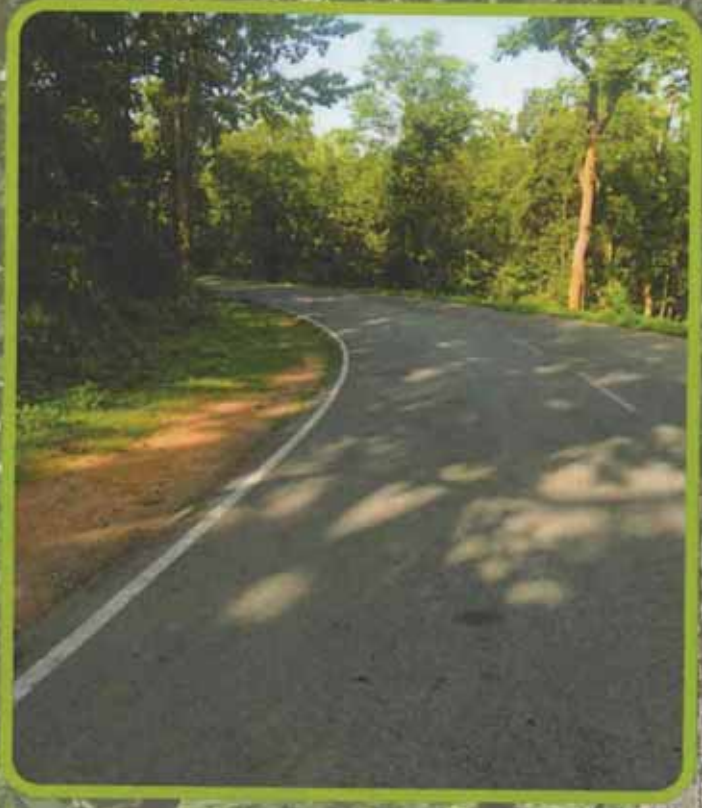
WILDLIFE MANAGEMENT AND CONSERVATION PLAN

For

Proposed Six lane Raipur-Vishakhapatanam Project of NH-130 CD under Bharatmala Priyojna in the state of Chhattisgarh

Lot-3/Odisha & Jharkhand/Package-2



Prepared by

We the Foresters Welfare Society

CG Govt. Registered No. 122202194229

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From the desk of "We the Foresters Welfare Society"

India is the fast developing country as far as to increase the mobility and efficiency of the road transport system in India for which the Ministry of Road Transport and Highways (MoRTH), is undertaking the road transport and highways development in India.

The Ministry of Road Transport and Highways (MoRTH) of India is the apex body to regulate the laws related to road transport and transport related issues in order to increase the facilities, movement of vehicles and the road transport system in India.

For the purpose of smooth functioning of the system, Government of India through its Ministry of Road Transport and Highways (MoRTH) have appointed National Highway Authority of India (NHAI) as its nodal agency which has decided to develop Economic Corridors, Inter Corridors, Feeder Routes and Coastal road primarily to improve the efficiency of freight movement in India under Bharatmala Pariyojana.

This prestigious proposed Bharatmala Pariyojana is connecting from Chhattisgarh to Odisha and Andhra Pradesh. In the state of Chhattisgarh the proposed road starts from near Abhanpur (Raipur District) and passes through the revenue and forest areas of Dhamtari, Kanker and Kondagaon districts i.e. Raipur to Vishakhapatnam (Ch 0.00 KM to Ch 124.661Km) total length of the road in Chhattisgarh state is measured to 124.661 Km.

Our society, ***'We the Foresters Welfare Society'*** through its team of forestry experts, visited the entire forest areas passing through and gathered first-hand information on status of Flora and Fauna of the forest areas. Also contacted field forest officers and people of the area to locate and understand the presence of wild life, biodiversity of the locality along with many other natural features and also referred working plans of the concerning divisions to prepare this plan.

We thankfully acknowledge and pay our deep regards to **Shri P.V. Narsinga Rao IFS PCCF (Wildlife) and CWLW Chhattisgarh, Shri A.K. Bishwas IFS APCCF (Wildlife)** for their valuable guidance as well as providing necessary information regarding formulation of the plan.

We would like to express our gratitude towards **Mr. S.S.D.Badgaiya IFS CCF Kanker, Mr. J.R. Nayak IFS CCF Raipur, Mr. Rajesh Pandey IFS CCF (Wild life) Raipur & Field Director Udanti-Sitanadi Tiger Reserve, Mr. Abhay Shrivastav IFS CCF (Wild life) & P.D. ITR Jagdalpur, Mrs. Satovisha Samajdar IFS Divisional Forest Officer Dhamtari, Mr. Arvind PM IFS Divisional Forest Officer Kanker, Mr. B.S. Thakur IFS Divisional Forest Officer Keshkal and Mr. Aayush Jain IFS Deputy Director, Udanti- Sitanadi Tiger Reserve.**

We would like to express our special gratitude and thanks to **Mr. A.K. Mishra Chief Gen. Managaer/ R.O. NHAI Raipur, Mr. Savyasachi Choudhary PD NHAI – PIU Dhamtari, Mr. Vaibhav Goyal Dy Manager (Tech.)** for providing relevant information and support.

We also acknowledge and pay regards to **Range Forest officers of the Dhamtari, Kanker, Keshkal division and Udanti-Sitanadi Tiger Reserve and Field staff of NHAI** for their great field support. Without help and necessary support by them the task could have not been taken shape.

Chandra Shekhar Tiwari IFS
Retd.CCF (Wildlife)
President

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Retd. CCF
Vice President

"We the Foresters welfare society"

Executive Summary

The ministry of Road Transport and Highway (MoRTH), Govt. of India has proposed "Bharat Mala Pariyojna" an Umbrella scheme of road development through National Highways Authority of India (NHAI), National Highways Industrial Development Corporations Ltd (NHIDCL)and state Public works departments (PWDs).

The ministry of Road Transport and Highway (MoRTH) through National Highways Authority of India (NHAI) mainly aims at development of Economic Corridors, Inter Corridors, Feeder Routes and Coastal roads primarily to improve the efficiency of freight movement in India .

The Proposed National Highway is under construction to connect from Chhattisgarh to Andhra Pradesh starting from Chhattisgarh passing through Odisha and reaching Andhra Pradesh.

The project road is Green Field Alignments passing through the Raipur, Dhamtari, Kanker and Kondagaon districts of the Chhattisgarh state. The total length which falls within state is 124.661 Kms. The entire road passes through the green field areas which include plain areas to hill terrain.

The entire stretch is 124.661 kms in the state. The project location in Chhattisgarh state starts from Jhanki village near Abhanpur (District Raipur) connecting Abhanpur, Kurud, Magarload, Dhamtari, Nagari of Dhamtari district, Narharpur of Kanker district and Bade Rajpur (Vishrampuri) of Kondagaon district and terminates at Marangpuri village (Kondagaon district).

The project road is 124.661 Kms out of which 44.534kms passing through the forest areas affecting 228.0425 hectares of forest land spread under jurisdiction of Dhamtari, Kanker and Keshkal Forest divisions. The forest types of the project area and its buffer zone can be broadly classified into Tropical Moist Deciduous and Tropical Dry deciduous forest types falling under three forest divisions.

The proposed affected forest areas are very rich in flora and fauna with ample of diversity.

The proposed road is passing very close to the Udanti-Sitanadi Tiger Reserve at about 0.7 Kms away from the eco sensitive zone of the Udanti-Sitanadi Tiger Reserve in Dhamtari district.

The entire forest cover in Project area and Impact zone of the Bharatmala project is very rich in sense of biodiversity, Flora and Fauna.

Majority of wildlife found in entire area under three forest divisions can be listed as Tiger (Visit occasional), Leopard, Bear, Neel gai, Sambhar, Deer, Chital, Kotari, Siyar, Rabbit, wild dogs, Wild Elephants (Visit occasional), Lomdi, Wild boar and many more small sized animals. Reptiles and Amphibians in water bodies, Common birds and birds of schedule categories are in abundance, varieties of butterfly and other flies. Faunal status is also found very rich in entire core and buffer areas.

The start of the project in forest area of Dhamtari district which has mixed forest mainly Saja, Dhawda, Haldu, Mundi, bamboo, Lendia, Tendu, Achar, Karra, Semal, salai, Moyan etc but as go on progressing towards Kanker and Keshkal forest division, the major forest species found is Sal and its associates. The forest quality is ranging between IV (a) to III with forest density of <.4 to .6. The regeneration status in entire forest area is sufficiently adequate.

The major adverse effect and threats due to the project implementations would be fragmentation of wild life habitat, destruction of forest including biodiversity depletion, increase in human - wild life conflicts, increase in fire incidence etc.

Keeping in view the disturbance in Project areas, we propose to undertake various conservation and development plan to minimize the losses such as plantation of fruit bearing trees etc. Cut back operations, Pasture land development, constructions of water bodies, soil and water conservation, fire protection work, measures for habitat improvements, training and awareness programs etc.

To minimize the Wild animal road accidents and ease of their movement from one area to another while crossing the road , we propose to construct Under Pass at certain points considering the norms laid down by WII (2016) Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife .

The total cost of this Highway project is 4068.16 Cr (approx.) and estimated expenditure on Wild life management plans would be 1205.20 lacs

"We the Foresters Welfare Society" is a registered society with Chhattisgarh firms and societies. The core members of the society are retired forest officers of IFS and SFS cadre who possess rich experience in making wildlife conservation and management plans.

The team of experts visited the project area and conducted various surveys and took observations. Interacted with the stake holders (local peoples, forest officers and NHAI project authority) and after due consultation and considering norms of WII and Chhattisgarh forest department. Wildlife conservation plan is prepared for due approval.

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Chapter-I

INTRODUCTION

In Indian context, the need become necessity in order to maintain balance between infrastructure development and ecology balance including living, healthy landscape.

There needs to be balance between development and conservation of nature including forest, habitats and other ecological factors. It's well established fact that the need to promote measures and practices that assimilate conservation concerns in infrastructure development are being seriously taking into consideration by the involved agencies and stake holders.

1.1 Project brief note:

The National Highways Authority of India (NHAI) has been entrusted with the assignment of Development of Economic Corridors, Inter-corridors and feeder routes and Coastal road primarily to improve the efficiency of freight movement in India under Bharatmala Pariyojna Lot-3/Odisha & Jharkhand/Package-2 having length of proposed alignment 463.265 km (which is totally green field) which starts from near Abhanpur (ch. 0.000)/ch. 61.600 of proposed Raipur-Durg Bypass and ends at Vishakhapatnam bypass (ch.463.265) of Existing section ofSH-38. This brief report is for from Ch 0.00 km to 124.661km. This package of proposed project will start from Jhanki village of Abhanpur tehsil in Raipur district and passing through four districts such as Raipur, Dhamtari, Kanker and Kondagaon districts of Chhattisgarh state and ends at Marangpuri village of Baderajpur tehsil in Kondagaon district.

1.1.1 Project Location:

The length proposed for the phase-1 stretch measures 124.661Km and starts at near Abhanpur village (Raipur) and terminates at Marangpuri village in the state of Chhatisgarh.

This phase of the Raipur-Vishakhapatnam economic corridor alignment starts at Jhanki village near Abhanpur and connecting Abhanpur of Raipur district Kurud,Magarlod, Dhamtari&Nagri of Dhamtari district, Naraharpur of Kanker District, Bade Rajpur (visrampuri) of Kondagaon District in Chhattisgarh.

1.1.2 Project Benefits:

The benefits of the Project are multi-fold. It will substantially reduce the travel time and the other remote areas falling on the alignment. In addition to the improved connectivity, it will also provide a boost to the economic status of the villages /towns falling in the dedicated Project area. Overall improvement will be expected in local area in terms of:

- Better connectivity to economic, social and political hubs of Chhattisgarh.
- Fast and safe connectivity resulting in savings in fuel, travel time and total transportation cost.
- Better approach to medical & educational services.
- Faster transportation of perishable goods like fruits, vegetables, dairyproducts and marketing of agricultural products.
- Development of local agriculture and handicrafts.
- Opening up of opportunities for new occupations and trade on the route.
- Better connectivity to rice mills of Chhattisgarh, industrial cities and Vishakhapatnam port.

- Indirect and direct employment opportunity to people from all skilled, semiskilled and unskilled streams.

1.1.3 Project alignment:

The length proposed for the phase-1 stretch measures 124.661 km and starts at near Abhanpur village (Raipur) and terminates at Marangpuri village in the state of Chhattisgarh.

This phase of the Raipur-Vishakhapatnam economic corridor alignment starts at Jhanki village near Abhanpur and connecting Abhanpur of Raipur district Kurud, Magarlod, Dhamtari&Nagri of Dhamtari district, Naraharpur of Kanker District, Bade Rajpur (visrampuri) of Kondagaon District in Chhattisgarh.

Proposed National Highway is Green field alignment project and proposed for 6 lane carriageway width with paved shoulders. The project road starts from Jhanki village of Abhanpur tehsil in Raipur district and passing through four districts such as Raipur, Dhamtari, Kanker and Kondagaon districts of Chhattisgarh state and ends at Marangpuri village of Baderajpur tehsil in Kondagaon districts from CH: 0+000 to 124+661 having a total length of 124.661kms. The proposed National Highway project has been envisaged through an area which shall have the advantage of simultaneous development as well as shall result in a shorter distance to travel.

The salient features of the proposed project have been presented below:

1.1.4 Salient features of the project

1	Project Road	Development of Economic Corridors, Inter-corridors, feeder routes and Coastal Road to improve the efficiency of freight movement in India (Lot-3/Odisha& Jharkhand/Package-2) aipur-Vishakhapatnam (Ch. 0.000 - Ch. 124.661 km) (Length 124.661 km) in the State of Chhattisgarh under Bharatmala Pariyojana in the state of Chhattisgarh
2	Location of the proposed project	The Part 1 of this proposed project will start from Jhanki project village of Abhanpur tehsil in Raipur district and passing through four districts such as Raipur, Dhamtari, Kanker and Kondagaon districts of Chhattisgarh state and ends at Marangpuri village of Baderajpur tehsil in Kondagaon districts in the state of Chhattisgarh.
3	No, of affected villages by Land acquisition	Raipur District: 06 villages Dhamtari District : 35 villages Kanker District: 16 villages Kondagaon District: 09 villages **Total: 66 villages**
4	Total Length of the proposed project	124.661 km
5	Total Area of Land Acquisition	Total Land Requirement: 745.13 Ha. Forest Land: 228.0425 Ha.

6	Terrain	Mostly plain and hilly area.
7	Seismic	Zone Zone - II
8	Geographical Location	Starting Point: 21°05'18.85"N 81°45'01.40"E Ending Point: 20°01'44.59"N 81° 51'58.13"E
9	Proposed Bridges	Major Bridges -09 Nos Minor Bridges -43 Nos.
10	Proposed ROBs / Underpasses / Flyover including Pedestrian underpass/ Tunnels and Viaducts	ROBS: 1, VUP:04, SUOP/LVOP/VOP/SVOP:02, SVUP/VOP:29, FLYOVER:01, VIADUCT: 06, TUNNELS: 01
11	Culverts	148 Nos
12	Right of Way	60 m and 45 m in forest areas
13	Design Speed	100 km/hr for plain terrain and for rolling terrain
14	Carriageway	2x14.5 m.
15	Embankment	1.2m *(*Average)
16	Proposed Toll Plazas	01 location at km 13+300; 10 lanes on both side
17	Safety Measure	Crash Barriers
18	Lighting	Lighting all along including High Masts at Toll plazas, interchanges, major bridges /ROB's and Amenities and Truck Parking Areas.
19	No of Structures Affected	54
20	Total Project Cost	4068.16 Cr (approx.)
Environmental & Social Features		
21	Forest Land Diversion	228.0425 Ha.
22	Water bodies Impacted	At 36 locations (08 Ponds, 10 canals, 10 local streams, 06 Seasonal streams, 01 location (Mahanadi River) and 01 Nalah/Canal)
23	Existing trees within ROW	Estimated number of tree is approx. 40000 (will be confirmed after joint enumeration with Forest Department)
24	Green belt development	As per IRC SP21:2009 /MORTH Code/Guidelines
25	No. of project affected persons (PAFs) & (PAPs)	Total PAFs – 54 Total PAPs – 270
26	Resettlement & Rehabilitation Cost (R&R) including land Cost.	Rs. 227.61 Crores

1.2 Wildlife conservation, management and its relevance in linear infrastructure projects:

Wildlife conservation allows stakeholders to include rare, threatened and endemic biodiversity along with strategically planning for ecological balance for natural wealth and human being through sustainable approach of development.

Wildlife conservation started nearly 50 years ago across the world where "protected areas" were established and were treated as natural islands that remained largely untouched or unexploited by the human or system influences.

The forest cover in India is 21.34% ofthe total geographical area of the country out of which 4.89% treated as "protected areas" where no. of National parks, sanctuaries, conservation reserves and community reserves are notified. (www.wl.gov.in/national_wildlife_database).

The forest cover in the Chhattisgarh State is 55674 Sq. Km which is 41.18% of the state's geographical area.

In Indian context, the core area in PAs are relatively very small so the PA management gradually extended to landscape conservation where support to wildlife in core areas are duly complimented by its management in wildlife protection point view. Hence the approaches of wildlife management legalized to manage core, buffer areas and areas that provide connecting corridors.

With the introduction of linear developments such as roads, highways, there are head on conflicts with the objectives of wildlife conservation.

The increasing trends in extent of linear developments in most landscape outside PA face major challenge for wild life conservation and management. There is need of an hour to guide developments which often ruin or disturb habitats and ultimately adversely affect the wildlife conservation and ecosystems.

1.3 Mandate for making wild life conservation plan:

The Wildlife conservation and management plan has been prepared as per the mandate of TOR by file number-10-3/2020 IA,III Government of India MoEF&CC, New Delhi (Impact assessment division) dated 02.03.2020 ..... **Annexure-1**

1.4 Scope of work:

Compliance of specific conditions of TOR pertained to above mentioned study as

A: As the proposed alignment falls within the 10 kms of eco- sensitive zone of Udanti- Sitanadi Tiger Reserve the proponent shell obtained the NOC from National Tiger Conservation Authority. Proponent shall also obtain the NOC from the project Elephant of MOEF&CC.

B: A thorough is undertaken with respect to the movement of Elephant in this area, impact of project on elephant movement and viability of the alignment specific to elephant movement. In the study, proponent shall map wild life crossing, (particularly for elephant movement) accurately thorough, the thorough conclusion with State Forest Department and Project Elephant at MOEF&CC, New Delhi.Wild life conservation plans (including construction of underpasses of adequate length and height for elephant movement) and other appropriate mitigation measures shall be prepared in consultation with The Chief Wildlife Warden of the state along with implantation schedule and appropriate monitoring mechanism subject to NOC from Project Elephant of MOEF&CC.

C: Study to be carried out on acoustic and light proofing measures considering the Wildlife Institute of India manual and other studies by the reputed institutes on the matter. The study shall be carried by the qualified professionals, scientists from any national institutes/universities of repute having requisite experience to conduct such study.

1.5 Specific Objectives of this Wildlife management plan are :

1. Understanding the flora and fauna resources both in core and buffer areas through primary and secondary sources to get baseline information.
2. Preparation of Wildlife conservation and management plan based on the findings in view of threat to wildlife movement and their natural habitat which historically recorded and observed.
3. Developing phase wise mitigation measures to minimize the destruction of habitat and rehabilitate flora and fauna in buffer area.
4. Developing participatory initiatives of local people for conservation and management of habitats in the buffer zone.
5. To prepare a comprehensive conservation plan for endangered, endemic and economically important plant and animal species.
6. Preparing Wildlife management plan 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 harmful effects of limiting factors that keep the animal population lower than the carrying capacity of the area. It also aims at management of human dimensions relating to regulation of habitat use, sufferance from animal damages, livelihood issues and taking people as partners in conservation management.
7. The main objective of this plan is to reduce/minimize/ mitigate various stress occur due to implementation of this project in this particular locality having wildlife importance by using modern technologies and available Science.
8. This Conservation Plan will suggest measures to mitigate such stress and if possible how to avoid certain activities which could reduce the negative impact and the most important to ensure safe passage of wildlife. The management of the project area aims for maintenance of habitat for smaller 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.
9. 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 proposed highway project.
10. Prepare mitigation a measure refers to avoid, reduce or remedy harm and addresses the conservation concerns likely to be associated with the development proposals. Hence there is need to follow the mitigation principles to deliver potential benefits of Green Infrastructure Development Approach as per the recommendation considering wild life institute of India i.e Eco- friendly measures to mitigate impacts of Linear infrastructure on wild life.

Chapter-II

LOCATION, TOPOGRAPHY, LAND USE PATTERN AND DETAILS OF STUDY AREA

2.1 Location and accessibility:

- The proposed road shall connect different parts of Chhattisgarh. The proposed stretch is directly connected to various important roads.
- The length proposed for the stretch measures 124.661 km and the starting point of phase-1 of proposed alignment of Economic corridor is near Abhanpur at Ch 61.600 km of proposed Raipur-Durg bypass.
- Raipur Airport is 10.83 km in NW direction from starting point of Highway.
- Hence the site is well connected to other parts of INDIA.

2.2 Project area:

The project area finds place in Topo sheet number F44V10, F44V11, F44V14, F44V15 and F44V16.

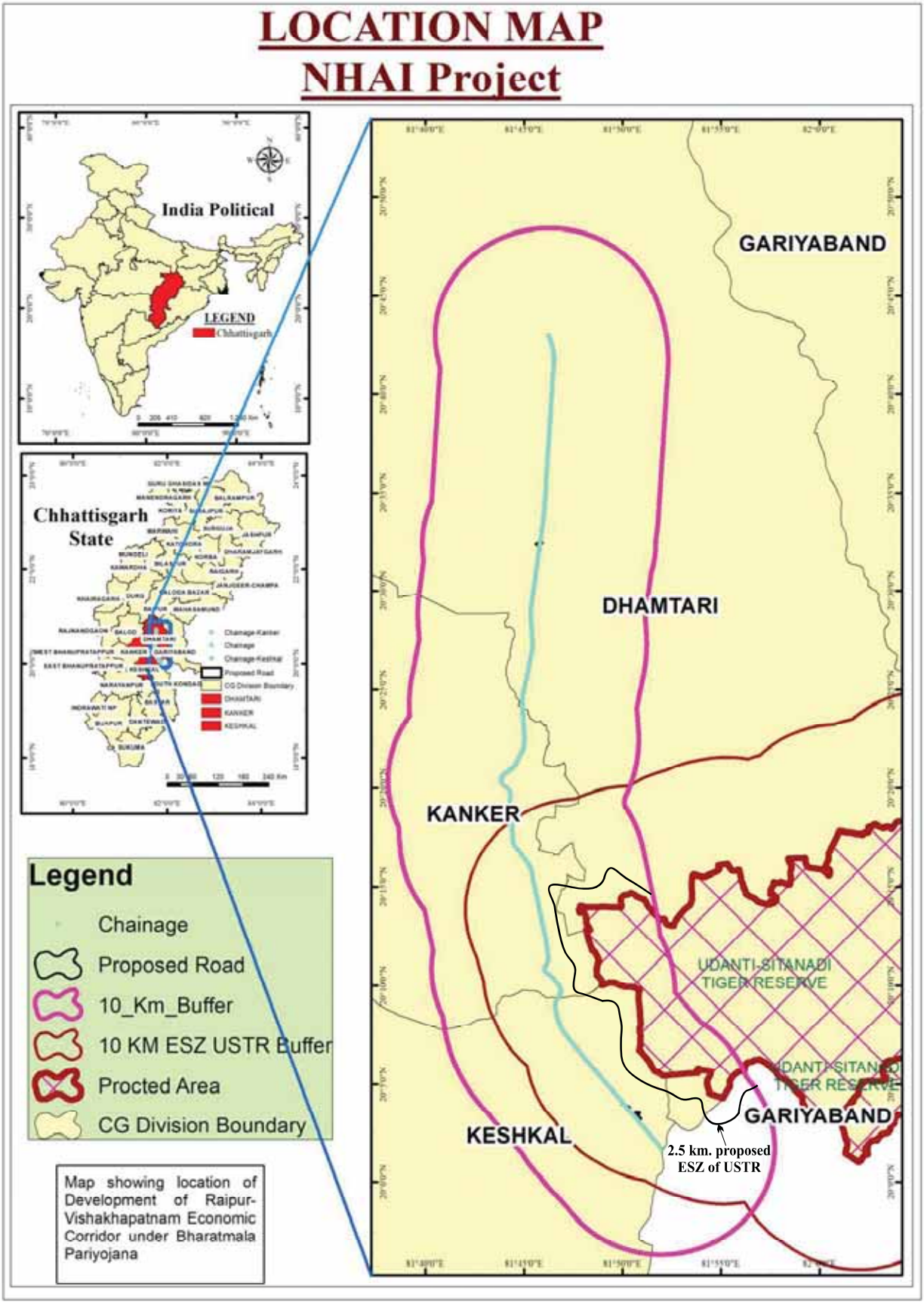
The Total length of project road from Ch 0.000 to Ch 124.661, portion of the road project in Chhattisgarh state starts from Jhanki village near Abhanpur (District Raipur) connecting Abhanpur, Kurud, Magarload , Dhamtari, Nagari of Dhamtari district, Narharpur of Kanker district and Bade Rajpur (Vishrampuri) of Kondagaon district and terminates at Marangpuri village (Kondagaon district).

Total land required for the Highway project is **745.13 Ha. which comprises 228.0425 Ha. of Forest land and 203.727 of non-forest land**.

2.3 Geographical location:

Geographically the 124.661 km alignment lies between Latitude 21°05'18.85"N Longitude 81°45'01.40"E and Latitude20°01'44.59"N Longitude 81° 51'58.13"E

LOCATION MAP
NHAI Project



Map showing location of Development of Raipur-Vishakhapatnam Economic Corridor under Bharatmala Pariyojana

2.4 Details of study area:

The study area is divided into two parts i.e. **Project area and Impact zone.**

2.4.1 Project area :

Core zone consists of forest area falling in road alignment which passes through Dhamtari, Kanker and Keshkal Forest divisions of which land statement (Forest division wise)with Chainage is listed as below:

It should be noted that **the proposed road is not any part of Protected Area.**

In process of development of highway (Lot-3/Odisha& Jharkhand/Package-2) Raipur-Vishakhapatnam (Ch. 0.000 – Ch. 124.661 km) (Length 124.661 km) in the State of Chhattisgarh under Bharatmala Pariyojana following are the forest land statements

TABLE – 2.1 Forest land statement of Dhamtari Forest Division

Sl	Chainage		Length (m)	PRoW (m)	Forest Area (in Ha)	Forest Type	Forest Division	Forest Range	Forest Beat	Comp. No	Remarks
	From	To									
1	42+844	44+040	1196	45	5.3956	RF	DHAMTARI	NORTH SINGPUR	RAJPUR BEAT	58	Area As per Polygon Size
2	44+040	44+073	33	45	0.1520	RF	DHAMTARI	NORTH SINGPUR	KENWARA DIH BEAT	60	_DO_
3	44+073	44+866	793	45	3.5803	RF	DHAMTARI	NORTH SINGPUR	RAJPUR BEAT	58	_DO_
4	44+866	45+630	764	45	3.4494	RF	DHAMTARI	NORTH SINGPUR	KENWARA DIH BEAT	60	_DO_
6	46+600	48+112	1512	45	6.8383	RF	DHAMTARI	NORTH SINGPUR	KENWARA DIH BEAT	61	_DO_
7	48+112	51+651	3539	45	15.9804	RF	DHAMTARI	NORTH SINGPUR	PAHADA BEAT	113	_DO_
8	51+651	52+073	422	45	1.9408	RF	DHAMTARI	KEREGAON	BASIKHAI BEAT	112	_DO_
10	52+972	53+351	379	45	1.7233	RF	DHAMTARI	KEREGAON	BASIKHAI BEAT	121	_DO_
11	53+351	55+090	1739	45	7.6565	RF	DHAMTARI	KEREGAON	BASIKHAI BEAT	112	_DO_
12	55+090	55+230	140	45	0.8306	RF	DHAMTARI	KEREGAON	BASIKHAI BEAT	121	_DO_
13	55+230	56+686	1456	45	6.5667	RF	DHAMTARI	KEREGAON	BASIKHAI BEAT	111	_DO_
14	56+686	57+933	1247	45	5.6280	RF	DHAMTARI	KEREGAON	DOKAL BEAT	110	_DO_
15	57+933	59+213	1280	45	5.7802	RF	DHAMTARI	KEREGAON	DOKAL BEAT	109	_DO_

PROJECT DIRECTOR NHAI,PIU,Dhamtari(C.G.)

उप परिक्षेत्र अधिकारी केम्पडी (ख.)

परिक्षेत्र अधिकारी कोरगांव

वन परिक्षेत्र अधिकारी दक्षिण सिंगपुर

परिक्षेत्र अधिकारी उत्तर सिंगपुर

16	59+213	60+655	1442	45	6.5104	RF	DHAMTARI	KEREGAON	DOKAL BEAT	108	_DO_
17	60+655	61+910	1255	45	5.4729	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	103	_DO_
18	61+910	62+176	266	45	1.3919	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	103A	Verified Non-Forest Land within Forest Compartment
19	62+176	62+500	324	45	2.6980	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	105A	0.8465 ha (RoW) + 1.8515 (Junction Area) = 2.6980 Ha. Verified Non-Forest Area land within forest Compartment.
20	62+320	62+600	280		1.7823	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	105A	0.9201 ha (RoW) 0.7093 ha Junction part RHS) + 0.1529 ha (Junction Part LHS)
21	Junction Area -1		-		1.2355	RF	DHAMTARI	KEREGAON	KEREGAON BEAT	106	Additional Area for Junction Development, Forest Area as per polygon size
22	Junction Area -2		-		0.4335	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	105	_DO_
23	Junction Area -3		-		1.5824	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	105	_DO_
24	62+567	65+992	3425	45	15.0048	RF	DHAMTARI	SOUTH SINGPUR	PALWADI BEAT	105	Area As per Polygon Size
25	65+992	67+178	1186	45	5.8050	RF	DHAMTARI	SOUTH SINGPUR	PALGAON (B) BEAT	414	_DO_
26	67+178	67+452	274	45	1.2369	RF	DHAMTARI	SOUTH SINGPUR	PALGAON (B) BEAT	412	_DO_
27	67+452	68+438	986	45	4.4240	RF	DHAMTARI	BIRGUDI	KHAIRBHARI BEAT	413	_DO_
28	68+438	68+919	481	45	2.1983	RF	DHAMTARI	BIRGUDI	KHAIRBHARI BEAT	413	Verified Non-Forest Land within Forest Compartment
29	68+919	69+913	994	45	4.5031	RF	DHAMTARI	BIRGUDI	KHAIRBHARI BEAT	433	Verified Non-Forest Land within Forest Compartment
30	69+913	70+209	296		1.3261	RF	DHAMTARI	BIRGUDI	KHAIRBHARI BEAT	433	

PROJECT DIRECTOR
NHAI,PIU,Dhamtari(C.G.)

उप परिक्षेत्र अधिकारी
बिन्द्रानवागढ़ (चा.)

परिक्षेत्र अधिकारी
बीरगांव

उप परिक्षेत्र अधिकारी
दक्षिण सिंगपुर

परिक्षेत्र अधिकारी
उत्तर सिंगपुर

31	70+209	70+438	229	45	1.0473	RF	DHAMTARI	BIRGUDI	KHAIRBHARI BEAT	434A	_DO_
32	70+438	71+526	1088	45	4.8935	RF	DHAMTARI	BIRGUDI	KHAIRBHARI BEAT	434A	Verified Non-Forest Land within Forest Compartment
33	71+526	72+767	1241	45	5.5710	RF	DHAMTARI	BIRGUDI	KARAIHA BEAT	435	Verified Non-Forest Land within Forest Compartment
34	72+767	73+108	341	45	1.5744	RF	DHAMTARI	BIRGUDI	KARAIHA BEAT	435	_DO_
35	73+108	73+697	589	45	2.6139	RF	DHAMTARI	BIRGUDI	KARAIHA BEAT	436	_DO_
36	74+533	75+325	792	45	3.5660	RF	DHAMTARI	BIRGUDI	KARAIHA BEAT	439	_DO_
37	76+032	77+299	1267	45	5.7128	RF	DHAMTARI	BIRGUDI	KARAIHA BEAT	441	_DO_
38	77+299	77+700	401	45	1.5633	RF	DHAMTARI	BIRGUDI	KARAIHA BEAT	442	_DO_
			31657								
Total (Forest Land & Non-Forest land within Forest Compartment					**147.6694**						
Total Forest Land					**126.4136**						
Total Non-Forest Land within Forest Compartment					**21.2558**						

Note: -1 Compartment wise Forest land diversion Area is as per polygon size (with shape of particular compartment) in between particular chainage. In general, proposed with of Project road is 60 meters but in Forest area PRoW is restricted to 45 meters.

Date:- 04/06/21
Place:-Dhamtari

परिक्षेत्र अधिकारी
उत्तर सिंगपुर

वन परिक्षेत्र अधिकारी
दक्षिण सिंगपुर

परिक्षेत्र अधिकारी
कैरागांव

उप परिक्षेत्र अधिकारी
बिन्द्रानवागढ़ (चा.)

Project Director
NHAI – PIU Dhamtari , Chhattisgarh

Name: - Savyasachi Choudhury

04/06/21

Seal & Signature

PROJECT DIRECTOR
NHAI,PIU,Dhamtari(C.G.)

(Satorisha Samajdar)
I.F.S.
Divisional Forest Officer
Dhamtari Division, DHAMTARI

TABLE – 2.2 Forest land statement of Kanker Forest Division

Sl	Chainage		Length (m)	PRoW (m)	Forest Area (in Ha)	Forest Type	Forest Division	Forest Range	Forest Beat	Comp. No	Remarks
	From	To									
1	80+905	81+044	139	45	0.6119	OA	KANKER	NARHARPUR	JAMGAON	472	Forest Area is calculated as per Polygon size.
2	81+044	82+134	1090	45	4.9339	RF	KANKER	NARHARPUR	JAMGAON	211	_DO_
3	82+134	82+169	35	45	0.1863	OA	KANKER	NARHARPUR	JAMGAON	472	_DO_
4	82+169	82+245	76	45	0.3226	OA	KANKER	NARHARPUR	JAMGAON	472	Non-Forest Land within Forest Compartment.
5	82+245	82+523	278		1.2421	OA	KANKER	NARHARPUR	JAMGAON	472	Forest Area is calculated as per Polygon size.
6	83+802	83+934	132	45	0.5203	OA	KANKER	NARHARPUR	DABBIPANI	480	_DO_
7	84+055	84+357	302	45	1.3559	RF	KANKER	NARHARPUR	SHAMTRA	158	_DO_
8	84+937	85+030	93	45	0.4309	OA	KANKER	NARHARPUR	SHAMTRA	478	Non-Forest Land within Forest Compartment.
9	85+030	85+180	150	45	0.3470	RF	KANKER	NARHARPUR	SHAMTRA	207	Non-Forest Land (RHS) within Forest Compartment.
10	85+030	85+375	345	45	1.2002	RF	KANKER	NARHARPUR	SHAMTRA	207	180 meters from start chainage 85+030 RF land is in LHS.
11	85+375	85+501	126	45	0.5695	RF	KANKER	NARHARPUR	SHAMTRA	158	Forest Area is calculated as per Polygon size.
12	85+501	86+400	899	45	3.7082	OA	KANKER	NARHARPUR	SHAMTRA	479	_DO_
13	91+015	91+480	465	45	2.1028	OA	KANKER	SARONA	BARKAI	427	_DO_
14	94+725	95+380	655	45	2.9270	RF	KANKER	SARONA	DHUDHAWA	153	_DO_
15	103+640	105+692	2052	45	9.2590	RF	KANKER	SARONA	KOTALBHATTI	127	_DO_
15	105+692	107+419	1727	45	9.3693	RF	KANKER	SARONA	KOTALBHATTI	128	_DO_
			8564		**39.0869**						

Note: -1 Compartment wise Forest land diversion Area is as per polygon size (with shape of particular compartment) in between particular chainage. In general, proposed with of Project road is 60 meters but in Forest area PRoW is restricted to 45 meters.

Date:- 04/06/21
Place:-Dhamtari

परिक्षेत्र अधिकारी
नरहरपुर

वन परिक्षेत्र अधिकारी
सरोना

Project Director
NHAI – PIU Dhamtari , Chhattisgarh

Name: - Savyasachi Choudhury

04/06/21

Seal & Signature

PROJECT DIRECTOR
NHAI,PIU,Dhamtari(C.G.)

Divisional Forest Officer
Forest Division Kanker

TABLE – 2.3 Forest land statement of Keshkal Forest Division

Sl	Design Chainage		Length(m)	PRoW (m)	Forest Area (in Ha)	Forest Type	Forest Division	Forest Range	Forest Beat	Comp. No	Previous Comp. no.	Remarks
	From	To										
1	107+419	108+255	836	45	3.7665	RF	KESHKAL	BADERAJPUR	KHALLARI	1152	2831	Area as per polygon Size
2	108+255	109+872	1627	45	8.8425	RF	KESHKAL	BADERAJPUR	KHALLARI	1151	2830	_DO_
3	109+872	110+186	314	45	1.6482	RF	KESHKAL	BADERAJPUR	GOVINDPUR	1154	2833	_DO_
4	112+030	112+600	570	45	2.5172	OA	KESHKAL	BADERAJPUR	GOVINDPUR	OA1512	2979	_DO_
5	116+910	119+522	2612	45	11.8020	RF	KESHKAL	BADERAJPUR	MANIKPUR	1169/	2848	_DO_
6	Additional Area (RHS)				1.6553	RF	KESHKAL	BADERAJPUR	MANIKPUR	1169/	2848	For Junction development
7	Toll (RHS)				0.0683	RF	KESHKAL	BADERAJPUR	MANIKPUR	1169/	2848	For Toll building
8	Additional Area (LHS)				0.1952	RF	KESHKAL	BADERAJPUR	MANIKPUR	1169/	2848	For Junction development
9	Toll (LHS)				0.0602	RF	KESHKAL	BADERAJPUR	MANIKPUR	1169/	2848	For Toll building
10	Additional Area (RHS)				1.3883	PF	KESHKAL	BADERAJPUR	SALNA	P1335	P2877	For Junction development
11	Additional Area (LHS)				1.2010	PF	KESHKAL	BADERAJPUR	SALNA	P1335	P2877	For Junction development
12	Additional Area (LHS)				0.4013	PF	KESHKAL	BADERAJPUR	SALNA	P1335	P2877	For Junction development
13	Toll (RHS)			45	0.0669	PF	KESHKAL	BADERAJPUR	SALNA	P1335	P2877	For Toll building
14	119+522	120+817	1295	45	5.8554	PF	KESHKAL	BADERAJPUR	SALNA	P1335	P2877	Area as per polygon Size
15	120+817	121+222	405	45	1.8179	OA	KESHKAL	BADERAJPUR	SALNA	OA1522	2989	_DO_
			7659	Total	41.2862							

Note: -1 Compartment wise Forest land diversion Area is as per polygon size (with shape of particular compartment) in between particular chainage. In general, proposed with of Project road is 60 meters but in Forest area PRoW is restricted to 45 meters.

Date:- 04/06/21
Place:- Dhamtari

Project Director
NHAI – PIU Dhamtari , Chhattisgarh

Name: - Savyasachi Choudhury

04/06/21

Seal & Signature

PROJECT DIRECTOR
NHAI,PIU,Dhamtari(C.G.)

वन परिक्षेत्र अधिकारी
मोहगांव

Divisional Forest Officer
Keshkal Division
Keshkal (C G.)

Note: - 1 Compartment wise Forest land diversion Area is as per polygon size (with shape of particular compartment) in between particular chainage.

In general, proposed width of Project road is 60 meters but in Forest area PRoW is restricted to 45 meters.

2.4.2 Impact Zone:

Impact zone consists of 10 Km radius of the proposed alignment which passes through Forest area of Dhamtari, Kanker and Keshkal Forest divisions. Details of forest area compartment wise, division wise is annexed as **Annexure-2**

TABLE 2.4 Abstract of Forest area falling in Core and Buffer zone.

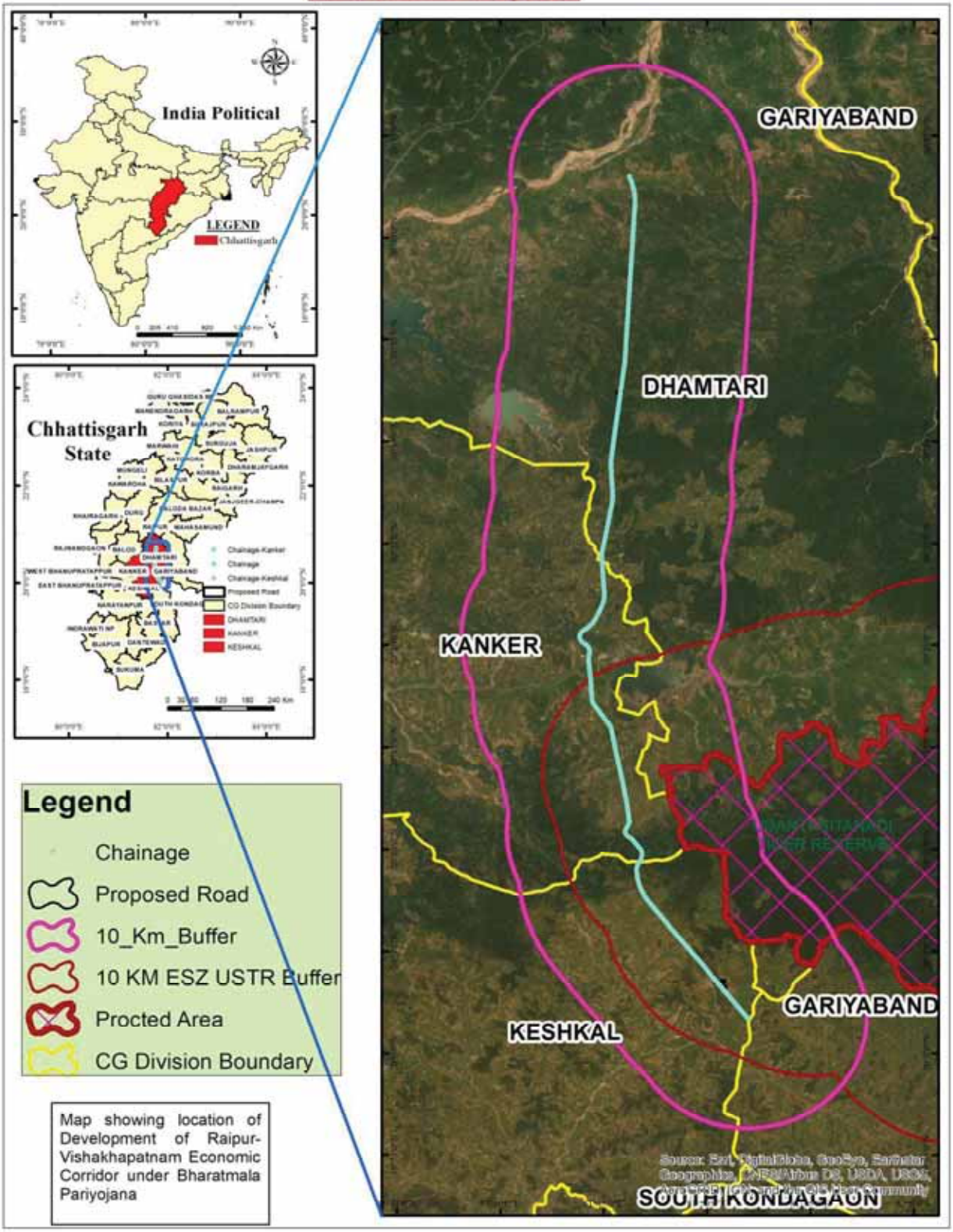
S.No.	Forest Division	RF		PF		OA		Total	
		No. of Comptt.	Area in Ha.	No. of Comptt.	Area in Ha.	No. of Comptt.	Area in Ha.	No. of Comptt.	Area in Ha.
1	USTR	56	9932.262	0	0	0	0	**56**	**9932.262**
2	Dhamtari	203	52097.09	22	1976.948	0	0	**225**	**54074.038**
3	Kanker	94	18212.709	0	0	121	2805.323	**215**	**21018.032**
4	Keshkal	39	9600.831	22	3336.507	15	468.31	**76**	**13405.648**
Total		**392**	**89842.892**	**44**	**5313.455**	**136**	**3273.633**	**572**	**98429.98**

The boundary of Impact zone (10 Km radius) passing through approx. 35.02 km of length in Eco Sensitive Zone of Udanti- Sitanadi Tiger Reserve.

It should be noted that **the proposed road alignment is not passing through the Protected Area.**

Special attention was taken while studying flora and fauna of the Eco Sensitive Zone of Udanti-Sitanadi Tiger Reserve.

LOCATION MAP
NHAI Project



Map showing location of Development of Raipur-Vishakhapatnam Economic Corridor under Bharatmala Pariyojana

2.5 Topography:

The topography of the Impact zone has been studied using the Survey of India Toposheet considering the elevation and drainage pattern including drainage order.

Topography of Project area and Impact zone(10Km radius) falls within the Reserve and Protected Forest of Dhamtari forest division, where the terrain mostly flat to gentle slope. Kanker and Keshkal divisions falls within the Orange area,RF/PF, where the terrain is gentle slope to hilly.

A tunnel is proposed in the forest area of Keshkal Forest Dn. for vehicular movement.

River and Nalas:

Small river and water passage(Nala) passing through the core zone i.e. Amanala,SalariyaNadi in Birgudi range, Kanda nala in South Singpur range and Narharanala in Keregaon range of Dhamtari forest division.

Jhuranala in Kanker Forest Dn.

Bhawarseekh Nadi, Khurdahi nala in Baderajpur range of Keshkal division.

2. 6 Land Use and Land Cover (LULC) analysis:

The digital image processing has been performed using ERDAS imaginary software tools and Garmin 12 GPS have been used for ground truthing.

Necessary care has been taken to identify proper land use classes, the interpreted map was verified on ground at limited points and final land use / land cover map was prepared.

2.6.1 Land use / Land cover classification for Project area and Impact zone:

Digital image processing was carried out to delineate various land use/ land cover categories in 10 Km Impact zone viz Forest with various density classes, built up area, crop area land with or without scrub, water bodies etc.

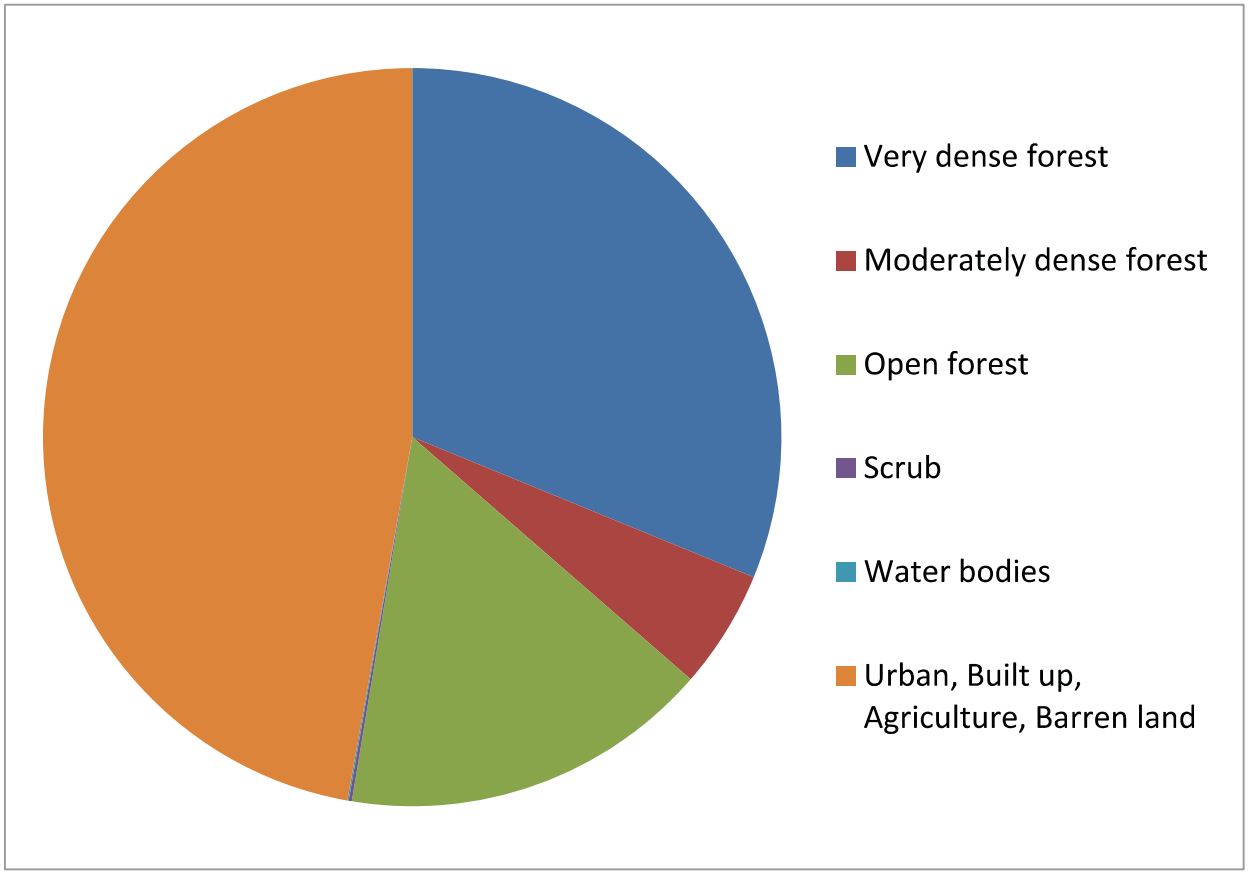
Various land use classes are – Very dense forest, Moderately dense forest, Open forest, Urban, Built up, Agriculture, Barren area, Scrub land , Water bodies.

The land use cover statistics of Project area is shown in table below

Table 2.5 Land use land cover of Project area

S No	Class_Name	Area_in Ha
1	Very dense forest	134.660
2	Moderately dense forest	22.470
3	Open forest	70.525
4	Scrub	0.610
5	Water bodies	0.250
6	Urban, Built up, Agriculture, Barren land	517.0875
	TOTAL	**74513**

LULC Project area

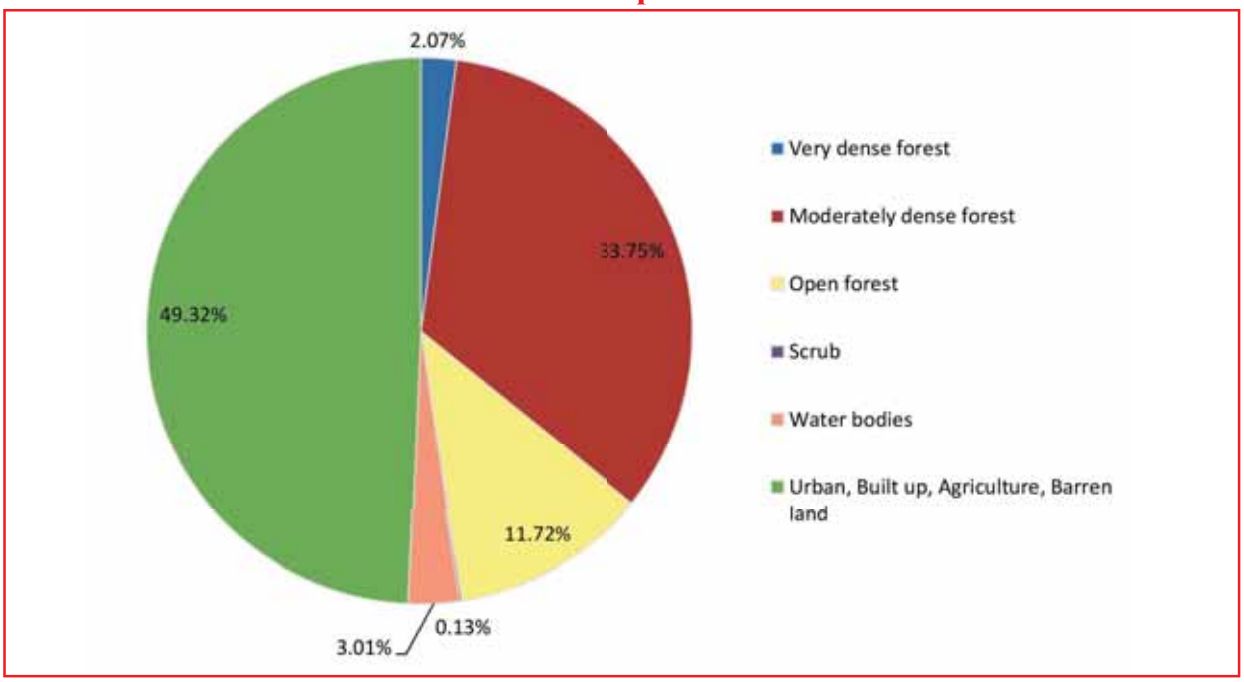


Land use land cover statistics of Impact zone (10 Km radius) is shown in table below

Table 2.6 Land use land cover of Impact zone

Land use land cover class	Area in Ha.	Area in%
Very dense forest	3755.370	2.07%
Moderately dense forest	61228.330	33.75%
Open forest	21266.854	11.72%
Scrub	242.594	0.134%
Water bodies	5451.822	3.006%
Urban, Built up, Agriculture, Barren land	89463.694	49.32%
Total	**181408.664**	**100%**

LULC : Impact zone



2.7 Demography of the villages- Project area and Impact zone(as per census 2011)

There are 752 villages in core and buffer area of the NHAI project. Out of that 244 villages comes under Dhamtari district, 430 villages comes under Kanker district 78 villages comes under Kondagaon district.

Agriculture scenario in Chhattisgarh state:- Favorable soil and climatic conditions helped state to be a prominent producer of Paddy, Jwar, groundnut, oilseeds, gram, wheat .

The major crop seasons are Kharif and Rabi.

Area under Kharif(Ha.)- 1197247

Area under Rabi (Ha.)- 398144

Table 2.7 Demographical statistics of the districts on various parameters

No.	District	Poplulation		Sex ratio		No. of household	Population density	Literacy rate	SC%	ST%
		M	F	M	F					
1.	Dhamtari	397897	401884	1000	1010	170590	196	78.36	7.32	25.96
2	Kanker & Keshkal*	373338	375603	1000	1006	160482	105	70.29	4.21	56.38

*In 2011 Keshkal was part of Kanker district.

Table 2.8 Demographical statistics of the districts (Impact Zone)

No	District	Poplulation		Sex ratio		No. of household	Literacy rate	SC%	ST%
		M	F	M	F				
1.	Dhamtari	151002	152515	1000	1010	64739	78.36	7.32	25.96
2	Kanker	148514	149415	1000	1006	63840	70.29	4.21	56.38
3	Kondagaon (Keshkal)	26955	27119	1000	1006	11587	70.29	4.21	56.38

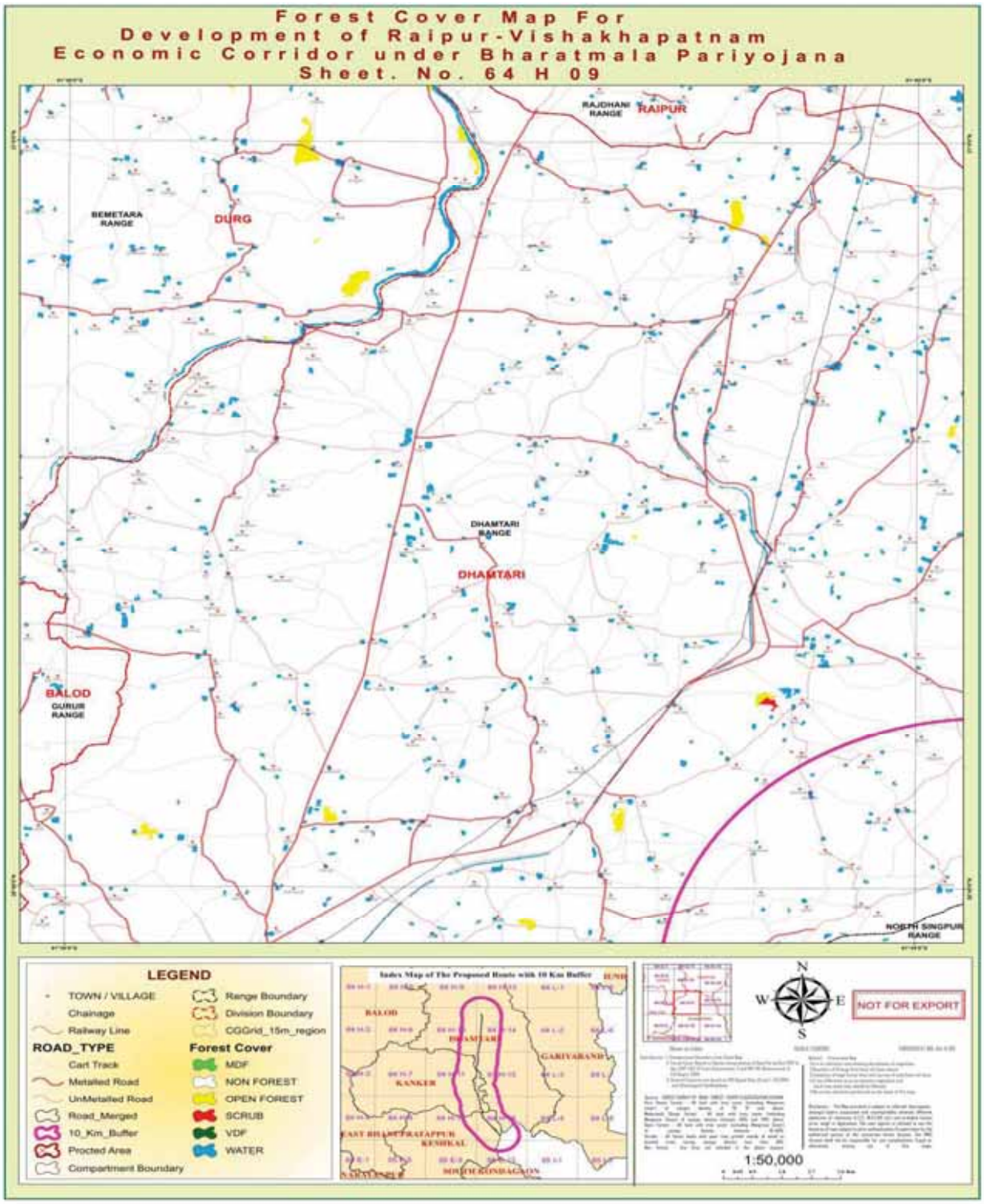
*In 2011 Census Kondagaon (Keshkal) was part of Kanker district.

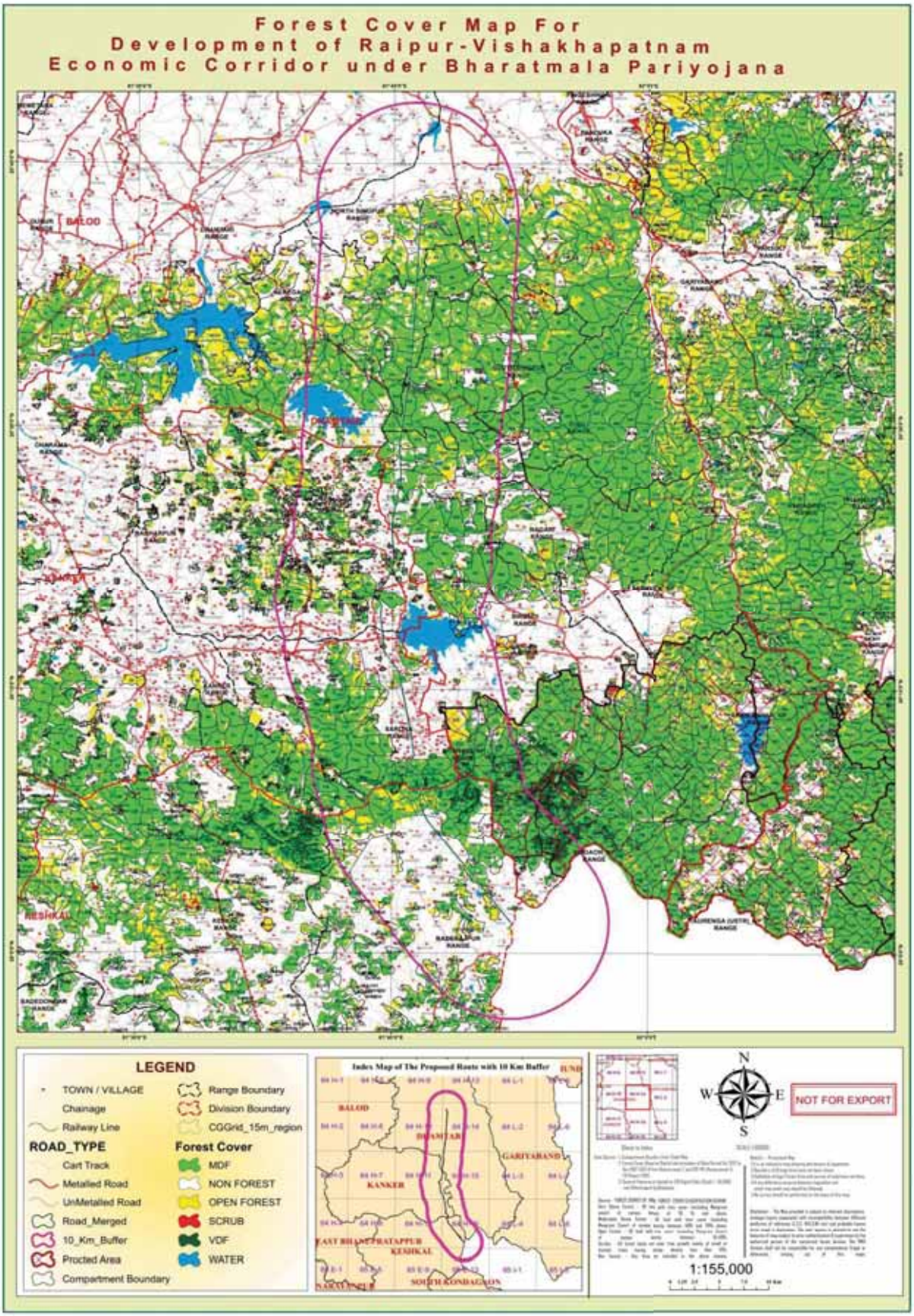
District wise List of villages Project area and Impact zone is annexed as..... **Annex. No. 2**

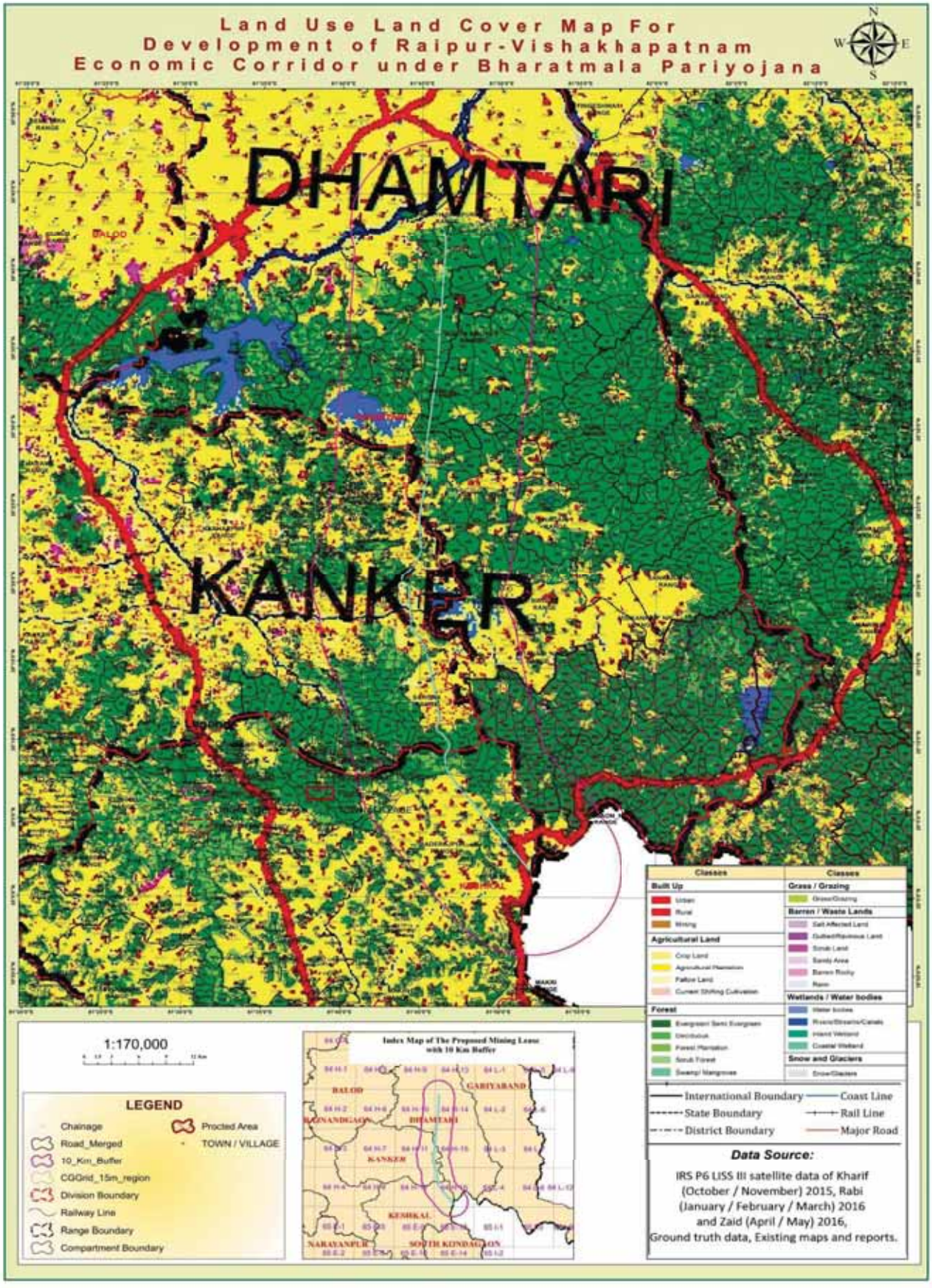
Cropping pattern in Impact zone:

Approximately 35% land is cultivating land. Most of the cultivated land belongs to single crop land. The area is characterized by yellow to red soil ranging from sandy loam, lateritic soil, in some patches with poor moisture retention, cultivation near forest are rich in forest humus and Potash.

The major crop is Paddy, followed by Jwar, Kodo ,Kulthi, Urad, Maize and oil seeds like Til, Kusum, Rapsid, Lentil etc.




Forest Cover Map For
Development of Raipur-Vishakhapatnam
Economic Corridor under Bharatmala Pariyojana
BALOD
DHAMTARI
KANKER
KESHKAL
LEGEND
TOWN / VILLAGE
Chainage
Railway Line
ROAD_TYPE
Cart Track
Metalled Road
UnMetalled Road
Road_Merged
10_Km_Buffer
Procted Area
Compartment Boundary
Range Boundary
Division Boundary
CGGrid_15m_region
Forest Cover
MDF
NON FOREST
OPEN FOREST
SCRUB
VDF
WATER
Index Map of The Proposed Route with 10 Km Buffer
BALOD
DHAMTARI
GARIYABAND
KANKER
KESHKAL
N
W
E
S
NOT FOR EXPORT
1:155,000


Land Use Land Cover Map For
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Economic Corridor under Bharatmala Pariyojana
N
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S
DHAMTARI
KANKER
1:170,000
LEGEND
Chainage
Road_Merged
10_Km_Buffer
CGGrid_15m_region
Division Boundary
Railway Line
Range Boundary
Compartment Boundary
Procted Area
TOWN / VILLAGE
Index Map of The Proposed Mining Lease with 10 Km Buffer
BALOD
GARIYABAND
DHAMTARI
KANKER
KONDAGAON
KESHKAL
NARAYANPUR
SOUTH KONDAGAON
Classes
Built Up
Urban
Rural
Mining
Agricultural Land
Crop Land
Agricultural Plantation
Fallow Land
Current Shifting Cultivation
Forest
Evergreen/ Semi Evergreen
Deciduous
Forest Plantation
Scrub Forest
Swamp/ Mangroves
Classes
Grass / Grazing
Grass/Grazing
Barren / Waste Lands
Salt Affected Land
Gullied/Ravinous Land
Scrub Land
Sandy Area
Barren Rocky
Rann
Wetlands / Water bodies
Water bodies
Rivers/Streams/Canals
Inland Wetland
Coastal Wetland
Snow and Glaciers
Snow/Glaciers
International Boundary
State Boundary
District Boundary
Coast Line
Rail Line
Major Road
Data Source:
IRS P6 LISS III satellite data of Kharif (October / November) 2015, Rabi (January / February / March) 2016 and Zaid (April / May) 2016,
Ground truth data, Existing maps and reports.

Chapter-III
METHODOLOGY FOLLOWED

3.1 Methodology followed for ecology study :

The study for the Flora and Fauna of the project area and Impact zone give ample idea to formulate a Wild life Conservation and Management Plan required for NHAI Bharat Mala Project of Chhattisgarh stretch.

An eco-system can be studied from different perspectives, this report has tried to explore various aspects of the study area to understand mostly of the forest eco–system and associated one. For this study sampling techniques was followed.

The study is a rapid one conducted in the month of April-June2021.

3.2 Faunal Study:

- For Faunal identification, primary data was prepared by interaction with field staff and local people, even from identification of field sign and call of the animals. Indirect evidences and information collected from forest dept. staff, villagers etc.
- Secondary data on Fauna was collected from working plan of concerned Forest divisions, Wildlife offence cases, conflict data.
- Different habitat was also indicative of presence of particular type of animal in those habitats.

An ecological survey for understanding the Fauna of the study area was conducted, particularly with reference to listing of species and assessment of the existing base line ecological conditions of study area in the following manner:

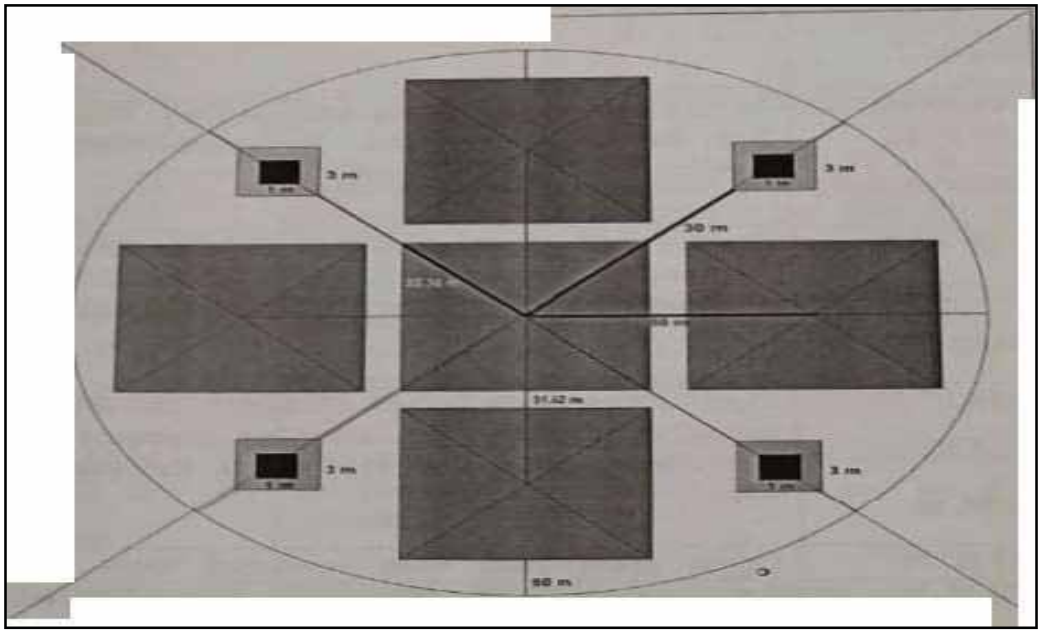
- **Direct Count Method:** Track census was the effective method for detecting richness, followed by camera trapping and direct faunal count.
- **Transect Method:** Line transects method was followed for estimation of abundance of population.
- **Dropping/ Scat:** Dropping and scat analysis are survey technique in which presence animals are recorded without capturing or even seeing them and are most useful technique for identifying species that are present in that area.
- **Interaction with Local villagers:** Forest dwellers are well aware of the species found in the forest area as they frequently come across with these species when they go to the forest for many reasons. The data recorded through interaction with local people an additional support of the presence of certain species in the study area.
- **Geo-reference:** GPS locations of the area where species or evidences of species were collected for our reference.

3.3 Floral Status study:

Study of the forest type was done through visit both Project area and Impact zone involved in the project for primary information regarding the varying forest types of the region. The secondary information was gathered from the concerned forest division.

- Status of floral species was assessed in representative vegetation types existing in the study area.
- Quantitative data was collected using Quadrant sampling method.
- Status of tree, shrubs and annuals (grass and herbs)was assessed using sample plots of different sizes.
- Plant species ascertained from the secondary sources was included in the report as Annexure along with the field data to give near complete floral list of the study area.
- Species of Economical, Ecological and Ethno botanical importance was identified.
- Types of Forest area and its conservation status were observed to the best possible extent.
- Information on the dependence of local people on minor forest products was also assessed.

The vegetation survey was randomly conducted in a sample plot of size 31.62 m X 31.62 m in each of the compartments falling in core and buffer area of the Highway project



3.4 Canopy statistics:

Canopy cover (CC) is an important indicator of the forest habitat conditions, the movement and behavioral pattern of large mammalian herbivores as well as birds and several groups of insects are dictated to a large extent, by the status of canopy cover. The overall forest cover may easily be estimated from the satellite imaginary. However, within the forest area shows, different patches of the forest understandably showed different characteristics, depending on the floral composition, age structure of the stand and the history and degree of perturbationlike fragmentation and felling etc. Instead of depending on the generalized satellite estimation, a more direct and authentic estimate of canopy cover was undertaken by the study team by physically measuring the canopy spread.

We have adopted a geometric measurement to estimate CC, by directly measuring the crown diameter at right angle in specific quadrant. Half of the average of these diameters gives the mean radius of the canopy, hence the mean canopy area of each tree can be calculated as $2\pi r$ (where ri is the mean canopy

radius for i^{th} individual tree). The total canopy cover area (CC) in a sample quadrant equals the sum total of the canopy area of all trees within the quadrant, $\sum \pi r^2$ Thus the Canopy Cover Index (CCI) is the ratio of C to A where A = XY , (X and Y denoting axes of the quadrant being measured.) Open canopy inferred when CCI <0.4.

3.5 Ethno-botanical Study:

This is the study related to use of the different plant species by the local people for food, medicine and other traditional uses.

- Information on plants associated with food, medicine, material culture and worship. The conservation aspects of the community, natural history, ethnology has been observed by interviewing and asking villagers by doing Rapid Ethno botanical Appraisal (REA as suggested by Martin (!995)). REA is a method by which quick assessment of ecological knowledge and resource use can be studied and assessed. This technique is adopted from various disciplines to form a collaborative approach.
- Study team was accompanied by some of the villagers and forest field staff to identify the species of importance to the local people.
- Ethno-botanical information has been collected for this study from the following sources also, these are (a) Old literature (b) Oral history.
- The present study was done with many sources such as secondary data available in various forest divisions working plan, field observation and notes taken on Herbarium, and recorded natural history, ethnologist etc. In the present study all the tools mentioned above have been taken as source of information.

List of Ethno-botanical importance species **Annexure-3**

3.6 Study techniques adopted and details of visit:

- All the topographical details were collected for the Survey of India Topo Sheets
- The Village list and demographic composition has been collected from 2011 Census Report.
- Data were collected from prevailing Working Plans of the forest divisions.
- A questionnaire has been prepared with our own developed model for the survey of field data.
- Wild life movement and presence data collected from the concerned forest divisional records.
- Flora and fauna study have been done by field visit and in consultation with Forest Field Staff and villagers and confirmation by divisional working plan.

3.7 Records Referred:

The following books/records were referred for preparation of site specific conservation plan.

1. State of India's Forest Report-2019; Forest Survey of India. Dehradun
2. Champion H G. and Seth S K. (1968). A revised survey of forest types of India.
3. Right of Passage-Elephant corridors of India - Wildlife Trust of India.
4. Working Plans of Dhamtari, Kanker and Keshkal Forest Divisions
5. Book on Indian Birds by Salim Ali
6. Wildlife (Protection) Act 1972
7. WII (2016). Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife. Wildlife Institute of India, Dehradun, India

3.8 Survey and data collection team:

The team of ***"We the Foresters Welfare Society"*** visited the project area and its buffer zone during March-April 2021 with an objective to gather first-hand information of Flora, Fauna and Ecological status of the study area.

Sr. No	Member Name	Expertise
1.	Mr. Chandra ShekharTiwari IFS Retd. CCF (Wild Life)	Wild life Conservation and Forest management
2	Mr. Narendra Kumar Pandey IFS Retd . CCF	Forest Management, Wild life conservation and Forest Protection
3	Mr. Atul Shrivastava, SFS Retd. ACF	Forest management and Protection
4	Mr. Shirish Sinha SFS Retd. ACF	Wild life management, forest Protection
5	Mr. Dilip Kumar Verma, SFS Ex. Forest Officer	Forest Management, Environmentalist, Statistical Data Analyst

Accompanied by field staff from NHAI .

(Photographs of field visit)


कार्यालय

Chapter-IV

STATUS OF FLORAL DIVERSITY

4.1 Description of Forest:

The state of Chhattisgarh being placed in Deccan bio-geographical Area, which is an important part of rich and unique biological diversity. What is a more conspicuous is that the state is significantly rich in endemism with respect to many plants having medicinal importance.

Biogeographically, the state comprising representative fauna of central India like the Elephant,Tiger, Leopard, Gaur, Sambhar, Chital, Nilgai and Wild boar etc. The state is a proud possessor of rare wildlife like the Wild buffalo and Hill myna which have been declared as StateAnimal and State Bird respectively and comes under Rare and Endangered species. Apart from the species diversity, the state is also endowed with rich genetic diversity. The variation in the genetic composition of individuals within or among floristic and faunal species is large.

The recorded forest area in the state is 59,772 km2 which is 44.21 of its geographical area. Reserved, Protected and Unclassed Forests constitute 43.13%, 40.21% and 16.65% of the total forest area respectively.

The forests of the state fall under two major forest types, i.e., Tropical Moist Deciduous forest and the Tropical Dry Deciduous forest. The state of Chhattisgarh is endowed with about 22 varied forest sub-types existing in the state.

The prominent floral species found in these areas are as annexed in..... **annexure 4, 5, 6 & 7**

4.1.1 Tropical Moist Deciduous Forests (Sal Forests)

These forests are found in areas of moderate rainfall of 1000 to 1800 mm per annum, mean annual temperature of about 27°C and the average annual relative humidity of 60 to 75 per cent. Found in southern part of Chhattisgarh. The trees of these forests drop their leaves for about 6-8 weeks during the spring and early summer when sufficient moisture for the leaves is not available.

The sub-soil water is not enough to enable the trees to retain their leaves throughout the year. These are very useful forests because they yield valuable timber and several other forest products. The main species found in these forests are

- **Top canopy–** Sal, Saja, Dhawda, Bija, Kusum, Semal, Haldu, Mahua, Mundi etc.
- **Middle canopy –** Lendiya, Jamun, Amla, Char, Harra, Baheda, Baranga, Tendu, Ghont, Bel , Dhaman, Salai, Moyan , Karra etc.
- **Lower canopy –** Dhawai, Dikamali, Doodhi, Harsingar, Gudsakri, Neel ,Chhind etc.
- **Climbers –** Palasbel, Mahulbel, Ram dataun, Kewati, Satavari etc.

4.1.2 Tropical Dry Deciduous Forests (Teak Forests)

These are similar to moist deciduous forests and shed their leaves in dry season. The major difference is that the species of dry deciduous forests can grow in areas of comparatively less rainfall of 1000-1500 mm per annum.

They represent a transitional type; on the wetter side, they give way to Moist deciduous and on the drier side they degenerate into Dry deciduous forests. Such forests are characterized by closed and rather uneven canopy, composed of a mixture of a few species of deciduous trees, rising upto a height of 20 meters or so. Enough light reaches the ground to permit the growth of grass and climbers. Bamboos also grow but they are not luxuriant. The important species are Saja, Dhawda, Bija, Sal, Kusum, Salai, Moyan ,Semal, Haldu, Tendu, Mahua, Mundi etc.

4.1.3 Mixed Forests

The Chhattisgarh Forests are covered maximum with mixed Forests, which includes Teak or Sal mixed with other species like

Saja, Dhawda, Bija, Sal, Kusum, Salai, Moyan ,Semal, Haldu, Tendu, Mahua, Mundi,Karra, Lendiya, Jamun, Amla, Char, Kullu, Harra, Baheda, Bhirra, Ghont, Bel,Dhaman,Dhawai, Dikamali, Doodhi, Harsingar, Gudsakri, Neel, Chhind etc. and Climbers likePalasbel, Ram dataun, Kewati, Satavari, Nasbel etc.

Medicinal plants –

Medicinal trees and plants of various kinds are found in abundance in the Chhattisgarh Forests.

Important ones are: Aeglemarmelos, Azadirachtaindica, Bixaorellana, Buteamonosperma, Asparagus racemosus, Argemonemexicana,Buchananialanzan, Aloe barbadensis, Acoruscalamus, Cassia tora, Curculigoorchioides, Curcuma longa etc.

4.2 Classification of Forest:

As per Champion and Seth the study area (Core and Buffer) in Dhamtari, Kanker and Keshkal Forest divisions can be grouped as follows:

A. Sal Forest:

(a) Moist Peninsular Low Level Sal Forest – 3C/C2e(ii)

(b) Moist Peninsular Valley Sal Forest – 3C/C2e(iii)

(c) Tropical Dry Deciduous Peninsular Sal Forest – 5B/C1e

B. Mixed Forest

(a) Tropical dry deciduous mixed forest - 5A/C3

C. Teak Forest (Plantation area) :

(a) Tropical dry deciduous Teak forest - 5A/C1

4.3 Flora of the study area

During field visit, status of floral species was assessed in representative vegetation types existing in the study area (Dhamtari, Kanker, Keshkal and USTR divisions) Status of trees , shrub , herbs, grasses, climbers found during sample survey, Regeneration status of these species are in the study area is listed below

Table 4.1

Flora of Study area in Dhamtari, Kanker, Keshkal and Udanti-Sitanadi Tiger Reserve

(Result of sample survey)

Trees

Hindi	Scientific name	Family	Regen.	Hindi	Scientific	Family	Regen.
Jamun	Syzygium cumini	Myrtaceae	Inadequate	Moyan	*Lannea*	*Anacardiaceae*	Adequate
Aamla	*Emblica officinalis*	*Euphorbiaceae*	Inadequate	Tinsa	*Ougeinia dalbergioides,*	*Leguminosae*	Adequate
Imli	*Tamarindus indica,*	*Leguminosae*	Adequate	Dhawada	*Anogeissess latifolia, Wall.*	*Combretaceae*	Adequate
Kekad	*Saccopetalum tomentosum*	*Lauraceae*	Inadequate	Tendu	*Diospyros melanoxylon,*	*Ebenaceae*	Adequate
Kachnar	*Bauhinia riegata, Linn.*	*Leguminosae*	Adequate	Dhaman	*Grewia tiliifolia, Vaht.*	*Tiliaceae*	Inadequate
Harra	*Terminalia chebula*	*Combretaceae*	Adequate	Sal	*Shorea robusta, Gaertn*	*Diptarocarpaceae*	Adequate
Haldu	*Adina cardifolia,*	*Rubiaceae*	Adequate	Salai	*Boswellia serrata Roxb*	*Burseraceae*	Adequate
Padhar	*Sterospermum suaweolenus DC*	*Bignoniaceae*	Inadequate	Mundi	*Mitragyna parviflora*	*Rubiaceae*	Adequate
Bel	*Aegle marmelos,*	*Rutaceae*	Inadequate	Mahua	*Madhuca latifolia, Roxb*	*Sapotaceae*	Adequate
Paapara	*Gardenia latifolia,*	*Rubiaceae*	Adequate	Bhirra	*Chloroxylon*	*Meliaceae*	Adequate
Beeja	*Pterocarpus*	*Leguminosae*	Inadequate	Kumbhi	*Careya arborea, Roxb.*	*Myrtaceae*	Adequate
Ber	*Zizyphus jujuba*	*Rhamnaceae*	Adequate		*Schleichera trijuga, Willd.*	*Sapindaceae*	Adequate
Saja	*Terminalia tomantosa*	*Combretaceae*	Adequate	Karee	*Sacceopetalum tomentosum, HK&Th*	*Anonaceae*	Adequate
Lendia	*Lagerstroemia parviflora, Vahl*	*Lythracae*	Adequate	Kasai	*Bridelia retusa, Spreng.*	*Euphorbiaceae*	Adequate
Bhelwa	*Semecarpus anacardium, Linn*	*Anacardiaceae*	Adequate	Achar	Buchanania latifolia, Rexb.	Anacardiceae	
Amaltas	Cassia fistula, Linn.	Legumisosae		Kewlar	Bauhinia purpurea, Linn.	Leguminosae	
Sehra	Bauhinia retusa,	Leguminosae		Palash	Butea monosperma,	Leguminosea	

Shrubs and Herbs

Dhawai	*Woodfordia*	*Lythraceae*	Adequate	Bay	*Embelia*	*Myrsinaeasae*	Adequate
Dikamali	*Gardenia*	*Rubiaceae*	Adequate	Charota	*Cassia tora,*	*Leguminosae*	Adequate
Indrajat	*Petalidium*	*Acanthaceae*	Inadequate	Mororfali	*Helicteres*	*Sterculiaceae*	Inadequate
Gud sakari	*Grewia hirsuta, Vahl*	*Tiliaceae*	Adequate	Safed musli	*Chlorophytum tuberosum,*		Adequate
Gokhru	*Tribulus terrestris, Linn*	*Compositae*	Adequate	Chhind	*Phoenix acaulis, Buch*	*Palmae*	Adequate
Chirchira	*Achyranthes aspera, Linn*	*Amaranthaceae*	Adequate	Chirayta	*Swertia angustifolia,*	*Acanthaceae*	Adequate

Hindi name	Scientific name	Family	Hindi name	Scientific name	Family
Climbers and Parasites					
Dokar bel	*Vitix latifolia, Roxb*	Vitaceae	Mahul	*Bauhinia vahlii, W&A*	Leguminosae
Nashbel	*Spatholobus roxburghii, Benth*	Leguminosae	Malkangani	*Celastrus paniculata, Willd*	Celastraceae
Plasbel	*Butea superba, Roxb*	Leguminosae	Ramdataun	*Smilax acrophylla,Roxb*	Liliaceae
Kewati	*Ventilago*	Rhamnaceae	Shatavari	*Asparagus racemosus*	Liliaceae
Bamboos and Grasses					
Bans	*Dendrocalamus strictus*	Graminae	Doob	*Cynodon dactylon*	Graminae
Baru	*Sorghum*	Graminae	Sukla	*Heteropogon*	Graminae
Ghadela	*Cynodon dactylon,pers*	Graminae	Gunhar	*Themeda*	Graminae
Sabai	*Eulaliopsis binata*	Graminae	Chhir	*Eragrostis diarrhena*	Graminae

4.4 Endangered flora in study area (REET SPECIES)

Floristic Study of the erstwhile seven district of Chhattisgarh was made by National Botanical Research Institute, Lucknow and identified 45 species as endangered taxa of the state.

In study area, following species has been identified during field visit and survey.

Table 4.2 REET species

Sl. No.	Scientific Name
1	Butea monosperma varlutea (Parsa)
2	Chlorophytum arundinaceum baker (Safedmusli)
3	Chlorophytum tuberosum baker (Safedmusli)
4	Clerodendrum serratum (i) moon (Chantakarni)
5	Cordia rothilroem and schult (Lasoora)
6	Costus speciosus (Koen) (Kanda)
7	Curculi goorchioides gaertn (Kali musli)
8	Curculi goangustifolia roxb (Tikhur)
9	Curcuma aromatic salish (Van haldi)
10	Curcuma caesiaroxb (Kali Haldi)
11	Embelia tsjerian-cottom A Dc (Baibriang)
12	Euphorbia fusiformisbuch-ham (Duddhi)
13	Gloriosasuperba L Kalihari

14	Oryzameyeriana Maillis spgraulata takeoka (Jangli Dl)
15	PlumbagoZeylanica L (Chitra)
16	Pterocarpus marsupium roxb (Bija)
17	Smilax Zeylanica (Ram Dataun)
18	Terminalia arjuna (Koha)
19	Spilanthus calva DC (Akarkara)
20	Swertia angustifolia buch ham ex D Don (Chirayata)
21	Madhuca longifolia (Mahua)
22	Tylophora indica (Burm f) Merr (Anantmool)
23	Brginea indica (Kunth) Roxb (Gondila)
24	Diosporos paniculata (Tendu)

Sal Forest

Teak Forest

Chapter-V
STATUS OF FAUNAL DIVERSITY

Geomorphology of the region affects the occurrence of wild animals. Composition of species depends directly upon the plant and vegetative composition and climatic condition in habitats.

As per the reference available in working plans and field data collection, the faunal diversity status has been recorded in study area as follows-**Elephant, Panther, Sloth bear, Cheetal, Barking deer, Nilgai, Wild Boar, Jackal, Rabbit, Monkey, Porcupine, Palm Squirrel, Jungle cat, Hyena etc.**

As per the report of Tiger census (status of tigers co predators & prey in India) 2018 in Udanti Sitanadi Tiger reserve 01 Tiger observe inside the PA. Details of report annex as ……..……**annexure 3.**

The detailed list of Fauna seen reported in Project area and Impact zone is attached as

..... **annexure 8, 9, 10 & 11.**

5.1 Avifauna:

Because of luxuriant forest growth, tall tree, thick ground covers and shrubs, water bodies and wetlands, the area contains vast variety of birds.

The birds commonly seen in Project area and Impact zone are Spotted dove, Collared dove, Golden oriole, Jungle babbler, Tree pie, Black hooded oriole, Muniya, Tailor bird, Paradise flycatcher, Bush lark, jungle fowl , King fisher, Blue Jay etc.

With a number of rivers and water bodies with sufficient food material, the area also contains a large variety of Aquatic birds Asian open bill, Glossy ibis, Cattle egret, Grey heron, Little cormorant, Whistling duck, Common teal, Lapwing, Snipe, Water hen etc.

5.2 Reptiles:

The reptiles found in the Project area and Impact zone are- common garden lizard, monitor lizard, Chameleon, Kobra, Python, Rat snake, Common krait, Banded krait, Russel's viper, Water snake etc.

5.3 Fish:

The fish reported in Project area and Impact zone - Bata, Katla, Rohu, Magur, Singhi, Nanbus, Punti, Kotri, Mirgal etc.

5.4 IUCN Red List Categories:-

IUCN, now known as World Conservation Union with the headquarter at Gland Switzerland is the premier coordinating body for international conservation efforts. It produces directories of specialist who are knowledgeable about captive breeding programs and other aspects of conservation. To highlight the legal status of rare species for the purpose conservation, the International Union for Conservation of Nature and Natural Resources (IUCN) Red List recognized the following categories of species.

Extinct Category	EXTINCT (EX) EXTINCT IN WILD (EW)
Threatened Category	CRITICALLY ENDANGERED (CR) ENDANGERED (EN) VULNERABLE (VU)
Lower Risk Category	NEAR THREATENED (NT) CONSERVATION DEPENDENT (CD) LEAST CONCERNED (LC)
Other Category	DATA DEFFICIENT (DD)

5.4.1 Data Analysis for IUCN Red list category

Among the various species found in the area, Elephant, Panther, Sloth Bear, Four horned antelope, Peacock and python are in schedule 1 of the wild life protection act (1972). As per IUCN red list Elephant, Panther, Sambhar, Four horned antelope, Indian monitor lizard and sloth bear are vulnerable and Hyena is nearly threatened.

5.5 Study of Elephant Movement/Presence in Project area and Impact zone of the NHAI project Chhattisgarh–

Specific information gathered regarding Elephant movement in Project area and Impact zone falling under Udanti-Sitanadi Tiger Reserve, Dhamtari, Kanker and keshkal divisions. For the purpose, last 5 yearsof Division records have been verified and at the same time, data was also collected during field visit and primary information gathered from the local people of study area. The following observations were recorded :

5.5.1 Udanti-Sitanadi Tiger Reserve – In Udanti-Sitanadi Tiger Reserve, the elephant movement observed during rainy season from the month July to October and December to February in the forest area of Sitanadi Range compartment number RF 335, RF 323, RF 324 and Rf325, which are outside of Study Area.

Likewise adjoining to Impact zone of project, presence of herd of 2 Elephants was recorded during the month of April 2019 and herd of 15 Elephants was observed during April 2021 recently in the forest area of Risgaon Range compartment number RF 231, RF 232, RF 250, RF 251, RF 165, RF 166, Rf148 which are outside of Study Area.

5.5.2 Dhamtari- In Dhamtari forest division, forest area of Dugli, Keregaon, North Singpur, South Singpur, Birgudi Range, two herds of elephant namely Chanda group of 22elephants and Sikasar group of 8 elephants in numbers observed during rainy season from the month July to October in compartment number 40, 66, 69, 96,111, 112, 118, 138, 183, 184, 186, 187 .

5.5.3 Kanker – In Kanker forest division, forest area of Narharpur and Sarona Range, **no elephant movement** in last 5 years have been observed in **Project area and Impact zone** of the project.

The movement of elephant observed recently in adjoining forest area (adjoining to buffer area of project), compartment no. OA 1437, RF 213 of Narharpur Range and RF 215, RF 216, RF 217, RF 218. RF 219, RF 220 and RF 226 of Charama Range, which are outside of Study Area.

5.5.4 Keshkal - In Keshkal forest division, forest area of Baderajpur Range, **no Elephant movement** in last 5 years have been observed in Project area and Impact zone of the project.

5.6 Study of Tiger Movement / Presence in Project area and Impact zone of the NHAI project Chhattisgarh –

Specific information gathered regarding Tiger movement in Project area and Impact zone falling under Udanti-Sitanadi Tiger Reserve, Dhamtari, Kanker and keshkal divisions. For the purpose, last 5 years of Division records have been verified and at the same time, data was also collected during field visit and information gathered from the local people of core and buffer area. The following observations were recorded.

5.6.1 Udanti-Sitanadi Tiger Reserve – In Udanti-Sitanadi Tiger Reserve, **no Tiger movement/Presence** in last 5 years have been observed in **Project area and Impact zone of the project.**

However as per secondary data obtained from Deputy Director USTR the presence/movement of Tiger at Kulhadighat Range compartment no. 836, 905, 956, 904, 884 since 2014 is found **outside of study area.**

5.6.2 Dhamtari - In Dhamtari forest division, **no Tiger movement/Presence** in last 5 years have been observed in Project area and Impact zone of the project.

5.6.3 Kanker – In Kanker forest division, forest area of Narharpur and Sarona Range, **no Tiger movement/Presence** in last 5 years have been observed in Project area and Impact zone of the project.

5.6.4 Keshkal - In Keshkal forest division, forest area of Baderajpur Range, **no Tiger movement/Presence** in last 5 years have been observed in Project area and Impact zone of the project.

The Following Tables A,B,C Indicate the Human-Wildlife Conflicts in the divisions of Project and Impact Zone

Table: A- Loss of property and lives by wild Elephant in last four years (2018-2021)

No	Division	Loss due to attack of Wild Elephant and Compensation(Rs.)										Total cases	Total Compensation paid (Rs.)
		Human lives	Compsn. Paid*	Injuries to human life	Compsn. Paid*	Agri crop damage	Area in Ha.	Compsn Paid*	Building House loss	Compsn Paid*	Other property loss	Compsn Paid*		
Year 2018														
1	Dhamtari	0	0	0	0	0	0		0	0	0	0	0	0
2	Udanti-Sitanadi Tiger Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0
Year 2019														
1	Dhamtari	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Udanti-Sitanadi Tiger Reserve	0	0	1	58389	60	30.516	678656	0	0	0	0	61	737045
Year 2020														
1	Dhamtari	0	0	0	0	88	24.86	55950	0	0	2	11000	90	66950
2	Udanti-Sitanadi Tiger Reserve	0	0	0	0	128	41.268	917768	31	331600	6	33300	167	1282668
Year 2021														
1	Dhamtari	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**85362**	**0**	**0**	**12**	**85362**
2	Udanti-Sitanadi Tiger Reserve	**0**	**0**	**0**	**0**	**102**	**-**	**1212912**	**10**	**171758**	**0**	**0**	**112**	**1384670**

Compsn paid* - Compensation paid

Remarks: 1. **No incidences happened of Elephant attack in Kanker and Keshkal division in last five years.**

2. Above instances have been reported outside the study area.

Table: B- Loss of property and lives by wild animals (Other than Elephant) in 2018-2020

Settled Cases

No.	Division	Loss and compensation														Total	Amount
		2018-19															
		Human lives	Compsn Paid*	Injuries to human life	Compsn Paid*	Agri crop dam-age	Area in Ha.	Compsn Paid*	Build-ing House loss	Com-psn Paid*	Cattle loss	Compsn Paid*	Other property loss	Com-psn Paid*			
1	Dhamtari	2	800000	15	257266	8	13.54	182790	28	163000	1	3200	0	0		54	1406256
2	Kanker	3	1200000	4	15623	6	-	27195	93	563700	2	4595	0	0		108	1811113
3	Keshkal	0	0	0	0	11	2.589	17286	36	300000	0	0	0	0		47	317286
4	Udanti-Sitanadi Tiger Reserve	0	0	1	10	2	-	7500	19	138500	0	0	0	0		22	146010
		2019- 2020															
1	Dhamtari	0	0	8	114252	12		168885			41	311000				61	594137
2	Kanker	2	800000	3	89921	1	-	8000	0	0	21	167000	0	0	0	27	1064921
3	Keshkal	0	0	1	20413	4	2.3	11500			24	196500				29	228413
4	Udanti-Sitanadi Tiger Reserve	0	0	0	0	0	0			0	0	0	0	0	0	0	0

Remarks: 1. **Above instances have been reported outside the study area.**
2. Other than Elephant : (Panther, Sloth bear, Wild dog, Hyna)

Chapter-VI

IMPACT ASSESMENT

6.1 General impact:

The aim is to ensure that potential environmental problems are foreseen and avoid data nearly stage in planning cycle so as to pre-empt problems. The EIA mechanism shall be applied to the project in the following order of priority:

- Avoid adverse environmental impact
- Minimize and control adverse environmental impact
- Mitigate adverse environmental impact

It's been observed that there are general impacts on the environment due to linear infrastructure project. Developmental projects have both positive and negative impact on the society and the environment. However to achieve the goal of sustainable development it is necessary to minimize/ mitigate the negative impact with modern technology and scientific study. This project is not left untouched in these aspects.. Such negative impacts are discussed here to help in implementing mitigate measures.

This project has certain impacts on the wildlife and their habitat as it passes through the forest area of Dhamtari, Kanker and Keshkal forest division . It exerts impacts on the soil, water, air, noise, and overall environment.

These impacts are discussed below in details

6.2 Impact on Land:

Road construction mainly affects the natural soil of the area. So quality, texture, water holding capacity of the soil of the project area will be affected during the construction phase. Thus direct loss of vegetation from certain area can be seen.

Anticipated Impact

- The road itself–land requirement, removal of vegetation, fragmentation of natural habitat, removal of buildings and severance of form land causes, direct impact. The most immediate and obvious effect of road development on soil is the elimination of the productive capacity of soil covered by the roads
- Impact of the project construction leading to soil contamination, soil erosion, destabilization of slopes, side-tipping of spoils material, loss of properties, loss of fertility and diversion of natural surface water flow.

Mitigation Measures

- Before finalizing the alignment erosion potential of each alternative should be carefully examined and the one involving least disturbance to the natural ground should be preferred
- Drainage improvement requirements to minimize water logging and flooding due to disturbance of the natural drainage pattern are to be examined
- Afforestation plan to compensate for the cutting of the trees during the proposed road construction activity

6.3 Impact on Water :

Water bodies found in project area are liable to be polluted as many water related activities are going to be utilized which shall directly and adversely affect the quality of the water. But the road design stage has taken care of the drainage across the section as part of good engineering practice which will control the soil erosion and will reduce the impact on the water bodies.

Anticipated Impact

- Impact on surface water flow modifications can contribute to flooding, soil erosion, channel modification and siltation of streams
- Impact on water quality degradation (surface & ground water) can take place due to sedimentation, changes in biological activity in streams and on their banks
- Indicate whether there is a possibility of soil runoff from the bare lands resulting from earthmoving activities such as cutting and filling will cause water quality degradation in downstream water course water bodies

Mitigation Measures

- Leaving buffer zone so disturbed vegetation (within creased in proportion to slope) between road sites and bodies of water
- Mitigation measures such as providing adequate drainage modifications, settling basins, paving, infiltration ditches etc.is to be examined
- Adequate sanitation facilities and hygiene at construction workers colony should be provided
- Environmental specifications for contractors should cover the required safeguards during the

6.4 Impact on Air :

Anticipated Impact

- During the construction phase and the operational phase of the road, there will be increase in emission of exhaust fumes from the vehicles will affect the air quality in general.

- Prediction of impact on ambient air quality using appropriate mathematical model, description of model, input requirement and reference of derivation, distribution of major pollutants and presentation in tabular form for easy interpretation shall be carried out
- Dust pollution generally reduces photosynthesis process in trees which leads to reduce growth of plants and trees. Dust when settled on the grasses, shrubs and even on trees of small height will make them unfit to be used as fodder for the herbivores.

Mitigation Measures

- Planting tall leafy vegetation between roads and human settlements
- Water sprinkling and transporting construction materials with tarpaulin coverage during the construction stage.

6.5 Impact on Vegetation:

Forest clearance in project area has several impacts on the vegetation. The construction of new roads destroys and damages vegetation such as trees, shrub and grasses. This vegetation may provide valuable habitat for wild life. Loss of habitat would result in a reduced carrying capacity of the landscape to sustain wildlife. The degree of impact is likely to be proportional to the width and length of the disturbance corridor.

Some species tolerate very little disturbance (low disturbance threshold). Where a particular critical habitat is restricted, The habitat loss is not only limited within the loss of area alone, but also attributed to the fragmentation of the habitat.

A total 40000 approx. number of trees will be felled, and that will affect to the existing wildlife habitat. The loss of such trees and construction of the road will fragment the existing habitat of the wildlife. The proposed road may also act as a barrier for their movement and safe passage within their home ranges. In addition the effect of this project further leads to degradation of habitat, road accident of wildlife and isolation to the small creature within a small portion of their home range.

6.6 Habitat fragmentation

Linear project like Road dissect contiguous habitat patches, resulting in smaller patch sizes and higher edge-to–interior ratios, making them increasingly vulnerable to outside disturbance. The fragmentation of the habitat into spatially isolated parts is a major cause of the decline of biodiversity; e.g. habitat loss and fragmentation of amphibian population worldwide has led to a substantial decline in their numbers during the last century (Stuart et al. 2004).

Habitat fragmentation has become a global issue associated with most linear form of infra structural development including road. The fragmentation process initiates a shrinking in available habitat, which in turn leads to a progressive reduction in species diversity in the landscape. The contraction in available habitat together with isolation becomes the most important impact.

Anticipated Impact

- Loss of wildlife habitat and biodiversity due to change in land use
- Fragmentation of wildlife habitat and territories
- Changes in water quality, soil profile, noise, light and air pollution, which may affect the nature and character of habitats
- Pressure on habitats wildlife as a result of increased access provided by roads
- Loss of forest resources, economically important plants, medicinal plants and threat to rare, endemic and endangered species

Mitigation Measures

- Provision of animal crossings in identified areas
- Compensate the loss of forest cover age by compensatory plantation programme
- Development of green belt along the alignment
- Regeneration and conservation of flora and fauna including rare plants of economic importance, medicinal plants and wildlife species
- Institutional arrangements for implementation and monitoring of various mitigating measures
- Environmental specifications for contractors should cover management of work forces (control of poaching and fire wood collection), machinery (speed, noise, and traffic), and prevention of erosion and contamination during construction.

6.7 Noise Impact:

The Road project has long term noise effect on the environment as significant noise pollution will be generated both during the construction and its post operational phase. During the construction phase noise will be generated by the movement of heavy vehicular movement, transportation, loading and unloading of earth moving machineries. And after the construction due to movement of a large numbers of vehicles significant amount of noise will be produced which will have significant impact on the wildlife. These are as follows

- Loud noise interferes with the communication systems of wild animals, brings out a “flight or fight” response, and interferes with the behavior of both predator and prey.
- The fact remains that a large number of wild animals rely heavily on auditory signals for their sustenance, defense and reproduction.
- In principle suggest that all artificial source of noise in a natural eco system should be minimized. .
- Noise effect reduces bird population due to muffling of mating calls.

Mitigation Measure

- Adoption of proper surface design and maintenance
- Provision of noise barriers. Specifications for installation of noise protection devices clearly indicating the location, design and material, and also provide for future maintenance requirements
- Prediction model outputs justify the selection of type of the noise barrier and thickness of the noise barrier etc.
- Planting tall leafy and dense vegetation between roads and noise sensitive areas

  Environmental specifications for contractors should cover the required safeguards during construction stage

6.8 Impact of Vehicle head light glare on wild life:

All animals are adapted to rhythm of solar light and darkness and accordingly remain passive or active depending on their nature (diurnal or nocturnal). Artificial lights due to this project may contribute to disturbance of wildlife near roads. It may disorient birds, disturb breeding and foraging behavior in birds, repel spiders and beetles, and influence the behavior of nocturnal frogs.

It is also thought that a flash of artificial light causes an animal to become temporarily blind, popularly called the 'deer-in-the headlights' effect, reducing its chances of avoiding collisions with vehicles. (Rich and Long core 2006)

Headlight glare can interfere with the f lights of birds and bats. It can disrupt homing behavior and mating calls (croaking) of amphibians in wetland habitats, and influence navigational ability and decline in population of reptiles. (Beier 2006, Perry and Fisher 2006)For migrating and dispersing animals, highway lights can be disorienting. Found that dispersing Pumas avoided highways while looking for new habitat and travelled only when they could see clearly the land beyond the highways. However singular impact of head lights or marginal importance unless they contribute to the mortality and barrier effects multiplying the overall effect (Seiler 2001).

Mitigation Measure

Anti-Glare for highways helps improve traffic safety and also could beautify the highway landscape. Anti-glare screens come in different sizes and heights to suit the requirement on site. A reflective tape on these anti-glare screens also helps in identifying the road pattern. Anti-glare for highways is a must where speeds are generally in excess of 80 Km/hr as these help prevent glare of oncoming headlights into the eyes of drivers from the opposite side.

The anti-glare system improves night visibility on roads where drivers are dazzled by cars or other light sources coming from the opposite direction. Anti-glare installations lead to a remarkable reduction of accident rates.

Area of application:

Anti-glare systems are generally recommendable in all places where drivers shall be protected from dazzling lights. Usually, they are installed in the following areas:

- In the median of streets and motorways with several lanes
- On roads with heavy traffic in dark periods
- Between parallel or approaching roads, when traffic runs in opposite directions
- In areas of humps or other unfavorable topographic conditions
- In long curves
- On bridges
- Beside railroad or tram lines running beside roads
- Near buildings which reflect lights towards the road

All new development should use latest management technologies so that continued growth and expansion leads to no increase in the impact of light pollution.

6.9 Impact of Fire on Forests:

A large number of workers (1000 approx) will be engaged during the construction phase. Such large no of labour force may pose serious threat of forest fire. Such fires can cause irreversible damage to plants and animals.

Fire not only destroys plants and displaces animals; it also impacts the soil properties and increases run-off and soil erosion and moisture content.

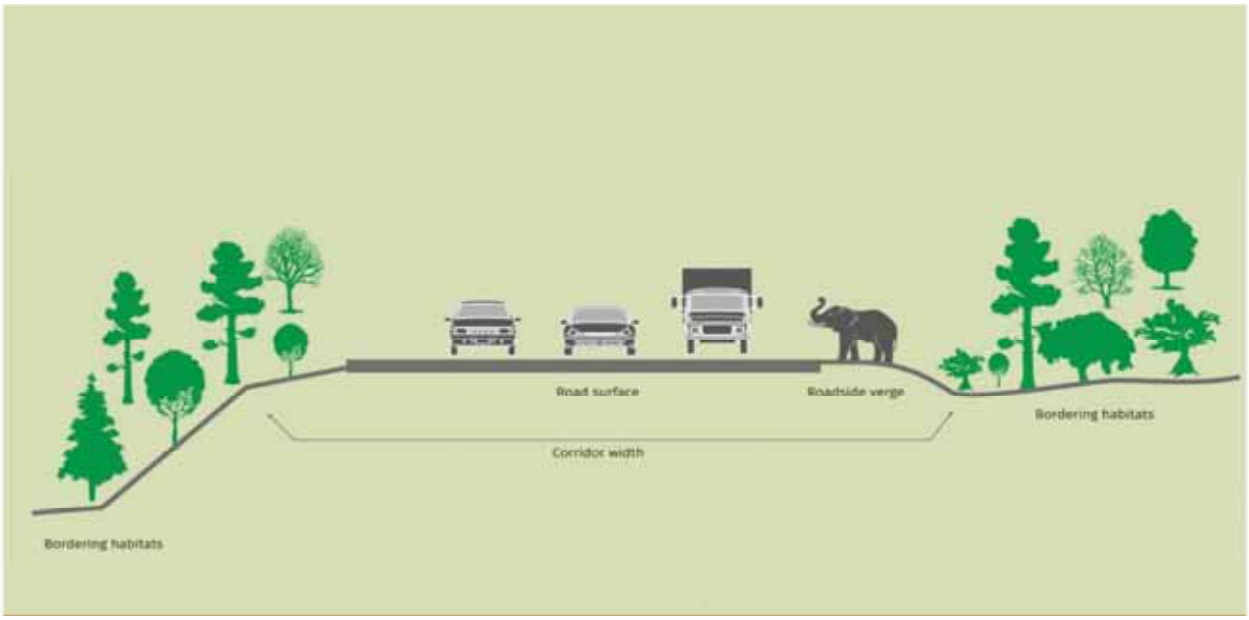
Post fire scenario usually shows temporary increase in forage of fire hardy coarse grasses. Thus affect grazing food chain also.

The project proponent has planned for regular awareness programme among the laborer regarding the importance of the wildlife and will direct them to work carefully in the forest area. Besides, several awareness posters will be posted along the road to aware people on the threat of forest fire which will definitely reduce this threat.

Chapter-VII

GUIDELINES FOR MITIGATION OF IMPACTS ON WILDLIFE

Transportation planners know that highway systems must accommodate other elements of human infrastructure (e.g. water supply systems, sewer systems, electric and gas utilities). Biologists and natural resource planners can define networks of core conservation areas and connectivity zones, effectively defining the ecological infrastructure for a region. They can then work with transportation agencies to ensure that transportation systems are designed to accommodate this ecological infrastructure. Traditionally, highway impacts on wildlife have been viewed in terms of road mortality and threats to selected populations of animals. Viewing this issue from a wider perspective, however, it is clear that both highways have the potential to undermine ecological processes at a landscape scale through the fragmentation of wildlife populations, restriction of wildlife movements, and the disruption of gene flow and meta-population dynamics.



7.1 Mitigation measures;

Mitigation measures essentially fall into two categories

7.1.1 Regulatory or prescriptive measures

That are intended to alter human behavior

- ❖ Speed control
- ❖ temporary road closure
- ❖ control on feeding of wild animals on the road

- ❖ regulatory guidelines for upgrading roads through sensitive habitats and wilderness areas
- ❖ prescriptions for width of verge to be retained in different landscapes and habitats
- ❖ restrictions on stopping/ parking of vehicles on highways segments passing through sensitive habitats

7.1.2 Measures to manage habitat

On or near the site that are intended to influence animal responses.

- ❖ Clearing vegetation for improving visibility along road,
- ❖ Erection of animal proof fencing to prevent animals entering road,
- ❖ Installation of wild life detection systems,
- ❖ Suitable positioning and construction of well scientifically designed underpass or culverts,
- ❖ Retrofitting existing drainage culverts to facilitate crossing by wildlife and animals.
- ❖ Maintenance of hedge rows along the road to serve as movement corridors

7.2 Measures specifically to address habitat fragmentation effects;

These measures for transportation infrastructure fall into two broad categories

- **Structural (Engineering) options**
- **Non-structural options**

7.2.1 Structural (Engineering) options:

There are several types of crossing structures that are used to mitigate impacts on highways corridors on animal movement and safety, fundamentally, these structures are designed either to allow animals to travel below the infrastructure (underpass) or over it (overpass).

The crossing structures are primarily about maintaining connectivity and animal movement and less about reducing animal mortality.

Types of crossing structures - Types of crossing structures (Engineering options)are as under-

- Glider poles
- Bridge or viaduct ,
- Box culvert,
- Fish passages ,
- Fences

Glider poles

These are vertical poles placed in the centre median or on the road or rail verge to provide intermediate landing and launch opportunities for gliding species.

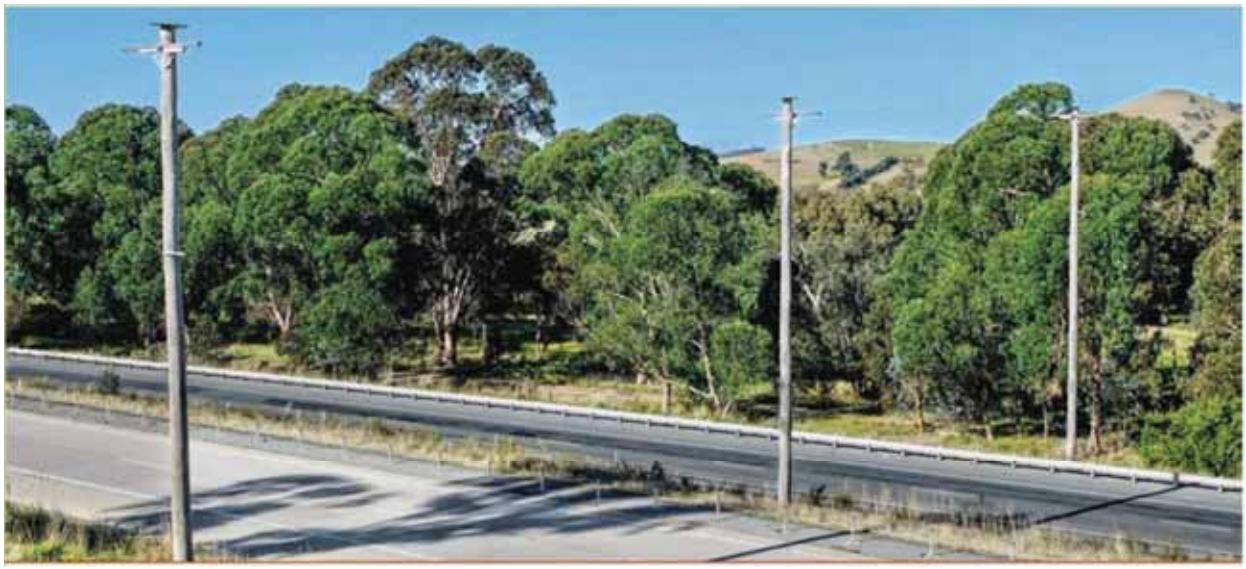
Design considerations:

- Poles should be constructed on the centre median of roads which are wider than the gliding distance of the local gliding mammals.

- While erecting glider poles, the gliding ability of juvenile animals should be taken into account. It is important to consider the ability of juvenile animals to land on a narrow pole after a 50 mglied and their ability to glide as far as adults.

Nest boxes should also be provided for the animals to rest and hide from predatory birds.

Photograph 7.1 – Glider poles



Bridge or Viaduct for underpasses

This type of structure maintains or elevates the grade of the road or railway, allowing for the passage of fauna below. There may be seasonal drainage associated with the viaduct. Viaducts are useful near valley bottoms to lead roads or railway lines across the valley.

Photograph 7.2 – Bridge or Viaduct

Box culverts

These are typically square or rectangular structures built under the linear infrastructure for passage of fauna (including aquatic species) and/or water.

Design considerations

Culverts may be of different types depending on their shape and size, and the need to cater for natural drainage. Adding ledges or planks above the water level in culverts has been shown to encourage many terrestrial species to use the structures. The type of materials and substrate used in the structure, and the establishment of native vegetation at each end of the underpass for cover, are other factors that affect use of underpasses by animals.

Photograph 7.3– Box culvert

Fish Passages

Bridges and arch structures across waterways can facilitate fish movement if the following site and design considerations are incorporated:

Avoid locating bridge piers or foundations within the main waterway channel to avoid the formation of large-scale turbulence or the erosion of the bed and banks of the waterway. Locate bridge abutments well away from the channel banks.

Culverts can also serve as successful fish passages if they are sufficiently large and installed flat to allow the natural movement of bed load to form a stable bed inside the culvert.

Photograph 7.4 – Fish passes

Fences:

Fences are best used in combination with properly placed wildlife crossing structures; they direct animals away from roads or railways and towards these structures. Fencing has been clearly demonstrated to make crossing structures much more efficient and effective. Different fence designs can be used for small or large mammals, amphibians and reptiles.

Design considerations:

Fencing may be erected along the entire length of the linear infrastructure or only along sections known to present a risk to wild animals or livestock. Decisions on continuous or partial fencing will depend on land-use patterns (e.g. private land, forest land). Both sides of the road or railway should be fenced. Fences should be symmetrical and not staggered. Breaks in the fences should have wildlife warning systems, warning signs or cattle guards/gates to avoid animal mortality. The height, material and mesh size of the fence should be decided based on the target species.

7.2.2 Non-structural options

There are as many non – structural approaches provide additional measures for restoring wildlife connectivity across linear infrastructure and helping to improve the permeability of affected habitat, following are the recommendations

(a) Canopy connectivity: The width of the linear cleaning is kept sufficiently small to allow the tree canopy to remain continuous above the clearing.

Where the tree canopy is not continuous, the clearing width is kept small enough to allow gliders (and other flying species) to traverse the clearing safety.

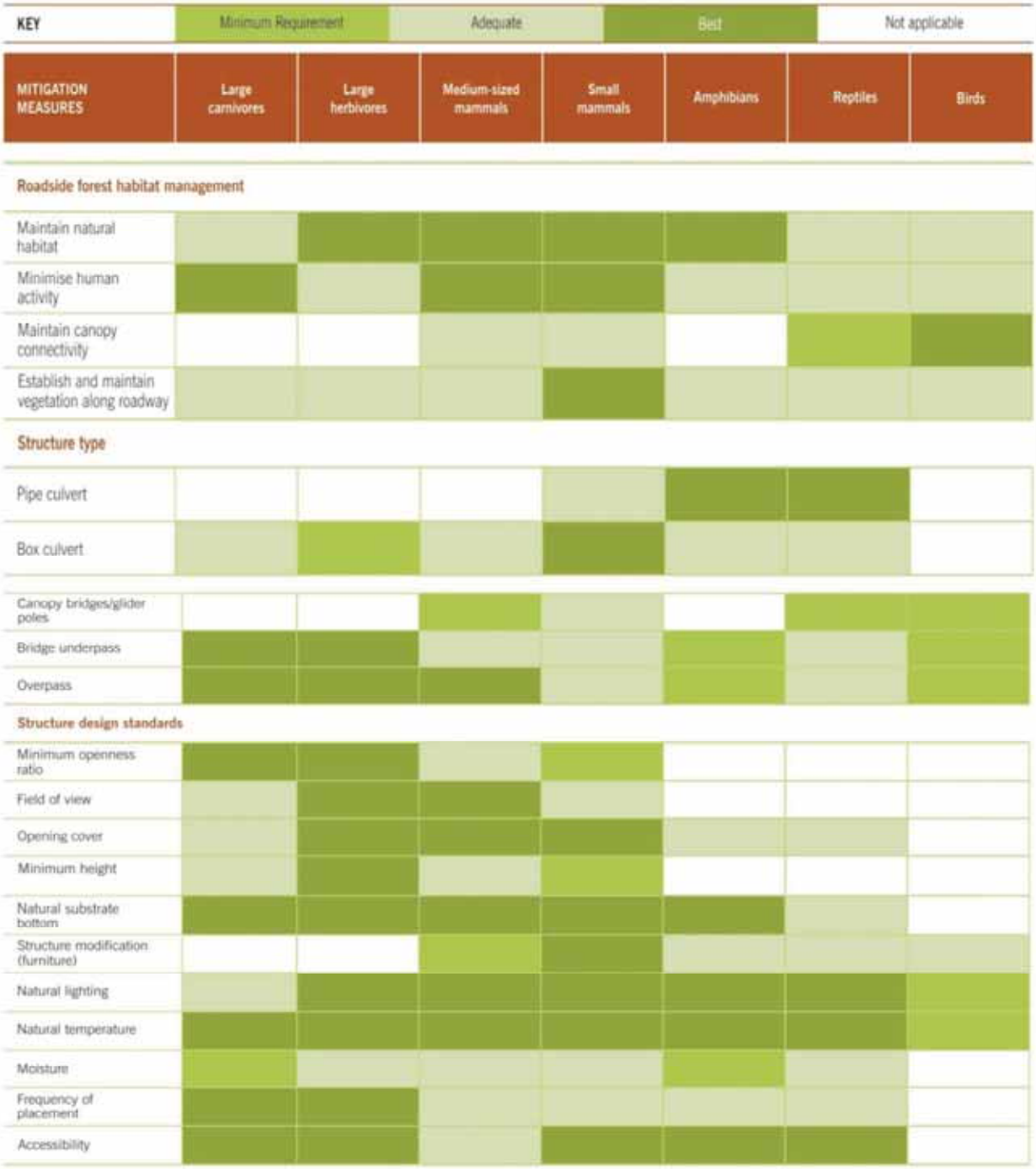
(b) Habitat management: Vegetation or other habitat features (e.g. rocks, fallen timber) are strategically placed, planted or allowed to regrow so that animals are directed to preferred crossing locations. At these locations , animals cross the road or railway line without the aid of any structure (e.g. similar to a pedestrian crossing)

(c) Elevating linear infrastructure: The road or rail is elevated above the vegetation to minimize clearing (limiting it to area required for bridge piers or pylons) and allow natural vegetation to grow under the infrastructure.

(d) Corridor planting: Strips of vegetation are planted on either side of the linear clearing to provide attractive corridors for the animal movement.

(e) Local traffic management: Devices to reduce noise, speed or volume of traffic, convey early warning of risks, are used to manage traffic. They may include noise attenuation walls, road closures, lighting and signage.

Relative importance of different types of strategies and measures for mitigating the impacts of roads on different functional groups of animals



7.3 Factors for enhancing permeability of crossing structure

The design and number of structures to improve the permeability of road corridors must facilitate animal movement across these corridors and maintain habitat connectivity across the landscape.

The design of animal passages must consider the specific requirements and behavior of target species, where communities of animals may be affected, passages will need to be designed and managed to accommodate multiple species with different needs.

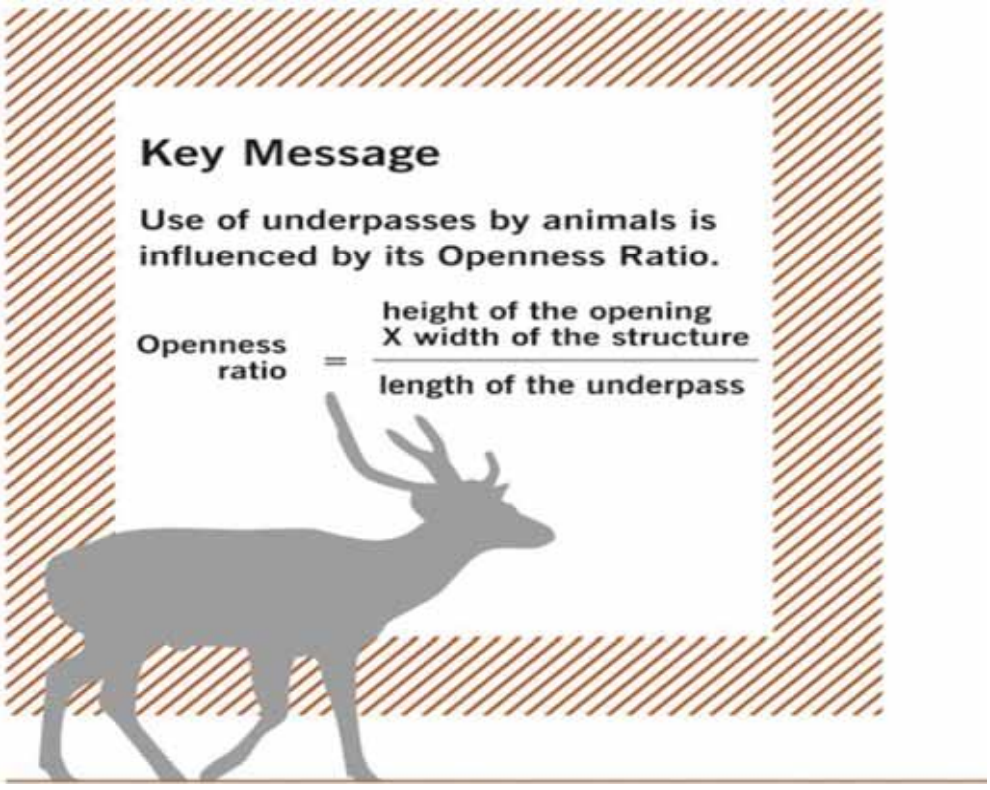
The design must also consider site-specific variables such as vegetation, topography and hydrology.

The types and levels of disturbance must be taken into account too: Traffic/vehicles noise and vibrations may discourage wild animals from using crossing structures.

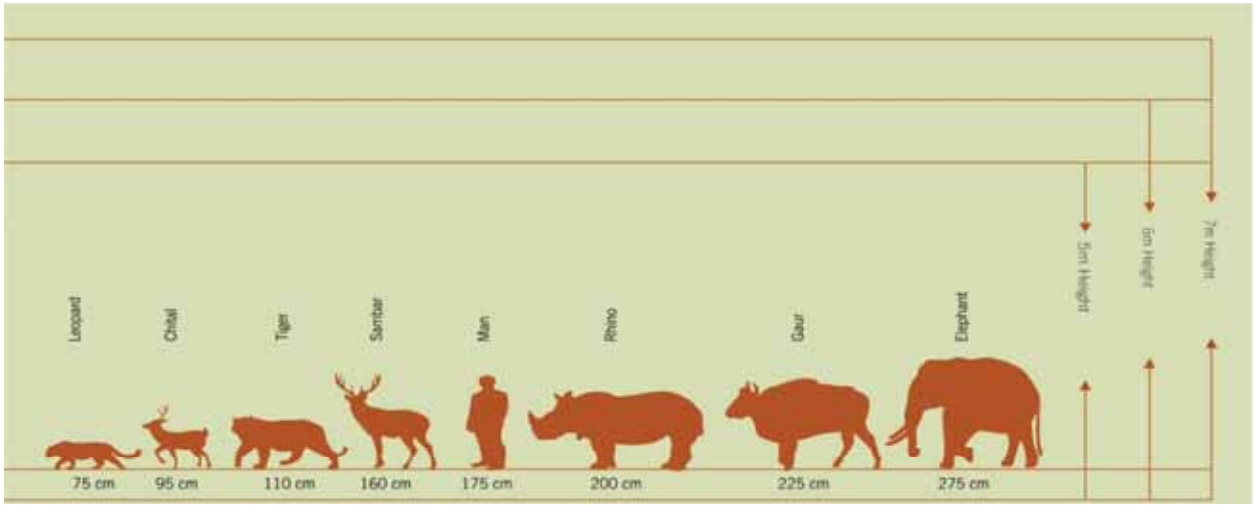
The following sections focus on the design of underpasses as the predominant structural form of mitigation of impacts of roads and railways on wildlife

7.3.1 Designing an underpass

A crossing structure will only be effective if it is accessible and acceptable to the species that will potentially utilise it: its design and size can greatly influence its use. The body size of the animal and its behavior (e.g. solitary or group living, diurnal or nocturnal) will influence the design of the structure. In general, the bigger these structures, the more they are used (Goosem 2001). Where there is little or no research available to determine the appropriate dimensions of a crossing structure for a specific species particularly if that animal is threatened or rare the design should err on the side of caution and cater for relatively large animals.



Underpass heights as one should relate to animals



List of categories of wildlife functional group

Wildlife functional groups	General animals considered (specific to India)
Large carnivores	Tiger, leopard, wolf, wild dog
Large herbivores	Elephant, gaur, rhino
Medium-sized mammals	Sambar, spotted deer, wild boar, bear
Small mammals	Hare, civets, mongoose, mouse and similar sized animals
Amphibians	Toads, frogs, salamanders
Reptiles	Snakes, lizards, turtles, tortoises, crocodilians
Birds	Great Indian bustard, eagles, vultures, munia, dove

7.3.2 Species specific Measures

Its all time important fact to consider, remember and implement the design and construction of wildlife crossings and animal passages to cater for, all of the species using the area affected by the linear infrastructure, to improve the efficiency and effectiveness of mitigation solutions.

Underpasses for terrestrial mammals

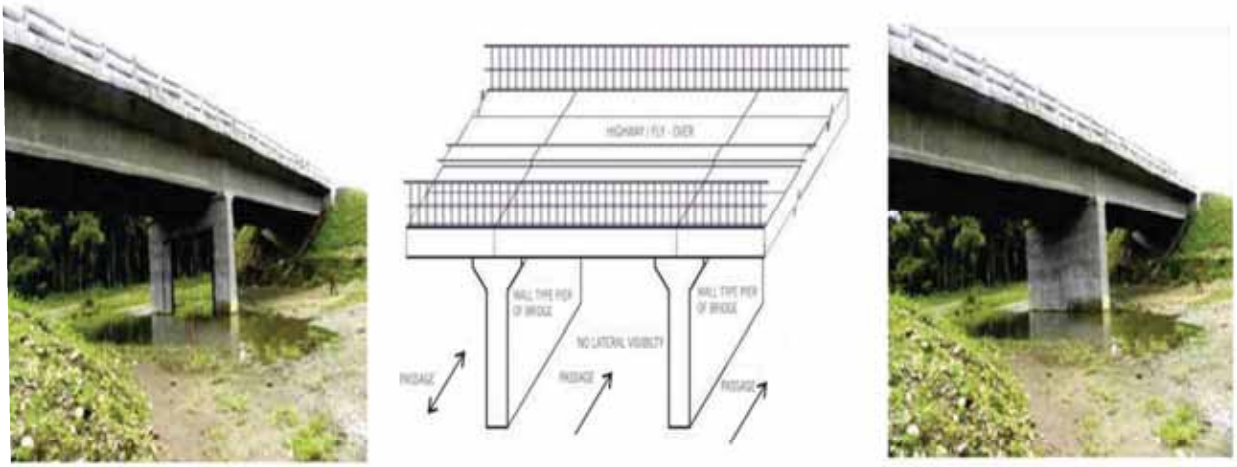
Effectiveness of underpass for the species (Largest animals)						
Chital		Sambhar		Gaur		Remarks
Shoulder height	Openness index	Shoulder height	Openness index	Shoulder height	Openness index	
Upto75cms	.52 (Metric)	Upto 160 cms	1.12 (Metric)	Upto 175 cms	1.22 (Metric)	

Minimum Height of the Underpass according to the average height of the animals

The height of the underpass shall be dependent on the length of viaduct and length of underpass .

For an example if the viaduct is 300mts and length of underpass is 28-30mts the height would be not less than 5 mts.

Photograph 7.5 Diagrammatic representation of isolated and wall piers



7.3.3 Locating wild life crossings

The location of the wild life crossings is critical. Wildlife crossings are very important, it should be built at places where allowing them to use it naturally and maximum. The general locations of the wild life crossings can be decided by ascertaining pathways of animal movement and observations or evidences of habitat use along the road corridor.

Wildlife crossings should be located precisely where animals want to approach road or where they have historically done. Often, animals prefer to choose areas with specific terrain features or vegetation.

In case of roads, a reduction in number of lanes, ridges, valley bottoms, streams and river coarse greatly influence the movements of animals across the landscapes.

The following points should be kept in mind while locating and determining the wildlife crossings

- Perfect survey by qualified person and assessment of the habitat and identify the areas of crossings.
- Local people and ground staff can help in locating the movements of animals.
- Forest cover and habitat maps should be used to decide crossings.
- Local geographical conditions such as drainage lines are indicative factors for probable crossing zones.
- Tracking of animal movement with the help of various scientific methods, historic data of animal crossing zones and reports of killing on road can be used to plan for determining of the locations.

7.3.4 Spacing of wildlife crossings:

Terrain, habitat type, level of human activity, climate and species behavior is some of the factors that influence wildlife movement and ecological flows.

For this reason, the spacing of wild life crossings on a given section of road will depend largely on the viability of the landscape, terrain, densities of animal populations, the prevalence of critical wild life habitat intersecting the transport corridor and the requirement of different species for habitat connectivity.

Other factor that must be considered while locating animal crossings are animal home range sizes, migration pattern and goals of mitigation.

A range and types of wild life crossings should be provided at frequent intervals along the road or railways. It may be appropriate to install several structures in one location to reduce to reduce competition between individual, predator attraction, travel time to a safe crossing and habituation time (Barnes 2007) , as well as increase connectivity incrementally (Jaeger 2007)

7.4 Provision for Safe wildlife passes in forest area :

For the uninterrupted movement of wildlife there is need to enhance permeability of crossing structures which are to be effective and acceptable.

According to the guidelines given in the book **"Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife"** WII (2016)

Suitable underpasses/passageway should be created in forested habitats. Following are the forest division wise list of wild life underpasses.

There are underpasses in Dhamtari Forest Division (19), Kanker Forest Division (6) and Keshkal Forest Division (2)

7.4.1 PROPOSED LOCATIONS FOR ANIMAL UNDERPASS SHOWN IN FOLLOWING TABLE

Table 7.1 Proposed locations of Animal Underpass in all three divisions

No.	Proposed Chainage	Size (No. Width, Height) (M)	Wildlife functional Group
1	43+654	1x10x5	Large Carnivores
2	45+200	1x10x5	Medium size mammals
3	46+667	2x30x7	Large Herbivores
4	48+230	4x30x7	Large Herbivores
5	49+146	5x30x7	Large Herbivores
6	50+526	1x10x5	Large Carnivores
7	54+950	1x10x5	Medium size mammals
8	55+700	1x10x5	Small Mammals
9	56+765	3x30x7	Large Herbivores
10	57+736	3x30x7	Large Herbivores
11	59+686	1x10x5	Medium size mammals
12	60+614	3x30x7	Large Herbivores
13	63+500	1x10x5	Medium size mammals
14	64+388	4x30x7	Large Herbivores
15	65+188	1x5x5	Small Mammals
16	66+546	1x10x5	Medium size mammals
17	66+806	1X30X5	Large Carnivores
18	67+700	1x10x5	Medium size mammals
19	73+000	1x10x5	Large Carnivores
20	85+650	1x10x5	Medium size mammals
21	95+050	1x10x5	Large Carnivores
22	104+235	3x30x7	Large Herbivores
23	104+900	1x10x5	Medium size mammals
24	106+652	3x30x7	Large Herbivores
25	117+300	1x10x5	Small Mammals
26	118+500	1x10x5	Medium size mammals

Remarks : Proposed civil structure of NHAI at same chainage can be used for wildlife mitigation purpose after due corrections in span , if required.

7.5 Mitigations measures for the very important species like Elephants

ELEPHANT LANDSCAPES

Roads impact Elephants in multiple ways. Loss and fragmentation of elephant habitat is the most severe problem arising from linear infrastructure development: it alters the elephant's home range and, consequently, may lead to an escalation of human-elephant conflict where these animals are forced into new areas. In addition, it may lead to elephant populations becoming isolated, resulting in a loss of their

genetic diversity. To aggravate these impacts, elephants trapped in isolated areas rapidly destroy their own habitats. Poorly planned roads and railway lines in elephant landscapes result in loss of both elephant and human life due to accidents. However, these critical problems can be addressed by appropriate mitigation measures. The principal mitigation measures proposed to minimise the impact of linear infrastructure in elephant landscapes are set out below.

Elevated linear infrastructure

Raising the linear infrastructure (road and railway line) on pillars above the ground is the best solution in elephant landscapes. A major consideration while elevating the linear infrastructure is height: the height of the pillars should be at minimum 8-10 m (thrice the height of an adult bull elephant) above ground, so as to provide safe passage for elephants. In the event that the costs of elevating infrastructure would be prohibitively expensive, other measures covered below should be considered.

Underpasses

The height of the underpass, to allow elephant movement, should be the major consideration. A minimum span of 50 m with a height of 6-8 m and a width of 10-12 m is desirable for movement of elephants. The selection of sites for elephant underpasses should be carefully planned before road or railway design is finalised. Elephants tend to use fairly regular paths/trails and drainage lines in the forest. Such trails and drainage lines need to be identified by specialists trained specifically for this task (i.e. not untrained staff), following a thorough survey of the area. Underpasses should be located where the linear infrastructure corridor intersects with these paths/trails and drainage lines. Girder bridges are one of the best forms of underpass that can be provided for elephants' passage. Physical barriers should be erected along the remaining length of roads or railways in order to funnel elephant movement through these underpasses.

Overpasses

Construction of overpasses in flat terrain is not desirable in elephant landscapes. Overpasses can be considered as a mitigation measure only when the linear infrastructure passes through a stretch with steep terrain on both sides: the steep terrain on both sides of the road or railway can be connected with an overpass of at least 10-12 m in width.

Density of mitigation structures:

The density and numbers of mitigation structures is an important consideration for addressing the impacts of linear infrastructure in elephant landscapes. If elevating the linear infrastructure above the ground on pillars is not possible due to prohibitive costs, at least 100 m of passageways per 1 km length of linear infrastructure in elephant landscapes would ensure habitat connectivity.

Visual barriers:

Visual barriers as proposed in tiger landscapes are applicable for elephant landscapes.

Sound barriers:

Since elephants are sensitive to sound, all mitigation measures such as elevated structures, underpasses and overpasses need to be fortified with sound barriers.

7.6 Measures for reducing bird hits:

The adverse impact of the rods and associated vehicular traffic on birds can minimized to their careful design, controlling the disturbance they cause and reducing the availability of resources that attract birds next to roads.

Points of consideration

- Vehicle collision with birds is likely to be more pronounced during the breeding season and migration period. They can be minimized by avoiding undertaking road construction and maintenance activities during this time period.
- A 5 meter wide clear zone with three meter height clearance should be given for safe flight of birds. Along the road side tall and dense foliage plant species should be grown.
- Birds such as Black kite, Vultures and crows are scavenging carcasses of road kills, it should be removed as soon as detected.
- Use of appropriate lighting system for illumination of road ways can reduce attraction for birds: artificial lights should generally be discouraged and reflective posts should be used instead.

7.7 Mitigation measures specific to Reptiles and Amphibians:

Background

Herpetofaunal (Reptiles and Amphibians) road kill is often a function of species – specific ecological and life history traits, behavior and movement pattern. They move between spatially separated breeding and foraging sites, and often need to cross landscapes that are fragmented by roads.

Seasonal amphibian's movement also makes them particularly susceptible to road mortality.

Thermal profile s of high ways suggest that snakes are active at night may be at particular risk, because the road is warmer than surroundings grass land, thus attractive to snakes at this time.

Turtle are known to cover long distance seasonally and persistent road mortality may cause a serious bottle neck in the affected population

Mitigation

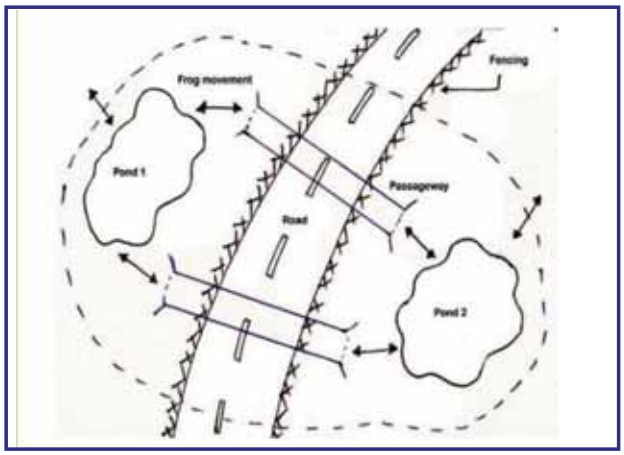
In order to design appropriate and species-specific mitigation measures, it is necessary to determine which species are at risk: In assessment of species composition (Threatened species if any), relative abundance and habitat association along the road stretch must be made.

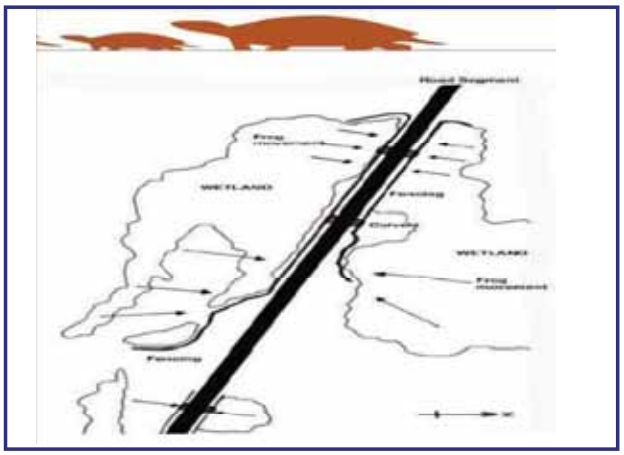
· Thermal profile s of high ways suggest that snakes are active at night may be at particular risk, because the road is warmer than surroundings grass land , thus attractive to snakes at this time.

Photograph 7.6 Snake kill on road

- Providing passages to retain habitat connectivity- During road construction drainage structures, like pipe culvert, box culvert and minor bridges also act as passages for herpetofauna movement

Photograph 7.7 Habitat connectivity





- Reptiles particularly cross more frequently through circular structures, while rectangular or square - shaped structures are preferred by amphibians. Frogs often prefer squared- shaped tunnels that are buried close to the ground surface.

  Box culverts of dimensions 2X2 m or 2X3 m are widely used above water ways in highway construction in India. These structures can provide passageways for reptile and frogs connecting their habitat.
- Fencing to guide movement of amphibians – The aim of fencing is to prevent mortality and deter herbetofaunal movement onto road by directing them to safe crossing points or passageways. It should ideally be located between two underpasses so as to guide animals to safe passageways. An ideal design may be a zig –zag pattern likely to direct animals towards passageways.
- 1 m height and RCC wall having an outward lip of at least 50 cms. May be constructed along two sides of the road to prevent animals from accessing it and direct them to use passageways.
- Measures to reduce use of road surfaces by snakes for thermo regulation - thermo regulation has been found to be the primary factor influencing the number of snakes on roads or the time spent on the road surface. Thus recommended placing strips of different surfaces that may be thermo regulating snakes next to the road in areas known to have high mortality. Results and practical applications of these trials should significantly reduce the mortality of snake of high conservation importance, including the Indian Rock Python and Russell's Viper.

8.8 Non-structural measures for reducing mortality

8.8.1 SIGNAGE AND WARNING SYSTEMS –

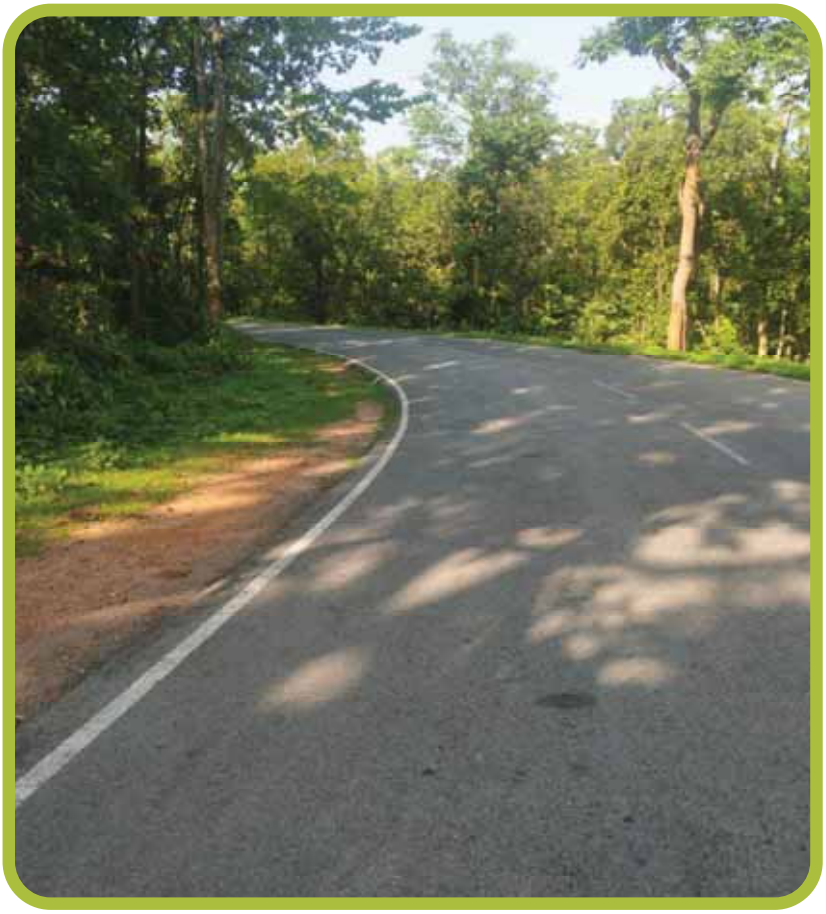
The purpose of animal warning signs and detection system is to prevent or reduce the number of Animal Vehicle Collision (AVCs), Animal Detection System (ADS) detect large animals before they enter the road to alert drivers of their presence and drivers of collision risk.

Photograph 7.8 Road sign

A. Caution sign : Simple caution signs are commonly used to alert drivers to the presence of wild life crossing zones. Simple warning signs with Silhouettes of the animals that may be using the crossings, sometimes together with a prescribed speed limit or written messages

Photograph 7.9 Caution sign on road

B. Enhanced caution sign: Many caution signs are enhanced by adding words like "Deer Xing" or illuminated with reflective tape in addition to Silhouettes of the animals.



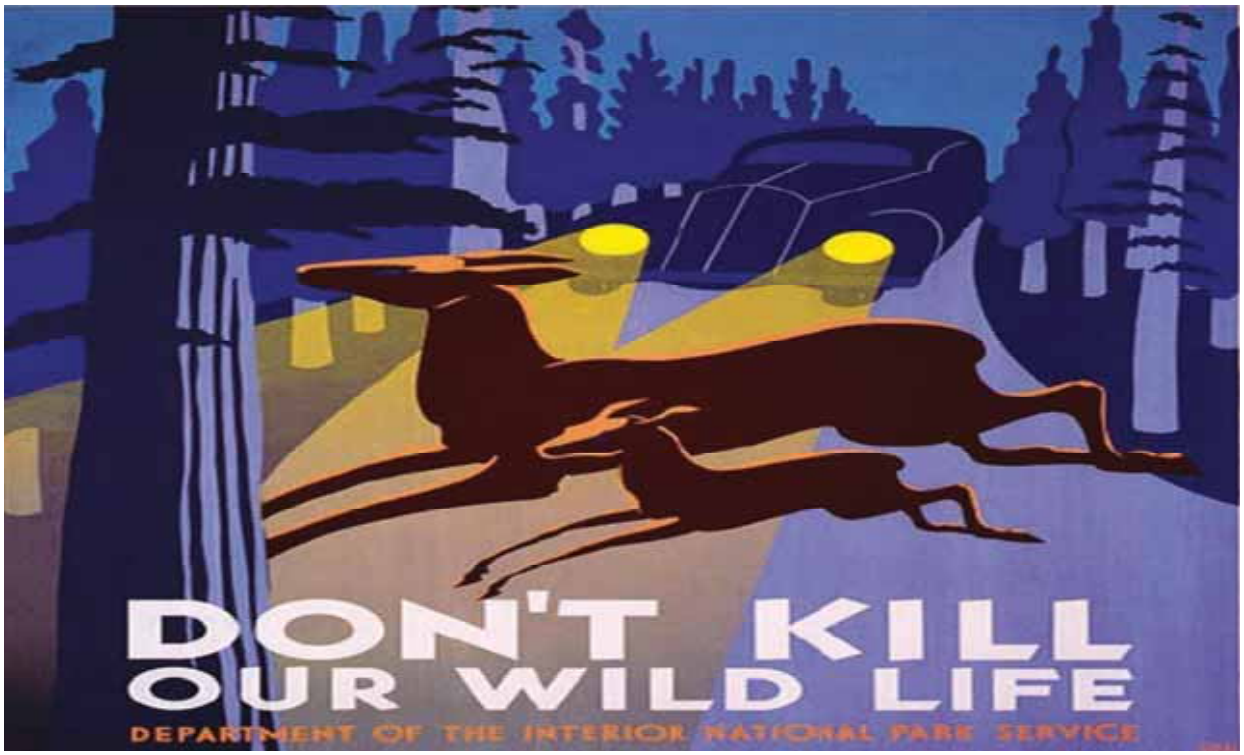
C. Temporary wildlife warning signs: these signs may be put to warn drivers of wild life presence during specific time of the day.

D. Dynamic message signs: These electronic signs can be used to alert motorist for the presence of wild animals or in areas of high AVCs

7.10 Photograph dynamic message sign

E. Posters and billboards: Poster and road side billboards are put up on highways as part of programs and campaigns to reduce animal mortality due to collisions with vehicles.

7.11 photograph billboard



7.8.2 Factors influencing the effectiveness of signs are listed below.

- Animal detection systems are best installed at locations that has a history of AVCs, specially involving large mammals such as Elephant, Gour, Tiger and where animals are known to pass frequently : daily or seasonally.
- The distance between signs and frequency of these signes should be decided according to the occurrence of AVCs inn particular stretches of roads: the higher the incidence of AVCs , the greater the signage.
- Road side vegetation should be cleared specially near curves and embankments, to make the signs visible to motorist.
- The size, shape, color and material (Reflective, Non reflective) of signs should be chosen to make the signs most effective.
- Signs that highlight the conservati0n importance of the site through which the transportation corridor passes such as ESZ of National Park, can help garner support for reducing traffic speed and increased awareness of drivers, thereby helping to protect several threatened species.

7.9 Measures to reduce noise effect:

Wild animals rely on sound for effective navigation, intra and inter – specific communication, avoiding danger and finding food for survival. Excessive noise caused by engines and emission of exhaust, aero dynamic sources, tyre/ pavement interactions and movement of vehicle have multiple effects on eco- systems. Roads and traffic alter the physical and acoustic environment of species and ecological communities, both during construction and when a road is open to traffic.

Noise pollution is one many factors contributing to the depletion of wild life population. Limited studies in India indicate a lower abundance and variability of birds in forests affected by air and noise pollution than in non polluted forest in the same bio-geographic zone (Saha and Padhy 2011). Generally accepted definition of 'excessive noise' is an increase of 10 dB (A) or greater.

- Mammals – < 10 Hz to 150 KHz : sensitivity to – 20dB(A)
- Birds – 100 Hz to 8-10 KHz : sensitivity at 0 – 10dB(A)
- Reptiles – 50 Hz to 2 KHz : sensitivity at 40 – 50dB(A)
- Amphibians – 100 Hz to 2 KHz : sensitivity from 10 - 60dB(A)

I. Structural noise barrier:

Design of a noise barrier begins with the determination of its height and location relative to the road way.

Basic types of noise barrier system commonly used ground mounted system are noise barrier. They consist of noise berms, noise walls or combination of both.

II. Use of vegetation as noise barrier:

Vegetation, if it is high enough, wide enough, dense enough and opaque, may reduce highways traffic noise up to 10 dB (A).To achieve such reduction to plant enough vegetation along the road.

It would be ideal to create noise buffer using a diversity of tree species, with a range of foliage, shapes and sizes: a combination of shrubs and trees may be necessary to achieve this effect.

7.10 Anti-Glare Screen to reduce light effect

Anti-glare board, Anti-glare Screens or Anti dazzle boards are to protect the traffic from headlights of oncoming traffic. It is usually used in combination with the central guardrail, central barrier (cement barrier and steel guardrail). It is designed to solve the glare of the headlights which can be a huge factor in blinding the drivers and cause accidents.

Anti-Glare for highways help improve traffic safety and also could beautify the highway landscape. Anti-glare screens come in different sizes and heights to suit the requirement on site. A reflective tape on these anti-glare screens also helps in identifying the road pattern. Anti-glare for highways is a must where speeds are generally in excess of 80 Km/hr as these help prevent glare of oncoming headlights into the eyes of drivers from the opposite side.The anti-glare system improves night visibility on roads where drivers are dazzled by cars or other light sources coming from the opposite direction. Anti-glare installations lead to a remarkable reduction of accident rates.

Areas of application

Anti-glare systems are generally recommendable in all places where drivers shall be protected from dazzling lights. Usually, they are installed in the following areas:

- In the median of streets and motorways with several lanes
- On roads with heavy traffic in dark periods
- Between parallel or approaching roads, when traffic runs in opposite directions
- In areas of humps or other unfavorable topographic conditions
- In long curves
- On bridges
- Beside railroad or tram lines running beside roads

Near buildings which reflect lights towards the road

Anti-glare systems can be installed either according to category 1 (open passage at every place) or category 2 (no passage possible. This can be useful in urban areas, in order to prevent pedestrians from crossing the road).

7.11 Good practice guidance:

In the form of "Do's and Don'ts" for avoiding and regulating the impacts of the linear infrastructure projects

Do's	Don't's
During CONSTRUCTION Phase	
1. Recommond construction schedule to avoid breeding/ migration sesons of important species. 2. Take care to avoid direct impact on land, water and habitats due to labour camps, storage sheds and parking lots. 3. Initiate construction of mitigation structures along with road/ railway upgradation projects so that damage/losses during this phase can be minimized. Installl sufficient drainage works under all access roads to avoid flooding land and damaging streams. 4. Protect top soil and control soil erosion. 5. Avoid minimize/removal of natural vegetation. 6. Take measures to prevent animal injuries and moratlity during earthwork, claening of vegetation, managing pools and streams. 7. Enhance good behaviour by construction workers to prevent iilegal hunting, fishing and pilfirage of resources. 8. Restored cleared area wherever possible.	1. Do not add to direct and physical impacts by careless material management and inducing avoidable disturbences. 2. Do not violate condition and specification agreed upon as part of mitatgation. 3. Do not dump or stack construction material inside sensitive habitats. 4. Do not dispose debries and other excavated material near water bodies and in valley bottom. 5. Do not wash vehicle or change lubricants in waterways or wetland.
During Operation and Monitoring	
1. Conduct independent regular site inspections to ensure compliance with all EMP provisions, particularly in sensitive areas. 2. Ing evidence.mplemet an evidence-based system of collection, collisiion and analysis of data to assess efficacy of mitigation measures, Use audio-visual tools for generating more convincing evidences.	1. Do not forget to draw a schedule for maintenance of crossing students such as drains and culverts to ensure their functionality. 2. Do not justify lack of manpower and financial resources to neglect/avoid monitoring.

Chapter-VIII

WILDLIFE CONSERVATION AND MANAGEMENT PLAN

8.1 Objectives of Management:

Wildlife management is a probable solution to maintain the balance between needs of wildlife and people living together in the area with the help of scientific strategies, which consist of applying and executing proper recommendations of the plan to reduce the impacts of decimating factors and neutralizing harmful effects of limiting factors that keep the animal population lower than the carrying capacity of the area.

It also aims at management of human dimensions relating to 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 occur 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 impact and the most important to ensure safe passage of wildlife.

The management of the project area aim for maintenance of habitat for smaller 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 ofBuffer 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 impactof theproject.

The project area has Reserve Forest, orange area with composition of rich flora and fauna

The displaced animals should be taken care with the highest degree of development measures. Their rehabilitation would be the major objective of the plan.

To fulfill all these requirements, the plan focused on improving forage and browse volume by increasing food plant diversity with vertical and horizontal cover.

These measures will arrest habitat destruction and fragmentations also prevent soil erosion and loss of bio-diversity. Keeping natural water resource free from negative impact during construction phase will also be targeted.

Mitigation measures refer to avoid, reduce or remedy harm and address the conservation concerns likely to be associated with the development proposals. Hence there is need to follow the mitigation principles to deliver potential benefits of **Green Infrastructure Development Approach.**

The proposed plan has the same pitch of mitigation measures for sustainable development of habitats and wildlife.The major adverse effect and threats due to the project implementations would be displacement of wild life and their loss of habitat, destruction of forest including biodiversity loss, increase in human and wild life conflicts, forest areas shall be susceptible to fire hazard, loss of natural harmony of villages in core area, increase in pollutions, reduction in water bodies, encroachments etc.

Keeping in view the Wild Life (Protection) Act 1972 and the rules made there under, Forest conservation Act (1980) and the rules made there under, Biological Diversity Act 2002 & its rule, the National Forest Policy 1988 and the National Wildlife Action Plan (2002-2016)have also been kept in mind while formulating this Wildlife Conservation Plan (WLCP).

8.2 Important knowledge on conservation plan for Fauna:

1. Home range of the animal– As explained in chapter no.4
2. Territorial requirement of the animal depends on species in the area.
3. Deciding the number of animals to be conserved and accordingly evaluating the carrying capacity of the habitat.
4. Conservation is aimed at single species or multiple species.

8.3 Basis and references for conservation plan

The following books and records were referred for preparation of site specific conservation plan.

1. Working Plan of Dhamtari, Kanker and Keshkal Forest Divisions.
2. Wildlife (Protection) Act 1972
3. WII (2016). Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife. Wildlife Institute of India, Dehradun, India
4. Menon-Vivek 2009, Mammals of India, A field guide , wild life trust of India.
5. Book on Indian Birds by Salim Ali
6. Right of Passage-Elephant corridors of India - Wildlife Trust of India.
7. State of India's Forest Report-2019; Forest Survey of India. Dehradun
8. Champion H G. and Seth S K. (1968). A revised survey of forest types of India.

8.4 Wildlife Habitat structures

This has been increasingly concerned in recent years about potential negative effects on wildlife caused by infrastructural development and other modifications of wildlife habitat.

Conversion of naturally regenerated mature and old-growth forests to intensively managed plantations for wild life habitat is associated with forest structures. As a result of the concerns, regulatory pressures on forest management to provide habitat has resulted in creating a system of development for wildlife habitat with the hope of providing an increased amount of habitat for species associated.

The concept of wildlife habitat varies according to the needs of each species, and for management purpose the concept may include a description of those areas that are best suited for a species to successfully nest, roost, forage, and reproduce. Given the wide diversity of wildlife, however, all terrestrial species require food, cover, water, and space (Yarrow and Yarrow 1999).

It is generally accepted that increases in the diversity of vegetation across a landscape will lead to increases in the value of the landscape as habitat for a variety of species (Whitaker and McCuen 1976).

Focus have been shifted from a narrow view that is guided by the habitat value of one or a few individual species to a broader view that recognizes the multiple values that wildlife habitat can provide for a wider mix of species (Johnson and O'Neil 2001).

The most critical aspect of wildlife conservation is habitat management. Habitat loss presents the greatest threat to wildlife.

The most important features of wildlife habitat is its canopy cover, availability of fodder, prey , water etc. In general, good habitat conditions for wildlife can be created while managing canopy cover through plantation of indigenous species or other management practices. The proposed plan here will help in planning for integrated land management program that optimizes timber growth , plantation of fodder species for herbivores and thus planting to create wildlife habitats and corridors.

Wildlife has four basic needs: food, cover, water and space. The quality and quantity of these components determine the carrying capacity of the land – the maximum number of animals that can be supported in good conditions throughout the year. Carrying capacity changes by season and by year as a direct result of changes in forest habitat.

Most animals can be found where food and cover meet, particularly near a water source. This is called edge effect. Edge effects can be in the form of topographical or vegetation edges, such as the saddle of a mountain range. River bottoms are ideal, offering many animals all their habitat needs along one corridor.

With proper planning, forest management can be conducted in such a fashion as to improve habitat conditions for certain species of wildlife. As forest are altered to grow timber products, wild life habitat are also changed. Some of the habitat characteristics that influence wildlife are edge, habitat diversity,Interspersion and plant succession.

The arrangement of habitat patches also influences the presence of certain types of wildlife. Some species require large tracts of similar habitats (low interspersion), whereas others use a variety of habitats at different stages in their life cycle and require multiple habitat types in close proximity to one another (high interspersion)

A Forest stand arrangement also has an effect on the quality of wildlife habitat. Stand arrangement refers to how the forest stands are located in relation to each other. For quality wildlife habitat, forest stands providing habitat components must be available within the home ranges of the wildlife species being managed.

Arrangement refers to the placement of food, water, cover, and space in a habitat. The ideal arrangement allows animals to meet all of their needs in a small area so that they minimize the energy they use traveling from food to cover to water.

Proper arrangement of food, water and cover can often determine the use and value of these habitat components to wildlife. Poor arrangement of habitat components fails to make the best use of a particular site for wildlife. Mixture of development measures such as pasture land, forest plantations, development of water bodies etc. creates more diversity.

8.4.1 Special Habitat Features

In addition to general wildlife-habitat relationships, some species also require special habitat features and will be absent if these features are not present. These features include snags, cavities, dead and downed wood, rock outcrops, caves, evergreens, temporary pools, and spring seeps.

Snags and Cavity Trees

Snags are dead or partially dead standing trees. They provide a number of important benefits to wildlife. As a tree dies, its bark begins to loosen and form bark cavities, which are used as roost sites by forest-dwelling bats and as nest sites by brown creepers. Insects, a valuable high-protein food source for certain species, are abundant in snags. A wide variety of birds, including raptors, kingfishers, flycatchers, and many songbirds, also use snags as hunting and singing perches.

Cavities are holes excavated in snags by woodpeckers. They are used for shelter and nesting cover by many species. Over 35 species of birds and 20 species of mammals in study area require cavities for nesting, and reptiles and amphibians also use cavities for shelter.

Dead and Downed Wood

Dead wood, including fallen branches and trees lying on the ground, is also important for wildlife habitat. As wood decays, it slowly returns nutrients to the ground and supports colonies of insects on which many animals feed. Amphibians rely on downed trees for cover, especially during droughts, when the undersides of fallen logs become a critical source of moisture. Small mammals also use logs on the ground as runways, and reptiles that prey on small mammals and insects use them as hunting areas. In addition, grouse use large logs for drumming sites.

To provide dead, downed wood for wildlife, resist the urge to clean up your property. Strike a compromise by tidying up some of the dead branches into a brush pile, but leave the rest where they land. You can also add dead wood to your habitats during tree cutting by leaving some felled trees on the forest floor and building brush piles with others.

Rocky Outcrops and Caves

Rocky outcrops and caves are generally less common than some other habitat features. Certain species, however, such as the Indian Monitor lizard (Varanusbegalensis), Sloth Bear (**Melursusursinus**) require the unique habitat provided by rocky outcrops and many species of snakes use outcrops as escape cover and sunning sites also use caves and rock outcrops for nest sites, food storageand traveling, many of the nocturnal animals use caves and outcrops for den sites and cover. Caves are especially important in the winter for hibernating bats, and some bats inhabit caves throughout the year. To protect these uncommon species, minimize disturbances around caves and rocky outcrops.

Evergreens

Evergreens, trees and shrubs that retain their leaves or needles through the fall and winter, provide thermal cover for wildlife during cold months. Evergreens with branches that extend down to the bottom of the trunk provide the best thermal cover because these branches keep wind and snow out. Evergreens also provide nest sites and food.

Temporary Pools

Temporary, or vernal, pools are unique wetland habitats that fill with water during a rainy season and then dry up later in the year. Although temporary, they provide a critical breeding ground for amphibians. Because temporary pools do not support fish populations, amphibian eggs can develop there without high losses to fish predation.

In addition to providing breeding and hibernating habitat for amphibians, temporary pools also support a complex web of interactions among a variety of organisms, including aquatic insects, salamanders, frogs, turtles, snakes, small and large mammals, waterfowl, and songbirds.

Spring Seeps

Spring seeps are small streams or ponds fed by fresh water from beneath the surface of the ground. Spring seeps are different from temporary pools because the water source persists year-round. This constant water supply provides important benefits to wildlife.

Spring seeps are particularly important during the winter when they may be an animal's only source of fresh water and food. Wildlife use spring seeps heavily during severe winters, when other sources of water are frozen for extended periods of time. Spring seeps can be critical during periods of deep snow, when the area around a seep remains unfrozen and provides a snow-free travel lane. In early spring, vegetation grows first around seeps, providing a food source at a time of year when most others have been depleted.

To assess condition of the habitats, it is essential to manage areas as per the needs of the wildlife.

Fire protection, Grazing control, ANR works and introduction of fodder species, wherever needed, are essential taking into consideration the suitability of the wild animals.

The above objectives should be brought about following the principles such as:

(a) Removal of Alien grass and reduction of other competitive plants to allow moisture and soil nutrients for the planted seeds/slips.

(b) Elimination or control of grazing.

(c) Terrain and soil should be suitable to support the desired forage species.

(d) Plantation of suitable species for the habitat.

(e) Plantation of mixture (mixed species)/ fruit trees because it supports different species.

8.5 Development of water and its resources to ensure availability:

Water is an integral part for survival of wildlife. Availability of water is life saving for many birds, infants and small sized wildlife.

The requirement of water is one of the basic needs of wild animals, though its consumption varies in accordance with the species concerned. Hence water affects density of the animal's population and therefore, the management and maintenance of waterholes is an important tool in habitat-improvement in wildlife management.

Sometimes in quest of water animals have to run a long distance even near village where they may become victim to poachers.

Hence development of water resources and its management are utmost important aspect in the Wildlife conservation.

Important and necessary measures would be undertaken in order to ensure the availability of water for a longer duration especially in the pinch period.

Even ample of food and shelter cannot alone do survival for the wild life and the mortality of animals increase in absence of water holes specially in pinch period.

Proper distribution and numbers of water holes are in the habitat matter a lot. If sufficient numbers are not developed or made available, there will be crowd of the animals around water holes beyond its carrying-capacity.

There shall all the chances one can experience misbalance of natural ecology. As the resultant, the animals will come under psychological pressure due to over-crowding hampering their productivity.

There should be at least one waterhole in each home-range for the animals which require water daily regularly, for others, it may be at distinct places serving their requirement.

For the purpose, maintenance of natural waterholes and development of artificial waterholes are must.Followingare the methods of improving waterholes for wildlife:

8.5.1 Development of Natural Waterholes

Natural waterholes can be maintained and improved as follows:

(i) Natural waterholes are often found in nalas and rocky areas where run-off water is accumulated in depressions. At times, such holes can be improved by deepening the catchments or by trenching run-off water directly to the basin.

(ii) For natural waterholes, arrangement of restructuring or development of water holes should be done under strict supervision of experienced and expert persons to make if available to the wildlife.

(iii) Seeping of water is geographical condition, where water oozes out drop by drop through rock or soil. Such water cannot be consumed directly by the wildlife. Such water can be collected in a artificially made ditch/tank by applying devices like through hollow bamboo or pipe catching those Seeping water.

8.5.2 Development of artificial waterholes

Artificial waterholes are developed as follows:

(i) Reservoirs and Ponds: Man- made reservoir and ponds shall help animals to avail which can be constructed at places of requirement.

(ii) Water Catchments: These are the natural channels through which water flows . These channels can be identified and developed.

(iii) Other Water Developments like small ponds or water collection points can be developed.

8.5.3 Soil & water conservation -

Good vegetation and cover in any area can restore and retain water and soil carrying capacity of area. From habitat improvement point of view, it is important to take care simultaneously for soil and water conservation.

Soil is the prime natural base for the development of vegetation. Soil is one of the factors determining the kinds and growth of the plant of a place . Soil and water can be conserved by proper selection of suitable plant species during plantation.. This will also solve water and food problem of wildlife. In addition, formation of check-dams and other suitable devices are also necessary to prevent soil-erosion and run-off sof water.

8.6 Improvement and development of natural and artificial shelter:

In addition to Water and Soil, shelter is also considered as the main factor for wildlife.Therefore, the management technique should be accessed and applied as per the need of the target species. The various artificial measures for shelter/cover improvement are as follows:

8.6.1 Development of natural shelter:

Plant succession is phenomenon of continuous and contiguous nature in its own way unless and until it is manipulated by the human being.

If the plant succession is in favorable direction for the target species, then it should be enhanced in the habitat by applying measures such as fire-protection, control-grazing, plantation of suitable species, if required and so on.

If a particular stage of succession itself is beneficial for target species, then measures for manipulation should be applied to retain that particular stage of the succession such as felling, grazing, control burning, changes in the silvicultural operations etc.

Management of shelter or improvement is to support wildlife so that they can stay long and propagate with desired speed.

8.6.2 Development of artificial shelter:

(I) Plantation of Trees (Afforestation/Reforestation) : Preference would be given fruit tree plantation, pasture development and palatable grass plantation

(ii) Caves and Rock-cliff Shelters: Suitable development for area specific species.

(iii) Development of Brush-piles: Suitable development for area specific species.

(iv) Artificial Nesting: Its dependent on the local conditions, if required then artificial nest development can be done for particular species in consideration.

(v) Suggestive Silvicultural Operations:

a) Felling of shade and fruit trees should be stopped as far as possible.

b) In There should be always mixed-species plantation to meet the various foods-chains of various wildanimals.

c) The felling of coups should be in such a way that they may given maximum core-effects to the wildanimals resulting highest interspersion and juxtaposition for them.

d) After felling and trading operations, the left-out parts of the trees should be arranged in the form or brush-piles to provide shelter for certain small wild animals and birds.

e) There should not be interruption near the riparian zone as well as shelters like caves and rock-cliffs.

f) At least, five snag trees per hectare should be left for protection and propagation purposes of wild animals.

8.7 Prevention of forest fire:

Forest fires are the most damaging factor for habitat-management. It causes damage to the habitat of the wild animals destroying its food and shelter, forest crop, regeneration, productivity of forest and soil. Hence, wildlife is caused excessive loss by the fire by burning their eggs, young ones and the habitat. .

Anthropogenic causes will be minimized through forming a fire line around the forest area. To add to the prevention of fire local persons will be employed as fire watchers, during the fire prone season.

8.7.1 Management Prescriptions for fire protection

Forest Fire management is crucial for entire forest area falling under core or buffer zone .The forest fires along with unregulated grazing have been acknowledged as the main causes of degradations of forest eco-systems and wildlife habitat.Fire also exposes the soil to erosion and, hence, causes habitat degradation in the process.

Due to deciduous nature of the forests, the grasses, weeds and falling leaves and twigs forms a thick layer of undergrowth which is highly inflammable in nature.

The Fire lines are classified into the following, categories in order of priority.

A- **Class Fire lines:** These Fire lines comprise of the external boundary These are the prominent Fire lines, which should be prescribed for clearing, burning and maintenance every year on priority basis.

B- **Class Fire lines:** These Fire lines include internal boundaries and roads. These Fire lines should also be prescribed for clearing, burning and maintenance, every year.

C- **Class Fire lines:** It includes the remaining Fire lines including the internal boundaries of compartments and coupe lines.

8.8 Weed Management:

"A weed is a plant growing at place where it is not desired" - Jethro Tail (1731) was the first person to use the word . Alien species are non-native or exotic organisms that occur outside their natural adapted ranges and dispersal potential. Many alien species support our forestry systems in a big way. However, some of the alien species become invasive when they are introduced deliberately or unintentionally outside their natural habitats into new areas where they express the capability to establish, invade and out compete native species.

8.9 Addressing human-animal conflicts:

Threat to the mankind by wildlife often happens when they cross the edges and move towards villages and damage the houses and crops, Man-animal conflict is a difficult problem to be eliminated. The conflict is both deliberate as well as in advertent.

There is a considerable loss of agricultural crops by the wild animals such as Elephant, Nilgai, Wild boar, Chital and other species.

In most cases, wild animals move out of forests in search of water and food. Therefore, forests should have enough water and food resources well distributed within the forest boundary.

8.10 ConductingTraining and Awareness Programamongst Forest Stake Holders:

Besides various measures applied in forest management, community and people awareness shall be important tool for the conservation.

Education and knowledge imparting about environment and wild life will be created amongst the adjoining villagesthrough slide and film shows people will be made convinced about the sustenance of natural ecosystems.

People and community shall be educated about the balance of natural eco-system boards, also conducting audio visual classes and distributing literature in respective villages in the buffer zone.

Wildlife exposure visits can be organized for the people. Awareness programs will be run with the help of Forest Officers and more importantly some national experts will be invited to deliver talks on awareness related to wildlife conservation.

8.11 Working Plan prescriptions for Wild life Management

The study area falls in the Dhamtari, Kanker and Keshkal Forest Divisions. Working plans, prepared now-a-days, have more ecologically systemic approach as compared to earlier reports which had more emphasis on exploitation of the forest products for economic gains. Working plans have several circles but one related to wildlife conservation is the Wildlife and Bio-diversity Conservation Working Circle.

Main objectives of the circle are:

- Conservation and Propagation of Biodiversity
- Increase density of forest crop
- Soil & water conservation
- Improve habitat for wildlife
- Conservation and propagation of endangered species
- Provide special protection to plants of medicinal value
- Involve fringe villagers for active co-operation in Eco development.

However, it is worth mentioning that none of the presently proposed impact areas fall under areas marked by the circle for special biodiversity treatment.

For wildlife conservation, the areas have been divided in to three zones as follows:

- P-1 High presence of wildlife
- P-II Medium level presence of wildlife
- P-III Minimum level presence of wildlife

8.12 Objective of management to mitigate the threats in Project area and Impact zone:

The Objective of management to mitigate the threats to the wildlife arecovering the following aspects-

8.12.1 PROJECT AREA

- Ensure appropriate measures to avoid / minimize or mitigate the adverse impacts like accidents and causalities of wildlife in and around the road.

- Create appropriate facilities like **underpass and /or overpass** for safe movement of large animals like Tiger, Leopard, Wild boar, Sloth bear, Elephants, Gaur, Deer etc and small animals like hare, civets, mongoose etc , Reptiles, Amphibians, Fishes etc.
- Provision of Canopy Bridge such as rope or wooden ladder or walk way suspended over the road for tree dwelling species.
- Provision of rumble strips at suitable distance on the roadway passing through forest area.
- Provision of noise reduction measures like Noise barrier - Noise berm, Noise walls etc. Create noise buffer using a diversity of tree species with a range of foliage shapes and sizes : a combination of shrubs and trees necessary to achieve this effect.
- Mount Hoarding, Posters and roadside billboards to generate awareness among people also by displayingsignages like caution signs, dynamic message signs.
- Infrastructure like torch, and fixing light in villages to prevent human wildlife interface.

8.12.2 Impact zone:

- Improvement of water availability by digging of ponds and water bodies to create water hole.
- Soil moisture conservation works like contour trench, contour bund, gulley plugging, check dams etc.
- Removal of invasive Alien Species hindering the growth and regeneration of valuable fodder species.
- Mopping up the same area to remove the remnants.
- Pasture development by removing Alien Species in natural grass land and also in potential grass land where the density of canopy is < 0.4.
- Planting / Sowing of palatable grass seeds / slips of local species like **Dicanthiumannulatum (ChhotiKandi), Dicanthiumcaricosum (BadiKandi), Iselimalaxum (Machhori grass), Chlorisbarbata (Finger grass), Themedaquadrivalvis (Gunher), Apludamutica (Fulera), Heteropogoncontortus (Sukla grass), Brachiariaramosa and wild leguminous plants like Jungalimoong, jungaliurad, jungalituaretc**and their maintenance.
- Improvement of stock by dressing of existing stumps of browsable species and cut back.
- Gap Planting of fruit bearing trees like **Aonla, Jamun, Anjan, Bel, Ber, Gular, Bargad,Peepal etc.** by pitting and planting.
- Fire protection by cleaning and maintaining the fire line and engaging the firefighting squad.
- Activate and support **Hathimitra dal** (In Elephant presence area),empowering VFC, public awareness trainingetc and miscellaneous works/ activities that may be developed subsequently to reduce human - animal conflicts.
- Purchase of utility vehicle “GajrajVahan” for the field for combating human-Elephant Conflict.
- Create a Corpus Fund to facilitate meeting expenses in exigencies of human-wildlife conflict

Chapter-IX

SUMMARY AND FINANCIAL OUTLAY OF WILDLIFE MANAGEMENT AND CONSERVATION PLAN

Keeping in view of various impacts, a wildlife conservation and management plan has been proposed for Development of Economic Corridors Lot-3/Odisha&Jharkhand/Package-2Raipur-Visakhapatnam (Ch 0.000 – Ch 124.661 km) in the state of Chhattisgarh under Bharatmala Pariyojana.

The salient feature of this management plan is summarized as below:-

I. Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project developmental activities,

II. Conservation, preservation and betterment of natural habitats in buffer area

III. Rehabilitation of critical species (endemic and threatened species of this region), if any with provisions for in-situ or ex-situ conservation of critical/ important plant/ animal species,

IV. Mitigation and control of project induced biotic and/or abiotic pressures/influences that may affect the natural habitats,

V. Habitat enhancement in project buffer area by taking up afforestation and soil conservation measures,

VI. Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing man animal conflict.

All the remedial measures for wildlife safety in the project area and Impact zone have been discussed earlier. The financial requirement of various interventions suggested in the plan as per current labor wage rate i.e. Rs. 299/- is given in following table of financial estimate. 15% escalation is proposed in the financial outlay for future rate of inflation. The Plan period is 10 years. All the activities given in the financial outlay of plan will be implemented by State Forest Department with budgetary provision from user agency i.e. NHAI.

IMPORTANT Provisions for Divisional Forest Officers / Project Director

(i) All the activities given in the financial outlay of plan will be implemented by State Forest Department through Divisional Forest Officer of Dhamtari, Kanker, Kondagaon Forest divisions and

Director Udanti- Sitanadi Tiger Reserve with availability of budgetary provision by user agency i.e.National Highways Authorities of India .

(ii) Area for habitat development as suggested in plan shall be finalized by the Divisional Forest Officer of Dhamtari, Kanker, Kondagaon Forest divisions and Director Udanti- Sitanadi Tiger Reserve after thorough field visit and verification of suitability.

(iii) Any changes in proposed plan shall be allowed to all Divisional Forest Officers of Dhamtari, Kanker and Keshkal forest divisions and project director of Udanti-Sitanadi Tiger Reserves after getting due approval from concerned Chief Conservator Of Forest.

Monitoring and Evaluation :

A monitoring committee will be formed in each forest division under the Chairmanship of the concern D.F.O. for the monitoring of the implementation of the work. The other members will be concerned SDO, Range Officers and a representative of Village Forest Committee. Monitoring committee will meet at least twice in a year to review implementation of the prescriptions of this plan and sort out bottlenecks and if necessary may suggest for addition/alteration etc. also the committee will evaluate level of human-animal conflict indicators like human injuries and death of human in the zone of influence, incident and extent of fire, area burnt, grazing pressure and illegal felling.

Works proposed to be done by user agency (NHAI) in Project area

S.No.	Reference para	Works proposed to be done	Chainage/ Location	Cost	Remarks
1	6.7, 7.4.1 & 7.9	Provision of noise barrier like noise berm, noise walls, avenue plantation etc.	At both sides of the underpass for large herbivores and large carnivores	Actual cost shall be borne by User agency	
2	6.8, 7.10	Anti glare screen	In long curves, on bridge in median of the highway wherever needed, near buildings etc.	Actual cost shall be borne by User agency	
3	7.2.1	Fixing of glider poles	Placed in the center of median at suitable intervals	Actual cost shall be borne by User agency	
4	7.2.1	Fences	At both sides of all wildlife underpasses minimum 50 m. to direct the animals towards underpass.	Actual cost shall be borne by User agency	

Abstact of Financial Proposal component wise (In lacs)

Components	Expenditure
Water and soil improvement works	206.00
Pasture development works	292.50
Improvement of stock by cut back and planting of fruit bearing trees with its maintenance	280.00
Fire protection	94.50
Empowerment of JFMCs/Hathi Mitra Dal, public awareness training etc	74.00
Purchase of utility vehicle" Gajraj Vahan", early warning Elephant alert system, Semi reflective Wildlife warning signages and hoardings	68.00
Empowerment of BMCs, public awareness, training	22.00
Monitoring and evaluation	15.00
Total (A)	1052.00
15% Escalation + Total (A)	1209.80

ABSTRACT OF FINANCIAL PROPOSAL

Table 9.1

S.no.	Details of Works	Estimated Expenditure for 10 years (Division wise) (Rs. In Lacs)				Total (Rs. In Lacs)
		Dhamtari	Kanker	Keshkal	USTR	
1	Improvement of water availability by digging of ponds and water holes.	75.00	20.00	**40.00**	13.00	**148.00**
2	Soil water conservation works (LBCD, BCD,Gulley plucking, Dams)	30.00	10.00	**16.00**	2.00	**58.00**
3	(A)Removal of invasive Alien species hindering the growth and regeneration of valuable species for wild life .	32.00	16.00	**16.00**	12.00	**76.00**
	(B)Mopping up the same area to remove the reminants	16.00	8.00	**8.00**	6.00	**38.00**
4	(A)Pasture development by removing alien species in natural grass lands and also in potential grass lands where the density of canopy <0.4	60.00	0.00	**0.00**	10.00	**70.00**
	(B) Pasture development by Planting / sowing of palatable grass seeds/ slips	64.00	0.00	**0.00**	16.00	**80.00**
	(C) Maintenance works of grass seed planting area for Three years	18.00	0.00	**0.00**	10.50	**28.50**
5	Improvement of stock by dressing of existing stumps of browsable species and cut back (The DFO should inspect the area and after proper marking and hammering , the dressing of live stumps can be permitted) and Gap plantation of fruit bearing trees like Aonla, Jamun, Bel, Ghular, Bargad, and Peepal by planting in 1st year itself)	60.00	30.00	30.00	0.00	**120.00**

Cont.-2

6	Maintenance of fruit trees plantation for 5 years	80.00	40.00	40.00	0.00	**160.00**
7	Fire protection by cleaning and maintaining the fire lines (Natural and artificial) and purchase of fire fighting equipments.	50.00	15.00	22.00	7.50	**94.50**
8	Hathi Mitra Dal / Empowerment of JFMCs, public awareness training etc. and miscellaneous works/ activities that may be developed subsequently to reduce human - animal conflicts.	60.00	5.00	5.00	4.00	**74.00**
9	Establishment of early warning Elephant alert system	10.00	2.00	2.50	0.00	**14.50**
10	Purchase of utility vehicle" Gajraj Vahan" for the field to transport of man, materials used in Human-Wildlife conflicts. And POL and maintenance for 5 years	43.00	0.00	0.00	0.00	**43.00**
11	Biodiversity conservation, empowerment of BMC, training awareness etc	10.00	4.00	4.00	4.00	**22.00**
12	Semi reflective Wildlife warning signages and hoardings near wildlife passes and in forest area.	6.00	2.00	2.50	0.00	**10.50**
13	Monitoring and evaluation of works	5.00	3.50	4.00	2.50	**15.00**
	Total	**619.00**	**155.50**	**190.00**	**87.50**	**1052.00**
	+15% Escalation	**92.85**	**23.325**	**28.50**	**13.125**	**157.80**
	Grand Total	**711.85**	**178.825**	**218.50**	**100.625**	**1209.80**

Details of financial proposal - Dhamtari Division

Table 9.2

S.no.	Description of Item of work	Unit (No./ Area)	Estimated expenditure (Rs.in Lakhs)										
			1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th Yr	8th Yr	9th Yr	10th yr	Total
1	Improvement of water availability by digging of ponds and water holes.	L.S.	15.00	15.00	15.00	15.00	15.00	0.00	0.00	0.00	0.00	0.00	**75.00**
2	Soil water conservation works (LBCD, BCD,Gulley plucking, Dams)	L.S.	8.00	6.00	6.00	5.00	5.00	0.00	0.00	0.00	0.00	0.00	**30.00**
3	(A)Removal of invasive Alien species hindering the growth and regeneration of valuable species for wild life .	400 Ha.	6.40 80 Ha.	6.40 80 Ha.	6.40 80 Ha.	6.40 80 Ha.	6.40 80 Ha.	0.00	0.00	0.00	0.00	0.00	**32.00**
	(B)Mopping up the same area to remove the reminants	400 Ha.		3.20 80 Ha.	3.20 80 Ha.	3.20 80 Ha.	3.20 80 Ha.	3.20 80 Ha.	0.00	0.00	0.00	0.00	**16.00**
4	(A)Pasture development by removing alien species in natural grass lands and also in potential grass lands where the density of canopy <0.4	300 Ha.	12.00 60 Ha.	12.00 60 Ha.	12.00 60 Ha.	12.00 60 Ha.	12.00 60 Ha.	0.00	0.00	0.00	0.00	0.00	**60.00**
	(B) Pasture development by Planting / sowing of palatable grass seeds/ slips	200 Ha.	16.00 50 Ha.	16.00 50 Ha.	16.00 50 Ha.	16.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	0.00	**64.00**
	(C) Maintenance works of grass seed planting area for Three years	200 Ha.	0.00	1.50 50 Ha.	3.00 100 Ha.	4.50 150 Ha.	4.50 150 Ha.	3.00 100 Ha.	1.50 50 Ha.	0.00	0.00	0.00	**18.00**

Cont.-2

5	Improvement of stock by dressing of existing stumps of browsable species and cut back (The DFO should inspect the area and after proper marking and hammering , the dressing of live stumps can be permitted) and Gap plantation of fruit bearing trees like Aonla, Jamun, Bel, Ghular, Bargad, and Peepal by planting in 1st year itself)	400 Ha.	12.00 80 Ha.	12.00 80 Ha.	12.00 80 Ha.	12.00 80 Ha.	12.00 80 Ha.	0.00	0.00	0.00	0.00	0.00	**60.00**
6	Maintenance of fruit trees plantation for 5 years	400 Ha.	0.00	3.20 80 Ha.	6.40 160 Ha	9.60 240 Ha.	12.80 320 Ha.	16.00 400 Ha.	12.80 320 Ha.	9.60 240 Ha.	6.40 160 Ha.	3.20 80 Ha.	**80.00**
7	.Fire protection by cleaning and maintaining the fire lines (Natural and artificial) and purchase of fire fighting equipments.	L.S.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	**50.00**
8	Hathi Mitra Dal & Empowerment of JFMCs, public awareness training etc. and miscellaneous works/ activities, purchase of equipments that may be developed subsequently to reduce human - animal conflicts.	L.S.	8.00	8.00	8.00	8.00	8.00	4.00	4.00	4.00	4.00	4.00	**60.00**

9	Establishment of early warning Elephant alert system	L.S	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**10.00**
10	Purchase of utility vehicle" Gajraj Vahan" for the field to transport of man, materials used in Human-Wildlife conflicts. And POL and maintenance for 5 years	L.S.	0.00	23.00	4.00	4.00	4.00	4.00	4.00	0.00	0.00	0.00	**43.00**
11	Biodiversity conservation, empowerment of BMC, training awareness etc	L.S.	4.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**10.00**
12	Semi reflective Wildlife warning signages and hoardings near wildlife passes and in forest area.	L.S.	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**6.00**
13	Monitoring and evaluation of works	L.S.	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	**5.00**
	Total		**102.40**	**114.30**	**100.00**	**100.70**	**87.90**	**36.20**	**28.30**	**19.60**	**16.40**	**13.20**	**619.00**
	+15% Escalation		**15.36**	**17.145**	**15.00**	**15.105**	**13.185**	**5.43**	**4.245**	**2.94**	**2.46**	**1.98**	**92.85**
	Grand Total		**117.76**	**131.445**	**115.00**	**115.805**	**101.085**	**41.63**	**32.545**	**22.54**	**18.86**	**15.18**	**711.85**

Chief Conservator of Forests
Raipur Circle, Raipur (C.G.)

Divisional Forest Officer
Dhamtari Division, Dhamtari

Details of Financial proposal - Kanker Division

Table 9.3

S. no.	Description of Item of work	Unit (No./ Area)	Estimated expenditure (Rs.in Lakhs)										
			1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th Yr	8th Yr	9th Yr	10th yr	Total
1	Improvement of water availability by digging of ponds and water holes.	L.S.	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00
2	Soil water conservation works (LBCD, BCD,Gulley plucking, Dams)	L.S.	3.00	3.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
3	(A)Pasture development by Removal of invasive Alien species hindering the growth and regeneration of valuable species for wild life .	200 Ha.	4.00 50 Ha.	4.00 50 Ha.	4.00 50 Ha.	4.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	0.00	16.00
	(B)Mopping up the same area to remove the reminants	200 Ha.	0.00	2.00 50 Ha.	2.00 50 Ha.	2.00 50 Ha.	2.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	8.00
4	(A)Pasture development by removing alien species in natural grass lands and also in potential grass lands where the density of canopy <0.4		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Cont.-2

	(B) Pasture development by Planting / sowing of palatable grass seeds/ slips		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(C) Maintenance works of grass seed planting area for Three years		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Improvement of stock by dressing of existing stumps of browsable species and cut back (The DFO should inspect the area and after proper marking and hammering , the dressing of live stumps can be permitted) and Gap plantation of fruit bearing trees like Aonla, Jamun, Bel, Ghular, Bargad, and Peepal by planting in 1st year itself)	200 Ha.	6.00 40 Ha.	6.00 40 Ha.	6.00 40 Ha.	6.00 40 Ha.	6.00 40 Ha.	0.00	0.00	0.00	0.00	0.00	30.00

Cont.-3

6	Maintenance of fruit trees plantation for 5 years	200 Ha.	0.00	1.60 40 Ha.	3.20 80 Ha	4.80 120 Ha.	6.40 160 Ha.	8.00 200 Ha.	6.40 160 Ha.	4.80 120 Ha.	3,20 80 Ha.	1.60 40 Ha.	40.00
7	.Fire protection by cleaning and maintaining the firelines (Natural and artificial) and purchase of fire fighting equipments.	L.S.	2..00	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	15.00
8	Empowerment of JFMCs, public awareness training etc. and miscellaneous works/ activities that may be developed subsequently to reduce Human - animal conflicts.	L.S.	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	5.00
9	Establishment of early warning Elephant alert system	L.S.	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
10	Biodiversity conservation, empowerment of BMC, training awareness etc	L.S.	2.0	1.0	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00

Cont.-4

11	Semi reflective Wildlife warning signages and hoardings near wildlife passes and in forest area.	L.S.	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.0
12	Monitoring and evaluation of works		0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.50	0.50	0.50	3.50
	Total		27.00	25.60	26.20	26.80	17.40	10.00	8.40	6.30	4.70	3.10	155.50
	+15% Escalation		4.05	3.84	3.93	4.02	2.61	1.50	1.26	0.945	0.705	0.465	23.325
	Grand Total		31.05	29.44	30.13	30.82	20.01	11.50	9.66	7.245	5.405	3.565	178.825

Divisional Forest Officer
Kanker Division Kanker

Chif Conservator of Forest
Kanker Circle,Kanker

2.0
3.50
155.50
23.325
178.825

Details of Financial proposal -Keshkal Division

Table 9.4

S. no.	Description of Item of work	Unit (No./ Area)	Estimated expenditure (Rs.in Lakhs)										
			1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th Yr	8th Yr	9th Yr	10th yr	Total
1	Improvement of water availability by digging of ponds and water holes.	L.S.	10.00	10.00	10.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	**40.00**
2	Soil water conservation works (LBCD, BCD,Gulley plucking, Dams)	L.S.	4.00	4.00	4.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	**16.00**
3	(A)Pasture development by Removal of invasive Alien species hindering the growth and regeneration of valuable species for wild life .	200 Ha.		4.00 50 Ha.	4.00 50 Ha.	4.00 50 Ha.	4.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	**16.00**
	(B)Mopping up the same area to remove the reminants	200 Ha.	2.00 50 Ha.	2.00 50 Ha.	2.00 50 Ha.	2.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	0.00	**8.00**
4	(A)Pasture development by removing alien species in natural grass lands and also in potential grass lands where the density of canopy <0.4		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	(B) Pasture development by Planting / sowing of palatable grass seeds/ slips		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	(C) Maintenance works of grass seed planting area for Three years		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

Cont.-2

5	Improvement of stock by dressing of existing stumps of browsable species and cut back (The DFO should inspect the area and after proper marking and hammering , the dressing of live stumps can be permitted) and Gap plantation of fruit bearing trees like Aonla, Jamun, Bel, Ghular, Bargad, and Peepal by planting in 1st year itself)	200 Ha.	6.00 40 Ha.	6.00 40 Ha.	6.00 40 Ha.	6.00 40 Ha.	6.00 40 Ha.	0.00	0.00	0.00	0.00	0.00	**30.00**
6	Maintenance of fruit trees plantation for 5 years	200 Ha.		1.60 40 Ha.	3.20 80 Ha	4.80 120 Ha.	6.40 160 Ha.	8.00 200 Ha.	6.40 160 Ha.	4.80 120 Ha.	3,20 80 Ha.	1.60 40 Ha.	**40.00**
7	.Fire protection by cleaning and maintaining the firelines (Natural and artificial) and purchase of fire fighting equipments.	L.S.	3..00	3..00	3..00	3..00	3..00	2.00	2.00	1.00	1.00	1.00	**22.00**
8	Empowerment of JFMCs, public awareness, training etc. and miscellaneous works/ activities that may be developed subsequently to reduce human - animal conflicts.	L.S.	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	**5.00**
9	Establishment of early warning Elephant alert system	L.S.	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.50**

Cont.-3

10	Biodiversity conservation, empowerment of BMC, training awareness etc	L.S.	2.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.00**
11	Semi reflective Wildlife warning signages and hoardings near wildlife passes and in forest area.	L.S.	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.50**
12	Monitoring and evaluation of works		0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.50	0.50	**4.00**
	Total		**35.00**	**32.60**	**34.20**	**34.80**	**18.40**	**11.00**	**9.40**	**6.80**	**4.70**	**3.10**	**190.00**
	+15% Escalation		**5.25**	**4.89**	**5.13**	**5.22**	**2.76**	**1.65**	**1.41**	**1.02**	**0.705**	**0.465**	**28.50**
	Grand Total		**40.25**	**37.49**	**39.33**	**40.02**	**21.16**	**12.65**	**10.81**	**7.82**	**5.405**	**3.565**	**218.50**

Chif Conservator of Forest
Kanker Circle,Kanker

वन मण्डलाधिकारी
केशकाल वन मण्डल
केशकाल (छ.ग.)

Details of Financial proposal -Udanti-Sitanadi Tiger Reserve

Table 9.5

S. no.	Description of Item of work	Unit (No./ Area)	Estimated expenditure (Rs.in Lakhs)										
			1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th Yr	8th Yr	9th Yr	10thyr	Total
1	Improvement of water availability by digging of ponds and water holes.	L.S.	5.00	4.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**13.00**
2	Soil water conservation works (LBCD, BCD,Gulley plucking, Dams)	L.S.	1.0	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.00**
3	(A)Pasture development by Removal of invasive Alien species hindering the growth and regeneration of valuable species for wild life .	150 Ha.	4.00 50 Ha.	4.00 50 Ha.	4.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**12.00**
	(B)Mopping up the same area to remove the reminants	150 Ha.		2.00 50 Ha.	2.00 50 Ha.	2.00 50 Ha.	0.00	0.00	0.00	0.00	0.00	0.00	**6.00**
4	(A)Pasture development by removing alien species in natural grass lands and also in potential grass lands where the density of canopy <0.4	50 Ha.	5.00 25 Ha.	5.00 25 Ha.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**10.00**

Cont.-2

	(B) Pasture development by Planting / sowing of palatable grass seeds/ slips	50 Ha.	0.00	8.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**16.00**
				25 Ha.	25 Ha.								
	(C) Maintenance works of grass seed planting area for Three years	50 Ha.	0.00	0.00	1.75	3.50	3.5	1.75	0.00	0.00	0.00	0.00	**10.50**
					25 Ha	50 Ha	50 Ha.	25 Ha					
5	Improvement of stock by dressing of existing stumps of browsable species and cut back (The DFO should inspect the area and after proper marking and hammering , the dressing of live stumps can be permitted) and Gap plantation of fruit bearing trees like Aonla, Jamun, Bel, Ghular, Bargad, and Peepal by planting in 1st year itself)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
6	Maintenance of fruit trees plantation for 5 years		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
7	Fire protection by cleaning and maintaining the firelines (Natural and artificial) and purchase of fire fighting equipments.	L.S.	1.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.50	0.50	**7.50**

Cont.-3