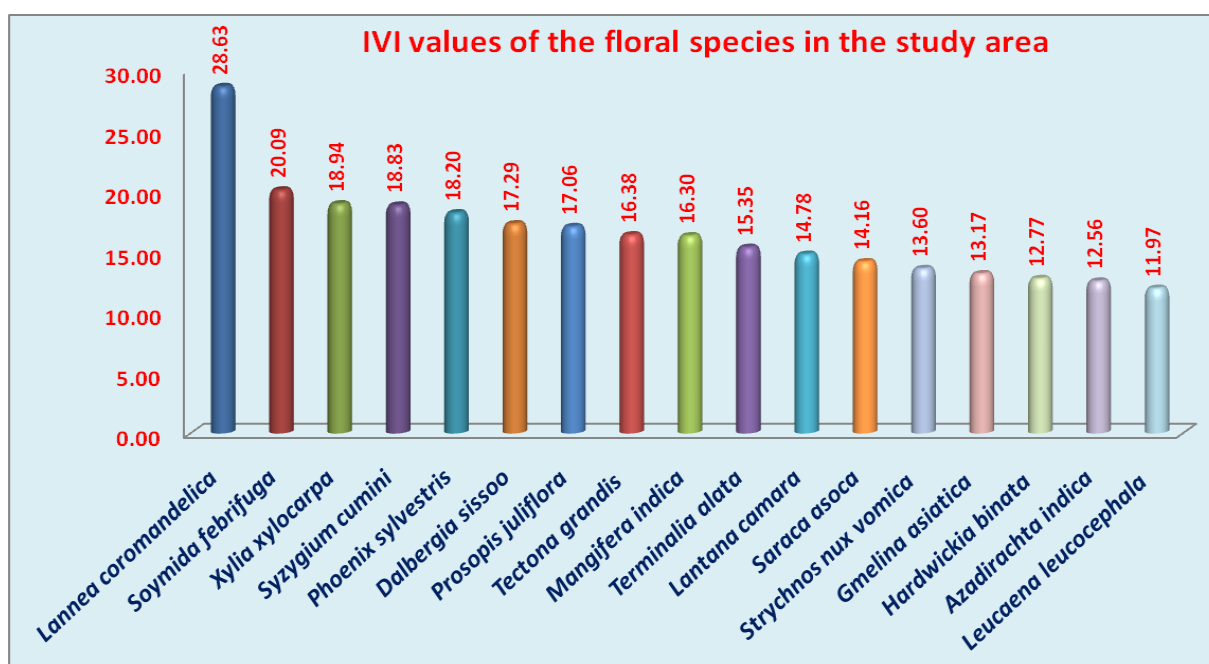
Table : Biodiversity indices values of the sampling sites in buffer zone:

Dominance D	0.056
Shannon H	2.912
Simpson 1-D	0.944
Evenness e^H/S	0.976
A/F value	0.045

Distribution pattern (A/F ratio): The ratio between abundance and frequency was used to interpret the distribution pattern of species (Whitford, 1949). Distribution pattern of species in the study area is identified as **random distribution** as the value of A/F ratio is **0.045.** This random distribution of species is mainly due to various ecosystems present in the buffer zone. The Shannon indices value of study area is **2.912** indicates **Good diversity** (Normal diversity in ecological studies is 1.5 to 3.5 range (Kerkhoff, 2010). Population size and Dominance of the species is **6%** and Evenness is around **98%** (Indicates the species are evenly distributed in core and buffer zones). This might be due to contiguous patches of Eucalyptus and Subabul species and natural species such *Azadirachta indica, Phoenix, Prosopis juliflora (near*

the villages), Peltophorum pterocarpum and *Delonix regia (near road side).* The present study indicates A<B<C>D>E in frequency classification and as per the Raunkiaer's law of frequency classification indicates that species diversity is distributed maximum for 40 to 60%. This result indicates that all most all plants frequency is more or less equal due to some of the plant species such as *Xylia xylocarpa, Syzygium cumini, Phoenix sylvestris, Dalbergia sissoo, Prosopis juliflora, Tectona grandis, Mangifera indica, Terminalia alata and Lantana camara* are **frequently found** floral species throughout the region.

Latitude: 14.997369
Longitude: 79.110617
Elevation: 269.17±7 m
Accuracy: 12.7 m
Time: 20-03-2022 15:50
Note: 14

LIST OF PLANT SPECIES RECORDED

TREES:

Sl. No	Species	Common Name	Family	Habit
1	*Acacia auriculiformis*	Acacia	Mimosaceae	Tree
2	*Acacia chundra*	Sandra	Mimosaceae	Tree
3	*Acacia leucophloea*	Tella tumma	Mimosaceae	Tree
4	*Acrocarpus fraxinifolius*	Galivana chettu	Fabaceae	Tree
5	*Adina cordifilia*	Bandaru	Rubiaceae	Tree
6	*Aegle marmelos*	Maredu	Rutaceae	Tree
7	*Alangium salvifolium*	Ooduga	Alangiaceae	Tree
8	*Albizia amara*	Nallaremi	Mimosaceae	Tree
9	*Albizia odoratissima*	Ganara	Mimosaceae	Tree
10	*Anacardium occidentale*	Jeedimamidi	Anacardiaceae	Tree
11	*Angeissus latifolia*	Vellama	Combretaceae	Tree
12	*Annona reticulata*	Ramaphalam	Annonaceae	Tree
13	*Annona squamosa*	Seethaphalam	Annonaceae	Tree
14	*Anogeissus acuminata*	Pasi	Combretaceae	Tree
15	*Artocarpus heterophyllus*	Panasa	Anacardiaceae	Tree
16	*Atalantia monophylla*	Karunimma	Rutaceae	Tree
17	*Azadirachta indica*	Vepa	Meliaceae	Tree
18	*Bauhinia racemosa*	Are	fabaceae	Tree
19	*Bombax ceiba*	Burugu	Bombacaceae	Tree
20	*Bridelia monoica*	Tella balli	Euphorbiaceae	Tree
21	*Bridelia retusa*	Anem	Euphorbiaceae	Tree
22	*Buchanania lanzan*	Jarumamidi	Anacardiaceae	Tree
23	*Calophyllum inophyllum*	Pagada	Calophyllaceae	Tree
24	*Canthium dicoccum*	Noorillu	Rubiaceae	Tree
25	*Careya arborea*	Kumbi	Lecethydaceae	Tree

26	*Cassia fistula*	Rela	Caesalpinaceae	Tree
27	*Cassia montana*	Konda tangedu	Caesalpinaceae	Tree
28	*Casuarina equisetifolia*	Sarugudu	Casurinaceae	Tree
29	*Chloroxylon swietenia*	Billa	Meliaceae	Tree
30	*Cinchona orixense*	Potaka	Rubiaceae	Tree
31	*Cochlospermum religiosum*	Kondagogu	Cochlospermaceae	Tree
32	*Dalbergia latifolia*	Rose wood	fabaceae	Tree
33	*Dalbergia paniculata*	Pachari	fabaceae	Tree
34	*Dichrostachys cinerea*	Velthuru	Mimosaceae	Tree
35	*Diospyros ferrea*	Pisineka	Ebenaceae	Tree
36	*Diospyros melanoxylon*	Thuniki	Ebenaceae	Tree
37	*Diospyros sylvatica*	Gatha	Ebenaceae	Tree
38	*Ehretia Leavis*	Gidugu	Boraginaceae	Tree
39	*Eucalyptus tereticornis*	Nelagiri	Myrtaceae	Tree
40	*Ficus benghalensis*	Pittamarri	Moraceae	Tree
41	*Ficus mollis*	Juvvi	Moraceae	Tree
42	*Garuga pinnata*	Garuga	Burseraceae	Tree
43	*Gmelina arborea*	Konda gummidi	Verbenaceae	Tree
44	*Grevia tilifolia*	Tada	Tiliaceae	Tree
45	*Grevillea robusta*	Silver oak	Protiaceae	Tree
46	*Holarrhena pubescens*	Tedlapala	Apocynaceae	Tree
47	*Holoptelia integrifolia*	Naviledu	Ulmaceae	Tree
48	*Ixora parviflora*	Puttapala	Rubiaceae	Tree
49	*Kydia calycina*	Konda patti	Malvaceae	Tree
50	*Lagerstroemia parviflora*	Chennagi	Lythraceae	Tree
51	*Lannea coromandelica*	Gumpena	Anacardiaceae	Tree
52	*Litsea glutinosa*	Naramamidi	Annonaceae	Tree
53	*Madhuca longifolia*	Ippa	Sapotaceae	Tree
54	*Mallotus philippensis*	Kunkuma	Euphorbiaceae	Tree

55	*Mangifera indica*	Mamadi	Anacardiaceae	Tree
56	*Manilkara hexandra*	Pala	Sapotaceae	Tree
57	*Melia azedarach*	Turka Vepa	Meliaceae	Tree
58	*Melia dubia*	Munnatikaaraka	Meliaceae	Tree
59	*Morinda pubescens*	Togaramogali	Moraceae	Tree
60	*Mundulea sericea*	Tella bitlu	fabaceae	Tree
61	*Murraya paniculata*	Gulimi	Rutaceae	Tree
62	*Naringi crenulata*	Korivelaga	Rutaceae	Tree
63	*Ochna obtusa*	Tammi	Ochnaceae	Tree
64	*Phyllanthus acidus*	Racha usiri	Phyllanthaceae	Tree
65	*Phyllanthus emblica*	Usiri	Phyllanthaceae	Tree
66	*Pongamia pinnata*	Kanuga	fabaceae	Tree
67	*Protium serratum*	Unduruka	Burseraceae	Tree
68	*Pterocarpus marsupium*	Yegisa	fabaceae	Tree
69	*Pterospermum xylocarpum*	Loluga	Malvaceae	Tree
70	*Sapindus emarginata*	Kunkudu	Sapindaceae	Tree
71	*Schrebera swietenioides*	Esuka rasi	Oleaceae	Tree
72	*Sclechera oleosa*	Busi	Annonaceae	Tree
73	*Semecarpus anacardium*	Nalla jeedi	Anacardiaceae	Tree
74	*Sterculia urens*	Thapsi	Sterculiaceae	Tree
75	*Streblus asper*	Barrenka	Moraceae	Tree
76	*Strychnos nux-vomica*	Mushini	Loganiaceae	Tree
77	*Strychnos potatorum*	Induga	Loganiaceae	Tree
78	*Syzygium cumini*	Neredu	Myrtaceae	Tree
79	*Tamarindus indica*	Chintha	Caesalpinaceae	Tree
80	*Tenctona grandis*	Teak	Verbenaceae	Tree
81	*Terminalia alata*	Nallamaddi	Combretaceae	Tree
82	*Terminalia bellirica*	Thani	Combretaceae	Tree
83	*Terminalia chebula*	Karaka	Combretaceae	Tree

| 84 | *Wrightia tinctoria* | Ankudu | Apocynaceae | Tree |
| 85 | *Ziziphus xylopyrus* | Gotti | Rhamnaceae | Tree |

SHRUBS

Sl. No	Species Name	Local Name	Habit
1	*Artocarpus lacucha*	Kamirami	Tree
2	*Bauhinia vahlii*	Adda	Shrub/Liana
3	*Butea superba*	Teega moduga	Shrub/Liana
4	*Calophyllum inophyllum*	Pagada	Tree
5	*Canthium parviflorum*	Balusu	Shrub
6	*Cassia auriculata*	Tangedu	Shrub
7	*Celastrus montana*	Chinni	Shrub
8	*Coffea arabica*	Coffe	Shrub
9	*Coromona microphylla*	Bapana buri	Shrub
10	*Diospyros ferrea*	Pisineka	Tree
11	*Diospyros sylvatica*	Tella	Tree
12	*Ehretia microphylla*	Bapana puridi	Shrub
13	*Gardenia resinifera*	Karinga	Shrub
14	*Glycosmis arborea*	Goliga	Shrub
15	*Gmelina arborea*	Konda Gummidi	Tree
16	*Helicteres isora*	Nulithada(gubatada)	Shrub
17	*Hibiscus rosa-sinensis*	Mandaram	Shrub
18	*Hugonia mystax*	Kaki beera	Shrub
19	*Lantana camera*	Campurodda	Shrub
20	*Limonia monophylla*	Karunimma	Shrub
21	*Macaranga peltata*	Bodda	Shrub
22	*Murraya paniculata*	Konda golimi	Tree
23	*Nerium indicum*	Ganneru	Shrub

24	*Ochna obtusa*	Tammi	Shrub
25	*Pavetta indica*	Papidi	Shrub
26	*Plecospermum spinosum*	Sali	Shrub
27	*Premna tomentosa*	Kokkiti	Tree
28	*Randai spinosa*	Manga mullu	Shrub
29	*Senna occidentalis*	Kasina	Shrub
30	*Tamarix troupii*	Paladhonda	Shrub
31	*Woodfordia fruticosa*	Jeguru	Shrub
32	*Xylia xylocarpa*	Bojja	Tree
33	*Ziziphus mauritiana*	Regu	Tree
34	*Zizyphus oenoplia*	Parimi	Shrub

HERBS:

Sl. No.	Species Name	Local Name	Habit
1	*Abutilon indicum*	Athibala thuppa	Herb
2	*Andrograpis paniculata*	nelavemu	Herb
3	*Barleria cristata*	Gobbu chettu	Herb
4	*Cassia sophera*	Konda kasimi	Herb
5	*Cissus quadrangularis*	Nalleru	Herb
6	*Combretum decandrum*	Bontha gaddi	*Herb*
7	*Croton bonplandianus*	Gallivane tuppalu	Herb
8	*Curcuma pseudomontana*	konda pasapu	Herb
9	*Hyptis suaveolens*	Adavi tulasi	Herb
10	*Ipomoea biloba*	Bedatega	Herb
11	*Lucenia luecocephala*	Subabul	Herb
12	*Mimosa pudica*	Attipatti	Herb
13	*Phyllanthus niruri*	Nela usiri	Herb
14	*Pisonia aculeata*	Konki rivva	Herb

15	*Solanum erlanthum*	Rasa gaddi	Herb
16	*Tamarix troupii*	Paladonda	Herb
17	*Tephrosia purpurea*	vempali, wild indigo	Herb
18	*Tribulus terrestris*	Palleru	Herb
19	*Tridax procumbens*	Gadi chamanthi	Herb

GRASSES:

Sl. No.	*Species Name*	Local Name	Habit	Family
1	*Aristida adscensionis*	chepurugaddi	Grass	Poaceae
2	*Cynodon dactylon*	garikagaddi	Grass	Poaceae
3	*Cyperus rotundus*	Thunga gaddi	Grass	Cyperaceae
4	*Setaria glauca*	korragadi	Grass	Poaceae
5	*Imperata cylindrica*	Dharba	Grass	Poaceae
6	*Bambusa arundinacea*	Bamboo	Grass	Bombaceae
7	*Heteropogon contortus*	gonda gaddi	Grass	Poaceae
8	*Aristida setaceae*	Dry grass	Grass	Poaceae
9	*Andropogon contortus*	Pandimutti	Grass	Poaceae
10	*Spinifex littoreus*	Ravanasurini meesalu	Grass	Poaceae
11	*Saccharum spanteneum*	Rellu gaddi	Grass	Poaceae

CLIMBERS:

Sl. No.	Scientific Name	Local Name	Habit	Family
1	*Cryptolepis elegans*	Pala tiga	Climber	Apocynaceae
2	*Jasminum auriculatum*	Adavi malli	Climber	Olaecaceae
3	*Mucuna prurience*	Pilli adugu,Dula gaddi	Climber	Fabaceae
4	*Ipomoea biloba*	Bedatega	Climber	Convolvulaceae
5	*Cuscuta reflexa*	Passi theega	Climber	Convolvulaceae

6	*Abrus precatorius*	Guruginja	Climber	Fabaceae
7	*Hemidesmus indicus*	Sugandi Pala	Climber	Apocynaceae
8	*asparagus resemosa*	Pilli pichari(Shatvari)	Climber	Asparagaceae
9	*Cissus quadrangularis*	Nalleru	Climber	Vitaceae
10	*Atylosia scarabaiodes*	Adavi ulva	Climber	Fabaceae
11	*Tinospora cardifolia*	Tippa teega	Climber	Apocynaceae
12	*Tylophora indica*	Gori pala teega	Climber	Apocynaceae
13	*Tribulus terrestris*	Palleru	Climber	Zygophyllaceae

FAUNA OF THE STUDY AREA

Throughout the study area, there no direct evidence of wild animal species observed. From the secondary source (local people near villages) it is also revealed that presence of common snakes exists here. Common bird species such as Paddy egrets, Green bee eaters, Indian rollers, Parakeets, common babblers, Weaver birds, Mynas, Black drangos, Crows, Sparrows are sighted here. Mammals such as Indian wild boar, Three striped palm squirrel, Black-naped Hare, Grey Mongoose are commonly seen.

In Mammals, the predominant species found are Tiger, Panther, Sloth bear, Jungle cat, Bonnet macaque (*Macaca radiate*), Rhesus macaque *(Macaca mulatta),* Jackal (*Canis aureus*), Wolf (*Canis lupus*), Wild boar (*Sus scrofa*), Spotted deer (*Axis axis*), Sambar (*Cervus unicolor*), and Nilgai (*Boselaphus tragocamelus*), Five striped palm squirrel (*Petaurista Pennanti),* Indian Giant Squirrel *(Ratufa indica),* Four-horned antelope (*Tetracerus quadricornis),* Indian hare (*Lepus nigricollis*), Grey House shrew *(Suncus murinus)* and Indian Tree shrew (*Anatha eliioti).*

List of Mammals:

S.No.	Scientific Name	Common Name	WPA Status	IUCN
1	*Panthera tigris*	Tiger	Part I of Schedule I	EN
2	*Panthera pardus*	Leopard	Part I of Schedule I	EN
3	Melursus ursinus	Sloth bear	Part I of Schedule I	VU
4	*Hyaena hyaena*	Hyena	Schedule III	NT
5	*Canis aureus*	Jackal	Schedule II	LC

6	*Hystrix indica*	Porcupine	Schedule IV	LC
7	*Sus scrofa*	Wild pig	Schedule III	LC
8	*Felis chaus*	Jungle cat	Schedule II	LC
9	*Viverricula indica*	Civet Cat	Schedule II	LC
10	*Cuon alpinus*	Wild Dog	Schedule II	EN
11	*Paradoxurus hermaphroditus*	Palm Civet	Schedule II	LC
12	*Semnopithecus entellus*	Deccan Hanuman Langur	Part-II of Sch-II	LC
13	*Vulpes bengalensis*	Common Fox	Part-II of Sch-II	LC
14	*Macaca mulatta*	Macaque Rhesus	Part-I of Sch-II	LC
15	*Herpestes edwardsii*	Indian grey Mongoose	Part II of Schedule II	LC
16	*Axis axis*	Spotted Deer	Schedule III	LC
17	*Cervus unicolor*	Sambar	Schedule III	VU
18	*Boselaphus tragocamelus*	Nilgai	Schedule III	LC
19	*Muntiacus muntjak*	Barking deer	Schedule III	LC
20	*Bendicota bengalensis*	Indian mole rat	Schedule V	LC
21	*Mus musculus*	House Mouse	Schedule V	LC
22	*Ananthana ellioti*	Tree shrew	Schedule V	LC
23	*Rattus rattus*	House rat	Schedule V	LC
24	*Bendicota indica*	Bandicoot rat	Schedule V	LC
25	*Mus booduga*	Little Indian Field mouse	Schedule V	LC
26	*Cynopterus sphinx*	Short-Nosed Fruit Bat	Schedule V	LC
27	*Rousettus leschenaulti*	Fruit bat	Schedule V	NT
28	*Pipistrellus coromandra*	Indian Pipistrelle	Schedule V	LC
29	*Rhinopoma hardwickii*	Lesser Mouse-Tailed Bat	Schedule V	LC
30	*Lepus nigricollis*	Black-naped Hare	Schedule IV	LC
31	*Funambulus palmarum*	Three striped palm squirrel	Schedule IV	LC

Birds are very common near the ponds and terrestrial habitats. Peafowls are found near the ponds. Among the reptiles, Skinks, Gickos, lizards are commonly sighted. Snakes such as Krait, Common Tree Snake, Saw scaled wiper, Russell's earth boa, Johns earth boa, Common wolf snake, Indian Cobra, Common Rat snake and Green pit viper are informed by the local villagers. The amphibians were relatively more frequent but not abundant. Butterflies and dragonflies are fairly common near aqatic habitats.

List of AVES either spotted or reported or recorded from the study area.

Scientific Name	Common name	IUCN Status	Conservation status as per WL (P) Act,1972
Phalacrocorax niger	Little cormorant	LC	Sch-IV
Ardea cinerea	Grey heron	LC	Sch-IV
Ardea purpurea	Purple heron	LC	Sch-IV
Ardeola grayii	Pond heron	LC	Sch-IV
Bubulcus ibis	Cattle egret	LC	Sch-IV
Egretta garzetta	Little egret	LC	Sch-IV
Ixobrychus cinnamomeus	Chestnut bittern	LC	Sch-IV
Pseudibis papillosa	Black ibis	LC	Sch-IV
Porphyrio porphyrio	Purple moorhen	LC	Sch-IV
Fulica atra	Coot	LC	Sch-IV
Vanellus indicus	Redwattled lapwing	LC	Sch-IV
Vanellus malabaricus	Yellow-wattled lapwing	LC	Sch-IV
Strptopelia chinensis	Spotted dove	LC	Sch-IV
Psittacula cyanocepahala	Blossomheaded parakeet	LC	Sch-IV
Eudynamis scolopacea	Koel	LC	Sch-IV
Tyto alba	Barn owl	LC	Sch-IV
Glaucidium radiatum	Jungle owlet	LC	Sch-IV

Scientific Name	Common name	IUCN Status	Conservation status as per WL (P) Act,1972
Athene brama	Spotted owlet	LC	Sch-IV
Apus affinis	House swift	LC	Sch-IV
Cypsiurus parvus	Palm swift	LC	Sch-IV
Ceryle rudis	Lesser Pied kingfisher	LC	Sch-IV
Merops leschenaultii	Chestnutheaded bee-eater	LC	Sch-IV
Merops philippinus	Bluetailed bee-eater	LC	Sch-IV
Merops orientalis	Small green bee-eater	LC	Sch-IV
Coracias benghalensis	Indian roller	LC	Sch-IV
Megalaima viridis	Small green barbet	LC	Sch-IV
Pitta brachyura	Indian pitta	LC	Sch-IV
Hirundo rustica	Eastern swallow	LC	Sch-IV
Dicrurus adsimilis	Black drongo	LC	Sch-IV
Dicrurus caerulescens	Whitebellied drongo	LC	Sch-IV
Artamus fuscus	Ashy swallow-shrike	LC	Sch-IV
Sturnus pagodarum	Brahminy myna	LC	Sch-IV
Acridotheres tristis	Common myna	LC	Sch-IV
Corvus splendens	House crow	LC	Sch-IV
Corvus macrorhynchos	Jungle crow	LC	Sch-IV
Pericrocotus cinnamomeus	Small minivet	LC	Sch-IV
Pycnonotus cafer	Redvented bulbul	LC	Sch-IV
Turdoides affinis	Whiteheaded babbler	LC	Sch-IV
Copsychus saularis	Magpie-Robin	LC	Sch-IV
Saxicoloides fulicata	Indian robin	LC	Sch-IV

Scientific Name	Common name	IUCN Status	Conservation status as per WL (P) Act,1972
Monticola solitarius	Blue rock thrush	LC	Sch-IV
Zoothera citrina	White-throated ground thrush	LC	Sch-IV
Turdus merula	Blackbird	LC	Sch-IV
Parus major	Grey tit	LC	Sch-IV
Parus xanthogenys	Yellowcheeked tit	LC	Sch-IV
Anthus hodgsoni	Indian tree pipit	LC	Sch-IV
Anthus trivialis	Tree pipit	LC	Sch-IV
Motacilla flava	Yellow wagtail	LC	Sch-IV
Dicaeum agile	Thickbilled flowerpecker	LC	Sch-IV
Dicaeum erythrorhynchos	Tickell's flowerpecker	LC	Sch-IV
Nectarinia zeylonica	Purplerumped sunbird	LC	Sch-IV
Nectarinia asiatica	Purple sunbird	LC	Sch-IV
Zosterops palpebrosa	White-eye	LC	Sch-IV
Passer domesticus	House sparrow	LC	Sch-IV
Ploceus philippinus	Baya	LC	Sch-IV
Ploceus manyar	Streaked weaver bird	LC	Sch-IV
Lonchura punctulata	Spotted munia	LC	Sch-IV
Lonchura malacca	Blackheaded munia	LC	Sch-IV
Anser indicus	Bar-headed goose	LC	Sch-IV

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated, R : Resident; RM : Resident Migratory;   M: Migratory. All the birds observed from the study area.

List of Reptiles either spotted or reported from the study area.

Scientific Name	Common Name	IUCN	IWPA
Bungarus caeruleus	Krait		Not listed
Dendrelaphis tristis	Common Tree Snake	LC	
Echis carinatus	Saw scaled wiper		
Eryx conicus	Russells earth boa		
Eryx johii	Johns earth boa		
Lycodon aulicus	Common wolf snake		
Naja naja	Indian Cobra	LC	Sch- II
Ptyas mucosus	Common Rat snake	LC	Sch- II
Trimeresurus gramineus	Green pit viper	LC	Sch- IV
Hemidactylus flaviviridis	North house gecko		
Cyrtodactylus kacchensis	Black rock gecko		
Hemimidactylus brooki	House gecko	LC	
Vipera russelli	Russel Viper	LR	II
Calotes rouxi	Forest Calottes	LC	
Calotes versicolor	Common garden lizard	LC	
Ophisops microlepis	Skink		
Mabuya carinata	Common Skink	LC	
Chamaeleon zelanicus	Chameleon	VU	Sch- II

List of **Amphibians** either spotted or reported from the study area.

Scientific Name	Common Name	IUCN	IWPA
Rana hexadactyla	Commn green frog	LC	Sch- IV
Bufo melanosticus	Common Indian Toad	LC	Sch- IV
Polypedates maculatus	Common Tree Frog	LC	Sch- IV
Hoplobatrachus tigerinus	Indain Bull Frog	LC	Sch- IV

List of **Butterflies** either spotted or reported from the study area.

Scientific Name	Common Name	IUCN	IWPA
Acraea violae	Tawny Coster	LC	
Danaus chrysippus chrysippus	Plain Tiger	LC	
Danaus genutia genutia	Striped Tiger	LC	
Euploea core core	Common Crow	LC	Sch- IV
Phalanta phalantha phalantha	Common Leopard	LC	
Precis lemonias lemonias	Lemon Pansy	LC	
Precis orithya ocyale	Blue Pansy	LC	
Chilades laius	Lime Blue	LC	
Everes lacturnus syntala	Indian Cupid	LC	
Freyeria trochylus	Grass Jewel	LC	
Jamides celeno aelianus	Common Cerulean	LC	
Tarucus nara	Rounded Pierrot	LC	
Colotis etrida	Small Orange Tip	LC	
Colotis eucharis eucharis	Plain Orange Tip	LC	
Catopsilia pomona	Common Emigrant	LC	
Eurema hecabe simulata	Common Grass Yellow	LC	
Papilio demoleus	Lime Butterfly	LC	
Papilio polytes polytes	Common Mormon	LC	
Papilio polytes stichius	Common Mormon	LC	

6.0   IMPACTS OF PROJECT ACTIVITIES ON BIODIVERSITY

List the likely Positive and Negative impacts of the proposed project

Since the proposed diversion area lies in Panther and other wildlife corridor, it is used frequently by wild animals including Leopards, Wild dogs etc. The proposed project will affect the movement of wildlife through disturbance during and after construction, habitat fragmentation and barrier effect etc. In the past there has been mortalities of tigers and panthers & other wild animals due to accidents. However, mitigation measures including fencing along strategic location, underpasses / overpasses, early warming systems etc., after due study will have to be taken by user agency to minimize the disturbance to wildlife habitat. Also, project has positive impact too on environment as it is one of the most environment friendly mode of transport and hence in public interest 9837 trees are proposed to be fell. Due to this project, deforestation can lead to a direct loss of wildlife habitat as well as a general degradation of their habitat and may cause disturbance to Wildlife and fragmentation of habitat. However, necessary mitigation measures are proposed at the cost of the user agency.

Negative impacts due to the diversion of area for the projects:

1. Habitat fragmentation.
2. Obstruction for movement of Wildlife.
3. Man-Animal Conflicts incidents increased.

Even though the impacts are not permanent, it leaves a scar on the environment. The implementation of the timely mitigation measures would reduce the impacts to certain extent. Development is not possible without disturbing the environment. The players who are involved in the execution of the project should have concern to protect our pristine environment while executing the project. The degradation of the mountain environment is a wide spread problem in all over the World and there is an urgent need to maintain the ecological balance of such environment is of critical concern. Degradation leads to the development of geological hazards such as debris flows and landslides associated with development of soil erosion. Newly built highway projects in the mountain areas are bound to lead to changes in geomorphic features, destruction of vegetation and arbitrary placing of immense quantities spoils. These impacts will aggravate the degradation of the mountain environment if appropriate

treatment counter measures are not introduced. Manmade linear infrastructure roads and highways now widely recognized to have many highly detrimental ecological effects in both terrestrial and aquatic natural ecosystems. The linear intrusions into ecologically sensitive areas cause habitat loss and fragmentation, spread of invasive alien species, desiccation, wind throw, fires, animal injury and mortality, changes in animal behaviour, increased developmental, tourist and hunting pressures, increase in pollution, garbage, and various disturbances.

Impacts on the Wildlife:

Disturbance to Wildlife The wildlife population often decline due to the cumulative impacts of the linear projects. The impacts are quite substantial are severe and more detrimental.

The major impacts are listed below:

- ✓ Wildlife mortality
- ✓ Habitat loss and degradation
- ✓ Causes habitat fragmentation
- ✓ Landslides and soil erosion.
- ✓ Effect on arboreal animals
- ✓ Impact on the flora and fauna
- ✓ Impacts on aquatic ecosystem.
- ✓ Change in animal behavior
- ✓ Pollution from construction activity and due to construction equipment.

There is a direct loss of habitat during establishment and maintenance of linear project. This may happen due to clearing of vegetation, dumping of excavated earth and material movement of heavy vehicles and earth movers, creation of labour camps etc. the effect of these disturbances may persist in the landscape for years to decades. The effect of infrastructure on bird populations extended over distances up to 1 km and for mammal's population up to about 5 km. Mammals and birds seemed to avoid infrastructure in open areas over larger distances compared to forested areas. The construction work gives raise to landslides and other forms of erosion in steep forested landscapes. During the construction period, large number of machinery and construction workers shall be mobilized, which may create disturbance to wildlife

population in the vicinity of project area. The operation of equipment will generate significant noise, especially during blasting which will have adverse impact on fauna of the area. The noise may scare the fauna and force them to migrate to other areas. Likewise siting of construction plants, workshops, stores, labour camps etc. could also lead to adverse impact on the fauna of the area. During the construction phase, accessibility to area will lead to influx of workers and the people associated with the allied activities from outside will also increase. Increase in human interference could have an impact on terrestrial ecosystem. The other major impact could be the blasting to be carried out during construction phase. This impact needs to be mitigated by adopting controlled blasting and strict surveillance regime and the same is proposed to be used in the project. This will reduce the noise level and vibrations due to blasting to a great extent. The impacts caused by the construction activity can be easily mitigated.

Impacts during Construction Phase:

1. Potential impacts through habitat loss and fragmentation,
2. Potential displacement,
3. Injury or mortality of resident invertebrate, reptile, nesting bird and foraging bat species.
4. Potential disturbance caused by construction.
5. Potential pollution impacts through fuel run off as well as light pollution.

Impacts during Operation Phase:

Potential impacts through increase recreational pressures from members of the public due to public path along the base of the cliff, including trampling, canine pollution and predation and increased risk of fires.

Prediction of Impacts on local flora and fauna:

Proposed activity involve in removal of vegetation on either side of the roads. Thus, there are few major adverse impacts are envisaged. There are no migratory corridors, nesting and breeding sites within the core zone. No need to take any mitigation measures specific to these parameters. From the list of floral and faunal species, it is very clear that there are four Rare or Endangered or Endemic or Threatened (REET) species present in core zone.

Impact on Terrestrial and Aquatic Ecology

Prediction of impacts is based on the direct and indirect; short-term as well as long-term; reversible and irreversible impacts that are most likely to occur owing to the proposed industrial activity during operation. The following ecological factors that are considered most significant as far as the impact on flora and fauna are concerned:

The overall impact of the project on ecological aspects is:

Magnitude: less

Extent: The extent of the impact is on-site as the impacts are limited to the boundaries of the Site.

Duration: short-term

Intensity or magnitude: moderate.

Reversible or Irreversible: Reversible

Ecological factors and their impacts due to proposed activity:

Species diversity	No reduction
Habitat loss or fragmentation	yes
Affect on any additional risk or threat to the rare or endangered or endemic or threatened (REET) species	Nil

Any impairment of ecological functions such as (i) disruption of food chains, (ii) decline in species population and or (iii) alterations in predator-prey relationships	Nil
Is it possible to attain the global objectives of "no net loss" of biodiversity	Yes

From the above table, it is very clear that proposed activity shall not impact on the biodiversity of the region. Hence, it is recommended to proposed project in the proposed locality by following certain conservation measures.

The removal of top soil during construction leads to effect on hibernating animals such as Amphibians and some burrowing faunal species. Impact due to loss of habitat for bird species and disturbance created. Mitigation measures suggested based on the impacts identified.

Project specific and site-specific Impacts identified Vs Mitigation measures suggested:

Impacts	Mitigation measures
The major impacts observed from the proposed project on flora and fauna are during expansion phase only. The direct impacts are quantified statistically. As the alignment passes through Ghat sections at few locations and fragile areas the up gradation will involve tree cutting and vegetation removal will induce landslides and land slips activities in the area. This may hinder the movement of wild life and their passage	Compensatory afforestation activities shall be made discussed with concern forest officials.
The major impacts identified are. removal of trees up to 20m either side of the road.	More Avenue plantation should be done in the buffer zone. (Around 13 ha of degraded forest land has been identified for avenue plantation near Gudivaripalem)
Loss of top soil during the construction activity Soil erosion will take place.	Sprinkling of water during dust generation activities by vehicles; erosion and sediment control;
Barricading to Reptilian species	Effective under passes
Effect on hibernating animals such as Amphibians and some burrowing faunal species (invertebrates such as Annelids and few reptilian species).	Care shall be taken during construction phase No solid waste should be released into the water body. The subsoil tubers and other faunal species should be carefully

	translocated to nearby undisturbed areas.
	Care should be taken during material transportation and avoid the routes nearer to Reserve forests.
	Annual ecological monitoring on breeding and nesting habitats for faunal species in the core and buffer zone habitats should be done annually.
Impact on eggs laid in the subsoil by lizards and skinks during the removal of soil.	Care shall be taken during construction phase
Noise and Vibration: Major impacts on ecology are due to dust and noise emitted from vehicles transporting raw material especially near reserve forest areas. Due to increase of Noise levels impact on Egg shells of fauna, and particulate matter impacts on reduction of photosynthesis and damage the vegetation.	Noise and fugitive dust control measures shall be taken considering the wildlife in the reserve forest areas.
Impact due to loss of habitat for bird species and disturbance created during proposed activity.	Creating more water number of small ponds and plantation of bird habitat specific trees

7.0 MITIGATION MEASURES

A. Objectives of Management:

Wildlife management is an attempt to balance the needs of wildlife with the needs of people using the best available science. It consists of promoting welfare factors, arresting or reducing the impacts of decimating factors and neutralizing the harmful effects of limiting factors that keep the animal population lower than the carrying capacity of the area. It also aims at the management of human dimensions relating to the regulation of habitat use, sufferance from animal damages, livelihood issues and taking people as partners in conservation management.

Hence, the main objective of this plan is to reduce/minimize/ mitigate various stress predicted due to implementation of this project in this particular locality having wildlife importance by using modern technologies and available science. This Conservation Plan will suggest measures to mitigate such stress and if possible how to avoid certain activities which could reduce the negative influence and the most important to ensure the safe passage of wildlife. The management of the project area aims for the connectivity and maintenance of habitat for animals that used to live and share habitat along with the traffic and vehicular movement along the road. At the same time, it ensures the safe passage of wildlife in their habitat.

The management of Buffer Zone will target optimization and maintenance of wildlife habitat and biodiversity, involving local people as far as practicable and aim to avoid/minimize or mitigate the adverse impacts of the wide NH. The project area has Reserve Forest and tall trees stand in the virgin area. Besides small animals, larger ones make use of the area regularly, as the area is undisturbed. Large animals will be affected in the area once the project is completed.

The displaced animals should not be left as a refugee. Their rehabilitation would be the major objective of the plan. To fulfil all these requirements, the plan focused on improving forage and browse volume by increasing food plant diversity with vertical and horizontal cover. These will arrest habitat destruction and fragmentations also prevent soil erosion and loss of biodiversity.

Mitigation measure refers to avoid, reduce, or remedy harm and addresses the conservation concerns likely to be associated with the development proposals. Hence there is a need to follow the mitigation principles to deliver potential benefits of the Green Infrastructure Development Approach. The Objective of management to mitigate the threats to wildlife is covering the following aspects.

CORE ZONE

- Undertake appropriate ameliorative measures to avoid/minimize or mitigate the adverse impacts like accidents and casualties of wildlife in and around the road.
- Undertake appropriate facilities for the safe movement of wildlife
- Promote and aware by displaying hoardings and signage
- Infrastructure to monitor wildlife and prevent human-wildlife interface.

Latitude: 14.990695
Longitude: 79.105772
Elevation: 333.84±8 m
Accuracy: 8.4 m
Time: 20-03-2022 16:05
Note: 45
Powered by NoteCam

ZONE OF INFLUENCE

- To prepare strategies for fire management plan to prevent forest fire. by engaging fire, fighting squad to combat the fire damage.
- Create an anti-depredation squad to dissuade the wild animal from coming at-times out of their home range and approach the adjoining villages either for crop-raiding or in search of water and locating the mega fauna from Watch Tower and with the assistance of elephant trekkers.
- Create a Corpus Fund to facilitate meeting expenses in exigencies of man-wildlife conflict.
- To engage research fellows in the concern forest division for the long term monitoring of the impact of the road on the wildlife and to develop strategies to reduce the impact Strategies to mitigate and minimize adverse impacts.

Strategies for Project Area:

In the project area, the primary focus is to reduce the barrier effect and ensure the safe passage of not only the mega herbivores but also other wild animals living on both sides of the NH. Besides, the focus will also towards the reduction of wildlife accidents and road-kill. These are provided below with a detailed description

Facilities for Safe wildlife underpasses:

In the project area, for the uninterrupted movement of wildlife there is a need to enhance the permeability of crossing structures which are to be effective and acceptable. Hence, to ensure safe passage and crossing of wildlife the User Agency has proposed to provide additional 4 numbers of animal underpasses in the following locations.
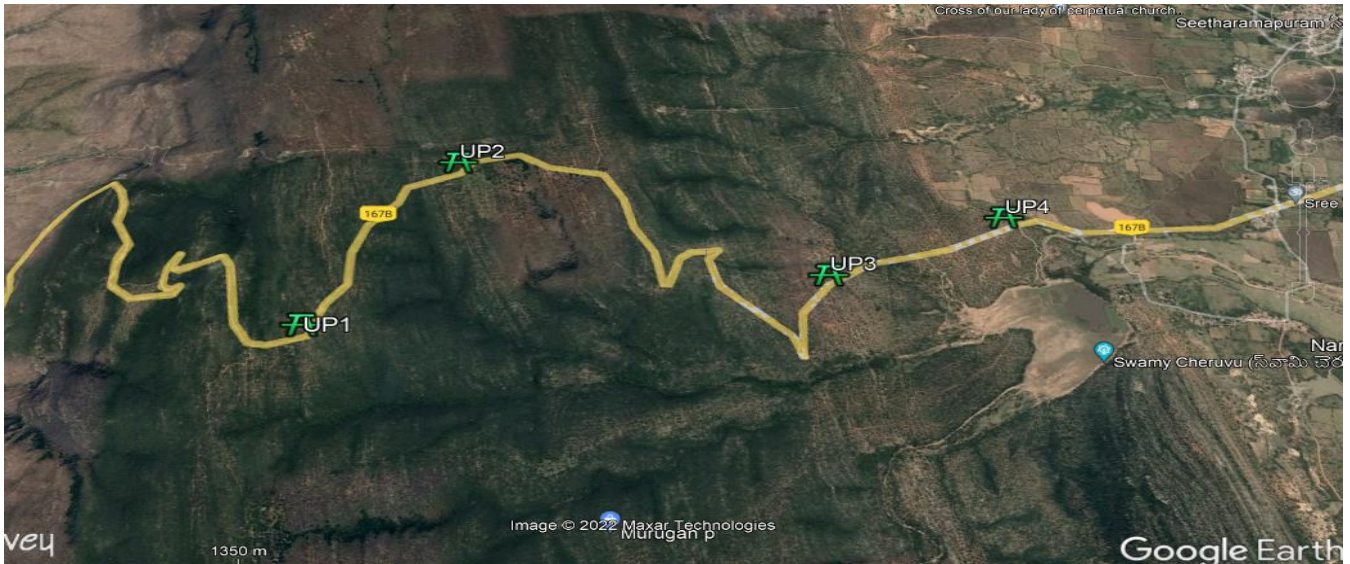
Proposed locations of Underpasses

The size of the underpasses is deliberately kept medium. Even though no such large herbivores were observed in proposes area, however construction of underpasses at 4 locations having a clear dimensions of 10 feet width and 6 feet height for easy movement of wildlife from both sides and connectivity of entire stretch. The design of the underpass is provided below.

Passages for other small animals, Reptiles, Amphibians, etc.

According to the guidelines provided by the book "Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife, it is suggested to have bridges or pipe culverts for the safe passage of small creatures such as Amphibians and Reptiles at every 100 m stretches of the road.

Source: Photograph by Public works department, Government of the Netherlands.

Source: Photograph from Sharma and Hrithey 2011

Key Message

Use of underpasses by animals is influenced by its Openness Ratio.

$$\text{Openness ratio} = \frac{\text{height of the opening} \times \text{width of the structure}}{\text{length of the underpass}}$$

Figure 7.1. Dimensions of an underpass determining its openness.
Source: *Photograph by Akanksha Saxena.*

In this proposed project all the canals, Rivers, Nalas and streams which will facilitate the movement of small mammals, reptiles, amphibians and fishes. However any structures (bridges/culvert) falling inside the critical wildlife habitat should at least meet the guideline of the Wildlife Institute of India manual for the safe passage of small and medium size animal. The wildlife habitat located on both the side of the structure will be developed for smooth passage of small wild animals.

Hoarding and Signage

Hoarding, banners, flexes and Sign Boards with good write up should be displayed at sensitive locations in every 400 meter in the straight road and in every 100 meter on/near the turns. All the signage related to animal crossings, drive slow to save wildlife, will be WILDLIFE CROSSING placed on the roadside where it passes through the forest area. Such signboards should be repainted at least at a particular interval.

Rumble Strip

To control the speed of vehicles in the forest areas, it is proposed to build rumble stripe in every 500 meter on the road where it passes through the forest land. It will reduce the speed of the vehicle, which will ultimately reduce the chance of road kill to the animals.
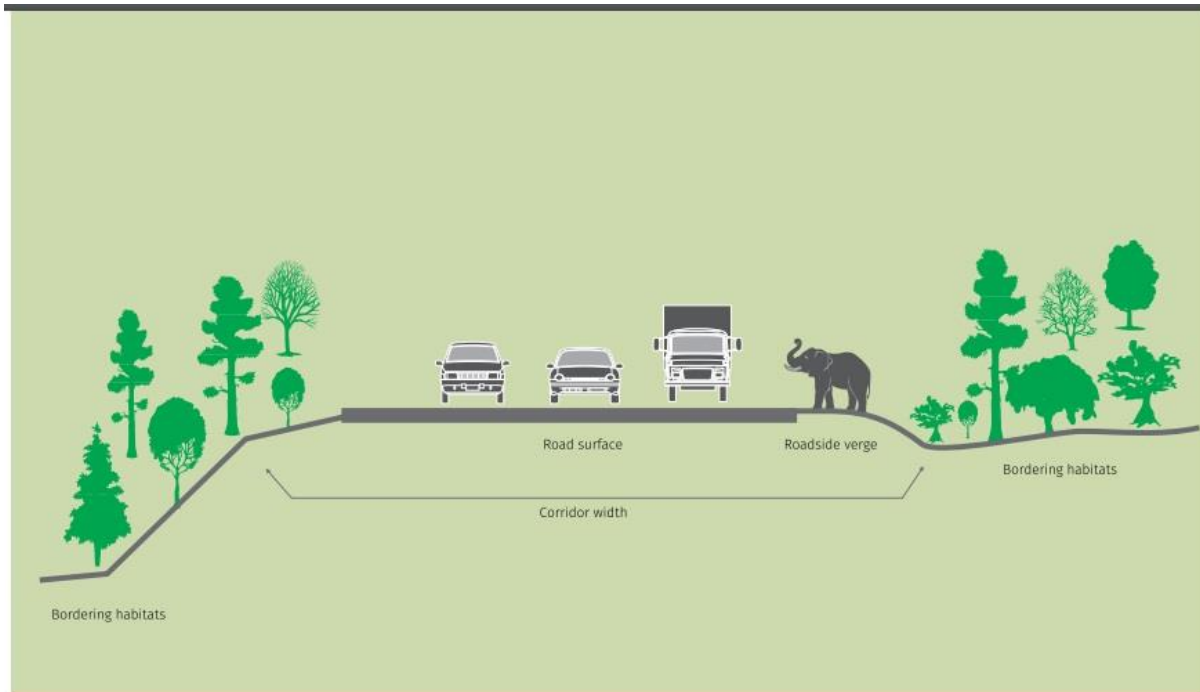
Awareness program

There is also provision to spread awareness on the importance of conservation of wildlife, forest and environment particularly at school, college and village level.

Infrastructure

There is the provision for the User Agency to provide torch and solar lights to the villagers prone to wildlife attack.

Firefighting squad:

The forest blocks are prone to annual fires. Hence, adequate measures to protect the forest area from fire are essential to sustain biodiversity. There is a provision of deploying 10 no of fire watchers in the Nellore forest Division during fire season, a period of 5 months from February to June of every year. They will be supplied with fire blowers.

ANR Plantation

For maintaining the stability of the forest and habitat of the surrounding it is suggested to develop AN Plantation over 20.00 ha. Here the suggestion is only for selection of specific plant species to provide better habitat and fodder for wildlife present there. The choice of species can be decided in consultation with local forest officers but shall be indigenous to that particular area which will provide food and cover to variety of wildlife.

Map Showing the Compensatory area Identified in Degraded Reserve Forest of Gudivaripalem RF in lieu of Diversion of Forest Land for Porumamilla - Seetharampuram National Highway - 167 B Passing through Seetharampuram RF in Comp No-553&554 of Seetharampuram Beat, Seetharampuram Section of Udayagiri Range.

1:4000

S no	Point Name	Northing	Eastrg	Elevaton	Latitude	Longitude
1	BO-1	1647013.233	329775.656	124.129	14.89225524	79.41759320
2	BO-2	1647017.024	329887.517	122.236	14.89229667	79.41863252
3	BO-3	1647021.587	330008.090	119.771	14.89234564	79.41975277
4	BO-4	1646923.180	329990.403	120.524	14.89145512	79.41959488
5	BO-5	1646824.793	329972.745	121.735	14.89056478	79.41943726
6	BO-6	1646722.332	329954.185	122.128	14.88963756	79.41927153
7	BO-7	1646627.982	329937.305	122.596	14.88878375	79.41912087
8	BO-8	1646529.555	329919.644	124.222	14.88789305	79.41896323
9	BO-9	1646431.100	329901.910	125.361	14.88700210	79.41880491
10	BO-10	1646345.701	329886.559	126.530	14.88622929	79.41866788
11	BO-11	1646387.505	329803.504	127.090	14.88660178	79.41789327
12	BO-12	1646432.789	329714.038	127.642	14.88700531	79.41705885
13	BO-13	1646615.527	329733.402	126.562	14.88865812	79.41722676
14	BO-14	1646714.963	329743.949	125.847	14.88955748	79.41731821
15	BO-15	1646814.412	329754.523	124.637	14.89045697	79.41740992
16	BO-16	1646913.851	329765.101	124.392	14.89135635	79.41750166

Surveyed Area 13.08 Ha

Legend
● DGPS Points
▭ Surveyed Area

FOREST RANGE OFFICER (GIS), O/o. Pri.CCF (HoFF). Aranya Bhavan, Guntur

The DGPS/GNSS/ETS data is only verified, the absolute locations of Points shall be verified by the concerned field officers.

Latitude: 14.997312
Longitude: 79.110589
Elevation: 262.97±11 m
Accuracy: 7.2 m
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Note: 15

Drones to monitor wildlife

To monitor wildlife movement in the Nellore forest division it is proposed to provide two numbers of drones to the DFO Nellore (T) Division. The drones will be used by the forest department personnel for the monitoring of animal movement.

Corpus fund/compassionate grant:

Government has the provision of providing compensation to the victims of the wildlife attacks. However, due to the complex process, it often get delayed and people agitate. To make the process smoother there is the provision of a corpus or compassionate fund which can be used as an emergency funds to pay Ex-gratia.

Engaging two research fellowships

It is proposed to engage two research fellows in the Nellore forest division for the long-term monitoring of the effect of the road on the existing wildlife. The research fellow will conduct research on the biodiversity, movement pattern of wildlife and the impact of the road on the existing flora and fauna of Nellore forest division. They will also identify vulnerable zones for the wildlife moment and develop management strategies. There is also provisions for purchasing scientific equipment's (Laptops, Cameras, Binoculars, GPS, and Compass etc.) which will be used during the research.
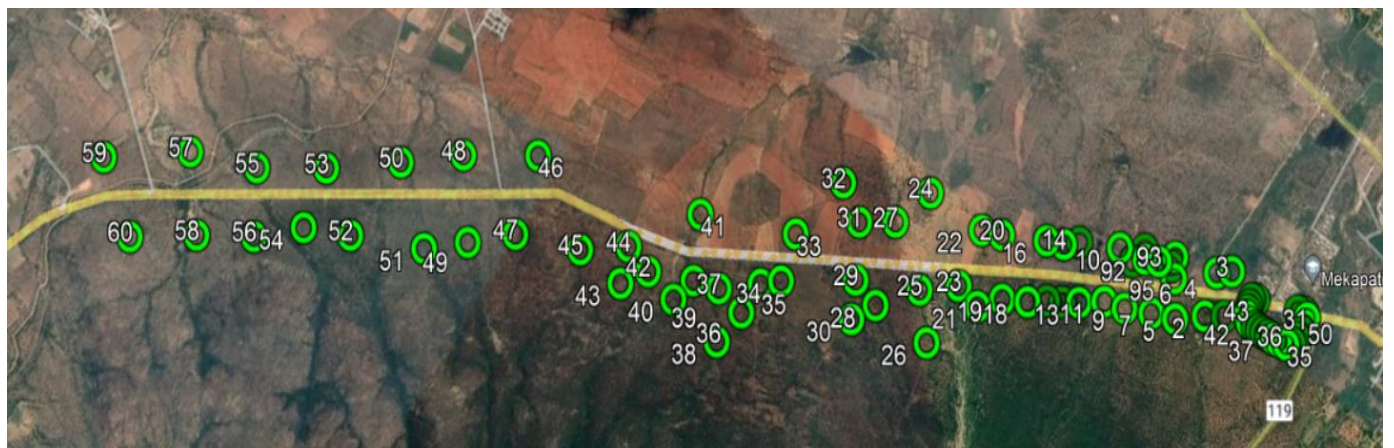
Saucer pits:

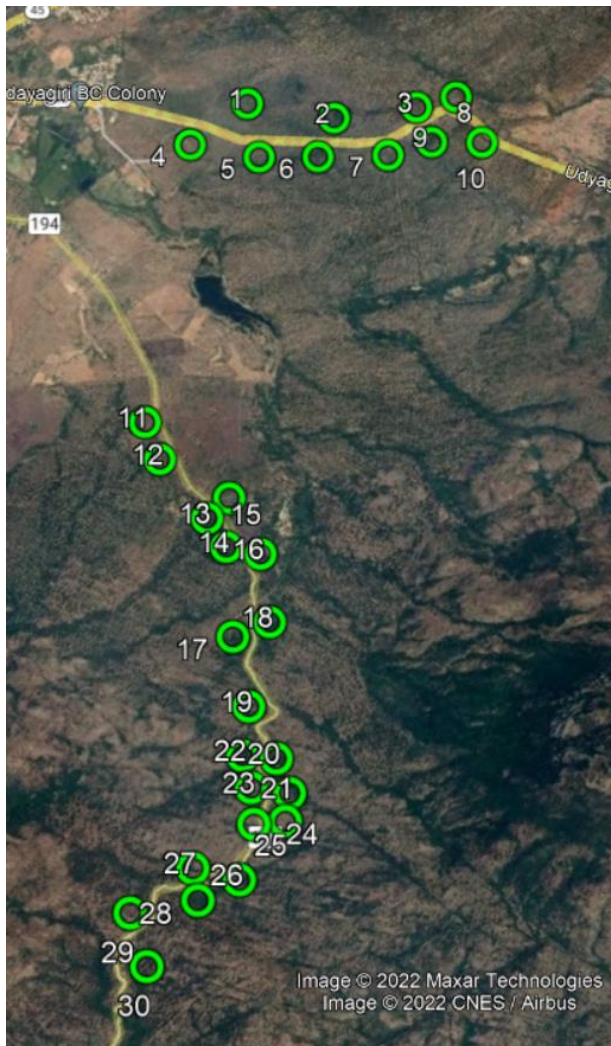100 no. saucer pits to be dug near the road side are proposed.

Locations of Proposed Saucer pits(Within the project Core area)
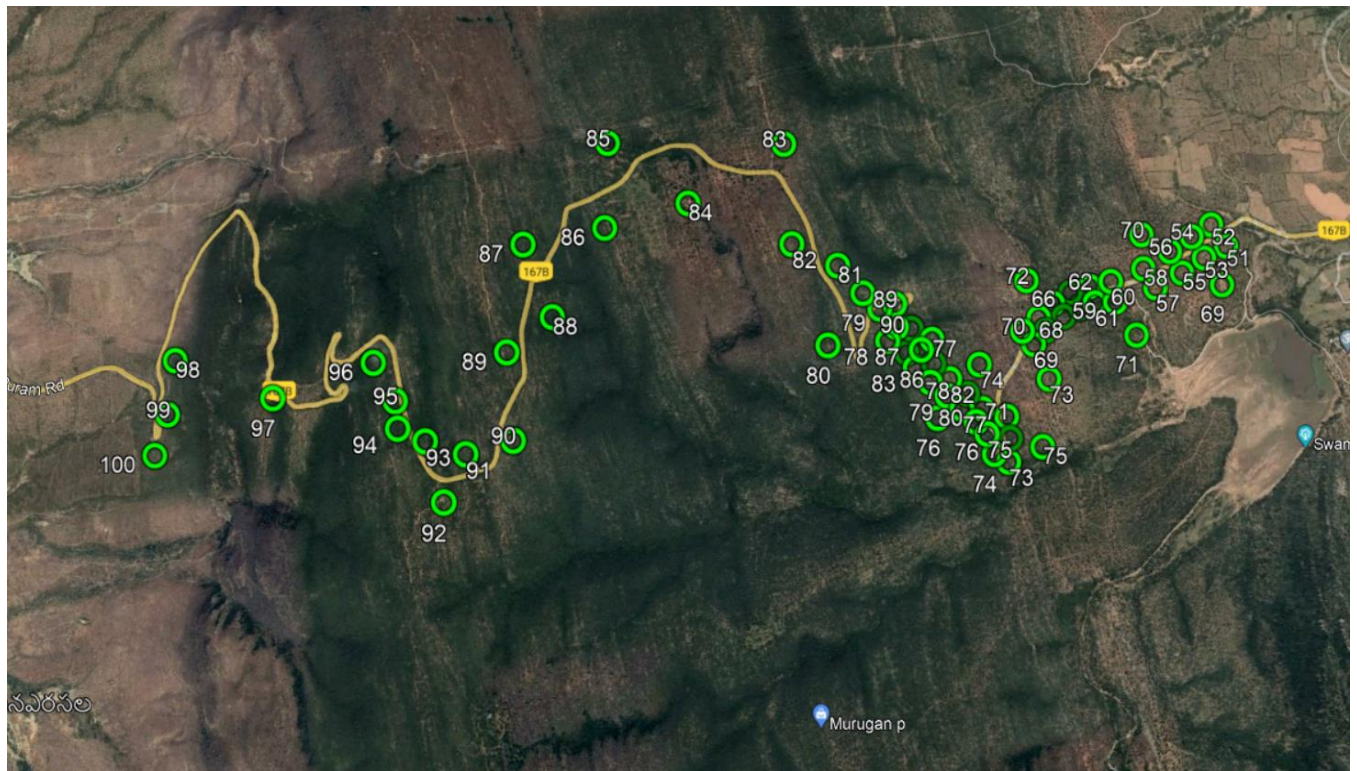
Locations of Proposed Saucer pits (Within the project Buffer area)

Locations of Proposed Saucer pits (Within the project Buffer area)

MITIGATION MEASURES DURING CONSTRUCTION PHASE:

- ➢ Comply with environmental standards and strictly control workers to behave responsibly with respect to environmental issues;
- ➢ Replant natural vegetation and transfer rich soil of the construction sites to nearby areas;
- ➢ Decommission temporary assembly areas and restore to the original conditions;
- ➢ Limit decommissioning activities to the excavation site where possible and replant site with native plants;
- ➢ Site-specific waste collection and disposal management plan should be in place to, include good site practices such as: Providing the appropriate spill kits (e.g., containing absorbent cloths and disposal containers) on-site during construction; Prohibition of dumping or burying wastes within Project site; Implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials.
- ➢ Work should be under ISO14001 accreditation for environmental management which also be imposed on all the subcontractors; and Cover each spot where excavated material is stored when climate conditions requires to effect dust control by usage of dust suppression substances.

Species specific mitigation measures suggested

Species specific more ecological monitoring should be done seasonally and once in every 4 years.

All the critical points suggested in impacts which are very critical are to be managed properly.

Avoid Attraction

Minimizing the area's attractiveness can be through coordinated temporal and spatial land management, minimizing food resources and food availability, and adapting lighting in colour and intensity to avoid bringing wildlife.

Lighting intensity

Lighting intensity can attract or disorient wildlife with the aim of deterring species to avoid collision.

Luring

sensitive species away can be achieved through habitat enhancement offsite or replacing habitat lost, i.e. compensation. These can include creation of ponds increase of prey or food availability outside the potential impacted area.

Habitat Management

For bats, the creation or establishment of fallows and hedgerows as new foraging habitat can help as compensation for facility impacts, especially around agricultural or farming areas.

Retaining of Vegetation

Cleared vegetation can be retained for uses such as erosion control and rehabilitation. Consultation on proper re-use of the cut arboreal vegetation will be conducted with local Reforestation from Forest Department.

In surface water crossings, vegetation clearing will be delayed until immediately before trenching (as far as practical) so as to reduce the potential for stream bank destabilization from rainfall event sit the catchment.

Landslide Management

The top cover of soil on the slopes around the Project facilities is mainly sand and fine clay. Any excavation work during the construction activities, whether permanent or temporary, would lead to loss of soil. Excavated material collected during boring of the tunnels may be used during construction of the road. Erosion of soil can occur from removal of vegetation cover, runoff from unprotected excavated areas, muck disposal sites and quarry sites. Excavations on slopes would also decrease its stability. Given the topography of the area, unprotected excavations on sloping grounds may lead to landslides, especially during the rainy season. Major landslides will disturb the slopes of the area and may also alter the bed of streams and rivers.

The proposed mitigation measures include:

- ❖ Vegetation loss will be limited to demarcated construction area;
- ❖ Areas such as muck disposal area, batching plant, labor camp and quarry sites after the closure will be covered with grass and shrubs;

❖ Slope stabilization measures will be adopted such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls;

❖ Slope movements will be monitored around excavation work areas.

All works will be carried out in a manner such that damage or disruption to vegetation is minimized;

a) Trees and bushes will be demarcated and cordoned off;

b) Cutting down will not be take place without the prior approval of the relevant Local Authorities;

c) No ancient trees will cut down or impacted by the construction or operation;

d) Trees and shrubs will only be felled or removed if they impinge directly on the permanent works or necessary temporary works;

e) Trees and bushes outside the construction width but within the road reserve will be generally preserved from damages;

f) Trees immediately adjacent to the required construction corridor will be lopped;

g) Habitat destruction will be minimized during construction;

h) Construction will be minimized on bridge sites during spawning seasons;

i) No excavated soil is to be dumped in the ecologically important areas, all soil will be removed off site;

j) Dust pollution will be minimized to reduce the disturbance to animals as far as possible;

k) Temporary land take will be minimized in ecologically important areas through minimizing operational area during construction to as narrow as practical ROW;

l) Replacement of top soil to restore conditions for biological activity;

m) Providing wildlife crossings so that impacts of habitat fragmentation are minimized;

n) Hunting and poaching will be prevented to protect species of conservation importance and minimize loss of wildlife;

o) Clearance of mature woodland will be minimized as far as possible to prevent the species habitat;

p) Contamination of aquatic areas will be prevented to minimize risk of contamination of its food source;

q) Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife;

r) Noise pollution will be minimized to reduce the disturbance to animals as far as disturbance to pools and small pond habitats will be minimized to preserve the species habitat;

s) Final forming and re-vegetation will be completed after regeneration of stabilizing ground conversable;

8.0 SPECIES SPECIFIC CONSERVATION PLAN:

The Indian peafowl or blue peafowl (*Pavo cristatus*)

IUCN Red List Category & Criteria: Least Concern (ver 3.1)

Indian Wildlife Protect Act (1972) status: Schedule I

Scientific classification

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Order: Galliformes

Family: Phasianidae

Genus: Pavo

Species: *P. cristatus*

Binomial name: *Pavo cristatus* Linnaeus, 1758

The Indian peafowl or blue peafowl (*Pavo cristatus*), a large and brightly coloured bird, is a native species to the Indian subcontinent, but introduced in many other parts of the world and is declared as the national bird of India during 1963 due to its 'flagship' value found on its glorious position in mythology and its widespread distribution. The Indian Peafowl appears so frequently in religion, folklore, art and craft, that it is possibly the most recognized bird across India. Internationally as well, the peafowl (perhaps alongside the tiger) is immediately associated with India. The Peafowl is a resident breeder across the Indian subcontinent and found mainly on the ground in dry, semi-desert areas, grasslands, scrublands, open and deciduous forest, roost in trees or other high places at night. Peafowl are omnivorous and eat seeds, insects, fruits, small mammals and reptiles. They feed on small snakes but keep their distance from larger ones. The Indian Peafowl are terrestrial birds, their loud calls make them easy to detect, their loud calls make them easy to detect, and in forest areas often indicate the presence of a predator such as tiger.

Having been declared the national bird in 1963, the species also finds itself under the highest level of legal protection in the country, being placed in Schedule I of the Wildlife (Protection) Act, 1972 and further amendments.

Population and Distribution status:

Indian peafowl are widely distributed in the wild across South Asia and protected both culturally in many areas and by law in India. Conservative estimates of the population put them at more than 100,000. Illegal poaching for meat, however, continues and declines have been noted in parts of India. Peafowl breed readily in captivity and as free-ranging ornamental fowl. Zoos, parks, bird-fanciers and dealers across the world maintain breeding populations that do not need to be augmented by the capture of wild birds.

Peafowl are spread across the plains and hills of India, except in extremely dry or wet regions. The abundance trend is that of a general increase, both in the long term and currently. This trend appears to result from a combination of range expansion (e.g. into Kerala, from where it was formerly absent), and a population increase virtually throughout its distribution. The reasons for this pattern have not been investigated in detail, but expansion into Kerala may be associated with an overall drying trend, and expansion into the Thar desert appears to have accompanied the spread of canals and irrigation. The protection (and associated penalties for poaching and poisoning) afforded by being in Schedule I may also have contributed to increase. Some parts of the country report greater levels of crop damage by peafowl, a trend that calls for careful conflict assessment and management. According to the State of India's Birds 2020 Report, Peacock population more than doubled in India during the past one decade. In the neighbouring Sri Lanka, is assumed the proportions of a pest.

Legal Status:

It is a species listed under Schedule-I out of six schedules which give varying degrees of protection Species— offences under these are prescribed the highest penalties. It is fully protected under the Indian Wildlife (Protection) Act, 1972 i.e. legal stipulations are well defined for poaching and hunting. The Indian peafowl is listed as of "Least

Concern" by the International Union for Conservation of Nature (IUCN). In India, it is given the utmost protection by inclusion in the Schedule I of Wildlife (Protection) Act, 1972, Wildlife Protection (Amendment) Act, 2002; and Appendix-1 of CITES (Dodia, 2011). To save endangered national bird peacock Govt. has banned trade of its feathers. MoEF&CC has proposed amend section 43 (3) and 44 of the wild life protection act 1972 which relative to transfer and sale of peacock feather. But the act allows domestic trade in feathers for articles that these are naturally shed. The present amendment avoids / blocks the killing by catching through various traps / nets and with arrows / guns. This act also prohibits the exporting the peacock feathers.

Source: https://en.wikipedia.org/wiki/Indian_peafowl

Threats:

The Indian Peafowl is under threat from various quarters that include the demand for feathers and wild meat, conflict with farmers during cropping season, increased use of chemical fertilizers and pesticides, and habitat degradation. An adult peacock has about 200 tail feathers, which it sheds from August onwards; fully-developed new feathers appear in February (Sharma 1974; Ali & Ripley 1980). The fallen feathers are collected and sold in local markets and the birds are also reportedly killed to increase revenue return. Other threats include habitat degradation and loss - more significantly from conversion of their habitat to agriculture, habitation and industrial growth, poisoning to counter crop damage, consumption of eggs and fat extracts for alleged medicinal values, and killing for wild meat (del Hoyo et al. 1994; Chakkaravarthy 2002). Although these threats are believed to be causing an alarming decline in populations, the magnitude and pattern of the effects in different parts of the country are yet to be quantified. Poaching of peacocks for their meat and feathers and accidental poisoning by feeding on pesticide treated seeds are known threats to wild birds. Methods to identify if feathers have been plucked or have been shed naturally have been developed as Indian law allows only the collection of feathers that have been shed.

Peacock is a large and beautiful flying bird and rightly crowned as the National Bird. It occurs all over India both in forest and non-forest areas. The Peacocks worshipped as the Vahana/ carriers of Karthikeya / Subrahmanya Swamy/ Murugan in India , Nepal

and Sri Lanka. Hence, there is no threat from locals. In the project under consideration, Peacocks were found in the buffer zone mainly in local temples where they are protected. They were not found in the project site or core area.

There are two major kinds of threats to Peacock. One is illegal poaching for meat and feathers and the other is due to consumption of pesticide treated seeds sown by farmers. In spite of the above, there are healthy populations according to the State of India's Birds 2020 Report and there is no risk of extinction. If allowed to domesticate, Peacocks shall become pet birds and their numbers can increase very rapidly.

Conservation Actions:

No special emphasis required for this species, as the population of this species is abundant. But site-specific conservation plan to be followed.

Peacocks are of widespread occurrence and there is no specific conservation plan for Peacocks similar to the specific conservation plan of Tigers, Elephants, Crocodiles, Sea Turtles etc. The project proponent is prohibited by law to capture the Peacocks and domesticate them or breed them under captivity. Any plan designed to conserve and mange a Schedule I species should take in to the account the basic scientific principles and criteria. Conservation does not mean preservation. Species conservation implies sustainable management under in-situ conditions. When an isolated male or female is found in one place within the buffer zone, no one can conserve the species by taking care of that solitary bird without violating the WPA. The conservation plan should be need -based, realistic, practically feasible, scientific and technical. In case of Peacocks found in the buffer zone, the only thing that the project proponent can do is to create of awareness among the public in general and the project dependent people in particular about the need to conserve them and to motivate them to act as protectors of Peacocks through mass media, social media, public education and Nature clubs.

The State of India's Birds 2020 Report, suggests that it is important to promote collaborations between public initiatives and researchers. It also suggests that the government should support the monitoring and conservation efforts by citizens and researchers. The report also suggests that there should be a dedicated fund for high concern species so that scientists and researchers can save those birds. The project proponent is willing to contribute 0.5% of the profits subject to a minimum of Rs.50,000/- per year to the National Wildlife Board for conservation of Wildlife including Peacocks.

Leopard (*Panthera pardus*)

The leopard's fur is generally soft and thick, notably softer on the belly than on the back. Its skin colour varies between individuals from pale yellowish to dark golden with dark spots grouped in rosettes. Its belly is whitish and its ringed tail is shorter than its body. Its pupils are round. Leopards living in arid regions are pale cream, yellowish to ochraceous and rufous in colour; those living in forests and mountains are much darker and deep golden. Spots fade toward the white underbelly and the insides and lower parts of the legs. The fur tends to be grayish in colder climates, and dark golden in rain forest habitats. The pattern of the rosettes is unique in each individual. This pattern is thought to be an adaptation to dense vegetation with patchy shadows, where it serves as camouflage.

Protection Status:

Indian Wildlife (Protection) Act, 1972: Schedule I.

International Union for Conservation of Nature (IUCN) Red List: Vulnerable.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): Appendix I.

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Carnivora
Suborder:	Feliformia
Family:	Felidae
Subfamily:	Pantherinae
Genus:	Panthera
Species:	*P. pardus*

Population and Distribution status:

In the Indian subcontinent, the leopard is still relatively abundant, with greater numbers than those of other Panthera species. As of 2020, the leopard population within forested habitats in India's tiger range landscapes was estimated at 12,172 to 13,535 individuals. Surveyed landscapes included elevations below 2,600 m (8,500 ft) in the Shivalik Hills and Gangetic plains, Central India and Eastern Ghats, Western Ghats, the Brahmaputra River basin and hills in Northeast India. Some leopard populations in the country live quite close to human settlements and even in semi-developed areas. Although adaptable to human disturbances, leopards require healthy prey populations and appropriate vegetative cover for hunting for prolonged survival and thus rarely linger in heavily developed areas. Due to the leopard's stealth, people often remain unaware that it lives in nearby areas.

Behaviour and ecology

The leopard is a solitary and territorial animal. Adults associate only in the mating season. Females continue to interact with their offspring even after weaning and have been observed sharing kills with their offspring when they cannot obtain any prey. They produce a number of vocalizations, including growls, snarls, meows, and purrs. The roaring sequence in leopards consists mainly of grunts, also called "sawing", as it resembles the sound of sawing wood. Cubs call their mother with a urr-urr sound.

The whitish spots on the back of its ears are thought to play a role in communication. It has been hypothesized that the white tips of their tails may function as a 'follow-me' signal in intraspecific communication. However, no significant association were found between a conspicuous colour of tail patches and behavioural variables in carnivores.

Leopards are active mainly from dusk till dawn and rest for most of the day and for some hours at night in thickets, among rocks or over tree branches. Leopards have been observed walking 1–25 km (0.62–15.53 mi) across their range at night; they may

even wander up to 75 km (47 mi) if disturbed. In some regions, they are nocturnal. In western African forests, they have been observed to be largely diurnal and hunting during twilight, when their prey animals are active; activity patterns vary between seasons. Leopards can climb trees very skillfully, often rest on tree branches and descend from trees headfirst. They can run at over 58 km/h (36 mph), leap over 6 m (20 ft) horizontally, and jump up to 3 m (9.8 ft) vertically.

Hunting and diet

The leopard is a carnivore that prefers medium-sized prey with a body mass ranging from 10–40 kg (22–88 lb). Prey species in this weight range tend to occur in dense habitat and to form small herds. Species that prefer open areas and have well-developed anti-predator strategies are less preferred. More than 100 prey species have been recorded.

Measures for Habitat specific alternations

There are few eco sensitive habitats such as Penna River and four ponds within the study area. In these, it was found from the primary data Peafowl species need for conservation. The following measures are to be taken during construction and operation phases of the proposed project:

- ❖ The water bodies are to be protected from all kinds of pollution releases from industries.
- ❖ The water from nearby ponds should not be utilised for industrial purpose.
- ❖ The construction material should not be taken from the nearby reserve forests.
- ❖ Proper training and protection measures to be given to working groups.
- ❖ Protection measures such as fencing etc are to be strictly followed
- ❖ Sign boards and display boards are to be kept near the eco sensitive zones
- ❖ During transportation, proper care should be taken towards Peafowls.
- ❖ Seasonal or Annual monitoring should be taken up on population status of peafowl species with expert Ecologist.
- ❖ Not to discharge and solid or liquid wastes directly or indirectly into the surrounding habitat.
- ❖ Regular consultation with local forest officials and NGOs to improve the degraded habitat and participate in conservation practices also with them.

❖ Conducting more awareness programmes near the surrounding villagers and local staff members.

Conservation measures with financial outlay:

The condition for habitat protection for Peafowl's is deteriorating day by day due to narrowing down of its habitat by putting it under plough and also due to its vulnerability to poachers besides birds own poor breeding potential. In order to ensure full protection to the birds of the region and its associate species, the following measures are taken up both within and outside the sanctuary limits.

Species specific mitigation measures:

1. Scheduling construction activities to avoid disturbances to bird populations during feeding and reproduction periods;
2. Keeping an inventory of all large trees to be removed in order to identify bird eggs and nests and minimize impacts;
3. The contractors to establish environmental units and implement public awareness programs during construction regarding the impacts caused by the construction activity.
4. All wood building material for workers' housing should be brought from outside the project area it should not be procured from the same project site.
5. Workers should be supplied with non-wood fuels such as kerosene or liquefied petroleum gas for the duration of the contract
6. All contract equipment and plants should be cleaned to the satisfaction of the project engineer prior to their relocation to project sites.
7. During site clearance, care should be taken to ensure that the minimum area of vegetation area is affected
8. The water sprinkling of trucks used, as construction vehicles should be properly and regularly undertaken, so that dust deposition problem on vegetation is minimised.
9. Clearing only necessary amount of vegetation from the forest area.
10. Project staff and workers should not be allowed to have fire-arms and animal traps etc.
11. Employment agreements should specify heavy penalties for illegal hunting, trapping and wildlife trading – all other ancillary works should also agree not to participate in such activities;

12. If any of the hunting activity is observed then the worker will be removed from the employment with immediate effect.
13. There should be speed limit for the material carrying trucks/dumpers while traversing through the forest areas if at all. It is always better not to travel in the forest areas that would disturb the animal behavior.
14. Honking should be strictly prohibited in the forest area by the trucks and dumper used for the construction activity.
15. No construction yard will be established at the forest area.
16. No disposal of construction waste in the forest premises
17. No earthen material or water from the springs present in the forest area will be used for the construction activity.
18. Hunting will be strictly prohibited for the workers.
19. Protection against poaching.
20. Protection against habitat encroachment
21. Protection against fire.
22. Protection against indiscriminate use of natural resource base for furniture etc
23. Creating awareness among public

Financial plan

Physical and Financial plan for the proposed project

S.No	Particulars	Nos	Unit cost	Total (Rs. in lakhs)
1	Underpasses	4	25.00	100.00
2	Fencing	4 km	10.00	40.00
3	Saucer pits	100	0.20	15.00
4	Camera traps	50	0.50	25.00
5	Signage and boards	30	0.40	12.00
6	Rumble strips	50	1.00	50.00
7	Checkpost up gradation	1	50.00	50.00
8	Wages to protection watchers (4 years)	5	4.8	24.00
9	Awareness camps	15	2.00	30.00
10	Fire lines creation with 3M width	10 km	7.18/rmt	1.00
11	Ecological monitoring	3 times	5.00	15.00
12	Overhead charges	-	30	30.00
13	Research	2	12	24.00
14	Administrative cost	-	20	20.00
	Grand total			436.00

The user agency shall execute the underpasses works proposed at appropriate locations with 10 feet width and 6 feet height on the above amount i.e., 100.00 lakh towards mitigation measures. The User Agency shall deposit balance amount Rs. 336.00 lakh with the Chief Wildlife Warden, State of Andhra Pradesh.

(User Agency)   DFO, Nellore (T) Division   CCF, Guntur

Prl. Chief Conservator of Forests (WL) & CWLW

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(User Agency)
EXECUTIVE ENGINEER (R&B)
N.H. DIVISION, VIJAYAWADA

DFO, Nellore (T) Division
District Forest Officer
SPSR NELLORE

CCF, Guntur
Chief Conservator of Forests
GUNTUR CIRCLE.
GUNTUR

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

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